

European Cooperation in the Ground Segment Domain

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Ground System Architectures Workshop



Presentation outline

- ◆ **What is Europe ?**
- ◆ **Players in Europe**
- ◆ **Ground Segment Domain**
- ◆ **Cooperation initiatives**
- ◆ **Outlook**

What is Europe ?

Geographical entity ?



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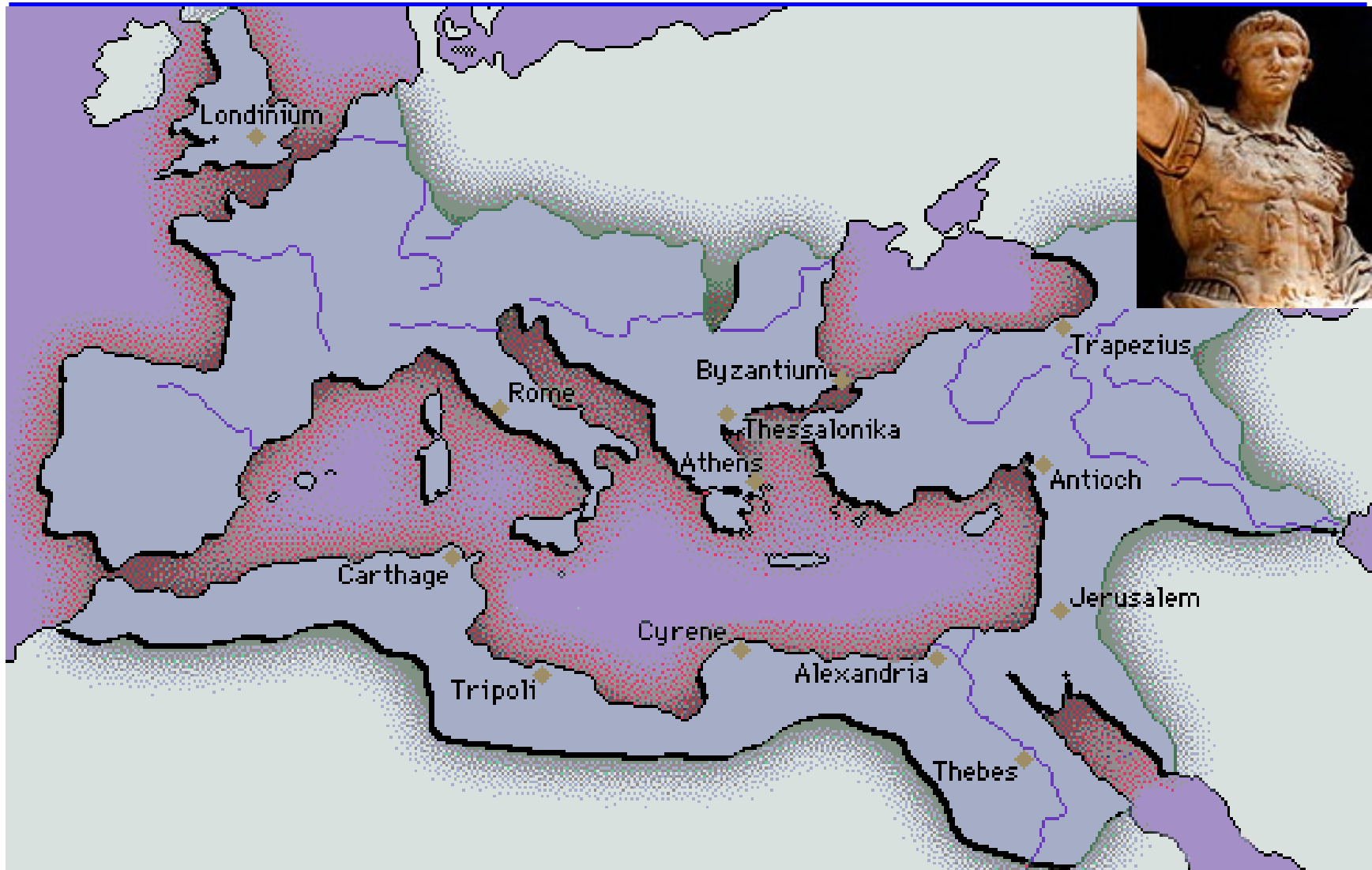
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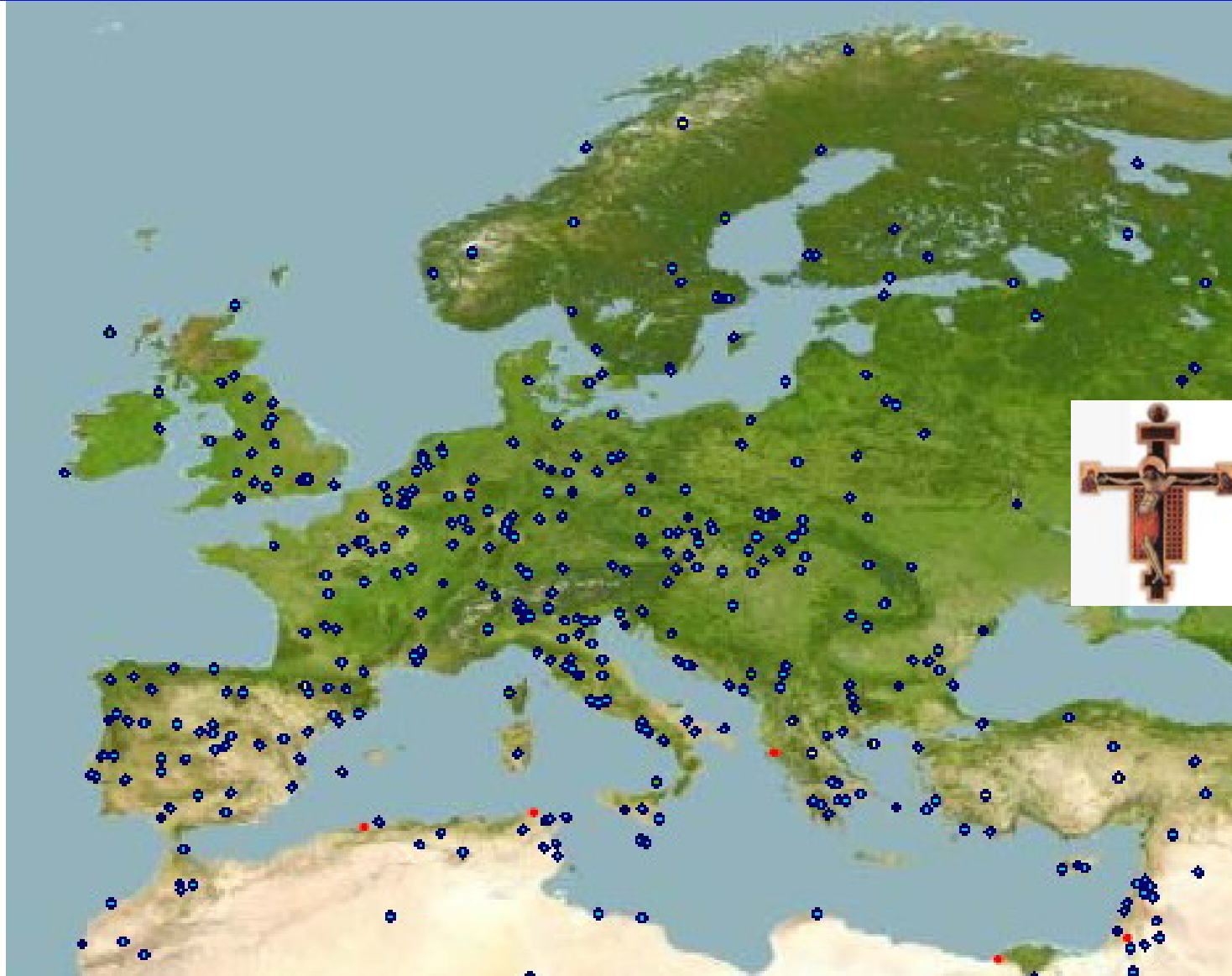
A Celtic culture ? (-1500 → +500)



