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EDA-Industry Standardisation Conference
Brussels, 04th April 2013

EUROPEAN DEFENCE AGENCY

Enhanced Interoperability for Military Land Vehicle Systems by defining an Open Reference Architecture for Land Vehicles

Dr. Norbert Härle, Rheinmetall Defence Electronics

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Introduction & Background: Current Situation

- **Increasing Total Cost of Ownership of Military Land Vehicles**
  - Due to increasing technology complexity of mission systems (e.g. sensors, effectors, C4I equipments)
  - Proprietary interfaces lead to significant integration costs
- **Civil Automotive Sector successfully developed AUTOSAR (AUTomotive Open System ARchitecture) to standardize HW and SW interfaces**
- **British MoD mandates Open Architecture for Land Vehicles through UK DefStan 23-09**
- **Coordinated Approach at European Level would bring benefits to all EDA participating Member States**

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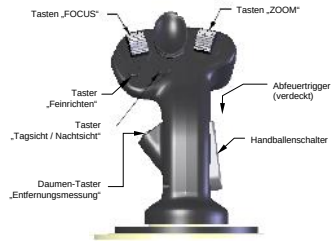
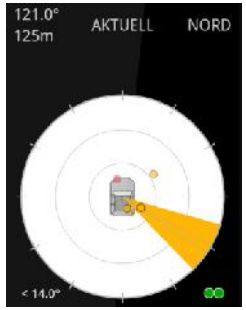
Current Mission Systems | User Interface Concepts | Features/Services

System 1: E/O Panoramic Sensor System
System 2: E/O Sector Sighting System

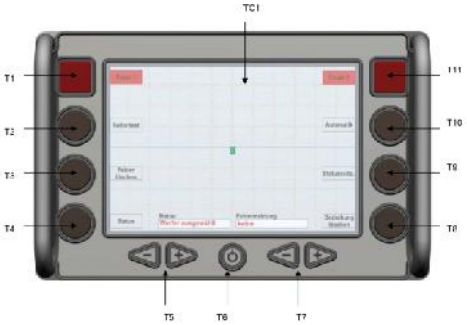
System 4: Remote Controlled Weapon Station



System 3: Acoustic Sniper Detection



System 5: Obscuring Systems



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Land Vehicle with Open System Architecture (LAVOSAR, EDA 12.R&T.OP.336)

Aim: Define Electronic & Information Technological Reference Architecture for Mission Systems of Military Land Vehicles

- **Consolidation of Requirements of Relevant Stakeholders (Procurement, System Integrators, Component Suppliers, Military Users) and Business Cases within European Military Environment**
- **Applying Open Architecture Principles**
- **Reference Solution for Developing and Integrating Vehicle Mission Systems into completely Networked Vehicle**
- **Flexible Vehicle Configuration depending on Vehicle Platform and Mission**

- **To be recommended as Basis for European Standard**
  - Saving Procurement & Life Cycle Costs
  - Improving EU's Defence Capabilities
  - Sustain the Common Security and Defence Policy (CSDP)
  - LAVOSAR could influence NATO GVA (NGVA) STANAG currently under development

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Open System Architecture Principles and Advantages

Open Architecture (OA) is Key to Cost Efficient Vehicle Life Cycle[1]

- Open, publicly available specifications,
- Well-defined, Widely used Non-proprietary (Standard) Interfaces, Services and Formats
- Durable Component Interfaces (stable or slowly evolving)
- Decoupled Mechanical, Hardware, Software Interfaces

- Reduce Vendor Lock-in
- Larger Market, Enhanced Competition
- Continuous Innovation
- Independent Upgrade of Subsystems with minimal Impact on Overall System
- Decrease Costs for System Engineering, Integration, Verification & Validation
- Reduce Training
- Facilitate Equipment Sharing

[1] Definitions based on: Capt. T.J. Strei, United States Navy, “Open Architecture in Naval Combat System Computing of the 21st Century”, 2003

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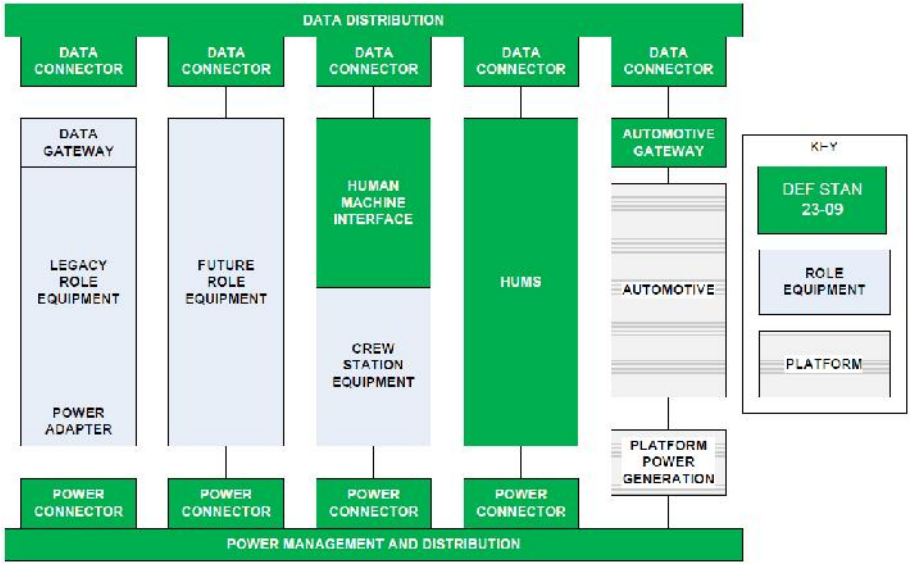
DefStan 23-09, Generic Vehicle Architecture

Approach: Interface Standardization & Design Constraints, e.g.

