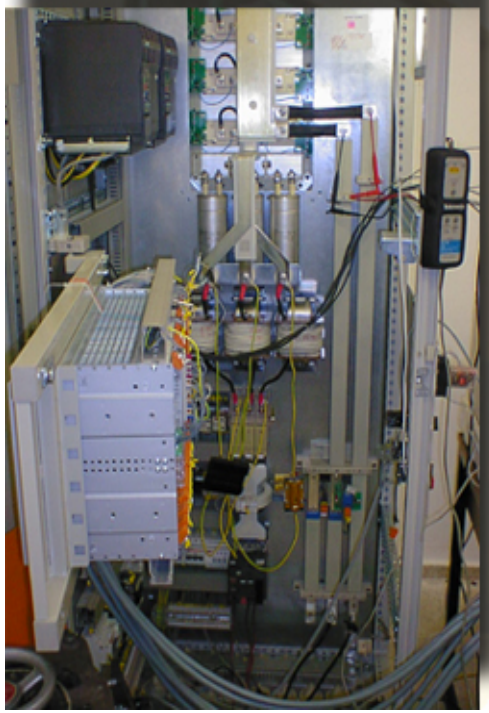
TÜBİTAK
BİLTEN



The Scientific and Technical Research Council of Turkey

Information Technologies and Electronics Research Institute

History

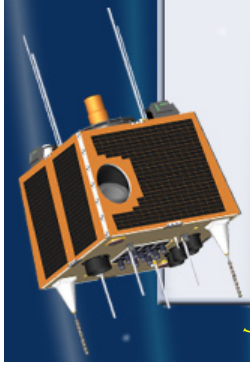
- Established on 30 October 1984 according to an agreement between TÜBİTAK and Middle East Technical University (METU)
- In 1995, its name changed from “Ankara Elektronics R&D Institute” to BİLTEN
- In 1998, moved to its own premises in METU Campus

TS EN ISO 9001
CERTIFIED

Staff

- Researcher : 88 + ~30
- Tech. Support: 24
- Administrative: 31

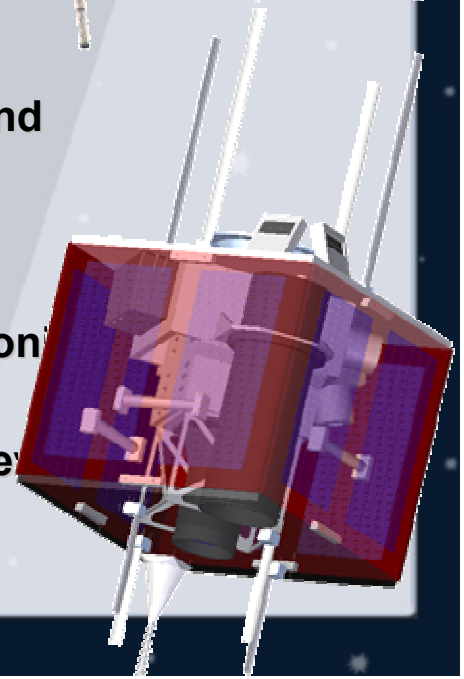
- Organized in 12 Project Groups

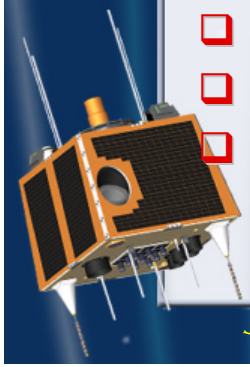


Project Groups

- **Satellite Technologies**
- **Communication Systems**
- **Electronic System Design**
- **Signal Processing and Remote Sensing**
- **VLSI Design**

- Application Software Development
- Information Society Infrastructure, Electronic Commerce and Information Security
- Intelligent Energy Conversion
- Internet Technologies and Applications
- ORBIT: Organization, Information Gathering and Project Mon
- Power Electronics
- Power Systems and Information Technologies Hardware De



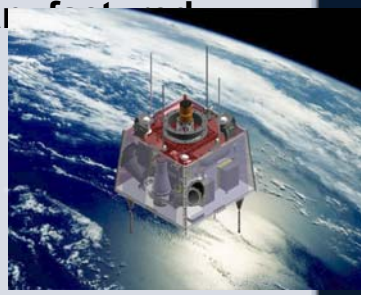


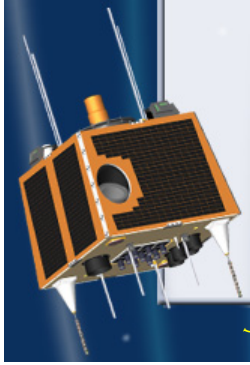
Satellite Technologies Group

- Established in 1998.
- Staff
  - 14 Researchers (4 Aeronautical and Aerospace Engineer, 10 Electronics Engineer)
  - Technical and Administrative Suppport
- Also supported by around 30 researchers from other groups
- Target: Establish and improve technologies related with small satellite design and manufacture
- Focuses on module and system level design, manufacture, integration and test of small satellites