Roman Empire ? (-700 → +500)



Region of monasteries ? (St. Benoît : Protector of Europe !)



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A region of great physicist, mathematicians ?

- ◆ **Ampere**
- ◆ **Becquerel, Bernoulli, Boole, Bohr, Boyle,**
- ◆ **Cassini, Copernic, Coulomb, Curie**
- ◆ **Da Vinci, Descartes, Dirac**
- ◆ **Einstein, Euler**
- ◆ **Fahrenheit, Fermat, Fermi, Fibonacci**
- ◆ **Galileo**
- ◆ **Halley, Heisenberg, Herschel, Huygens**
- ◆ **Kelvin, Kepler**
- ◆ **Lagrange, Laplace, Leibnitz**
- ◆ **Maxwell, Mercator**
- ◆ **Newton**
- ◆ **Pascal, Planck, Pauli**
- ◆ **Rutherford**
- ◆ **Schrödinger, Sommerfeld**
- ◆ **Turing**
- ◆ **Volta**
- ◆ **Watt**

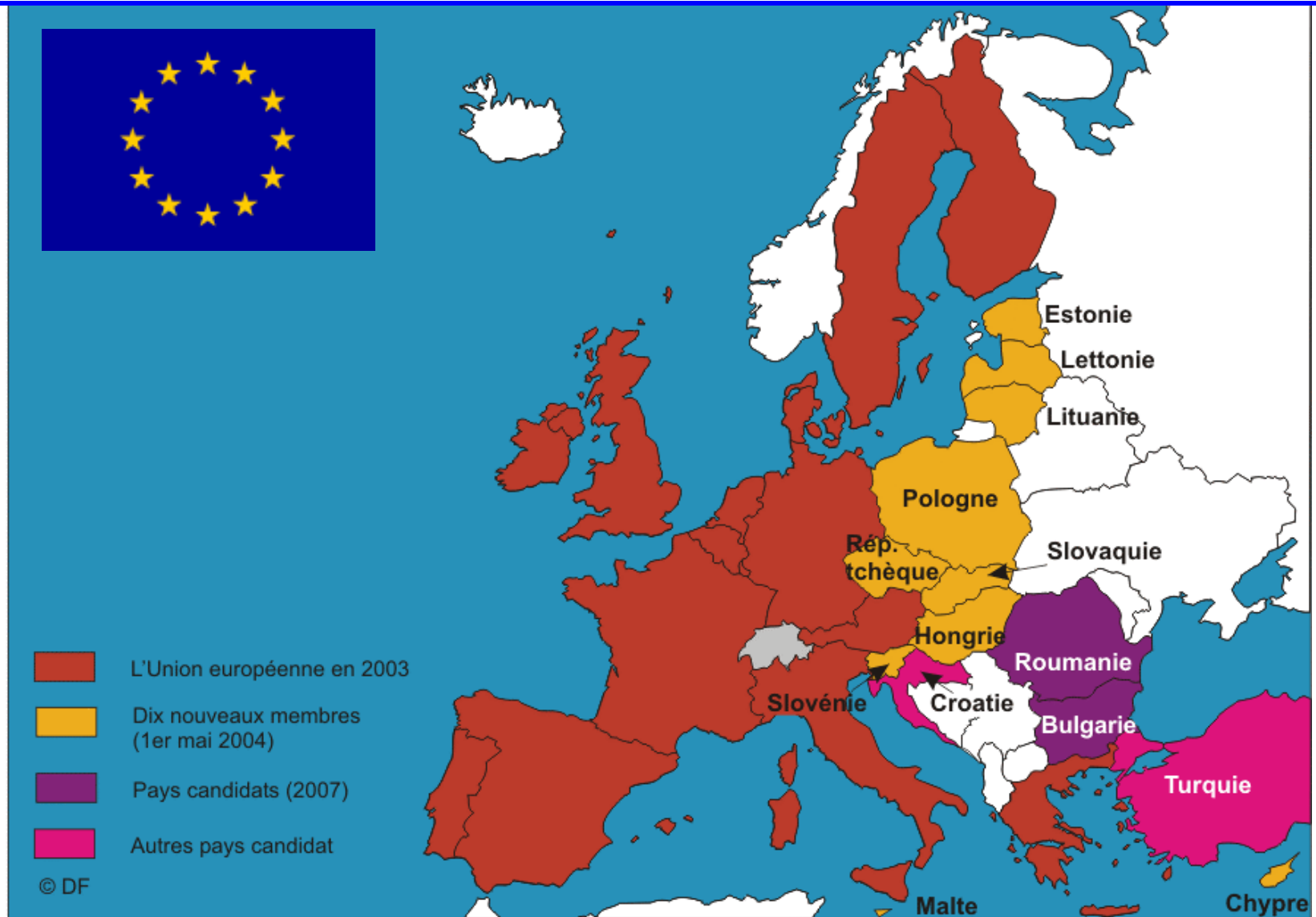
A puzzle ?



Europe: the new shape

- ◆ 1950 – Robert Schuman ► D, F
- ◆ 1951 – European Community for Coke and Steel ► B, D, F, I, L, NL
- ◆ 1958 – Rome Treaty (European Economic Union)
- ◆ 1973 – New members ► DK, IRL, UK
- ◆ 1981 – New member ► GR
- ◆ 1986 – New members ► E, P
- ◆ 1986 – European Parliament
- ◆ 1992 – Maastricht Treaty (European Union)
- ◆ 1995 – New members ► A, FIN, S
- ◆ 1997 – Amsterdam Treaty
- ◆ 2001 – Nice Treaty
- ◆ 2004 – New members ► CY, CZ, EE, HU, LV, LT, MT, PL, SK, SI
- ◆ 2006 – European Constitution ??

