Earth Observation
Remote Sensing Trends

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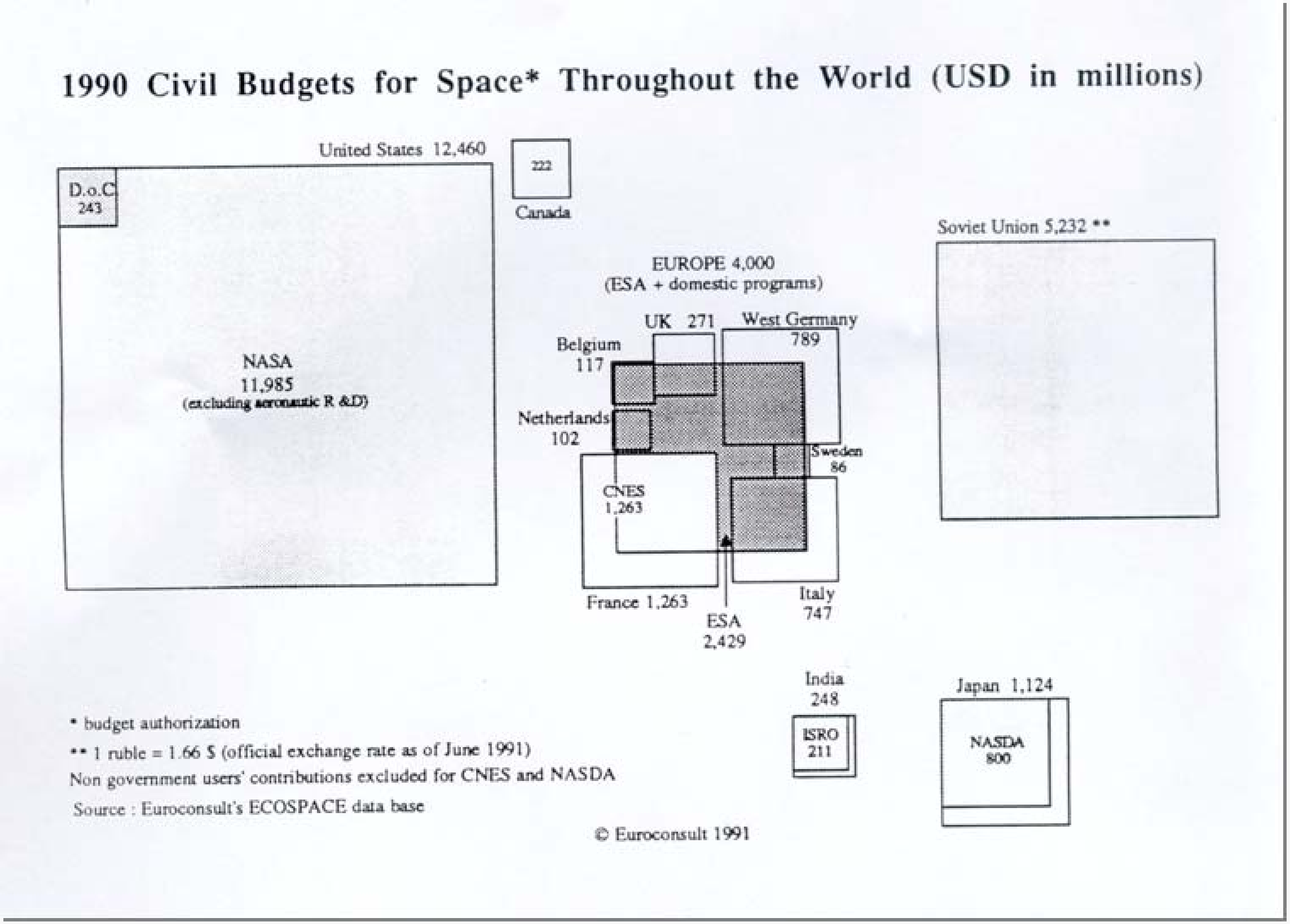
Key Themes:

- Overview: Earth observation investment
- EO program focus
- The commercial data market
- Challenges and conclusions