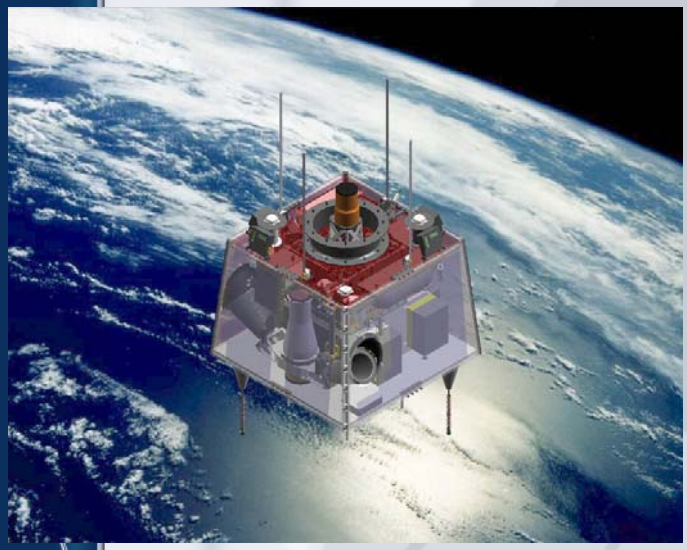
Projects

- **BİLSAT-1 Project**
  - Fulfilled with a budget around larger than 14 million USD to establish all necessary infrastructure and know-how transfer about LEO Micro satellites
  - Conducted with SSTL, a spin-off from Surrey University in the UK
  - A satellite so-called BILSAT-1 was designed launched to LEO- and is operational
- **Space Research and Development Project**
  - Training have been given to various satellite related staff working for government and industrial organisations. Satellite conceptual design tools are developed. Reports are written on satellite technology.
- **RASAT Project**
  - Second LEO EO Satellite
  - By fulfillment of this project, a satellite will have been designed and ma[illegible] Turkey
- **Other Development Projects**
  - BİLGE (On board computer)
  - ALP (Intelligent Lithium Battery)
  - Orbit propagator
  - GEZGİN-2 (VLSI Group)
  - Image Archieve and processing software (Remote sensing and signal processing group)
  - X-Band Communication System (Communication Systems Group)



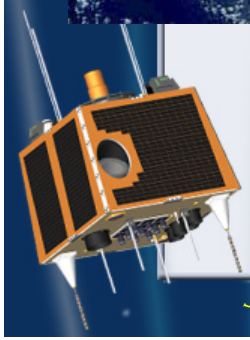


BILSAT-1 Project

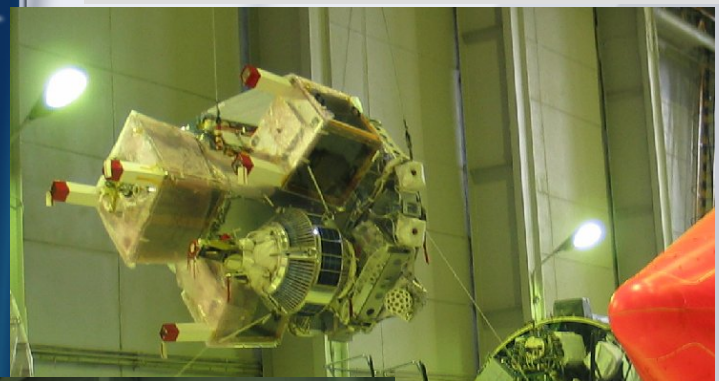


Objective

- To acquire necessary skills required to design, manufacture and test of small satellites
  - Establish required infrastructure
  - Train people
  - Acquire necessary know-how
- Acquire necessary skills to manage a satellite project
- To launch and operate a LEO EO satellite
- A “start point” for future LEO satellite projects



