ANNEX C

SYSTEM PERFORMANCE SPECIFICATION

CAF UAS SERIVES

DRAFT

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DRAFT

1. SCOPE

1.1. The requirements listed in this System Performance Specification (SPS) document are for the Unmanned Aircraft System (UAS) that must be used in the delivery of the Canadian Armed Forces (CAF) UAS Services Contract.

2. OPERABILITY

2.1 Launching & Recovery

2.1.1 The UAS must be ready to launch from a Cold Start in no more than 30 minutes. Readying for launch includes, but is not limited to:

a. Powering all systems in the UAS;
b. Performing all pre-launch functional checks;
c. Incorporating pre-flight Mission data;
d. Loading any pre-planned Mission routes;
e. Configuring all communication, navigation and installed Payload systems for the Mission; and
f. Moving the UA within the launch and recovery area.

2.1.2 The UAS must be readied for launch from a storage condition in no more than three (3) hours.

2.1.3 The UAS must be readied for launch from a maintenance condition in no more than three (3) hours.

2.1.4 The UAS must be able to recover, refuel, change removable data storage devices, and launch for a second six (6) hour Sortie in no more than 30 minutes.

2.1.5 The UAS must conduct Sortie Missions with no more than two Operators.

2.1.6 The UAS must launch and recover under ship motion limits of up to and including Sea State 3 as described in Table 1, Displacement, Velocity and Acceleration at Center of Flight Deck.

2.1.7 The UAS must launch and recover from an area the size of the launch and recovery area as described in this document without causing health and safety hazards to personnel located outside the launch and recovery area.

2.2 Shipping & Storage

2.2.1 The UAS must be able to be stored and transported in a standard 20 foot ISO shipping container.

2.2.2 The UAS must be able to be stored in the Halifax-class torpedo magazine with dimensions as described in Figure 1, with the exception of the antenna(s) and GCS.

2.3 Weight

2.3.1 Individual UAS components must not exceed 84 kg, with the exception of the UA and Communications antenna when fully assembled.

2.3.2 The UA and Communications antenna must be disassembled for storage and transport into components weighing less than 84 kg.

2.4 Data Zeroize

2.4.1 The UAS must provide a data Zeroize function to zeroize all data stored within the UAS, with the exception of ground based removable data storage devices.

2.4.2 The Zeroize function should render data unrecoverable within five minutes.
2.4.3 The Zeroize function should be accessible to the Operators at the UAO station and PO station as defined in this document.
2.4.4 The UAS should have an independent guarded means to zeroize ground based removable data storage devices.
2.4.5 The UAS must have a means of zeroizing equipment that due to component failure cannot be zeroized prior to releasing the equipment for repairs. This may include maintenance instructions on removing and/or destroying on board memory devices.

2.5 External Electrical Power

2.5.1 The UAS must operate using 50-60 Hz single phase 110/220 Volts Alternating Current (VAC) external power supply.
2.5.2 The UAS must have the capacity to maintain positive control of the UA for a period of not less than 30 minutes without external power supply.
2.5.3 The UAS should operate from a 28 Volts Direct Current (VDC) vehicle power supply without the use of a 110 VAC inverter/power supply.

3. SURVIVABILITY

3.1 The UAS Availability and Reliability must be sustained in the environmental conditions as specified in this document.
3.2 The UA must have a sound profile of <35dB at a slant range of 4,330 m under the following conditions:

a. International Standard Atmospheric conditions with zero wind; and
b. With the UA operating both at cruise power setting and at loiter power settings required to maintain altitude when executing standard turns to orbit a nearby point.

3.3 The UA must return to an Operator specified point upon loss of communication link.
3.4 The UA should return by multiple waypoint route upon loss of communication link.
3.5 The UAS must operate in conditions of up to and including the upper limit of Sea State 3 as defined in World Meteorological Organization, Manual on Codes, International Codes, Vol I.1 table 3700, p.I.1-C-106.
3.6 For ship-based operations, stowed UAS shipboard components must survive conditions of at least up to and including Sea State 6 as described in World Meteorological Organization, Manual on Codes, International Codes, Vol I.1 table 3700, p.I.1-C-106.
3.7 The UAS must use a GPS anti-jamming system.
3.8 The UAS should have a secondary navigational and position information system.
3.9 The UA should have a low visibility profile while in flight.
3.10 The UAS should be equipped with an audible and visual alarm system to alert the UAS Operator at any time an instruction is issued to the UA, or a situation arises that would result in the UA failing to maintain safe UA-ground separation (e.g. a routine that periodically compares UA altitude and position with DTED information, and warns Operators if the UA will encounter terrain in the next two minutes).
3.11 Electromagnetic Compatibility (EMC)

a. The UAS must operate in an Electromagnetic Interference (EMI) environment of a Halifax-class frigate.

b. The UAS emissions must not interfere with existing shipboard systems.
c. All UAS components and wiring must be provided with suitable shielding to be immune to the electromagnetic conditions in the operational area.
d. The UAS must operate in an EMI environment of a populated area without emissions interfering with day-to-day activities of the general population.
e. The UAS must operate in a contested and congested EM/GPS environment.

