I-SEAMORE

D4.1 Assessment of I-SEAMORE UxVs and Payloads Capabilities

WP4 I-SEAMORE UxVs, Satellites & Payloads

Integrated surveillance ecosystem for European Authorities responsible for Maritime Operations leveraged by reliable and enhanced aerial support

Co-funded by the European Union

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D4.1 – Assessment of I-SEAMORE UxVs and Payloads Capabilities

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Authors	Alexandre LEFEUVRE (EXAIL)
Reviewers	Luís FERNANDES (INOV) Marius BUDILEANU (TS)
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EXECUTIVE SUMMARY

The I-SEAMORE consortium proposes several UAV and USV with the required capabilities for I-SEAMORE operational missions. These UAV and USV rely on internal and external capabilities. Internal capabilities are functions integrated in the platform such as:

- Autonomous navigation
- Remote control
- Data processing

These capabilities are mostly for system control and to assist the operator or fully automate the system.

The external capabilities are capabilities provided by various payloads that can be carried and connected to the platforms. There are almost as many types of payloads as missions but the most important and impactful are the following:

- USV:
    - EO/IR camera with object recognition capabilities for above water survey.
    - LIDAR for above water survey.
    - SONARs for underwater survey.
    - Communication relay.
- UAV:
    - EO/IR camera with object recognition capabilities

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LIST OF ACRONYMS

ADCP	Acoustic Doppler Current Profiler
C2	Command and Control
COLREG	Collision Regulations
CTD	Conductivity Temperature Depth
DRI	Detection, Recognition, Identification
EO/IR	Electro-Optical/InfraRed
GNSS	Global Navigation Satellite System
IMU	Inertial Measurement Unit
IR	Infrared
ISR	Intelligence, Surveillance and Reconnaissance
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
Lidar	Laser Imaging Detection And Ranging
LOS	Line Of Sight
MBES	Multi Beam Echo Sounder
MCM	Mine Countermeasures
MIO	Maritime Interdiction Operations
MOAS	Mine and Obstacle Avoidance Sonar
OTH	Over The Horizon
RCU	Remote Control Unit
ROTV	Remotely Operated Towed Vehicle
ROV	Remotely Operated underwater Vehicle
SBES	Single Beam Echo Sounders
SBP	Sub-Bottom Profiler
SVP	Sound Velocity Profilers
UAV	Unmanned Aerial Vehicle
USBL, LBL	Ultra-Short Baseline
USV	Unmanned Surface Vehicle
UXV	Unmanned (Aerial/Surface) Vehicle
VTOL	Vertical Take-Off and Landing

1 INTRODUCTION

1.1 Purpose of the document

This deliverable is an assessment of the capabilities of the different UAV, USV and their respective payloads that are available for the I-SEAMORE project.

The description of the capabilities is not limited to the context of I-SEAMORE operation missions. It provides the full scope of capabilities of each UxV (and their payloads) to have a global overview of their possibilities. The UxVs and their software are continuously upgraded, and additional functions can be developed so this overview must be considered as a snapshot of the current capabilities. As for the payloads, new payloads can easily be integrated if needed, therefore it only lists the current payloads considered and/or integrated on the UxVs which includes the payloads necessary for the I-SEAMORE project.

1.2 Structure of the document

This document is structured as follows. After the introduction, each system is described. They are gathered in categories, first the USVs then the UAVs. For each system, a global description is given. The description contains:

- Presentation of the system
- The main purposes of the system
- The main characteristics of the system
- An illustration of the system

Then a sub-chapter lists the main functions of the systems, which contains also the different payloads associated to the different functions.

2 USVS

USV, Unmanned surface vehicle, are multi-use system able to contribute on the surface of water and underwater depending on the equipped capabilities.

2.1 INTERCEPTOR

2.1.1 DESCRIPTION

The INTERCEPTOR is set of USV developed by Exail. They are flexible remote controlled surface platform capable of conducting a broad range of missions and tasks in the following domains:

- Mine Warfare, Mine Countermeasures (MCM),
- Shallow & Very Shallow Water surveying and inspection,
- Littoral and inshore hydrographic operations,
- Intelligence, Surveillance and Reconnaissance (ISR),
- Coastal and Port Security,
- Maritime Interdiction Operations (MIO)
- Naval Combat, Electronic Warfare,
- Fleet training,
- Oil & Gaz survey.

