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# GOSSRA

Generic Open Soldier System Reference Architecture

**Collaborative Project**

**PADR_FPSS_A_2017_800783**

# GOSSRA Architecture for Standardisation - Vol. 4

## Service Oriented View (NSOV)

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# 1 Overview and Summary Information

The Generic Open Soldier System Reference Architecture (GOSSRA) is described in this set of documents and represents the proposal of the GOSSRA Consortium for subsequent standardisation.

The standardisation itself lies outside the scope of this project. However, the consortium plans to propose the architecture to the “C4I and System Architecture” Working Group of the NATO “Land Capability Group Dismounted Soldier System” (LCG DSS) which has been following the work through GOSSRA Presentations and discussions during the course of the project.

The architecture consists of a set of documents with seven volumes /1/, /2/, /3/, /4/, /5/, /6/, and /7/ which contain the different architectural views according to the NATO Architecture Framework v3.1, with the addition of a Security View (see Figure 1-1). It is accompanied by a formal architecture represented by a set of computer files, compiled by using the SparxSystems Enterprise Architect (version 13) /8/.

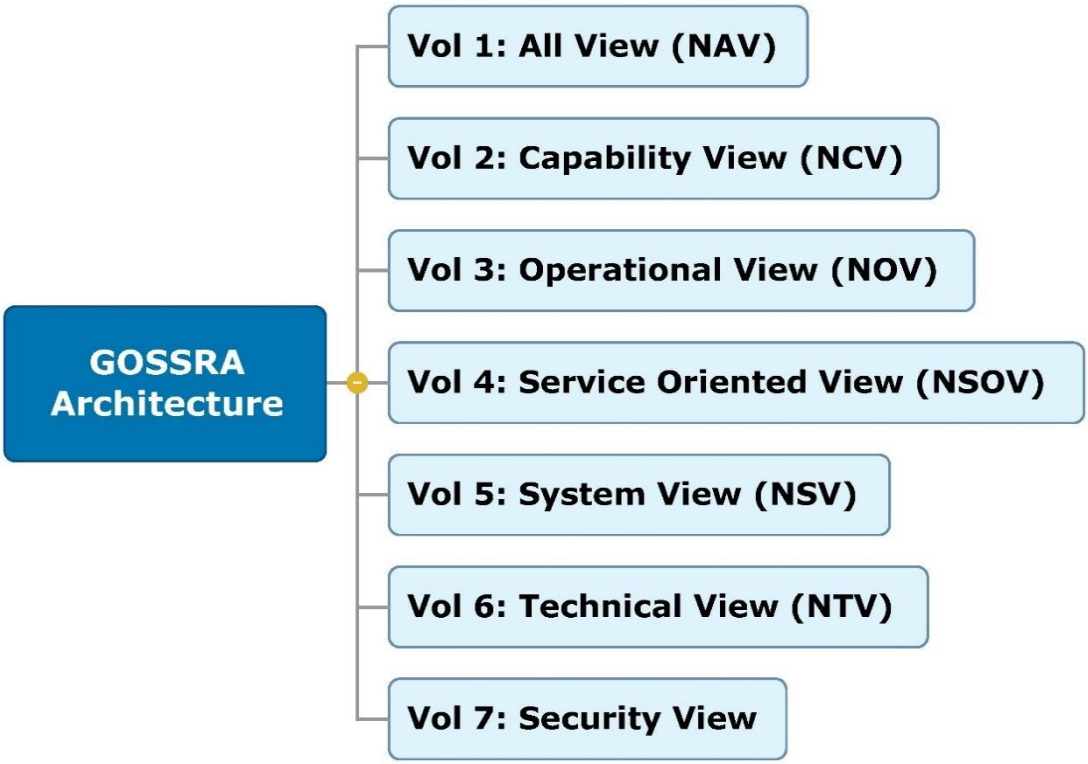


**Figure 1-1 – GOSSRA Document Structure**

This for Soldier Systems was developed based on following assumptions:

- **This is a reference architecture**. It consists of common best practices and does not depict any one nation's solution. When nations define, specify or develop their specific dismounted soldier system, they may elect to use this architecture as a reference.
- As a reference architecture, it is **not intended to dictate acquisition or procurement decisions**. Rather, it is meant to be used as a template for developing solutions.
- Nations are responsible for **using this reference to create target architectures (solutions)** depicting their implementation including specific equipment for specific roles.
- The reference architecture **standardizes specific aspects where innovation is expected to be slow**, but **leave options open where innovation is fast and competition is desired**.
- **Nations are also responsible for using this reference** when creating system-of-system architectures that include soldier systems.
- This architecture models **a squad as well as a single soldier**. We recognize soldiers do not operate on their own, are networked, and share equipment (especially vehicle platforms). A squad also consists of soldiers performing different roles, e.g. as commander, machine gunner, sniper, scout, medic, or other mission specific role and thus, needing different equipment.
- This architecture focuses on the **electrical and electronic equipment** a soldier wears, carries, and consumes as well as on **software and data communication**.
- This architecture embraces concepts of **interoperability, interchangeability, and commonality**.
- This reference architecture does not strictly and blindly comply with the process and views in the NATO Architectural Framework but rather takes the underlying concepts and uses them to efficiently develop **views which** are thought to be **useful for the purpose and the community**.

## 1.1 Architecture Scope

The purpose of the Generic Open Soldier System Reference Architecture (GOSSRA) is to serve as a common reference architecture on EU-/NATO-Level for deriving a Target Architecture at country-level.

This Reference Architecture comprehensively focuses on:

- software
- electronics
- voice and data communication
- sensors
- effectors
- human interface devices
- C4I

This Reference Architecture for Soldier Systems is ready for standardization to become openly available and not implying any protected intellectual property. The architecture, to be applied during at least the next 10 years, shall consider trends and potentials with respect to capabilities, operations and technologies.

The architecture represents “best practice”, “future trends and developments” and suggests standard interfaces. It shall be used as a reference to derive the “Target Architecture” which is the architecture for a specific Soldier System to be procured.

By referring to this reference architecture, the “Target Architecture” then:

- is easier to develop,
- includes all major aspects, and
- uses specific common standards enabling interoperability.

## 1.2 Identification

This set of documents represent the “GOSSRA Architecture for Standardisation” which is the deliverable D8.5 of the GOSSRA project.

The architecture had been developed between the 6th May 2019 and the 30st April 2020 by the GOSSRA Consortium. Led by Rheinmetall Electronics GmbH (Germany), GOSSRA’s consortium encompasses 9 participants from 7 countries: GMV (Spain), iTTi (Poland), Tekever-ASDS (Portugal), Larimart (Italy), Leonardo (Italy), SAAB (Sweden), Indra (Spain) and TNO (the Netherlands) and received an EU grant of roughly €1.5 million over 23 months (1st July 2018 to 30st April 2020).

The companies include major European Soldier System companies which developed and already delivered Soldier Systems in large numbers. Further, participants are smaller companies which provided subsystems or components and contributed their specific and valuable expertise to the project. Finally, a research institute provided knowledge about newest developments and technologies.

Following are the GOSSRA project team members:

- Rheinmetall Electronics GmbH (DEU, prime contractor)
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  - Daniel Riggers (Technical Coordinator)
  - Dr. Deepak Das (Technical Expert)
- GMV Aerospace and Defence (ESP)
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  - Duarte Belo (Technical Expert)
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  - André Oliveira (former Project Manager & Technical Expert)
- Larimart SpA (ITA),
  - Marco Stella (Technical Expert),
  - Fabrizio Parmeggiani (Project Manager and Technical Expert)
  - Luigi Esposito (Technical Expert)
- Leonardo SpA (ITA)
  - Francesco Fedi, LDO (Principal Editor)
  - Rosa Ana Lopez Mazuelas (Technical Expert)
  - Fabio Casalino (Technical Expert)
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- Zamburru Lorenzo (Technical Expert)
- SAAB AB (SWE)
  - Dennies Olesen (Technicas l Expert)
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- TNO (NLD)
  - Marcel van der Lee (Technical Expert)
  - Angela Kwaijtaal (Project Manager)
  - RonaldRonald in ’t Velt (Technical Expert)
  - Eelco Cramer (Technical Expert)

Additional to the consortium, the GOSSRA project established a Stake Holder Advisory Board with representatives from following European Governments:

- NLD
  - Luc de Beer (Mindef, DMO, DP&V, Ressort Projecten, Soldier System Procurement)
  - Major Koen van Veen (Defence Centre of Expertise for Soldier and Equipment)
  - Jasper Groenewegen (DNV GL)
- DEU
  - Dr. Karl-Heinz Rippert (Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support, Soldier System Procurement)
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  - Col. (ET) Moisés Serrano Martínez (ET MDE)
- PRT
  - Lt. Col. Luís Paz Lopes (Portugese Army)
  - LTCol Simão Sousa (Portugese Army)

Special thanks for their feedback and contributions.

# 2 Service Oriented View

A service is understood in its broadest sense as a well-defined way to provide a unit of work through which a provider provides a useful result to a consumer. A service defined in this way does not necessarily equate to a web service.

In essence, a service is a set of strictly delineated functionalities, restricted to answering the what-question, independent of construction or implementation issues.

## 2.1 NSOV-1 Service Taxonomy

Figure 2-1 below depicts the general categories of services as part of the Services.

In the Service Taxonomy, the following categories of services are assumed:

- **Operational Services**, which are the set of services provided by a STU and individual soldiers with specific roles in order to accomplish a mission.
- **Functional Services**, which are the set of services provided by the DSS to support Operational Services, which resultantly support the individual soldier and, thus, also the STU in order to accomplish specific tasks.
- **Enterprise Services,** which are services provided by the enterprise in terms of network services, security services, geographical reference services, cloud services for storage / applications, collaboration services; situational awareness services.


**Figure 2-1 – Categories for Services Taxonomy**

### 2.1.1 Operational Services Taxonomy

The Operational Services Taxonomy is depicted at Figure 2-2 and can be categorized into operational services based on capability requirement areas, which have been described in the ensuing paragraphs.

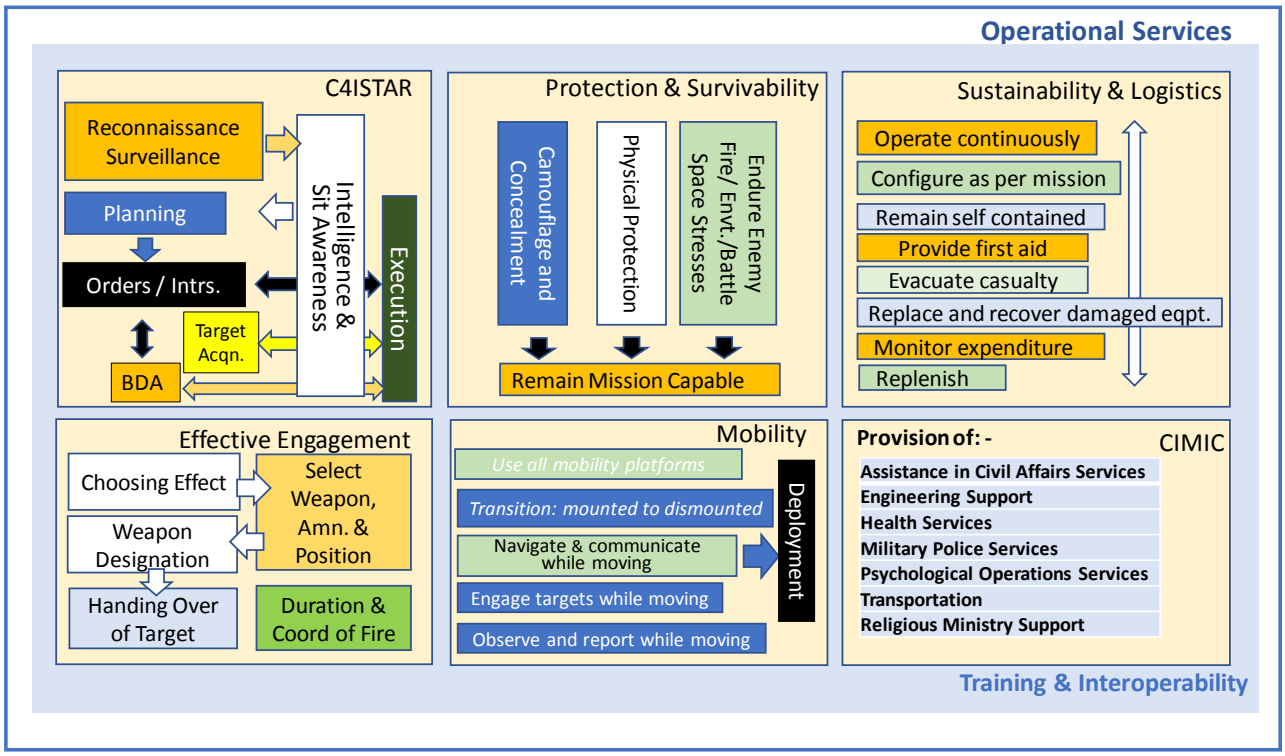


**Figure 2-2 – Operational Services Taxonomy**

The description for each of the service categories is provided in Section 2.2.1.

### 2.1.2 Functional Services Taxonomy

This section provides the taxonomies of the key Functional Services provided by the soldier system.

As depicted in Figure 2-3 below, the DSS Functional Services includes:

- **Power Services**, which provide power to the connected consumers.
- **Data Exchange Services**, which provide exchange of information among entities in different DSS Domains;
- **Human Interface Device Service**, which provide interaction between the Soldier and the DSS services / components.
- **C4I Services**, which provide the support of the Soldier operations;
- **Communication Services**, which provide the data transfer via radio communication infrastructures serving different DSS Domains.
- **Sensor Services**, which provide the acquisition of both soldier personal data and environment data.
- **Effector Services**, which support the DSS to provide the desired effects on real or potential threats in the fulfilment of the mission.

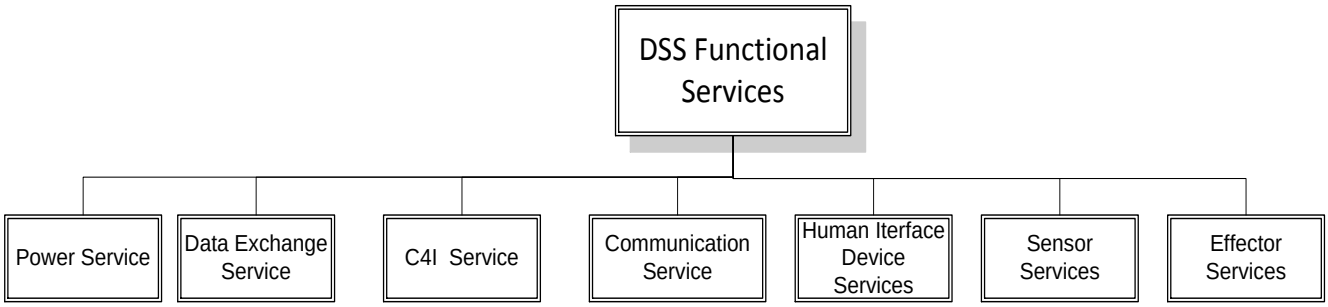


**Figure 2-3 – DSS Functional Services Taxonomy**

### 2.1.2.1 Power Services Taxonomy

The Power Services provide power to the connected consumers. Consumers, or the power distribution network, provide interfaces to manage power consumption (e.g. switched devices on/off or to other power modes) remotely and provide information about their identity. Power services include:

- Power Supply Services;
- Power Distribution Services;
- Power Information Services;
- Power Management Services.

The description for each service is provided in Section 2.2.2.1 Power Services Definitions


**Figure 2-4 – Power Services Taxonomy**

### 2.1.2.2 Data Exchange Service Taxonomy

Data Exchange Services include:

- Data Delivery, which is described in Section 2.2.2.2.1.1
- Tactical Data Delivery, which is described in Section 2.2.2.2.1.2
- Streaming, which is described in Section 2.2.2.2.1.3
- File Transfer, which is described in Section 2.2.2.2.1.4

Depending on the DSS Domain needs, a different set of Data Exchange Services is provided.