4. AVAILABILITY

4.1 The UAS must have a Sortie Availability of not less than 95%.
4.2 Availability must not be limited to launching a Sortie on time.
4.3 Availability must include performing in accordance with the SPS for the duration of the scheduled Sortie to meet the Mission.

5. MATURITY AND RELIABILITY (OPERATIONAL HOURS)

5.1 The UAS must either:
5.1.1 Have accumulated over 2,100 flying hours of military operational experience for each of the components affecting Airworthiness as defined at para 5.3; or
5.1.2 Have accumulated over 5,000 flying hours of operational experience for each of the components affecting Airworthiness as defined at para 5.3.
5.2 The UAS must have had a system reliability of not less than 95% for the most recent 1,000 operational flight hours.
5.3 The UAS must meet the minimum maturity requirement of paragraph 5.1 of this SPS for each one of the following components:

5.3.1 Airframe;
5.3.2 Propulsion system;
5.3.3 Avionics system;
5.3.4 Data link;
5.3.5 Payloads;
5.3.6 Command & control system; and
5.3.7 Corresponding software builds.

5.4 **Environmental**

5.4.1 The UAS must launch, operate and recover the UA in all environmental categories described in STANAG 2895 with the exception of zones C4 Extreme Cold, C3 Severe Cold, C2 Cold, C1 Intermediate Cold and M3 Marine Cold for temperatures below –28°C.
5.4.2 The UAS must launch and recover in sustained and gusting winds of up to and including 25 knots.
5.4.3 The UAS should operate in icing conditions.
5.4.4 The UAS must operate in precipitation of up to 1.4 mm per minute.
5.4.5 The UAS must launch and recover on ground slopes up to and including 10 degrees as measured from the horizontal oriented along any radial.
5.4.6 The UAS must launch and recover on unprepared ground, including unevenness of terrain and small debris.

5.4.7 The UAS must launch and recover on packed snow, ice, and slush not more than an inch in depth.
5.4.8 The UAS may be operated in a nuclear fallout environment.
5.4.9 The UAS will not be operated in, nor expected to withstand, a nuclear Electro-Magnetic Pulse (EMP).
5.4.10 Canada will provide nuclear decontamination of all UAS components.
5.4.11 The UAS may be operated in a radioactive environment.
5.4.12 Canada will provide radiological decontamination of all UAS components.
5.4.13 The UAS may be operated in a biological warfare environment.
5.4.14 Canada will provide biological decontamination of all UAS components.
5.4.15 The UAS may be operated in a chemical warfare environment.
5.4.16 Canada will provide chemical decontamination of all UAS components.

6. FLIGHT SAFETY REQUIREMENTS

6.1 The UAS must have a voice recorder in the GCS.
6.2 The GCS voice recorder must record:

6.2.1 Voice communications transmitted from or received in the GCS;
6.2.2 Voice communications in the GCS;
6.2.3 Voice communications of UAS crew using the UCS's intercommunication system; and
6.2.4 Voice or audio signals introduced into a headset or speaker.

6.3 The GCS must have an area microphone, which records voice communications originating at UAS crew work place and voice communications of other ground staff when directed to those stations.
6.4 The GCS voice recorder must have an aural or visual means for pre-flight checking of the recorder for proper operation.
6.5 The GCS voice recorder must have a Universal time reference signal recorded on a special track.
6.6 The UAS must have a GCS data recorder
6.7 The GCS data recorder must continuously record all the data transmitted via the command and control data link and the status of the GCS.
6.8 The GCS data recorder must have a capacity to record the maximum duration of a Sortie.
6.9 The GCS data recorder time basis used must be synchronised with a uniform time basis.
6.10 The GCS downlink data must be labelled and recorded with the time basis at which they have been generated in the UA.
6.11 The GCS uplink data must be labelled and recorded with the time basis at which they have been generated in the GCS.
6.12 The GCS data recorder must record a reference to Air Traffic Control time.
6.13 The GCS data and voice recorder time basis must allow a post synchronisation of all recorded data or information with an accuracy better than half a second (0.5 s) between any of the recorders.
6.14 The GCS should provide a function that is able to read the data recorder for post-flight operation.

