



RECENT SPACE ACTIVITIES IN TURKEY

Enes KOYTAK - Advisor



MINISTRY OF
TRANSPORT,
MARITIME AFFAIRS
AND
COMMUNICATIONS



AGENDA

- **Establishment of Directorate General of Aeronautics and Space Technology**
- **The Satellite-Space Technology and Subsystem Roadmap of Turkey**
- **Studies on Space Technology in Turkey**
- **Satellite-Space System Projects**
- **The Use of Space Technology Applications**





Directorate General of Aeronautics and Space Technology

Duties:

- To specify Turkish space policy and strategy and goals.
- To regulate the space activities.
- To product, establish, operate and develop space technologies.
- To support space research and development activities.
- To support the public applications of space.
- To represent Turkish government in international space activities and platforms

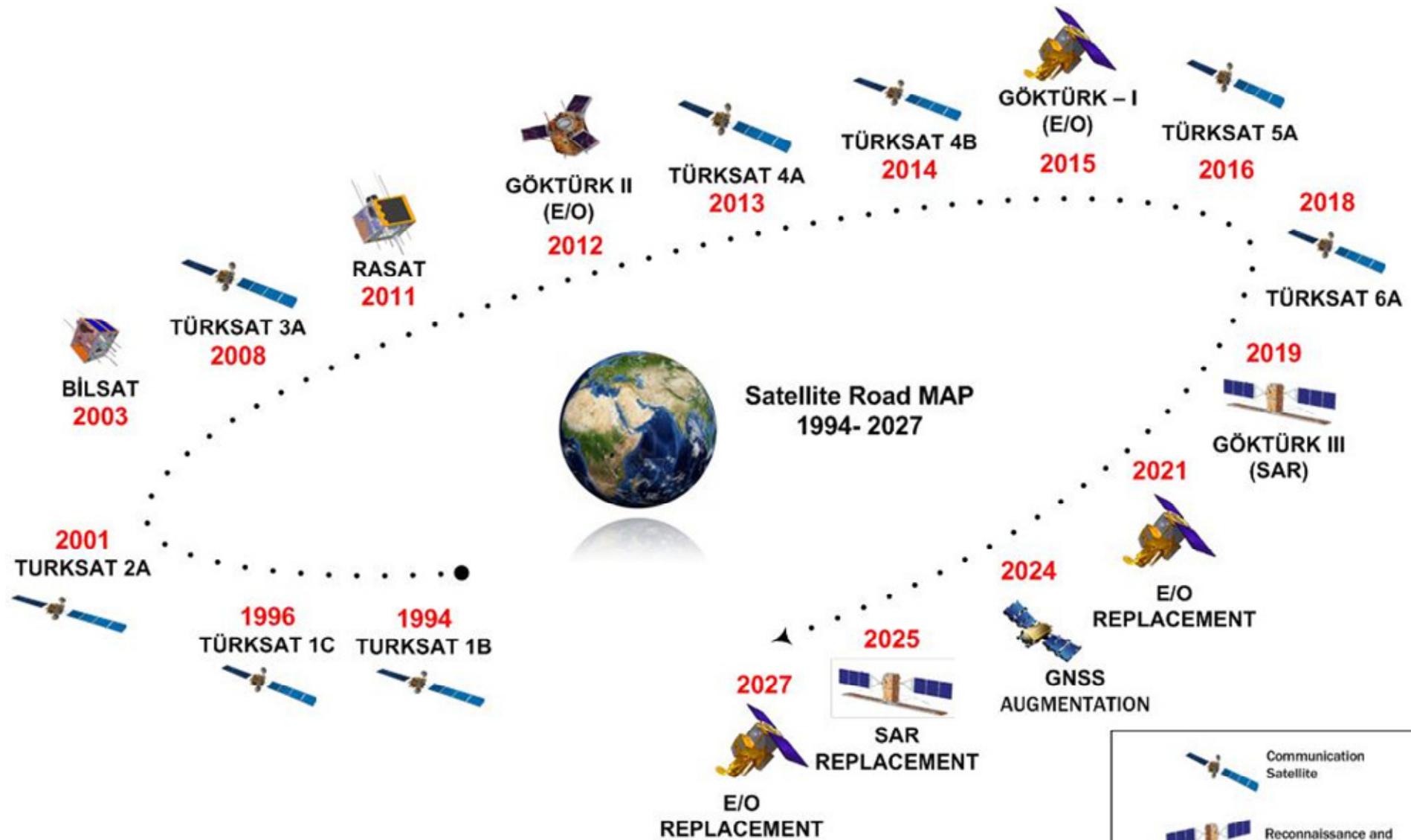




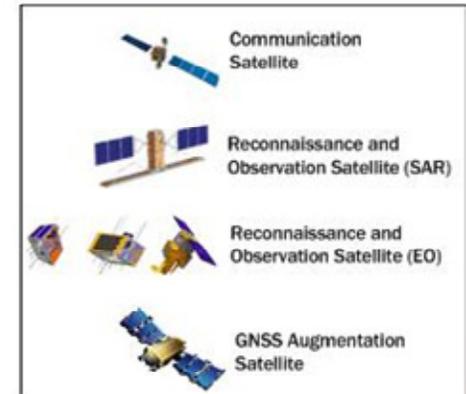
The Satellite-Space Technology and Subsystem Roadmap of Turkey

- Satellite-space technology and sub-system roadmap of Turkey is created to determine the space technologies needed for Turkey's short and medium term space plans.
- Roadmap clearly lists the already acquired technologies and the areas which needs more research and development.
- In Turkey, communication, earth observation, reconnaissance satellite systems and sub-systems and also launch vehicle projects are already carried out by public and private sector.
- The Roadmap provides Turkish space industry a clear view of the future market opportunities and encourages them to invest more.