Depending on the DDS Domain communication infrastructure the same Data Exchange Services might be supported by different protocol stacks, see /5/ for a description of the protocol stacks supporting each Data Exchange Services in different DSS Domains.

Where applicable the post and smart pull approach will be adopted, to improve the robustness of the network infrastructure supporting the soldier applications.

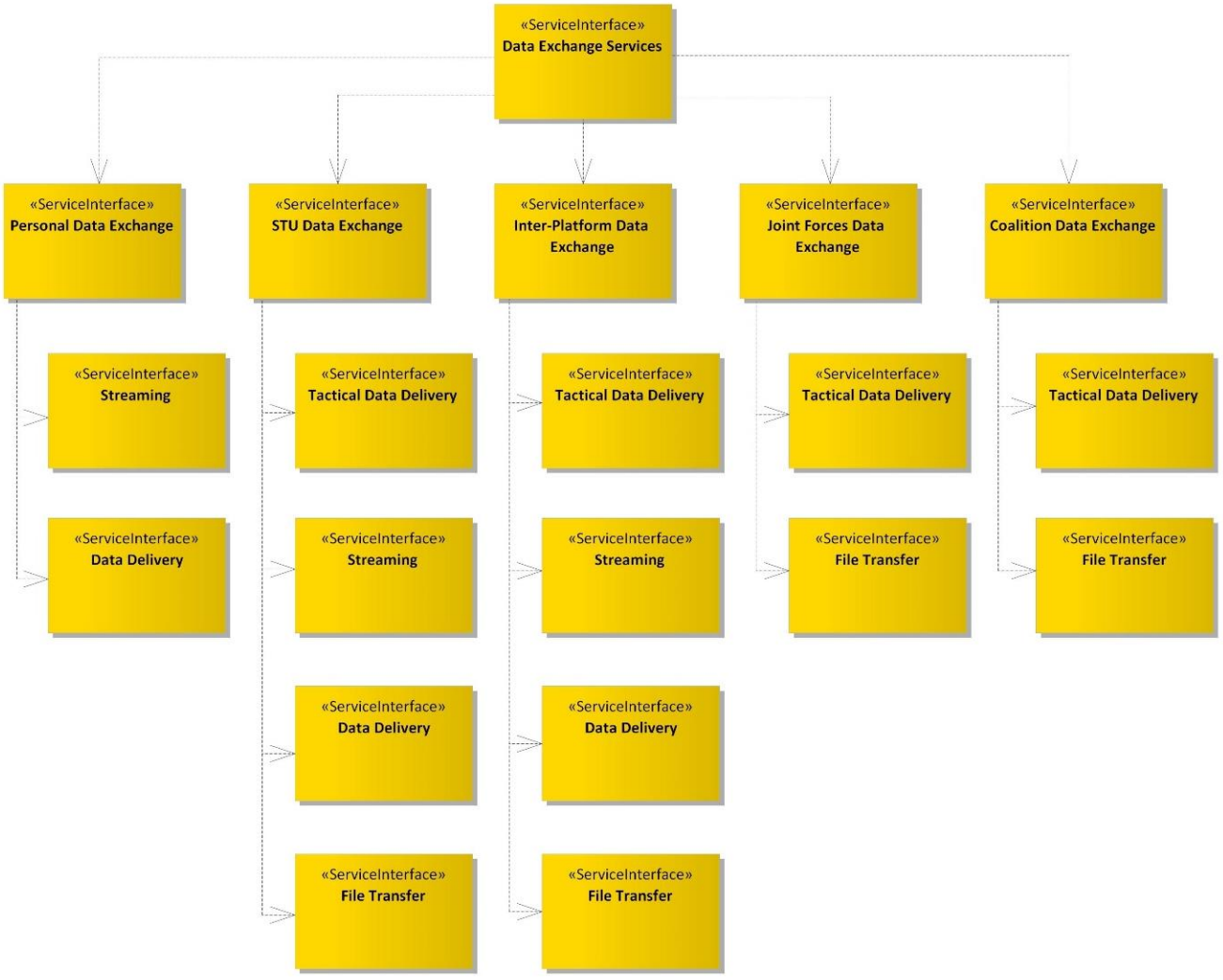


**Figure 2-5 – DSS Data Exchange Services Taxonomy**

### 2.1.2.3 Communication Service Taxonomy

The goal of Communication Services is to provide interoperable and flexible communication capabilities, covering all the possible mission needs in terms of transmitting voice and data while fulfilling all the requirements with respect to range, throughput, number of nodes, connectivity (e.g. MANET), terrain adaptation etc. Specific national waveforms may be used inside forces of a single nation. For multi-national forces, this can be achieved through communication capabilities, available in form of standards, e.g. waveforms developed within multi-national EU/NATO joint programs.

In particular, the functional services respective to **Radio Communications,** address communication bearers based on the following classification:

- User services
- Radio services

The User Services represent the functionalities available at user level, which are:

- Voice
- Data

The Radio Service represent the functionalities intrinsically provided by the radio waveform, encompassing:

  - (Optional) Network services (L3 routing, IP Transport services: Broadcast, Unicast, Multicast )
  - Layer 2 services: Topology management, Synchronization w/o GNSS, etc.)
  - Traffic Encryption (COMSEC)
  - Embedded Service Support: e.g. PLI, RBCI, Radio Silent
  - Frequency Spectrum Management (Cognitive Capability)

Functionalities labelled as ‘Optional’ imply that WFs that have Network services should have the capability to deactivate this and work in bridge mode.

When Network Services are not available or deactivation is possible for the adoption of a dedicated Layer 3 device (e.g., a router) external to the radio. This may be the preferable solution in an operative configuration where the soldier has two or more radios (e.g., short range and long haul, national and coalition) which need to be interconnected at the IP layer.

Waveforms provide physical and data link layers on different radio frequencies and bandwidths being able to support or implement any higher layer (IP) communications. In addition, they should also provide functionalities such as networking and secure transmissions, allowing for different behaviours and performance in terms of connectivity, throughput, operation range and communication reliability. A waveform is a building block of a tactical soldier network and especially in coalition scenarios multiple waveforms are likely to be present.

The availability of a set of waveforms, with their characteristics, allows for a better flexibility and adaptability to different mission needs.

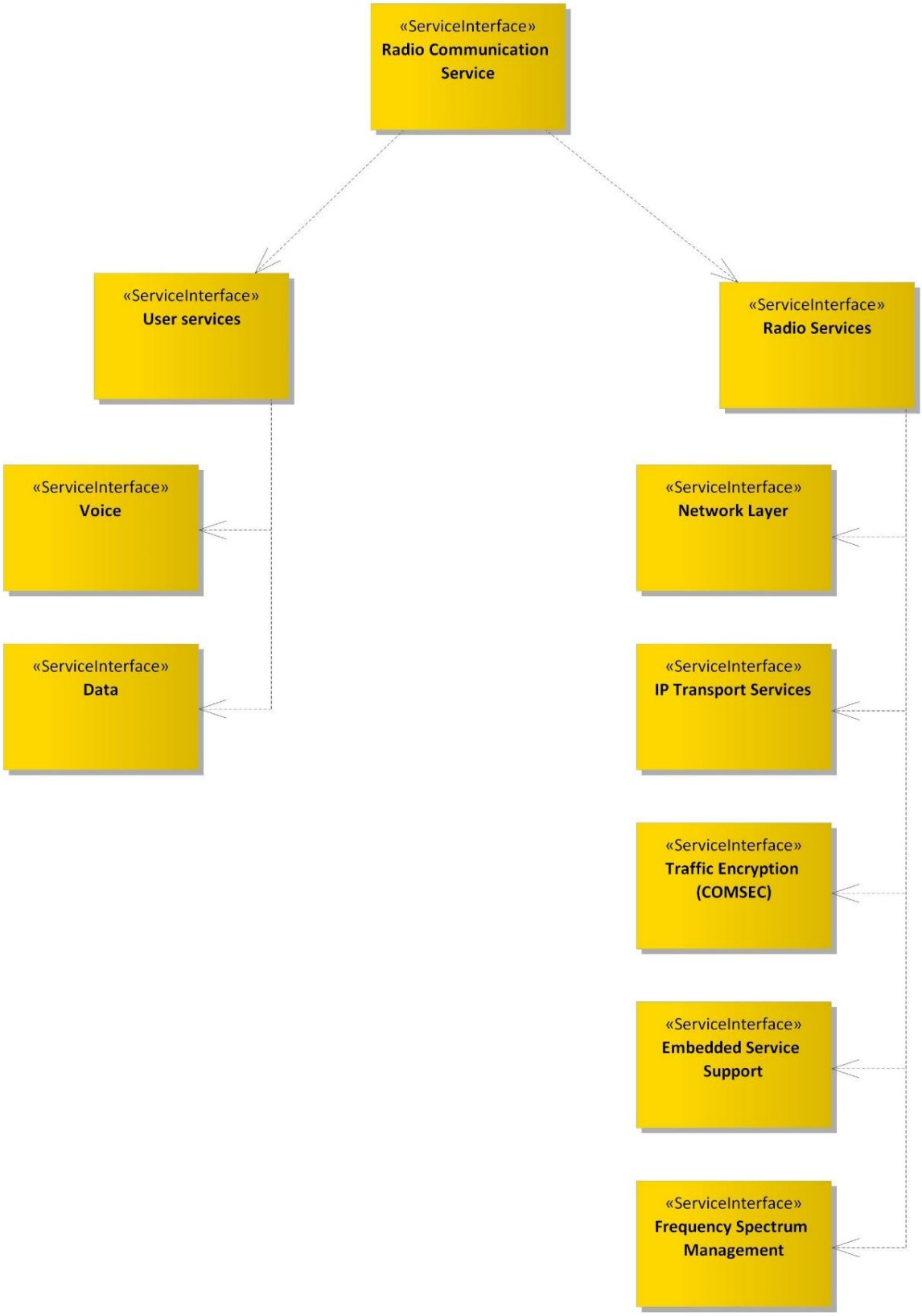


**Figure 2-6 – DSS Radio Communication Service Taxonomy**

### 2.1.2.4 Human Interface Device Service Taxonomy

The HID services include:

- Audio Exchange
- Video Exchange
- Remote Controls (PTT, Radio silence, Shared UAV/UGV control, on/off switches, etc.)
- Warnings and feedbacks (CBRN, health, movement, heading, etc.)
- Body Monitoring
- Perception enhancement
- Messaging

The HID services are described in Section 2.2.2.4, Human Interface Device Service Definitions.

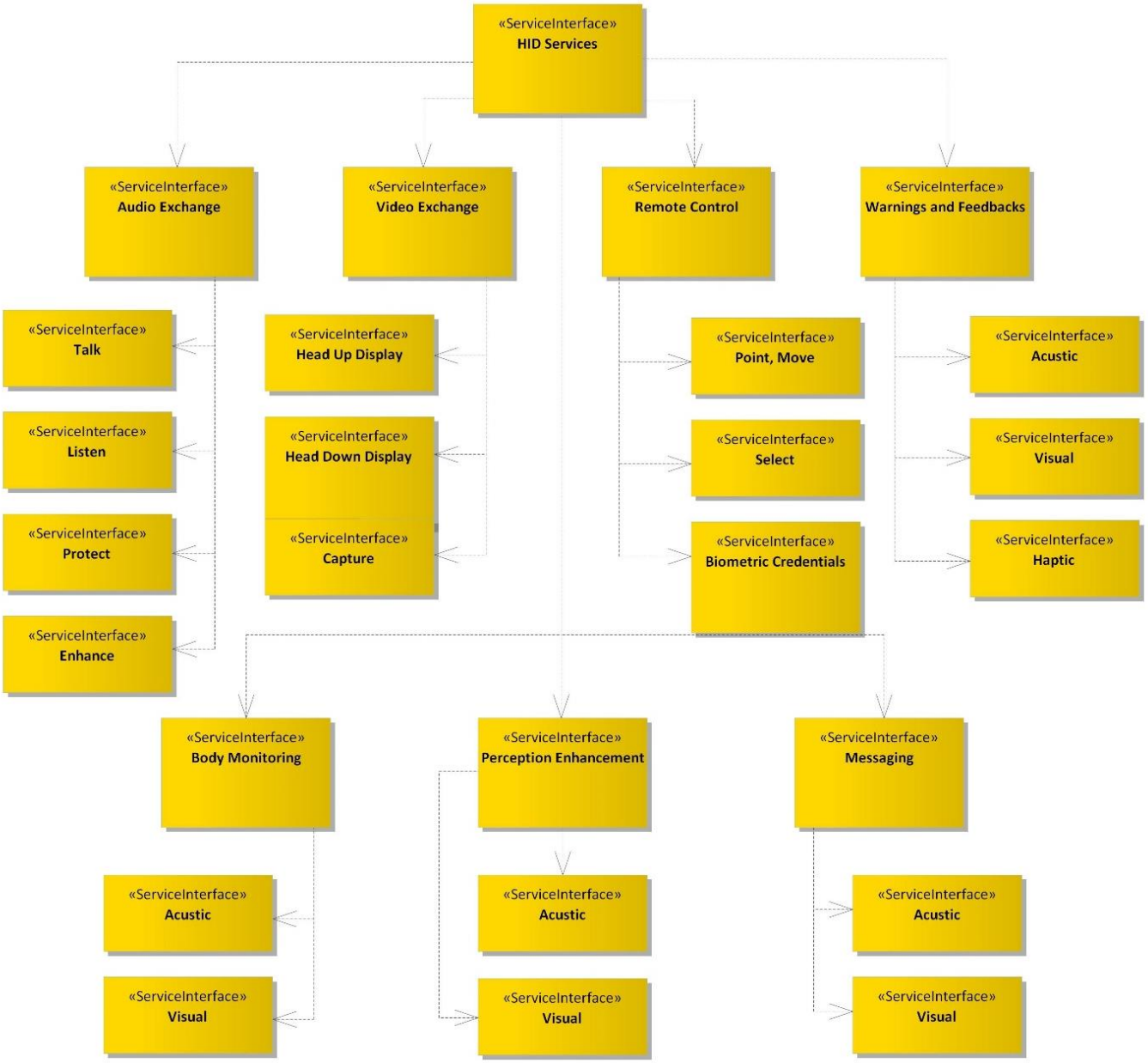


**Figure 2-7 – DSS Human Interface Device Services Taxonomy**

### 2.1.2.5 C4I Service Taxonomy

The C4I services support the DSS Squad Commander(s) in managing the Squad/Team in coordinated actions with higher tier(s) nodes, i.e. Vehicle or Base and within itself.

The C4I Service taxonomy, depicted in Figure 2-8, refers to the C2 Tactical segment, as described in /2/. Then the taxonomy addresses the lower levels of command, which is based on a stimulus/response mechanism.

This set of services support:

- Asynchronous relationship between inputs to the system (e.g., sensor reports from networked DSS squads) and outputs from the system (e.g., orders from higher echelons).
- Self-organisation, which implies the coming together of a group of individuals to perform a particular task.
- Clustering, as the dynamic composition of squad/team to perform a given higher echelon's command.
- Human- RAS (Robotic Autonomous System) Interaction (HRI), as the extension of both the self-organisation and clustering features to include Robotic Autonomous Systems, e.g. squad of UxV(s),

As depicted in Figure 2-8, the C4I services are organised in the following functional areas:

- **Battlefield Management System (BMS) Services**, which support the Commander in the organization and control of the Small Tactical Unit and its coordination with peers to execute higher echelons commands. Section 2.2.2.5.1 describes the set of Battlefield Management System Services
- **Situational Awareness (SA) Services**, which improve (i) the Shared Awareness and Understanding of the higher Commander's Intent and Decision quality at both individual levels, i.e. the single (dismounted) soldier, and (ii) at the collective level, i.e. STU level. The awareness is strongly based on the access and control of sensors, both embedded and remote. Section 2.2.2.5.2 describes the set of Situational Awareness Services
- **Human RAS Interaction (HRI),** which manages the usage of RAS, e.g. (squad of) UxVs, as support to both individual and collective tasks executions. Section 2.2.2.5.3. describes the set of Human RAS Interaction Services.
- **System Management (SYS),** which manages the individual DSS as a system. Section 2.2.2.5.4 describes the set of System Management Services.