7. SUB-SYSTEM REQUIREMENTS

7.1 Unmanned Aircraft (UA)

7.1.1 The UA must have a maximum takeoff weight less than 300 kg.
7.1.2 The UA must have an endurance of not less than six (6) hours of flight, while carrying the Imaging Payload throughout all environments as specified in this document.
7.1.3 The UA must be capable of being programmed with flight profiles prior to launch.
7.1.4 The UA must operate automatically from launch to recovery under the supervision of the Operator.
7.1.5 The UA must be able to receive commands from an Operator, including manual override of automatic functions, at all times to ensure positive control is maintained.
7.1.6 The UA must be capable of automated launch and recovery without requiring input from the Operator.
7.1.7 In addition to the Imaging Payload, the UA must simultaneously employ not less than two (2) other Payloads defined in this document.
7.1.8 In addition to the Imaging Payload, the UA should have at least 15 kg of payload capacity.
7.1.9 The UA must take off and land vertically.
7.1.10 The UA must launch and recover from areas as restrictive as the Halifax-class flight deck; which measures 22 m x 13.5 m surrounded by 10 m high obstacles.
7.1.11 The UA must have a heavy fuel engine, operating NATO F76 / F44 for naval assignments.
7.1.12 When tracking a moving contact, the UA must maintain at least 70 knots.
7.1.13 The UA must record and store at least one (1) Sortie of all Payload data (including Full Motion Video), related metadata and Mission data in accordance with the associated Payload SPS requirements.
7.1.14 The UA and its payloads should operate down to altitudes of 30 m AGL.
7.1.15 The UA must use the GPS anti-jamming system for primary navigation and position information.
7.1.16 The UA must include an IFF transponder to respond to interrogation in mode 3C.
7.1.17 The UA must have a low visibility colour scheme suitable for typical daylight operations in both the land and maritime environment.
7.1.18 The UA must be equipped with an Infrared (IR) strobe visible to generation III Night Vision Goggles, to allow other airspace users to locate the UA during night operations.

7.1.18.1 The IR strobe must be controllable by the UAS Operator.
7.1.18.2 The IR strobe must not emit light visible to the unaided eye.

7.2 Payloads

7.2.1 Imaging Payload

7.2.1.1 The UAS must include an Imaging Payload.
7.2.1.2 The Imaging Payload must have a surface positional accuracy of at least a 20m Circular Error of 90% (CE 90) at a slant range of 1,300 m.
7.2.1.3 The Imaging Payload must have a colour high definition daylight Electro-Optical (EO) video camera, a medium wave IR video camera, and an IR illuminator.
7.2.1.4 The Imaging Payload must have a laser target designator within 12 MACA.
7.2.1.5 Under clear atmospheric conditions, the Imaging Payload must produce a colour EO image of at least NATO Imagery Interpretability Rating Scale (NIIRS) Level 7 at a slant range of 4,330 m.
7.2.1.6 Under clear atmospheric conditions, the Imaging Payload must produce an IR image of at least NATO Imagery Interpretability Rating Scale (NIIRS) Level 5 at a slant range of 4,330 m.
7.2.1.7 The Imaging Payload must be a 4 axis gimbal with 360 degree continuous azimuth pan.
7.2.1.8 The Imaging Payload must be stabilized in 4 axis.
7.2.1.9 The Imaging Payload must be controllable by the operator, including video and still image capture.
7.2.1.10 The EO camera must have variable Fields of View (EOW/EON) with multiple levels of zoom.
7.2.1.11 The IR camera must have variable Fields of View.
7.2.1.12 The Imaging Payload must synchronise the EO and IR video fields of view, to allow the UAS Operator to switch back and forth between the two views.
7.2.1.13 The EO camera must have an optical zoom capability.
7.2.1.14 The Imaging Payload must provide a zoom capability with selectable continuous fields of view for both EO and IR cameras.
7.2.1.15 The Imaging Payload must be interchangeable in the field without the need for calibration.
7.2.1.16 The Imaging Payload must automatically track Contacts of Interest (COI) once identified by the Operator.
7.2.1.17 The Imaging Payload must continuously track moving COIs with speeds up to 80 km/h ground track speed; unless the COI is obstructed for more than 5 seconds.
7.2.1.18 The laser target designator must have an effective range of at least 6,000 m.
7.2.1.19 The IR illuminator must indicate contacts or areas of interest to other observers with generation III Night Vision Goggles at a slant range of at least 1,000 m.

