

UNITED NATIONS

International Tribunal for the
Prosecution of Persons
Responsible for Serious Violations of
International Humanitarian Law
Committed in the Territory of the
former Yugoslavia since 1991

Case No. IT-06-90-A

Date: 3 August 2012

IN THE APPEALS CHAMBER

Before: Judge Theodor Meron, Presiding
Judge Carmel Agius
Judge Patrick Robinson
Judge Mehmet Güney
Judge Fausto Pocar

Registrar: Mr. John Hocking

THE PROSECUTOR

v.

**ANTE GOTOVINA
MLADEN MARKAČ**

PUBLIC

**NOTICE OF FILING OF PUBLIC REDACTED VERSION OF
PROSECUTION RESPONSE TO GOTOVINA'S SECOND RULE
115 MOTION, AND REQUEST FOR CHANGE IN STATUS OF
CORRIGENDUM**

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THE INTERNATIONAL CRIMINAL TRIBUNAL
FOR THE FORMER YUGOSLAVIA

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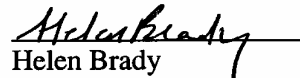
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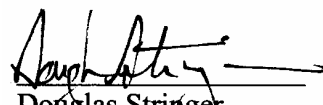
**NOTICE OF FILING OF PUBLIC REDACTED VERSION OF
PROSECUTION RESPONSE TO GOTOVINA'S SECOND RULE 115
MOTION, AND REQUEST FOR CHANGE IN STATUS OF CORRIGENDUM**

1. The Prosecution hereby files the public redacted version of its Response to Gotovina's Second Motion to Admit Additional Evidence Pursuant to Rule 115 and Supplemental Response to Gotovina's First Rule 115 Motion, filed confidentially on 27 April 2012 ("Response").
2. The Prosecution requests that the Registry change the status of the Corrigendum to the Response, filed on 2 May 2012, from confidential with confidential annex to public with public annex.

Word Count: 96

Dated this 3rd day of August 2012
At The Hague, The Netherlands


Helen Brady
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MLADEN MARKAČ**

PUBLIC REDACTED VERSION

**PROSECUTION RESPONSE TO GOTOVINA'S SECOND
MOTION TO ADMIT ADDITIONAL EVIDENCE PURSUANT
TO RULE 115 AND SUPPLEMENTAL RESPONSE TO
GOTOVINA'S FIRST RULE 115 MOTION**

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I. OVERVIEW	2
II. THE FIRST FOUR PROPOSED DOCUMENTS COULD NOT AFFECT THE CHAMBER’S FINDINGS	4
A. THE CHAMBER FOUND THAT CIVILIANS FLED DUE TO THE FEAR INSTILLED BY THE SHELLING ATTACK.....	4
1. Civilians fled in fear after the onset of the artillery attack and not because of a post-facto and ineffective evacuation order	4
B. THE [REDACTED] DOCUMENTS COULD NOT IMPACT THE VERDICT	6
1. [REDACTED]	6
2. [REDACTED]	8
3. [REDACTED]	9
C. [REDACTED]	10
D. “ALL PARTIES” DO NOT ATTRIBUTE THE CIVILIAN DEPARTURES TO THE RSK EVACUATION ORDER.....	10
III. THE GRANVILLE-CHAPMAN REPORT WOULD NOT AFFECT THE CHAMBER’S FINDING OF UNLAWFUL SHELLING	12
A. THE GRANVILLE-CHAPMAN REPORT WAS AVAILABLE AT TRIAL	13
B. THE GRANVILLE-CHAPMAN REPORT IS NOT CREDIBLE OR RELIABLE.....	14
C. THE GRANVILLE-CHAPMAN REPORT WOULD NOT AND COULD NOT AFFECT THE VERDICT	15
1. The Granville-Chapman report is cumulative of the Scales, Shoffner and Griffith reports.....	15
2. The Rebuttal Reports, and associated evidence, further demonstrate that the Four Defence Reports could not affect the verdict	17
IV. CONCLUSION	24
V. GLOSSARY	25

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ADMIT ADDITIONAL EVIDENCE PURSUANT TO RULE 115
AND SUPPLEMENTAL RESPONSE
TO GOTOVINA'S FIRST RULE 115 MOTION**

I. OVERVIEW

1. The Appeals Chamber should dismiss Gotovina's Second Motion seeking admission on appeal of five documents.¹
2. The first three documents—[REDACTED]—could not affect the Chamber's finding that the fear from unlawful shelling was the primary and direct cause of the mass civilian flight from Knin, Obrovac, Benkovac and Gračac. These documents are either consistent with the Judgement or so vague, speculative or otherwise lacking in probative value that they are incapable of affecting the Chamber's findings.

¹ Appellant Ante Gotovina's Second Motion to Admit Additional Evidence pursuant to Rule 115 (Confidential), 30 March 2012 ("Motion").

3. Equally, the fourth document—[REDACTED]²—could not affect the Chamber’s findings regarding the cause of the civilian exodus. It is duplicative of evidence considered at trial.

4. The fifth document—“Observations by General Sir Timothy Granville-Chapman”—is a further attempt by Gotovina to buttress his trial case and his first R115 Motion with proposed expert evidence.³ Gotovina fails to explain why this evidence could not have been obtained at trial with the exercise of due diligence. This statement would not (nor could) affect the Chamber’s findings. In order to show that this document is inadmissible, the Prosecution has submitted the expert reports of three rebuttal witnesses and two HV firing tables. This rebuttal evidence also serves as a supplemental response to the Defence’s First R115 Motion, showing that the three expert reports proposed by the Defence could not affect the Chamber’s verdict.

5. Instead of explaining how the evidence he seeks to admit could affect the Chamber’s thorough and detailed analysis of the evidence and its subsequent findings,⁴ Gotovina uses his R115 application as a pretext to re-litigate his failed trial arguments. Approximately half his Motion consists of an almost verbatim reproduction of parts of his Closing Brief, without reference to the Chamber’s contrary findings. This lengthy “chronology” details evidence relating to the existence of the RSK evacuation order.⁵ Gotovina largely ignores that these arguments and evidence were carefully considered by the Chamber.⁶ In particular, Gotovina does not address the Chamber’s findings (or the underlying evidence) that the evacuation order was issued after the civilian population was already on the move and was ineffectual.⁷ Moreover, Gotovina supplements his chronology with references to documents outside the record (i.e. SDC minutes and [REDACTED] which are the subject of his First R115 Motion).⁸

² [REDACTED].

³ See Gotovina’s First R115 Motion, Annexes 20-22, proposing the admission of three new purported expert reports obtained after the issuance of the Judgement.

⁴ Motion, paras.11-51.

⁵ Motion, paras.24-40.

⁶ Judgement, paras.1512-1539.

⁷ Judgement, paras.1512-1539.

⁸ Motion, paras.42-49. See Gotovina’s First R115 Motion, Annexes 1, [REDACTED].

II. THE FIRST FOUR PROPOSED DOCUMENTS COULD NOT AFFECT THE CHAMBER'S FINDINGS

6. The first four proposed documents could not affect the Chamber's finding that the HV's unlawful shelling was the primary and direct cause of the Serb civilian population's departure from Knin, Benkovac, Obrovac and Gračac. They do not "directly contradict and impugn the Chamber's findings."⁹ Instead, they are either consistent with the Chamber's findings regarding the civilian flight from the four towns, too vague to potentially affect these findings, or duplicative of trial evidence.

A. The Chamber found that civilians fled due to the fear instilled by the shelling attack

1. Civilians fled in fear after the onset of the artillery attack and not because of a post-facto and ineffective evacuation order

7. The Chamber found that the primary and direct cause of the civilian flight was the fear from the artillery attack, not the RSK and SVK's *post-facto* and poorly implemented evacuation efforts.¹⁰ In merely pointing to the existence of an RSK evacuation order, Gotovina continues to ignore that the Chamber considered this evidence in detail and found it was not the cause of civilian departures.¹¹ As the Appeals Chamber has already noted, the Chamber "reviewed extensive evidence regarding the reasons underlying Serb civilians' departure from the Krajina."¹² The proposed evidence has no impact on this evidence or the Chamber's findings.

8. The shelling attack began at approximately 5:00 a.m. on 4 August 1995,¹³ causing immediate panic and instilling great fear amongst the civilian populations of the four towns.¹⁴ For example:

- In Knin, civilians initially took shelter, but began to gather their possessions and flee the town as early as noon.¹⁵

⁹ *Contra* Motion, para.4.

¹⁰ Judgement, paras.1512-1539.

¹¹ Judgement, paras.1512-1539.

¹² R54bis Decision, para.8.

¹³ Judgement, paras.1365-1367, 1420, 1451, 1473 (7:00 a.m in Obrovac town).

¹⁴ Judgement, paras.1743-1745.

- Inhabitants of the surrounding villages initially fled from the shelling in columns towards Benkovac town, but by mid-afternoon the panicked civilians in Benkovac were also spontaneously leaving.¹⁶
- The shelling of the Obrovac area also commenced at 5:00 a.m. and the shelling of the town itself began at 7:00 a.m. Almost immediately, throughout the morning, civilians in Obrovac spontaneously fled from their homes.¹⁷
- In Gračac, some civilians initially hid in shelters, but started fleeing from the town during the morning and into the afternoon.¹⁸

9. The Chamber found that RSK President Martić's evacuation order was not signed and conveyed to Civilian Protection until 6:00 p.m. on 4 August.¹⁹ The purpose of the order was, in part, to bring some order to the evacuation of the civilian population *already on the move*.²⁰ The order only envisaged moving civilians within the RSK, not outside the region,²¹ and not on a permanent basis.²²

10. At 6:00 p.m., UN authorities met with SVK and RSK officials, and were requested to assist proposed evacuation efforts. At that time, SVK representatives appeared confused, panicked and unprepared for the decision to evacuate. UNCRO Sector South Commander Forand was told at the meeting that the plan for evacuation would be ready within a few hours, but he never saw it.²³

11. Even after the evacuation order was conveyed to Civilian Protection, it was not directly distributed to the civilian population.²⁴ The Chamber found that it was not forwarded through the "official mail" or publicised through the RSK media, which was not functioning at the time.²⁵ The Chamber recognised that there was a great deal

¹⁵ See Prosecution Response Brief, paras.184-185.

¹⁶ See Prosecution Response Brief, para.191.

¹⁷ See Prosecution Response Brief, paras.201-202.

¹⁸ See Prosecution Response Brief, para.204.

¹⁹ Judgement, para.1524.

²⁰ Judgement, para.1521, *see also* para.1537. In the meeting, the SVK sought assistance from the UN in "protecting civilian [sic] who were leaving their homes": Exh.P1092, p.10.

²¹ Judgement, para.1522, 1524.

²² Judgement, paras.1513-1514, 1519-1522.

²³ Judgement, para.1525, *see also* 1537.

²⁴ Judgement, para.1523.

²⁵ Judgement, paras.1523-1524.

of Croatian propaganda encouraging evacuation that did not emanate from the RSK/SVK authorities.²⁶

12. Witnesses confirmed that civilians fled as a result of fear, not because of any order to leave.²⁷ Witnesses on the ground testified that civilians spontaneously fled in a chaotic and disorganised manner and by routes and to locations other than those envisaged in the evacuation order.²⁸ The population had already started to panic and flee long before the evacuation order was issued.²⁹

B. The [REDACTED] documents could not impact the verdict

13. Gotovina's descriptions of the content and significance of the [REDACTED] documents³⁰ are overstated. Relying on negative inferences, he draws unfounded conclusions based on what the documents *do not say*, as opposed to their actual content. He fails to appreciate that, in the appellate stage, new evidence must be capable of impacting the Judgement, including the Chamber's clear findings about the timing and poor implementation of the evacuation order. Instead, he simply re-asserts his trial theory, which the Chamber rejected.

1. [REDACTED]

14. [REDACTED].³¹ This is consistent with the Chamber's findings and could³² not have any impact on the verdict.

15. The Chamber considered the evidence of the RSK/SVK's evacuation efforts in the evening of 4 August. The Defence introduced at trial, *inter alia*, the evacuation order itself,³³ a report that the order was publicised at 8 p.m. on 4 August,³⁴ and two

²⁶ Judgement, para.1526, citing Novaković's evidence that messages were being broadcast on Radio Knin frequencies after the station shut down. *See also* para.1527, discussing leaflets purportedly signed by Mrkšić, but which he denied issuing. The Chamber concluded these were leaflets not issued by the RSK/SVK: para.1538.

²⁷ Judgement, paras.1532, 1535.

²⁸ Judgement, paras.1528-1530, *see also* para.1539.

²⁹ Judgement, para.1533

³⁰ [REDACTED].

³¹ [REDACTED].

³² This document was disclosed to the Defence on 13 January 2012. The Prosecution accepts that this information may not have been available to the Defence at trial and therefore addresses the question whether the proposed new evidence "could" have had an impact on the verdict.

³³ Exh.D137.

³⁴ Exh.D928, p.23.

transcripts of a radio broadcast at 9:30 p.m. on 4 August allegedly featuring Mrkšić discussing the evacuation.³⁵ [REDACTED].

16. [REDACTED], Gotovina again ignores the Chamber's findings that the evacuation efforts were introduced after the onset of the mass exodus and were an attempt to bring order to the civilian flight already well underway.³⁶ [REDACTED].³⁷ [REDACTED]³⁸ [REDACTED].³⁹ Even if this were the case, this would not affect the Chamber's findings on the timing and impact of the evacuation order.

17. [REDACTED].⁴⁰ [REDACTED],⁴¹ [REDACTED]. The Chamber considered minutes and notes taken from a meeting between UN, RSK and SVK officials, regarding the request for assistance with the proposed evacuation.⁴² This request—late in the day and without any evidence of its implementation—does not demonstrate that the civilian population's flight was triggered by such an order.

18. [REDACTED]⁴³ [REDACTED].⁴⁴ [REDACTED],⁴⁵ [REDACTED],⁴⁶ [REDACTED].

19. [REDACTED]⁴⁷ [REDACTED],⁴⁸ Gotovina again confuses the *existence* of an evacuation order with the *cause* of civilian departures. The Chamber was well aware of the existence of the order, but due to its timing and poor implementation found that it was not the primary and direct cause of the mass exodus.

20. Gotovina's assertion that "no RSK official claimed at the time that civilians had departed because of HV shelling"⁴⁹ is similarly pointless. What RSK officials *did not say* cannot be determinative of the cause of the deportation. The Chamber's

³⁵ Exhs.D106, D713.

³⁶ Judgement, paras.1521, 1537.

³⁷ [REDACTED].

³⁸ [REDACTED].

³⁹ [REDACTED].

⁴⁰ [REDACTED].

⁴¹ [REDACTED].

⁴² Judgement, para.1525. *Above*, para.10.

⁴³ [REDACTED].

⁴⁴ [REDACTED].

⁴⁵ [REDACTED].

⁴⁶ [REDACTED].

⁴⁷ [REDACTED].

⁴⁸ [REDACTED].

⁴⁹ Motion, para.7(iv)(b).

findings were based on first-hand evidence of civilians and international officials who witnessed the events in the four towns. [REDACTED].

2. [REDACTED]

21. [REDACTED]⁵⁰ [REDACTED].⁵¹ This document would not (and could not) affect the verdict.⁵²

22. [REDACTED],⁵³ [REDACTED]. Gotovina fails to explain why he could not have obtained at trial the primary evidence [REDACTED] through the exercise of due diligence.

23. [REDACTED].⁵⁴ It is not tenable to suggest that the sudden mass exodus of tens of thousands of civilians was triggered by a desire to “resettle in other areas” rather than the terrifying artillery attack.⁵⁵

24. [REDACTED].⁵⁶ Regardless of what the *original purpose* of the evacuation order may have been,⁵⁷ the Chamber found that it came too late and was insufficiently disseminated to trigger the civilian flight. [REDACTED].⁵⁸ [REDACTED].

25. Again, Gotovina attempts to draw tenuous negative inferences based on what the document does *not* say. [REDACTED].⁵⁹ [REDACTED];⁶⁰ [REDACTED]. Moreover, the inference that Gotovina attempts to draw is undermined by his own evidence at trial. [REDACTED].⁶¹

⁵⁰ [REDACTED].

⁵¹ [REDACTED].

⁵² This document was disclosed to the Defence on 13 January 2012. [REDACTED].

⁵³ [REDACTED].

⁵⁴ [REDACTED].

⁵⁵ Motion, para.8(ii)(c).

⁵⁶ [REDACTED].

⁵⁷ Motion, para.8(i).

⁵⁸ [REDACTED].

⁵⁹ [REDACTED].

⁶⁰ [REDACTED].

⁶¹ See Exh.D929, p.2. *Contra* Motion, para.25.

3. [REDACTED]

26. [REDACTED].⁶² This document is too cursory and vague to have any effect on the Chamber's findings.

27. Gotovina's assertion that this document undermines the Chamber's findings regarding Knin, Benkovac, Obrovac or Gračac rests on speculation rather than the document's actual contents.⁶³ [REDACTED],⁶⁴ [REDACTED].

28. [REDACTED]. He again overstates the significance of this document, based on illogical inferences. That shelling "is not mentioned" is of little value. The fact that one document does not refer specifically to shelling cannot "establish[] that no civilian [REDACTED] claimed contemporaneously to have left because of HV shelling"⁶⁵ nor can this "contradict[] any suggestion that [...] the departure had already been triggered by HV artillery."⁶⁶

29. [REDACTED]⁶⁷ [REDACTED]⁶⁸— [REDACTED].⁶⁹ Once again, Gotovina relies on tenuous negative inferences, seeking to impute meaning into what *is not mentioned* [REDACTED].

30. [REDACTED].⁷⁰ *Even if* it were accepted that some civilians left because of evacuation orders, this does not "directly contradict" the Chamber's findings relating to the primary and direct cause of departure for the vast majority of civilians from the Indictment area,⁷¹ which was based on the best evidence,⁷² including first-hand, detailed eyewitness testimony:

- from civilians who fled as a result of the shelling of the four towns,⁷³

⁶² [REDACTED].

⁶³ *Contra* Motion, para.6(i).

⁶⁴ [REDACTED].

⁶⁵ Motion, para.6(ii).

⁶⁶ Motion, para.6(iv).

⁶⁷ [REDACTED].

⁶⁸ [REDACTED].

⁶⁹ [REDACTED].

⁷⁰ [REDACTED].

⁷¹ Judgement, para.1539. *Contra* Motion, para.6(i).

⁷² *See* R54bis Decision, para.8.

⁷³ Judgement, paras.1277, 1446, 1559, 1580.

- from international observers who saw civilians panicking or fleeing in response to this shelling,⁷⁴
- regarding the disorganised and spontaneous nature of the flight,⁷⁵ and
- regarding the unsuccessful implementation of the evacuation order issued in the evening hours of 4 August in response to this flight.⁷⁶

31. [REDACTED].⁷⁷

C. [REDACTED]

32. [REDACTED].⁷⁸ [REDACTED]. Nothing in this document could affect the verdict.

33. [REDACTED].⁷⁹ [REDACTED].⁸⁰ [REDACTED].⁸¹ [REDACTED].⁸² [REDACTED].⁸³ [REDACTED]. [REDACTED].

D. “All parties” do not attribute the civilian departures to the RSK evacuation order

34. In keeping with the flawed logic and overstatement that characterises his portrayal of [REDACTED], Gotovina seeks to “attribute” to a number of parties the view that the mass civilian departures were a result of the RSK evacuation order.⁸⁴ In fact, the majority of these parties did not *express any view* on the cause of the departures. Gotovina’s attribution of cause to this wide range of “parties” is misleading:

⁷⁴ Judgement, paras.1281-1286, 1292-1293, 1297, 1562.

⁷⁵ Judgement, paras.1532, 1561-1562, 1580.

⁷⁶ Judgement, paras.1521, 1525, 1537.

⁷⁷ This document was disclosed to the Defence on 9 March 2012 as a result of a Defence R66(B) request. The Prosecution accepts that this information may not have been available to the Defence at trial and therefore addresses the question whether the proposed new evidence “could” have had an impact on the verdict.

⁷⁸ [REDACTED].

⁷⁹ [REDACTED].

⁸⁰ [REDACTED].

⁸¹ [REDACTED].

⁸² Judgement, para.2002.

⁸³ Equally, the information was available in a different form during trial; *see Mrkšić* Second R115 Decision, para.6.

⁸⁴ Motion, para.9.

- [REDACTED],⁸⁵ [REDACTED]:
 - o [REDACTED].
 - o [REDACTED].⁸⁶
- [REDACTED].⁸⁷ [REDACTED].
- [REDACTED]⁸⁸—[REDACTED]⁸⁹—[REDACTED].⁹⁰
- Galbraith did not “attribute” the civilian exodus to the RSK evacuation order to the exclusion of the HV campaign. [REDACTED]⁹¹ [REDACTED].⁹²
- [REDACTED],⁹³ [REDACTED].⁹⁴
- With respect to “Krajina Serb civilians”, [REDACTED].⁹⁵ He also cites to the testimony of two trial witnesses who did not originate from Knin, Benkovac, Obrovac or Gračac.⁹⁶ Further, Gotovina cites one paragraph of Mirković’s witness statement to argue he did not have a “contemporaneous awareness” that he was evicted through shelling. Gotovina neglects the preceding paragraphs where Mirković details the shelling of nearby hamlets; hiding with his mother, wife and two daughters; witnessing people fleeing; his wife’s fear of being killed; and his realisation that “there was nothing to do but to leave [...] We were not told to go”.⁹⁷
- [REDACTED].⁹⁸

⁸⁵ [REDACTED].

⁸⁶ [REDACTED].

⁸⁷ [REDACTED].

⁸⁸ [REDACTED].

⁸⁹ [REDACTED].

⁹⁰ [REDACTED].

⁹¹ [REDACTED].

⁹² [REDACTED].

⁹³ [REDACTED].

⁹⁴ [REDACTED].

⁹⁵ [REDACTED].

⁹⁶ See Judgement, paras.221-222, 1547-1548, 1762. Vujinović resided in Oton Polje and Mirković in Mirkovići.

⁹⁷ Exh.P723, paras.3-6.

⁹⁸ [REDACTED].

35. Gotovina overstates and misrepresents the purported unanimous attribution of the flight of Serb civilians to the RSK evacuation order. The sources he relies upon do not support this assertion.

III. THE GRANVILLE-CHAPMAN REPORT WOULD NOT AFFECT THE CHAMBER'S FINDING OF UNLAWFUL SHELLING

36. The Granville-Chapman report was available at trial with the exercise of due diligence. Gotovina should not be permitted to make tactical corrections to his case by producing further expert witnesses on appeal—especially without showing good cause for filing outside the R115 time-limit.

37. As it is submitted late, the Granville-Chapman report is admissible only if it *would* affect the verdict. Gotovina cannot meet this standard. The report is collateral to proposed Defence Exhibits 20, 21 and 22 previously tendered in Gotovina's First R115 Motion ("the Scales, Shoffner and Griffith reports" respectively; and together the "Four Defence Reports")—already opposed by the Prosecution—and cannot meet the R115 standard. Its brevity, lack of citation, and paucity of reasoning renders it neither credible nor reliable as an expert report within the meaning of R94*bis*. Moreover, the Granville-Chapman report only addresses the so-called '200-metre rule,' which is subsidiary to the Chamber's broader analysis of the evidence establishing the unlawfulness of the Operation Storm artillery attack.

38. Prosecution rebuttal evidence obtained after the filing of Gotovina's First R115 Motion, set out in Annexes I-V, further demonstrates that none of the Four Defence Reports would, or even could, affect the Chamber's findings of unlawful attack. Rebuttal expert reports ("Rebuttal Reports")⁹⁹ prepared by Generals Applegate, Brown, and Ashmore ("Rebuttal Experts") endorse the Chamber's reliance on a range of evidence—including Gotovina's order to put towns under fire—to determine the lawfulness of the artillery attack rather than a simplistic reference to a margin of error. They also explain that the narrow conclusions of the Four Defence

⁹⁹ See Annexes I (Lt-Gen. Applegate Report), II (Lt-Gen. Brown Report), III (Maj-Gen. Ashmore Report).

Reports, when viewed in light of broader artillery doctrine and the evidence, support the Chamber's finding of deliberate and unlawful use of artillery.

39. Ordinarily, the Prosecution would wait until the Appeals Chamber has decided on the admissibility of proposed additional evidence before filing rebuttal evidence pursuant to R115(A). However, in certain circumstances, the Prosecution has filed rebuttal evidence at the admissibility stage, either going to particular limbs of the R115 test for admissibility¹⁰⁰ or to the merits.¹⁰¹ The Rebuttal Reports bear directly on both the admissibility and the substance of the Granville-Chapman Report as well as the admissibility and the substance of the Scales, Shoffner and Griffith reports. Should the Appeals Chamber admit any of the documents tendered in Gotovina's First or Second R115 Motions, the Prosecution reserves the right to file further rebuttal evidence, in addition to these Rebuttal Reports and associated tables,¹⁰² as provided by R115(A).

40. The Prosecution also gives notice pursuant to R94*bis* that, in the event Gotovina's Second R115 Motion is granted with regard to the Granville-Chapman report, it does not accept the report and will request the Appeals Chamber to order Granville-Chapman to attend for cross-examination. Given its shortcomings, the Granville-Chapman report should not be accepted in whole or in part until his testimony has been tested.¹⁰³

A. The Granville-Chapman report was available at trial

41. Gotovina relies on the Chamber's reference to a so-called '200-metre rule' to claim that the Granville-Chapman report was "neither available at trial nor could have been discovered through the exercise of due diligence".¹⁰⁴ Yet counsel's choice not to call expert evidence on the issue of margin of error at trial is not sufficient to claim that expertise was unavailable.¹⁰⁵ Presenting his case, Gotovina elected to advance expert evidence on the practical application of the laws of war in military operations

¹⁰⁰ *E.g.* Naletilić R115 Decision paras.46-47.

¹⁰¹ *See* Haradinaj R115 Decision, paras.2, 44.

¹⁰² The Rebuttal Reports are also being submitted under R94*bis*.

¹⁰³ *See also* Prosecution Response to Gotovina's First R115, fn.264.

¹⁰⁴ Motion, para.61.

¹⁰⁵ Prosecution Response to Gotovina's First R115, para.72 (citing *Tadić* Extension Decision, para.50).

(expert Geoffrey Corn, who was not an expert on artillery),¹⁰⁶ rather than calling expert artillery evidence. This was despite the fact that in presenting expert evidence on the use of artillery in military operations (expert Harry Konings),¹⁰⁷ the Prosecution clearly indicated the relevance of artillery technicalities to its case, including margin of error. Other Prosecution witnesses testified on factual matters material to this issue,¹⁰⁸ and relevant parts of their testimony were specifically drawn to Gotovina's attention.¹⁰⁹

42. Furthermore, although Gotovina seeks the admission of the Granville-Chapman report more than "thirty days from the date for filing of the brief in reply",¹¹⁰ he neglects to show good cause as required by R115. Good cause requires him at least to demonstrate an inability to comply with the deadline and to prove that he filed as soon as possible after discovering the additional evidence.¹¹¹ Not only is the Granville-Chapman report undated—preventing the Appeals Chamber from ascertaining when it was created and thus the timeliness of its filing—Gotovina fails to explain why he could not obtain the report at the same time as the Scales, Shoffner and Griffith reports.

B. The Granville-Chapman report is not credible or reliable

43. The Granville-Chapman report is deficient as an expert report within the meaning of R94*bis*.

44. Granville-Chapman frankly acknowledges the limits of his personal expertise on the material point at issue ("my knowledge of technical gunnery matters is in my past").¹¹² Instead, he states that he concurs with the Scales, Shoffner and Griffith reports on the basis of an unknown degree of consultation with an unidentified

¹⁰⁶ See Judgement, para.1163.

¹⁰⁷ See Judgement, paras.1163, 1165.

¹⁰⁸ E.g. Leslie (Judgement, paras.1167, 1898), Rajčić (Judgement, para.1237), Steenberg (T.5499), Munkelien (Exh.P60, p.3), Anttila (Exh.P173, paras.9-10).

¹⁰⁹ E.g. T.21252 (in response to Gotovina's erroneous argument that no evidence had been led on range of error). See also Prosecution Closing Brief, para.555.

¹¹⁰ R115(A). The Motion was filed on 30 March 2012, six months after Gotovina's Reply Brief.

¹¹¹ Šainović R115 Decision, para.20.

¹¹² Granville-Chapman report, p.1. The Prosecution understands that "Master Gunner St James' Park" is a ceremonial appointment. Cf. Motion, para.58 (citing "Exhibit F" which was not appended to his motion).

“variety of expert sources”.¹¹³ Such a second-hand endorsement cannot be adequately tested, and affords the Appeals Chamber no means to weigh its probative value. The dangers of this approach are magnified when the three reports which he purports to evaluate—unlike the Rebuttal Reports—also lack specific citation to the sources upon which they rely.¹¹⁴

C. The Granville-Chapman report would not and could not affect the verdict

45. The Granville-Chapman report neither would nor could affect the verdict.¹¹⁵ Like the Scales, Shoffner and Griffith reports, it emphasises a subsidiary aspect of the Chamber’s reasoning and fails to address the bulk of the trial evidence and the Chamber’s findings.¹¹⁶

1. The Granville-Chapman report is cumulative of the Scales, Shoffner and Griffith reports

46. The Granville-Chapman report provides a largely un-reasoned endorsement of the Scales, Shoffner and Griffith reports.¹¹⁷ Such endorsements, without more, are merely duplicative of other proposed additional evidence. As such, they do not satisfy the relevance criterion under R115.¹¹⁸

47. Granville-Chapman asserts that there is “no justification for concluding that rounds falling outside the 200 metre box were indicative of a deliberate attempt to fire on separate (and possibly inappropriate) targets.”¹¹⁹ This misstates the Chamber’s reasoning. On the basis of the Defence and Prosecution expert reports the Prosecution

¹¹³ Granville-Chapman report, p.1.

¹¹⁴ See Prosecution Response to Gotovina’s First R115, paras.95-96. Cf. Annexes I-III (including in-text citations and schedules of materials provided for review).

¹¹⁵ *Contra* Motion, paras.59-60.

¹¹⁶ Much of Gotovina’s appeal is premised on this misapprehension, which he terms the “200-metre rule” or “the Chamber’s case” and understands as meaning that the Chamber founded his liability on the fact that artillery landed more than 200-metres from certain targets: *e.g.* Gotovina Appellant’s Brief, paras.10-11. This oversimplification disregards the evidence and Judgement: *e.g.* Judgement, paras.1892, 1911. *Below* paras.51-53. See also Prosecution Amicus Response, para.21.

¹¹⁷ Granville-Chapman report, p.1 (purporting to concur with all three Defence experts without noting the contradictions between them, *e.g.* the differing calculations of Scales and Shoffner concerning margin of error). Cf. Motion, para.59 (characterising the Granville-Chapman report as “provid[ing] further corroboration”).

¹¹⁸ *Delalić* Evidence Decision, para.33. See also Prosecution Response to Gotovina’s First R115, para.98.

¹¹⁹ Granville-Chapman report, p.1. See also Motion, para.60(iv).

agrees that the 200-metre margin of error is overly narrow. However, this was but one factor relied upon by the Chamber as part of its comprehensive analysis of the evidence in the record.¹²⁰ As set out in the Prosecution Response Brief, the Chamber employed the margin primarily as a ‘rule of thumb’ to assess the testimony of Gotovina’s artillery chief, Rajčić, who claimed—contrary to the weight of evidence—that Gotovina’s attack order was understood as a direction only to target military objectives.¹²¹ The Granville-Chapman report makes Rajčić no more credible.¹²² As explained below, the use of weapons with a margin of error significantly greater than 200 metres—making them less accurate and more likely to hit civilians and civilian objects—only reinforces the conclusion that the HV deliberately treated the four towns as targets and thereby conducted an indiscriminate artillery attack. In the context of the weight of evidence in the record, this conclusion is reinforced by the reckless disregard of technical or tactical measures available to mitigate the danger posed by these weapons.

48. In all other respects, Granville-Chapman’s “personal observations”¹²³ are unsupported by reference to evidence in the record or to technical sources¹²⁴ and are generally irrelevant and/or incapable of affecting the verdict.¹²⁵ For example:

- His assessment that the “number of rounds fired” is “entirely consistent” with neutralisation fire in an urban setting¹²⁶ is irrelevant. Such statements are meaningless in this case since neutralisation fire targeting the civilian population is no more lawful than harassment fire targeting the civilian population. The material question is the intent behind the use of artillery.¹²⁷ Moreover, this opinion contradicts Shoffner’s assessment that he would have expected the number of rounds to be greater by a factor of two.¹²⁸

¹²⁰ Below para.52.

¹²¹ Prosecution Response to Gotovina’s First R115, para.77; Prosecution Response Brief, paras.43-44, 57, 63-70.

¹²² Prosecution Response to Gotovina’s First R115 Motion, para.78. Below paras.55, 59-60.

¹²³ Granville-Chapman report, p.1.

¹²⁴ Granville-Chapman report, pp.1-2. Above paras.43-44.

¹²⁵ *Contra* Motion, para.60.

¹²⁶ Granville-Chapman report, p.1.

¹²⁷ See Annex I, pp.2-3; Annex II, pp.3-4.

¹²⁸ Shoffner report, p.2.

- His assertion that artillery is an “area weapon”¹²⁹ is already well-established in this case.¹³⁰

2. The Rebuttal Reports, and associated evidence, further demonstrate that the Four Defence Reports could not affect the verdict

49. Given the novelty of Gotovina’s attempt to introduce expert evidence on appeal, the Prosecution has identified and instructed experts to assess the Four Defence Reports. The Rebuttal Experts—serving and retired decorated senior army officers with combat experience in the use, deployment and command of artillery—prepared the Rebuttal Reports, annexed to this response.¹³¹ These reports, which are confined to questions arising from the Four Defence Reports, “directly affect the substance of the additional evidence”¹³² tendered by Gotovina.

50. The Rebuttal Experts are eminently qualified to address the content of the Four Defence Reports:

- Lieutenant-General (retired) Richard Applegate held leadership posts in the British Army including Master-General of the Ordnance and Quartermaster General. A career artillery officer from troop to brigade level, he was the decorated commander of the European Rapid Reaction Force artillery battlegroup, which in 1995 fired more than 1,499 rounds and 56 fire missions in support of the intervention to lift the siege of Sarajevo.
- Lieutenant-General (retired) Christopher Brown is former Director Royal Artillery (*i.e.* professional head of artillery) of the British Army. A career artillery officer from troop to brigade level, he was decorated for gallantry as a forward artillery observer in the Falklands war. Subsequent staff appointments included responsibilities as chief UK planner attached to US Central Command for coordination of all UK-US indirect fire planning for

¹²⁹ Granville-Chapman report, p.1.

¹³⁰ See Exh.P1259, p.11 (Konings report).

¹³¹ See Annexes I (Applegate Report), II (Brown Report), III (Ashmore Report). Annexes IV and V, HV firing tables for the 130mm howitzer and 122mm multiple rocket launchers, are tendered as rebuttal exhibits both in the interest of completeness (since they are relied upon in Annex II; see below paras.58-59) and to rebut the acknowledged “estimates” in the Four Defence Reports (*e.g.* Shoffner report, p.3).

Afghanistan and Iraq, and as Chief of Staff of ISAF (Afghanistan) for coordination of all indirect fires and training of the Afghan National Army artillery.

- Major-General Nicholas Ashmore is a serving British Army officer. He presently holds a staff post at the UK Ministry of Defence. A career artillery officer, he was decorated for his command of the 3rd Regiment, Royal Horse Artillery, which in 2003 fired 9,513 rounds in and around Basra, Iraq, in support of the capture of the city and the defeat of its garrison.

51. The Rebuttal Reports demonstrate that the Four Defence Reports could not affect the verdict. First, they show that the Chamber applied the proper method to assess the use of artillery against the four towns by considering all the evidence (and not by referring simply to where shells impacted, as wrongly premised in the Four Defence Reports). Second, although the Prosecution agrees that based on all the expert reports (Prosecution and Defence) the 200-metre margin of error applied by the Chamber is overly narrow, the Rebuttal Reports demonstrate that any greater margin of error found to apply would have required, at a minimum, the use of artillery practices and techniques to minimize collateral damage, which was not done. In this context, in light of all the evidence in the record and notwithstanding either Rajčić's testimony or the Four Defence Reports, it remains the only reasonable inference that the four towns were deliberately treated as targets, at Gotovina's express order.

(a) The Chamber's comprehensive analysis of the evidence of unlawful attack was reasonable and correct

52. Contrary to Gotovina's claim¹³³ and the premise assumed in the Four Defence Reports,¹³⁴ the Chamber's analysis of the use of artillery against the four towns was rigorous and drew upon all the evidence. The Judgement neither changes international

¹³² *Krajišnik* Rebuttal Decision, para.9. The test for rebuttal evidence is distinct from the test for admission of R115 evidence: *Haradinaj* R115 Decision, para.44.

¹³³ *Above* fn.116.

¹³⁴ *E.g.* Scales report, pp.2 (emphasizing fall of shot as the controlling factor in the Chamber's analysis), 11 (referring to a "200 meter standard"); Shoffner report, p.4 (criticising the "200 meter standard", characterised as an "interpretation of international law"); Granville-Chapman report, p.1 (describing the Judgement as concluding "that rounds falling outside the 200 metre box were indicative of a deliberate attempt to fire on" unlawful targets).

law nor exposes professional soldiers to new liability.¹³⁵ Beyond considering the limited issue of where specific artillery shells impacted in the four towns (“fall of shot”), the Chamber considered the Brioni agreement;¹³⁶ Gotovina’s attack order which included an express direction to treat the four towns as targets;¹³⁷ the insufficiency of the designation of specific military targets within the four towns;¹³⁸ the repetition of this direction in orders down the chain of command;¹³⁹ contemporaneous reports from artillery units consistent with this direction;¹⁴⁰ eyewitness evidence consistent with this direction;¹⁴¹ the disregard for civilian safety demonstrated by the disproportionate attacks on Martić;¹⁴² and the coordinated nature of the artillery attack upon the four towns.¹⁴³ The Rebuttal Experts confirm the correctness of this approach, endorsing a rigorous analysis which,

in addition to the fall of shot, considers factors such as: higher commander’s intent and orders; specific tasks given in those orders; the general application and pattern of fire throughout the operation; nature, quality and extent of target lists; modifications to tactics, techniques and procedures to minimize risk; training; a willingness to halt fire missions where the initial analysis is shown to be faulty; and explicit rules of engagement.¹⁴⁴

53. Since the Four Defence Reports neither address nor take into account any of this broader analysis by the Chamber, their challenge to the use of a 200-metre margin of error is of limited significance and could not affect the verdict.

54. The Rebuttal Reports assess the Four Defence Reports as overly narrow and simplistic in their analysis. As General Brown states, “[t]he Defence appears to have latched onto a single erroneous conclusion of the Trial Chamber while ignoring a raft of evidence which suggests that the HV fires [...] were at best reckless and

¹³⁵ E.g. Annex I, p.13; Annex II, p.18 (“The evidence suggests that the use of artillery on Knin was not an appropriately conducted military operation pursuant ‘to accepted technical and tactical standards’”).

¹³⁶ Judgement, paras.1912, 2311.

¹³⁷ Judgement, paras.1194, 1893, 1911.

¹³⁸ Judgement, paras.1172-1173.

¹³⁹ Judgement, paras.1185, 1187, 1402, 1405.

¹⁴⁰ Judgement, paras.1249, 1263-1264, 1407, 1439-1440, 1896, 1911, 1915, 1923, 1927, 1935.

¹⁴¹ Judgement, paras.1269-1270, 1277-1278, 1284, 1287-1288, 1295-1296, 1301, 1309, 1311.

¹⁴² Judgement, paras.1910-1911.

¹⁴³ Judgement, paras.1911, 1923, 1935, 1943.

¹⁴⁴ Annex I, p.10; *see also* p.20; Executive Summary, p.i.

indiscriminate”.¹⁴⁵ Likewise, General Applegate found that “they argue on a very narrow point and frequently use unsubstantiated assertions and apply contradictory arguments when addressing the substantive issue of whether the civilian populations [...] were deliberately targeted in order to drive them from the region.”¹⁴⁶ Applegate notes the inconsistency in Scales’ overall logic: “[I]n emphasising the inherent inaccuracy of these systems to support an argument concerning the nature of their fall of shot, he undermines the case for their widespread use in Knin (and elsewhere) without significant mitigating measures.”¹⁴⁷ The Four Defence Reports make no attempt to reconcile this fundamental flaw in reasoning.

55. The Four Defence Reports are deficient in that they omit to discuss other relevant technicalities of artillery use, and necessary tactical considerations expected when artillery is fired into a civilian town.¹⁴⁸ These additional measures, identified by experts who have personally commanded the use of artillery in urban environments, demonstrate that the Chamber’s analysis was both reasonable and correct. The following factors further justify the finding that the four towns were deliberately placed under fire, and render incredible Rajčić’s isolated contrary evidence:

- the failure to implement the corrective practices and tactical measures reasonably available to the HV to compensate for the substantial risk to civilians and civilian objects,¹⁴⁹ given the significant “error budget” affecting

¹⁴⁵ Annex II, p.2; *see also* p.11. *See also* Annex I, pp.12 (“one must examine the artillery tactics used in the light of this margin of error to reach a balanced judgement”), 13 (“it is the failure to pay appropriate attention to targeting, weapon selection, adjustment etc and the indiscriminate use of harassing fire in residential areas which should be in question, not [...] a narrow judgement over whether a shell fell within 200 or 400m of target”).

¹⁴⁶ Annex I, Executive Summary p.i.; p.20. *See also* p.18 (“a full analysis of the use of HV artillery should rest upon a much broader base” than the position taken in the Four Defence Reports).

¹⁴⁷ Annex I, p.4. *See also* Annex II, p.5 (“Scales’ personal testament ‘to the inherent inaccuracy of these weapons’ does not sit well with his contention that they were ‘well suited’ to neutralization and harassment of enemy positions at Knin, especially given the relatively close proximity of civilians”).

¹⁴⁸ *E.g.* Annex I, pp.9 (noting that Scales’ consideration of the “science” of artillery is sound but omits consideration of the “art” of its application, “which provides greater insight into whether the use of that fire is proportionate, timely and moral”), 11-12, 18 (“the scientific limitations of the artillery system at the time could have been mitigated by appropriate HV orders, tactics, techniques and procedures”), 19.

¹⁴⁹ *E.g.* Annex I, pp.3-9, 11-12, 14-15, 17, 19; Annex II, pp.4-10, 12, 20, 22 (fn.51); Annex III, pp.1-5.

the HV's use of artillery (on which Defence and Rebuttal experts broadly agree);¹⁵⁰

- the generally disproportionate nature of the artillery fire—taking into account characteristics such as its scope, timing and duration—to the limited military threat in Knin;¹⁵¹
- the extensive use of multiple rocket launchers against targets in an urban environment;¹⁵² and
- the absence of any change in the tactical use of artillery fire notwithstanding the significant changes in the tactical environment as the HV advanced toward Knin during 4-5 August.¹⁵³

56. As General Applegate concluded, despite “more than adequate opportunity to improve [the] technical accuracy, targeting and proportionality” of fire,¹⁵⁴ “this was patently not the case in the actions under investigation [...] [T]here is little evidence of mitigation measures nor changes to the tactical handling of the HV artillery. Weapon selection (MRLs) was poor and targeting information woefully inadequate.”¹⁵⁵ “[B]ased on the evidence available, I believe the HV considered the population as the target of the operation and hence the lack of such procedural measures. The failure to apply such measures is at the heart of my judgement on the HV's use of artillery.”¹⁵⁶

¹⁵⁰ E.g. Scales report, pp.5-10; Shoffner report, pp.3-4; Annex I, pp.8, 10-12 (concurring with some of Scales' inferences from the trial record; disputing others); Annex II, pp.5, 7-8, 12, 20.

¹⁵¹ E.g. Annex I, pp.3, 4.

¹⁵² E.g. Annex I, pp.4-7, 14 (“I regard the use of 122mm MRL as inappropriate and disproportionate for use against targets within a town”), 17. *See also* Scales report, fn.5 (“I can testify personally to the inherent inaccuracy of these weapons”); cf. fn.4; Annex III, p.3.

¹⁵³ E.g. Annex I, pp.2, 5-8, 17; Annex II, pp.5-6, 8-10.

¹⁵⁴ Annex I, p.13.

¹⁵⁵ Annex I, p.17. *See also* Annex II, p.18 (“the weapon systems and associated tactics, techniques and procedures used in the bombardment of Knin were [...] reckless, indiscriminate and inappropriate”); Annex III, p.5.

¹⁵⁶ Annex I, p.19 (emphasis supplied).

(b) The margin of error for the relevant weapons indicates an unlawful attack

57. The Rebuttal Reports demonstrate that even if the Chamber erred in its consideration of a margin of error, this could not affect the finding of an unlawful attack or the verdict.¹⁵⁷ The “indiscriminate, reckless and inappropriate” attitude to the use of artillery¹⁵⁸ is plainly inconsistent with the evidence of the training and professionalism of the HV.¹⁵⁹ Indeed, the reckless disregard for any measures to protect the numerous civilians and civilian objects in Knin vulnerable to artillery fire is consistent only with the intent to target the towns and civilian populations as such. The Chamber’s conclusion that Rajčić’s evidence does not raise a reasonable doubt as to the proper interpretation of Gotovina’s order remains the only reasonable inference—both on the basis of the evidence in the trial record and, *arguendo*, the Four Defence Reports and the Rebuttal Reports.¹⁶⁰

58. In his rebuttal report, General Brown evaluated both the Scales and Shoffner reports,¹⁶¹ as well as the firing tables for the HV’s 130mm howitzer and 122mm multiple rocket launcher systems.¹⁶² Although Brown agrees with Scales that 400 metres is more realistic than 200 metres, he states that Scales’ analysis remains “overly simplistic”.¹⁶³ For example, not only do the calculations of Scales and Shoffner fail to take into account the full statistical picture,¹⁶⁴ they are based on

¹⁵⁷ E.g. Annex II, p.2 (“But it does not matter whose figures are accepted by the Court [...] the HV used inappropriate weapon systems for targets in close proximity to the 15000 civilians in Knin, and were both negligent in their tactics, techniques and procedures, as well as indiscriminate in their targeting between military targets and civilians/civilian installations”).

¹⁵⁸ E.g. Annex II, pp.16, 18.

¹⁵⁹ E.g. Annex I, pp.11, 15, 20; Annex II, pp.13, 22. Granville-Chapman also contradicts Scales, opining that the accuracy of HV gunnery was “[i]n many ways [...] remarkable”: see Granville-Chapman report, p.1; Annex I, p.18).

¹⁶⁰ E.g. Judgement, paras.1893,1911.

¹⁶¹ Annex II, p.2.

¹⁶² Annex II, p.2. The Rebuttal Reports are supplemented by the firing tables for the weapon systems used by the HV in Operation Storm: the 130mm howitzer and the 122mm multiple rocket launcher (Annexes IV, V. Partial English translations provided.) These firing tables were provided to the Prosecution by the Croatian authorities on 27 December 2007 in response to a Request for Assistance; they were disclosed to the Defence on 29 February 2008. This material was provided to the rebuttal experts at their express request (See Annex II, p.2).

¹⁶³ Annex II, p.13. See also Annex I, pp.12, 20.

¹⁶⁴ For example, Scales and Shoffner calculate only 6 probable errors rather than 8 probable errors: e.g. Scales report, p.10; Shoffner report, p.3. Accounting for 100% of rounds requires calculation of 8 probable errors (8xPE), see Annex II, Fig.1. See further Annex II, pp.14 (explaining the “Circular Error Probable” as applied by Shoffner), 15 (explaining that one probable error as applied by Scales equates to one “Circular Error Probable”, or two probable errors as applied by Brown).

anecdotal evidence or hypotheticals rather than the actual HV firing table data.¹⁶⁵ Furthermore, although both Scales and Shoffner acknowledge the relevance and significance of ‘external’ factors on probable error, neither give these factors any weight in their estimate of probable error.¹⁶⁶ Their calculations are of marginal assistance at best.

59. Conversely, General Brown’s report takes all these factors into account. Relying on the HV firing table data, he distinguishes between figures based on perfect conditions¹⁶⁷ and his estimate of the “actual” figures taking into account the evidence in the record of the applicable “error budget”¹⁶⁸ (i.e., error inherent to the weapons systems plus error from ‘external’ factors).¹⁶⁹ He concludes that, even if HV fire was confined to the possible military targets identified by the Chamber “very little of Knin and its civilian population would have been safe”.¹⁷⁰ Based on HV firing tables, and applying basic artillery principles, the HV would have known this. Given the HV’s level of skill and training, the reckless disregard for any reasonable measures to minimise this collateral effect¹⁷¹ undermines Rajčić’s testimony regarding Gotovina’s attack order. To the contrary, it supports the conclusion that Gotovina’s order was understood to treat the town as targets, and carried out as such down the chain of command.

¹⁶⁵ E.g. Annex II, pp.2, 17, fns.43-44 (comparing the estimates for probable error range (PER) and probable error deflection (PEd) applied by Scales and Shoffner with firing table data). See further Annex II, p.17 (noting that the Shoffner report is based on his “estimate” whereas the Brown report is based on HV figures).

¹⁶⁶ E.g. Scales report, pp.9-10; Shoffner report, pp.3-4.

¹⁶⁷ For the applicable probable error in perfect conditions (i.e. not including errors for factors other than the inherent accuracy of the weapon system), see Annex II, pp.14 (Fig.2), 15 (Fig.3). See also fns.43, 44, p.17.

¹⁶⁸ See above fn.150.

¹⁶⁹ Brown’s report gives both a technical and a simplified analysis of the margin of error. In his technical analysis, he explains that margin of error is properly calculated as an ellipse (e.g. Annex II, p.14 (Fig.1) and that shells and rockets vary in the proportion of the dimensions of the ellipse (see also Scales report, p.5)). In contrast, the simplified guide is based on a circle. In both instances, he indicates that the margin of error in perfect conditions should be doubled to take account of factors not inherent to the weapon system: Annex II, pp.12-15, 18. Thus, his technical analysis explains that 130mm shells could have landed as far as 616m ‘in front’ or ‘behind’ the aimpoint, or 80m to either ‘side’ (Annex II, p.14 (Fig.2), doubled); 122mm rockets could have landed as far as 624m ‘in front’ or ‘behind’ the aimpoint, or 1,136m to either ‘side’ (Annex II, p.15 (Fig.3), doubled). As a simplified ‘rule of thumb’, he states “collateral damage is likely to occur to any object within a 300m radius from the aimpoint of a 130mm gun or a 600m radius from the aimpoint of a 122m rocket launcher [...] other elements of the error budget [...] could easily have the effect of doubling these distances”: Annex II, p.15.

¹⁷⁰ Annex II, pp.2, 19. Cf. Judgement, Vol.II, fns.932, 935.

¹⁷¹ E.g. Annex I, pp.8, 11, 14.

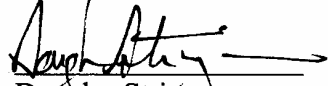
60. Admission of the Four Defence Reports would not and could not affect the Chamber's finding that the artillery attack carried out on the four towns was an unlawful, indiscriminate attack. To the extent that the 200-metre margin is an overly restrictive reflection of the applicable margin of error, the other evidence available to the Chamber amply supports its findings both about the unreliability of Rajčić's evidence and the unlawful nature of the attack as a whole.

IV. CONCLUSION

61. Gotovina's Second R115 Motion should be denied.

Word Count: 8941


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Dated this 27th day of April 2012
At The Hague, The Netherlands

V. GLOSSARY

Pleadings, Orders, Decisions etc. from *Prosecutor v. Ante Gotovina & Mladen Markač*, Case No. IT-06-90

Abbreviation used in Prosecution Response	Full citation
Judgement	<i>Prosecutor v. Ante Gotovina, Ivan Čermak & Mladen Markač</i> , Case No. IT-06-90-T, T.Ch., Judgement, 15 April 2011 (public with confidential appendix).
Gotovina Appellant's Brief	<i>Prosecutor v. Ante Gotovina & Mladen Markač</i> , Case No. IT-06-90-A, Appellant's Brief of Ante Gotovina, 2 August 2011 (public redacted).
Gotovina's EU Motion	<i>Prosecutor v. Ante Gotovina, Ivan Čermak & Mladen Markač</i> , Case No. IT-06-90-T, Defendant Ante Gotovina's Motion to Compel Access to EUMM Archives, 28 December 2007 (Made public by oral Order of 3 April 2009).
Gotovina's First R115 Motion	<i>Prosecutor v. Ante Gotovina & Mladen Markač</i> , Case No. IT-06-90-A, Appellant Ante Gotovina's Motion to Admit New Evidence Pursuant to Rule 115, 27 October 2011 (public redacted version, filed 4 November 2011).
Gotovina's Reply Brief	<i>Prosecutor v. Ante Gotovina & Mladen Markač</i> , Case No. IT-06-90-A, Reply Brief of Appellant Ante Gotovina, 30 September 2011 (public redacted version).
Gotovina Reply to EU Response	<i>Prosecutor v. Ante Gotovina, Ivan Čermak & Mladen Markač</i> , Case No. IT-06-90-T. Gotovina Defence Reply to European Union's Response to Defendant Ante Gotovina's Motion to Enforce the Trial Chamber's Previous Rule 54bis Order Compelling Access to the Archives of the EUMM, 23 April 2009 (public with partly confidential annexes).
Motion	<i>Prosecutor v. Ante Gotovina & Mladen Markač</i> , Case No. IT-06-90-A, Appellant Ante Gotovina's Second Motion to Admit Additional Evidence Pursuant to Rule 115, 30 March 2012 (public redacted version, filed 31 July 2012).
Prosecution Amicus Response	<i>Prosecutor v. Ante Gotovina & Mladen Markač</i> , Case No. IT-06-90-A, Prosecution Response to "Application and Proposed Amicus Curiae Brief" Filed on 13 January 2012, 23 January 2012 (public).

Prosecution Closing Brief	<i>Prosecutor v. Ante Gotovina, Ivan Čermak & Mladen Markač</i> , Case No. IT-06-90-T, Prosecution's Public Redacted Final Trial Brief, 2 August 2010 (public).
[REDACTED]	[REDACTED]
Prosecution Response to Gotovina's First R115	<i>Prosecutor v. Ante Gotovina & Mladen Markač</i> , Case No. IT-06-90-A, Prosecution Response to Gotovina's Rule 115 motion, 28 November 2011 (redacted public version, filed 16 December 2011).
R54bis Decision	<i>Prosecutor v. Ante Gotovina & Mladen Markač</i> , Case No. IT-06-90-A, App.Ch., Decision on Ante Gotovina's Renewed Application for an Order Pursuant to Rule 54 bis Directing the Government of the Republic of Serbia to Produce Documents, 16 November 2011 (public).
Prosecution Response Brief	<i>Prosecutor v. Ante Gotovina & Mladen Markač</i> , Case No. IT-06-90-A, Prosecution Response to Ante Gotovina's Appeal Brief, 12 September 2011 (redacted public version, filed 29 September 2011).

Other ICTY authorities

Abbreviation used in Prosecution Response	Full citation
<i>Delalić</i> Evidence Decision	<i>Prosecutor v. Zejnil Delalić et al</i> , Case No.IT-96-21-T, Decision on the Motion of the Joint Request of the Accused Persons Regarding the Presentation of Evidence, Dated 24 May 1998, 12 June 1998.
<i>Haradinaj</i> R115 Decision	<i>Prosecutor v. Ramush Haradinaj et al</i> , Case No.IT-04-84-AR65.2, Decision on Lahi Brahimaj's Request to Present Additional Evidence under Rule 115, 3 March 2006.
<i>Krajišnik</i> Rebuttal Decision	<i>Prosecutor v. Momčilo Krajišnik</i> , Case No.IT-00-39-A, Decision on Prosecution's Motion to Adduce Rebuttal Material, 8 October 2008 (made public).
<i>Mrkšić</i> Second R115 Decision	<i>Prosecutor v. Mile Mrkšić & Veselin Šljivančanin</i> , Case No. IT-95-13/1-A, App.Ch., Decision on Mrkšić's Second Rule 115 Motion, 13 February 2009 (public).
<i>Naletilić</i> R115 Decision	<i>Prosecutor v. Mladen Naletilić & Vinko Martinović</i> , Case No.IT-98-34-A, Decision on Naletilić's Consolidated Motion to

	Present Additional Evidence, 20 October 2004 (public).
<i>Šainović</i> 115 Decision	<i>Prosecutor v. Nikola Šainović et al</i> , Case No.IT-05-87-A, Decision on Nikola Šainović's Second Motion for Admission of Additional Evidence on Appeal, 8 September 2010 (public).
<i>Tadić</i> Extension Decision	<i>Prosecutor v. Duško Tadić</i> , Case No.IT-94-1-A, Decision on Appellant's Motion for the Extension of the Time-Limit and Admission of Additional Evidence, 15 October 1998 (public).

Other Abbreviations

Abbreviation used in Prosecution Response	Full citation
BCS	Bosnian/Croatian/Serbian
BiH	Bosnia and Herzegovina
Chamber	Trial Chamber in <i>Prosecutor v. Ante Gotovina, Ivan Čermak & Mladen Markač</i> , Case No. IT-06-90-T
[REDACTED]	[REDACTED]
Exh.	Exhibit
Exhs.	Exhibits
EU	European Union
HV	<i>Hrvatska Vojska</i> – Croatian Army
ISAF	International Security Assistance Force
FRY	Federal Republic of Yugoslavia
para.	Paragraph
paras.	Paragraphs
p.	Page
R	Rule
RS	Republika Srpska
RSK	Republika Srpska Krajina (Republic of Serb Krajina)

R115	Rule 115 of the Rules of Evidence and Procedure of the International Criminal Tribunal for the Former Yugoslavia
SDC	Supreme Defence Council
SVK	Srpska Vojska Krajine (Serbian Army of Krajina)
T.	Trial Transcript
UN	United Nations
UNMO	United Nations Military Observer
UNCRO	United Nations Confidence Restoration Operation
[REDACTED]	[REDACTED]

Public Annex I

LT GENERAL APPELATE - EXECUTIVE SUMMARY

In reviewing the evidence of Generals Scales, Griffith, Shoffner and Granville-Chapman, I concur with their arguments concerning the specific ruling that the 200m zone of error for the use of artillery fire is inappropriate and fails to take into account the characteristics of the artillery weapon system, and that 400m is a more appropriate rule of thumb. However, I find they argue on a very narrow point and frequently use unsubstantiated assertions and apply contradictory arguments when addressing the substantive issue of whether the civilian populations of Knin and other towns were deliberately targeted in order to drive them from the region.

I argue that this wider judgement should be made against a broader set of factors which consider, *inter alia*: the overall objectives of the operation; the general pattern of fire; and the orders, tactics, techniques and procedures used by the HV artillery. When so doing, and based on the evidence I have read and my own experience of engaging targets in Sarajevo with artillery fire in this same period, I find that the HV, at the very least, failed to exercise due care in the application of artillery fire during Operation Storm; they certainly failed to meet the standards laid out by Gen Griffith in his evidence.

Only a very few military targets were the subject of neutralization fire, and those that were appear to have been neutralized accurately and quickly on the first day. The general pattern of fire throughout the remaining period was one of harassment of the general area. I find it highly unlikely that the HV did not have Knin under some level of observation at the beginning of the first day and simply incredible in the light of the evidence of adjustment and supporting fire to units that they did not achieve over-watch as the Serb defensive front collapsed and HV units infiltrated into the Serb depth. In such circumstances, it would have been possible to exercise greater discrimination in the application of artillery fire, but I found no evidence that this was the case.

I could find no evidence which indicated that the command and handling of HV artillery demonstrated endemic incompetence or lack of training and experience. There was time and opportunity to introduce and practice the necessary tactics and mitigating techniques and procedures if there had been a will to do so. Consequently, I consider that civilian casualties were not only regarded as irrelevant in the general scheme of fire, but a specific target in their own right in order to cause panic and demoralization.

I found a common thread running from discussions at Brioni, through the subsequent orders issued for Operation Storm and to subordinate artillery units, to the application of widespread fire throughout residential areas of Knin and other towns and villages. I cite in evidence:

- That the intent of Operation Storm was to force the Serb population from the area by engendering fear and panic, and that the widespread use of indiscriminate harassing fires was consistent with this stated goal.
- 'Putting towns under fire' was a deliberate tactic and stated as an extra and specific task within subordinate unit orders.
- Targets were rarely described by the nature of the enemy at the location, rather by their physical location, which suggests there was no concern over the conditions in the target area at the time of firing, nor if those targets were occupied by civilians.
- There was no priority placed on maintaining accurate and up-to-date target lists.
- The pattern of fire covered the general area of Knin and was not limited to the vicinity of recognized military targets.
- Evidence in war diaries noted that Knin would be kept under fire in uneven intervals, and that fire was directed "in the general area of Knin" rather than against specific enemy targets.
- Inappropriate selection of weapons, specifically the frequent and extended use of MRLs in urban areas. MRLs are not appropriate for point targets in civilian occupied urban areas, and I could find only occasional consideration of an intention to limit collateral damage and civilian casualties - primarily in after-action reviews.

- There were neither direct instructions concerning rules of engagement (ROE) nor any general instructions on restricted engagement areas. Where ROEs were mentioned, the term appears to be used not in the accepted sense but rather to describe artillery tactics and target prioritization.
- There is little evidence of defensive activity within Knin, nor of defensive fires emanating from Knin that would have merited the continuation of neutralization and harassing fires.

Lt Gen (Ret'd) RAD Applegate CB, OBE

Lieutenant General (Ret'd) RAD Applegate, CB, OBE

Lieutenant General Applegate served in the British Army for 37 years, retiring in 2010. Latterly he was a member of the leadership board of the Army, first as Master General of the Ordnance and then as Quartermaster General. He was also Chief of Materiel in the defence acquisition and support organisation, and a member of the Main and Executive boards in that organisation. He had particular responsibility for the provision of urgent equipment requirements and logistic support for operations in Iraq and Afghanistan.

In senior staff appointments as a Major General and Brigadier, he was responsible for the conceptual development, planning, research and financial programming for a wide variety of equipment capabilities, including artillery systems. He has also been responsible for the conceptual development activity of the British Army, designing the standard methodology now used for all military capability planning in the UK, the so called 'lines of development' process.

He joined the Royal Artillery on commissioning, commanding tracked, towed and airmobile field artillery from junior officer to the rank of Brigadier, the latter incorporating the role of deputy Divisional Commander for operations for the UK's 3rd Division. As a Gunner, he has served in UK, Germany, Central America, Asia and Africa, and conducted combat operations in Kosovo and Bosnia, and intelligence duties in Northern Ireland.

In Bosnia, he deployed his airmobile artillery regiment to Bosnia in 1995, without a mission and at no notice due to the uncertainty of events at the time. There he established and assumed command of the UK/NL artillery battlegroup under UNPROFOR command, developing procedures and tactics for engaging targets in the populated urban areas of Sarajevo, and creating the artillery rules of engagement for subsequent artillery operations. His force then became part of the European Rapid Reaction Force artillery group deployed in Sarajevo and on Mount Igman. There he took under command French artillery and mortar systems, and established and commanded the surveillance and targeting centre for all artillery fires.

The unit subsequently fired into and around Sarajevo in support of Operation Deliberate Force. In total, his force consisted of 12x105mm guns, 6x155mm self-propelled howitzers, 12x120mm mortars, 5 artillery locating radars, a sound-ranging troop, a company of armoured infantry, a troop of armoured engineers, a meteorological section and numerous observation parties and sniper teams. In total, the force fired 1499 rounds and conducted 56 fire missions. He was awarded the OBE in UK's 1996 Operational honours list and made an Honorary French Foreign Legionnaire in the same year for his command of Foreign Legion forces. His organisation and handling of this force were subsequently used as a case study in UK doctrine, and the basis of a study by UK's science and technology laboratory into the use of surveillance and targeting networks.

He has written on artillery system development and concepts for military operations in complex environments, winning the Thales essay competition. He has been a frequent contributor to international journals and has lectured widely on firepower issues, capability planning and acquisition. He is a regular lecturer to industry and the Swiss higher command and staff course. He was the only non-US member of the Pentagon's Army/Marine Corps Board, which sought improved inter-operability and force development to support operations in Iraq and Afghanistan. For his contribution on this Board and wider US/UK cooperation in technology and acquisition, he was awarded the US Legion of Merit (Officer Class) in 2007.

LT GENERAL APPLGATE'S COMMENTS ON EXPERT WITNESS REPORTSMethod

My analysis is based on targeted reading of the Judgement Summary, Volume 1 (paras 1163-1175 and 1176-1476) and Volume 2 (paras 1892-1945, 1970-1996 and 2303-2321), plus a number of further exhibits relating to military orders, artillery reports, target lists, maps and reviews of artillery action conducted after the operation. I have focused principally on the actions in and around Knin, but have also reviewed evidence of artillery activity in other areas - notably Benkovac, Gračac and Obrovac - in order to gain a view of any general pattern in the use of artillery.

Where appropriate, I have reviewed my own experience as the Rapid Reaction Force artillery commander in and around Sarajevo from May to December 1995. My responsibilities included command and coordination of surveillance, targeting and indirect fire in support of UN forces, Operation Deliberate Force and the transition to NATO command for the subsequent imposition of the peace deal.

I have structured my comments (in black) against a set of specific questions (shown in blue). Many of the questions are inter-related but I have sought to limit repetition as much as possible.

Report of Major General (ret) Robert H. Scales, Jr., Proposed Defence Exhibit DA20

1. In Section 5, General Scales states that the Croatian Army ("HV") fired into Knin to achieve the effects of neutralization and harassment. He further states that "the weapons employed, Soviet 130mm guns and 122mm rockets, were well suited to achieve these effects."

a. Please describe the distinction between neutralization fires and harassment fires.

There are various doctrinal distinctions, but in essence neutralization fires are designed to prevent a target (personnel, vehicles, installations, artillery etc) from continuing with its mission or to degrade its performance, thereby gaining military advantage. In view of the difficulty of achieving destruction of many targets (essentially due to excessive ammunition expenditure and time requirements for indirect artillery fire when not using precision munitions), neutralization is the most frequent type of mission for artillery systems. It is usually conducted using high explosive or smoke, depending on the characteristics of the target and the effect desired by the attacking force.

Harassment fires are largely designed to produce a psychological effect or to shape the actions of an opponent over an extended period of time (for example through forcing the use of alternative routes, to deny a location or cause panic). They are routinely conducted in an unpredictable manner to heighten the psychological effect. They are more efficient in the use of ammunition and weapon systems, but effects cannot be guaranteed. They are frequently conducted using a pre-planned fire plan, and against locations and targets which are important to the opponent. As a result, the fire is not usually timed to hit a specific target at a particular time, but is speculative and based on an expectation of probable enemy activity.

b. Please comment on whether you agree that harassment and neutralization fires were directed against Knin.

I agree that both tactical techniques were used on Knin. It is stated that the attack against Martić was designed to try and kill him or to prevent him taking command of Knin defence (neutralization); Mrksić also mentions that he was forced to take shelter¹ and that the artillery fire delayed movement through the town. The fires against the intersection are classic harassment missions.

c. If so, please comment on the HV's tactic of directing harassment and neutralization fires against Knin.

HV neutralization fires were conducted against specific military targets on both 4th and 5th August, but the number of military targets was very small on both days and from the statements of a large number of experienced witnesses (eg Forand, Leslie, Dawes and Hill) the pattern of fire was more widespread than required by the small quantity of Serb forces in Knin. I would have expected harassment missions to decline by 5th August at the latest as the town should have been under observation by this time, thereby allowing more targeted fire. From the evidence, I judge that the HV forces were firing at a number of fixed locations throughout the town, only some of which related to known military or para-military positions.

Gen Scales mentions that the fires were not in keeping with soviet ammunition norms: I believe this is an irrelevance. Earlier JNA doctrine did not follow soviet doctrine slavishly and artillery numbers and ammunition levels were necessarily limited in comparison to soviet standards. Also the tactics and pattern of use of artillery fire in the Balkans

¹ Vol 1, para 1269.

developed over a number of years of hard-won experience to reflect the realities of combat in this theatre of operations.

d. Please comment on the extent of any military advantage in using harassment fire against targets in Knin.

I would expect the harassment fire to have had psychological effects against military, para-military and civilian personnel in the town. Indeed there is evidence of one inexperienced officer committing suicide due to the effects of the shelling². The fire would have kept up a form of constant pressure and heightened a sense of powerlessness among the occupants. I found little evidence of Serb fires from Knin warranting the continuation of such fires and there is only limited evidence of Serb forces transiting through the town. The use of harassment fires in a civilian-occupied area needs very careful planning and over-sight in view of the high likelihood of collateral damage and civilian casualties.

e. Please comment on whether the HV's firing on targets in Knin was appropriate from a military perspective to achieve the effects of neutralization and harassment.

The evidence over the two days indicates that there was very little by way of any coordinated defensive effort, suggesting such forces as were in Knin were already of limited military effectiveness. Intelligence reports discussed at the Brioni conference had identified movement out of the town and it was decided to leave routes out of the area in order to encourage a withdrawal by the Serb forces and population³. At the meeting there was a discussion about creating panic around Knin and the use of artillery to create a sense of demoralization⁴.

The neutralization of the few military targets should have been achieved in the first few hours of the 4th August. In light of the available orders, target lists and subsequent pattern of fire, I assess that the main target soon became the town itself rather than obvious military targets. This is in keeping with the direction that the towns should be 'placed under artillery fire', a thread which runs from the Brioni meeting, through the artillery orders and target lists to the nature of the fire missions and effects produced.

The target lists are instructive. Rarely is a target described by the enemy at that location, but rather as a list of geographical co-ordinates. As highlighted by Konings⁵, detailed target descriptions are essential to ensure that the correct weapon system, and pattern and weight of fire are selected to achieve the desired goal of the fire mission. It is also a matter of professional competence and pride to ensure that the information on the target is as up-to-date as possible, which is usually achieved through a mixture of intelligence and observation. I see no evidence of the HV attempting to develop the quality of these target lists and can only assume that the level of detail they contained was appropriate for the general purpose of the fire, namely the engagement of the terrain and not because of any enemy forces in those areas. I also found no evidence of any detailed 'proportionality analysis' as mentioned by Corn⁶ conducted prior to or during the operation and will examine the wider issue of rules of engagement (ROEs) and limiting the likelihood of civilian casualties later when I assess weapon selection.

² Vol 1, para 1269

³ Vol 2, paras 1974 and 1975

⁴ Vol 2, para 1975

⁵ Vol 1, para 1172

⁶ Vol 1, para 1171

In sum, I judge the artillery fire to have been disproportionate to deal with the military threat, but entirely appropriate to a mission designed to create panic and drive the occupants from the town, not least by the widespread and extended use of harassing fire against the urban area.

- f. Please comment on whether 130-mm guns and 122-mm rockets would have been “well suited” to neutralization and harassment of enemy operations in Knin.

These weapons would have been “well suited” to neutralization and harassment of enemy *military* operations in and around Knin, but the fact that the town was occupied by civilians at the time demanded greater care in the choice of targets, and the matching of weapon and effects to the target. The use of 130mm would have provided greater effect against buildings (heavier shell and variety of fuses) and a tighter ‘zone of fire’ at range than the MRLs – indeed much of the neutralization fire appears to have been remarkably accurate. Their fire can also be ‘converged’ to minimize the spread of fire and hence the likelihood of collateral damage; such fire is also better suited for observed attacks against point targets.

- g. Please compare and comment on General Scales’ statement that the 130-mm guns and 122-mm rockets were “well suited” to neutralization and harassment of enemy operations in Knin vis-à-vis footnote 5 of his report, where he states that he “can testify personally to the inherent inaccuracy of these weapons.”

This comment illustrates an inconsistency in Gen Scales’ overall logic: in emphasising the inherent inaccuracy of these systems to support an argument concerning the nature of their fall of shot, he undermines the case for their widespread use in Knin (and elsewhere) without significant mitigating measures. In my judgement, the use of 130mm artillery would have been acceptable given great care in planning and subsequent adjustment and registration at the earliest opportunity - realistically once the initial shock bombardment had been completed. The evidence indicates that accurate fire was produced against some military targets⁷.

The use of MRL systems in such built-up areas is more surprising in view of the wider dispersal of their rockets: they are better suited to the engagement of large areas or groupings of forces. It is of note that the MLRS rocket system – a superior system to that used by the HV and mentioned in Gen Scales’s evidence - was not deployed to support UN forces in Bosnia because of its inherently larger spread of fire and lack of discrimination when engaging targets in built-up areas occupied by non-combatants. Rajcic noted after the event that MRLs were inappropriate against certain point targets⁸.

As a former artillery commander, I would have expected MRLs to have been used sparingly and with more discretion if there had been a desire to minimize civilian casualties. They would have been appropriate for use against the air defence site, on the edges of the town, against forward defensive positions, and to counter any counter-attack, but I could find no evidence that these were the tactics used. Their use was more routine and included the engagement of targets in Knin and other towns.

Despite the general characteristics of these weapons, I have found only limited reference to measures designed to mitigate civilian casualties, or that can be implied to refer to this end. There is mention of avoiding casualties to the UN post; secondly, in firing early in

⁷ In Vol 1, para 1269, Mrksic notes the very accurate fire against his command post. In paras 1285, 1287 and 1288 Dawes and Dreyer note the bracketing of their vehicle. In para 1327 Dreyer states his belief that rounds were adjusted against civilians near the UN base, albeit the source of the fire is unclear.

⁸ Vol 1, 1183-84

the morning against Martić when civilians were most likely off the streets (but fire continued through the next day and a half); in the HV General Staff Operational Directive⁹; and in the post-operational analysis by Rajčić¹⁰. In the latter, he states that the ROE used were consistent with those contained in Chapter 6, p213-217 of a 1983 JNA manual, *'Artillery regiment (brigade) for Support (JNA), 1983 - Combat in populated area'*¹¹. I have been unable to review this publication. However, I believe Rajčić was discussing tactics, not ROEs and cite Turkalj's statement that there were no rules of engagement *per se*, but artillery tactics: in Exh P02336 the targets are listed in priority order, not with respect to any collateral damage or proportionality analysis.

I have found no specific direction concerning mitigation measures in lower level orders, no listing of restricted engagement zones in view of the risk of civilian casualties or collateral damage, and no obvious evidence that improving the accuracy and focusing of fire was a priority as the operation developed. Rather I note in Chief of Artillery First's orders¹² to put Benkovac, Obrovac and Gračac under fire as a separate task; that these are then repeated in Fuzul's orders for Benkovac and Obrovac; in the attacking orders for artillery for Operation Storm¹³ and that 3 TRS tasks included shelling the towns of Drvar, Knin, Benkovac, Obrovac and Gračac.

I regard the continued use of MRL against urban targets as entirely disproportionate in view of the known presence of civilians in the town, the limited number of specific military targets, the lack of resistance and the absence of mitigation measures to minimize collateral damage and civilian casualties. The use of such systems was either due to poor command and tactical handling of the artillery, a conscious decision 'to put the town under fire' or carelessness towards civilian casualties: I judge it to have been a combination of the last two factors.

2. In Section 7, General Scales states, "Missions fired against Knin in Operation Storm, by definition were GS [General Support] fires by long range rockets and guns designed for that purpose."

a. Please comment on whether you agree that the artillery missions against Knin were GS fires.

Doctrinally, GS fires tend to support the overall operation rather than providing support to a specific subordinate unit. Command is normally retained at the formation (higher) level. Its priority task is usually the depth battle, but it can be used to reinforce the contact/close battle when required. They can be both observed and unobserved. On the balance of evidence, I find that the fires against Knin were primarily GS in the sense that they were engaging depth targets: I saw only limited evidence of a close battle in or around the town, for example in Exh P02336, page 10, it is stated that 47 shells were fired into Knin at the request of supported units.

b. If so, please comment on the HV's tactic of conducting GS fires against Knin during Operation Storm.

As a tactic, the selective use of depth GS fires is understandable and can be judged as appropriate for the initial fire on 4th August. I would have expected the fire to have been increasingly controlled by observers over time, and by other HV manoeuvre forces as

⁹ Exh D00956

¹⁰ Exh P02336

¹¹ Exh P02336, p9

¹² Exh P01201

¹³ Exh D00970

they approached Knin, and certainly by 5th August: this should have resulted in a reduction in the level of fire in the light of the small numbers of military targets and lack of resistance. The categorization as GS fire does not negate the need for careful target analysis and location, plus modification to the fire as events developed during the operation.

3. In Section 7, General Scales states, "Individual fire missions were directed against relatively small area targets, such as command and control facilities, where lethal effects are achieved by selecting a single point of aim, allowing the natural wide dispersion of such fires to cover the target."

a. Please comment on whether you agree that the artillery attack against Knin was directed at "relatively small area targets."

This was true in the case of certain targets, including the initial attack against Martić, the SVK Main Staff, HQ of RSK and a roundabout¹⁴. But it is equally clear that the nature of the fire – not least in the use of MRLs – was inconsistent with the engagement of only point or small area targets and careless in their consideration of the impact on the local population. I note particularly Colonel Leslie's comment¹⁵ that from 7am onwards on the 4th August the mass of shells fell mainly on the residential areas. I also note Gen Forand's view that "the shelling of Knin on 4th and 5th August 1995 was indiscriminate and directed against the civilian population to create mass panic"¹⁶

b. If so, please comment on the HV's tactic of directing artillery fire against "relatively small area targets" in Knin during Operation Storm.

In the absence of observation and measures to minimize the artillery 'error budget', such targets would require large volumes of fire. Normal practice is to adjust fire first, using single rounds, and only adopt salvo fire once an adjusting round had been seen to fall in the near vicinity of the point target.

Using examples from my own experience firing into and around Sarajevo, we used modified adjustment techniques (eg firing single rounds onto an open area then adjusting onto the target line once the fire was seen to be falling 'true'). We also used smoke rounds where collateral damage risks were considered high, or to see the fall of shot over extended distance, or when it might fall out of view behind buildings. We also identified a number of restricted engagement zones based on a detailed analysis of known residential areas, hospitals or sites of special significance eg churches and mosques. I have seen no evidence that such techniques were used to mitigate the risk of using artillery fire in any occupied town.