There are two different models of INSPECTOR developed for different uses:

- The USV INSPECTOR 90,
- The USV INSPECTOR 125.

The main difference between both USVs is the size of the platform.

A complete system is made of:

- A USV: Unmanned Surface Unit,
- A RCU: Remote Control Unit.

The RCU communicates to the USV through a radio link.

2.1.1.1 INSPECTOR 90

The INSPECTOR 90 [3] has been designed and developed before the INSPECTOR 125 with the objective to provide a truly multipurpose USV capability. It was developed with the idea of a few initial missions:

- Mine Warfare, Mine Countermeasures (MCM),
- Coastal and Port Security,
- Fleet training,
- Littoral and inshore hydrographic operations.

But the USV is not limited to these missions as its capability to accommodate various payloads makes it versatile.

FIGURE 1: INSPECTOR 90

Its main strengths are:

- High speed for transit,
- Station keeping and accurate flight path for seafloor survey and inspection,
- Low draught for very shallow water (VSW) operations,
- High sea state survivability for offshore constraints.

TABLE 1: INSPECTOR 90 TECHNICAL INFORMATION

Hull	Aluminium Rigid Hull
Overall length with fenders **Hull length** **Width with fenders**	9,20 m (9,00 m without fenders) 8,20 m 2,91 m (2,55 m without fenders)
Full load draught	Approx 0,6 m
Max load	Approx. 8T
Variable deck payload	900 kg
Propulsion	2 diesel hydrojets (2 x 215 KW)
GO capacity	Approx 750 l
Maximum speed with full load **Maximum speed with mid load** **Maximum speed without load**	Approx 20 kts Approx 26 kts Approx 30 kts
Endurance	10h at 12 kts Up to 80h depending on mission profiles

2.1.1.2 INSPECTOR 125

The INTERCEPTOR 125 [4] is a 12.5m multipurpose, autonomous naval platform. It is a heavy carrier able of transporting and launching payloads.

- Versatile USV with great endurance, capable of carrying various payloads.
- Designed to be launched and recovered from a mother ship by Sea State 5.
- MOAS sonar retractable (remotely operated) in the hull to allow the recovery of the USV in a floating dock.
- Folding mast (remotely operated) to allow recovery of the USV on a mother vessel.
- Equipped with an anti-roll system: increases the payload utilization window for L/R phases and sea state for operating the USV.

- Accessibility to the engine room and wheelhouse, even with a payload on deck.
- Autonomous navigation and obstacle avoidance taking into account the COLREGs.

FIGURE 2: INSPECTOR 125

TABLE 2: INSPECTOR 125 TECHNICAL INFORMATION

Structure	Fiber glass
Length overall (with removable fenders)	12.33 m
Length at waterline	11.98 m
Beam overall (with removable fenders)	4.20 m
Beam (without removable fenders)	3.85 m
Draft	0.90 m
Height overall (mast down)	3.70 m
Light displacement	13.4 T
Full loaded displacement	19.5 T
Propulsion	2 hydro jets (nominal) or propellers
Energy	Diesel
Top speed	Up to 25 knots
Launching and recovery of payloads	Up to sea state 4
Sea keeping	Up to sea state 5 : maintains the capability to communicate, navigate and hold a course at reduced speed in order to reach a shelter
Endurance	40 to 100 hours depending on mission profile
Typical radio operational range	16 nautical miles (depending on the height on antennas on ship or shore side)
Maximum payload on board	2.5 Ton aft deck (23.6 m2)
Potential areas of use	All the world's seas except ice covered areas

2.1.2 MAIN FUNCTIONS

Both versions of the INSPECTOR have similar version, but the INSPECTOR 125, having a greater payload capability, can deploy more functions simultaneously.

2.1.2.1 DEPLOYMENT AND RECOVERY OF AUV AND HEAVY PAYLOAD (INSPECTOR 125 ONLY)

The INSPECTOR 125 can carry AUV, ROV or heavy payload to be deployed and recovered. Here are listed a few examples:

- AUV A18-M

- Towed sonar T18-M
- Identification ROV SEASCAN-M
- Neutralization ROV K-STER C

The deployment and recovery of these items is fully automated, so it does not require manual operation. It could be interesting in the context of I-SEAMORE if underwater surveillance was considered.

2.1.2.2 AUTONOMOUS NAVIGATION

The USV can be operated following a mission plan. This mission plan is defined by the RCU (remote control unit) operator with the help of software launched in the RCU computer.

