



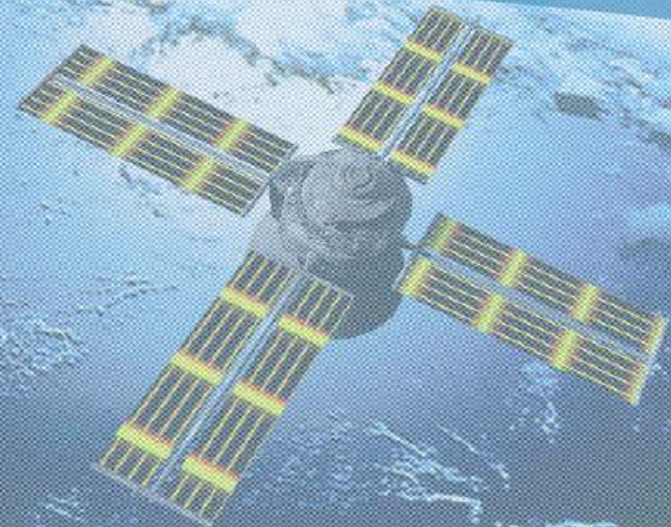
CS & SPACE



Presentation to:



CONCEPTEUR, INTÉGRATEUR ET OPÉRATEUR DE SYSTÈMES CRITIQUES





CS, designer, integrator & operator of mission critical systems

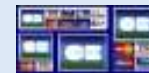


- Prime contractor for turnkey systems, featuring innovation and performance
- Active across the entire value chain: Consulting, Design, Build, Run
- Culture of expertise & innovation
- www.c-s.fr