4. The artillery attack against Knin employed 130-mm guns and 122-mm rockets. The Trial Chamber found in paragraph 1233 of the Judgement that the civilian population of Knin was at least 15,000 at the time Operation Storm was launched on 4 August 1995.

a. In your opinion, was the use of 130-mm guns and 122-mm rockets to strike targets in the town of Knin an appropriate use of those weapons systems? Please comment.

I have already stated that in my professional judgement and experience, the use of MRL systems within the town was not proportional in the absence of any obvious mitigation

¹⁴ Vol 1 para 1244

¹⁵ Vol 1 para 1278 -79

¹⁶ Vol 1 para 1336

techniques, or significant Serb resistance. I disagree with Corn's assessment¹⁷ that a commander could make "a good faith determination that rocket artillery is better suited to achieve the desired effect" in such circumstances. The use of 130mm guns could be considered more appropriate against known or suspected military targets, but I would have expected to see increasing discretion in their use after the initial shock barrage: instead the same pattern of fire seems to have continued throughout the operation. Even when used, I would still have expected to see the number of rounds fired and choice of weapon (ie HE or smoke rounds, and airburst, point detonating or delay fuses) to be based on careful analysis of the target.

- b. To what extent, if any, does the appropriateness of firing 130-mm guns and 122-mm rockets into Knin depend on whether the HV was:
 - (1) directing neutralization and harassment fires against Knin;
 - (2) using GS fires against Knin; or
 - (3) directing fire against "relatively small area targets"?
 Feel free to address the factors together or in isolation.

As I have mentioned, 130mm would have been the most appropriate system to engage small targets given the limited choice of weapons available, and providing the appropriate tactics, techniques and procedures were also applied. The decision on weapon selection depends more on the degree of accuracy required, the characteristics of the target, the need to minimize collateral damage and non-combatant casualties, and the lie of the surrounding terrain.

5. On page 9, 1st paragraph, General Scales states, "It does not appear that the HV artillery or MBRLs had the opportunity to register targets at Knin." In Section 12, General Scales states, "All rounds at issue on 4 and 5 August were both unregistered and unobserved. Thus, tracking doctrine, all 900 rounds effectively were 'first rounds,' since none of the rounds fired over two days could have been adjusted closer to the target than the initial rounds fired."

- a. Please comment on the HV firing all rounds unregistered into Knin.

I have found no evidence to suggest that targets were registered before the initial attack on 4th August.

If Gen Scales is correct, the lack of registration would have made it even more important to consider the use of mitigating techniques and tactics. I would point out that I was not allowed to register targets nor conduct live firing training prior to engaging targets in and around Sarajevo in support of Deliberate Force, and hence I emphasized the importance of using mitigating techniques and tactics to reduce the operational risks. I note that the HV conducted extensive training, including live firing, prior to the operation and had conducted testing operations earlier that year. They may also have had an opportunity to calibrate their weapons (a significant source of gun-end errors, not mentioned by Gen Scales).

Gen Scales notes in Footnote 11 that "*pre-digitization, no American artillery unit would be permitted to fire a GS preparatory and harassment mission without first registering*". I agree that this was a general standard within NATO, but it could be broken in extremis. I also find his comment revealing: if HV artillery had not pre-registered, the widespread use of GS fires into a known occupied town would have been indiscriminate. A failure to improve the accuracy of fires as the operation progressed would have compounded this act of negligence, or have been evidence that minimizing collateral damage and civilian casualties were not of operational significance.

¹⁷ Vol 1, para 1166

b. Please comment on the HV firing all rounds unobserved into Knin.

This appears to be an assertion not supported by the evidence. The HV did not seem to lack intelligence assets. They utilized UAV, air and electronic surveillance, and, as Rajcic states, also deployed some 22 OPs (observation posts) and numerous infantry OPs¹⁸; I would also have expected them to have made great use of human intelligence sources. Importantly, the quality of the information should have increased as HV forces approached Knin: the need to improve one's intelligence picture is a pre-requisite in any military operation. I find it incredible that the HV would not have sought observation of Knin in view of its importance and the earlier availability of intelligence which informed their plans and discussions at Brioni.

I note that Gotovina stated at the Brioni meeting that his "weapons were directly guided" and "could attack very precisely" when questioned about the danger of hitting the UN base¹⁹. I also note that "artillery OPs are to be positioned so as to offer full view of whole zone ... and enable confidence in handling artillery fire"²⁰. This was either a case of extreme bravado or based on his knowledge of the intelligence and surveillance capabilities at his disposal.

The deployment of a large number of OPs shows a clear understanding of the need to observe terrain, gain information on enemy deployments and focus one's own firepower and manoeuvre to gain an operational advantage. If the HV did have observation, I would have expected artillery fire into Knin to have been adjusted and modulated in order to minimize civilian casualties if it had been an operational priority. If they did not have observation, the widespread and extended use of artillery fire was even more indiscriminate and careless of the lives of those within the town. On both counts, the widespread and extensive use of artillery fire was disproportionate to the threat.

c. Please comment on the HV firing 900 rounds over two days into Knin without adjusting rounds closer to the target.

The evidence is mixed, with Leslie, Dreyer and Dawes noting the use of adjustment of fire or bracketing. I would also expect targets to have been adjusted as the operation developed and observation improved. This would be particularly true in the handling of mortars, largely ignored in Gen Scales's evidence. Of course, if the main aim of the artillery fire was to bring the town(s) under fire there would have been less need to adjust as the effect would have been to induce a sense of fear and panic among the population, and simply hitting the town would have represented a sufficient level of accuracy.

d. Please comment on General Scales' conclusion on page 9, 1st paragraph that registration fires "normally would not be employed in relation to an attack such as that conducted by the HV" and that "[u]se of registration fires doubtless would have compromised the attack's shock effect...."

I concur with this point for the initial fire missions only, but disagree that this would have remained true as the operation continued and the shock effect lost.

e. Please compare and comment on General Scales' discussion of registration in the main text in pages 8-9 vis-à-vis his statement in footnote 11 that "pre-digitization, no

¹⁸ Vol 1, para 1182

¹⁹ Vol 2 para 1977

²⁰ Exh PO1273

American artillery unit would be permitted to fire a GS preparatory and harassment mission without first registering.”

I cannot comment on US practice, but the need to fire a registration mission should depend on an assessment of the situation including the operational conditions and circumstances, the stability of the meteorological conditions, whether the targets had been engaged before, the characteristics of those targets, the desired effects, and the level of confidence in the calibration and location of the firing systems. The firing of a registration mission is therefore highly desirable but not essential in all circumstances. If registration has not been possible, it reinforces the need to exercise greater care in the planning and execution of fires to minimize operational and collateral risk²¹.

6. In Section 6, General Scales states that “general support missions are predictive (unobserved, or ‘shooting off a map’)” and that “the GS mission provides unobserved, longer range fires”.

a. Please comment on whether GS fires are unobserved.

I have already noted that GS fires can be observed. GS fires can be predicted, but such fire might also be adjusted by special forces, observers infiltrated into the area, UAVs etc. I note that the HV had possessed and used UAVs since 1993²² (and in this were in advance of many NATO countries), had made extensive use of infiltration tactics in earlier operations and had their own special forces. On the balance of evidence, I think it would be realistic to conclude that some or all of these techniques were available to improve the accuracy and general effectiveness of GS fire.

b. Please comment on whether or to what extent difficulty in establishing observation of the target affects a decision to employ GS fires and/or to engage certain targets.

Any uncertainty as to the target and/or the conditions in the surrounding area should inform the planning and execution of such missions. Much greater discretion should be applied in engaging targets which cannot be observed. An artillery commander or observer must then exercise judgement to decide whether the balance of operational benefit outweighs the risks for each and every mission.

7. In Section 8, pages 5-9, General Scales discusses the factors bearing on the accuracy of fires.

a. Please comment on General Scales’ discussion.

General Scales – like Konings - provides a good, but not complete, description of many of the factors bearing on the accuracy of indirect artillery fire. His consideration of the science of artillery is sound, but I see little discussion on the ‘art’ of its application in the light of certain scientific truths. It is the application of fire which provides greater insight into whether the use of that fire is proportionate, timely and moral.

b. Please compare and comment on General Scales’ discussion vis-à-vis the factors bearing on accuracy discussed in paragraph 1898 and other parts of the Judgement.

²¹ For example, my own preparatory fire on Bosnian Serb positions in and around Sarajevo was conducted without preliminary registration. Targets were selected with care after much prior analysis and gaming, and kept under constant observation.

²² Vol 1, para 1177.

I believe the criterion of whether the rounds fell within 200 rounds of a known target has some validity, but cannot be definitive in and of itself: it should be but one factor in reaching a balanced judgement. I do not believe that rounds falling just outside of 200m from a known target definitively prove that the firing was indiscriminate and non-proportional, not least because the 'outliers' mentioned by Gen Scales cannot be avoided, nor can one banish human error.

Any calculation requires an understanding of the centre point of aim against which the measurement is taken. Clearly this is relatively simple for a point target such as an individual building, but is much more difficult if the target itself is spread over an area or irregular in shape. I would recommend that any definitive judgement should be based on a more thorough analysis which, in addition to the fall of shot, considers factors such as: higher commander's Intent and orders; specific tasks given in those orders; the general application and pattern of fire throughout the operation; nature, quality and extent of target lists; modifications to tactics, techniques and procedures to minimize risk; training; a willingness to halt fire missions where the initial analysis is shown to be faulty; and explicit rules of engagement. Such an approach recognizes the characteristics of the weapon system, retains its utility in the messy business of combat, underpins acceptable standards of use, informs operational judgements over acceptable risk and allows its practitioners to plan and execute their missions with confidence.

8. In Sections 8 and 10, General Scales notes factors that would affect HV artillery accuracy, including:

- The 130-mm guns and 122-mm rockets "were fired at the extreme limits of range (122 mm MBRLs, 19,000 meters and 130 guns, 26,000 meters)." (page 6, 1st bullet)

I concur: the potential for error increases with range.

- "The HV artillery appears to have relied generally on classic 'map spot' techniques" when locating targets, introducing "a target error of 100 meters—and likely somewhat more." (page 7, 1st bullet)

I am not convinced the evidence supports this statement. Targets were often stated with an accuracy of 10 figures (a 1 metre error, albeit that does not guarantee a hit within 1 metre), were clearly identifiable from existing mapping and survey (rather than moving or distant from an identifiable feature – much more difficult propositions), and would have been able to be assessed against a wide range of intelligence sources.

- "None of the artillery pieces employed in the Knin missions were surveyed. They were located using the 'resection' technique." (page 7, 2nd bullet)

I found no evidence to support this statement. Resection is a valid method of survey and could also involve survey schemes from known and very accurately surveyed points. GPS was in its infancy in this period and I used largely similar techniques to survey my own gun and mortar positions on Mount Igman.

- "At best, HV artillery appears to have set direction by either a Soviet compass (creating at least 10-15 mil error, on average) or by an aiming circle from the firing position, giving rise to 5-10 mils of error." (page 7, 3rd bullet)

I found no evidence to this effect. If true, I would need to know whether these techniques supplemented laying weapons using the sights on the weapons. Regardless, the use of a compass is an accepted reversionary technique and often used by staff

checking for safety. I am unclear what is meant by the term 'aiming circle', albeit the UK used to use a form of plotting chart prior to the introduction of fire control computers.

- "There is no evidence that the HV units in this engagement aggregated common lots or separated out those 'odd' lots, without which this can become the greatest source of error for mass, unobserved fires." (page 8, 1st paragraph)

I concur.

- "[T]he range dispersions shown on the survey charts for some of these targets suggest rocket range 'creep,' which could mean that some of the launcher vehicles were not adequately grounded." (page 8, 2nd bullet)

I concur, which makes the selection of rocket systems to engage targets in occupied towns even more surprising.

- "The most telling technical shortcoming of HV artillery operations at Knin was the lack of an accurate meteorological message prior to firing." (page 10, 1st bullet)

I believe this assertion is only partially accurate. I note explicit mention of weather conditions in Exh P02467, the diary of Rudolf Franjcec, commanding a platoon of 122mm MRLs. In addition, errors such as 'met' can be 'shot out' in the course of an operation given observation of the fall of shot. Indeed, I would expect it to have been an operational priority.

- "Quality of artillery materiel, guns, rocket launchers and ammunition was highly questionable." (page 10, 3rd bullet)

I could not find any evidence for this assertion.

- "[M]ost if not all of [HV artillerymen] were inexperienced gunners." (page 10, 4th bullet)

I could not find the evidence for this assertion, rather to the contrary. I note that extensive preparation and training had occurred prior to the operation and there had been a number of combat operations prior to this attack in which many of the artillerymen must have taken part, thereby gaining invaluable experience. Artillery was also a prestigious weapon system in the Balkans and effectiveness in its handling was seen as key element in reducing the level of infantry casualties, a major concern for Tudman in the Brioni meeting.

Specifically, Rajcic states²³ that in 1994, 750 artillery personnel and units were trained under the Promina-94 exercise and they also conducted live firing training in Bandira-94. Intelligence and artillery staff also visited the HV Main staff to coordinate their activity. According to Rajcic, Gotovina was also aware of the relative inaccuracy of artillery and considered that the HV had trained, experienced artillery troops who were able to exceed the standards of precision in artillery fire²⁴.

a. Please comment on how these factors would affect HV artillery accuracy. Feel free to address the factors together or in isolation.

Much of this evidence rightly describes some of the factors which contribute to the accuracy of the artillery system, but it is not exhaustive. For example, there are errors

²³ Vol 1, para 1178

²⁴ Vol 1, para 1183

relating to target location, the lie of the land in the target area and even rotation of the earth for long range fires. The more important issue is how one seeks to minimize these effects through sensible planning, training, weapon siting, adjustment to shoot-out the accumulated errors and the application of appropriate artillery tactics – the ‘art’ element I mentioned earlier. The art lies in minimizing the inherent weaknesses of the artillery system and maximizing its strengths relative to enemy, place, time and mission. The tactics must be based on judgements which ensure the fire is applied in a professionally competent and morally responsible manner, as emphasized in General Shoffner’s evidence.

- b. Please comment on how these factors would affect a commander's decision to launch an artillery attack against “relatively small area targets” in Knin. Feel free to address the factors together or in isolation.

See my comments above. The bottom line is that such fires needed to be planned and executed with great care.

9. In Sections 3, 10 and 12, General Scales concludes that the Trial Chamber’s 200-meter margin of error is too restrictive and that a 400-meter standard would be “more accurate and realistic.”

- a. Please comment on General Scales’ conclusion.

I concur that this would be a more acceptable ‘rule of thumb’, but it still remains a rule of thumb and not sufficient in and of itself.

- Please comment on whether or to what extent the applicable margin of error affects the analysis as to whether the artillery attack against Knin was a properly conducted military operation.

I would argue that one must examine the artillery tactics used in the light of this margin of error to reach a balanced judgement. For example: what were the objectives of the fire mission?; was the fire proportionate to the nature of the real or perceived threat to one’s own forces?; what were the characteristics and intentions/actions of the target?; what were the potential benefits to be gained by the mission?; were sensible measures taken to limit collateral damage and civilian casualties?; was there time to adopt a more measured but equally effective alternative approach?; was the fire adjusted at the earliest opportunity to mitigate and minimize the margin of any errors?; and was fire halted if it was seen to be causing disproportionate damage or death? In my mind, it is this set of factors which allows a more balanced judgement on the professional competence and morality shown by those using such weapons in what will always be confusing conditions at the tactical level.

10. In Section 13, General Scales states, “Indeed, simply disregarding the myriad sources of common ballistic error, as it appears was the case in the Opinion here under review, would expose to criminal prosecution an untold number of combat military officers who did no more than follow indirect fire doctrine that has been universally accepted for decades, both within the United States and throughout the world.”

- a. Please comment on whether the HV’s employment of artillery against Knin represents the application of an indirect fire doctrine that has been universally accepted for decades.

At the risk of repetition, it is the failure to pay appropriate attention to targeting, weapon selection, adjustment etc and the indiscriminate use of harassing fire in residential areas which should be in question, not the decision to use artillery *per se* or a narrow judgement over whether a shell fell within 200 or 400m of target, especially in the confusing conditions of combat.

Gotovina's order of 2 August²⁵ to put Drvar, Knin, Benkovac, Obrovac and Gračac under artillery fire did not specify targets to be engaged, nor the effects to be achieved. Corn's argument that commanders do not make the orders themselves is a gross over-simplification: commanders are responsible for the orders they give and, in particular, in specifying their Intent, general scheme of manoeuvre, specific objectives, principal coordinating measures and any key constraints on action. The application of artillery fire on occupied towns fell into the critical category for a commander at this time, particularly as the issue of the local population had been raised at Brioni. Moreover, I would have expected Gotovina to have monitored events as they unfolded to ensure his orders were being followed: the use of his artillery was central to his overall plan. Time was not an issue and I would have also expected such issues to have been well-practised in the pre-operational training and rehearsals.

From my reading of the evidence, artillery was used to target the population in order to cause panic and the abandonment of the towns and villages in the local area. Its use flowed from higher level decisions and orders which included the term of "putting the towns under fire". Some point targets were engaged with good effect, but the bulk of fires were spread over a wide area and an extended period of time; there was more than adequate opportunity to improve its technical accuracy, targeting and proportionality.

Doctrine informs and guides, but must not become dogma. Artillerymen need to apply considered and professional judgement to extant doctrine to match the use of artillery to the circumstances and conditions that exist at a particular time and place. I believe that artillerymen who demonstrate they acted in good faith within those particular circumstances and conditions, and who reach decisions over operational and collateral risk after a rational and moral analysis of the available evidence should have nothing to fear.

²⁵ Vol 1, para 1172

Report of Lieutenant General (ret) Wilson A. Shoffner, Proposed Defence Exhibit DA21

1. In Section 2.b.i., General Shoffner states that 122-mm rockets are “well suited for use against troops in the open or for use in artillery preparations. Because these weapons have a large circular area probable . . . they are not suited for attacks against point targets.”

a. Please comment on General Shoffner’s conclusion.

I concur.

b. In light of your answer to the prior question, please comment on the use of 122-mm rockets by the HV when firing on Knin.

As already mentioned, and as evidenced by Gen Shoffner’s observation, I regard the use of 122mm MRL as inappropriate and disproportionate for use against targets within a town, particularly when there were other weapons available to conduct those missions (namely howitzers) and only limited resistance.

2. In Section 2.b.ii, General Shoffner discusses factors that can affect the accuracy of a 130-mm gun. Please comment on General Shoffner’s discussion.

I am in general agreement with his comments.

3. On pages 2-4 of the report, General Shoffner notes his disagreement with a 200-meter margin of error for the HV artillery used in Knin during 4-5 August 1995. In particular, in Section 2.c., General Shoffner states that “95% of the rockets fired can be expected to fall within 900 meters of the aim-point and the [sic] 95% of the artillery projectiles would be within 495 meters of the aim-point.”

- Please comment on General Shoffner’s analysis.

His statistics illustrate the increased and inherent inaccuracy of rocket systems at this time, and their unsuitability for firing against point targets and targets in populated areas. I also agree that the 200m judgement is too narrow, as I have mentioned in my comments on Gen Scales’s evidence. Recognizing this inherent inaccuracy with initial rounds, I would have expected the use of adjusting rounds as soon as possible and for the level of accuracy to increase rapidly as errors were ‘shot out’ in early engagements, recorded and then disseminated to other firing units.

4. In Section 2.c., General Shoffner states, “the fires were unregistered with no correction for non standard [sic] conditions or for specific meteorological conditions”

- Please comment on the HV firing into Knin without registration and without correction for non-standard or meteorological conditions.

I have no evidence that registration took place before the operation was launched. I have noted that there is evidence of meteorological corrections being available and considered. Once again, in circumstances where accurate fire could not be guaranteed, I would have expected mitigating measures to have been adopted to limit the consequences of any early errors and a priority placed on shooting out the errors as soon as possible.

5. In Section 3, General Shoffner states that the Trial Chamber's standard of review "would unfairly condemn commanders who have properly conducted military operations pursuant to accepted technical and tactical standards."

- Please comment on whether the use of artillery on Knin was a properly conducted military operation pursuant to accepted technical and tactical standards.

It is a self-evident truth that doctrine and tactics have to adapt to the conditions and circumstances otherwise they become dogma. Much of the written doctrine of this period related to war-fighting tactics against large military formations, but the Balkans demanded a more nuanced approach against fewer numbers of targets, which were often well hidden and deployed among the population; although common-place now, this was very new at the time.

I had to confront these challenges in Bosnia and in this same period. The challenge was a difficult one, not least due to the nature of the targets, poor intelligence, the difficult terrain, the meteorological conditions, a lack of a coherent international strategy and a very complex political environment. I was further inhibited by limitations on in-theatre live-fire training. As a consequence, I had to ensure that fire was applied with great discretion, that my surveillance and targeting system was first class and that the application of fires was timely, proportional and carefully monitored. Where I found individuals failed in meeting these exacting standards I removed them from the front-line. If fire endangered the local population, it was stopped and alternative tactics adopted. I also ensured that mitigation measures were in place and practiced to minimize collateral damage or civilian casualties, and developed an appropriate set of rules of engagement. These measures were developed and implemented within an international ad hoc force, unknown to each other only months before. I see no reason why these tactics, techniques and procedures could not have been adopted by the HV, who had the advantages of excellent local knowledge, extensive experience of combat in the region, recent live-firing training and rehearsals, a unified command structure and excellent intelligence. From the evidence reviewed, I believe the HV were not 'simply' indifferent to the well-being of the civilian populations of the towns and villages but directly targeted them in order to use fear and panic to force their evacuation of the area.

Report of General (ret) Ronald H. Griffith, Proposed Defence Exhibit DA22

1. In paragraph 2, General Griffith states, "Nor does it appear from what is described in the report that the pattern of indirect fire employment supports a conclusion that the use of these fires was intended to kill or wound civilians, or that the fires were employed in an inherently indiscriminate manner."

a. Do you agree that the use of artillery fire against Knin was not intended to kill or wound civilians, or that artillery fire against Knin was not employed in an inherently indiscriminate manner? Please comment.

I do not agree with this statement for, *inter alia*, the following reasons:

- That the intent of Operation Storm was to force the Serb population from the area using fear and panic. The widespread use of indiscriminate harassing fires was consistent with this stated goal.
- 'Putting towns under fire' was a deliberate tactic and stated as an extra and specific task within subordinate unit orders.
- Targets were rarely described by the nature of the enemy at the location, rather their physical location suggesting there was no concern over the conditions in the target area at the time of firing, nor concern whether the targets were occupied by civilians.
- There was no priority placed on maintaining accurate and up-to-date target lists.
- The pattern of fire covered the general area of Knin and was not limited to the vicinity of recognized military targets. Highly experienced witnesses such as Forand and Leslie comment on the indiscriminate pattern of fire.
- Evidence in war diaries, eg that of TS-4²⁶, noted that Knin would be kept under fire for the next hour in uneven intervals. Reports from the commander of TS-4²⁷ record that fire was directed "in the general area of Knin" rather than against specific targets.
- The frequent and extended use of MRLs in urban areas was not appropriate for point targets, yet there was no evidence of measures designed to limit collateral damage and civilian casualties.
- There were neither direct instructions concerning rules of engagement nor any general instructions on restricted engagement areas.
- There is little evidence of defensive activity that would have merited the continuation of neutralization and harassing fires.

2. General Griffith states:

- "I have been advised that the evidence at trial did not establish conclusively that the artillery attack against targets in Knin caused a single civilian death or injury, nor did any evidence prove that civilians who fled the city did so as a result of being terrorized by the shelling. Assuming this to be true, the absence of a single casualty strongly reinforces the other reasons why, and the conclusion that, General Gotovina's use of indirect fires was done in a responsible manner and was in no way unlawful by any reasonable standard." (paragraph 3)
- "Military leaders are morally compelled to take every prudent action to protect non-combatants in their zones and / or areas of operations. From Major General Scales [sic] report, I can see no evidence that General Gotovina violated his responsibility to meet this obligation in his employment of artillery fires during the battle at Knin." (paragraph 6)

²⁶ Exh P02533

²⁷ Exh PO1268 and 1269

- a. Please comment on whether the artillery attack against Knin was conducted in a responsible manner.

I note that the Judgement does not find that any specific individual directly died as result of artillery fire, but I also note the frequent mention of casualties by multiple witnesses. I consider it highly likely that the population of the town was put at significant risk of death or wounding, and that artillery fire was explicitly aimed at causing fear and panic in the population in order to drive them from the area. I deal with these issues at length in my comments on Gen Scales's evidence. Consequently, I do not consider the artillery attack against Knin was conducted in a responsible manner.

- b. Please comment on whether every prudent action was taken during the artillery attack against Knin to protect non-combatants.

I concur with General Griffith's comment that *"Military leaders are morally compelled to take every prudent action to protect non-combatants in their zones and/or areas of operations"* but, as I have already noted in my evidence concerning Gen Scales's comments, this was patently not the case in the actions under investigation. I have seen no compelling evidence that this was the case in Knin, nor elsewhere. As I have mentioned in my comments on Gen Scales's evidence, there is little evidence of mitigation measures nor changes to the tactical handling of the HV artillery. Weapon selection (MRLs) was poor and targeting information woefully inadequate.

Report of General Granville-Chapman, Proposed Defence Exhibit

1. On p.1, General Granville-Chapman states, "There is, in my opinion, absolutely no justification for concluding that rounds falling outside the 200 metre box were indicative of a deliberate attempt to fire on separate (and possibly inappropriate) targets. The spread of the few rounds outside that box is entirely within the limits of an area artillery system as explained very fully in the reports of Generals Scales and Shoffner."

Please comment on this, in light of your analysis of the use of artillery against Knin as a whole.

I concur with Gen Granville-Chapman's specific point, but I have already mentioned that a full analysis of the use of HV artillery should rest upon a much broader base. The general pattern of fire and the evidence of UN staff in the town at the time, indicate that significant quantities of fire fell in residential areas and continued for an extended period – a period well beyond the immediate need for neutralization, or in response to hostile Serb fire.

I also note and concur with Gen Granville-Chapman's comment that "*the users showed particular care in laying guns (using the slow and thorough clinometers laying technique) and in the fact that such a high proportion of the rounds fell within 200 metres bears this out*". Such accurate fire is not the mark of inexperienced artillerymen, as Gen Scales suggested.

2. On pp.1-2, General Granville-Chapman states, "The Trial Chamber concluded its judgements nearly a decade and a half after the event at a time when the techniques and capability that have prevailed in the most recent operations have reached a remarkable level of sophistication. Today in NATO those calling for fire have to reach a certified standard of competence, meteorological data is highly reliable, ammunition lots are carefully controlled and muzzle velocity can be constantly measured on each gun. Despite these advances, artillery remains an area weapon and, in the British case, a gun used in Afghanistan typically delivers only 90% of its rounds within a 250 metre box at operational range."

Please comment on the extent, if any, to which contemporary advances in capability may affect your analysis of the proposed defence expert reports authored by Generals Scales, Shoffner or Griffith, which address the use of artillery in 1995.

As Gen Granville-Chapman notes, advances in capability and techniques have improved the overall sophistication of the artillery system. For example, new technology has improved the ability to conduct extended and detailed observation of potential and actual targets (for example due to improved sensors and the proliferation of UAVs, of all sizes); improved communications and computing power have improved the passage and fusion of information in a timely manner; and a range of improvements have increased the accuracy of munitions and reduced the gun-end error budget.

However, I considered such issues in my own analysis and find that they do not undermine my findings. In particular, I emphasize that the scientific limitations of the artillery system at the time could have been mitigated by appropriate HV orders, tactics, techniques and procedures. I also point to my own experience in using artillery in the same region, at the same time and against targets in urban areas, working under very similar technical and capability limitations to those affecting the HV – at times more so (for example in the lack of UAVs).

3. Please consider General Granville-Chapman's comment on pp.1-2 that, even though the use of artillery today has "reached a remarkable level of sophistication", "artillery remains

an area weapon” and, as such, “special procedures” are applied if friendly forces are within 250 metres of the aimpoint.

a. Please comment on whether non-combatants also require protection by the use of “special procedures”, and evaluate whether the use of artillery against Knin was consistent with the use of any such precautions.

I examine this issue in detail in my earlier analysis of the evidence provided by Generals Scales, Shoffner and Griffith. I concur with Gen Griffith’s comment that *“Military leaders are morally compelled to take every prudent action to protect non-combatants in their zones and/or areas of operations”*.

I find that the HV did not routinely and actively apply such procedures and consequently put the population of Knin and other towns at risk by the use of indiscriminate, speculative and non-proportional use of artillery. Furthermore, and based on the evidence available, I believe the HV considered the population as the target of the operation and hence the lack of such procedural measures. The failure to apply such measures is at the heart of my judgement on the HV’s use of artillery.

b) Please explain whether the importance of the use of precautions has changed given technical advances in the use of artillery since 1995.

Due to the availability of improved computing capacity and specialist programmes, the planning and execution of such fires can now be conducted with greater confidence and consistency, and also in reduced times. At this time, much of this activity had to be conducted using manual systems and written records.

The increased availability of precision rocket, missile and cannon munitions also allows attacks against point targets with much reduced spread in the fall of shot (within 10 metres given accuracy in weapon and target location, meteorological prediction etc and corrections to the terminal stage of the weapon’s flight). Surveillance, locating and targeting technology have also improved dramatically, as has the ability to move data (eg UAV imagery) rapidly around the battlespace.

In the tactical cat-and-mouse game which is combat, those less technologically advanced increasingly hide among the civilian population in order to reduce their vulnerability and gain an ability to move more freely. The application of such precautions arises, first of all, from a moral perspective, namely how best to act responsibly and within the codes of accepted behaviour and international law; and, secondly, on a much more pragmatic and military basis, in order to gain and maintain the support of the indigenous population - something which does not seem to have been an objective for the HV. A consideration of such precautions was as relevant in 1995 as it is today, and will be tomorrow.

Overall Conclusion

In reviewing the evidence of Generals Scales, Griffith, Shoffner and Granville-Chapman, I concur with their arguments concerning the specific ruling that the 200m zone of error for the use of artillery fire is inappropriate and fails to take into account the characteristics of the weapon system, and that 400m is a more appropriate rule of thumb. However, I find they argue on a very narrow point and frequently use unsubstantiated assertions and apply contradictory arguments when addressing the substantive issue of whether the civilian populations of Knin and other towns were deliberately targeted in order to drive them from the region.

I argue that this wider judgement should be made against a broader set of factors which consider, *inter alia*: the overall objectives of the operation; the general pattern of fire; and the orders, tactics, techniques and procedures used by the HV artillery. When so doing, and based on the evidence I have read and my own experience of engaging targets in Sarajevo with artillery fire in this same period, I find that the HV, at the very least failed to exercise due care in the application of artillery fire during Operation Storm; they certainly failed to meet the standards laid out by Gen Griffith in his evidence.

A very few military targets were the subject of neutralization fire, and this appears to have been achieved quickly and accurately on the first day. Thereafter, the pattern of fire becomes one of harassment against general target areas rather than specific enemy locations. I find it highly unlikely that the HV did not have Knin under some observation at the beginning of the first day and simply incredible that they had not achieved over-watch as the Serb defensive front collapsed and HV units infiltrated into the Serb depth. In such circumstances, even greater discrimination of fire would have been possible.

Furthermore, I see a common thread running from discussions at Brioni, through the subsequent orders issued for Operation Storm and subordinate artillery units, to the application of widespread fire throughout residential areas of Knin and other towns and villages. I believe that civilians were a specific target in their own right in order to cause panic and demoralization. I cite in evidence: the overall higher intent flowing from the Brioni meeting; the lack of any routine and obvious mitigating measures (such as rules of engagement or restricted areas for engagement etc); inappropriate weapon selection (ie MRLs in populated areas); the use of terms such as bringing Knin and other towns under fire; the pattern of fire; and poor quality targeting description and latency.

Finally, I do not regard the command and handling of HV artillery as showing endemic incompetence or lack of training and experience. There was time and opportunity to introduce and practice the necessary tactics and mitigating techniques and procedures if there had been a will to do so – I can find no evidence that such a will existed within the HV command.



21 April 2012

Lt General (Ret'd) RAD Applegate CB, OBE

Attached: List of sources provided



United Nations
Nations Unies



International
Criminal Tribunal
for the former
Yugoslavia

Tribunal Pénal
International pour
l'ex-Yougoslavie

**Office of the
Prosecutor**

**Bureau du
Procureur**

15 March 2012

Lt-Gen. (Ret.) Dick Applegate CB OBE

Dear General Applegate,

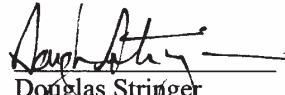
Re: Expert report in *Prosecutor v. Ante Gotovina*, Case No. IT-06-90-A

Thank you for agreeing to prepare an expert report. We have drafted the questions in the Annex for you to answer. Each question is specifically linked to the proposed defence expert reports. In your answers, please feel free to cite to the materials you have been provided.

This letter and attached list of questions should be included as an appendix to your report, to assist the Appeals Chamber in understanding the process by which you were instructed as an expert. You should also include in an appendix a list of materials that you reviewed in preparing the report.

Please do not hesitate to contact Todd Schneider (+31 70 512 5185), Matthew Cross (+31 70 512 5716) or me (+31 70 512 8523) should there be any questions.

Yours very truly,


Douglas Stringer
Senior Appeals Counsel

Annex

Please structure your report around the following questions. Please reproduce the questions verbatim as headings in your report.

Although references to specific portions of the proposed defence expert reports are provided below, please feel free to consider any other portions of the reports which you think are significant.

Report of Major General (ret) Robert H. Scales, Jr., Proposed Defence Exhibit DA20

- 1) In Section 5, General Scales states that the Croatian Army (“HV”) fired into Knin to achieve the effects of neutralization and harassment. He further states that “the weapons employed, Soviet 130mm guns and 122mm rockets, were well suited to achieve these effects.”
 - a) Please describe the distinction between neutralization fires and harassment fires.
 - b) Please comment on whether you agree that harassment and neutralization fires were directed against Knin.
 - c) If so, please comment on the HV’s tactic of directing harassment and neutralization fires against Knin.
 - d) Please comment on the extent of any military advantage in using harassment fire against targets in Knin.
 - e) Please comment on whether the HV’s firing on targets in Knin was appropriate from a military perspective to achieve the effects of neutralization and harassment.
 - f) Please comment on whether 130-mm guns and 122-mm rockets would have been “well suited” to neutralization and harassment of enemy operations in Knin.
 - g) Please compare and comment on General Scales’ statement that the 130-mm guns and 122-mm rockets were “well suited” to neutralization and harassment of enemy operations in Knin vis-à-vis footnote 5 of his report, where he states that he “can testify personally to the inherent inaccuracy of these weapons.”
- 2) In Section 7, General Scales states, “Missions fired against Knin in Operation Storm, by definition were GS [General Support] fires by long range rockets and guns designed for that purpose.”
 - a) Please comment on whether you agree that the artillery missions against Knin were GS fires.
 - b) If so, please comment on the HV’s tactic of conducting GS fires against Knin during Operation Storm.
- 3) In Section 7, General Scales states, “Individual fire missions were directed against relatively small area targets, such as command and control facilities, where lethal effects are achieved by selecting a single point of aim, allowing the natural wide dispersion of such fires to cover the target.”
 - a) Please comment on whether you agree that the artillery attack against Knin was directed at “relatively small area targets.”

- b) If so, please comment on the HV's tactic of directing artillery fire against "relatively small area targets" in Knin during Operation Storm.
- 4) The artillery attack against Knin employed 130-mm guns and 122-mm rockets. The Trial Chamber found in paragraph 1233 of the Judgement that the civilian population of Knin was at least 15,000 at the time Operation Storm was launched on 4 August 1995.
- a) In your opinion, was the use of 130-mm guns and 122-mm rockets to strike targets in the town of Knin an appropriate use of those weapons systems? Please comment.
- b) To what extent, if any, does the appropriateness of firing 130-mm guns and 122-mm rockets into Knin depend on whether the HV was:
- directing neutralization and harassment fires against Knin;
 - using GS fires against Knin; or
 - directing fire against "relatively small area targets"?
- Feel free to address the factors together or in isolation.
-
- 5) On page 9, 1st paragraph, General Scales states, "It does not appear that the HV artillery or MBRLs had the opportunity to register targets at Knin." In Section 12, General Scales states, "All rounds at issue on 4 and 5 August were both unregistered and unobserved. Thus, tracking doctrine, all 900 rounds effectively were 'first rounds,' since none of the rounds fired over two days could have been adjusted closer to the target than the initial rounds fired."
- a) Please comment on the HV firing all rounds unregistered into Knin.
- b) Please comment on the HV firing all rounds unobserved into Knin.
- c) Please comment on the HV firing 900 rounds over two days into Knin without adjusting rounds closer to the target.
- d) Please comment on General Scales' conclusion on page 9, 1st paragraph that registration fires "normally would not be employed in relation to an attack such as that conducted by the HV" and that "[u]se of registration fires doubtless would have compromised the attack's shock effect...."
- e) Please compare and comment on General Scales' discussion of registration in the main text in pages 8-9 vis-à-vis his statement in footnote 11 that "pre-digitization, no American artillery unit would be permitted to fire a GS preparatory and harassment mission without first registering."
- 6) In Section 6, General Scales states that "general support missions are predictive (unobserved, or 'shooting off a map') and that "the GS mission provides unobserved, longer range fires".
- a) Please comment on whether GS fires are unobserved.
- b) Please comment on whether or to what extent difficulty in establishing observation of the target affects a decision to employ GS fires and/or to engage certain targets.

-
- 7) In Section 8, pages 5-9, General Scales discusses the factors bearing on the accuracy of fires.
- Please comment on General Scales' discussion.
 - Please compare and comment on General Scales' discussion vis-à-vis the factors bearing on accuracy discussed in paragraph 1898 and other parts of the Judgement.
- 8) In Sections 8 and 10, General Scales notes factors that would affect HV artillery accuracy, including:
- The 130-mm guns and 122-mm rockets “were fired at the extreme limits of range (122 mm MBRLs, 19,000 meters and 130 guns, 26,000 meters).” (page 6, 1st bullet)
 - “The HV artillery appears to have relied generally on classic ‘map spot’ techniques” when locating targets, introducing “a target error of 100 meters—and likely somewhat more.” (page 7, 1st bullet)
 - “None of the artillery pieces employed in the Knin missions were surveyed. They were located using the ‘resection’ technique.” (page 7, 2nd bullet)
 - “At best, HV artillery appears to have set direction by either a Soviet compass (creating at least 10-15 mil error, on average) or by an aiming circle from the firing position, giving rise to 5-10 mils of error.” (page 7, 3rd bullet)
 - “There is no evidence that the HV units in this engagement aggregated common lots or separated out those ‘odd’ lots, without which this can become the greatest source of error for mass, unobserved fires.” (page 8, 1st paragraph)
 - “[T]he range dispersions shown on the survey charts for some of these targets suggest rocket range ‘creep,’ which could mean that some of the launcher vehicles were not adequately grounded.” (page 8, 2nd bullet)
 - “The most telling technical shortcoming of HV artillery operations at Knin was the lack of an accurate meteorological message prior to firing.” (page 10, 1st bullet)
 - “Quality of artillery materiel, guns, rocket launchers and ammunition was highly questionable.” (page 10, 3rd bullet)
 - “[M]ost if not all of [HV artillerymen] were inexperienced gunners.” (page 10, 4th bullet)
- Please comment on how these factors would affect HV artillery accuracy. Feel free to address the factors together or in isolation.
 - Please comment on how these factors would affect a commander's decision to launch an artillery attack against “relatively small area targets” in Knin. Feel free to address the factors together or in isolation.
-
- 9) In Sections 3, 10 and 12, General Scales concludes that the Trial Chamber's 200-meter margin of error is too restrictive and that a 400-meter standard would be “more accurate and realistic.”

- a) Please comment on General Scales' conclusion.
 - b) Please comment on whether or to what extent the applicable margin of error affects the analysis as to whether the artillery attack against Knin was a properly conducted military operation.
-

10) In Section 13, General Scales states, "Indeed, simply disregarding the myriad sources of common ballistic error, as it appears was the case in the Opinion here under review, would expose to criminal prosecution an untold number of combat military officers who did no more than follow indirect fire doctrine that has been universally accepted for decades, both within the United States and throughout the world."

- a) Please comment on whether the HV's employment of artillery against Knin represents the application of an indirect fire doctrine that has been universally accepted for decades.

Report of Lieutenant General (ret) Wilson A. Shoffner, Proposed Defence Exhibit DA21

- 1) In Section 2.b.i., General Shoffner states that 122-mm rockets are “well suited for use against troops in the open or for use in artillery preparations. Because these weapons have a large circular area probable . . . they are not suited for attacks against point targets.”
 - a) Please comment on General Shoffner’s conclusion.
 - b) In light of your answer to the prior question, please comment on the use of 122-mm rockets by the HV when firing on Knin.
- 2) In Section 2.b.ii, General Shoffner discusses factors that can affect the accuracy of a 130-mm gun.
 - a) Please comment on General Shoffner’s discussion.
- 3) On pages 2-4 of the report, General Shoffner notes his disagreement with a 200-meter margin of error for the HV artillery used in Knin during 4-5 August 1995. In particular, in Section 2.c., General Shoffner states that “95% of the rockets fired can be expected to fall within 900 meters of the aimpoint and the [sic] 95% of the artillery projectiles would be within 495 meters of the aimpoint.”
 - a) Please comment on General Shoffner’s analysis.
- 4) In Section 2.c., General Shoffner states, “the fires were unregistered with no correction for non standard [sic] conditions or for specific meteorological conditions”
 - a) Please comment on the HV firing into Knin without registration and without correction for non-standard or meteorological conditions.
- 5) In Section 3, General Shoffner states that the Trial Chamber’s standard of review “would unfairly condemn commanders who have properly conducted military operations pursuant to accepted technical and tactical standards.”
 - a) Please comment on whether the use of artillery on Knin was a properly conducted military operation pursuant to accepted technical and tactical standards.

Report of General (ret) Ronald H. Griffith, Proposed Defence Exhibit DA22

- 1) In paragraph 2, General Griffith states, “Nor does it appear from what is described in the report that the pattern of indirect fire employment supports a conclusion that the use of these fires was intended to kill or wound civilians, or that the fires were employed in an inherently indiscriminate manner.”
 - a) Do you agree that the use of artillery fire against Knin was not intended to kill or wound civilians, or that artillery fire against Knin was not employed in an inherently indiscriminate manner? Please comment.
- 2) General Griffith states:
 - “I have been advised that the evidence at trial did not establish conclusively that the artillery attack against targets in Knin caused a single civilian death or injury, nor did any evidence prove that civilians who fled the city did so as a result of being terrorized by the shelling. Assuming this to be true, the absence of a single casualty strongly reinforces the other reasons why, and the conclusion that, General Gotovina’s use of indirect fires was done in a responsible manner and was in no way unlawful by any reasonable standard.” (paragraph 3)
 - “Military leaders are morally compelled to take every prudent action to protect non-combatants in their zones and / or areas of operations. From Major General Scales [sic] report, I can see no evidence that General Gotovina violated his responsibility to meet this obligation in his employment of artillery fires during the battle at Knin.” (paragraph 6)
 - a) Please comment on whether the artillery attack against Knin was conducted in a responsible manner.
 - b) Please comment on whether every prudent action was taken during the artillery attack against Knin to protect non-combatants.



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4 April 2012

Lt-Gen. (Ret.) Dick Applegate CB OBE

Dear General Applegate,

Re: Expert report in *Prosecutor v. Ante Gotovina*, Case No. IT-06-90-A

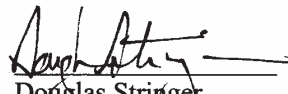
As we alerted you by telephone on Monday, the Defence on Friday filed a further (fourth) report by General Timothy Granville-Chapman, British Army (Ret.), which they seek to tender as additional expert evidence on appeal. We provided you this report by e-mail of 3 April 2012.

In this context, we have drafted the supplementary questions in the Annex for you to answer in your report, in addition to those set out in our letter of 15 March 2012. Each supplementary question is specifically linked to General Granville-Chapman's report. In your answers, please feel free to cite the materials you have been provided.

This letter and attached list of supplementary questions should be included as an appendix to your report, in addition to our initial letter of 15 March 2012, to assist the Appeals Chamber in understanding the process by which you were instructed as an expert.

Please do not hesitate to contact Todd Schneider (+31 70 512 5185), Matthew Cross (+31 70 512 5716) or me (+31 70 512 8523) should there be any questions.

Yours very truly,


Douglas Stringer
Senior Appeals Counsel

Annex

Supplementary Questions

Please structure your report around the following supplementary questions, in addition to those you have already received. Please reproduce the questions verbatim as headings in your report.

Although references to specific portions of the proposed defence expert report authored by General Granville-Chapman are provided below, please feel free to consider any other portions of the report which you think significant.

- 1) On p.1, General Ganville-Chapman states, “There is, in my opinion, absolutely no justification for concluding that rounds falling outside the 200 metre box were indicative of a deliberate attempt to fire on separate (and possibly inappropriate) targets. The spread of the few rounds outside that box is entirely within the limits of an area artillery system as explained very fully in the reports of Generals Scales and Shoffner.”

Please comment on this, in light of your analysis of the use of artillery against Knin as a whole.

- 2) On pp.1-2, General Granville-Chapman states, “The Trial Chamber concluded its judgements nearly a decade and a half after the event at a time when the techniques and capability that have prevailed in the most recent operations have reached a remarkable level of sophistication. Today in NATO those calling for fire have to reach a certified standard of competence, meteorological data is highly reliable, ammunition lots are carefully controlled and muzzle velocity can be constantly measured on each gun. Despite these advances, artillery remains an area weapon and, in the British case, a gun used in Afghanistan typically delivers only 90% of its rounds within a 250 metre box at operational range.”

Please comment on the extent, if any, to which contemporary advances in capability may affect your analysis of the proposed defence expert reports authored by Generals Scales, Shoffner or Griffith, which address the use of artillery in 1995.

- 3) Please consider General Granville-Chapman’s comment on pp.1-2 that, even though the use of artillery today has “reached a remarkable level of sophistication”, “artillery remains an area weapon” and, as such, “special procedures” are applied if friendly forces are within 250 metres of the aimpoint.
 - a) Please comment on whether non-combatants also require protection by the use of “special procedures”, and evaluate whether the use of artillery against Knin was consistent with the use of any such precautions.
 - b) Please explain whether the importance of the use of precautions has changed given technical advances in the use of artillery since 1995.



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21 April 2012

Lt-Gen. (Ret.) Dick Applegate CB OBE

Dear General Applegate,

Re: Expert report in *Prosecutor v. Ante Gotovina*, Case No. IT-06-90-A

By our letters of 20 March 2012 and 4 April 2012, and our e-mail of 16 April 2012, we provided you with materials which may assist the preparation of your expert report.

Appended to this letter, please find attached an updated consolidated chart of all those materials provided to you on these dates.

Please annex this final letter and chart to your report, together with our letter of instruction of 15 March 2012 and our supplementary letter of instruction of 4 April 2012.

Please do not hesitate to contact Todd Schneider (+31 70 512 5185), Matthew Cross (+31 70 512 5716) or me (+31 70 512 8523) should there be any questions.

Yours very truly,

Douglas Stringer
Senior Appeals Counsel

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

Count	Doc ID	Main Date	Title	Description of Exhibit	Confidential	Exhibit Number
Draft list of materials to be sent to experts						
1		?	Report of Major General (ret) Robert H. Scales, Jr.			Proposed DA20
2		20-Oct-11	Report of Lieutenant General (ret) Wilson A. Shoffner			Proposed DA21
3		26-Oct-11	Report of General (ret) Ronald H. Griffith			Proposed DA22
4		?	Report of General (ret) Timothy Granville-Chapman			Proposed Exhibit E
Trial Expert reports						
1	0643-6709	18-Jan-08	Expert Report of Lt. Col. Harry Konings	Report 'Fire Support during Operation Storm, by Lt. Col. Harry Konings Royal Artillery, Royal Netherlands Army, August 1995	No	P01259
2	0643-6546	31-Oct-95	Addendum to Expert Report of Lt. Col. Harry Konings	Addendum to Expert Report	No	P01260
3	0645-2665		Corrigendum to the Expert Report and Addendum of Expert witness Lt. Col. Harry Konings	Corrigendum to the Expert Report and Addendum of Expert witness Lt. Col. Harry Konings	No	P01262
4	1D72-3442	28-Jun-09	Expert report of Professor Geoffrey Corn	Expert report of Professor Geoffrey Corn, dated 28.06.09.	No	D01642
5	1D72-3762	06-Sep-09	Supplemental Information Sheet / Clarification of witness Geoffrey Corn (AG-11)	Supplemental Information Sheet / Clarification of witness Geoffrey Corn, dated 06.09.09	No	D01643
Brioni Meeting						
1	1D76-0013	31-Jul-95	Presidential Transcript of meeting held in Brioni on 31st July 1995, including modifications as agreed by the parties and references to the attached CLSS memorandum in relation to disputed portions of the original transcription and translation (BCS Orig)	Minutes of the meeting held by the President of the Republic of Croatia F. Tudjman with military officials on 31 July 1995 at Brioni	No	P00461
	1D76-0001 P461			Translation		P00461
	1D76-0010 P461			Translation		P00461
	1D76-0110 P461			Translation		P00461
Orders						

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

1	0342-2520	02-Aug-95	Orders dated 02/08/95 by Ante GOTOVINA for the Offensive Operation involving forces of the Split Military District.	R. Croatia, Ministry of Defence HV Main Staff, Split Military District, Offensive Operation Order, signed by General Ante Gotovina, dated 2 August 1995 Translation	No	P01125
	0342-2520- 0342-2538-ET P1125					P01125
2	0279-8827	03-Aug-95	Orders of artillery attacking issued by Chief of artillery Marijan FIRST pursuant to Orders issued by Ante GOTOVINA dt. 3 August 1995	Orders of artillery attacking issued by Chief of artillery Marijan FIRST pursuant to Orders issued by Ante GOTOVINA, dated 03.10.95. Translation	No	P01201
	0279-8827- 0279-8828- EDT P1201					P01201
3	0211-8050	03-Aug-95	Orders issued by Colonel Mladen FUZUL, Zadar OG Commander re: implementing Ante GOTOVINA's Orders of attacking.	Orders issued by Colonel Mladen FUZUL, Zadar OG Commander, dated 03 August 1995. Translation	No	P01263
	0211-8050- 0211-8057-ET P1263					P01263
4	0342-2548	02-Aug-95	Attacking orders, attachment for artillery, operation Kozjak Storm, Operation Storm, re: RFA 432, dated 02 August 1995.	R. Croatia, Ministry of Defence, HV Main Staff, Split ZP, 'Order to Attack - attachment for the artillery', signed by Brigadier Marko Rajic, dated 2 August 1995 Translation	No	D00970
	0342-2548- 0342-2551-ET- 1 D970					D00970
5	0609-8347	26-Jun-95	HV General Staff Operational Directive 12-4/95. Signed by General Bobetko.	HV General Staff Operational Directive 12-4/95. Signed by General Bobetko.	No	D00956
	ET 0609-8347- 0609-8354 D956					D00956
6	0349-3647		Orders for attacking to Ministry of the Interior Special Police	Orders for attacking to Ministry of the Interior Special Police.	No	D02078
	0349-3647- EDT				No	D02078
Target Lists						

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

1	0634-7312		Table of identified targets in Knin for HV firing positions from Karli, Kljuc and Pakovo Selo	Document entitled: 'Table of Identified Targets', Region Karli, Kljuc and Pakovo Selo. Translation	No	P01271
	ET 0634-7312- 0634-7312 P1271					P01271
2	0634-7307		List of targets for artillery preparation fire in Knin	Documents/Charts Entitled: '2. Artillery preparation' and '1. Battalion Tasks' Translation	No	P01272
	0634-7307- 0634-7311-ET P1272					P01272
3	0614-2311		Coded Map Poskok 93	Coded Map Translation	No	P01273
	0614-2311- 0614-2311-ET P1273					P01273
4	0614-2441		ANNEX 12: the "Ivancica" positions map of the 7th gbr (digital)	ANNEX 12: the "Ivancica" positions map of the 7th gbr.	No	P02338
5	1D69-0104		List of targets of the TS/artillery group/ 3 of OG Zadar (Code Name: Jagoda)	List of targets of the TS/artillery group/ 3 of OG Zadar (Code Name: Jagoda). Translation	No	D01447
			English translation			D1447
General Maps						
1	0629-0379		ANNEX 3: Working Map of the NT of the ZP – Croatian Forces (digital)	ANNEX 3: Working Map of the NT of the ZP – Croatian Forces.	No	P02322
2	0645-2949		ATTACHMENT 2, 4th GB: Coded map Bura	ATTACHMENT 2, 4th GB: Coded map Bura.	No	P02475
3	1D63-0082	04-Aug-94	Map: Artillery Positions for Storm - Deployment of HV/HVO Operational Artillery Groups in Operation Kozjak (4 Aug 1995)	Map: 'Deployment of HV/HVO Operational Artillery Groups in Operation -Kozjak- 04 Aug 95'	No	D00971
Logs/Reports/Diaries						
1	0155-8825	14-Sep-95	Split Military District Operations Diary for the period 25-07-1995 to 14-09-1995	Split Military District, Operational Diary for the period 25 July to 14 September 1995, signed by Chief of Staff Rahim Ademir Translation	No	P00071
	0155-8825-ET- 1 P71					P00071

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

2	0361-1051	05-Aug-95	Report by Mladen MARKAC to Zvonimir CERVENKO on positions taken over by Special Police joint forces	R. Croatia, Ministry of the Interior, Special Police Sector, document entitled: Report on lines reached by the Special Police Joint Forces, signed by Colonel General Mladen Markac, dated, Seline Headquarters, 5 August 1995.	No	P00583
	0361-1051-ET P583			Translation		P00583
3	0609-7506	23-Aug-95	Summary report from the 134 Hme Gurads Regiment to Commander of MD Split on performed combat task (artillery shelling of Benkovac without observation or correction of fire), No. 8286-01-95-75	Summary report from the 134 Hme Gurads Regiment to Commander of MD Split on performed combat task, dated 23.08.95.	No	P01200
	0609-7506-ET P1200			Translation		P01200
4	0611-0832	04-Aug-95	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 1300 hours	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 1300 hours.	No	P01267
	0611-0832-ET P1267			Translation		P01267
5	0611-0836	04-Aug-95	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 2000 hours	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 2000 hours, dated 04.08.95.	No	P01268
	0611-0836-ET-1 P1268			Translation		P01268
6	0611-0839	05-Aug-95	Regular report from Bruno MILIN, commander of TS-4 on combat operations at unspecified time	Regular report from Bruno MILIN, commander of TS-4 on combat operations at unspecified time, dated 05.08.95.	No	P01269
	0611-0839-ET P1269			Translation		P01269
7	0643-0437		ANNEX 11: TS-3 diary for period 3 to 9 August 1995	ANNEX 11: TS-3 diary for period 3 to 11 August 1995.	No	P02342
	0643-0437-ET P2342					P02342
8	0609-8869-1		ANNEX 13: Operations Diary of the 4th gbr	ANNEX 13: Operations Diary of the 4th gbr.	No	P02343

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

	0609-8869-ET-2 P2343					P02343
9	0606-1300	Extract from log of Special Police activities and movements during Operation Oluja. No author or source for the document at this time. ??-Aug-1995	Extract from log of Special Police activities and movements during Operation Oluja. No author or source for the document at this time. 2/7 -Aug-1995.	No		P02385
	ET-0606-1300 P2385		Translation			P02385
10	0643-0502	ANNEX 18: Operations diary of the 1st Sector from 20 June to 20 October 1995	ANNEX 18: Operations diary of the 1st Sector from 20 June to 20 October 1995.	No		P02436
	0643-0502-ET P2436		Translation			P02436
11	0645-3067	ATTACHMENT 16, 7th GB: Diary of Jura SEKANOVIC, Arty Bn/7th Gds Bgd.	ATTACHMENT 16, 7th GB: Diary of Jura SEKANOVIC, Arty Bn/7th Gds Bgd. 29-Jul-08-Aug-95.	No		P02455
	0645-3067-ET P2455		Translation			P02455
12	0645-3091	ATTACHMENT 23, 7th GB: Daily operations report of the bSVBR of 122mm BM21	ATTACHMENT 23, 7th GB: Daily operations report of the bSVBR of 122mm BM21; dated 04.08.95.	No		P02461
	0645-3091-ET P2461					P02461
13	0645-3092	ATTACHMENT 24, 7th GB: Daily operations report of the bSVBR of 122mm BM21	ATTACHMENT 24, 7th GB: Daily operations report of the bSVBR of 122mm BM21; dated 05.08.95.	No		P02462
	0645-3092-ET P2462		Translation			P02462
14	0645-3096	ATTACHMENT 28, 7th GB: Expenditure of Ammo/Arty Bn/7th Gds Bgd. 03-09-Aug-95	ATTACHMENT 28, 7th GB: Expenditure of Ammo/Arty Bn/7th Gds Bgd.; dated 04-08.08.95.	No		P02466
	0645-3096-ET P2466		Translation			P02466

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

15	0645-3099		ATTACHMENT 29 , 7th GB: Diary of Rudolf FRANJCEC, Commander of commanding Pltn/122mm MBRs. 13-Jul-Sep 1995	ATTACHMENT 29 , 7th GB: Diary of Rudolf FRANJCEC, Commander of commanding Pltn/122mm MBRs.; dated 13-Jul-Sep 1995.	No	P0246Z
	0645-3100-ET P2467			Translation		P0246Z
16	0645-3151		ATTACHMENT 35 , 7th GB: Daily order book: Artillery and Rocket Battalion – Battery of the SVBR Gvere, 31-Jul-08-Aug-95	ATTACHMENT 35 , 7th GB: Daily order book: Artillery and Rocket Battalion – Battery of the SVBR Gvere; dated 31-Jul-08-Aug-95.	No	P02473
	0645-3151-ET P2473			Translation		P02473
17	0645-2954		ATTACHMENT 5, 4th GB: Report on artillery ops, 122mm MBRs battery/Arty Bn/4th Gds Bgd. 26-Jul-09-Aug-95	ATTACHMENT 5, 4th GB: Report on artillery ops, 122mm MBRs battery/Arty Bn/4th Gds Bgd; dated 26.07.-09.08.95.	No	P02478
	0645-2954-ET P2478			Translation		P02478
18	0646-5076-ET P2478		War Diary of Artillery Group TS-4	War Diary of Artillery Group TS-4	No	P02533
	0646-5076-ET			Translation		P02533
19	0613-3896	25-Aug-95	Report from 92nd Mountain Brigade Commander to the VSK Main Staff	Report from 92nd Mountain Brigade Commander to the VSK Main Staff, dated 25.08.95.	No	D00828
	0613-3896-ET			Translation		D00828
20	0279-8900	04-Aug-95	Zadar Operative Group daily combat report re: combat activities of 7th and 134th Homeguard regiment and 112th Bde	Zadar Operative Group daily combat report re: combat activities of 7th and 134th Homeguard regiment and 112th Bde	No	D01095
	0279-8900-ET			Translation		D01095
Rajcic Reconstructions						
1	0643-0369	17-Oct-08	Rajcic Analysis of artillery Actions during Storm Operation	Rajcic Analysis of artillery Actions during Storm Operation, dated 17.10.08.	No	P02336
	0643-0369-ET-REV P2336			Translation		P02336

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

2	0645-2895		Rajcic Storm Reconstruction, analysis of artillery use at the 2nd and 3rd level (concentrating on 4th & 7th Guards Brigades in period from 4-9 August 95)	Rajcic Storm Reconstruction, analysis of artillery use at the 2nd and 3rd level (concentrating on 4th & 7th Guards Brigades in period from 4-9 August 95).	No	P02339
	0645-2897-ET P2339			Translation		P02339
3	0645-3163	28-Nov-08	Rajcic Analysis of artillery use at the first (Corps) level	Rajcic Analysis of artillery use at the first (Corps) level, dated 28.11.08.	No	P02340
	0645-3163-ET P2340			Translation		P02340
4	0645-3222		ATTACHMENT 6a: Reconstruction of the command and control of the Split Military District Corps Artillery for TS3 and TS4 during Operation Storm from 4-9 August 1995	ATTACHMENT 6a: Reconstruction of the command and control of the Split Military District Corps Artillery for TS3 and TS4 during Operation Storm from 4-9 August 1995.	No	P02341
	0645-3222-ET P2341			Translation		P02341
Witness Statements						
1	0035-1489	12-Aug-95	summary report on Possible Violation of International Humanitarian Law relating to the shelling ON Knin dated 12 Aug 1995. This document has been restamped to R104-1422-R104-1426.	Report entitled Possible Violation of International Humanitarian Law, sent by COS UNCRO, Col Andrew LESLIE, to G2 UNCRO for forwarding to G3 Ops UNPF HQ, dated 12 August 1995, with a Letter of protest from UNCRO South Sector Commander, Brigadier General A	No	P00084
2	1D00-0767	13-Feb-09	92ter statement of Marko Rajcic taken by the Gotovina Defence	92ter statement of Marko Rajcic taken by the Gotovina Defence, Dated 7th, 9th, 11th, 12th and 13th February 2009.	No	D01425
	1D00-0788		Translation of 1D00-0767	Translation		D01425
3	0638-2648	11-Jul-08	Official Note of the Military Police Department's Crime Police Section Interview of Rajcic	Official Note of the Military Police Department's Crime Police Section Interview of Rajcic, dated 11.07.08.	Yes	P02323
	0638-2648-ET P2323			Translation		P02323

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

4	0350-7998		Witness Statement dated 3 & 4 February 2004	Statement of Witness Josip Turkalj, dated 3 & 4 February 2004.	No	P01149
5	V000-5303	11-Mar-05	Video Tape I and transcripts	Video Tape I and transcripts of Josip Turkalj interview, dated 11.03.05.	No	P01150
6	V000-5304	15-Mar-05	Video Tape II and transcripts	Video Tape II and transcripts of Josip Turkalj interview, dated 11.03.05.	No	P01151
Transcripts						
1				Testimony of Geoffrey Corn, Defence Expert, T21141-21225 (7/9/09), T21228-21338 (8/9/09), T21428-21524 (10/9/09), T21529-21588 (11/9/09)		Corn
2				Testimony of Harry Konings, Prosecution Expert, T14301-14333 (13/1/09), T14339-14443 (14/1/09), T14460-14548 (15/1/09), T14549-14649 (16/1/09), T14650-14749 (19/1/09), T14755-14812 (20/1/09)		Konings
3				Testimony of Andrew Leslie, UNCRO Chief of Staff, T1929-2021 (22/4/08), T2022-2129 (23/1/09), T2131-2203 (24/4/08)		Leslie
4				Testimony of Marko Rajcic, Split MD Chief of Artillery, T16229-16289 (18/2/09), T16306-16383 (19/2/09), T16391-16461 (20/2/09), T16470-16627 (23/2/09), and T17634-17724 (25/5/09)		Rajcic
5				Testimony of Josip Turkalj, Special Police artillery unit commander, T13540-13557 (11/12/08), T13564-13656 (12/12/08), T13657-13745 (15/12/08), T13746-13787 (16/12/08)		Turkalj
Maps/Photos of Knin Discussed in Judgement, paras. 1372-1392, 1907						
1	IC00-0001		Aerial photograph of Knin marked by the witness	Aerial photograph of Knin marked by the witness P-136 in court on 13 March 2008	No	P00004

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

2	0632-9425		Aerial Photo of Knin Marked by Witness 6 - from 65ter 4769	Aerial Photo of Knin (65ter 4769) marked by Witness P-006 in court on 7 April 2008	Yes	P00017
3	0632-9427	03-Apr-98	Reproduction of annotations made by witness 20 on aerial photo of Knin on 3 April 1998. Poor quality original attached to her statement and 65ter number 37471	Knin Aerial Photo with annotations made by witness Mira Grubor, Belgrade, 3 April 1998.	No	P00058
4	0632-1989		AD-1 Aerial Photograph of Knin with (red) circles indicating shell impact areas and letter-marked locations	Aerial Photograph marked with red lines and letter-marks	No	P00078
5	0042-1627	04-Feb-96	Attached to statement by Andreas DREYER: Aerial photograph of Knin	Aerial Photograph marked in green and black, entitled Summary of statements of areas shelled and potential military targets in Knin from August 1995	No	P00079
6	IC00-0012			Aerial photograph marked by Witness Mikhail Ermolaev in court on 28 April 2008	No	P00096
7	0634-6442		Photographs of Knin with Markings made by Witness 54 (65ter numbers 4892 and 4893) with a Legend.	Index for Witness 54 markings on pictures (Legend) and two marked photographs, dated 12 May 2008	Yes	P00189
8	0634-7966	21-May-08	Supplementary Witness Statement of Prosecution Witness 56 including two marked photographs of Knin .	Supplementary Statement of Witness P-056, dated 21 May 2008 and two areal photos marked	Yes	P00289
9	0634-8607		Area photo of Knin Marked by Witness 123 (Original 65ter 4769)	Area photo marked red	No	P00300
10	0632-3967		Aerial Map of Knin with Witness Markings	Aerial map with red markings.	No	P00430
11	0635-4624		Aerial photograph of Knin marked by Witness 97	Aerial photograph marked red.	No	P00547
12	0635-5637		Aerial Map of Knin with Witness' Markings	Black & white aerial photograph of Knin with 7 marked locations	No	P00681
13	0635-5638		Map of Knin with Witness' Markings	Colour aerial photograph of Knin with 8 marked locations	No	P00682
14	0636-1508		Aerial Photo of Knin Marked by Prosecution Witness 103	Aerial Photo Marked	No	P00697
15	0632-2648		Witness Statement of Erik Lennart Widen, 26-27-Feb-08	Witness Statement of Erik Lennart Widen, dated 26-27-Feb-08.	No	P00722, p.10

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

16	IC00-0046			Aerial Photograph of Knin Marked by Witness 154	Aerial Map of Knin, Marked in Court by Witness BERIKOFF, Philip.	No	P00746
17	0641-8270			Aerial Photograph of Knin Marked by Witness 154	Aerial Photograph Marked	No	P00928
18	0632-9250-MARKED			Digitally Enhanced version of P00984: Aerial Photograph of Knin with Witness Markings.	Aerial Photograph of Knin with Witness Markings.	No	P00984
19	IC00-0059				Black and white aerial photograph of Knin, additional markings in red color made by witness DAWES, Murray on 14.10.08.	No	P00985
20	0424-9211	03-Oct-08		Attachement to Supplemental Witness Statement of Kosta NOVAKOVIC (02&03-10-2008). Aerial Photograph of Knin with witness markings	Aerial Photograph with red markings.	No	P01095
21	0424-9337			Marked Photograph and Legend of Knin - Witness 100	Document entitled 'Locations Marked by Normand Boucher on Aerial Photograph of Knin, marked areal photograph and an areal photograph makred by witness Normand Boucher in court on 18 December 2008	No	P01179
22	0634-3876			Aerial Photo of Knin marked by witness 130	Aerial Photo marked red	No	P01293
23	IC00-0074				Aerial photograph of Knin, marked by witness RAJCIC on 19.02.09.	No	P02337
24				Court Binder Map 29: Knin Town Plan	Court Binder Map 29: Knin Town Plan		P02430
25	1D17-0390			Maps - Knin situation 4 Aug 1995 - Legitimate Military targets	Aerial photographs - Knin situation 4 August 1995 - Legitimate Military Targets	No	D00131
26	IC00-0057				Black and white ariel photograph marked by witness Murray DAWES in court on 14 October 2008.	No	D00864

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

27	IC00-0060			Black and white aerial photo marked in court by witness Maria Teresa Mauro on 18 November 2008.	No	D00955
28	1D65-0495		D-131 Map of legitimate military targets with addition of information from 0634-7312 (List of Known Targets [red] - targets located in Knin)	Maps entitled: 'D-131 Map of legitimate military targets'; 'Table of Identified Targets'; 'Artillery Preparation Plan'	No	D01261
Maps/fotos of Benkovac Discussed in Judgement, paras. 1424-1429						
1	IC00-0025			Color map of Benkovac marked in court by Witness P-056 on 27 May 2008.	No	P00290
2	IC00-0065			Color map of Benkovac marked by witness RAJCIC on 19.02.09.	No	P0232Z
3	IC00-0075			05186 - Map marked in court	No	P02363
4	1D25-0140		Maps of the city of Benkovac and area.	Maps of the city of Benkovac and area.	No	D00248
	1D25-0143.D248					D00248
5	1D69-0145		Map presentations of Benkovac area showing targets according to 'Jagoda' and incorporated information from admitted exhibit P2327	Map presentations of Benkovac area marked by witness SINOBAD, Dusan on 2 March 2009.	No	D01446
	1D69-0159.D1446					D01446
6	1D72-4002		Corrected version of D1460 (JAGODA target list on Google Earth / Overlay of P2327)	Maps: 'JAGODA Target List on Google Earth'	No	D01460
7	IC00-0080			Aerial map of Benkovac marked by witness VUKASINOVIC on 15.06.09.	No	D01500
8	IC00-0081			Aerial map of Benkovac marked by witness VUKASINOVIC on 15.06.09.	No	D01501
Maps/fotos of Gracac Discussed in Judgement, paras. 1455-1459						
1	0424-8876	23-Apr-08	Map marked by Witness P-48. The map represents different locations in Gracac. Based on Map of Gracac Area. Extracted from Map: Base 470-2 UNPROFOR 1002.651er 4855.	Map of Gracac area marked by Witness Mile Sovilj, dated 23 April 2008.	No	P00088
2	0634-6508		Map annotated on by Witness 165	Map of Gracac city marked red	No	P00192

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

3	0634-8609		Cut out of UNPROFOR Road Map of the former Krajina area, Marked by Witness 123	Road Map of the former Krajina area marked, signed and dated 25 May 2008	No	P0030Z
4	0635-4554		Computer version of the map bearing ERN 0611-1555 mentioned under 65 ter number 4687. This map is related to Gracac	Gracac area color map marked red.	No	P0053Z
5	IC00-0036			Gracac area color map marked by witness Herman Steenberg in court on 30 June 2008.	No	P00538
6	IC00-0067			Color map of Gracac, marked by witness RAJCIC on 19.02.09.	No	P02329
7	IC00-0011			Map of Gracac area marked by witness SOVILJ, Mile on 25 April 2008	No	D00135
8	1D35-0001		Map of Gracac - Military Targets (blue additions made by Gotovina Defence to P537)	Map of Gracac - Military Targets (blue additions made by Gotovina Defence to P537).	No	D00439
9	1D72-4002		Corrected version of D1460 (JAGODA target list on Google Earth / Overlay of P2327)	Maps: JAGODA Target List on Google Earth'	No	D01460
10	IC00-0090			Map marked in court by witness Dragutin Vumek on 15 December 2009	No	D01900
Maps/fotos of Obrovac Discussed in Judgement, paras. 1474-1476						
1	0635-7526		Photograph of Obrovac with markings made by W-15.	Color Photograph marked red	No	P00549
2	IC00-0066			Color map of Obrovac marked by witness RAJCIC on 19.02.09.	No	P02328
3	1D25-0201		Maps of the city of Obrovac to be commented on by witness 56	Maps of the city of Obrovac.	No	D00249
	1D25-0203		Translation of 1D25-0201-1D25-0202		No	D00249
Trial Judgement materials						
1				Gotovina Trial Judgement, Volume 1		Gotovina Trial Judgement, Volume 1
2				Gotovina Trial Judgement, Volume 2		Gotovina Trial Judgement, Volume 2
3				Summary of Gotovina Trial Judgement		Summary of Gotovina Trial Judgement
Firing tables						

List of Materials Provided to Lt-Gen. (Ret.) Dick Applegate, updated as 21 April 2012

1			Firing table for 122mm mbri	Firing tables for self-propelled rocket launcher 122mm M-21-OF and self-propelled rocket launcher 122mm VULKAN.	No	<u>Not in evidence--ERN: 0631-5718-0631-5767</u>
2				Partial translation	No	<u>Not in evidence--ERN: 0631-5728-0631-5732-ET</u>
3			Firing table for 130mm gun	Firing tables for gun 130mm M46	No	<u>Not in evidence--ERN: 0631-5673-0631-5717</u>
4				Partial translation	No	<u>Not in evidence--ERN: 0631-5689-0631-5693-ET</u>

Public Annex II

COMMENTS BY LIEUTENANT GENERAL (RETIRED) C C BROWN ON THE REPORTS, COMMENTS AND OBSERVATIONS OF GENERALS (RETIRED) SCALES, SHOFFNER, GRIFFITH AND GRANVILLE-CHAPMAN ON CROATION ARMY (“HV”) USE OF ARTILLERY AND ROCKETS ON TARGETS BASED IN KNIN, CROATIA, 4-5 AUGUST 1995

Biography

I am a retired British Army lieutenant general with 36 years’ active duty service. I have served in 8 different theatres of combat of which I was directly or indirectly responsible for artillery fire in the Falklands war, Bosnia-Herzegovina, Kosovo, Afghanistan and Iraq. My relevant experience includes:

- Command as a field artillery officer from second lieutenant (1974) to lieutenant colonel (1994 – 96), including platoon (UK ‘troop’), battery and battalion (UK ‘regimental’) command of 105mm parachute artillery. Mentioned in dispatches for gallantry as a forward artillery observer in the 1982 Falklands war. Five years’ service between 1974 and 1992 in Germany, where the focus was on Warsaw Pact indirect fire systems, including battery command and battalion operations officer (S3) 1984 - 1986 with 155mm self-propelled conventional and nuclear artillery.
- Divisional artillery gun and missile brigade command in the 1st (UK) Armoured Division (1999 – 2002), responsible for all aspects of gun and rocket artillery.
- Staff appointments including:
 - As a major, responsibility for briefing the Army Board and Defence Planning Staff on all aspects of artillery and rocket systems (1987 – 1989);
 - As a lieutenant colonel, instructor at the Army Staff College (1992 – 94) with responsibility for indirect fire tactics and doctrine;
 - As a colonel, chief of plans branch (NATO ‘ACOS G5’) of a multinational corps headquarters, responsible for the planning of multinational artillery operations for NATO in Bosnia-Herzegovina (IFOR, 1996), Kosovo (KFOR, 1999) and for NATO’s rapid reaction contingency plans;
 - As a brigadier, chief UK planner in US Central Command (2002), responsible for coordination of all UK-US indirect fire planning for Afghanistan and Iraq;
 - As a major general, Chief of Staff of NATO’s International Security Assistance Force in Afghanistan (2006), responsible for the coordination of all indirect fires and the training of Afghan National Army artillery using former Warsaw Pact weapon systems. Awarded a Queen’s Commendation for Valuable Service;
 - As a lieutenant general, head of the UK’s Iraq lessons programme (2009 – 10), including all lessons from artillery and rocket systems.

- Professional head of the UK Army Artillery Branch (UK 'Director Royal Artillery' 2002 - 03) covering all aspects of artillery doctrine and training.
- Deputy Commanding General Multinational Forces Iraq (2009), deputising to a US 4 star general, responsible for in-theatre strategic direction of all aspects of the coalition campaign.

Executive Summary

The Defence appears to have latched onto a single erroneous conclusion of the Trial Chamber while ignoring a raft of evidence which suggests that the HV fires at Knin on 4 and 5 August 1995 were at best reckless and indiscriminate with regard to civilian casualties and collateral damage and suggest negligence in terms of HV tactics, techniques and procedures. Various 'experts' have produced or estimated Probable Error figures for the weapons systems in question. I have proposed the figures from the HV firing tables which would have been known and understood by the appellants. But it does not matter whose figures are accepted by the Court: the best case Probable Error, combined with no evidence to show that the HV conducted accepted procedures to reduce the inaccuracy of artillery directed against Knin on 4 and 5 August 1995, shows that the HV used inappropriate weapon systems for targets in close proximity to the 15000 civilians in Knin, and were both negligent in their tactics, techniques and procedures, as well as indiscriminate in their targeting between military targets and civilians/civilian installations. If the probable error ellipses are overlaid on the targets which the Trial Chamber found were engaged by HV artillery, let alone the additional inaccuracy caused by apparent negligence to correct other errors, very little of Knin and its civilian population would have been safe.

Methodology.

I was invited by ICTY prosecutors in February 2012 to provide expert consultancy on artillery issues in the current case. I was provided with the background materials and a framework of questions listed in Annex A. I also requested and received from prosecutors BCS versions (plus partial translations) of firing tables for the artillery and rocket systems in question in order. I also requested further assistance in navigating and translating more of the BCS versions in order to produce as accurate as possible an opinion on this issue. In producing this report, where appropriate I have also drawn from unclassified doctrine, as it would have appeared at the time of the actions in this case.

Report of Major General (ret) Robert H. Scales, Jr., Proposed Defence Exhibit DA20

1) *In Section 5, General Scales states that the Croatian Army ("HV") fired into Knin to achieve the effects of neutralization and harassment. He further states that "the weapons employed, Soviet 130mm guns and 122mm rockets, were well suited to achieve these effects."*

a) *Please describe the distinction between neutralization fires and harassment fires.*

Answer: Neutralization fires are defined by Jane's Dictionary of Military Terms¹ as "Fire which is delivered to hamper and interrupt movement, and/or the firing of weapons", whereas harassment fires are defined² as "Fire designed to disturb the rest of the enemy troops, to curtail movement and, by threat of losses, to lower morale". The distinction therefore lies in the intent, rather than the number of rounds fired, although neutralization is target-dependent - for example, a hardened or protected target is more likely to require a greater number of rounds over a given time in order to neutralize it, rather than a target which has no protection - and unlikely to be effective without accurate fire at a rate sufficient to interrupt movement and/or fires.

b) *Please comment on whether you agree that harassment and neutralization fires were directed against Knin.*

Answer: Given my answer above that the distinction between these 2 types of fire lies in the firer's intent, there does not appear to be evidence that HV made any distinction between the 2 types of fire. In terms of what was actually achieved by the artillery fires against Knin, the evidence³ that the bombardment of Knin started with a relatively heavy rate of fire on 4 August 1995, then reduced before increasing again as HV forces approached the town on 5 August is consistent with neutralization and harassment fires, although there is more evidence to suggest that rates of fire were dictated by limited ammunition stocks⁴. The distinction in this case may therefore be academic.

c) *If so, please comment on the HV's tactic of directing harassment and neutralization fires against Knin.*

Answer: The appropriateness of the HV's tactic of directing harassment and neutralization fires against Knin should be judged against its proportionality and actual, as opposed to intended, effect, given the weapons systems and tactics, techniques and procedures used⁵. Evidence⁶ suggests that the actual neutralizing effect of the HV fires on military targets was expected by the HV to be limited, particularly in firing against targets such as Martić's apartment. This is unsurprising given the analysis of likely error in Paragraphs 4 and 8 below. On the other hand, the Trial Chamber concluded that "even a small number of artillery projectiles can have great effects on nearby civilians"⁷.

d) *Please comment on the extent of any military advantage in using harassment fire against targets in Knin.*

¹ Macdonald & Co (Publishers) Ltd, Page 112 of the 1975 edition. Similar NATO definitions are available, but the reference is chosen to show as close to universally accepted definitions as possible.