**Figure 2-8 – DSS C4I Functional Service Taxonomy**

### 2.1.2.6 Sensor Services Taxonomy

The sensor services provide information to the user of the DSS as well as to the DSS Squad over the C4I-System.

The services are organized in the following functional areas:

- **Self-Measurement services**, which provide information of the DSS and the soldier carrying it, such as stress level or own position.
- **Soldier protection services** provide warnings to increase the survivability of the soldier and to enhance his immediate situational awareness. These results may be distributed via the C4I-Systems.
- **The reconnaissance service** provides the ability to detect possible threats by reconnaissance and improve the COP with new or updated information.

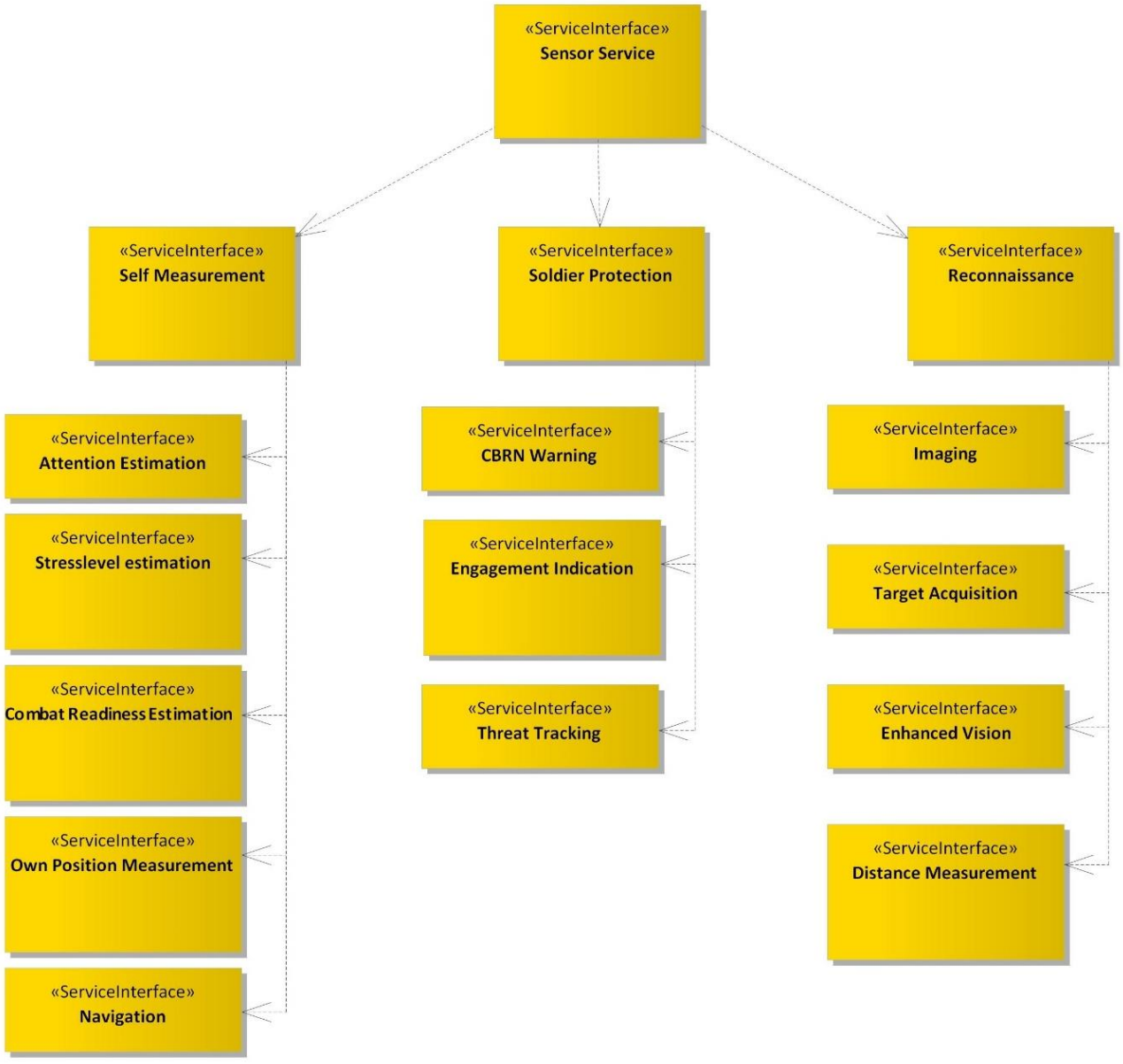


**Figure 2-9 – DSS Sensors Service Taxonomy**

### 2.1.2.7 Effectors Service Taxonomy

The Effectors services support the DSS in providing the desired effects on real or potential threats in the fulfilment of the mission. Although the main service is the elimination of the threat by making use of the weapon, a more general approach will be considered in this taxonomy: the term effector will be used in order to include other devices and the final service of elimination of the threat itself will not be considered, as it happens outside the scope of the DSS.

The provided taxonomy in Figure 2-10 addresses the *Effector Services* at dismounted soldier level, making use of the effectors STU.

The taxonomy also includes networked small weapon within the squad using e.g. imaging services and specific sensors associated to the individual effector.

The Effector Services are organized in the following functional areas:

- **Target Surveillance Services (TSS)**, which support key features such as observation, target detection, target recognition, target identification and target damage assessment from longer distances.
- **Target Engagement Services (TES)**, which embrace individual functions, related directly to weapon handling, ammunition programming, target marking/illumination, indirect aiming and fratricide alert.
- **Operational Measurement Services (OMS)**, which support key functionalities such as round counting, range finding and bearing with a direct effect on combat efficiency and force protection (fratricide alert).
- **Data Exchange Services (DES)**, which support functionalities to exchange relevant data to and from DSS's weapon and DSS's C2I subsystems.
- **Power Management Services (PMS)**, which provide electrical power functions to guarantee effector system sustainability throughout the mission
- **System Management Services (SMS)**, which include configuration and control of the effector system itself as well as features to control from the weapon other DSS functionalities outside the weapon system (remote control of the radio for instance).
- **Imaging Services (IS)**, which support key system functionalities such as capturing, processing and transmission of video and steady images from the effector system to the DSS and/or other DSS (network small arms weapons).


**Figure 2-10 – DSS Effectors Services Taxonomy**

### 2.1.3 Enterprise Services Taxonomy

The individual DSS would not be operating in isolation and would be connected to a tactical network (to enable Net Centric Operations or capabilities like the NATO Network Enabled Capability).

These capabilities would include several services such as

- Cloud Services for storage
- Applications for compiling, analysing and fusing sensor-data,
- Change detection,
- Software updates,
- Updating enemy ORBAT,
- Internet Services,
- etc.

Since network architecture and systems are not part of this architecture they are not being described in detail. However, requirements and standards for network compatibility would have to be a part of the DSS architecture in the Standards View.

## 2.2 NSOV-2 Service Definitions

The Service Definitions in this NSOV-2 section briefly describe each service listed in the Service Taxonomies of the previous section NSOV-1. For the Operational Services, the definitions are rather brief as much more detail is given in NSOV-3 (see 2.3) where the Operational Services are mapped

- onto the Operational Activities performed by the soldier and also
- onto examples of Functional Services provided by the DSS.

### 2.2.1 Operational Services Definitions

#### 2.2.1.1 Command, Control, Communications and Computing, Intelligence, Surveillance, Target Acquisition and Reconnaissance (C4ISTAR)

The operational services under the capability requirement areas C4 and ISTAR have been combined to identify the operational services that a soldier or STU provides in terms of reconnaissance and surveillance – to provide current information about the enemy. This information is then correlated to the existing database of enemy ORBAT, TTPs, etc. and analysed to generate actionable intelligence and a relevant COP. This is then used for operational planning and to issue operational orders or instructions for an STU to allow target acquisition, designation and execution of the mission based on the operational plan. Evaluation of the impact of the execution generates a Battle Damage Assessment (BDA) Report.

#### 2.2.1.2 Effective Engagement

The operational services under the capability requirement area Effective Engagement entail choosing the desired effect, selection of means of engagement - weapon and munition (type and quantity), selection of the most appropriate position to engage target, designate weapon(s), orient and align (coordinate) fire control/weapon system, input meteorological and ballistic corrections, decide on duration of fire and coordinate fire and hand over of targets for engagement by other means (beyond STU level).

#### 2.2.1.3 Mobility

The operational services under the capability requirement area Mobility entail movement to desired position(s) using different mobility platforms, transition from mounted to dismounted, dismounted movement across various terrain, navigate while moving, achieve desired tactical mobility, communicate while moving, engage targets while moving and observe and report while moving. Mobility services also include use of exoskeletons, support devices / systems to enhance mobility of a soldier / STU.

#### 2.2.1.4 Protection and Survivability

The operational services under the capability requirement area Protection and Survivability entail to remain capable during the mission, to conceal from the enemy, to endure during enemy fire, to endure a hostile environment, to endure physical and psychological stresses and to provide protection to others.

#### 2.2.1.5 Sustainability and Logistics

The operational services under the capability requirement area Sustainability and Logistics entail operating continuously for a desired period of time, configuring system according to mission needs, repairing, replacement and recovering damaged equipment, providing first aid and evacuating casualty, remaining self-contained for the required period of mission, monitoring expenditure and requesting for ammunition, supplies and spares and keep soldier system state of the art.

#### 2.2.1.6 CIMIC

The operational services under the capability requirement area CIMIC are services which the military can inherently provide due to their organisational structure and resources to civilian authorities / government like assistance in civil affairs services, engineering services, health-care services, military/police services, psychological services, transportation and religious ministry support services.

#### 2.2.1.7 Training and Interoperability

The operational services under the capability requirement area Training and Interoperability are services which are cross cutting across all the capability requirement areas. Training for example entail services like building endurance to operate continuously during the mission duration / desired period of time, handling weapons & equipment at a desired level of proficiency, becoming proficient in tactical operations, achieving proficiency in CTC / simulation training, validating operational concepts and doctrines, measuring operational readiness, resulting in increased affiliation, coordination and confidence. Similarly, interoperability entails achieving technical, tactical and logistic interoperability in joint as well as combined (alliance/coalition) operations in all the capability requirement areas, but importantly in C4ISTAR. Training therefore enhances interoperability.

## 2.2.2 Functional Services Definitions

### 2.2.2.1 Power Services Definitions

#### 2.2.2.1.1 Power Supply Services

The Power Supply Service delivers power to the Power Distribution Service by using power sources like batteries, mobile generators/energy harvesters and platform power from vehicles or other platforms like boats/helicopters. The different subcategories have distinct properties to be taken into account when applied as a power source service in a soldier system.

##### 2.2.2.1.1.1 Rechargeable Batteries

**Rechargeable Batteries** are used to:

- provide power to the consumers
- handle power for a dynamic load case
- absorb excess power by charging it in the battery

##### 2.2.2.1.1.2 Platform Power

**Platform Power** uses the energy distribution system of a platform (e.g. vehicle) to:

- recharge partly discharged or fully discharged batteries
- supply fresh/new batteries or fuel for mobile generators

##### 2.2.2.1.1.3 Mobile Power Generator

**Mobile Power Generator**:

- provides constant power which is controllable to fit to the systems demands
- converts energy carriers with high energy density, e.g. methanol or diesel, to electricity
- is refuelled with energy carrier

##### 2.2.2.1.1.4 Power Buffers

**Power Buffers** are for:

- handling temporary peak current consumption from high power, occasional loads
- providing power to the system during the replacement of the central rechargeable battery

##### 2.2.2.1.1.5 Energy Harvesting

**Energy Harvesting** aims to:

- capture erratic intermittent “dirty” power
- convert intermittent external energy sources into stabilised electrical energy

#### 2.2.2.1.2 Power Distribution Services

The Power Distribution Service provides physical transport of power to the consumers. It conditions and converts power and also protects the Power System against overcurrent, overvoltage and other faults possibly generated by consumers or power sources. The transfer of power can be interrupted by disconnecting the consumer(s). The subcategories describe these different functionalities which may be present both in source and consumption devices as well as within a distribution system.

##### 2.2.2.1.2.1 Power Transfer

The service **Power Transfer** aims to:

- transport energy between different parts of the system
- transport information

##### 2.2.2.1.2.2 Protect

The service **Protect** is used to:

- protect circuits against overcurrent
- protect circuits against overvoltage

##### 2.2.2.1.2.3 Switching

The service **Switching** allows to:

- interrupt power transfer
- allow power transfer

##### 2.2.2.1.2.4 Power Conversion

The service **Power Conversion** is responsible to:

- convert system voltage to device specific voltage
- convert power supply voltage to system voltage

##### 2.2.2.1.2.5 Power Conditioning

The service **Power Conditioning** is applied to:

- filter noise and disturbances
- maximize the power output by e.g. maximum power point tracking (MPPT) for wind turbines and photovoltaic (PV) solar systems
- stabilize erratic kinetic power

#### 2.2.2.1.3 Power Information Services

The Power Information Service identifies connected consumers and the consumption of power absorbed by them. Furthermore, the Power Information Service identifies active sources and their status with respect to power.

The Power Information Service can be configured by the user/soldier to increase the power supply by activating/accelerating power sources and to reduce the consumption by degrading the DSS performance or function.

With this service, information to the user/soldier is provided as follows:

- remaining runtime of the DSS (State of Charge, SoC)
- status of power consumption (instantaneous and averaged)
- status of the power supply (State of Health, SoH)

##### 2.2.2.1.3.1 Supply Status

The service **Supply Status** is used to:

- identify which sources are connected
- identify source status (voltage / current / temperature / SoC / fuel level)

##### 2.2.2.1.3.2 Consumption Status

The service **Consumption Status** is used to:

- identify which power consumers are connected
- identify power consumption

##### 2.2.2.1.3.3 Soldier Informing

The service Soldier Informing aims to:

- inform on supply status (SoC, SoH)
- inform on consumption status (instantaneous and averaged)
- inform on remaining runtime

#### 2.2.2.1.4 Power Management Services

The Power management Services are used to boost, reduce or turn on and off power supply to consumers and mobile power sources, depending on the configuration of the service and the situation provided by the Power Information Services.

##### 2.2.2.1.4.1 Change Power Supply

The service **Change Power Supply** allows to:

- switch on/off the mobile power generator
- control the safe charging of rechargeable batteries

#### 2.2.2.1.4.2 Change Power Consumption

The service Change Power Consumption is dedicated to:

- turn on/off devices
- configure the system to increase power supply
- configure the system to reduce power consumption

#### 2.2.2.1.4.3 Power Profiles Service

The Power Profiles service provides user- or software-selectable pre-set groups of consumers. Each pre-set profile is tailored to provide power only to the consumers that are strictly required for a given task, sacrificing (i.e. switching off) unnecessary ones.

## 2.2.2.2 Data Exchange Services Definitions

### 2.2.2.2.1 Data Exchange Service Description

#### 2.2.2.2.1.1 Data Delivery

Data Delivery service provides for data transfer among two or more nodes, i.e. it supports unicast, multicast, and optionally broadcast data transfer.

This service is general purpose and typically supports applications such as sensor control, messaging and system management. Commercial protocol technologies normally fulfil all the requirements without the need to develop a specific military variant.

Data Delivery shall be able to serve

- a large number of nodes,
- different typologies of applications, and
- information flows with different level and kind of criticalities.

A sound support to Quality of Services is a key feature for the protocol stacks which implements such a service.