Roadmap





Studies on Space Technology in Turkey

□ Turkish State Meteorological Service (DMI)

- DMI joined the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) in 1986 as a founding member, 2.27% shareholder and began using meteorological satellite products.

□ Space Activities in Universities:

○ METU (Middle East Technical University)

- The 2.5 meter resolution Earth Observation Satellite Camera development project initiated in 2007 by Middle East Technical University, Department of Physics and completed in 2011.



Studies on Space Technology in Turkey

○ ITU (Istanbul Technical University)

- The Satellite Communications and Remote Sensing Centre of Istanbul Technical University (ITU-UHUZAM) was established in 2000 and currently operated as an data uplink downlink earth station. ITU-UHUZAM satellites are SPOT-2, SPOT-4, ERS-2, RADARSAT-1, NOAA-AVHRR, METEOSAT.
- A pico satellite (ITU-pSat) was developed, produced and launched under QB-50 project.
- A low-earth orbit experimental satellite Turksat-3USAT was designed and produced in Turkey and launched from Jiuquan Launch Center (China) on 26 th April 2013.





Studies on Space Technology in Turkey

□ TURKSAT Corporation Space Activities;

- Turksat 1B satellite, was launched into space on 11 August 1994 (42° E),
- Turksat 1C satellite, was launched on 10 July 1996 (31° E),
- Turksat 2A satellite, was launched on 11 January 2001 (42° E),
- Turksat 3A satellite, was launched on July 16, 2008 (42° E),
- Turksat 4A and 4B satellites are being manufactured by the Japanese company MELCO.