² Ibid, Page 79.

³ Judgment, Paragraphs 1365-68.

⁴ P461, 1D76-0110 (Brioni transcript), Page 21/22.

⁵ See Answer 1e below.

⁶ E.g. Judgment, Paragraph 1910: "Rajčić recognized that the chance of hitting or injuring Martić by firing artillery at his building was very slight".

⁷ Judgment, Paragraph 1909.

Answer: The military advantage of using harassment, as opposed to neutralization, fires against targets in Knin would include the likelihood of less damage to military installations which might be useful to HV forces once the town had been occupied. Although reduced rates of fire normally associated with harassment, as opposed to neutralization, would mathematically result in fewer rounds impacting outside targets smaller than 6 x Probable Error (PE) for range and deflection⁸, harassing fire is not *per se* less likely than neutralizing fires to cause collateral damage to civilians/civilian installations: the likelihood of such damage is related more to the accuracy of the weapon systems and the tactics, techniques, and procedures employed.

e) *Please comment on whether the HV's firing on targets in Knin was appropriate from a military perspective to achieve the effects of neutralization and harassment.*

Answer: From the evidence available the HV's artillery fire against Knin appears inappropriate from the perspective of both intent and effect. While a clear intent supported by orders to fire on military targets in Knin would be evidence of appropriate military neutralization and/or harassment, the evidence suggests that Knin itself was the target: the apparent absence of rules of engagement, other than the order to "put Knin under artillery fire", with a presidential caveat of avoiding the UNCRO barracks⁹, the reports of TS-4 firing at the general area of Knin or at Knin on at least two occasions without specifying an artillery target¹⁰, the identification of targets purely by coordinates without militarily-relevant target descriptions¹¹, all indicate recklessness. The actual effect achieved by the HV bombardment, given the proximity of civilians in Knin and the weapon systems¹², tactics, techniques and procedures¹³ employed might be summarized as:

	Initial bombardment 4 August 1995	Intermediate bombardment	Final bombardment 5 August 1995
130mm gun	Shock and limited neutralization of military targets with significant damage to civilian infrastructure	Harassment of military targets with less extensive damage to civilian infrastructure	Limited neutralization of military targets with significant damage to civilian infrastructure
122mm rocket	Shock /indiscriminate haphazard neutralization throughout Knin	Indiscriminate harassment throughout Knin	Harassment /haphazard indiscriminate neutralization throughout Knin

f) *Please comment on whether 130-mm guns and 122-mm rockets would have been "well suited" to neutralization and harassment of enemy operations in Knin.*

⁸ This encompasses some 95% of the distribution of fire from a gun or rocket. See Answer 9 below for a more detailed discussion of PE.

⁹ Judgment, Paragraph 1977, citing P461, 1D76-0110 (Brioni transcript), Page 15.

¹⁰ Judgment, Paragraph 1906.

¹¹ Judgment, Paragraph 1898 (FN20).

¹² See Answers 1f and 4 below for more detailed comment.

¹³ See Answers 5 - 9 below for more detailed comment.

Answer: While 130 mm guns and 122 mm rockets are not inherently inappropriate for neutralization and harassment, the tactics, techniques and procedures employed in their use at Knin made them poorly suited, given that the military targets were in relatively close proximity to civilians/civilian installations. The inherent inaccuracy of these weapon systems, combined with the tactics, techniques and procedures employed at Knin, was likely to cause collateral civilian damage. This would have been known by HV commanders. Moreover, the use of more accurate HV weapon systems (mortars and/or smaller caliber and more accurate guns), rather than 130mm guns and 122mm rockets, could have reduced the likelihood of civilian collateral damage, especially if combined with appropriate tactics, techniques and procedures.

g) *Please compare and comment on General Scales' statement that the 130-mm guns and 122-mm rockets were "well suited" to neutralization and harassment of enemy operations in Knin vis-à-vis footnote 5 of his report, where he states that he "can testify personally to the inherent inaccuracy of these weapons."*

Answer: General Scales' personal testament "to the inherent inaccuracy of these weapons" does not sit well with his contention¹⁴ that they were "well suited" to neutralization and harassment of enemy positions at Knin, especially given the relatively close proximity of civilians/civilian installations within the town. I agree with General Scales' comment¹⁵ on "the inherent inaccuracy of these weapons": both were designed against Soviet doctrine of mass bombardment of targets where collateral civilian casualties or damage had little or no relevance. Inherent accuracy is measured in terms of PE¹⁶. By this yardstick the 122mm rocket system is inherently more inaccurate than the 130 mm gun. Both are inherently less accurate than the nearest equivalent NATO systems¹⁷. The inherent inaccuracy of both systems is exacerbated where procedures such as accurate survey of gun positions and targets, and input of meteorological data are omitted. There is little evidence to suggest that such measures were employed at Knin¹⁸.

2) *In Section 7, General Scales states, "Missions fired against Knin in Operation Storm, by definition were GS [General Support] fires by long range rockets and guns designed for that purpose."*

a) *Please comment on whether you agree that the artillery missions against Knin were GS fires.*

Answer: The important issue here is not whether the fires were GS or direct support (DS): it is that the further distinction which General Scales draws between observed DS and unobserved GS fires does not appear to be underpinned by doctrine; more importantly it does not override the general principle that indirect fire should be as accurate as possible in order to be both effective and proportionate. The evidence suggests that the fires against Knin could be

¹⁴ Proposed Defence Exhibit 20 ("Scales Report"), Page 3, Section 5.

¹⁵ Scales Report, Footnote 5.

¹⁶ See Answer 9 below for more detail.

¹⁷ 155mm gun (see Konings' p1898 and report Exhibit P1259 Pages 11-13) and Multi-Launch Rocket System (MLRS).

¹⁸ See Answer 8 below for a detailed analysis of the factors.

described as GS in the initial stages of the battle, but perfectly feasible that they were DS during the latter stages when HV units were in close proximity to the town. Whether or not the “missions fired against Knin in Operation Storm, by definition, were GS [General Support] fires” is a question of whether they were fired in support of a designated unit or in general support of the operation¹⁹. In attempting to look at this issue from the perspective of those involved at the time, there does not appear to be evidence that HV themselves consciously differentiated between GS and DS; as with the distinction between neutralization and harassment analyzed above, such distinction may therefore be academic.

b) *If so, please comment on the HV's tactic of conducting GS fires against Knin during Operation Storm.*

Answer: Irrespective of the doctrinal distinction between DS and GS, it was incumbent on the HV to observe fires against Knin whenever possible and with whatever means were available in order to ensure accuracy and correct the fall of shot wherever it was not impacting on a designated military target. Observation improves accuracy. If, as General Scales suggests, the fires against Knin were unobserved and uncorrected²⁰, the impression of indiscriminate firing is thereby strengthened.

3) *In Section 7, General Scales states, “Individual fire missions were directed against relatively small area targets, such as command and control facilities, where lethal effects are achieved by selecting a single point of aim, allowing the natural wide dispersion of such fires to cover the target.”*

a) *Please comment on whether you agree that the artillery attack against Knin was directed at “relatively small area targets.”*

Answer: HV target lists²¹ appear to comprise ten-figure grid references which, by definition, imply point targets (1 metre x 1 metre): this, however, is not supported by the descriptions of military targets in Knin²² where targets appear to range from individual buildings to areas measuring several hundred metres in breadth and/or depth.

b) *If so, please comment on the HV's tactic of directing artillery fire against “relatively small area targets” in Knin during Operation Storm.*

Answer: The issue is not whether the targets engaged were relatively small: the issue is how much spread might be expected from engaging those targets. Very few, if any, of the target areas identified could be engaged “by selecting a single point of aim, allowing the natural wide dispersion of such fires to cover the target” without a high probability that some of the rounds would land outside the target area, particularly where 122mm rockets were used. This would have been known

¹⁹ See Jane's Dictionary of Military Terms, Pages 57 and 75.

²⁰ Scales Report, Section 12: “All rounds at issue on 4 and 5 August were both unregistered and unobserved. Thus, tracking doctrine, all 900 rounds effectively were ‘first rounds,’ since none of the rounds fired over two days could have been adjusted closer to the target than the initial rounds fired.”

²¹ P1271 and P1272.

²² E.g. D1261.

by HV commanders. If General Scales is correct that the artillery attack against Knin was directed at “relatively small targets”, the weapon systems and tactics, techniques and procedures employed by the HV artillery would be even less appropriate by virtue of their inaccuracy.

4) *The artillery attack against Knin employed 130-mm guns and 122-mm rockets. The Trial Chamber found in paragraph 1233 of the Judgment that the civilian population of Knin was at least 15,000 at the time Operation Storm was launched on 4 August 1995.*

a) *In your opinion, was the use of 130-mm guns and 122-mm rockets to strike targets in the town of Knin an appropriate use of those weapons systems? Please comment.*

Answer: The use of 130mm guns and 122mm rockets to strike targets in Knin appears inappropriate, especially since there is no evidence of measures to minimize the inaccuracy of the fires. Given the 15000 civilian population of Knin at the time of the attack²³, the use of 130mm guns and 122mm rockets against Knin could only be described as “appropriate” and proportionate if 2 conditions applied:

- First, that the effect desired by HV against SVK targets in Knin could not be achieved with more accurate weapon systems such as mortars or smaller calibre guns; and
- All measures to minimise the ‘error budget’ of the inherently inaccurate 130mm gun and 122mm rocket systems were taken, including:
 - Moving the weapon systems closer to Knin to achieve an optimal range in order to minimise PE;
 - Accurate survey of gun/rocket positions;
 - Observation and, where possible, accurate survey of targets;
 - Incorporation of ballistic meteorological data;
 - Firing of registration missions.

There does not appear to be any evidence to suggest that either condition, let alone both, was met. General Scales’ suggestion that ‘HV gunners were instructed to “fire using gunner’s quadrant”’²⁴ appears neither supported by evidence nor, in itself, would make the use of these weapon systems more appropriate or accurate. Indeed, without accurate survey of gun positions or targets, the use of quadrant laying merely imparts greater precision in range from an inaccurate gun position to an inaccurate target. Quadrant laying does not eradicate other underlying inaccuracies: it perpetuates them. The most common use of quadrant laying is in DS fires where friendly forces are in close proximity to the fall of shot, thereby further calling into question General Scales’ distinction between DS and GS fires.

²³ Judgment, Paragraph 1233.

²⁴ Scales Report, Paragraph 5.

b) *To what extent, if any, does the appropriateness of firing 130-mm guns and 122-mm rockets into Knin depend on whether the HV was:*

- *directing neutralization and harassment fires against Knin;*
 - *using GS fires against Knin; or*
 - *directing fire against “relatively small area targets”?*
- Feel free to address the factors together or in isolation.*

Answer: The appropriateness of these weapons has nothing to do with whether the fire is described as harassment or neutralization, DS or GS. The issue of “relatively small targets” is analyzed in Answer 3 above. The appropriateness of these weapon systems is confined to the issues analyzed in Answer 4a above.

5) *On page 9, 1st paragraph, General Scales states, “It does not appear that the HV artillery or MBRLs had the opportunity to register targets at Knin.” In Section 12, General Scales states, “All rounds at issue on 4 and 5 August were both unregistered and unobserved. Thus, tracking doctrine, all 900 rounds effectively were ‘first rounds,’ since none of the rounds fired over two days could have been adjusted closer to the target than the initial rounds fired.”*

a) *Please comment on the HV firing all rounds unregistered into Knin.*

Answer: Given the lack of evidence to suggest that the HV artillery adopted the other measures in Answer 4a above in order to ensure that the fires into Knin were appropriate, the firing of all rounds unregistered into Knin strengthens the impression of indiscriminate fire. In extremis an artillery unit may have to fire such missions without registration, but in such circumstances it would be expected that all other practical measures to reduce the ‘error budget’ would be taken: the evidence from Knin suggests this was not done.

b) *Please comment on the HV firing all rounds unobserved into Knin.*

Answer: General Scales’ contention that the HV fires were unobserved further strengthens the impression of indiscriminate fire. It appears from the evidence available to the Trial Chamber²⁵ that HV artillery units had ground observers and UAVs, but there appears to be no evidence to suggest that sufficient priority was given to ensuring that observation of the fires into Knin were observed.

c) *Please comment on the HV firing 900 rounds over two days into Knin without adjusting rounds closer to the target.*

Answer: The aspect which underscores my impression of indiscriminate fire the most is General Scales’ accusation of HV failure to adjust fire more accurately onto the military targets, particularly on 5 August when HV forces were close enough to observe the fall of shot. By 5 August the tactical situation around Knin suggests that ground observers should have been able to

²⁵ Including General Map 1, Exhibit Number P2322.

observe and correct artillery fires against military targets in Knin itself. The difficulty of observing military targets in an urban area may explain the inability of ground observers to correct fires onto designated military targets, but any such inability merely confirms that artillery fires were allowed to continue at targets which could not be verified as legitimate. Even if targets in the heart of Knin could not be observed, several of the targets which the Trial Chamber concluded had been engaged are on the outskirts of Knin where fires should have been more easily observed and corrected. And if that was not possible, techniques are available to artillery observers to direct fire into a safe area which can be observed, such as open terrain outside a town, in order to establish accuracy, and then adjust the fires from there onto a legitimate target²⁶.

- d) *Please comment on General Scales' conclusion on page 9, 1st paragraph that registration fires "normally would not be employed in relation to an attack such as that conducted by the HV" and that "[u]se of registration fires doubtless would have compromised the attack's shock effect....".*

Answer: General Scales' conclusion²⁷ that registration fires "normally would not be employed in relation to an attack such as that conducted by the HV" runs contrary to his Footnote 11, cited above, while his conclusion that "[u]se of registration doubtless would have compromised the attack's shock effect" can, at best, justify a failure to register in the opening stages of the attack. Once the opening salvos had impacted, the element of surprise or shock effect would have been lost. Following the initial shock effect, the subsequent reduction in rates of fire which supports the "harassment" description²⁸ further suggests that compromise was not an issue after the initial bombardment. But the risk of compromise is, in any case, no justification to forego registration²⁹ since registration can take place on targets well away from the intended objective. Moreover, registration would normally be undertaken at the conclusion of the validity of current meteorological data, normally a maximum of 12 hours. Had HV gunners been concerned to maximize the accuracy of their fires during what was an engagement lasting more than 24 hours, they would have conducted registration missions at least twice and, in the absence of accurate meteorological data, more frequently.

- e) *Please compare and comment on General Scales' discussion of registration in the main text in pages 8-9 vis-à-vis his statement in footnote 11 that "pre-digitization, no American artillery unit would be permitted to fire a GS preparatory and harassment mission without first registering."*

Answer: General Scales' observation that "no American artillery unit would be permitted to fire a GS preparatory and harassment mission without first registering"³⁰ is an accurate and telling reflection not just of US doctrine, but of a general principle of indirect fire. Registration is a process whereby a

²⁶ Akin to the 'registration' process.

²⁷ Ibid, Page 9, first paragraph.

²⁸ Analyzed in Answer 1e above.

²⁹ Again, Footnote 11 is telling in this respect.

³⁰ Ibid, Footnote 11.

known point is engaged, the difference between that known point and the initial fall of shot equating to the combined error budget. Applying that difference to targets effectively irons out the error, albeit limited by area and time³¹. Thus the known point can be offset from the intended targets in order to maintain surprise. As argued in Answer 5a above, where registration is for any reason impractical, it may in extremis be acceptable to open fire, but it would be reasonable to expect that all other possible measures to reduce the 'error budget' would have been taken. Failure to do so, as appears to be the case here, would rightly, as General Scales suggests, be considered negligence.

6) *In Section 6, General Scales states that "general support missions are predictive (unobserved, or 'shooting off a map')" and that "the GS mission provides unobserved, longer range fires".*

a) *Please comment on whether GS fires are unobserved.*

Answer: As stated in Answer 2 above, the distinction which General Scales draws between observed direct support (DS) and unobserved GS fires does not appear to be underpinned by doctrine; more importantly it does not override the general principle that indirect fire should be as accurate as possible in order to be both effective and proportionate.

b) *Please comment on whether or to what extent difficulty in establishing observation of the target affects a decision to employ GS fires and/or to engage certain targets.*

Answer: Given General Scales' suggestion that HV gunners applied none of the other measures³² to improve the accuracy of their fires, observation takes on an importance which ought to have afforded it a priority, in terms of getting ground observers into suitable positions and/or for use of aerial observation platforms, in order to discriminate between military targets and civilians/civilian installations. Difficulty in observing a target is one of several 'error budget' factors which would affect a decision to employ GS fires and/or to engage certain targets³³. Where as many as possible of those measures have been taken, it may be appropriate to employ GS fires without observation, but only in a situation where the likelihood of civilian casualties or collateral damage is low. At Knin, knowing that there were thousands of civilians in close proximity to the targets selected, not only is there no evidence to suggest that any of the normal measures were taken, but there is also no evidence to suggest that such apparent negligence was offset by attempts to observe and correct the fall of shot, despite the fires continuing over a period of 2 days, by the end of which HV forces were positioned to observe the fires.

7) *In Section 8, pages 5-9, General Scales discusses the factors bearing on the accuracy of fires.*

³¹ Normally 3 km from the point of registration and the validity of the current meteorological data (under normal circumstances a minimum of 6 and a maximum of 12 hours).

³² Analyzed in Answers 4a above and 8 below.

³³ Others are described in both the Judgment, Paragraph 1898 and Section 8 of the Scales' Report.

a) *Please comment on General Scales' discussion.*

Answer: I agree with General Scales' discussion of the factors bearing on the accuracy of fires³⁴, apart from his conclusions on registration missions discussed above.

b) *Please compare and comment on General Scales' discussion vis-à-vis the factors bearing on accuracy discussed in paragraph 1898 and other parts of the Judgement.*

Answer: Although the judgment of the Court on this issue³⁵ considers appropriate factors, it contains two conclusions, one of which I disagree with and another which has the potential to mislead:

- The final sentence of Paragraph 1898 is, in my opinion, a weak conclusion: "Evaluating all of this evidence, the Trial Chamber considers it a reasonable interpretation of the evidence that those artillery projectiles which impacted within a distance of 200 metres of an identified artillery target were deliberately fired at that artillery target". In this respect I concur with General Scales. In attempting to consolidate a complex technical issue, the Trial Chamber appears to have reached a simplistic and unsound conclusion. A sound conclusion from the evidence available to the Trial Chamber might have been that HV use of the weapon systems and associated, tactics, techniques and procedures in the attack on Knin were inappropriate, indiscriminate and reckless for the engagement of targets in close proximity to civilians or civilian installations.
- The statement that "that the HV used a ten digit coordinate system, which would enable it to plot its targets with an accuracy of up to one metre" should not be taken to imply that the fires directed at those targets would be accurate to one metre, nor even that the coordinates accurately define a legitimate target.

8) *In Sections 8 and 10, General Scales notes factors that would affect HV artillery accuracy, including:*

- *The 130-mm guns and 122-mm rockets "were fired at the extreme limits of range (122 mm MBRLs, 19,000 meters and 130 guns, 26,000 meters)." (page 6, 1st bullet)*
- *"The HV artillery appears to have relied generally on classic 'map spot' techniques" when locating targets, introducing "a target error of 100 meters—and likely somewhat more." (page 7, 1st bullet)*
- *"None of the artillery pieces employed in the Knin missions were surveyed. They were located using the 'resection' technique." (page 7, 2nd bullet)*
- *"At best, HV artillery appears to have set direction by either a Soviet compass (creating at least 10-15 mil error, on average) or by an aiming circle from the firing position, giving rise to 5-10 mils of error." (page 7, 3rd bullet)*

³⁴ Scales Report, Pages 5-9.

³⁵ Particularly Paragraph 1898.

- *“There is no evidence that the HV units in this engagement aggregated common lots or separated out those ‘odd’ lots, without which this can become the greatest source of error for mass, unobserved fires.” (page 8, 1st paragraph)*
- *“[T]he range dispersions shown on the survey charts for some of these targets suggest rocket range ‘creep,’ which could mean that some of the launcher vehicles were not adequately grounded.” (page 8, 2nd bullet)*
- *“The most telling technical shortcoming of HV artillery operations at Knin was the lack of an accurate meteorological message prior to firing.” (page 10, 1st bullet)*
- *“Quality of artillery materiel, guns, rocket launchers and ammunition was highly questionable.” (page 10, 3rd bullet)*
- *“[M]ost if not all of [HV artillerymen] were inexperienced gunners.” (page 10, 4th bullet)*

a) *Please comment on how these factors would affect HV artillery accuracy. Feel free to address the factors together or in isolation.*

Answer: The limited evidence at the trial to suggest that HV acted on any of these factors in order to improve the accuracy of their fires strengthens the impression of reckless and indiscriminate fires on Knin. To put some flesh on General Scales’ generalities³⁶:

- The firing of 130mm guns and 122mm rockets at “the extreme limits of range” resulted in the maximum PE³⁷. For example, at a range of 12km the PED of the 122mm rocket system is less than half that at 20km. At a range of 14km the PER of the 130mm gun is less than half that at 26km. There appears to be no evidence to suggest that HV took the opportunity to move their weapon systems forward to optimal ranges in order to minimize PE at any stage in the battle. Even collocation of the 130mm guns with the 122mm rockets in order to reduce the guns’ range to 20km would have substantially improved their accuracy.
- In terms of meteorological data, BCS firing tables confirm that at a range of 20km a 10 metre per second tail- or head-wind would make the 122mm rocket system 453 metres inaccurate for range; and a difference of 10°C in air temperature would add a further 264 metres of inaccuracy. The same meteorological variations applied to the 130mm gun system at a range of 26km would impart a range inaccuracy of 583 metres and 317 metres respectively.
- In terms of the quality of the 130mm guns, barrel wear which reduced muzzle velocity by 10 metres per second would reduce range by 336 metres at a range of 26km.

Errors of hundreds of metres – greater than the inherent PE of the weapon systems themselves³⁸ - can build up as a result of failure to address these factors.

³⁶ Judgment, Paragraph 1898 cites Konings’ evidence that “a number of external factors (such as muzzle velocity, wind speed, air temperature and density) can lead to variations in the locations of impacts of between 18 and 60 metres per factor”.

³⁷ See Answer 9 below.

³⁸ See Answer 9 below.

In respect of all other bullets above, I agree with general Scales' conclusion, except in his judgment of HV gunners' experience. The evidence of Rajcac claims a greater degree of expertise than General Scales credits; at the very least the evidence of artillery orders, target lists etc suggests that HV artillery commanders would have known they were negligent in failing to apply measures to reduce the error budget.

b) *Please comment on how these factors would affect a commander's decision to launch an artillery attack against "relatively small area targets" in Knin. Feel free to address the factors together or in isolation.*

Answer: General Scales' conclusions in respect of these factors therefore reinforces my contention that the weapon systems were inappropriate for use targets in close proximity to civilians/civilian installations in an urban area, especially "relatively small area targets" against which the majority of rounds would knowingly have impacted outside the target area.

9) *In Sections 3, 10 and 12, General Scales concludes that the Trial Chamber's 200-meter margin of error is too restrictive and that a 400-meter standard would be "more accurate and realistic."*

a) *Please comment on General Scales' conclusion.*

Answer: Although I agree with General Scales that a "400 meter radius is a more accurate and realistic standard", particularly when applied to the 130 mm gun, it remains overly simplistic, particularly in the context of 122 mm rockets, to conclude conversely that any rounds landing outside a 400 metre radius of a military target were deliberately fired at something other than that target. Without wishing to increase the complexity of this issue for the Court, an understanding of how such a margin of error is arrived at is a necessary precursor to a judgment on whether the HV fires on Knin were appropriate. In light of the analysis of the 'error budget' above, the Court needs to be clear that the combined effect of probable error³⁹ together with the other factors affecting accuracy⁴⁰ made the HV fires on Knin sufficiently indiscriminate between military targets and civilians/civilian installations as to be reckless and inappropriate.

b) *Please comment on whether or to what extent the applicable margin of error affects the analysis as to whether the artillery attack against Knin was a properly conducted military operation.*

Answer: Best case scenarios indicate that, at a range of 26km, engagement by 130 mm gun of any target within a 300 metre radius of civilians or civilian infrastructure carried significant risk of collateral damage, and that engagement of any target by 122 mm rocket within 600 a metre radius of civilians or civilian

³⁹ "The error in range, deflection, or in radius, which a weapon may be expected to exceed as often as not. Horizontal error of weapons making a nearly vertical approach to the target is described in terms of circular error probable. Horizontal error of weapons producing elliptical dispersion pattern is expressed in terms of probable error." Jane's Dictionary of Military Terms, Page 83.

⁴⁰ Analyzed in Answers 4 and 8 above.

infrastructure carried significant risk of collateral damage. Given the lack of evidence that HV carried out accepted artillery practice to minimize other elements of the 'error budget', these figures could easily be doubled as explained in Answer 8 above. HV commanders would have known this from their training and doctrine. Therefore it is reasonable to conclude that any 130mm gun fires targeted within 600 metres or 122 mm rocket fires targeted within 1200 metres of civilians or civilian infrastructure were reckless or indiscriminate with regard to civilian casualties. Having agreed with General Scales' conclusion that the Trial Chamber's 200 metre margin of error is simplistic and too restrictive a basis on which to infer deliberate targeting, it may help the Court for me to attempt to crystallize the evidence which has been presented to it variously by Messrs Konings, Corn and Leslie and that which is offered by the reports of Generals Scales and Shoffner using extracts where appropriate from UK doctrine⁴¹. Firing at a fixed elevation the fall of shot from a single gun will be distributed in the following pattern:

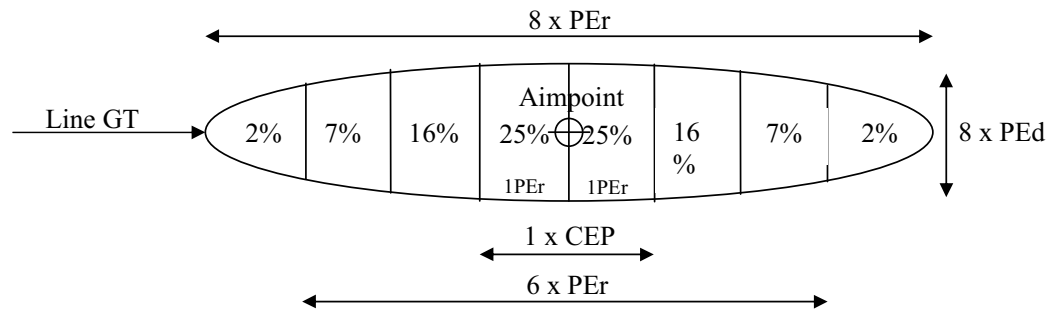


Figure 1: Diagram showing fall of shot pattern created by 1 x gun firing 100 rounds

It can be seen that whilst 50% of an appreciable number of rounds fired will land within 1PEr either side of the target (= 1 Circular Error Probable (CEP) in General Shoffner's terminology), it is possible that other rounds could land up to 4 PEr (along Line GT) away from the point of aim. Applying these principles to the HV artillery systems involved and using the evidence available to the parties, best case:

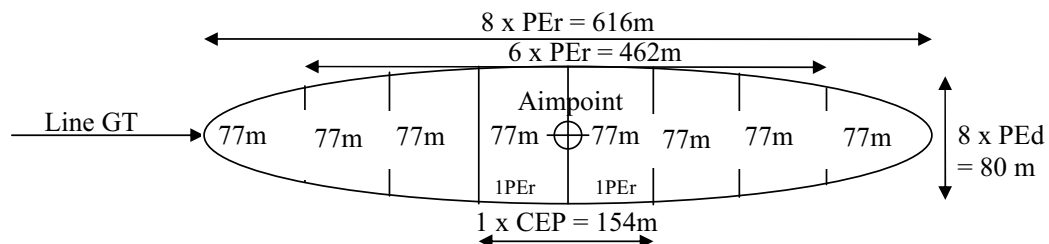


Figure 2: Diagram (not to scale) showing fall of shot pattern created by 130mm Gun at 26km⁴² range using BCS Firing Table data⁴³.

⁴¹ Abridged from Artillery Orders, Deployment and Operations (ODOPs), UK's artillery doctrine.

⁴² The mean range considered by the Trial Chamber in the Judgment, Paragraph 1898 and the range which Rajcac used to describe PE.

⁴³ Page 115 of the 130mm gun firing tables gives the value of 1 x PEr at a range of 26 km as 77 metres (Cf General Scales' "75meters in range (PEr)", General Shoffner's PEr estimate of 82.5 metres and

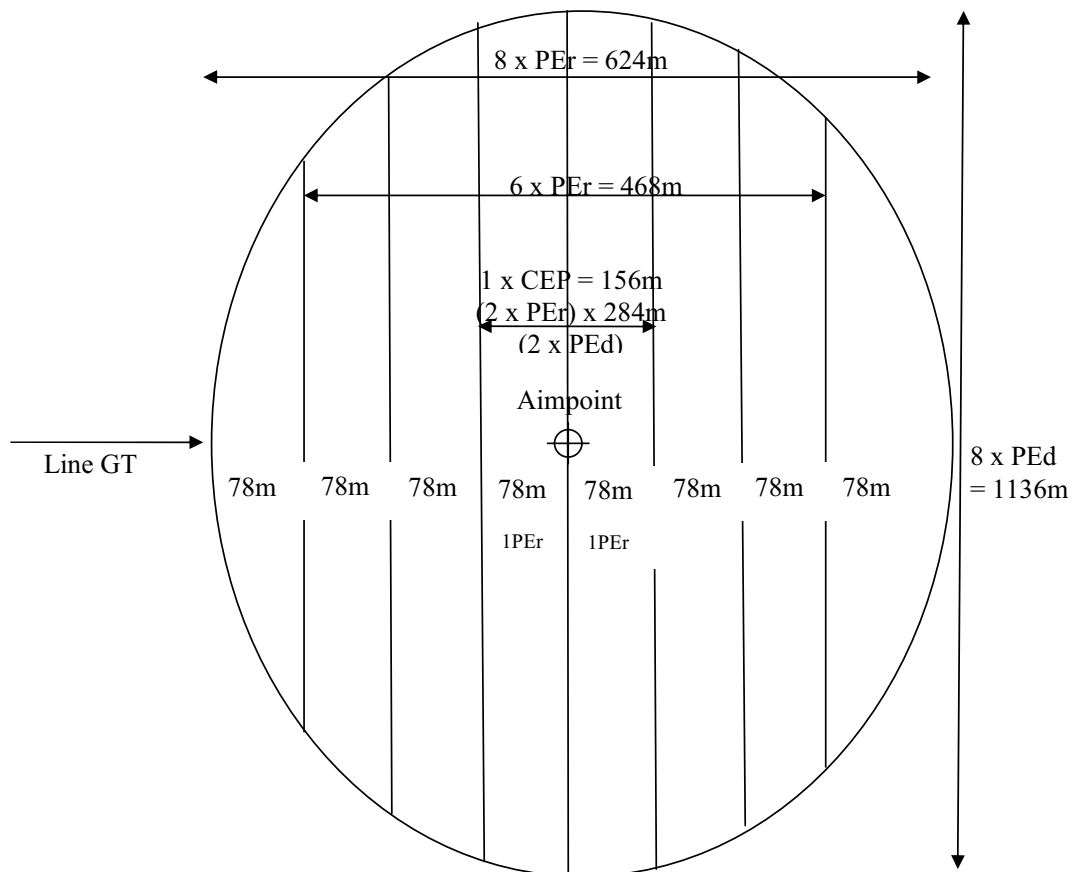


Figure 3: Diagram (not to scale) showing fall of shot pattern created by 122mm Rockets at 20km range using BCS Firing Table data⁴⁴.

There are significant differences in terminology between the evidence available and substantial discrepancies between the figures quoted. General Scales appears to use “PE” to equate to Shoffner’s “CEP”; this may account for some of his figures appearing half of what others have estimated. Nevertheless, and whichever figures are used, it may now be clear that the weapon systems which HV used in the bombardment of Knin were inherently likely to cause collateral damage when targeted within a 300 metre radius for 130 mm guns or a 600 metre radius for 122 mm rockets from civilians or civilian installations. Moreover, these distances account only for the errors inherent in the weapon systems themselves: they do not include the other elements of the error budget⁴⁵ which could easily have the effect of doubling these distances.

Rajcac’s “about 70 to 75 metres in distance”) and 1 x PEd as 10 metres (Cf General Scales “26 meters left and right of the target (PEd)” and “about 15 metres along the axis”).

⁴⁴ Page 13 of the 122mm rocket firing tables gives the value of 1 x PEr at a range of 20 km as 78 metres (Cf General Shoffner’s “CEP ... = 300m” PEr figure and General Scales’ “82m”) and 1 x PEd as 142 metres (Cf General Scales’ “125m in direction” PEd figure).

⁴⁵ Analyzed in Answers 4 and 8 above.

10) *In Section 13, General Scales states, “Indeed, simply disregarding the myriad sources of common ballistic error, as it appears was the case in the Opinion here under review, would expose to criminal prosecution an untold number of combat military officers who did no more than follow indirect fire doctrine that has been universally accepted for decades, both within the United States and throughout the world.”*

a) *Please comment on whether the HV’s employment of artillery against Knin represents the application of an indirect fire doctrine that has been universally accepted for decades.*

Answer: There appears to be no evidence to show that the HV’s employment of artillery at Knin represents “indirect fire doctrine that has been universally accepted for decades”. Far from “follow[ing] indirect fire doctrine”, the lack of evidence brought by the Defence to the Trial Chamber suggests that HV officers negligently abused their own doctrine and generally accepted principles of indirect fire. My opinion in this respect is not changed by General Scales’ observations. I agree with General Scales’ conclusion that the final sentence of Paragraph 1898 “would expose to criminal prosecution ... combat officers who did no more than follow the indirect fire doctrine that has been universally accepted for decades, both within the United States and throughout the world”, but I disagree that the Trial Chamber “simply disregard[ed] the myriad sources of common ballistic error, as it appears was the case in the Opinion here under review”. It appears from the evidence that the relevant factors were considered, albeit in a potentially confusing way which led the Trial Chamber to a genuine, albeit erroneous attempt to articulate their conclusion. The underlying implication - that the HV fires on Knin were indiscriminate, reckless and inappropriate – stands.

Report of Lieutenant General (ret) Wilson A. Shoffner, Proposed Defence Exhibit DA21

1) *In Section 2.b.i., General Shoffner states that 122-mm rockets are “well suited for use against troops in the open or for use in artillery preparations. Because these weapons have a large circular area probable . . . they are not suited for attacks against point targets.”*

a) *Please comment on General Shoffner’s conclusion.*

Answer: I concur with General Shoffner’s statement that 122mm rockets are “well suited for use against troops in the open for use in artillery preparations. Because these weapons have a large circular error probable ... they are not suited for attacks against point targets.”

b) *In light of your answer to the prior question, please comment on the use of 122-mm rockets by the HV when firing on Knin.*

Answer: For the same reason – a best case probable error in perfect conditions which means that, at a range of 20km, 50% of rounds would fall outside an ellipse 156 metres x 284 metres – 122 mm rockets are unsuited to attacks against any targets, but especially point targets, in close proximity to civilians or civilian installations.

2) *In Section 2.b.ii, General Shoffner discusses factors that can affect the accuracy of a 130-mm gun.*

a) *Please comment on General Shoffner’s discussion.*

Answer: I concur with General Shoffner’s discussion⁴⁶ of factors which affect the accuracy of a 130mm gun. My only observation is that, as with his analysis of the accuracy of 122mm rockets, the PE figures are his “estimate”, whereas the figures on which my report, including Answer 1b above, is based are taken from the BCS firing tables which are both more accurate and a reflection of what HV commanders at the time would have known from their doctrine and training.

3) *On pages 2-4 of the report, General Shoffner notes his disagreement with a 200-meter margin of error for the HV artillery used in Knin during 4-5 August 1995. In particular, in Section 2.c., General Shoffner states that “95% of the rockets fired can be expected to fall within 900 meters of the aimpoint and the [sic] 95% of the artillery projectiles would be within 495 meters of the aimpoint.”*

a) *Please comment on General Shoffner’s analysis.*

Answer: General Shoffner’s analysis that “95% of the rockets fired can be expected to fall within 900 meters of the aimpoint and the [sic] 95% of the

⁴⁶ Proposed Defence Exhibit 21 (General Shoffner’s Report), Section 2.b.ii

artillery projectiles would be within 495 meters of the aimpoint” is a logical deduction from his estimated PE figures.

- 4) *In Section 2.c., General Shoffner states, “the fires were unregistered with no correction for non standard [sic] conditions or for specific meteorological conditions”*

a) *Please comment on the HV firing into Knin without registration and without correction for non-standard or meteorological conditions.*

Answer: I concur with General Shoffner’s observation that “[s]ince the fires were unregistered with no correction for non standard conditions or for specific meteorological conditions ... these are very conservative estimates of dispersion”. I have argued⁴⁷ that the lack of evidence to suggest that the HV attempted to correct for external factors could be a greater factor in inaccuracy than PE, easily doubling the dispersion.

- 5) *In Section 3, General Shoffner states that the Trial Chamber’s standard of review “would unfairly condemn commanders who have properly conducted military operations pursuant to accepted technical and tactical standards.”*

a) *Please comment on whether the use of artillery on Knin was a properly conducted military operation pursuant to accepted technical and tactical standards.*

Answer: I disagree with General Shoffner’s statement: “Nor is there anything that would lead me to conclude there was any negligence on the part of commanders directing or executing the use of indirect fires in Knin”. The evidence suggests that the use of artillery on Knin was not an appropriately conducted military operation pursuant “to accepted technical and tactical standards”. I would have sacked for negligence any officer under my command where the evidence failed to show that he/she took any of the accepted measures to improve the ‘error budget’ in a situation similar to Knin. I find it surprising that General Shoffner thinks otherwise. I agree with General Shoffner’s conclusion that to “allow this fallacious finding [“that anything beyond 200 meters would have been intentionally aimed ... “] by the Trial Chamber to stand ... would place at risk ... commanders who are executing their responsibilities in a professionally competent and morally responsible manner”, but the weapon systems and associated tactics, techniques and procedures used in the bombardment of Knin were nevertheless reckless, indiscriminate and inappropriate.

⁴⁷ My Answer 8 to the ‘Scales report’.

Report of General (ret) Ronald H. Griffith, Proposed Defence Exhibit DA22

1) *In paragraph 2, General Griffith states, “Nor does it appear from what is described in the report that the pattern of indirect fire employment supports a conclusion that the use of these fires was intended to kill or wound civilians, or that the fires were employed in an inherently indiscriminate manner.”*

a) *Do you agree that the use of artillery fire against Knin was not intended to kill or wound civilians, or that artillery fire against Knin was not employed in an inherently indiscriminate manner? Please comment.*

Answer: I disagree with General Griffith’s conclusion: “Nor does it appear ... that the fires were employed in an inherently indiscriminate manner” in a city with 15000 inhabitants and civilian installations in close proximity to the targets engaged. General Shoffner estimates, reasonably in my view, that “[m]ore than 50% of the rockets can be expected to fall more than 300 meters from the aim point and more than 50% of the artillery can be expected to fall more than 165 meters from the aim point and that assumes everything else is perfect” and “[s]ince the fires were unregistered with no correction ... these are very conservative estimates of dispersion”. If the probable error ellipses for 130mm guns and 122mm rockets firing at almost maximum range, let alone the additional inaccuracy caused by apparent negligence to correct other errors, are overlaid on the targets which the Trial Chamber found were engaged by HV artillery, very little of Knin and its civilian population would have been safe.

2) *General Griffith states:*

- *“I have been advised that the evidence at trial did not establish conclusively that the artillery attack against targets in Knin caused a single civilian death or injury, nor did any evidence prove that civilians who fled the city did so as a result of being terrorized by the shelling. Assuming this to be true, the absence of a single casualty strongly reinforces the other reasons why, and the conclusion that, General Gotovina’s use of indirect fires was done in a responsible manner and was in no way unlawful by any reasonable standard.” (paragraph 3)*
- *“Military leaders are morally compelled to take every prudent action to protect non-combatants in their zones and / or areas of operations. From Major General Scales [sic] report, I can see no evidence that General Gotovina violated his responsibility to meet this obligation in his employment of artillery fires during the battle at Knin.” (paragraph 6)*

a) *Please comment on whether the artillery attack against Knin was conducted in a responsible manner.*

Answer: The absence of conclusive evidence of civilian casualties as a result of the shelling or its effect on the minds of civilians is not in itself, in my view, proof of “a responsible manner”. It seems to me that the action/inaction of the HV commanders should be the deciding factor in this respect.

b) *Please comment on whether every prudent action was taken during the artillery attack against Knin to protect non-combatants.*

Answer: There is no evidence to suggest that HV commanders took measures which were intended to discriminate or were effective in discriminating between legitimate military targets and civilians. If the reports of Generals Scales and Shoffner are correct, almost every prudent action which the HV could have taken to protect non-combatants was ignored. Moreover, the Trial Chamber dismissed⁴⁸ Rajcic's claim that "the HV took the rules of distinction and of proportionality into account".

⁴⁸ Judgment, Paragraph 1910.

Report of General (ret) Sir Timothy Granville-Chapman, Proposed Defence Exhibit E

1) On p.1, General Granville-Chapman states, “There is, in my opinion, absolutely no justification for concluding that rounds falling outside the 200 metre box were indicative of a deliberate attempt to fire on separate (and possibly inappropriate) targets. The spread of the few rounds outside that box is entirely within the limits of an area artillery system as explained very fully in the reports of Generals Scales and Shoffner.”

a) Please comment on this, in light of your analysis of the use of artillery against Knin as a whole.

Answer: I concur with General Granville-Chapman’s statement that “[t]here is, in my opinion, absolutely no justification for concluding that rounds falling outside the 200 metre box were indicative of a deliberate attempt to fire on separate (and possibly inappropriate) targets”⁴⁹.

2) On pp.1-2, General Granville-Chapman states, “The Trial Chamber concluded its judgements nearly a decade and a half after the event at a time when the techniques and capability that have prevailed in the most recent operations have reached a remarkable level of sophistication. Today in NATO those calling for fire have to reach a certified standard of competence, meteorological data is highly reliable, ammunition lots are carefully controlled and muzzle velocity can be constantly measured on each gun. Despite these advances, artillery remains an area weapon and, in the British case, a gun used in Afghanistan typically delivers only 90% of its rounds within a 250 metre box at operational range.”

a) Please comment on the extent, if any, to which contemporary advances in capability may affect your analysis of the proposed defence expert reports authored by Generals Scales, Shoffner or Griffith, which address the use of artillery in 1995.

Answer: My analysis of this case is based on the technical capabilities which were available and the accepted tactics, techniques and procedures in 1995, when I was an artillery regimental commander. Advances since 1995 have indeed, as General Granville-Chapman explains, reduced the error budget in comparison with 1995; however, many of these advances have come about as a result of improvements to guided munitions delivered by both air and artillery systems which were not available to HV forces in 1995. My analysis is based on free-flight ballistic projectiles (130mm shells and 122mm rockets) which, as General Granville-Chapman states, carry comparable accuracy risks as British systems, both in 1995 and still today.

3) Please consider General Granville-Chapman’s comment on pp.1-2 that, even though the use of artillery today has “reached a remarkable level of sophistication”, “artillery remains an area weapon” and, as such, “special

⁴⁹ Hence my comments on the final sentence of Paragraph 1898 in both the Executive Summary and Answer 10 to the Scales Report above.

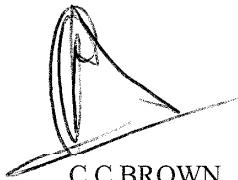
procedures" are applied if friendly forces are within 250 metres of the aimpoint.

a) *Please comment on whether non-combatants also require protection by the use of "special procedures", and evaluate whether the use of artillery against Knin was consistent with the use of any such precautions.*

Answer: The principles of taking great care to avoid collateral damage, either to friendly forces or to non-combatants, are not new: they have evolved with the laws of war and would have been understood by the combatants in Operation STORM. HV commanders' training and doctrine would have included the factors affecting the error budget, particularly probable error. In the same way that I have argued⁵⁰ that HV artillery accuracy in Knin could have been improved by firing into observed safe areas and then adjusting fire from there onto legitimate targets, the corollary is that evidence of HV use of such a technique would have provided an indication of a genuine attempt to minimize collateral damage.

b) *Please explain whether the importance of the use of precautions has changed given technical advances in the use of artillery since 1995.*

Answer: The importance of the use of precautions has changed little since 1995: what has changed in the intervening time is the ability to make more accurate collateral damage predictions. The precautions in 1995 were based on probable error calculations and were unsophisticated in the sense that, if anything, they were overly cautious and restrictive. They were nevertheless effective if practised⁵¹.



C C BROWN

Date 18 April 2012

Annex:

A. List of Materials.

⁵⁰ Answer 5c to the Scales Report above.

⁵¹ In the 1982 attack on South Georgia, the rules of engagement I was given by the Task Force Commander included the avoidance of damage to either the British Antarctic Survey installations or the former whaling station at Grytviken. My targets were therefore selected no closer than 8 x PE to these installations, even though it was known from intelligence that the Argentine forces had occupied some of these buildings which could have therefore justified their inclusion as legitimate military targets.

ANNEX A TO COMMENTS BY
LIEUTENANT GENERAL (RETIRED)
C C BROWN ON THE REPORTS,
COMMENTS AND OBSERVATIONS
OF GENERALS (RETIRED) SCALES,
SHOFFNER, GRIFFITH AND
GRANVILLE-CHAPMAN ON
CROATION ARMY (“HV”) USE OF
ARTILLERY AND ROCKETS ON
TARGETS BASED IN KNIN,
CROATIA, 4-5 AUGUST 1995

LIST OF MATERIALS (with dates of receipt in parenthesis)

- Trial Chamber Gotovina Judgement (2 volumes plus summary) (14 February 2012).
- Defence Expert Reports (Proposed Exhibit 20 - “Scales Report”; Proposed Exhibit 21 - “Shoffner Report”; and Proposed Exhibit 22 – “Griffith Report” (13 March 2012).
- Terms of Reference and Questions Letters (15 March 2012).
- CD of ‘Materials for Experts’ (154 documents) dated 26 March 2012 (27 March 2012 by courier)
- Fourth proposed expert report by General Granville-Chapman (3 April 2012).
- Supplemental materials (including General Map 1 [P2322] in both soft and hard copy, plus 130mm and 122mm rocket firing tables in BCS and part translation), and supplemental questions dated 4 April 2012 (4 April 2012).
- Abridged extract of UK ODOPS from 7th Parachute Regiment RHA (5 April 2012).
- Translation of P461 dated 16 April 2012 (16 April 2012).
- Updated consolidated list of materials dated 17 April 2012 (18 April 2012).

Abridged Extract of UK ODOPS from 7th Parachute Regiment RHA

PROBABLE ERROR (PE)

1. Probable Error for range (PEr) and deflection (PEd) are calculated by either ballistic modelling or from controlled firings with single lot ammunition which define the most likely variance in fall of shot for length and lateral spread from line GT. For UK CS Arty the value of 1 PEr and 1 PEd is listed in Table G of the firing tables relevant to the eqpt in use. In practice there are other factors that increase the size of PE, in particular:

- a. **For range (PEr).** The wear of the gun, changes in Met conditions, lot to lot variations in the propellant and the effects of slope.
- b. **For line (PEd).** Changes in the cross component of the wind.

ZONE

2. Firing at a fixed Quadrant Elevation (QE) the fall of shot from a single gun will be distributed in the following pattern:

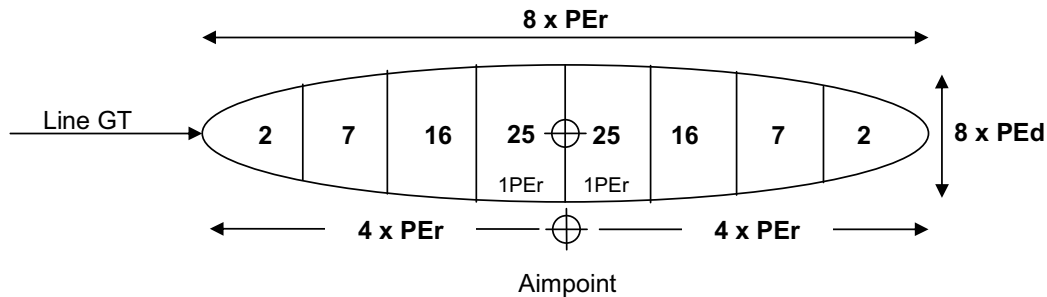


Figure 1: zone diagram showing fall of shot pattern created by 1 x gun firing 100 rounds

- a. It can be seen that whilst 50% of an appreciable number of rounds fired will land within 1 PEr either side of the target, it is possible that other rounds could land up to 4 PEr (along line GT) away from the point of aim. As a rule of thumb, 1 PEd is approximately 1/5 x PEr.

MEAN POINT OF IMPACT (MPI)

3. Each gun will have its own individual MPI and the fall of shot of all guns will form the MPI of the fire unit.

Abridged from CS ODOPS



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15 March 2012

Lt-Gen. (Ret.) Chris Brown CBE

Dear General Brown,

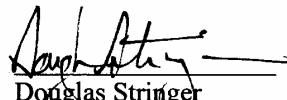
Re: Expert report in *Prosecutor v. Ante Gotovina*, Case No. IT-06-90-A

Thank you for agreeing to prepare an expert report. We have drafted the questions in the Annex for you to answer. Each question is specifically linked to the proposed defence expert reports. In your answers, please feel free to cite to the materials you have been provided.

This letter and attached list of questions should be included as an appendix to your report, to assist the Appeals Chamber in understanding the process by which you were instructed as an expert. You should also include in an appendix a list of materials that you reviewed in preparing the report.

Please do not hesitate to contact Todd Schneider (+31 70 512 5185), Matthew Cross (+31 70 512 5716) or me (+31 70 512 8523) should there be any questions.

Yours very truly,


Douglas Stringer
Senior Appeals Counsel

Annex

Please structure your report around the following questions. Please reproduce the questions verbatim as headings in your report.

Although references to specific portions of the proposed defence expert reports are provided below, please feel free to consider any other portions of the reports which you think are significant.

Report of Major General (ret) Robert H. Scales, Jr., Proposed Defence Exhibit DA20

- 1) In Section 5, General Scales states that the Croatian Army (“HV”) fired into Knin to achieve the effects of neutralization and harassment. He further states that “the weapons employed, Soviet 130mm guns and 122mm rockets, were well suited to achieve these effects.”
 - a) Please describe the distinction between neutralization fires and harassment fires.
 - b) Please comment on whether you agree that harassment and neutralization fires were directed against Knin.
 - c) If so, please comment on the HV’s tactic of directing harassment and neutralization fires against Knin.
 - d) Please comment on the extent of any military advantage in using harassment fire against targets in Knin.
 - e) Please comment on whether the HV’s firing on targets in Knin was appropriate from a military perspective to achieve the effects of neutralization and harassment.
 - f) Please comment on whether 130-mm guns and 122-mm rockets would have been “well suited” to neutralization and harassment of enemy operations in Knin.
 - g) Please compare and comment on General Scales’ statement that the 130-mm guns and 122-mm rockets were “well suited” to neutralization and harassment of enemy operations in Knin vis-à-vis footnote 5 of his report, where he states that he “can testify personally to the inherent inaccuracy of these weapons.”
- 2) In Section 7, General Scales states, “Missions fired against Knin in Operation Storm, by definition were GS [General Support] fires by long range rockets and guns designed for that purpose.”
 - a) Please comment on whether you agree that the artillery missions against Knin were GS fires.
 - b) If so, please comment on the HV’s tactic of conducting GS fires against Knin during Operation Storm.
- 3) In Section 7, General Scales states, “Individual fire missions were directed against relatively small area targets, such as command and control facilities, where lethal effects are achieved by selecting a single point of aim, allowing the natural wide dispersion of such fires to cover the target.”
 - a) Please comment on whether you agree that the artillery attack against Knin was directed at “relatively small area targets.”

- b) If so, please comment on the HV's tactic of directing artillery fire against "relatively small area targets" in Knin during Operation Storm.
- 4) The artillery attack against Knin employed 130-mm guns and 122-mm rockets. The Trial Chamber found in paragraph 1233 of the Judgement that the civilian population of Knin was at least 15,000 at the time Operation Storm was launched on 4 August 1995.
- a) In your opinion, was the use of 130-mm guns and 122-mm rockets to strike targets in the town of Knin an appropriate use of those weapons systems? Please comment.
- b) To what extent, if any, does the appropriateness of firing 130-mm guns and 122-mm rockets into Knin depend on whether the HV was:
- directing neutralization and harassment fires against Knin;
 - using GS fires against Knin; or
 - directing fire against "relatively small area targets"?
- Feel free to address the factors together or in isolation.
-
- 5) On page 9, 1st paragraph, General Scales states, "It does not appear that the HV artillery or MBRLs had the opportunity to register targets at Knin." In Section 12, General Scales states, "All rounds at issue on 4 and 5 August were both unregistered and unobserved. Thus, tracking doctrine, all 900 rounds effectively were 'first rounds,' since none of the rounds fired over two days could have been adjusted closer to the target than the initial rounds fired."
- a) Please comment on the HV firing all rounds unregistered into Knin.
- b) Please comment on the HV firing all rounds unobserved into Knin.
- c) Please comment on the HV firing 900 rounds over two days into Knin without adjusting rounds closer to the target.
- d) Please comment on General Scales' conclusion on page 9, 1st paragraph that registration fires "normally would not be employed in relation to an attack such as that conducted by the HV" and that "[u]se of registration fires doubtless would have compromised the attack's shock effect...."
- e) Please compare and comment on General Scales' discussion of registration in the main text in pages 8-9 vis-à-vis his statement in footnote 11 that "pre-digitization, no American artillery unit would be permitted to fire a GS preparatory and harassment mission without first registering."
- 6) In Section 6, General Scales states that "general support missions are predictive (unobserved, or 'shooting off a map') and that "the GS mission provides unobserved, longer range fires".
- a) Please comment on whether GS fires are unobserved.
- b) Please comment on whether or to what extent difficulty in establishing observation of the target affects a decision to employ GS fires and/or to engage certain targets.

-
- 7) In Section 8, pages 5-9, General Scales discusses the factors bearing on the accuracy of fires.
- Please comment on General Scales' discussion.
 - Please compare and comment on General Scales' discussion vis-à-vis the factors bearing on accuracy discussed in paragraph 1898 and other parts of the Judgement.
- 8) In Sections 8 and 10, General Scales notes factors that would affect HV artillery accuracy, including:
- The 130-mm guns and 122-mm rockets “were fired at the extreme limits of range (122 mm MBRLs, 19,000 meters and 130 guns, 26,000 meters).” (page 6, 1st bullet)
 - “The HV artillery appears to have relied generally on classic ‘map spot’ techniques” when locating targets, introducing “a target error of 100 meters—and likely somewhat more.” (page 7, 1st bullet)
 - “None of the artillery pieces employed in the Knin missions were surveyed. They were located using the ‘resection’ technique.” (page 7, 2nd bullet)
 - “At best, HV artillery appears to have set direction by either a Soviet compass (creating at least 10-15 mil error, on average) or by an aiming circle from the firing position, giving rise to 5-10 mils of error.” (page 7, 3rd bullet)
 - “There is no evidence that the HV units in this engagement aggregated common lots or separated out those ‘odd’ lots, without which this can become the greatest source of error for mass, unobserved fires.” (page 8, 1st paragraph)
 - “[T]he range dispersions shown on the survey charts for some of these targets suggest rocket range ‘creep,’ which could mean that some of the launcher vehicles were not adequately grounded.” (page 8, 2nd bullet)
 - “The most telling technical shortcoming of HV artillery operations at Knin was the lack of an accurate meteorological message prior to firing.” (page 10, 1st bullet)
 - “Quality of artillery materiel, guns, rocket launchers and ammunition was highly questionable.” (page 10, 3rd bullet)
 - “[M]ost if not all of [HV artillerymen] were inexperienced gunners.” (page 10, 4th bullet)
- Please comment on how these factors would affect HV artillery accuracy. Feel free to address the factors together or in isolation.
 - Please comment on how these factors would affect a commander's decision to launch an artillery attack against “relatively small area targets” in Knin. Feel free to address the factors together or in isolation.
-
- 9) In Sections 3, 10 and 12, General Scales concludes that the Trial Chamber's 200-meter margin of error is too restrictive and that a 400-meter standard would be “more accurate and realistic.”

- a) Please comment on General Scales' conclusion.
 - b) Please comment on whether or to what extent the applicable margin of error affects the analysis as to whether the artillery attack against Knin was a properly conducted military operation.
-

10) In Section 13, General Scales states, "Indeed, simply disregarding the myriad sources of common ballistic error, as it appears was the case in the Opinion here under review, would expose to criminal prosecution an untold number of combat military officers who did no more than follow indirect fire doctrine that has been universally accepted for decades, both within the United States and throughout the world."

- a) Please comment on whether the HV's employment of artillery against Knin represents the application of an indirect fire doctrine that has been universally accepted for decades.

Report of Lieutenant General (ret) Wilson A. Shoffner, Proposed Defence Exhibit DA21

- 1) In Section 2.b.i., General Shoffner states that 122-mm rockets are “well suited for use against troops in the open or for use in artillery preparations. Because these weapons have a large circular area probable . . . they are not suited for attacks against point targets.”
 - a) Please comment on General Shoffner’s conclusion.
 - b) In light of your answer to the prior question, please comment on the use of 122-mm rockets by the HV when firing on Knin.
- 2) In Section 2.b.ii, General Shoffner discusses factors that can affect the accuracy of a 130-mm gun.
 - a) Please comment on General Shoffner’s discussion.
- 3) On pages 2-4 of the report, General Shoffner notes his disagreement with a 200-meter margin of error for the HV artillery used in Knin during 4-5 August 1995. In particular, in Section 2.c., General Shoffner states that “95% of the rockets fired can be expected to fall within 900 meters of the aimpoint and the [sic] 95% of the artillery projectiles would be within 495 meters of the aimpoint.”
 - a) Please comment on General Shoffner’s analysis.
- 4) In Section 2.c., General Shoffner states, “the fires were unregistered with no correction for non standard [sic] conditions or for specific meteorological conditions”
 - a) Please comment on the HV firing into Knin without registration and without correction for non-standard or meteorological conditions.
- 5) In Section 3, General Shoffner states that the Trial Chamber’s standard of review “would unfairly condemn commanders who have properly conducted military operations pursuant to accepted technical and tactical standards.”
 - a) Please comment on whether the use of artillery on Knin was a properly conducted military operation pursuant to accepted technical and tactical standards.

Report of General (ret) Ronald H. Griffith, Proposed Defence Exhibit DA22

- 1) In paragraph 2, General Griffith states, “Nor does it appear from what is described in the report that the pattern of indirect fire employment supports a conclusion that the use of these fires was intended to kill or wound civilians, or that the fires were employed in an inherently indiscriminate manner.”
 - a) Do you agree that the use of artillery fire against Knin was not intended to kill or wound civilians, or that artillery fire against Knin was not employed in an inherently indiscriminate manner? Please comment.
- 2) General Griffith states:
 - “I have been advised that the evidence at trial did not establish conclusively that the artillery attack against targets in Knin caused a single civilian death or injury, nor did any evidence prove that civilians who fled the city did so as a result of being terrorized by the shelling. Assuming this to be true, the absence of a single casualty strongly reinforces the other reasons why, and the conclusion that, General Gotovina’s use of indirect fires was done in a responsible manner and was in no way unlawful by any reasonable standard.” (paragraph 3)
 - “Military leaders are morally compelled to take every prudent action to protect non-combatants in their zones and / or areas of operations. From Major General Scales [sic] report, I can see no evidence that General Gotovina violated his responsibility to meet this obligation in his employment of artillery fires during the battle at Knin.” (paragraph 6)
 - a) Please comment on whether the artillery attack against Knin was conducted in a responsible manner.
 - b) Please comment on whether every prudent action was taken during the artillery attack against Knin to protect non-combatants.



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4 April 2012

Lt-Gen. (Ret.) Chris Brown CBE

Dear General Brown,

Re: Expert report in *Prosecutor v. Ante Gotovina*, Case No. IT-06-90-A

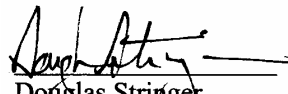
As we alerted you by telephone on Monday, the Defence on Friday filed a further (fourth) report by General Timothy Granville-Chapman, British Army (Ret.), which they seek to tender as additional expert evidence on appeal. We provided you this report by e-mail of 3 April 2012.

In this context, we have drafted the supplementary questions in the Annex for you to answer in your report, in addition to those set out in our letter of 15 March 2012. Each supplementary question is specifically linked to General Granville-Chapman's report. In your answers, please feel free to cite the materials you have been provided.

This letter and attached list of supplementary questions should be included as an appendix to your report, in addition to our initial letter of 15 March 2012, to assist the Appeals Chamber in understanding the process by which you were instructed as an expert.

Please do not hesitate to contact Todd Schneider (+31 70 512 5185), Matthew Cross (+31 70 512 5716) or me (+31 70 512 8523) should there be any questions.

Yours very truly,


Douglas Stringer
Senior Appeals Counsel

Annex

Supplementary Questions

Please structure your report around the following supplementary questions, in addition to those you have already received. Please reproduce the questions verbatim as headings in your report.

Although references to specific portions of the proposed defence expert report authored by General Granville-Chapman are provided below, please feel free to consider any other portions of the report which you think significant.

- 1) On p.1, General Ganville-Chapman states, “There is, in my opinion, absolutely no justification for concluding that rounds falling outside the 200 metre box were indicative of a deliberate attempt to fire on separate (and possibly inappropriate) targets. The spread of the few rounds outside that box is entirely within the limits of an area artillery system as explained very fully in the reports of Generals Scales and Shoffner.”

Please comment on this, in light of your analysis of the use of artillery against Knin as a whole.

- 2) On pp.1-2, General Granville-Chapman states, “The Trial Chamber concluded its judgements nearly a decade and a half after the event at a time when the techniques and capability that have prevailed in the most recent operations have reached a remarkable level of sophistication. Today in NATO those calling for fire have to reach a certified standard of competence, meteorological data is highly reliable, ammunition lots are carefully controlled and muzzle velocity can be constantly measured on each gun. Despite these advances, artillery remains an area weapon and, in the British case, a gun used in Afghanistan typically delivers only 90% of its rounds within a 250 metre box at operational range.”

Please comment on the extent, if any, to which contemporary advances in capability may affect your analysis of the proposed defence expert reports authored by Generals Scales, Shoffner or Griffith, which address the use of artillery in 1995.

- 3) Please consider General Granville-Chapman’s comment on pp.1-2 that, even though the use of artillery today has “reached a remarkable level of sophistication”, “artillery remains an area weapon” and, as such, “special procedures” are applied if friendly forces are within 250 metres of the aimpoint.
 - a) Please comment on whether non-combatants also require protection by the use of “special procedures”, and evaluate whether the use of artillery against Knin was consistent with the use of any such precautions.
 - b) Please explain whether the importance of the use of precautions has changed given technical advances in the use of artillery since 1995.



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17 April 2012

Lt-Gen. (Ret.) Chris Brown CBE

Dear General Brown,

Re: Expert report in *Prosecutor v. Ante Gotovina*, Case No. IT-06-90-A

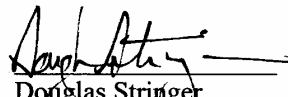
By our letters of 26 March 2012 and 4 April 2012, and our e-mail of 16 April 2012, we provided you with materials which may assist the preparation of your expert report.

Appended to this letter, please find attached an updated consolidated chart of all those materials provided to you on these dates.

Please annex this final letter and chart to your report, together with a.) our letter of instruction of 15 March 2012 and b.) our supplementary letter of instruction of 4 April 2012.

Please do not hesitate to contact Todd Schneider (+31 70 512 5185), Matthew Cross (+31 70 512 5716) or me (+31 70 512 8523) should there be any questions.

Yours very truly,



Douglas Stringer
Senior Appeals Counsel

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

Count	Doc ID	Main Date	Title	Description of Exhibit	Confidential	Exhibit Number
Draft list of materials to be sent to experts						
1		?	Report of Major General (ret) Robert H. Scales, Jr.			Proposed DA20
2		20-Oct-11	Report of Lieutenant General (ret) Wilson A. Shoffner			Proposed DA21
3		26-Oct-11	Report of General (ret) Ronald H. Griffith			Proposed DA22
4		?	Report of General (ret) Timothy Granville-Chapman			Proposed Exhibit E
Trial Expert reports						
1	0643-6709	18-Jan-08	Expert Report of Lt. Col. Harry Konings	Report Fire Support during Operation Storm, by Lt. Col. Harry Konings Royal Artillery, Royal Netherlands Army, August 1995	No	P01259
2	0643-6546	31-Oct-95	Addendum to Expert Report of Lt. Col. Harry Konings	Addendum to Expert Report	No	P01260
3	0645-2665		Corrigendum to the Expert Report and Addendum of Expert witness Lt. Col. Harry Konings	Corrigendum to the Expert Report and Addendum of Expert witness Lt. Col. Harry Konings	No	P01262
4	1D72-3442	28-Jun-09	Expert report of Professor Geoffrey Corn	Expert report of Professor Geoffrey Corn, dated 28.06.09.	No	D01642
5	1D72-3762	06-Sep-09	Supplemental Information Sheet / Clarification of witness Geoffrey Corn (AG-11)	Supplemental Information Sheet / Clarification of witness Geoffrey Corn, dated 06.09.09	No	D01643
Brioni Meeting						
1	1D76-0013	31-Jul-95	Presidential Transcript of meeting held in Brioni on 31st July 1995, including modifications as agreed by the parties and references to the attached CLSS memorandum in relation to disputed portions of the original transcription and translation (BCS Orig)	Minutes of the meeting held by the President of the Republic of Croatia F. Tudjman with military officials on 31 July 1995 at Brioni	No	P00461
	1D76-0001 P461			Translation		P00461
	1D76-0010 P461			Translation		P00461
	1D76-0110 P461			Translation		P00461
Orders						

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

1	0342-2520	02-Aug-95	Orders dated 02/08/95 by Ante GOTOVINA for the Offensive Operation involving forces of the Split Military District.	R. Croatia, Ministry of Defence HV Main Staff, Split Military District, Offensive Operation Order, signed by General Ante Gotovina, dated 2 August 1995 Translation	No	P01125
	0342-2520-0342-2538-ET P1125					P01125
2	0279-8827	03-Aug-95	Orders of artillery attacking issued by Chief of artillery Marijan FIRST pursuant to Orders issued by Ante GOTOVINA dt. 3 August 1995	Orders of artillery attacking issued by Chief of artillery Marijan FIRST pursuant to Orders issued by Ante GOTOVINA, dated 03.10.95. Translation	No	P01201
	0279-8827-0279-8828-EDT P1201					P01201
3	0211-8050	03-Aug-95	Orders issued by Colonel Mladen FUZUL, Zadar OG Commander re: implementing Ante GOTOVINA's Orders of attacking.	Orders issued by Colonel Mladen FUZUL, Zadar OG Commander, dated 03 August 1995. Translation	No	P01263
	0211-8050-0211-8057-ET P1263					P01263
4	0342-2548	02-Aug-95	Attacking orders, attachment for artillery, operation Kozjak Storm, Operation Storm, re: RFA 432, dated 02 August 1995.	R. Croatia, Ministry of Defence, HV Main Staff, Split ZP, 'Order to Attack - attachment for the artillery', signed by Brigadier Marko Rajic, dated 2 August 1995 Translation	No	D00970
	0342-2548-0342-2551-ET-1 D970					D00970
5	0609-8347	26-Jun-95	HV General Staff Operational Directive 12-4/95. Signed by General Bobetko.	HV General Staff Operational Directive 12-4/95. Signed by General Bobetko.	No	D00956
	ET 0609-8347-0609-8354 D956					D00956
6	0349-3647		Orders for attacking to Ministry of the Interior Special Police	Orders for attacking to Ministry of the Interior Special Police.	No	D02078
	0349-3647-EDT				No	D02078
Target Lists						

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

1	0634-7312		Table of identified targets in Knin for HV firing positions from Karli, Kljuc and Pakovo Selo	Document entitled: 'Table of Identified Targets', Region Karli, Kljuc and Pakovo Selo. Translation	No	P01271
	ET 0634-7312- 0634-7312 P1271					P01271
2	0634-7307		List of targets for artillery preparation fire in Knin	Documents/Charts Entitled: '2. Artillery preparation' and '1. Battalion Tasks' Translation	No	P01272
	0634-7307- 0634-7311-ET P1272					P01272
3	0614-2311		Coded Map Poskok 93	Coded Map Translation	No	P01273
	0614-2311- 0614-2311-ET P1273					P01273
4	0614-2441		ANNEX 12: the "Ivancica" positions map of the 7th gbr (digital)	ANNEX 12: the "Ivancica" positions map of the 7th gbr.	No	P02338
5	1D69-0104		List of targets of the TS/artillery group/ 3 of OG Zadar (Code Name: Jagoda)	List of targets of the TS/artillery group/ 3 of OG Zadar (Code Name: Jagoda). Translation	No	D01442
			English translation			D1442
General Maps						
1	0629-0379		ANNEX 3: Working Map of the NT of the ZP – Croatian Forces (digital)	ANNEX 3: Working Map of the NT of the ZP – Croatian Forces.	No	P02322
2	0645-2949		ATTACHMENT 2, 4th GB: Coded map Bura	ATTACHMENT 2, 4th GB: Coded map Bura.	No	P02475
3	1D63-0082	04-Aug-94	Map: Artillery Positions for Storm - Deployment of HV/HVO Operational Artillery Groups in Operation Kozjak (4 Aug 1995)	Map: 'Deployment of HV/HVO Operational Artillery Groups in Operation -Kozjak- 04 Aug 95'	No	D00971
Logs/Reports/Diaries						
1	0155-8825	14-Sep-95	Split Military District Operations Diary for the period 25-07-1995 to 14-09-1995	Split Military District, Operational Diary for the period 25 July to 14 September 1995, signed by Chief of Staff Rahim Ademir Translation	No	P00071
	0155-8825-ET- 1 P71					P00071

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

2	0361-1051	05-Aug-95	Report by Mladen MARKAC to Zvonimir CERVENKO on positions taken over by Special Police joint forces	R. Croatia, Ministry of the Interior, Special Police Sector, document entitled: Report on lines reached by the Special Police Joint Forces, signed by Colonel General Mladen Markac, dated, Seline Headquarters, 5 August 1995.	No	P00583
	0361-1051-ET-P583			Translation		P00583
3	0609-7506	23-Aug-95	Summary report from the 134 Hme Gurads Regiment to Commander of MD Split on performed combat task (artillery shelling of Benkovac without observation or correction of fire), No. 8286-01-95-75	Summary report from the 134 Hme Gurads Regiment to Commander of MD Split on performed combat task, dated 23.08.95.	No	P01200
	0609-7506-ET-P1200			Translation		P01200
4	0611-0832	04-Aug-95	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 1300 hours	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 1300 hours.	No	P01267
	0611-0832-ET-P1267			Translation		P01267
5	0611-0836	04-Aug-95	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 2000 hours	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 2000 hours, dated 04.08.95.	No	P01268
	0611-0836-ET-1 P1268			Translation		P01268
6	0611-0839	05-Aug-95	Regular report from Bruno MILIN, commander of TS-4 on combat operations at unspecified time	Regular report from Bruno MILIN, commander of TS-4 on combat operations at unspecified time, dated 05.08.95.	No	P01269
	0611-0839-ET-P1269			Translation		P01269
7	0643-0437		ANNEX 11: TS-3 diary for period 3 to 9 August 1995	ANNEX 11: TS-3 diary for period 3 to 11 August 1995.	No	P02342
	0643-0437-ET-P2342					P02342
8	0609-8869-1		ANNEX 13: Operations Diary of the 4th gbr	ANNEX 13: Operations Diary of the 4th gbr.	No	P02343

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

	0609-8869-ET-2 P2343					P02343
9	0606-1300		Extract from log of Special Police activities and movements during Operation Oluja. No author or source for the document at this time. ??-Aug-1995	Extract from log of Special Police activities and movements during Operation Oluja. No author or source for the document at this time. 2/7 -Aug-1995.	No	P02385
	ET-0606-1300 P2385			Translation		P02385
10	0643-0502		ANNEX 18: Operations diary of the 1st Sector from 20 June to 20 October 1995	ANNEX 18: Operations diary of the 1st Sector from 20 June to 20 October 1995.	No	P02436
	0643-0502-ET P2436			Translation		P02436
11	0645-3067		ATTACHMENT 16, 7th GB: Diary of Jura SEKANOVIC, Arty Bn/7th Gds Bgd.	ATTACHMENT 16, 7th GB: Diary of Jura SEKANOVIC, Arty Bn/7th Gds Bgd. 29-Jul-08-Aug-95.	No	P02455
	0645-3067-ET P2455			Translation		P02455
12	0645-3091	04-Aug-95	ATTACHMENT 23, 7th GB: Daily operations report of the bSVBR of 122mm BM21	ATTACHMENT 23, 7th GB: Daily operations report of the bSVBR of 122mm BM21; dated 04.08.95.	No	P02461
	0645-3091-ET P2461					P02461
13	0645-3092	05-Aug-95	ATTACHMENT 24, 7th GB: Daily operations report of the bSVBR of 122mm BM21	ATTACHMENT 24, 7th GB: Daily operations report of the bSVBR of 122mm BM21; dated 05.08.95.	No	P02462
	0645-3092-ET P2462			Translation		P02462
14	0645-3096		ATTACHMENT 28, 7th GB: Expenditure of Ammo/Arty Bn/7th Gds Bgd. 03-09-Aug-95	ATTACHMENT 28, 7th GB: Expenditure of Ammo/Arty Bn/7th Gds Bgd.; dated 04-08.08.95.	No	P02466
	0645-3096-ET P2466			Translation		P02466

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

15	0645-3099		ATTACHMENT 29 , 7th GB: Diary of Rudolf FRANJCEC, Commander of commanding Pltn/122mm MBRs. 13-Jul-Sep 1995	ATTACHMENT 29 , 7th GB: Diary of Rudolf FRANJCEC, Commander of commanding Pltn/122mm MBRs.; dated 13-Jul-Sep 1995.	No	P02467
	0645-3100-ET P2467			Translation		P02467
16	0645-3151		ATTACHMENT 35 , 7th GB: Daily order book: Artillery and Rocket Battalion – Battery of the SVBR Gvere, 31-Jul-08-Aug-95	ATTACHMENT 35 , 7th GB: Daily order book: Artillery and Rocket Battalion – Battery of the SVBR Gvere; dated 31-Jul-08-Aug-95.	No	P02473
	0645-3151-ET P2473			Translation		P02473
17	0645-2954		ATTACHMENT 5, 4th GB: Report on artillery ops, 122mm MBRs battery/Arty Bn/4th Gds Bgd. 26-Jul-09-Aug-95	ATTACHMENT 5, 4th GB: Report on artillery ops, 122mm MBRs battery/Arty Bn/4th Gds Bgd; dated 26.07.-09.08.95.	No	P02478
	0645-2954-ET P2478			Translation		P02478
18	0646-5076-ET		War Diary of Artillery Group TS-4	War Diary of Artillery Group TS-4	No	P02533
	0646-5076-ET			Translation		P02533
19	0613-3896	25-Aug-95	Report from 92nd Mountain Brigade Commander to the VSK Main Staff	Report from 92nd Mountain Brigade Commander to the VSK Main Staff, dated 25.08.95.	No	D00828
	0613-3896-ET			Translation		D00828
20	0279-8900	04-Aug-95	Zadar Operative Group daily combat report re: combat activities of 7th and 134th Homeguard regiment and 112th Bde	Zadar Operative Group daily combat report re: combat activities of 7th and 134th Homeguard regiment and 112th Bde	No	D01095
	0279-8900-ET			Translation		D01095
Rajcic Reconstructions						
1	0643-0369	17-Oct-08	Rajcic Analysis of artillery Actions during Storm Operation	Rajcic Analysis of artillery Actions during Storm Operation, dated 17.10.08.	No	P02336
	0643-0369-ET-REV P2336			Translation		P02336

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

2	0645-2895		Rajcic Storm Reconstruction, analysis of artillery use at the 2nd and 3rd level (concentrating on 4th & 7th Guards Brigades in period from 4-9 August 95)	Rajcic Storm Reconstruction, analysis of artillery use at the 2nd and 3rd level (concentrating on 4th & 7th Guards Brigades in period from 4-9 August 95).	No	P02339
	0645-2897-ET P2339			Translation		P02339
3	0645-3163	28-Nov-08	Rajcic Analysis of artillery use at the first (Corps) level	Rajcic Analysis of artillery use at the first (Corps) level, dated 28.11.08.	No	P02340
	0645-3163-ET P2340			Translation		P02340
4	0645-3222		ATTACHMENT 6a: Reconstruction of the command and control of the Split Military District Corps Artillery for TS3 and TS4 during Operation Storm from 4-9 august 1995	ATTACHMENT 6a: Reconstruction of the command and control of the Split Military District Corps Artillery for TS3 and TS4 during Operation Storm from 4-9 august 1995.	No	P02341
	0645-3222-ET P2341			Translation		P02341
Witness Statements						
1	0035-1489	12-Aug-95	summary report on Possible Violation of International Humanitarian Law relating to the shelling ON Knin dated 12 Aug 1995. This document has been restamped to R104-1422-R104-1426.	Report entitled Possible Violation of International Humanitarian Law, sent by COS UNCRO, Col Andrew LESLIE, to G2 UNCRO for forwarding to G3 Ops UNPF HQ, dated 12 August 1995, with a Letter of protest from UNCRO South Sector Commander, Brigadier General A	No	P00084
2	1D00-0767	13-Feb-09	92ter statement of Marko Rajcic taken by the Gotovina Defence	92ter statement of Marko Rajcic taken by the Gotovina Defence, Dated 7th, 9th, 11th, 12th and 13th February 2009.	No	D01425
	1D00-0788		Translation of 1D00-0767	Translation		D01425
3	0638-2648	11-Jul-08	Official Note of the Military Police Department's Crime Police Section Interview of Rajcic	Official Note of the Military Police Department's Crime Police Section Interview of Rajcic, dated 11.07.08.	Yes	P02323
	0638-2648-ET P2323			Translation		P02323