BILSAT-1 Project

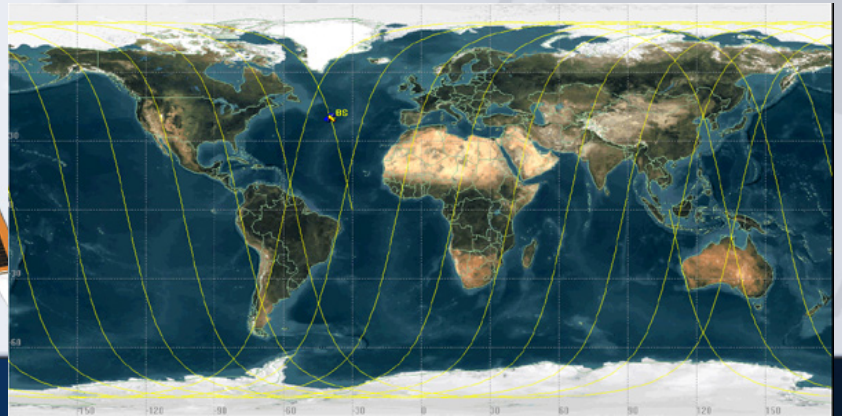


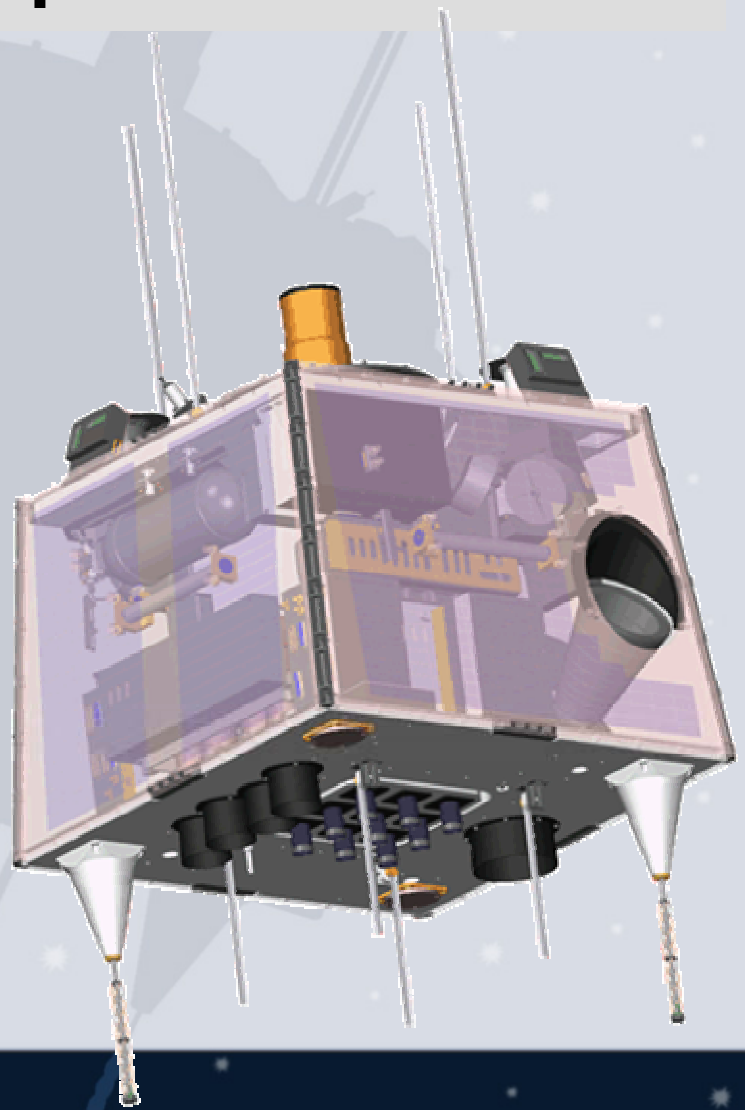
The project covers:

- The satellite
  - Design, manufacture, test, insurance, launch and comissioning
- Ground Station
  - Satellite control ground station
- Infrastructure
  - Satellite test and integration labs
  - Design office
- Know-How Transfer
  - Turkish team worked with SSTL team in close cooperation and gained hands on experience
  - Limited license
  - MSc. and PhD. studies at Surrey University
  - R & D payloads carried out by BILTEN engineers

BİLSAT-1 Specs

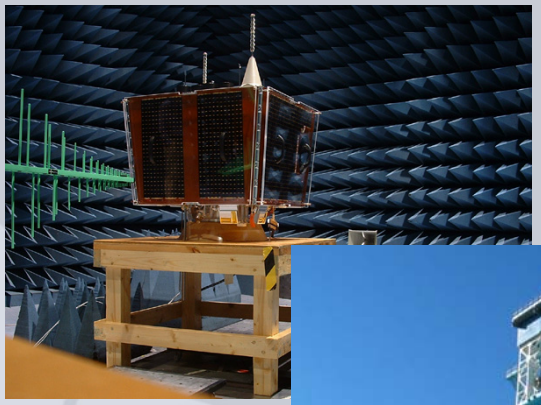
- Mass: 129 kg
- Orbit: 686 km, SSO
- 3-axes control
- On board propulsion
- 5+10 life time
- Imaging system
  - 26.7 m MSI (red,blue,green,NIR)
  - 12.6 m PAN
- Store and forward comms
- Research and Development payloads