Studies on Space Technology in Turkey

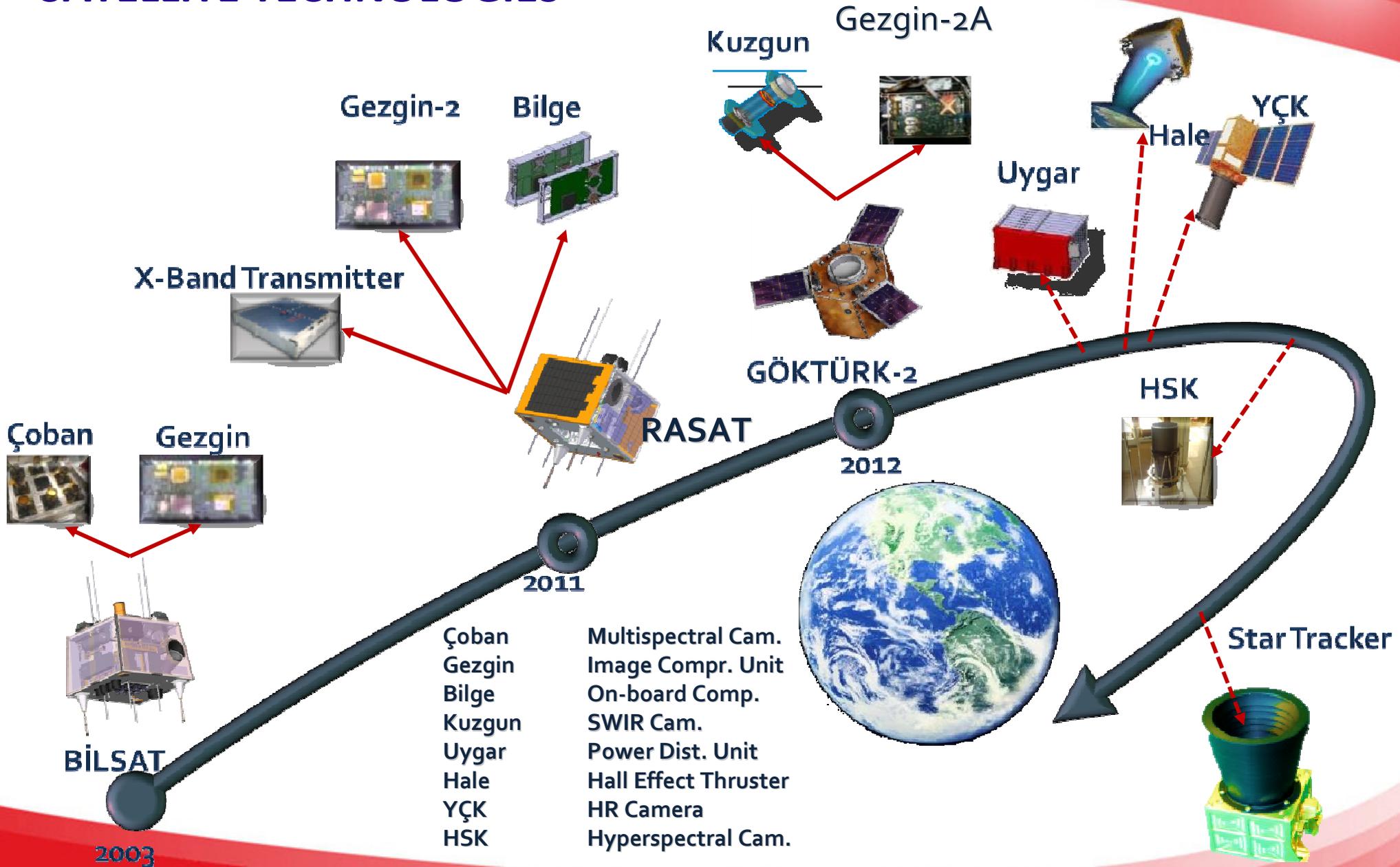
□ TÜBİTAK Uzay-Space Technologies Research Institute

- BILSAT: co-produced with the SSTL (Survey Satellite Technology Limited Company). BILSAT carried an Electro-Optical camera .
- RASAT: The overall objective is to establish and develop small satellite technologies in Turkey. It is the first remote sensing satellite that is being developed and manufactured in Turkey by Turkish engineers.
- Satellite sub-systems listed below are designed by TUBITAK Space.
 - GEZGİN: Real-time image satellite sub-system.
 - COBAN : Multi-Band Camera(Location sampling distance of 120 m.)
 - BİLGE: Flight Computer and Data Path.
 - X-BAND: X-Band Communication subsystem.
 - Flight and Ground Station Software
- GOKTURK-2 Satellite (completed project)
- Under IMECE Satellite System, Sub-System Development

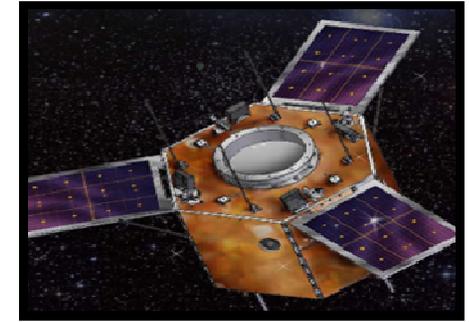
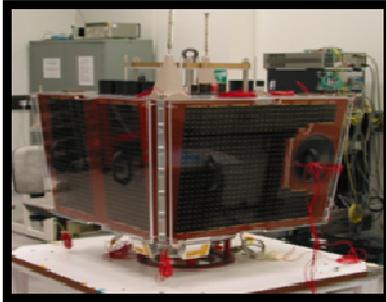




SATELLITE TECHNOLOGIES



SATELLITES



- BİLSAT, design, manufacture, test, test, insurance, launch, commissioning
- Technology Transfer
- Ground Station

2001-2003

2004-2011

- RASAT Design and Manufacture
- Capacity Build-up
- Launch, Commissioning and Ground Ops.
- Technology Implementation