- IP-Networked Vehicle
- Data Distribution Service (DDS) as Data Exchange Mechanism
- Land Data Model
- Electrical Interfaces & Plugs
- Power Supply
- Common Crew Station
- IP-based Video Distribution (DefStan 00-82)

Interfaces & Boundaries



Objective:

- Improved Operational Effectiveness
- Reduced Integration Risks
- Reduced Cost of Ownership

- Issue 1: 20 August 2010
- Issue 2: October 2011
- Issue 3: to be expected
  - Part 0 – GVA Approach Introduction
  - Part 1 – GVA Infrastructure
  - Part 2 – GVA Human Machine Interfaces (HMI)
  - Part 3 – GVA Health Usage Monitoring System (HUMS)
  - Part 4 – GVA Physical Interfaces

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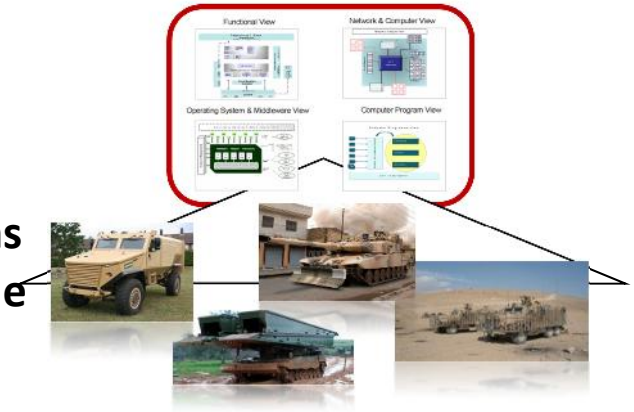
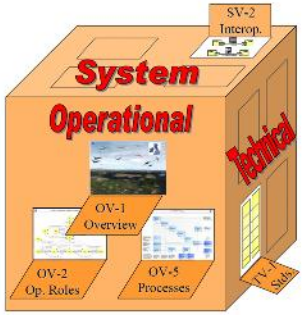
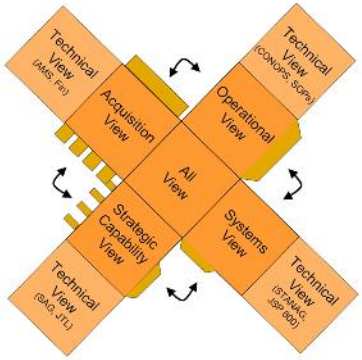
Need for Open Reference Architecture



- **Missionsystem Infrastructure includes Processing Chains with Functions Distributed over Several Devices over the Network, e.g.**
  - Video Processing Chain
    - Image Conditioning / Enhancement, Preprocessing, Compression / Decompression, Transmission, Object / Optical Flow Detection, Clustering, Classification, Tracking, Display
- **True Plug'n'Play requires a comprehensive, overall concept**
  - standardised Open Reference Architecture, focus point of EDA LAVOSAR
- **Types of Architectures**
  - overarching (cross domain, global),
  - base-line (existing, as-is),
  - reference (well proven, to-be),
  - target (specific, transitional)
- **Fundamental Characteristics of all Architectures**
  - uses several carefully chosen views to describe a complex system or structure





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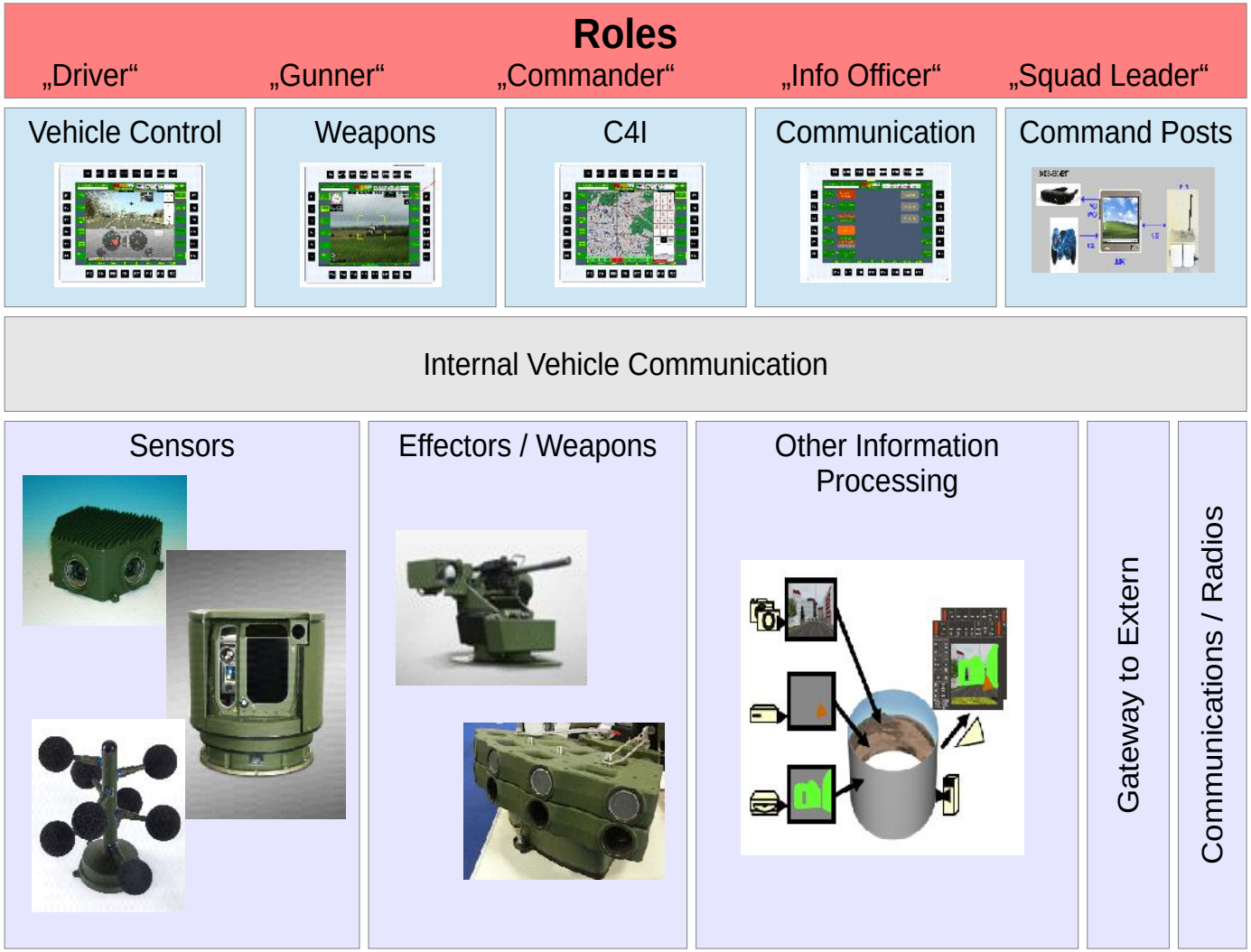
Architectural View Example
- Mission System Elements View