The Navigation computer will control in real time the position and the speed of the vessel in Remote and in Autonomous modes. It will get attitude from the Inertial Motion Unit (IMU) sensor, position from the GPS, and speed from NMEA2K sensors; it will calculate the adjustment of speed and steer to apply to the engines, buckets and steering unit.

To do so it relies on the following sensors:

- Multi antenna GNSS based
- High end inertial unit (for GNSS denied environment)
- Doppler Velocity Log
- USBL sensor for ROV positioning

All these sensors and control data are stored on disk for mission data logging; part of them is send to the RCU for remote control.

The autonomous navigation is a necessity to reduce the workload of operator in the context of I-SEAMORE.

INTERCEPTORs can also be tele-operated or locally controlled through the cabin's commands.

2.1.2.3 COMMUNICATION LINKS

Besides its radio link, the USV can be used as relay for different type of communications:

- Underwater (acoustic communication with AUV)
- Radio relay with other systems
- Satellite communication

2.1.2.4 SURVEY ABOVE THE WATER:

One of the main uses of the USV is for survey above the water. In order to do so it can be equipped with different kinds of payloads:

- EO/IR camera, with SWIR or cooled MWIR
- Video camera
- Radar

It also implements algorithms to detect and identify targets on water. It relies on the data fusion of the multiple sensors.

2.1.2.5 SURVEY BELOW THE WATER:

The USV can also be used to survey below the water with different kinds of payload:

- Mine and Obstacle Avoidance Sonar (MOAS)
- Multi Beam Echo Sounder (MBES)

2.1.2.6 SECURITY

The USV implements the necessary function to ensure the system and data integrity with :

- On board data encryption
- In the event of an attempt by hostile personnel to take control of USV:
  - Automatic detection of the intrusion and sending of an alarm to the remote C2 (on board the mothership or at shore)
  - Ability to remotely deactivate local control of the USV by on-board personnel
  - Ability to remotely destroy data stored on board the USV

2.2 DriX

2.2.1 DESCRIPTION

FIGURE 1: DRIX

The DriX USV [5] has been designed to be operated under the remote supervision of an operator while conducting missions with a high level of autonomy. In its class, DriX provides the best compromise between performance and minimal environmental footprint. The USV has a proven track record in supporting hydrographic, geophysics as well as scientific monitoring or subsea positioning (AUV/ROV operations). It is a highly versatile open platform, accommodating a wide range of payloads inside its underwater gondola, and supporting Line of Sight or Over the Horizon operations through its multi-channel communication infrastructure.

- Best-in-class seakeeping capability and stability up to sea state 5.
- Autonomous operation under human remote supervision.
- Highly versatile payload conveyance capability. Easy to swap and configure payloads.
- Ultra-low fuel consumption and CO2 footprint due to a highly efficient hull design.
- Multi-channels communication infrastructure to support Line of Sight (LOS) or Over the Horizon (OTH) operations.
- Underwater gondola for payloads deployment with CFD optimized design ensuring reduced acoustic noise signature and bubble-free environment.

- Launch and Recovery System.
- Robust composite construction (vacuum infusion) / Kevlar reinforced.

TABLE 3: DRIX TECHNICAL INFORMATION

Displacement	1.7 tons
Beam	0.8 meters
Length	7.7 meters
Speed	14 knots (payload configuration dependent)
Endurance	Up to 10 days (operation speed dependent)
Control	Autonomous operation under human supervision, direct remote control
Communications	Redundant LOS (Wi-Fi and Broadband Radio), OTH (4G, Iridium Certus), smart traffic management, Starlink
Power for payload	750W (contact us for higher requirements)

There is also more open sea version of the DriX, the DriX Ocean. It is a slightly bigger version with specific upgrades to adapt to open sea.

2.2.2 MAIN FUNCTIONS

2.2.2.1 ADVANCED AUTONOMOUS

The DriX is fully capable of autonomous navigation. It relies on advanced autonomy functions based on the CortiX software framework and an Obstacle avoidance system based on IR camera, Lidar and AIS.

It can be programmed to execute transit a pre-programmed pattern according to the mission preparation.

It provides a user-friendly web-based interface for mission planning and supervision.

Also, an API is provided to interface with third-party SW packages.