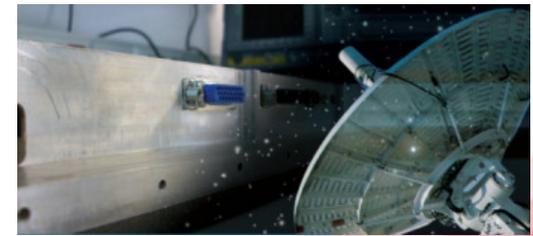
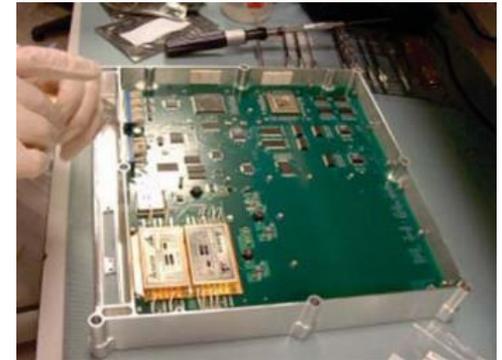
- GÖKTÜRK-2 Satellite Development
- Capacity build up for state of the art satellite development
- Customer Focused Development

2007-2012

PROJECTS - SUBSYSTEMS

Indigeneous Satellite Modules and Subsystems

- Multi-spectral CCD Satellite Imager
- Thermo Electrically Cooled Satellite SWIR Camera
- GEZGIN: High performance real-time image compression
- Satellite Power System Design
- X-Band Transmitter
- S-Band Transmitter/Receiver
- BILGE: High performance, radiation tolerant mission computer and high capacity data recorder
- Hall Effect Thruster





COSPAR 2016 İstanbul

COMMITTEE ON SPACE RESEARCH

The 41th COSPAR Scientific Assembly will be held in İstanbul, Turkey in 2016.

Around 60 countries 3000 participants are expected.

The 40th COSPAR Scientific Assembly will be held in Moscow, Russia in 2014.

COSPAR Scientific Assembly previously organized in:

- 2012 - Mysore, India
- 2010 - Bremen, Germany
- 2008 - Montréal, Canada
- 2006 - Beijing, China
- ...

TUBITAK UZAY has the National Coordination Point for the organization of COSPAR 2016 and the representative institution for COSPAR.





Space System Key Capabilities of TAI

Mission Planning & Control

System & Subsystem Design and Manufacturing

Verification & Validation

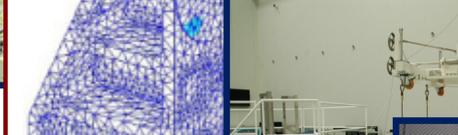
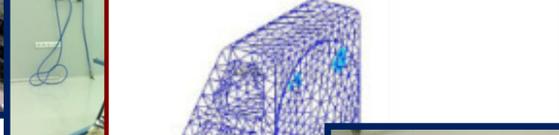
Structure & Mechanisms Design & Analysis

Thermal Control Design & Analysis

Assembly & Integration

Environmental Testing

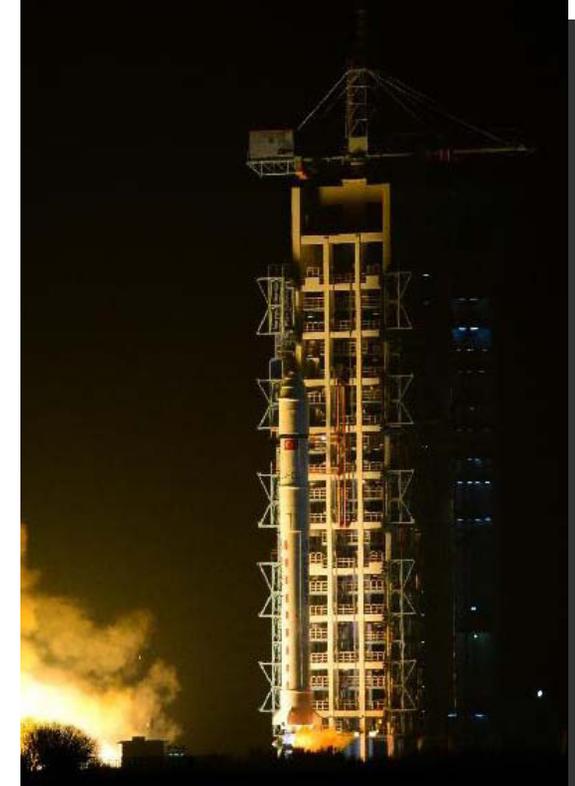
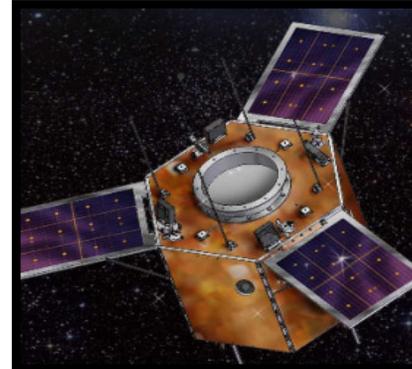
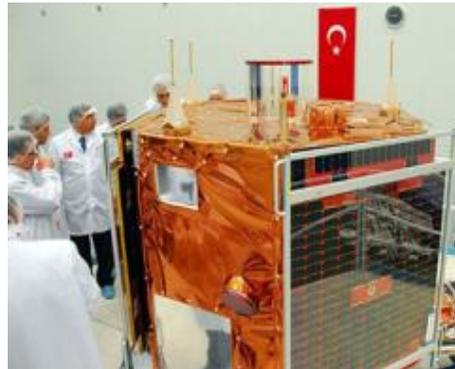
Operation Support