#### 2.2.2.2.1.2 Tactical Data Delivery

The protocols mentioned in previous section, may also be used for tactical purposes. Here, Tactical Data Delivery specifies services which are considered as a specialization of Data Delivery service for the delivery of critical data even in constrained transmission infrastructures, such as the tactical radio networks.

This service typically supports Battlefield Management Service (BMS) applications, and need to be optimised to be deployed also in environments with disadvantaged communication infrastructures, i.e. network infrastructure which are characterised by low bandwidth, and intermittent connectivity.

Protocol stacks supporting Tactical Data Delivery need to be highly optimised with respect to the supported data. Typically, the data model is included in the protocol specification.

#### 2.2.2.2.1.3 Streaming

The streaming service supports the delivery of continuous flows of data. It supports applications such as video and audio.

Protocol stacks supporting this service shall

- be time-sensitive in order to maintain the time relationships between consecutive piece of information, and
- support the session concept.

#### 2.2.2.2.1.4 File Transfer

File Transfer service provides delivery of files, e.g. images, documents.

This service supports an ample set of applications, every time it is requested to move a file between two different nodes.

File Transfer shall be reliable, in the sense that all data a file is composed of, shall be transferred and recomposed in the correct order as the original copy.

#### 2.2.2.2.2 Personal Data Exchange Service Description

The Personal Data Exchange provides services in the context of the dismounted soldier, i.e. among the components of a same DSS Nodes.

Personal Data Exchange services can adopt different Data Exchange Services depending on the kind and criticality of data to be distributed. The supported Data Exchange Services for Personal Soldier Domain are:

- Data Delivery
- Streaming

The protocol stacks for each data exchange service are described in /5/.

#### 2.2.2.2.3 STU Data Exchange Service Description

The Squad Data Exchange provides services in the context of a STU.

This service can adopt different Data Exchange Services depending on the kind and criticality of data to be distributed.

The supported Data Exchange Services for STU Domain are:

- Data Delivery (see above)
- Tactical Data Delivery (see above)
- Streaming (see above)
- File Transfer (see above)

The protocol stacks for each Data Exchange Service in the STU Domain are described in /5/.

#### 2.2.2.2.4 Inter-Platform Data Exchange Service Description

The Inter-Platform Data Exchange provides services in the context of the battlefield among different typologies of nodes belonging to the same system. A typical example is the data exchange between a (squad of) soldier(s) and the supporting vehicle(s).

Inter-Platform Data Exchange Service can adopt different Data Exchange Services depending on the kind and criticality of data to be distributed. The supported Data Exchange Services for Inter-Platform Domain are:

- Data Delivery (see above)
- Tactical Data Delivery (see above)
- Streaming (see above)
- File Transfer (see above)

The protocol stacks for each Data Exchange Service in the Inter-platform Domain NGVA Vehicle Mounted Soldier are described in /5/.

The protocol stacks for each Data Exchange Service in the Inter-platform Domain Dismounted Soldier are described in /5/.

#### 2.2.2.2.5 Joint Force Data Exchange Services Description

The Joint Force Data Exchange provides services in the context of the battlefield between a DSS Node and a peer node belonging to a Joint Force.

Joint Force Data Exchange Service can adopt different Data Exchange Services depending on the kind and criticality of data to be distributed. The supported Data Exchange Services for Inter-Platform Domain are:

- Tactical Data Delivery
- File Transfer

The protocol stacks for each Data Exchange Service in the Joint Force Domain are described in /5/.

#### 2.2.2.2.6 Coalition Data Exchange Services Description

The Coalition Data Exchange provides services in the context of the battlefield between a DSS Node and a peer node belonging to an Allied Nation.

Joint Forces Data Exchange services can adopt different Data Exchange Services depending on the kind and criticality of data to be distributed. The supported Data Exchange Services for Coalition Domain are:

- Tactical Data Delivery
- File Transfer

The protocol stacks for each Data Exchange Service in the Coalition Domain are described in /5/.

### 2.2.2.3 Communication Services Definitions

#### 2.2.2.3.1 User Services

The **Voice Service** enables the user to exploit a secure, reliable, comprehensible and bidirectional voice communication. Main offered functionalities are:

- legacy CNR-Like point to multi-point voice service (Push-To-Talk voice)
  - voice selective call
  - voice conference call

The **Data Service** support functionalities for a secure and reliable, as well as best-effort, data transfer. Transferred information can be gathered into two communication services: Real-Time and non-Real-Time bearers.

Real-Time communications are typically:

- Video Streaming, see 2.2.2.5.2.1
- VOIP calls
- C2 (Command and Control) critical traffic, see 2.2.2.5.1
- Radio based combat identification (RBCI), see Section 2.2.2.5.1.15
- Fire Support and Targeting, see 2.2.2.5.1

Non Real-Time communications are typically:

- Short Messages / Predefined Messages, see 2.2.2.5.1.11
- File Transfers
- Situational Awareness, see section 2.2.2.5.2
- C2 (Command and Control) not critical traffic
- Friendly Force Tracking (FFT), see section 2.2.2.5.1.1.1
- Tactical Situation data, see section 0

#### 2.2.2.3.2 Radio Services

Radio Services refer to the functionalities that the DSS (including radios / waveforms and other dedicated communications equipment and/or software functions) is able to provide to the upper user services enumerated in the preceding subsection, de facto characterizing the overall communication performance and capabilities.

The Radio Service accomplishes its tasks at different layers (L1-L4) in different components, although not all of them are necessarily available, depending on the specific capabilities used or needed in a specific mission.

In fact, the radio layers were such functionalities are located are mainly:

- Network
- Data link
- Physical

Network layer potentially includes features such as MANET, addressing, routing, fragmentation, network topology management, etc.

The Data Link layer manages the radio resource access, basically establishing mechanisms to support Broadcast or Unicast or Multicast transmission links. The Data Link layer should support at least some basic service differentiation mechanisms (e.g., priority queues) in order to enable Quality-of-Service differentiation at the higher layers.

The Physical layer manages the actual modulation on a certain frequency and bandwidth, all providing for different performances and capabilities in terms of throughput and operation range. Waveforms will include the physical and data link layer and should include a networking layer.

The DSS should accommodate both Layer 2 and Layer 3 waveforms and facilitate seamless integration of multiple attached radio bearers (multiple radios or multi-channels radio) into a heterogeneous networking arrangement.

Security aspects are key for tactical communications, especially when a complex and sensible environment is concerned; it is then essential to define and put in place adequate security paradigms, in order to guarantee data protection and secure communications.

Security, in this context, may be provided by “secure communication” mechanisms, usually referred to as COMSEC, which has the goal to protect both classified and unclassified user traffic with cyphering algorithms.

At lower level, other secure mechanisms are applicable:

- encryption of radio network intrinsic signalling (NETSEC)
- transmission security (TRANSEC) through anti-jamming techniques such as frequency-hopping.

Once the communication capability is selected for a specific mission within for example a multi-national/coalition operation, the next step is to define a mechanism to share the crypto information (keys) among the participants.

In the following block diagram dashed lines represents the identified Services domains: User and Radio Services. Not all the capabilities in the Radio domain could be available, depending on the waveforms, but they are in general recommended in order to provide communication efficiency over the radio link.

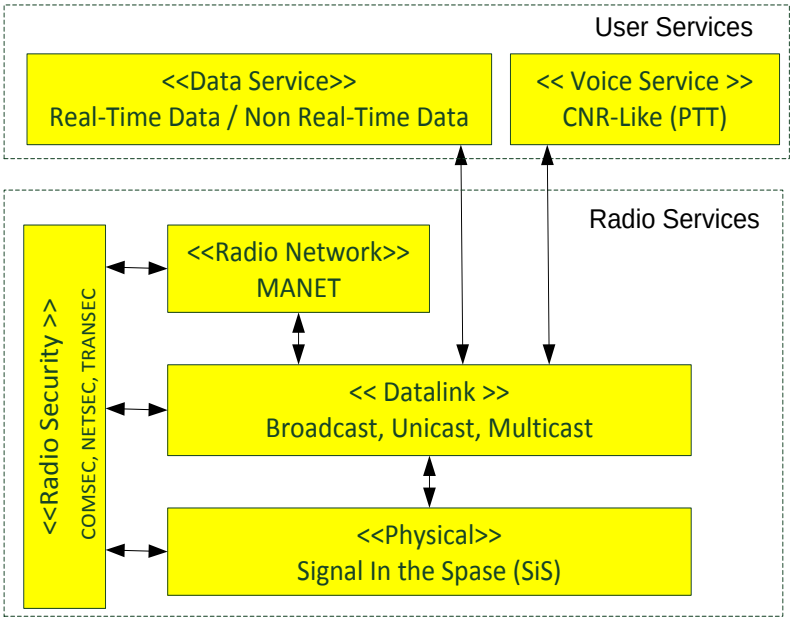


**Figure 2-11 – Communication Services**

### 2.2.2.4 Human Interface Device Service Definitions

#### 2.2.2.4.1 Audio Exchange

- **Talk:** performed via a transducer in the Head section placed near the mouth, like a microphone or osteophone, it is used to send voice to the radio (mandatory) or to the computing platform (optional).
- **Listen:** Stereo earbuds/headphones in the Head section, used to listen voice calls and signal sounds from the radio (mandatory) or the computing platform (optional). A loudspeaker may be present (possibly integrated into the computing platform) when audio needs to be shared.
- **Protect:** includes acoustic (mechanical) and electronic devices to protect the ears against the pressure waves created by explosions, e.g. Combat Hearing Protection (CHP);
- **Enhance:** comfort devices to counteract ambient noise, e.g. Active Noise Suppression (ANS), Active Noise Reduction (ANR) and to reduce the dynamic range of voice calls (compressors, limiters, etc.)

#### 2.2.2.4.2 Video Exchange

- **Head Up Display (HUD)**: placed in the Head section, hinged or hooked to the helmet to ensure hands free operation, the HUD can be worn for a long time or removed to allow the use of other sight-enhancement devices (e.g. NVG). The HUD may be fully opaque for Virtual Reality (VR) or transparent (see-through) for Augmented Reality (AR).
- **Head Down Display (HDD):** usually integrated in the computing platform, it is commonly placed in the Torso section, chest-mounted. Used occasionally (e.g. browsing maps).
- **Capture:** camera used to acquire video or pictures, may be placed in the Head or Torso sections. The camera can be used also as a remote control HID (e.g. hand tracking).

#### 2.2.2.4.3 Remote Controls (PTT, Radio silence, Shared UAV/UGV control, on/off switches, etc.)

- **Point, Move:** moving devices include 1D (e.g. cursor) and 2D (e.g. pad, trackball, eye position) pointing actuators. Virtual 3D pointing devices could be implemented by tracking hand or head movements.
- **Select:** buttons can be assigned to perform fixed/parametric functions (e.g. hard-wired or soft-configured PTT, function keys) or to select the item pointed with the Point/Move actuator.
- **Biometric credentials (fingerprints, retina scanners, etc.):** used to assess the identity of the soldier and the relevant access rights.

#### 2.2.2.4.4 Warnings and Feedbacks (CBRN, health, movement, heading, etc.)

- **Acoustic:** mixed with the audio from the radio, requires an audio hub.
- **Visual:** context-dependent signals may be integrated in the HDD or overlapped in the HUD.
- **Haptic:** feedback provided by an array of tactile transducers integrated in the vest.

#### 2.2.2.4.5 Body Monitoring

- State of health (heartbeat, temperature, humidity)
- Position and heading detect (head/eyes orientation)

#### 2.2.2.4.6 Perception Enhancement

- Augmented Reality.
- Real time speech translator (increase communication effectiveness)

#### 2.2.2.4.7 Messaging

- **Compose:** includes standard composing with a physical or virtual keyboard and selection of pre-set messages.
- **Read:** either visual through HUD/HDD or audio through text to speech.
- **Store, Recall:** standard archiving features but linked to the available HIDs.

### 2.2.2.5 C4I Services Definitions

#### 2.2.2.5.1 Battlefield Management System Functional Area Description

The **Battlefield Management System (BMS)** services display and manipulate information and mapping relating to Battlefield Situational Awareness.

The BMS services display and manipulate information relating to tactical and operational C2.

This Functional Area includes the following services:

- Land Combat Operations
- Joint Task Force Operations
- Special Operations
- Fire Support Operations
- Combat Support
- General Information Exchange
- Mission Preparation

The BMS Services may exchange data on all of the Data Exchange Context.

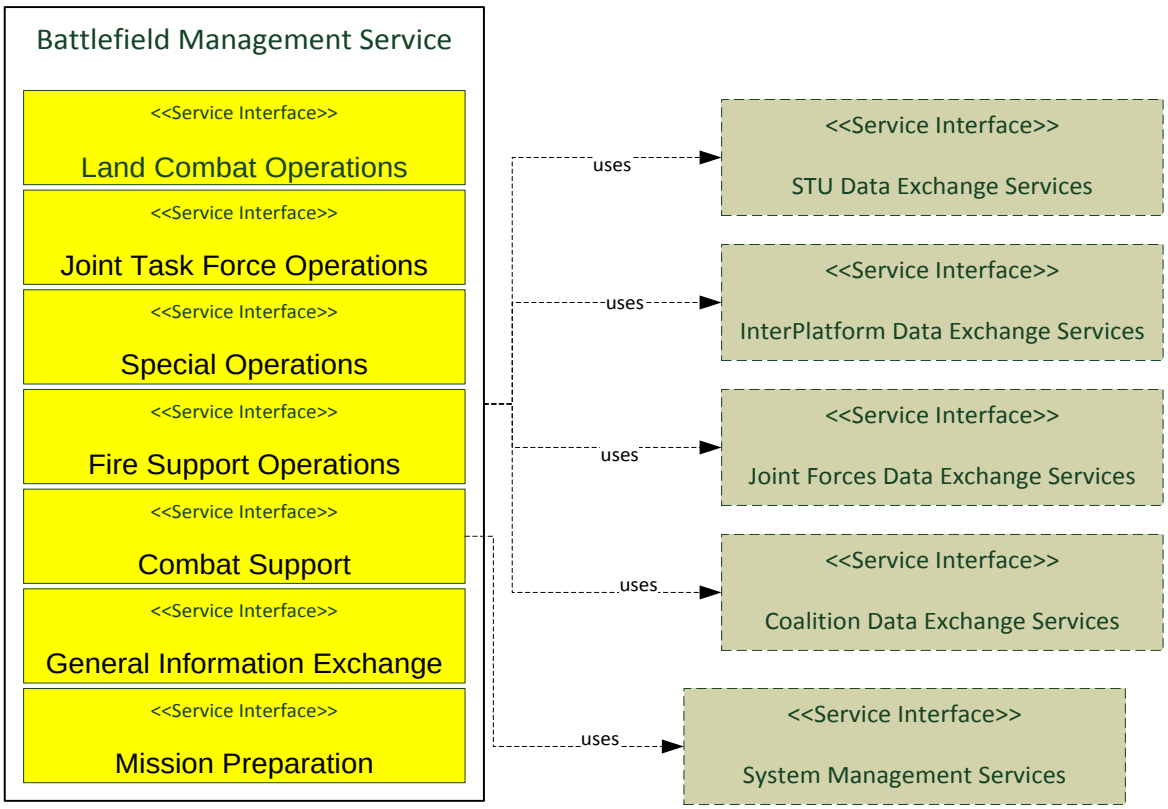


**Figure 2-12 – Battlefield Management System Services**

#### 2.2.2.5.1.1 Land Combat Operations Services

The Land Combat Operations services support the coordination and control of land combat operations, and planning and control tactical employment of ground units and related aviation units.

This service also supports manoeuvre, communications, deception, electronic warfare, land minefield/mine laying, helicopter air assault, nuclear, biological, and chemical (NBC) warfare, and civil affairs.