2.2.2.2 MULTI-VEHICLES COLLABORATIVE AUTONOMY

- Established track-record in supporting AUV/ROV operations for acoustic communication and positioning. Advanced AUV tracking capability.
- Autonomous ROTV operation (combined with Exail's FlipiX ROTV)
- Multi-DriX collaborative operations.

2.2.2.3 SURVEY ABOVE THE WATER

The DriX can be equipped to capture above water data with the following payloads:

- Lidar
- Radar
- Cameras and optical sensors

The DriX can acquire the payload data to process it and apply object recognition algorithms.

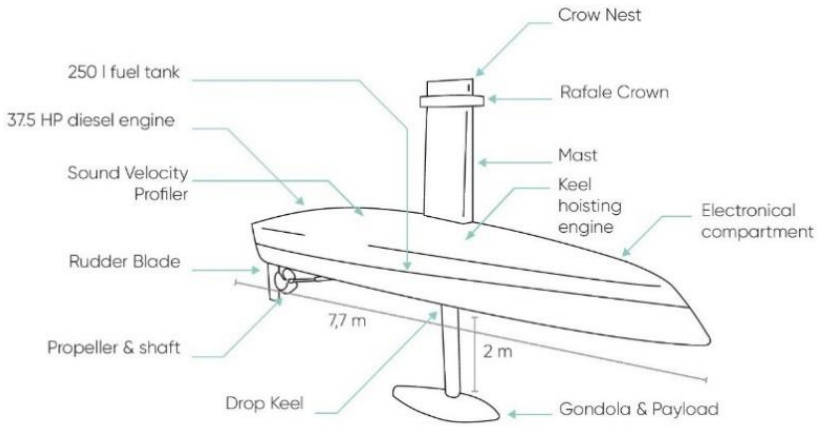
2.2.2.4 SURVEY BELOW THE WATER

The DriX main purpose is for underwater survey. It has already integrated many kinds of sensors such as:

- MBES

- SBP
- FlipiX ROTV for Side Scan Sonars and magnetometers operations
- SBES
- USBL, LBL
- Acoustic modems
- ADCP, SVP, CTD, turbidimeter, fathometer, hydrophones…
- Lidar
- Radar
- Cameras and optical sensors

FIGURE 2: DRIX COMPONENTS



3 UAVS

3.1 IT180-60

FIGURE 3: IT180-60

3.1.1 DESCRIPTION

The IT180-60 [6] is a dual counter rotating rotor Unmanned Aerial Vehicle (UAV) belonging to the VTOL (Vertical Take-Off and Landing) category.

This helicopter-type drone has been developed to cover a large number of ISTAR (Intelligence, Surveillance, Target Acquisition and Reconnaissance) missions.

It allows, among other things, to visualize in real time, day and night, video images taken in flight by the cameras of the drone and thus allow the various military or civilian users operating in the field of homeland security to:

- Detect, survey, identify people,
- Recognize a security zone around a suspicious point,
- Detect any trace of anomaly in the immediate environment.

Thanks to its electric engine, this UAV benefits from an undeniable advantage of sound stealth compared to other aircraft.

This allows the realization of missions in all discretion, particularly ISTAR type missions during military operations.

This IT180-60 UAV has a flight autonomy of 60 minutes without payload and 50 minutes with a 4 kg payload.

The architecture of the IT180-60 UAV is combat proven through its use in various foreign operational theatres within the French armed forces market.

The IT180-60 goes with a dedicated Ground Control Station to plan the mission and control the UAV.

TABLE 4: IT180-60 TECHNICAL INFORMATION

Diameter / height	2000mm / 821mm
Endurance	Up to 60 min
Range	10 km (with tracking antenna)
Max payload	15 kg
Deployment	< 6 min
Engine	DC Brushless

Total mass (unloaded)	21 kg
Operating temperature	- 10°C up to + 40°C (- 30°C in option)
Maximum speed	80 km/h
Wind resistance	Up to 60 km/h (17 m/s)
Noise emission (100 m AGL)	44 dBA
Maximum ceiling	3000 m (9000 ft)
Range from ground station	> 5km (omnidirectional antenna) 75 km (antenna tracking)
Fuel/Batteries	Li-po 26Ah (IATA certified)

3.1.2 MAIN FUNCTIONS

3.1.2.1 FLIGHT CONTROL SYSTEM

The IT180-60 has a fully integrated autopilot and a dedicated mission preparation software. It enables to set-up mission plan in advance and then execute them automatically.