Indigenous Development-GÖKTÜRK-2

Göktürk-2 was launched on December, 18th 2012. It operates successfully



Responsibilities of TAI

System Engineering Support	Assembly, Integration & Test
Structure & Mechanisms Design & Analysis	Environmental Testing
Thermal Control Design & Analysis	Power Systems and Harness
Attitude & Orbit Determine & Control System	Ground Systems Control & Operations
Avionics System Integration & Verification	Integrated Logistics Support



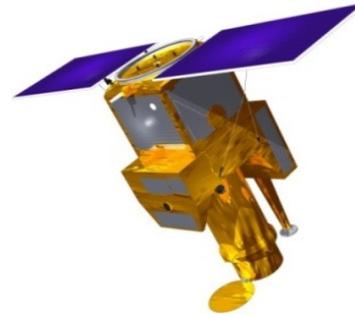


GÖKTÜRK-1 Satellite

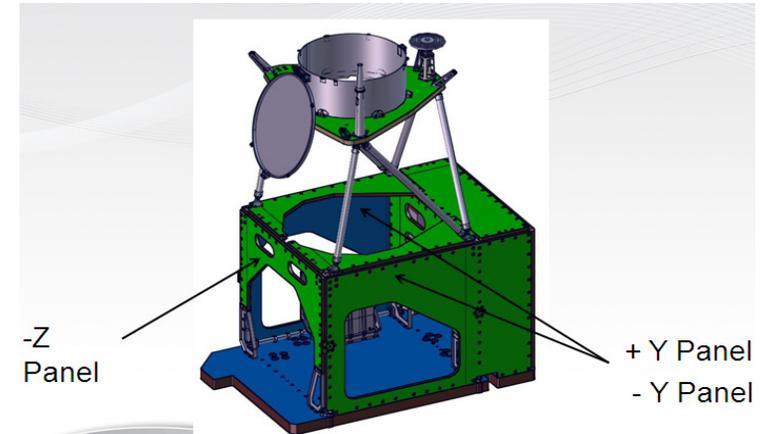
Product	Earth Observation Satellite System & Ground Segment
Prime Contractor	TELESPAZIO
Responsibilities of TAI	<ul style="list-style-type: none"><input type="checkbox"/> All Engineering Activities Direct Participation<input type="checkbox"/> Local Development & Manufacturing in TAI Facilities (3 Panels of MMS -Z, -Y, +Y)<input type="checkbox"/> AIT Center Establishment in TAI Facilities
Status	CDR in process



Launch 2015



Acceptance Test 2015



Mission Model Structure-MMS

Acceptance AIT 2013



<< Ulaşan ve Erişen Türkiye >>



AIT Center Infrastructure Under Construction in TAI

AIT Center Infrastructure capable to support all AIT activities including GEO Satellites up to 5 tons:

- Integration Capabilities for Both GEO & LEO Satellites simultaneously
- Thermal Vacuum Chamber
- Compact Antenna Test Range Facility
- Solar Array Deployment Facility
- EMI/EMC Test Facility
- Vibration Test Facility
- Mass Properties Measurement System
- Acoustic Test Facility
- MLI Preparation Room
- Battery Storage & Preparation Room