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

4	0350-7998		Witness Statement dated 3 & 4 February 2004	Statement of Witness Josip Turkalj, dated 3 & 4 February 2004.	No	P01149
5	V000-5303	11-Mar-05	Video Tape I and transcripts	Video Tape I and transcripts of Josip Turkalj interview, dated 11.03.05.	No	P01150
6	V000-5304	15-Mar-05	Video Tape II and transcripts	Video Tape II and transcripts of Josip Turkalj interview, dated 11.03.05.	No	P01151
Transcripts						
1				Testimony of Geoffrey Corn, Defence Expert, T21141-21225 (7/9/09), T21228-21338 (8/9/09), T21428-21524 (10/9/09), T21529-21588 (11/9/09)		Corn
2				Testimony of Harry Konings, Prosecution Expert, T14301-14333 (13/1/09), T14339-14443 (14/1/09), T14460-14548 (15/1/09), T14549-14649 (16/1/09), T14650-14749 (19/1/09), T14755-14812 (20/1/09)		Konings
3				Testimony of Andrew Leslie, UNCRO Chief of Staff, T1929-2021 (22/4/08), T2022-2129 (23/1/09), T2131-2203 (24/4/08)		Leslie
4				Testimony of Marko Rajcic, Split MD Chief of Artillery, T16229-16289 (18/2/09), T16306-16383 (19/2/09), T16391-16461 (20/2/09), T16470-16627 (23/2/09), and T17634-17724 (25/5/09)		Rajcic
5				Testimony of Josip Turkalj, Special Police artillery unit commander, T13540-13557 (11/12/08), T13564-13656 (12/12/08), T13657-13745 (15/12/08), T13746-13787 (16/12/08)		Turkalj
Maps/Photos of Knin Discussed in Judgement, paras. 1372-1392, 1907						
1	IC00-0001		Aerial photograph of Knin marked by the witness	Aerial photograph of Knin marked by the witness P-136 in court on 13 March 2008	No	P00004

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

2	0632-9425		Aerial Photo of Knin Marked by Witness 6 - from 65ter 4769	Aerial Photo of Knin (65ter 4769) marked by Witness P-006 in court on 7 April 2008	Yes	P00017
3	0632-9427	03-Apr-98	Reproduction of annotations made by witness 20 on aerial photo of Knin on 3 April 1998. Poor quality original attached to her statement and 65ter number 3747)	Knin Aerial Photo with annotations made by witness Mira Grubor, Belgrade, 3 April 1998.	No	P00058
4	0632-1989		AD-1 Aerial Photograph of Knin with (red) circles indicating shell impact areas and letter-marked locations	Aerial Photograph marked with red lines and letter-marks	No	P00078
5	0042-1627	04-Feb-96	Attached to statement by Andreas DREYER: Aerial photograph of Knin	Aerial Photograph marked in green and black, entitled Summary of statements of areas shelled and potential military targets in Knin from August 1995	No	P00079
6	IC00-0012			Aerial photograph marked by Witness Mikhail Ermolaev in court on 28 April 2008	No	P00096
7	0634-6442		Photographs of Knin with Markings made by Witness 54 (65ter numbers 4892 and 4893) with a Legend.	Index for Witness 54 markings on pictures (Legend) and two marked photographs, dated 12 May 2008		P00189
8	0634-7966	21-May-08	Supplementary Witness Statement of Prosecution Witness 56 including two marked photographs of Knin .	Supplementary Statement of Witness P-056, dated 21 May 2008 and two areal photos marked	Yes	P00289
9	0634-8607		Area photo of Knin Marked by Witness 123 (Original 65ter 4769)	Area photo marked red	No	P00300
10	0632-3967		Aerial Map of Knin with Witness Markings	Aerial map with red markings.	No	P00430
11	0635-4624		Aerial photograph of Knin marked by Witness 97	Aerial photograph marked red.	No	P00547
12	0635-5637		Aerial Map of Knin with Witness' Markings	Black & white aerial photograph of Knin with 7 marked locations	No	P00681
13	0635-5638		Map of Knin with Witness' Markings	Colour aerial photograph of Knin with 8 marked locations	No	P00682
14	0636-1508		Aerial Photo of Knin Marked by Prosecution Witness 103	Aerial Photo Marked	No	P00697
15	0632-2648		Witness Statement of Erik Lennart Widen, 26-27-Feb-08	Witness Statement of Erik Lennart Widen, dated 26-27-Feb-08.	No	P00722, p.10

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

16	IC00-0046			Aerial Map of Knin, Marked in Court by Witness BERIKOFF, Philip.	No	P00746
17	0641-8270		Aerial Photograph of Knin Marked by Witness 154	Aerial Photograph Marked	No	P00928
18	0632-9250-MARKED		Digitally Enhanced version of P00984: Aerial Photograph of Knin with Witness Markings.	Aerial Photograph of Knin with Witness Markings.	No	P00984
19	IC00-0059			Black and white aerial photograph of Knin, additional markings in red color made by witness DAWES, Murray on 14.10.08.	No	P00985
20	0424-9211	03-Oct-08	Attachement to Supplemental Witness Statement of Kosta NOVAKOVIC (02&03-10-2008). Aerial Photograph of Knin with witness markings	Aerial Photograph with red markings.	No	P01095
21	0424-9337		Marked Photograph and Legend of Knin - Witness 100	Document entitled 'Locations Marked by Normand Boucher on Aerial Photograph of Knin, marked areal photograph and an areal photograph makred by witness Normand Boucher in court on 18 December 2008	No	P01179
22	0634-3876		Aerial Photo of Knin marked by witness 130	Aerial Photo marked red	No	P01293
23	IC00-0074			Aerial photograph of Knin, marked by witness RAJCIC on 19.02.09.	No	P02337
24			Court Binder Map 29: Knin Town Plan	Court Binder Map 29: Knin Town Plan		P02430
25	1D17-0390		Maps - Knin situation 4 Aug 1995 - Legitimate Military targets	Aerial photographs - Knin situation 4 August 1995 - Legitimate Military Targets	No	D00131
26	IC00-0057			Black and white ariel photograph marked by witness Murray DAWES in court on 14 October 2008.	No	D00864

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

27	IC00-0060				Black and white aerial photo marked in court by witness Maria Teresa Mauro on 18 November 2008.	No	D00955
28	ID65-0495			D-131 Map of legitimate military targets with addition of information from 0634-7312 (List of Known Targets [red] - targets located in Knin)	Maps entitled: 'D-131 Map of legitimate military targets'; 'Table of Identified Targets'; 'Artillery Preparation Plan'	No	D01261
Maps/fotos of Benkovac Discussed in Judgement, paras. 1424-1429							
1	IC00-0025				Color map of Benkovac marked in court by Witness P-056 on 27 May 2008.	No	P00290
2	IC00-0065				Color map of Benkovac marked by witness RAJCIC on 19.02.09.	No	P0232Z
3	IC00-0075				05186 - Map marked in court	No	P02363
4	ID25-0140			Maps of the city of Benkovac and area.	Maps of the city of Benkovac and area.	No	D00248
	ID25-0143.D248						D00248
5	ID69-0145			Map presentations of Benkovac area showing targets according to 'Jagoda' and incorporated information from admitted exhibit P2327	Map presentations of Benkovac area marked by witness SINOBAD, Dusan on 2 March 2009.	No	D01446
	ID69-0159.D1446						D01446
6	ID72-4002			Corrected version of D1460 (JAGODA target list on Google Earth / Overlay of P2327)	Maps: 'JAGODA Target List on Google Earth'	No	D01460
7	IC00-0080				Aerial map of Benkovac marked by witness VUKASINOVIC on 15.06.09.	No	D01500
8	IC00-0081				Aerial map of Benkovac marked by witness VUKASINOVIC on 15.06.09.	No	D01501
Maps/fotos of Gracac Discussed in Judgement, paras. 1455-1459							
1	0424-8876	23-Apr-08		Map marked by Witness P-48. The map represents different locations in Gracac. Based on Map of Gracac Area. Extracted from Map: Base 470-2 UNPROFOR 1002.65ier 4855.	Map of Gracac area marked by Witness Mile Sovilj, dated 23 April 2008.	No	P00088
2	0634-6508			Map annotated on by Witness 165	Map of Gracac city marked red	No	P00192

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

3	0634-8609		Cut out of UNPROFOR Road Map of the former Krajina area, Marked by Witness 123	Road Map of the former Krajina area marked, signed and dated 25 May 2008	No	P0030Z
4	0635-4554		Computer version of the map bearing ERN 0611-1555 mentioned under 65 ter number 4687. This map is related to Gracac	Gracac area color map marked red.	No	P0053Z
5	IC00-0036			Gracac area color map marked by witness Herman Steenberg in court on 30 June 2008.	No	P00538
6	IC00-0067			Color map of Gracac, marked by witness RAJCIC on 19.02.09.	No	P02329
7	IC00-0011			Map of Gracac area marked by witness SOVILJ, Mile on 25 April 2008	No	D00135
8	1D35-0001		Map of Gracac - Military Targets (blue additions made by Gotovina Defence to P537)	Map of Gracac - Military Targets (blue additions made by Gotovina Defence to P537).	No	D00439
9	1D72-4002		Corrected version of D1460 (JAGODA target list on Google Earth / Overlay of P2327)	Maps: JAGODA Target List on Google Earth'	No	D01460
10	IC00-0090			Map marked in court by witness Dragutin Vumek on 15 December 2009	No	D01900
Maps/fotos of Obrovac Discussed in Judgement, paras. 1474-1476						
1	0635-7526		Photograph of Obrovac with markings made by W-15.	Color Photograph marked red	No	P00549
2	IC00-0066			Color map of Obrovac marked by witness RAJCIC on 19.02.09.	No	P02328
3	1D25-0201		Maps of the city of Obrovac to be commented on by witness 56	Maps of the city of Obrovac.	No	D00249
	1D25-0203		Translation of 1D25-0201-1D25-0202		No	D00249
Trial Judgement materials						
1				Gotovina Trial Judgement, Volume 1		Gotovina Trial Judgement, Volume 1
2				Gotovina Trial Judgement, Volume 2		Gotovina Trial Judgement, Volume 2
3				Summary of Gotovina Trial Judgement		Summary of Gotovina Trial Judgement
Firing tables						

List of Materials Provided to Lieutenant-General (Ret.) Christopher Brown, updated as 17 April 2012

1		Firing table for 122mm mbri	Firing tables for self-propelled rocket launcher 122mm M-21-OF and self-propelled rocket launcher 122mm VULKAN.	No	Not in evidence--ERN: 0631-5718-0631-5767
2			Partial translation	No	Not in evidence--ERN: 0631-5728-0631-5732-ET
3		Firing table for 130mm gun	Firing tables for gun 130mm M46	No	Not in evidence--ERN: 0631-5673-0631-5717
4			Partial translation	No	Not in evidence--ERN: 0631-5689-0631-5693-ET

Public Annex III



BIOGRAPHY

MAJOR GENERAL ND ASHMORE OBE (LATE RA)

Major General Nick Ashmore was born in 1961 and was commissioned into the Royal Artillery in August 1984. He has served at regimental duty in the UK and Germany, including a tour as the adjutant of the Honourable Artillery Company in the City of London. He has a variety of operational experience from Northern Ireland (two tours), Bosnia, Cyprus with the United Nations and Iraq. He commanded 3rd Regiment Royal Horse Artillery from 2001 to 2004, a period which included the initial entry into Iraq in 2003 (for which he was appointed OBE) and a tour on the Green Line in Cyprus. He has held four staff appointments in the Ministry of Defence in London, including tours in the Directorate of Policy Planning and the Directorate of Army Resources and Plans. He attended the Higher Command and Staff Course (HCSC) in 2007 and spent a short time at the Royal College of Defence Studies (RCDS) in 2009. He assumed the appointment of Director Plans in Headquarters Land Forces in July 2009 and he is responsible for Top Level Budget planning and programming issues. He was appointed the Director Strategic Asset Management and Programming Team in the Defence Infrastructure Organisation in August 2011.

Comments by Major General Ashmore on the reports, comments and observations of Generals Scales, Shoffner, Griffith, Granville-Chapman, Brown and Applegate.

Methodology

In compiling my report I have focused on a detailed review of the reports, comments and observations of General Scales, Shoffner, Griffith, Granville-Chapman, Brown and Applegate, but I also read into some of the other material provided for me (as set out in the attached Annex). I was provided with a framework of questions around which I have constructed this report. In producing my report, I have drawn primarily on my operational experience as an artillery unit commander on Op Operation Iraqi Freedom during the initial entry into Iraq in 2003, but also on my 28 years of experience as a commissioned officer in the Royal Regiment of Artillery (The Gunners).

1. Please describe your operational experience in the use and command of artillery in an urban environment.

I am a serving British Army officer, commissioned into the Royal Regiment of Artillery (the Gunners), and I commanded 3rd Regiment Royal Horse Artillery (3 RHA) on Operation TELIC 1, the British contribution Operation Iraqi Freedom during the initial entry into Iraq in 2003. 3 RHA was the only British 155mm artillery regiment deployed on the operation. I was the principal Joint Fires (surface-to-surface artillery and air-delivered fires) advisor to the Commander of the UK's 7th Armoured Brigade, part of 1st (UK) Division, which deployed on Operation TELIC 1 as part of the US Marine Corps. As such, I oversaw all Joint Fires and targeting into the densely populated city of Basra, southern Iraq, during some 17 days of warfighting from 20th March 2003 to 6th April 2003, a period in which my regiment, 3 RHA, fired 9,513 155mm artillery rounds. I was appointed Order of the British Empire (OBE) in the TELIC 1 Operational Honours List for my leadership on operations.

2. Based on your operational experience in the use and command of artillery:

- a. Comment on the factors that a commander is obliged to consider and address when deciding whether to engage military targets that are in an urban environment and are in close proximity to civilians or civilian installations.

Answer:

There are a number of factors (covered below) that I believe, based on my operational experience in Iraq in 2003, a military commander is obliged to consider and address when engaging military targets in close proximity to civilians or civilian installations. But the overriding principle is as stated by General Griffith; 'military leaders are morally compelled to take every prudent action to protect non-combatants in their zones and/or areas of operations'. I believe the factors to be considered include:

- Factor 1. The nature of the military target to be engaged and the weapon system and ammunition most appropriate to its engagement in light of the proximity of civilians or civilian installations;

- Factor 2. The need to ensure that the weapon system selected is as accurate as possible. While the use of artillery against military targets in populated areas is not in itself inappropriate, 'tubed' artillery (guns) is more accurate than rocket artillery, and factors such as; survey of guns, calibration, meteorological data, and firing data computation, must all be as accurate, up-to-date and precise as possible.
- Factor 3. The tactics, techniques and procedures to be employed when using artillery in populated areas, including:
 - Factor 3a. The use of observed fires wherever possible, and the requirement for clear and detailed target descriptions from observers to inform the clearance of fire procedures, such as those I imposed on artillery fire missions in and around Basra in March/April 2003, which required all fire missions to be cleared through me and the regimental Fire Support Control Centre (FSCC) at Brigade Headquarters.
 - Factor 3b. The need for accurate and precise targeting, using the best available intelligence and data. Most artillery fire missions in and around Basra in March and April 2003 were conducted by observers, relating military targets to firm map detail, using 1:15,000 mapping (rather than the usual 1:50,000 mapping), allowing targets to be engaged using 10 figure grid references, which increased the likelihood of first round hits, and thereby reducing the need for adjustment and minimizing collateral damage as a result.
 - Factor 3c. The need to conduct battle damage assessments (BDA)/collateral damage assessments following the prosecution of an artillery target, through observation of the target area to determine the effect achieved on the military target. In Iraq in 2003, these were conducted both by the observer (or through UAV observation) at the time of the engagement and subsequently through a BDA survey by one of my officers at the cessation of warfighting.
 - Factor 3d. To have clear and understood rules of engagement (ROE) for artillery observers. In advance of combat operations in Iraq, we spent time training the Regiment's artillery observers in the application of ROE; training which involved judgmental training with the 1(UK) Armoured Division's legal advisor.
 - Factor 3e. The application of Fires control measures (referred to doctrinally as Fire Support Coordination Measures (FSCMs), such as no fire areas and restricted fire areas. Given the heavily populated nature of Basra, and the number of restricted and no fire areas imposed from higher headquarters, I treated the whole of Basra as a restricted fire area, imposing a procedure which required clearance of Fires into Basra through me and the regimental FSCC at Brigade Headquarters. This was because my FSCC was equipped with the best intelligence picture of the battlefield and a targeting tool, which we used for checking where artillery rounds would impact in relation to restricted or no fire areas. And we also established a 'red team' role within

Brigade Headquarters with whom we tested various fires missions to ensure that they were appropriate and discriminate.

- o Factor 3f. The retention of control of artillery at higher levels than would be the norm in doctrine (artillery doctrine is to command artillery at the highest level and control at the lowest appropriate level, such as by a forward observation officer, rather than by the artillery Commander at Brigade level). As mentioned above, during operations in and around Basra, I retained control of all fire missions, requiring forward observers to clear their fire missions through myself and the FSOC.

b. Please indicate if you think the significance of these factors has changed from 1995 to the present day.

Answer:

The significance of these factors has not, in my view, changed from 1995 to the present day, as their significance is derived from the overriding principle, as stated by General Griffith in his report, that 'military leaders are morally compelled to take every prudent action to protect non-combatants in their zones and/or areas of operations'. However, some of the enabling technology (such as GPS survey, individual gun continuous calibration, targeting tools, etc), which underpinned some of the tactics, techniques and procedures I adopted in Iraq in 2003 were not available in 1995.

It is my view that the factors set out above are the ones that must be considered in order to minimise the 'error budget' inherent in the artillery 'system of systems' (the weapon system, the computation system, the target acquisition system, etc) and, more importantly, to minimise the risk of civilian casualties.

c. In light of the Applegate, Brown, Granville-Chapman, Griffith, Scales and Shoffner reports, please comment on whether or to what extent these factors were properly considered and addressed when the HV fired on Knin in August 1995.

Factor 1 (above), I can find nothing in the reports to indicate that the HV gave appropriate consideration to matching weapon systems and ammunition to targets and effects required and I would, based on my experience in Iraq in 2003, regard the use of rocket artillery in particular as inappropriate – indeed I would agree with General Brown that the use of MRL in populated areas could be regarded as reckless and indiscriminate. Indeed, General Scales, in Footnote 5 of his report, states that he 'can testify personally to the inherent inaccuracy of these weapons'.

Factor 2. The adoption of quadrant laying (Scales report Paragraph 5) could be interpreted as the HV use of one procedure to ensure the most accurate and precise application of artillery when firing on Knin in August 1995. However, there appears to be no other evidence from the various reports to suggest that the HV actively sought to reduce the artillery 'error budget', as they did not appear, for example, to have sought to: accurately survey gun/rocket positions; incorporate ballistic meteorological data; conduct registration missions; and, wherever possible, prosecute observed fire missions (which I will return to under Factor 3a below). I

therefore find little evidence in the reports that measures were taken to minimise the inaccuracy of artillery fires on Knin. However, I would highlight that I agree with the statements in various reports that the Trial Chamber's conclusion as to a reasonable radius of error (200m) was far too restrictive and that a 400m radius is a more accurate and realistic standard to use.

Factor 3a. The most important factor for me in engaging military targets in populated areas in and around Basra in 2003 was the observation of fires by observers or by Unmanned Aerial Vehicles (UAVs). The 'human in the loop' enables accurate engagement of the target, allows judgement to be applied to the engagement of the target and allows the observers commanders', at various levels, to interrogate the observer on what he is seeing. This is why, in Iraq in 2003, I placed so much emphasis on the target description from the observer, particularly as I retained the final authority for executing a fire mission at my level through the FSCC. That all 900 rounds fired on Knin on 4/5 August 1995 were unobserved (and unregistered) (Scales paragraph 12) is, in my view, a disregard for perhaps the most important factor in seeking to minimise civilian casualties in a populated area. And the doctrinal distinction emphasised by General Scales (Scales paragraph 6) between Direct Support (employing observed fire) and General Support (employing predictive, unobserved fire) is an artificial one in the context of the application of artillery in populated areas. It is my view, that all fires into populated areas, whether DS or GS, should be observed where possible and that every effort should be made to observe fires.

Factor 3b. There is some evidence from the reports that 10 figure grid references were used in targeting in Knin in August 1995. But given that this was predictive, 'shooting off the map, and not observed fire, this rather negates the proper consideration of this factor by the HV. In Basra in 2003, I required observers to produce the most accurate target locations possible, which was done by the observer relating the military target to firm map detail (on 1:15,000 mapping) and generating the 10 figure grid for engagement.

Factor 3c. I found nothing in the reports to indicate that any form of battle damage assessment/collateral damage assessment was conducted by the HV during the period 4-5 August 1995.

Factor 3d. I found nothing in the reports to indicate that the HV had, and applied, clear rules of engagement (ROE) for the application of artillery fires, and nor any evidence that judgmental training in ROE was conducted in advance of the operation. As General Applegate states; 'There were neither direct instructions concerning ROE....'

Factors 3e and 3f. General Applegate also states that there were no "...general instructions on restricted engagement areas". In my view, these are an essential control mechanism for the application of artillery and must be applied when using artillery in populated areas. In Basra in 2003, I had a targeting tool available to me within my FSCC at Brigade Headquarters (and not available at lower levels) which allowed me to plot requested fire missions in relation to identified restricted and no fire areas. This tool enabled the procedure I imposed of retaining control (in the form of the final and ultimate authority to prosecute a fire mission) at my level

through the FSCC. While such targeting tools were not in existence in 1995, I would have expected control procedures, enabled by the application of fire support coordination measures (FSCMs) to have been evident during HV operations in Knin in August 1995. No such procedures appear evident to me from the reports I have studied.

Conclusion

Based on my analysis of the various reports (and of some analysis of other material), it is my view that the HV did not properly consider and address the key factors that, based on my operational experience from warfighting operations in and around the populated area of Basra, Iraq, in March/April 2003, I believe should be properly considered and addressed when prosecuting artillery Fires in populated areas. Furthermore, given the apparent failure of the HV to properly consider and address these factors in their prosecution of tubed and rocket artillery Fires in Knin on 4/5 August 1995, I would consider those Fires to have been, in the main, inappropriate, indiscriminate and reckless.



Maj Gen ND Ashmore OBE

27th May 2012

Annex:

A. List of Materials



United Nations
Nations Unies



International
Criminal Tribunal
for the former
Yugoslavia

Tribunal Pénal
International pour
l'ex-Yougoslavie

**Office of the
Prosecutor**

**Bureau du
Procureur**

20 April 2012

Major-General Nicholas Ashmore

Dear General Ashmore,

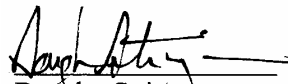
Re: Expert report in *Prosecutor v. Ante Gotovina*, Case No. IT-06-90-A

Thank you for agreeing to prepare an expert report. We have drafted the questions in the Annex for you to answer. In your answers, please feel free to cite to the materials you have been provided.

This letter and attached list of questions should be included as an appendix to your report, to assist the Appeals Chamber in understanding the process by which you were instructed as an expert. You should also include in an appendix a list of materials that you reviewed in preparing the report.

Please do not hesitate to contact Todd Schneider (+31 70 512 5185), Matthew Cross (+31 70 512 5716) or me (+31 70 512 8523) should there be any questions.

Yours very truly,


Douglas Stringer
Senior Appeals Counsel

Annex

Please structure your report around the following questions. Please reproduce the questions verbatim as headings in your report.

- 1) Please describe your operational experience in the use and command of artillery in an urban environment.
- 2) Based on your operational experience in the use and command of artillery:
 - a) Please comment on the factors that an operational commander is obliged to consider and address when deciding whether to engage military targets that are in an urban environment and are in close proximity to civilians or civilian installations.
 - b) Please indicate if you think the significance of these factors has changed from 1995 to the present day.
 - c) In light of the Applegate, Brown, Granville-Chapman, Griffith, Scales and Shoffner reports, please comment on whether or to what extent these factors were properly considered and addressed when the HV fired on Knin in August 1995.



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International
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for the former
Yugoslavia

Tribunal Pénal
International pour
l'ex-Yougoslavie

**Office of the
Prosecutor**

**Bureau du
Procureur**

26 April 2012

Maj-Gen. Nicholas Ashmore

Dear General Ashmore,

Re: Expert report in *Prosecutor v. Ante Gotovina*, Case No. IT-06-90-A

By our letter of 10 April 2012, and our e-mail of 16 April 2012, we provided you with materials which may assist the preparation of your expert report. We have also since provided you with the reports of proposed Prosecution rebuttal experts Lt-Gen (ret) Chris Brown and Lt-Gen (ret) Dick Applegate.

Appended to this letter, please find attached an updated consolidated chart of all those materials provided to you on these dates.

Please annex this final letter and chart to your report, together with our letter of instruction.

Please do not hesitate to contact Todd Schneider (+31 70 512 5185), Matthew Cross (+31 70 512 5716) or me (+31 70 512 8523) should there be any questions.

Yours very truly,

Douglas Stringer
Senior Appeals Counsel

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

Count	Doc ID	Main Date	Title	Description of Exhibit	Confidential	Exhibit Number
Draft list of materials to be sent to experts						
1		?	Report of Major General (ret) Robert H. Scales, Jr.			Proposed DA20
2		20-Oct-11	Report of Lieutenant General (ret) Wilson A. Shoffner			Proposed DA21
3		26-Oct-11	Report of General (ret) Ronald H. Griffith			Proposed DA22
4		?	Report of General (ret) Timothy Granville-Chapman			Proposed Exhibit E
5		21-Apr-12	Report of Lieutenant General (ret) Richard Applegate			Proposed PA1
6		19-Apr-12	Report of Lieutenant General (ret) Chris Brown			Proposed PA2
Trial Expert reports						
1	0643-6709	18-Jan-08	Expert Report of Lt. Col. Harry Konings	Report 'Fire Support during Operation Storm, by Lt. Col. Harry Konings Royal Artillery, Royal Netherlands Army, August 1995	No	P01259
2	0643-6546	31-Oct-95	Addendum to Expert Report of Lt. Col. Harry Konings	Addendum to Expert Report	No	P01260
3	0645-2665		Corrigendum to the Expert Report and Addendum of Expert witness Lt. Col. Harry Konings	Corrigendum to the Expert Report and Addendum of Expert witness Lt. Col. Harry Konings	No	P01262
4	1D72-3442	28-Jun-09	Expert report of Professor Geoffrey Corn	Expert report of Professor Geoffrey Corn, dated 28.06.09.	No	D01642
5	1D72-3762	06-Sep-09	Supplemental Information Sheet / Clarification of witness Geoffrey Corn (AG-11)	Supplemental Information Sheet / Clarification of witness Geoffrey Corn, dated 06.09.09	No	D01643
Brioni Meeting						
1	1D76-0013	31-Jul-95	Presidential Transcript of meeting held in Brioni on 31st July 1995, including modifications as agreed by the parties and references to the attached CLSS memorandum in relation to disputed portions of the original transcription and translation (BCS Orig)	Minutes of the meeting held by the President of the Republic of Croatia F. Tudjman with military officials on 31 July 1995 at Brioni	No	P00461
	1D76-0001 P461			Translation		P00461

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

	1D76-0010 P461			Translation		P00461
	1D76-0110 P461			Translation		P00461
Orders						
1	0342-2520	02-Aug-95	Orders dated 02/08/95 by Ante GOTOVINA for the Offensive Operation involving forces of the Split Military District.	R Croatia, Ministry of Defence HV Main Staff, Split Military District, Offensive Operation Order, signed by General Ante Gotovina, dated 2 August 1995	No	P01125
	0342-2520- 0342-2538-ET P1125			Translation		P01125
2	0279-8827	03-Aug-95	Orders of artillery attacking issued by Chief of artillery Marijan FIRST pursuant to Orders issued by Ante GOTOVINA dt. 3 August 1995	Orders of artillery attacking issued by Chief of artillery Marijan FIRST pursuant to Orders issued by Ante GOTOVINA, dated 03.10.95.	No	P01201
	0279-8827- 0279-8828- EDT P1201			Translation		P01201
3	0211-8050	03-Aug-95	Orders issued by Colonel Mladen FUZUL, Zadar OG Commander re: implementing Ante GOTOVINA s Orders of attacking.	Orders issued by Colonel Mladen FUZUL, Zadar OG Commander, dated 03 August 1995.	No	P01263
	0211-8050- 0211-8057-ET P1263			Translation		P01263
4	0342-2548	02-Aug-95	Attacking orders, attachment for artillery, operation Kozjak Storm, Operation Storm, re: RFA 432, dated 02 August 1995.	R Croatia, Ministry of Defence, HV Main Staff, Split ZP, 'Order to Attack - attachment for the artillery', signed by Brigadier Marko Rajic, dated 2 August 1995	No	D00970
	0342-2548- 0342-2551-ET- 1 D970			Translation		D00970
5	0609-8347	26-Jun-95	HV General Staff Operational Directive 12-4/95. Signed by General Bobetko.	HV General Staff Operational Directive 12-4/95. Signed by General Bobetko.	No	D00956
	ET 0609-8347- 0609-8354 D956					D00956

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

6	0349-3647		Orders for attacking to Ministry of the Interior Special Police	Orders for attacking to Ministry of the Interior Special Police.	No	D02078
	0349-3647-EDT				No	D02078
Target Lists						
1	0634-7312		Table of identified targets in Knin for HV firing positions from Karli, Kljuc and Pakovo Selo	Document entitled: 'Table of Identified Targets', Region Karli, Kljuc and Pakovo Selo. Translation	No	P01271
	ET 0634-7312-P1271					P01271
2	0634-7307		List of targets for artillery preparation fire in Knin	Documents/Charts Entitled: '2. Artillery preparation' and '1. Battalion Tasks' Translation	No	P01272
	0634-7307-0634-7311-ET P1272					P01272
3	0614-2311-0614-2311-ET P1273		Coded Map Poskok 93	Coded Map Translation	No	P01273
4	0614-2441		ANNEX 12: the "Ivancica" positions map of the 7th gbr (digital)	ANNEX 12: the "Ivancica" positions map of the 7th gbr.	No	P02338
5	1D69-0104		List of targets of the TS/artillery group/ 3 of OG Zadar (Code Name: Jagoda)	List of targets of the TS/artillery group/ 3 of OG Zadar (Code Name: Jagoda).	No	D0144Z
			English translation	Translation		D144Z
General Maps						
1	0629-0379		ANNEX 3: Working Map of the NT of the ZP – Croatian Forces (digital)	ANNEX 3: Working Map of the NT of the ZP – Croatian Forces.	No	P02322
2	0645-2949		ATTACHMENT 2, 4th GB: Coded map Bura	ATTACHMENT 2, 4th GB: Coded map Bura.	No	P02475
3	1D63-0082	04-Aug-94	Map: Artillery Positions for Storm - Deployment of HV/HVO Operational Artillery Groups in Operation Kozjak (4 Aug 1995)	Map: 'Deployment of HV/HVO Operational Artillery Groups in Operation -Kozjak- 04 Aug 95'	No	D00971
Logs/Reports/Diaries						
1	0155-8825	14-Sep-95	Split Military District Operations Diary for the period 25-07-1995 to 14-09-1995	Split Military District, Operational Diary for the period 25 July to 14 September 1995, signed by Chief of Staff Rahim Ademi	No	P00071

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

	0155-8825-ET-1 P71			Translation		P00071
2	0361-1051	05-Aug-95	Report by Mladen MARKAC to Zvonimir CERVENKO on positions taken over by Special Police joint forces	R Croatia, Ministry of the Interior, Special Police Sector, document entitled: Report on lines reached by the Special Police Joint Forces, signed by Colonel General Mladen Markac, dated, Seline Headquarters, 5 August 1995.	No	P00583
	0361-1051-ET-P583			Translation		P00583
3	0609-7506	23-Aug-95	Summary report from the 134 Hme Gurads Regiment to Commander of MD Split on performed combat task (artillery shelling of Benkovac without observation or correction of fire), No. 8286-01-95-75	Summary report from the 134 Hme Gurads Regiment to Commander of MD Split on performed combat task, dated 23.08.95.	No	P01200
	0609-7506-ET-P1200			Translation		P01200
4	0611-0832	04-Aug-95	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 1300 hours	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 1300 hours.	No	P01267
	0611-0832-ET-P1267			Translation		P01267
5	0611-0836	04-Aug-95	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 2000 hours	Regular report from Bruno MILIN, commander of TS-4 to OG Sibenik on combat operations at 2000 hours, dated 04.08.95.	No	P01268
	0611-0836-ET-1 P1268			Translation		P01268
6	0611-0839	05-Aug-95	Regular report from Bruno MILIN, commander of TS-4 on combat operations at unspecified time	Regular report from Bruno MILIN, commander of TS-4 on combat operations at unspecified time, dated 05.08.95.	No	P01269
	0611-0839-ET-P1269			Translation		P01269
7	0643-0437		ANNEX 11: TS-3 diary for period 3 to 9 August 1995	ANNEX 11: TS-3 diary for period 3 to 11 August 1995.	No	P02342
	0643-0437-ET-P2342					P02342

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

8	0609-8869-1		ANNEX 13: Operations Diary of the 4th gbr.	ANNEX 13: Operations Diary of the 4th gbr.	No	P02343
	0609-8869-ET-2 P2343					P02343
9	0606-1300		Extract from log of Special Police activities and movements during Operation Oluja. No author or source for the document at this time.??-Aug-1995	Extract from log of Special Police activities and movements during Operation Oluja. No author or source for the document at this time. 2/7 -Aug-1995. Translation	No	P02385
	ET-0606-1300 P2385					P02385
10	0643-0502		ANNEX 18: Operations diary of the 1st Sector from 20 June to 20 October 1995	ANNEX 18: Operations diary of the 1st Sector from 20 June to 20 October 1995. Translation	No	P02436
	0643-0502-ET P2436					P02436
11	0645-3067		ATTACHMENT 16, 7th GB: Diary of Jura SEKANOVIC, Arty Bn/7th Gds Bgd.	ATTACHMENT 16, 7th GB: Diary of Jura SEKANOVIC, Arty Bn/7th Gds Bgd. 29-Jul-08-Aug-95. Translation	No	P02455
	0645-3067-ET P2455					P02455
12	0645-3091	04-Aug-95	ATTACHMENT 23, 7th GB: Daily operations report of the bSVBR of 122mm BM21	ATTACHMENT 23, 7th GB: Daily operations report of the bSVBR of 122mm BM21; dated 04.08.95.	No	P02461
	0645-3091-ET P2461					P02461
13	0645-3092	05-Aug-95	ATTACHMENT 24, 7th GB: Daily operations report of the bSVBR of 122mm BM21	ATTACHMENT 24, 7th GB: Daily operations report of the bSVBR of 122mm BM21; dated 05.08.95. Translation	No	P02462
	0645-3092-ET P2462					P02462
14	0645-3096		ATTACHMENT 28, 7th GB: Expenditure of Ammo/Arty Bn/7th Gds Bgd. 03-09-Aug-95	ATTACHMENT 28, 7th GB: Expenditure of Ammo/Arty Bn/7th Gds Bgd.; dated 04-08.08.95. Translation	No	P02466
	0645-3096-ET P2466					P02466

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

15	0645-3099		ATTACHMENT 29 , 7th GB: Diary of Rudolf FRANJCEC, Commander of commanding Pltn/122mm MBRLs. 13-Jul-Sep 1995	ATTACHMENT 29 , 7th GB: Diary of Rudolf FRANJCEC, Commander of commanding Pltn/122mm MBRLs.; dated 13-Jul-Sep 1995.	No	P0246Z
	0645-3100-ET P2467			Translation		P0246Z
16	0645-3151		ATTACHMENT 35 , 7th GB: Daily order book: Artillery and Rocket Battalion – Battery of the SVBR Gvere, 31-Jul-08-Aug-95	ATTACHMENT 35 , 7th GB: Daily order book: Artillery and Rocket Battalion – Battery of the SVBR Gvere; dated 31-Jul-08-Aug-95.	No	P0247Z
	0645-3151-ET P2473			Translation		P0247Z
17	0645-2954		ATTACHMENT 5, 4th GB: Report on artillery ops, 122mm MBRLs battery/Arty Bn/4th Gds Bgd. 26-Jul-09-Aug-95	ATTACHMENT 5, 4th GB: Report on artillery ops, 122mm MBRLs battery/Arty Bn/4th Gds Bgd; dated 26.07.-09.08.95.	No	P02478
	0645-2954-ET P2478			Translation		P02478
18	0646-5076-ET		War Diary of Artillery Group TS-4	War Diary of Artillery Group TS-4	No	P02533
	0646-5076-ET			Translation		P02533
19	0613-3896	25-Aug-95	Report from 92nd Mountain Brigade Commander to the VSK Main Staff	Report from 92nd Mountain Brigade Commander to the VSK Main Staff, dated 25.08.95.	No	D00828
	0613-3896-ET			Translation		D00828
20	0279-8900	04-Aug-95	Zadar Operative Group daily combat report re: combat activities of 7th and 134th Homeguard regiment and 112th Bde	Zadar Operative Group daily combat report re: combat activities of 7th and 134th Homeguard regiment and 112th Bde	No	D01095
	0279-8900-ET			Translation		D01095
Rajcic Reconstructions						
1	0643-0369	17-Oct-08	Rajcic Analysis of artillery Actions during Storm Operation	Rajcic Analysis of artillery Actions during Storm Operation, dated 17.10.08.	No	P02336
	0643-0369-ET- REV P2336			Translation		P02336

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

2	0645-2895		Rajcic Storm Reconstruction, analysis of artillery use at the 2nd and 3rd level (concentrating on 4th & 7th Guards Brigades in period from 4-9 August 95)	Rajcic Storm Reconstruction, analysis of artillery use at the 2nd and 3rd level (concentrating on 4th & 7th Guards Brigades in period from 4-9 August 95).	No	P02339
	0645-2897-ET P2339			Translation		P02339
3	0645-3163	28-Nov-08	Rajcic Analysis of artillery use at the first (Corps) level	Rajcic Analysis of artillery use at the first (Corps) level, dated 28.11.08.	No	P02340
	0645-3163-ET P2340			Translation		P02340
4	0645-3222		ATTACHMENT 6a: Reconstruction of the command and control of the Split Military District Corps Artillery for TS3 and TS4 during Operation Storm from 4-9 August 1995	ATTACHMENT 6a: Reconstruction of the command and control of the Split Military District Corps Artillery for TS3 and TS4 during Operation Storm from 4-9 August 1995.	No	P02341
	0645-3222-ET P2341			Translation		P02341
Witness Statements						
1	0035-1489	12-Aug-95	summary report on Possible Violation of International Humanitarian Law relating to the shelling ON Knin dated 12 Aug 1995. This document has been restamped to R104-1422-R104-1426.	Report entitled Possible Violation of International Humanitarian Law, sent by COS UNCRO, Col Andrew LESLIE, to G2 UNCRO for forwarding to G3 Ops UNPF HQ, dated 12 August 1995, with a Letter of protest from UNCRO South Sector Commander, Brigadier General A	No	P00084
2	1D00-0767	13-Feb-09	92ter statement of Marko Rajcic taken by the Gotovina Defence	92ter statement of Marko Rajcic taken by the Gotovina Defence, Dated 7th, 9th, 11th, 12th and 13th February 2009.	No	D01425
	1D00-0788		Translation of 1D00-0767	Translation		D01425
3	0638-2648	11-Jul-08	Official Note of the Military Police Department's Crime Police Section Interview of Rajcic	Official Note of the Military Police Department's Crime Police Section Interview of Rajcic, dated 11.07.08.	Yes	P02323
	0638-2648-ET P2323			Translation		P02323

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

4	0350-7998		Witness Statement dated 3 & 4 February 2004	Statement of Witness Josip Turkalj, dated 3 & 4 February 2004.	No	P01149
5	V000-5303	11-Mar-05	Video Tape I and transcripts	Video Tape I and transcripts of Josip Turkalj interview, dated 11.03.05.	No	P01150
6	V000-5304	15-Mar-05	Video Tape II and transcripts	Video Tape II and transcripts of Josip Turkalj interview, dated 11.03.05.	No	P01151
Transcripts						
1				Testimony of Geoffrey Corn, Defence Expert, T21141-21225 (7/9/09), T21228-21338 (8/9/09), T21428-21524 (10/9/09), T21529-21588 (11/9/09)		Corn
2				Testimony of Harry Konings, Prosecution Expert, T14301-14333 (13/1/09), T14339-14443 (14/1/09), T14460-14548 (15/1/09), T14549-14649 (16/1/09), T14650-14749 (19/1/09), T14755-14812 (20/1/09)		Konings
3				Testimony of Andrew Leslie, UNCRO Chief of Staff, T1929-2021 (22/4/08), T2022-2129 (23/1/09), T2131-2203 (24/4/08)		Leslie
4				Testimony of Marko Rajcic, Split MD Chief of Artillery, T16229-16289 (18/2/09), T16306-16383 (19/2/09), T16391-16461 (20/2/09), T16470-16627 (23/2/09), and T17634-17724 (25/5/09)		Rajcic
5				Testimony of Josip Turkalj, Special Police artillery unit commander, T13540-13557 (11/12/08), T13564-13656 (12/12/08), T13657-13745 (15/12/08), T13746-13787 (16/12/08)		Turkalj
Maps/Photos of Knin Discussed in Judgement, paras.1372-1392, 1907						
1	IC00-0001		Aerial photograph of Knin marked by the witness	Aerial photograph of Knin marked by the witness P-136 in court on 13 March 2008	No	P00004

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

2	0632-9425		Aerial Photo of Knin Marked by Witness 6 - from 65ter 4769	Aerial Photo of Knin (65ter 4769) marked by Witness P-006 in court on 7 April 2008	Yes	P0001Z
3	0632-9427	03-Apr-98	Reproduction of annotations made by witness 20 on aerial photo of Knin on 3 April 1998. Poor quality original attached to her statement and 65ter number 3747)	Knin Aerial Photo with annotations made by witness Mira Grubor, Belgrade, 3 April 1998.	No	P00058
4	0632-1989		AD-1 Aerial Photograph of Knin with (red) circles indicating shell impact areas and letter-marked locations	Aerial Photograph marked with red lines and letter-marks	No	P00078
5	0042-1627	04-Feb-96	Attached to statement by Andreas DREYER: Aerial photograph of Knin	Aerial Photograph marked in green and black, entitled Summary of statements of areas shelled and potential military targets in Knin from August 1995	No	P00079
6	IC00-0012			Aerial photograph marked by Witness Mikhail Ermolaev in court on 28 April 2008	No	P00096
7	0634-6442		Photographs of Knin with Markings made by Witness 54 (65ter numbers 4892 and 4893) with a Legend.	Index for Witness 54 markings on pictures (Legend) and two marked photographs, dated 12 May 2008		P00189
8	0634-7966	21-May-08	Supplementary Witness Statement of Prosecution Witness 56 including two marked photographs of Knin.	Supplementary Statement of Witness P-056, dated 21 May 2008 and two areal photos marked	Yes	P00289
9	0634-8607		Area photo of Knin Marked by Witness 123 (Original 65ter 4769)	Area photo marked red	No	P00300
10	0632-3967		Aerial Map of Knin with Witness Markings	Aerial map with red markings.	No	P00430
11	0635-4624		Aerial photograph of Knin marked by Witness 97	Aerial photograph marked red.	No	P00547
12	0635-5637		Aerial Map of Knin with Witness' Markings	Black & white aerial photograph of Knin with 7 marked locations	No	P00681
13	0635-5638		Map of Knin with Witness' Markings	Colour aerial photograph of Knin with 8 marked locations	No	P00682
14	0636-1508		Aerial Photo of Knin Marked by Prosecution Witness 103	Aerial Photo Marked	No	P00697
15	0632-2648		Witness Statement of Erik Lennart Widen, 26-27-Feb-08	Witness Statement of Erik Lennart Widen, dated 26-27-Feb-08.	No	P00722, p.10

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

16	IC00-0046				Aerial Map of Knin, Marked in Court by Witness BERIKOFF, Philip.	No	P00746
17	0641-8270			Aerial Photograph of Knin Marked by Witness 154	Aerial Photograph Marked	No	P00928
18	0632-9250-MARKED			Digitally Enhanced version of P00984: Aerial Photograph of Knin with Witness Markings.	Aerial Photograph of Knin with Witness Markings.	No	P00984
19	IC00-0059				Black and white aerial photograph of Knin, additional markings in red color made by witness DAWES, Murray on 14.10.08.	No	P00985
20	0424-9211	03-Oct-08		Attachement to Supplemental Witness Statement of Kosta NOVAKOVIC (02&03-10-2008). Aerial Photograph of Knin with witness markings	Aerial Photograph with red markings.	No	P01095
21	0424-9337			Marked Photograph and Legend of Knin - Witness 100	Document entitled 'Locations Marked by Normand Boucher on Aerial Photograph of Knin, marked areal photograph and an areal photograph makred by witness Normand Boucher in court on 18 December 2008	No	P01179
22	0634-3876			Aerial Photo of Knin marked by witness 130	Aerial Photo marked red	No	P01293
23	IC00-0074				Aerial photograph of Knin, marked by witness RAJCIC on 19.02.09.	No	P02337
24				Court Binder Map 29: Knin Town Plan	Court Binder Map 29: Knin Town Plan		P02430
25	ID17-0390			Maps - Knin situation 4 Aug 1995 - Legitimate Military targets	Aerial photographs - Knin situation 4 August 1995 - Legitimate Military Targets	No	D00131
26	IC00-0057				Black and white ariel photograph marked by witness Murray DAWES in court on 14 October 2008.	No	D00864

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

27	IC00-0060				Black and white aerial photo marked in court by witness Maria Teresa Mauro on 18 November 2008.	No	D00955
28	ID65-0495			D-131 Map of legitimate military targets with addition of information from 0634-7312 (List of Known Targets [red]) - targets located in Knin)	Maps entitled: 'D-131 Map of legitimate military targets'; 'Table of Identified Targets'; 'Artillery Preparation Plan'	No	D01261
Maps/fotos of Benkovac Discussed in Judgement, paras. 1424-1429							
1	IC00-0025				Color map of Benkovac marked in court by Witness P-056 on 27 May 2008.	No	P00290
2	IC00-0065				Color map of Benkovac marked by witness RAJCIC on 19.02.09.	No	P02327
3	IC00-0075				05186 - Map marked in court	No	P02363
4	ID25-0140			Maps of the city of Benkovac and area.	Maps of the city of Benkovac and area.	No	D00248
	ID25-0143.D248						D00248
5	ID69-0145			Map presentations of Benkovac area showing targets according to 'Jagoda' and incorporated information from admitted exhibit P2327	Map presentations of Benkovac area marked by witness SINOBAD, Dusan on 2 March 2009.	No	D01446
	ID69-0159.D1446						D01446
6	ID72-4002			Corrected version of D1460 (JAGODA target list on Google Earth / Overlay of P2327)	Maps: 'JAGODA Target List on Google Earth'	No	D01460
7	IC00-0080				Aerial map of Benkovac marked by witness VUKASINOVIC on 15.06.09.	No	D01500
8	IC00-0081				Aerial map of Benkovac marked by witness VUKASINOVIC on 15.06.09.	No	D01501
Maps/fotos of Gracac Discussed in Judgement, paras. 1455-1459							
1	0424-8876	23-Apr-08		Map marked by Witness P-48. The map represents different locations in Gracac. Based on Map of Gracac Area. Extracted from Map: Base 470-2 UNPROFOR 1002.65ter 4855.	Map of Gracac area marked by Witness Mile Sovilj, dated 23 April 2008.	No	P00088
2	0634-6508			Map annotated on by Witness 165	Map of Gracac city marked red	No	P00192

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

3	0634-8609		Cut out of UNPROFOR Road Map of the former Krajina area, Marked by Witness 123	Road Map of the former Krajina area marked, signed and dated 25 May 2008	No	P0030Z
4	0635-4554		Computer version of the map bearing ERN 0611-1555 mentioned under 65 ter number 4687. This map is related to Gracac	Gracac area color map marked red.	No	P0053Z
5	IC00-0036			Gracac area color map marked by witness Herman Steenberg in court on 30 June 2008.	No	P00538
6	IC00-0067			Color map of Gracac, marked by witness RAJCIC on 19.02.09.	No	P02329
7	IC00-0011			Map of Gracac area marked by witness SOVILJ, Mile on 25 April 2008	No	D00135
8	1D35-0001		Map of Gracac - Military Targets (blue additions made by Gotovina Defence to P537)	Map of Gracac - Military Targets (blue additions made by Gotovina Defence to P537).	No	D00439
9	1D72-4002		Corrected version of D1460 (JAGODA target list on Google Earth / Overlay of P2327)	Maps:'JAGODA Target List on Google Earth'	No	D01460
10	IC00-0090			Map marked in court by witness Dragutin Vumek on 15 December 2009	No	D01900
Maps/fotos of Obrovac Discussed in Judgement, paras. 1474-1476						
1	0635-7526		Photograph of Obrovac with markings made by W-15.	Color Photograph marked red	No	P00549
2	IC00-0066			Color map of Obrovac marked by witness RAJCIC on 19.02.09.	No	P02328
3	1D25-0201		Maps of the city of Obrovac to be commented on by witness 56	Maps of the city of Obrovac.	No	D00249
	1D25-0203		Translation of 1D25-0201-1D25-0202		No	D00249
Trial Judgement materials						
1				Gotovina Trial Judgement, Volume 1		Gotovina Trial Judgement, Volume 1
2				Gotovina Trial Judgement, Volume 2		Gotovina Trial Judgement, Volume 2
3				Summary of Gotovina Trial Judgement		Summary of Gotovina Trial Judgement
Firing tables						

List of Materials Provided to Major-General Nicholas Ashmore, updated as 26 April 2012

1			Firing table for 122mm mbri	Firing tables for self-propelled rocket launcher 122mm M-21-OF and self-propelled rocket launcher 122mm VULKAN.	No	Not in evidence--ERN: 0631-5718-0631-5767
2				Partial translation	No	Not in evidence--ERN: 0631-5728-0631-5732-ET
3			Firing table for 130mm gun	Firing tables for gun 130mm M46	No	Not in evidence--ERN: 0631-5673-0631-5717
4				Partial translation	No	Not in evidence--ERN: 0631-5689-0631-5693-ET

Public Annex IV

06315673

TABULICE GARDANJA

za

TOP 130 mm M46

06315674

Glava IV

UPUTSTVO ZA KORIŠĆENJE TABLICA GADANJA

1 - DEŠIFROVANJE METEOROLOŠKOG BILTENA »METEOSREDNJI«

141. Meteorološki podaci uzimaju se iz biltena »meteo-srednji«, koji se predaje, obično, u vidu brojnog telefonograma ovakvog izgleda (primer):

555NN-05074-0080-50668-0206-671908-0405-661909-0804-642210-1203-622410, itd.

Značenje cifara određuje se njihovim mestom u svakoj grupi i mestom grupe u telefonogramu:

555 uslovna oznaka biltena »meteo-srednji«
NN numeracija meteorološke stanice

Prva grupa
(5 cifara) 05074

- dan u mesecu kada je vršeno osmatranje (05) petog;
- čas i minut (u deseticama minuta) kada je završeno radio-sondažno osmatranje (074) = 7 časova i 40 minuta;

Druća grupa
(4 cifre) 0080

- nadmorska visina meteorološke stanice (0080) = 80 m;

Treća grupa
(5 cifara) 50668

- odstupanje prizemnog vazdušnog pritiska od tablične vrednosti 1000 mbar (506) = minus 6 mbar;
- odstupanje prizemne virtualne temperature od tablične vrednosti + 15,9°C (68) = minus 18°;

Četvrta grupa
(4 cifre) 0206

- standardne visine putanja u stotinama metara (02) = 200 m;
- srednje odstupanje gustine vazduha u sloju od površine zemlje do date visine standardne putanje u procentima (06) = 6%;

Peta grupa
(6 cifara) 671908

- srednje odstupanje temperature vazduha od površine zemlje do standardne visine putanje u stepenima (67) = - 17°;
- pravougli azimut pravca srednjeg vetra (otkuda duva) u sloju od površine zemlje do standardne visine putanja (u stotinama hiljaditih) i
- brzina srednjeg vetra sloja za koji je dat prava u m/s (08) = 8 m/s.

Sve sledeće četvorcifrene grupe pokazuju standardnu visinu putanje u stotinama metara i srednje odstupanje gustine vazduha, kao u petoj grupi, a šestocifrene grupe - srednje odstupanje temperature vazduha, pravac i brzinu srednjeg vetra kao u petoj grupi.

Ako se neka grupa brojeva izražava manjim brojem cifara nego što je za nju predviđeno, tada se mesta, gde cifre nedostaju, popunjavaju nulama ispred postojećeg broja.

Znak minus, koji označava negativne vrednosti podataka u biltenu, ne predaje se. U tom slučaju umesto minusa na prvu cifru brojeva navedene grupe dodaje se uslovni broj 5.

Ako negativno odstupanje temperature dostigne - 50° i niže, u biltenu se stavlja ovo odstupanje bez dodavanja uslovnog broja 5.

142. Na kraju biltena nalazi se grupa od četiri cifre (2216) u kojoj prve dve pokazuju do kojih je visina ostvareno merenje temperature radio-sondom (22 km), a druge dve do koje je visine izvršeno radio-sondžno merenje vetra (16 km).

2. - DEŠIFROVANJE METEOROLOŠKOG BILTENA »METEOVATRENI«

143. Meteorološki podaci uzimaju se iz biltena »meteo-vatreni«, koji se predaje, obično, u vidu brojnog telefonograma ovakvog izgleda (primer):

»M e t e o - v a t r e n i : 170805-0084-51567-02-695204-04-685304-08-675507-12-995910 itd. i na kraju 090460.

144. Bilten se može šifrovati - predavati slovima.

145. Značenje cifara ili slova određuje se njihovim mestom u svakoj grupi i mestom grupe u telefonogramu:

- Prva grupa
(6 cifara) (170805)
- dan u mesecu (17) = 17-ti;
 - čas osmatranja (08) = 8 časova;
 - minuta osmatranja (05) = 5 minuta;
- Druge grupa
(4 cifre) (0084)
- nadmorska visina meteorološke stanice (0084) = 84 m.

Treća grupa
(5 cifara) (51567)

- odstupanje vazdušnog pritiska pri zemlji (515) = - 15 mm;
- odstupanje temperature vazduha pri zemlji (67) = - 17°;

Četvrti grupa
(2 cifre) (02)

- visina putanje u stotinama metara (02) = 200 m;

Peta grupa
(6 cifara) (695204)

- balističko odstupanje temperature vazduha za tu putanju (69) = - 19°C;
- pravougli azimut pravca balističkog vetra za istu putanju (52) = 52-00°;
- brzina balističkog vetra (04) = 4 m/s.

Sledeće dvocifrene grupe pokazuju visinu putanje u stotinama metara kao i četvrti grupa, a šestocifrene grupe - balističko odstupanje temperature vazduha, pravac i brzinu balističkog vetra kao i peta grupa.

146. Ako se neka grupa brojeva u momentu merenja (osmatranja) kod meteorološke stanice izražava manjim brojem cifara nego što je za nju predviđeno, tada se mesta gde cifre nedostaju popunjavaju nulama ispred postojećeg broja (na primer, nadmorska visina stanice predaje se 0084 kad joj je stvarna visina 84 m).

147. Znak »-« (minus) za negativne vrednosti odstupanja vazdušnog pritiska ili temperature vazduha ne predaje se. U tom slučaju umesto minusa uz prvu cifru brojeva, navedenih za odstupanje pritiska ili temperature, dodaje se (aritmetički) uslovni broj 5 (na primer, odstupanje pritiska - 15 mm predaje se sa 515, a odstupanje 15 mm predaje se sa 015, odstupanje temperature vazduha - 17° - predaje se sa 67, a odstupanje +17° predaje se sa 17).

148. Na kraju biltena stavlja se šestocifrena grupa. Prva dva broja označavaju visinu u stotinama metara, počinjući od one od koje su dobijeni podaci o vetru na raznim visinama ekstrapolacijom neposrednih merenja, druga dva broja označavaju vreme upotrebljivosti (važenja) biltena, a treća dva broja označavaju u kojim podelama su dati azimuti pravca balističkog vetra (1/6-400 ili 1/6-000), na primer: 090464 = iznad 900 m podaci o vetru dobijeni su ekstrapolacijom (09), a vreme upotrebljivosti biltena je 4 časa (04), azimuti pravca balističkog vetra dati su u podelama 1/6-400 (64).

149. Odstupanje vazdušnog pritiska uzima se iz treće grupe cifara biltena i svodi na visinu vatrene položaja po ovom pravilu: na svakih 10 m visinske razlike između vatrene položaja i meteorološke stanice pritisak se menja za 1 mm. Tu popravku dodati odstupanju pritiska, uzetom iz biltena - ako je vatreni položaj niže od meteorološke stanice, odnosno oduzeti - ako je vatreni položaj više.

06315675

Primer: Odstupanje vazdušnog pritiska iz biltena = -15 mm. Vatrene položaji niži je od meteorološke stanice za 100 m. Odstupanje pritiska u bateriji (na vatreom položaju) biće -15 + (+10) = -5 mm. Preračunavanje vazdušnog pritiska za vatrene položaje može se izvršiti i po Tablici XIa i Xlb.

150. Balističko odstupanje temperature vazduha, pravac i brzina balističkog vetra uzimaju se iz biltena prema visini putanje ispravljenoj za veličinu visinske razlike između artiljerijske meteorološke stanice i vatrene položaja.

151. Od pravouglonog azimuta pravca gađanja (cilja) oduzeti pravouglonje vetra na komponente, prema Tablici VI.

152. Za predaju biltena radio-telegrafijom cifre biltena ispišu se redom i podele na grupe od pet cifara. Radi dešifrovanja takvog biltena postupa se obrnuto, tj. prepišu se cifre redom, pa se podele na grupe prema odredbama t. 143 i 145.

3. - KORIŠĆENJE GRAFIČKOG DELA TABLICA GAĐANJA

153. U grafički deo tablica gađanja spadaju:

- **grafikon za izbor punjenja**, koji se nalazi na početku brojnog dela tablica gađanja, i
- **grafička tablica gađanja** za svako punjenje, na početku brojnog dela odnosno punjenja.

154. Grafikon za izbor punjenja je dat za trenutno-fugasne projektil M79 i OF-482M i na njemu je punom linijom predstavljena putanja za najveću elevaciju (≈833 hiljadita) svakog punjenja. Mesni uglovi su nacrtani zrakastim linijama na po 100 hiljaditih.

Izbor punjenja se vrši prema sledećem:

- svi ciljevi koji su na prostoru između penjućeg kraka najveće elevacije i krive sigurnosti mogu da se gađaju datim punjenjem.

Primer 1: Izvršiti izbor punjenja za $D_c = 19000$ m, sa trenutno-fugasnim projektilom M79, $S = 0$.

Cilj može da se gađa prvim i punim punjenjem.

Primer 2: Izvršiti izbor punjenja za $D_c = 20000$ m, $S = +300$ hiljaditih.

Cilj može da se gađa samo punim punjenjem.

Iz gornja dva primera moguće je sagledati praktičnost ovog grafikona. Vidi se da nije uvek isto punjenje za cilj na horizontu, nad ili pod horizontom.

155. Grafička tablica gađanja data je za sva punjenja. Ona pruža podatke o ordinatni putanje za svaku tačku između oruđa i cilja. Putanje su predstavljene na svakih 100 hiljaditih, a interpolacijom se može doći do ordinate za elevacije između predstavljenih putanja. Tablica sadrži i krive jednakih vremena leta.

Primer 1: Punjenje prvo, gađa se cilj na 17000 m, sa TF projektilom M79.

Između oruđa i cilja na daljini 10.000 m od oruđa nalazi se greben koji nadvišava oruđe za 2000 m, mesni ugao cilja je $S = 0$ hiljaditih. Odrediti mogućnost prebacivanja grebena.

Za ovaj cilj odgovara putanja od 346 hiljaditih, koja na daljini grebena od oruđa ima ordinatu 2500 m, što znači da se cilj može gađati.

Primer 2: Punjenje drugo, gađa se cilj na 13.000 m koji je pod horizontom oruđa 500 m. Između oruđa i cilja na daljini od 9000 m od oruđa nalazi se greben koji nadvišava oruđe za 1500 m. Odrediti mogućnost prebacivanja grebena.

Za ovaj cilj odgovara putanja od 240 hiljaditih, koja na daljini grebena ima ordinatu 1000 m, što znači da se cilj ne može gađati.

4. - KORIŠĆENJE TABLICE I

156. Tablica I daje podatke za izbor punjenja za gađanje. Punjenje se bira tako, da se dobije najpodesnije dejstvo projektila na cilj uz mogućnost vršenja korekture. Uvek se gađanje vrši manjim punjenjem, koje na dotičnoj daljini obezbeđuje dejstvo.

157. Tablica I je data za tablične uglove od 10° do oko 45° . Za manje uglove (do 20°) Tablica I nije data (ciljevi do ovih daljina mogu da se gađaju svim punjenjima) već se uzima najpovoljnije punjenje prema karakteru cilja, željenom dejstvu i najmanjem V_d .

158. Izbor punjenja za gađanje na rikošet se vrši na osnovu padnog ugla. Padni ugao se izračunava zavisno od nagiba zemljišta tako, što se **uslovnom** udarnom uglu ($Q = 20^\circ$ ili $3-33$) doda ili oduzme od njega ugao nagiba zemljišta (n).

Prednji nagib: $\ominus = Q - n$; Zadnji nagib: $\ominus = Q + n$

Sa tako izračunatim padnim uglom i daljinom gađanja u Tablicama gađanja se traži odgovarajuće punjenje.

5. - KORIŠĆENJE TABLICE II

159. Tablice II daju tablični ugao, balističke elemente putanje i podatke za popravku pravca i daljine zbog meteoroloških i balističkih uslova gađanja na svakih 200 m daljine.

Svako punjenje i vrsta projektila ima posebnu Tablicu II.

Tablica IIa sadrži podatke za trenutno-fugasni projektil M79 (sa upaljačem UTU, M72 i BU-130-M83) i OF-482M (sa upaljačem RGM-2 i V-429), za nadmorsku visinu vatrene položaja oruđa 0.

Tablica IIb sadrži podatke za trenutno-fugasni projektil OF-482M sa temperirnim upaljačem V-90, za nadmorsku visinu vatrene položaja oruđa -0.

Tablica IIc sadrži podatke za pancirno-obeležavajući projektil BR-482 (BR-482B), za nadmorsku visinu vatreneog položaja oruđa -0.

Tablica IIId sadrži podatke za osvetljavajući projektil SP-46 za visinu rasprsnuća 600 m.

Podaci u Tablicama II uneti su po opštem redu ustajanih kolona.

160. Kolona 1 – sadrži za svakih 200 m odgovarajuću daljinu u m. Kada se gađa na daljinu između onih koje su date u tablicama, podaci se dobijaju interpolacijom.

161. Kolona 2 – sadrži podatke za **podeljke daljinara**. Ova se kolona koristi pri gađanju optičkim nišanom (daljinarom).

162. Kolona 2a – sadrži podatke za **podeljke daljinara**. Ovo se odnosi na daljinar kod kojeg se tablični ugao može da zauzima u podeljima i hiljaditima (S 71-35).

163. Kolona 3 – sadrži podatke za **daljinar u hiljaditima** 1/6000 obima kruga. Ova kolona se koristi pri gađanju daljinarom ili kada se gađanje izvodi kvadrantom sa podelom 1/6000.

164. Kolona 4 – sadrži podatke za tablični ugao u stepenima i minutama. Podatke iz te kolone treba smatrati najtačnijim i uzimati ih pri gađanju kada se koristi kvadrant u stepenima.

165. Kolona 5 – sadrži podatke za izbor visine sloja iz meteo-biltena »meteo-srednji«.

166. Kolona 6 – sadrži podatke za **ordinatu temena putanje** u metrima, koji se koriste za izračunavanje popravki pravca i daljine gađanja zbog vetra i popravki daljine gađanja zbog odsutovanja temperature vazduha.

167. Kolona 7 – sadrži podatke za **vreme letenja projektila** u sekundama. Podaci iz ove kolone koriste se za razlikovanje eksplozija svojih projektila, za izračunavanje preticanja pri gađanju kretnih ciljeva i za ostvarenje planskih vatri.

168. Kolona 8 – sadrži podatke za **krajnju brzinu** u m/s a koriste se za izračunavanje energije u padnoj tački.

Za izračunavanje udarne energije treba najpre razložiti krajnju brzinu (V_k) u dve komponente: vertikalnu (V_y) i horizontalnu (V_x):

$$V_y = V_k \cdot \sin \Theta$$

i

$$V_x = V_k \cdot \cos \Theta$$

Udarne energija (E_u) je živa sila koju ima projektil u udarnoj tački. Njegova vertikalna komponenta (E_y) dolazi u obzir pri gađanju vodoravnih ciljeva, a horizontalna komponenta (E_x) – pri gađanju vertikalnih ciljeva:

$$E_y = \frac{p \cdot V_k^2 \cdot \sin^2 \Theta}{2g}$$

i

$$E_x = \frac{p \cdot V_k^2 \cdot \cos^2 \Theta}{2g}$$

169. Kolona 9 – sadrži podatke za **padni ugao** Θ_p u hiljaditima 1/6000. Podaci iz ove kolone služe da se po Tablici IV uzme koeficijent za izračunavanje veličine verovatnog skretanja i skoka po daljini, kad se cilj nalazi na nagibu. Pored toga, padni ugao daje podatak za izračunavanje udarnog ugla θ za proračun da li će se dobiti rikošet kad je potreban, odnosno da do rikošeta neće doći kad nije potreban, kao i za mogućnost gađanja ciljeva na zadnjim nagibima.

170. Kolona 10 – sadrži podatke za **tempiranje u podeljima** tempirnog upaljača V-90. Tempiranje je dato za visinu rasprsnuća u horizontu usta cevi.

171. Kolona 10 – kod Tablice IIId za osvetljavajući projektil SP-46, sadrži podatke za **tempiranje** u podeljima upaljača TM-16L (TM-16M), koji treba zauzeti prema odgovarajućim daljinama gađanja da bi se dobila visina baklje od 600 m.

172. Kolona 11 – sadrži podatke o **veličini verovatnog skretanja po daljini** (V_d) u metrima. Veličina V_d na zemljištu zavisi od izabranog punjenja, daljine gađanja i nagiba zemljišta. Na prednjem nagibu V_d je manje, a na zadnjem je veće od tabličnog. Koliko će se V_d na zemljištu razlikovati od tabličnog izračunava se iz Tablice IV. Od veličine V_d zavisi zona sigurnosti za pešadiju i činiac verovatnoće koji po Tablici VII daje podatke o procentu pogodaka, koje treba očekivati po jednom cilju.

173. Kolona 12 – sadrži podatke o **veličini verovatnog skretanja po pravcu** (V_p) u metrima. Od veličine V_p zavisi veličina opasne zone i činiac verovatnoće pri bočnom gađanju. γ – nosno gađanju uzanih ciljeva.

174. Kolona 13 – sadrži podatke o **veličini verovatnog skretanja po visini** (V_v) u metrima.

175. Kolona 14 – sadrži podatke o **veličini verovatnog skretanja rasprsnuća po daljini** (V_{rd}) u metrima za tempirne upaljače V-90 i TM-16L (TM-16M).

176. Kolona 15 – sadrži podatke o **veličini verovatnog skretanja rasprsnuća po visini** (V_{rv}) u metrima za tempirne upaljače V-90 i TM-16L (TM-16M).

Popravke pravca

Popravke pravca date su u vrednostima hiljaditih (1/6000).

177. Kolona 17 – sadrži popravku pravca u hiljaditima zbog derivacije. Pošto zbog derivacije projektil skrece udesno, popravku pravca treba vršiti ulivo.

178. Kolona 18 – sadrži popravku pravca u hiljaditima zbog bočne komponente vetra za $W_v=10$ m/s. Bočna komponenta vetra menja pravac i treba ga popraviti u stranu odakle duva vetar a smisao bočne komponente određuje se Tablicom VI na osnovu veličine ugla vetra i brzine vetra. Način izračunavanja ugla vetra dat je u Tablici VI.

Popravka pravca zbog uticaja vetra uzima se za ordinatu temena putanje.

Pri izračunavanju popravke pravca zbog uticaja vetra, vrednost iz ove kolone podeliti sa 10, pa je pomnožiti sa vrednošću bočne komponente vetra iz Tablice VI.

179. Kolona 19 – sadrži popravke pravca zbog **kosine ramena kolenke oruđa**. Pošto zbog mase projektili skreće prema nižoj strani, pravac treba popraviti u suprotnu stranu.

Da bi se izračunala popravka pravca zbog kosine ramena kolenke oruđa, treba vrednost iz ove kolone podeliti sa 10, a dobijeni rezultat pomnožiti sa vrednošću kosine ramena kolenke oruđa izraženoj u hiljadima.

Popravke daljine

180. Kolona 21 – sadrži popravke daljine gađanja u metrima zbog **uzdužne komponente vetra** za $W_x=10$ m/s. Uzdužna komponenta menja daljinu dvojakom: povećava je ako je vetar u pravcu gađanja, a smanjuje je ako je vetar suprotan pravcu gađanja. U prvom slučaju popravka ima negativan predznak, a u drugom pozitivan.

Popravke daljine zbog vetra uzimaju se za ordinatu temena putanje. Vrednost uzdužne komponente vetra dobija se iz Tablice VI posle razlaganja vetra na komponente. Da bi se izračunala popravka daljine, treba podeliti vrednost iz ove kolone sa 10, čime se dobija popravka za $W_x=1$ m/s i rezultat pomnožiti brojem dobijenim u Tablici VI, za uzdužnu komponentu vetra.

181. Kolona 23 – sadrži popravku daljine u metrima, zbog **razlike u temperaturi vazduha** za $\Delta t=10^\circ\text{C}$.

Ako je temperatura veća od normalne (tablične) atmosfera je reda i do met se povećava, pa je predznak popravke minus i obrnuto.

Povećanje temperature za 10° smanjuje gustinu vazduha za oko 45 g/m^3 , a promenom visinske razlike za oko 180 m menja se temperatura vazduha za 1°C . Ako visina raste, temperatura opada.

Da bi se izračunala popravka daljine zbog razlike u temperaturi vazduha, treba vrednost iz ove kolone podeliti sa 10, pa rezultat pomnožiti odstupanjem temperature na visini putanje (ordinate temena putanje).

Ako nema meteorološkog biltena, uzima se odstupanje prizemne temperature.

182. Kolona 24 – sadrži popravke daljine u metrima zbog **razlike vazdušnog pritiska** za $\Delta H=10$ mbar.

Razliku vazdušnog pritiska daje meteorološka stanica za svoju visinu. Ako se visina stanice razlikuje od visine vatrenog položaja, treba preračunati razliku vazdušnog pritiska za visinu vatrenog položaja koristeći se Tablicama Xla i Xlb, čije su vrednosti date u mbar.

Vazdušni pritisak ravnometno se smanjuje s povećanjem visine, približno za 13 mbar na svakih 100 metara visine.

Ako je razlika vazdušnog pritiska negativna (pritisak manji od normalnog/tabličnog), atmosfera je reda i projektil ima veći domet, pa popravku treba oduzeti i obrnuto.

Da bi se izračunala popravka daljine, treba podeliti vrednost iz ove kolone sa 10, čime se dobija popravka daljine za $\Delta H=1$ mbar, pa rezultat pomnožiti sa razlikom vazdušnog pritiska svedenog za visinu vatrenog položaja.

183. Kolona 25 – sadrži popravku daljine u metrima zbog **razlike početne brzine** za $\Delta V_0=10$ m/s. Iz ove kolone uzima se popravka zbog odstupanja početne od tablične brzine.

Manja početna brzina daje manji domet, pa popravku treba dodati.

Da bi se izračunala popravka daljine, treba podeliti vrednost iz ove kolone sa 10, čime se dobija popravka za $\Delta V_0=1$ m/s, a zatim rezultat pomnožiti opadanjem početne brzine u m/s u odnosu na tabličnu brzinu.

184. Kolona 26 – sadrži popravke daljine u metrima zbog **razlike temperature baruta** $\Delta t_b=10^\circ\text{C}$.

Ukoliko je temperatura baruta veća i početna brzina je veća, a popravka negativna i obrnuto.

Tablična temperatura baruta je 15°C (288K).

Da bi se izračunala popravka zbog razlike u temperaturi baruta, treba podeliti vrednost iz ove kolone sa 10 i pomnožiti rezultat sa razlikom između stvarne i tablične temperature baruta.

185. Kolona 27 – sadrži popravke daljine u metrima zbog **razlike u masi projektila** od normalne za $\Delta m=1$ oznaka.

Svi projektili normalne mase imaju oznaku N.

Ukoliko projektil ima veću masu, utoliko su početna brzina i usporenje zbog otpora vazduha manji i obrnuto. Manja početna brzina daje manji domet, ali manje usporenje zbog otpora vazduha daje veći domet. Ukupna popravka koja se nalazi u ovoj koloni, ravna je zbiru popravki zbog razlike u početnoj brzini i usporenju zbog otpora vazduha.

Na manjim daljinama dolazi više do izražaja popravka zbog uticaja mase projektila na početnu brzinu, pa je predznak popravke pozitivan. Na većim daljinama, međutim, dolazi više do izražaja manje usporenje zbog otpora vazduha, pa je domet veći i vrednost popravke se smanjuje.

Da bi se izračunala popravka daljine zbog razlike u masi projektila treba pomnožiti vrednost iz ove kolone sa razlikom oznaka masa od normalnih.

186. Kolona 33 – sadrži podatak o pomeranju **padne tačke** po daljini menjajući daljinar (tablični ugao) za 1 hiljaditi.

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187. Kolona 34 – sadrži podatke koliko 1 podeljak visinske skale panomare (daljinara, kvadranta) menja visinu padne tačke projektila u metrima. Podaci u ovoj koloni koriste se pri neposrednom gađanju vertikalnih ciljeva.

188. Kolona 40 – sadrži podatke o potrebnoj promeni tabličnog ugla (elevacije), da bi se visina rasprsnuća promenila za 100 m.

189. Kolona 40a – sadrži podatke o potrebnoj promeni temperature pri promeni visine rasprsnuća za 100 m.

190. Kolona 46 i 46a – sadrži veličinu popravke tabličnog zbog mesnog ugla cilja (pS), za svaki jedan hiljadit mesnog ugla (pozitivnog ili negativnog). U koloni je dat i predznak popravke.

Ova kolona se koristi za izračunavanje popravki tabličnog zbog mesnog ugla samo za mesne uglove do ± 30 hiljaditih.

Za veće mesne uglove koristi se Tablicu III. Kada se ima vremena, treba koristiti Tablicu III i za manje vrednosti mesnog ugla, jer daje tačnije vrednosti pS.

191. U Tablici IIe – date su brdske tablice gađanja za trenutno-fugasni projektil M79 sa upaljačima UTU, M72 i BU-130-M83 i trenutno-fugasni projektil OF-482M sa upaljačima RGM-2 i V-429 i koriste se u brdskim uslovima. Pri promeni nadmorske visine menjaju se pritisak i temperatura vazduha, što direktno utiče na veličinu dometa oruđa pri gađanju istim tabličnim uglom. Da bi se uticao ovaj promena uzeo u obzir, u brdskim tablicama gađanja data je zavisnost promene daljine gađanja za nadmorske visine 0,500, 1000 i 1500 m, pri istom tabličnom uglu. U brdskim tablicama nisu date popravke zbog meteoroloških i balističkih uslova gađanja za pomenute visine, jer bi takve tablice bile preobimne i nepodesne za rukovanje, a ne bi time poboljšale tačnost gađanja. Zato pri korišćenju ovih brdskih tablica gađanja, popravke pravca i daljine zbog meteoroloških i balističkih uslova gađanja kao i podatke o elementima putanje prema daljini gađanja uzimati iz osnovnih tablica gađanja.

Prilikom izvođenja artiljerijskih gađanja sa vatrene položaja oruđa na nadmorskim visinama preko 250 m, obavezno koristiti brdske tablice gađanja, jer će se time izbesci greška po daljini i poboljšati tačnost gađanja.

192. U Tablici IIIf – date su brdske tablice gađanja za trenutno-fugasni projektil OF-482M sa temperirnim upaljačem V-90.

193. U Tablici IIg – date su brdske tablice gađanja za osvetljavajući projektil SP-46 sa upaljačem TM-16L (TM-16M).

Za određivanje odsutpanja izmerenog pritiska i temperature vazduha od normalnih tabličnih uslova na nekoj visini (Z), koristi se Pregled 7, u kojem su date vrednosti promene pritiska i temperature vazduha u normalnim-tabličnim uslovima za usvojene tablične visine (Z).

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Pregled 7

Postupak određivanja pomenutih odsutpanja temperature i pritiska isti je kao i pri normalnoj visini-nula, samo što više nisu tablične vrednosti za temperaturu 15,9°C i pritisak 1000 mbar, već neke od vrednosti iz Pregleda 7, koje odgovaraju normalnim vrednostima visine (Z), na kojoj se vrši gađanje.

Nadmorska visina	Tablična temperat. vazduha	Tablični vazdušni pritisak
m	°C	m bar
0	15,9	1000
500	12,7	942
1000	9,6	887
1500	6,4	834

Pošto su u tablicama daljine date za svakih 200 m a vrednosti tabličnog ugla za visine oruđa 0,500, 1000 i 1500 m, pri gađanju kada je vatreni položaj na nadmorskoj visini između datih visina (na primer 1420 m) i daljina gađanja nije izražena u okruglim stotinama metara (na primer 8530 m) treba se koristiti interpolacijom.