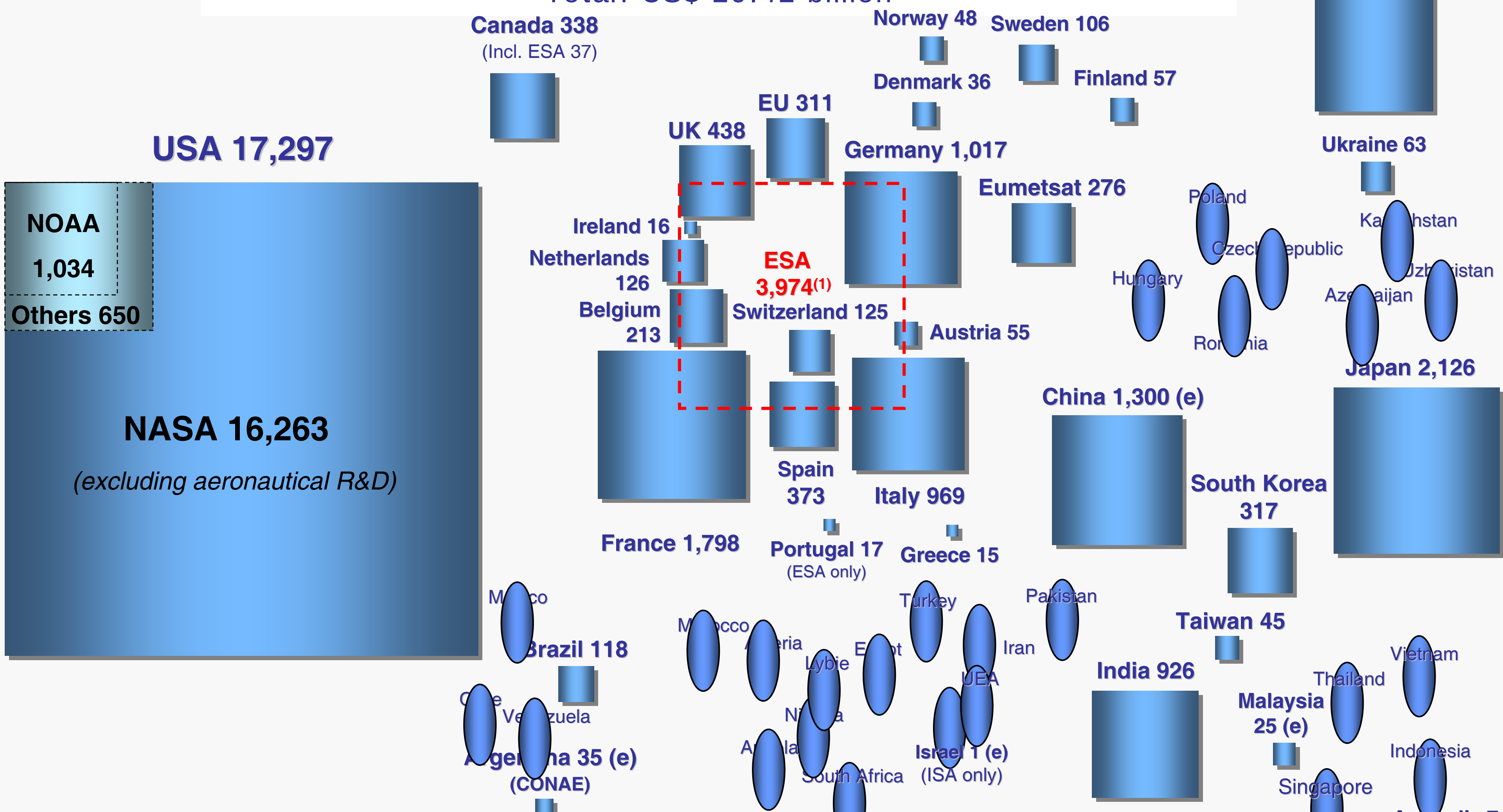
Overview:
EO Investment

Government Space Program Investment … The Past…



...and today

World Government Expenditures for Civil Space Programs in 2007
Total: US$ 29.42 billion



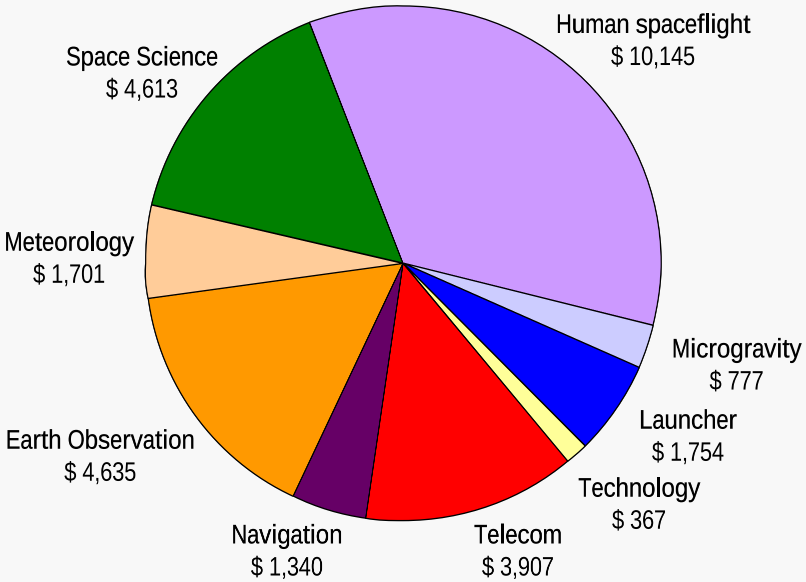
Budget Authority for the United States and Payment Appropriations for ESA; Non-governm[...] user contributions (CNES, JAXA) excluded; (1) Excludes funding from Third Parties; (e) estimate. 2006 figures for Austria, Belgium, Denmark, Finland,Netherlands, Norway, Sweden

Source: World Prospects for Government Space Markets, Euroconsult 2007

Government EO Programs (1)

Earth Observation is the largest satellite-based investment

Government Investment in Space Activities: Breakdown by application 2006



Source: World Prospects for Government Space Markets, Euroconsult 2007

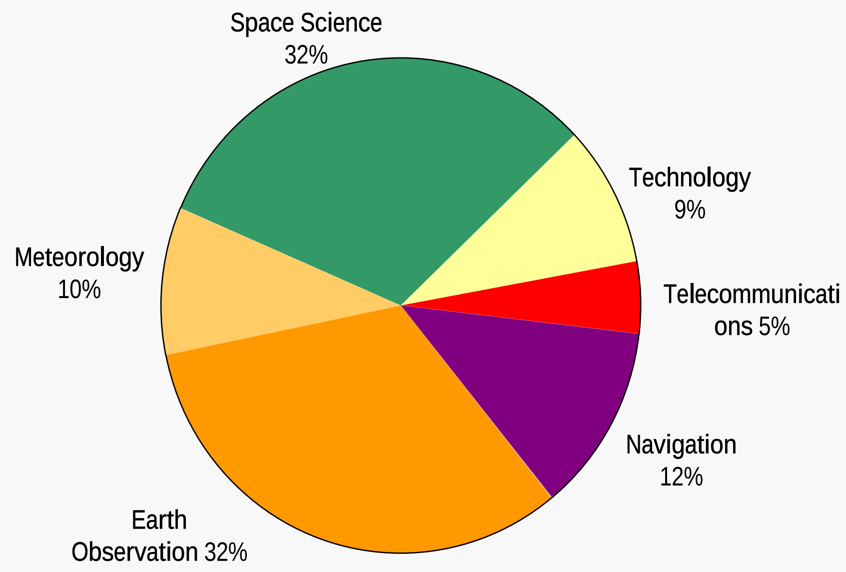
- ✓ Human spaceflight is very specific to the US representing 90% of overall investment
- ✓ EO is a primary area of investment for the majority of government space programs
- ✓ In 2006 $6.3 billion was invested into EO and meteo programs reaching **$7 billion in 2007**
- ✓ Representing 24% of all space sector investment (38% excl. human spaceflight)in 2007

Government EO Programs (2)

1st application for satellite to be launched over the next 5 years

- ✓ Earth observation to remain a priority area
- ✓ Over 2007-2012 42% of all civil-government satellites launched will be for Earth observation purposes
- ✓ In terms of satellite capacity the key however will be emerging programs

