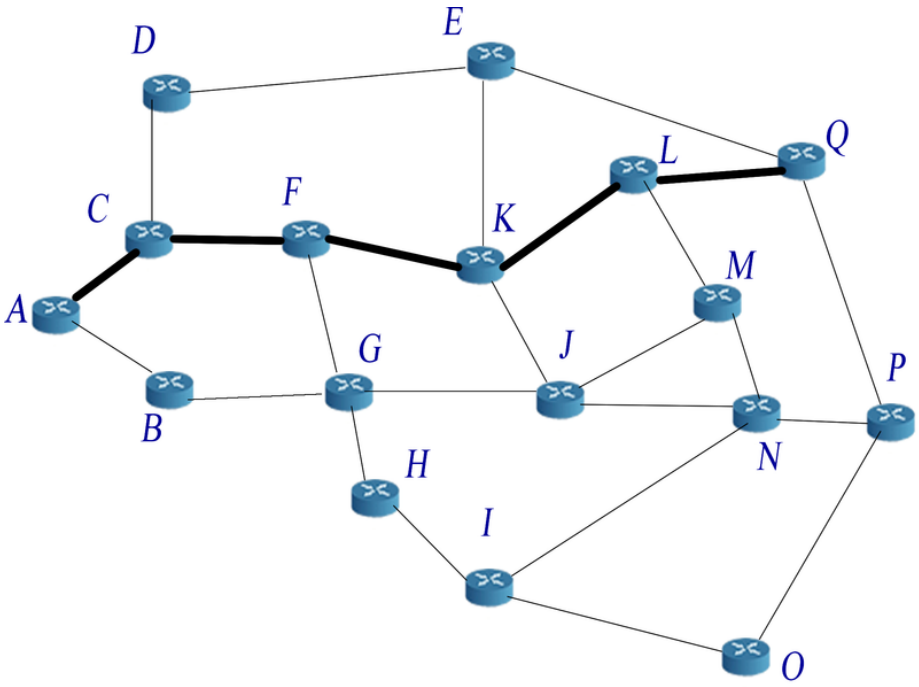

Smæsh Operational Analysis

Smæsh GmbH

September 16, 2024

Contents

0.1 Introduction

This document provides the Operational Analysis of the Smæsh Network. The Smæsh Network is a de-central mesh based communication system currently under development at the Smæsh GmbH. The methodology and terminoligy used in this analysis document is the ARCADIA method. In this context, Operational Analysis means to define stakeholder needs and the environment. In partuciluar:

- To capture and consolidate operational needs from stakeholders
- To define what the users of the system have to accomplish
- To identify entities, actors, roles, activities and concepts

0.2 Operational Entities

In the following section an overview of the Operational Entities that are defined in this Operational Analysis is given.

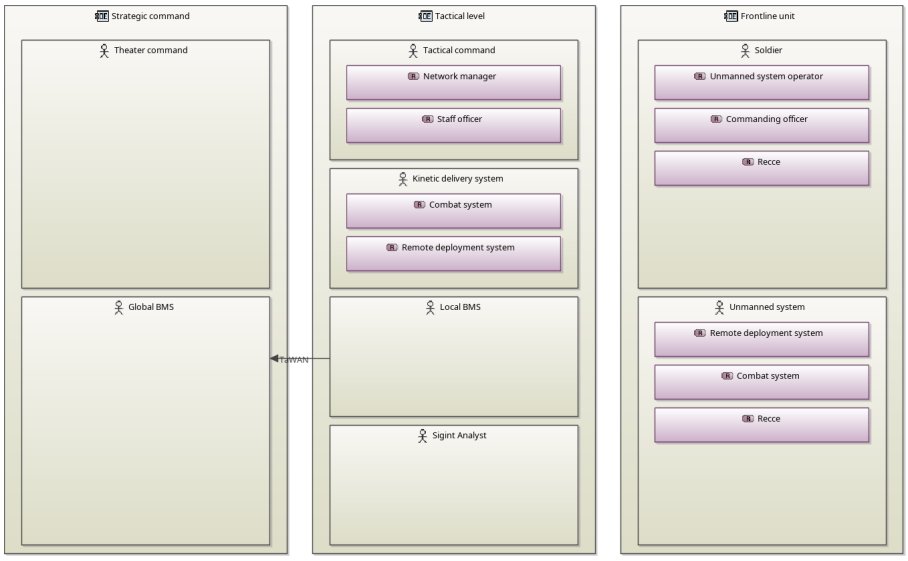

Figure 1: [OAB] Operational Entities

0.2.1 Strategic command

The Strategic Command is an Operational Entity representing a command center for a large area such as an operational theater or even the general staff. It usually is far away from the frontline in a safe location and has its own infrastructure such as IT networks situation rooms etc.

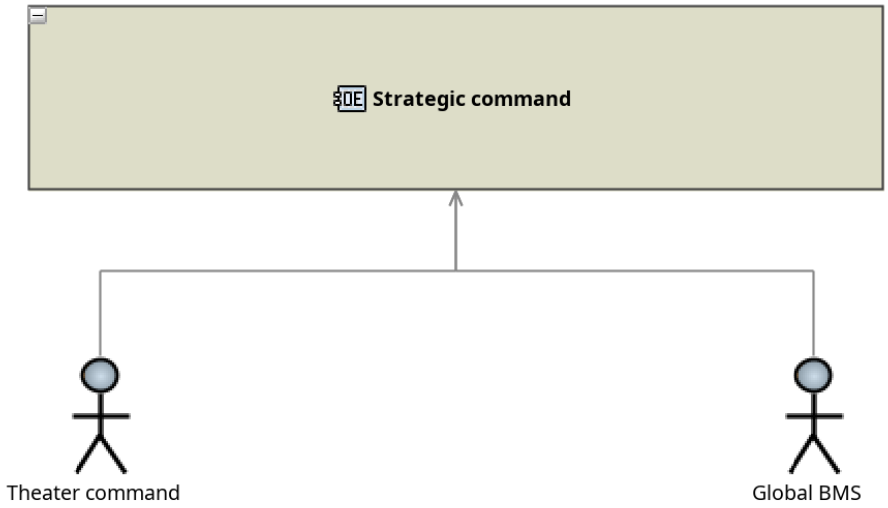

Figure 2: [OEBD] Strategic command

Actors in Strategic command

Theater command The Theater command is an Operational Actor representing the highest ranking officer who is responsible for the overall command of the theater of operations.

Global BMS The Global BMS (Battle Management System) is an Operational Actor representing the a central IT infrastructure which is used to provide the theater level command with situational awareness data.

The following Operational Activities are allocated to the actor Global BMS (for details see section "Activities" below):

- Provide strategical awareness data
- Provide data lake
- Receive updates from local BMS

0.2.2 Tactical level

The Tactical Command is an Operational Entity representing a command post for a small unit such as a Brigade or Regiment. It usually is quite close to the area of operations and provides only a limited amount of infrastructure such as situation rooms.