AIT CENTER will be fully operational in 2014



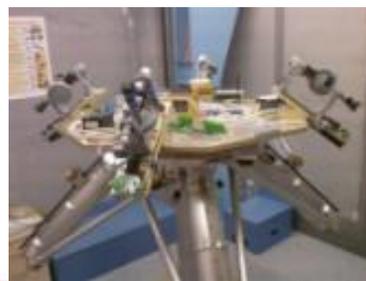
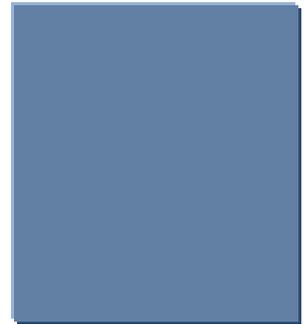
AIT Center will serve national and international space programs



Space System Integration & Test Infrastructure

Existing Space Systems Infrastructure of TAI:

- Thermal Vacuum Chamber
- Mass Properties Measurement System
- Satellite Container, AIT Tools and GSE's
- Attitude Determination & Control Test Bed
- Satellite Dynamic Integration Laboratory
- Space Harness Workshop
- Space Avionics Integration Laboratories
- Avionics EMI/EMC Test Laboratory
- Space Electronics HW Development Laboratories





Other Satellite Programs of TAI

GÖKTÜRK-3 SAR 1 Satellite

The contract of GÖKTÜRK-3 Program was signed on 8th May 2013 (at IDEF-2013) between SSM and TAI. TAI is the Prime Contractor and proposed launch is 2019.



IMECE E/O Satellite

TAI works on IMECE Indigenous EO Satellite with a resolution of 1 meter or better, an E/O camera and a second camera, hyperspectral camera and about 15,000 to 2000 kg. This program supported by General Directorate of Aeronautical and Space Technologies. TAI acts the Prime Contractor Role.



National Communication Satellites

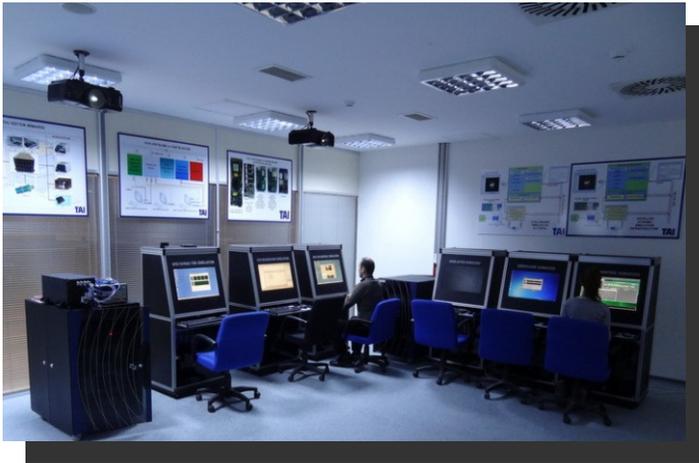
MoU signed between TAI and TÜRKSAT for manufacturing National Communication Satellites.

Within the scope of signed MoU, TAI will have significant roles on National Communication Satellite Programs.



Other R&D Projects of TAI

Project	Satellite Simulation Integration and Functional Test Laboratory (SATSIL)
Product	Dynamic satellite simulation, on-board software verification, avionic system integration and functional test laboratory



R&D Project	LEO Satellite On Board Computer (OBC)
Product	On Board Data Handling (OBDH) System Component
R&D Project	Satellite Management Software Development & Verification
Product	On Board Data Handling Software Ground Control Station Software





Roketsan Company

- Turkey's is keen to own (indigenous) launching systems. In this context Turkey plans to win satellite launching capability to LEO and GEO orbits in the next 15 years.
- ROKETSAN is defined as the local company to develop Satellite launch and propulsion systems in TURKEY.
- The direct participation of ROKETSAN in GÖKTÜRK-1 Project will provide experience of engineering services, satellite propulsion system design, manufacturing, integration and test activities to the company.





