NATO STANDARD

AEDP-20

VISUAL AND INFRARED IMAGERY COLLECTION STANDARD FOR TARGET ACQUISITION TRAINERS

Edition A Version 1
DECEMBER 2019

NORTH ATLANTIC TREATY ORGANIZATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

10 December 2019

1. The enclosed Allied Engineering Documentation Publication AEDP-20, Edition A, Version 1, VISUAL AND INFRARED IMAGERY COLLECTION STANDARD FOR TARGET ACQUISITION TRAINERS, which has been approved by the nations in the NATO AIR FORCE ARMAMENTS GROUP, is promulgated herewith. The recommendation of nations to use this publication is recorded in STANREC 4595.

2. AEDP-20, Edition A, Version 1, is effective upon receipt.

4. This publication shall be handled in accordance with C-M(2002)60.

for Zoltán GULYÁS
Brigadier General, HUNAF
Director NATO Standardization Office

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RESERVED FOR NATIONAL LETTER OF PROMULGATION

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]

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TABLE OF CONTENTS

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CHAPTER 1 INTRODUCTION

1.1. AIM

1. The aim of this standard is to provide a standard method for NATO participating nations to collect visual and infrared (IR) imagery of NATO allied vehicles.

2. Participating nations agree to follow the format for recording visual and IR imagery of their vehicles and possible include the Allied database.

3. All nations will protect all imagery within the NATO database in accordance with NATO regulations for items classified as NATO CONFIDENTIAL.

1.2. DEFINITIONS

The terms and definitions listed at ANNEX A are used for the purpose of this agreement only.

1.3. GENERAL

1. Numerous NATO countries are simultaneously developing training devices for their respective soldiers. These IR training devices are designed to improve the soldier's ability to detect, recognize and identify targets by providing visual and IR images of numerous combat vehicles. This program will maximize the effect of these trainers by increasing the number of vehicle images available for participating nations. This program will ensure that improved target identification can be accomplished for future NATO exercises and operations. It is understood that the calibrated infrared imagery of certain vehicles will be classified by the participating country. In order to maximize the number of vehicles, the standard has established that each country will reserve the right to collect uncalibrated data on those vehicles, which it determines will have a classification of higher than NATO CONFIDENTIAL.

2. In order to minimize cost, the collection of imagery will be performed by each participating country. Each participating country shall provide imagery for their respective vehicles in accordance with ANNEX B.

3. This standard defines the procedures for collecting visual and infrared imagery of combat vehicles to fidelity necessary to meet the needs of current and future needs of vehicle identification trainers. ANNEX B defines the critical categories necessary to ensure that the minimum level of standardization is provided for these collections. The standard will allow any NATO nation to independently collect imagery to exchange with other participating nations.

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ANNEX A TERMS AND DEFINITIONS

A.1. Ambient Temperature

The air temperature surrounding the target of interest.

A.2. Calibrated Infrared Imagery

Imagery collected with a known thermal device, which provides sufficient information to map the temperature differences between pixels across the scene and at least two known temperatures. There should never be a blackbody in the scene with the target. Imagery of at least two blackbodies with known temperatures outside the training image scene may be used as calibration references. These temperature reference images should be collected approximately three times per hour.

A.3. Calibrated sensor

A sensor for which the measured performance has been compared to the expected performance with the deviation defined, and/or corrected.

A.4. Combat vehicle

Any vehicle found consistently in the contact zone (i.e. within 20 km of the forward line own troops (FLOT)).

A.5. Image

Representation of a target of interest as viewed through a sensor. An image is not a signature.

A.6. Instantaneous Field of View

Angular subtense of a single detector element.

A.7. Noise Equivalent Temperature Difference (NETD)

The temperature difference between the target (usually 10 times the detector angular subtense) and the background, which is required to produce a peak signal to rms. Noise value of one.

A.8. Signature

The two-dimensional representation of a three-dimensional environment in a certain waveband/at a certain frequency.

A.9. 3 Dimensional Images

Scaled and perpendicular views of targets from specific wavebands for drafting of virtual models with high-fidelity characteristic features and appearance.