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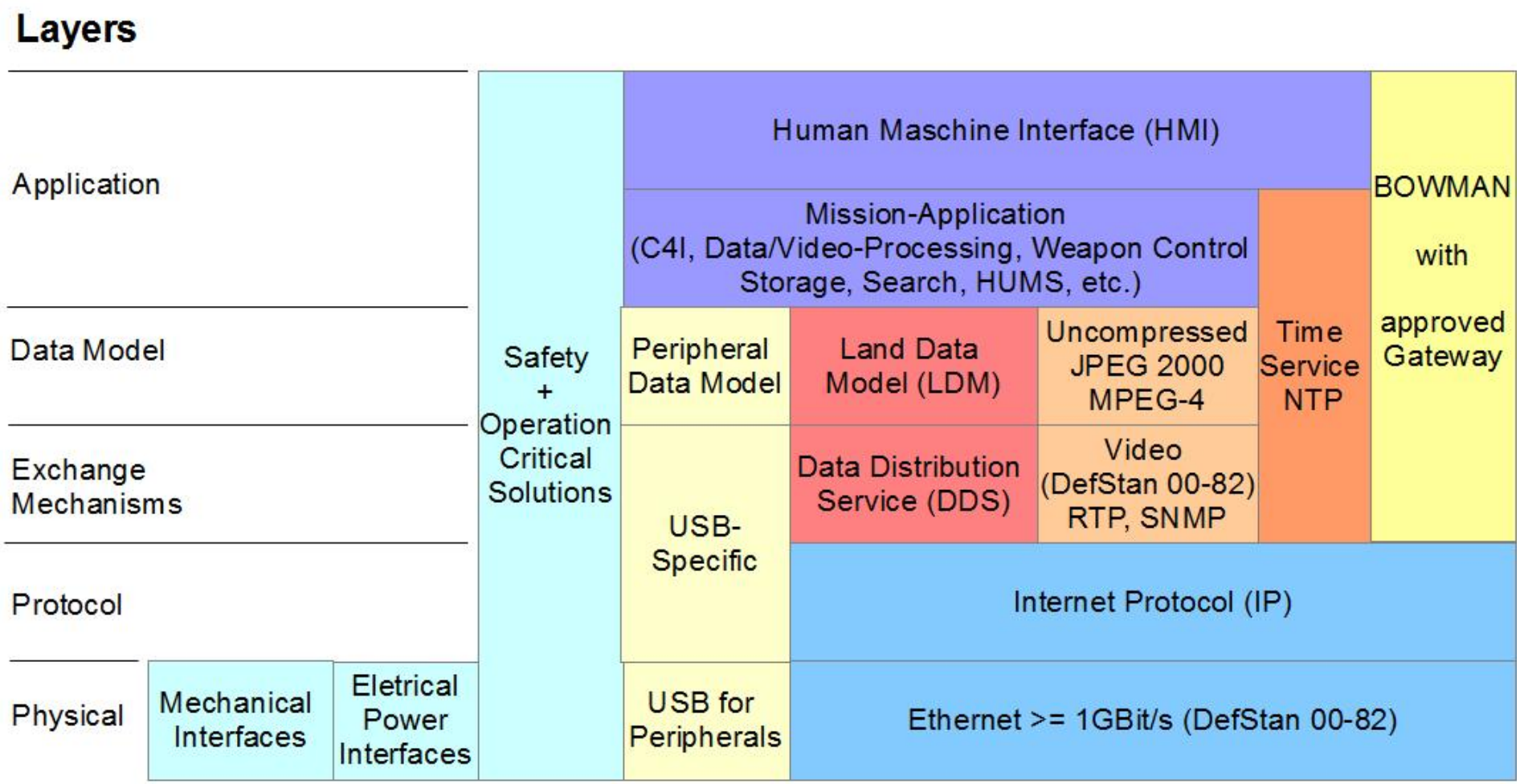
Architectural View Example
- Layer View (developed from DefStan 23-09)



seperate independent implementations for „restricted and below“ and for „confidential and above“