It includes:

- Blue Force Tracking
- Acquisition of Tactical Situation
- Processing of Tactical Situation
- Distribution of Tactical Situation
- Decision Making
- Target Engagement

##### *2.2.2.5.1.1.1 Blue Force Tracking*

The functional service Blue Force Tracking provides devices/tools for:

- automatic distribution of acquired geolocation of own forces to other relevant nodes (configurable)
- indicating these geolocations at the DSS (dependent on the role of the soldier)
- Generation and sending of POIs (Point of Interest) based on events or particular objects/things position to freeze on a map.

Any communication-capable node can be considered as potential provider and consumer of this service.

#### 2.2.2.5.1.2 Acquisition of Tactical Situation

The functional service **Acquisition of Tactical Situation** provides devices/tools:

- to support and enhancements for human senses to detect and identify objects in the field
- to locate the identified objects and enrich them with further relevant information

#### 2.2.2.5.1.3 Processing of Tactical Situation

The functional service **Processing of Tactical Situation** provides devices/tools:

- to store, process, edit and display the tactical situation at the DSS
- to consolidate and aggregate, disaggregate Operational Picture
- to analyse Tactical Situation and assist in Decision Making

#### 2.2.2.5.1.4 Distribution of Tactical Situation

The functional service **Distribution of Tactical Situation** interconnects the other functional services to the appropriate Data Exchange Services available in different Soldier Domain (see /5/):

- to receive/transmit the acquired tactical situation and targets from/to other relevant nodes
- to distribute tactical situation according to the common relevant operational picture

Any communication-capable node can be considered as potential provider and consumer of this service.

#### 2.2.2.5.1.5 Target Engagement

The functional service **Target engagement** provides devices/tools:

- to engage targets with the required effect (e.g. suppression of the enemy)
- to engage targets with maximum hit probability

#### 2.2.2.5.1.6 Mission Preparation

The functional service Mission Preparation provides:

- devices/tools to prepare the mission of a team/squad in accordance to the order

The preparation includes:

- safe guarding
- establishing state of readiness
- logistic support
- reconnaissance / establishing connections
- definition of waypoints

And, especially for the Commanders:

- assessment of tactical situation
- decision making
- operation planning
- issuing of orders

Before starting an operation, the preparation needs to consider:

- the time available
- the order
- the distance to the place of deployment
- the mission effectiveness of the unit
- the daytime, weather conditions and the terrain conditions

#### 2.2.2.5.1.7 Combat Support Services

The Combat Support services support the:

- movement and maintenance of forces

Combat service support also includes:

- supplies and material related
  - acquisition,
  - movement,
  - storage,
  - distribution,
  - maintenance,
  - evacuation, and
  - disposition;
- personnel related
  - acquisition,
  - movement,
  - evacuation,
  - hospitalization, and
  - status;
- facility related
  - acquisition or construction,
  - maintenance,
  - operation, and
  - disposition;
- service related
  - acquisition and
  - furnishing

The functional area covers

- logistics support,
- health services,
- personnel services,
- non-combat engineering, and
- explosive ordnance disposal.

It includes:

- Emergency Prevention.

This services may request:

- System Management Services.

#### 2.2.2.5.1.8 Emergency Prevention

The functional service **Emergency Prevention** provides devices and tools:

- to monitor the health status of the soldier
- to monitor the status of consumables
- to monitor the status of supportive devices and equipment
- to initiate immediate replacement of consumables
- to initiate immediate evacuation/rescue in case of emergency
- to initiate decommissioning of equipment in case of hostile takeover

#### 2.2.2.5.1.9 Joint Task Force Operations

The Joint Task Force Operations services support the coordination and control of all forces assigned and attached to and in a (multi-national) Joint force.

#### 2.2.2.5.1.10 Special Operations

The Special Operations services pertain to operations conducted by specially trained, equipped, and organized land forces against strategic or tactical targets in pursuit of military, political, economic, or psychological objectives.

The service supports foreign internal defense and development, unconventional warfare, direct action, counter terrorism, psychological operations, and civil affairs.

#### 2.2.2.5.1.11 General Information Exchange

General Information Exchange services pertain to the sharing of information that is common to more than one of the BMS services or does not fit into any of the Joint functional areas.

Messaging and Common Information Exchange are example of this basic C2 services.

#### 2.2.2.5.1.12 Fire Support Operations

Fire support operations services include direct and indirect surface-to-surface artillery (SSA) and mortar fire, naval surface fire support (NSFS), close air support (CAS), and assault support.

The functions of fire support are technical fire control, tactical fire control, fire support coordination, fire planning, target intelligence, survey data, meteorological data, support and sustainment, and fire unit status.

It includes:

- Target Acquisition
- Target Marking/Illumination
- (Radio Based) Combat Identification

#### 2.2.2.5.1.13 Target Acquisition

The functional service **Target acquisition** provides devices/tools:

- to detect and identify targets in the field
- to locate the identified targets and enrich them with further relevant information

#### 2.2.2.5.1.14 Target Marking/Illumination

The functional service **Target marking/illumination** provides devices/tools:

- to mark or illuminate targets to engage

#### 2.2.2.5.1.15 Combat Identification

The Combat Identification service is used in close combat operations as well as in air support or artillery support operations to avoid friendly fires. For the former, Combat Identification (or CID) might be a request /response collaborative type of service based on laser integration and RF response where the shooter starts an interrogation with an identity code and the addressed friendly node should respond positively via RF. The latter might be a Radio Based Combat Identification (RBCI) service. It is a request / response type of service where the shooter sends a request indicating the location of the target and a danger radius, all the friendly nodes within the danger radius should respond.

### 2.2.2.5.2 Situational Awareness Functional Area Description

Situational Awareness (SA) Functional Area will allow the access and control of sensors, both embedded and remote. SA services also provide for acquisition, presentation and distribution of the sensor data, either sampled or streamed.

The presentation of sensor data includes the mosaic view, which allows the display of a mix of data gathered by different sensors, e.g. cameras.

When in mosaic view, a given data source can be selected to move from background to forefront, thus becoming the principal SA source.

SA services also provide the operator with Augmented Reality presentation where the real-time video of a camera is mixed with the outcome of other sensors, which are typically geo-referenced.

This Functional Area includes the following services:

- Geolocation
- Video Services
- Tactical Sensor Control

The SA Services may exchange data on all of the Data Exchange Context.

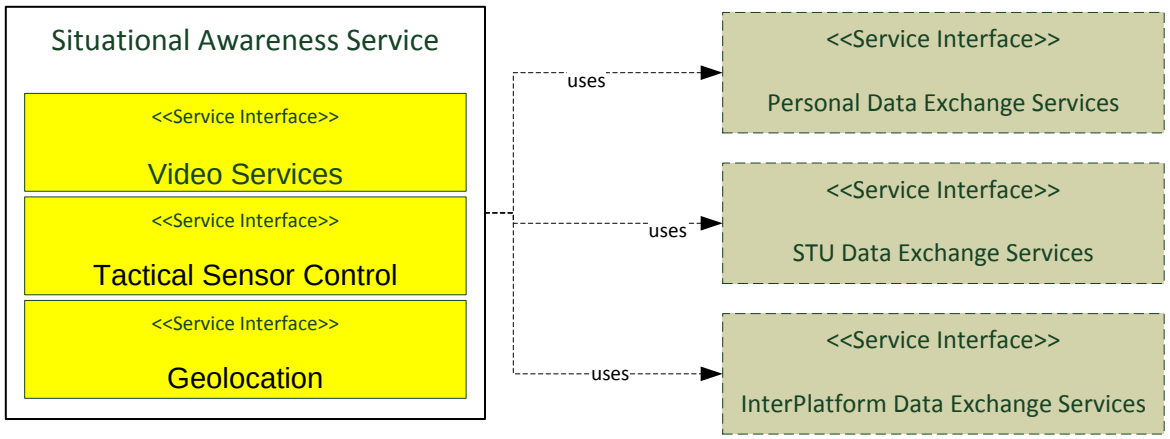


**Figure 2-13 – Situational Awareness Services**

#### 2.2.2.5.2.1 Video Services

Video Services provides functions and tools for the control of one or more Pan-Tilt-Zoom (PTZ) Camera(s), which can be equipped with either TV Sensor(s), or Infrared Sensor(s), or both.

This set of services can be classified in the following group of services depending on the kind of camera component controlled:

- TV Sensor Services, which control a visual band sensor
- Infrared Sensor Services, which control an infrared sensor
- Rotational Mount Services, which control elevation and azimuth movements of the Camera
- Linear Mount Services, which control a vertical / horizontal movements of the Camera

#### 2.2.2.5.2.2 Tactical Sensor Control

The functional service **Tactical Sensor Control** provides for the control of tactical sensors, e.g. Laser Range Finder. Both embedded and remote sensors are supported.

#### 2.2.2.5.2.3 Geolocation

The **Geolocation** functional service refers to specific devices/tools such as GNSS systems. But in satellite denied environments the radio communication bearer can be exploited to estimate the Position Location Indication (PLI) data of a node, within a network of nodes in radio visibility.

In a very close future a new generation of MANET waveforms could exploit their SiS (Signal In Space) radio propagation to generate their position in absolute or relative way, as an alternative geolocation source in case of satellite denied environment.

The ranging capacity is based on propagation time estimations between two nodes. This propagation time estimation can be done via an exchange of messages between nodes. Being a radio network time-synchronized, aware of its own transmitting time and knowing the measurements of the time of arrival of the other node's messages, it is possible to perform a triangulation in order to estimate its relative position referred to the neighbourhoods' nodes.

- Any communication-capable node can be considered as potential provider and consumer of this service.

#### 2.2.2.5.3 Human RAS Interaction Services Description

Human RAS (Robotic Autonomous System) Interaction Services (HRI) provides an operator for the set of capability to manage and control a (squad) of UxV(s).

Typically, these services are available at DSS Squad level, i.e. a RAS is controlled by an assigned member of a DSS Squad, e.g. Reconnaissance, Surveillance, and Target Acquisition (RSTA) Operator.

It shall be possible to control a given RAS also from a Vehicle, via the Arbitration Services.

It includes:

- RAS Management Services, which manage the RAS as a System;
- RAS Mission Control, which support the operator(s) during the mission tasks. It provides functions and tools for Human-Autonomy Teaming.

The HRI Services may exchange data in both Inter-Platform and Squad Data Exchange Contexts.

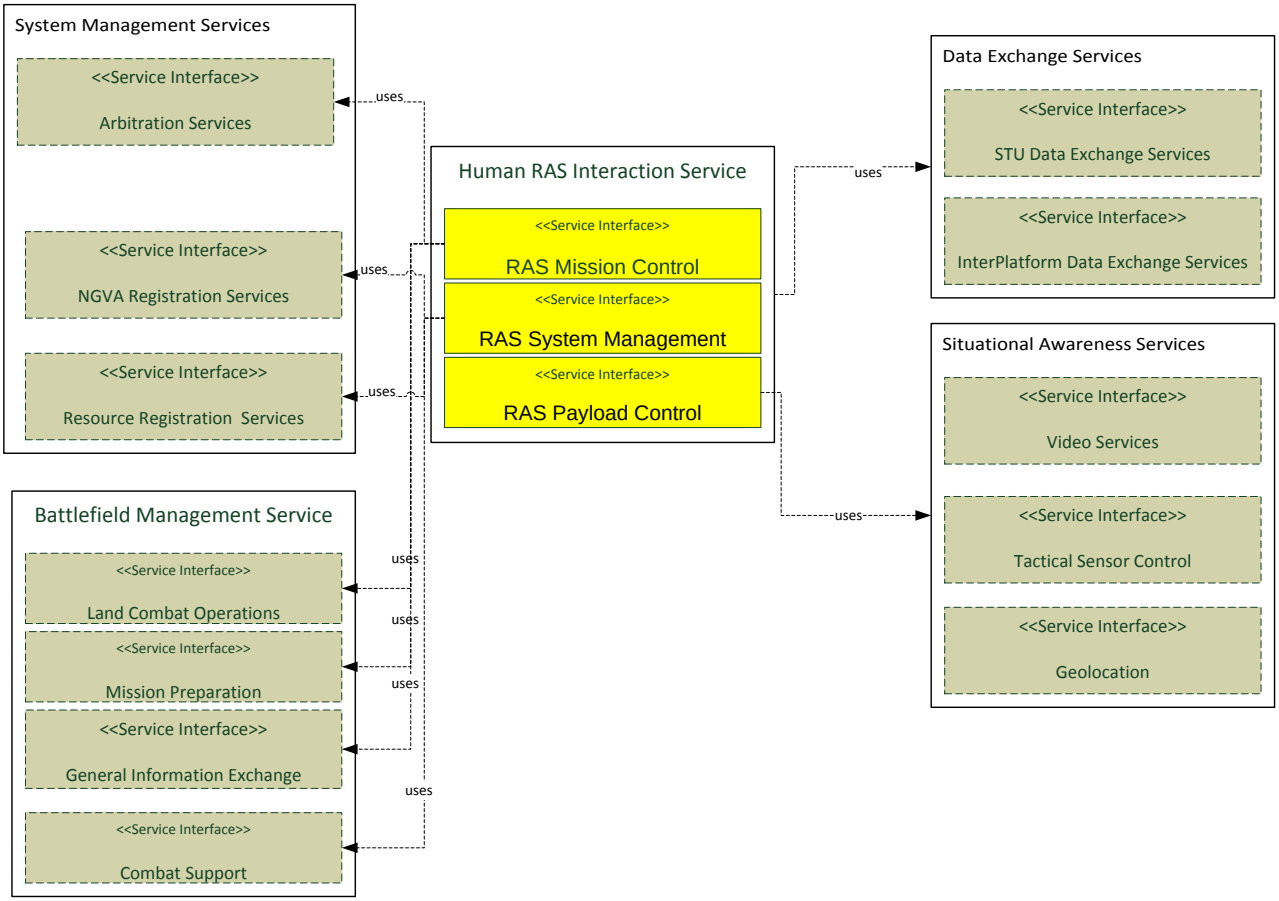


**Figure 2-14 – Human RAS Interaction Services**

#### 2.2.2.5.3.1 RAS Management Service

RAS Management Service provides functions and tools to manage the RAS as a system.

Typical system management functions are:

- RAS Configuration Management
- RAS Fault Management
- RAS Security Management
- RAS Performance Management.

This functions work in the same manner as the one described for DSS in Section 2.2.2.5.3.3, but applied to the RAS as a system.

The RAS Management Services request:

- Resource Registration Services, for the registration of the RAS to the controlling DSS.
- Arbitration services to support the RAS sharing among different nodes, e.g. DSS, Vehicle Operator;
- NGVA Registration Services, to register to a NGVA Vehicle, which is cooperating with the Soldier Squad.

#### 2.2.2.5.3.2 RAS Mission Control Services

RAS Mission Control Service provides functions and tools to support the RAS Commander to manage the mission tasks performed via a RAS. The key functions are related to Human-Autonomy Teaming.

Specifically, this services support:

- **Flexible Autonomy,** which allows the control of
  - tasks,
  - functions,
  - sub-systems, and even
  - entire swarm

  To pass back and forth over time between the human and the autonomous system, as needed to succeed under changing circumstances. Many UxV functions will be supported at varying levels of autonomy:
  - from fully manual,
  - to recommendations for decision aiding,
  - to human-on-the-loop supervisory control of an autonomous system,
  - to fully autonomous operation with no human intervention at all.
- **Shared Situation Awareness**, which is needed to:
  - (i) ensure that the swarm and the human are able to align their goals,
  - (ii) track function allocation and re-allocation over time,
  - (iii) communicate decisions and courses of action, and
  - (iv) align their respective tasks to achieve coordinated actions.

RAS Mission Control Service require the following services:

- Geolocation service, to define the correct location of the RAS Payload Control Station(s)
- Land Combat Operation, to control the RAS Mission in the Battlefield and coordinate with the STU Commander
- Mission Preparation, to plan the RAS Mission
- General Information Exchange to support the coordination between the RAS Commander with the STU / Vehicle Commander.

#### 2.2.2.5.3.3 RAS Payload Control Service

RAS Payload Control Service provides functions and tools to support the RSTA Operator to control the set of payloads, which equip the (squad of) UxVs.