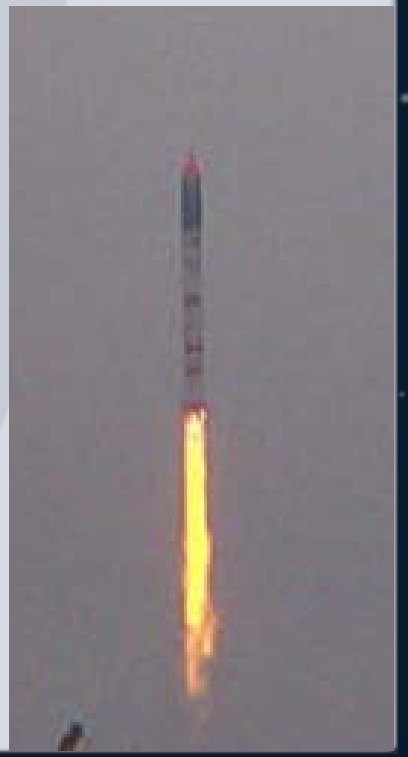


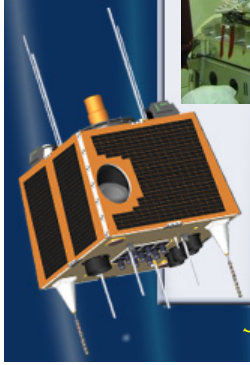


BILSAT - Project Milestones

Kick-off	Mission Definition Review	Preliminary Design Review	Critical Design Review	Module Readiness Review	Test Readiness Review	Flight Readiness Review	Launch
12 Aug 2001	10 Oct 2001	13 Dec 2001	18 Apr 2002	25 Jul 2002	14 Mar 2002	3 Jun 2003	27 Sep 2003