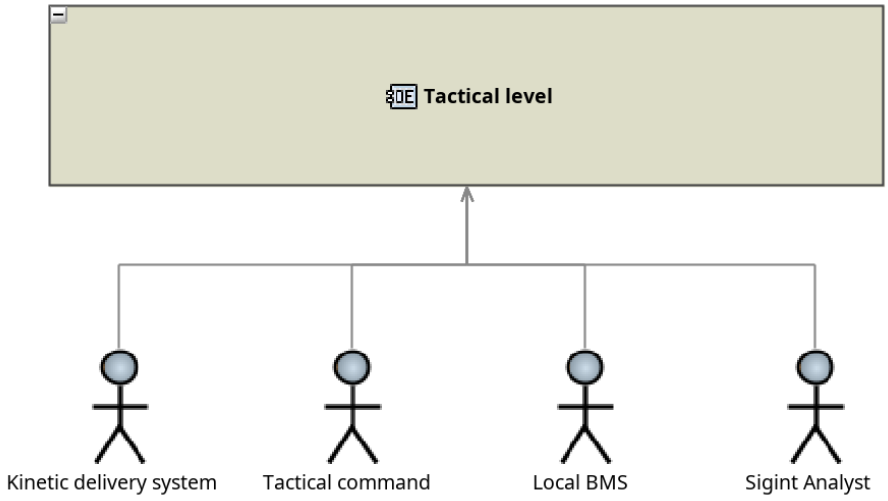

Figure 3: [OEBD] Tactical level

Actors in Tactical level

Kinetic delivery system ERROR: No description. Please provide description in Capella model.

The actor Kinetic delivery system is allocated to the following roles (for details see section "Roles" below):

- Remote deployment system
- Combat system

The following Operational Activities are allocated to the actor Kinetic delivery system (for details see section "Activities" below):

- Remotely deploy

Tactical command The Tactical command is an Operational Actor representing the highest ranking officer of the unit who is responsible for the overall command of the area of operations.

The actor Tactical command is allocated to the following roles (for details see section "Roles" below):

- Network manager
- Staff officer

Local BMS The Local BMS (Battle Management System) is an Operational Actor representing an IT infrastructure which is used to provide the tactical command and the units operating in the deployment area with situational awareness data. It usually is connected to the Global BMS in order to provide the Strategic Command with situational awareness data.

The following Operational Activities are allocated to the actor Local BMS (for details see section "Activities" below):

- Provide situational awareness data
- Receive updates from local assets
- Provide threat analysis
- Provide updates to global BMS
- Generate engagement orders
- Aggregarte optical surveilance data

Sigint Analyst ERROR: No description. Please provide description in Capella model.

The following Operational Activities are allocated to the actor Sigint Analyst (for details see section "Activities" below):

- Monitor RF spectrum
- Identify RF emitters
- Locate RF emitters

0.2.3 Frontline unit

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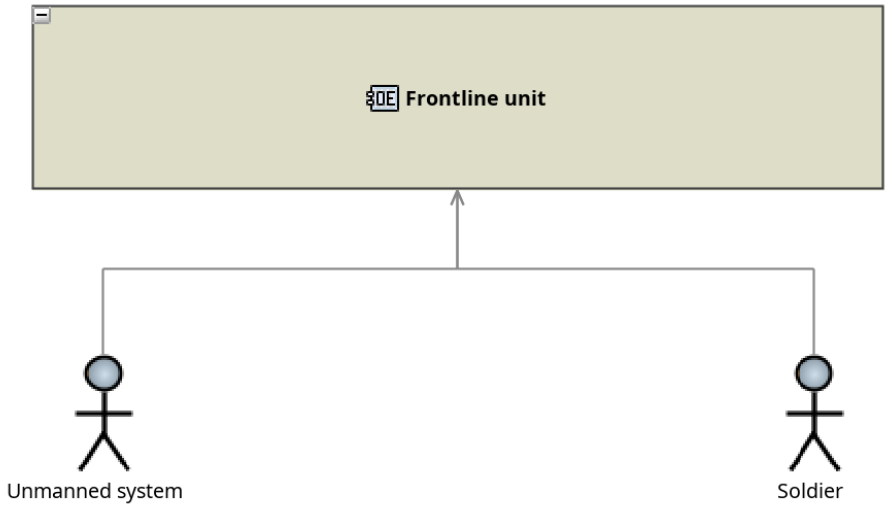


Figure 4: [OEBD] Frontline unit

Actors in Frontline unit

Unmanned system ERROR: No description. Please provide description in Capella model.

The actor Unmanned system is allocated to the following roles (for details see section "Roles" below):

- Remote deployment system
- Combat system
- Recce

The following Operational Activities are allocated to the actor Unmanned system (for details see section "Activities" below):

- Receive commands
- Send video data
- Provide location
- Send telemtry data

Soldier ERROR: No description. Please provide description in Capella model.

The actor Soldier is allocated to the following roles (for details see section "Roles" below):

- Unmanned system operator
- Commanding officer
- Recce

The following Operational Activities are allocated to the actor Soldier (for details see section "Activities" below):

- Send voice message
- Receive voice message
- Receive text message
- Send text message
- Access BMS
- Receive orders
- Identify need of fire support
- Talk
- Listen

0.3 Roles

0.3.1 Commanding officer

ERROR: No description. Please provide description in Capella model.

0.3.2 Unmanned system operator

ERROR: No description. Please provide description in Capella model.

0.3.3 Recce

ERROR: No description. Please provide description in Capella model.

0.3.4 Remote deployment system

ERROR: No description. Please provide description in Capella model.

0.3.5 Combat system

ERROR: No description. Please provide description in Capella model.

0.3.6 Network manager

ERROR: No description. Please provide description in Capella model.

0.3.7 Staff officer

ERROR: No description. Please provide description in Capella model.

0.4 Operational Capabilities

0.4.1 Deploy [Done]

This Operational Capability Package contains all Operational Capabilities related to the deployment of the system.

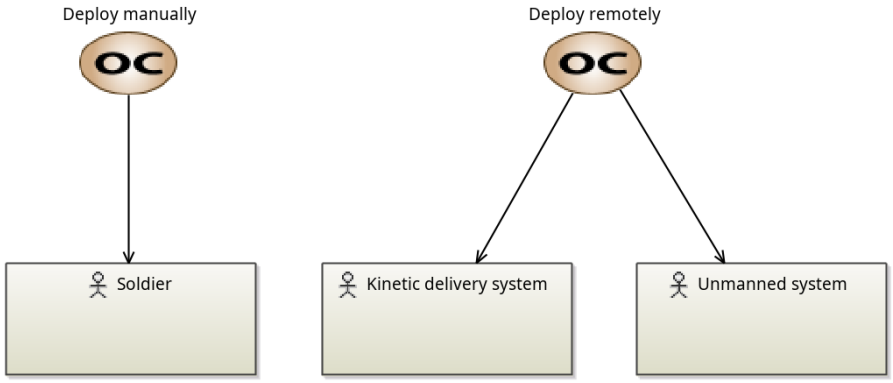


Figure 5: [OCB] Deploy [Done]

Deploy manually

This Operational Capability represents the capability of the system to be deployed manually by soldiers and/or other human actors. While it is benefitial if the person deploying the system has some special training in order to optimize the deployment, the neccessary knowledge shall be as minimal as possible.

Deploy manually ERROR: No description. Please provide description in Capella model.