TurksatMaps Project



- Satellite Imaging
- Street maps
- 3D street views
- Search function
- Navigation check
- TurksatMaps-3D
- TurksatMaps API





SATELLITE BASED VSAT SERVICES IN TURKEY

□ TURKSAT

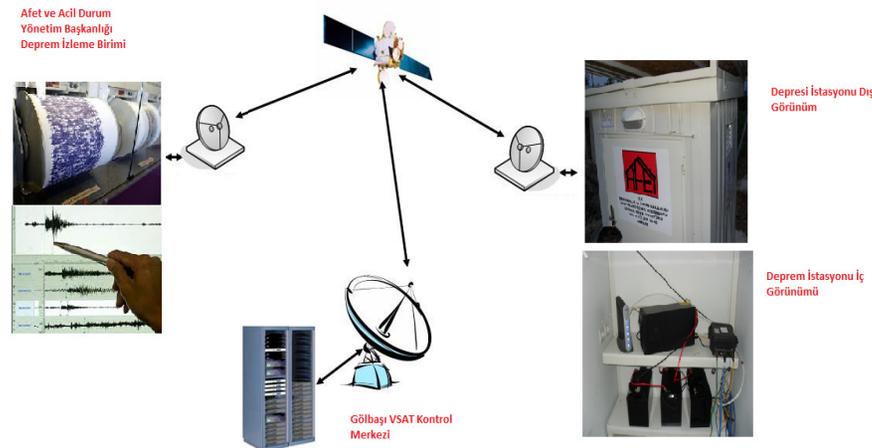
- The Ministry of Education VSAT Project
Approx. 5000 Schools Connected
Broadband Internet Access
Centralized Management and Security
- VSAT National Judicial Network Project of the Ministry of Justice
Local Branches Connected
Working Both As Primary and Backup Line
- Turkish Redcrescent VSAT Project
Voice and data services
- Directorate General of Meteorology VSAT Project
Data services





Other Users of the VSAT Services

- Undersecretariat of Maritime Affairs
- Agricultural Bank
- TIKA (Turkish International Cooperation and Development Agency)
- Ministry of Foreign Affairs
- Information and Communication Technologies Authority
- Undersecretariat of Foreign Trade
- Turkey Petroleum Corporation
- Earthquake and Emergency Management Office VSAT Project



Emergency communication

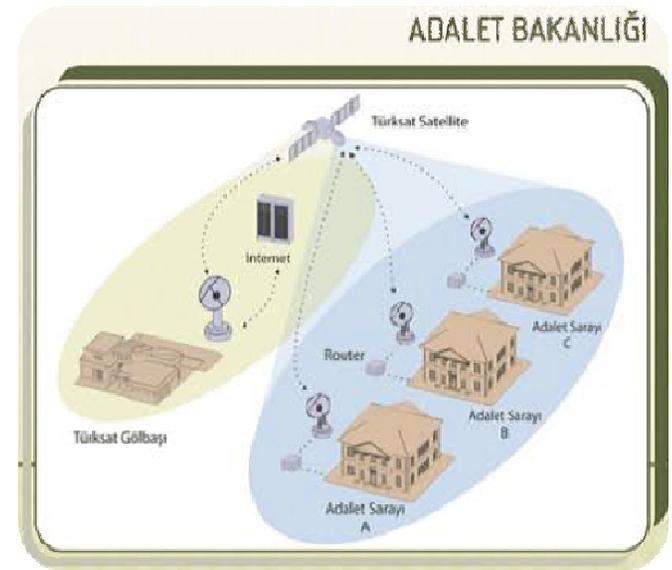
- Terrestrial and cellular networks are vulnerable to catastrophic events.
- Hurricanes, earthquakes, floods and fires can damage ground infrastructures within minutes.
- And yet it is in times of crisis that communications are needed most.
- Communications is a major enabler in the management of humanitarian aid and emergency response.