It can be used in fully automatic mode, including Take-off and landing, or it can be manually control through an ergonomic joystick controller.

3.1.2.2 CONFIGURABLE PAYLOAD

The IT180-60 has a high payload capacity considering its size. It can embark many different kind of payload to achieve different types of missions:

3.1.2.2.1 Gyro-stabilized EO/IR Camera

Different cameras have been mounted on the UAV. A representative one is the T-STAMP-XR from Controp:

- Day Sensor:
  - HD resolution (1080x720pixels)
  - 17x optical zoom
- Thermal sensor:
  - Cooled MWIR (3-5µm) sensor
  - 640 x 512 pixels
  - 15x optical zoom
- Laser range finder:
  - Up to 1km
- Laser pointer in near Infrared (830nm)
- Performances:
  - 3 axis stabilization (2 axis mechanical stabilization+ 3 electrical stabilization)
  - DRI performances for a human target:
    - The detection of people up to more than 1500 meters with the day camera and 500 m in Infrared,

FIGURE 4: IT180-60 EO/IR CAMERA

- The recognition of people up to more than 700 m with the day camera and 200 m with the infrared camera,
- Identification of persons up to 500 m with day camera and 150 m with infrared.

- Functions
  - Manual mode: the operator orientates the camera day or night using the joystick connected to the ground station. The joystick can also be used to adjust the zoom level and activate the automatic tracking modes.
  - Automatic tracking mode "Videotracking": the camera follows the movement of a moving form (human or vehicle). This function is based on the color differences of the pixels.
  - Automatic tracking mode " Geotracking ": when the drone moves, the camera is oriented to keep the image center on a georeferenced point.

3.1.2.2.2 Magnetometer sensor

The IT180 can be equipped with a magnetometer sensor allowing to locate underground metal up to 5 m according to flight height.

3.1.2.2.3 Orthophoto camera

One of the popular configurations of the IT180 includes an orthophoto camera allowing aerial photography with a geometric correction of images.

3.1.2.2.4 Gamma sensor

The IT180 can carry a gamma sensor to gather information in nuclear environment. Associated with the capability of the RPAS to be operated in a complete autonomous mode with no operator interaction on site, the gamma sensor is a key solution to perform CBRN (Chemical, Biological, Radiological and Nuclear) missions. Data collected during the flight are geo-located, transmitted in real time to the Ground Control Station (GCS) and optionally recorded on board. After mission, they can be positioned on a map to get a global situation of level of contamination. The ground station can be integrated in a vehicle to prevent the operator from all unnecessary exposure to hazmat material. IT180 that is already in use in many countries by civil security organizations is qualified to operate in ionizing radiation environment.

3.2 Primoco One 150 UAS

3.2.1 DESCRIPTION

The Primoco One 150 UAS [2] is a high endurance fixed-wing UAV. It has a maximum take-off weight of 150 kg combined with a flight time of up to 15 hours, a range from ground station of up to 200 km and an overall distance covered of up to 2,000km. This endurance combined with a cruise speed of 100-150 km/h, gives the Primoco UAV - compared to electric aircraft - unmatched performance in its category, while at the same time operating costs are kept to a minimum. The unique features of the UAV ONE 150 are the 30 kg payload and the high-altitude operation (to 3,300 m above sea level) allowing extended missions with a mixed sensor payload and operation at altitudes of 2,000 m or higher.

It has received approvels from major European and international aviation authorities for operation in unrestricted and restricted airspaces. The major approvals are:

- EU directives 945/2019 and 947/2019 SORA (Specific Operational Risk Assessment) compliance with multiple SORA approvals granted within EU territory since 2021. The SORA approvals were granted for SAIL II level already with hundreds of flights performed. The SORA previous experience guarantees the

Primoco One 150 UAS is deployable within any EU-member country based on the conditions defined in the above-mentioned regulation.

- EU directives 945/2019 and 947/2019 LUC (Light Unmanned Operator Certificate) compliance with CZE LUC-0001 granted for the SAIL II level Specific category. The LUC allows the cross-border operation of the UAS in any EU-member country and creates the risk-free approach for I-Seamore project flight testing.
- EMAR 21 (European Military Airworthiness Regulation) with approval of Primoco UAV SE company as Design (DOA) and Production (POA) organisation with relevance for military and tate aircraft not regulated by the civilian regulations.
- The Czech telecommunication authority approval for datalink spectra usage which is based on harmonised EU and ITU approved frequency ranges for UAS

The combination of the approvals allows deploy ability of the I-SEMORE solution within any EU-member country.

