

## APPENDIX 6 TO ANNEX K

# CANADIAN ARMY MEDIUM RANGE RADAR (MRR)

## LIVE FIRE EVALUATION PLAN OVERVIEW

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## 1. Introduction

### 1.1. Purpose

- 1.1.1. The purpose of the Live Fire Evaluation is to validate the field operation of each competing System in order to assess their effectiveness in meeting the required indirect fire weapon locating and air surveillance capabilities. This evaluation will be used to provide the project team with data to support an overall competition decision.

### 1.2. Evaluation Summary

- 1.2.1. The Live Fire Evaluation will be conducted at each bidder's proposed location. Canada has no restriction on the selection of location however; bidder's Live Fire Evaluation plan will be reviewed for safety, fairness and efficacy.
- 1.2.2. Following the closing of the RFP, Canada will request a date for the conduct of Live Fire Evaluation from each of the participating bidders. The final date will be set with consultation with each bidder.
- 1.2.3. The Bidders shall arrange to fire their proposed shot matrix that meets the evaluation requirements in order to capture operational performance parameters while observing live fire weapons.
- 1.2.4. Weapon locating and air surveillance evaluation will be compared against the requirements stated in the RFP specifications.
- 1.2.5. All rounds fired other than those fired during a proposed initial pilot test, will be used for the record.

### 1.3. The MRR System

- 1.3.1. Bidders are responsible for delivery and operation of their proposed MRR System for the live fire evaluation.
- 1.3.2. Bidders are responsible for providing configuration managed versions of hardware and software for the live fire evaluation.
- 1.3.3. No engineering is to be performed during the live fire evaluation. While malfunctioning parts may be replaced, no System improvements shall be allowed during the live fire evaluation.
- 1.3.4. If the bidder decides to deploy more than one System for the purpose of these evaluations, all Systems shall be inspected and validated by DND before any testing. These Systems shall be identical with no configuration changes allowed at the time of test.

#### 1.4. Bidder Live Fire Plan

- 1.4.1. The Bidder shall provide a complete Live Fire Evaluation Plan which satisfies the entire requirements outline in this document with the bid. The Plan is a mandatory part of the bid submission requirements.
- 1.4.2. Zero merit points will be awarded for any desirable requirements outlined in this document for which there are no planned Live Fire Evaluation. The Bidder shall be awarded the maximum merit points for which their System has passed the corresponding shot set.
- 1.4.3. In addition to the requirement herein, the Bidder shall prepare and submit with the bid the Live Fire Evaluation Plan as per the requirements of DID 1278-HWT-007: Acceptance Test Plan.

#### 1.5. Bidder Responsibilities

- 1.5.1. The Bidders shall be responsible for the conduct of their respective Live Fire Evaluation. The Bidder shall provide Canada with access to all data, hardware and information for the validation and verification of the results as necessary.

## **2. Conduct of the Evaluation and System Failure Definition**

### 2.1. Weapon Location

- 2.1.1. No mode changes or adjustment to the performance of the System shall be allowed for the mandatory requirements in paragraph 4.1.5 to 4.1.12 inclusive.
- 2.1.2. If the System under test fails, the test may be repeated. Any failed test shall be repeated in its entirety.
- 2.1.3. The False Location rate shall be recorded during the weapon location evaluation.

### 2.2. Weapon Location Desirable Requirements

- 2.2.1. The bidder may only change the operating mode from 360 degrees to 90 degrees during the desirable requirements evaluation.
- 2.2.2. The Bidder shall propose an added desirable shot set, if doing so accommodates the evaluation of their claimed maximum range.
- 2.2.3. The System under test shall be required to locate these weapons to the required desirable accuracy for 80% of the shots fired.

### 2.3. Air Surveillance

- 2.3.1. For a successful flight test, the system under test shall demonstrate the required parameters for two out of three range incursions by the aircraft. The bidder shall demonstrate that the tracked range translates into the specified range for the specified radar cross section. As per paragraph 3.2 of the System Performance Specification at Appendix 1 to Annex A