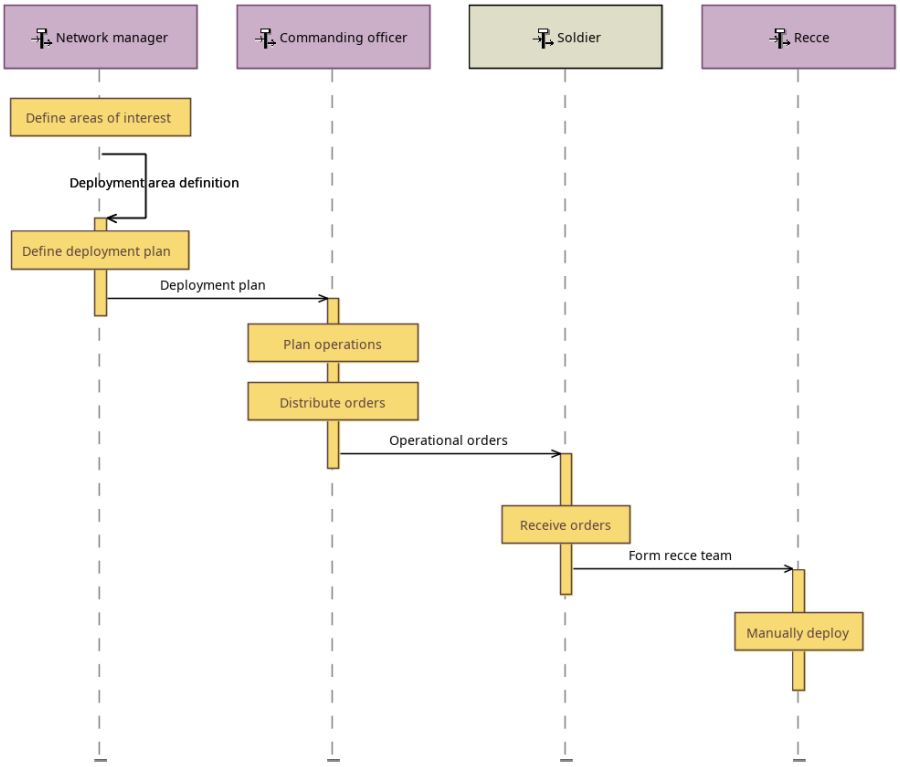


Figure 6: [OES] Deploy manually

Deploy remotely

This Operational Capability represents the capability of the system to be deployed remotely either by UVs or via kinetic means, for example mortar or rocket artillery.

Deploy remotely ERROR: No description. Please provide description in Capella model.

0.4.2 Maintain [ToDo]

This Operational Capability Package contains all Operational Capabilities related to the maintenance and survivability of the system.

Resist Jamming

This Operational Capability represents the capability of the system to resist jamming by enemy assets. This can be achieved by different means. For example

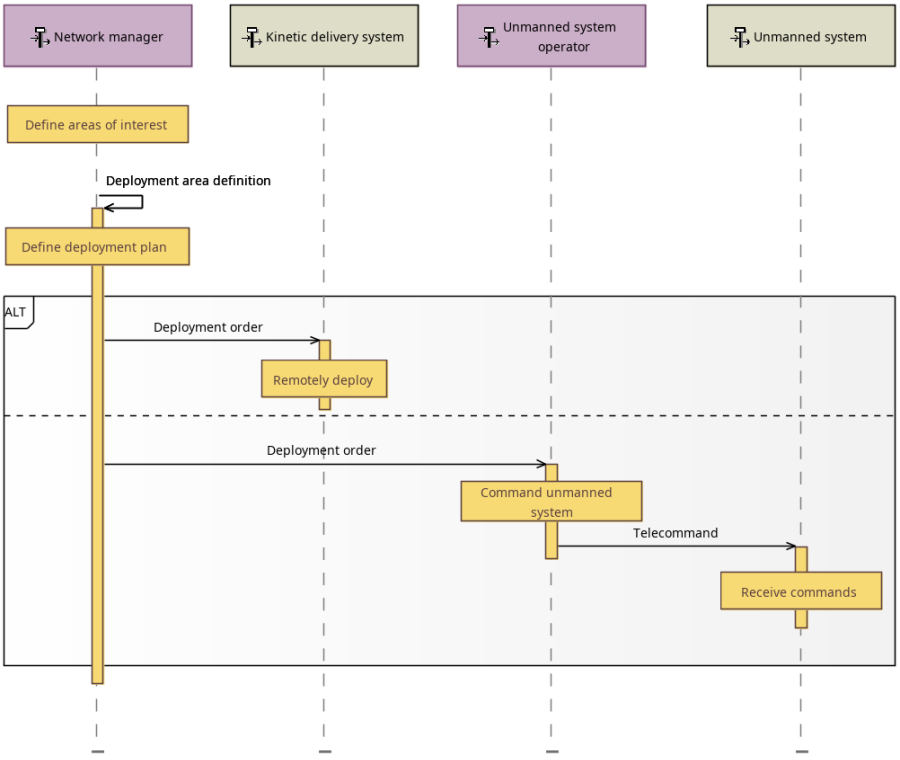


Figure 7: [OES] Deploy remotely

Figure 8: [OCB] Maintain [ToDo]

the usage of multiple frequencies, by frequency hopping, by using higher and adaptive transmission power or by routing traffic around areas with jamming interference.

Resist Clearing

This Operational Capability represents the capability of the system to resist clearing operations by the enemy. This can be achieved by different means. For example the nodes of the system can be deployed in hard to reach locations, be disguised, be hard to detect via RF direction finding, or even be equiped with anti-clearing protections such as explosives.

Retrieve and redeploy

This Operational Capability represents the capability of the system to be retrieved and redeployed. This allows to reuse the system in case the battlefield moves or the stored energy of the system is depleeted.

0.4.3 Communicate [Working]

This Operational Capability Package contains all Operational Capabilities related to communications.

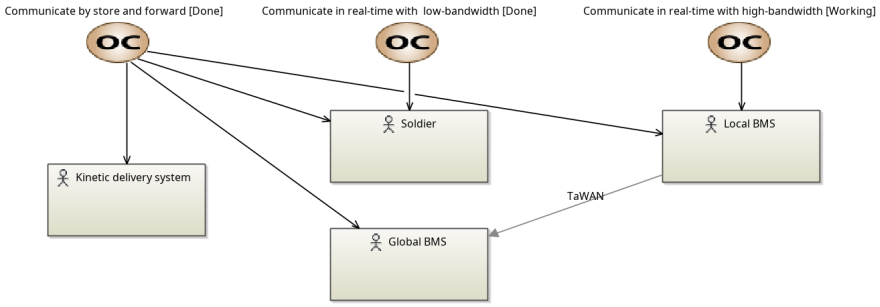


Figure 9: [OCB] Communicate [Working]

Communicate by store and forward [Done]

This Operational Capability represents the capability of communicating via a store and forward mechanism. This includes for example a messaging service, the capability to request and coodinate fire support and access to information stored in a battle management system.

Messaging service ERROR: No description. Please provide description in Capella model.

Coordinate fire support ERROR: No description. Please provide description in Capella model.

Update BMS with processed sensor data ERROR: No description. Please provide description in Capella model.

Provide situational awareness through BMS access ERROR: No description. Please provide description in Capella model.