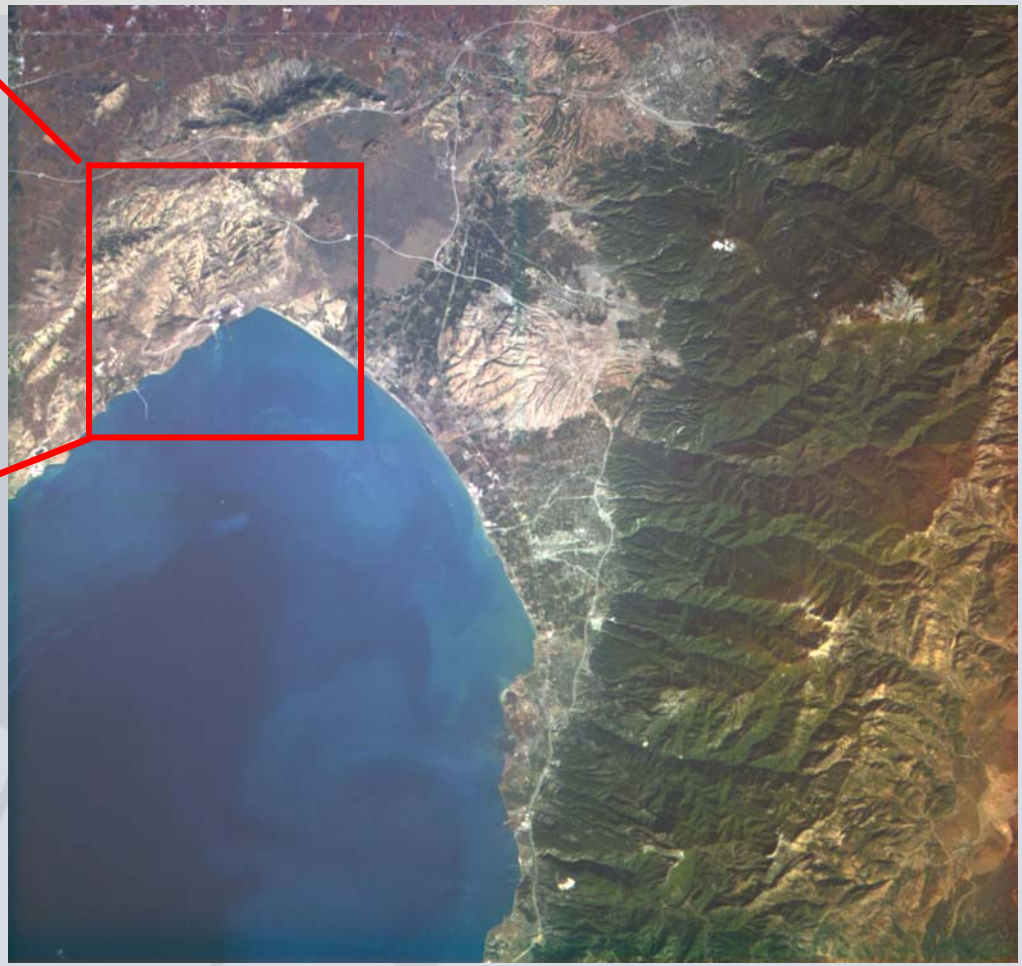




Multi Spec Image Sample

Northern Cyprus; Oct 3rd, 2003, 4:06 UTC

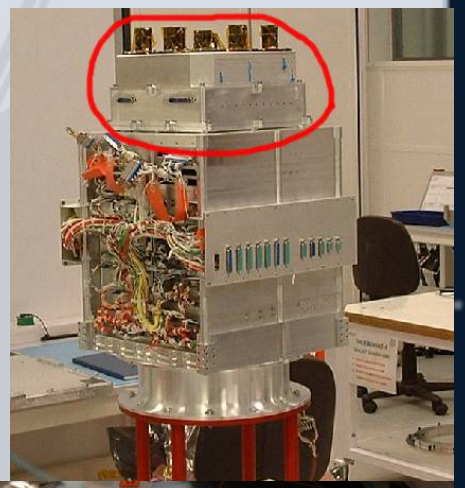
BILSAT - Sample Multispectral Image

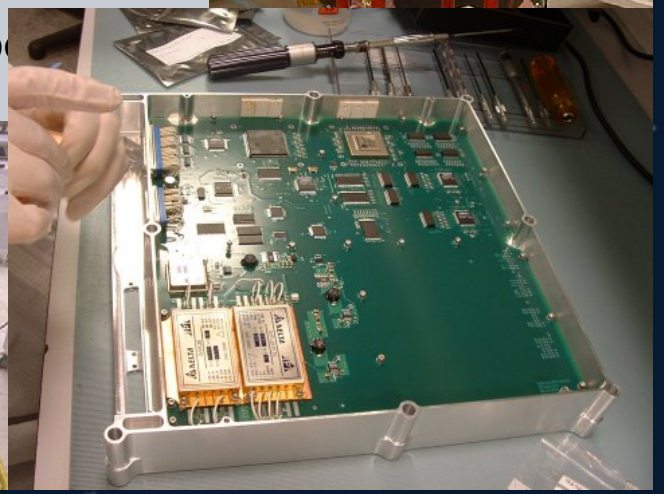


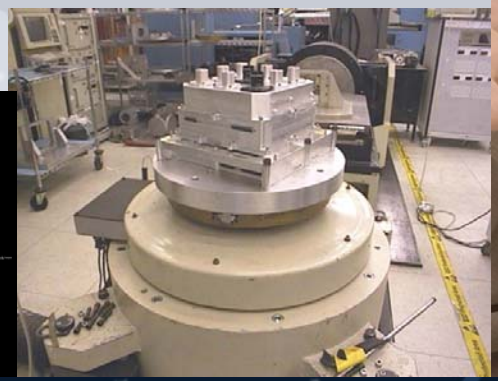
Iskenderun Bay, 30 Oct 2003, 9:14 (GMT+2)

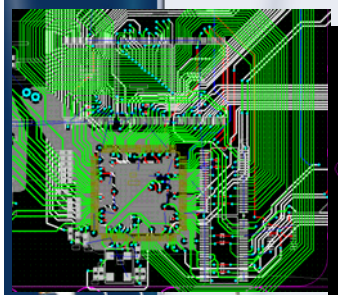
BILSAT - R&D Payloads

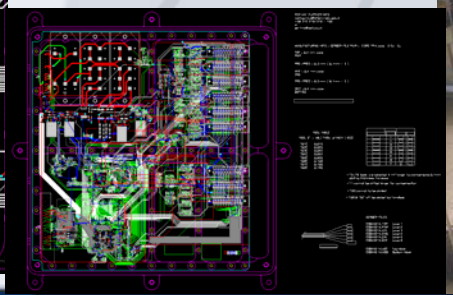
- **Turkish Payloads**
  - There are two Turkish R&D Payloads on board of BILSAT: ÇOBAN (Low-Res Camera) and GEZGIN (Real-time JPEG2000 Image Compression Card)
  - Designed, manufactured and tested in Turkey
  - Succesfully functioning in orbit
- **Joint Payloads**
  - GPS attitude determination system
  - Control moment gyro for agility (ESA supp