### 3. Test Description

#### 3.1. Weapon Locating Shot Description

- 3.1.1. The following is a general description of the types of shots to be presented for evaluation.
- 3.1.2. The Evaluation Requirements demonstrates the bidder's System performance in a set of scenarios which exercises the key elements of performance requirements stated in the specification at Appendix 1 to Annex A – System Performance Specification. The Bidders shall design their fire plan based on the evaluation requirements. Figure 1 illustrates a sample of geometry for Live Fire shot evaluation and defines angles used in shot definition. Weapon to Radar Azimuth and Radar to Weapon Azimuth are measured from UTM grid north.
- 3.1.3. The Live Fire Evaluation shall test the System performance with respect to location range, accuracy of the point of origin, probability of location, probability of false location, classification of the weapon and the accuracy of the point of impact.
- 3.1.4. Twenty (20) detection opportunities is the minimum number of locations required for each Live Fire Shot test.
- 3.1.5. The bidders shall bring attention to Requirement 11 to ensure that their System can locate weapons in noise, clutter and EP effects at the specified levels.

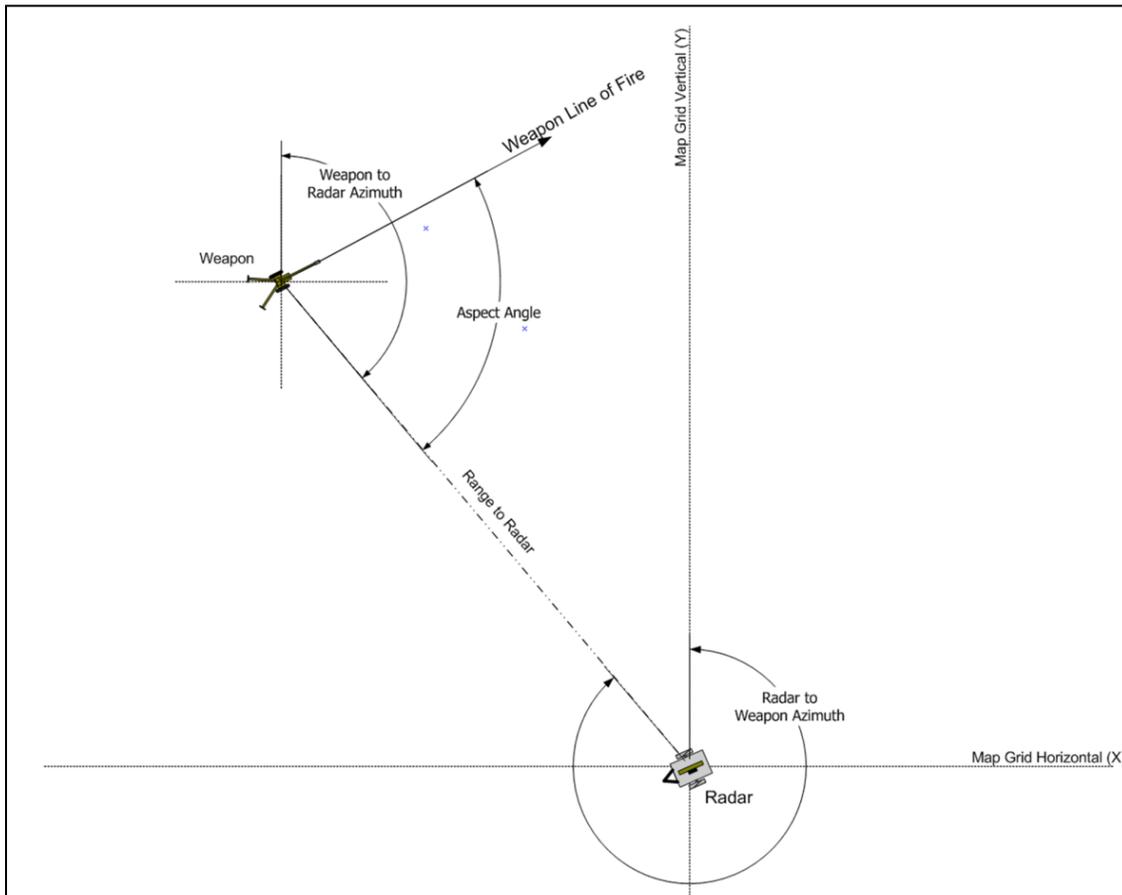


Figure 1 Sample Live Fire Evaluation Problem geometry

### 3.2. Air Surveillance Evaluation Description

- 3.2.1. The Air Surveillance mode of the radar under test will be validated with a dedicated flight of an aircraft or several aircraft. The radar System under test shall not operate its secondary radar during this test.
- 3.2.2. The aircraft or target used shall be arranged in such a way that the RCS can be extrapolated to the specified range and RCS for air surveillance for both the 75km range and 25 km range requirements in accordance with paragraph 3.1.5 of the SPS. Appendix 1 to Annex A – System Performance Specification.
- 3.2.3. The Air Surveillance evaluation shall evaluate the range, accuracy, elevation, altitude, the detection rate, the false track rate and the new track latency capabilities of the bidders System with three passes of aircraft for each component of the evaluation.