6. - POMOĆNE TABLICE

1) KORIŠĆENJE TABLICE III

194. Tablica III sadrži popravke tabličnog zbog mesnog ugla cilja (pS), za određenu vrednost tabličnog i mesnog ugla.

195. Tablica III je data za svako punjenje posebno, prema sledećim:

- donja grupa uglova, mesni ugao pozitivan, i
- donja grupa uglova, mesni ugao negativan.

Kod gađanja donjom grupom uglova popravka tabličnog ugla je islog predznaka kao i mesni ugao, tako da obrazac za elevacioni ugao glasi: $E = T \pm (S \pm pS)$. U svakoj Tablici III je dat obrazac za izračunavanje elevacionog ugla u zavisnosti od predznaka mesnog ugla i popravke tabličnog zbog mesnog ugla.

Primer: Punjenje četvrti, tablični ugao 660 hiljaditih $S = -80$ hiljaditih, izračunati elevacioni ugao?

$$E = T - pS = 660 - 80 - 75 = 505 \text{ hiljaditih}$$

2) KORIŠĆENJE TABLICE IIIa

196. Tablica IIIa sadrži popravku daljine u metrima i popravku pravca u hiljaditima zbog uticaja rotacije zemlje. Tablica odgovara geografskoj širini od 45° i s obzirom na geografski položaj može se primeniti na celo područje naše zemlje. Znak popravke daljine se odnosi na pravac gađanja od 0-00 do 30-00 dok za pravac gađanja od 30-00 do 60-00 znak popravke treba promeniti.

Sve popravke pravca su u levo.

Primer 1: Cilj na daljini 25000 m azimuta 15-00 gađa se punim punjenjem. Odrediti popravku daljine i pravca zbog uticaja rotacije zemlje.

Iz tablice IIIa za puno punjenje za azimut gađanja cilja 15-00 i daljinu 25000 m dobija se popravka daljine -54 m i pravca 3 hiljadita tj. 0-03.

Popravka daljine iznosi: $25000 - 54 = 24946$ m.

Popravka pravca iznosi: $(15-00) - (0-03) = 14-97$.

Primer 2: Cilj na daljini 25000 m azimuta 45-00 gađa se punim punjenjem. Odrediti popravku daljine i pravca.

Kao i u Primeru 1. iz Tablice IIIa za puno punjenje popravka daljine iznosi 54 m (znak je promenjen jer je pravac gađanja od 30-00 do 60-00) a popravka pravca 3 hiljadita, tj. 0-03.

Popravka daljine iznosi: $25000 + 54 = 25054$ m.

Popravka pravca iznosi: $(45-00) - (0-03) = 44-97$.

3) KORIŠĆENJE TABLICE IV

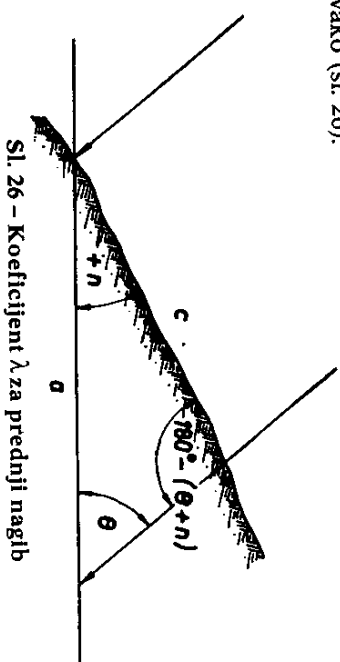
197. Ova tablica sadrži vrednost koeficijenta kojim treba da se množe veličine tabličnih verovatnih skretanja i skokovi po daljini kad se cilj nalazi na prednjem (+n) ili zadnjem (-n) nagibu. Koeficijenti su dati za padni ugao i nagib zemljišta u podelama 1/6000.

198. Vrednosti za daljine i verovatna skretanja, koje su date u tablici II, važe samo onda kad se cilj nalazi na horizontalnom zemljištu a izračunate su za sliku pogodaka novog oruđa.

Ako se cilj nalazi na prednjem nagibu (zemljište se penje od baterije ka cilju) verovatno skretanje i skok na zemljištu se smanjuje, a ako je cilj na zadnjem nagibu oni se povećavaju.

199. Koeficijent λ za prednji nagib manji je od jedinice.

Koeficijent kojim treba množiti poznatu dužinu na horizontu (a) da bi se dobila njena veličina na prednjem nagibu (c), izračunava se ovako (sl. 26):



Sl. 26 - Koeficijent λ za prednji nagib

$$c = a \cdot \frac{\sin \theta}{\sin (\theta + n)}, \text{ a ako } \frac{\sin \theta}{\sin (\theta + n)} \text{ označimo sa } \lambda, \text{ onda je:}$$

$$c = a \cdot \lambda.$$

Koeficijent kojim treba množiti poznatu dužinu na prednjem nagibu, pa da se dobije njena veličina na horizontu, dobija se ako se 1 podeli sa vrednošću iz tablice IVa, tj:

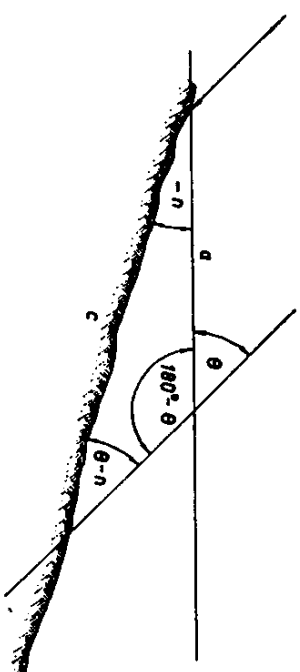
$$a = c \cdot \frac{1}{\lambda}$$

200. Koeficijent λ' za zadnji nagib veći je od jedinice.

Koeficijent λ' kojim treba množiti poznatu dužinu na horizontu da bi se dobila njena veličina na zadnjem nagibu, izračunava se ovako (sl. 27):

$$c = a \cdot \frac{\sin \theta}{\sin (\theta - n)}, \text{ a ako } \frac{\sin \theta}{\sin (\theta - n)} \text{ označeno sa } \lambda', \text{ onda je:}$$

$$c = a \cdot \lambda'.$$



Sl. 27 - Koeficijent λ' za zadnji nagib

Koeficijent kojim treba množiti poznatu dužinu na zadnjem nagibu da bi se dobila njena veličina na horizontu, dobija se ako se 1 podeli sa vrednošću iz tablice IVb, tj:

$$a = c \cdot \frac{1}{\lambda'}$$

Vrednost λ i λ' zavise od padnog ugla i nagiba zemljišta. Poslednja vertikalna kolona tablice IV daje vrednost koeficijenta kad se gađa vertikalna meta. Tim vrednostima može se izračunati veličina verovatnog skretanja po visini, po obrascu:

$$V_v = V_d \cdot \lambda; \text{ gde je } \lambda = \lg \Theta$$

Nagib zemljišta u procentima izračunava se tako da se visinska razlika između dve tačke podeli s horizontalnim rastojanjem, i dobijeni koeficijent pomnoži sa 100.

4) KORIŠĆENJE TABLICE V

201. Tablica V sadrži prirodne vrednosti trigonometrijskih funkcija za uglove u hiljaditima, a koristi se prilikom izračunavanja elemenata u pripremi gađanja.

202. Tablica Va se koristi za uglove u podelama 1/6400, za sve potrebne trigonometrijske funkcije, a tablica Vb za uglove u podelama 1/6000. Tablica Vc sadrži prirodne vrednosti tangensa uglova i tablica za lakše određivanje u kojem se kvadrantu nalazi ugao α , kao i za određivanje azimuta gađanja (AzG). Ove tablice koriste računati u potpunoj pripremi početnih elemenata.

5) KORIŠĆENJE TABLICE VI

203. Ova tablica služi za razlaganje vetra na komponente.

204. Vetar se izračunava po slojevima u stotinama metara (200, 400, 800, 1200, 2400, 3200 i 4000) i daje se u četvrtoj grupi brojeva biltena. Pravougli azimut vetra za istu putanju daje se u stotinama hiljaditih, a brzina u metar-sekundama u petoj grupi brojeva biltena.

205. Vetar utiče na pravac i daljinu gađanja, zavisno od ugla i brzine. Ugao vetra (αW) je ugao između pravca gađanja i pravca vetra a meri se u suprotnom smislu kretanja kazaljke na satu. Izračunava se po formuli:

$$\alpha W = AzC - AzW$$

Azimut i brzina vetra uzimaju se iz biltena meteorološke stanice, za visinu koja odgovara ordinati temena putanje.

Pravougli azimut cilja i vetra se uzimaju u podelama 1/6000. Međutim, ako su u biltenu dati u podelama 1/6400, potrebno ih je prethodno pretvoriti u podelu 1/6000, po tablici Xa.

Ako je pravougli azimut cilja manji od pravougllog azimuta vetra, pre oduzimanja povećava se za 60-00.

Podaci za uzdužnu i bočnu komponentu vetra uzimaju se iz tablice na osnovu ugla i brzine balističkog vetra.

Pravac vetra računa se sa tačnošću od 1-00, a brzina od 1 m/s. Ako je brzina vetra veća od 10 m/s, uzeti vrednost iz kolone 10 i onog broja koji sabran sa 10 daje stvarnu brzinu vetra.

Tablica VIa se koristi za uglove u podelama 1/6400, a Tablica VIb za uglove u podelama 1/6000.

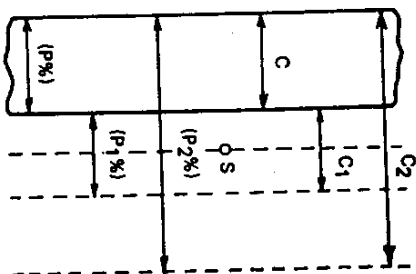
6) KORIŠĆENJE TABLICE VII

206. Ova tablica sadrži podatke za činilac verovatnoće pomoću koga se može odrediti procenat pogodaka u cilj, ovako:

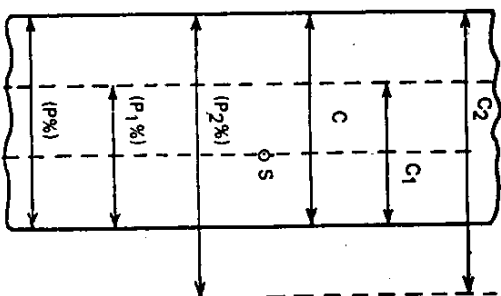
a) Kad je srednji pogodak ma gde u cilju (sl. 28):

$$C = \frac{C_1}{2} + \frac{C_2}{2}$$

$$\text{Činilac} = \frac{C}{V_d} = \frac{C_1}{V_d}, \text{ odnosno } \frac{C_2}{V_d}$$



Sl. 28 - Izračunavanje procenata pogodaka u cilj kad je srednji pogodak izvan cilja



Sl. 29 - Izračunavanje procenata pogodaka u cilj kada je srednji pogodak ma gde u cilju

$$P = \frac{P_1}{2} + \frac{P_2}{2} \text{ gdeje:}$$

P = procenat pogodaka.

b) Kad je srednji pogodak izvan cilja (sl. 29)

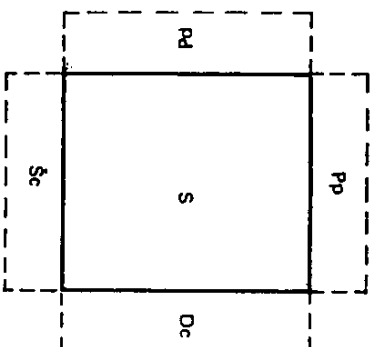
$$C = \frac{C_2}{2} - \frac{C_1}{2}$$

$$\text{Činilac} = \frac{C_1}{V_d}, \text{ odnosno } \frac{C_2}{V_d}$$

$$P = \frac{P_2}{2} - \frac{P_1}{2}$$

Izračunavanje procenata pogodaka u pravouglu metu (sl. 30):
prvo se odredi verovatnoća za pojas I pa za pojas II, a zatim se međusobno pomnože i dobijeni proizvod podeli sa 100.

$$P = \frac{P_1 \cdot P_2}{100}$$



Sl. 30 – Izračunavanje procenata pogodaka u pravouglu metu

207. Određivanje procenata pogodaka slikom rasturanja prikazano je u pregledu 6.

2%		7%	16%		25%		25%	16%		7%	2%				
1	1	2,5	4,5	7	9	12	13	13	12	9	7	4,5	2,5	1	1

7) KORIŠĆENJE TABLICE VIII

208. Ova tablica sadrži podatke za pretvaranje stepeni i minuta u hiljade 1/6400 i 1/6000 obima kruga.

Pretvaranje stepeni u hiljadite vrši se po tablici VIIa, a pretvaranje minuta u hiljadite po tablici VIIIb.

8) KORIŠĆENJE TABLICE IX

209. Ova tablica sadrži podatke za pretvaranje hiljaditih u stepene i minute.

Pretvaranje hiljaditih u stepene i minute za svakih 100 hiljaditih dato je u tablici IXa, a za svaki hiljaditi od 1 do 100 u tablici IXb.

9) KORIŠĆENJE TABLICE X

210. Tablica X daje podatke za pretvaranje hiljaditih 1/6400 u 1/6000 obima kruga i obratno.

Vrednosti od 100 do 6400 hiljaditih za svaku stotinu dati su u levom delu tablice, a od 1 do 100 hiljaditih (za svaki hiljaditi) u desnom delu tablice i prilikom pretvaranja treba ih dodati na vrednost za stotine hiljaditih.

Tablica Xa koristi se za pretvaranje hiljaditih 1/6400 u hiljadite 1/6000 obima kruga, a tablice Xb – za pretvaranje hiljaditih 1/6000 u hiljadite 1/6400 obima kruga.

10) KORIŠĆENJE TABLICE XI

211. Ova tablica služi za preračunavanje vazdušnog pritiska za vatrene položaj ako je poznat pritisak, na meteorološkoj stanici i vistska razlika između varenog položaja i stanice.

Tablica XIa koristi se kad je vatreni položaj niži, a tablica XIb kad je vatreni položaj viši od meteorološke stanice.

11) KORIŠĆENJE TABLICE XII

212. Ova tablica služi za sigurno određivanje predznaka popravki pri izračunavanju elemenata za gađanje.

12) KORIŠĆENJE TABLICE XIII

213. Ove tablice služe za određivanje:

- najmanje dozvoljene udaljenosti oruđa od grebena zaklona, koja obebeđuje prebacivanje grebena zaklona pri gađanju ciljeva na njoj najmanje daljine, i
- najmanje elevacije.

Ove tablice se mogu koristiti pri određivanju mesta oruđa i u tom slučaju nije potrebno izračunavati mesni ugao zaklona (s).

13) KORIŠĆENJE TABLICE XIV

214. Ova tablica služi za izračunavanje topografskih elemenata cilja (repera) na sledeći način:

1. Odredi se razlika koordinata cilja i vatrenog položaja.
2. Manja po apsolutnoj veličini razlika koordinata podeli se sa većom razlikom koordinata s tačnošću do tri decimale i dobije se koeficijent pravca P ($P = \text{tangens ugla } \gamma$).
3. U koloni P tablice za proračun topografske daljine i azimuta cilja pronađe se broj, koji je jednak ili blizak vrednosti proračunskog koeficijenta pravca: jednovremeno se prepiše iz (desne kolone) »D« tablice veličina koeficijenta daljine D ($D = \text{kossecans ugla } \gamma$).
4. Odredi se azimut cilja-repera (uglomer) zavisno od znakova razlika koordinata i nađene vrednosti P ; pri ovome broj stotina pod-eljaka uglomera uzima se u gornjem ili donjem delu tablice prema odgovarajućem odnosu razlika koordinata; broj desetica i jedinica podeljaka uglomera uzima se u redu u kome je nađena veličina P i to u krajnjoj levoj koloni kada se stotina podeljaka uglomera uzima iz gornjeg dela tablice ili u krajnjoj desnoj koloni kada se stotina podeljaka uglomera uzima iz donjeg dela tablice.
5. Odredi se daljina gađanja tako što se veća razlika koordinata pomnoži sa vrednošću D iz tablice.
6. Odredi se skretanje od osnovnog pravca na cilj, radi čega se od azimuta cilja oduzme azimut osnovnog pravca.

Glava V

OSNOVNE TABLICE

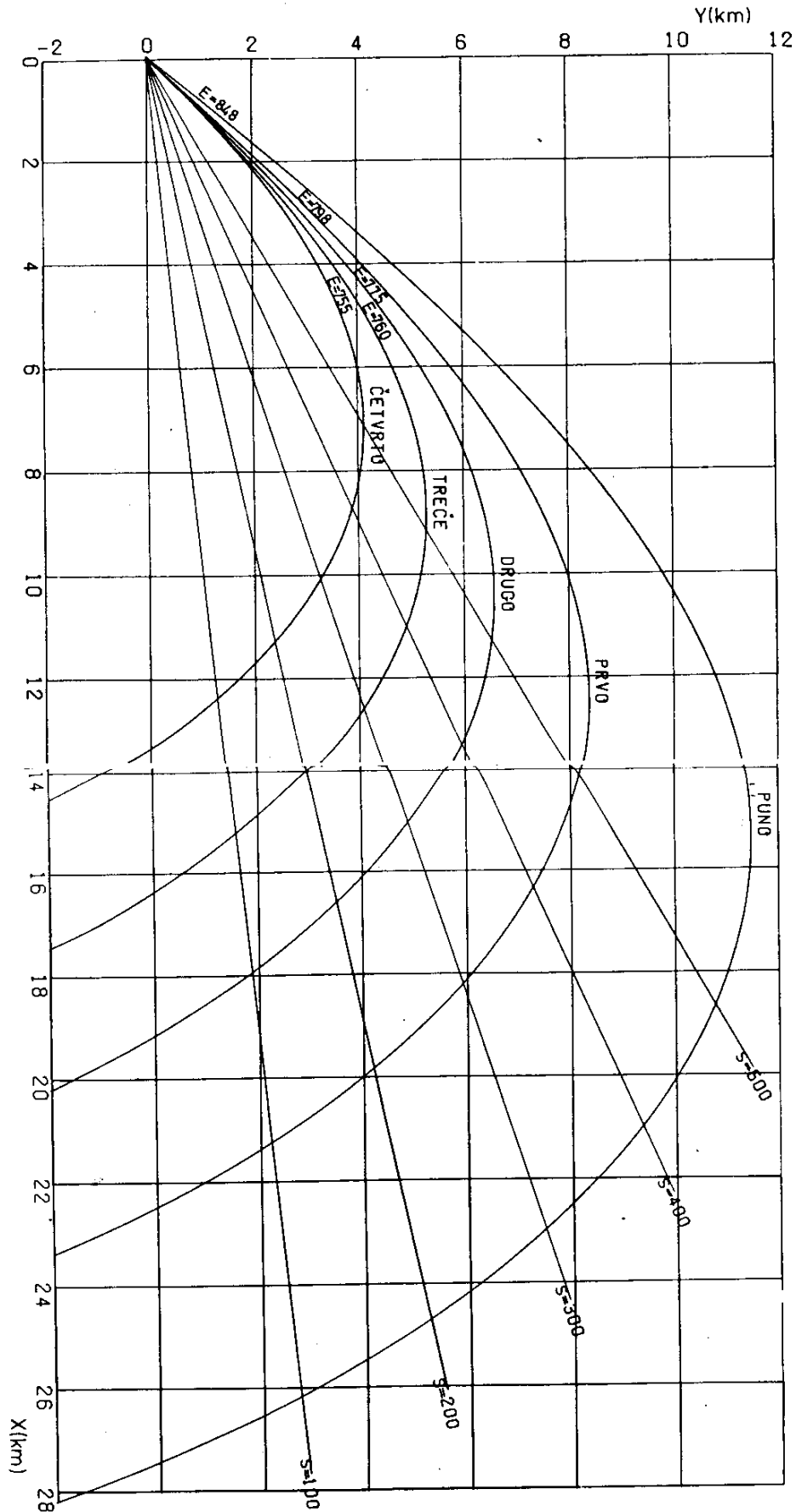
1. – **Grafikon za izbor punjenja** za trenutno-fugasni projektil M79 sa upaljačem UTIU, M72 i BU-130-M83 i trenutno-fugasni projektil OF-482M sa upaljačem RGM-2 i V-429.
2. – **Tablica Ia:** Izbor punjenja za trenutno fugasni projektil M79 sa upaljačem UTIU, M72 i BU-130-M83 i trenutno-fugasni projektil OF-482M sa upaljačem RGM-2 i V-429.
3. – **Tablica IIa:** Grafičke i brojne tablice gađanja za trenutno-fugasni projektil M79 sa upaljačem UTIU, M72 i BU-130-M83 i trenutno fugasni projektil OF-482M sa upaljačem RGM-2 i V-429.
4. – **Grafikon za izbor punjenja** za trenutno-fugasni projektil OF-482M sa upaljačem V-90.
5. – **Tablica Ib:** Izbor punjenja za trenutno-fugasni projektil OF-482M sa upaljačem V-90.
6. – **Tablica IIb:** Grafičke i brojne tablice gađanja za trenutno-fugasni projektil OF-482M sa upaljačem V-90.
7. – **Tablica IIc:** Brojna tablica gađanja za pancirno-obeležavajući projektil BR-482 (BR-482B) sa upaljačem DBR.
8. – **Tablica IId:** Brojna tablica gađanja za osvetljavajući projektil SP-46 sa upaljačem TM-16L (TM-16M).
9. – **Tablica IIe:** Brojne brdske tablice gađanja za trenutno-fugasni projektil M79 sa upaljačem UTIU, M72 i BU-130-M83 i trenutno-fugasni projektil OF-482M sa upaljačem RGM-2 i V-429.
10. – **Tablica IIIf:** Brojne brdske tablice gađanja za trenutno-fugasni projektil OF-482M sa upaljačem V-90.
11. – **Tablica IIg:** Brojna brdska tablica gađanja za osvetljavajući projektil SP-46 sa upaljačem TM-16L (TM-16M).

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TABLICA Ia i IIa

Grafikon za izbor punjenja
Izbor punjenja, i
Grafčke i brojne tablice gađanja za:
Trenutno-fugasni projektil M79 sa upaljačem UTIU,M72 i
BU-130-M83
Trenutno-fugasni projektil OF-482M sa upaljačem RGM-2 i
V-429

GRAFIKON ZA IZBOR PUNJENJA
 TOP 130 mm M-46
 TREKUTNO-FUGASNI PROJEKTIL M79 I OF-482M



Tablica Ia

IZBOR PUNJENJA

TRENUTNO-FUGASNI PROJEKTIL M79 SA UPALJACEM UTIU, M72 i BU-130-M83
TRENUTNO-FUGASNI PROJEKTIL OF-482M SA UPALJACEM RGM-2 i V-429

D a l j n a	Četvrto punjenje $V_0=525$ m/s			Treće punjenje $V_0=621$ m/s			Drugo punjenje $V_0=705$ m/s			Prvo punjenje $V_0=810$ m/s			Puno punjenje $V_0=930$ m/s			D a l j n a
	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	1Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	
	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	
m	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	m
400	7	7	11													400
800	14	15	10													800
1200	22	23	10													1200
1600	30	32	10													1600
2000	38	42	11													2000
2400	47	54	11													2400
2800	56	66	12													2800
3200	66	79	13													3200
3600	76	94	14													3600
4000	88	111	16													4000
4400	99	129	17	68	87	16										4400
4800	112	149	19	77	99	17										4800
5200	125	170	21	85	113	18										5200
5600	139	192	23	94	128	20										5600
6000	154	216	25	104	144	21										6000
6400	170	240	27	114	162	22										6400
6800	186	265	29	125	181	24										6800
7200	203	291	31	136	201	26										7200
7600	221	317	33	148	223	27										7600
8000	240	345	35	160	245	29										8000

Tablica Ia

IZBOR PUNJENJA

TRENUTNO-FUGASNI PROJEKTIL M79 SA UPALJACEM UTIU, M72 i BU-130-M83
TRENUTNO-FUGASNI PROJEKTIL OF-482M SA UPALJACEM RGM-2 i V-429

D a l j n a	Četvrto punjenje $V_0=525$ m/s			Treće punjenje $V_0=621$ m/s			Drugo punjenje $V_0=705$ m/s			Prvo punjenje $V_0=810$ m/s			Puno punjenje $V_0=930$ m/s			D a l j n a
	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	
	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	
m	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	m
8400	260	372	37	174	269	31	127	195	25							8400
8800	280	401	39	188	294	32	137	214	26							8800
9200	302	430	40	203	319	34	147	235	27							9200
9600	325	460	42	218	345	36	158	247	29							9600
10000	349	492	44	234	372	37	170	280	30							10000
10400	374	524	46	252	399	39	182	303	31							10400
10800	402	558	49	269	427	40	195	328	32							10800
11200	431	594	51	288	454	42	208	353	34							11200
11600	464	632	54	308	483	43	222	379	35							11600
12000	501	674	57	329	512	45	237	405	36							12000
12400	543	720	60	350	541	46	252	432	37	180	324	36				12400
12800	594	773	63	373	571	48	269	459	38	191	348	38				12800
13200	666	844	67	397	601	49	286	486	39	203	373	39				13200
13600				423	632	51	303	513	40	216	399	40				13600
14000				450	663	52	322	541	41	229	424	42				14000
14400				479	696	54	341	569	43	242	450	43				14400
14800				511	730	56	362	597	44	257	477	44				14800
15200				547	766	58	383	625	45	272	503	45				15200
15600				588	806	60	406	653	46	287	529	46				15600
16000				640	855	63	430	682	47	303	556	48				16000

Tablica Ia

IZBOR PUNJENJA

TRENUTNO-FUGASNI PROJEKIL M79 SA UPALJAČEM UTIU, M72 i BU-130-M83
TRENUTNO-FUGASNI PROJEKIL OF-482M SA UPALJAČEM RGM-2 i V-429

D a l j n a	Četvrto punjenje $V_0=525$ m/s			Treće punjenje $V_0=621$ m/s			Drugo punjenje $V_0=705$ m/s			Prvo punjenje $V_0=810$ m/s			Puno punjenje $V_0=930$ m/s			D a l j n a
	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	
	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	
m	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	m
16400				760	957	68	455	712	48	320	582	49	213	422	44	16400
16800							483	741	49	337	608	50	224	446	45	16800
17200							512	772	50	356	635	51	236	471	46	17200
17600							543	804	51	374	661	52	249	496	47	17600
18000							579	838	53	394	687	54	261	521	49	18000
18400							620	875	54	415	714	55	274	546	50	18400
18800							671	919	57	436	740	56	288	571	51	18800
19200										459	766	57	302	596	52	19200
19600										483	793	59	317	620	53	19600
20000										508	820	60	332	645	55	20000
20400										535	848	61	347	669	56	20400
20800										565	876	62	363	693	57	20800
21200										597	906	64	379	717	58	21200
21600										634	938	65	396	740	60	21600
22000										680	975	67	414	763	61	22000
22400										752	1029	70	432	786	62	22400
22800													450	809	64	22800
23200													470	832	65	23200
23600													489	855	67	23600
24000													510	877	68	24000

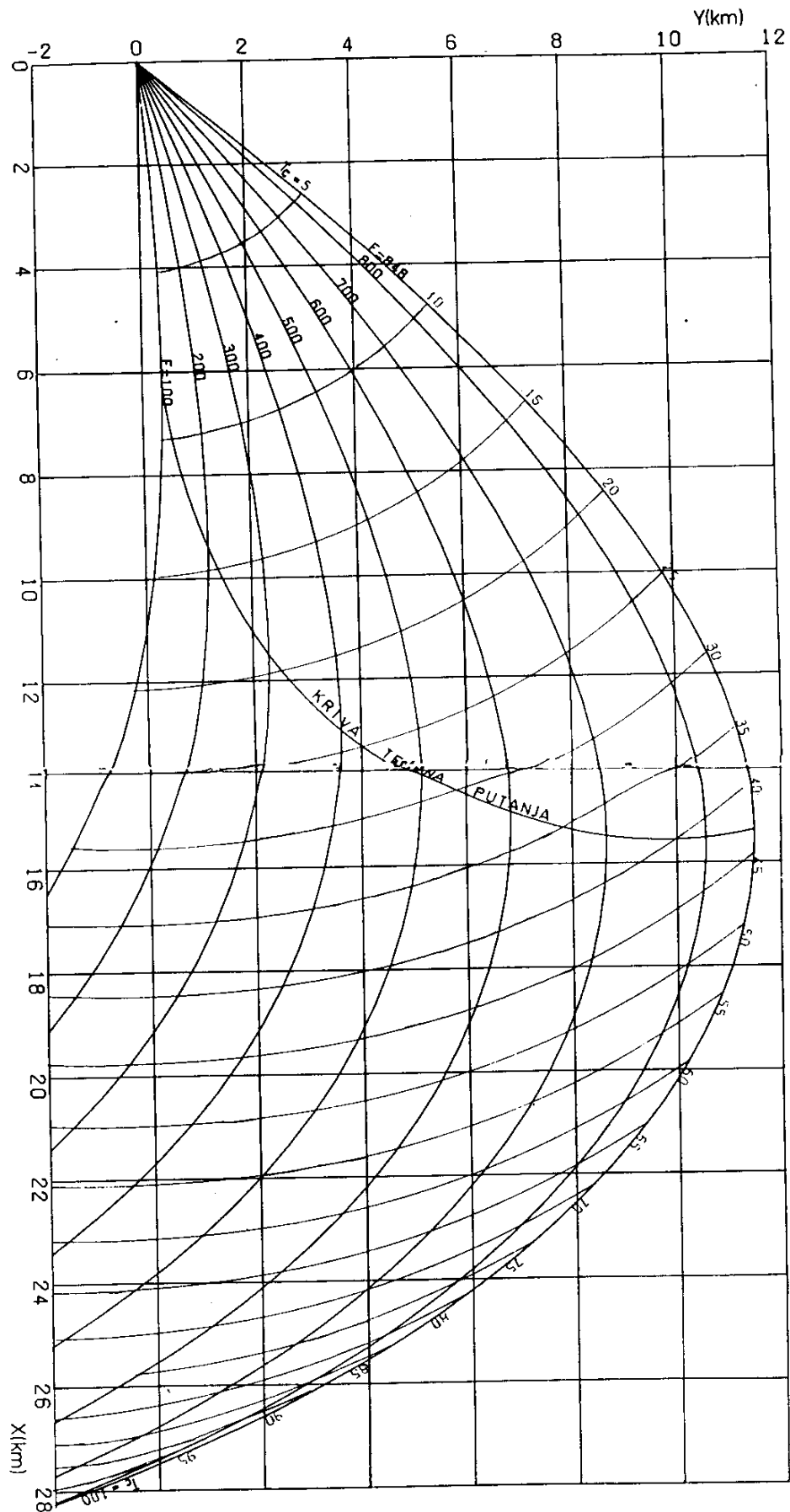
Tablica Ia

IZBOR PUNJENJA

TRENUTNO-FUGASNI PROJEKIL M79 SA UPALJAČEM UTIU, M72 i BU-130-M83
TRENUTNO-FUGASNI PROJEKIL OF-482M SA UPALJAČEM RGM-2 i V-429

D a l j n a	Četvrto punjenje $V_0=525$ m/s			Treće punjenje $V_0=621$ m/s			Drugo punjenje $V_0=705$ m/s			Prvo punjenje $V_0=810$ m/s			Puno punjenje $V_0=930$ m/s			D a l j n a
	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	Tabl. ugao	Padni ugao	Vd	
	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	
m	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	hiljaditih		pod.	m
24400													532	900	70	24400
24800													555	923	72	24800
25200													579	949	73	25200
25600													605	969	75	25600
26000													634	994	77	26000
26400													666	1019	79	26400
26800													704	1047	82	26800
27200													757	1081	85	27200
27481													848	1129	92	27481

06315687



GRAFIČKA TABLICA ŠKADANJA
TOP 130 mm M46
TRENUTNO-FUGASNI PROJEKTIL M79 I OF-482M

06315688
Funo punjenje
 $V_0 = 930 \text{ m/s}$

TRENTNO-FUGASNI PROJEKTIL M79
TRENTNO-FUGASNI PROJEKTIL OF-482M

[illegible]

SA UPALJAČEM UTU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

P o p r a v k e																	
pravca zbog			daljina zbog			odstupanja											
bočnog vetra $W_b = 10 \text{ m/s}$			kosine ramena ko- levke za 10 hijli.			uzdužnog vetra $W_u = 10 \text{ m/s}$		temp. vazduha $\Delta t = 10^\circ\text{C}$	vazd. pritiska $\Delta H = 10 \text{ mbar}$	početna brzina $V_u = 10 \text{ m/s}$	temp. baruta $\Delta t_b = 10^\circ\text{C}$	masе projektila $\Delta p = 1 \text{ oznaka}$					
hijladih						m e t a r a							m	hijlad.		s	m
17	18	19	21	23	24	25	26	27	33	46	46a	1					
0	0	0	0	0	0	4	5	1	182	0,00	0,00	200					
0	0	0	0	0	0	8	10	2	179	0,00	0,00	400					
0	0	0	0	0	0	13	15	2	176	0,00	0,00	600					
0	0	0	0	1	0	17	20	3	173	0,00	0,00	800					
0	0	0	1	1	0	21	25	4	171	0,00	0,00	1000					
0	0	0	1	2	1	25	30	4	168	0,00	0,00	1200					
0	0	0	1	2	1	29	35	5	165	0,00	0,00	1400					
0	0	0	2	3	1	33	40	5	163	0,00	0,00	1600					
0	0	0	2	3	1	37	44	6	160	0,00	0,00	1800					
0	0	0	2	4	2	40	49	6	158	0,00	0,00	2000					
0	0	0	3	5	2	44	53	7	155	0,00	0,00	2200					
0	0	0	3	6	2	48	57	7	152	0,00	0,00	2400					
0	0	0	4	7	3	52	61	8	150	0,00	0,00	2600					
0	0	0	4	8	3	56	65	8	147	0,00	0,00	2800					
0	0	0	5	10	3	60	69	9	145	0,00	0,00	3000					
0	0	0	6	11	4	65	75	9	143	0,00	0,00	3200					
0	0	0	7	12	4	69	79	9	140	0,00	0,00	3400					
0	0	0	8	14	5	72	83	10	138	0,00	0,00	3600					
0	0	0	9	15	5	76	87	10	135	0,00	0,00	3800					
0	0	0	10	17	6	80	91	10	133	0,00	0,00	4000					
0	0	0	11	19	7	85	96	10	131	0,00	0,00	4200					
0	0	0	12	20	7	89	99	10	129	0,00	0,00	4400					
0	0	0	13	22	8	92	103	11	126	0,00	0,00	4600					
0	0	0	14	24	9	95	107	11	124	0,00	0,00	4800					
0	0	0	15	26	9	98	111	11	122	0,00	0,00	5000					
0	0	0	17	28	10	102	114	11	120	0,00	0,00	5200					
0	0	0	18	30	11	105	118	11	118	0,00	0,00	5400					
0	0	0	19	32	12	108	121	11	115	0,00	0,00	5600					
0	0	0	21	35	12	111	125	11	113	0,00	0,00	5800					
0	0	0	22	37	13	114	128	11	111	0,00	0,00	6000					

06315689

Puno punjenje
 $V_0 = 930 \text{ m/s}$

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

Daljina	Daljinar		Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinate temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovato skr.		
	optički durbini	mehanički							putanja		
1	2	2a	3	4	5	6	7	8	9	10	11
m	podjeljak	2a	hij.	o	m	m	s	m/s	hij.	metara	metara
1	2	2a	3	4	5	6	7	8	9	10	11
6200	62	122,6	44	2038	103	81	8,1	632	57	26	1,2
6400	64	126,7	46	244	112	87	8,4	623	60	26	1,3
6600	66	130,8	48	251	120	94	8,8	615	63	26	1,3
6800	68	134,9	50	258	130	101	9,1	606	66	26	1,4
7000	70	139,0	51	305	139	109	9,4	598	69	26	1,4
7200	72	143,1	53	312	150	117	9,8	590	72	26	1,4
7400	74	147,2	55	320	161	125	10,1	582	76	26	1,5
7600	76	151,3	58	327	172	134	10,4	574	79	26	1,5
7800	78	155,4	60	335	184	143	10,8	566	83	26	1,6
8000	80	159,5	62	343	196	153	11,2	558	87	27	1,6
8200	82	163,6	64	351	209	163	11,5	550	91	27	1,7
8400	84	167,7	66	359	222	174	11,9	542	95	27	1,7
8600	86	171,8	69	407	235	188	12,3	534	99	27	1,8
8800	88	175,9	71	416	249	199	12,7	527	103	27	1,8
9000	90	180,0	73	424	264	213	13,0	519	108	27	1,8
9200	92	184,1	76	433	279	222	13,4	512	113	28	1,9
9400	94	188,2	78	442	295	235	13,8	504	117	28	1,9
9600	96	192,3	81	451	320	249	14,2	497	122	28	1,9
9800	98	196,3	84	501	340	264	14,6	490	128	28	2,0
10000	100	200,4	86	510	359	279	15,1	483	133	29	2,0
10200	102	204,4	89	520	380	295	15,5	475	138	29	2,1
10400	104	208,5	92	530	402	312	15,9	469	144	29	2,1
10600	106	212,5	95	540	425	329	16,4	462	150	30	2,2
10800	108	216,5	97	551	448	348	16,8	455	156	30	2,2
11000	110	220,6	100	602	473	367	17,3	448	163	30	2,3
11200	112	224,6	103	612	499	386	17,7	442	169	31	2,3
11400	114	228,6	107	624	526	407	18,2	435	176	31	2,3
11600	116	232,6	110	635	555	429	18,7	429	183	31	2,4
11800	118	236,5	113	647	584	451	19,1	423	190	32	2,4
12000	120	240,5	116	659	615	475	19,6	417	197	32	2,5

SA UPALJACEM UTIU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V-429

P o p r a v k e											
pravca zbog			daljina zbog								
derivacije			odstupanja								
bočnog vetra $W_b = 10 \text{ m/s}$			temp. vazduha $\Delta t = 10^\circ\text{C}$								
kosine ramena ko- levke za 10 hijli.			vazd. pritiska $\Delta H = 10 \text{ mbar}$								
			početna brzina $V_0 = 10 \text{ m/s}$								
			temp. baruta $\Delta t_b = 10^\circ\text{C}$								
			mase projektila $\Delta p = 1 \text{ oznaka}$								
			Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hijladiti								
			Popravke menog ugla (ps) za svakih								
			Daljina								
17	18	19	21	23	24	25	26	27	33	46	46a
hijladiti	hijladiti	hijladiti	metara	metara	metara	metara	metara	metara	m	hijlad.	s
1	2	0	24	39	14	109	132	11	109	0,00	0,00
1	2	0	25	42	15	112	135	11	107	0,00	0,00
1	2	0	27	44	16	114	138	11	105	0,00	0,00
1	3	1	29	47	17	117	142	10	103	0,00	0,00
1	3	1	31	50	18	120	145	10	101	0,00	0,00
1	3	1	33	52	19	122	148	10	99	0,00	0,00
1	3	1	35	55	20	125	151	10	97	0,00	0,00
1	3	1	37	58	21	128	154	10	96	0,00	0,00
1	3	1	39	61	22	130	157	9	94	0,00	0,00
1	3	1	41	64	23	132	160	9	92	0,00	0,00
1	3	1	43	67	24	135	163	9	90	0,01	0,00
1	3	1	45	70	26	137	166	8	88	0,01	0,00
1	3	1	47	73	27	140	169	8	87	0,01	0,00
2	4	1	50	76	28	142	172	7	85	0,01	0,01
2	4	1	52	79	29	144	175	7	83	0,01	0,01
2	4	1	55	83	31	146	178	7	81	0,01	0,01
2	4	1	58	86	32	149	181	6	80	0,01	0,01
2	4	1	60	90	33	151	182	6	78	0,01	0,01
2	4	1	63	93	35	153	185	5	77	0,01	0,01
2	4	1	66	96	36	155	188	5	75	0,01	0,01
2	4	1	69	100	37	157	190	4	73	0,01	0,01
2	5	1	72	104	39	159	193	4	72	0,01	0,01
2	5	1	75	107	40	161	195	3	70	0,01	0,01
2	5	1	78	111	42	163	197	3	69	0,01	0,01
2	5	1	81	115	43	165	200	2	67	0,01	0,01
2	5	1	84	118	45	167	202	1	66	0,01	0,01
2	5	1	88	122	46	169	204	1	65	0,01	0,01
2	5	1	91	126	48	171	207	0	63	0,01	0,01
2	5	1	95	130	49	173	209	0	62	0,01	0,01
2	5	1	98	134	51	175	211	0	60	0,01	0,01
3	6	1									

Puno punjenje
 $V_0 = 930 \text{ m/s}$

06315690

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

1	2	3	4	5	6	7	8	9	11	12	13	Verovatno skr.		
												putanja		
												po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
optički durbín	mehanički	1/6000	Tablični ugao	Uslovna visina za izbor sloja u meteorobiltenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao						
podgljak	2a	hilj.	o	m	m	s	m/s	hilj.	metar a					
12200	244,5	120	7011	647	499	20,1	411	205	33	2,5	7,1			
12400	248,4	123	724	681	525	20,6	405	213	33	2,6	7,5			
12600	252,4	127	737	716	552	21,1	400	221	34	2,6	7,9			
12800	256,3	131	750	752	579	21,7	394	230	34	2,7	8,4			
13000	260,3	134	803	790	608	22,2	389	238	35	2,7	8,8			
13200	264,2	138	817	830	638	22,7	384	247	35	2,8	9,3			
13400	268,1	142	831	871	670	23,3	379	256	36	2,8	9,8			
13600	272,1	146	846	914	702	23,8	374	266	36	2,9	10			
13800	276,0	150	900	959	736	24,4	369	275	37	2,9	11			
14000	279,9	154	915	1006	772	25,0	365	285	37	3,0	11			
14200	283,8	159	931	1055	809	25,6	360	296	38	3,0	12			
14400	287,8	163	947	1106	847	26,1	356	306	38	3,1	13			
14600	291,7	168	1003	1158	887	26,7	353	317	39	3,1	13			
14800	295,6	172	1020	1213	929	27,4	349	328	39	3,2	14			
15000	299,5	177	1037	1272	972	28,0	346	339	40	3,2	15			
15200	303,5	182	1054	1330	1016	28,6	343	350	40	3,3	16			
15400	307,4	187	1112	1390	1063	29,2	340	362	41	3,3	16			
15600	311,4	192	1130	1454	1111	29,9	337	373	41	3,4	17			
15800	315,3	197	1149	1520	1161	30,5	335	385	42	3,5	18			
16000	319,3	202	1208	1589	1213	31,2	333	397	43	3,5	19			
16200	323,3	208	1227	1660	1267	31,8	331	409	43	3,6	20			
16400	327,3	213	1247	1734	1323	32,5	330	422	44	3,6	21			
16600	331,3	219	1307	1810	1381	33,2	328	434	44	3,7	22			
16800	335,3	224	1328	1889	1440	33,9	327	446	45	3,8	23			
17000	339,4	230	1349	1971	1502	34,6	326	459	46	3,8	24			
17200	343,4	236	1410	2056	1566	35,3	325	471	46	3,9	25			
17400	347,5	242	1434	2143	1632	36,0	324	484	47	4,0	26			
17600	351,5	249	1454	2234	1700	36,7	323	496	47	4,0	27			
17800	355,6	255	1517	2327	1771	37,4	323	509	48	4,1	28			
18000	359,7	261	1540	2424	1843	38,2	322	521	49	4,2	29			

SA UPALJACEM UTU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V429

P o p r a v k e																							
pravca zbog		daljina zbog		odstupanja		Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi		Popravke mernog ugla (pS) za svakih															
hiljaditih		m e t a r a		m		hiljad.		m															
17	18	19	21	23	24	25	26	27	33	46	46a	1											
derivacije		božnog vetra $W_v = 10 \text{ m/s}$		kosine ramena kol- lelike za 10 hilj.		uzdužnog vetra $W_u = 10 \text{ m/s}$		temp. vazduha $\Delta t = 10^\circ\text{C}$		vazd. pritiska $\Delta H = 10 \text{ mbar}$		početna brzina $V_0 = 10 \text{ m/s}$		temp. baruta $\Delta t_b = 10^\circ\text{C}$		mase projektila $\Delta p = 1 \text{ oznaka}$		+1		-1		Daljina	
3	3	1	102	137	52	177	213	-1	59	0.01	-0.01	12200											
3	6	1	106	141	54	178	216	-2	58	0.01	-0.01	12400											
3	6	1	110	145	56	180	218	-3	57	0.01	-0.01	12600											
3	6	1	114	149	57	182	220	-3	55	0.01	-0.01	12800											
3	6	1	118	153	59	184	222	-4	54	0.01	-0.01	13000											
3	6	1	122	157	61	185	224	-5	53	0.01	-0.01	13200											
3	6	1	127	161	63	187	226	-6	52	0.01	-0.01	13400											
3	7	2	131	165	64	189	228	-7	51	0.01	-0.01	13600											
3	7	2	136	169	66	191	230	-8	50	0.01	-0.01	13800											
3	7	2	140	174	68	192	232	-8	49	0.01	-0.01	14000											
4	7	2	145	178	70	194	235	-9	47	0.01	-0.01	14200											
4	7	2	150	182	71	195	238	-10	46	0.01	-0.01	14400											
4	7	2	155	186	73	197	240	-11	45	0.01	-0.01	14600											
4	8	2	160	190	75	199	243	-12	44	0.01	-0.01	14800											
4	8	2	165	194	77	200	245	-13	44	0.01	-0.01	15000											
4	8	2	170	198	79	202	247	-14	43	0.01	-0.01	15200											
4	8	2	176	202	80	204	247	-15	42	0.01	-0.01	15400											
4	8	2	181	206	82	206	249	-16	41	0.01	-0.01	15600											
4	8	2	187	210	84	207	251	-16	40	0.01	-0.01	15800											
5	8	2	192	214	86	209	253	-17	39	0.01	-0.01	16000											
5	9	2	198	218	88	211	255	-18	39	0.01	-0.01	16200											
5	9	2	204	222	89	213	257	-19	38	0.01	-0.01	16400											
5	9	2	210	226	91	214	259	-20	37	0.01	-0.01	16600											
5	9	2	216	230	93	216	261	-21	36	0.01	-0.01	16800											
5	9	2	222	233	95	218	263	-22	36	0.01	-0.01	17000											
6	9	3	228	237	96	220	265	-22	35	0.01	-0.01	17200											
6	10	3	235	241	98	221	268	-23	34	0.01	-0.01	17400											
6	10	3	241	245	100	223	270	-24	34	0.01	0.00	17600											
6	10	3	247	248	102	225	272	-25	33	0.01	0.00	17800											
6	10	3	254	252	103	227	274	-26	33	0.00	0.00	18000											

TRENTINO-FUGASNI PROJEKTIL M79
TRENTINO-FUGASNI PROJEKTIL OF-482M

Daljina	Doljinar		hili.	o	m	m	s	m/s	hili	Vertikalno skr.		
	optički durbin	mehanički								putanja		
1	2	2a	3	4	5	6	7	8	9	10	11	12
18200		363,8	268	16°03'	2523	1918	38,9	322	534	49	4,3	31
18400		367,9	274	16°27'	2626	1995	39,6	322	546	50	4,4	32
18600		372,0	281	16°52'	2732	2075	40,4	321	558	50	4,4	33
18800		376,1	288	17°16'	2842	2156	41,2	321	571	51	4,5	35
19000		380,2	295	17°41'	2954	2241	41,9	321	583	52	4,6	36
19200		384,3	302	18°07'	3070	2327	42,7	321	596	52	4,7	38
19400		388,4	309	18°33'	3190	2417	43,5	321	608	53	4,8	39
19600		392,5	317	18°59'	3313	2508	44,3	322	620	53	4,9	41
19800		396,6	324	19°26'	3439	2603	45,1	322	633	54	5,0	42
20000		400,6	332	19°53'	3569	2699	45,9	322	645	55	5,1	44
20200		404,7	339	20°21'	3703	2799	46,7	322	657	55	5,2	45
20400		408,7	347	20°49'	3840	2901	47,5	323	669	56	5,3	47
20600		412,7	355	21°17'	3981	3006	48,3	323	681	56	5,4	49
20800		416,7	363	21°45'	4127	3114	49,2	324	693	57	5,5	51
21000		420,7	371	22°13'	4277	3225	50,0	324	705	58	5,6	53
21200		424,6	379	22°41'	4427	3339	50,9	325	717	58	5,7	54
21400		428,6	388	23°09'	4584	3455	51,7	325	728	59	5,8	56
21600		432,5	396	23°37'	4745	3575	52,6	326	740	60	6,0	58
21800		436,4	405	24°05'	4910	3699	53,5	326	752	60	6,1	61
22000		440,3	414	24°33'	5080	3825	54,4	327	763	61	6,2	63
22200		444,2	423	25°01'	5255	3955	55,3	327	775	62	6,4	65
22400		448,1	432	25°29'	5434	4088	56,3	328	786	62	6,5	67
22600		452,0	441	25°57'	5618	4226	57,2	329	798	63	6,7	70
22800		455,9	450	26°25'	5807	4367	58,1	329	809	64	6,8	72
23000		459,8	460	26°53'	6001	4512	59,1	330	821	65	7,0	75
23200		463,7	470	27°21'	6202	4661	60,1	331	833	65	7,1	78
23400		467,7	479	27°49'	6408	4815	61,1	331	845	66	7,3	80
23600		471,6	489	28°17'	6620	4974	62,1	332	855	67	7,5	83
23800		475,6	500	28°45'	6838	5137	63,2	333	866	68	7,7	86
24000		479,6	510	29°13'	7065	5306	64,2	333	877	68	7,9	89

SA UPALJACEM UTIU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V-429

P o p r a v k e												
pravca zbog		daljina zbog										
derivacije		odstupanja										
bočnog vetra $W_y = 10 \text{ m/s}$		uzdužnog vetra $W_x = 10 \text{ m/s}$										
kosine ramena ko- levke za 10 hilj.		temp. vazduha $\Delta t = 10^\circ\text{C}$										
		vazd. pritiska $\Delta H = 10 \text{ mbar}$										
		početna brzina $V_0 = 10 \text{ m/s}$										
		temp. baruta $\Delta t_b = 10^\circ\text{C}$										
		mase projektila $\Delta p = 1 \text{ oznaka}$										
		Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi										
		Popravke mestnog ugla (β) za svakih										
		Daljina										
17	18	19	20	21	22	23	24	25	26	27	28	29
hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.
17	18	19	20	21	22	23	24	25	26	27	28	29
10	10	3	261	256	105	229	276	276	276	276	276	276
10	10	3	267	259	107	230	279	279	279	279	279	279
10	10	3	274	263	108	232	281	281	281	281	281	281
11	11	3	281	266	110	234	283	283	283	283	283	283
11	11	3	288	269	112	236	285	285	285	285	285	285
11	11	3	295	273	113	238	288	288	288	288	288	288
11	11	3	302	276	115	240	290	290	290	290	290	290
11	11	3	309	279	117	242	293	293	293	293	293	293
11	11	3	317	282	118	244	295	295	295	295	295	295
11	11	4	324	285	120	246	298	298	298	298	298	298
12	12	4	331	288	122	248	300	300	300	300	300	300
12	12	4	339	291	123	251	303	303	303	303	303	303
12	12	4	346	294	125	253	305	305	305	305	305	305
12	12	4	354	296	127	255	308	308	308	308	308	308
12	12	4	361	299	128	257	311	311	311	311	311	311
12	12	4	369	302	130	259	314	314	314	314	314	314
12	12	4	377	304	131	262	317	317	317	317	317	317
13	13	4	385	306	133	264	319	319	319	319	319	319
13	13	4	392	309	135	267	322	322	322	322	322	322
13	13	5	400	311	137	269	325	325	325	325	325	325
13	13	5	408	313	138	272	329	329	329	329	329	329
13	13	5	417	314	140	274	332	332	332	332	332	332
13	13	5	425	316	142	277	335	335	335	335	335	335
13	13	5	433	318	143	280	338	338	338	338	338	338
13	13	5	441	319	145	283	342	342	342	342	342	342
14	14	5	450	321	147	285	345	345	345	345	345	345
14	14	5	459	322	149	288	349	349	349	349	349	349
14	14	6	467	323	151	291	352	352	352	352	352	352
14	14	6	476	324	152	294	356	356	356	356	356	356
14	14	6	485	324	154	298	360	360	360	360	360	360
14	14	6										

Puno punjenje
 $V_0 = 930 \text{ m/s}$

06315692

TRENTNO-FUGASNI PROJEKTIL M79
TRENTNO-FUGASNI PROJEKTIL OF-482M

Daljina	Daljinar		Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovatno skr. putanje			
	optički durbin	mehanički							po daljini (Vd)	po pravcu (Vp)	po visini (Vv)	
1	2	2a	3	4	5	6	7	8	9	11	12	13
m	podajak	hij.	o	m	m	s	m/s	hij	metara			
24200		483,7	521	31°14'	7299	5481	65,3	334	889	69	8,1	93
24400		487,8	532	31 54	7540	5661	66,4	335	900	70	8,3	96
24600		491,9	543	32 34	7791	5849	67,5	336	911	71	8,5	100
24800		496,0	555	33 16	8052	6044	68,7	336	923	72	8,7	104
25000		500,2	567	33 59	8324	6247	69,9	337	934	72	9,0	108
25200		504,3	579	34 43	8607	6458	71,2	338	946	73	9,2	112
25400		508,4	592	35 29	8905	6680	72,4	339	957	74	9,5	116
25600		512,4	605	36 17	9160	6914	73,8	340	969	75	9,8	121
25800		516,3	619	37 7	9422	7150	75,2	341	981	76	10,1	126
26000		520,1	634	37 59	9694	7387	76,6	342	994	77	10,4	132
26200		523,8	649	38 55	9983	7603	78,1	343	1006	78	11,1	137
26400		527,3	666	39 55	10284	7807	79,8	344	1019	79	11,4	144
26600		530,8	684	41 0	11152	8342	81,6	345	1033	80	12,1	151
26800		534,8	704	42 13	11667	8718	83,5	347	1047	82	12,5	159
27000		540,3	728	43 37	12276	9157	85,8	348	1063	83	13,1	169
27200		0,0	757	45 21	13045	9710	88,5	351	1081	85	13,8	181
27400		0,0	801	47 53	14144	10520	92,4	355	1105	88	15,2	200
27481		0,0	848	50 53	15328	11487	96,9	360	1129	92	16,2	225

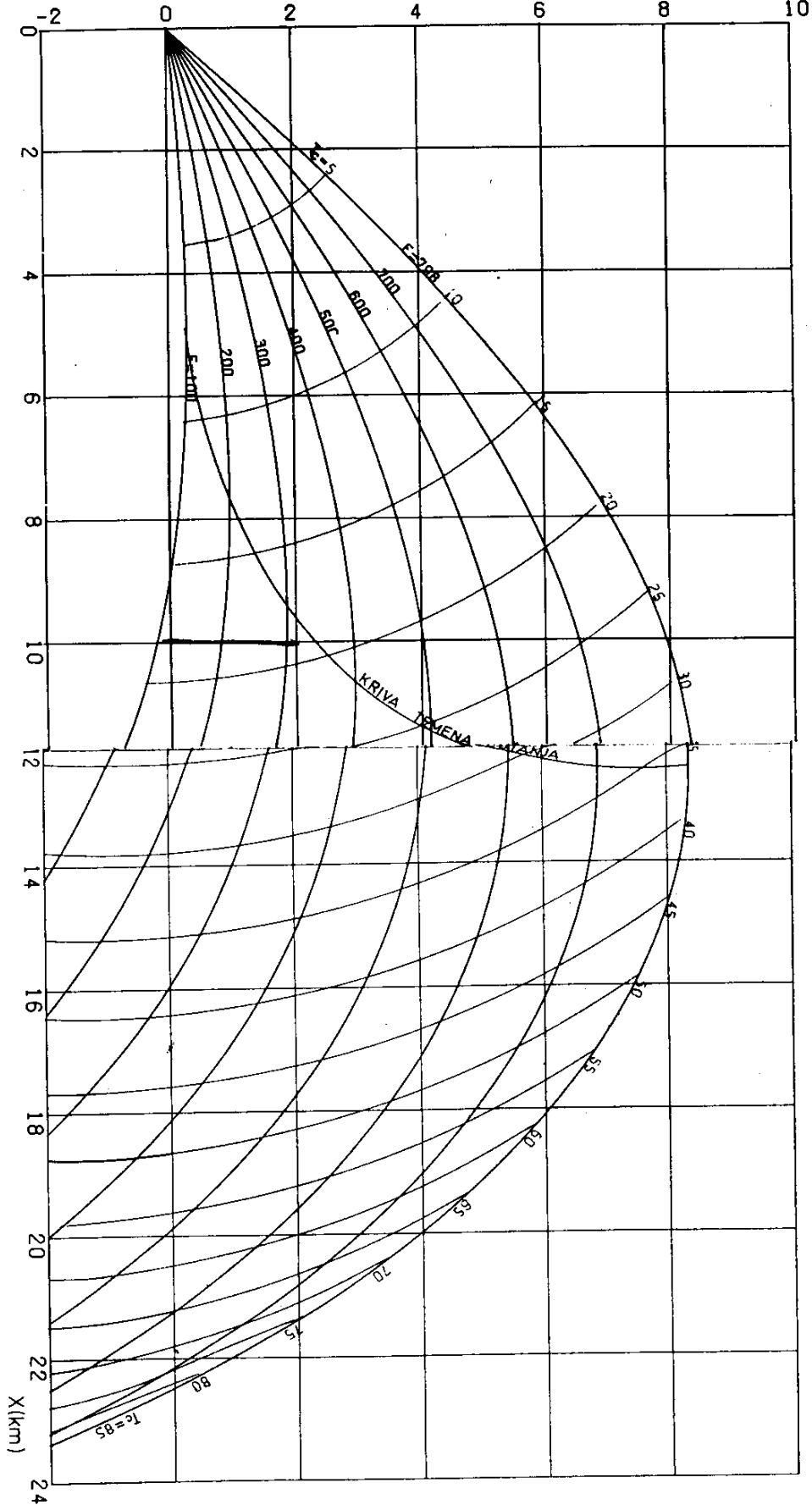
06315693

Puno punjenje
V₀ = 930 m/s

SA UPALJAČEM UTIU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

p o p r a v k e																								
pravac zbog			daljina zbog																					
17	18	19	21	23	24	25	26	27	33	46	44a	1												
													derivacije	bočnog vetra $W_y = 10 \text{ m/s}$	kosine ramena ko- levke za 10 hijl.	uzdužnog vetra $W_x = 10 \text{ m/s}$	odstupanja				Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi	Popravke mernih ugla (ps) za svakih		
																	temp. vazduha $\Delta t = 10^\circ\text{C}$	vazd. pritiska $\Delta H = 10 \text{ mbar}$	početna brzina $V_0 = 10 \text{ m/s}$	temp. baruta $\Delta t_b = 10^\circ\text{C}$		mase projektila $\Delta p = 1 \text{ oznaka}$	+1	-1
hiljaditi																								
m e t a r a																								
m																								
hiljad.																								
s																								
m																								
14	14	6	494	325	156	301	364	-47	18	0,03	-0,02	24200												
14	15	6	503	325	158	304	368	-48	18	0,04	-0,03	24400												
15	15	6	512	325	160	308	372	-48	17	0,05	-0,04	24600												
15	15	7	522	325	162	311	376	-49	17	0,06	-0,05	24800												
15	15	7	531	325	164	315	381	-50	16	0,08	-0,06	25000												
16	15	7	541	324	166	319	385	-50	16	0,09	-0,08	25200												
16	15	7	551	323	168	323	390	-51	15	0,12	-0,10	25400												
17	15	7	561	321	170	327	395	-52	14	0,14	-0,12	25600												
17	15	7	572	320	172	331	400	-53	14	0,18	-0,15	25800												
18	16	8	583	317	175	336	405	-53	13	0,22	-0,19	26000												
18	16	8	595	315	177	340	410	-54	12	0,28	-0,23	26200												
19	16	8	606	311	179	345	415	-54	11	0,34	-0,30	26400												
20	16	9	619	307	182	351	424	-55	10	0,44	-0,38	26600												
20	16	9	633	302	184	357	431	-56	9	0,59	-0,51	26800												
21	17	10	648	295	187	363	439	-56	8	0,87	-0,74	27000												
22	17	10	666	286	191	373	451	-57	6	1,35	-1,17	27200												
24	17	10	690	274	197	388	469	-58	3	3,11	-2,63	27400												
26	18	11	709	254	205	410	496	-59	0	0,00	0,00	27481												

Y(km)



GRAFIČKA TABLICA
 TOP 130 mm M46
 TRENUTNO-FUGASNI PROJEKIL M79 I OF-482M

Prvo punjenje
 $V_0 = 810$ m/s

06315694

TRENUTNO-FUGASNI PROJEKTIL M79
TRENUTNO-FUGASNI PROJEKTIL OF-482M

Dajina	Dajinar			Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovatno skr.		
	optički durbin	mehanički	1/6000							putanja		
										po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
m	podajnik	hilj.	o	m	m	s	m/s	hilj	11	12	13	
1	2	2a	3	4	5	6	7	8	9			
200	2	4,9	1	0°05'	0	0,1	0,2	800	1	26	0,0	0,0
400	5	9,8	3	0 10	0	0,3	0,5	789	3	25	0,1	0,1
600	8	14,8	4	0 16	1	0,7	0,8	779	5	25	0,1	0,1
800	10	19,8	6	0 21	2	1,3	1,0	769	6	25	0,2	0,2
1000	13	24,8	7	0 27	3	2,0	1,3	759	8	24	0,2	0,2
1200	16	29,8	9	0 33	4	2,9	1,5	749	10	24	0,2	0,2
1400	18	34,8	11	0 38	5	4,0	1,8	739	11	24	0,3	0,3
1600	21	39,8	12	0 44	7	5,3	2,1	729	13	23	0,3	0,3
1800	23	44,8	14	0 50	9	6,8	2,4	719	15	23	0,4	0,4
2000	26	49,9	16	0 56	11	8,5	2,6	709	17	23	0,4	0,4
2200	28	54,9	17	1 02	13	11	2,9	700	19	22	0,4	0,4
2400	31	60,0	19	1 09	16	13	3,2	690	21	22	0,5	0,5
2600	33	65,0	21	1 15	18	15	3,5	681	23	22	0,5	0,5
2800	36	70,1	23	1 22	21	18	3,8	671	26	22	0,6	0,6
3000	39	75,1	25	1 28	24	21	4,1	662	28	22	0,6	0,6
3200	41	80,2	26	1 35	27	24	4,4	653	31	22	0,6	0,7
3400	44	85,3	28	1 42	30	27	4,7	644	33	21	0,7	0,7
3600	46	90,3	30	1 49	33	31	5,0	634	36	21	0,7	0,8
3800	49	95,4	32	1 56	35	35	5,3	625	38	21	0,8	0,9
4000	51	100,5	34	2 04	39	39	5,7	616	41	21	0,8	0,9
4200	54	105,6	36	2 11	42	44	6,0	607	44	21	0,8	1,0
4400	56	110,6	39	2 19	45	49	6,3	599	47	21	0,9	1,0
4600	59	115,7	41	2 27	48	55	6,7	590	50	21	0,9	1,1
4800	61	120,7	43	2 35	51	60	7,0	581	54	21	1,0	1,2
5000	64	125,8	45	2 43	54	66	7,4	572	57	21	1,0	1,3
5200	66	130,8	48	2 51	57	73	7,7	564	61	21	1,0	1,4
5400	69	135,9	50	2 60	60	80	8,1	555	64	21	1,1	1,4
5600	71	140,9	52	3 09	63	87	8,4	547	68	22	1,1	1,5
5800	74	145,9	55	3 17	66	95	8,8	539	72	22	1,2	1,6
6000	76	150,9	57	3 27	69	104	9,2	530	76	22	1,2	1,7

SA UPALJAČEM UTLU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

P o p r a v k e																			
pravca zbog		daljina zbog				Popravke mestnog ugla (α) za svakih													
hijladitih		18	19	21	m e t r a			33	hijlad.		m								
					23	24	25		26	27		+1	-1						
derivacije		bočnog vetra W _y = 10 m/s		kosine ramena ko- levke za 10 hilj.		uzdužnog vetra W _z = 10 m/s		temp. vazduha Δt = 10°C		vazd. pritiska ΔH = 10 mbar		početna brzina V ₀ = 10 m/s		temp. baruta Δt _b = 10°C		mase projektila Δp = 1 oznaka		Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hijladiti	
17	18	19	21	23	24	25	26	27	m	hijlad.	s	1							
0	0	0	0	0	0	5	6	1	138	0,00	0,00	200							
0	0	0	0	0	0	10	13	1	135	0,00	0,00	400							
0	0	0	0	0	0	15	19	2	133	0,00	0,00	600							
0	0	0	0	0	0	19	25	2	131	0,00	0,00	800							
0	0	0	1	1	0	24	31	3	128	0,00	0,00	1000							
0	0	0	1	2	1	28	37	3	126	0,00	0,00	1200							
0	1	0	1	2	1	33	43	4	124	0,00	0,00	1400							
0	1	0	2	3	1	37	48	4	122	0,00	0,00	1600							
0	1	0	2	4	1	42	54	5	119	0,00	0,00	1800							
0	1	0	3	5	2	46	60	5	117	0,00	0,00	2000							
0	1	0	4	6	2	50	65	5	115	0,00	0,00	2200							
0	1	0	4	7	2	55	71	6	113	0,00	0,00	2400							
0	1	0	5	8	3	59	78	6	111	0,00	0,00	2600							
0	1	0	6	9	3	63	83	6	109	0,00	0,00	2800							
0	1	0	7	10	4	67	86	6	107	0,00	0,00	3000							
0	1	0	8	12	4	71	89	7	105	0,00	0,00	3200							
0	2	0	9	13	5	75	92	7	103	0,00	0,00	3400							
0	2	0	10	15	5	78	102	7	101	0,00	0,00	3600							
0	2	0	11	16	6	82	106	7	99	0,00	0,00	3800							
0	2	0	12	18	7	86	111	7	97	0,00	0,00	4000							
0	2	0	13	20	7	89	116	7	95	0,00	0,00	4200							
0	2	0	15	22	8	93	121	7	93	0,00	0,00	4400							
0	2	0	16	24	9	97	125	7	91	0,00	0,00	4600							
0	2	0	18	26	10	100	130	7	89	0,00	0,00	4800							
0	2	0	19	28	10	104	134	7	87	0,00	0,00	5000							
0	2	0	21	30	11	107	138	7	86	0,00	0,00	5200							
0	2	0	22	33	12	110	143	7	84	0,00	0,00	5400							
0	2	0	24	35	13	113	147	7	82	0,00	0,00	5600							
0	2	0	26	37	14	117	151	6	80	0,00	0,00	5800							
0	2	0	28	40	15	120	155	6	79	0,00	0,00	6000							

06315695
Prvo puñenje
 $V_0 = 810$ m/s

Tablica IIa

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

Daljina	Daljinar		hij.	°	m	m	s	m/s	hij.	Verovano skr.		
	optički durbir	mehanički								putanje		
										po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
1	2	2a	3	4	5	6	7	8	9	11	12	13
6200	78	155,9	60	30'36"	144	112	9,6	522	80	22	1,2	1,9
6400	80	160,9	63	3'45"	156	122	10,0	514	85	22	1,3	2,0
6600		165,8	65	3'55"	169	132	10,3	506	89	22	1,3	2,1
6800		170,8	68	4'05"	182	142	10,8	498	94	23	1,4	2,2
7000		175,7	71	4'15"	197	153	11,2	490	99	23	1,4	2,4
7200		180,6	74	4'25"	212	165	11,6	483	104	23	1,5	2,5
7400		185,5	77	4'36"	227	177	12,0	475	109	24	1,5	2,7
7600		190,4	80	4'47"	244	190	12,4	468	115	24	1,5	2,9
7800		195,2	83	4'58"	262	204	12,9	460	120	24	1,6	3,1
8000		200,1	86	5'10"	281	218	13,3	453	126	25	1,6	3,3
8200		204,9	89	5'21"	300	233	13,8	446	133	25	1,7	3,5
8400		209,7	93	5'33"	321	249	14,2	439	139	25	1,7	3,7
8600		214,5	96	5'45"	348	266	14,7	432	146	26	1,8	4,0
8800		219,2	99	5'58"	376	283	15,2	425	152	26	1,8	4,2
9000		224,0	103	6'11"	409	302	15,7	418	160	27	1,8	4,5
9200		228,7	107	6'24"	441	321	16,1	412	167	27	1,9	4,8
9400		233,4	110	6'38"	473	341	16,6	405	175	28	1,9	5,1
9600		238,0	114	6'51"	500	363	17,2	399	183	28	2,0	5,4
9800		242,7	118	7'06"	531	385	17,7	393	191	29	2,0	5,8
10000		247,3	122	7'20"	563	409	18,2	387	199	29	2,1	6,2
10200		251,9	126	7'35"	598	433	18,7	381	208	30	2,1	6,6
10400		256,5	131	7'50"	634	459	19,3	376	217	30	2,2	7,0
10600		261,1	135	8'06"	671	487	19,9	370	227	31	2,2	7,5
10800		265,7	140	8'22"	711	515	20,4	365	236	31	2,3	7,9
11000		270,2	144	8'39"	752	545	21,0	360	246	32	2,3	8,5
11200		274,8	149	8'56"	796	576	21,6	356	257	33	2,4	9,0
11400		279,3	154	9'13"	841	609	22,2	351	267	33	2,4	9,6
11600		283,8	159	9'31"	889	643	22,8	347	278	34	2,5	10
11800		288,3	164	9'49"	938	679	23,4	343	289	35	2,5	11
12000		292,9	169	10'08"	987	716	24,0	340	301	35	2,6	12

SA UPALJACEM UTU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V-429

Prvo punjenje
 $V_0 = 810 \text{ m/s}$

P o p r a v k e																
prava zbog		daljina zbog														
derivacije		božnog veta $W_z = 10 \text{ m/s}$		kosine ramena ko- levke za 10 hilj.		uzdužnog veta $W_x = 10 \text{ m/s}$		odstupanja				Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi			Popravke masnog ugla (pS) za svih	
								m e t a r a								
						</										

06315696

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

Daljina	Daljinier		1/6000	Tablični ugao	Uslovna visina za izbor sloja u meteobitenu	Ordinate temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovatno skr.		
										putanja		
	optički durbini	mehanički								po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
m	podajak	hiti	o	m	m	s	m/s	hiti	metara			
1	2	2a	3	4	5	6	7	8	9	11	12	13
12200		297,4	174	10°27'	990	755	24,7	337	312	36	2,6	12
12400		301,9	180	10 47	1045	796	25,3	334	324	36	2,7	13
12600		306,4	185	11 07	1101	839	26,0	331	336	37	2,7	14
12800		310,9	191	11 28	1160	883	26,6	329	348	38	2,8	14
13000		315,5	197	11 49	1222	929	27,3	327	361	38	2,9	15
13200		320,0	203	12 11	1287	978	28,0	325	373	39	2,9	16
13400		324,6	209	12 33	1354	1028	28,6	323	386	40	3,0	17
13600		329,1	216	12 56	1424	1080	29,3	322	399	40	3,1	18
13800		333,7	222	13 19	1497	1135	30,0	321	412	41	3,1	19
14000		338,3	229	13 43	1573	1191	30,7	320	424	42	3,2	20
14200		342,9	235	14 07	1653	1250	31,5	319	437	42	3,3	21
14400		347,5	242	14 32	1736	1311	32,2	318	450	43	3,3	22
14600		352,1	249	14 58	1824	1374	32,9	317	463	43	3,4	23
14800		356,8	257	15 23	1917	1440	33,7	317	477	44	3,5	24
15000		361,4	264	15 50	2007	1508	34,4	316	490	45	3,6	25
15200		366,1	272	16 17	2101	1579	35,2	316	503	45	3,6	26
15400		370,8	279	16 45	2200	1652	35,9	316	516	46	3,7	28
15600		375,5	287	17 13	2305	1727	36,7	315	529	46	3,8	29
15800		380,2	295	17 41	2413	1806	37,5	315	543	47	3,9	30
16000		384,9	303	18 11	2526	1887	38,3	315	556	48	4,0	31
16200		389,6	311	18 41	2642	1970	39,1	315	569	48	4,1	33
16400		394,3	320	19 11	2762	2057	39,9	316	582	49	4,2	34
16600		398,9	329	19 42	2887	2147	40,8	316	595	49	4,3	36
16800		403,6	337	20 14	3016	2239	41,6	316	608	50	4,4	37
17000		408,3	346	20 46	3150	2335	42,4	317	622	51	4,5	39
17200		413,0	356	21 19	3288	2434	43,3	317	635	51	4,6	40
17400		417,6	365	21 53	3431	2536	44,2	317	648	52	4,7	42
17600		422,3	374	22 27	3579	2642	45,1	318	661	52	4,8	44
17800		426,9	384	23 03	3732	2752	46,0	319	674	53	4,9	45
18000		431,5	394	23 39	3890	2865	46,9	319	687	54	5,1	47

SA UPALJACEM UTILU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V-429

P o p r a v k e												
Pravac zbog			daljina zbog					Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi				
derivacije	bočnog vetra $W_r = 10 \text{ m/s}$	kosine ramena kol- evke za 10 hilj.	uzdužnog vetra $W_r = 10 \text{ m/s}$	odstupanja				m	Popravke mesnog ugla (ρ_5) za svakih		Daljina	
				temp. vazduha $\Delta t = 10^\circ\text{C}$	vazd. pritiska $\Delta H = 10 \text{ mbar}$	početna brzina $V_r = 10 \text{ m/s}$	temp. baruta $\Delta t_b = 10^\circ\text{C}$		mase projektila $\Delta p = 1 \text{ oznaka}$	+1		-1
hiljaditih			m e t a r a					h	hiljad.	s	m	
17	18	19	21	23	24	25	26	27	33	46	46a	1
4	8	2	135	147	57	196	254	-11	38	0,02	-0,02	12200
4	8	2	141	151	59	198	256	-11	37	0,02	-0,02	12400
4	8	2	146	155	60	200	259	-12	36	0,02	-0,02	12600
4	8	2	152	159	62	201	261	-13	35	0,02	-0,02	12800
5	8	2	157	163	63	203	263	-14	34	0,02	-0,02	13000
5	9	2	163	167	65	205	266	-15	34	0,02	-0,02	13200
5	9	2	169	171	66	207	268	-15	33	0,03	-0,02	13400
5	9	2	175	175	68	209	271	-16	32	0,03	-0,02	13600
5	9	2	181	180	70	211	273	-17	32	0,03	-0,03	13800
5	9	2	188	184	71	213	275	-18	31	0,03	-0,03	14000
6	9	3	194	188	72	214	278	-18	30	0,03	-0,03	14200
6	10	3	200	192	74	216	280	-19	30	0,03	-0,03	14400
6	10	3	207	196	75	218	283	-20	29	0,03	-0,03	14600
6	10	3	214	200	77	220	285	-20	29	0,04	-0,03	14800
6	10	3	221	204	78	222	287	-21	28	0,04	-0,03	15000
7	10	3	228	208	79	223	290	-22	27	0,04*	-0,04	15200
7	10	3	235	212	81	225	292	-22	27	0,04	-0,04	15400
7	11	3	242	216	82	227	294	-23	26	0,04	-0,04	15600
7	11	3	249	220	84	229	297	-24	26	0,05	-0,04	15800
7	11	3	257	224	85	231	299	-24	25	0,05	-0,04	16000
8	11	3	264	228	86	233	302	-25	25	0,05	-0,05	16200
8	11	3	272	232	88	235	304	-26	24	0,05	-0,05	16400
8	11	4	280	236	89	236	306	-26	24	0,06	-0,05	16600
8	12	4	288	240	90	238	309	-27	23	0,06	-0,06	16800
9	12	4	296	244	91	240	311	-28	23	0,06	-0,06	17000
9	12	4	304	248	93	242	314	-28	22	0,07	-0,06	17200
9	12	4	312	251	94	244	316	-29	22	0,07	-0,07	17400
9	12	4	320	255	95	246	319	-29	22	0,08	-0,07	17600
9	12	4	329	258	97	248	321	-30	21	0,08	-0,08	17800
10	13	4	337	262	98	250	324	-31	21	0,09	-0,08	18000

06315697

Prvo punjenje
 $V_0 = 810 \text{ m/s}$

TRENTNO-FUGASNI PROJEKTIL M79
TRENTNO-FUGASNI PROJEKTIL OF-482M

Daljina	Dajinar		hij.	o	m	m	s	m/s	hij	Vrednotno skr.		
	podajak	2a								po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
1	2	2a	3	4	5	6	7	8	9	11	12	13
18200	436,2	404	24°15'	4054	2982	47,8	320	701	54	5,2	49	
18400	440,8	415	24 53	4224	3103	48,7	320	714	55	5,3	51	
18600	445,4	426	25 31	4398	3229	49,7	321	727	55	5,5	53	
18800	450,1	436	26 10	4580	3359	50,7	322	740	56	5,6	55	
19000	454,8	448	26 51	4767	3494	51,7	323	753	57	5,8	57	
19200	459,5	459	27 32	4961	3634	52,7	323	766	57	5,9	59	
19400	464,3	471	28 14	5163	3779	53,8	324	780	58	6,1	62	
19600	469,1	483	28 58	5372	3930	54,8	325	793	59	6,2	64	
19800	474,0	495	29 43	5588	4088	55,9	326	806	59	6,4	67	
20000	478,9	508	30 29	5811	4253	57,1	327	820	60	6,6	69	
20200	484,0	522	31 17	6041	4425	58,2	327	834	60	6,8	72	
20400	489,1	535	32 07	6291	4605	59,4	328	848	61	7,0	75	
20600	494,3	550	32 58	6551	4795	60,7	329	862	62	7,3	78	
20800	499,5	565	33 52	6811	4996	62,0	330	876	62	7,5	82	
21000	504,8	581	34 49	7106	5209	63,4	331	891	63	7,8	85	
21200	510,0	597	35 48	7409	5437	64,8	332	906	64	8,1	89	
21400	515,2	615	36 52	7732	5684	66,3	333	921	65	8,4	93	
21600	520,3	634	38 01	8083	5953	68,0	334	938	65	8,7	98	
21800	525,1	655	39 17	8468	6254	69,8	335	956	66	9,1	104	
22000	530,0	680	40 44	8909	6603	71,8	336	975	67	9,6	110	
22200	535,7	709	42 29	9425	7028	74,3	338	998	69	10	118	
22400	549,2	752	44 60	10152	7648	77,8	340	1029	70	11	131	
22477	589,5	798	47 53	10932	8369	81,7	343	1062	72	12	147	