The European Union



Space Players in Europe



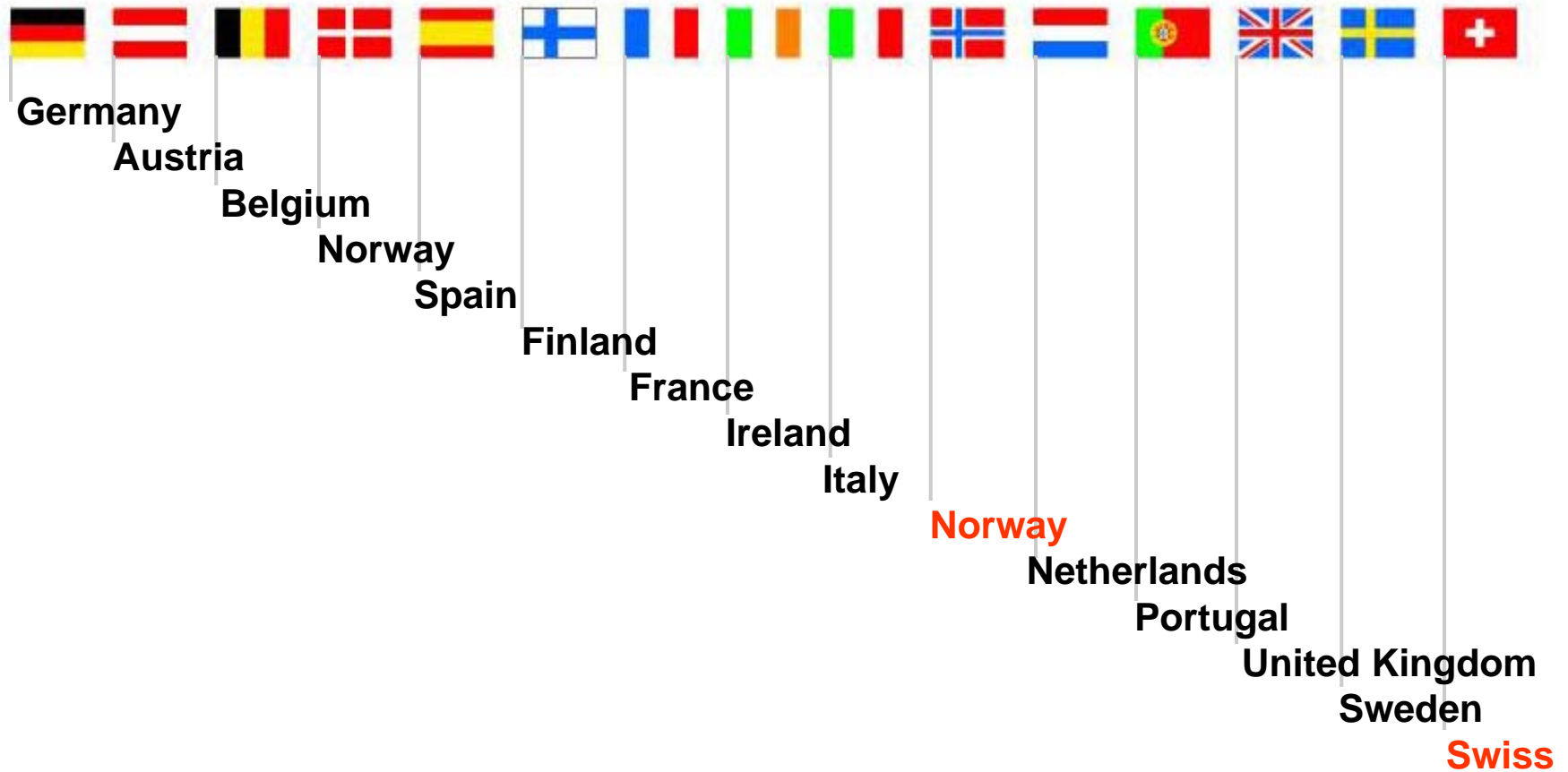
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Europe in Space (ESA Member States)



Key players in Europe

◆ National Agencies

- ASA Austrian Space Agency
- ASI Agenzia Spaziale Italiana
- BNSC British National Space Centre
- CDTI Centre para el Desarrollo Tecnológico Industrial
- CNES Centre National d'Etudes Spatiales
 - ◆ Toulouse, Kourou
- DLR Deutsches Zentrum für Luft- und Raumfahrt
 - ◆ Oberpfaffenhoven → Munich



◆ ESA European Space Agency

- ◆ ESTEC (Nordwijk → Amsterdam)
- ◆ ESOC (Darmstadt → Frankfurt)
- ◆ ESRIN (Frascati → Rome)
- ◆ ESAC (Villafranca → Madrid)
- ◆ EAC (Bonn)

Key players in Europe

- ◆ Industry (EUROSPACE)



- ◆ Primes

- Astrium (EADS)