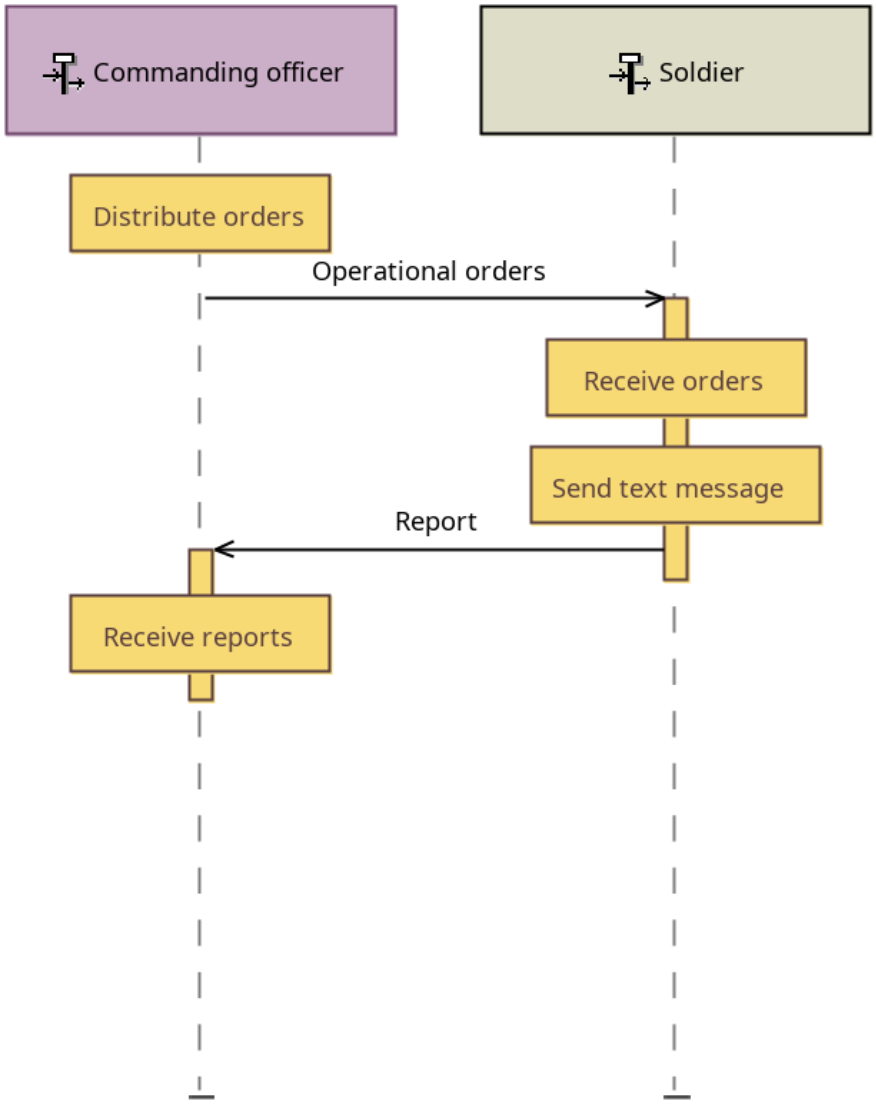


Figure 10: [OES] Messaging service

Communicate in real-time with low-bandwidth [Done]

This Operational Capability represents the capability of communicating in real time with a low bandwidth. For example the command and control link for UAVs, the real-time acquisition of processed sensor-data or highly compressed voice communication.

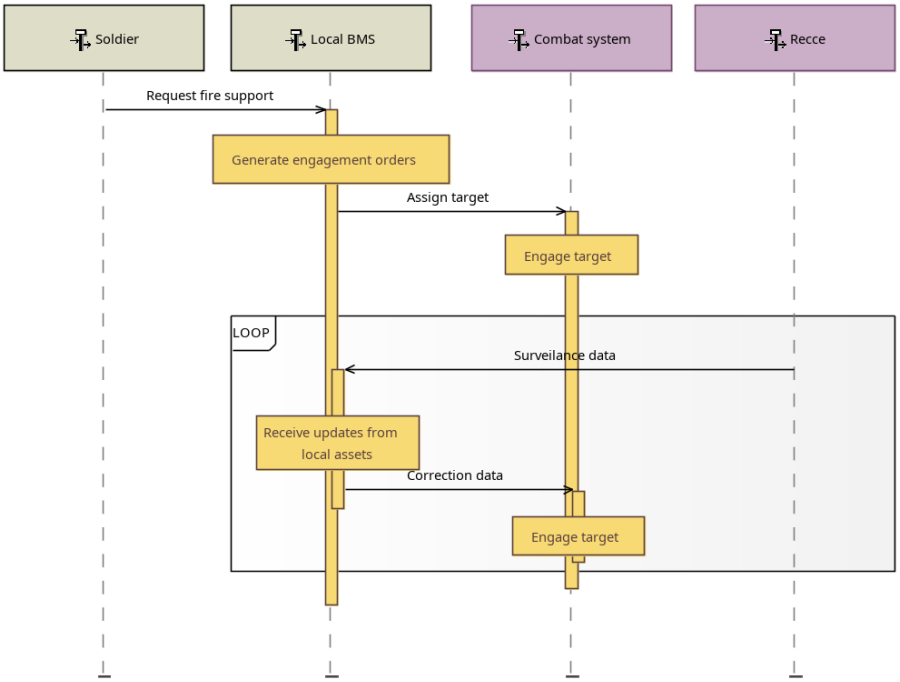


Figure 11: [OES] Coordinate fire support

Control unmanned systems ERROR: No description. Please provide description in Capella model.

Provide real-time voice communication ERROR: No description. Please provide description in Capella model.

Communicate in real-time with high-bandwidth [Working]

This Operational Capability represents the capability of communicating in real time with a high bandwidth. For example streaming video data from UAVs or other optical surveilance systems, transmission of unprocessed RF spectrum data for processing at a back-end or transmission of unprocessed audio data from sensor networks.

Transmit optical surveilance data ERROR: No description. Please provide description in Capella model.

Transmit unprocessed RF sensor data ERROR: No description. Please provide description in Capella model.

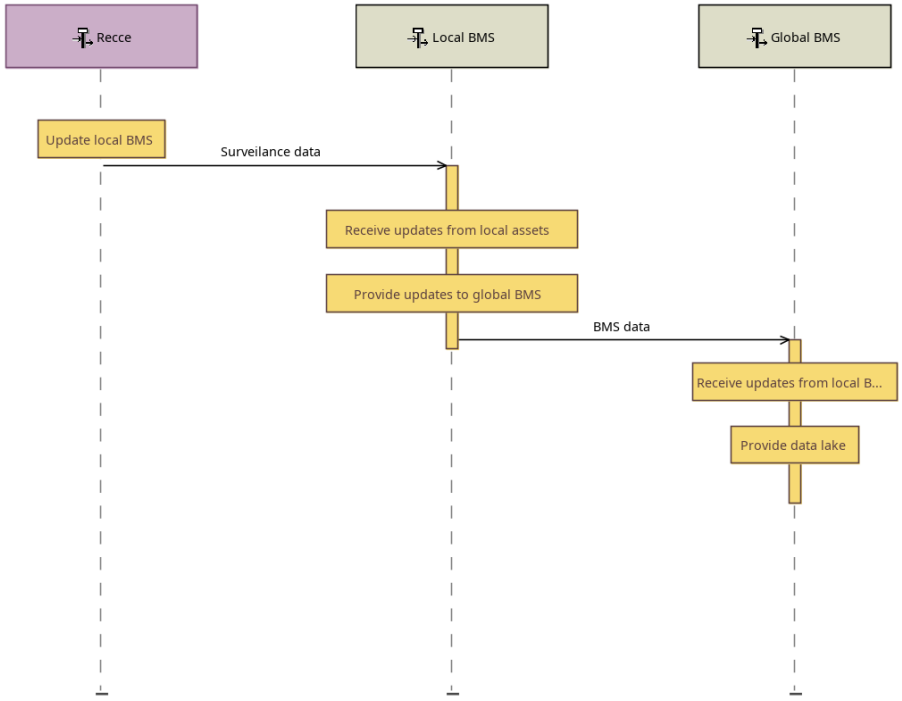


Figure 12: [OES] Update BMS with processed sensor data

Transmit unprocessed audio sensor data ERROR: No description. Please provide description in Capella model.