7.2.2 Automatic Identification System (AIS) Payload

7.2.2.1 The UAS must include an AIS Payload.
7.2.2.2 The AIS Payload must receive AIS messages from contacts within VHF range.

7.2.3 Synthetic Aperture RADAR (SAR) Payload

7.2.3.1 The UAS must include a SAR Payload.
7.2.3.2 The SAR Payload must include Spot SAR, Strip SAR, Ground Moving Target Indicator (MTI), Maritime MTI, Coherent Detection, and slow moving/man sized target detection modes.
7.2.3.3 The SAR Payload must provide spot SAR with a resolution of at least 1m resolution at 8 km.
7.2.3.4 The SAR Payload must provide strip SAR with a resolution of at least 1m at 20km.

7.2.3.5 The SAR Payload must operate in day/night, blowing dust, fog/cloud, and precipitation as defined in this document.

7.2.4 Communication Relay Payload

7.2.4.1 The UAS should include a Communication Relay Payload
7.2.4.2 If the Communications Relay Payload is included, it must relay VHF and UHF radio broadcasts to ground elements within range.
7.2.4.3 If the Communications Relay Payload is included, it must be compatible with VHF and UHF frequencies used by joint and combined forces as follows:

7.2.4.3.1 30 to 512 MHz narrowband VHF/UHF;
7.2.4.3.2 762 to 870 MHz narrowband VHF/UHF; and
7.2.4.3.3 225 to 450 MHz wideband UHF.

7.2.4.4 If the Communications Relay Payload is included, it should relay Link 16 messages and Tactical Common Data Link as follows:

7.2.4.4.1 969 to 1206 MHz Link 16;
7.2.4.4.2 1.25 MHz wideband UHF;
7.2.4.4.3 Transmission Modes Simplex or half-duplex 16 kbps data;
7.2.4.4.4 Link 16 TDMA; and
7.2.4.4.5 All OP modes and enhanced throughput.

7.2.5 Communication Intercept Payload

7.2.5.1 The UAS should include a Communication Intercept Payload
7.2.5.2 If the Communications Intercept Payload is included, it must find, localize and listen to cell phone signals within range.
7.2.5.3 If the Communications Intercept Payload is included, it must detect and intercept terminal and call activity including voice, fax, data, and SMS on Thuraya and ISatPhone Pro networks.
7.2.5.4 If the Communications Intercept Payload is included, it must passively monitor up to 30 full duplex channels simultaneously on Thuraya and ISatPhone Pro networks (60 total).

7.3 Ground Control Station (GCS)

7.3.1 The GCS must fit and be able be operated from an area no larger than 2.44 m wide, 2.59 m high, and 3.05 m long.
7.3.2 The GCS must have UA Operator and Payload Operator work stations.
7.3.3 The GCS must have a Tactical Fiber Optic Cable Assemblies (TFOCA) II MIL-C-83526 compliant optical fiber Ethernet interface. The interface will be used to collect Payload data during and post flight.
7.3.4 Upon Operator selection, the GCS must change the UA flight profile to maintain contact tracking (commonly referred to as “Fly the Foot print” or “Camera Guide”).
7.3.5 The GCS mapping software must be able to use Compressed ARC Digitized Raster Graphic (CADRG), ADRG, ECRG, ECW, Esri Grid, Geo Tiff, JPEG 2000, MrSID, and netCDF maps of scales 1:50,000, 1:100,000, 1:250,000, 1:500,000, and 1:1,000,000.

7.3.6 The GCS mapping software must be able to use and display map data in Military Grid Reference System (MGRS), Universal Transverse Mercator (UTM), Latitude and Longitude coordinate systems.
7.3.7 The GCS coordinate systems must be Operator selectable.
7.3.8 The GCS must display UA and contact positions in the selected coordinate systems.
7.3.9 The GCS must use Digital Terrain Elevation Data (DTED) Levels 0-3.
7.3.10 The GCS must have a removable data storage device for the recording of all Payload data.
7.3.11 The GCS removable data storage device must be removable and replaceable by hand, without tools.
7.3.12 The GCS removable data storage device must have data storage capacity not less than 24 hours of Imaging and SAR Payload data.

