TURKISH AEROSPACE INDUSTRIES, INC.

INTRODUCTION OF TAI CAPABILITIES
&
GENERAL EVALUATION FOR GLOBAL SPACE ACTIVITIES

Presented By:
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TAI.

United Nations/Turkey/European Space Agency

“Workshop on Space Technology Applications for Socio-Economic Benefits”

14-17 Sept. 2010
Istanbul, Turkey

OUTLINE

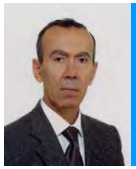
- **Vision – Mission**
- **Organization**
- **National Space Roadmap & Potential Space/Satellite Projects**
- **Space/Satellite Projects of TAI**
- **Capabilities of TAI for Satellite Development Activities**
- **National Demands for Socio-Economic Application Areas**
- **Conclusion**

VISION – MISSION STATEMENTS

- **Vision:**
  - **In the 100th anniversary of the Republic of Turkey; TAI, by possessing indigenous/co-designed aircraft and satellites; seizing modern high technologies in modification, modernization and production, and attaining global competitive power, will become a world brand company with its devoted employees.**

- **Mission:**
  - **With our great leader Atatürk's vision: "The Future is in the Skies" and our nation's eagerness to "Build its own aircraft and aerospace industry" ; TAI has dedicated itself to be in the skies and space and be pioneer in developing Turkey's aviation and space industry for the benefit of the nation.**

ORGANIZATION



SENIOR EXECUTIVE VICE PRESIDENT, AEROSTRUCTURE & SPACE

Bekir Ata YILMAZ

MANAGER OF SATELLITE SYSTEMS

Teoman GÜNGÖR

SATELLITE SYSTEMS PROGRAM

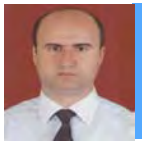
Baha ARBAK

SATELLITE TECHNOLOGIES

Dr.Erhan SOLAKOĞLU

SATELLITE SYSTEMS PRODUCT ASSURANCE

Muhittin GÖÇER



SATELLITE INTEGRATION & TEST

İzzet BAYIR

As of today 75 full time design engineers are employed for different disciplines and subsystems of space/satellite development projects

NATIONAL SPACE ROADMAP AND POTENTIAL SPACE/SATELLITE PROJECTS 1

- **TAI is the main local partner or prime in GÖKTÜRK Programs for military satellite projects.**
- **National Satellite Assembly, Integration and Test (AI&T) Facility shall be fully operational at the end of 2012.**
- **This AI&T Facility shall be also used for all types of civil and military satellite/space projects of Turkey.**

NATIONAL SPACE ROADMAP AND POTENTIAL SPACE/SATELLITE PROJECTS 2

- **GÖKTÜRK-1, GÖKTÜRK-2 and GÖKTÜRK-3 Programs**
- **Development of Communication Satellites for civil and military institutions**
- **Replacement of all type civil and military satellites on request**
- **R&D Projects for subsystem development (CMG,AODCS Simulator)**
- **Space qualification of satellite subsystems developed by TAI.**
- **Operate the National AI&T Facility & provide satellite assembly, integration and test services**

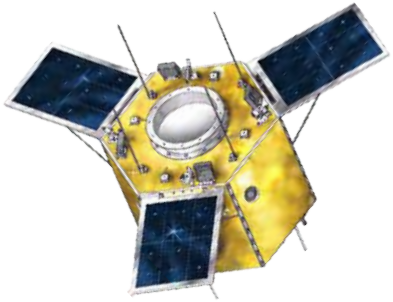
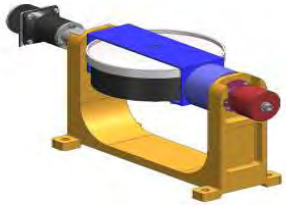
SPACE/SATELLITE PROJECTS OF TAI$_1$

