



SKA & Space Exploration

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Africa Managing Director

Agenda

- 
1. Brief Corporate Presentation
 2. Solar Energy Offerings
 3. Space Offerings

DEPENDABLE
TECHNOLOGIES
FOR CRITICAL
SYSTEMS

Critical Software (1/5)

Spin-off of the University of Coimbra in 1998

- Dependable Technologies for Critical Systems

Software engineering company

- Mission: to support mission and business critical solutions

Development of dual use technology: aimed at military and civil markets

- Aeronautics, Space and Defence
- Energy, Finance, Health, Government, Telecom

Engineering Centers

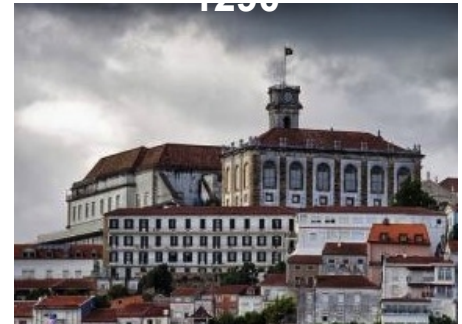
- ~250 engineers

Strong investment in R&D and quality

- CMMI Level 5
- 10% of turnover invested every year in R&D
- More than 20 people allocated to R&D

To become an international software technology and engineering business, recognized for excelling in the provision of pioneering and innovative solutions in multiple markets, while ensuring the highest quality and dependability.

Coimbra University:
1290



CMMI[®] 5
RATED LEVEL
APPRaised BY KAMO CONSULTING LLC
CMMI is registered in the U.S. Patent and Trademark Office by Carnegie Mellon University



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BUSINESS UNIT

Aeronautics, Space, Defence and



Dual Use
Technology

BUSINESS UNIT

Enterprise Critical Solutions



Dual Use Technology

October 2001	Nov. 2001	May 2003	March 2004	Dec. 2004	March 2005
Quality Department is formally created	1° SPICE Assessment ISO15504	2° SPICE Assessment ISO15504	ISO 9001 TickIT Certification	ITIL Certification	ISO 9001 TickIT Certification
Set. 2005	March 2006	March 2006	Dec. 2008	Dec. 2009	June 2011
AQAP Certification	EN 9100 & 9006 Certification	CMMI Level 3 Certification	Certification on Six Sigma practices	CMMI Level 5 Certification	CMMI Level 5 Intermediate Internal Evaluation