0.4.4 Surveil [Working]

This Operational Capability Package contains all Operational Capabilities related to surveilance of the battlefield.

Characterize RF spectrum

This Operational Capability represents the capability to characterize the RF spectrum of the deployment area. This includes for example the general characterization of used frequencies, the ammount of jamming present in the area and the detection of typicall threads such as UAVs through their RF signatures.

Characterize RF spectrum ERROR: No description. Please provide description in Capella model.

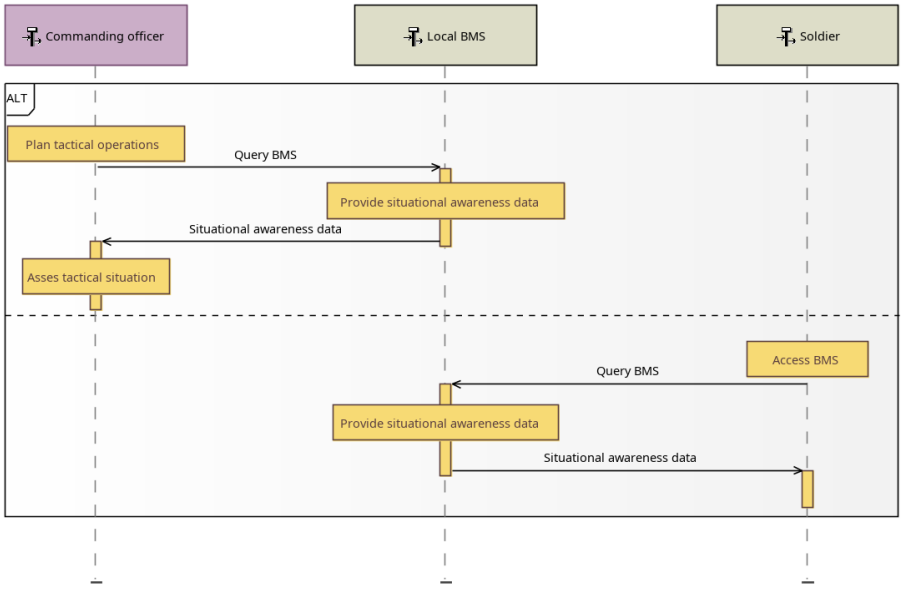


Figure 13: [OES] Provide situational awareness through BMS access

Detect UAV presence ERROR: No description. Please provide description in Capella model.

Locate RF emiiters

This Operational Capability represents the capability to locate adversary RF emitters in the deployment areaeither by triangulation or by comparison of receive signal strength.

Locate RF emiiters ERROR: No description. Please provide description in Capella model.

Monitor and decode RF signals

This Operational Capability represents the capability to monitor and if possible decode adversary RF signals. This is highly reliant on the presence and type of encryption used by the adversary.

Monitor and decode RF signals ERROR: No description. Please provide description in Capella model.

Provide surveilance data

ERROR: No description. Please provide description in Capella model.

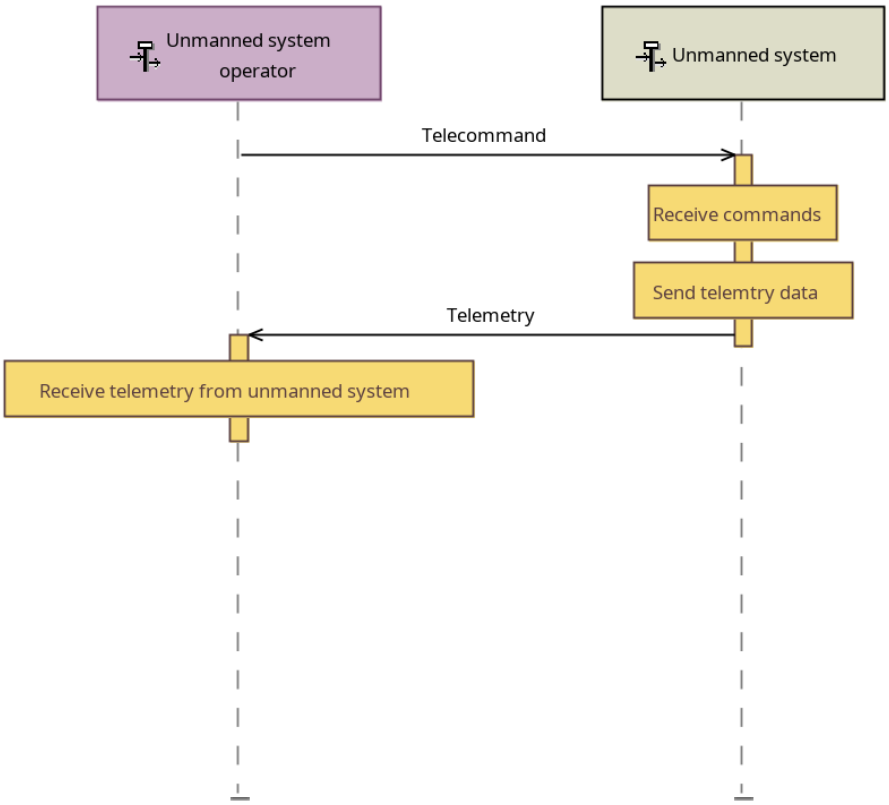


Figure 14: [OES] Control unmanned systems

Provide audio surveilance data ERROR: No description. Please provide description in Capella model.

Provide video surveilance data ERROR: No description. Please provide description in Capella model.

0.4.5 Interdict [ToDo]

This Operational Capability Package contains all Operational Capabilities related to interdiction of enemy assets.

Interdict RF transmissions

This Operational Capability represents the capability to interdict the transmission and reception of adversary RF signals. Either by jamming of certain