7.4 Unmanned Aircraft Operator (UAO) Station

7.4.1 The UAO station must enable near real time control and monitoring of the UA in flight.
7.4.2 The UAO station must permit the UAO to create, store, update and delete waypoints during all phases of flight.
7.4.3 The UAO station must permit the UAO to assign waypoint position, course, speed, altitude, and selectable overfly with heading.
7.4.4 The UAO station must permit the UAO to create, store, update and delete Routes during all phases of flight.
7.4.5 The UAO station must permit the UAO to assign Route Leg altitude, track, airspeed, and selectable altitude transition.
7.4.6 The UAO station should have the capability to hand over control of an UA to, and to receive hand-over control of an UA from another GCS.
7.4.7 Upon Operator selection, the UAO station software must conduct a pre-set:

7.4.7.1 Loiter;
7.4.7.2 Orbit; and
7.4.7.3 Route

7.4.8 The UAO station must continuously display:

7.4.8.1 UA position;
7.4.8.2 UA status (e.g. fuel state, engine, battery, etc.);
7.4.8.3 UA Altitude (AGL or MSL);
7.4.8.4 UA Speed (true and ground);
7.4.8.5 UA Bearing;
7.4.8.6 Wind speed; and
7.4.8.7 Live multiple view map display.

7.4.9 Upon Operator selection, the UAO station must display:

7.4.9.1 The flight plan;
7.4.9.2 GCS location;
7.4.9.3 Contacts provided by manual updates;
7.4.9.4 Selectable units (metric and imperial); and
7.4.9.5 Available remaining data storage.

7.4.10 The UAO station must have Operator tools that include:

7.4.10.1 Surveillance area coverage planning;
7.4.10.2 Data link range and Line of Sight (LOS) calculations;
7.4.10.3 Danger/no fly zones such as inputted Air Space restrictions with automatic and audible warnings;
7.4.10.4 Provision for standard Military icons and overlays;
7.4.10.5 Provision for user defined graphics and overlays;
7.4.10.6 Loading and changing of map data;
7.4.10.7 Automatic Operator alerts for emergencies;
7.4.10.8 Electronic checklists and vehicle monitoring;
7.4.10.9 UA location history; and
7.4.10.10 Camera view history.

7.5 Payload Operator (PO) Station

7.5.1 The PO Station must allow the PO near real time control and monitoring of the Payload(s) in flight.
7.5.2 The PO Station must allow the PO to review and manipulate still and video imagery while continuing to record real-time data.
7.5.3 The PO Station must display the following as a minimum:

7.5.3.1 Imagery Payload outputs (e.g. imagery, contacts, etc.);
7.5.3.2 UA location, altitude, bearing;
7.5.3.3 Contact location;
7.5.3.4 Indication of CEP of selected contact location;
7.5.3.5 Selectable units in metric and imperial;
7.5.3.6 Camera mode;
7.5.3.7 Date/time;
7.5.3.8 Camera zoom level;
7.5.3.9 Status of laser designator/pointer/flood;
7.5.3.10 Terrain elevation;
7.5.3.11 Camera bearing;
7.5.3.12 Selectable Sensor Image Overlay colour; and
7.5.3.13 Compass indicating North.

7.5.4 The PO station must have Operator tools including as a minimum:

7.5.4.1 Surveillance area coverage planning;
7.5.4.2 Automated search patterns;
7.5.4.3 Payload control modes such as automatic search, point to coordinates and automatic tracking;
7.5.4.4 Marking, storing and reviewing contacts or data of interest;
7.5.4.5 Graphic definition tools (e.g. the PO can overlay traces indicating contact movement);
7.5.4.6 Imagery Analysis tools to produce imagery products of contacts of interest; and
7.5.4.7 Loading and changing of map data.

7.6 Training Simulator

7.6.1 The training simulator must provide the means to conduct training and pre-Mission rehearsal using both simulated and recorded data.

7.6.2 The training simulator must:

- 7.6.2.1 Be embedded in the GCS or a separate stand-alone, operator-deployable system;
- 7.6.2.2 Employ the UAS operational software interface to provide enough fidelity to conduct acceptable pilot currency training;
- 7.6.2.3 Provide Operator alterable environment conditions and geographical topography; and
- 7.6.2.4 Simulate launch, recovery and in-flight emergencies.

7.6.3 The training simulation should be able to operate independently of other onboard training systems to facilitate individual station Operator training.

7.7 Compatibility With Coalition Interoperability Standards

7.7.1 The UAS information must enable Canada to adapt the native metadata to the Canadian Multilateral Interoperability Program (MIP) format.

7.7.2 The UAS Command and Control metadata should already be compliant with coalition Command and Control (C2) system interfaces via the NATO sponsored Multilateral Interoperability Program (MIP) data handling processes.

7.8 Communications

7.8.1 The GCS Information Technology (IT) equipment must conform to current Internet Protocol Standards and minimum USB2 standards, enabling the passage and receipt of data via readily available compatible non-proprietary equipment.