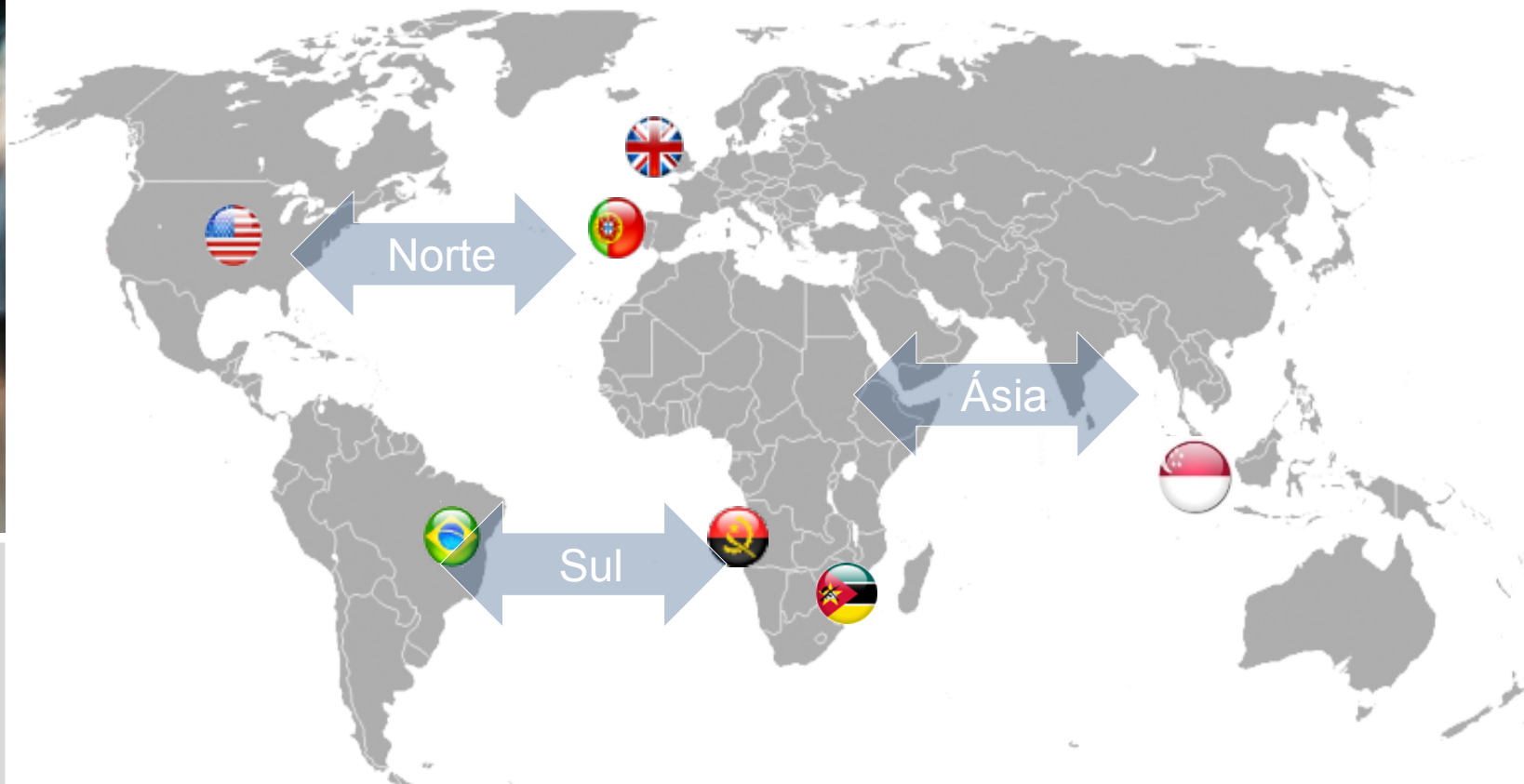


June 2012

**CMMI Level 5
Certification
renewal**

Critical Software | Critical in the World

(4/5)



Exports represent ~80% of the turnover

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Critical

software

Critical Software | Markets and Customers (5/5)