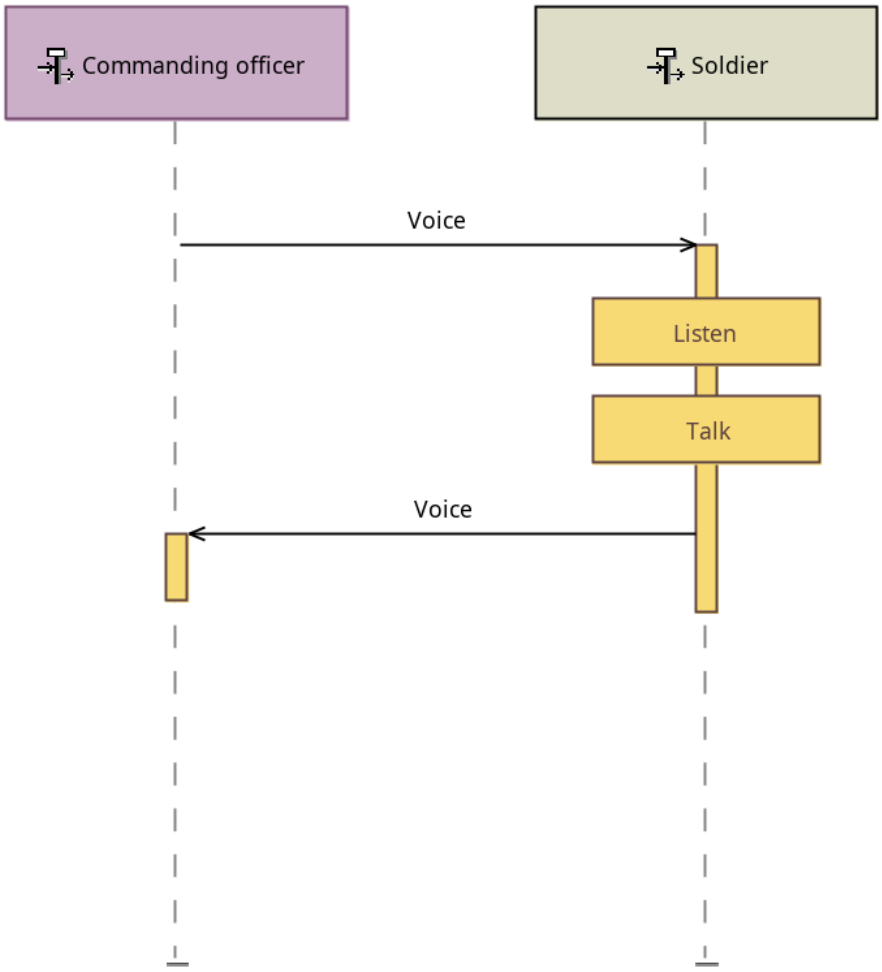


Figure 15: [OES] Provide real-time voice communication

frequencies in certain areas of the deployment or by more sophisticated attacks depending on the technology used by the adversary.

Spoof RF signals

This Operational Capability represents the capability to spoof adversary RF signals. Either by recording and retransmission or by more sophisticated means depending on the technology used by the adversary.

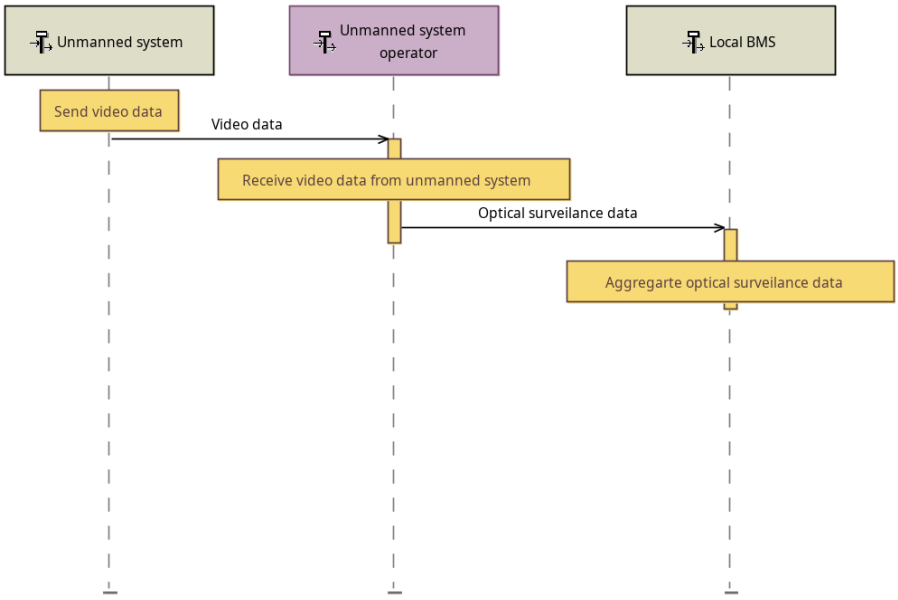


Figure 16: [OES] Transmit optical surveilance data

0.5 Activities

0.5.1 Access BMS

ERROR: No description. Please provide description in Capella model.

0.5.2 Asses tactical situation

ERROR: No description. Please provide description in Capella model.

0.5.3 Command unmanned system

ERROR: No description. Please provide description in Capella model.

0.5.4 Define areas of interest

ERROR: No description. Please provide description in Capella model.

0.5.5 Define deployment plan

ERROR: No description. Please provide description in Capella model.

0.5.6 Define maintenance plan

ERROR: No description. Please provide description in Capella model.

0.5.7 Distribute orders

ERROR: No description. Please provide description in Capella model.

0.5.8 Engage target

ERROR: No description. Please provide description in Capella model.

0.5.9 Generate engagement orders

ERROR: No description. Please provide description in Capella model.

0.5.10 Identify need of fire support

ERROR: No description. Please provide description in Capella model.

0.5.11 Manually deploy

ERROR: No description. Please provide description in Capella model.

0.5.12 Observe engagement

ERROR: No description. Please provide description in Capella model.

0.5.13 Plan operations

ERROR: No description. Please provide description in Capella model.

0.5.14 Plan tactical operations

ERROR: No description. Please provide description in Capella model.

0.5.15 Provide data lake

ERROR: No description. Please provide description in Capella model.

0.5.16 Provide location

ERROR: No description. Please provide description in Capella model.

0.5.17 Provide situational awareness data

ERROR: No description. Please provide description in Capella model.

0.5.18 Provide strategical awareness data

ERROR: No description. Please provide description in Capella model.

0.5.19 Provide threat analysis

ERROR: No description. Please provide description in Capella model.

0.5.20 Provide updates to global BMS

ERROR: No description. Please provide description in Capella model.

0.5.21 Receive commands

ERROR: No description. Please provide description in Capella model.

0.5.22 Receive orders

ERROR: No description. Please provide description in Capella model.

0.5.23 Receive reports

ERROR: No description. Please provide description in Capella model.

0.5.24 Receive text message

ERROR: No description. Please provide description in Capella model.

0.5.25 Receive updates from local assets

ERROR: No description. Please provide description in Capella model.

0.5.26 Receive updates from local BMS

ERROR: No description. Please provide description in Capella model.

0.5.27 Receive voice message

ERROR: No description. Please provide description in Capella model.

0.5.28 Remotely deploy

ERROR: No description. Please provide description in Capella model.

0.5.29 Send text message

ERROR: No description. Please provide description in Capella model.

0.5.30 Send video data

ERROR: No description. Please provide description in Capella model.

0.5.31 Send voice message

ERROR: No description. Please provide description in Capella model.

0.5.32 Update local BMS

ERROR: No description. Please provide description in Capella model.

0.5.33 Manually retrieve

ERROR: No description. Please provide description in Capella model.

0.5.34 Monitor RF spectrum

ERROR: No description. Please provide description in Capella model.

0.5.35 Identify RF emitters

ERROR: No description. Please provide description in Capella model.

0.5.36 Locate RF emitters

ERROR: No description. Please provide description in Capella model.

0.5.37 Receive telemetry from unmanned system

ERROR: No description. Please provide description in Capella model.

0.5.38 Receive video data from unmanned system

ERROR: No description. Please provide description in Capella model.

0.5.39 Send telemtry data

ERROR: No description. Please provide description in Capella model.

0.5.40 Talk

ERROR: No description. Please provide description in Capella model.

0.5.41 Listen

ERROR: No description. Please provide description in Capella model.

0.5.42 Aggregarte optical surveilance data

ERROR: No description. Please provide description in Capella model.