RAS Payload Control Service require the following services:

- Video Service to control one or more PTZ Camera(s), which equip one or more RAS elements;
- Tactical Sensor Control services to control one or more tactical sensor(s), e.g. Laser Range Finder, which equip one or more RAS elements;
- Geolocation service, to define the correct location of the RAS Payload Control Station(s)

### 2.2.2.5.4 System Management Functional Area Description

The System Management Functional Area provides for services to manage the DSS as a system.

It addresses the typical management functions, such as

- Fault Management,
- Configuration Management,
- Security Management,
- Performance Management.

Typically, this set of services is supported by a centralised System Management Station.

Moreover, it also includes service to support (self-) coordination at both Squad/Team and Cluster levels, such as:

- Arbitration Services, which support the sharing of collective resources such as UxV, PTZ Camera and tactical sensors. It is worth noting that the coordinated, shared usage can occur both at Squad/Team level, i.e. between DSSs belonging either to the same or to a different Squad, and at Cluster level, i.e. between DSS and Vehicle Operator(s).
- NGVA Registration Services, which support the registration of a DSS as an external node of an NGVA Vehicle;
- Resource Registration Services, which provides for (semi-)automatic registration of DSS resources to mutually exchange information needed to support Data Exchange services. Both embedded and remote resources are supported.
- Combat Support, to request for logistic support during the RAS Mission.

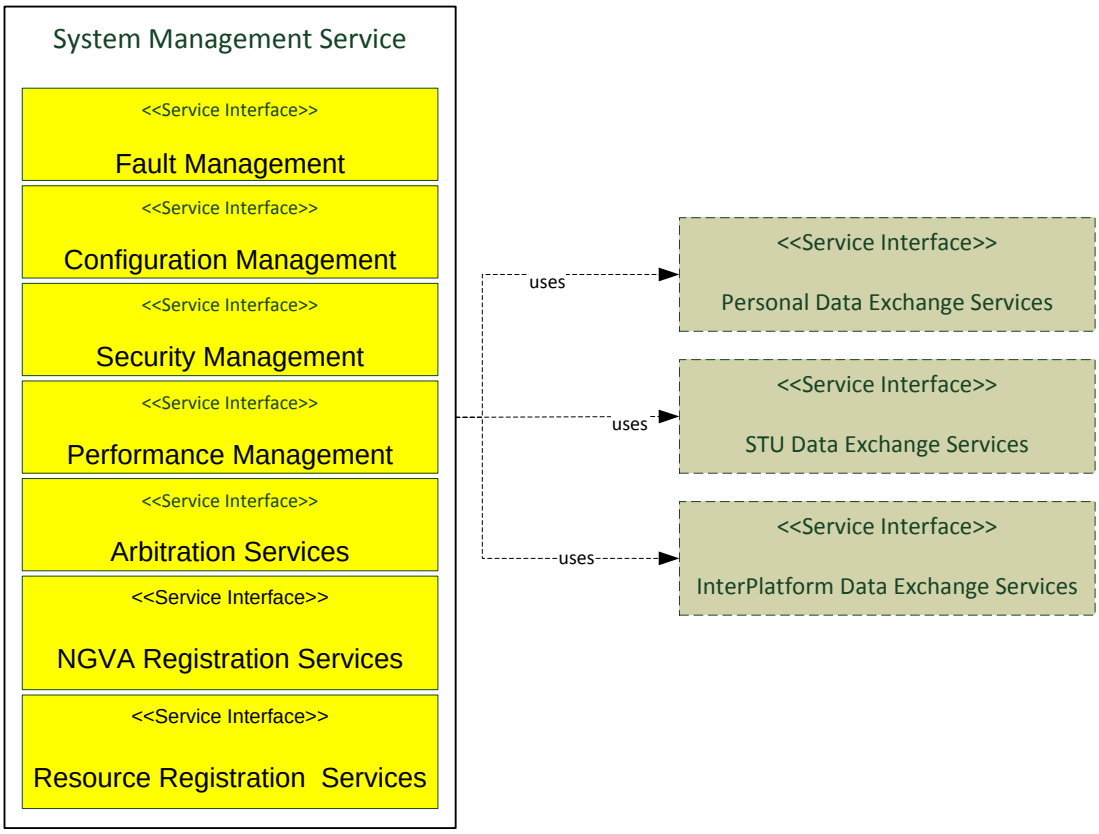


**Figure 2-15 – System Management Services**

#### 2.2.2.5.4.1 DSS Configuration Management

The DSS Configuration Management provides services and tools for the configuration of both HW and SW components of the DSS.

Configuration management is concerned with monitoring system configuration information, and any changes that take place. This area is especially important, since many system issues arise as a direct result of changes made to configuration files, updated software versions, or changes to system hardware.

Typical Configuration Management provides functions and tools to:

- Gather and store configurations from system devices (this can be done locally or remotely).
- Configure devices.
- Configure SW Applications.
- Track configuration changes.
- Plan configurations for future system/device expansion and scaling

#### 2.2.2.5.4.2 DSS Fault Management

DSS Fault Management provides functions and tools to:

- Support to recognize, isolate, correct and log faults that occur in the DSS.
- Produce trend analysis to “predict” system errors.
- Collect information about system devices abnormal behaviour and log it to the soldier.
- Communicate fault events to the System Management Station, to produce statistics and plan recovery actions.
- Support to detect and isolate a faulty LRU and that the user can remove it and replace, configure and check-out the new LRU.
- Collect information about system behaviour and log it to the System Management Station in order to:
    - Produce statistics and plan corrective maintenance and repair.
    - Produce trend analysis to “predict” faults and support obsolescence and innovation management.

#### 2.2.2.5.4.3 DSS Performance Management

DSS Performance Management Services provide functions and tools to:

- Monitor system performance against expected key performance indicator thresholds, which are mission dependent.
- Detect abnormal performance events, e.g. performance threshold outage, overload conditions.
- Log abnormal performance events to the soldier.
- Communicate abnormal performance events to the System Management Station to produce statistics and plan maintenance actions.

#### 2.2.2.5.4.4 DSS Security Management

DSS Security Management provides functions and tools to:

- Control access to assets in the DSS.
- Gather and analyse security-related information.
- Manage DSS system authentication, authorization, and auditing, such that both internal and external users only have access to appropriate system resources.
- Configure and manage (i) security tools (such as firewalls, intrusion detection systems), (ii) security policies (such as access lists, trust naming schema).

## 2.2.2.6 Sensor Services Definitions

### 2.2.2.6.1 Attention estimation

The **attention estimation service** provides information about the soldier's current level of attention. This can be used e.g. to identify tired or sleeping soldiers in forward positions.

### 2.2.2.6.2 Stress Level Estimation

The **stress level estimation** service provides information about the current stress level of the soldier measured by different body sensors. The information from this service can be used to indicate the exhaustion of the soldier as well as improving reaction time in case of a hidden or surprise attack.

### 2.2.2.6.3 Combat Readiness Estimation

The **combat readiness estimation** service allows the commander to estimate which soldiers are combat ready. Using different body sensors, the decision about which STU is combat ready or not may be lifted from the binary choice to a more detailed information.

For example: two STU's are equal in size and equipment. STU 1 has marched six hours to reach the position, STU 2 has already reached the position a day before and was able to rest. Both STUs may be considered as combat ready, but STU 2 may be better suited for high intensity jobs.

### 2.2.2.6.4 Own Position Measurement

The functional service **own position measurement** provides the position of the soldier (system).

Possible information can be, but is not limited to:

- Absolute position
- Possibly relative position to other objects
- Altitude
- Height

This service therefore, provides the major input for the Navigation Service.

### 2.2.2.6.5 Navigation

The functional service **Navigation** provides devices/tools:

- for the determination of the best route to destination (based on the environment, geographic characteristics, enemy/neutral position, mission strategy/tactics, etc.)
- for the consideration of topographic conditions and tactical situation
- with several methods to guide along the best route to destination

It uses the Own Position Measurement service (see section 2.2.2.6.4) to estimate the position and other information such as attitude.

#### 2.2.2.6.6 CBRN-Warning

The service **CBRN-Warning** provides information about possible CBRN-Threats close to the soldier (system). This information can either be provided by own CBRN-Sensors, sensor information in the squad or reconnaissance by a higher echelon unit.

#### 2.2.2.6.7 Engagement Indication

The **engagement indication** provides devices/tools:

- to determine the position (relative or absolute) of the origin of the engagement
- to update the COP
- to share the information in the STU
- for sensor (data) fusion

#### 2.2.2.6.8 Threat Tracking

The **threat tracking** service provides devices/tools:

- To alarm in case incoming threats
- To provide a track of the threat
- To classify the threat

#### 2.2.2.6.9 Imaging

The **imaging** service provides devices/tools to provide imagery to the soldier (system) in form of video, pictures or sequences of pictures to

- improve the information shared in the COP by analysing the imagery
- by sharing the imagery in the COP

#### 2.2.2.6.10 Target Acquisition

The **target acquisition** services provides devices/tools:

- to measure the position of a target
- to mark a target
- to forward the target to another entity (e.g. for Close Air Support)
- to provide target information to the COP

#### 2.2.2.6.11 Enhanced Vision

The **enhanced vision** services provides devices/tools for e. g.

- night vision
- thermal vision
- wall penetrating radar
- other spectral visions

#### 2.2.2.6.12 Distance Measurement

The **distance measurement** services provides devices/tools to measure the distance to objects.

### 2.2.2.7 Effectors Service Definitions

#### 2.2.2.7.1 Target Surveillance

The functional service **Target Surveillance** provides devices/tools:

- to enhance DSS vision capabilities under all visibility conditions (day, night and poor visibility conditions)

##### 2.2.2.7.1.1 Target Acquisition

The functional service **Target Acquisition** provides devices/tools:

- to detect, recognise and identify targets in the battlespace
- to locate the identified targets and enrich them with further relevant information

##### 2.2.2.7.1.2 Target Damage Assessment

The functional service **Target Damage Assessment** provides devices/tools:

- to evaluate battle damage caused to a target after its engagement, which can be achieved using the same devices/tools as for target acquisition

#### 2.2.2.7.2 Target Engagement

The functional service **Target Engagement** provides devices/tools:

- to engage targets with the required effect (e.g. suppression of the enemy)
- to engage targets with maximum hit probability

##### 2.2.2.7.2.1 Handling Weapon

Typical activities of the operational service **Handling Weapon** are the preventive maintenance, preparation of ammunition and the correct use of weapons and their fire control system.

The operational service **Weapon Handling** provides:

- improvement of survivability under fire
- successful execution of fire missions

It also refers to handling effectors in general.

##### 2.2.2.7.2.2 Ammunition Programming

The functional service **Ammunition Programming** provides devices/tools:

- to set the fuse of programmable ammunition to explode at the desired point of the trajectory

##### 2.2.2.7.2.3 Target Marking/Illumination

The functional service **Target Marking/Illumination** provides devices/tools:

- to mark or illuminate targets to engage

#### 2.2.2.7.2.4 Indirect Aiming

The functional service **Indirect Aiming** provides devices/tools:

- to aim the weapon at the target to be engaged without exposure or minimum exposure to enemy fire (e.g. firing around corners and over walls)

#### 2.2.2.7.2.5 Fratricide Alert

The functional service **Fratricide Alert** provides devices/tools:

- to warn the soldier of potential blue fire when aiming his/her weapon towards the location of a member of his/her squad/team

### 2.2.2.7.3 Operational Measurements

The functional service **Operational Measurements** provides devices/tools:

- to measure relevant parameters that have a direct effect on combat efficiency and force protection (fratricide alert)

#### 2.2.2.7.3.1 Round Counting

The functional service **Round Counting** provides devices/tools:

- to give the soldier an account of the remaining rounds in the soldier's weapon magazine

#### 2.2.2.7.3.2 Range Finding

The functional service **Range Finding** provides devices/tools:

- to measure the distance between the soldier's weapon and the potential target.

#### 2.2.2.7.3.3 Bearing Finding

The functional service **Bearing Finding** provides devices/tools:

- to measure the azimuth and elevation angles between DSS's weapon and a potential target

### 2.2.2.7.4 Data Exchange

The functional service **Data Exchange** provides devices/tools:

- to exchange relevant data to and from DSS's weapon and DSS's C2I subsystems

Data to be exchanged include at least azimuth and elevation angles, range, remaining ammunition, battery status, video streaming, pictures, etc.

#### 2.2.2.7.5 Power Management

The functional service **Power Management** provides devices/tools:

- to feed the DSS's weapon electronic devices directly from the DSS's power subsystem.
- to recharge DSS's weapon central battery

Recharge can be accomplished both on-line from the DSS and off-line from external chargers (vehicle, etc.)

#### 2.2.2.7.6 System Management

The functional service **System Management** provides devices/tools:

- to configure the array of electronic devices integrated/installed on the DSS's weapon
- to control functionalities of the electronic devices integrated/installed on the DSS's weapon (video channel, polarity, video transmission, etc.)
- to control radio voice activation from the weapon without separating hands from the DSS's weapon

#### 2.2.2.7.7 Imaging

The functional service **Imaging** provides devices/tools:

- to capture and transmit video from the DSS's weapon.
- to capture and transmit still pictures from the DSS's weapon

## 2.3 NSOV-3 Services to Operational Activities Mapping

It is important to expand the operational capability requirements of the Soldier System into *operational services* provided by an individual soldier or an STU, to ensure that the envisioned capability enables the soldier to provide all operational services linked to the accomplishment of the mission. Each of these *operational services* comprises a number of *operational activities* or functions. The soldier system helps the soldier / STU perform these functions by provision of *functional services* (See Systems View).

The ensuing paragraphs elucidate the linkages of different *operational capabilities* (CGx) to *operational services* and the DSS *functional services*, which need to support the operational activities and services.

### 2.3.1 Capability Category 1: C4 – Operational Services – Activities – DSS Functional Services

The operational services provided by a soldier / STU under the Capability Category 1: C4 (Command, Control, Communications and Computers) are related to establishment of situational awareness; receiving of orders, operational directives and understanding the commander's intent; performing mission planning at the tactical level; executing the mission; observation and report of progress of mission; and provision of feedback and post mission evaluation report.

For example, the operational service - *Execute Planned Mission* under CG1 consists of activities like moving to a location, deployment and coordination; perform tasks as per tactics, techniques and procedures (TTP), modify plan during mission, etc.