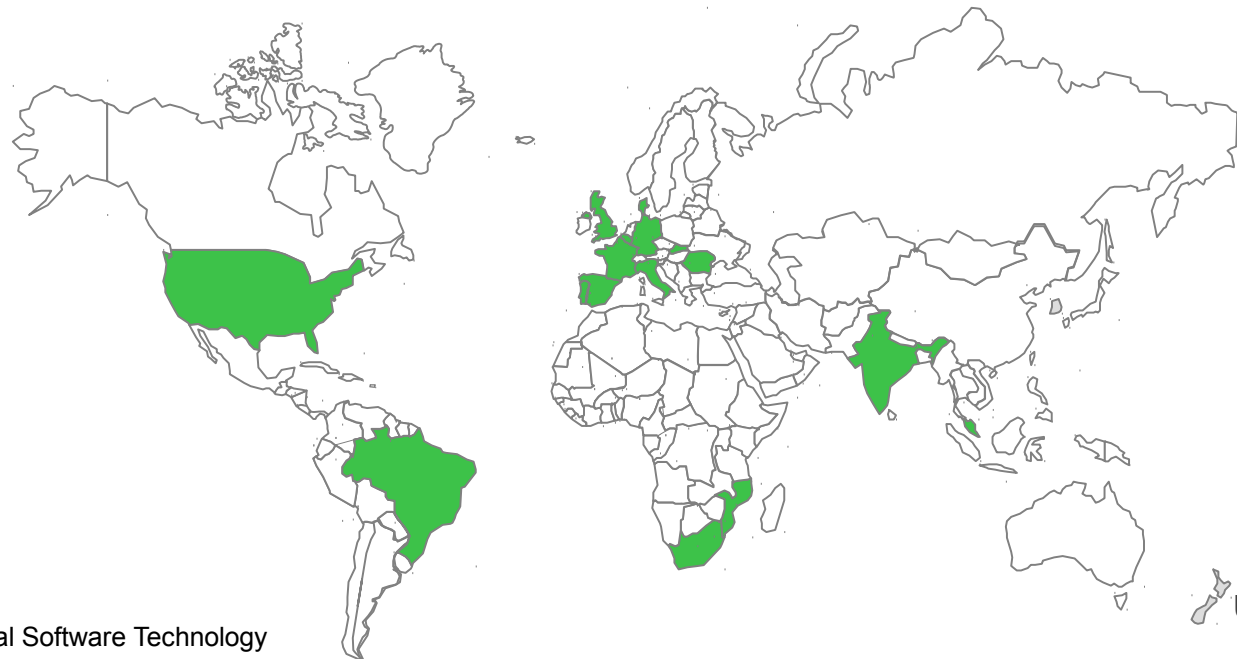


Solar Energy

Feel Our Energy

CSW Energy Management Systems Coverage

- 16+ GW Managed Worldwide: 7 GW Thermal, 0.7 GW Wind, 0.1MW Wave, 0.2GW Solar and 9GW Hydro
- 17+ Countries
- 200+ Power Plants Integrated
- 7 different generation technologies



Belgium
Brazil
Cape Verde
Denmark
France
Germany
India
Italy
Mozambique
Portugal
Romania
Singapore
Slovakia
South Africa
Spain
United Kingdom
United States



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WAVE



WIND



SOLAR

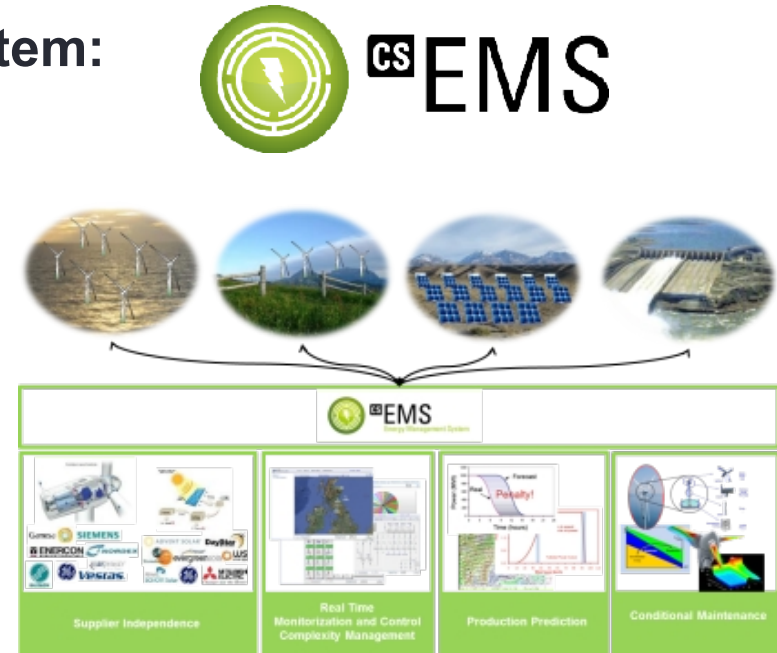


HYDRO

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Integrated Generation Asset Management System:

- Centralized real-time integrated management of multiple production centers geographically distributed
- Supports main wind turbine or solar panel OEM vendors
- High data buffering capabilities mitigating loss of information due to loss of communications
- Equipment outage time quantification and analysis providing the right information to ensure proper SLAs compliance
- Customizable dashboards and reports allowing detailed analysis and ensure keeping know-how in the company
- Total scalability and flexibility to easily adjust to different company strategies and sizes



Martifer Solar

• Challenge

- Enable Martifer Solar to retrieve operation data from the several production centres (solar farms) geographically distributed

• Solution

- Remote supervision, control and data acquisition 24/7
- Distributed system consisting of central and remote sites
- Web based user configurable command and control platform

• Key Benefits

- Single web based interface to monitor and control the entire energy production
- Operational, management, contractual and ad-hoc reporting capabilities
- Multi layer command & control chain
- Increasing effectiveness (kWh produced) – improved O&M
- Generic system, independent of equipment manufacturers
- Real-time solar farm monitoring
- Highly



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FUNAE (Off Grid Control)