Civil Government Satellites to be launched 2007-2012
Total: 237 satellites

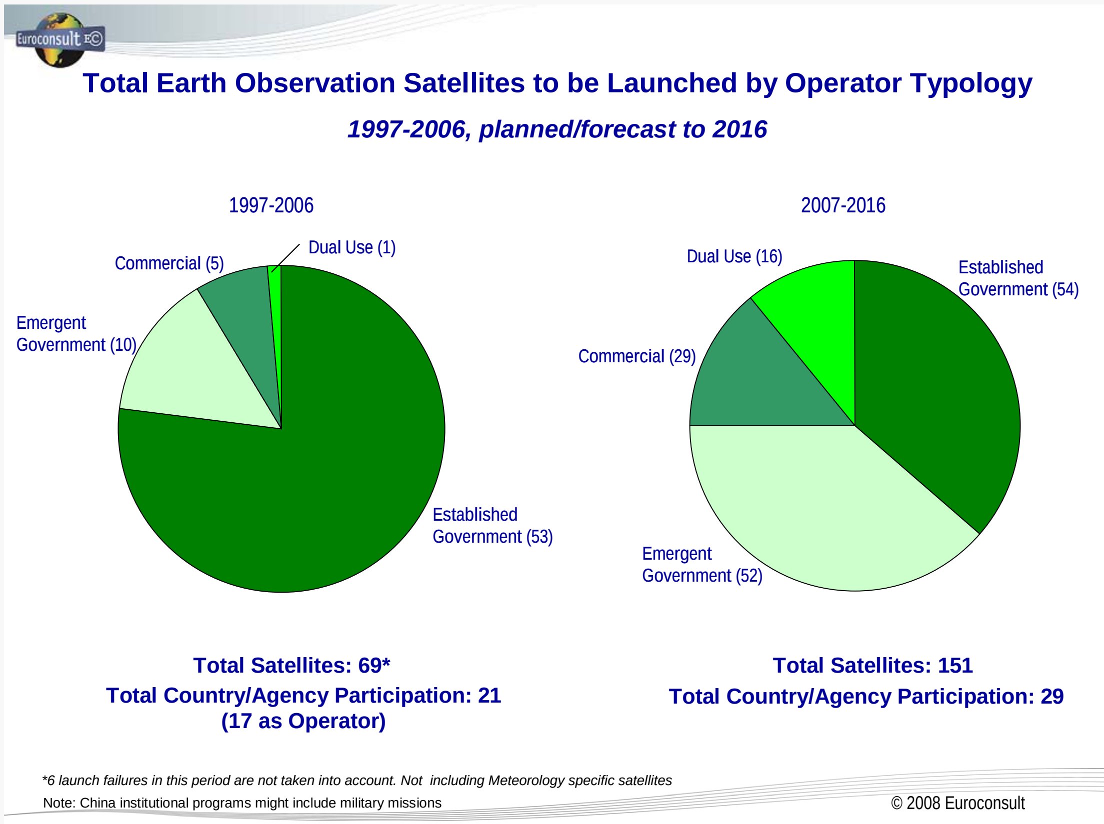


Source: World Prospects for Government Space Markets, Euroconsult 2007

EO program focus

EO actors are diversifying

Estimated 151 LEO EO satellites to be launched 2007-2016



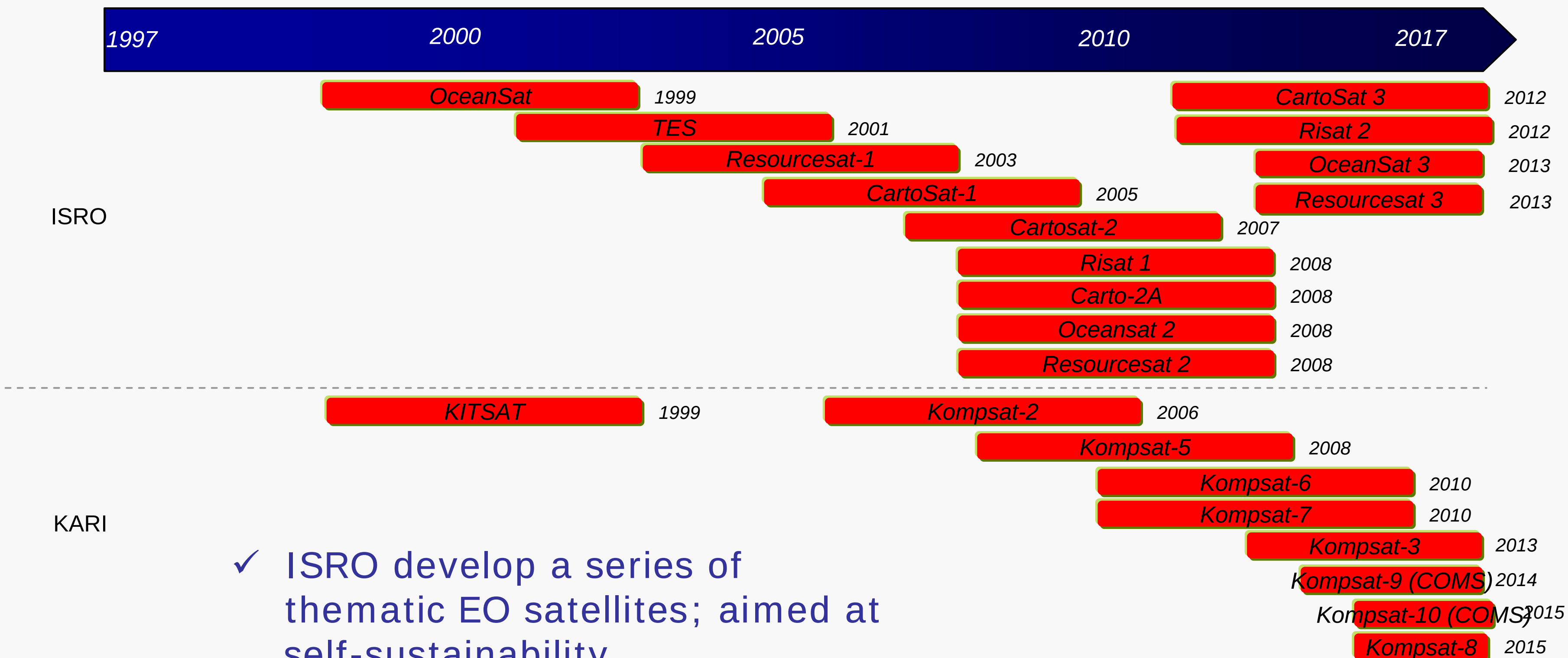
Source: "Satellite-Based Earth Observation, Market Prospects to 2017", Euroconsult 2008