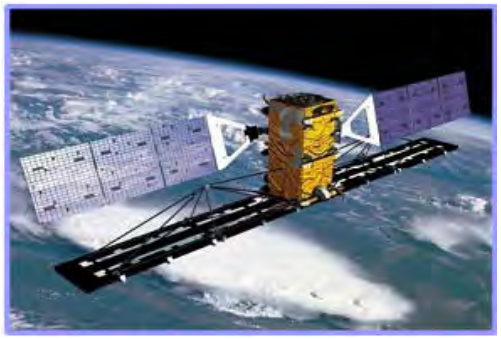
- **GÖKTÜRK-1 Program (2010-2014)**
  - **Remote Sensing LEO satellite procurement and development program.**
  - **TAI's role: Main local partner. System level design, structure, thermal, AODCS, OBDH, AIT & Launch operations.**
  - **AI&T Facility Establishment**

Closed Area : 9,000 sqm

Total Area : 17,800 sqm

SPACE/SATELLITE PROJECTS OF TAI_2



- **GÖKTÜRK-2 Program**

  Remote Sensing LEO satellite system development , by a partnership with TUBITAK Space Technologies Research Institute.

- **GÖKTÜRK-3 Program**
  - **SAR Satellite System development**
  - **Development of Satellite, Subsystems and Ground System**
- **Subsystem R&D Projects:**
  - **Development of CMG and S/C simulator for AODCS**
  - **Infrastructure development activities, know-how improvement tasks**

SPACE/SATELLITE PROJECTS OF TAI$_3$

Subsystem R&D Project; 3D Air Bearing Table for HIL Tests

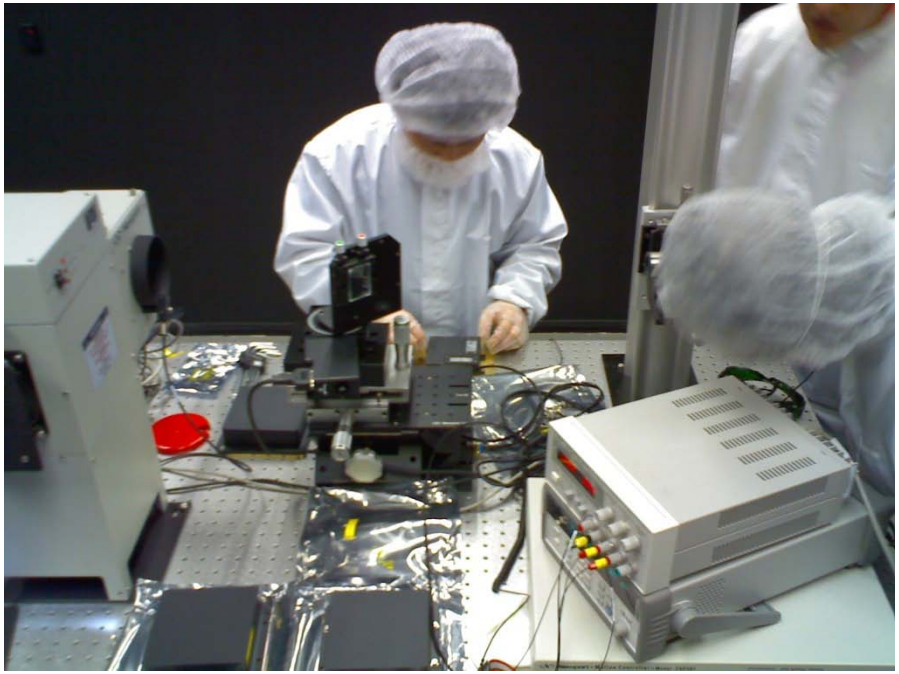
- **S/C simulator was established for AODCS hardware in the loop actuator development.**
- **CMG development & validation / verification.**

CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 1

CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 2

AI&T Facility

Dark Room
Test and Calibration For Sun Sensor



Clean Room Applications

CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 3

AI&T Facility

Satellite Lifting Device

Satellite Container

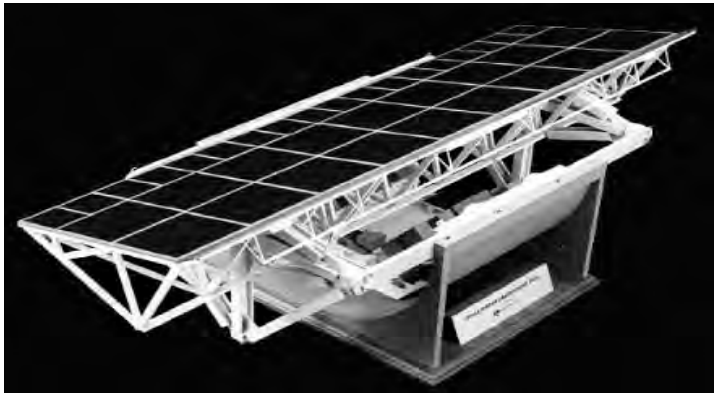
Multi Purpose Trolley

CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 4

AI&T Facility

Thermal Vacuum Chamber

CATR Facility