170 M
in revenues

1700
employees worldwide

1480
employees in France
220
employees abroad



CON



DSNA

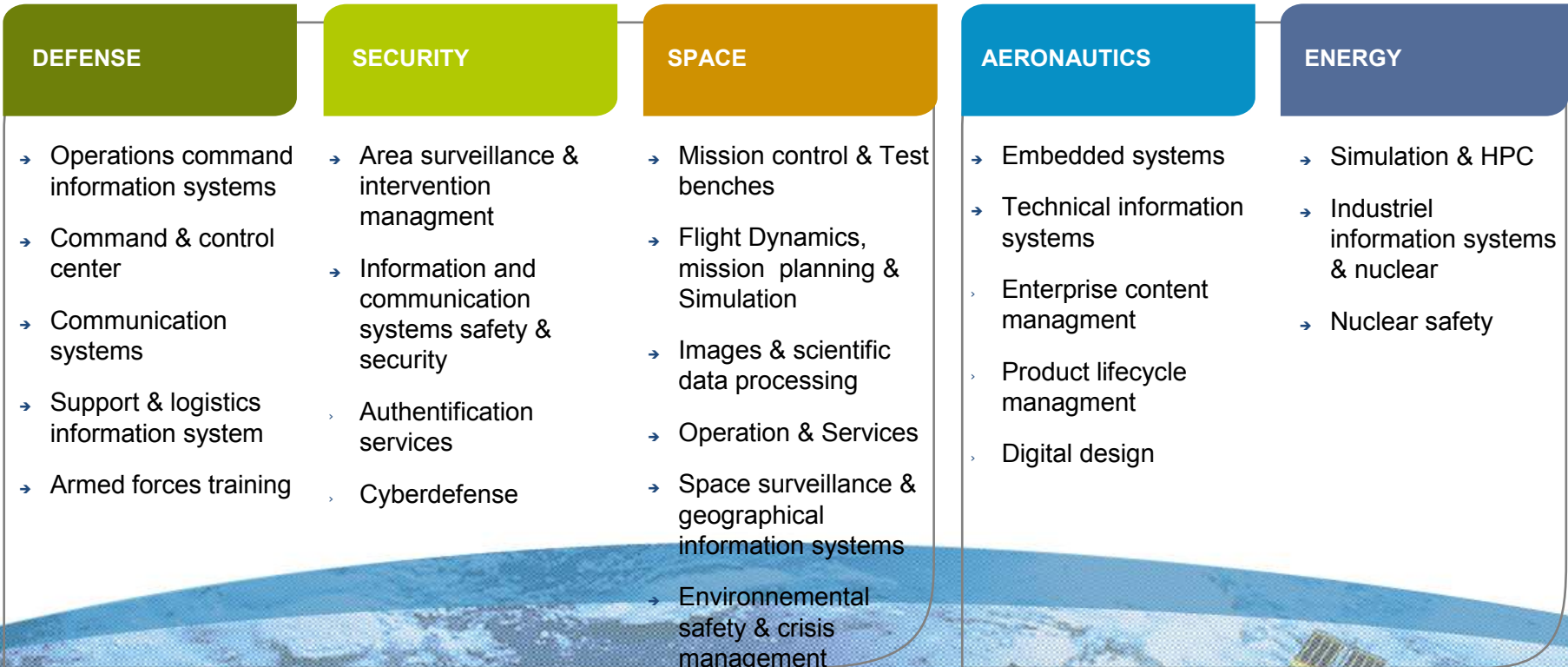


Pratt & Whitney
A United Technologies Company





Fields of activities



DIGINEXT PRODUCTS

A CS group subsidiary, Diginext ensures product industrialization and marketing in the fields of :

- Tactical data links (TACTX, STARLINX, SOLSTICE)
- Simulation and virtual reality systems (VisualSim, CS Wave)
- Navigation, géolocalisation et détection (MILGPS, LORANC, STRADIVARIUS)
- Systèmes d'information pour les transports publics (MOLBILTX)

CONCEPTEUR, INTÉGRATEUR ET OPÉRATEUR DE SYSTÈMES CRITIQUES

Space & Intelligence Business Unit



CONCEPTEUR, INTÉGRATEUR ET OPÉRATEUR DE SYSTÈMES CRITIQUES

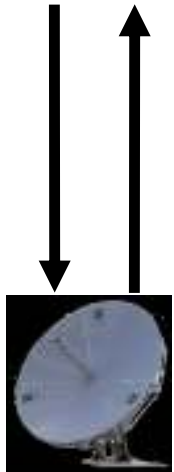
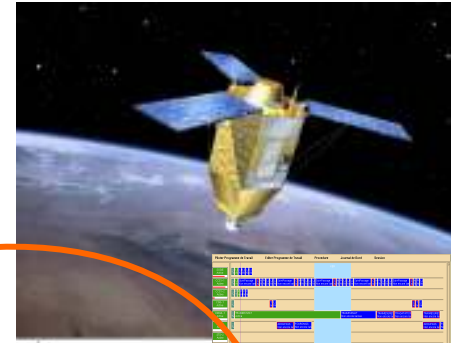
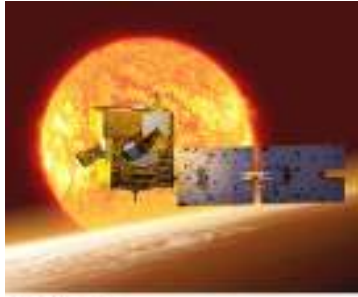


Extensive portfolio of software and services dedicated to space

On-Board Software

Control ground segment

User ground segment



Ground Stations & User terminals

Skill Centers

**Mission Control
Flight Dynamics
Mission Planning
Image Processing
Embedded Software
Simulation
Maintenance
Training & Operation support**

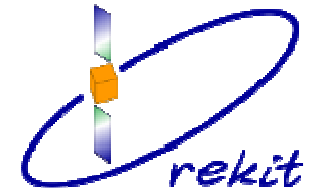


Data management, secured networks & applications



Final users

➔ Open Source Strategy

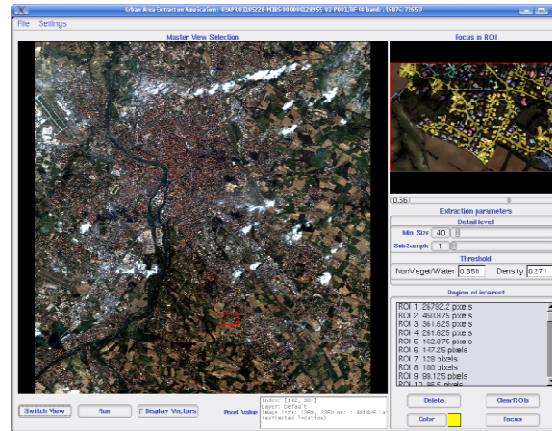


➔ OREKIT

- Flight Dynamics Library, Fully Java
- Governance Board opened
- Major applications:
 - SIRIUS: FDS for CNES
 - SKAT (Station keeping strategy analysis) for EUMETSAT, just delivered with congratulations of the customer
 - THALES ALENIA SPACE, THALES IS, ASTRIUM, LOGICA (hummingbird)
 - Training: SUPAERO, Munich University, French Dod