The DSS assists in the performance of these activities by provision of functional services for each – e.g. the operational activities of *Validate / Consolidate operational picture* and *Exchange information updates* are enabled by the following functional services:

- Observe area during day and night
- Identify Friend and Foe
- Receive & Display Operational Picture
- Feed/Upload data onto CROP
- Communicate information (voice and data) securely.

| CAPABILITY CATEGORY | OPERATIONAL SERVICE | OPERATIONAL ACTIVITY | FUNCTIONAL SERVICES (Indicative and not comprehensive) |
|---|---|---|---|
| **CG1: C4** | • Establish Situational Awareness | • Validate / Consolidate operational picture.<br>• Exchange information updates. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I: SA<br>• HID: Audio Exchange<br>• HID: Video Exchange<br>• HID: Remote Control<br>• HID: Warnings & Fbks<br>• Sensor: Self Measurement<br>• Sensor: Soldier Protection<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES<br>• |
| | • Receive Operational Orders | • Receive and confirm commands from higher echelons.<br>• Request additional resources/assistance | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• HID:Audio Exchange |
| | • Perform Mission Planning | • Convert order into tactical operational plan.<br>• Coordination and synchronisation of plans. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance |
| | • Execute Planned Mission | • Move to a location.<br>• Deployment and coordination.<br>• Execute tasks using planned and rehearsed tactics, techniques and procedures (TTP).<br>• Modify plan during mission. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Sensor: Soldier Protection<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: P&SM<br>• Effectors: I&DES<br>• Effectors: OM |

| | | | |
|---|---|---|---|
| | • Observe and Report Progress of Mission | • Evaluate progress of operational plan<br>• Report progress of operational plan | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Effectors: TSE<br>• Effectors: P&SM<br>• Effectors: OM |
| | • Send Post Mission Report & Returns to Higher Echelons | • Request casualty evacuation<br>• Evaluate mission completion<br>• Assess damage after mission (enemy/ own)<br>• Evaluate logistic supply status<br>• Generate report | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• HID:Audio Exchange<br>• HID:Remote Control<br>• Effectors: I&DES |

**Table 2-1 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (Capability Category 1: C4)**

### 2.3.2 Capability Category 2: ISTAR – Operational Services – Activities – DSS Functional Services

The **operational services** provided by a soldier /STU under the **Capability Category 2: ISTAR** (Intelligence, Surveillance Target Acquisition and Reconnaissance) include *carrying out reconnaissance, surveillance, provide intelligence, target acquisition and designation, and battle damage assessment.* Provision of each *operational service* entails carrying out a number of *operational activities.* As an example, to provide the *operational service* 'Carrying Out Reconnaissance' entails the **activities** of - observe new areas for enemy presence; terrain analysis; suitability for deployment of personnel, systems / equipment; patrol new areas by moving, observing and communicating; report observations and/or integrate reconnaissance information into CROP; and; upload/display and communicate relevant intelligence. In turn the DSS enables the fulfilment of these operational activities through **functional services** like: –

- Wide angle telescopic observation by day and night (hemisphere awareness/night vision).
- CID
- Going map of terrain with timings (mounted (tracked/wheeled) and dismounted).
- Optimal screening diagrams for line of sight sensor deployment.
- Enhanced mobility (through low SWaP/augmentation).
- Image / video streaming for auto update of CROP through multiple sensor data fusion.
- Change detection through AI assisted imagery interpretation.

| CAPABILITY CATEGORY | OPERATIONAL SERVICE | OPERATIONAL ACTIVITY | FUNCTIONAL SERVICES (Indicative and not comprehensive) |
|---|---|---|---|
| **CG2: ISTAR** | • Carry out Reconnaissance | • Observe new areas for:<br>  ○ enemy presence;<br>  ○ terrain analysis;<br>  ○ suitability for deployment of personnel and systems / equipment.<br>• Patrol new areas by moving, observing and communicating.<br>• Report observations and/or integrate reconnaissance information into CROP.<br>• Upload/Display and communicate relevant intelligence. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SA<br>• C4I:HRI<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES |
| | • Carry out Surveillance | • Continuously observe terrain and enemy (for detection, locating, movement, activities and likely intentions) in selected battle space. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SA<br>• C4I:HRI<br>• HID:Audio Exchange |

| | | | |
|---|---|---|---|
| | | • Report observations and/or integrate surveillance information into CROP.<br>• Upload/Display and communicate relevant intelligence. | • HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES |
| | • Provide Intelligence | • Receive and collate information from multiple sources.<br>• Analyse information from observations and raw data.<br>• Display and communicate relevant intelligence. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:HRI<br>• HID:Audio Exchange<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES |
| | • Target Acquisition and Designation | • Target detection.<br>• Acquire target in terms of distance, bearing, elevation, speed, direction of movement, quantity and type of target.<br>• Track target manually or electronically (manually or automatic target tracking).<br>• Select appropriate weapon.<br>• Assign target(s) to means / weapons. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SA<br>• C4I:HRI<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Sensor: Soldier Protection<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: P&SM<br>• Effectors: I&DES<br>• Effectors: OM |
| | • Battle Damage Assessment | • Visual / electronic assessment.<br>• Report observations and / or integrate BDA Information into CROP.<br>• Display and communicate relevant intelligence. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES |

**Table 2-2 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (Capability Category 2: ISTAR)**

### 2.3.3 Capability Category 3: Effective Engagement – Operational Services – Activities – DSS Functional Services

The **operational services** provided by a soldier /STU under the **Capability Category 3: Effective Engagement** are: choose desired effect, select means - weapon and munition (type and quantity), select most appropriate position to engage target from, designate weapon(s), orient and align (coordinate) the fire control /weapon system, input meteorological and ballistic corrections, decide on duration of fire, coordinate fire and handing over of targets for engagement by other means (beyond STU level). Provision of each operational service entails carrying out a number of **operational activities**. As an example, to provide the operational service Manage Duration and Coordination of Fire, activities like - start and stop fire based on movement of target and own troops and desired effect; and; coordination of fire when both air and land forces are engaging the enemy as per the joint fire plan, need to be carried out by the STU. In turn the DSS enables the fulfilment of these operational activities through **functional services** like:

- Ensure optimal use of ammunition (including restricting weapon fire based on remaining ammunition).
- Accurate coordination of direct / indirect / supporting fire.
- Improve first salvo - effectiveness through computation of most opportune time for attaining max enemy casualties based on enemy concentrations / vulnerable posture.

| CAPABILITY CATEGORY | OPERATIONAL SERVICE | OPERATIONAL ACTIVITY | FUNCTIONAL SERVICES (Indicative and not comprehensive) |
|---|---|---|---|
| **CG 3: Effective Engagement** | • Choose Desired Effect | • Based on effect-based operational objective like destruction, neutralisation, suppression, etc.<br>• Based on nature and profile of target – soft/hard,<br>• open/covered, individual, group or swarm, etc. | • HID:Video Exchange<br>• HID:Warnings & Fbks<br>• Effectors: TSE<br>• Effectors: I&DES |
| | • Select most Appropriate Position to Engage Target from. | • Direct – line of sight & range of deployed weapons<br>• Indirect – Obstacle clearance / range / minimum dead range of weapons. | • HID:Video Exchange<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES<br>• Effectors: OM |
| | • Select Weapon and Munition | • Direct / Indirect / Cyber weapon.<br>• Type of Munition - Air burst, proximity fuse incendiary, penetrating, etc. | • Effectors: TSE<br>• Effectors: OM |
| | • Weapon | • Designate desired | • SW: Data Exchange |

| | | | |
|---|---|---|---|
| | Designation, Orientation, Alignment, Ballistic Corrections, etc. | number of weapons.<br>• Provide target data for weapon orientation, target alignment and tracking.<br>• Provide weather data for ballistic corrections. | • SW: Soldier Application<br>• C4I:BMS<br>• C4I:HRI<br>• Sensor:Self Measurement<br>• Effectors: TSE<br>• Effectors: I&DES<br>• Effectors: OM |
| | • Manage Duration and Coordination of Fire | • Start and stop fire based on movement of target and own troops and effect desired.<br>• Coordinate fire when both air and land forces are engaging the enemy as per the joint fire plan. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:HRI<br>• Effectors: P&SM<br>• Effectors: OM |
| | • Handing Over of Targets | • From one sensor to another.<br>• From one platform / weapon system to another. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:HRI<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES |

**Table 2-3 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (Capability Category 3: Effective Engagement)**

### 2.3.4 Capability Category 4: Mobility – Operational Services – Activities – DSS Functional Services

The **operational services** provided by a soldier /STU under the **Capability Category 4: Mobility** are - move to desired position(s) using different mobility platforms, transition from mounted to dismounted, dismounted move across various terrain, navigate while moving, achieve desired tactical mobility, communicate while moving, engage targets while moving and observe and report while moving.

Provision of each of these operational services entails carrying out a number of operational activities. As an example, to provide the operational service - achieve desired tactical / operational mobility, entails the activities of correct positioning of fire and move elements, correct and timely deployment of personnel, equipment and operational logistic elements. The **functional services** provided by the DSS to carry out these activities are:

- Ensure own OODA loop is quicker than adversaries.
- Integration of UxVs and DSS
- Improve mission planning using AI/IT tools for better configuration management.

| CAPABILITY CATEGORY | OPERATIONAL SERVICE | OPERATIONAL ACTIVITY | FUNCTIONAL SERVICES (Indicative and not comprehensive) |
|---|---|---|---|
| **CG 4: Mobility** | • Move to Desired Position using different mobility platforms (Land, Air, Maritime) | • Own<br>• Joint<br>• Combined<br>• Civil | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:HRI |
| | • Transition from Mounted to Dismounted | • Dismounting on objective area.<br>• Dismounting short of objective area. | • Enable quick transition of all functions of DSS from mounted to dismounted mode of operation.<br>• DSS design should have magnetic connectors, / minimal wired and preferably wireless data / electrical connections. |
| | • Dismounted Move Across Various Terrain | • Mountains / high altitude areas<br>• Riverine / marshy areas<br>• Deserts / semi- deserts<br>• Plain / open country<br>• Jungle / Forested | • Enhance mobility through low SWaP and augmentation of strength of individual soldier.<br>• Provide ruggedness and protection of components against wind, rain, dust / sand and humidity. |
| | • Navigate While Moving | • Point to point map reading / navigation.<br>• Satellite data fed real time automatic navigation using GPS / other GNSS device. | • C4I:BMS<br>• C4I:SA<br>• C4I:HRI<br>• HID:Video Exchange<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement |

| | | | |
|---|---|---|---|
| | • Achieve Desired Tactical / Operational Mobility | • Through the correct positioning of fire and move elements.<br>• Through the correct and timely deployment of personnel, equipment and operational logistic elements. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:SYS<br>• C4I:HRI<br>• Sensor:Self Measurement |
| | • Communicate while Moving | • Operate radio set on the move.<br>• Communicate using hands free communication equipment. | • SW: Data Exchange<br>• SW: Soldier Application<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks |
| | • Engage Targets while Moving | • Obtain target parameters on the move.<br>• Carry out target engagement while moving both mounted and dismounted | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:HRI<br>• HID:Video Exchange<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES |
| | • Observe and Report while moving | • Carry out observation of the area around while moving.<br>• Report about any cognizable activity or untoward observation to higher echelon. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:HRI<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance<br>• Effectors: TSE<br>• Effectors: I&DES |

**Table 2-4 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (Capability Category 4: Mobility)**

### 2.3.5 Capability Category 5: Protection and Survivability – Operational Services – Activities – DSS Functional Services

The **operational services** provided by a soldier /STU under the **Capability Category 5: Protection and Survivability** are: Remain Mission Capable, Conceal from Enemy, Endure Enemy Fire, Endure Hostile Environment, Endure Physical and Psychological Stresses and Provide Protection to Others.

Provision of each of these operational services entails carrying out a number of operational activities. As an example, provision of the operational service Endure Physical and Psychological Stresses entails tangible and intangible activities such as overcoming fear and fatigue, preparing or training the body and mind to bear prolonged physical stresses due to load, distance, gradient, injury, etc. and withstanding or alleviating psychological stresses due to loneliness, disorientation, not knowing what's happening, loss of comrades, fear of death, capture by enemy, remaining motivated in the purpose of continued fighting, etc.

Such intangible operational activities like overcoming fear and fatigue are especially assisted by the soldier system functional services of armour protection, additional strength (exo-skeleton), navigation, communication, real time information sharing, etc.

| CAPABILITY CATEGORY | OPERATIONAL SERVICE | OPERATIONAL ACTIVITY | FUNCTIONAL SERVICES (Indicative and not comprehensive) |
|---|---|---|---|
| **CG 5: Protection and Survivability** | • Remain Mission Capable | • Protect self from enemy actions to injure /destroy.<br>• Maintain mission weapons, equipment and ammunition to keep it serviceable at all times. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SYS<br>• Sensor:Self Measurement |
| | • Conceal from Enemy | • Camouflage as per terrain.<br>• Use broken ground and cover to conceal from enemy line of sight sensors and weapons. | • Adaptive camouflage/ Remain invisible to enemy sensors (Anti-IR).<br>• Navigation.<br>• Radio silence / encrypted burst transmission.<br>• HID:Warnings & Fbks |
| | • Endure Enemy Fire | • Protection from small arms fire<br>• Protection from CBRNE<br>• Protection from shrapnel and splinters | • Sensor: Soldier Protection |
| | • Endure Hostile Environment | • Extreme temperatures cold or heat<br>• Rain / snow /sleet<br>• High winds | • Sensor: Soldier Protection |

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|---|---|---|---|
| | | • Low oxygen levels in HA areas<br>• Breathe under-water | |
| | • Endure Physical and Psychological Stresses | • Bear prolonged physical stresses due to load, distance, gradient, injury, etc.<br>• Withstand psychological stresses due to loneliness, disorientation, not knowing what's happening, loss of comrades, fear of death, capture by enemy, remain motivated in the cause / purpose of continued fighting, etc. | • SW: Data Exchange<br>• SW: Soldier Application<br>• Sensor:Self Measurement<br>• Sensor: Soldier Protection<br>• |
| | • Provide Protection to Others | • Protect civilians, own comrades, VIPs, public property.<br>• Protect national borders / MNF Borders.<br>• Provide aid to civil authorities, NGOs and other friendly organisations. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:HRI<br>• Sensor:Self Measurement<br>• Sensor: Soldier Protection |

**Table 2-5 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (Capability Category 5: Protection and Survivability)**

### 2.3.6 Capability Category 6: Sustainability & Logistics – Operational Services – Activities – DSS Functional Services

The **operational services** provided by a soldier /STU under the **Capability Category 6: Sustainability and Logistics** are - operate continuously for a desired period of time; configure system according to mission needs; repair, replace and recover damaged equipment; provide first aid and evacuate casualty; remain self-contained for the required period of mission; monitor expenditure and request for ammunition, supplies and spares; and keep soldier system state of the art.

Provision of each of these operational services entails carrying out a number of operational activities. As an example, provision of the operational service Operate Continuously for a Desired Period of Time entails the activities of operating for mission duration of 48 or 72 or mission specified hours; operating during day/night and adverse weather conditions; and remaining self -contained and if required live off the land till evacuated / return to own/friendly logistic area. These operational activities are enabled through the DSS functional services of:

- Long life batteries /alternate energy recharging means (solar/ motion /wind).
- Decreased logistic requirements by reduced system inventory and improved re-supply speed (UAV/Drones/Air delivery).
- Reserve of energy and emergency rations and stores.
- Improved interoperability / interchangeability.

| CAPABILITY CATEGORY | OPERATIONAL SERVICE | OPERATIONAL ACTIVITY | FUNCTIONAL SERVICES (Indicative and not comprehensive) |
|---|---|---|---|
| **CG 6: Sustainability & Logistics** | • Operate Continuously for a Desired Period of Time | • Operate for mission duration of 48 or 72 or specified hours.<br>• Operate during day/night and adverse weather conditions.<br>• Remain self -contained and if required live off the land till evacuated / return to own/friendly logistic area. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SYS<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Effectors: OM |
| | • Configure System According to Mission Needs | • Be able to configure DSS according to selected mission needs.<br>• Be able to quickly adapt to new mission configuration. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SYS |
| | • Repair, Replace and Recover Damaged Equipment | • Repair in the field.<br>• Replace modular components easily and quickly.<br>• Recover / destroy | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SYS |

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| | | (zeroizing) damaged / compromised equipment remotely. | |
| | • Provide First Aid and Evacuate Casualty | • Monitor critical human body parameters of self / others.<br>• Administer first aid in the field.<br>• Provide advance information and give SOS call for *casevac / medevac.* | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:HRI<br>• Sensor:Self Measurement<br>• Sensor: Soldier Protection<br>• |
| | • Remain Self Contained for Desired Period of Operation | • Estimate mission duration accurately.<br>• Train troops in remaining self-contained / living off the land. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SYS<br>• Sensor:Self Measurement<br>• |
| | • Monitor Expenditure and Request for Ammunition, Supplies and Spares | • Evaluate needs as per mission requirements.<br>• Incorporate automated system of monitoring expenditure / remaining supplies and spares. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SYS<br>• Sensor:Self Measurement<br>• Effectors: OM |
| | • Keep Soldier System State of the Art | • Software Updates<br>• Component Upgrade<br>• Obsolescence Management | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:SYS |

**Table 2-6 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (Capability Category 6: Sustainability & Logistics)**

### 2.3.7 Capability Category 7: Education & Training – Operational Services – Activities – DSS Functional Services

The **operational services** provided by a soldier /STU under the **Capability Category 7: Education &Training** are:

- Provision of each of these operational services entails carrying out a number of operational activities. As an example, provision of the operational service Operate Continuously for the Mission Duration / Desired Period of Time entails the activities of Handling Weapons & Equipment Proficiently, Becoming Proficient in Tactical Operations, Becoming Proficient in all Capability Areas, Achieving Standard of Interoperability in Joint / Combined Operations, Adapting to CTC / Simulation Training, Validate Operational Concepts and Doctrines, Measuring Operational Readiness and Increasing Affiliation, Coordination and Confidence.
- Provision of each of these operational services entails carrying out a number of operational activities. As an example, provision of the operational service Achieve Standard of Interoperability in Joint / Combined Operations entails activities like identify interoperability gap areas, carry out joint/combined training in interoperability gap areas, incorporate interoperability criteria in force structuring and joint forces training.