- ✓ Increasing number of satellites from emergent national programs, with countries looking for autonomous satellite capacity
- ✓ By 2017 :
  - ✓ About 29 national agencies to launch EO satellites
  - ✓ Will represent 1/3rd of EO satellites worldwide

1A. Established government program

Rapidly developing capacity for self-sufficiency and commercial gain

(ISRO, KARI …)



- ✓ ISRO develop a series of thematic EO satellites; aimed at self-sustainability

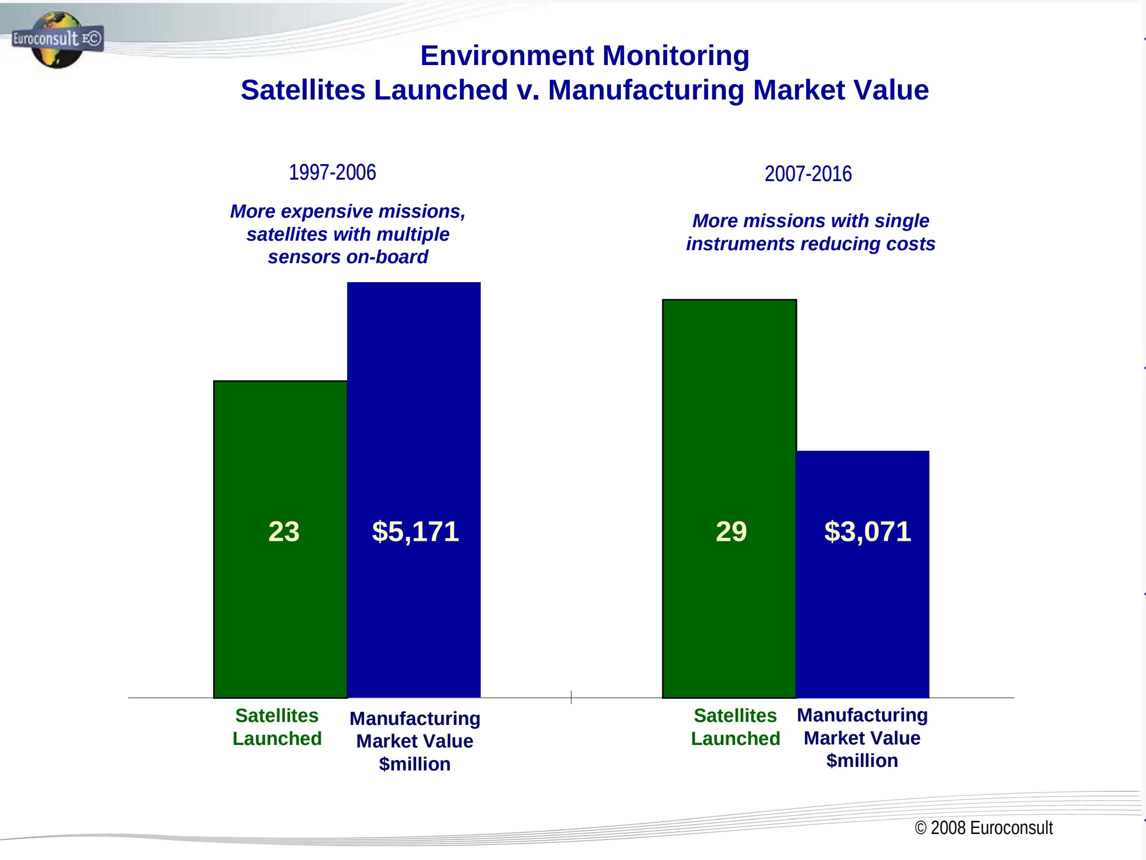
- ✓ KARI quickly building on early missions

Source: World Prospects for Government Space Markets, Euroconsult 2007

1B. Established government program

Preference towards smaller, lighter, faster missions for env. mon.

(NASA, ESA, JAXA…)