ANNEX B COLLECTION GUIDELINES

B.1. Introduction

The following guideline defines the minimum requirements for the collection of visual and infrared images of combat vehicles. This annex describes the collection scenarios (moving and static), spectral bandwidths required, imagery collection camera requirements, imagery formats, meteorological data required, and level of vehicle conditioning.

B.2. Collection Scenarios

Multi-aspect: Static images of each vehicle are to be recorded with a calibrated imager if possible. If a calibrated imager is not available, at least two blackbody references at a known range and temperature must be collected outside the Field Of View (FOV) approximately three times per hour. Each image must have minimal dimensions of 590 x 400 pixels. Three different on-target resolutions should be collected: twenty millimeters per pixel +/- one millimeter per pixel; sixty four millimeters per pixel +/- five millimeters per pixel; two hundred millimeters per pixel +/- sixteen millimeters per pixel. Within the various targets of resolution mentioned above, signatures should be collected in a daytime solar loaded condition and in a nighttime post-crossover non-solar loaded condition. Images will be collected in all of the above conditions with the vehicle orientations of 0 degrees, 30 degrees, 90 degrees, 150 degrees, 180 degrees 210 degrees, 270 degrees and 330 degrees +/- 1 degree. Orientation is defined such that 0 degrees is the front aspect of the vehicle, and the aspect angle increases as the vehicle is rotated clockwise (as viewed from the top of the vehicle). Scene content should be as neutral as possible. There should be no man-made structures or buildings, no paved roads, and any tree line should be at least 200 meters behind the target. An empty flat open grass field with mowed grass between the sensor and vehicle is optimal. The target should always be in the center of Field Of View (FOV). There should be no water, large rocks, wild animals, or other natural or manmade clues or artifacts visible within the image.

B.3. 3 Dimensional Images

Static, close-up images of each vehicle are to be recorded with a calibrated imager to support simulation efforts, and should include the following aspects:

a. 4 cardinal aspects (0, 90, 180, 270 degrees) at minimum 20mm per pixel. (The 20 millimeter per pixel resolution for multi aspect collection fulfills this requirement).

b. One top-down view (+/- 3 degrees of perpendicular). Each picture should contain a minimum of 400 pixels along the longest axis of the target. If multiple images must be taken in order to obtain sufficient pixels on target, the images should be stitched together to create a complete image.

B.4. Moving

1. Imagery of various moving vehicles will be recorded in a cross-country setting at target resolutions between 16mm per pixel and 64mm per pixel, where the range within a given moving image series should not exceed 32mm per pixel. Thus a smaller vehicle might be collected with target pixel resolutions varying between 32 and 64mm per pixel, and a larger vehicle at 16-48mm per pixel. The moving vehicle sequences should be collected with the vehicle driving in a figure-eight pattern. The furthest point of the figure-eight pattern should be no more than 100 meters from the closest point relative to the sensor. No blackbodies should be placed in the moving scene. The vehicle should run a standard figure-eight course at least two times in both directions. There should be no man-made structures or buildings, no paved roads, and any tree line should be at least 200 meters behind the target. An empty flat open grass field with mowed grass between the sensor and vehicle is optimal. The vehicle should always be near the center of Field Of View (FOV), with the sensor panning to follow the vehicle. There should be no water, large rocks, wild animals, or other natural or man-made clues or artifacts visible within the image.

2. The priority for all collections is consistent day and night imagery. For all scenarios, the vehicles should be totally contained within the FOV with a five-pixel margin between the vehicle and the edge s of the image. The vehicle should be centered within the FOV. If a vehicle is too large to fit in a required FOV, the range to the sensor should be increased until the vehicle fits within that FOV and the corresponding change in millimeters per pixel should be noted. For example, if the gun tube of a tank is too long to fit properly in the image at 20mm per pixel, the target pixel resolution could be adjusted by increasing the distance between sensor and target until the desired image is obtained, and the difference in range to vehicle determined to calculate the corrected millimeters per pixel.