- Challenge**

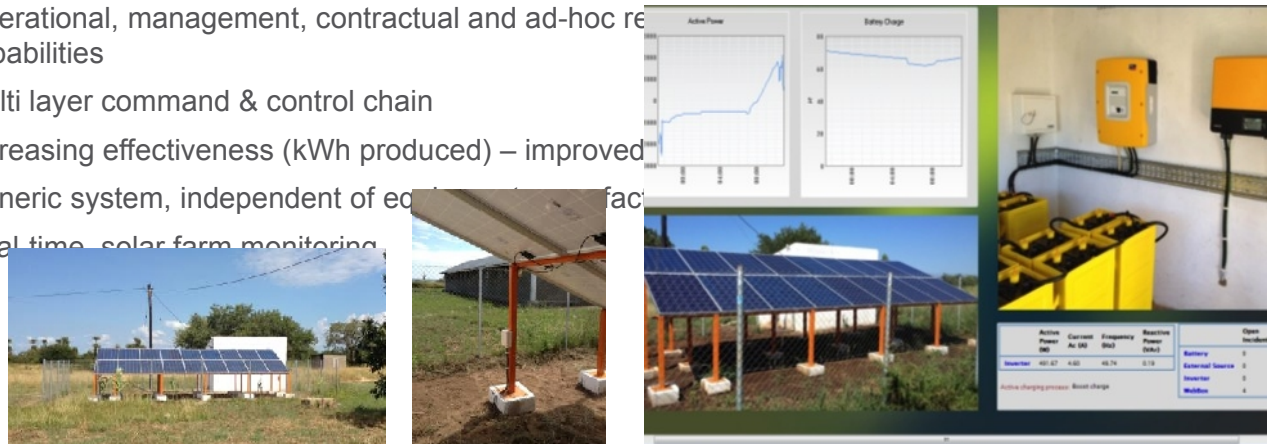
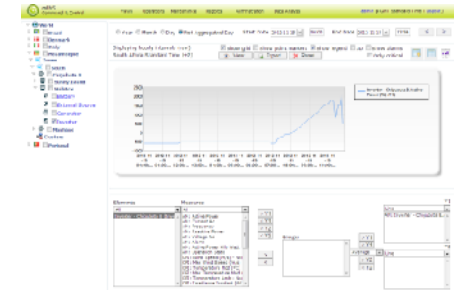
- Enable FUNAE to retrieve, and manage operational data from the several remote island production centres (solar platforms) geographically distributed and off grid

- Solution**

- Remote supervision, control and data acquisition 24/7
 - Distributed system consisting of central system in SaaS mode
 - Web based user configurable command and control platform

- Key Benefits**

- Single web based interface to monitor and control the entire energy production
 - Operational, management, contractual and ad-hoc reporting capabilities
 - Multi layer command & control chain
 - Increasing effectiveness (kWh produced) – improved productivity
 - Generic system, independent of equipment and facilities
 - Real time solar farm monitoring



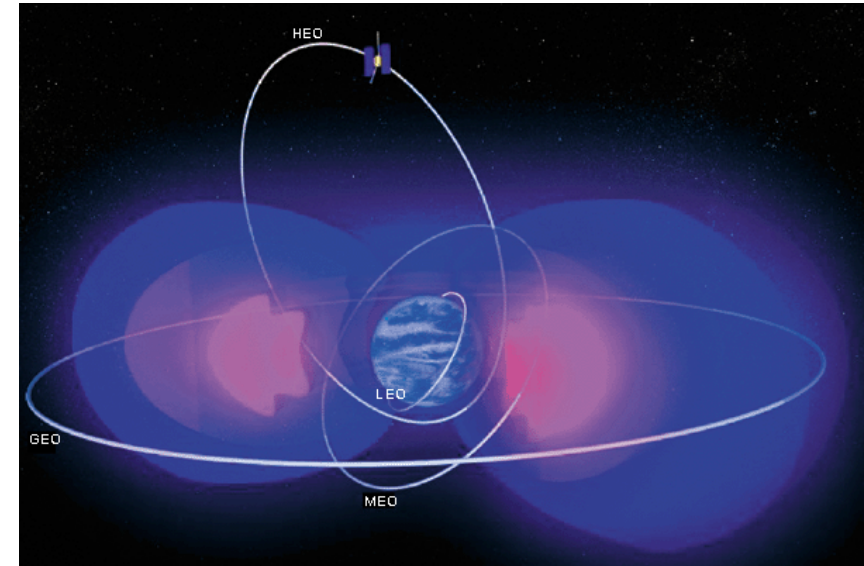
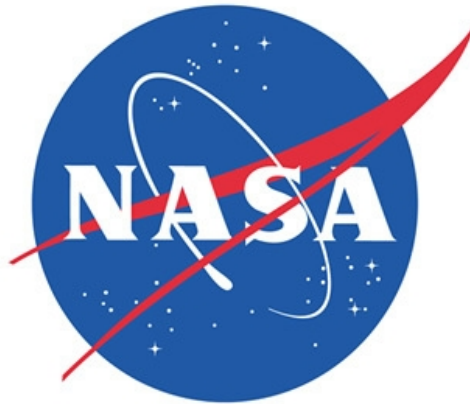
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Space

Critical

software

How did we get there?

