Space in Germany -
Structure and German Space Planning

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Head DLR Space Administration
Member of the DLR executive board
Radar Navigation for Autonomous Driving

Hartmut Runge - Earth Observation Center (EOC) - DLR

Overall Winner of the Copernicus Masters competition

- high precision navigation system
- based on landmarks
- utilization of radar satellites (TerraSAR-X or Sentinel-1)
- independence from GPS
- driver assistance systems and autonomous driving
National Agencies
- Promote and support national strategic goals
- Qualify national industries and scientific institutions for competition
- Prepare projects for ESA/EU programmes

European Space Agency - ESA
- Peaceful purpose, cooperation of European states
- Implementing agency for the European space program
- Programs and activities beyond the scope of any single member

European Union - EU
- Lisbon-Treaty: Parallel responsibility of the EU for research & space policy
- Responsibility for flagship programmes:
  - Galileo - global satellite navigation
  - Copernicus/GMES - global monitoring of environment and security
DLR – a dual capacity entity
**Governmental Tasks**

- **Space Administration**
  - Legal Order: RAÜG
  - Representing German interests at international level on behalf of the German government
  - Framework: Space strategy of the German Government
  - Funding allocation on one's own responsibility *(frequent controle by BRH)*
  - Supervisory body: Ressortausschuss Raumfahrt (AfR)
    - Chairman: Dr. A. Halldorn, BMWi

**Science, Technology, Operations**

- **R&T**
  - Program oriented Funding via HGF
  - Research Centre for Space/Transport & Aeronautics/Energy
  - Program control via external HGF-Evaluation
  - Basic funding + Third Party Funding *(i.a. Agency funds via ESA & NP)*
  - Supervisory body: Senat of DLR
    - Chairman: St Kapferer, BMWi
means / instruments

- participation in ESA and EU programmes, bi- and multi-lateral cooperation
- national R&D space programme
- institutional support to DLR
- PPP, legislation, etc.

strong focus on European cooperation

- Germany is among the strongest contributors to the European Space Program
- BMWi funding (2014)
  - contribution to ESA programs 634 M€uro
  - national R&D space program 272 M€uro
  - DLR (in its capacity as a large-scale research center) 181 M€uro
- BMVi funding (2014)
  - contribution to ESA programs 116 M€uro
  - EUMETSAT 51 M€uro
German Stakeholders in Space Flight

Federal Government

International Partners

International Organisations

German Space Research

German Space Industry
Nationwide distributed capacities

- Major research institutions:
  - German Aerospace Center R&D,
  - Max Planck Society (MPG),
  - Fraunhofer Society (FhG)

- Various Universities and Universities of Applied Science

- DLR Space Administration

- ESA locations
  - European Astronaut Centre (EAC) in Cologne
  - European Space Operation Centre (ESOC) in Darmstadt

- Total number of employees
  ~ 5,000
German Space Industry

Key data of the German space industry
- Employees: ~ 8,300
- Total revenue: ~ 2,42 Bln. €

Regional concentrations
- Baden-Württemberg: ~ 2,700 employees (e.g. Astrium, Tesat, Thales, SpaceTech, vH&S, ND SatCom, numerous SMEs)
- Bavaria: ~ 1,700 employees (e.g. Astrium, MT Aerospace, Kayser-Threde, numerous SMEs)
- Bremen: ~ 1,500 employees (e.g. Astrium, OHB, SMEs)

Industrial structure
- Two large system providers (Astrium, OHB)
- approx. 80 ‘pure’ Space SMEs
- approx. 200 to 300 companies with a small space business
German Industry structure

LSI
Large System Integrators

SSI
Small System Integrators

Supplier and Services

- AIM
- ALROUND
- ASP
- ADVANCED SPACE POWER EQUIPMENT GmbH
- AZUR SPACE
- EPDK
- Fraunhofer
- etamax
- GFZ
- HELMHOLTZ GEMEINSCHAFT
- HPS
- HTS
- IABG
- IFEN GmbH
- Infineon Technologies
- Infoterra
- JENOPTIK
- LEWICKI microelectronic GmbH
- MenloSystems GmbH
- MT AEROSPACE
- MST
- ND SatCom
- Rockwell Collins
- RTG
- RWTH
- STI-Systemtechnik GmbH
- TESAT SPACECOM
- THALES
- THALES ELECTRON DEVICES
- THALES ELECTRON DEVICES
- vH&S
- VES
- TUM
- Universität Stuttgart
- ZARM
- DLR
- DLR Space Administration • Chart 10
Space Strategy of the federal government