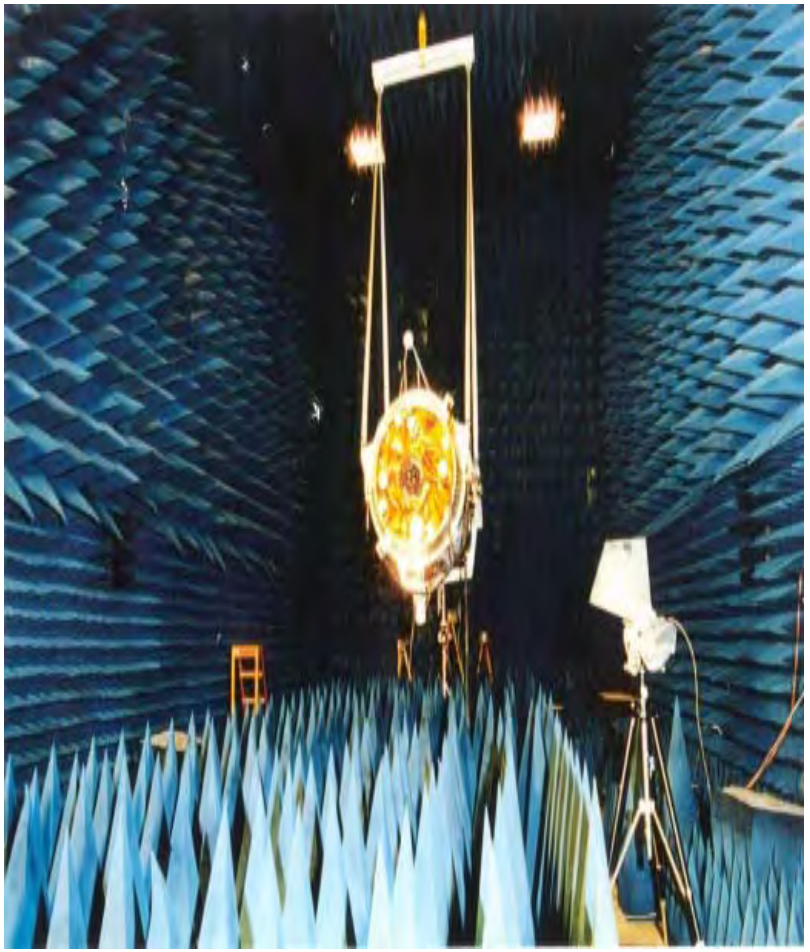


Solar Array Deployment Test

CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 5

AI&T Facility

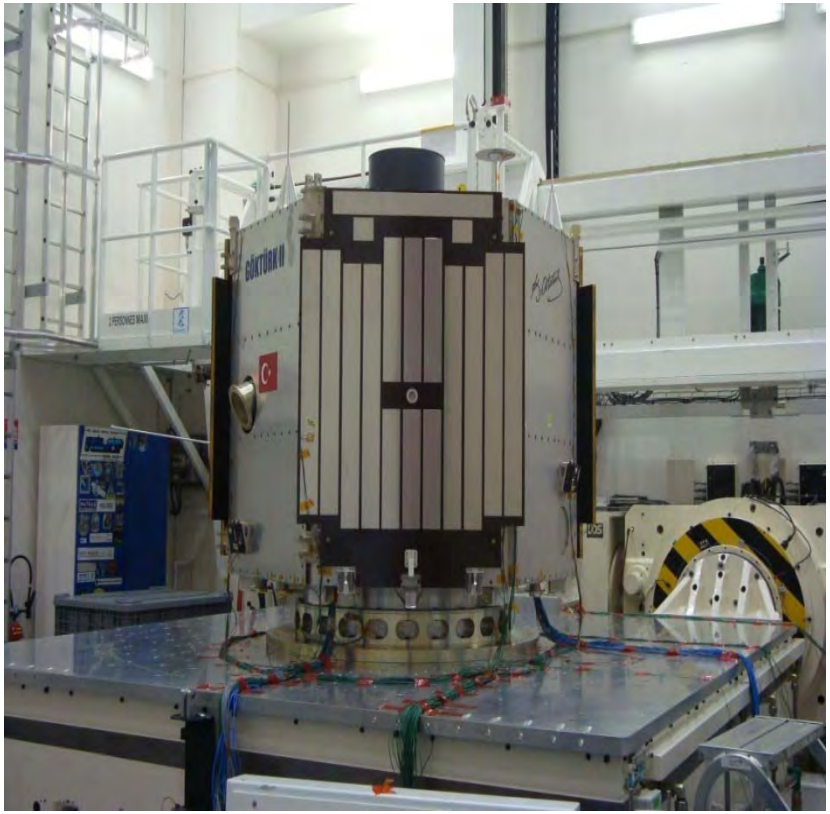
Mass Properties Measurement



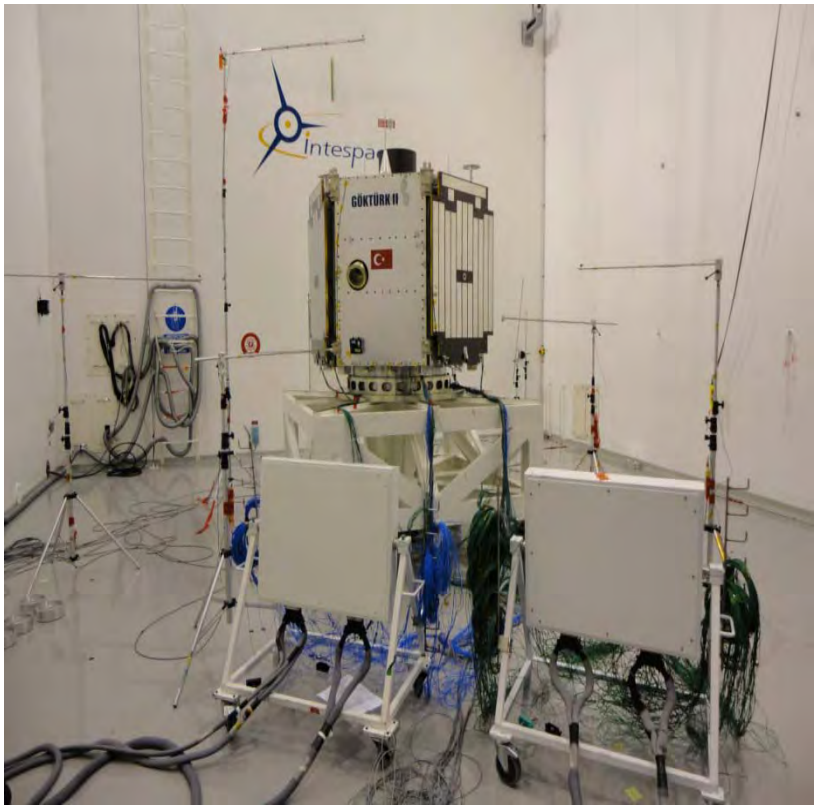
EMI/EMC Test

CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 6

AI&T Facility



Vibration Test



Acoustic Test

CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 7

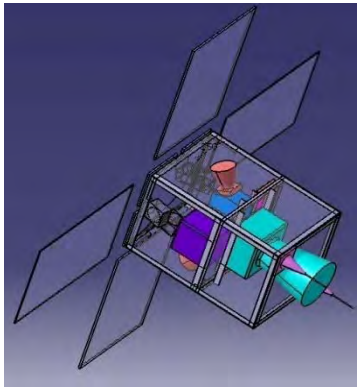
Some Tasks and Tools Used For Satellite Design