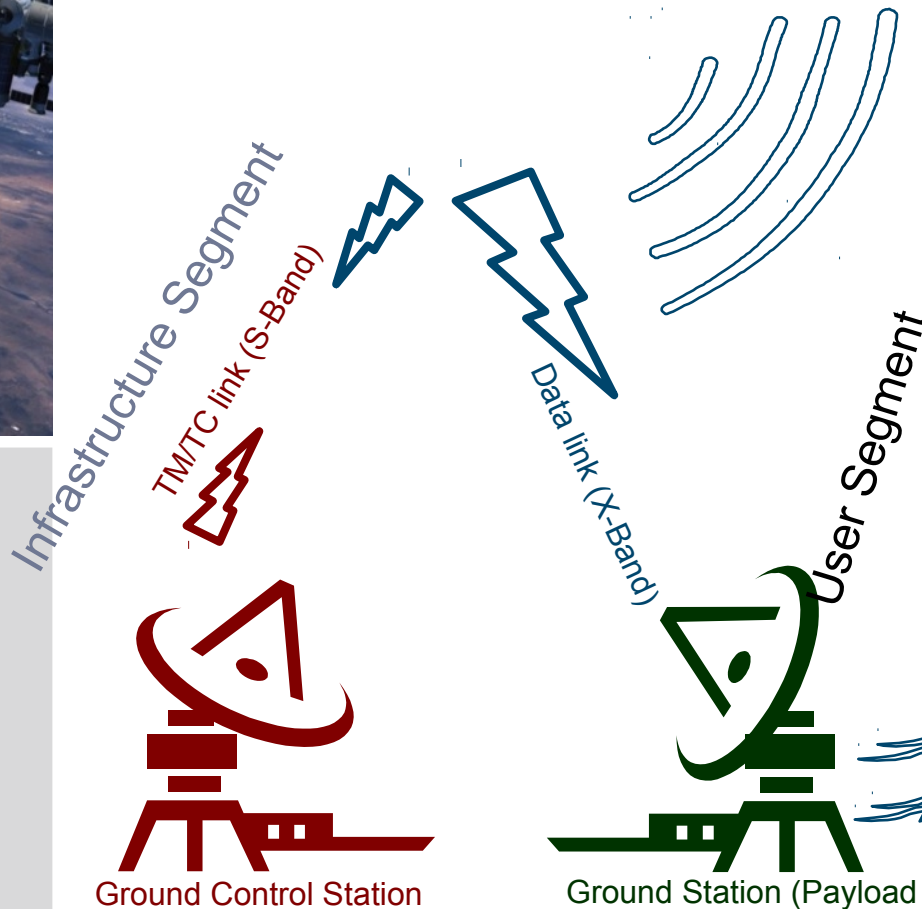


Critical

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An Integrated Market Presence

End User Segment



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Overview

- Safety Critical development of software solutions (real time and embedded, satellite on-board software), real-time systems (specification, design and development, distributed architectures, IMA and data distribution services) and advanced engineering (parallel computing, control engineering and programmable logic)
- Safety Critical Validation: system/software V&V and RAMS, safety critical assessment (on-board and airborne systems); software certification (ARP4754/ARP4761 for airborne and ECSS Q-40 and NASA STD-8719.13 for on-board systems) and software certification support (DO-178B)
- Critical track record includes work with the four main space agencies: ESA, NASA, JAXA, CASC

Supplier of software solutions, certifiable services and products for subsystems and interfaces since 1998.