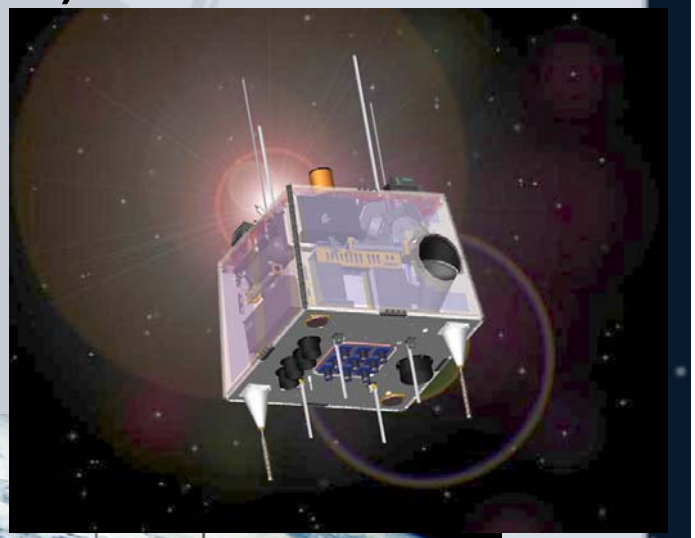


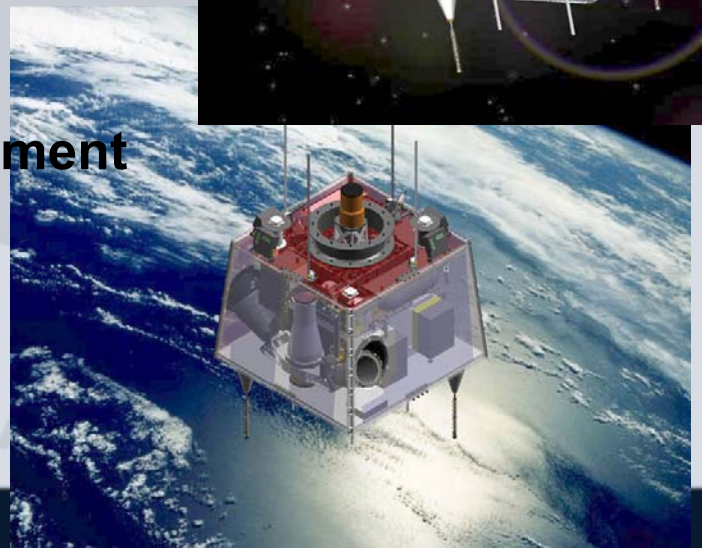


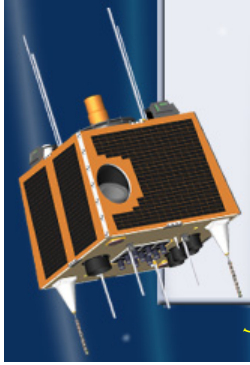


BILSAT - DMC

- Disaster Monitoring Constellation (DMC)
  - Algeria – Alsat
  - Nigeria – Nigeriasat
  - Turkey – BILSAT
  - UK – UK-DMC
- Everybody controls own satellite
- Operated in coordination
- Daily coverage
- Free data for disaster management