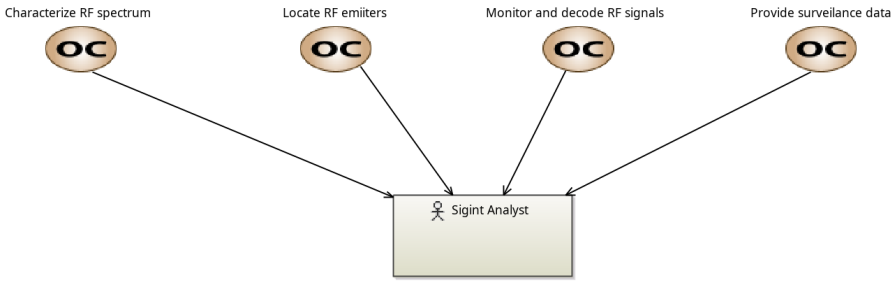
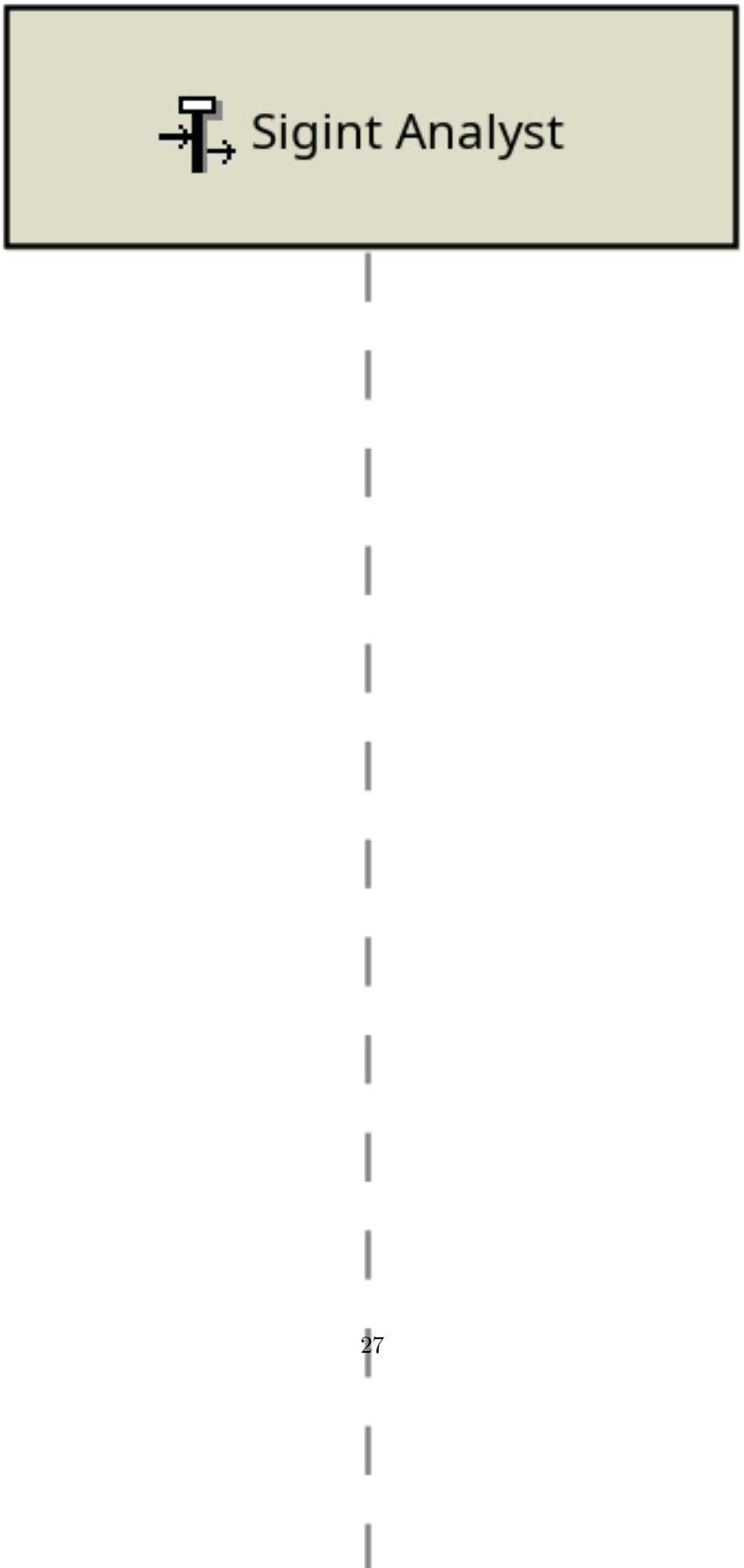
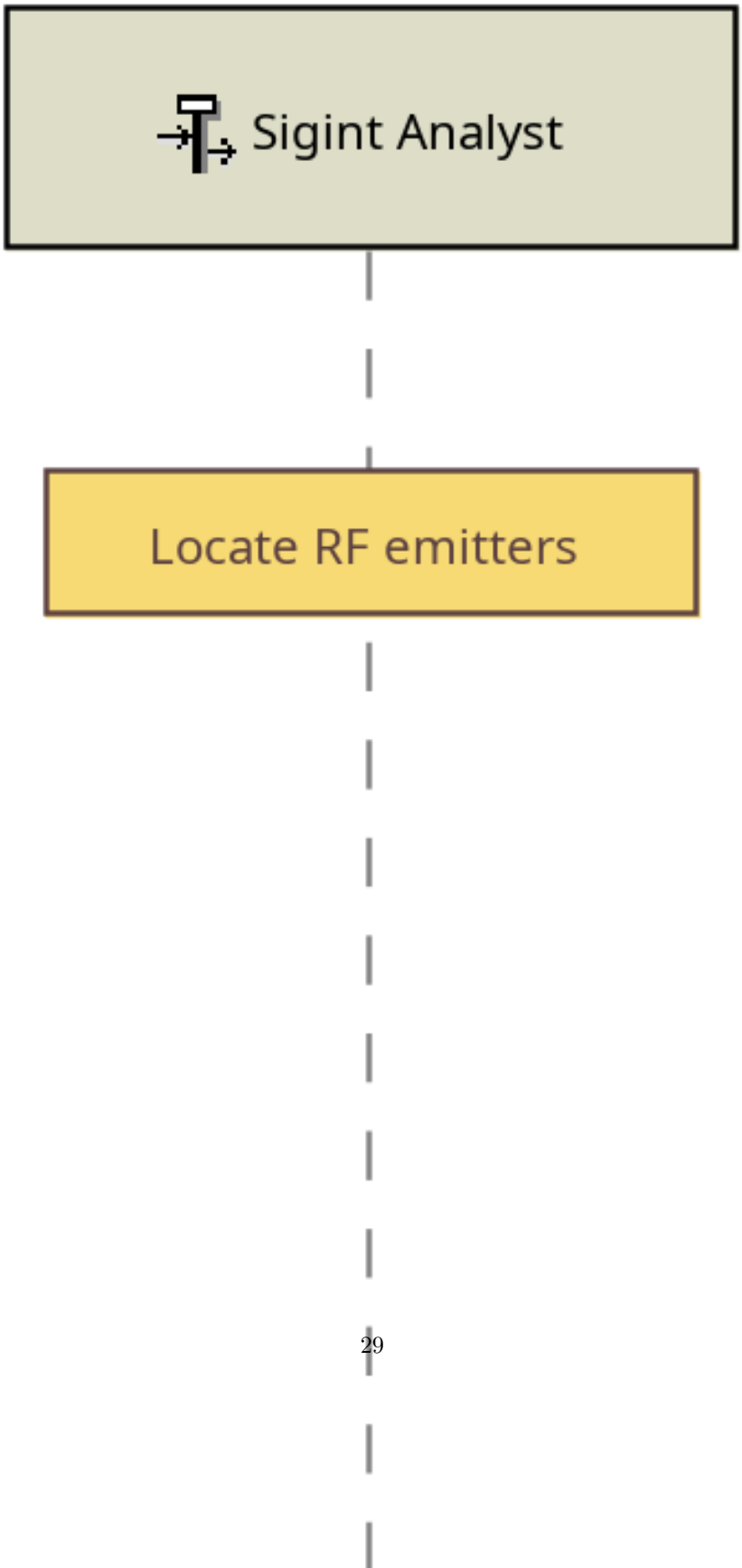
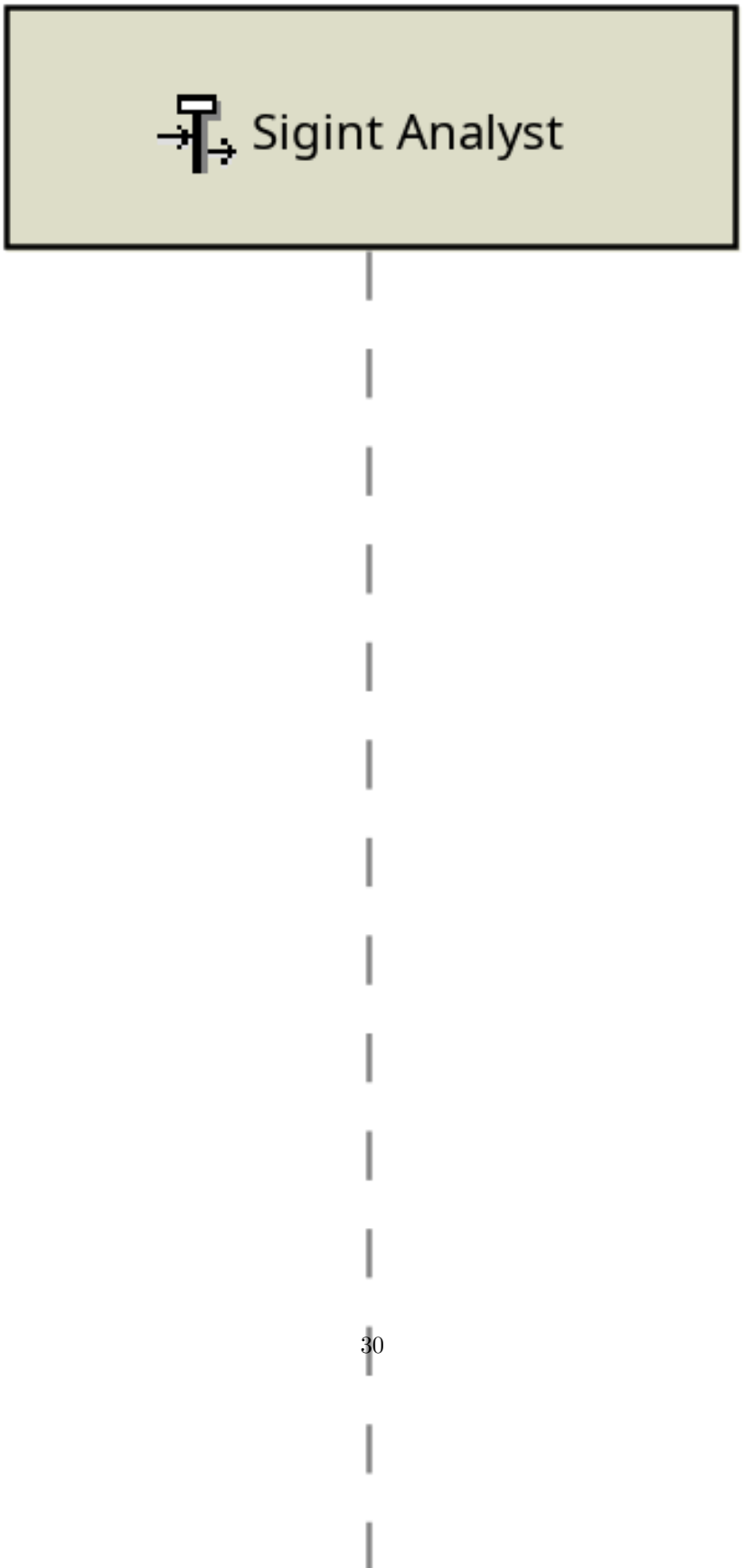