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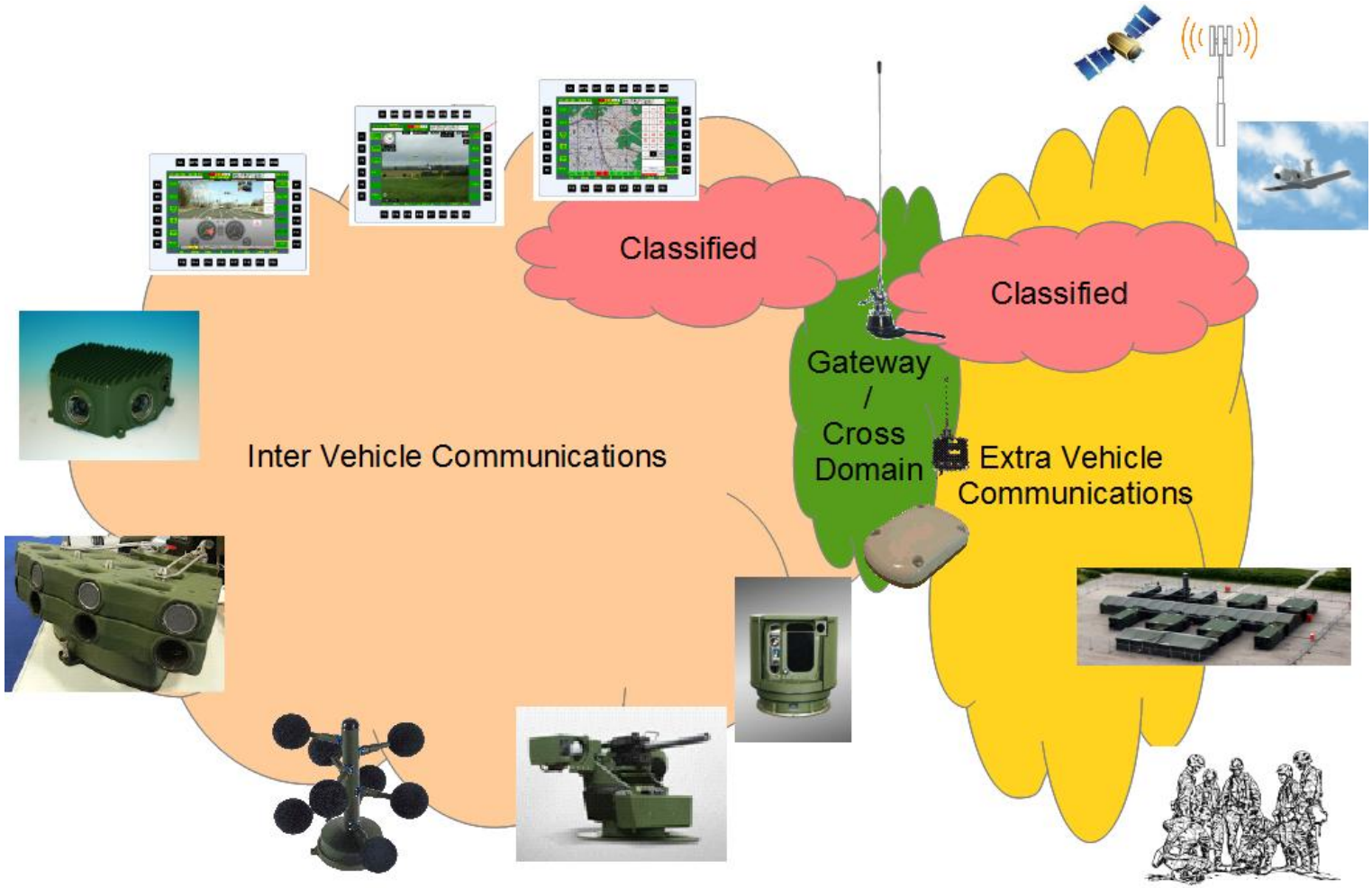
Architectural View Example
- Communication Domain View



