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TÜBİTAK
Space Technologies Research Institute
Space Science Studies

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Özet TÜBİTAK Space Technologies Research Institute leads and takes part in R&D projects in space technologies, electronics, information technologies and related fields. The institute aims at having a pioneering role in the national research community and assisting the industry in solving technical problems encountered. TÜBİTAK UZAY places special emphasis on developing on small satellite design, manufacturing and test, leading Turkish Space Program and initiating international collaboration in space technologies.

1 Introduction

Established in 1985, TÜBİTAK Space Technologies Research Institute (hereafter TÜBİTAK UZAY) leads and takes part in R&D projects in space technologies, electronics, information technologies and related fields. TÜBİTAK UZAY conducts its research and development activities in the following areas with its expert staff, out of which %85 are researchers and technical support personnel.
Space Technologies: Satellite systems, satellite sub-systems, satellite ground station sub-systems, satellite test and integration.
Electronics: Communication systems, electronics system design, electro-optic payloads, high-speed digital design, IC design.
Software: Computer vision, speech processing, pattern recognition, remote sensing, multimedia technologies, video processing.
Power Electronics: Power quality, compensation systems, electrical motor drives, switching power supplies, renewable energy resources.
Power Distribution Systems: Analysis of electric production and transmission systems, strategic research and development in distribution automation, Supervisory Control and Data Acquisition (SCADA) systems, master planning of distribution systems.

TÜBİTAK UZAY is a member of Committee on Earth Observation Satellites (CEOS) and a supporting member of ISPRS (International Society for Photogrammetry and Remote Sensing). It also represents Turkey in Asia-Pacific Space Cooperation Organization (APSCO).

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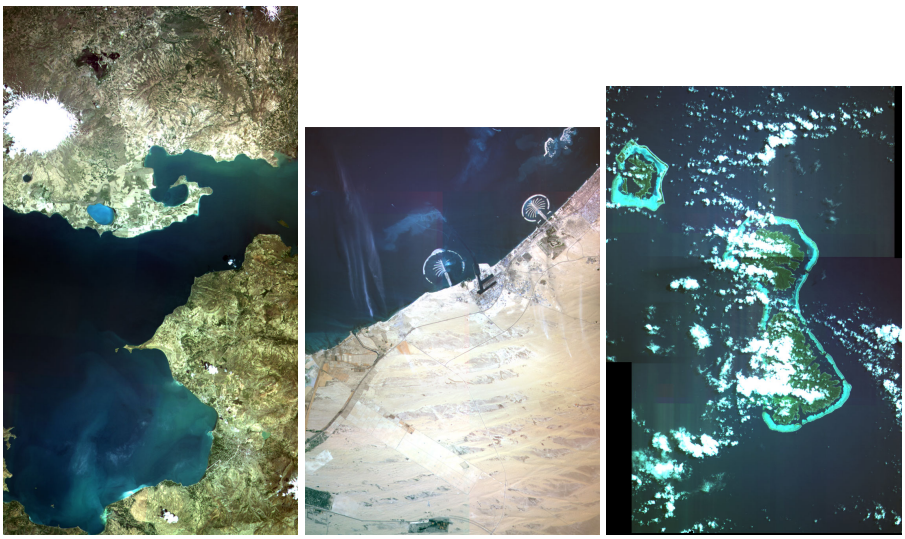
2 SPACE RELATED R&D PROJECTS

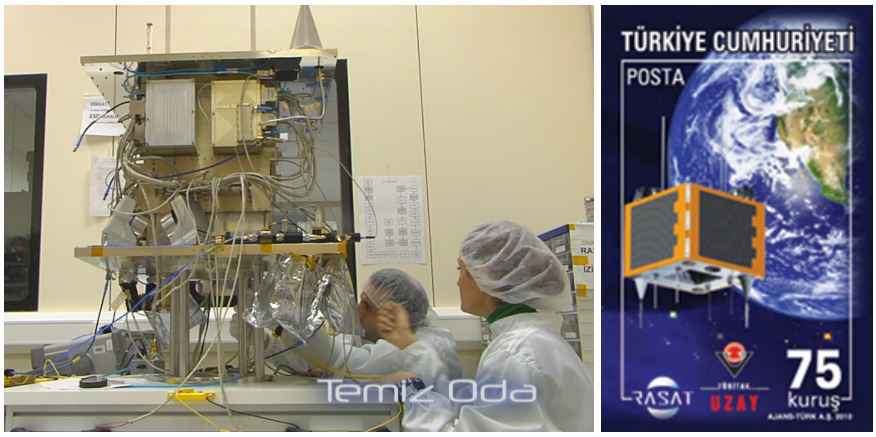
TÜBİTAK UZAY has a pioneering role in space technologies in Turkey. Some examples of our projects, which are the first seeds of the Turkish space capability are listed below.

2.1 Research Satellite (BİLSAT) Project

The aim of BiLSAT project was to initiate, develop and support small satellite technologies in Turkey. In cooperation with Surrey Satellite Technology Limited (SSTL), the infrastructure for design and manufacturing of small satellites and a ground station were established, and BİLSAT, TurkeyÕs first remote sensing satellite, was manufactured and launched. In addition, a Turkish engineering team had worked in cooperation with SSTL engineers in design, manufacturing, test and launch phases of BiLSAT. Two payloads of the satellite, GEZGİN and COBAN, were designed and manufactured by TÜBİTAK UZAY staff in Turkey and integrated into BiLSAT.
GEZGİN (Real time image processor): A satellite sub-system capable of real time multi-band image compression in compliance with JPEG2000 standard.
ÇOBAN (Multi Band Camera): An eight-band multispectral camera with a ground sampling distance of 120 m.