06315698

Prvo punjenje
 $V_0 = 810 \text{ m/s}$

5A UPALJACEM UTIU, M72 i BU-130-M83
5A UPALJACEM RGM-2 i V-429

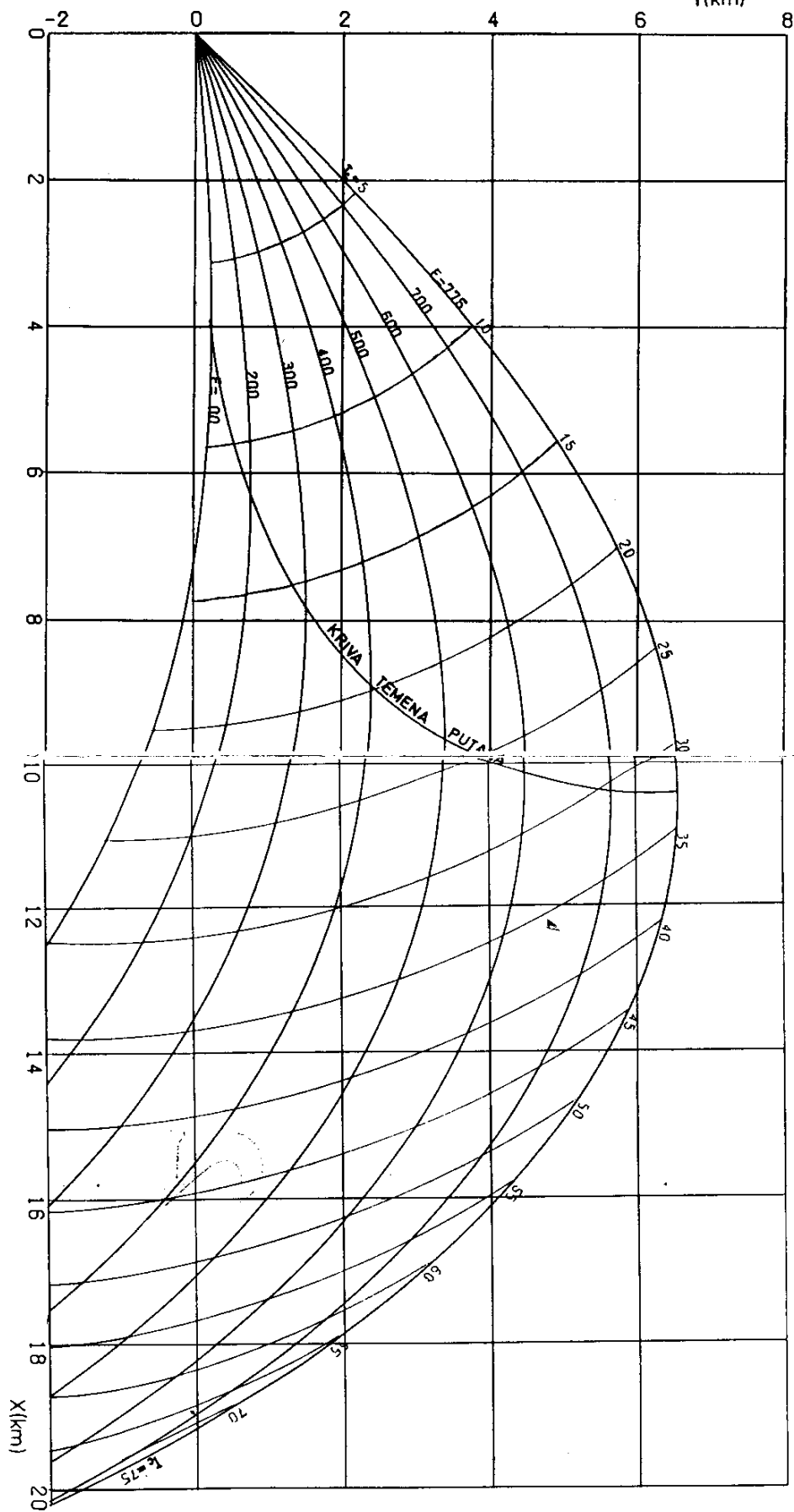
Dajinar	Dajinar		hij.	o	m	m	s	m/s	hij	Vrednotno skr.		
	podajak	2a								po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
1	2	2a	3	4	5	6	7	8	9	11	12	13
18200	436,2	404	24°15'	4054	2982	47,8	320	701	54	5,2	49	
18400	440,8	415	24 53	4224	3103	48,7	320	714	55	5,3	51	
18600	445,4	426	25 31	4398	3229	49,7	321	727	55	5,5	53	
18800	450,1	436	26 10	4580	3359	50,7	322	740	56	5,6	55	
19000	454,8	448	26 51	4767	3494	51,7	323	753	57	5,8	57	
19200	459,5	459	27 32	4961	3634	52,7	323	766	57	5,9	59	
19400	464,3	471	28 14	5163	3779	53,8	324	780	58	6,1	62	
19600	469,1	483	28 58	5372	3930	54,8	325	793	59	6,2	64	
19800	474,0	495	29 43	5588	4088	55,9	326	806	59	6,4	67	
20000	478,9	508	30 29	5811	4253	57,1	327	820	60	6,6	69	
20200	484,0	522	31 17	6041	4425	58,2	327	834	60	6,8	72	
20400	489,1	535	32 07	6291	4605	59,4	328	848	61	7,0	75	
20600	494,3	550	32 58	6551	4795	60,7	329	862	62	7,3	78	
20800	499,5	565	33 52	6811	4996	62,0	330	876	62	7,5	82	
21000	504,8	581	34 49	7106	5209	63,4	331	891	63	7,8	85	
21200	510,0	597	35 48	7409	5437	64,8	332	906	64	8,1	89	
21400	515,2	615	36 52	7732	5684	66,3	333	921	65	8,4	93	
21600	520,3	634	38 01	8083	5953	68,0	334	938	65	8,7	98	
21800	525,1	655	39 17	8468	6254	69,8	335	956	66	9,1	104	
22000	530,0	680	40 44	8909	6603	71,8	336	975	67	9,6	110	
22200	535,7	709	42 29	9425	7028	74,3	338	998	69	10	118	
22400	549,2	752	44 60	10152	7648	77,8	340	1029	70	11	131	
22477	589,5	798	47 53	10932	8369	81,7	343	1062	72	12	147	

IT-06-90-A $\gamma(\text{km})$

GRAFIČKA TABLICA IGAĐANJA
 TOP 130 mm M-46
 TRENUTNO-FUGASNI PROJEKTIL M79 I OF-482M

06315699

Drugo puzanje
 $V_0 = 705 \text{ m/s}$



TRENTUNO-FUGASNI PROJEKIL M79
TRENTUNO-FUGASNI PROJEKIL OF-482M

Daljina	Daljinar		1/6000	Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovatno skr.		
	optički durbin	mehanički								po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
m	podjeljak	2a	hij.	o	m	m	s	m/s	hij.	metara	metara	metara
1	2	2a	3	4	5	6	7	8	9	11	12	13
200	3	5,5	2	0°07'	0	0,1	0,3	696	5	20	0,0	0,0
400	7	9,2	4	0 14	1	0,4	0,6	686	4	19	0,1	0,1
600	10	13,0	6	0 21	1	0,9	0,9	677	6	19	0,1	0,1
800	14	16,7	8	0 28	2	1,7	1,2	667	8	19	0,2	0,2
1000	17	20,5	10	0 36	3	2,6	1,5	658	10	18	0,2	0,2
1200	20	24,3	12	0 43	5	3,9	1,8	649	13	18	0,2	0,2
1400	23	28,1	14	0 51	7	5,3	2,1	640	15	18	0,3	0,3
1600	27	31,9	16	0 59	9	7,1	2,4	631	18	18	0,3	0,3
1800	30	35,7	18	1 06	12	9,1	2,7	622	20	18	0,4	0,4
2000	33	39,6	21	1 15	14	11	3,0	613	23	17	0,4	0,4
2200	36	43,4	23	1 23	18	14	3,4	604	26	17	0,4	0,5
2400	40	47,3	25	1 31	22	17	3,7	595	28	17	0,5	0,5
2600	43	51,2	28	1 40	30	20	4,0	586	31	17	0,5	0,6
2800	46	55,2	30	1 49	35	24	4,4	577	34	17	0,6	0,6
3000	49	59,1	33	1 58	38	28	4,7	569	38	17	0,6	0,7
3200	52	63,0	35	2 07	41	32	5,1	560	41	17	0,6	0,7
3400	56	67,0	38	2 16	45	36	5,5	552	45	17	0,7	0,8
3600	59	71,0	41	2 26	53	42	5,8	543	48	17	0,7	0,9
3800	62	75,0	43	2 36	60	47	6,2	535	52	17	0,8	0,9
4000	65	79,0	46	2 46	68	53	6,6	527	56	17	0,8	1,0
4200	68	83,0	49	2 56	76	59	7,0	518	60	17	0,8	1,1
4400	71	87,0	52	3 06	85	66	7,4	510	64	18	0,9	1,2
4600	74	91,1	55	3 17	94	74	7,7	502	69	18	0,9	1,3
4800	77	95,1	58	3 28	105	82	8,2	494	73	18	1,0	1,4
5000	79	99,2	61	3 39	116	90	8,6	486	78	18	1,0	1,5
5200		103,3	64	3 51	127	99	9,0	478	83	18	1,1	1,6
5400		107,3	67	4 02	140	109	9,4	471	88	19	1,1	1,7
5600		111,4	71	4 14	153	119	9,8	463	93	19	1,1	1,9
5800		115,5	74	4 27	167	130	10,3	456	99	19	1,2	2,0
6000		119,6	78	4 39	182	141	10,7	448	105	20	1,2	2,2

SA UPALJAČEM UTIU M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

p o p r a v k e														
Daljina	pravca zbog		daljina zbog			odstupanja						m		
	derivacije	bočnog vetra W _b = 10 m/s	kosine ramena ko- levke za 10 hilj.	uzdužnog vetra W _z = 10 m/s	temp. vazduha Δt = 10°C		vazd. pritiska ΔH = 10 mbar	početna brzina V ₀ = 10 m/s	temp. baruta Δt _b = 10°C		mase projektila Δp = 1 oznaka	Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi	Popravke mesnog ugla (p5) za svakih	
					+1	-1								
									+1	-1				
													+1	-1
17	18	19	21	23	24	25	26	27	33	46	46a	1		
2	0	0	0	0	0	0	6	1	1	104	0,00	0,00	0,00	200
2	0	0	0	0	0	0	11	2	2	102	0,00	0,00	0,00	400
1	0	0	0	0	0	0	17	3	3	100	0,00	0,00	0,00	600
1	0	0	0	0	1	0	22	3	4	99	0,00	0,00	0,00	800
1	0	0	0	1	1	0	27	4	5	97	0,00	0,00	0,00	1000
1	1	0	0	1	2	1	33	5	6	95	0,00	0,00	0,00	1200
1	1	0	0	2	2	1	38	6	7	93	0,00	0,00	0,00	1400
0	1	0	0	3	3	1	43	7	8	91	0,00	0,00	0,00	1600
0	1	0	0	3	4	2	48	8	9	90	0,00	0,00	0,00	1800
0	1	0	0	3	5	2	53	9	9	88	0,00	0,00	0,00	2000
0	1	0	0	4	6	2	58	10	10	86	0,00	0,00	0,00	2200
0	1	0	0	5	7	3	63	11	11	84	0,00	0,00	0,00	2400
0	1	0	0	6	8	3	68	12	12	83	0,00	0,00	0,00	2600
0	1	0	0	7	9	4	73	13	13	81	0,00	0,00	0,00	2800
1	2	0	0	8	11	4	78	14	14	79	0,00	0,00	0,00	3000
1	2	0	0	9	12	5	83	15	15	78	0,00	0,00	0,00	3200
1	2	0	0	10	14	5	88	16	16	76	0,00	0,00	0,00	3400
1	2	0	0	12	15	6	93	17	17	75	0,00	0,00	0,00	3600
1	2	0	0	13	17	6	98	18	18	73	0,00	0,00	0,00	3800
1	2	0	0	14	19	7	103	19	19	71	0,00	0,00	0,00	4000
1	3	1	1	16	21	8	108	20	20	70	0,00	0,00	0,00	4200
1	3	1	1	18	23	9	113	21	21	68	0,00	0,00	0,00	4400
1	3	1	1	19	25	9	118	22	22	67	0,00	0,00	0,00	4600
1	3	1	1	21	27	10	123	23	23	65	0,00	0,00	0,00	4800
1	3	1	1	23	29	11	128	24	24	64	0,00	0,00	0,00	5000
1	3	1	1	25	31	12	133	25	25	62	0,00	0,00	0,00	5200
1	3	1	1	27	34	13	138	26	26	61	0,00	0,00	0,00	5400
1	3	1	1	29	36	14	143	27	27	60	0,00	0,00	0,00	5600
1	4	1	1	32	39	15	148	28	28	58	0,00	0,00	0,00	5800
2	4	1	1	34	41	16	153	29	29	57	0,00	0,00	0,00	6000

06315700

Drugo punjenje
 $V_0 = 705$ m/s

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

Daljina	Daljinar		hili	o	m	m	s	m/s	hili	Verovatno skr.		
	optički durbin	mehanički								putanja		
										po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
1	2	2a	3	4	5	6	7	8	9	11	12	13
6200			81	4°52'	198	154	11,2	441	111	20	1,3	2,3
6400	123,7		85	5 05	215	167	11,7	434	117	20	1,3	2,5
6600	127,8		89	5 19	233	181	12,1	427	124	21	1,4	2,7
6800	131,9		92	5 33	252	195	12,6	420	130	21	1,4	2,9
7000	136,0		96	5 47	273	211	13,1	413	137	22	1,4	3,1
7200	140,1		96									
7400	144,2		100	6 01	294	227	13,6	406	145	22	1,5	3,4
7600	148,3		105	6 16	317	245	14,1	400	152	22	1,5	3,6
7800	152,4		109	6 32	341	263	14,6	394	160	23	1,6	3,9
8000	156,5		113	6 48	367	283	15,1	387	169	23	1,6	4,2
	160,6		118	7 04	394	303	15,7	381	177	24	1,7	4,5
8200	164,7		122	7 20	423	325	16,2	376	186	25	1,7	4,8
8400	168,8		127	7 37	453	347	16,8	370	195	25	1,8	5,2
8600	172,9		132	7 55	483	371	17,4	364	205	26	1,8	5,6
8800	176,9		137	8 13	513	397	17,9	359	214	26	1,9	6,0
9000	181,0		142	8 31	543	423	18,5	354	224	27	1,9	6,4
9200	185,0		147	8 50	573	451	19,1	350	235	27	2,0	6,9
9400	189,0		153	9 10	603	481	19,7	345	246	28	2,0	7,4
9600	193,0		158	9 30	633	512	20,3	341	257	29	2,1	7,9
9800	197,1		164	9 50	663	545	21,0	338	268	29	2,1	8,4
10000	201,0		170	10 11	693	579	21,6	334	280	30	2,2	9,0
10200	205,0		176	10 33	723	615	22,2	331	291	30	2,2	9,6
10400	209,0		182	10 55	753	652	22,9	329	303	31	2,3	10
10600	212,9		188	11 18	783	692	23,6	326	316	32	2,4	11
10800	216,8		195	11 41	813	733	24,2	324	328	32	2,4	12
11000	220,7		201	12 05	843	776	24,9	322	341	33	2,5	12
11200	224,6		208	12 29	873	822	25,6	321	353	34	2,5	13
11400	228,5		215	12 54	903	869	26,3	319	366	34	2,6	14
11600	232,4		222	13 20	933	918	27,0	318	379	35	2,7	15
11800	236,2		230	13 46	963	970	27,7	317	392	35	2,7	15
12000	240,1		237	14 13	993	1023	28,5	315	405	36	2,8	16

SA UPALJAČEM UTIU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

Daljina	P o p r a v k e		m	hili	s	m
	pravek zbog	daljina zbog				
17	derivacije	bočnog vetra W ₁₀ = 10 m/s	17	18	19	20
21	kosine ramena ko- levke za 10 hili	uzdužnog vetra W ₁₀ = 10 m/s	21	22	23	24
25	temp. vazduha Δt = 10°C	vazd. pritiska ΔH = 10 mbar	25	26	27	28
29	početna brzina V ₀ = 10 m/s	temp. baruta Δt _b = 10°C	29	30	31	32
33	mase projektila Δp = 1 oznaka	Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi	33	34	35	36
40	Popravke mestnog uga (p ₅) za svakih		40	41	42	43
44	+1		44	45	46	47
48	-1		48	49	50	51
52	Daljina		52	53	54	55

Drugo punjenje
V₀ = 705 m/s

06315701

Tablica Ila

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

Daljina	Daljinar		Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovatno skr. putanje			
	optički durbin	mehanički							po daljini (Vd)	po pravcu (Vp)	po visini (Vv)	
m	podjelak	hilj.	o ' "	m	m	s	m/s	hilj.	metara			
1	2	2a	3	4	5	6	7	8	9	11	12	13
12200		243,9	245	14°41'	1442	1079	29,2	315	418	36	2,9	17
12400		247,8	252	15 09	1523	1138	29,9	314	432	37	3,0	18
12600		251,6	260	15 38	1608	1198	30,7	313	445	38	3,0	19
12800		255,5	269	16 07	1697	1261	31,4	313	459	38	3,1	20
13000		259,3	277	16 37	1789	1327	32,2	312	472	39	3,2	21
13200		263,2	286	17 08	1886	1395	33,0	312	486	39	3,3	22
13400		267,1	294	17 40	1987	1466	33,8	312	499	40	3,4	23
13600		271,0	303	18 12	2092	1540	34,6	312	513	40	3,5	24
13800		274,9	313	18 45	2201	1617	35,4	312	527	41	3,6	25
14000		278,8	322	19 19	2315	1697	36,3	312	541	41	3,7	26
14200		282,8	332	19 54	2433	1779	37,1	312	555	42	3,8	28
14400		286,8	341	20 29	2556	1865	37,9	312	569	43	3,9	29
14600		290,8	352	21 06	2681	1955	38,8	312	582	43	4,0	30
14800		294,9	362	21 43	2808	2048	39,7	312	597	44	4,1	31
15000		299,0	373	22 21	2937	2144	40,6	313	611	44	4,3	33
15200		303,1	383	23 00	3067	2245	41,5	313	625	45	4,4	34
15400		307,3	395	23 40	3199	2349	42,5	314	639	45	4,5	36
15600		311,5	406	24 22	3340	2458	43,4	314	653	46	4,7	37
15800		315,7	418	25 04	3481	2571	44,4	315	668	46	4,8	39
16000		319,9	430	25 48	3627	2689	45,4	316	682	47	5,0	41
16200		324,1	442	26 33	3770	2813	46,4	317	697	47	5,1	42
16400		328,4	455	27 19	3900	2942	47,4	317	712	48	5,3	44
16600		332,7	469	28 07	4081	3077	48,5	318	726	48	5,5	46
16800		336,9	483	28 57	4269	3218	49,6	319	741	49	5,7	48
17000		341,1	497	29 49	4467	3366	50,8	320	757	50	5,9	50
17200		345,2	512	30 42	4679	3523	51,9	321	772	50	6,1	53
17400		349,3	527	31 38	4899	3688	53,2	322	788	51	6,4	55
17600		353,3	543	32 36	5134	3864	54,4	323	804	51	6,6	58
17800		357,2	561	33 38	5379	4052	55,8	324	821	52	6,9	61
18000		361,0	579	34 43	5638	4254	57,2	325	838	53	7,2	64

SA UPALJAČEM UTIU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

P o p r a v k e																			
pravac zbog		daljina zbog										Popravke menog ugla (5°) za svaki		m					
hijladitih		odstupanja								m									
17	18	19	21	23	24	25	26	27	33	hijlad.	s	1							
derivacije		božnog vetra $W_s = 10 \text{ m/s}$		kosine ramena ko- levke za 10 hilj.		uzdužnog vetra $W_s = 10 \text{ m/s}$		temp. vazduha $\Delta t = 10^\circ\text{C}$		vazd. pritiska $\Delta H = 10 \text{ mbar}$		početna brzina $V_s = 10 \text{ m/s}$		temp. baruta $\Delta t_b = 10^\circ\text{C}$		mase projektila $\Delta p = 1 \text{ oznaka}$		Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hijladiti	
5	9	3	172	154	56	218	34	7	27	0,06	-0,05	12200							
6	9	3	179	158	57	220	34	6	26	0,06	-0,06	12400							
6	10	3	186	163	58	222	34	6	25	0,06	-0,06	12600							
6	10	3	193	167	59	224	35	5	25	0,07	-0,06	12800							
6	10	3	201	172	60	226	35	5	24	0,07	-0,07	13000							
6	10	3	208	176	61	227	35	5	24	0,08	-0,07	13200							
6	10	3	216	181	62	229	36	4	23	0,08	-0,08	13400							
7	11	3	223	185	64	231	36	4	23	0,09	-0,08	13600							
7	11	3	231	189	65	233	36	3	22	0,09	-0,09	13800							
7	11	4	239	194	66	235	36	3	22	0,10	-0,10	14000							
7	11	4	247	198	67	236	37	3	21	0,11	-0,10	14200							
8	11	4	256	203	68	238	37	2	21	0,11	-0,11	14400							
8	11	4	264	207	69	240	37	2	20	0,12	-0,12	14600							
8	12	4	273	211	70	242	37	2	20	0,13	-0,12	14800							
8	12	4	282	216	71	243	37	1	20	0,14	-0,13	15000							
9	12	4	290	220	72	245	38	1	19	0,15	-0,14	15200							
9	12	4	300	224	73	248	39	0	19	0,16	-0,15	15400							
9	12	5	309	229	74	248	39	0	18	0,17	-0,16	15600							
10	12	5	318	233	76	250	39	0	18	0,18	-0,17	15800							
10	13	5	328	237	77	252	39	0	17	0,19	-0,19	16000							
10	13	5	337	241	78	254	39	0	17	0,21	-0,20	16200							
11	13	5	347	245	79	255	40	0	16	0,23	-0,22	16400							
11	13	5	357	249	80	257	40	-1	15	0,24	-0,23	16600							
11	13	6	367	253	81	259	40	-1	15	0,26	-0,25	16800							
12	14	6	378	256	82	261	40	-2	14	0,28	-0,27	17000							
12	14	6	388	260	83	263	41	-2	14	0,31	-0,30	17200							
13	14	6	399	263	85	265	41	-2	13	0,34	-0,33	17400							
13	14	6	410	266	86	267	41	-3	12	0,38	-0,36	17600							
14	14	7	421	269	87	269	42	-3	12	0,43	-0,40	17800							
15	15	7	432	272	89	272	42	-4	11	0,49	-0,46	18000							

Drugo punjenje
 $V_0 = 705 \text{ m/s}$

06315702

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

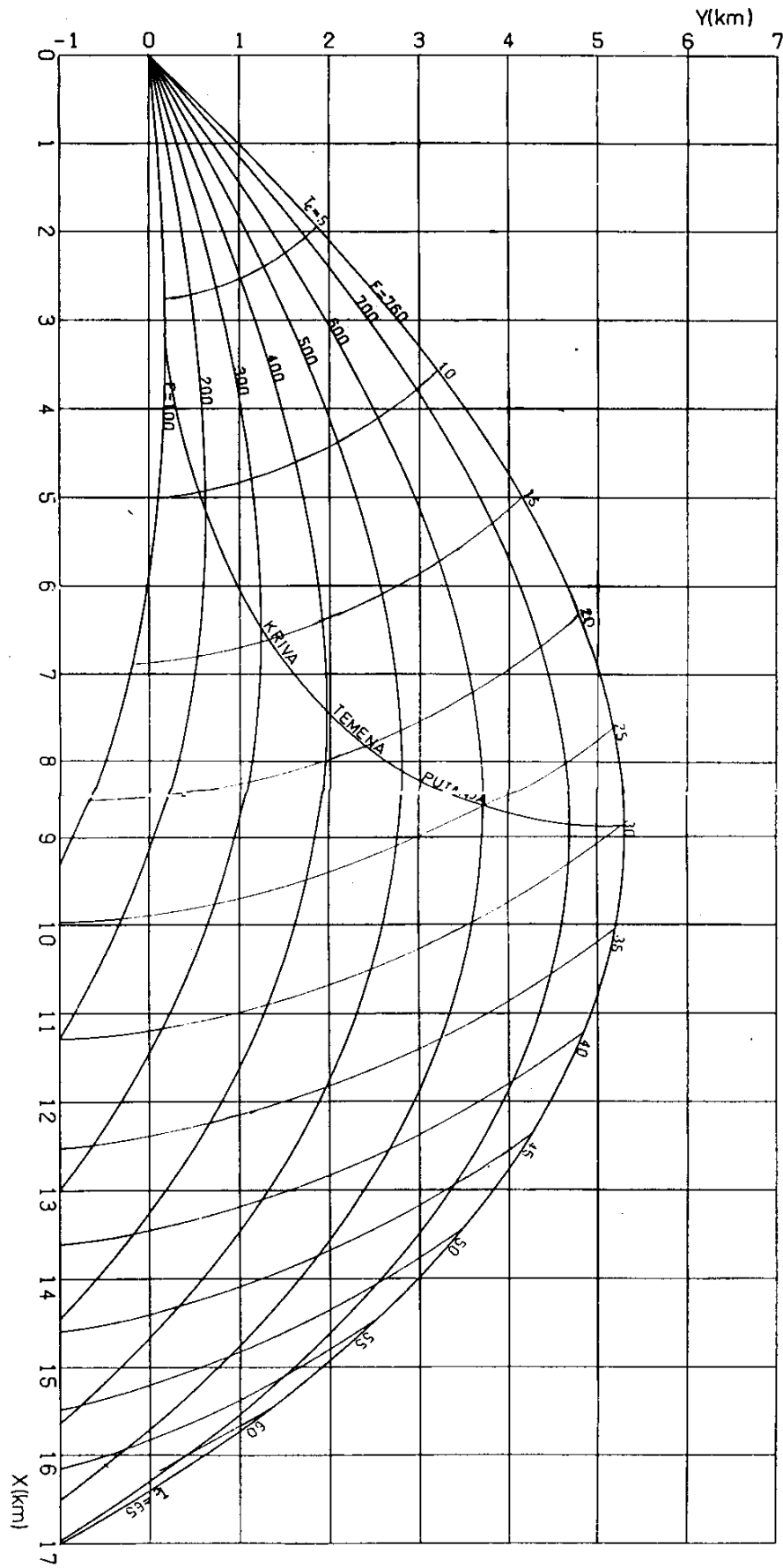
Daljina	Dajinar			Tablični ugao	Uslovna visina za izbor sloja u meteoblitenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovatno skr.		
	optički durblin	mehanički	hij.							putanja	putanja	putanja
1	2	2a	3	4	5	6	7	8	9	11	12	13
18200		364,7	599	35,53	611,3	447,4	58,7	327	856	54	7,6	67
18400		368,1	620	37,10	613,3	447,4	60,4	328	875	54	7,9	71
18600		371,5	643	38,34	615,3	447,4	62,2	329	895	55	8,4	76
18800		374,9	671	40,13	617,3	447,4	64,3	331	919	57	8,9	81
19000		378,8	707	42,20	619,3	447,4	66,9	333	948	58	9,6	89
19163		387,7	775	46,30	626,3	458,7	72,0	336	1002	60	11	105

06315703

Drugo punjenje
 $V_0 = 705 \text{ m/s}$

SA UPALJAČEM UTIU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

P o p r a v k e												
pravca zbog			daljina zbog						Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi			
derivacije			odstupanja						Popravke mernog ugla (ps) za svakih			
bočnog vetra $W_y = 10 \text{ m/s}$	kosine ramena ku- levke za 10 hilj.	uzdužnog vetra $W_x = 10 \text{ m/s}$	temp. vazduha $\Delta t = 10^\circ\text{C}$	vazd. pritiska $\Delta H = 10 \text{ mbar}$	početna brzina $V_0 = 10 \text{ m/s}$	temp. baruta $\Delta t_b = 10^\circ\text{C}$	mase projektila $\Delta p = 1 \text{ oznaka}$		+1	-1		Daljina
17	18	19	21	23	24	25	26	27	33	46	46a	1
15	15	7	44,3	274	90	275	43	-4	10	0,56	-0,53	18200
16	15	8	45,5	276	92	278	44	-5	9	0,68	-0,63	18400
17	15	8	46,7	277	94	281	45	-5	8	0,84	-0,76	18600
18	16	8	48,0	278	95	285	46	-6	6	1,15	-1,03	18800
19	16	9	49,3	276	98	291	47	-6	4	1,97	-1,68	19000
22	17	11	51,2	267	102	300	47	-7	0	0,00	0,00	19163



GRAFIČKA TABLICA GADANJA
TOP 130 mm M-46
TRENUTNO-FUGASNI PROJEKTIL M79 I OF-482M

Treće punjenje
V0 = 621 m/s

06315704

TRENTUNO-FUGASNI PROJEKTIL M79
TRENUTNO-FUGASNI PROJEKTIL OF-482M

Daljina		Dajinar		Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Verovano skr.		
		optički durbin	mehanički						putanja		
m	podjeljak	hilj.	o	m	m	s	m/s	hilj	po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
1	2a	3	4	5	6	7	8	9	11	12	13
200	6,6	2	0°09'	0	0,1	0,3	612	2	15	0,0	0,0
400	11,4	5	0 18	1	0,3	0,7	602	5	15	0,1	0,1
600	16,1	8	0 27	2	1,2	1,0	593	8	15	0,1	0,1
800	20,9	10	0 36	3	2,2	1,3	584	11	14	0,2	0,2
1000	25,7	13	0 46	4	3,4	1,7	575	13	14	0,2	0,2
1200	30,6	16	0 56	6	5,0	2,0	566	16	14	0,2	0,2
1400	35,4	18	1 06	9	6,9	2,4	557	20	14	0,3	0,3
1600	40,3	21	1 16	12	9,2	2,7	549	23	14	0,3	0,3
1800	45,1	24	1 26	15	12	3,1	540	26	14	0,4	0,4
2000	50,0	27	1 37	19	15	3,5	531	30	14	0,4	0,4
2200	54,9	30	1 48	23	18	3,9	523	34	14	0,4	0,5
2400	59,8	33	1 59	28	22	4,2	514	38	14	0,5	0,5
2600	64,6	36	2 11	36	26	4,6	506	42	14	0,5	0,5
2800	69,5	40	2 22	40	31	5,0	498	46	14	0,6	0,7
3000	74,4	43	2 34	42	36	5,4	489	50	14	0,6	0,7
3200	79,3	46	2 47	54	42	5,9	481	55	14	0,6	0,8
3400	84,3	50	2 59	59	49	6,3	473	60	15	0,7	0,9
3600	89,2	53	3 12	67	55	6,7	465	65	15	0,7	1,0
3800	94,1	57	3 25	81	63	7,1	457	70	15	0,8	1,1
4000	99,0	61	3 39	91	71	7,6	450	75	16	0,8	1,2
4200	103,9	65	3 52	102	80	8,0	442	81	16	0,9	1,4
4400	108,8	68	4 06	115	89	8,5	435	87	16	0,9	1,5
4600	113,7	72	4 21	128	99	9,0	427	93	17	0,9	1,6
4800	118,6	77	4 36	142	110	9,5	420	99	17	1,0	1,8
5000	123,4	81	4 51	157	121	9,9	413	106	18	1,0	2,0
5200	128,3	85	5 07	173	134	10,4	406	113	18	1,1	2,2
5400	133,2	90	5 23	191	147	10,9	399	120	19	1,1	2,4
5600	138,0	94	5 39	209	161	11,5	392	128	20	1,2	2,6
5800	142,8	99	5 56	229	177	12,0	386	136	20	1,2	2,9
6000	147,7	104	6 14	251	193	12,5	379	144	21	1,3	3,2

06315705

Treće punjenje
 $V_0 = 621 \text{ m/s}$

SA UPALJAČEM UTU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

P o p r a v k e																
pravca zbog			daljina zbog													
derivacije			bočnog vetra $W_r = 10 \text{ m/s}$		kosine ramena ko- levke za 10 hilj.		odstupanja						Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi			
							uzdužnog vetra $W_r = 10 \text{ m/s}$		temp. vazduha $\Delta t = 10^\circ\text{C}$		vazd. pritiska $\Delta H = 10 \text{ mbar}$				početna brzina $V_0 = 10 \text{ m/s}$	
hiljaditi			m		m		m		m		m		m		m	
			+1		-1											
			46		46a											
			1													
17	18	19	21	23	24	25	26	27	33	46	46a	1				
0	0	0	0	0	0	6	1	1	81	0,00	0,00	200				
0	0	0	0	0	0	13	2	2	79	0,00	0,00	400				
0	0	0	0	0	0	19	3	3	77	0,00	0,00	600				
0	0	0	0	0	0	25	4	4	76	0,00	0,00	800				
0	0	0	0	0	0	31	5	5	74	0,00	0,00	1000				
0	0	0	0	0	0	37	6	6	73	0,00	0,00	1200				
0	0	0	0	0	0	43	7	7	71	0,00	0,00	1400				
0	0	0	0	0	0	48	8	8	70	0,00	0,00	1600				
0	0	0	0	0	0	54	9	9	68	0,00	0,00	1800				
0	0	0	0	0	0	60	9	9	67	0,00	0,00	2000				
1	1	0	4	5	2	65	10	10	65	0,00	0,00	2200				
1	1	0	5	6	3	70	10	10	64	0,00	0,00	2400				
1	1	0	6	7	3	76	11	11	62	0,00	0,00	2600				
1	1	0	7	9	4	81	12	12	61	0,00	0,00	2800				
1	1	0	8	10	4	86	12	12	60	0,00	0,00	3000				
1	1	0	9	12	4	91	13	13	58	0,00	0,00	3200				
1	1	0	10	13	5	96	13	13	57	0,00	0,00	3400				
1	1	0	11	15	6	101	15	15	55	0,00	0,00	3600				
1	1	0	12	16	7	105	16	16	54	0,00	0,00	3800				
1	1	0	13	18	8	110	16	16	53	0,00	0,00	4000				
1	1	0	14	20	9	114	17	17	52	0,01	-0,01	4200				
1	1	0	15	23	9	119	18	18	50	0,01	-0,01	4400				
1	1	0	16	25	10	123	18	18	49	0,01	-0,01	4600				
1	1	0	17	27	11	127	19	19	48	0,01	-0,01	4800				
1	1	0	18	29	12	132	20	20	47	0,01	-0,01	5000				
2	4	1	29	32	13	136	20	15	45	0,01	-0,01	5200				
2	4	1	32	34	13	140	21	15	44	0,01	-0,01	5400				
2	4	1	35	37	14	143	21	15	43	0,01	-0,01	5600				
2	4	1	37	40	15	147	22	15	42	0,01	-0,01	5800				
2	5	1	40	42	16	151	23	15	41	0,01	-0,01	6000				

TRENTUNO-FUGASNI PROJEKTIL M79
SA UPALJACEM RGM-2 I V429

SA UPALJACEM UTU, M72 I BU-130-M83
SA UPALJACEM RGM-2 I V429

Treće punjenje
 $V_0 = 621 \text{ m/s}$

Daljina	Dalliner			Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovatno skr.		
	optički durbin	mehanički	hij.							putanja		
1	2	2a	3	4	5	6	7	8	9	10	11	12
6200	152,4	109	6032	274	210	13,1	373	153	22	1,3	3,5	3,5
6400	157,2	114	650	298	228	13,6	367	162	22	1,4	3,8	3,8
6600	162,0	119	709	324	248	14,2	361	171	23	1,4	4,2	4,2
6800	166,7	125	729	352	269	14,8	356	181	24	1,5	4,6	4,6
7000	171,4	130	749	381	291	15,3	351	191	25	1,5	5,0	5,0
7200	176,1	136	809	412	314	15,9	346	201	26	1,6	5,5	5,5
7400	180,8	142	830	445	339	16,6	341	212	27	1,6	6,0	6,0
7600	185,4	148	852	480	365	17,2	337	223	28	1,7	6,5	6,5
7800	190,0	154	915	517	393	17,8	333	234	29	1,8	7,0	7,0
8000	194,6	160	938	557	422	18,4	330	245	29	1,8	7,6	7,6
8200	199,2	167	1001	598	453	19,1	327	257	30	1,9	8,2	8,2
8400	203,7	174	1026	642	486	19,8	324	269	31	1,9	8,9	8,9
8600	208,2	181	1050	688	520	20,4	322	282	32	2,0	9,6	9,6
8800	212,6	188	1116	739	556	21,1	320	294	32	2,1	10	10
9000	217,1	195	1142	791	594	21,8	318	307	33	2,2	11	11
9200	221,5	203	1209	847	634	22,5	316	319	34	2,2	12	12
9400	225,8	210	1237	901	676	23,2	314	332	35	2,3	13	13
9600	230,2	218	1305	957	721	23,9	313	345	36	2,4	14	14
9800	234,5	226	1334	1032	767	24,6	312	359	36	2,5	14	14
10000	238,8	234	1404	1101	815	25,4	310	372	37	2,6	15	15
10200	243,1	243	1434	1173	865	26,1	309	385	38	2,7	16	16
10400	247,3	251	1505	1248	918	26,9	308	399	39	2,8	17	17
10600	251,6	260	1537	1328	973	27,6	308	413	39	2,9	18	18
10800	255,8	269	1610	1410	1031	28,4	307	427	40	3,0	19	19
11000	260,1	279	1643	1497	1091	29,2	306	440	41	3,1	20	20
11200	264,4	288	1718	1587	1153	30,0	306	454	42	3,2	22	22
11400	268,6	298	1753	1682	1219	30,8	305	469	42	3,3	23	23
11600	272,9	308	1828	1780	1287	31,6	305	483	43	3,4	24	24
11800	277,2	318	1905	1882	1358	32,4	305	497	44	3,6	25	25
12000	281,6	329	1943	1989	1431	33,3	305	512	45	3,7	27	27

P o p r a v k e												
Pravac zbog			daljina zbog			odstupanja			Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi			
derivative	božnog vetra $W_y = 10 \text{ m/s}$	kosine ramena kolovke za 10 hilj.	uzdužnog vetra $W_x = 10 \text{ m/s}$	temp. vazduha $\Delta t = 10^\circ\text{C}$	vazd. pritiska $\Delta H = 10 \text{ mbar}$	početna brzina $V_0 = 10 \text{ m/s}$	temp. baruta $\Delta t_b = 10^\circ\text{C}$	mase projektila $\Delta p = 1 \text{ oznaka}$	Popravke mernog ugla (ρ_5) za svih			
17	18	19	21	23	24	25	26	27	40	46	48a	1
2	5	1	47	48	18	155	23	15	0,02	-0,01	6200	6200
2	5	1	50	51	19	158	24	15	0,02	-0,02	6400	6400
2	5	1	54	55	20	162	24	15	0,02	-0,02	6600	6600
3	6	1	58	58	22	165	25	15	0,02	-0,02	6800	6800
3	6	1	62	61	23	168	25	14	0,02	-0,02	7000	7000
3	6	1	66	65	24	172	26	14	0,02	-0,02	7200	7200
3	6	1	70	68	25	175	26	14	0,03	-0,02	7400	7400
3	6	2	75	72	26	178	27	14	0,03	-0,03	7600	7600
3	7	2	79	76	28	181	27	13	0,03	-0,03	7800	7800
3	7	2	84	79	29	184	27	13	0,03	-0,03	8000	8000
4	7	2	89	83	30	188	28	13	0,04	-0,03	8200	8200
4	7	2	95	87	31	189	28	13	0,04	-0,04	8400	8400
4	7	2	100	91	32	192	29	12	0,04	-0,04	8600	8600
4	8	2	106	95	33	194	29	12	0,05	-0,04	8800	8800
4	8	2	112	100	35	197	29	12	0,05	-0,05	9000	9000
5	8	2	118	104	36	199	29	11	0,05	-0,05	9200	9200
5	8	2	124	108	37	201	30	11	0,06	-0,05	9400	9400
5	8	2	131	113	38	203	30	11	0,06	-0,06	9600	9600
5	9	2	137	117	39	206	31	10	0,06	-0,06	9800	9800
5	9	3	144	122	40	208	31	10	0,07	-0,06	10000	10000
6	9	3	151	126	41	210	31	10	0,07	-0,07	10200	10200
6	9	3	158	131	42	212	32	9	0,07	-0,07	10400	10400
6	9	3	166	136	43	214	32	9	0,08	-0,08	10600	10600
6	10	3	173	140	44	216	32	9	0,08	-0,08	10800	10800
6	10	3	181	145	45	217	32	8	0,09	-0,09	11000	11000
7	10	3	189	150	46	219	33	8	0,10	-0,10	11200	11200
7	10	3	197	155	47	221	33	8	0,10	-0,10	11400	11400
7	10	3	205	159	48	223	33	7	0,11	-0,10	11600	11600
7	10	3	213	164	49	224	33	7	0,11	-0,11	11800	11800
8	11	4	222	169	50	226	34	7	0,12	-0,12	12000	12000

6,012

6,0-47

06315706

TRENTUTNO-FUGASNI PROJEKTIL M79
TRENUTNO-FUGASNI PROJEKTIL OF-482M

Daljina	Daljinar			Tablični ugao	Uslovna visina za izbor sloja u meteoblitenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovalno skr.		
	optički durbin	mehanički	1/6000							putanja		
m	pedaljak	hili.	o	m	m	s	m/s	hili.	metara	po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
1	2	3	4	5	6	7	8	9	10	11	12	13
12200	285,9	339	20°21'	2099	1508	34,1	305	526	45	3,8	28	28
12400	290,3	350	21 01	2214	1589	35,0	305	541	46	4,0	29	29
12600	294,7	362	21 41	2334	1672	35,9	305	556	47	4,1	31	31
12800	299,2	373	22 23	2458	1760	36,8	305	571	48	4,3	32	32
13000	303,7	385	23 06	2587	1851	37,7	305	586	48	4,5	34	34
13200	308,2	397	23 50	2721	1946	38,7	306	601	49	4,7	36	36
13400	312,8	410	24 35	2860	2045	39,7	306	616	50	4,8	37	37
13600	317,4	423	25 22	3004	2149	40,7	307	632	51	5,0	39	39
13800	322,0	436	26 10	3152	2259	41,7	307	647	51	5,2	41	41
14000	326,6	450	26 60	3304	2373	42,7	308	663	52	5,5	43	43
14200	331,3	464	27 51	3472	2494	43,8	309	679	53	5,7	46	46
14400	335,9	479	28 45	3645	2621	44,9	310	696	54	5,9	48	48
14600	340,5	495	29 41	3818	2757	46,1	311	713	55	6,2	51	51
14800	345,1	511	30 40	4002	2901	47,3	312	730	56	6,5	53	53
15000	349,6	528	31 42	4195	3055	48,5	313	748	57	6,8	56	56
15200	354,1	547	32 48	4399	3222	49,9	314	766	58	7,1	60	60
15400	358,5	566	33 59	4616	3403	51,3	316	786	59	7,5	64	64
15600	362,7	588	35 17	4849	3605	52,8	317	806	60	7,9	68	68
15800	366,9	612	36 43	5105	3835	54,5	319	829	62	8,4	73	73
16000	371,1	640	38 24	5395	4106	56,5	321	855	63	9,0	79	79
16200	375,5	676	40 33	5751	4459	58,9	323	886	65	9,7	87	87
16400	385,3	760	45 32	6524	5296	64,5	328	957	68	12	106	106

06315707

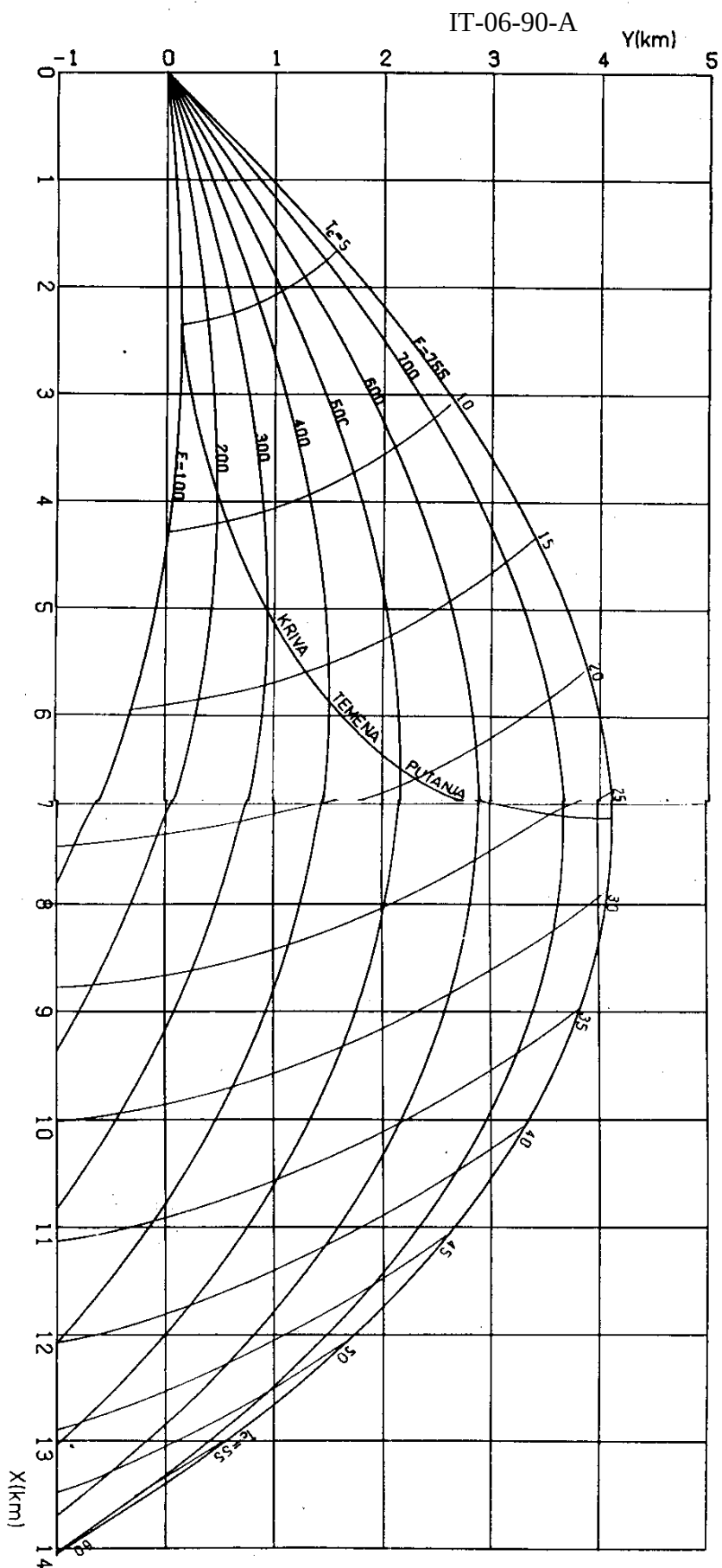
Treće punjenje
 $V_0 = 621 \text{ m/s}$

SA UPALJAČEM UTIU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

		P o r a v k e																					
pravac zbog		daljina zbog																					
hiliaditih		17	18	19	21	23	24	25	26	27	33	m	Popravke mestnog ugla (p.s.) za svakih		m								
													bočnog vetra $W_y=10 \text{ m/s}$	kosine ramena ko- levke za 10 hili.		uzdužnog vetra $W_x=10 \text{ m/s}$	odstupanja						
																	temp. vazduha $\Delta t=10^\circ\text{C}$	vazd. pritiska $\Delta H=10 \text{ mbar}$	početna brzina $V_0=10 \text{ m/s}$	temp. baruta $\Delta t_b=10^\circ\text{C}$	mase projektila $\Delta p=1 \text{ oznaka}$		
46	46a	1																					
derivacije																							
bočnog vetra $W_y=10 \text{ m/s}$	11	11	4	230	174	51	228	34	34	6	19	0,13	-0,13	12200									
kosine ramena ko- levke za 10 hili.	11	11	4	239	179	51	229	34	34	6	19	0,14	-0,13	12400									
uzdužnog vetra $W_x=10 \text{ m/s}$	9	11	4	248	184	52	231	34	34	6	18	0,15	-0,14	12600									
temp. vazduha $\Delta t=10^\circ\text{C}$	9	11	4	257	188	53	232	35	35	5	18	0,16	-0,15	12800									
vazd. pritiska $\Delta H=10 \text{ mbar}$	9	12	4	266	193	54	234	35	35	5	17	0,17	-0,16	13000									
početna brzina $V_0=10 \text{ m/s}$	10	12	4	275	198	55	236	35	35	5	17	0,18	-0,17	13200									
temp. baruta $\Delta t_b=10^\circ\text{C}$	10	12	5	285	202	56	237	35	35	4	16	0,19	-0,19	13400									
mase projektila $\Delta p=1 \text{ oznaka}$	10	12	5	294	207	57	239	35	35	4	16	0,21	-0,20	13600									
Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiliaditi	10	12	5	304	212	58	240	35	35	3	15	0,23	-0,22	13800									
Popravke mestnog ugla (p.s.) za svakih	11	12	5	314	216	59	242	35	35	3	15	0,24	-0,24	14000									
	11	13	5	324	220	60	244	36	36	3	14	0,27	-0,26	14200									
	11	13	5	334	225	62	246	37	37	2	14	0,29	-0,28	14400									
	12	13	6	344	229	63	248	37	37	2	13	0,33	-0,31	14600									
	12	13	6	354	233	64	250	37	37	1	12	0,37	-0,35	14800									
	13	13	6	364	237	65	252	38	38	1	12	0,42	-0,39	15000									
	14	14	6	374	240	67	254	38	38	0	11	0,47	-0,45	15200									
	15	14	7	385	243	68	257	38	38	0	10	0,55	-0,53	15400									
	15	14	7	395	246	70	260	39	39	0	9	0,66	-0,62	15600									
	16	14	7	406	249	71	263	39	39	0	8	0,84	-0,77	15800									
	17	15	8	417	250	73	267	40	40	-1	6	1,13	-1,04	16000									
	19	15	9	429	251	76	271	40	40	-2	5	1,84	-1,61	16200									
	22	16	10	449	247	79	279	42	42	-3	0	0,00	0,00	16400									

GRAFIČKA TABLICA
 TOP 130 mm/46
 TRENUTNO-FUGASIPROJEKTIL M79 I OF-482M

06315708
 Četvrti punjenje
 $V_0 = 525 \text{ m/s}$



TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

m	Dajlinar		hili.	o	m	m	s	m/s	hili.	Vetrovno skr.		
	optički durbín	mehanički								putanja	putanja	putanja
1	2'	2a	3	4	5	6	7	8	9	11	12	13
200	2	4,4	3	0°12'	0	0,2	0,4	517	3	11	0,0	0,0
400	4	8,3	7	0 25	1	0,7	0,8	509	7	11	0,1	0,1
600	6	12,1	11	0 38	2	1,7	1,2	501	11	11	0,1	0,1
800	8	16,0	14	0 51	4	3,0	1,6	493	15	10	0,2	0,2
1000	10	19,9	18	1 05	6	4,8	2,0	485	19	10	0,2	0,2
1200	12	23,8	22	1 18	9	7,1	2,4	477	23	10	0,2	0,3
1400	14	27,7	26	1 32	13	9,8	2,8	469	28	10	0,3	0,3
1600	16	31,6	30	1 47	17	13	3,3	461	32	10	0,3	0,4
1800	18	35,5	34	2 02	21	17	3,7	453	37	11	0,4	0,4
2000	20	39,4	38	2 17	27	21	4,1	445	42	11	0,4	0,5
2200	22	43,4	42	2 33	33	26	4,6	437	48	11	0,4	0,5
2400	24	47,3	47	2 49	41	32	5,1	429	54	11	0,5	0,6
2600	26	51,3	51	3 05	49	38	5,5	421	60	12	0,5	0,7
2800	28	55,3	56	3 22	57	45	6,0	413	66	12	0,6	0,8
3000	30	59,3	61	3 40	65	52	6,5	406	72	12	0,6	0,9
3200	32	63,3	66	3 58	73	61	7,0	398	79	13	0,7	1,1
3400		67,3	71	4 16	81	70	7,5	390	87	14	0,7	1,2
3600		71,4	76	4 35	90	80	8,1	383	94	14	0,7	1,4
3800		75,4	82	4 55	91	91	8,6	376	102	15	0,8	1,6
4000		79,5	88	5 15	103	103	9,2	369	111	16	0,8	1,8
4200		83,6	93	5 36	117	117	9,7	362	120	17	0,9	2,1
4400		87,7	99	5 58	131	131	10,3	356	129	17	0,9	2,4
4600		91,8	105	6 20	146	146	10,9	350	138	18	1,0	2,7
4800		95,9	112	6 43	163	163	11,5	344	149	19	1,0	3,0
5000		100,0	118	7 06	181	181	12,1	339	159	20	1,1	3,4
5200		104,1	125	7 31	200	200	12,7	334	170	21	1,1	3,8
5400		108,2	132	7 56	221	221	13,4	330	181	22	1,2	4,3
5600		112,3	139	8 21	243	243	14,0	326	192	23	1,3	4,8
5800		116,4	147	8 48	267	267	14,7	322	204	24	1,3	5,3
6000		120,5	154	9 15	292	292	15,3	319	216	25	1,4	5,8

SA UPALJAČEM UTIU, M72 i BU-130-M83
SA UPALJAČEM RGM-2 i V-429

Četvrtu punjenje
 $V_0 = 525 \text{ m/s}$

m	P o p r a v k e		m	hili.	s	m
	pravac zbog	dajlinar zbog				
17	derivacije	bočnog vetra $W_y = 10 \text{ m/s}$	18	19	20	21
22	kosine ramena ko- levke za 10 hili.	uzdužnog vetra $W_x = 10 \text{ m/s}$	23	24	25	26
27	temp. vazduha $\Delta t = 10^\circ\text{C}$	vazd. pritiska $\Delta H = 10 \text{ mbar}$	28	29	30	31
32	početna brzina $V_0 = 10 \text{ m/s}$	temp. baruta $\Delta t_b = 10^\circ\text{C}$	37	38	39	40
42	mase projektila $\Delta p = 1 \text{ oznaka}$	Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi	47	48	49	50
52	Popravke mešnog ugla (ps) za svakih	+1	57	58	59	60
62	-1	67	68	69	70	71
72			77	78	79	80
82			87	88	89	90
92			97	98	99	100
102			107	108	109	110
112			117	118	119	120
122			127	128	129	130
132			137	138	139	140
142			147	148	149	150
152			157	158	159	160
162			167	168	169	170
172			177	178	179	180
182			187	188	189	190
192			197	198	199	200
202			207	208	209	210
212			217	218	219	220
222			227	228	229	230
232			237	238	239	240
242			247	248	249	250
252			257	258	259	260
262			267	268	269	270
272			277	278	279	280
282			287	288	289	290
292			297	298	299	300
302			307	308	309	310
312			317	318	319	320
322			327	328	329	330
332			337	338	339	340
342			347	348	349	350
352			357	358	359	360
362			367	368	369	370
372			377	378	379	380
382			387	388	389	390
392			397	398	399	400
402			407	408	409	410
412			417	418	419	420
422			427	428	429	430
432			437	438	439	440
442			447	448	449	450
452			457	458	459	460
462			467	468	469	470
472			477	478	479	480
482			487	488	489	490
492			497	498	499	500
502			507	508	509	510
512			517	518	519	520
522			527	528	529	530
532			537	538	539	540
542			547	548	549	550
552			557	558	559	560
562			567	568	569	570
572			577	578	579	580
582			587	588	589	590
592			597	598	599	600
602			607	608	609	610
612			617	618	619	620
622			627	628	629	630
632			637	638	639	640
642			647	648	649	650
652			657	658	659	660
662			667	668	669	670
672			677	678	679	680
682			687	688	689	690
692			697	698	699	700
702			707	708	709	710
712			717	718	719	720
722			727	728	729	730
732			737	738	739	740
742			747	748	749	750
752			757	758	759	760
762			767	768	769	770
772			777	778	779	780
782			787	788	789	790
792			797	798	799	800
802			807	808	809	810
812			817	818	819	820
822			827	828	829	830
832			837	838	839	840
842			847	848	849	850
852			857	858	859	860
862			867	868	869	870
872			877	878	879	880
882			887	888	889	890
892			897	898	899	900
902			907	908	909	910
912			917	918	919	920
922			927	928	929	930
932			937	938	939	940
942			947	948	949	950
952			957	958	959	960
962			967	968	969	970
972			977	978	979	980
982			987	988	989	990
992			997	998	999	1000

06315709

TRENTNO-FUGASNI PROJEKIL M79
TRENTNO-FUGASNI PROJEKIL OF-482M

Daljina	Dajinar		Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Vraćanje skr.		
	optički durbini	mehanički							putanja		
1	2	2a	3	4	5	6	7	8	9	10	11
6200	124,5	162	9043	425	319	16,0	317	228	26	1,5	6,4
6400	128,6	170	10 11	465	347	16,7	314	240	27	1,5	7,0
6600	132,6	178	10 40	508	377	17,4	312	253	28	1,5	7,7
6800	136,6	186	11 10	553	409	18,1	310	265	29	1,7	8,4
7000	140,6	195	11 41	601	443	18,8	308	278	30	1,8	9,1
7200	144,5	203	12 12	653	478	19,5	306	291	31	1,8	9,8
7400	148,5	212	12 44	707	516	20,2	305	304	32	1,9	11
7600	152,4	221	13 17	763	555	20,9	303	317	33	2,0	11
7800	156,3	231	13 50	823	596	21,7	302	331	34	2,1	12
8000	160,2	240	14 24	885	639	22,4	300	345	35	2,2	13
8200	164,1	250	14 59	951	684	23,2	299	358	36	2,3	14
8400	168,0	260	15 36	1016	732	23,9	298	372	37	2,4	15
8600	171,9	270	16 12	1081	781	24,7	297	387	38	2,5	16
8800	175,8	280	16 49	1146	833	25,5	296	401	39	2,7	17
9000	179,7	291	17 27	1212	888	26,3	296	415	40	2,8	18
9200	183,6	302	18 07	1279	945	27,2	295	430	40	2,9	20
9400	187,5	313	18 47	1346	1005	28,0	294	445	41	3,1	21
9600	191,4	325	19 28	1413	1068	28,8	294	460	42	3,2	22
9800	195,4	336	20 11	1484	1134	29,7	293	476	43	3,4	24
10000	199,4	349	20 55	1559	1203	30,6	293	492	44	3,5	25
10200	203,4	361	21 40	1634	1276	31,5	293	508	45	3,7	27
10400	207,4	374	22 27	1713	1353	32,5	292	524	46	3,9	28
10600	211,5	388	23 15	1795	1434	33,4	292	541	48	4,1	30
10800	215,6	402	24 06	1881	1520	34,4	292	558	49	4,3	32
11000	219,7	416	24 58	1971	1611	35,4	292	576	50	4,5	34
11200	223,8	431	25 53	2065	1708	36,5	292	594	51	4,7	37
11400	228,0	447	26 50	2165	1811	37,6	293	613	52	5,0	39
11600	232,2	464	27 50	2268	1922	38,7	293	632	54	5,3	42
11800	236,4	482	28 54	2374	2042	39,9	293	652	55	5,6	45
12000	240,5	501	30 02	2487	2171	41,2	294	674	57	5,9	48

SA UPALJACEM UTIU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V429

P o p r a v k e												
pravca zbog			daljina zbog				Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi		Popravke (menjanje) ugla (p.s.) za svakih		Daljina	
derivacije	božnog vetra $W_y=10 \text{ m/s}$	kosine ramena kol-levke za 10 hilj.	uzdužnog vetra $W_z=10 \text{ m/s}$	temp. vazduha $\Delta t=10^\circ\text{C}$	vazd. pritiska $\Delta H=10 \text{ mbar}$	početna brzina $V_0=10 \text{ m/s}$	temp. baruta $\Delta t_b=10^\circ\text{C}$	mase projektila $\Delta p=1 \text{ oznaka}$	+1	-1		
m i l j a d i t i h									h i l j a d .	s	m	
17	18	19	21	23	24	25	26	27	33	46	46a	1
3	6	2	74	61	19	169	36	12	26	0,05	-0,05	6200
4	7	2	79	65	19	172	36	12	25	0,05	-0,05	6400
4	7	2	86	69	20	175	37	12	25	0,05	-0,05	6600
4	7	2	92	74	21	178	37	11	24	0,05	-0,05	6800
4	7	2	98	78	22	180	38	11	24	0,05	-0,05	7000
4	8	2	105	83	23	183	38	11	23	0,05	-0,05	7200
5	8	2	112	87	24	185	39	11	23	0,06	-0,05	7400
5	8	2	119	92	24	188	39	11	22	0,06	-0,06	7600
5	8	2	127	97	25	190	40	10	22	0,06	-0,06	7800
5	8	3	134	102	26	192	40	10	21	0,07	-0,06	8000
6	9	3	142	106	27	194	41	10	21	0,07	-0,07	8200
6	9	3	150	111	28	196	41	10	20	0,08	-0,07	8400
6	9	3	158	116	28	198	41	10	20	0,08	-0,08	8600
6	9	3	166	121	29	200	42	9	19	0,09	-0,08	8800
7	9	3	174	126	30	202	42	9	19	0,09	-0,09	9000
7	9	3	182	131	31	204	42	9	18	0,10	-0,10	9200
7	10	4	191	136	32	206	43	8	18	0,11	-0,11	9400
7	10	4	199	141	32	208	44	8	18	0,12	-0,12	9600
8	10	4	208	147	33	209	44	8	17	0,14	-0,13	9800
8	10	4	217	152	34	211	44	8	17	0,15	-0,14	10000
8	10	4	226	157	35	213	45	7	16	0,16	-0,16	10200
9	11	4	235	162	36	214	45	7	16	0,18	-0,17	10400
9	11	4	245	167	37	216	45	6	15	0,20	-0,20	10600
10	11	4	254	172	38	218	46	6	15	0,22	-0,21	10800
10	11	5	263	177	39	220	46	6	14	0,25	-0,24	11000
10	11	5	273	182	40	221	46	5	14	0,28	-0,27	11200
11	12	5	283	187	41	223	47	5	13	0,31	-0,30	11400
11	12	5	293	191	42	225	47	4	12	0,35	-0,33	11600
12	12	6	303	196	43	227	48	4	12	0,40	-0,38	11800
12	12	6	313	201	45	229	48	3	11	0,45	-0,43	12000

Četvrti punjenje
 $V_0 = 525 \text{ m/s}$

TREKUTNO-FUGASNI PROJEKTIL M79
TREKUTNO-FUGASNI PROJEKTIL OF-482M

Daljina	Daljinar			Tablični ugao	Uslovna visina za izbor sloja u meteoblitenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovsko skr.		
	optički durbin	mehanički	1/6000							putanje		
m	podajak	2a	hili.	o	m	m	s	m/s	hili.	po daljini (Vd)	po pravcu (Vp)	po visini (Vv)
1	2	2a	3	4	5	6	7	8	9	11	12	13
12200		244,7	521	31°15'	3025	2314	42,5	295	696	58	6,2	52
12400		248,7	543	32 34	319	2471	44,0	296	720	60	6,6	56
12600		252,7	567	34 01	337	2648	45,6	297	745	61	7,1	61
12800		256,5	594	35 39	357	2851	47,3	298	773	63	7,6	67
13000		260,0	626	37 34	379	2995	49,3	300	805	65	8,2	73
13200		263,3	666	39 59	4099	3412	51,9	303	844	67	9,1	82
13399		267,2	755	45 18	4716	4129	57,2	310	923	70	11	102

06315711

SA UPALJACEM UTU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V-429

Četvrto punjenje
 $V_0 = 525 \text{ m/s}$

P o p r a v k e												
pravca zbog			daljina zbog									
derivacije			odstupanje									
bočnog vetra $W_y = 10 \text{ m/s}$			uzdužnog vetra $W_x = 10 \text{ m/s}$			temp. vazduha $\Delta t = 10^\circ\text{C}$				vazd. pritiska $\Delta H = 10 \text{ mbar}$		
kosine ramena ko- levke za 10 hili.			temp. baruta $\Delta t_b = 10^\circ\text{C}$			početna brzina $V_0 = 10 \text{ m/s}$				mase projektila $\Delta p = 1 \text{ oznaka}$		
hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.	hili.
17	18	19	21	23	24	25	26	27	33	46	46a	1
13	13	6	323	205	46	231	48	3	10	0,52	-0,50	12200
14	13	6	333	209	47	233	49	2	9	0,61	-0,57	12400
15	13	7	343	213	49	236	50	1	8	0,72	-0,69	12600
15	14	7	393	217	50	239	51	1	7	0,89	-0,84	12800
17	14	8	364	220	52	245	52	0	6	1,16	-1,09	13000
18	14	8	374	222	54	246	53	0	4	1,84	-1,64	13200
22	16	10	390	222	56	253	53	0	0	0,00	0,00	13399

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

Duljina	Duljinar		Tablični ugao	Uslovna visina za izbor sloja u meteobitlenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Vertikalno skr. putanja			
	optički durbin	mehanički							po daljini (Vd)	po pravcu (Vp)	po visini (Vv)	
1	2	2a	3	4	5	6	7	8	9	11	12	13
m	podj. jak	hij.	o	m	m	s	m/s	hij	metara			
6200	124.5	162	90.43	425	319	16.0	317	228	26	1.5	6.4	
6400	128.6	170	10.11	465	347	16.7	314	240	27	1.5	7.0	
6600	132.6	178	10.40	508	377	17.4	312	253	28	1.6	7.7	
6800	136.6	186	11.10	553	409	18.1	310	265	29	1.7	8.4	
7000	140.6	195	11.41	601	443	18.8	308	278	30	1.8	9.1	
7200	144.5	203	12.12	653	478	19.5	306	291	31	1.8	9.8	
7400	148.5	212	12.44	707	516	20.2	305	304	32	1.9	11	
7600	152.4	221	13.17	763	555	20.9	303	317	33	2.0	11	
7800	156.3	231	13.50	823	596	21.7	302	331	34	2.1	12	
8000	160.2	240	14.24	885	639	22.4	300	345	35	2.2	13	
8200	164.1	250	14.59	951	684	23.2	299	358	36	2.3	14	
8400	168.0	260	15.35	1019	732	23.9	298	372	37	2.4	15	
8600	171.9	270	16.12	1089	781	24.7	297	387	38	2.5	16	
8800	175.8	280	16.49	1161	833	25.5	296	401	39	2.7	17	
9000	179.7	291	17.27	1235	888	26.3	296	415	40	2.8	18	
9200	183.6	302	18.07	1313	945	27.2	295	430	40	2.9	20	
9400	187.5	313	18.47	1393	1005	28.0	294	445	41	3.1	21	
9600	191.4	325	19.28	1493	1068	28.8	294	460	42	3.2	22	
9800	195.4	336	20.11	1594	1134	29.7	293	476	43	3.4	24	
10000	199.4	349	20.55	1679	1203	30.6	293	492	44	3.5	25	
10200	203.4	361	21.40	1777	1276	31.5	293	508	45	3.7	27	
10400	207.4	374	22.27	1879	1353	32.5	292	524	46	3.9	28	
10600	211.5	388	23.15	1985	1434	33.4	292	541	48	4.1	30	
10800	215.6	402	24.06	2095	1520	34.4	292	558	49	4.3	32	
11000	219.7	416	24.58	2210	1611	35.4	292	576	50	4.5	34	
11200	223.8	431	25.53	2330	1708	36.5	292	594	51	4.7	37	
11400	228.0	447	26.50	2455	1811	37.6	293	613	52	5.0	39	
11600	232.2	464	27.50	2586	1922	38.7	293	632	54	5.3	42	
11800	236.4	482	28.54	2724	2042	39.9	293	652	55	5.6	45	
12000	240.5	501	30.02	2870	2171	41.2	294	674	57	5.9	48	

06315712

Četvrti punjenje
V₀ = 525 m/s

SA UPALJACEM UTIU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V-429

P o p r a v k e												
praveca zbog	daljina zbog	odstupanja				m	hiljad.	s	m			
		temp. vazduha $\Delta t = 10^{\circ}\text{C}$	vazd. pritiska $\Delta H = 10 \text{ mbar}$	početna brzina $V_0 = 10 \text{ m/s}$	temp. baruta $\Delta t_s = 10^{\circ}\text{C}$					mase projektila $\Delta P = 1 \text{ oznaka}$		
derivacije	bočnog vetra $W_y = 10 \text{ m/s}$	kosine ramena ko- levke za 10 hilj.	uzdužnog vetra $W_z = 10 \text{ m/s}$	temp. vazduha $\Delta t = 10^{\circ}\text{C}$	vazd. pritiska $\Delta H = 10 \text{ mbar}$	početna brzina $V_0 = 10 \text{ m/s}$	temp. baruta $\Delta t_s = 10^{\circ}\text{C}$	mase projektila $\Delta P = 1 \text{ oznaka}$	Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi	Popravke merno- sugla (ps) za svakih	Daljina	
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24	25	26	27	33	46	46a	1
17	18	19	21	23	24</							

Tablica IIa

TRENTUNO-FUGASNI PROJEKTIL M79
TRENTUNO-FUGASNI PROJEKTIL OF-482M

Daljina	Dajlinar			Tablični ugao	Uslovna visina za izbor sloja u meteoblitenu	Ordinata temena putanje	Vreme letenja	Krajnja brzina	Padni ugao	Verovatno skr.		
	optički durbin	mehanički	hili.							putanja		
1	2	2a	3	4	5	6	7	8	9	11	12	13
12200		244,7	521	31°15'	3025	2314	42,5	295	696	58	6,2	52
12400		248,7	543	32 34	319	2471	44,0	296	720	60	6,6	56
12600		252,7	567	34 01	337	2648	45,6	297	745	61	7,1	61
12800		256,5	594	35 39	357	2851	47,3	298	773	63	7,6	67
13000		260,0	626	37 34	379	2995	49,3	300	805	65	8,2	73
13200		263,3	666	39 59	4099	3412	51,9	303	844	67	9,1	82
13399		267,2	755	45 18	4716	4129	57,2	310	923	70	11	102

SA UPALJACEM UTU, M72 i BU-130-M83
SA UPALJACEM RGM-2 i V-429

06315713

Četvrtu punjenje
 $V_0 = 525 \text{ m/s}$

P o p r a v k e															
pravca zbog			daljina zbog						Pomeranje padne tačke po daljini menjajući tablični ugao za 1 hiljaditi				Popravka mernog ugla (ps) za svaki		Daljina
17	18	19	21	23	24	25	26	27	33	46	46a	m			
													derivacije	bočnog vetra $W_y=10 \text{ m/s}$	kosine ramena kol- levke za 10 hilj.
m e t a r a													h i l j a d i t i h	m	
13	13	6	373	205	46	231	48	3	10	0,52	-0,50	12200			
14	13	6	333	209	47	233	49	2	9	0,61	-0,57	12400			
15	13	7	343	213	49	236	50	1	8	0,72	-0,69	12600			
15	14	7	393	217	50	239	51	1	7	0,89	-0,84	12800			
17	14	8	364	220	52	245	52	0	6	1,16	-1,09	13000			
18	14	8	374	222	54	246	53	0	4	1,84	-1,64	13200			
22	16	10	380	222	56	253	53	0	0	0,00	0,00	13399			

PREDZNACI POPRAVKI PRAVCA I DALJINE GABANJA

Po- pravke	Činilac koji utiče na let projektila	Kako utiče	Predznak popravke
pravca	d e r i v a c i j a		ulevo
	Bočni vetar	s leva s desna	skreće projektil udesno skreće projektil ulivo
	Uzdužni vetar	spreda otpozadi	smanjuje daljinu povećava daljinu
	Temperatura vazduha	veća od normalne	povećava daljinu
		manja od normalne	smanjuje daljinu
	Vazdušni pritisak	veći od normalnog	smanjuje daljinu
		manji od normalnog	povećava daljinu
	Početna brzina	veća od normalne	povećava daljinu
		manja od normalne	smanjuje daljinu
	Temperatura baruta	veća od normalne	povećava daljinu
		manja od normalne	smanjuje daljinu
Daljine	Masa projektila	veća od normalne	utiče različito
		manja od normalne	utiče različito

Tablica VIB

RAZLAGANJE BALISTIČKOG VETRA NA KOMPONENTE (1/6000)

Ugao vetra AzC - AzW											Brzina balističkog vetra u m/sek										

06315714

KP	0-105		105-213		213-325		325-445		445-577		577-727		727-900		900-1000		KP		
4 $\frac{+\Delta X}{-\Delta Y}$	45-00		46-00		47-00		48-00		49-00		50-00		51-00		52-00		$\frac{+\Delta X}{-\Delta Y}$		
3 $\frac{-\Delta Y}{-\Delta X}$	30-00		31-00		32-00		33-00		34-00		35-00		36-00		37-00		$\frac{-\Delta Y}{-\Delta X}$		
2 $\frac{-\Delta X}{+\Delta Y}$	15+00		16-00		17-00		18-00		19-00		20-00		21-00		22-00		$\frac{-\Delta X}{+\Delta Y}$		
1 $\frac{+\Delta Y}{+\Delta X}$	0-00		1-00		2-00		3-00		4-00		5-00		6-00		7-00		$\frac{+\Delta Y}{+\Delta X}$		
	0	KP	KD	0	KP	KD	0	KP	KD	0	KP	KD	0	KP	KD	0	KP	KD	
00	000	000	105	006	213	022	325	051	445	095	577	155	727	236	900	346	100		
02	002	000	107	006	215	023	327	052	448	096	580	156	730	238	904	348	98		
04	004	000	109	006	217	024	330	053	450	097	583	157	733	240	908	351	96		
06	006	000	111	006	219	024	332	054	453	098	586	159	736	242	912	353	94		
08	008	000	114	006	221	025	334	054	455	099	589	160	739	244	916	355	92		
10	010	000	116	007	224	025	337	055	458	100	591	161	743	245	920	358	90		
12	012	000	118	007	226	026	339	056	460	101	594	163	746	247	923	360	88		
14	015	000	120	007	228	026	341	057	463	102	597	164	749	249	927	363	86		
16	017	000	122	007	230	027	344	057	465	103	600	165	752	251	931	366	84		
18	019	000	124	007	232	027	346	058	468	104	603	167	756	253	935	369	82		
20	021	000	126	008	235	027	348	059	471	105	606	169	759	255	939	372	80		
22	023	000	128	008	237	028	351	059	473	106	608	171	762	257	943	374	78		
24	025	000	131	009	239	028	353	060	476	107	611	172	766	259	947	377	76		
26	027	000	133	009	241	029	355	061	478	109	614	174	769	261	951	379	74		
28	029	000	135	009	243	029	358	062	481	110	617	175	772	263	955	382	72		
30	031	000	137	009	246	030	360	063	483	111	620	176	776	265	959	385	70		
32	034	001	139	010	248	030	362	064	486	112	623	178	779	267	963	388	68		
34	036	001	141	010	250	031	365	064	489	113	626	179	782	269	967	391	66		
36	038	001	143	010	252	031	367	065	491	114	629	181	786	272	971	394	64		
38	040	001	146	010	255	032	370	066	494	115	632	183	789	274	975	397	62		
40	042	001	148	011	257	032	372	067	496	116	635	185	793	276	979	400	60		
42	044	001	150	011	259	033	374	068	499	117	638	186	796	278	983	403	58		
44	046	001	152	011	261	033	377	068	502	119	641	188	799	280	986	405	56		
46	048	001	154	012	263	034	379	069	504	120	643	189	803	282	992	408	54		
48	050	001	156	012	266	034	381	070	507	121	646	190	806	285	996	411	52		
50	052	001	158	012	268	035	384	071	510	122	649	192	810	287	1000	414	50		

52	055	001	161	013	270	036	386	072	512	124	652	193	813	289			48
54	057	002	163	013	272	036	389	073	515	125	655	195	817	291			46
56	059	002	165	013	275	037	391	074	517	126	658	197	820	293			44
58	061	002	167	014	277	037	394	075	520	127	661	199	824	295			42
60	063	002	169	014	279	038	396	075	523	129	664	200	827	298			40
62	065	002	171	014	281	040	398	076	525	130	667	202	831	300			38
64	067	002	173	015	284	040	401	077	528	131	670	204	834	302			36
66	069	002	176	015	286	041	403	078	531	132	673	206	838	305			34
68	071	002	178	015	288	041	406	079	534	134	677	208	841	307			32
70	073	003	180	016	291	042	408	080	536	135	680	209	845	309			30
72	076	003	182	016	293	042	411	081	539	136	683	211	849	311			28
74	078	003	184	016	295	043	413	082	542	138	686	212	852	314			26
76	080	003	186	017	297	043	415	083	544	139	689	214	856	316			24
78	082	003	189	017	300	044	418	084	547	140	692	216	860	318			22
80	084	003	191	018	302	044	420	085	550	142	695	218	863	321			20
82	086	004	193	018	304	045	423	086	552	143	696	220	867	323			18
84	088	004	195	018	306	045	425	087	555	144	701	221	871	326			16
86	090	004	197	019	309	046	428	088	558	145	704	223	874	328			14
88	092	004	199	019	311	047	430	089	561	146	708	225	878	330			12
90	094	004	202	020	313	048	433	090	563	148	711	227	882	333			10
92	097	005	204	020	316	048	435	091	566	149	714	229	885	335			08
94	099	005	206	021	318	049	438	092	569	150	717	231	889	338			06
96	101	005	208	021	320	050	440	093	572	152	720	233	893	340			04
98	103	005	210	021	323	050	443	094	575	153	723	235	897	343			02
100	105	006	213	022	325	051	445	095	577	155	727	236	900	346			00
$\frac{+\Delta X}{+\Delta Y}$	14-00		13-00		12-00		11-00		10-00		9-00		8-00		7-00		$\frac{+\Delta X}{+\Delta Y}$
$\frac{+\Delta Y}{-\Delta X}$	29-00		28-00		27-00		26-00		25-00		24-00		23-00		22-00		$\frac{+\Delta Y}{-\Delta X}$
$\frac{-\Delta X}{-\Delta Y}$	44-00		43-00		42-00		41-00		40-00		39-00		38-00		37-00		$\frac{-\Delta X}{-\Delta Y}$
$\frac{-\Delta Y}{+\Delta X}$	59-00		58-00		57-00		56-00		55-00		54-00		53-00		52-00		$\frac{-\Delta Y}{+\Delta X}$
KP	0-105		105-213		213-325		325-445		445-577		577-727		727-900		900-1000		KP

NAPOMENA:

Kp = tga

Kd = seca

06315715

Ovaj postupak se izvodi na obrascu TPG-4 (izračunavanje topografskih elemenata), prema označenom tijeku rada. Da bi se odredile vrijednosti u rubrici 13 (Kd-koeficijent daljine) i 14 (AzG) koristi se tablica za izračunavanje topografskih elemenata cilja (repera) (tabl. 1-A i 1-B).