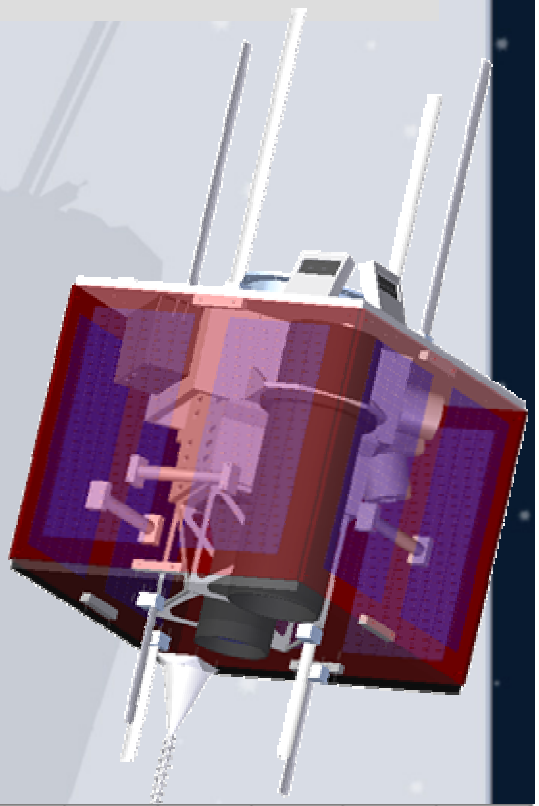




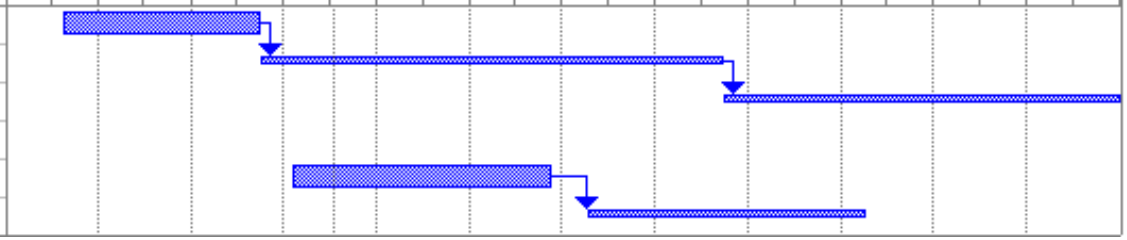


RASAT Project

- Funded by State Planning Office as a research project for and 8 m res. LEO EO satellite
- End of project scheduled for end of 2006
- Launched scheduled for late 2007
- Main imaging system to be procured from external suppliers
- By successfull completion of this project:
  - New payloads have been tested in space
  - First LEO EO satellite designed and manufacture totally in Turkey will have been launched
  - Infrastructure and skills about LEO satellites will have been improved

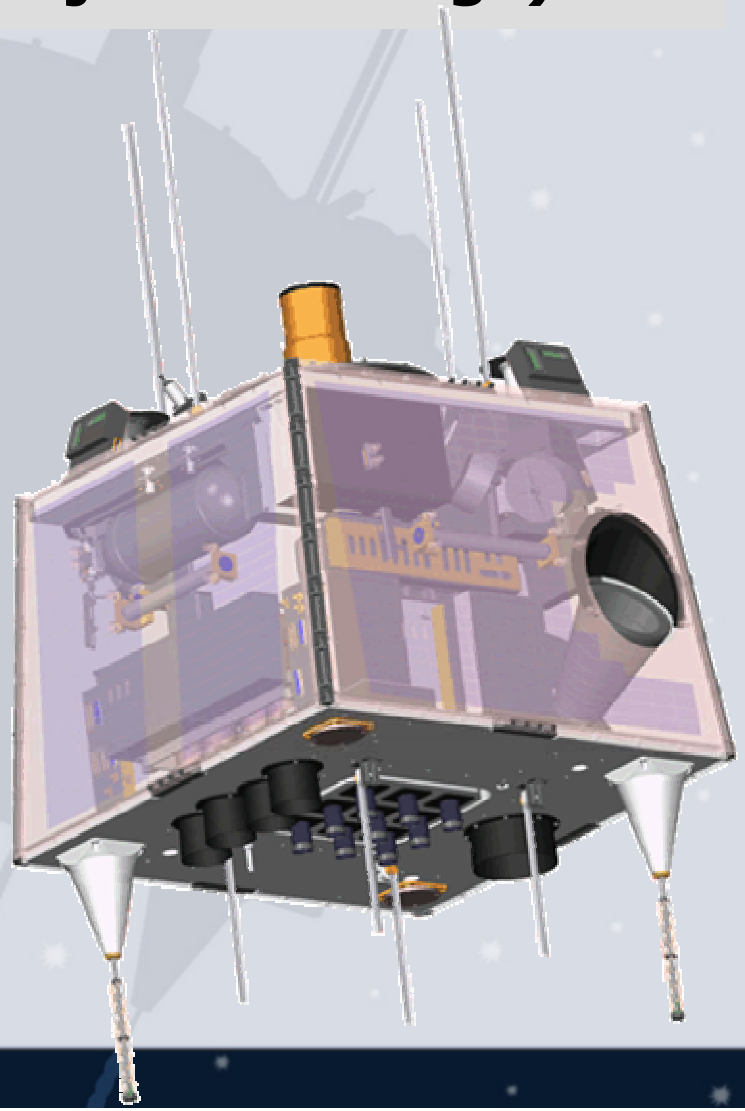


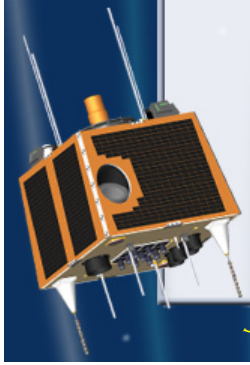
ID	Task Name	Duration	Start	Finish
1	**BILSAT Project**	111 w	13.08.01	28.09.03
2	Operation in 3-Axis St. Mode	260 w	28.09.03	19.09.08
3	Operation in Nadir Looking Mode	520 w	19.09.08	07.09.18
4				
5	RASAT Project	146 w	02.02.04	20.11.06
6	Operation	156 w	09.04.07	05.04.10



RASAT - Properties (Subject to change)