It has been designed to adapted to various applications:

- Reconnaissance and surveillance
- Target search and designation
- Border protection
- Coastal surveillance
- Search and Rescue
- Communication Relay
- Disaster response & environmental Management

FIGURE 3: PRIMOCO ONE 150 UAV

TABLE 5: PRIMOCO UAV TECHNICAL INFORMATION

Wingspan:	4.85 m
Length:	3.65 m
Maximum take-off weight:	150 kg
Payload:	1 – 30 kg
Maximum range from GCS:	200 km

Maximum distance:	2,000 km
Cruising speed:	100 – 150 km/h
Endurance:	15 hours
Maximum altitude:	3,300 metres (FL100)
Runway length:	300 metres
Navigation system:	GPS/Glonass/Galileo/Beidou
Air traffic control:	Transponder S-Mode
Communication:	Radio Datalink 5 - 6 GHz or Satellite Communication
Equipment:	Standard HD/MWIR camera on gimbal mount Options including Lidar sensor Customized sensors / payload as required
Shipping format:	Container 290 x 125 x 100 cm

3.2.2 MAIN FUNCTIONS

3.2.2.1 FLIGHT CONTROL SYSTEM

The Primoco UAV has a unique advanced Flight Control System. The plane is controlled remotely during all its flight phases via EU-origin Autopilot and has the ability to start, land and conduct a flight completely automatically according to its flight plan. In the UAV, the Flight Control System is handled by the autopilot and datalink with multiple redundant CPUs.

The autopilot provides safe and controlled execution of remote flight plans including:

- Automatic take-off
- Automatic flight plan execution (through up to 400 waypoints with use of additional manoeuvres such as loitering with defined circle diameter etc.)
- Fly-to/nav-to
- Loiter and Follow Target
- Auto Return-To-Base (RTB) in case of communications failure or combination with altitude gain and loiter for defined time for communication restoration.
- Auto landing
- Manual override within all flight phases

3.2.2.2 CONFIGURABLE PAYLOAD

The Primoco UAS can be equipped with different payloads to achieve its mission. The diversity of payload is a key factor for the versatility of the system. For the I-SEAMORE project only EO/IR payload and SDR SIGINT payload are to be presented. However, the versatility is higher and includes below mentioned payloads.

3.2.2.2.1 EO/IR gimbal systems:

Octopus EO/IR Epsilon 180 camera [1] is one of the gimbals which can be mounted on PRIMOCO UAV and it is the sensor proposed for I-SEAMORE operation.

FIGURE 4 EPSILON 180 CAMERA

It provides all the necessary features for the operational mission of the project.

- Day Sensor:
  - Full HD resolution (1920x720 pixels), optionally 4K
  - Global shutter camera
  - 30x optical zoom or 67x zoom with SD resolution (+4x digital zoom)
  - GCS or UAV data storage
- Thermal sensor:
  - Cooled MWIR (3-5µm) sensor
  - 640 x 512 pixels
  - 15x optical (+4x digital)
- Laser range finder:
  - Up to 15.0km (static applications), up to 10.0km (dynamic appl.)
- Laser pointer in near Infrared (830nm)
- Performances:
  - 3 axis stabilization (2 axis mechanical stabilization+ 3 electrical stabilization)
  - High stabilization bandwidth: 100Hz
  - DRI capabilities:

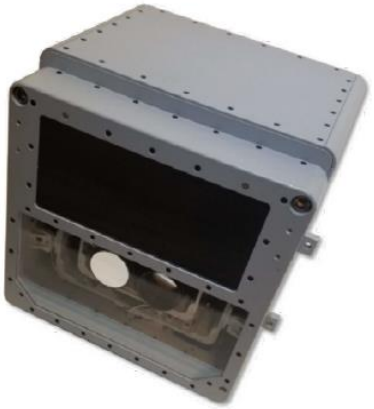
	Human target [1,7x0,5m]	NATO target [2,3x2,3m]
Detection	8600m	12400m
Recognition	2900m	7000m
Identification	1400m	3500m

- Software features:
  - Automatic object tracking (onboard)
  - Moving Target Indicator (onboard)
  - Picture-in-Picture dual video
  - Electronic video enhancement