- Alcatel



- Alenia



- ◆ Satellite subsystem or payload integrators

- ◆ SMEs



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Ground Segment Domain



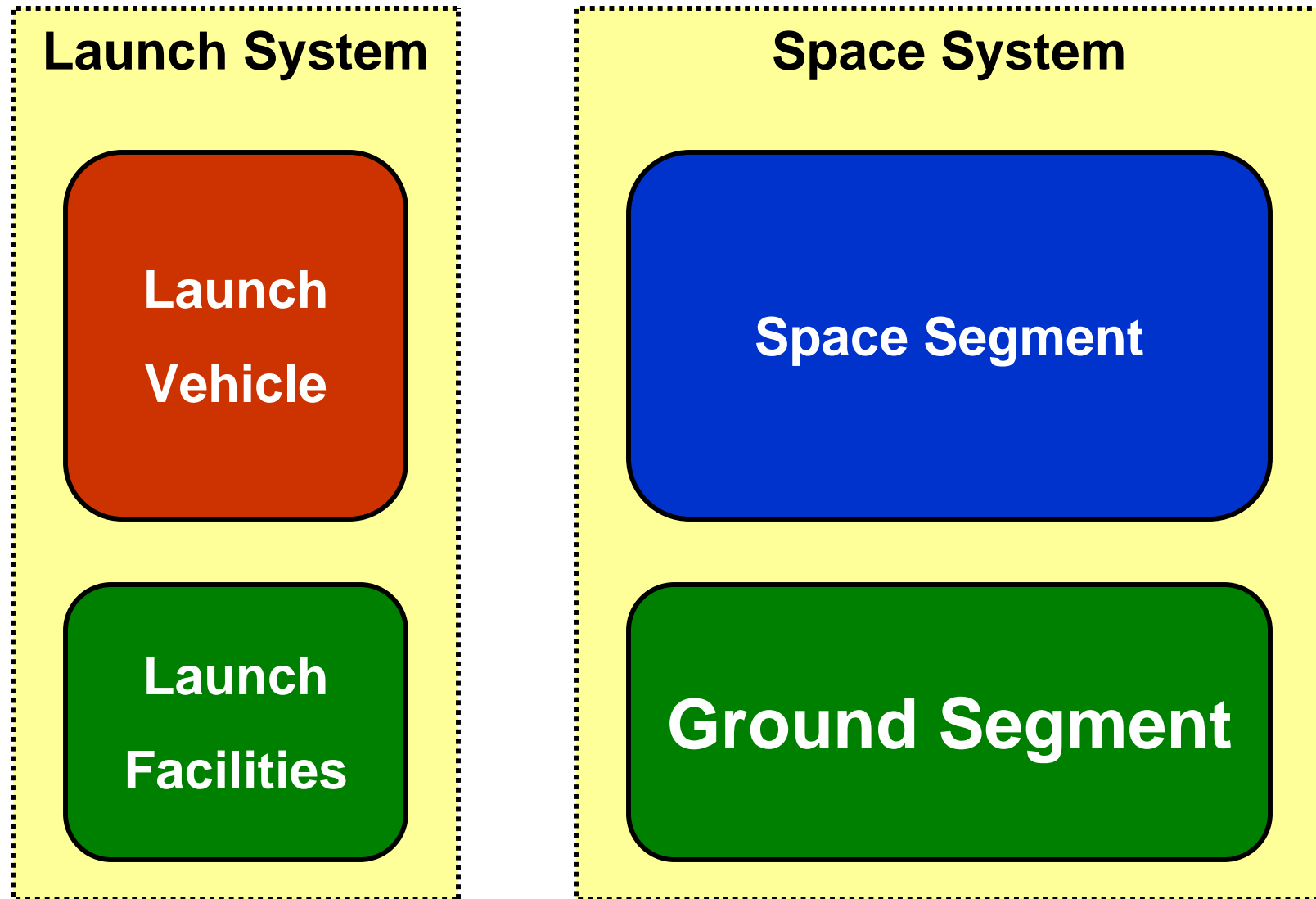
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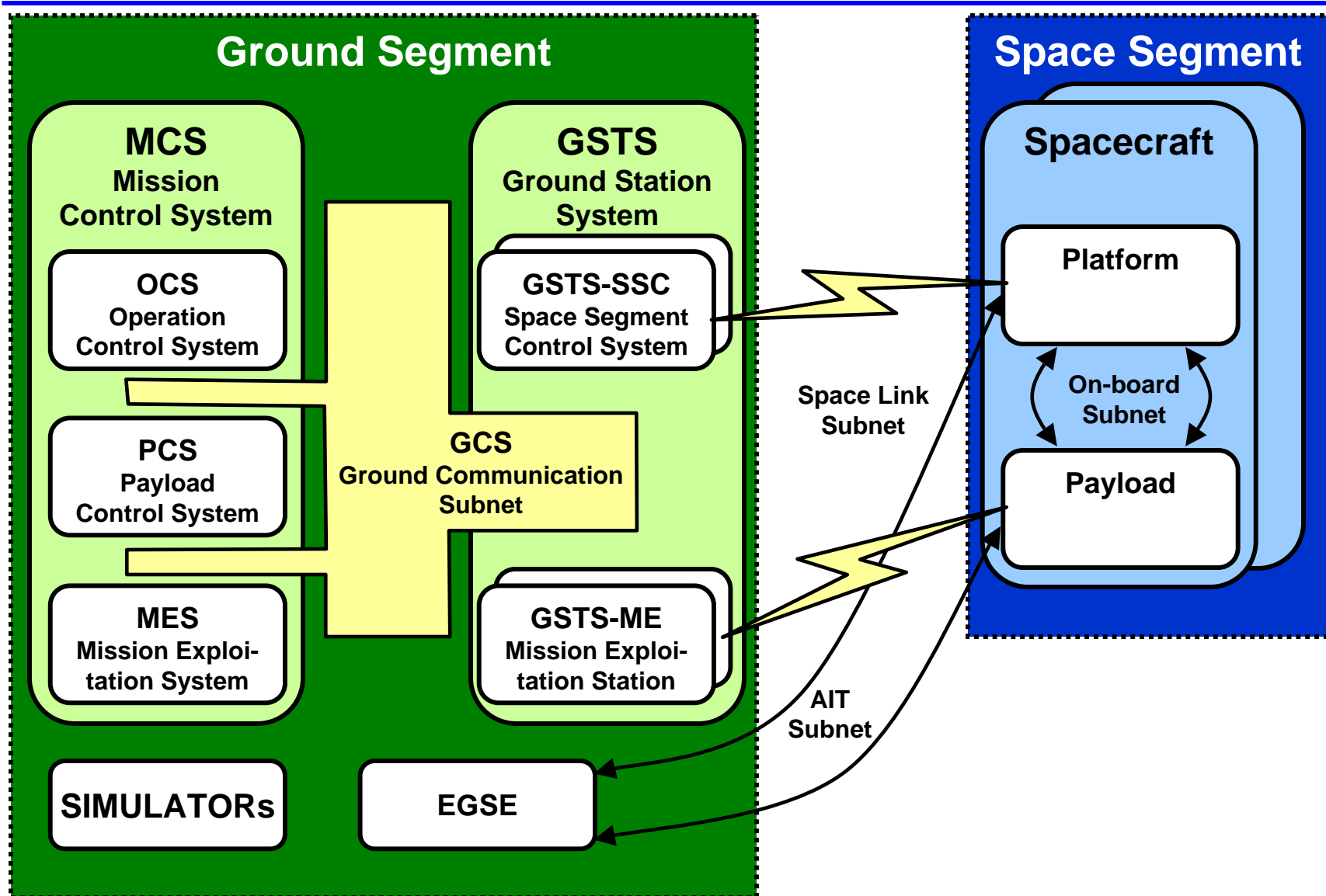
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Systems, Segments