➔ OTB

- Image processing



➔ IMOGEN: MMI generation for ECLIPSE RCP



➔ Major references

- ➔ **First space software provider for CNES**
- ➔ **Prime contractor (FCO) for ESOC/GFC8**
 - Positions in Flight dynamics
 - GIMUS: maintenance of MCS and general application systems
- ➔ Earth observation (SPOT, HELIOS families, PLEIADES, SAR LUPE, VENUS, **SENTINEL 2**, ...)
- ➔ Telecommunication satellites LEOP and station keeping control centers and flight dynamics
- ➔ Scientific missions (SSALTO, SIPAD, MYRIADE, MARS, ROSETTA, ...)
- ➔ Launcher & Human spaceflight (ARIANE, VEGA SOYOUZ, ATV)
- ➔ **Space Situation Awareness** (TLE, CO...)
- ➔ GEOINT & IMINIT (DNG3D program – KHEPER, GEODE4D Program, SEVI)



CS ROMANIA

a CS Group Company

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CONSULTING / DESIGN / BUILD / DEPLOYMENT / RUN →

THE POWER OF INNOVATION





A general overview on Company, can reveal today:



→ What kind of business it done

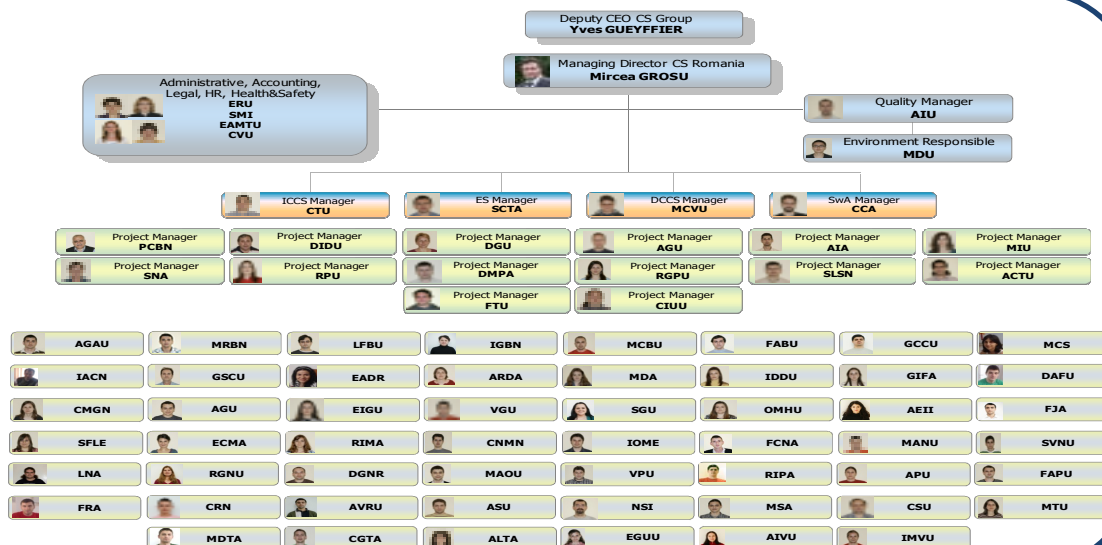
- Software applications development based on clients requirements
- IT R&D projects and in-house software products development
- Command and Control Systems – SCADA, Automation, Control Centers
- IT software Outsourcing

→ The Operational units

- Software Applications Development & Maintenance
- Embedded Software
- Command & Control Systems Design and Development
- Integration and Maintenance of Command & Control Systems

→ The most important capital

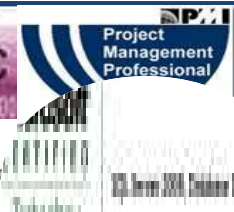
- 85 employees: 77 eng. in Computer Engineering, Control Systems and Informatics - Master and PhD levels
- Employee attrition rates are low compared with the industry attrition rates in Romania : 3.5% - 2006, 7.4% - 2007, 6.5% - 2008, 4.5% - 2009, 4% - 2010, 3.5% 2011, 4% - 2012



→ Certifications & Partnerships



SQL Server 2008





The offered services aim at some target industries, and are based on the good understanding of the clients business



➤ Aeronautics&Space

- Total or partial outsourcing of the life cycle of embedded software development
 - R&D, Specification, Design & development, QA & Testing
- Remote working in integrated teams
- Increase customer teams
- Meeting industrial standards for software developments: **DO178B**, all levels