Şekil 1. BİLSAT images of (a) Van, Turkey, 22 May 2004 Turkish Local Time 09:49:25, (b) Dubai, United Arab Emirates, 02 February 2005, Turkish Local Time 08:15, (c) Bora Bora Islands, 02 April 2005, Turkish Local Time 20:27



Şekil 2. BİLSAT images of (a) Van, Turkey, 22 May 2004 Turkish Local Time 09:49:25, (b) Dubai, United Arab Emirates, 02 February 2005, Turkish Local Time 08:15, (c) Bora Bora Islands, 02 April 2005, Turkish Local Time 20:27

2.2 RASAT Project

With the financial support of State Planning Organization, TÜBİTAK UZAY has started the RASAT project in order to improve satellite design and manufacturing capabilities in Turkey. RASAT is planned to be launched in late 2009, and it will be the first satellite designed and built entirely in Turkey.

2.3 Satellite Sub-Systems

GEZGİN-2: The new version of the real-time JPEG2000 image compression system, GEZGİN, that will also include total integration of JPEG2000 algorithm and new image processing and encryption capabilities.
X-BAND COMMUNICATION SYSTEM: Communication system designed for low earth orbit spacecraft to provide a 100 Mb/s downlink at 7W output using an efficient power amplifier.
BİLGE (Flight Computer): A flight computer for use in space missions that require high performance, with the capability to utilize Spacewire, which is a high-speed data bus standard advocated by the European Space Agency (ESA).
Ground Station Software: Ground Station Software is the software that is used for remote command control functions of the LEO satellites such as receiving telemetry, sending telecommands, mission planning, downloading satellite images and displaying the calculated positions of the tracked satellites in 2D or 3D earth map on a graphical user interface.
Flight Software: Flight Software is a set of computer code which operates, monitors and organizes all the subsystems of a satellite to succeed the mission. To accomplish this, it configures the subsystems and monitors their operation,

records, process and produces mission and payload data. Flight software is desired to be able to autonomously decide and act against the changing mission parameters such as modified mission, or subsystem performance degradations and also should detect any subsystem fault and isolate it from the rest of the system to maintain the overall satellite mission performance above a desired level.

2.4 Absolute Radiometric Calibration at Tuz Gölü

Remote sensing applications employing quantitative approaches by establishing a correlation between radiometric data and physical properties of material under inspection has become more frequent and increased the need for accurate radiometric calibration coefficients for remote sensing sensors, in order to transform digital numbers into physical values like radiance and reflectance. Therefore, the importance of performing a calibration campaign increased significantly. Being aware of this significance, TUBITAK-UZAY is planning to build-up an absolute radiometric calibration test site in Tuz Gölü salt lake.

3 SOME OTHER PROJECTS

National Power Quality Project of Turkey A project financed by TÜBİTAK under the Support Programme for Research Projects of Public Institutions for monitoring the components affecting the power quality and the reactive power

flow in Turkish Electrical Power Transmission System. The project also includes determination and evaluation of the problems thereof and implementation of counter measures. The project is conducted in collaboration with TEİAŞ (Turkish Electricity Transmission Company), TÜBİTAK UZAY, Middle East Technical University, Hacettepe University, 9 Eylül University and Yıldız Technical University.

3.1 HESKON

A project for design, development and prototype production of an automation and control, measurement and protection system for small and medium sized

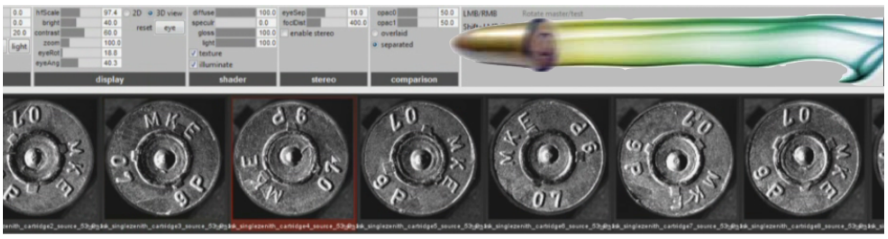
Hydroelectric Power Plants (HEPP). The project is financed by TÜBİTAK under the Support Programme for Research Projects of Public Institutions. A domestic packet solution for HEPP automation and control system will be developed for TEMSAN, which is a national public corporation supplying infrastructure for the HEPP.

3.2 SKAAS

SKAAS is a large scale digital media archiving and content management system development project. The client of the project, Radio and Television Supreme Council of Turkey, demands monitoring of more than 300 TV channels and 900 radio stations which constitutes all the broadcast content of Turkey. TÜBİTAK UZAY, with its expertise on audio/image/video processing and pattern recognition, is responsible for the development of the software component of the system, for the analysis of video, voice and image as a sub-contractor of TÜBİTAK UEKAE.

3.3 Balistika®

A project for development of a system for matching cartridge cases and bullets, using ballistic traces after firing and 3D scanning of surfaces via its own 3D shape extraction system and matching algorithm. The operator of the system can move a virtual light over the surfaces and control the visualization process,



Şekil 3. The current screenshot of cartridge case visual comparison.

as if the physical cartridge case or bullet is at hand. Balistika®'s modular design enables scalability and expandability of its capacity, both in terms of storage and processing power, depending on the workload. The system is unique in the world with its use of 3D data, its high success in matching, and its scalability.

4 Space Science

Kaynaklar

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