7.9 Information Formats

7.9.1 The GCS must capture and enable editing of still images from the UA in NATO Secondary Imagery Format (NSIF) and National Imagery Transfer Format (NITF) files IAW STANAG 4545.

7.9.2 The UAS must have telemetry data synchronized to the video in a format complying with STANAG 4609, and follow the applicable implementation guide version of AEDP-8, NATO Motion Imagery STANAG 4609 Implementation Guide.

7.9.3 The UA must format the data from the SAR Payload using the UA datalinks in STANAG 4545 format for Imagery and STANAG 4607 for GMTI contact tracks.

7.9.4 These data formats must conform to STANAG 4559 (Coalition Shared Database) population requirements.

7.9.5 All payload information and associated metadata must be accessible via the Ethernet interface as specified in this document.

7.9.6 The UAS captured metadata elements must include not less than the elements listed in Table 2.

7.9.7 The GCS must be able to open, manipulate and save files compliant with STANAG 4609.

7.9.8 The metadata time code must be derived from GPS time.

7.10 Data Link

7.10.1 The effective UAS data link range for land assignments must be up to and including 80NM in all types of environmental conditions as described in this document.
7.10.2 The effective UAS data link range for naval assignments must be up to and including 50NM in all types of environmental conditions as described in this document.
7.10.3 The data link quality must be sufficient to control the UA and receive all Payload data within range.
7.10.4 The UAS data link must use Advanced Encryption Standard (AES) 256 encryption.
7.10.5 The UAS data link should be able to integrate High Assurance Internet Protocol Encryptor (HAIPE) Type 1 encryption.
7.10.6 The UAS should include a HAIPE Type 1 encryption device.
7.10.7 The GCS data link antenna must automatically track the UA.
7.10.8 The UAS data link must provide all payload sensor and metadata information to the GCS.
7.10.9 The UA data link must be compatible with the CAF remote video terminal, the Stinger and Remote Optical Video Enhanced Receiver (ROVER) family of equipment (L3 Tactical Network Rover (TNR), Rover 5i and Rover 6).
7.10.10 The UA Payload data link must provide sensor and metadata information to a remote station separate from the control station.
7.10.11 The GCS must transmit received Payload data via the Ethernet interface as specified in this document.
7.10.12 The UA Control data link should have a backup capability, in the event that the primary control link is lost.
7.10.13 The GCS should use a STANAG 7085 compliant data link.

7.11 Frequency Management

7.11.1 Industry Canada is the approving authority for frequency spectrum clearance for training and operations in Canada, and therefore the UAS will operate using approved frequencies.
7.11.2 The UAS must be capable of frequency selection to allow for frequency allocation in NATO coalition operational environments and to allow separate UASs to operate in the same airspace without interference.
7.11.3 The UAS must allow the Operator to change the frequency during the Mission preparation phase without physically changing components.
7.11.4 In Canada, the UAS must operate using frequencies assigned to DND. The frequency bands for which there is a high degree of assurance that Industry Canada will grant DND the required licenses are listed below:

7.11.4.1 225 – 400 MHz (NATO Wide harmonized spectrum)
7.11.4.2 2360 – 2400 MHz
7.11.4.3 4400 – 4940 MHz (NATO Wide harmonized spectrum)
7.11.4.4 14.4 – 14.83 / 15.15 – 15.35 GHz (STANAG 7085 Ku band spectrum)

7.11.4.5 Note: Industry Canada has provided DND 160 MHz of the Ku band which has been allocated to the CAF in Canada, with a signal level (EIRP) criterion of – 47.33 dBm/5 MHz at the band edges. This criterion must be met in order to operate in Canada in the Ku band.