➤ Energy&Environment

- Operational Information Systems
 - Command & Control Centers
 - Energy Generation Management Systems
 - CRM and Energy Trading
- SCADA & DCS Systems
- Prime contractor or subcontractor
- Partners in R&D Environmental Projects

➤ Intelligent Transportation

- ITS for highways – BackOffice System
- Railways – Embedded Software Development
- Command & Control Systems for locks on rivers
- Remote working in integrated teams
- Meeting industrial standards and methodologies for software developments: Safety Integrity Level (SIL1-4), Agile

➤ Top clients





For Aeronautics&Space industries, the services are performed by a young team, with the fastest growing in the last years



- Software Services Center for BUs Aeronautics & Space
 - Opened in 2005; audits performed by Thales Avionics, Turbomeca, SNECMA / SAGEM and EADS before the beginning of the first collaboration
 - 35 well skilled resources today, working in integrated teams with CS Aeronautics and Space BUs
- Examples of Aeronautics projects
 - Airbus: new versions Flight Warning System for A350/A380/A400M and Air Traffic Control ((DO178B A-C)
 - Thales Avionics: Applications for Cockpit Avionics Suite of Sikorsky S76-D helicopter: MapWorkShop (DO-178B level C,D + DO200), Unit Tests (DO-178B levels A-C), IVV FDS (DO-178B level A, B)
 - Liebherr: OPS ACCU (Operational Software for Air Conditioning and Control Unit) for A400M, (DO178B B)
 - SAFRAN (SAGEM, Turbomeca), Pratt & Whitney: Digital engine control (FADEC, DO 178B A)
- Participation to Space projects
 - CNES, Scientific programs:
 - SW evolutions for project STILO, conception and development of remote controls for satellite mission JASON-2
 - SW development for Interface Control Unit - MICROSCOPE satellite, MYRIADE series
 - SW development for CU (Charge Utile - Payload) - PICARD satellite, MYRIADE series
 - EUROCONTROL:R&D projects, flight data processing&forecasts (CONTRAILS, GAES-MOVE and WISDOM)
 - ESA: A proposal was submitted for the 1st call for outline proposals under the Romanian Industry Incentive Scheme: Implementation of the DSST orbit and attitude propagator in Orekit open-source Flight Dynamics Library





With over 20 years of experience in design, build and maintain information systems for Energy&Environment, the Company became a market leader in Romania

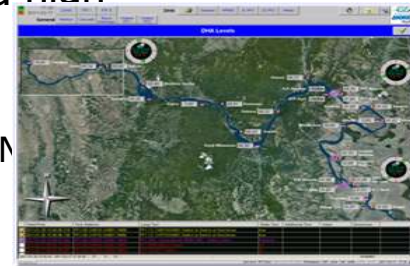


- Information Systems for Control Centers, SCADA, Automation, Generation Management Systems, energy trading on the wholesale market...
 - > Control Center Systems for Hydropower schemes: Iron Gates on Danube River and Siriu, Buzău, Arges, Raul Mare, Olt, Siret and Bistrita rivers
 - > SCADA and automation systems → Hidroelectrica and its 13 subsidiaries, Complexul Energetic Craiova, SCUT Cogenerare Giurgiu, Electrica Muntenia, CEZ, Michelin, Saint Gobin, ROMAG...
 - > Information systems "Energy Management" (eExploitation) and "Energy Trading" ("eSaleEnergy") – > national wide system at Hidroelectrica Bucharest and its 13 subsidiaries
 - > Multiprotocol "Data Gateways" applications and technical support for SCADA systems integration at company level and for Dispatch Centers

- European R&D projects
 - > Partner in the EU FP7 ENVISION project- ENVIronmental Services Infrastructures with ONTologies, www.envision-project.eu

- Maintenance (TMA) and development of industrial informatics applications and high performance computing (HPC) for EDF - France
 - > Development: Project ERP Flamanville 3,
 - > 3rd party Dev. and Maintenance applications - MISTRAL, OPALE, DOBERMAN, EDF SEPTEN

- ➔ Systems Integrator and projects partner for Schneider Electric
- ➔ Subcontractor for refurbishment projects
 - > Command&Control Centres, Energy Management Systems, SCADA, automation – ANDRITZ Hydro, Voith Hydro



sistemes - ESPACE






Very skilled peoples from Company became the core teams of some key software products addressing the ITS field