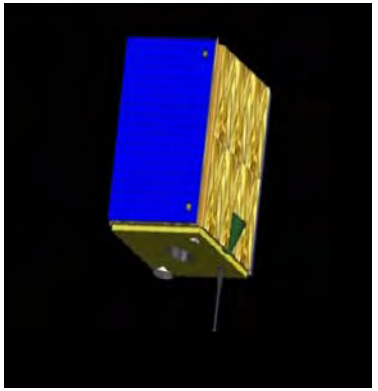
- Program Management- Primavera
- Risk Management- RM Software developed by TAI
- Systems Engineering
- Requirements Management – DOORS
- Document Management – EDMS
- Product Data Management – Team Center Engineering
- 3D Modeling – Catia, UG
- Structural Analysis – Nastran / Patran
- Thermal Mathematical Modeling & Analysis – Thermica + Sinda/G
- Mission and Operation Analysis – Matlab (supported with Excel)
- Hardware Mathematical Modelling – Matlab
- Software Development – Matlab, Simulink
- Harness Pin-to-Pin Design – LCable, Zuken
- Satellite Digital Mock-up – Catia
- Process Follow up – Access
- Accessibility, Human Factors – Jack

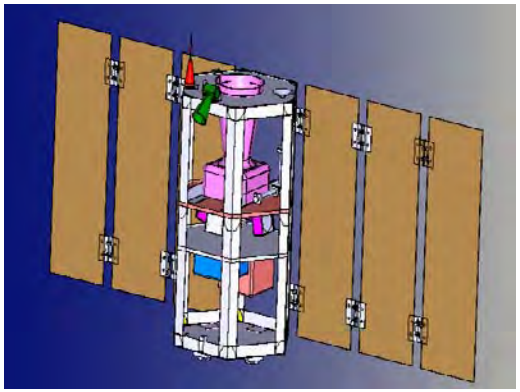
CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 8

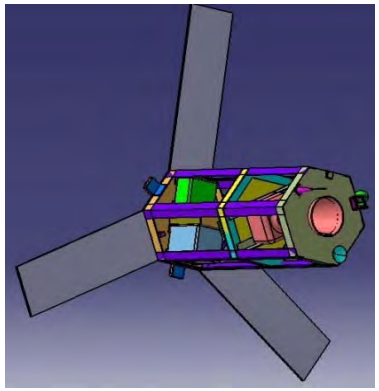
Satellite Design

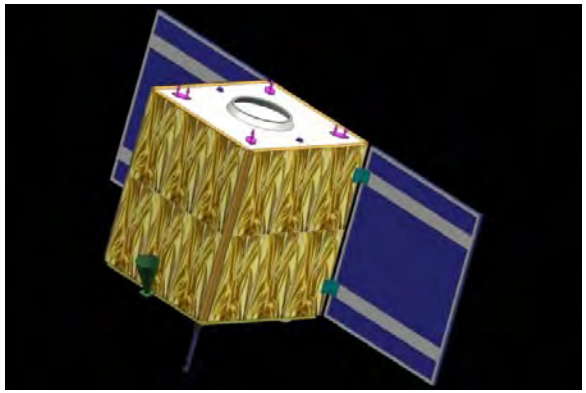
TAI has been working for LEO satellite design and manufacturing since 2002.