Figure 19: [OCB] Surveil [Working]


Sigint Analyst


Sigint Analyst
Locate RF emitters


Sigint Analyst

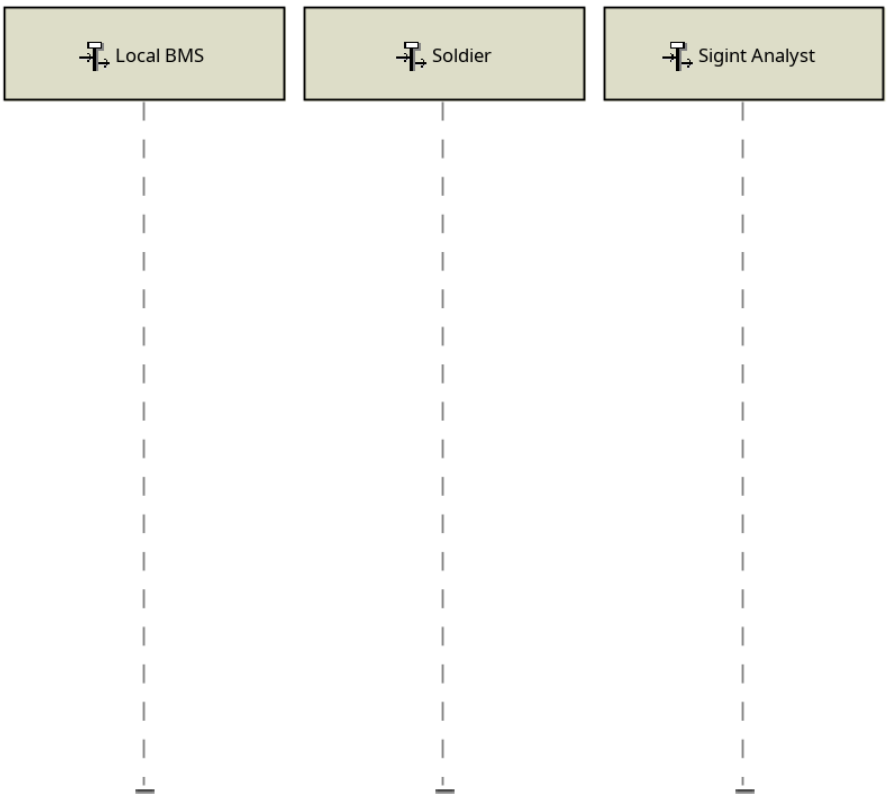


Figure 25: [OES] Provide video surveilance data

Figure 26: [OCB] Interdict [ToDo]