→ Software development center for SANEF ITS

- Opened in 2007; 17 skilled resources today, ready do be assigned to ITS projects
- Development and maintenance (TMA based on SLA) of "Tolle2E" (BackOffice) software product
 - Implemented in Free-flow Toll Collection Systems: Golden Ears Bridge and Port Mann Highway 1 - Vancouver, M50 Highway – Ireland, MAIPO Highway – Chili, San Diego Highway -USA...
- Development of the "Hub Interoperability System"
 - Interoperability HUB competition for the Association of Toll Operators in the USA – client Alliance for Tolling Interoperability (ATI)

→ Software development center for FAIVELEY Transport

- 
- Opened in 2006, after an audit performed by Faiveley Transport
 - 8 skilled resources today ready to be assigned to FY projects
 - Railway systems, SIL levels 1-4, embedded sw and open source technologies
 - Video recording and monitoring, Odo – Tachymetry, Registration of events, VISION/CCTV systems, Software for real – time production systems, Software for railway data communications, Testing tools for electronic boards

→ Command and Control Systems for the locks on Danube River – Iron Gates sector - Hidroelectrica





Reference Projects as relevant for Space developments: TopDeck-S76D (Thales Av)



→ **Project Objective**

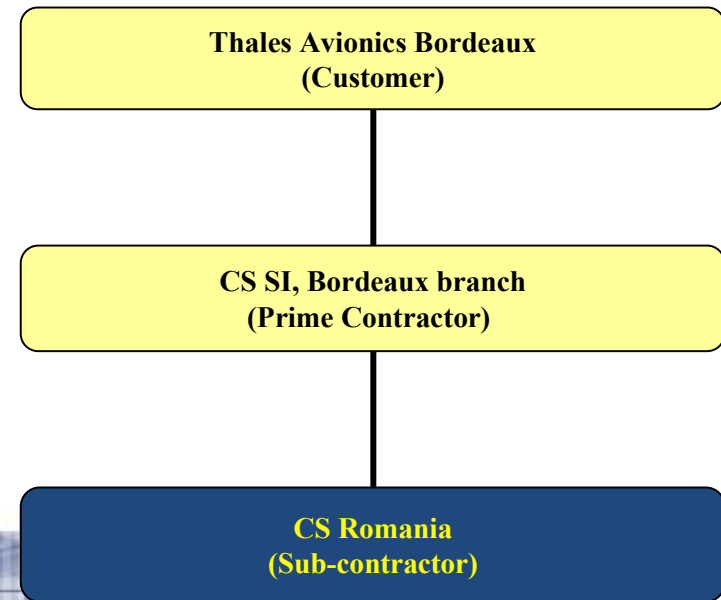
- Cockpit Avionic Suite (Thales' TopDeck) of Sikorsky S76-D helicopters
- All software lifecycle activities: specification, design, development, integration, verification, validation

→ **CS RO challenges**

- First DO178B Project
- Client demanding high quality work

→ **Lessons learned**

- Importance of technical experts in front-office
- Local resources experience, longtime workload planning



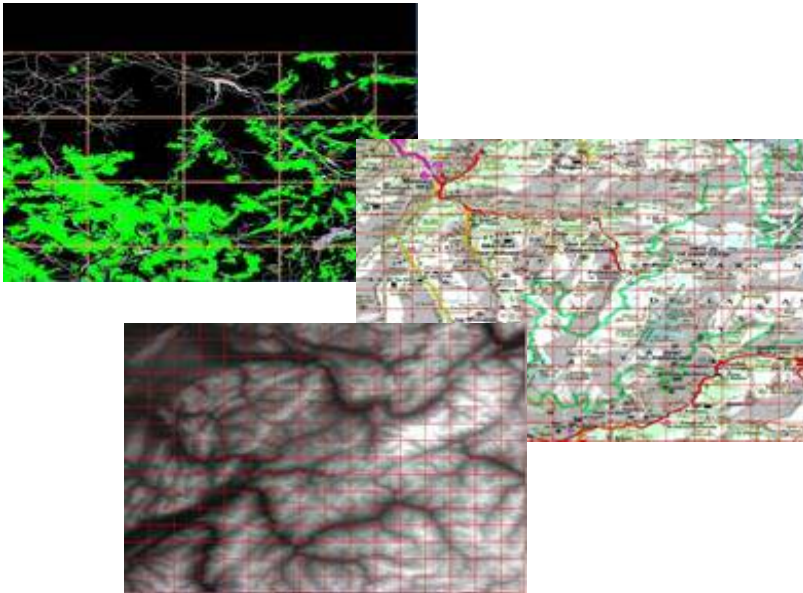


Reference Projects as relevant for Space developments: TopDeck-S76D (Thales Av) - cont