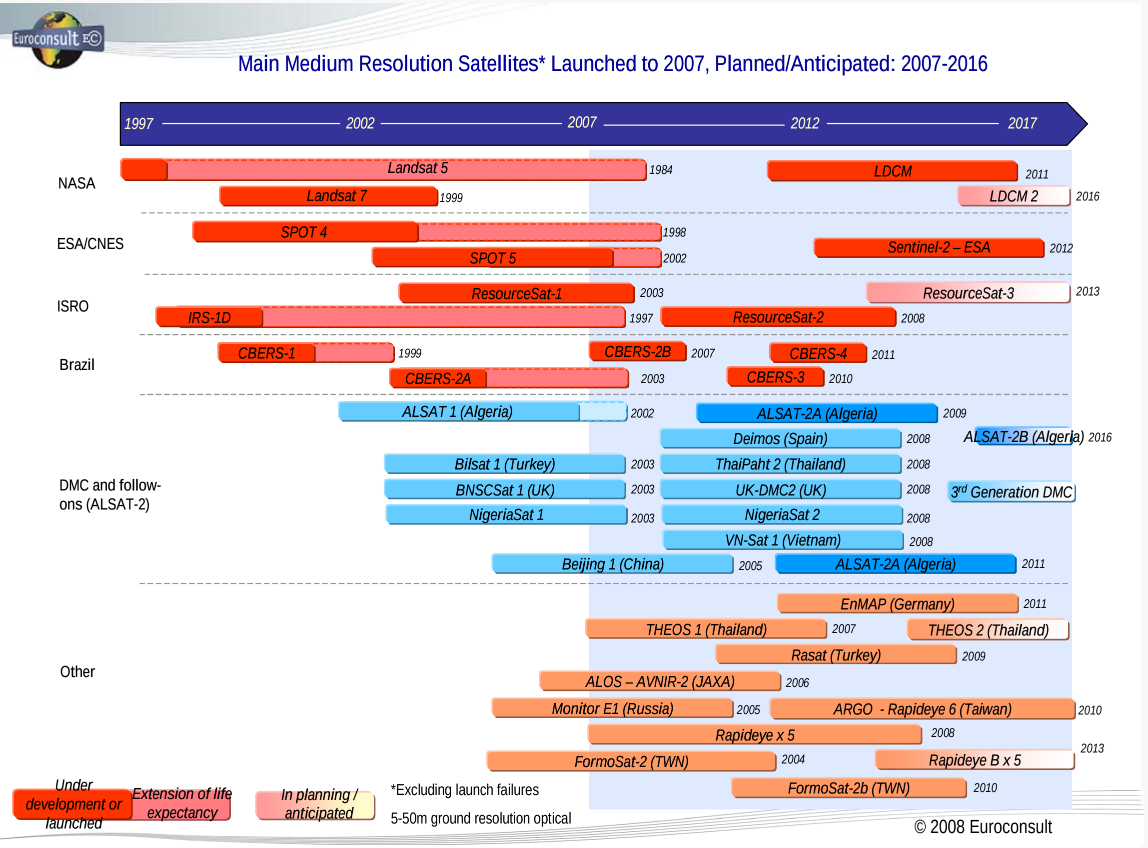


Source: "Satellite-Based Earth Observation, Market Prospects to 2017", Euroconsult 2008

- ✓ Established government programs have climate change at the top of the agenda, however programs prone to cuts
- ✓ Science missions tend to be one-offs; need for greater continuity
- ✓ Single-instrument specific missions are preferred over multi-instrument arrays.
- ✓ Net result in the medium-term is a loss in instrumentation.

2. Emerging government program

Looking to develop satellite technology



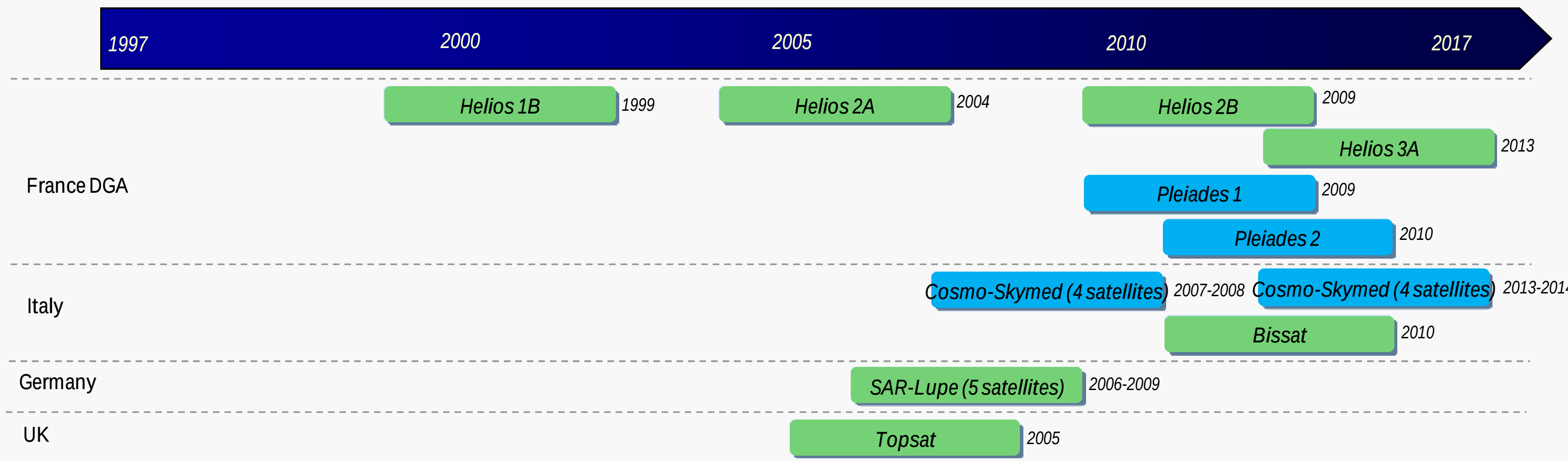
Source: "Satellite-Based Earth Observation, Market Prospects to 2017", Euroconsult 2008

- ✓ Most emerging nations launch generic (medium resolution optical sensors) to meet local/regional requirement
- ✓ Nations look to gain technology know-how and build on experiences: Algeria, Turkey, Thailand…
- ✓ 2nd Generation launched have been/will be more capable than the first: DMC, Alsat…
- ✓ Programs will look to commercialize data – initially data low cost / free

3. Dual-use coming to fruition

Cross-over between military and commercial high-res

Roadmap for European defense Earth observation satellites



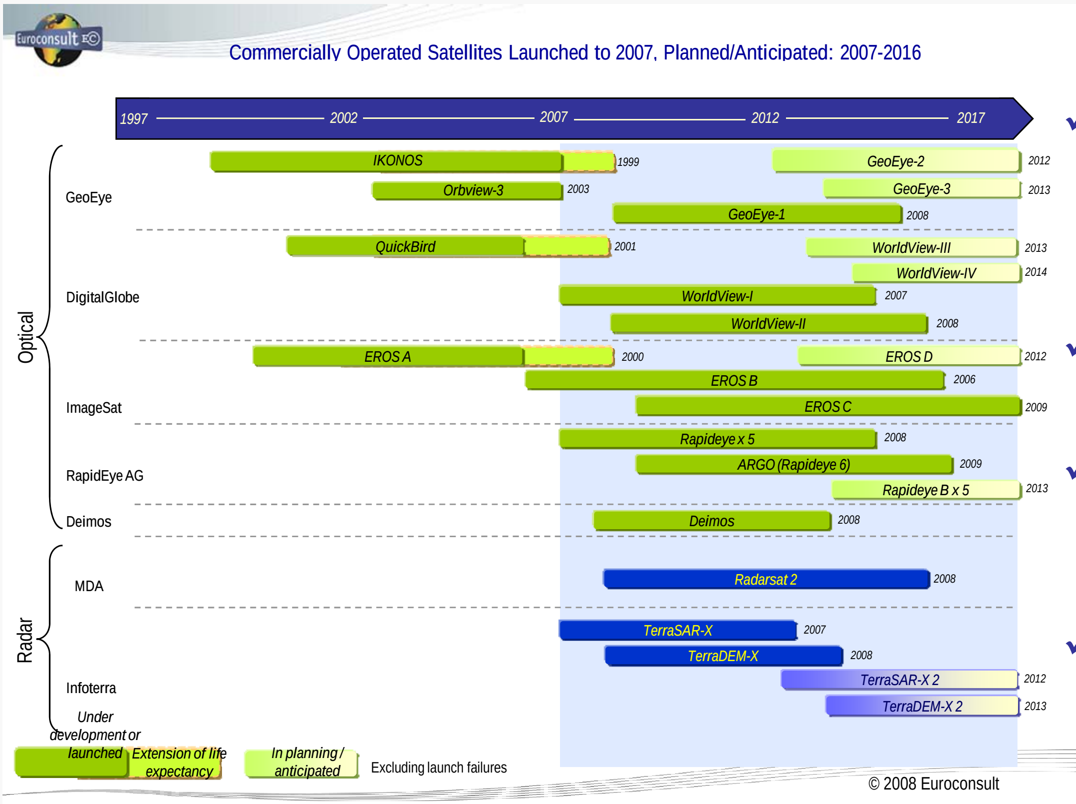
- ✓ Security the first consumer of commercial data
- ✓ Dual-use capacity realized through COSMO-Skymed and Pleiades; commercialized through data providers
- ✓ Further programs remaning military only: Helios, SAR-Lupe
- ✓ Calls for greater coordination European military EO; future to lie in MUSIS?