中国航天

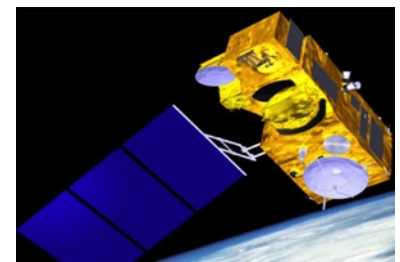
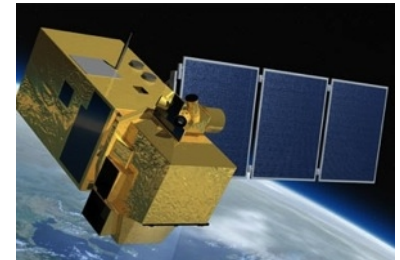


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ESA Sentinel Missions

- **Sentinel-1**
 - C-Band SAR payload following a Sun-Synchronous orbit with a 12 days repeat cycle
 - Critical Software is responsible for the ISVV
- **Sentinel-2**
 - Multispectral instrument spanning from visible to near-infrared; follows a Sun-Synchronous orbit with 5 days revisit time
 - Critical Software is responsible for the development of the on-board Central Software (AOCS, MSI and THC Subsystems)
- **Sentinel-3**
 - Four scientific instruments (OLCI, SLSTR, SRAL and MWR) following a Sun-Synchronous orbit with a 27 days repeat cycle
 - Critical Software is responsible for the development of the on-board Central Software (MAS and parts of the SMS)

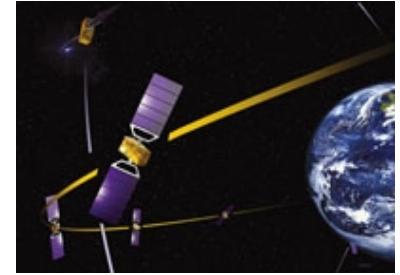


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Galileo – Payload Security Units



- **Challenge**

- Both platform and payload telecommandz and telemetry need to be protected from unauthorized access to guarantee navigational safety. Due to its criticality, both the platform security unit and the payload security unit had to be developed under the Galileo software norms applicable for DAL-B software

- **Solution**

- Critical Software developed the on-board encryption subsystem software to manage the platform and payload security units
- Guaranteeing the implementation of the demanding Galileo software norms under DAL B critically level which is comparable to the norm DO-1788 DAL B. The developed components will be used in the four satellites of the in-orbit validation phase

- **Benefit**

- The platform security unit and the payload security unit were proved to be highly reliable and mature which lead to successful milestones and eased the integration phase

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Space Verification & Validation

- **Challenge**

- Verify and Validate software according to rigorous standards and mission requirements

- **Solution**

- Static and dynamic analysis, test design, implementation and execution, specialized, specialized testing tools to improve productivity

- **Benefit**

- Ensure compliance with the applicable critically levels and overall mission success, as well as having Critical Software's best practices on V&V converted to an ESA Guide for V&V activities



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csXluna

- **Challenge**

- With the increase of the resources of on-board systems, we can now consider porting complex applications to perform tasks such as science data processing or autonomous mission planning
- Develop a reliable RTEMS/Linux based kernel that can be used for both payload and avionics applications

- **Solution**

- RTEMS/Linux based kernel
- Standard programming interfaces (e.g. POSIX, μ ITRON API)
- Co-existence of real and non real time tasks
- Spatial partitioning

- **Benefit**

- Allow for the integration of applications developed for Linux, without extra validation/qualification effort from Space Systems and without compromising the Hard Real Time critical applications



CS XLUNA



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Overview

- Mission Control Systems (SCOS-2000 Monitoring & Control System)
- Mission Planning Systems
- Simulation systems, particularly Operational Simulators and Validation Facilities, to support the validation of both Spacecraft Instruments and subsystems as well as Ground Control Systems
- Critical track record includes work with ESA and main European primes in the Ground Segment Domain



Supplier of software solutions for mission control, modeling, simulation, control and intelligence (C2I).

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SWARM Operational Simulator

- **Challenge**

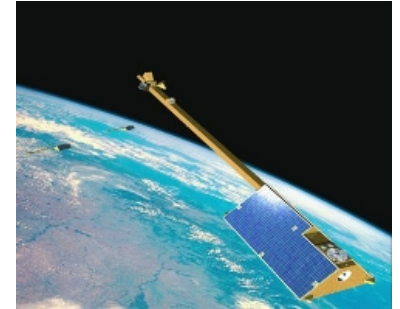
- Simulate SWARM operation environment
- Train SWARM operators
- Validate mission's ground segment and operational procedures

- **Solution**

- Design and implement payload and platform modules that simulate SWARM behaviour
- Model-driven software development approach based on EGOS-MF
- Constellation management as simulation

- **Benefit**

- Integration guaranteed with the remaining simulation infrastructure (SIMULUS) due to usage of well established standards such as SMP2
- Cost effective simulation environment