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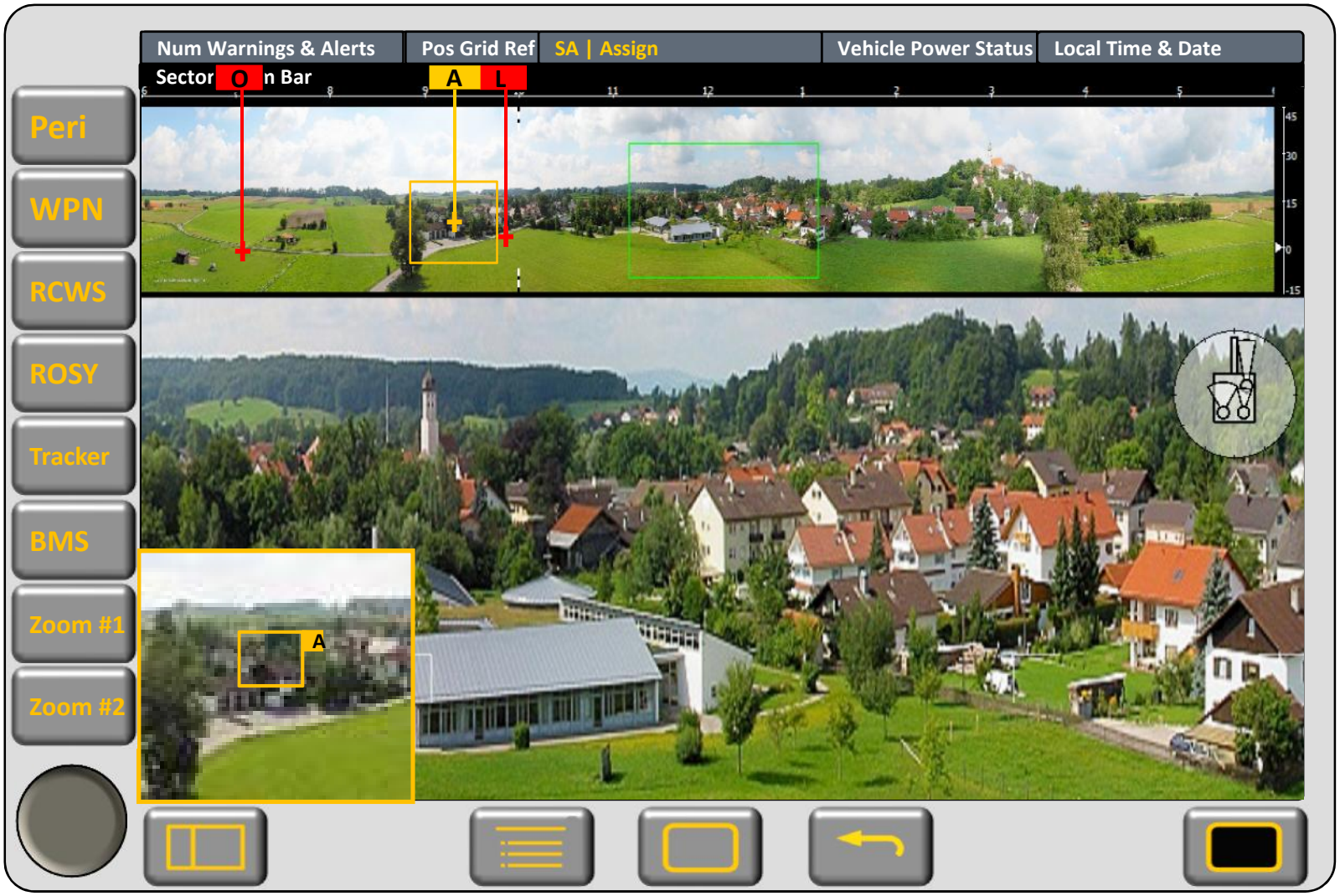
Architectural View Example
- HMI Situational Awareness View - Alarming



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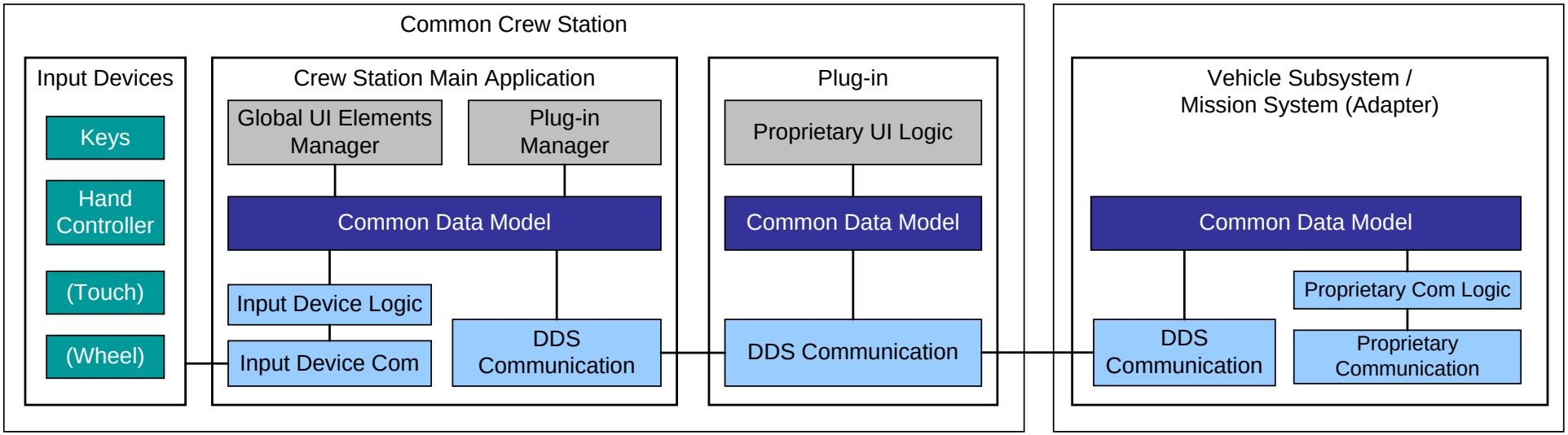
Architectural View Example
- Common Crew Station: Structure



- **Plug-in Manager**
  - registers plug-ins
  - starts or stops plug-ins
  - positions, minimises, and maximises HMI fragments
- **Plug-ins**
  - Global UI Elements (Basic Plugins), e.g. Status Bar, Sliding Side Window
  - standard plug-ins, e.g. HMI for mission systems, data fusion, groupware