→ MapWorkShop (DO-178B level C,D + DO200)

- Ground tools for cockpit embedded maps (custom format)
- design, development, validation test based on client specification



→ IVV FDS (DO-178B level A, B)

- Verification procedures for embedded software FDS ("Flight Display System")
- Design of verification procedures
- Development and debugging on simulated platform
- Pair-reviews
- Formal qualification tests (FQT)

→ Unit test activities (DO-178B levels A-C)

- RTRT+ DiabData + SingleStep



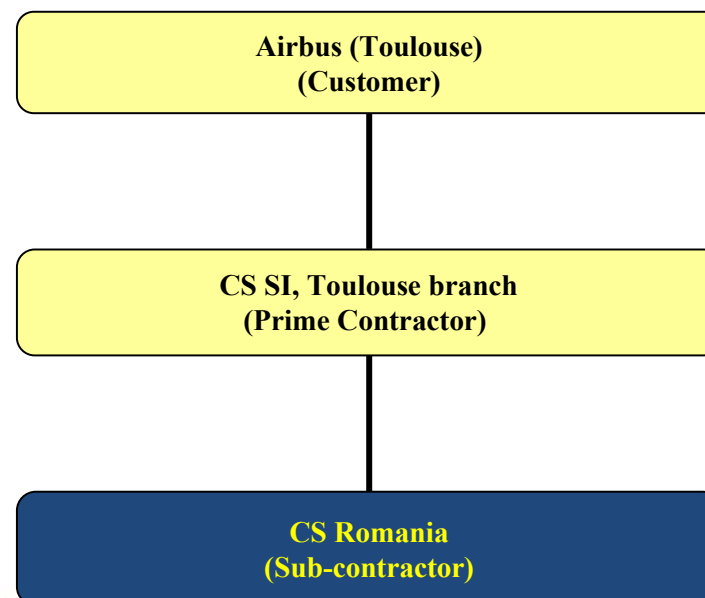


Reference Projects as relevant for Space developments: Projects ATC (AIRBUS/EYAC)



→ Project Objective

- > Formal specification for ATC (Air Traffic Control) systems
- > Multiple standards : A380, A350, FANS B+, SESAR (Single European Sky ATM Research)
- > Detailed specification using SDL formal language (editor & code gen: RTDS)
- > Test definition for Verification of Detailed Technical Specifications
- > Test execution on simulated platform



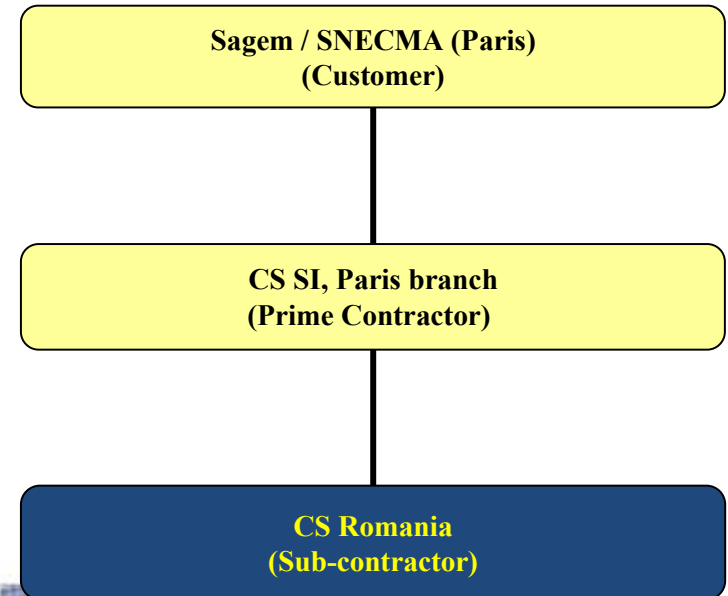


Reference Projects as relevant for Space developments: SaM146 (SAGEM/SNECMA)