3.2.2.2.2 Multispectral scanner - ground:

- Electrooptical multispectral camera
- Land system (TK-7
- Multiple bands – NIR, SWIR, MWIR, LWIR, RGB & NDVI
  - 12 MPix resolution for RGB
  - 12 MPix resolution for NIR
  - 0,2 MPix resolution for LWIR
- UAV data processing, GCS thumbnail + result
  - Real time-processing
  - On board image bands blending
  - On-board compression and AI
- Positional data
  - Geo-localisation of the targets
  - Map overlay for any mapping software
  - 300 km2 scanned per hour

FIGURE 5: MULTISPECTRAL GROUND SCANNER



3.2.2.2.3 MULTISPECTRAL SCANNER - SEA

- Electrooptical multispectral camera
  - Maritime day system PT-8
  - 3x 20 MP resolution CMOS
  - UAV data processing, GCS thumbnail + result
  - 20 km detection range (10 m boat)
- Maritime night system PT-8N
  - 2.6 MP resolution for LWIR
  - UAV data processing, GCS thumbnail + result
  - 40 km detection range (10 m boat)
- Positional data
  - Geolocalisation of the targets
  - 4,000 km$_2$ scanned per hour

FIGURE 6: MULTISPECTRAL SEA SCANNER

3.2.2.2.4 LASER 3D LIDAR SENSOR

- < 1.8 MHz laser pulse repetition rate
  - < 400 lines per second scan speed
  - 20 mm accuracy
  - 15 mm precision
  - Operation altitude up to 1,400 m
  - 75° field of view
  - Perfectly linear and parallel scan lines

FIGURE 7: 3D LIDAR

- Echo signal digitalisation
- Multiple target capability
- Online waveform processing
- UAV data storage + GCS thumbnail

3.2.2.2.5 SAR RADAR

- Ku band synthetic aperture radar
  - 12 km range for vehicle tracking
  - 24 km max range for SAR imaging
  - 100 km max range for maritime tankers
- Strip & Spotlight modes
  - GMTI & MMTI tracking modes
  - Non-coherent & coherent change detection
  - Maximum resolution 10 cm
  - STANAG 4676 imagery results
  - Cursor on target function
  - Operation altitude up to 10,000 ft AGL
  - Available in multiple sizes
    - Small (multisensory configuration)
    - Medium (coupled with EO/IR)
    - Large (SAR system only)

FIGURE 8: SAR RADAR

3.2.2.2.6 SATCOM CATCHER

- Fully passive SatCom interception system
- L-band frequency band
- Ultra long-range detection (hundreds of km)
- All 3 bands
  - Inmarsat (including GSPS)
  - Iridium (including SDB)
  - Thuraya
- Precise localisation of the SatPhone
- Capacity for 10,000 targets
- All data processing at the GCS
- Flexible installation
  - UAV system can be installed in vehicle or as stationary.
  - Dual antenna on UAV only (Uplink and Downlink)

3.2.2.2.7 IMSI CATCHER

- Multiband IMSI Catcher
- 4 channels minimum
- 4W per channel
- Modules for 2G, 3G, 4G (TDD & FDD) and CMDA2000
- Optionally 5G
- Long range detection (25 km)
- Monitoring and scanning capability
- Precise geo-localisation capability (heat map)
- Unlimited time of operation
- Ultra fast scanning capability
- GCS data management
- Connectivity to big data SW
    - Direct inputs to customer´s databases
    - Full big data software available
    - Automatic reporting capability

3.2.2.2.8 TACTICAL BATTLEFIELD DATA COMMUNICATION

- Multiple datalinks installed at once
- VHF/UHF frequency (L-band, S-band…)
- Support of multiple waveforms
- Ultra high-speed & long-range connection
- Voice and data streams
- Multicast concept
- Power only (relay) or power & streaming (of on-board sensors) setup
- Plug&play concept
- Easy overcoming of no-RLOS areas
- Long loitering time of the UAV over battlefield

4 CONCLUSIONS

The consortium possesses all the necessary capabilities to conduct the operational mission of I-SEAMORE, whether that be autonomy or observation capacity. Now that we ascertain the platform and the sensors exist and can provide the necessary data, it is necessary to control them, make them collaborate and process efficiently the collected data to ensure that the operator workload remains acceptable. To do so, it is most important to correctly rely on the autonomous functions and data processing functions of each UxV.

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