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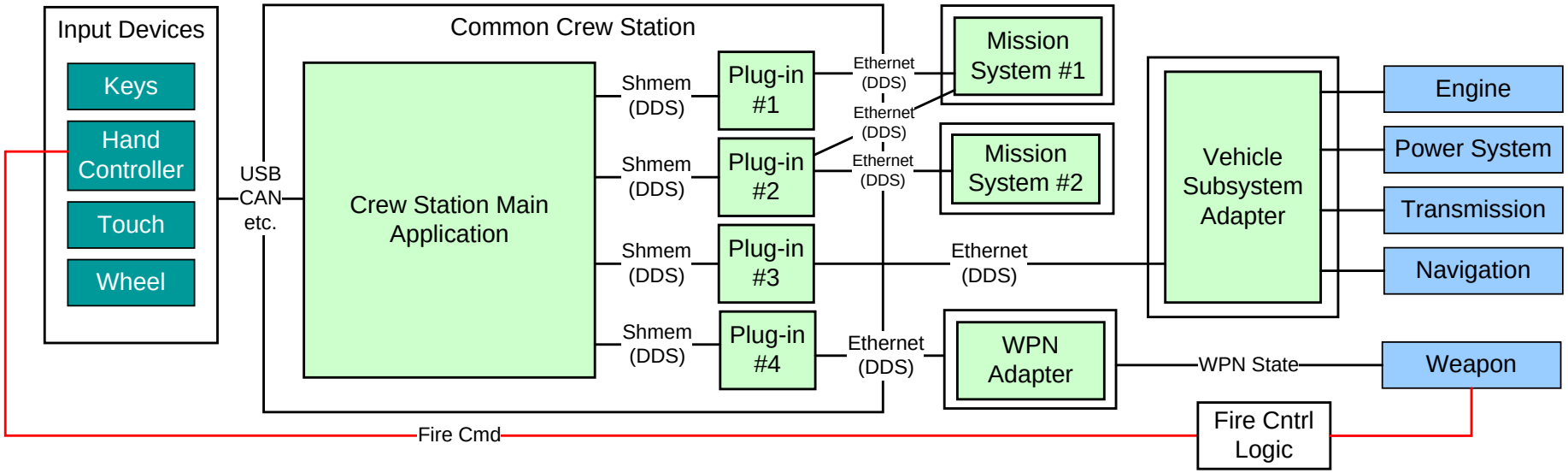
Architectural View Example
- Common Crew Station: Plug-ins



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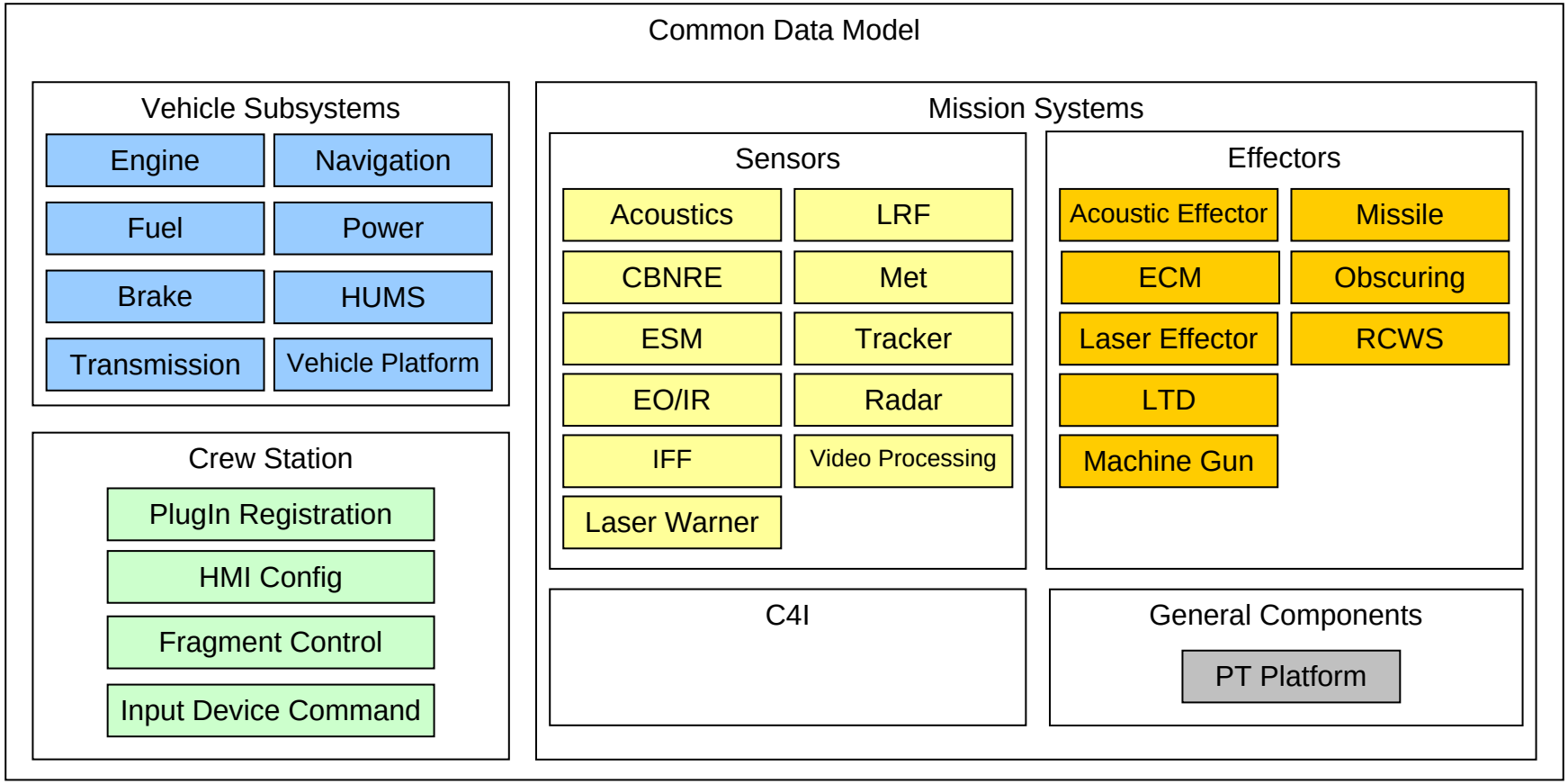
Architectural View Example
- Logical Data Model View