*Goals*
- Achieving social, economic and scientific goals
- Addressing key global challenges
- Greater utilization of economic potential

*New Challenges*
- Globalization
- Knowledge society,
- Climate change, conservation of natural resources and global change
- Military and civil security

*Guidelines*
- Benefit and demand oriented
- Subsidiarity and complementarity
- Sustainability
- Intensifying international cooperation
Space Strategy of the German Federal Government 2010
Political focus on benefits, new markets and transfer

- **Orientation toward benefits and needs**

- **Tapping new markets**

- **Knowledge and Innovation**

- **Transfer**
Initiative of DLR Space Administration for Advancement of Innovation and New Markets

Objectives
- Enhancement of innovation and technology transfer from/into space sector
- Exploitation of new markets and new applications for space technologies and space competences
- Creating platforms for information and communication between space sector and other industrial sectors

Activities
- Expert conferences between space sector and other industrial sectors
- Space Science Masters - competition of ideas Identifying innovation and transfer potentials out of space science
- Space Innovation Expo and Workshops „New Markets“

Cooperation with
- Federal Ministry of Economics and Energy and Federal States
- Space Companies and Research Centers
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Backup
Radar satellites **TerraSAR-X** and **TanDEM-X**

- nearly identical construction
- 500 km altitude
- in close formation (few hundred meters)
- scanning the surface of the Earth
- deliver a homogenous elevation model
German Earth Observation

- **EnMAP: Environmental Mapping and Analysis Program**
- Hyperspectral instrument with over 200 channels
- Broad spectral range
- Mission goal: Investigate wide range of ecosystem parameters - encompassing agriculture, forestry, soil and geological environments, coastal zones and inland waters

- **Intended Launch in 2017**
German Satellite Communication

- **SmallGEO (ARTES 11)**
  - Launch 2014

- **EDRS-C (ARTES 7)**
  - Launch 2016

- **Electra (ARTES 33)**
  - Launch 2018

- **Heinrich Hertz**
  - Launch 2018
German Satellite Navigation

- OHB Bremen is prime contractor for manufacturing 22 Galileo satellites
- German Galileo Control Centre in Oberpfaffenhofen.
- Several Galileo test beds (GATE, SeaGATE, …)
German Space Technology Development

DEOS (Deutsche Orbitale Servicing Mission)
- On-Orbit Servicing technology demonstration
- Guidance and Navigation
- Capturing of non-cooperative and cooperative client satellites
- Performance of orbital maneuvers with the coupled system
- Controlled de-orbiting of the two coupled satellites.
German Space Science

Rosetta
- First spacecraft to examine a comet over an extended period of time at close range
- ESA science Cornerstone Mission
- Rosetta Lander Philae: provided by a European consortium coordinated by DLR
- Lander will be operated from DLR Control Centre Cologne.
German satellites in space

- **SARLupe** – Radar reconnaissance system of the German armed forces – 5 satellites

- **SatcomBw 1+2** communication satellites of the German armed forces

- **TerraSAR-X** – radar earth observation satellite

- **TanDEM-X** – Radar earth observation satellite (formation flight with TerraSAR-X)

- **Firebird** – forest fire monitoring

- **Rapideye** – System for optical earth observation 5 satellites

\[\sum = 15 \text{ satellites in operation}\]
Space Strategy of the federal government

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 Guidelines
- Benefit and demand oriented
- Sustainability as a principle
- Intensifying international cooperation
# Space Strategy of the Federal Government
- Important aspects -

| **Sovereignty** | - own system skills  
|                 | - key strategic technologies for comprehensive space utilization |
| **Security**    | - contribution to national security; dual use  
|                 | - use joint technology and industrial policy/synergies |
| **Knowledge society** | - create knowledge & made data available worldwide  
|                   | - expand space research |
| **New Markets / Commercialization** | - value to downstream markets  
|                                   | - new business models - even beyond the demand of state |
| **Innovation transfer** | - space technology is at the boundary of the feasible  
|                         | - transfer spin-offs from space to terrestrial applications |
| **Sustainability** | - increase environmental awareness in space  
|                    | - avoid and reduce space debris |
| **Cooperation**   | - contribution to strengthening international cooperation |