The DSS **functional services** of:

- Measure areas of interoperability effectiveness, especially in areas identified as gaps.
- Measure mission effectiveness against laid down parameters and standards.
- Develop scenarios that will generate opportunities for the collection of data to measure performance and effectiveness.

| CAPABILITY CATEGORY | OPERATIONAL SERVICE | OPERATIONAL ACTIVITY | FUNCTIONAL SERVICES (Indicative and not comprehensive) |
|---|---|---|---|
| **CG 7: Training** | • Handle Weapons & Equipment Proficiently | • Individual weapon-skill training.<br>• Carry out technical training | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:HRI<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance |
| | • Become Proficient in Tactical Operations | • Battle physical proficiency training.<br>• Carry out STU level tactical training.<br>• Carry out joint and combined force collective training based on likely operational thematic areas. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:SYS<br>• C4I:HRI<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance |
| | • Become Proficient in all Capability Areas | • Balance out individual, collective and simulated versus live training.<br>• Balance out training in all capability areas like physical, weapon, tactics, mission planning, etc. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:SYS<br>• C4I:HRI |
| | • Achieve Standard of Interoperability in Joint / Combined Operations | • Identify interoperability gap areas.<br>• Carry out joint/combined training in interoperability gap areas.<br>• Incorporate interoperability criteria in force structuring and joint forces training. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:SYS<br>• C4I:HRI<br>• |
| | • Adapt to CTC / Simulation Training | • Incorporate simulation training at individual, weapon/system and collective training stages.<br>• Improve technical knowledge and skills of | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:SYS<br>• C4I:HRI |

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| | | individual soldiers, military leaders and planners.<br>• Update simulation training packages with feedback from operational / live training exercises. | • Sensor:Self Measurement<br>• Sensor: Soldier Protection<br>• Sensor: Reconnaissance |
| | • Validate Operational Concepts and Doctrines | • Evolve a common doctrine for affiliation / coalition forces.<br>• Field new concepts of operations during integrated training. | • |
| | • Measure Operational Readiness | • Lay and achieve training standards for operational readiness levels.<br>• Lay and achieve standards for equipment and system readiness levels | • Sensor:Self Measurement<br>• |
| | • Increase Affiliation, Coordination and Confidence | • Evolve and share multi-national planning & training norms.<br>• Carry out integrated collective training.<br>• Use interoperable systems and common procedures during training. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:SYS<br>• C4I:HRI<br>• Sensor:Self Measurement<br>• |

**Table 2-7 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (Capability Category 7: Education & Training)**

### 2.3.8 Capability Category 8: Multi-National Interoperability

#### 2.3.8.1 Multi-National Force Interoperability – Operational Services – Activities – DSS Functional Services

The operational services related to multi-national force planning and deployment entails cross cutting capability services common to all the previous capability categories of command and control, communications, intelligence, training and exercises, employment of common TTPs, operating bases, logistic support services, terminology, modelling and simulation systems, etc. - all of which would need to be supported by compatible DSS Functional Services. These have been tabulated in Table 2-8.

| Capability Category | Operational Service | Operational Activity | Functional Service |
|---|---|---|---|
| **Multi-National Force Interoperability** | • Joint Planning, Force Structuring & Deployment | • Task Oriented Force Composition<br>• Mission Planning and Rehearsal<br>• Force Mobilisation / Force Projection for OOA (Out of Area) Operations using land/air/sea transport | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I: BMS<br>• C4I: SA<br>• C4I: SYS<br>• C4I: HRI<br>• Sensor: Self Measurement |
| | • Components Compatibility | • Hardware / Armaments/ Equipment / Systems<br>• Information Exchange & Management Systems | • SW: Data Exchange<br>• SW: Soldier Application<br>• HID::Audio Exchange<br>• HID :Video Exchange<br>• HID: Remote Control<br>• HID: Warnings & Feedback |
| | • Command and Control | • Command and control at all levels – strategic, operational, tactical and STU.<br>• Common operational procedures (TTPs)<br>• Orders format and common terminology<br>• Mapping reference meta language data of non-standard dialects and merging national battle | • SW: Soldier Application<br>• C4I: BMS<br>• SW: Data Exchange<br>• HID:Audio Exchange<br>• HID:Video Exchange |

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| | | management boundaries | |
| | • Intelligence | • Joint intelligence sharing<br>• Provision and access to a Common Relevant Operating Picture (CROP) with Red and Blue Force tracking<br>• Establishing Sensor - Shooter Network through real time linkages | • Utilisation of UxVs configurable with soldier systems. |
| | • Communications | • Shared communication bandwidth<br>• Communication and data information exchange services | • HID: Audio Exchange<br>• HID: Video Exchange<br>• SW: Data Exchange<br>• SW: Soldier Application |
| | • Joint Operations | • Employment of common techniques, tactics and procedures (TTPs)<br>• Bringing about synergy and force multiplication through jointness and interoperability. | • Radio Based Combat Identification (RBCI)<br>• C4I: BMS<br>• C4I: SA<br>• C4I: SYS<br>• C4I: HRI |
| | • Operational Logistic Support | • Rapid Deployment of ERP for Battle Space Management<br>• Sharing Operational and Logistic Bases | • HID: Warnings & Fbks<br>• Sensor: Self Measurement<br>• Effectors: OM |
| | • Common M&S / MSaaS | • Training and Exercises<br>• Mission Planning and Deployment<br>• Concept Development and Evaluation (CD&E) | • Compatibility and interoperability of DSS with configurable scenarios and federated M&S Systems<br>• AR/VR Compatibility of DSS |

**Table 2-8 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (Multi-National Force Interoperability)**

### 2.3.8.2 CIMIC – Operational Services – Activities – DSS Functional Services

Civil Military Cooperation (CIMIC) is considered as an important cross-capability which relates to all other capabilities. It is often neglected and further elaborated in Table 2-9.

| CAPABILITY CATEGORY | OPERATIONAL SERVICE | OPERATIONAL ACTIVITY | FUNCTIONAL SERVICES (Indicative and not comprehensive) |
|---|---|---|---|
| **CIMIC**<br><br>**(By the very nature of the capabilities that a military force possesses it can render assistance to civil authorities in many ways)** | • Assist in Civil Affairs Services | • Legal<br>• Public Administration<br>• Public - Health/Education/Safety<br>• Law & Order<br>• Security of relief convoys | • HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• HID:Warnings & Fbks<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance |
| | • Provide Engineering Support | • Demining/ Removal of Explosives.<br>• Construction, repair and maintenance of airbases, naval ports, bridges, shelters, etc.<br>• Public Works – water purification / electricity / waste management.<br>• Construction, repair and maintenance of hospitals / clinics.<br>• Underwater construction and inspection. | • Early warning of asymmetric threats to civilian targets.<br>• Utilisation of CBRNE sensors for detection and response.<br>• Utilisation of UxVs configurable with soldier systems.<br>• Underwater operations.<br>• Communicate information (voice and data) securely. |
| | • Provide Health Services | • Minimize effects of wounds, injuries and diseases on own troops and civil population.<br>• Provide medical resources – staff, medicines, facilities for surgery, dental clinics, blood banks, logistics, etc.<br>• Patient movement including emergency air evacuation.<br>• Assist in preventive health care campaigns. | • SW: Data Exchange<br>• SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:HRI<br>• HID:Audio Exchange<br>• HID:Video Exchange<br>• HID:Remote Control<br>• Sensor:Self Measurement<br>• |
| | • Military | • Provide Police | • SW: Data Exchange |

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| | Police Services | intelligence.<br>• Provide anti-terrorist force/force protection.<br>• Maintain law and order.<br>• Internment / Resettlement.<br>• Route marking and traffic control.<br>• Provide area security. | • SW: Soldier Application<br>• C4I:BMS<br>• C4I:SA<br>• C4I:SYS<br>• C4I:HRI<br>• Sensor:Self Measurement |
| | • Psychological Operations Services | • All measures to prevent spread of misinformation, discredit adversary claims, intentions and favour own national interests. | |
| | • Provide Transportation | • Provide air mobility services – air lift /drop.<br>• Provide rapid movement of cargo.<br>• Provide operational support airlift. | • SW: Data Exchange<br>• SW: Soldier Application<br>• Sensor:Self Measurement<br>• Sensor: Reconnaissance |
| | • Provide Religious Ministry Support | • All religious activities such as worship, rites, ceremonies and pastoral care including care of the wounded and dying. | |

**Table 2-9 – Linking Capabilities with Operational Services, Operational Activities and DSS Functional Services (CIMIC)**

### 2.3.9 Back-End Services

In addition, there are back-end services which include:

- Technical Services,
- Core Services,
- Communication Services, and
- Cloud Services.

Within Technical Services there are the Community of Interest (COI) Services that support one or many collaborative groups of users with shared goals, interests, missions or business processes. The Core Services provide generic, Community of Interest (COI)-independent, technical functionality to implement service-based environments using infrastructure, architectural and enabling building blocks. The Communications Services interconnect systems and mechanisms for the opaque transfer of selected data between or among access points.

For the DSS the main services at operational level are COI-Specific Services that encompass:

- COI-Specific Communications and Information Systems (CIS) Security Services,
- COI-Specific Service Management and Control (SMC) Services,
- Joint Services,
- Air Services,
- Land Services,
- Maritime Services,
- Joint Intelligence, Surveillance and Reconnaissance (JISR) Services,
- Logistics Services,
- Electronic Warfare Services,
- Environmental Services,
- Civil-Military Co-operation (CIMIC) Services,
- Education, Training, Exercises and Evaluation (ETEE) Services,

Above COI-Specific Services are functional services.

# 3 Integrated Dictionary

## 3.1 Abbreviations and Acronyms

| | |
|---|---|
| AI | Artificial Intelligence |
| ANR | Active Noise Reduction |
| ANS | Active Noise Suppression |
| AR | Augmented Reality |
| BMS | Battery Management System |
| BDA | Bomb Damage Assessment |
| CG | Capability Group |
| CBRN | Chemical, Biological, Radiological, and Nuclear |
| CBRNE | Chemical, Biological, Radiological, Nuclear and Explosive |
| CIMIC | Civil Military Cooperation |
| CAS | Close Air Support |
| CHP | Combat Hearing Protection |
| CID | Combat Identification |
| CTC | Combat Training Centre |
| COP | Common Operational Picture |
| CROP | Common Reference Operational Picture |
| CIS | Communication and Information System |
| COI | Community of Interest |
| DDS | Data Distribution Services |
| DES | Data Exchange Services |
| DNV GL | Det Norske Veritas Germanischer Lloyd (NLD) |
| DEU | Deutschland (Germany) |
| DSS | Dismounted Soldier System |
| ETEE | Education, Training, Exercises and Evaluation Services |
| ET | Ejercito de Tierra |
| NETSEC | encryption of radio network intrinsic signalling |
| EDA | European Defence Agency |
| EU | European Union |
| GOSSRA | Generic Open Soldier System Reference Architecture |
| GNSS | Global Navigation Satellite System |
| GPS | Global Positioning System |
| HW | HardWare |
| HDD | Head Down Display |
| HUD | Head Up Display |
| HA | High Altitude |
| HID | Human Interface Device |
| HRI | Human RAS Integration |
| IS | Imaging Services |
| IT | Information Technology |
| IR | Infrared |

| | |
|---|---|
| ISTAR | Intelligence, Surveillance, Target Acquisition and Reconaissance |
| IP | Internet Protocol |
| ITA | Italy |
| JISR | Joint Intelligence, Surveillance and Reconnaissance Services |
| LCG-DSS | Land Capability Group – Dismounted Soldier Systems |
| LRU | Line replaceable unit |
| MPPT | Maximum Power Point Tracking |
| MDE | Ministerio de Defensa de España |
| MANET | Mobile Ad hoc Network |
| MNF | Multi National Force |
| NAV | NATO All View |
| NCV | NATO Capability View |
| NGVA | NATO Generic Vehicle Architecture (STANAG 4754) |
| NOV | NATO Operational View |
| NSOV | NATO Service Oriented View |
| NSV | NATO System View |
| NTV | NATO Technical View |
| NSFS | Naval Surface Fire Support |
| NLD | Netherlands |
| NEC | Network Enabled Capability |
| NVG | Night Vision Goggles |
| NATO | North Atlantic Treaty Organization |
| NBC | Nuclear Biological Chemical |
| OODA | Observe, Orient, Decide and Act |
| OM | Obsolescence Management |
| OMS | Operational Measurement Services |
| ORBAT | Order of Battle |
| PTZ | Pan-Tilt-Zoom |
| PV | Photo voltaic |
| POL | Poland |
| PRT | Portugal |
| PLI | Position and Location Information |
| PMS | Power Management Services |
| PADR | Preparatory Action on Defence Research |
| PU | Public |
| PTT | Push-to-talk |
| RF | Radio frequency |
| RBCI | Radio-Based Combat Identification |
| RSTA | Reconnaissance, Surveillance, and Target Acquisition |
| RAS | Robotic & Autonomous System |
| SOS | Save Our Souls |
| COMSEC | Secure Communications |
| SMC | Service Management and Control Services |
| SA | Situational Awareness |
| STU | Small Tactical Unit |

| | |
|---|---|
| SW | Software |
| ESP | Spain |
| SSA | Surface-to-Surface Artillery |
| SWE | Sweden |
| SMS | System Management Services |
| SysML | System Modelling Language |
| TES | Tactical Edge Syndicate |
| TSE | Tactical Support Element |
| TSS | Target Surveillance Services |
| TTP | Techniques, Tactics & Procedures |
| TV | Thermal View |
| TRANSEC | TRANsmission SECurity |
| UAV | Unmanned Aerial Vehicle |
| UGV | Unmanned Ground Vehicle |
| VR | Virtual Reality |
| VOIP | Voice Over IP |

## 3.2 Referenced Documents

/1/ GOSSRA Architecture for Standardisation – Volume 1 – All View (NAV) and Summary, PADR-FPSS-01-2017: GA 800783 GOSSRA (Generic Open Soldier System Reference Architecture), BL8464A037 REP, (GOSSRA Deliverable D8.5), V1.0, 30-04-2020

/2/ GOSSRA Architecture for Standardisation – Volume 2 – Capability View (NCV), PADR-FPSS-01-2017: GA 800783 GOSSRA (Generic Open Soldier System Reference Architecture), BL8464A037 REP, (GOSSRA Deliverable D8.5), V1.0, 30-04-2020

/3/ GOSSRA Architecture for Standardisation – Volume 3 – Operational View (NOV), PADR-FPSS-01-2017: GA 800783 GOSSRA (Generic Open Soldier System Reference Architecture), BL8464A037 REP, (GOSSRA Deliverable D8.5), V1.0, 30-04-2020

/4/ GOSSRA Architecture for Standardisation – Volume 4 – Service Oriented View (NSOV), PADR-FPSS-01-2017: GA 800783 GOSSRA (Generic Open Soldier System Reference Architecture), BL8464A037 REP, (GOSSRA Deliverable D8.5), V1.0, 30-04-2020

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