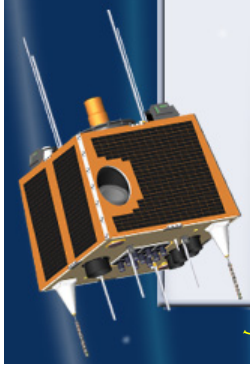
- Weight: 100 - 130 kg
- Orbit: 620-700 km, circular, Sun-Snchronous
- 3-axis control
- Life: 3 Years
- Cameras
  - TBD (At least 8 m GSD)
- R&D Payloads
  - Flight computer
  - Spacewire bus
  - X-band high rate comm.
  - Lithium battery
  - GEZGIN-2
  - Camera





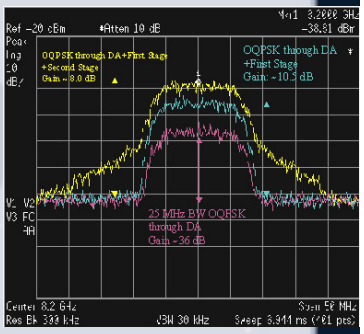
RASAT Project

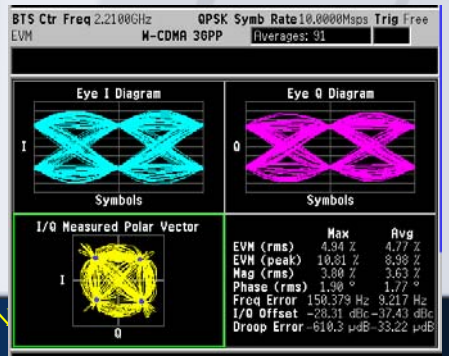
- MDR will be held soon
- The GSD will be at least 8 meters
- As outcome of the project:
  - First Turkish satellite will be built
  - National capacity will be increased
  - Our own modules will be qualified
  - We will have a step towards more capable satellites

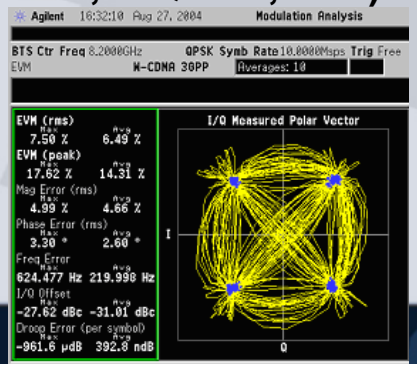


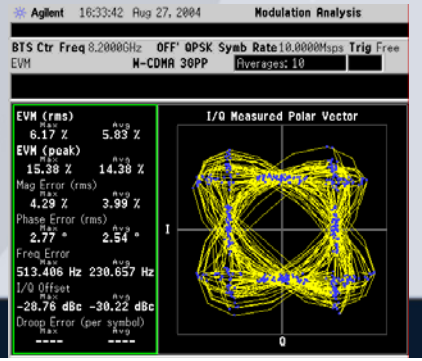
Other Projects - 1

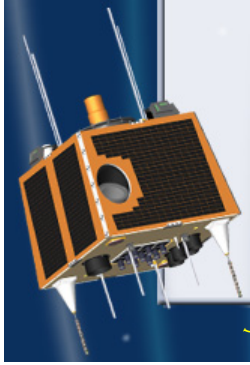
- **BİLGE (On board computer and Spacewire bus)**
  - An improved on board computer for future missions (PowerPC, 66 MHz, 4 HDLC Comm. Channel (LVDS), 3 Fast Transparent Data Input Port (LVDS), 2 CAN Ports, 4 x 100 Mbps ESA Spacewire ports)
- **ALP (Intelligent Lithium Battery)**
  - Recent technologies in Lithium Battery will are applied
- **GEZGİN-2 (VLSI group)**
  - An improved version of GEZGIN with image encryption and preprocessing capabilities
- **X Band Comms System**
  - Fast communications via X Band to download images (Phase Array Antenna, 8.2 GHz, 100 Mb/s, OQPSK, 7 W)





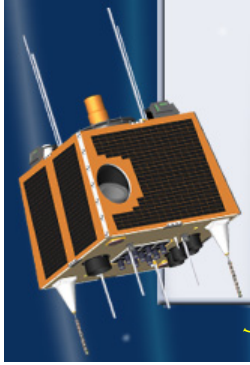






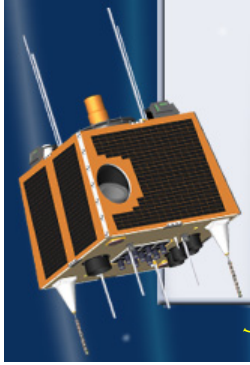
Other Projects - 2

- Orbit propagator
  - A software has been developed to propogate satellite orbits
- Super Resolution
  - A number of images are used to improve the resolution of a single image
- Satellite Images Archive, Browsing and Processing Package



Conclusion

- We have capability for designing, manufacturing and testing satellite systems and sub-systems
- We have close links with Turkish universities and companies
- We would like to take part in FP6 projects



Thanks

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