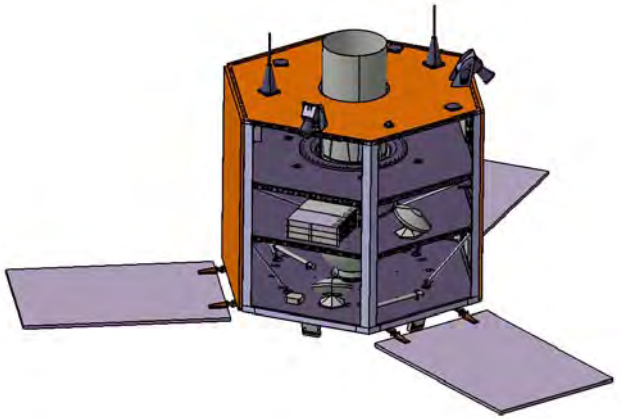


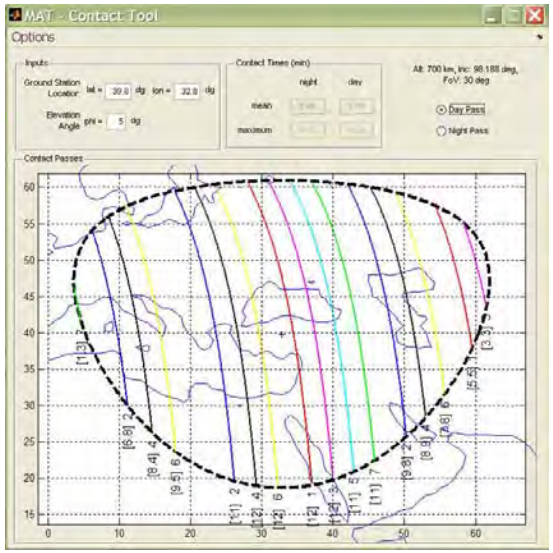
Various satellite configurations have been studied for concept development.

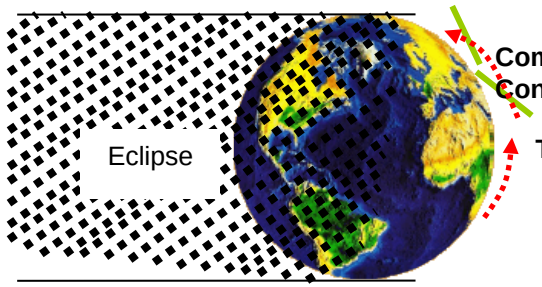
CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES

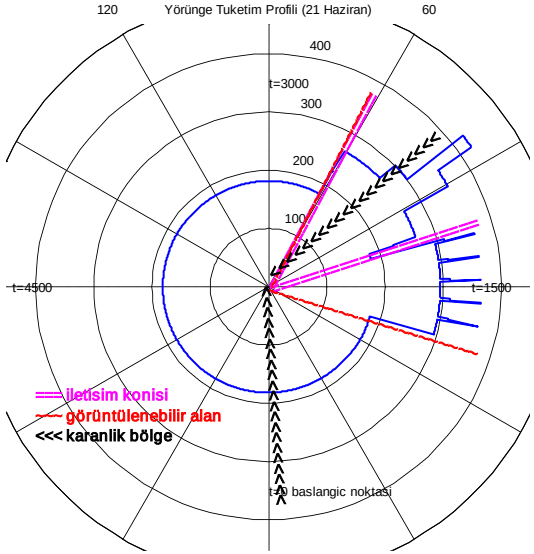
Systems Engineering;

- ***Requirement Management***
- ***Mission and Operation Analysis***
- ***Reliability, Safety***
- ***Accomodation Design***
- ***Harness Routing etc.***





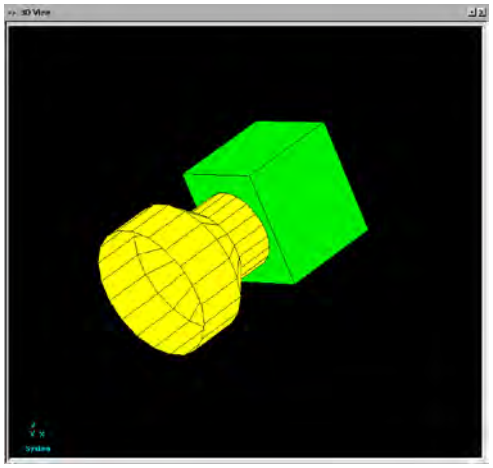




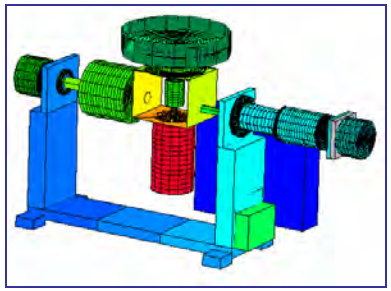
Mission & Operation Design Tools

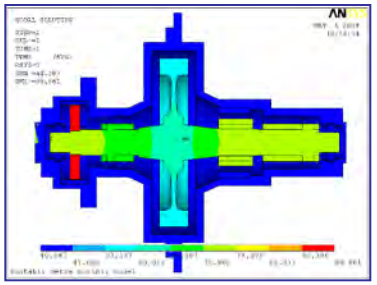
CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 10