06315716

Postupak (primjer 3-A):

1. redom upisati poznate podatke (rubrike 1 do 8),
2. izračunati rubrike 9 ($\Delta X = XC - XPP$) i 10 ($\Delta Y = YC - YPP$) upisujući i dobijene predznake,
3. veću razliku koordinata (po apsolutnoj vrijednosti) upisati, uvijek s pozitivnim predznakom, u rubriku 11,
4. podijeliti manju s većom razlikom koordinata (K_p), rezultat zaokružiti na tri decimale i uvijek pozitivan upisati u rubriku 12; u istu rubriku, u kutu, upisati koje su razlike dijeljene i koji su bili njihovi predznaci npr:

$$\frac{+\Delta X}{-\Delta Y}$$

5. u tablici 1 pronaći vrijednost K_p u odgovarajućem lijevom stupcu, te uz nju očitati pripadajuću vrijednost koeficijenta daljine K_d u desnom stupcu i upisati ga u rubriku 13 (pozor: vrijednost K_d je uvijek veća od 1, tj. 1, ...),
6. u gornjem ili donjem dijelu tablice pronaći red koji odgovara odnosu

$$\frac{+\Delta X}{-\Delta Y}$$

dijeljenih razlika koordinata iz rubrike 12 (npr: $-\Delta Y$). U presjeku toga reda i stupca u kojem se nalazi K_p očitati vrijednost stotica tisućitih AzG. Desetice i jedinice tisućitih AzG čitaju se iz krajnjeg lijevog ili krajnjeg desnog stupca tablice i to u redu u kojem se nalazi K_p , a po slijedećem pravilu: ako je odnos koordinatnih razlika iz rubrike 12 pronađen u gornjem dijelu tablice, desetice i jedinice AzG čitaju se iz krajnjeg lijevog stupca tablice; ako je pak odnos koordinatnih razlika pronađen u donjem dijelu tablice, desetice i jedinice AzG čitaju se iz krajnjeg desnog stupca tablice. Očitane desetice i jedinice dodaju se na ranije očitane vrijednosti stotica i tako izračunava AzG i upisuje u rubriku 14,

7. u rubrici 15 izračunava se smisao i veličina skretanja od OP prema formuli:

$$\text{skretanje od OP} = AzG - AzOP,$$

* ako je rezultat pozitivan skretanje je desno, a ako je negativan ono je lijevo,

8. u rubrici 16 izračunati K za C prema formuli:

$$K = OK \pm \text{skretanje od OP},$$

* ako podjele na ciljničkoj napravi oružja rastu u smislu suprotnom smislu kretanja satne kazaljke, skretanje od OP sa smislom lijevo se dodaje na OK, a sa smislom desno oduzima od OK, a u suprotnom obrnuto,
 smislu kretanja podjele na ciljničkoj napravi obrnuto,

$$Dt = Kd \times \text{veća razlika koordinata},$$

10. izračunati visinsku razliku C i PP (rubrika 18):

$$\Delta Z = ZC - ZPP,$$

11. izračunati mjesni kut S, sa PP na C (rubrika 19):

06315717

$$S = \frac{\Delta Z[m]}{Dt[km]}$$

(predznak S je jednak predznaku ΔZ),

12. ovisno o kutnoj podjeli na oružju izračunani kut S pretvara se u podjelu 64-00 (dodavanjem 2%) ili 60-00 (oduzimanjem 5%); da bi se izvršilo ovo pretvaranje potrebno je izračunati vrijednosti 2% ili 5%, koje se izračunavaju množenjem rubrike 19 sa 0.02 ili 0.05, a rezultat upisati u rubriku 20, da bi se kasnije pribrojio S,

13. popravak tabličnog zbog mjesnog kuta (pS) određuje se na temelju popravljene daljine, mjesnog kuta i punjenja, na dva načina:

a) ako je $S < 0-30$, prema formuli:

$$pS = S \times k \quad (k \text{ se čita iz osnovnih tablica u TG prema } Dp)$$

b) ako je $S > 0-30$,

pS se čita iz pomoćnih tablica u TG prema Dar za Dp,

te upisuje u rubriku 21.

Popravljen daljina dobija se dodavanjem popravaka na topografsku, te se stoga ova rubrika izračunava tek po izračunavanju ili saznanju popravaka.

14. u rubriku 22 se upisuje zbir $S \pm \Delta S \pm pS$ koji se naknadno dodaje na osnovni položaj MjS i time se izračunava MjS:

$$MjS = OPMjS \pm S \pm \Delta S \pm pS$$

Napomena: u skraćenoj pripremi p/e nije nužno uračunavanje pS (osim obvezatnog uračunavanja pri gađanju gornjom skupinom kutova i pri velikim vrijednostima S), te će u priložima sa skraćenom pripremom p/e biti izostavljen.

*English Translation**ET 0631-5673-0631-5717 partial*

FIRING TABLES

For

130 mm M46 CANNON

/.../

3. THE USE OF THE GRAPHICAL PART OF THE FIRING TABLES

153. The graphical part of the tables includes:

- **charge selection chart**, which may be found at the beginning of the tabular part of the tables, and
- **graphical firing table** for every charge, at the beginning of the tabular part or the charge.

154. The Charge Selection Chart is given for contact-fuse projectiles M79 and OF-482M, with the solid line representing the highest elevation (≈ 833 mils) for each charge. Site angles are represented by radial lines by 100 mils.

The charge is selected in the following way:

- all targets that lie between the ascending branch of the highest elevation and the safety curve may be fired at with this charge;

Example 1: Selecting charge for $D_{tc} = 19000$ m, with contact-fuse projectiles M79, $S = 0$;

No. 1 charge or full charge may be used.

Example 2: Selecting charge for $D_{tc} = 20000$ m, $S = +300$ mils.

Only full charge may be used.

The above two examples show the handiness of the chart. It shows that you do not use the same charge for the target at the horizon or above or under it.

155. The Graphical Firing Table is given for all types of charge. It provides data for the ordinate of the trajectory for every point between the artillery piece and the target. The trajectories are given for every 100 mils, and the ordinate for elevations between the given trajectories may be reached by interpolation. The table also contains curves of equal flight times.

Example 1: No. 1 charge, firing at a target at 17000 m with a TF /contact fuse/ projectile M79.

Between the artillery piece and the target, at the distance of 10,000 m, there is a ridge rising above the artillery piece by 2000 m; the site angle of the target is $S = 0$ mils. Establish a possibility of shooting over the ridge.

This target corresponds to the trajectory of 346 mils, with the ordinate of 2500 m between the artillery piece and the ridge, which allows firing at the target.

Example 2: No. 2 charge, firing at a target at 13000 m, which is 500 m under the horizon of the artillery piece. At the distance of 9000 m from the artillery piece, between it and the target, there is a ridge rising above the artillery piece by 1500 m. Establish a possibility of shooting over the ridge.

This target corresponds to the trajectory of 240 mils, with the ordinate of 1000 m at the ridge's distance, which does not allow firing at the target.

4. – THE USE OF TABLE I

156. Table I provides data for selecting firing charge. The charge is selected in such a way that it gives the best effect produced by the projectile on a target with a possibility of making corrections. The fire is always carried out with a small charge which enables the effect at a given range.

157. Table I shows the table angles between 10° and up to about 45° . Table I does not show smaller angles (up to 20°) (targets up to these distances may be fired at with any charge) rather, the most suitable charge is selected depending on the character of the target, desired effect and the smallest V_d .

158. The charge for the ricochet fire is selected based on the angle of fall. The angle of fall is calculated, depending on the gradient, by adding the gradient angle to the **provisional** impact angle ($Q = 20^\circ$ or 3-33) (n) or by subtracting from it. The front incline: $\Theta = Q - n$; the rear incline: $\Theta = Q + n$

Once the angle of fall is calculated, and knowing the firing range, a corresponding charge is then selected from the Firing Tables.

5. – THE USE OF TABLE II

159. The Tables II provide table angle, ballistic elements of the trajectory and the data for the correction of the direction and range caused by weather and ballistic conditions for every 200 meters.

Each charge and type of projectile has a separate Table II.

Table IIa provides data for the contact-fuse projectile M79 (with the fuse UTIU, M72 and BU-130-M83) and OF-482M (with the fuse RGM-2 and V-429), for 0 altitude of the firing position.

Table IIb contains data for the contact-fuse projectile OF-482M with the delayed-action fuse V-90, for 0 altitude of the firing position.

Table IIc provides data for the armour-piercing tracer projectile (BR-482B), for 0 altitude of the firing position.

Table IId provides data for the illuminating projectile SP-46 at the height of burst of 600 meters.

The data in the Tables II were entered in columns in a standardized way.

160. Column 1 – provides a corresponding **range** in meters for every 200 m.

When firing at distances between those given in the tables, the data are obtained by interpolation.

161. Column 2 – provides data for the **adjustments on the range finder**. This column is to be applied when using optical sights (range finders).

162. Column 2a - provides data for the **adjustments on the range finder**. This concerns range finders with the table angle that can be set both by adjustments and in mils (S 71-35).

163. Column 3 - provides data for the range finder in mils 1/6000. This column is applied when using a range finder or when fire is carried out by a quadrant 1/6000.

164. Column 4 – provides data for the table angle in **degrees and minutes**. The data in this column should be taken as **the most accurate** and used when firing by use of the quadrant in degrees.

165. Column 5 – provides data for the **selection of the altitude of the layer** from the “weather-medium” bulletin.

166. Column 6 – provides data for the **ordinate of the trajectory at summit** in meters; this is used to calculate corrections of the direction and range due to wind and corrections of the range due to air temperature.

167. Column 7 – provides data for the **time of flight of the projectile** in seconds. Data from this column are used to distinguish explosions of own projectiles, to calculate deflection of moving targets and to realize planned fire.

168. Column 8 – provides data for the **terminal velocity** in m/s and is used to calculate the energy of the point of fall.

To calculate the impact energy one must first break down the terminal velocity (V_k) into two components – vertical (V_y) and horizontal (V_x):

$$V_y = V_k \cdot \sin \Theta \quad \text{and} \quad V_x = V_k \cdot \cos \Theta$$

The impact energy (E_k) is the actual force of the projectile at the point of impact. Its vertical component (E_y) is taken into account when firing at horizontal targets, and its horizontal component (E_x) when firing at vertical targets:

$$E_y = \frac{p \cdot V_k^2 \cdot \sin^2 \Theta}{2g} \quad \text{and} \quad E_x = \frac{p \cdot V_k^2 \cdot \cos^2 \Theta}{2g}$$

169. Column 9 – provides data for the **angle of fall Θ_c** in mils 1/6000.

The purpose of the data in this table is to take, from Table IV, the coefficient to calculate the scale of a probable deviation and jump by range, when target is on an incline. In addition, the angle of fall provides data to calculate the impact angle i.e. to calculate a possible ricochet when needed, or that there will be no ricochet when not needed, as well as for a possibility to fire targets on the rear incline.

170. Column 10 – provides data for **setting delayed action in adjustments** on the delayed-action fuse V-90. The setting of delayed action is provided for the height of burst when the muzzle points at the horizon.

171. Column 10 – in the Table IId for **illuminating projectile SP-46**, provides data for setting delayed action in adjustments on the fuse TM-16L (TM-16M), which should be set according to corresponding ranges in order to obtain the height of the flare of 600m.

172. Column 11 – provides data on the extent of a **probable deviation by range (V_d)** in meters. The extent of V_d on the ground depends on the charge selected, the range and gradient. The V_d is smaller on the front incline and larger on the rear incline than provided in the table. The extent of disparity between the V_d on the ground and the one provided in the table is calculated by Table IV.

The value of V_d is crucial for the zone of security of infantry and the probability factor which provides data in Table VII on the percentage of expected hits on a single target.

173. Column 12 – provides data on the extent of a **probable deviation by direction** (V_p) in meters. The value of the V_p is crucial for the range of the danger zone and the probability factor when carrying out lateral fire or shooting narrow targets.

174. Column 13 - provides data on the extent of a **probable deviation by altitude** (V_y) in meters.

175. Column 14 - provides data on the extent of a **probable deviation of burst by distance** (V_{rd}) in meters for the delayed-action fuses V-90 and TM-16L (TM-16M).

176. Column 15 - provides data on the extent of a **probable deviation of burst by altitude** (V_{rv}) in meters for the delayed-action fuses V-90 and TM-16L (TM-16M).

Corrections of direction

The corrections of direction are given in mils (1/6000).

177. Column 17 – provides corrections of direction in mils caused by derivation. Since projectiles drift right due to derivation, the correction of direction will be to the left.

178. Column 18 – provides corrections of direction in mils caused by the **lateral wind component** by W_y -10 m/s. The lateral wind component alters the direction /of the projectile/; the correction is made in the direction of the wind, and the implication of the lateral wind component is determined by Table VI based on the angle and the speed of the wind. The way to calculate the angle of the wind is given in Table VI.

The correction of direction due to wind is taken for the ordinate of the trajectory at summit.

When computing corrections of direction caused by wind, the reading in this column should be divided by 10 and multiplied by the lateral wind component from Table VI.

179. Column 19 – provides corrections of direction caused by the **inclination of the cradle trunnion**. Since projectiles shift towards the lower side due to mass, the correction needs to be made in the opposite direction.

In order to calculate the correction of direction caused by the inclination of the cradle trunnion, the reading in this column needs to be divided by 10 and the result multiplied by the value of the inclination in mils.

Corrections of range

180. Column 21 – provides corrections of range in meters caused by the **crosswind component** by $W_x=10$ m/s. The crosswind component changes the range in two ways: it increases it – if the wind is in the direction of fire, and it decreases it - if the wind is in the opposite direction. In the former case the correction is negative and in the latter it is positive.

The corrections of range caused by the wind are taken for the ordinate of the trajectory at summit. The value for the crosswind component is given in Table VI after the wind is broken down into components. In order to calculate the correction of the range, the reading in this column needs to be divided by 10, thus getting the correction by $W_x=1$ m/s, and the result multiplied by the number for the crosswind component from Table VI.

181. Column 23 – provides corrections of range in meters caused by the variation in the air temperature by $\Delta t = 10^\circ \text{C}$.

If the temperature is higher than standard (as provided in the table), the air is thinner and the range increases, rendering the correction negative and vice versa.

An increase in temperature by 10° decreases the air density for about 45 g/m^3 , and with a change in altitude by about 180 m the air temperature changes by 1°C . The higher the altitude, the lower the temperature.

To calculate corrections of range caused by the variation in air temperature, the reading in this column needs to be divided by 10 and the result multiplied by a temperature deviation at the peak of the trajectory (the ordinate of the trajectory at summit).

In case there is no weather bulletin, the deviation of ground temperature needs to be taken instead.

182. Column 24 – provides corrections of range in meters caused by the variation in **the air pressure** by $\Delta H=10$ mbar.

The variation in air pressure is provided by a weather station for its altitude. In case the altitude of the station is different from that of the firing position, the variation

in air pressure for the altitude of the firing position needs to be converted by use of Tables XIa and XIb, which readings are in mbar.

The air pressure evenly decreases as the altitude rises, approximately by 13 mbar for every 100 meters.

In case the variation in air pressure is negative (the pressure is lower than standard – as provided in the tables), the air is thinner and the projectile has larger range, then the correction needs to be subtracted and vice versa.

To calculate the correction of range, the reading in this column needs to be divided by 10, thus getting the correction of range by $\Delta H = 1$ mbar, and the result multiplied by the difference in air pressure minus the altitude of the firing position.

183. Column 25 – provides corrections of range in meters caused by the variation in **muzzle velocity** by $\Delta V_0 = 10$ m/s. The correction is taken from this column because the muzzle velocity deviates from the one given in the table.

Low muzzle velocity decreases range, thus the correction needs to be added.

To calculate the correction of range, the reading from this column needs to be divided by 10, thus getting a correction by $\Delta V_0 = 1$ m/s, and the result multiplied by a decrease in muzzle velocity in m/s relative to the velocity indicated in the table.

184. Column 26 – provides corrections of range in meters caused by variations in the **temperature of the propellant** $\Delta t_b = 10^\circ\text{C}$.

The higher the propellant temperature, the higher the muzzle velocity, which renders the correction negative and vice versa.

The table temperature of the propellant is 15°C (288K)

To calculate the correction caused by the variation in propellant temperature, the reading in this column needs to be divided by 10 and the result multiplied by the difference between the actual temperature and the one provided in the table.

185. Column 27 – provides corrections of range in meters caused by the deviation in **the mass of the projectile** from the standard one by $\Delta m = 1$ of the sign.

All projectiles of the standard mass have the sign N.

The larger the mass of a projectile, the lower the muzzle velocity and the deceleration due to air resistance and vice versa. Lower muzzle velocity gives smaller range, but smaller deceleration due to air resistance gives larger range. The total

correction in this column is equal to the sum of corrections caused by the difference in muzzle velocity and the deceleration due to air resistance.

The correction caused by the influence of projectile's mass on the muzzle velocity is better manifested at smaller ranges, thus the correction is positive. Smaller deceleration due to air resistance, however, is better manifested at higher ranges, thus the range is bigger and the value of the correction is decreasing.

To calculate the correction caused by the variation in projectile's mass, the reading in this table needs to be multiplied by the difference between the signs for the mass and the standard mass.

186. Column 33 – provides data on the shift in the **point of fall** by distance, changing the range finder (table angle) by 1 mil.

187. Column 34 – provides data on how much 1 adjustment on the altitude scale of the panorama (range finder, quadrant) changes the **altitude of the point of fall** in meters. Data in this column are used for direct fire of vertical targets.

188. Column 40 – provides data on the necessary **change of the table angle (elevation)** in order to change the height of burst by 100 m.

189. Column 40a – provides data on the necessary **change in delayed action** when the height of burst changes by 100 m.

190. Columns 46 and 46a – provides the degree of correction of the **table angle caused by the site angle of the target** (pS), for every mils of the site angle (either positive or negative). The column also shows whether the correction is positive or negative.

This column is used to calculate corrections of the table angle caused by the site angle only for the site angles up to ± 30 mils.

For larger site angles use Table III. If there is time, Table III should also be used even for smaller values of the site angle, because it gives more accurate reading of the pS.

191. Table IIe provides fire tables for contact-fuse projectile M79 with the fuses UTIU, M72 and BU-130-M83, and for contact-fuse projectile OF-482M with the fuses RGM-2 and V-429, and are used in alpine conditions. The air pressure and temperature change as the altitude changes, which has a direct influence on the range when using the same table angle. In order to take into account the influence of these changes, the firing tables for alpine conditions provide the interdependence of the range for the altitudes of 500, 1000 and 1500 meters at the same table angle. The

alpine tables do not provide corrections caused by weather and ballistic conditions for the above altitudes, because such tables would be voluminous and unhandy, and would not improve the accuracy of fire. **Therefore, when using these alpine firing tables, the corrections of direction and range caused by weather and ballistic conditions, as well as the data on the elements of the trajectory by range, should be taken from the basic firing tables.**

When carrying out artillery fire from firing positions higher than 250 m, it is obligatory to use firing tables for alpine conditions, because this will prevent errors in range and improve the accuracy of fire.

192. Table II_f provides the tables for alpine conditions for the contact-fuse projectiles OF-482M with the delayed-action fuse V-90.

193. Table II_g provides the tables for alpine conditions for the illuminating projectile SP-46 with the fuse TM-16L (TM-16m).

To determine deviation in the readings of air pressure and temperature from the standard table readings for any given altitude (Z), use Tabular Overview 7, which gives readings for the change in air pressure and temperature under standard conditions (as given in the table) for conventional table altitudes (Z).

Tabular Overview 7

Altitude	Table air temperature	Table air pressure
m	°C	m bar
0	15.9	1000
500	12.7	942
100	9.6	887
1500	6.4	834

The procedure of determining the said deviations in temperature and air pressure is the same as with the standard 0 altitude, except that the table readings for the temperature are no longer 15.9 °C or the air pressure 1000 mbar, rather they are the readings from the Overview 7 that correspond to standard values of the altitude (Z) at which the fire is carried out.

Since the tables for the range are given for every 200 meters, and the readings of the table angle for altitudes of the artillery piece are 500, 1000 and 1500 m, interpolation is needed when the firing position is at altitudes between those given

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above (for example 1420m) and the range is not a round number (for example 8530m).

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Chapter V

BASIC TABLES

1. **Charge Selection Chart** for the contact-fuse projectile M79 with the fuse UTIU, M72 and BU-130-M83 and the contact-fuse projectile OF-482M with the fuse RGM-2 and V429.
2. **Table Ia:** Charge selection for the contact-fuse projectile M79 with the fuse UTIU, M72 and BU-130-M83 and the contact-fuse projectile OF-482M with the fuse RGM-2 and V429.
3. **Table IIa:** Graphical and tabular firing tables for the contact-fuse projectile M79 with the fuse UTIU, M72 and BU-130-M83 and the contact-fuse projectile OF-482M with the fuse RGM-2 and V429.
4. **Charge Selection Chart** for the contact-fuse projectile OF-482M with the fuse RGM-2 and V429.
5. **Table Ib:** Charge selection for the contact-fuse projectile OF-482M with the fuse RGM-2 and V429.
6. **Table IIb:** Graphical and tabular firing tables for the OF-482M with the fuse RGM-2 and V429.
7. **Table IIc:** Tabular firing table for the armour-piercing tracer projectile BR-42 (BR-482B) with the fuse DBR.
8. **Table IId:** Tabular firing table for the illuminating projectile SP-46 with the fuse TM-16L (TM-16M).
9. **Table Iie:** Tabular firing tables for alpine conditions for the contact-fuse projectile M79 with the fuse UTIU, M72 and BU-130-M83 and the contact-fuse projectile OF-482M with the fuse RGM-2 and V429.

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10. **Table II_f:** Tabular firing tables for alpine conditions for the contact-fuse projectile OF-482M with the fuse RGM-2 and V429.
11. **Table II_g:** Tabular firing table for alpine conditions for the illuminating projectile SP-46 with the fuse TM-16L (TM-16M).

TABLES Ia and IIA

Charge Selection Chart.

Charge selection.

Graphical and tabular firing tables for:

Contact-fuse projectile M79 with the fuse UTIU, M72 and BU-130-M83,

Contact-fuse projectile OF-482M with the fuse RGM-2 and V429.

*English Translation**ET 0631-5673-0631-5717 partial*

CHARGE SELECTION CHART
130mm M-46 CANNON
CONTACT-FUSE PROJECTILE M79 AND OF-482M
/see original for numbers/

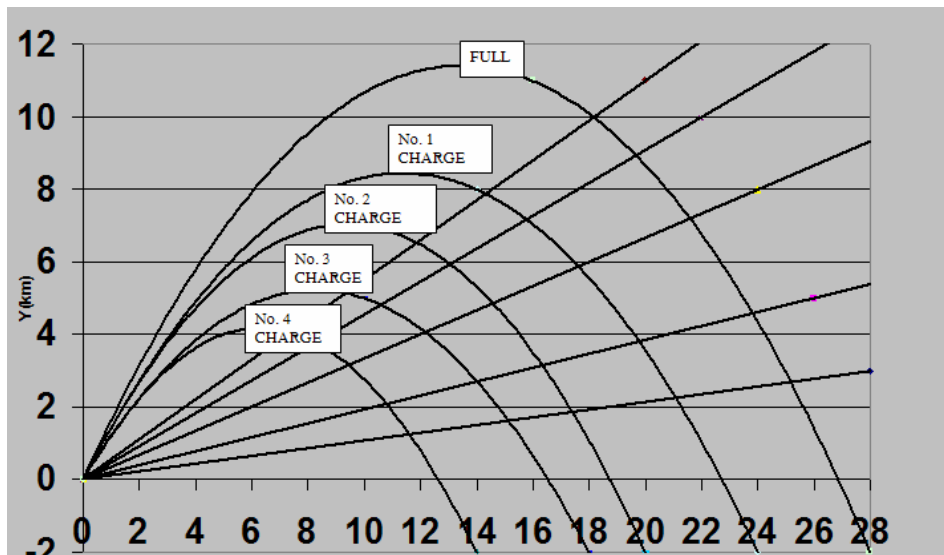


Table IIa

CONTACT-FUSE PROJECTILE M79

CONTACT-FUSE PROJECTILE OF-482M

Range	Range finder			Table angle	Altitude required to select a layer in the weather bulletin	Ordnate of the trajectory at maximum altitude	Flight time	Terminal velocity	Angle of drop	Probable deviation of trajectory by		
	Telescopic sights	Mechanical	1:6,000							Range(Vd)	Direction (Vp)	Altitude (Vv)
m	grade			°	m	m	s	m/s	in thousands		metres	
1	2	2a	3	4	5	6	7	8	9	11	12	13

/see original for numbers/

Full charge
V_o = 930 m/s

WITH UTIU, M72 and BU-130-M83 FUSE
WITH RGM-2 and V-429 FUSE

Adjusting												
direction because of			distance because of									
Derivation	Lateral wind W _v =10 m/s	The inclination of the cradle trunnion by 10,000	Longitudinal wind W _c =10 m/s	deviation					Shifting the drop point by range if table angle is changed by 1/1000			
				air TemperatureΔt =10°C	Air pressure ΔH=10mbar	Initial velocity V _o =10 m/s	powder Temperature Δ _{th} =10°C	Projectile mass Δp=1 mark				
1/1000			m e t r e s					m	1/1000	s	m	
17	18	19	21	23	24	25	26	27	33	46	46a	1
								Correction to the site angle (ps) for each	+1	-1	Range	

Public Annex V

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TABLICE GAĐANJA

ZA

SAMOVOZNI VIŠECIJEVNI RAKETNI LANSER 122mm M-21-OF

I

SAMOVOZNI VIŠECIJEVNI RAKETNI LANSER 122mm VULKAN

TT - 74

TT - 74 m

TT- 74 M

06315719

-1-

**SVATKO TKO POSJEDUJE OVE TABLICE I RUKUJE ISTIMA,
PREUZIMA POTPUNU ODGOVORNOST ZA RAD SA NJIMA I
ODGOVARA ZA NJIH.**

**NESTANAK, OŠTEĆENJE ILI UNIŠTENJE TABLICA
GAĐANJA, OBVEZATNO PRIJAVITI ZAPOVJEDNIKU.**

**TABLICE GAĐANJA PREDSTAVLJAJU SLUŽBENU TAJNU,
RUKOVATELJI OVIM TABLICAMA DUŽNI SU PODUZETI SVE
POTREBITE MJERE DA ISTE NE DOSPIJU U RUKE NEPRIJATELJU.**

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-2-
VAŽNE NAPOMENE ZA GAĐANJE SVLR 122 mm "VULKAN"

=====

SVE VRIJEDNOSTI U TABLICAMA GAĐANJA IZRAŽENE U TISUĆITIMA ,
PREDSTAVLJAJU TISUĆITE 1/6000 OBUJMA KRUGA. IZNIMKA OVOG JE SAMO
VRIJEDNOST DALJINARA KOJA JE, RADI BRŽEGA RADA, IZRAŽENA U OBJE
PODJELE (1/6000 I 1/6400)
NAPRIJED NAVEDENO TREBA POSEBNO IMATI NA UMU PRIGODOM GAĐANJA,
ODNOSNO IZRAČUNAVANJA ELEMENATA ZA GAĐANJE ZA
SVLR 122 VULKAN IZ RAZLOGA ŠTO SU NJEGOVE CILJNE SPRAVE IZVEDENE U
TISUĆITIMA 1/6400 OBUJMA KRUGA.

STOGA, KADA SE GAĐA SVLR 122 mm "VULKAN":

1.PRIGODOM IZRAČUNAVANJA METEOBALISTIČKIH POPRAVKI ELEMENATA
POMOĆU TABLICA GAĐANJA, SVE VRIJEDNOSTI IZRAČUNATIH POPRAVKI U
TISUĆITIMA (DOBIJENE U PODJELI 1/6000) OBVEZATNO PRETVARATI PO
POMOĆNIM TABLICAMA (DAJU TOČNIJE VRIJEDNOSTI OD KOEFICIJENATA) U
TISUĆITE 1/6400 OBUJMA KRUGA.

2.TREBA IMATI NA UMU DA JE TABLICA ZA RASČLANJIVANJE VJETRA NA
KOMPONENTE DATA SAMO ZA PODJELU 1/6000 JER SU VRIJEDNOSTI
POPRAVKA U TABLICAMA GAĐANJA, SHODNO NAVEDENOM NA POČETKU,
IZRAŽENE U TISUĆITIMA 1/6000 OBUJMA KRUGA. STOGA, AKO JE PRAVAC
VJETRA IZRAŽEN U TISUĆITIMA PODJELE 1/6400 ILI STUPNJEVIMA,
OBVEZATNO JE NJEGOVU VRIJEDNOST PRETVORITI U TISUĆITE 1/6000
OBUJMA KRUGA, PA PREMA TAKVOM VJETRU I AZIMUTU GAĐANJA U
TISUĆITIMA 1/6000 (AKO JE U PODJELI 1/6400 OBVEZATNO GA PRETVORITI U
PODJELU 1/6000) ODREDITI KUT VJETRA I NJEGOVE KOMPONENTE ("PRI TOME
NE KORISTITI PREDZNAKE KOMPONENTI NAZNAČENE IZNAD **KUTEVA
VJETRA U TABLICI ZA RASČLANJIVANJE VJETRA NA KOMPONENTE**
I PREDZNAKE POPRAVKI ZBOG VJETRA U TABLICAMA GAĐANJA, VEĆ
PREDZNAKE IZRAČUNATIH POPRAVKI PRAVCA ZBOG VJETRA (BOČNOG)
OBVEZATNO ODREĐIVATI PREMA TABLICI "PREDZNACI POPRAVKI", POD"2.
PREDZNACI POPRAVKI PRAVCA").

SA TAKO ODREĐENIM KOMPONENTAMA VJETRA I VRIJEDNOSTIMA POPRAVKI
ZBOG VJETRA IZ TABLICA GAĐANJA IZRAČUNATI ĆE SE POPRAVKE U
TISUĆITIMA 1/6000 OBUJMA KRUGA KOJEM POTOM OBVEZATNO PRETVARATI
PO POMOĆNIM TABLICAMA U PODJELU 1/6400.

3.POPRAVKE KUTOMJERA (PRAVCA), OVISNO O NJIHOVIM PREDZNACIMA,
PRAVILNO DODAVATI ILI ODUZIMATI, UZIMAJUĆI U OBZIR DA KUTOMJER NA
NJEGOVOJ CILJNOJ SPRAVI RASTE U SUPROTNOM SMJERU SATNE KAZALJKE,
ODNOSNO SUPROTNOM NEGO NA CILJNOJ SPRAVI SVLR M-21-OF.

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-3-

I. Osnovna upozorenja

Potpuna osnovna upozorenja

1. Raketni projektil **M-21-OF** označeni sa oznakom **9 M 22** trebali bi biti ispaljivani u skladu sa uvjetima za projekte sa oznakom **9 M 22 U**.

2. Identifikacija kočionih prstena (označenih crnom bojom) napravljena je ovako:

- veliki kočioni prsteni; označeni sa **640/73** - projektili su označeni sa oznakom **9 M 22/B**, a prsteni označeni sa **641/73** - projektili su označeni sa oznakom **9 M 22 U/M**;

- mali kočioni prsteni; označeni sa **640/73** - projektili su označeni sa oznakom **9 M 22/M**, a prsteni označeni sa **641/73** - projektili su označeni sa oznakom **9 M 22 U/m**.

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-4-

1. Zabranjeno je gađati:

Redni broj	U kojim uvjetima	Sa kojom vrstom projektila	Iz kojeg razloga
1.	Sa upaljačima (oznake 9 E 210) čija je membrana slomljena ili oštećena	M - 21 - OF	Mmoguća je prerana eksplozija projektila
2.	Kada čašica detonatora upaljača, tijelo bojne glave ili tijelo raketnog dijela ima prijelomne ili hrdave erozije ili duboka oštećenja	M - 21 - OF	Moguća je prerana eksplozija projektila
3.	Kada je kočioni prsten projektila deformiran ili nepropisan	M - 21 - OF	Moguć je normalan let projektila

2. Upozorenja za gađanje:

1. Ove tablice namjenjene su za gađanje sa raketnim topničkim bojnim vozilom **M-21-OF 122 mm**, raketnim projektilima oznake **9 M 22 U** ili **9 M 22** bez kočionog prstena, sa malim kočionim prstenom Φ **90 mm** i sa velikim kočionim prstenom Φ **112 mm**. Ovi projektili su opskrbljeni upaljačem oznake **9 E 210**.

2. Kada se gađa projektilima oznake **9 M 22** moraju se koristiti ove tablice. Uvodeći slijedeće dodatne popravke po daljini:

- minus **130 m** kada se gađa projektilima bez kočionog prstena
- minus **70 m** kada se gađa projektilima sa malim kočionim prstenom
- minus **40 m** kada se gađa projektilima sa velikim kočionim prstenom

3. Kada se gađa **M-21-OF** projektilima, mora se uvesti u svim slučajevima dodatna popravka po pravcu koja iznosi **d 0-07**.

4. Kočioni prstenovi koriste se za poboljšanje točnosti posrednog gađanja. Ovisno o daljini gađanja i vrsti prstena, u normalnim uvjetima gađanja, ove tablice trebaju se upotrebljavati ovako:

Dalajina gađanja u km	Kočioni prsten	Uporabiti tablice gađanja
Od 1.4 do 12.0	Veliki	TT-74 M Veliki prsten
Od 12.0 do 15.9	Mali	TT-74 m Mali prsten
Od 15.9 do krajnjeg dometa	Bez prstena	TT-74 Bez prstena

Gađnje projektilima **M-21-OF** na daljinama do **5 km** izvodljivo je u izuzetnim sličajevima i samo u situacijama kada nema vlastitih postrojbi na pravcu gađanja,

-5-

budući da se zbog velikog rasipanja projektila na ovim daljinama gađanja mogu dogoditi značajni podbačaji.

5. Gađanje projektilima M-21-OF dozvoljeno je samo pri temperaturama punjenja od **-40°C do +50°C**.

6. Balistički vjetar u aktivnom dijelu putanje mjereno je kao srednji vjetar aktivnog dijela putanje, stoga bi trebao biti uzet u obzir istovremeni utjecaj svake komponente (bočne i uzdužne) skretanja projektila i po daljini i po pravcu (dvojni utjecaj).

Ako nema gađanja kada se mjeri vjetar, početni elementi za gađanje mogu biti određeni korištenjem prizemnog vjetra, mjenog na visini od 3,5 m pomoću aerometra. Prizemni vjetar trebao bi biti mjen 2-4 puta prije nego što se raščlani na komponente (uzdužnu i bočnu).

Kada se koristi prizemni vjetar, ne bi trebao biti uzet u obzir dvojni utjecaj; u tom slučaju ne treba primjeniti popravku daljine zbog bočne komponente i popravku pravca zbog uložene komponente.

7. Bez obzira na postupak koji je korišten za određivanje elemenata za gađanje, uvođenje popravki (čak i približnih) zbog balističkog vjetra aktivnog dijela putanje (ili zbog prizemnog vjetra) i zbog odstupanja temperature raketnog punjenja datog tabličnom vrijednošću je obvezatno.

8. Priprema za gađanje projektilima **122 mm M-21-OF** izvršava se prema datim uputama.

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-6-

3. Predznaci popravki

1. Predznaci popravki daljine

Redni broj	Popravka	Predznak popravke
1.	Popravka zbog uzdužnog balističkog vjetra aktivnog dijela putanje: -- kut vjetra od 0-00 do 15-00 i od 45-00 do 60-00 (vjetar puše sprijeda, smanjuje daljinu) - kut vjetra od 15-00 do 45-00 (vjetar puše straga, povećava daljinu)	+ -
2.	Popravka zbog bočnog balističkog vjetra aktivnog dijela putanje: - kut vjetra od 0-00 do 30-00 (vjetar puše slijeva, povećava daljinu) - kut vjetra od 3-00 do 60-00 (vjetar puše s desna, smanjuje daljinu)	- +
3.	Popravka zbog uzdužnog balističkog vjetra pasivnog dijela putanje: - kut vjetra od 0-00 do 15-00 i od 45-00 do 60-00 (vjetar puše sprijeda, smanjuje daljinu) - kut vjetra od 15-00 do 45-00 (vjetar puše straga, povećava daljinu)	+ -
4.	Popravka zbog odstupanja temperature zraka i temperature raketnog baruta: - odstupanje temperature je pozitivno (temperatura je veća od normalne, povećava daljinu) - odstupanje temperature je negativno (temperatura je manja od normalne, smanjuje daljinu)	- +
5.	Popravka zbog odstupanja atmosferskog tlaka: - odstupanje tlaka je pozitivno (tlak veći od normalnog, smanjuje daljinu) - odstupanje tlaka je negativno (tlak je manji od normalnog, povećava daljinu)	+ -
6.	Predznaci komplementarnih popravki mjesnog kuta su prikazani u tablicama sa ovim popravkama	

2. Predznaci popravka pravca

Redni broj	Popravka	Predznak popravke
1.	Popravka zbog uzdužnog balističkog vjetra aktivnog dijela putanje: - kut vjetra od 0-00 do 15-00 i od 45-00 do 60-00 (vjetar puše sprijeda, skreće projektil u lijevo) - kut vjetra od 15-00 do 45-00 (vjetar puše straga, skreće projektil u desno)	udesno ulijevo
2.	Popravka zbog bočnog balističkog vjetra aktivnog dijela putanje: - kut vjetra od 0-00 do 30-00 (vjetar puše slijeva, skreće projektil u lijevo) - kut vjetra od 30-00 do 60-00 (vjetar puše zdesna, skreće projektil u desno)	udesno ulijevo
3.	Popravka zbog bočnog balističkog vjetra pasivnog dijela putanje: - kut vjetra od 0-00 do 30-00 (vjetar puše slijeva, skreće projektil u desno) - kut vjetra od 30-00 do 60-00 (vjetar puše zdesna, skreće projektil u lijevo)	ulijevo udesno

II. Tablice gađanja

- 1. M-21-OF Visoko eksplozivni raketni projektili
bez kočionog prstena (TT-74)**
- 2. M-21-OF Visoko eksplozivni raketni projektili
sa malim kočionim prstenom (TT-74 m)**
- 3. M-21-OF Visoko eksplozivni raketni projektili
sa velikim kočionim prstenom (TT-74 M)**

-8-

1. Tablice gađanja

**Za M-21-OF Visoko eksplozivne raketne projekte
bez kočionog prstena**

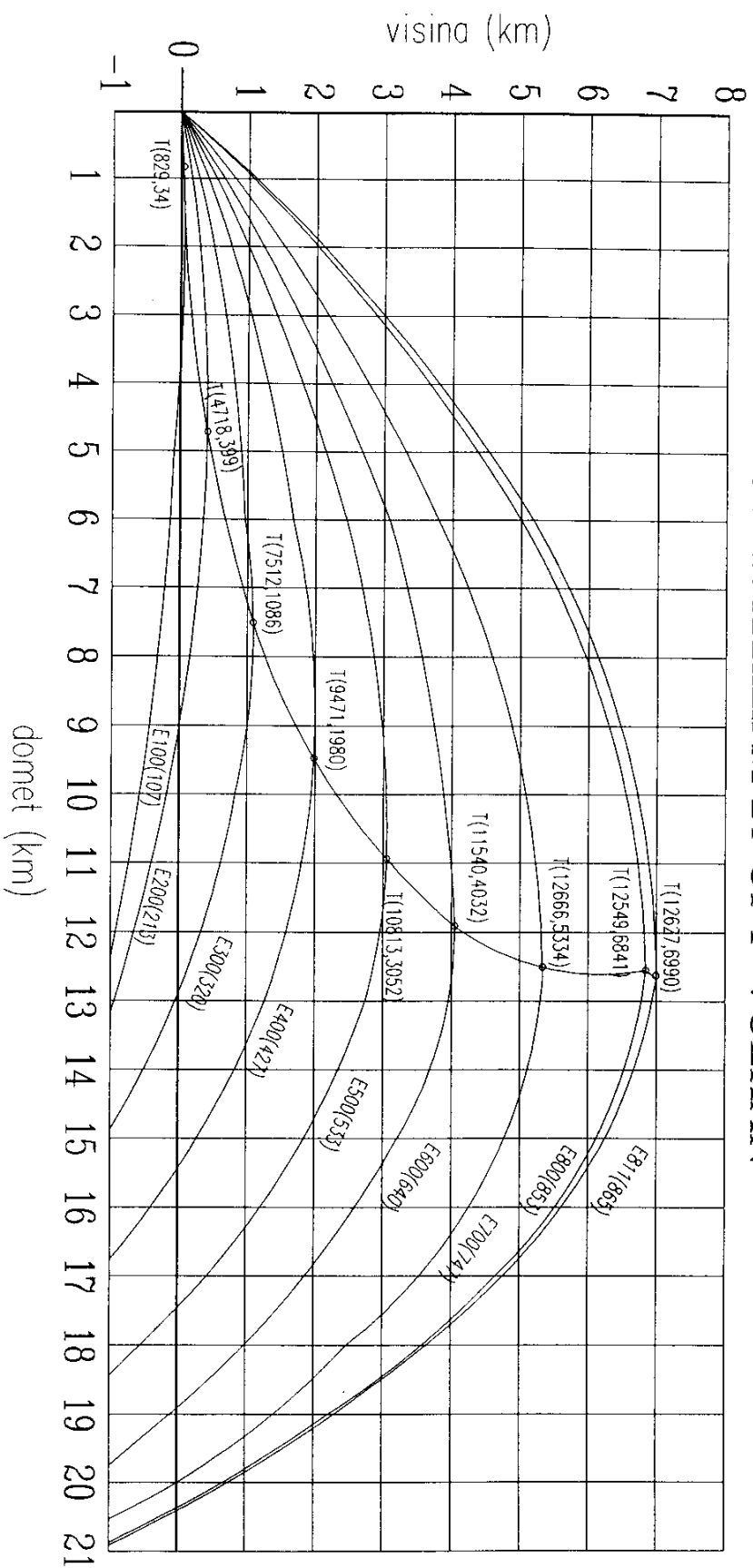
TT-74

**Kada se gađa projektilima oznake 9 M 22, uvedite dodatnu popravku
daljine od - 130 m.**

**Kada se gađa projektilima oznaka 9 M 22U i 9 M 22,
uvedite dodatnu popravku sustavnih devijacija (skretanja) projektila
po pravcu, koja iznosi d 0-07.**

GRAFIČKA TABLICA GAĐANJA ZA SVLR 122mm M-21-OF I "VULKAN"

BEZ KOČIONOG PRSTENA



Kutevi elevacije (E) dani su u podjeli 1/60-00 obujma kruga (izvan zgrade) i u podjeli 1/64-00 obujma kruga (u zgradi) točka T predstavlja tjeme putanje koje je određeno udaljenošću tjemena od PP (Xm; prvi broj u zagradi) i ordinatom tjemena putanje od horizonta PP (Ym; drugi broj u zagradi).

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M - 21 - OF Visoko eksplozivni raketni projektil

DALJINAR	VJEROJATNO SKRETANJE		POPRAVKE												Kut eleva- cije na kvad- rantu	Padni kut	Kraj- nja brzina	Vrije- me leta	Visi- na ula- ska u me- teo- bil- en 'se- dmi'	Ordi- nata tje- men- a puta- rije	DA- LJI- NA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	S	F	Ep	Ep	Ya	AD wat	AD wal	AE wat	AE tis	AD wpt	AR wpt	ARtA	ARH	ARtC								ARt																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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RSI - 12 M Praskasto punjenje

M - 21 - OF

Bez kočionog prstena

TT - 74

-10-

M - 21 - OF Visoko eksplozivni raketni projektili

DALJINAR	VJEROJATNO SKRETANJE										POPRAVKE										Kut eleva- cije na kvadrantu	Padni kut	Kraj- nja brzina	Vrste me- leta	Visi- na ula- ska u me- teo- bit- en- 'sre- dini'	Ordi- nata je- me- nita puta- nje	DA- LJI- NA
	S	ΔRmil	F	Ep	Ep	Ya	AD	AD	ΔE	ΔE	AD	ΔR	ΔRTa	ΔRH	ΔRTc	ΔRT	α	ω	Sr	ts							
m	tis	m	tis	m	m	m	wat	wat	tis	wat	tis	wpt	wpt	m	m	m	m	° >	°	m/s	s	m	m	m			
DA- LJI- NA	1/6000	1/6400	Pomak daljine za pomak kuta eleva- cije za 1 tisječit	Veliki- na prve rakije	Po- daljini	Po- pravka	Visi- na akti- nog dijela put- ovanja	Z-	Zbog	Zbog	Zbog	Zbog	Zbog	Zbog	Balis- tičke tem- pera- ture od 10°C	Pritje- mnog zrak- nog tlaka od 10 mm	TEMPERATURE PUNJENJA OD 10°C	Negat. odstu- panje	Pozit. odstu- panje	.							
								hog	uzdu	uzduž	boč-	bočni-	uzdu-														
								boč-	žnog	balis.	nog	og	žnog														
								balis	vje-	vjetra	balis.	balis.	puta-														
								vje- tra	u akt.	u akt.	vjetra	vjetra	u pasiv														
								akt.	dije-	puta-	puta-	nom	nom	puta-													
								hu	brzi-	re od	re od	rije	rije	rije													
								od	brzi-	re od	re od	brzi-	brzine	od													
								10	10	10	10	10	10	10													
								m/s	m/s	m/s	m/s	m/s	m/s	m/s													
R	S	ΔRmil	F	Ep	Ep	Ya	AD	AD	ΔE	ΔE	AD	ΔR	ΔRTa	ΔRH	ΔRTc	ΔRT	α	ω	Sr	ts	Ytot	Y	R				
m	tis	m	tis	m	m	m	wat	wat	tis	wat	tis	m	m	m	m	m	° >	°	m/s	s	m	m	m				
5 000	125	133	72	215	29	40	50	2	5.1	12.9	2	15	29	23	250	253	7.30	4.3	519	9.0		87	5 000				
200	128	134	70	213	30	42	51	2	5.3	12.9	2	17	31	24	248	249	7.40	4.5	511	9.4		95	200				
400	131	139	68	211	31	44	51	2	5.5	13.0	2	18	33	25	245	245	7.50	4.8	503	9.3		103	400				
600	134	142	66	208	32	46	51	2	5.7	13.0	2	20	35	26	243	241	8.01	5.0	495	10		112	600				
800	137	146	65	205	33	48	51	2	5.9	13.0	2	21	37	27	240	238	8.12	5.3	488	11		121	800				
6 000	140	149	64	202	34	51	51	2	6.1	13.0	2	23	39	29	238	235	8.23	5.6	481	11	200	130	6 000				
200	143	152	63	200	35	53	51	2	6.4	13.1	3	25	41	30	235	231	8.34	5.9	473	12		140	200				
400	146	155	62	197	36	55	51	2	6.6	13.1	3	27	43	32	232	227	8.45	6.1	466	12		151	400				
600	149	159	61	194	37	57	51	2	6.8	13.1	3	29	45	33	229	223	8.57	6.4	459	12		163	600				
800	152	163	60	191	38	59	51	2	7.1	13.1	3	31	47	35	228	220	9.09	6.8	452	13		176	800				
7 000	156	166	59	188	40	62	51	2	7.3	13.1	3	33	50	36	224	217	9.21	7.2	445	13		186	7 000				
200	159	170	58	185	41	64	51	3	7.6	13.2	4	35	52	38	221	213	9.33	7.6	438	14	300	203	200				
400	162	173	56	182	42	67	51	3	7.8	13.2	4	38	54	39	219	210	9.45	8.0	431	14		218	400				
600	166	177	55	179	43	69	51	3	8.0	13.2	4	40	56	41	216	207	9.58	8.4	425	15		234	600				
800	170	182	53	178	44	72	51	3	8.2	13.2	4	43	58	42	214	203	10.12	8.8	419	15		251	800				
8 000	174	185	52	173	45	75	52	3	8.5	13.2	4	45	61	43	211	200	10.25	9.3	413	16		268	8 000				
200	177	189	51	170	46	77	52	3	8.7	13.2	4	48	63	45	209	195	10.38	10	407	16	400	288	200				
400	181	194	49	167	47	80	52	3	9.0	13.2	4	51	66	46	206	193	10.53	10	401	17		305	400				
600	185	198	48	164	48	83	52	3	9.3	13.2	4	54	68	48	204	190	11.06	11	395	17		323	600				
800	190	203	47	161	49	86	52	3	9.5	13.2	4	57	71	49	201	188	11.23	11	389	18		346	800				

06315729

RSI 12 M Praškasto punjenje

M - 21 - OF

Bez kočionog punjenja

TT - 74

-11-

M - 21 - OF Visoko eksplozivni raketni projektili

IT-06-90-A

DALINAR	VJEROJATNO SKRETAJANJE										POPRAVKE										Kut ele- van- ja	Padn kut	Krai- nja brzina	Vrije me leta	Visi- na ula- ska	Ordi- nata je- mena	DA- LJI- NA
	I/6000	I/6400	Pomak daljine za pomak kuta ele- van- ja za 1 tiskiti	Veliki- na prve rakije	Po- daljini	Po- pravcu	PO PRAVACU		PO POLOŽAJU		Zbog boč- nog balis- vjeta	Zbog uzat- nog balis- vjeta	ZBOG ODSUPJANJA				Negat. odstup- janje	Pozit. odstup- janje									
							Z- bog boč- nog balis- vje- tra	Zbog uzat- nog balis- vjeta	Zbog boč- nog balis- vjeta	Zbog uzat- nog balis- vjeta			Balis- tičke tem- per- ture od 10°C	Pri- zrač- nog tlaka od 10 mm	TEMPERATURE PUNJENJA OD 10°C												
R	S	ΔR(m)	F	Ep	Ep	Ya	AD	AD	ΔE	ΔE	AD	AR	ARTa	ARRH	ARTE	ART	α	ω	St	ts	Ybul	Y	R				
m	tis	m	tis	m	m	m	wat	wat	tis	tis	wpt	wpt	m	m	m	m	° >	°	m/s	s	m	m	m				
							+	-	-	-	-	-	+	-	-	-											
9 000	194	207	46	14	158	51	52	2	9,8	13,2	5	60	73	51	199	183	11,38	12	384	18	500	367	9 000				
200	198	212	45	14	155	52	52	3	10,0	13,2	5	64	76	52	196	179	11,54	12	378	19		389	200				
400	203	216	44	14	152	53	52	3	10,3	13,2	5	67	78	54	194	176	12,10	13	373	19		413	400				
600	207	221	43	14	149	54	52	3	10,5	13,2	5	71	81	56	191	173	12,26	13	368	20	600	439	600				
800	212	226	42	14	148	55	52	3	10,8	13,2	5	74	84	58	189	170	12,43	14	363	20		467	800				
10000	217	231	41	14	143	56	52	3	11,1	13,2	5	78	97	60	186	167	13,00	15	358	21	700	497	10000				
200	222	236	40	14	140	57	52	3	11,4	13,2	6	82	90	62	184	164	13,18	15	353	22		528	200				
400	227	242	39	14	137	58	52	4	11,7	13,2	6	87	93	64	182	161	13,36	16	349	22	800	560	400				
600	232	247	38	14	134	59	52	4	12,0	13,2	6	91	96	66	180	158	13,54	16	345	23		593	600				
800	237	253	37	14	131	60	52	4	12,3	13,2	6	96	99	68	178	156	14,13	17	341	23	900	627	800				
11000	242	258	36	14	128	62	52	4	12,8	13,3	6	100	102	70	176	154	14,32	18	337	24	900	661	11000				
200	248	264	35	14	125	63	52	4	12,9	13,3	6	105	105	71	174	151	14,52	18	333	25		696	200				
400	253	271	35	14	122	64	52	4	13,2	13,3	7	110	108	73	172	149	15,12	19	329	25	1000	733	400				
600	259	277	34	14	120	66	52	4	13,6	13,3	7	115	111	75	170	146	15,33	20	326	26		774	600				
800	265	283	33	14	113	67	52	4	13,9	13,3	7	120	115	77	169	144	15,54	20	323	27	1100	818	800				
12000	271	298	32	15	116	69	52	4	14,3	13,3	7	125	119	79	168	142	16,16	21	320	27	1200	865	12000				
200	277	295	31	15	114	70	52	4	14,6	13,3	7	130	122	81	167	140	16,36	22	318	28	1300	913	200				
400	284	302	30	15	112	71	52	4	15,0	13,3	7	136	128	83	166	138	17,01	23	316	29	1400	952	400				
600	290	309	29	15	110	72	52	4	15,3	13,3	8	142	130	85	165	136	17,25	23	315	29	1500	1000	600				
800	297	316	28	15	108	74	52	5	15,7	13,3	8	148	134	87	164	134	17,49	24	314	30	1500	1060	800				

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RSI -12 M Praskasto punjenje

M - 21 - OF

Bez kočionog prstena

TT - 74

-12-

M - 21 - OF Visoko eksplozivni raketni projektil

DALJINAR	VIBRO/STATNO SKRETANJE		POPRAVKE										Kut eleva- cije na kvadrantu	Padni kut	Kraj- nja brzina	Vrije- me leta	Visi- na ula- ska u me- teo- bit- en- "stre- diti"	Ordi- nata ije- mena puta- nje	DA- LI- NA				
	Pomak daljine za pomak kuta eleva- cije za 1 tračini	Veliki- na prve rakije	Po- daljini	Po- pravcu	Visi- na akti- vnog dijela pu- tanje	PO PRAVACU		PO POLOŽAJU		PO PR- AV- CU	PO DALJINI												
						Z- bog boč- nog balis	Zbog užat- nog balis	Zbog užat- nog balis	Zbog boč- nog balis		Zbog boči- nog balis	Zbog užat- nog balis								ZBOG ODSUPANJA			
																				Balis- tičke tem- per- ature od 10°C	Prize- mnog zrač- nog tlaka od 10 mm	TEMPERATURE PUNJENJA OD 10°C	Negat. odstu- panje
R	S	ΔRmil	F	Ep	Ep	Ya	AD	AD	AE	AE	AD	AR	ARTa	ARH	ARTc	ART	α	ω	Sr	ts	Ybul	Y	R
m	tis	m	tis	m	m	m	wat	wat	wat	tis	tis	wat	wat	tis	m	m	°	°	m/s	s	m	m	m
13000	304	324	27	16	107	169	53	5	16,1	13,3	8	154	138	89	163	133	18,14	25	313	31	1600	1120	13000
200	311	332	27	16	106	174	53	5	16,4	13,4	8	160	142	91	162	131	18,39	26	313	32	1600	1170	200
400	318	339	27	16	105	179	53	5	16,8	13,4	8	166	148	93	161	130	19,05	27	313	32	1700	1230	400
600	325	347	26	16	104	184	54	5	17,2	13,4	8	172	150	95	160	129	19,31	27	313	33	1800	1290	600
800	333	355	26	16	103	189	54	5	17,6	13,4	8	178	154	97	159	128	19,58	28	312	34	1900	1360	800
14000	340	363	25	16	102	195	54	5	18,0	13,4	9	185	158	99	159	127	20,25	29	312	34	2000	1420	14000
200	348	372	25	16	101	200	54	5	18,4	13,4	9	192	162	101	158	126	20,54	30	312	35	2100	1490	200
400	356	380	25	16	100	206	54	6	18,8	13,4	9	199	166	103	158	125	21,25	31	311	36	2200	1560	400
600	364	388	24	16	99	212	54	6	19,2	13,4	9	208	170	105	157	124	21,52	31	311	37	2300	1640	600
800	373	397	24	16	98	218	54	6	19,6	13,4	9	213	174	107	157	123	22,22	32	311	38	2400	1720	800
15000	381	406	23	17	97	224	55	6	20,1	13,4	10	220	178	109	156	122	22,52	33	310	38	2500	1790	15000
200	390	416	23	17	96	230	55	6	20,5	13,4	10	227	182	111	156	121	23,23	34	310	39	2600	1870	200
400	398	425	22	17	95	236	55	6	21,0	13,5	10	235	188	112	156	120	23,54	35	310	40	2700	1960	400
600	407	435	22	17	94	242	55	6	21,4	13,5	10	242	190	114	156	119	24,26	36	310	41	2800	2050	600
800	416	444	22	17	93	248	55	7	21,9	13,5	10	250	194	116	155	118	24,59	36	311	42	3000	2140	800
16000	425	453	21	18	93	254	56	7	22,4	13,5	10	257	198	118	155	117	25,30	37	311	43	3100	2230	16000
200	435	464	21	18	92	260	56	7	22,9	13,5	10	265	202	119	154	116	26,06	38	311	44	3200	2330	200
400	445	474	20	18	91	267	56	7	23,4	13,5	11	273	206	121	154	115	26,41	39	312	45	3400	2440	400
600	455	485	20	18	90	273	56	7	24,0	13,5	11	281	210	122	154	114	27,17	40	312	45	3600	2540	600
800	465	496	19	19	89	280	57	7	24,5	13,5	11	289	214	124	153	113	27,54	40	313	46	3700	2650	800

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RSI - 12 M Praškasto punjenje

M - 21 - OF

Bez kočionog prstena

TT - 74

-13-

M - 21 - OF Visoko eksplozivni raketni projektil

DALJINAR	VITELOJATNO SKRETANJE		POPRAVKE												Kut eleva- cije na kvad- rantu	Padni kut	Kraj- nja brzina	Vri- jem e leta	Ordi- nata je- men ska puta- rije	DA- LIT- NA			
	PO PRAVACU	PO POLOŽAJU	PO PR- AV- CU	ZBOG DALJINI				ZBOG ODSUPJANJA				Negat. odstu- panje	Pozit. odstu- panje										
R	S	ΔRmil	F	Ep	Ep	Ya	AD wat	AD tis	ΔE wat	ΔE tis	AD wpt			AR mpt	ARta	ARH	ARtc	ART	α	φ	Sr	ts	Ybul
m	tis	m	tis	m	m	m	tis	tis	tis	tis	tis	m	m	m	m	m	°	°	m/s	s	m	m	m
17000	475	507	19	89	104	287	57	7	25.1	13.6	11	297	218	126	153	111	28.30	41	313	47	3900	2770	17000
200	486	519	18	88	106	294	57	8	25.6	13.6	11	306	222	127	152	110	29.11	42	314	48	4000	2890	200
400	497	531	17	87	108	302	57	8	26.2	13.6	11	315	228	129	152	109	29.50	43	314	49	4200	3020	400
600	509	543	17	86	109	310	58	8	26.8	13.6	12	324	230	131	151	108	30.34	44	315	50	4400	3150	600
800	521	556	16	85	111	318	58	8	27.3	13.6	12	333	234	133	151	107	31.16	45	316	51	4600	3290	800
18000	534	570	16	85	113	328	59	8	27.9	13.6	12	342	237	135	150	106	32.04	46	317	52	4800	3440	18000
200	547.50	584	15	84	115	335	59	9	28.5	13.7	12	353	341	137	149	105	32.51	47	318	54	5000	3500	200
400	561	599	14	83	118	344	60	9	29.1	13.7	12	363	344	139	149	103	33.40	48	319	55	5200	3750	400
600	575	613	14	83	120	353	60	9	29.7	13.7	12	373	348	141	148	101	34.31	48	320	56	5500	3920	600
800	590	629	13	83	123	362	61	9	30.4	13.7	13	383	351	143	147	99	35.25	49	322	57	5700	4100	800
19000	606	646	12	82	125	371	61	9	31.1	13.7	13	394	354	145	146	97	36.21	50	324	59	6000	4280	19000
200	622	664	11	81	128	380	62	10	31.8	13.7	13	405	356	147	145	95	37.20	51	325	60	6300	4490	200
400	640	683	10	80	131	390	63	10	32.8	13.8	13	416	358	149	144	93	38.23	52	326	61	6600	4720	400
600	659	702	9	80	134	402	64	10	33.7	14.0	14	428	360	151	143	91	39.31	53	327	63	6900	4950	600
800	680	725	8	79	136	415	65	11	35.3	14.3	14	440	362	154	141	88	40.48	55	328	65	7300	4220	800
20000	705	752	6.2	78	142	430	66	11	37.6	14.8	14	453	364	158	138	85	42.18	58	330	67	7800	5360	20000
200	737	786	2.8	78	147	447	68	12	42.6	15.5	14	463	366	159	135	79	44.14	59	332	70	8400	5990	200
20400	811	865	-	79	163	467	74	15	38.9	14.0	15	497	368	165	123	65	48.40	61	337	75	10000	6990	20400
380	833	889	-	80	183	499	78	15	34.7	11.5	15	504	369	167	119	60	50.00	62	337	77	10000	7290	380

06315732

TABLICE SA KOMPLEMENTARNIM POPRAVKAMA MJESNOG KUTA M-21-OF

A. Cilj je viši od paljenog položaja

BEZ KOČIONOG PRSTENA TT-74

MESNIT	ELEVACIJSKI																																	MESNIT					
	KUT																																						
KUT	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	833	KUT
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-10
0-20	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-20
0-30	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-30
0-40	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-40
0-50	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-50
0-60	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-60
0-70	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-70
0-80	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-80
0-90	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-90
1-00	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-00
1-10	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10
1-20	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-20
1-30	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-30

1. OSTALE KOMPLEMENTARNE POPRAVKE MJESNOG KUTA SU POZITIVNE

2. KUTEVI ELEVACIJE, MJESNI KUTEVI I POPRAVKE SU U TISUCAMA

B. Cilj je niži od paljenog položaja

MJEŠNI		ELEVACIJSKI																																KUT		MJEŠNI						
KUT	KUT	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	833	KUT	KUT	
0-10	0	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-10
0-20	0	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-20
0-30	0	0	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-30
0-40	0	0	0	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-40
0-50	0	0	0	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-50
0-60	0	0	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-60
0-70	0	0	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-70
0-80	0	0	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-80
0-90	-	0	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-90
1-00	-	0	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0-00
1-10	-	-	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10
1-20	-	-	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-20
1-30	-	-	-	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	1-30	

1. OSTALE KOMPLEMENTARNE POPRAVKE MJESNOG KUTA SU NEGATIVNE

2. KUTEVI ELEVACIJE, MJESNI KUTEVI I POPRAVKE SU U TISUCAMA

06315733

06315734

-15-

2. Tablice gađanja

**Za M-21-OF Visoko eksplozivne raketne projekte
sa malim kočionim prstenom**

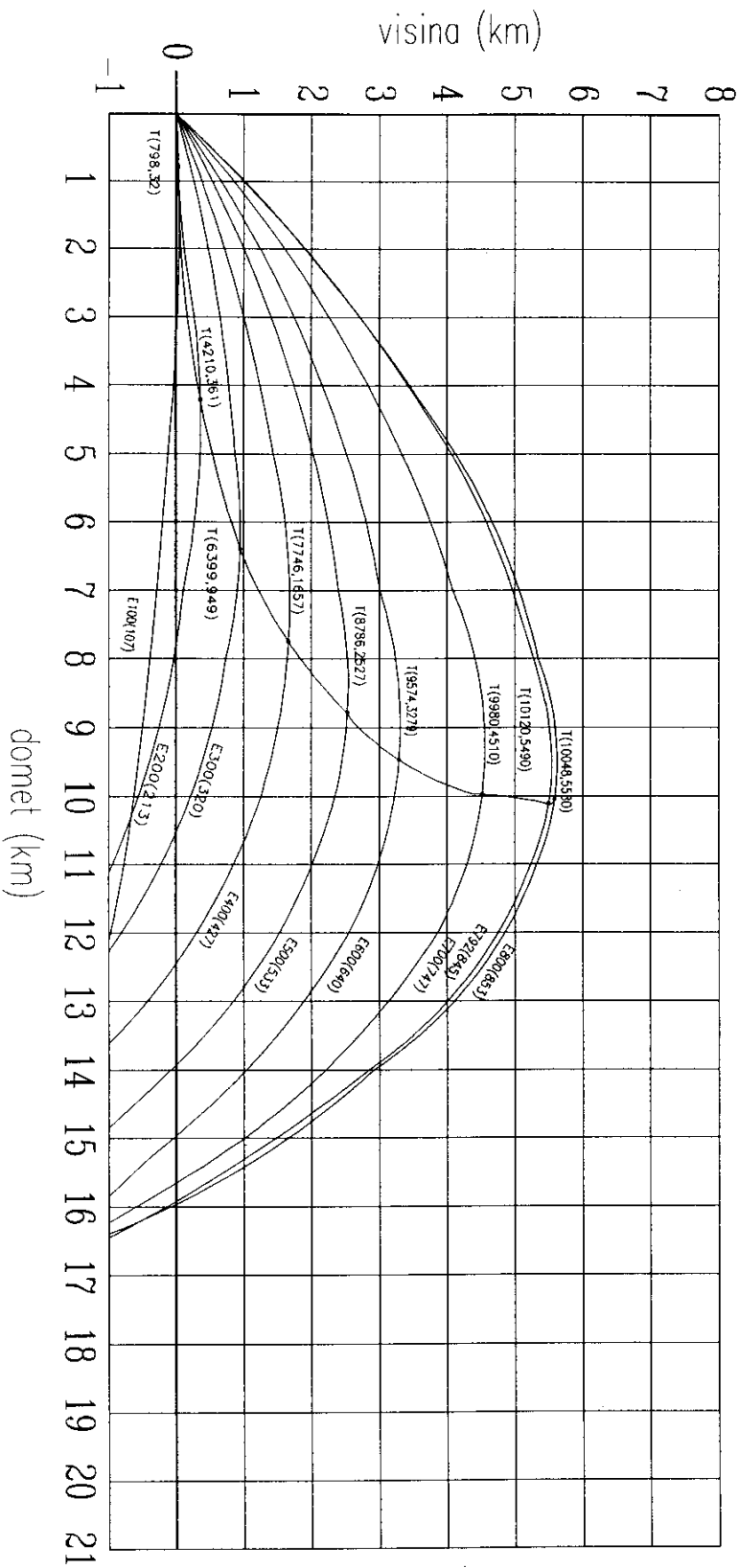
TT-74 m

**Kada se gađa projektilima oznake 9 M 22, uvedite dodatnu popravku
daljine od - 70 m.**

**Kada se gađa projektilima oznaka 9 M 22 U i 9 M 22,
uvedite dodatnu popravku sustavnih devijacija (skretanja) projektila
po pravcu, koja iznosi d 0-07.**

SA MALIM KOČIONIM PRSTENOM

GRAFIČKA TABLICA GADANJA ZA SVLR 122mm M-21-OF I "VULKAN"



Kutevi elevacije (E) dani su u podjeli 1/60-00 obujma kruga (izvan zgrade) i u podjeli 1/64-00 obujma kruga (u zgradi) točka T predstavlja tjemena putanje koje je određeno udaljenošću tjemena od PP (Xm; prvi broj u zagradi) i ordinatom tjemena putanje od horizonta PP (Ym; drugi broj u zagradi).