## 4. Live Fire Weapon Locating

### 4.1. Live Fire Evaluation Plan Requirements

- 4.1.1. The parameters of all proposed tests in the bidders live fire evaluation plan shall remain within the specification outlined in Appendix 1 to Annex A – System Performance Specification. Any deviation will be considered as non compliant and will result in disqualification of the bidders live fire evaluation plan.
- 4.1.2. Example: The fire weapons type and caliber shall match the specification in paragraph 3.1.3.4.1 of in Appendix 1 to Annex A– System Performance Specification.
- 4.1.3. The bidder shall demonstrate the remote capability of the radar system in accordance with paragraph 3.1.1.4, Appendix 1 to Annex A – System Performance Specification
- 4.1.4. The bidders shall demonstrate by analysis that mandatory live fire capability is not compromised by:
  - 4.1.4.1. Varying atmospheric noise from various sources such as galactic sources including the sun, and man-made noise including Ultra Wide Band (UWB) transmitters that are not specifically defined as an electronic threat in the specification at paragraph 3.2 of Appendix 1 to Annex A – System Performance Specification;
  - 4.1.4.2. rain clutter paragraph 3.5.12.1 of Appendix 1 to Annex A – System Performance Specification;
  - 4.1.4.3. land terrain clutter paragraph 3.5.12.2 of Appendix 1 to Annex A – System Performance Specification; and
  - 4.1.4.4. electronic threat environment as described in paragraph 3.2 of Appendix 1 to Annex A – System Performance Specification. As specified in paragraph 3.2.of Appendix 1 to Annex A – System Performance Specification, only jammers and chaff are allowed to result in limited performance degradation.

- 4.1.5. All the Evaluation Requirements 1 through Evaluation Requirements 7 and the Desirable Requirements 8 through Desirable Requirements 10 shall include an evaluation of the probability of false location, classification of the weapon and the accuracy of the point of impact.
- 4.1.6. Evaluation Requirement 1 - The bidder shall demonstrate through live fire the capability of their System to locate a mortar weapon system firing from a minimum distance of 15km, in 360 degree mode, at a minimum aspect angle of 40 degrees, with at least 85% probability of location, with a minimum accuracy of 0.5% of the range.
- 4.1.7. Evaluation Requirement 2 - The bidder shall demonstrate through live fire the capability of their System to locate a gun weapon system firing from a minimum distance of 15km, in 360 degree mode, at a minimum aspect angle of 40 degrees, with at least 85% probability of location, with a minimum accuracy of 1.0 % of the range.
- 4.1.8. Evaluation Requirement 3 - The bidder shall demonstrate through live fire the capability of their System to locate a gun weapon system firing from a minimum distance of 15km, in 360 degree mode, at a minimum aspect angle of -5 to +5 degrees, with at least 85% probability of location, with a minimum accuracy of 1.0 % of the range. The projectile shall not impact within 5km of the bidder's radar System.
- 4.1.9. Evaluation Requirement 4 - The bidder shall demonstrate through live fire the capability of their System to locate a mortar or gun weapon system firing from a minimum distance of 15km, in 360 degree mode, at an aspect angle of between 25-35 degrees, with at least 80% probability of location, with a minimum accuracy of 0.5% of the range. (reference accuracy)
- 4.1.10. Evaluation Requirement 5- The bidder shall demonstrate through live fire the capability of their System to locate a gun or mortars weapon system firing from a maximum distance of 5km, in 360 degree mode, at a minimum aspect angle of 40 degrees, with at least 80% probability of location, with a minimum accuracy of 75 for gun (reference accuracy) 50m CEP(50).
- 4.1.11. Evaluation Requirement 6 - The bidder shall demonstrate through live fire the capability of their System to locate a gun weapon system firing at least 300 mils less in quadrant elevation than the quadrant elevation used in evaluation requirement 3, from a minimum distance of 15km, in 360 degree mode, at an aspect angle of -5 to +5 degrees, with at least 80% probability of location, with a minimum CEP(50) accuracy of 1.0 % of the range. The projectile shall not impact within 5km of the bidder's radar system.
- 4.1.12. Evaluation Requirement 7 - The bidder shall demonstrate through live fire the capability of their System to locate a multiple weapon systems operating in volley fire. There shall be a minimum of 5 rounds per volley. Each round, while in flight, shall be a maximum of 400 m from the nearest round with the objective of have a distance of 200 meters between rounds. The bidder shall demonstrate through live fire the capability of their System to locate volley fire from a minimum distance of 15km, in 360 degree mode, at an aspect angle of between 25-35 degrees, with at least 80% probability of location, with a minimum accuracy of 0.5% of the range.