Space System



Cooperation Initiatives



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ESA role: promote cooperation

- ◆ **European Space Agency**
- ◆ **Provide for and promote, for exclusively peaceful purposes, cooperation among European states in the fields of:**
 - Space research and technology
 - Space applications
- ◆ **for scientific purposes and for operational space applications:**
 - by elaborating and implementing a long-term European space policy
 - by elaborating and implementing space activities and programmes
 - by elaborating and implementing an industrial policy

Standardisation cooperation - ECSS



- ◆ **European Cooperation for Space Standards**
- ◆ **ESA, National Agencies, Eurospace, Industry**



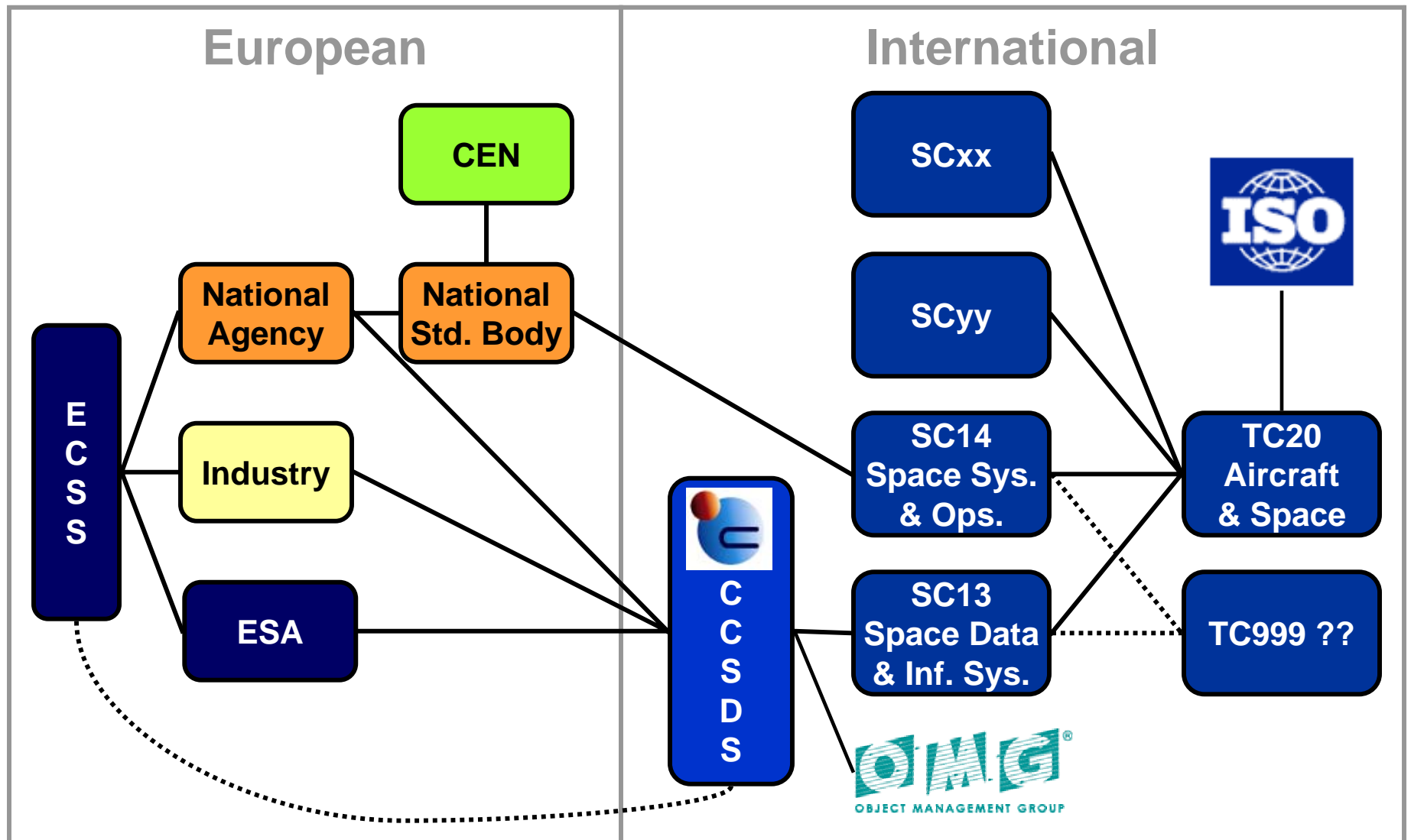
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ECSS and international standardisation