06315735

RSI - 12 M Praškasto punjenje

M-21 - OF

Sa malim kočionim prstenom TT - 74 m

-16-

M-21 - OF Visoko eksplozivni raketni projektil

DALJINAR	S	Akron	F	Ep	Ep	Ya	POPRAVKE										Kut ele- vaci- na	Padni kut	Kraj- nja brzina	Vrije- me leta	Visti- na ula- ska	Ordi- nata je- me- na	DA- LI- NA		
							VJEROJATNO SKRETANJE		PO PRAVACU		PO POLOŽAJU		PO PR- AV- CU		PO DALJINI									ZBOG ODSTUPANJA	
							Z- bog boč- nog balis- vje- tra u akt. dije- hu brzi- ne od 10 m/s	Zbog uzdu- nog balis- vje- tra u akt. dije- hu puta- ne od 10 m/s	Zbog uzduž- nog balis- vjetra dijelu u akt. dijelu puta- ne od 10 m/s	Zbog boč- nog balis- vjetra dijelu u pasiv- nom dijelu puta- ne od 10 m/s	Zbog boč- nog balis- vjetra dijelu u pasiv- nom dijelu puta- ne od 10 m/s	Zbog uzdu- nog balis- vjetra dijelu u pasiv- nom dijelu puta- ne od 10 m/s	Balis- tičke tem- perat- ure od 10°C	Prize- mnog zrač- nog tlaka od 10 mm	TEMPERATURE PUNJEVA OD 10°C	NEGAT. odstu- panje								POZIT. odstu- panje	
R	m	tis	m	m	m	m	AD wat	AD wal	AE wat	AE tis	AD wpt	AR wpt	ARtA	ARH	ARtC	ARt	α	ω	Sr	tS	Ybul	Y	R		
							+	-	-	-	-	-	-	+	-	-	°	>	m/s	s	m	m	m		
1 600	85	91	87	11	238	10	46	1	2,3	12,2	0	1	4	6	264	285	5,06	1,2	627	3,3		10	1 600		
800	87	93	84	11	236	11	46	1	2,5	12,3	0	2	6	7	260	280	5,14	1,4	614	3,6		13	800		
2 000	90	96	82	11	234	12	47	1	2,7	12,3	1	3	8	8	256	274	5,23	1,6	602	4,0	0	16	2 000		
200	92	98	81	11	232	13	47	1	2,9	12,4	1	3	9	9	251	268	5,32	1,8	590	4,3		19	200		
400	95	101	80	11	230	14	48	1	3,1	12,4	1	4	11	10	247	263	5,41	2,0	578	4,7		23	400		
600	97	104	79	11	228	16	48	1	3,3	12,4	1	5	13	11	242	257	5,50	2,2	568	5,0		27	600		
800	100	106	78	12	225	17	48	1	3,4	12,5	1	6	15	12	238	252	5,59	2,4	553	5,4		31	800		
3 000	102	109	76	12	222	19	48	1	3,6	12,5	2	7	16	13	233	246	6,08	2,6	541	5,7		35	3 000		
200	105	112	74	12	219	20	48	1	3,8	12,6	2	8	18	14	229	241	6,17	2,8	529	6,1		39	200		
400	107	115	72	12	216	22	49	1	4,0	12,6	2	10	20	15	225	235	6,27	3,0	518	6,5		44	400		
600	110	118	69	12	213	23	49	1	4,2	12,7	2	11	22	16	220	230	6,37	3,2	508	6,9		49	600		
800	113	121	67	13	210	24	50	1	4,4	12,7	2	13	24	17	213	224	6,48	3,5	494	7,3		54	800		
4 000	116	124	65	13	207	25	50	2	4,6	12,8	2	14	26	19	211	218	6,59	3,8	482	7,7		59	4 000		
200	119	127	62	13	204	26	50	2	4,8	12,8	3	16	28	20	207	213	7,10	4,1	470	8,1	100	59	200		
400	123	133	60	13	201	27	50	2	5,0	12,9	3	18	30	21	203	207	7,22	4,4	458	8,5		65	400		
600	126	134	58	14	198	28	50	2	5,2	12,9	3	20	32	23	199	202	7,34	4,7	446	8,9		70	600		
800	129	138	56	14	194	29	41	2	5,5	13,0	3	22	34	24	195	196	7,46	5,1	435	9,4		80	800		

06315736

06315737

RSI -12 M Prtškasto punjenje

M - 21 - OF

Sa malim kočionim prstenom TT - 74 m

-18-

M - 21 - OF Visoko eksplozivni raketni projektil

DALJINAR	VIEROJATNO SKRETANJE	PO PRAVACU	PO PR- AV- CU	PO DALJINI	Kut eleva- cije na kvad- rantu	Padni kut	Kraj- nja brzina	Vrije- me leta	Ybol	Y	R												
												Z- bog boč- nog balis vje- tra u akt. dije- hu brzi- ne od 10 m/s	Zbog uzdu- žnog balis vjetra u akt. dijelu puta- ne od 10 m/s	Zbog boč- nog balis vjetra u pasiv nom dijelu puta- nje brzine od 10 m/s	ZBOG ODSUPRANJA	TEMPERATURE PUNJENJA OD 10°C	Negat. odsu- panje	Pozit. odsu- panje					
																			Balis- tričke tem- pera- ture od 10°C nnn	Prize- mnog zrač- nog tla- ka od 10 mm			
R	S	Arml	F	Ep	Ep	Ya	AD	AD	AE	AE	AD	AR	ARTa	ARH	ARTc	ART	α	ω	Sr	ts	Ybol	Y	R
m	tis	m	tis	m	m	m	tis	tis	wat	wat	tis	wpt	m	m	m	m	° >	°	m/s	s	m	m	m
9 000	239	255	28	110	56	120	52	4	12,3	13,2	8	115	105	62	141	124	14 19	19	296	22	800	566	9 000
200	246	262	27	107	57	125	52	4	12,7	13,3	9	121	109	64	139	122	14 45	20	293	23	608	608	200
400	253	271	26	105	59	130	52	4	13,2	13,3	9	127	113	66	137	119	15 12	21	290	23	900	652	400
600	261	279	26	103	60	135	52	4	13,6	13,3	9	134	117	68	135	117	15 40	22	287	24	698	698	600
800	269	286	25	101	62	141	52	4	14,1	13,3	9	141	122	70	133	115	16 08	23	284	25	1000	747	800
10000	277	295	24	99	63	147	53	4	14,8	13,3	10	148	127	71	132	113	16 37	24	282	26	1100	798	10000
200	285	304	23	97	65	153	53	4	15,1	13,3	10	155	131	73	130	110	17 07	25	280	26	1200	852	200
400	294	313	22	95	66	159	53	4	15,8	13,3	10	162	136	75	129	108	17 38	26	278	27	1300	909	400
600	303	323	21	93	68	165	53	4	16,1	13,3	10	169	140	77	127	106	18 11	27	277	28	1400	969	600
800	312	333	21	91	69	171	53	4	16,6	13,3	11	177	144	79	126	104	18 45	28	276	29	1400	1030	800
11000	322	344	21	89	70	178	53	5	17,1	13,4	11	185	149	81	124	102	19 20	29	275	30	1500	1100	11000
200	332	354	20	87	71	185	54	5	17,6	13,4	11	193	152	83	123	100	19 55	30	275	31	1600	1170	200
400	342	365	19	85	73	192	54	5	18,1	13,4	11	201	158	85	122	99	20 31	31	275	32	1700	1240	400
600	352	375	19	83	75	199	54	5	18,6	13,4	12	209	162	87	121	97	21 08	32	275	33	1800	1310	600
800	363	387	18	82	76	206	54	5	19,1	13,4	12	217	167	89	120	96	21 46	33	274	34	2000	1390	800
12000	374	398	18	81	78	214	54	5	19,7	13,4	12	225	172	90	120	95	22 25	34	274	34	2100	1470	12000
200	385	411	17	79	79	222	54	6	20,3	13,4	12	234	176	92	119	93	23 06	35	273	35	2200	1500	200
400	397	423	17	78	81	230	55	6	20,9	13,4	13	243	181	93	119	92	23 48	36	273	36	2300	1630	400
600	409	436	16	76	82	238	55	6	21,5	13,5	13	252	186	95	118	91	24 31	37	272	37	2400	1740	600
800	421	448	16	75	84	246	55	6	22,1	13,5	13	261	191	97	118	90	25 15	38	272	38	2600	1840	800

06315738

RSI - 12 M Praškasto punjenje

M-21 - OF

Sa malim kočionim prstenom

TT -74 m

-19-

M-21 - OF Visoko eksplozivni raketni projektili

DA- LIL- NA	DALJINAR	Pomak daljine za pomak kuta eleva- cije za 1 tiskiti	Veliki- na pre- rakije	Po- daljini	Po- pravcu	Visi- na akti- vno djela pu- tanje	POPRAVKE										Kut eleva- cije na kvad- ratu	Padni kut	Kraj- nja brzina	Vrije- me leta	Visi- na ula- ska u me- teo- bil- en- 'stre- dnoj'	Ordi- nata je- mena	DA- LIL- NA	
							PO PRAVACU		PO POLOŽAJU		PO PR- AV- CU	PO DALJINI												
							Z- bog boč- nog balis- vje- tra u akt. dije- lu brzi- ne od 10 m/s	Zbog uzdu- žnog balis- vje- tra u akt. dije- lu brzi- ne od 10 m/s	Zbog uzduž- nog balis- vjetra u akt. dijelu puta- nje brzi- ne od 10 m/s	Zbog boč- nog balis- vjetra u akt. dijelu puta- nje brzi- ne od 10 m/s		Zbog boč- nog balis- vjetra u pas- ivnom dijelu puta- nje brzine 10 m/s	Zbog uzdu- žnog balis- vjetra u pas- ivnom dijelu puta- nje brzine 10 m/s	ZBOG ODSUTIPANJA		Prize- rmonog zrač- nika od 10 mm								TEMPERATURE PUNJENJA OD 10°C
AD wat	AD wal	AE wat	AE wat	AD wpt	AR wpt	ARTa	ARH	ARTc	ART	α	ω	Sr	ts	Ybul	Y		R							
m	tis	m	tis	m	m	m	tis	tis	tis	tis	m	m	m	m	m	m	°	°	m/s	s	m	m	m	
13000	434	462	15	20	74	85	255	56	7	22,8	13,5	13	270	196	99	117	89	26,01	39	272	39	2700	1950	13000
200	447	476	15	20	72	87	264	56	7	23,5	13,5	14	280	201	101	117	87	26,49	41	273	40	2900	2060	200
400	460	491	14	21	71	88	273	56	7	24,2	13,5	14	290	206	103	116	86	27,36	42	274	42	3100	2180	400
600	475	507	13	21	70	90	262	57	7	25,0	13,5	14	300	210	105	116	85	28,29	43	274	43	3200	2310	600
800	490	523	13	22	69	92	292	57	8	25,8	13,6	14	311	215	107	115	83	29,23	44	275	44	3400	2440	800
14000	506	539	12	23	68	94	302	58	8	26,6	13,6	15	322	219	109	114	82	30,19	45	276	45	3600	2580	14000
200	522	557	11	24	67	96	313	58	8	27,4	13,6	15	334	224	111	113	80	31,19	47	277	46	3800	2730	200
400	539	575	11	25	66	98	324	59	9	28,2	13,6	15	346	228	113	112	79	32,21	48	278	48	4100	2900	400
600	558	595	10	26	65	100	336	60	9	29,0	13,6	16	359	232	115	111	77	33,28	49	279	49	4300	3080	600
800	578	616	9,2	27	63	103	349	60	9	29,8	13,7	16	372	237	118	110	75	34,40	50	281	51	4600	3270	800
15000	599	639	8,4	29	62	106	362	61	9	30,7	13,7	16	385	241	121	109	73	35,58	52	283	52	4900	3480	15000
200	623	665	7,4	32	60	109	376	62	10	31,8	13,7	17	400	244	124	107	71	37,24	53	286	54	5200	3720	200
400	650	694	6,0	39	59	113	392	63	10	33,2	13,9	17	416	247	127	105	69	39,02	55	289	56	5600	3990	400
600	684	730	4,2	55	58	118	412	65	11	35,6	14,4	18	435	250	130	103	66	41,03	57	293	59	6100	4340	600
800	732	781	1,5	155	58	124	440	68	12	41,1	15,5	19	457	253	134	96	58	43,56	59	298	62	6600	4850	800
15890	792	745	---	---	58	131	472	72	14	41,0	15,2	20	479	255	138	81	46	47,30	62	302	66	7700	5490	15890
15850	833	889	---	---	59	138	494	75	15	34,7	11,5	21	492	255	140	58	24	50,00	64	307	59	8300	5950	15850

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A. Cilj je viši od paljbenog položaja

TABLICE SA KOMPLEMENTARNIM POPRAVKAMA MJESNOG KUTA
SA MALIM KOČIONIM PRSTENOM

IT-74 m

MJESENI		ELEVACIJSKI KUT																																MJESENI																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
KUT	KUT	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720	740	760	780	800	820	833	KUT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
0-10	0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

BILJEŠKA: 1. OSTALE KOMPLEMENTARNE POPRAVKE MJESNOG KUTA SU POZITIVNE

2. KUTEVI ELEVACIJE, MJESNI KUTEVI I POPRAVKE SU U TISUCAMA

B. Cilj je niži od paljbenog položaja

MJESENI KUT	ELEVACIJSKI KUT																																MJESENI KUT																		
	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	480	500	520	540	560	580	600	620	640	660	680	700	720		740	760	780	800	820	833												
0-10	0	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	3	3	4	4	5	6	7	8	10	15	22	31	43	62	87	107						
0-20	0	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	1	1	2	2	2	2	2	3	3	4	5	6	7	8	9	11	13	15	19	26	35	46	60	81	106	124								
0-30	0	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	0	1	1	2	2	2	3	3	3	3	3	4	4	5	6	7	8	9	11	13	15	18	22	27	35	45	57	72	92	116	134					
0-40	0	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	0	1	1	2	2	2	3	3	4	4	4	5	6	7	8	9	10	11	13	16	19	23	28	34	42	52	65	81	101	124	142					
0-50	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	1	1	2	2	2	3	3	4	4	4	5	6	7	8	9	10	11	13	16	19	23	27	33	40	48	59	72	88	108	131	149				
0-60	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	1	1	2	2	2	3	3	4	4	5	6	7	8	9	10	11	13	15	17	20	22	26	31	38	45	54	65	78	95	115	134	151		
0-70	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	0	1	1	2	2	2	3	3	4	4	5	6	7	8	9	10	11	12	15	17	18	22	29	35	42	50	60	71	84	101	121	144	161		
0-80	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	1	1	2	2	2	3	3	4	4	5	6	7	8	9	10	11	13	16	19	22	26	32	38	45	54	64	76	90	107	126	149	166		
0-90	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	1	1	2	2	2	3	3	4	4	5	6	7	8	9	10	11	13	16	19	22	28	34	41	48	57	67	80	95	112	131	153	170		
1-00	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	1	1	2	2	2	3	3	4	4	5	6	7	8	9	10	11	13	15	17	18	21	25	30	38	43	51	60	71	84	99	118	135	157	174
1-10	+1	+2	+2	+2	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	1	1	2	2	2	3	3	4	4	5	6	7	8	9	10	11	12	15	17	19	22	26	31	37	45	53	63	74	87	102	119	138	161	177
1-20	+1	+2	+2	+2	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	1	1	2	2	2	3	3	4	4	5	6	7	8	9	10	11	12	15	17	19	23	28	33	39	47	56	65	78	89	104	122	142	164	180
1-30	+1	+2	+2	+2	+2	+1	+1	+1	+1	+1	+1	+1	+1	+1	0	0	0	1	1	2	2	2	3	3	4	4	5	6	7	8	9	10	11	12	15	17	19	24	29	35	41	49	57	67	78	91	107	125	145	167	182

BILJEŠKE: 1. OSTALE KOMPLEMENTARNE POPRAVKE MJESNOG KUTA SU NEGATIVNE

2. KUTEVI ELEVACIJE, MJESNI KUTEVI I POPRAVKE SU U TISUCAMA

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-21-

3. Tablice gađanja

**Za M-21-OF Visoko eksplozivne raketne projekte
sa velikim kočionim prstenom**

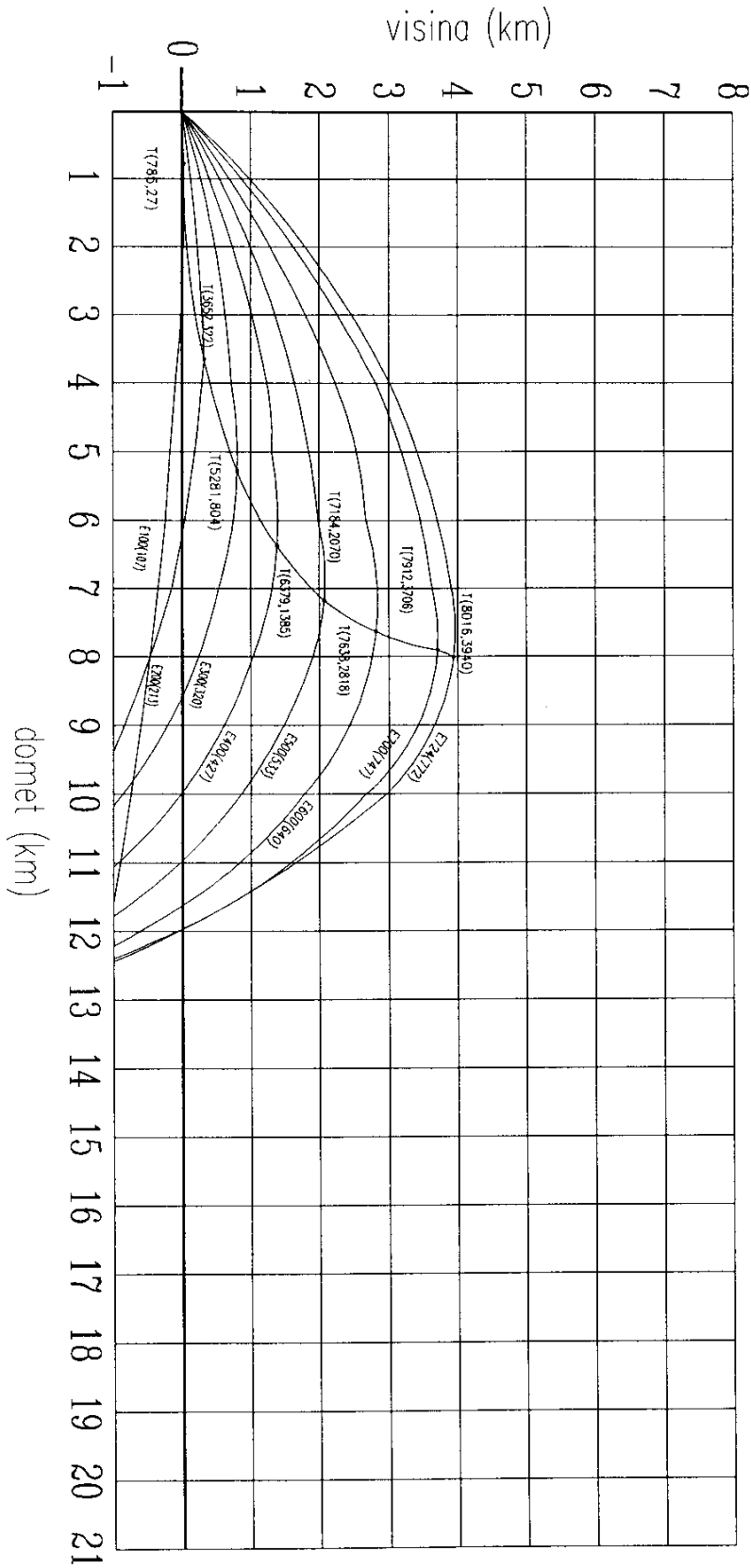
TT-74 M

**Kada se gađa projektilima oznake 9 M 22, uvedite dodatnu popravku
daljine od - 40 m.**

**Kada se gađa projektilima oznaka 9 M 22U i 9 M 22,
uvedite dodatnu popravku sustavnih devijacija (skretanja) projektila
po pravcu, koja iznosi d 0-07.**

SA VELIKIM KOČIONIM PRSTENOM

GRAFIČKA TABLICA GADANJA
ZA SVLR 122mm M-21-OF I "VULKAN"



RSI 12 M Praškasto punjenje

M 21 - OF

Sa velikim kočionim prstenom

TT - 74 M

-22-

M - 21 - OF Visoko eksplozivni raketni projektil

DALJINAR	VJEROJATNO SKRETANJE	POPRAVKE	PO DALJINI	Kut eleva- cije	Padni kut	Kro- nja brzina	Vrije- me leta	Visi- na ula- ska me- leo- bil- en- "ste- dugi"	Ordi- nata te- mena puta- nje	DA- LI- NA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
											PO PRAVACU	PO POLOŽAJU	PO PR- AV- CU	ZBOG ODSUPANJA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
														Z- bog boč- nog balis- vje- tra u akt. dije- lu brzi- ne od 10 m/s	Zbog uzdu- žnog balis- vje- tra u akt. dije- lu puta- nje od 10 m/s																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
DA- LI- NA	I/6000	I/6400	Pomak daljine za pomak kuta eleva- cije za 1 traktili	Veliki- na prve raklje	Po- daljini	Po pravcu	Visi- na akti- vno dijela pu- tanje	AD wat	AD wat	ΔE wat	ΔE wat	AD wpt	AR wpt	ARTa	ARRH	ARTc	ART	α	ω	Sr	ts	Ybul	Y	R																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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RSI -12 M Praškasto punjenje

M-21-OF

Sa velikim kočionim prstenom TT - 74 m

-24-

M - 21 - OF Visoko eksplozivni raketni projektil

[illegible]

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III. POMOĆNE TABLICE

Tablice sa minimalnim daljinama za određivanje vrha zaklanjanja, kada se gađa sa zaklonjenih položaja.

Tablice prirodnih vrijednosti trigonometrijskih funkcija.

Tablice za raščlanjivanje vjetra na komponente.

Tablica za pretvaranje stupnjeva i minutra u tisućite.

Tablice za pretvaranje tisućitih u stupnjeve i minute

Tablice za pretvaranje tisućitih $1/6400$ u tisućite $1/6000$ obujma kruga i obratno.

Tablice za izračunavanje topografskih elemenata cilja (repera).

**TABLICE SA MINIMALNIM DALJINAMA ZA ODREĐIVANJE GREBENA ZAKLONA KAD SE GABA
SA ZAKLONJENIH PALJEBNIH POLOŽAJA**

-27-

M-21-OF BEZ KOČIONILOG PRSTENA TT 74

Daljina do grebena zaklona (u metrima)	VISINSKA RAZLIKA U METRIMA IZMEĐU GREBENA ZAKLONA I PP									
	5	10	15	20	25	30	35	40	45	50
100	6530	9680	11000	12530	13800	14890	15830	16700	17440	18060
200	4340	6010	7460	8690	9750	10690	11530	12280	12950	13530
300	3520	4760	5860	6860	7760	8570	9310	9980	10600	11190
400	3130	4100	5000	5820	6580	7290	7940	8540	9100	9630
500	2930	3740	4490	5190	5840	6450	7030	7570	8080	8550
600	2810	3490	4130	4740	5320	5860	6360	6840	7310	7760
700	2780	3360	3920	4450	4960	5440	5900	6340	6780	7150
800	2760	3280	3770	4240	4700	5140	5550	5940	6320	6680
900	2780	3240	3680	4100	4510	4900	5280	5640	5990	6350
1000	2820	3220	3600	3980	4360	4730	5080	5420	5750	6060

M-21-OF SA MALIM KOČIONIIM PRSTENOM TT 74m

Daljina do grebena zaklona (u metrima)	VISINSKA RAZLIKA U METRIMA IZMEĐU GREBENA ZAKLONA I PP									
	5	10	15	20	25	30	35	40	45	50
100	5790	7650	9100	10260	11220	12050	12770	13390	13930	14400
200	3970	5360	6460	7370	8160	8860	9490	10060	10570	11010
300	3280	4340	5230	6030	6700	7290	7830	8330	8800	9230
400	2910	3780	4550	5220	5810	6340	6820	7260	7670	8060
500	2750	3480	4120	4700	5230	5710	6150	6560	6930	7270
600	2650	3280	3830	4330	4800	5240	5650	6030	6380	6700
700	2620	3180	3660	4100	4520	4920	5290	5630	5950	6260
800	2600	3080	3520	3920	4300	4660	5000	5320	5620	5900
900	2620	3050	3440	3800	4140	4470	4780	5080	5370	5640
1000	2650	3040	3400	3730	4040	4340	4620	4890	5160	5420

M-21-OF SA VELIKIM KOČIONIIM PRSTENOM TT 74M

Daljina do grebena zaklona (u metrima)	VISINSKA RAZLIKA U METRIMA IZMEĐU GREBENA ZAKLONA I PP									
	5	10	15	20	25	30	35	40	45	50
100	4940	6360	7460	8340	9060	9660	10170	10800	10960	11260
200	3330	4630	5460	6150	6760	7300	7770	8210	8590	8920
300	2950	3830	4540	6130	5640	6090	6500	6880	7240	7570
400	2640	3370	4010	4520	4970	5370	5730	6070	6390	6690
500	2490	3110	3650	4120	4530	4900	5240	5540	5810	6070
600	2430	2940	3410	3840	4220	4550	4850	5130	5390	5640
700	2420	2870	3280	3660	4000	4310	4590	4850	5090	5320
800	2430	2820	3180	3520	3830	4120	4390	4630	4850	5060
900	2460	2800	3130	3440	3730	4000	4240	4460	4660	4870
1000	2500	2810	3100	3370	3630	3880	4120	4340	4540	4720

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TABLICA PRIRODNIH VRIJEDNOSTI TRIGONOMETRIJSKIH FUNKCIJA 1/64000

[illegible][illegible]

TABLICA PRIRODNIH VRIJEDNOSTI TRIGONOMETRIJSKIH FUNKCIJA 1/60006

[illegible]

TABLICA ZA RAŠČLANJIVANJE VJETRA NA KOMPONENTE 1/6000

-30-

KUT VJETRA = AZIMUT GABANJA - AZIMUT VJETRA			BRZINA VJETRA u m/s																			
PREDZNACI KOMPONENTI VJETRA UZDUŽNA BOČNA			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
-	+	+																				
+	+	-																				
+	+	-																				
0	30	30	1/0	2/0	3/0	4/0	5/0	6/0	7/0	8/0	9/0	10/0	11/0	12/0	13/0	14/0	15/0	16/0	17/0	18/0	19/0	20/0
1	29	31	1/0	2/0	3/0	4/0	5/1	6/1	7/1	8/1	9/1	10/1	11/0	12/1	13/1	14/1	15/2	16/2	17/2	18/2	19/2	20/2
2	28	32	1/0	2/0	3/1	4/1	5/1+	6/1	7/1	8/2	9/2	10/2	11/2	12/2	13/3	14/3	15/3	16/3	17/4	18/4	19/4	20/4
3	27	33	1/0	2/1	3/1	4/1	5/2	6/2	7/2	8/2	9/3	10/3	10/3	11/4	12/4	13/4	14/5	15/5	16/5	17/6	18/6	19/6
4	26	34	1/0	2/1	3/1	4/2	5/2	5/2	6/3	7/3	8/4	9/4	10/4	11/5	12/5	13/6	14/6	15/7	16/7	16/7	17/8	18/8
5	25	35	1/0	2/1	3/2	3/2	4/3	5/3	6/4	7/4	8/5	9/5	10/6	10/6	11/6	12/7	13/8	14/8	15/9	16/9	16/10	17/10
6	24	36	1/1	2/1	2/2	3/2	4/3	5/4	6/4	6/5	7/5	8/6	9/6	10/7	11/8	11/8	12/9	13/8	14/10	15/11	15/11	16/12
7	23	37	1/1	1/1	2/2	3/3	4/3	4/4	5/5	6/5	7/6	7/7	8/7	9/8	10/9	10/9	11/10	12/11	13/11	13/12	14/13	15/13
8	22	38	1/1	1/1	2/2	3/3	3/4	4/4	5/5	5/6	6/7	7/7	7/8	8/9	9/10	9/10	10/11	11/12	11/13	12/13	13/14	13/15
9	21	39	1/1	1/2	2/2	2/3	3/4	4/5	4/6	5/6	5/7	6/8	6/9	7/10	8/11	8/11	9/12	9/13	10/14	11/15	11/15	12/16
10	20	40	0/1	1/2	2/3	2/3	3/4	3/5	4/6	4/7	5/8	5/9	6/10	7/11	7/11	7/12	8/13	8/14	9/15	9/16	8/16	10/17
11	19	41	0/1	1/2	1/3	2/4	2/5	2/5	3/6	3/7	4/8	4/9	4/10	5/11	5/12	6/13	6/14	7/15	7/16	7/16	8/17	8/18
12	18	42	0/1	1/2	1/3	+1/4	2/5	2/6	2/7	2/8	3/9	3/10	3/10	4/11	4/12	4/13	5/14	5/15	5/16	6/17	6/18	6/19
13	17	43	0/1	0/2	1/3	1/4	1/5	1/6	1/7	2/8	2/9	2/10	2/11	2/12	3/13	3/14	3/15	3/16	4/17	4/18	4/19	4/20
14	16	44	0/1	0/2	0/3	0/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	2/15	2/16	2/17	2/18	2/19	2/20
15	15	45	0/1	0/2	0/3	0/4	0/5	0/6	0/7	0/8	0/9	0/10	0/11	0/12	0/13	0/14	0/15	0/16	0/17	0/18	0/19	0/20

Brojnik - uzdužna komponenta u m/s
Nazivnik - bočna komponenta u m/s

BLUESKA: 1. Znak (+) pokazuje da vjetar puše straga (iz lijeva u desno). Znak (-) pokazuje da vjetar puše srijeda (iz desna u lijevo)
2. Ako je AzG manji od AzW, AzG trebalo bi povećati za 60 - 00

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-31-

Primjer određivanja komponenti vjetra:

Meteo bilten 1103-05074-0080-50668-0206-671908-661909-0804-642210-1203-622410-1603-602511-2002-602511-2402-592812- itd. je primljen.

Topografska daljina gađanja je 14 600 m, azimut gađanja je 18-00. Gađanje se vrši bez kočionih prstena.

Iz tablica gađanja TT-74, na daljini gađanja od 14 600 m. Ordinata tjemena putanje je $Y=1640$ m; visina ulaska u Meteo bilten "SREDNJI" je $Y_{bal}=2300$ m. Standardna visina iz biltena, najbliže konvencionalnoj visini je 2400 m.

Iz biltena za visinu od 2 400 m određeno je:

- Azimut balističkog vetra 28-00
- Brzina balističkog vjetra 12m/s

Određene su komponente balističkog vjetra:

- Azimut vjetra = $(18-00) + (60-00) - (28-00) = 50-00$
- Iz tablice za razlaganje vjetra komponente, broj 50-00 je u šestom odozdo, četvrtom stupcu slijeva.

Na gornjoj strani ovog stupca, predznaci su uzdužne koponente (-) i bočne komponente (-).

Presijecanjem šestog reda odozdo sa okomitim stupcem odgovarajućim za brzinu vjetra od 12m/s, dobije se uzdužna komponenta vjetra od 6m/s (u brojniku) i bočna komponenta od 10m/s (u nazivniku).

Predznak obiju komponenti je negativan.

Raščlanjivanje balističkog vjetra aktivnog dijela putanje i raščlanjivanje prizemnog vjetra na komponente je identično.

TABLICA ZA PRETVARANJE STUPNJEVA I MINUTA U TISUĆITE

STUPNJEVI	TISUĆITI		STUPNJEVI	TISUĆITI	
	1/6000	1/6400		1/6000	1/6400
1	16,67	17,8	46	766,67	818
2	33,33	35,6	47	783,33	836
3	50,00	53,3	48	800,00	853
4	66,67	71,1	49	816,67	871
5	83,33	88,9	50	833,33	889
6	100,00	107	51	850,00	907
7	116,67	124	52	876,67	924
8	133,33	142	53	883,33	942
9	150,00	160	54	900,00	960
10	166,67	178	55	916,67	976
11	183,33	196	56	933,33	996
12	200,00	213	57	950,00	1013
13	216,67	231	58	966,67	1031
14	233,33	249	59	983,33	1049
15	250,00	267	60	1000,00	1067
16	266,67	284	61	1016,67	1084
17	283,33	302	62	1033,33	1102
18	300,00	320	63	1050,00	1120
19	316,67	338	64	1066,67	1138
20	333,33	356	65	1083,33	1156
21	350,00	373	66	1100,00	1173
22	366,67	391	67	1166,67	1191
23	383,33	409	68	1133,33	1209
24	400,00	427	69	1150,00	1227
25	416,67	444	70	1166,67	1244
26	433,33	462	71	1083,33	1262
27	450,00	480	72	1200,00	1280
28	466,67	498	73	1216,67	1298
29	483,33	516	74	1233,33	1316
30	500,00	533	75	1250,00	1333
31	516,67	551	76	1266,67	1351
32	533,33	569	77	1283,33	1369
33	550,00	587	78	1300,00	1387
34	566,67	604	79	1316,67	1404
35	583,33	622	80	1333,33	1422
36	600,00	640	81	1350,00	1440
37	616,67	658	82	1366,67	1458
38	633,33	676	83	1383,33	1476
39	650,00	693	84	1400,00	1493
40	666,67	711	85	1416,67	1511
41	683,33	729	86	1433,33	1529
42	700,00	747	87	1450,00	1547
43	716,67	764	88	1466,67	1564
44	733,33	782	89	1483,33	1582
45	750,00	800	90	1500,00	1600

Prilikom pretvaranja stupnjeva u tiskute 1/6400 obujna kruga, treba množiti sa koeficijentom 1,7,7778

MINUTE	TISUĆITI		MINUTE	TISUĆITI	
	1/6000	1/6400		1/6000	1/6400
1	0,28	0,3	31	8,62	9,2
2	0,56	0,6	32	8,90	9,5
3	0,83	0,9	33	9,18	9,8
4	1,11	1,2	34	9,45	10,1
5	1,39	1,5	35	9,73	10,4
6	1,67	1,8	36	10,00	10,7
7	1,94	2,1	37	10,28	11,0
8	2,22	2,4	38	10,56	11,3
9	2,50	2,7	39	10,84	11,6
10	2,78	3,0	40	11,11	11,9
11	3,06	3,3	41	11,39	12,1
12	3,34	3,6	42	11,57	12,4
13	3,62	3,9	43	11,94	12,7
14	3,89	4,1	44	12,22	13,0
15	4,17	4,4	45	12,50	13,3
16	4,45	4,7	46	12,78	13,6
17	4,72	5,0	47	13,06	13,9
18	5,00	5,3	48	13,34	14,2
19	5,28	5,6	49	13,62	14,5
20	5,56	5,9	50	13,89	14,8
21	5,84	6,2	51	14,17	15,1
22	6,12	6,5	52	14,45	15,4
23	6,40	6,8	53	14,73	15,7
24	6,68	7,1	54	15,00	16,0
25	6,96	7,4	55	15,28	16,3
26	7,23	7,7	56	15,56	16,6
27	7,51	8,0	57	15,84	16,9
28	7,79	8,3	58	16,12	17,2
29	8,06	8,6	59	16,39	17,5
30	8,34	8,9	60	16,67	17,8

Prilikom pretvaranja stupnjeva u tiskute 1,6000 obujna kruga, stupnjeve treba množiti koeficijentom 16,6667.

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TABLICA ZA PRETVARANJE TISUĆITI U STUPNJEVE I MINUTE

TISUĆITI	1/6000		1/6400		TISUĆITI	1/6000		1/6400	
	STUPNJEVI	MINUTE	STUPNJEVI	MINUTE		STUPNJEVI	MINUTE		
100	6°	5° 37'	3600	216°	202° 30'				
200	12	11 15	3700	222	208 07				
300	18	16 52	3800	228	213 45				
400	24	22 30	3900	234	219 22				
500	30	28 07	4000	240	225 00				
600	36	33 45	4100	246	230 37				
700	42	39 22	4200	252	236 15				
800	48	45 00	4300	258	241 52				
900	54	50 37	4400	264	247 30				
1000	60	56 15	4500	270	253 07				
1100	66	61 52	4600	276	258 45				
1200	72	67 30	4700	282	264 22				
1300	78	73 07	4800	288	270 00				
1400	84	78 45	4900	294	275 37				
1500	90	84 22	5000	300	281 15				
1600	96	90 00	5100	306	286 52				
1700	102	95 37	5200	312	292 30				
1800	108	101 15	5300	318	298 07				
1900	114	106 52	5400	324	303 45				
2000	120	112 30	5500	330	309 22				
2100	126	118 07	5600	336	315 00				
2200	132	123 45	5700	342	320 37				
2300	138	129 22	5800	348	326 15				
2400	144	135 00	5900	354	331 52				
2500	150	140 37	6000	360	337 30				
2600	156	146 15	6100		343 07				
2700	162	151 52	6200		348 45				
2800	168	157 30	6300		354 22				
2900	174	163 07	6400		360 00				
3000	180	168 45							
3100	186	174 22							
3200	192	180 00							
3300	198	185 37							
3400	204	191 15							
3500	210	196 52							

Prilikom pretvaranja tisućitih 1/6400 obujma kruga, tisućite treba množiti sa koeficijentom 0,0563.
Prilikom pretvaranja tisućitih 1/6000 obujma kruga, tisućite treba množiti sa koeficijentom 0,6

TISUĆ.	1/6000		1/6400		TISUĆ.	1/6000		1/6400		TISUĆ.	1/6000		1/6400	
	STUPNJEVI	MINUTE	STUPNJEVI	MINUTE		STUPNJEVI	MINUTE	STUPNJEVI	MINUTE		STUPNJEVI	MINUTE	STUPNJEVI	MINUTE
1	0°	3,6'	0°	3,4'	34	2°	2,4'	1°	55'	67	4°	1,2'	3°	46'
2	0	7,2	0	6,7	35	2	6,6	1	58	68	4	4,8	3	49
3	0	10,8	0	10,1	36	2	9,6	2	1	69	4	8,4	3	53
4	0	14,4	0	13,5	37	2	13,2	2	4	70	4	12	3	56
5	0	18	0	16,9	38	2	16,8	2	8	71	4	15,6	3	59
6	0	21,6	0	20,2	39	2	20,4	2	11	72	4	19,2	4	3
7	0	25,2	0	23,6	40	2	24	2	15	73	4	22,8	4	6
8	0	28,8	0	27,0	41	2	27,6	2	18	74	4	26,4	4	10
9	0	32,4	0	30,4	42	2	31,2	2	22	75	4	30,0	4	13
10	0	36,0	0	33,7	43	2	34,8	2	25	76	4	33,6	4	16
11	0	39,6	0	37,1	44	2	38,4	2	28	77	4	37,2	4	20
12	0	43,2	0	40,5	45	2	42,0	2	31	78	4	40,8	4	23
13	0	46,8	0	43,9	46	2	45,9	2	35	79	4	44,4	4	26
14	0	50,1	0	47,2	47	2	49,2	2	38	80	4	48	4	30
15	0	54	0	50,6	48	2	52,8	2	42	81	4	51,6	4	33
16	0	57,6	0	54,0	49	2	56,4	2	45	82	4	55,2	4	36
17	1	1,2	1	57,4	50	3	0	2	49	83	4	58,8	4	40
18	1	4,8	1	0,7	51	3	3,6	2	52	84	5	2,4	4	43
19	1	8,4	1	4,1	52	3	7,2	2	55	85	5	6	4	47
20	1	12	1	8	53	3	10,8	2	59	86	5	9,6	4	50
21	1	15,6	1	11	54	3	14,4	3	2	87	5	13,2	4	53
22	1	19,2	1	14	55	3	18,0	3	5	88	5	16,8	4	57
23	1	22,8	1	18	56	3	21,6	3	9	89	5	20,4	5	00
24	1	26,4	1	21	57	3	25,2	3	12	90	5	24	5	3
25	1	30	1	24	58	3	28,8	3	16	91	5	27,6	5	7
26	1	33,6	1	28	59	3	32,4	3	19	92	5	31,2	5	10
27	1	37,2	1	31	60	3	36	3	22	93	5	34,8	5	14
28	1	40,8	1	35	61	3	39,6	3	26	94	5	38,4	5	17
29	1	44,4	1	38	62	3	43,2	3	29	95	5	42	5	20
30	1	48	1	42	63	3	46,8	3	32	96	5	45,6	5	24
31	1	51,6	1	45	64	3	50,4	3	36	97	5	49,2	5	27
32	1	55,2	1	48	65	3	54,0	3	39	98	5	52,8	5	30
33	1	58,8	1	51	66	3	57,9	3	43	99	5	56,4	5	34

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TABLICA ZA PRETVARANJE TISUĆITIH 1/6400
U TISUĆITE 1/600 OBUJIMA KRUGA

VRIJEDNOSTI ZA PO 100 TISUĆITIH				VRIJEDNOSTI OD 1 - 100 TISUĆITIH					
1/6400	1/6000	1/6400	1/6000	1/6400	1/6000	1/6400	1/6000	1/6400	1/6000
100	94	3400	3188	1	0.94	34	31.88	67	62.81
200	188	3500	3281	2	1.88	35	32.81	68	63.75
300	281	3600	3375	3	2.81	36	33.75	69	64.69
400	375	3700	3469	4	3.75	37	34.69	70	65.63
500	469	3800	3563	5	4.69	38	35.63	71	66.56
600	563	3900	3656	6	5.63	39	36.56	72	67.50
700	656	4000	3750	7	6.56	40	37.50	73	68.44
800	750	4100	3844	8	7.50	41	38.44	74	69.38
900	844	4200	3938	9	8.44	42	39.38	75	70.31
1000	938	4300	4031	10	9.38	43	40.31	76	71.25
1100	1031	4400	4125	11	10.31	44	41.25	77	72.19
1200	1125	4500	4219	12	11.25	45	42.19	78	73.13
1300	1219	4600	4313	13	12.19	46	43.13	79	74.06
1400	1313	4700	4406	14	13.13	47	44.06	80	75.00
1500	1406	4800	4500	15	14.06	48	45.00	81	75.94
1600	1500	4900	4594	16	15.00	49	45.94	82	76.88
1700	1594	5000	4688	17	15.94	50	46.88	83	77.81
1800	1688	5100	4781	18	16.88	51	47.81	84	78.75
1900	1781	5200	4875	19	17.81	52	48.75	85	79.69
2000	1875	5300	4969	20	18.75	53	49.69	86	80.63
2100	1969	5400	5063	21	19.69	54	50.63	87	81.56
2200	2063	5500	5156	22	20.63	55	51.56	88	82.50
2300	2156	5600	5250	23	21.56	56	52.50	89	83.44
2400	2250	5700	5344	24	22.50	57	53.44	90	84.38
2500	2344	5800	5438	25	23.44	58	54.38	91	85.31
2600	2438	5900	5531	26	24.38	59	55.31	92	86.25
2700	2531	6000	5625	27	25.31	60	56.25	93	87.19
2800	2625	6100	5719	28	26.25	61	57.19	94	88.13
2900	2719	6200	5813	29	27.19	62	58.13	95	89.06
3000	2813	6300	5906	30	28.13	63	59.06	96	90.00
3100	2906	6400	6000	31	29.06	64	60.00	97	90.94
3200	3000			32	30.00	65	60.94	98	91.88
3300	3094			33	30.94	66	61.88	99	92.81

PRILIKOM PRETVARANJA TISUĆITIH 1/6400 U TISUĆITE 1/6000,
PRAVE TISUĆITE TREBA MNOŽITI KOEFICIJENTOM 0,9375

TABLICA ZA PRETVARANJE TISUĆITIH 1/600
U TISUĆITE 1/6400 OBUJIMA KRUGA

VRIJEDNOSTI ZA PO 100 TISUĆITIH				VRIJEDNOSTI OD 1 - 100 TISUĆITIH					
1/6000	1/6400	1/6000	1/6400	1/6000	1/6400	1/6000	1/6400	1/6000	1/6400
100	106.67	3100	3306.77	1	1.07	34	36.27	67	71.47
200	213.34	3200	3413.44	2	2.13	35	37.33	68	72.54
300	320.00	3300	3520.11	3	3.20	36	38.40	69	73.60
400	426.68	3400	3626.78	4	4.27	37	39.47	70	74.67
500	533.35	3500	3733.45	5	5.33	38	40.53	71	75.74
600	640.02	3600	3840.12	6	6.40	39	41.60	72	76.80
700	746.69	3700	3946.79	7	7.46	40	42.67	73	77.87
800	853.36	3800	4053.46	8	8.53	41	43.73	74	78.94
900	960.03	3900	4160.13	9	9.60	42	44.80	75	80.00
1000	1066.70	4000	4266.80	10	10.67	43	45.87	76	81.07
1100	1173.37	4100	4373.47	11	11.73	44	46.93	77	82.14
1200	1280.04	4200	4480.14	12	12.80	45	48.00	78	83.20
1300	1386.71	4300	4586.81	13	13.87	46	49.07	79	84.27
1400	1493.38	4400	4693.48	14	14.93	47	50.13	80	85.34
1500	1600.00	4500	4800.00	15	16.00	48	51.20	81	86.40
1600	1706.72	4600	4906.82	16	17.07	49	52.27	82	87.47
1700	1813.39	4700	5013.49	17	18.13	50	53.34	83	88.54
1800	1920.06	4800	5120.16	18	19.20	51	54.40	84	89.60
1900	2026.73	4900	5226.83	19	20.27	52	55.47	85	90.67
2000	2133.40	5000	5333.50	20	21.33	53	56.54	86	91.74
2100	2240.07	5100	5440.17	21	22.40	54	57.60	87	92.80
2200	2346.74	5200	5546.84	22	23.47	55	58.67	88	93.87
2300	2453.41	5300	5653.51	23	24.53	56	59.74	89	94.94
2400	2560.08	5400	5760.18	24	25.60	57	60.80	90	96.00
2500	2666.75	5500	5866.85	25	26.67	58	61.87	91	97.07
2600	2773.42	5600	5973.52	26	27.73	59	62.94	92	98.14
2700	2880.09	5700	6080.19	27	28.80	60	64.00	93	99.20
2800	2986.76	5800	6186.86	28	29.87	61	65.07	94	100.27
2900	3093.43	5900	6293.53	29	30.93	62	66.14	95	101.34
3000	3200.00	6000	6400.00	30	32.00	63	67.20	96	102.40
				31	33.07	64	68.27	97	103.47
				32	34.13	65	69.34	98	104.54
				33	35.20	66	70.40	99	105.60

PRILIKOM PRETVARANJA TISUĆITIH 1/6000 U TISUĆITE 1/6400,
PRAVE TISUĆITE TREBA MNOŽITI KOEFICIJENTOM 1,0667.

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-35-

Prilog 1/3b
64-00TABLICA ZA SRACUNAVANJE TOPOGRAFSKIH
ELEMENATA CILJA (REPERA)

Kp	0 098	098 199	199 303	303 414	414 534	534 668	668 820	820 1000	Kp
4 $\frac{\Delta X}{\Delta Y}$	48 00	49 00	50 00	51 00	52 00	53 00	54 00	55 00	$\frac{\Delta X}{\Delta Y}$
3 $\frac{\Delta Y}{\Delta X}$	12 00	33 00	34 00	35 00	36 00	37 00	38 00	39 00	$\frac{\Delta Y}{\Delta X}$
2 $\frac{\Delta X}{\Delta Y}$	16 00	17 00	18 00	19 00	20 00	21 00	22 00	23 00	$\frac{\Delta X}{\Delta Y}$
1 $\frac{\Delta Y}{\Delta X}$	0 00	1 00	2 00	3 00	4 00	5 00	6 00	7 00	$\frac{\Delta Y}{\Delta X}$
	Kp	Kd	Kp	Kd	Kp	Kd	Kp	Kd	
00	000	000	098	005	199	020	303	045	414
02	002	000	100	005	201	020	305	046	417
04	004	000	102	005	203	020	308	046	419
06	006	000	104	005	205	021	310	047	421
08	008	000	106	006	207	021	312	048	423
10	010	000	108	006	209	022	314	048	426
12	012	000	110	006	212	022	316	049	428
14	014	000	112	006	213	022	318	049	430
16	016	000	114	007	215	023	321	050	433
18	018	000	116	007	217	023	323	051	435
20	020	000	118	007	219	024	325	051	437
22	022	000	120	007	221	024	327	052	440
24	024	000	122	007	224	025	329	053	442
26	026	000	124	008	226	025	331	053	444
28	028	000	126	008	228	026	334	054	447
30	029	000	128	008	230	026	336	055	449
32	031	000	130	008	232	027	338	056	452
34	033	001	132	009	234	027	340	056	454
36	035	001	134	009	236	027	342	057	456
38	037	001	136	009	238	028	345	058	459
40	039	001	138	010	240	028	347	058	461
42	041	001	140	010	242	029	349	059	463
44	043	001	142	010	244	029	351	060	466
46	045	001	144	010	246	030	353	061	468
48	047	001	146	011	248	030	356	061	471
50	049	001	148	011	250	031	358	062	473
52	051	001	150	011	253	031	360	063	475
54	053	001	152	012	255	032	362	064	478
56	055	002	154	012	257	032	364	064	480
58	057	002	156	012	259	033	367	065	483
60	059	002	158	012	261	033	369	066	485
62	061	002	160	013	263	034	371	067	487
64	063	002	162	013	265	035	373	067	490
66	065	002	164	013	267	035	376	068	492
68	067	002	166	014	269	036	378	069	495
70	069	002	168	014	271	036	380	070	497
72	071	002	170	014	274	037	382	071	500
74	073	003	172	015	276	037	385	071	502
76	075	003	175	015	278	038	387	072	505
78	077	003	177	015	280	038	389	073	507
80	079	003	179	016	282	039	391	074	510
82	081	003	181	016	284	040	394	075	512
84	083	003	183	017	286	040	396	076	514
86	085	004	185	017	288	041	398	076	517
88	087	004	187	017	291	041	400	077	519
90	089	004	189	018	293	042	403	078	522
92	091	004	191	018	295	043	405	079	524
94	093	004	193	018	297	043	407	080	527
96	095	004	195	019	299	044	410	081	529
98	097	005	197	019	301	044	411	082	532
100	098	005	199	020	303	045	414	082	535
$\frac{\Delta X}{\Delta Y}$	15 00	14 00	13 00	12 00	11 00	10 00	9 00	8 00	$\frac{\Delta X}{\Delta Y}$
$\frac{\Delta Y}{\Delta X}$	31 00	30 00	29 00	28 00	27 00	26 00	25 00	24 00	$\frac{\Delta Y}{\Delta X}$
$\frac{\Delta X}{\Delta Y}$	47 00	46 00	45 00	44 00	43 00	42 00	41 00	40 00	$\frac{\Delta X}{\Delta Y}$
$\frac{\Delta Y}{\Delta X}$	61 00	62 00	61 00	60 00	59 00	58 00	57 00	56 00	$\frac{\Delta Y}{\Delta X}$
Kp	0 098	098 199	199 303	303 414	414 534	534 668	668 820	820 1000	Kp

NAPOMENA: Kp = tg $\angle$ (sl. 18)Kd = sec $\angle$

TABLICA ZA SRAČUNAVANJE TOPOGRAFSKIH
ELEMENTA CILJA (REPERA)

Kp	0 - 105		105 - 213		213 - 325		325 - 445		445 - 577		577 - 727		727 - 900		900 - 1000		Kp
$4 \frac{+\Delta X}{-\Delta Y}$	45 - 00		46 - 00		47 - 00		48 - 00		49 - 00		50 - 00		51 - 00		52 - 00		$\frac{+\Delta X}{-\Delta Y}$
$3 \frac{-\Delta Y}{-\Delta X}$	30 - 00		31 - 00		32 - 00		33 - 00		34 - 00		35 - 00		36 - 00		37 - 00		$\frac{-\Delta Y}{-\Delta X}$
$2 \frac{-\Delta X}{+\Delta Y}$	15 - 00		16 - 00		17 - 00		18 - 00		19 - 00		20 - 00		21 - 00		22 - 00		$\frac{-\Delta X}{+\Delta Y}$
$1 \frac{+\Delta Y}{+\Delta X}$	0 - 00		1 - 00		2 - 00		3 - 00		4 - 00		5 - 00		6 - 00		7 - 00		$\frac{+\Delta Y}{+\Delta X}$
	Kp	Kd	Kp	Kd	Kp	Kd	Kp	Kd	Kp	Kd	Kp	Kd	Kp	Kd	Kp	Kd	
00	000	000	105	006	213	022	325	051	445	095	577	155	727	236	900	346	100
02	002	000	107	006	215	023	327	052	448	096	580	156	730	238	904	348	98
04	004	000	109	006	217	024	330	053	450	097	583	157	733	240	908	351	96
06	006	000	111	006	219	024	332	054	453	098	586	159	736	242	912	353	94
08	008	000	114	006	221	025	334	054	455	099	589	160	739	244	916	355	92
10	010	000	116	007	223	025	337	055	458	100	591	161	743	245	920	358	90
12	012	000	118	007	226	026	339	056	460	101	594	163	746	247	923	360	88
14	015	000	120	007	228	026	341	057	463	102	597	164	749	249	927	363	86
16	017	000	122	007	230	027	344	057	465	103	600	165	752	251	931	366	84
18	019	000	124	007	232	027	346	058	468	104	603	167	756	253	935	369	82
20	021	000	126	008	235	027	348	059	471	105	606	169	759	255	939	372	80
22	023	000	128	008	237	028	351	059	473	106	608	171	762	257	943	374	78
24	025	000	131	009	239	028	353	060	476	107	611	172	766	259	947	377	76
26	027	000	133	009	241	029	355	061	478	109	614	174	769	261	951	379	74
28	029	000	135	009	243	029	358	062	481	110	617	175	772	263	955	382	72
30	031	000	137	009	246	030	360	063	483	111	620	176	776	265	959	385	70
32	034	001	139	010	248	030	362	064	486	112	623	178	779	267	963	388	68
34	036	001	141	010	250	031	365	064	489	113	626	179	782	269	967	391	66
36	038	001	143	010	252	031	367	065	491	114	629	181	786	272	971	394	64
38	040	001	146	010	255	032	370	066	494	115	632	183	789	274	975	397	62
40	042	001	148	011	257	032	372	067	496	116	635	185	793	276	979	400	60
42	044	001	150	011	259	033	374	068	499	117	638	186	796	278	983	403	58
44	046	001	152	011	261	033	377	068	502	119	641	188	799	280	988	405	56
46	048	001	152	012	263	034	379	069	504	120	643	189	803	282	992	408	54
48	050	001	156	012	266	034	381	070	507	121	646	190	806	285	996	411	52
50	052	001	158	012	268	035	384	071	510	122	649	192	810	287	1.000	414	50
52	055	001	161	013	270	036	386	072	512	124	652	193	813	289			48
54	057	002	163	013	272	036	389	073	515	125	655	195	817	291			46
56	059	002	165	013	275	037	391	074	517	126	658	197	820	293			44
58	061	002	167	014	277	037	394	075	520	127	661	199	824	295			42
60	063	002	169	014	279	038	396	075	523	129	664	200	827	298			40
62	066	002	171	014	281	040	398	076	525	130	667	202	831	300			38
64	067	002	173	015	284	040	401	077	528	131	670	204	834	302			36
66	069	002	176	015	286	041	403	078	531	132	673	206	838	305			34
68	071	002	178	015	288	041	406	079	534	134	677	208	841	307			32
70	073	003	180	016	291	042	408	080	536	135	680	209	845	309			30
72	076	003	182	016	293	042	411	081	539	136	683	211	849	311			28
74	078	003	184	016	295	043	413	082	542	138	686	212	852	314			26
76	080	003	186	017	297	043	415	083	544	139	689	214	856	316			24
78	082	003	189	017	300	044	418	084	547	140	692	216	860	318			22
80	084	003	191	018	302	044	420	085	550	142	695	218	863	321			20
82	086	004	193	018	304	045	423	086	552	143	698	220	867	323			18
84	088	004	195	018	306	045	425	087	555	144	701	221	871	326			16
86	090	004	197	019	309	046	428	088	558	145	704	223	874	328			14
88	092	004	199	019	311	047	430	089	561	146	708	225	878	330			12
90	094	004	202	020	313	048	433	090	563	148	711	227	882	333			10
92	097	005	204	020	316	048	435	091	566	149	714	229	885	335			08
94	099	005	206	021	318	049	438	092	569	150	717	231	889	338			06
96	101	005	208	021	320	050	440	093	572	152	720	233	893	340			04
98	103	005	210	021	323	050	443	094	575	153	723	235	897	343			02
100	105	006	213	022	325	051	445	095	577	155	727	236	900	346			00
$\frac{+\Delta X}{+\Delta Y}$	14 - 00		13 - 00		12 - 00		11 - 00		10 - 00		9 - 00		8 - 00		7 - 00		$\frac{+\Delta X}{+\Delta Y}$ 1
$\frac{+\Delta Y}{-\Delta X}$	29 - 00		28 - 00		27 - 00		26 - 00		25 - 00		24 - 00		23 - 00		22 - 00		$\frac{+\Delta Y}{-\Delta X}$ 2
$\frac{-\Delta X}{-\Delta Y}$	44 - 00		43 - 00		42 - 00		41 - 00		40 - 00		39 - 00		38 - 00		37 - 00		$\frac{-\Delta X}{-\Delta Y}$ 3
$\frac{-\Delta Y}{+\Delta X}$	59 - 00		58 - 00		57 - 00		56 - 00		55 - 00		54 - 00		53 - 00		52 - 00		$\frac{-\Delta Y}{+\Delta X}$ 4
Kp	0 - 105		105 - 213		213 - 325		325 - 445		445 - 577		577 - 727		727 - 900		900 - 1000		Kp

NAPOMENA: Kp = tg α (sl. 18)

Kd = sec α

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-37-

**IV. ODREĐIVANJE UVJETA GAĐANJA
I PODATAKA IZ TABLICE
GAĐANJA, BOJNOG VOZILA,
CILJANJA I STRELJIVA**

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-38-

A. Određivanje uvjeta gađanja

1. Mjerenje temperature punjenja (raketnog baruta)

Za osiguranje spomenutih temperatura punjenja, smještenih u pakete ili van paketa punjenja moraju biti zaštićena sa priručnim materijalima od atmosferskih nepogoda i od izravnog utjecaja sunčevih zraka.

Materijali sa kojima je streljivo zaštićeno moraju biti isti za sva bojna vozila.

Za mjerenje temperature punjenja odviti zaštitni kontakt (bakelitni poklopac) i pored središnje mazalice staviti termometar i čekati dok se živa termometra ne smiri.

Za spriječavanje ulaska zraka izvana u prostor mjerenja nužno je ulazne otvore mlaznice zatvoriti čepovima od priručnih materijala. U prostoru mjerenja termometar mora biti minimalno 25 - 30 min.

Poslije mjerenja temperature punjenja izvaditi čepove i zaviti zaštitne kontakte.

Oduzimanjem $+15^{\circ}\text{C}$ (temperatura koja se smatra normalnom) od izmjerene temperature dobije se odstupanje temperature punjenja u odnosu na normalnu.

Podaci temperature punjenja neophodni za određivanje popravke ΔE_{T_0} ispravni su maksimalno 2 sata nakon mjerenja.

2. Određivanje meteoroloških uvjeta

Određivanje meteoroloških uvjeta putanje vrši se posebno za aktivni dio, a posebno za pasivni dio punjenja.

a) Određivanje meteoroloških uvjeta u pasivnom dijelu putanje

Meteorološki uvjeti u pasivnom dijelu putanje određeni su iz meteo biltena "srednjeg", prenešenog u skladu sa oblikom brojčanog telefonograma.

Primjer: "Meteo 1103-05074-0080-50668-0206-671908-0495-661909-0804-642210-1203-622410-1603-602511-2002-602511-2402-592812.....".

Značenje brojki određeno je njihovim položajem u skupini i položajem skupine u telefonogramu:

Prva skupina (Meteo i četiri brojke) - **Meteo 1103:**

-**Meteo 11** - uobičajeni naziv za meteo - bilten "Srédnji"

-03 uobičajeni broj meteorološke postaje

Druga skupina brojki - **05074:**

-05 - Dan u odnosnom mjesecu (5);

-074- Sat i minute (zaokruženo na desetice) u kojem je atmosfersko ispitivanje završeno (7 h i 40 min)

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39-

Treća skupina (četiri brojke)

-0080 - Visina meteorološke postaje u metrima (80 m)

Četvrta skupina (pet brojki) - 50668:

-506 - odstupanje prizemnog tlaka određenog u tablici u milimetrima (6 mm)

-68 - Odstupanje virtualne temperature prizemnog zraka, određene u tablici stupnjevima (-18°).**Peta skupina** (četiri brojke) - 0206:

-02 - Standardna visina u stotinama metara (200 m).

-06 - Srednje odstupanje gustoće zraka zadane u tablicama kroz atmosferske slojeve od zemljine površine do standardne visine (6%).

Šesta skupina (šest brojki) 671908:-67 - Srednje odstupanje temperature zraka zadane u tablicama za atmosferski sloj između zemljine površine i standardne visine dane u predhodnoj grupi (-17°);

-19 - Srednji azimut vjetra u atmosferskom sloju između zemljine površine i standardne visine (19-00).

-08 - Srednja brzina vjetra u danom sloju (8 m/s)

Slijedeća skupina od četiri brojke označava standardnu visinu i srednje odstupanje gustoće zraka, kao i u petoj skupini.

Skupina od šest brojki označava srednje odstupanje temperature zraka, kut i brzinu srednjeg vjetra kao i šestoj skupini.

U biltenu nije upisan predznak minus (-) za označavanje negativnih vrijednosti meteoroloških činitelja, konvencionalno je data brojka 5 kao prva brojka u skupini brojeva.

Ako je negativno odstupanje temperature dano kao dvije brojke jednako ili veće od

-50°C , to odstupanje u biltenu biti će dano bez broja 5.

Odstupanja atmosferskog tlaka dato u tablicama označeno u četvrtoj skupini biltena, svedeno je na visinu paljbenog položaja po slijedećem pravilu:

- za svakih 10 m visinske razlike između meteo postaje i paljbenog položaja, tlak se mijenja za 1 mm. Ta popravka je dodana odstupanju tlaka danog u biltenu ako je meteo postaja viša od paljbenog položaja i oduzeta ako je meteorološka postaja niža od paljbenog položaja.

Balističko odstupanje temperature zraka, pravac i brzina vjetra trebali bi biti uzeti iz biltena uzimajući u obzir visinu koja je ista kao i konvencionalna visina (Y_{bal}) određena iz tablice gađanja.

b) Određivanje balističkog vjetra u aktivnom dijelu putanje

Određivanje brzine i pravca balističkog vjetra u aktivnom dijelu putanje vrši se neposredno prije otvaranja paljbe pomoću hitca za mjerenje vjetra.

c) Određivanje prizemnog vjetra

Određivanje brzine i pravca prizemnog vjetra vrši se neposredno prije otvaranja paljbe anemometrom, koji se smješta na visinu od 3,5 m na stranu sa koje puše vjetar i na udaljenosti maksimalno 20 m od paljbenog položaja.

Prije razlaganja na komponente prizemni vjetar se mjeri 2 do 4 puta.

U ostalim slučajevima treba raditi po uputama za korištenja anemometre.

B. PODACI TABLICA GAĐANJ, CILJANJA I STRELJIVA

1. Podaci u tablicama gađanja

Podaci u tablicama gađanja skupirani su ovako:

- u **prvoj skupini** (gledano s lijeva) su podaci potrebni za izdavanje zapovijedi za gađanje:

- daljina (**R**) za svakih 200 m;
- daljinar (**S**) u tisućitima;
- pomak daljine za pomak kuta elevacije za 1 tisućiti (ΔR_{wal}) metrima;
- veličina prve raklje (**F = 4E_p**) u tisućitima;
- vjerojatno skretanje po daljini (**Ep**) i po pravcu (**Ep**) u metrima;

- u **drugoj skupini** su podaci za određivanje popravaka u aktivnom dijelu putanje:

- visina aktivne dijela leta (**Y_a**) u metrima;
- popravke pravca zbog bočne komponente (ΔD_{wal}) i zbog uzdužne komponente (ΔD_{wal}) balističkog vjetra u aktivnom dijelu putanje za brzinu od 10 m/s u tisućitima;
- popravke daljinara zbog uzdužnog balističkog vjetra (ΔE_{wal}) u aktivnom dijelu putanje za brzinu od 10 m/s u tisućitima.

- u **trećoj skupini** su podaci za određivanje popravaka u pasivnom dijelu putanje;

- popravka pravca (ΔD_{wpt}) zbog bočnog balističkog vjetra u pasivnom dijelu putanje za brzinu od 10m/s u tisućitima.;
- popravka daljine (ΔR_{wt}) zbog uzdužnog balističkog vjetra u pasivnom dijelu putanje za brzinu od **10 m/s** u metrima;
- popravak daljine zbog odstupanja balističke temperature zraka (ΔR_{ta}) od **10°C**, prizemnoga zračnoga pritiska (ΔRH) od **10 mm**, temperature raketnog baruta (ΔRT_a) od **10°C** (za pozitivno i negativno odstupanje u odnosu na normalnu temperaturu) u metrima.

- u **četvrtoj skupini** su elementi putanje:

- kut elevacije po kvadrantu (α) stupnjevima i minutama;
- padni kut (ω) stupnjevima i minutama;
- krajnja brzina (**S_r**) u m/s;
- vrijeme leta (**t_a**), u sekundama .

-u **petoj skupini** su podaci za ulaz u meteo bilten "**srednji**"

- visina ulaska u meteo - bilten "**srednji**" u metrima
- tjeme putanje **Y** u metrima;
- daljina (**R**) za svakih **200 m**

Osnova za ulaz u tablice je daljina za svakih **200 m**.

Poprvice su dane u tablicama s njihovim predznacima. Množeći popravke iz tablica sa odstupanjem pojedinih činitelja sa njihovim predznacima, dobivene su vrijednosti popravke sa predznakom potrebne za računanje u elemente.

U tablici za raščlanjivanje vjetra na komponente dani su predznaci komponenti vjetra, a ne predznaci popravaka.

Tablica gađanja sadrže tablice sa komplementarnim (dopunskim) popravkama mjesnog kuta ,odvojene za slučaj kada je cilj viši i niži od paljbenog položaja.

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-41-

Osnova za ulazak u tablice su kutevi elevacije za svakih **20 tisućitih** i mjesni kutevi za svakih **10 tisućitih**.

Tablice sa minimalnim daljinama za određivanje grebena zaklona kada se gađa sa zaklonjenog položaja za svakih 5 metara nalaze se u III. dijelu tablica gađanja pomoćne tablice.

Osnova ulaska u te tablice je visinska razlika između grebena zaklona i paljbenog položaja, za svakih 5 m, i udaljenosti do grebena zaklona za svakih **100 m**.

Intervali elemenata za ulazak u sve tablice su tako utemeljeni da su sve tablične vrijednosti, izuzimajući daljinar, određene bez interpolacije, u skladu sa najbližom vrjednošću elemenata za ulazak.

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-42-

Normalni (tablični) uvjeti gađanja

Za normalne uvjete gađanja smatra se:

A. Topografski uvjeti;

- a) Cilj je na istoj visini kao paljbeni položaj, mjesni kut cilja je jednak ništici i elevacija na kvadrantu je jednaka kutu elevacije iz tablica.
- b) Bojno vozilo je u vodoravnom položaju; nema premještanja sa linije gađanja.

B. Ballistički uvjeti;

- a) Oblik projektila odgovara proizvodnom dizanju

- b) Težina projektila:
 - bez kočionog prstena - 66,6 kg
 - sa malim kočionim prstenom - 66,7 kg
 - sa velikim kočionim prstenom - 66,75 kg

- c) Prah sa **RSI - 12 M** oznakom

- d) Težina praškastog punjenja **-20,5 kg**

- e) Temperatura punjenja **+ 15° C**

06315764

-43-

Podaci pomoću kojih su sastavljene tablice gađanja

Kut elevacije	Brzina na kraju aktivnog dijela	Kut na kraju aktivnog dijela		Koordinate na kraju aktivnog dijela		Koeficijent lica u skladu sa zakonom iz 1958. god.
α	S_a	Θ_a		X_a	Y_a	158
°	m/s	C_r	min	m	m	-
Bez kočionog prstena $\vartheta_p = 45,6$ kg						
10	699	5	02	686	70	0,888
20	697	15	16	661	190	0,891
30	695	25	33	614	303	0,893
40	692	35	57	549	407	0,897
50	690	46	30	465	499	0,904
Sa malim kočionim prstenom $\vartheta_p = 46,7$ kg						
10	690	5	00	679	69	1,373
20	688	15	14	654	186	1,375
30	685	25	31	609	299	1,377
40	683	35	56	543	402	1,379
50	681	46	29	461	494	1,381
Sa velikim kočionim prstenom $\vartheta_p = 46,75$ kg						
10	675	4	57	650	64	2,046
20	673	15	11	626	178	2,080
30	671	25	29	583	286	2,112
40	669	35	54	521	384	2,144
50	667	46	27	441	471	2,176

Vrijeme rada raketnog motora $\tau_a = 1,87$ s

Jedinični impuls reaktivne sile $I_1 = 206$ kg s/kg

Koeficijent vjeta izravnog utjecaja na balistički vjetar u aktivnom dijelu putanje
 $Y_w = -0,0055$ rad/m/s

Koeficijent vjeta dvojnog utjecaja na balistički vjetar u aktivnom dijelu putanje
 $Y_M = 0,0014$ rad/m/s

Sustavna devijacija (skretanje) po pravcu $D_0 = -7$ tisućitih

C. Meteorološki uvjeti

- Atmosfera je mirna, brzina vjeta na svim visinama je jednaka ničiti.
- Barometarski tlak na paljbenom položaju $H = 750$ mm stupca žive (mm Hg).
- Prizemna temperatura zraka na paljbenom položaju $t = 15,9$ °C.
- Temperatura zraka varira ovisno o visini, u skladu sa zakonom normale.

06315765

-44-

Primjer za određivanje nekih popravakaTopografska daljina gađanja **14 600 m**Kut gađanja **18 - 00**Brzina balističkog vjetra u aktivnom dijelu putanje **6 m/s**Azimut vjetra **14 - 00**Temperatura raketnog punjenja **+2°C** ($\Delta T_c = -13^\circ\text{C}$)

Gađa se bez kočionih prstena

Kut vjetra je **(18 - 00) - (14 - 00) = 4 - 00**Iz tablice za rasčlanjivanje vjetra na komponente, uzdužna komponenta je **- 5 m/s**, a bočna **+2 m/s**

Iz tablice TT-74 na daljini od m određeno je:

a) tablična popravka $\Delta E_{wal} = -19,2$ tispopravka daljine zbog uzdužne komponente vjetra je $\frac{19,2}{10} \cdot (-5) = +9,6$ tisb) tablična popravka $\Delta E_{wat} = -13,4$ tispopravak daljine zbog bočne komponente vjetra je $\frac{-13,4}{10} \cdot 2 = -2,7$ tisUkupna popravka daljine zbog 14 600 balističkog vjetra u aktivnom dijelu putanje je **(+9,6) + (-2,7) = +6,9** tisDobivena popravka zaokružena je na cijele tisućite, pa iznosi **+7 tisućitih**.c) tablična popravka $\Delta D_{wat} = +54$ tispopravka pravca zbog bočne komponente vjetra je $\frac{54}{10} \cdot 2 = +10,8$ tisd) tablična popravak $\Delta D_{wal} = -6$ tisUkupna popravka pravca balističkog vjetra u aktivnom dijelu putanje je **(+10,8) + (-6) = +4,8** tisDobivena popravka zaokružena je na cijele tisućite pa iznosi **+5 tisućitih**e) tablična popravka ΔR_{tc} pošto je $\Delta T_c = -13^\circ\text{C}$, tablična popravka zbog odstupanja temperature punjenja data za negativno odstupanje $\Delta R_{tc} = -157$ m.

Popravka daljine zbog odstupanja temperature punjenja od dane normalne je

 $\frac{-157}{10} \cdot (-13) = +204$ m**Primjer korištenja tablica sa minimalnim daljinama za određivanje grebena zaklona kada se gađa sa zaklonjenog položaja**

Tablice sa minimalnim daljinama koriste se za određivanje daljine koja određuje paljbeni položaj dobiven odgovarajućom visinom grebena zaklona i minimalnom daljinom 12 tablica za koju se određuje .

Kako i za određivanje grebena zaklona odgovarajuće visine grebena zaklonai visine za koju se određuje greben za bojno vozilo.

Kad se određuje greben zaklona, potrebno je minimalnu daljinu popraviti zbog balističkog vjetra aktivnog dijela putanje i zbog temperature punjenja.

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45.

Prvi primjer:

Odredite udaljenost na kojoj paljbeni položaj mora biti smješten u odnosu na greben zaklona. Visinska razlika između zaklona i paljbenog položaja je **5 m**. Gađa se malim kočionim prstenima.

U tablici sa minimalnim daljinama **TT-74 m** (cilj je u visini paljbenog položaja), minimalna daljina je **2 600 m**.

Prema toj daljini, visinska razlika između grebena zaklona i paljbenog položaja od 5 m određuje udaljenost od 800 m na kojoj bi trebalo biti smješten u odnosu na greben zaklona.

Drugi primjer:

Odredite greben zaklona. visinska razlika između grebena zaklona i bojnog vozila je 35 m, udaljenost između grebena zaklona i bojnog vozila je **200 m**;

balistički bočni vjetar u aktivnom dijelu putanje brzine **10 m/s** puše zdesna (kut vjetra **45-00**); temperatura punjenja **+5 °C**. Gađa se sa velikim kočionim prstenom (ϕ 112 mm).

U tablici sa minimalnim daljinama **TT- 74 M** je daljina od **7 770 m**.

U tablicama gađanja **TT-74 M** odgovarajuća daljina od **7 770 m** sadržava popravke daljinara zbog balističkog bočnog vjetra u aktivnom dijelu putanje od **13,3 tisućitih** i odstupanja temperature punjenja (**-10°C**) od **100 m**.

Predznaci popravka *vidi tablicu "Predznaci popravaka") su pozitivni.

Popravka za temperaturu punjenja je data na **7 770 m** i iznosi **7 870 m**. U tablici gađanja **TT-74 M** daljini od **7 870 m** odgovara daljinar od **259 tisućitih**. Na taj kut dodana je popravka od **13,3 tisućita** i iznosi **272 tisućita** za greben zaklona.

Zbroj između stupnjeva mjesne sprave (njezinim predznakom) i daljinara za dani primjer. Ne bi smio biti manji od **272 tis.** Ako je manji moguće je da projektil udari u greben zaklona.

2. Podaci daljinara

122 mm raketno topničko bojno vozilo opskrbljeno je mehaničkim panoramskim daljinarom bez bubnja daljine.

Daljinar ima dvije skale kuta elevacije: skalu u stotinama tisućitih, stupnjevima i označena brojkama za svakih **5 tisućitih 0 do 95**.

Način provjeravanja početnog stupnjevanja i nulte crte gađanja dan je priručnikom raketno topničko bojno vozilo.

3. Podaci o streljivu**a) Projektili**

Naziv i oznaka projektila	Upaljač	Težina projektila bez kočionog prstensa, sa upaljačem, u kg	Dužina projektila sa upaljačem, u kalibrima	Težina eksplozivnog punjenja u kg
Visokoeksplozivni fragmentirajući raketni projektil M-21 OF	9 E 210		23,4	6,4
Oznaka projektila:				
9 M 22 U		66,6		
9 M 22		66,0		

Različiti predznak projektila je oznaka stavljena na tijelu glave.

06315767

-47-

Upozorenje za rukovanje projektilima**1) Zabranjeno je:**

- transportiranje raspakiranih projektila;
- polaganje projektila na zemlju;
- paljenje vatre i pušenje na udaljenosti manjoj od 100 m od mjesta skladištenja projektila.

2). Projektili na paljbenom položaju trebali bi biti zaštićeni od direktnih Sunčevih zraka i od atmosferskih nepogoda.**3a). Prije punjenja bojnog vozila obaviti slijedeće:**

- očistiti projekte, skinuti mast, prljavštinu, pijesak i snijeg;
- provjeriti jesu li kontakti projektila čisti;
- provjeriti da na tijelu projektila nema oštećenja i je li vodilica u ispravnom položaju;
- odvit čep sa mjesta gdje dolazi upaljač;
- naviti upaljač na svaki projektil. Usporiti ga ključem, te učvrstiti držač;
- ako se vrši gađanje bez kočionog prstena umetnuti projektil bez balansiranja, a u slučaju gađanja sa kočionim prstenima, provjeriti i njihovo okretanje zakretanjem rukom.

b) Upaljač (popravke i funkcioniranje)

Oznaka upaljača	Djelovanje upaljača	Položaj za gađanje	Položaj za transport
9 E 210	Trenutno usporenjem	("00")	("0")
	sa malim usporenjem	("M")	
	Sa velikim usporenjem	("5")	

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FIRING TABLES

FOR

SELF-PROPELLED MULTIPLE ROCKET LAUNCHER 122mm M-21-OF

AND

SELF-PROPELLED MULTIPLE ROCKET LAUNCHER 122mm “*VULKAN*”

/“VOLCANO”/

TT-74**TT-74m****TT-74M**

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ALL THOSE IN POSSESSION OF THESE FIRING TABLES AND ALL THOSE WHO USE THEM TAKE FULL RESPONSIBILITY FOR THEIR USE AND ARE ANSWERABLE FOR IT.

DISAPPEARANCE, DAMAGE OR DESTRUCTION OF THE TABLES MUST BE REPORTED TO THE COMMANDER.

FIRING TABLES ARE KEPT AS AN OFFICIAL SECRET. THOSE WHO HANDLE THEM ARE OBLIGED TO TAKE ALL NECESSARY MEASURES TO PREVENT THE TABLES GETTING INTO ENEMY HANDS.

IMPORTANT NOTICE WHEN USING SVLR /self-propelled multiple rocket launcher/ 122MM “VULKAN/

All the values in the firing tables given in mils are in effect 1/6000. The only exception is the value for the range finder which, for efficiency reasons, is presented by both values (1/6000 and 1/6400).

This should particularly be taken into account when carrying out fire or computing firing data for the SVLR 122 Vulkan because its sights are given in 1/6400 mils.

THEREFORE, WHEN FIRING THE SVLR 122 mm “VULKAN:”

1. When using the firing tables to calculate weather and ballistic corrections of the firing data, all the values of the corrections in mils (given in 1/6000) are to be converted into 1/6400, using supplementary tables (they provide more accurate readings than the coefficient).
2. It should be noted that the table for wind components only provides 1/6000 value, because the values of the corrections in the tables, as stated above, are given in 1/6000 mils, therefore, if the direction of the wind is given in 1/6400 or in degrees, its value is to be converted into 1/6000 mils, and then according to such wind and the azimuth 1/6000 mils (if the value is 1/6400 it should be converted into 1/6000) determine the wind angle and its components (“do not use the signs of the components given above the **wind angles in the table for wind components** or the signs of correction caused by the wind in the firing tables, rather, the signs of correction of the direction caused by wind (lateral) are to be determined using the “Signs of Correction” Table, under “2. Signs of Correction of Direction”).
3. The corrections of the goniometer (direction), depending on their signs, should be correctly added or subtracted, taking into account the fact that the goniometer on its sight increases counter clockwise, in other words in the opposite direction than indicated on the sight of the SVRL M-21-OF.

I. Basic cautionary instruction

Full instruction

1. Rockets **M-21-OF** marked as **9 M 22** should be fired in accordance with the conditions for the **9 M 22 U** projectiles.

2. The identification of spoilers (coloured black) has been done in the following way:

- large spoilers; for those marked **640/73** – the projectiles are marked **9 M 22/B**, and for those marked **641/73** – the projectiles are marked **9 M 22 U/M**;

- small spoilers; for those marked **640/73** – the projectiles are marked **9 M 22/M**, and for those marked **641/73** – the projectiles are marked **9 M 22 U/m**.

1. Firing forbidden:

Number	Under what conditions	Type of projectile	Reason
1	When fuses (9 E 210) have a broken or damaged membrane	M 21 - OF	Premature explosion of projectile
2	When the nose on the fuse's detonator or the body of the warhead or rocket show cracks or rust or deep damages	M – 21 - OF	Premature explosion of projectile
3	When spoiler is deformed or irregular	M -21 -OF	Normal flight of projectile is possible

2. Cautionary instruction for fire:

1. These are tables for the fire with rocket artillery combat vehicle **M-21-OF 122 mm**, with the **9 M 22 U** or **9 M 22** rockets without a spoiler, or with a small spoiler **Φ 90 mm** and a large spoiler **Φ 112 mm**. These projectiles have **9 E 210** fuses.

2. When using **9 M 22** projectiles, the tables must be used. Entering the following additional corrections by distance:

- minus 130 m when firing projectiles without a spoiler
- minus 70 m when firing projectiles with a small spoiler
- minus 40 m when firing projectiles with a large spoiler

3. When using **M-21-OF** projectiles, an additional correction of direction must be entered in all cases, which is **d 0-07**.

4. Spoilers are used to improve accuracy of indirect fire. Depending on the range and type of spoiler, and for standard firing conditions, the tables should be used in the following way:

Distance in km	Spoiler	Use firing tables
Between 1.4 and 12.00	Large	TT-74 M large spoiler
Between 12.0 and 15.9	Small	TT-74 m Small spoiler
Between 15.9 and final range	No spoiler	TT-74 No spoiler

The use **M-21-OF** projectiles for distances up to **5 km** is possible in extraordinary cases and only in situations when there are no friendly troops in the direction of fire, since a significant amount of short rounds are possible, caused by a large disperse of the projectile at these ranges.

5. Firing **M-21-OF** projectiles is allowed only when temperatures of the charge are between **-40°C and +50°C**.

6. Ballistic wind in the active part of the trajectory is measured as the average wind of the active part of the trajectory, therefore, concurrent influence of every component (lateral and crosswind) needs to be considered on the deviation both by distance and direction (dual influence).

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ET 0631-5718-0631-5767 partial

If there is no fire when wind is being measured, the initial firing data may be set using the ground wind, measured at 3.5 m above, by an anemometer. The ground wind should be measured 2-4 times before it is divided into components (crosswind and lateral).

When using the ground wind, the dual influence should not be applied; in that case the correction of range caused by lateral component does not need to be applied or the correction of direction caused by the inserted component.

7. Irrespective of the procedure used to set the firing data, it is obligatory to enter corrections (even approximate ones) caused by the ballistic wind of the active part of the trajectory (or by the ground wind) or those caused by deviation in the temperature of the charge provided by a tabular value.

8. The preparations to fire **122 mm M-21-OF** projectiles are carried out following the instruction given.

3. Signs of correction

1. Signs of the correction of range

Number	Correction	Sign of correction
1	Correction caused by crosswind of the active part of the trajectory: - wind angle between 0-00 and 15-00 and between 45-00 and 60-00 (head wind, reduces range) - wind angle between 15-00 and 45-00 (tail wind, increases range)	+ -
2	Correction caused by lateral ballistic wind of the active part of the trajectory:	

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ET 0631-5718-0631-5767 partial

	- wind angle between 0-00 and 30-00 (left side wind, increases range) - wind angle between 3-00 and 60-00 (right side wind, reduces range)	- +
3	Correction caused by crosswind of the passive part of the trajectory: - wind angle between 0-00 and 15-00 and between 45-00 and 60-00 (head wind, reduces range) - wind angle between 15-00 and 45-00 (tail wind, increases range)	+ -
4	Correction caused by deviation in air temperature and propellant temperature: - the deviation in temperature is positive (temperature is higher than standard, increases range) - the deviation in temperature is negative (temperature lower than standard, reduces range)	- +
5	Correction caused by deviation of air pressure: - deviation of air pressure is positive (pressure higher than standard, reduces range) - deviation of air pressure is negative (pressure lower than standard, increases range)	+ -
6	Signs of complementary corrections for the site angle are tabulated in the tables containing these corrections.	

2. Signs of the correction of direction

Number	Correction	Sign of
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ET 0631-5718-0631-5767 partial

		correction
1	Correction caused by crosswind of the active part of the trajectory: - wind angle between 0-00 and 15-00 and between 45-00 and 60-00 (head wind, deflects the projectile to the left) - wind angle between 15-00 and 45-00 (tail wind, deflects the projectile to the right)	To the right To the left
2	Correction caused by lateral ballistic wind of the active part of the trajectory: - wind angle between 0-00 and 30-00 (left side wind, deflects the projectile to the left) - wind angle between 3-00 and 60-00 (right side wind, deflects the projectile to the right)	To the right To the left
3	Correction caused by lateral ballistic wind of the passive part of the trajectory: - wind angle between 0-00 and 30-00 (left side wind, deflects the projectile to the right) - wind angle between 15-00 and 45-00 (right side wind, deflects the projectile to the left)	To the left To the right

ET 0631-5718-0631-5767 partial

1. M-21-OF	High explosive rockets without a spoiler	(TT-74)
2. M-21-OF	High explosive rockets with a small spoiler	(TT-74m)
3. M-21-OF	High explosive rockets with a large spoiler	(TT-74M)

*Draft English Translation**ET 0631-5718-0631-5767 partial***1. Firing tables****For M-21-OF High explosive rockets without a spoiler****TT-74**

When 9 M 22 projectiles are used, introduce an additional correction of distance by - 130m.

When 9 M 22U and 9 M 22 projectiles are used, introduce an additional correction of the system deviation by direction, which is d 0-07.

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ET 0631-5718-0631-5767 partial

WITHOUT A SPOILER**GRAPHICAL FIRING TABLE****FOR SVLR /self-propelled multiple rocket launcher/ 122mm M-21-OF and
“VULKAN”**

/see original for the chart; vertical line represents altitude in km; horizontal line
represents range in km/

/Text below the chart:/

The angles of elevation (E) are given in 1/60-00 mils (outside brackets) and in 1/64-00 mils (between brackets). T stands for the summit of trajectory which is determined by the distance of the summit and the PP (Xm; first number in the brackets) and the ordinate of the trajectory at summit from the horizon PP (Ym; second number in the brackets).

/.../

ERN 0631-5733; p14

TABLES FOR COMPLEMENTARY CORRECTIONS OF THE SITE ANGLE
M-21-OF

A. Target higher than firing position**WITHOUT SPOILER TT-74**

Site angle	Angle of elevation	Site angle
	/see original for readings/	

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NOTE: 1. OTHER COMPLEMENTARY CORRECTIONS OF THE SITE ANGLE
ARE POSITIVE

2. THE ANGLES OF ELEVATION, SITE ANGLES AND THE
CORRECTIONS ARE GIVEN IN MILS

B. Target lower than firing position

Site angle	Angle of elevation	Site angle
	/see original for readings/	

NOTE: 1. OTHER COMPLEMENTARY CORRECTIONS OF THE SITE ANGLE
ARE POSITIVE

2. THE ANGLES OF ELEVATION, SITE ANGLES AND THE
CORRECTIONS ARE GIVEN IN MILS

/.../

ERN 0631-5747; p26

III. SUPPLEMENTARY TABLES

**Tables containing minimum distances for determining the peak of the shielding
element, when firing from shielded positions.**

Tables containing the values of trigonometric functions.

Tables of wind components.

Table for the conversion of degrees and minutes into mils.

Tables for the conversion of mils into degrees and minutes.

Tables for the conversion of 1/6400 mils into 1/6000 mils and vice versa.

Tables for computing topographic elements of targets (aiming points)

0631-5728-0631-5732-ET/Translation

RSL - 12 M Powder charge													
M-21 OF Without safety ring													
M - 21 - OF High-explosive rocket projectile													
TT-74													
ADJUSTMENTS													
Range finder		1/6000	Range adjustm ent to shift angle of elevatio n by 1/1000		Size of the first fork		Probable deviation		Altitud e of the active part of the traject ory				
		1/6400											
DISTANCE													
R	S	Arml	F	Ep	Ep	Ya	DIRECTION						
m	in thousan ds	m	in thousa nds	m	m	m							
							POSITION						
							DIRECTION						
							DISTANCE						
							BECAUSE OF DEVIATION						
							CHARGE TEMPERAT URES OF 10°C						
							Negative deviation						
							Positive deviation						
Elevation angle in the quadrant													
Drop angle													
Terminal velocity													
Flight time													
Altitude of entry into the weather bulletin, medium													
Ordinate of the trajectory at summit													
DISTANCE													

/see original for numbers/

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0631-5728-0631-5732-ET.doc.doc/hij