→ Project Objective

- maintenance and evolutions for API (manual coding) of the FADEC software for SaM146 engine
- All software lifecycle activities: specification, design, development, integration, verification, validation
- DO 178B, level A
- Target platform: PowerPC, Diab Data/Single Step, RTRT, development on Solaris OS
- Integrated CM-bug-tracking





Reference Projects as relevant for Space developments: CONTRAILS (Eurocontrol, sponsored by ESA)



→ Project Objective

- Assess the environmental impact of condensation trails



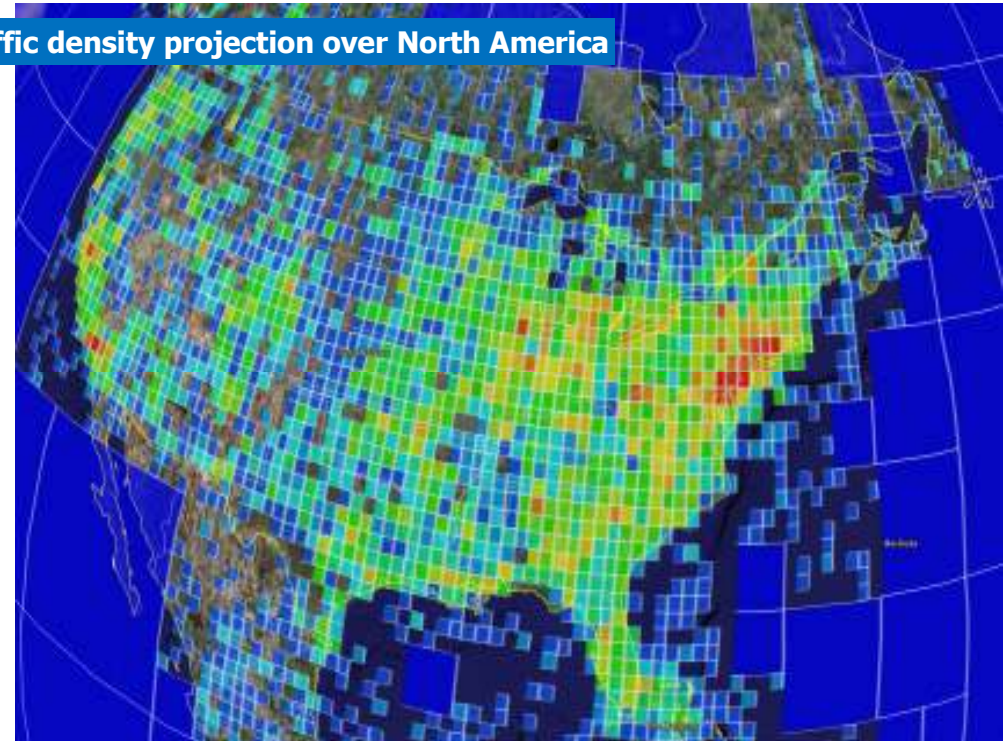
→ Contribution to project

- Implemented algorithm to generate traffic density maps
- Implemented tool to plot the maps in GIS (Geographic information system) applications.

→ Technologies used

- Programming Language: Java Standard, Oracle PL-SQL, JSP
- Technologies: JavaScript
- Programming Tools: Oracle JDeveloper, ESRI ArcGIS 9.2, Quest Software Toad for Oracle
- Modeling : Rational UML
- Application Servers: Oracle 11g, Apache Server

Traffic density projection over North America





Reference Projects as relevant for Space developments: Space Projects (CNES)