B.5. Spectral Bands

The spectral bands to be used for imagery recording are:

a. Infrared, 8-12 μm
b. Infrared, 3-5 μm
c. Visible

B.6. Infrared Sensor Requirements

a. 12-bit or higher calibrated sensor
b. NETD = 0.15°C maximum
c. Averaging of 16 frames minimum
d. Minimum 590 x 400 Resolution

B.7. Visible Sensor Requirements

a. Minimum 24 bit color image output (digitized film or digital sensor)
b. Minimum 590 x 400 Resolution

B.8. Calibrated Data

Generally, all infrared imagery is to be temperature calibrated. This may not be done using black bodies in the scene but may be done within the sensor itself. If a calibrated sensor is not available, the collection of two blackbody references outside the target FOV at a known distance and temperature should be collected three times an hour. Data descriptions within the headers or in another document shall clearly specify how the data is calibrated. Some countries may consider the infrared imagery of certain vehicles to be classified and will not provide calibrated data. A country may choose to provide uncalibrated imagery instead. Each country shall define the list of vehicles for which only uncalibrated imagery shall be provided.

B.9. Image Format

1. Imagery outputs will consist of two files per image, one for auxiliary information and one for imagery data. The auxiliary information may define the contents of the corresponding image, and may contain pertinent information about the scene, including the upper end temperature for the scene.

2. The still image file format is 16 bits per pixel (unsigned), with each pixel in the image representing the radiance value for the corresponding scene location. It is recommended to utilize STANAG 4545, the NATO Secondary Imagery Format, for the provision of still imagery.

3. It is recommended to utilize STANAG 4609, the NATO Digital Motion Imagery Format, for the provision of digital motion imagery. Although not recommended, analogue video is still acceptable and the images may be uncalibrated. For analogue video, 25 Hz is the frame rate, and PAL super VHS is the format. The camera used does not have to be the same camera used for still imagery but it must meet the minimum plan requirements for cameras.

B.10. Additional Information

Meteorological data should include, as a minimum, the following:

- Ambient temperature
- Relative humidity
- Barometric pressure
- Visibility
- Cloud conditions
- Wind conditions
- Time of day the image was taken
- Relative position of the sun to the target (when available)

B.11. Imaging Sensor Characteristics

Imaging sensor characteristics data should include, as a minimum, the following:

- Field of View
- Instantaneous Field of View
- NETD
- FPA pixel size
- Spectral band

B.12. Vehicle Identity

1. To include make and model number and specific NATO designation (e.g. M113-A2). If the vehicle has a specific combat load or any other treatment such as (CIPS Panel or camouflage). The armament, length, width and height of the vehicle should be provided.

2. Recommended vehicle information includes: Category (AFV, APC, SPA etc.); Aliases (2S3=Akatsiya, 2S6= Tunguska etc.); Origin; Crew/troop capacity; Mobility system; Amphibious/fording capability; Armor protection; Survivability systems (NBC overpressure etc.); Ammunition stowage; Sensors/night capability (Ku-band radar, gunner and commander's longwave thermal imager etc.); Associated systems (vehicles or platform found in association such as the M992 ammunition carrier for the M109 SPA).

3. Some countries may consider some of this information for certain vehicles to be classified and will not provide that data.

B.13. Vehicle Conditioning

All vehicle hatches must be closed. Where possible, no crewmembers or other individuals should be visible. For day time signatures vehicles should be solar loaded. For night time signatures vehicles should not be solar loaded. The vehicle engine should be running for at least 30 minutes before taking data to sufficiently heat up the engine. The vehicle should be driven for approximately, 15 minutes on hard surfaces or 20 minutes on sandy surfaces to heat up track suspension and road wheels. Field conditions may dictate shorter or longer running times based on the temperature of the suspension, tracks and wheels. All turrets should be slewed forward with gun tubes over the front deck as if driving into combat. Gun tubes should be approximately aligned with the access of the hull. If a vehicle has erectable radar, sensor missile mount or other device signatures should be collected with the device in both erected and stowed positions. No external equipment not normally carried into battle should be on the vehicle. If a vehicle has optional equipment such as removable external fuel drums or removable add-on armor the vehicle signature should be collected with and without such optional equipment.

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