Technology Harmonization – REF GS SW

• Challenge

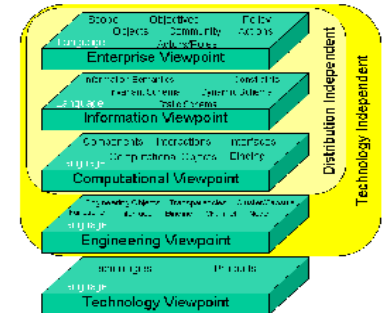
- Reduce diversity of products used in the ground segment and improve interoperability

• Solution

- Specify standar functions, interfaces and services using a methodology which combines RM-ODP, SOA and MDA
- Usage of Platform Independent Models (PIM) and Platform Specific Models (PSM)

• Benefit

- High Level Requirements for the Ground Systems Software
- Reference Architecture for Ground Segment Systems encompassing Information, Service and Interface Model
- Standard ICDs which can be reused in a wide variety of ESA Missions



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Overview

- Earth Observation Emergency Services: fire monitoring, burned areas, landslides and flooding mapping
- Earth Observation Land Services: land cover and land use, desertification monitoring, forestry management, spatial planning (forecast and urban land use planning); water monitoring (water balance, flow rates and depths of river and lakes, soil moisture level)
- Critical track record includes work with the Portuguese Ministry of the interior, pulp and paper producers, ESA, the Portuguese Navy, the European Community and the World Bank



Supplier of Earth Observation solution
and Downstream and User Segment
services.

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csEmergency – Emergency Management

- **Challenge**

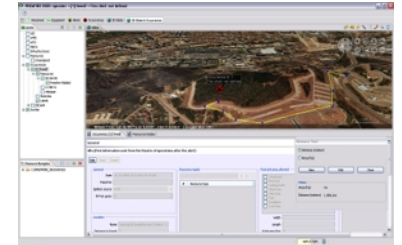
- Develop a generic platform for emergency management: fire and rescue service, emergency medical service and police safety service

- **Solution**

- Distributed client-server system, supporting all the emergency phases and managing all the related information
- Set of tools to manage users, roles, hierarchical levels, permissions and their geographical position; vehicles and their geographical position; alerts and occurrences

- **Benefit**

- Ability to manage generic or specific emergency scenarios by any entity
- By being fully configurable, this platform can be adjusted at any time, in order to be applies in new realities
- Ability to integrate data from external EMS (Emergency Management Systems) following common messaging protocols





Desertwatch

• Challenge

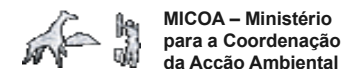
- Develop a system based on satellite images that permits to produce land use and desertification information
- Methodology for monitoring desertification processes that complies with the directives of the UNCCD
- Operation in Portugal, Brazil and Mozambique

• Solution

- Processing chains which only requires data from satellite sensors and whose products are, whenever possible, free of charge to users
- Information system without the need for licensing, implementation in open source GIS tool, with only small implementations/integrations
- Software tool that allows semi-automatic processing of satellite images for information extraction

• Benefit

- Semi-automatic processing of data from Earth Observation to extract the mapping of occupation and indicators of desertification based exclusively on satellite images
- Ability to use anywhere in the world (data), free for any user with minimal training





Africa EO Forestry Management

- **Challenge**

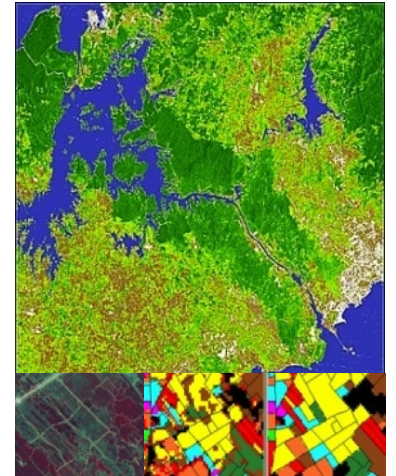
- Analyze concession land in Africa: What roads/paths exist on the land? Who is occupying the land? What use have the land right? What are the conditions of the forest areas?

- **Solution**

- SPOTView Ortho – Level 3 (2.5 meters) and multi-temporal Landsat (30m)
- Pathways and settlements digitalization and visual classification
- Segmentation of the high spatial resolution images; non-assisted classification of Landsat images; integration of the results of the two processes in order to obtain for each segment a land cover class (forest/agriculture/other)
- Integration of forest segments with vegetation index (NDVI) in order to estimate the quantity/vitality of vegetation

- **Benefit**

- Settlements/pathways/agricultural areas – Who is exploring the land?
- Land cover – Where can it be explored?
- Roads, pathways and vegetation status – How can it be explored?