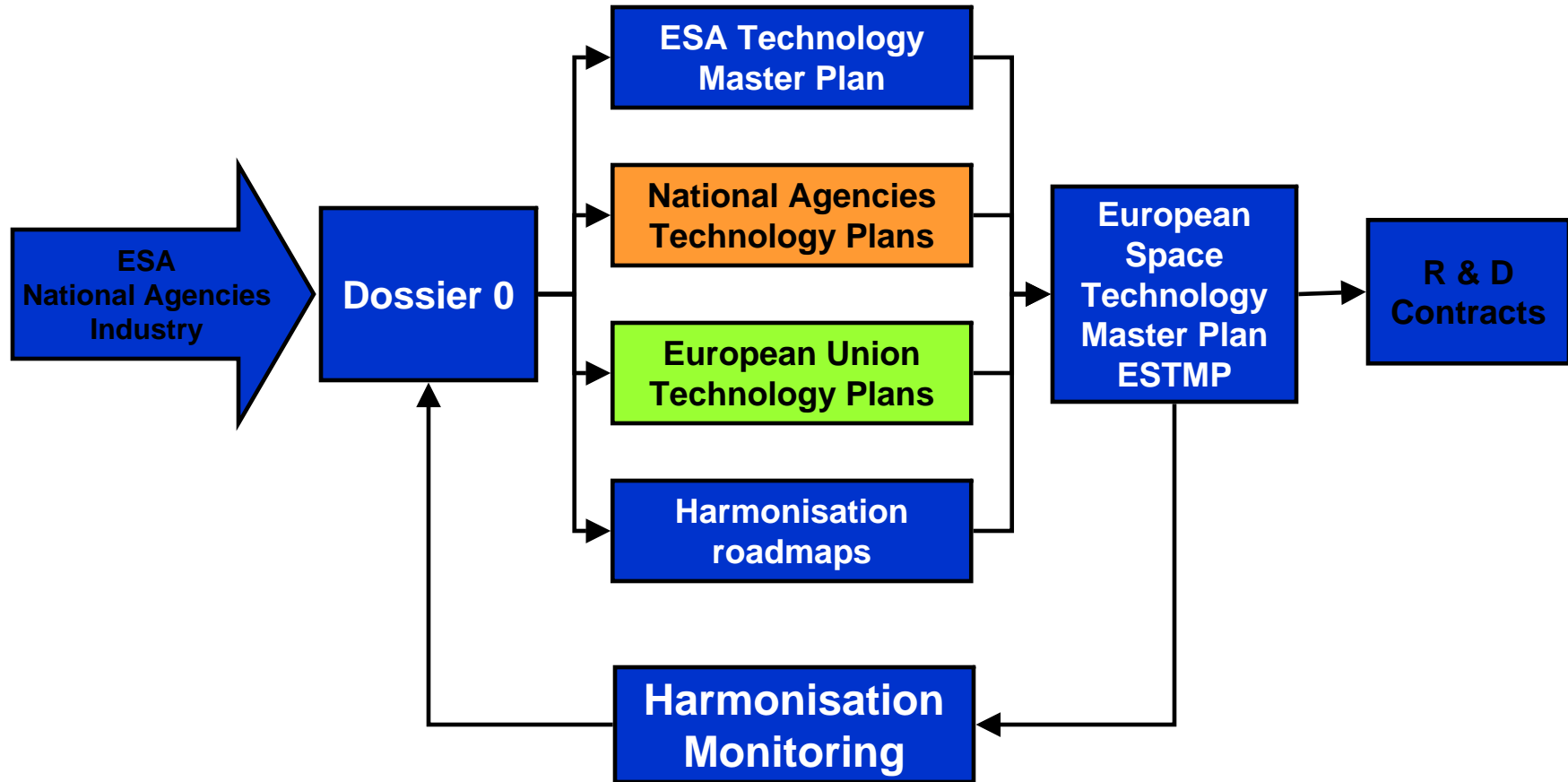
Network of Centre initiative – NoC

- ◆ **Objective: synergy in effective use of the ground facilities and resources of European space organisations**
 - **Mainly Agencies having facilities**
 - ◆ CNES, DLR, ESA
 - **But so do Industry e.g.**
 - ◆ Telespazio
 - **And other organisations**
 - ◆ EUMETSAT, EUTELSAT
- ◆ **Currently four pilot projects**
 - Flight Operations
 - Space Debris
 - Organisation of reviews
 - Test facilities
- ◆ **Start-up difficulties**
 - Different regimes
 - Different structures
 - Different priorities

Technology harmonisation initiative – Dossier 0

- ◆ **ESA is responsible for assembling the European Space Technology Requirements Document – Dossier 0**
- ◆ **Establish with other Agencies and Industry a common technology roadmap**
 - **Ensure awareness, complementarity, coherence**
 - **26 technology Domains, Technology Domain Representative**
 - **Ground Segment covers ~20% of the domains**
 - ◆ **TD-09: Ground Segment Data Systems**
 - ◆ **TD-10: Flight Dynamics & Precise Navigation**
 - ◆ **TD-11: Mission Analysis & Space Debris**
 - ◆ **TD-12: Ground Station System & Networking**
 - ◆ **TF-25: User Segment**
 - **Tangible and re-usable results (prototypes, products)**
 - **Ensure that European space programs use the results**

Technology harmonisation initiative – Dossier 0



ESA Ground Operation System - EGOS

◆ Addresses globally all ground segment software

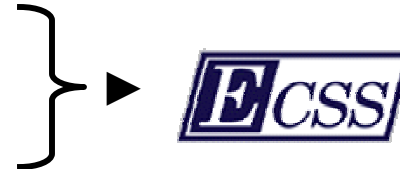
- Mission Control Systems
- Acceptance, Integration, Testing Systems
- Data Distribution Systems
- Mission Planning Systems
- Simulator Systems
- Station Computer Systems
- Flight Dynamics Systems



