DLR - The Year Ahead in Space R&D Space Program

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Research Center
&
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Budget Figures 2010
€1450 million

- **Space Agency**
  - German ESA contributions from the BMWi: 593 million
  - National Space Program *: 185 million

- **Research and Operations**
  - Institutional funding: 374 million
  - Third-party funding: 298 million

* without management budget
Space Budget - Germany

- **ESA-Program**
  - 593 Mio.€ (2009)

- **National Program**
  - 185 Mio.€ (2009)

- **DLR R&D**
  - HGF-Program

**Further Activities**
- EU, EUMETSAT
- DFG, Universities
- FhG, HGF, MPG
- Industry etc.

### ESA
- **Earth Observation**
- **Satellite Communication and Navigation**
- **Space Science**
- **Zero Gravity Research**
- **Spacestation**
- **Space Transport**
- **Space Technology**

### NP

### DLR

### Others

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**Budget Distribution:**
(905 Mio. € in 2009)

- **ESA**
- **NP**
- **F&E**
  - 14%
  - 20%
  - 66%
R&D Space Budget Share including third party funding

- Earth Observation: 69 Mio. Euro
- Communication/Navigation: 40 Mio. Euro
- Zero Gravity Research: 13 Mio. Euro
- Space Research: 14 Mio. Euro
- Space Technology: 74 Mio. Euro
- Space Transportation: 10 Mio. Euro

36 % Application
12 % Science
52 % Technology
DLR Space Research Program

- Space Science
- Zero Gravity Research
- Earth Observation
- Communication & Navigation
- Space Transportation
- Space Technology e.g. Robotics
Goals and Strategies of the Space Research Area

Primary goals
Development of space flight for the benefit of society

- **Scientific knowledge:**
  Research into the Earth, the universe and conditions in space

- **Commercial applications:**
  Internationally competitive commercial applications

- **Space flight for public service functions:**
  Meteorology, environment, resources, civilian and defence security

Fundamental strategic components
Development and deployment of key technologies

- **Infrastructure:**
  Launchers, platforms, instruments/sensors, ground segments

- **Application:**
  Methodology development, potential applications
DLR Space Research – Earth Observation

Focus:
- Sensors: SAR, Lidar, IR, optical, aircraft-based sensors
- Ground segments: Satellite control, payload ground segments
- Application areas: Land, atmosphere, sea, risks/disasters

Highlights:
- TerraSAR-X: in operational use since beginning of 2008
- Tandem-X: launch 2010, DEM of the earth
- EnMAP: start of phases C/D in 2008, operational 2014

Future:
- Tandem-L, Grace follow on
- Optical high-resolution national satellite mission,
- GMES operational…
DLR Space Research – Communication/Navigation

Focus:
- Satellite communications: optical communications, transmission standards (DVB-S2/RCS), applications/services
- Navigation: Galileo operation and operational support, applications (including indoor navigation)

Highlights:
- Galileo Control Center
- LCT application on TerraSAR-X and NFIRE

Future:
- Development of GALILEO II technologies
- Safety-of-life applications
- Combination of communications, navigation and earth observation
DLR Space Research – Space exploration

**Focus:**
- Exploration of the solar system
- Search for extrasolar planets

**Highlights:**
- Mars Express: high-resolution measurement of the Martian surface
- Venus Express: research into the atmosphere around Venus
- Cassini: exploration of Saturn and its moons
- COROT: Search for extrasolar planets
- Dawn: NASA asteroids mission
- Rosetta: ESA comet lander mission

**Future:**
- ‘Mission to Mars’ – ExoMars
- Participation in moon missions (national, European, or international)
Focus:
- Research under conditions experienced in space
- On sounding rockets, parabolic flights and the International Space Station
- In the fields of life sciences and materials science

Highlights:
- Biological radiation experiments on the ISS (Matroshka)
- Research under microgravity on parabolic flight campaigns and sounding rockets
- Bed rest studies for development of methods to prevent muscle and bone wastage

Future:
- Utilisation of ISS/Columbus
- Studies with the new ESA short-arm centrifuge
Focus:
- Ariane ‘Next Generation Launcher’ research
- Propulsion systems – research and test
- System analysis, innovative materials and simulation

Highlights:
- Flight experiments with SHEFEX (sounding rocket)
- Upper stage propulsion unit: altitude simulation
- Materials: innovative thermal protection

Future:
- European ‘Future Launcher Preparatory Programme’ (FLPP)
- Ceramic propulsion system
Focus:
- Servicing in space – robotics
- Future space systems – satellite technology, verification and operation

Highlights:
- Robotics missions: ROKVISS, on-orbit recovery (OLEV)
- Satellite missions: on-orbit technology verification program

Future:
- Exploration technology, compact satellites
Institutes and Facilities Involved in Space Research

- Bremen
- Berlin
- Braunschweig
- Goettingen
- Hamburg
- Koeln
- Lampoldshausen
- Oberpfaffenhofen
- Stuttgart
Facilities – Space

- Research aircraft
- Infrastructure for receiving, refining and distributing data
- Wind tunnels
- Mobile rocket base, MORABA
- Control centres
- Research test beds
Knowledge for Tomorrow

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