Source: World Prospects for Government Space Markets, Euroconsult 2008

The commercial data market

4. The commercial actor

Targets geometric accuracy, high-res. and data delivery

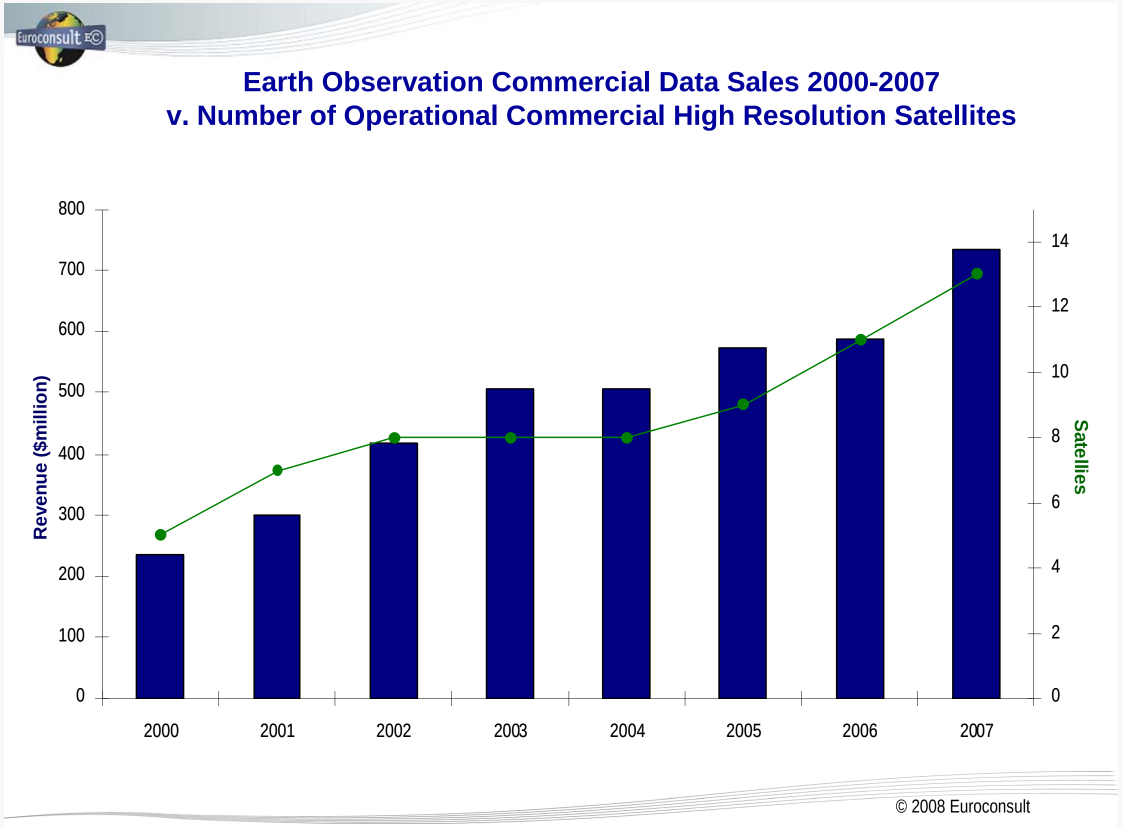


Source: "Satellite-Based Earth Observation, Market Prospects to 2017", Euroconsult 2008

- ✓ Commercial data focuses on optical high-res. timely data delivery and high geometric accuracy
- ✓ Increasing commercial radar
- ✓ 8 commercially operated satellites + 1 constellation in operation
- ✓ In 2007 Public-Private-Partnerships realized with the launch of TerraSAR-X, Radarsat-2 and RapidEye in 2008

Strong growth in the commercial data market

07' commercial data market $735M; to reach $2.5 - $3.4 billion in 2017



Source: "Satellite-Based Earth Observation, Market Prospects to 2017", Euroconsult 2008