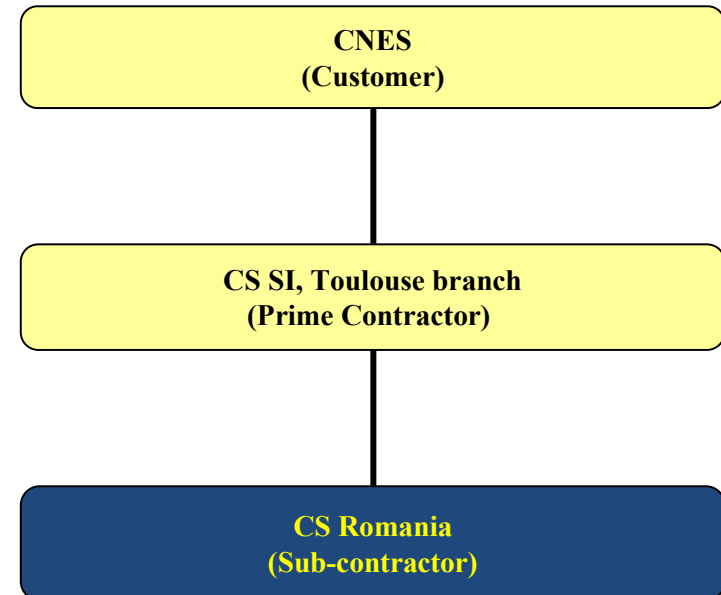


➤ **Projects Objectives**

- STILO : design & dev of remote controls of satellite mission JASON-2
- MICROSCOPE (MYRIADE series) : unit testing for ICU (Interface Control Unit)
- PICARD (MYRIADE series) : unit testing for CU (charge utile / payload)

➤ **Technologies**

- Design & dev : C/C++ under RHEL 4
- Unit testing : RTRT for C/C++ code, Analog Device's Visual DSP for ASM code





Reference Projects as relevant for Space developments: 1st Call for Outline Proposals under the Romanian Industry Incentive Scheme



- Part of the Romanian Industry Incentive Scheme, aiming at supporting the participation of Romania into the European Space Agency activities
- Joint proposal prepared by CS Romania as contractor and CS SI(France) as sub-contractor: "Implementation of the DSST (Draper Semi-analytic Satellite Theory) orbit and attitude propagator in OREKIT open-source Flight Dynamics Library"
- Outline proposal submitted at 15th of August, 2012 - now in the evaluation phase by ESA
- OREKIT (ORbits Extrapolation KIT) - free low-level space dynamics library written in Java (www.orekit.org), developed by CS SI France.
 - > Provides basic elements (orbits, dates, attitude, frames) and various algorithms to handle them (conversions, analytical and numerical propagation, pointing).
 - > OREKIT has also been selected by CNES (French space agency) for its next generation flight dynamics systems, both for operational systems and for studies and mission analysis systems.



Reference Projects as relevant for Space developments: 1st Call for Outline Proposals under the Romanian Industry Incentive Scheme



- Main objectives of the project:
 - > Validate the OREKIT implementation of DSST mean equations of motion
 - > Add loading of pre-computed coefficients to improve speed performances of the OREKIT implementation of DSST
 - > Add Short-period models (zonal terms of Earth gravity field, tesseral terms of Earth gravity field, third body attraction, atmospheric drag for simple spherical spacecraft model, direct radiation pressure)
 - > Analyze and merge DSST and OREKIT attitude modeling
 - > **Transfer of expertise in Flight dynamics activities and Space software development from CS SI France to CS Romania**

- Background experience
 - > CS Romania - 10+ years of experience in the conception, design, development, testing and maintenance of Java mission critical projects
 - > CS SI France – development of OREKIT library, strong experience in training international engineers in Flight dynamics (including use of Orekit). As ESOC (European Space Operation Center) GFC-8 frame contractor, CS SI has recently proposed to ESOC a roadmap for the re-engineering of ORATOS NG flight dynamics tools, using the OREKIT library



Target for ESA :

- Open source Tools : Orekit & Orfeo Toolbox (OTB)
- Other ESA Projects



CONCEPTEUR, INTÉGRATEUR ET OPÉRATEUR DE SYSTÈMES CRITIQUES

19 Septembre 2012 – Gwénaél Soullié



CS strategy to establish an IT Space Competencies Centre in Romania



→ Prerequisites

- CS Romania Subsidiary, already having strong competencies in the development of Critical Software for Aeronautics, Energy, Intelligent Transportation Systems, Applications Maintenance based on SLA
- Successfully past experiences in knowledge transfer from CS to CS Romania
- the establishment of Centers of Competencies for Aeronautics, Transportation and Nuclear Energy
- CS Romania has already participated to some Space projects
- Strong professional between CS Romania and the University of Craiova – teachers and PhD Students working on CS Romania projects



CS strategy to establish an IT Space Competencies Centre in Romania

- Knowledge transfer strategy in the field of the Open Source Toolbox for Space applications
 - Romanian teams for the implementation and maintenance of Open Source Toolboxes for space applications and image processing
 - OREKIT
 - ⤴ 1st Call for Outline Proposals under the Romanian Industry Incentive Scheme
 - ⤴ Training sessions done by the CS experts
 - EO -> OTB
 - ⤴ Participating to ITTs in the field of Environmental Risk Management, Agriculture, Biodiversity, desertification...
 - ⤴ Training sessions done by the CS experts



THANK YOU