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WP0: Project Management

- Administrative Management
- Technical Management (WPs Coherence)
- Quality Assurance and Configuration Management
- Coordination and Consultation with Relevant Stakeholders

Stakeholder Engagement

- Workshop 1 Procurement / Maintenance
- Workshop 2 Manufacturers, Integrators, Suppliers
- Briefing 1 EDA Industry Conference
- Briefing 2 MSG + MSHT
- Briefing 3 EDA Future Land System Experts Working Group
- Briefing 4 MilVA

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WP1: Standardization and Business Case

- Review Standards and Best Practices
- Create Normative Framework
- Develop Initial Business Case and Roadmap

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WP2 Analysis of Computing and Communication Environment

- Refine Scope
- Collect Information from Technology Stakeholders
- Define Criteria for Assessment
- Analyse and Review Technologies

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WP3 Functional and Technical Architecture

- Identify Domains and Interfaces
- Identify Suitable Architectural Structures
- Develop Architectural Views
- Verify with Normative Framework

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WP4 Specifications, Standards and Design Guidance

- Generate Specifications And Design Guidelines incl. Standards
- Refine Initial Business Case and Roadmap
- Verify with Normative Framework
- Derive Recommenda-tions for a EU wide Framework

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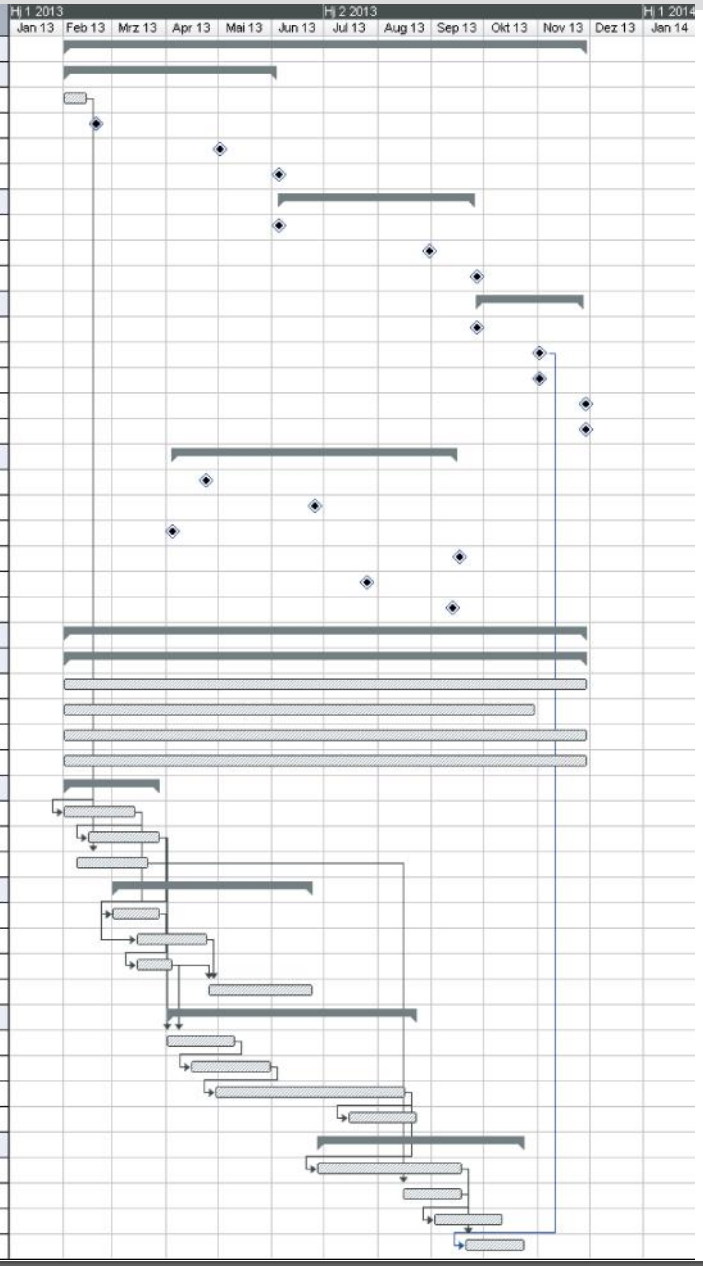
Name der Aufgabe	Dauer	Start	Ende
LAVOSAR Milestones	**216 Tage?**	**01.02.2013**	**29.11.2013**
Phase 1	**87 Tage**	**01.02.2013**	**04.06.2013**
Kick Off Meeting	10 Tage	01.02.2013	14.02.2013
Inception Report	0 Tag	19.02.2013	19.02.2013
Progress Report 1	0 Tag	01.05.2013	01.05.2013
Progress Meeting 1	0 Tag	04.06.2013	04.06.2013
Phase 2	**82 Tage**	**04.06.2013**	**26.09.2013**
Milestone 1	0 Tag	04.06.2013	04.06.2013
Progress Report 2	0 Tag	30.08.2013	30.08.2013
Progress Meeting 2	0 Tag	26.09.2013	26.09.2013
Phase 3	**45 Tage**	**26.09.2013**	**28.11.2013**
Milestone 2	0 Tag	26.09.2013	26.09.2013
Final Report	0 Tag	01.11.2013	01.11.2013
Public Executive Summary and PPT Presentation	0 Tag	01.11.2013	01.11.2013
Final Meeting	0 Tag	28.11.2013	28.11.2013
Milestone 3	0 Tag	28.11.2013	28.11.2013
Stakeholder Engagement	**117 Tage?**	**04.04.2013**	**16.09.2013**
Workshop 1: Government Officials	0 Tag	23.04.2013	23.04.2013
Workshop 2: Industry	0 Tag	25.06.2013	25.06.2013
Briefing at EDA Industry Conference	0 Tag?	04.04.2013	04.04.2013
Briefing of MILVA	0 Tag?	16.09.2013	16.09.2013
Briefing of EDA Future Land System Experts WG	0 Tag?	25.07.2013	25.07.2013
Briefing of EDA MSG and MSHT	0 Tag?	12.09.2013	12.09.2013
LAVOSAR Work Packages	**216 Tage?**	**01.02.2013**	**29.11.2013**
WP0 - Project Management (RDE)	**216 Tage?**	**01.02.2013**	**29.11.2013**
0.1 - Administrative Management	216 Tage	01.02.2013	29.11.2013
0.2 - Technical Management	194 Tage?	01.02.2013	30.10.2013
0.3 - Quality Assurance and Configuration Management	216 Tage	01.02.2013	29.11.2013
0.4 - Coordination and Consultation with relevant Stakeholders	216 Tage	01.02.2013	29.11.2013
WP 1 - Standardization and Business Case (SELEX)	**40 Tage**	**01.02.2013**	**28.03.2013**
1.1 - Review Standards and Best Practices	30 Tage	01.02.2013	14.03.2013
1.2 - Create Normative Framework for Study	30 Tage	15.02.2013	28.03.2013
1.3 - Develop Initial Business Case & Roadmap for an Open Architecture	30 Tage	08.02.2013	21.03.2013
WP 2 - Analysis of Computing and Communication Environment (Thales)	**82 Tage**	**01.03.2013**	**24.06.2013**
2.1 Refine Scope	20 Tage	01.03.2013	28.03.2013
2.2 Collect Information from Technology Stakeholders	29 Tage	15.03.2013	24.04.2013
2.3 Define Criteria for Assessment	15 Tage	15.03.2013	04.04.2013
2.4 Analyse and Review Technologies	43 Tage	25.04.2013	24.06.2013
WP 3 - Functional and Technical Architecture (RDE)	**105 Tage**	**01.04.2013**	**23.08.2013**
3.1 Identify Domains and Interfaces	30 Tage	01.04.2013	10.05.2013
3.2 Identify Suitable Architectural Structures	35 Tage	15.04.2013	31.05.2013
3.3 Develop Architectural Views	80 Tage	29.04.2013	16.08.2013
3.4 Verify Resulting Architecture Against the Proposed Normative Framework	30 Tage	15.07.2013	23.08.2013
WP 4 - Specifications, Standards and Design Guidance (Thales)	**86 Tage**	**27.06.2013**	**24.10.2013**
4.1 Generate Specifications and Design Guidelines	60 Tage	27.06.2013	18.09.2013
4.2 Refine the Initial Business Case and Roadmap defined in WP1	25 Tage	15.08.2013	18.09.2013
4.3 Verify Results Against Proposed Normative Framework	30 Tage	02.09.2013	11.10.2013
4.4 Recommend a European wide Vehicle Electronics Architecture Framework	25 Tage	20.09.2013	24.10.2013