◆ Preparation studies under ESA Technology Harmonisation Program

◆ Definition of a Ground Segment reference model

- Standard system elements
- Standard functions
- Standard interfaces



◆ Reduce number of solutions

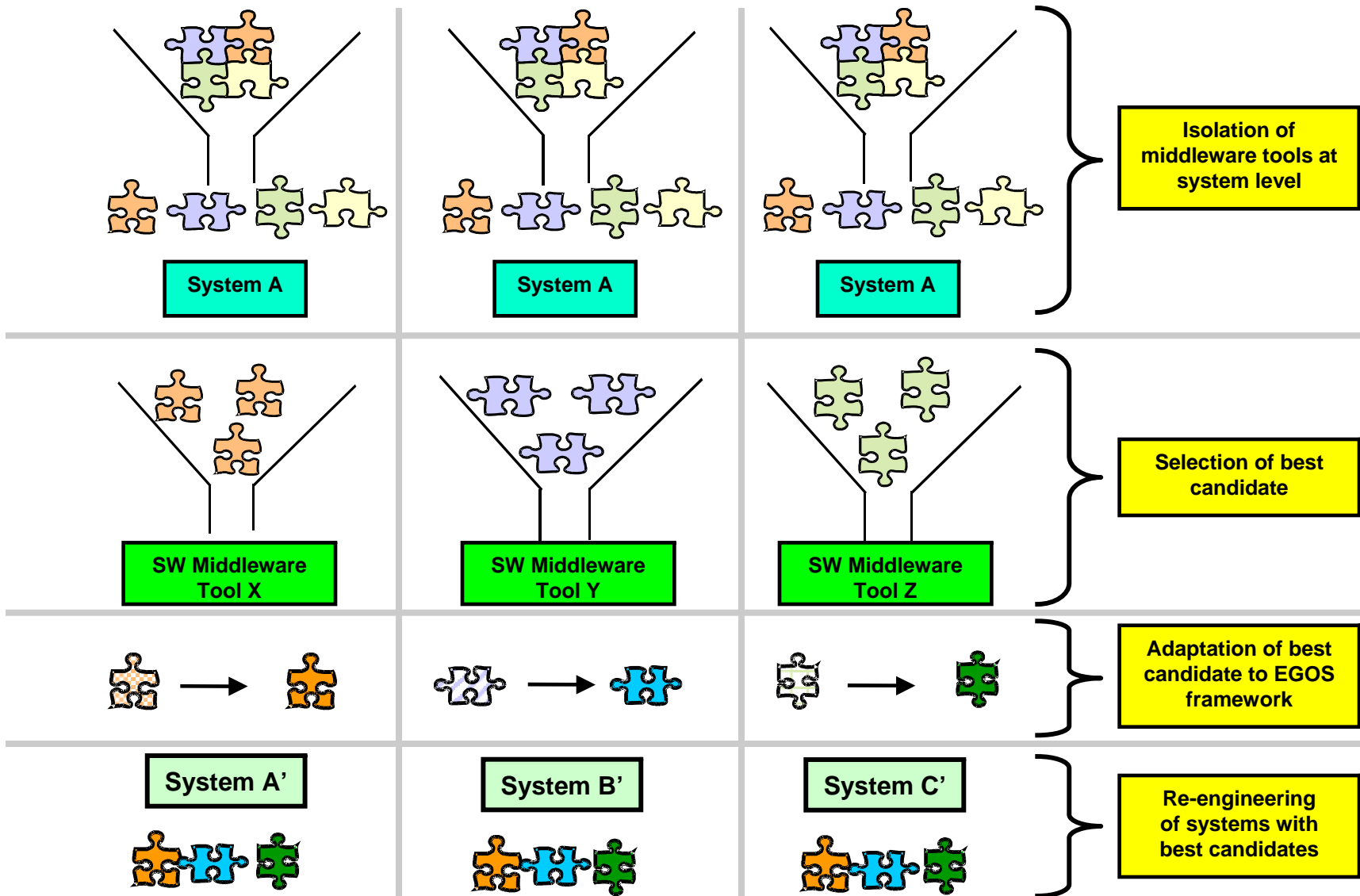
- make them compatible
- Less but better!

ESA Ground Operation System - EGOS

◆ **Architectural Framework**

- **Common layered system approach**
- **Common set of services**
- **Commonly usable new / adaptive middleware software tools**
- **Reduction of costs for new development (by using a common service model)**
- **Interoperability across systems**
- **Federation of Products**
- **Technology harmonisation**
- **Support of autonomous operations**
- **Common software maintenance policy**
- **Reduction of the familiarization efforts of both the users and developers teams**
- **Support to European Industry Harmonisation by giving them free licenses for EGOS products to give a stronger competition position worldwide**

ESA Ground Operation System - EGOS



Outlook

The future

- ◆ **Streamline European resources in the Ground Segment**
- ◆ **Reduce costs to European tax payers – use public funds more effectively**
- ◆ **Follow closely technology evolution trends**
- ◆ **European paradigm**

Better, Cheaper

But not necessarily Faster

- ◆ **Improve cooperation at international level**