Rio de Janeiro LandSlide Prevention

- **Challenge**

- Demonstrate the usage of VHR imagery in the identification and classification of housing built in order to:
- Improve Urban development (identify vacant, under-utilized or industrial areas – along with new transport investments – for housing development)
- Define flooding scenarios on low-lying areas
- Support the identification of housing built on areas at risk of floods (low-lying areas) or landslides (steep hills)

- **Solution**

- Provision of high resolution DEM and Slope maps
- Production of VHR Land Use with hierarchical nomenclature for multi-scale analysis and applications
- Land Slide Risk areas

- **Benefit**

- Act preventively to discourage informal settlement on risk areas
- Identification of land for further urban development



Overview

Engineering Services

Safety Critical
Development

Safety Critical Validation

Verification
and Validation

Reliability,
Availability,
Maintainability
and Safety
Analysis

Systems
Integration

Security

ASD&
T



AERONAUTICS



SPACE



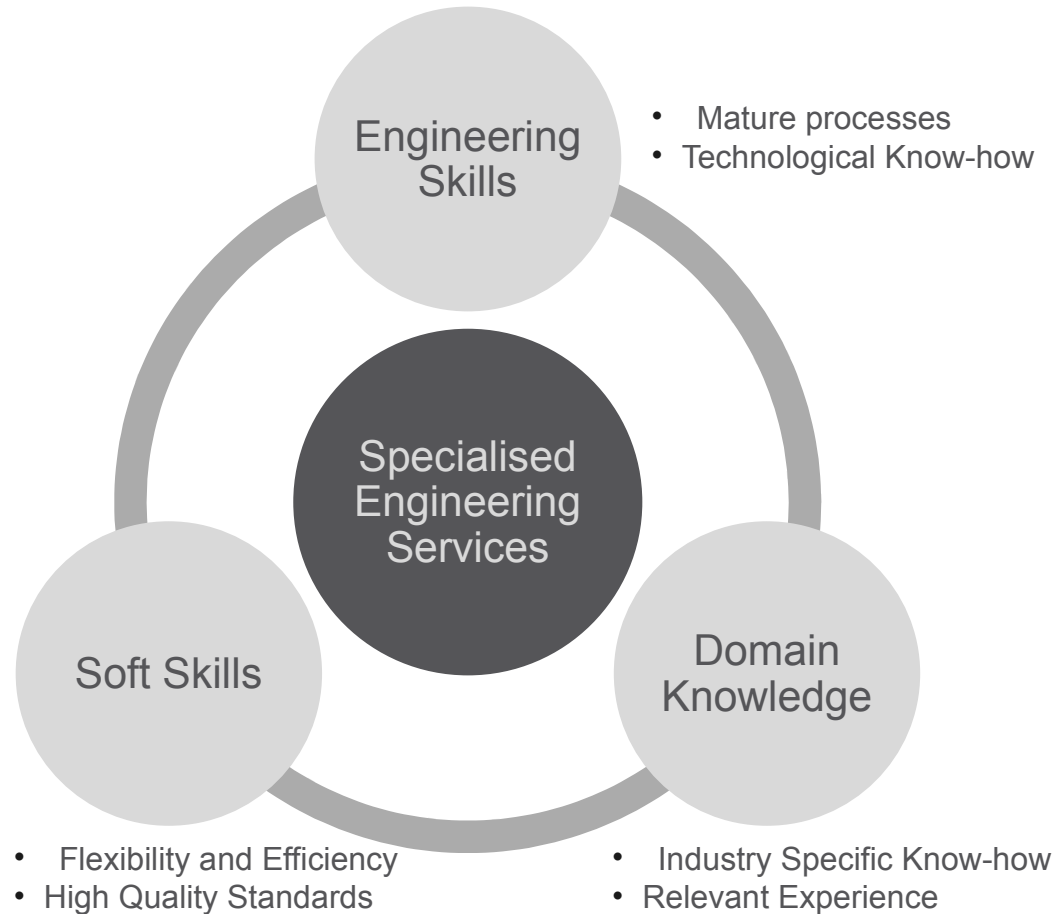
DEFENSE & SECURITY



TRANSPORTS

DEPENDABLE
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Our Approach



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