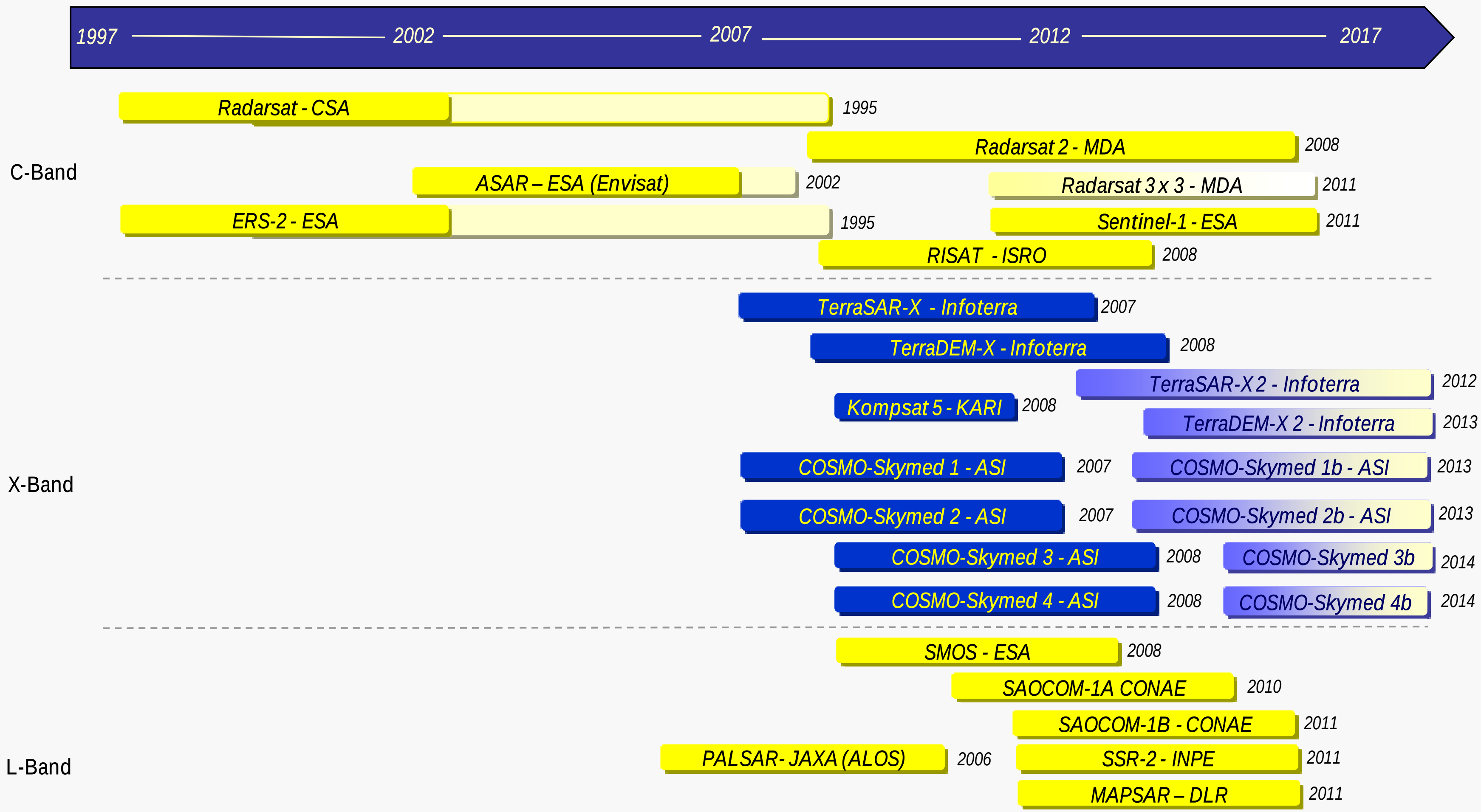
- ✓ More capable systems have boosted the commercial data market: +15% CAGR (02-07)
- ✓ Government the primary user for commercial data: over 80%, security first application
- ✓ Increasing data supply: commercial actor + dual-use + government…
- ✓ More commercial data to come through government-sponsored programs: India, Korea, Taiwan

EO commercial sector diversifying (1)

- ✓ 29+ commercially operated satellites will be launched 2007-2016
  - ❑ Commercial operators will look to develop constellations
  - ❑ Emergence of new entrants
    - ➢ Gazprom - 4 satellite constellation
    - ➢ Iridium NEXT - 66 satellites for environment monitoring
    - ➢ 4C Control - 2 high-res SAR satellites
    - ➢ E-Corce - high-res optical 13 satellite constellation
    - ➢ ...
- ✓ Increasing number of government satellites to look towards commercialization
  - ❑ maximize return on investment
  - ❑ Develop downstream services through free data
    - ➢ Landsat
    - ➢ CBERS

EO commercial sector diversifying (2)

✓ Increase in operational radar capacity;

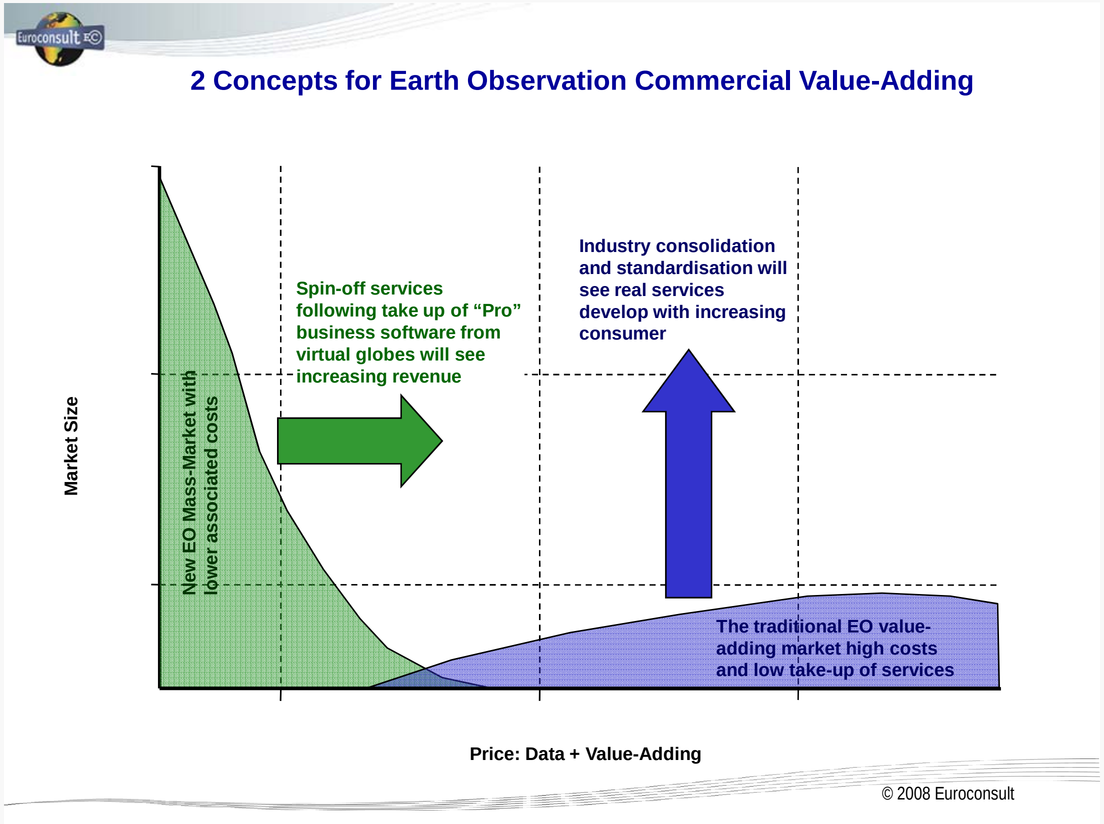


Source: "Satellite-Based Earth Observation, Market Prospects to 2017", Euroconsult 2008