- 4.1.13. Desirable Requirement 8 - The bidder must demonstrate through live fire the capability of their System to locate a gun weapon system firing from a minimum distance of 18km, in the preselected mode, at an aspect angle of +5 to +15 degrees, with at least 80% probability of location, with a minimum CEP(50) accuracy of 0.5 % of the range. If applicable the look angle shall be 0 degrees.
- 4.1.14. Desirable Requirement 9 - The bidder must demonstrate through live fire the capability of their System to locate a gun weapon system firing from a minimum distance of 24km, in the preselected mode, at an aspect angle of -5 to +5 degrees, with at least 80% probability of location, with a minimum CEP(50) accuracy of 0.5 % of the range. If applicable the look angle shall be 10 degrees.
- 4.1.15. Desirable Requirement 10 - The bidder must demonstrate through live fire the capability of their System to locate a gun weapon system firing from a minimum distance of 30km, in the preselected mode, at an aspect angle of +10 to +20 degrees, with at least 80% probability of location, with a minimum CEP(50) accuracy of 0.5 % of the range. If applicable the look angle shall be 30 degrees.
- 4.1.16. Desirable Requirement 11 - The bidder must demonstrate through live fire the capability of their System perform friendly fire registration to locate the point of impact of a friendly weapon system firing a distance of 15km to 30km, in the preselected mode, demonstrating the desirable range performance of the System.

## 5. Air Surveillance

### 5.1. Air Surveillance Requirements

- 5.1.1. Evaluation Requirement 12 - The bidder shall demonstrate through air surveillance the capability to detect and track a 1 meter<sup>2</sup> target from a range of less than 1 km to a range of a least 75 km, with a one-sigma accuracy of 20 meters in range, 0.6 degrees in azimuth and 600 meters in altitude at the 75 km range, establishing a new track within 10 seconds, 90% of the time at 75 km, and demonstrating the detection rate at 75 km as specified in paragraph 3.1.5.10 of Appendix 1 to Annex A – System Performance Specification. The results shall be extrapolated from the real target RCS to the specified 1 meter<sup>2</sup> target to show that the specifications have been met. The preferred method is to use a target that closely meets the 1 meter<sup>2</sup> RCS requirement. The false track rate through the test period shall not exceed the specified value at paragraph 3.1.5.11 of Appendix 1 to Annex A – System Performance Specification.
- 5.1.2. Evaluation Requirement 13 - The bidder shall demonstrate through air surveillance the capability to detect and track a 0.1 meter<sup>2</sup> target from a range of less than 1 km to a range of a least 25 km, with a one-sigma accuracy of 20 meters in range, 0.6 degrees in azimuth and 200 meters in altitude at the 25 km range, establishing a new track within 10 seconds, 90% of the time at 25 km, and demonstrating the detection rate at 25 km as specified in paragraph 3.1.5.10 of Appendix 1 to Annex A – System Performance Specification. The results shall be extrapolated from the real target RCS to the specified 0.1 meter<sup>2</sup> target to show that the specifications have been met. The preferred method is to use a target that closely meets the 0.1 meter<sup>2</sup> RCS requirement. The false track rate through the test period shall not exceed the specified value at paragraph 3.1.5.11 of Appendix 1 to Annex A – System Performance Specification.

- 5.1.3. Desirable Requirement 14 - The bidder must demonstrate through air surveillance the capability to detect and track a 1 meter<sup>2</sup> target at ranges from 75km to 125 km demonstrating the desirable range performance of the System.
- 5.1.4. Desirable Requirement 15 - The bidder must demonstrate through air surveillance the capability to detect and track a 0.1 meter<sup>2</sup> target at ranges from 25km to 40 km demonstrating the desirable range performance of the System.