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Workshops & Briefings

Deliverable	Date / Place	Description
Workshop 1	23-04-2013 EDA	Workshop with • government officials from the procurement and maintenance departments of the Ministries of Defence of all EDA participating Member States. Aim: • Information about project and first outcomes • Refinement of initial Work Package 1 results (Normative Framework, Best Practices and Standards, Business Case and Roadmap) • Collection requirements and ideas
Workshop 2	25-06-2013 EDA	Workshop with • platform manufacturers • system integrators • equipment suppliers Aim: • Information about project and outcomes to date • Refinement of Work Package 1 results (normative framework, best practices and standards, business case and roadmap) • Refinement of Work Package 2 results (computing and communication technologies, mission system technologies, current architectural structures, forecasts) • Input to Work Package 3 (current and potential future architectural structures)
Briefing 1	04-04-2013 EDA	Briefing to • EDA Industry Conference
Briefing 2	16/20-09-2013 Munich	Briefing to • Military Vetronics Association (MilVA)
Briefing 3	tbd	Briefing to • EDA Future Land System Experts Working Group
Briefing 4	26-09-2013 EDA	Briefing to • EDA Materiel Standardization Group (MSG) and Materiel Standardization Harmonization Team (MSHT)

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Summary

- **Increasing Technological Complexity of Mission Systems (e.g. sensors, effectors, C4I equipments) for military Vehicles and the Overwhelming use of Information Technology leads to substantial increase of costs due to proprietary interfaces**
- **Coordinated EU Approach would lead to Benefits to Member States**
  - Saving Procurement & Life Cycle Costs
  - Improving EU's Defence Capabilities
- **UK DefStan 23-09 GVA already took an important step in the right direction**
- **An EU Solution is Required with a Standardised Reference Architecture**
- **EU Project "LAVOSAR" (EDA 12.R&T.OP.336) will make recommendations for such a Standardised Reference Architecture**
- **The LAVOSAR work is carefully observed by the developpers of the NGVA STANAG and will have substantial influence**
- **The Project has just started (finish Nov. 2013) and first results will be available soon.**

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