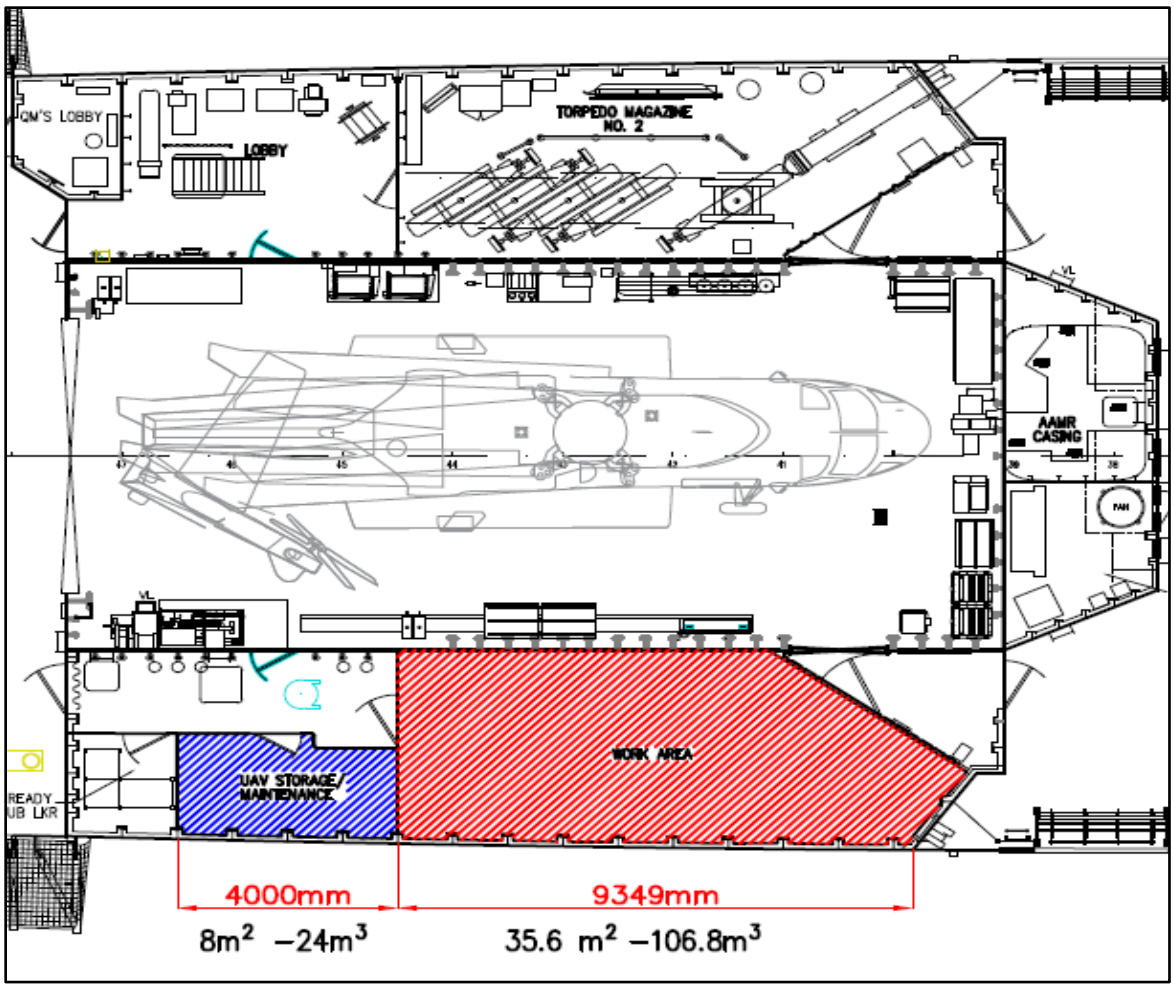

Figure 1 – Potential UAS storage and work space on Halifax-Class ship

Table 1 – Displacement, Velocity and Acceleration at Center of Flight Deck

The most conservative values from the worst heading at each sea state are presented in this table for the two duration/confidence (1 hour – 95% / 6 hour – 99%) scenarios discussed above. These results are the maximum expected ship motions and accelerations at the proposed UA launch and recovery location onboard a Halifax-Class ship at the respective sea state and speed with a 99% confidence level. The results provided are predictions and appropriate safety factors must be applied. These results do not take into account any shock and/or blast requirements. No safety factors or margins have been applied to these results.

		Displacement			Velocity	Acceleration		
	Speed	Vertical	Lateral	Longitudinal	Vertical	Vertical	Lateral	Longitudinal
	[knots]	[m]	[m]	[m]	[m/s]	[g]	[g]	[g]
Sea State 2	0	0.16	0.10	0.00	0.26	0.04	0.04	0.01
	5	0.16	0.10	0.00	0.21	0.04	0.04	0.01
	10	0.16	0.20	0.20	0.21	0.04	0.04	0.01
	15	0.16	0.65	0.20	0.21	0.04	0.03	0.01
	20	0.16	1.89	0.10	0.21	0.04	0.03	0.01
	25	0.16	0.92	0.15	0.21	0.04	0.03	0.01
	30	0.16	0.83	0.10	0.21	0.04	0.03	0.01
Sea State 3	0	1.18	0.77	0.10	1.49	0.20	0.12	0.02
	5	1.23	0.77	0.15	1.54	0.20	0.12	0.03
	10	1.23	0.92	0.29	1.54	0.20	0.12	0.03
	15	1.23	1.96	1.47	1.54	0.20	0.12	0.04
	20	1.29	4.10	1.30	1.59	0.21	0.13	0.04
	25	1.29	7.76	1.75	1.59	0.21	0.13	0.04
	30	1.29	14.94	2.44	1.65	0.21	0.12	0.04
Sea State 4	0	3.06	2.04	0.26	3.22	0.36	0.23	0.03
	5	2.96	2.29	0.41	3.28	0.38	0.25	0.04
	10	2.96	2.58	0.65	3.44	0.43	0.25	0.05
	15	3.01	3.72	2.67	3.66	0.48	0.26	0.06
	20	3.05	9.65	4.89	3.93	0.54	0.26	0.07
	25	3.06	21.78	8.32	4.14	0.59	0.26	0.08
	30	3.06	35.50	7.24	4.31	0.63	0.26	0.08