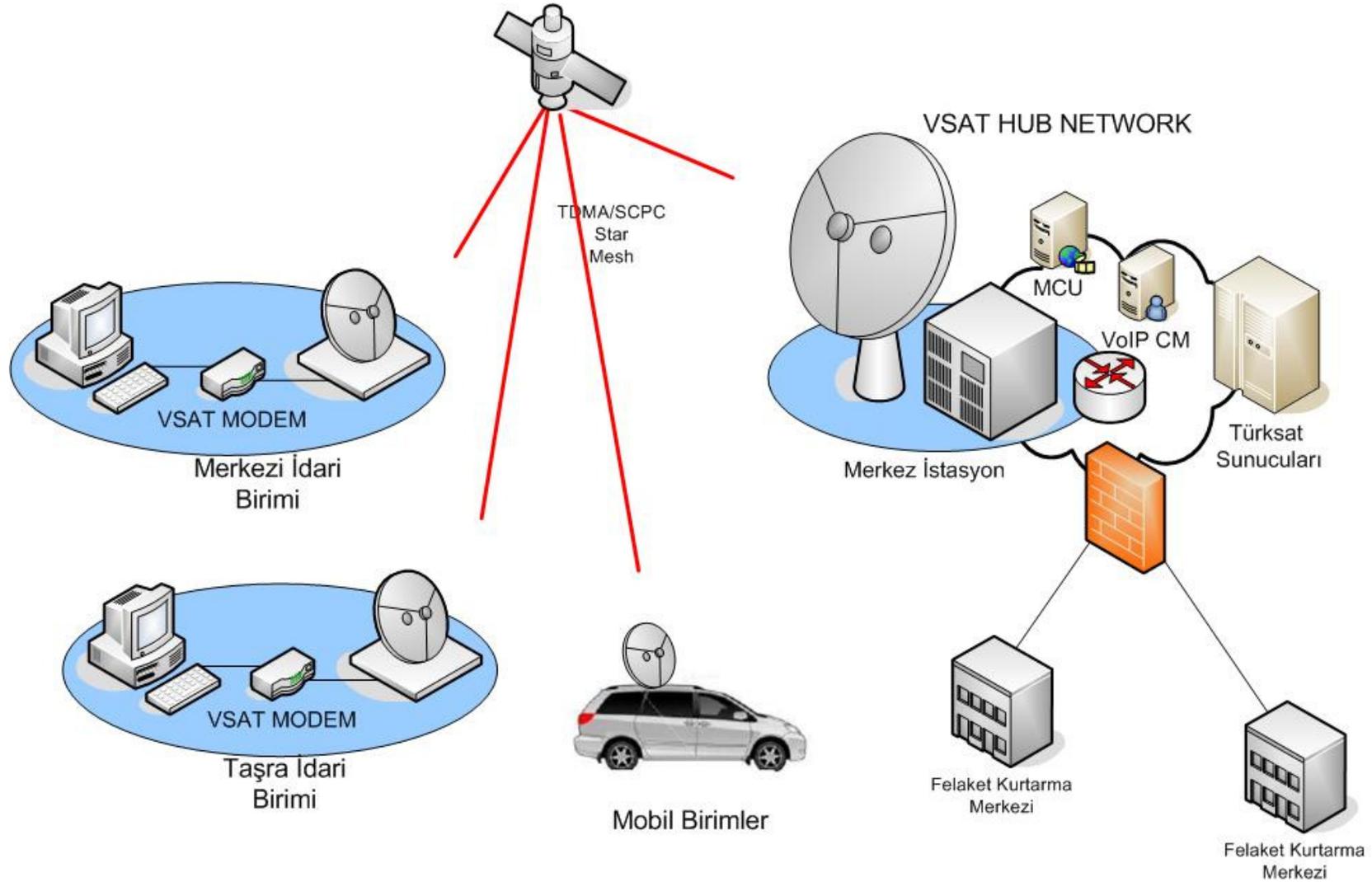
Emergency Communication

- TV / Radio Broadcasting Services
- Emergency Communication Systems
- Uplink and Teleport Services
- Live Broadcast Services
- Rural Telephone Communications
- VSAT Services



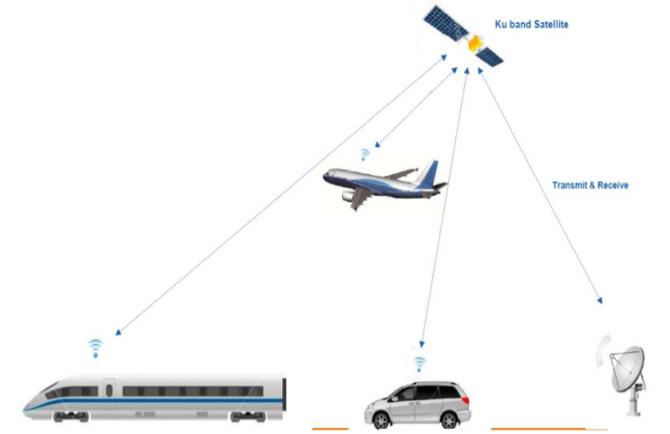


Emergency Communication Systems Applications



Emergency Communication Systems Applications

- Emergency Communication Systems-Full automatic satellite finding Flyaway
- Turksat 2011 after Van earthquake Flyaway VSAT Satellite Systems used.
- SOTM (Satcom on the move) satellite communication systems in motion. Satellite communication services were provided to the Ministry of Health of Pakistan, and Somalia.



DIRECTORATE GENERAL OF AERONAUTICS AND SPACE TECHNOLOGIES



THANK YOU



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