Challenges and Conclusions

Services showing slower uptake

Real take-up of commercial data relies on services

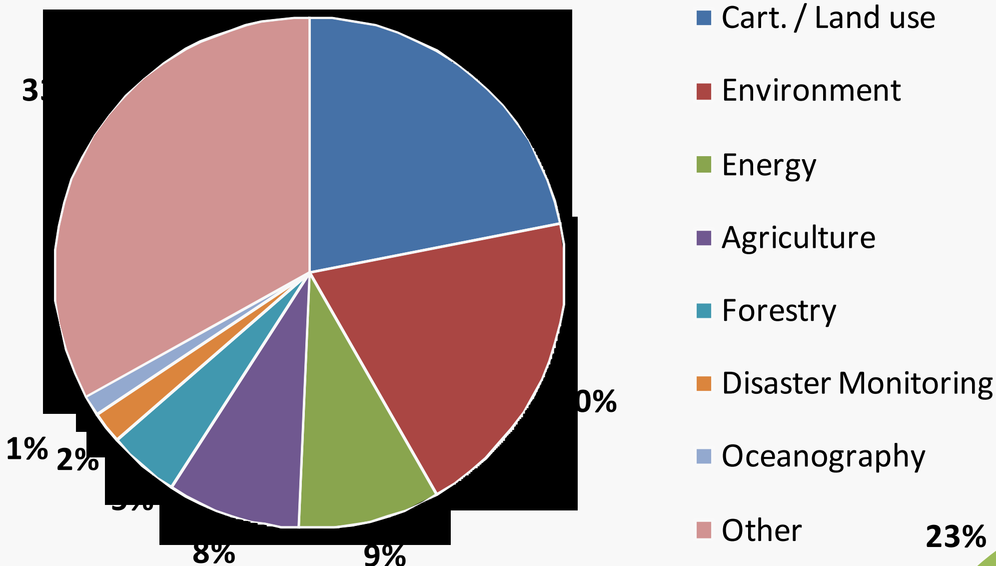


- ✓ The same growth witnessed in the data market is not experienced in EO services
- ✓ Value-added services valued at $1.5 billion in 2007; 5% CAGR
- ✓ Services will be aided by more dedicated systems and timely delivery of data
- ✓ Service industry given a boost with the advent of web-based virtual-globes
- ✓ Low-cost data reduces barriers of entry increases usage

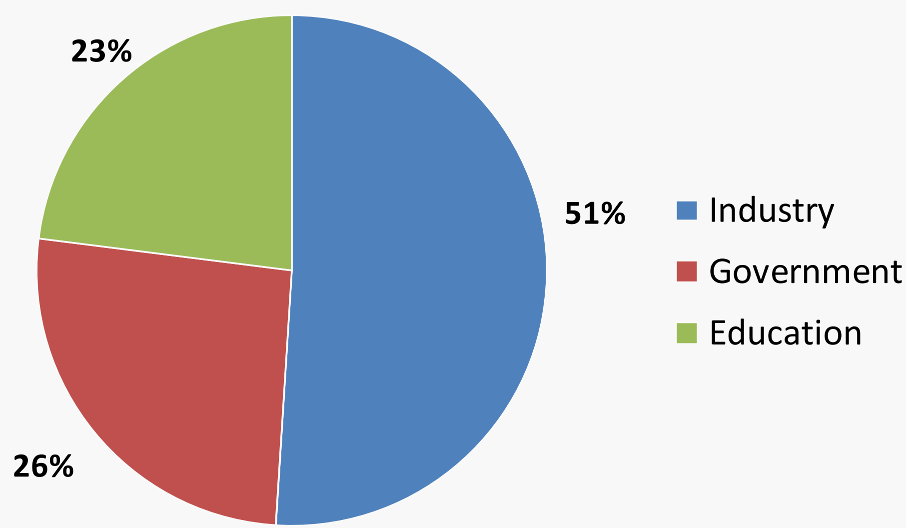
Services showing slower uptake (2)

Low-cost data increases user uptake of services

CBERS data usage by application, 2007



CBERS data usage by end-user, 2007



Emerging programs require greater coordination

Benefits for Environment and Security call for greater cooperation

- ✓ Global environment issues require constant supply of geo-information
  - ❑ CEOS calls for a coordinated response to global collection of geo-information
  - ❑ Emerging space nations first look to regional needs rather than global concerns
  - ❑ Increased cost and access to 3rd party data remains an issue
- ✓ Increasing high-resolution systems from numerous sources make tools for data restriction unworkable
  - ❑ Buy-to-Deny and Shutter control difficult to implement with multitude of satellites
  - ❑ To be addressed to counter friction in the market place and allay national security concerns

The EO industry takes shape

- ✓ Commercial operators look to diversify data usage away from security
- ✓ Commercial data competition will increase but will help develop downstream services: success of various methods of commercialization will encourage further systems
  - ❑ Which method of commercialization will be preferred?
- ✓ Commercialization creates vertically integrated actors
  - ❑ Thales / Telespazio
  - ❑ EADS Astrium / Infoterra
  - ❑ MDA / MDA Geospatial
- ✓ Further consolidation and integration within the value-chain as companies look to tap into the large but fragmented service sector
  - ❑ MDA Geospatial acquire Vexcel Canada
  - ❑ EADS Astrium Services acquires SPOT Image
  - ❑ Fugro GEOS acquire NPA Group

THANK YOU

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About Euroconsult

Established in 1983, Euroconsult has become a world reference for analysis and consulting in high-technology industries with a core expertise in satellite-related applications, ranging from technical supply to final services. Focused on supporting strategic decision making, the company is independent owned and operated.

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