TABLE 2: MINIMUM METADATA ELEMENTS		
Hex Key	**Name**	**EG601 tag map (Hex)(3)**
060e2b3402010101020802000000000	RP 102.3 Security Metadata Universal and Local Set	0x30
060e2b3401010103020802010000000	Security Classification	0x01
060e2b3401010103070120010209000	Release Instructions	0x06
060e2b3401010103010306010000000	Item Designator ID (16 byte)	0x15
060e2b3402010102070406010703060	TP079 CF TUAV Set (1)	(2)
060e2b3401010101042001020101000	Image Source Device	0x0b
060e2b3401010101070101010000000	Image Coordinate System	0x0c
060e2b3401010101070201020701000	Event Start Date and Time – UTC	0x48
060e2b3401010101070102010302000	Frame Center Latitude	0x17
060e2b3401010101070102010304000	Frame Center Longitude	0x18
060e2b3401010101070109020100000	Target Width	0x16
060e2b3401010101070102010202000	Device Altitude	0x0f
060e2b3401010103070102010204020	Device Latitude	0x0d
060e2b3401010103070102010206020	Device Longitude	0x0e
060e2b3401010101070108010100000	Slant Range	0x15
060e2b3401010101070110010200000	Angle to North	0x12
060e2b3401010101070110010300000	Obliquity Angle	0x13
060e2b3401010102042002010108000	Field of View (FOV-Horizontal)	0x10
060e2b3401010107042002010a0100	Field of View (FOV-Vertical FP-4)	0x11
060e2b3401010107070110010600000	Platform Heading Angle	0x05
060e2b3401010107070110010500000	Platform Pitch Angle	0x06
060e2b3401010101070110010100000	Sensor Roll Angle	0x14
060e2b3401010103070102010307010	Corner Latitude Point 1 (Decimal Degrees)	0x1a
060e2b3401010103070102010b0100	Corner Longitude Point 1 (Decimal Degrees)	0x1b
060e2b3401010103070102010308010	Corner Latitude Point 2 (Decimal Degrees)	0x1c
060e2b3401010103070102010c0100	Corner Longitude Point 2 (Decimal Degrees)	0x1d
060e2b3401010103070102010309010	Corner Latitude Point 3 (Decimal Degrees)	0x1e
060e2b3401010103070102010d0100	Corner Longitude Point 3 (Decimal Degrees)	0x1f
060e2b3401010103070102010a0100	Corner Latitude Point 4 (Decimal Degrees)	0x20
060e2b3401010103070102010e0100	Corner Longitude Point 4 (Decimal Degrees)	0x21
060e2b3401010101070201020101000	Start Date Time – UTC	---
060e2b3401010103070201010105000	User defined Time stamp – microseconds since 1970	0x02
060e2b3401010101070101020000000	Map Datum Used	---
060e2b3401010101010120010000000	Device Designation	0x0a
060e2b3401010105030201060f000000	Related Material Description	0x04
060e2b3401010101070103010101000	Device Absolute Speed	0x38
060e2b3401010107070110010400000	Platform Roll Angle	0x07
060e2b340101010a0701020103160000	Frame Center Elevation	0x19
060e2b3401010101010505000000000	Episode Number	0x03
060e2b3401010105030303100100000	Device Usage Description	---

Table notes:

1. Any Universal Set key compliant with SMPTE 336M-2007 is acceptable.

2. If implementing Engineering Guideline 601.1 (EG601), the UAS Local Data Set (LDS) 16 byte Unique Identifier must be used.

3. The Hexadecimal tags have been provided for reference if the encoding of metadata is delivered using EG601 encoding design (allowed in STANAGs). Where no corresponding tags exist, as identified by "---", the metadata must be coded outside the EG601 set using the 16 bytes key.