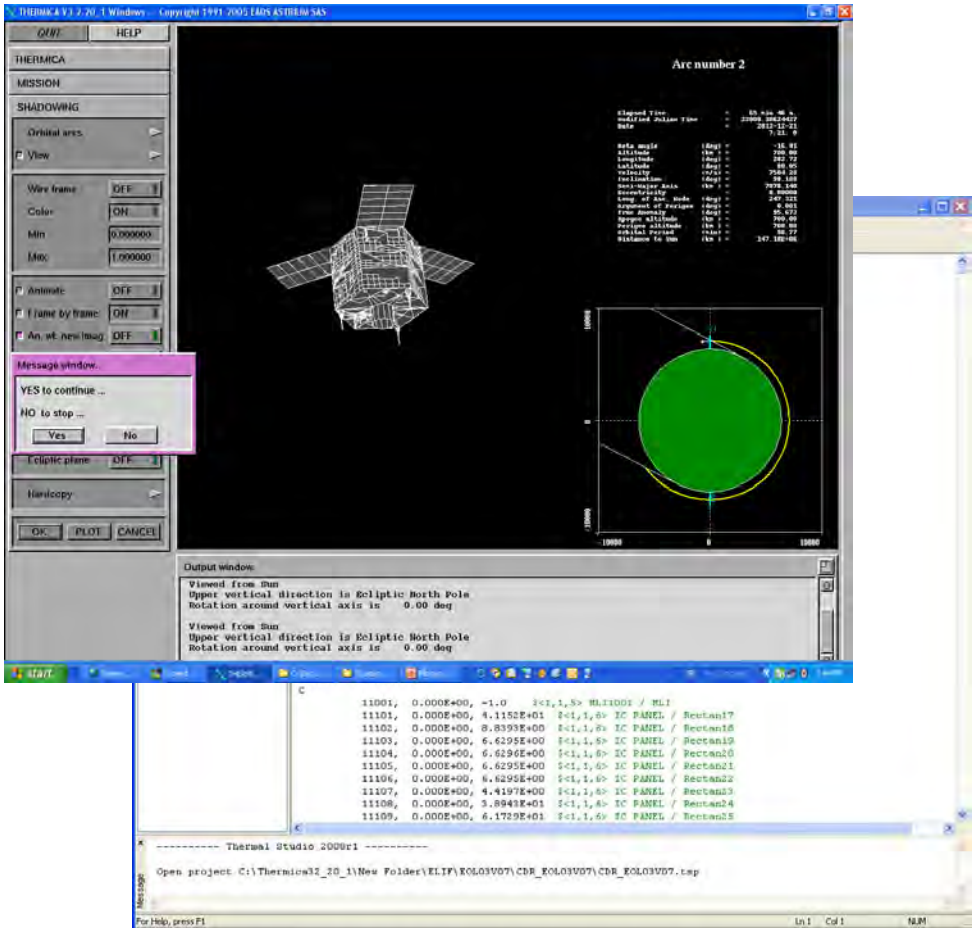
Thermal Design Engineering



Thermal Geometric Modelling



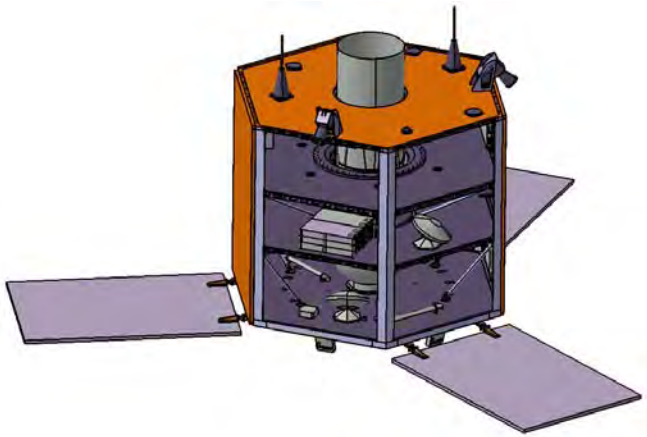




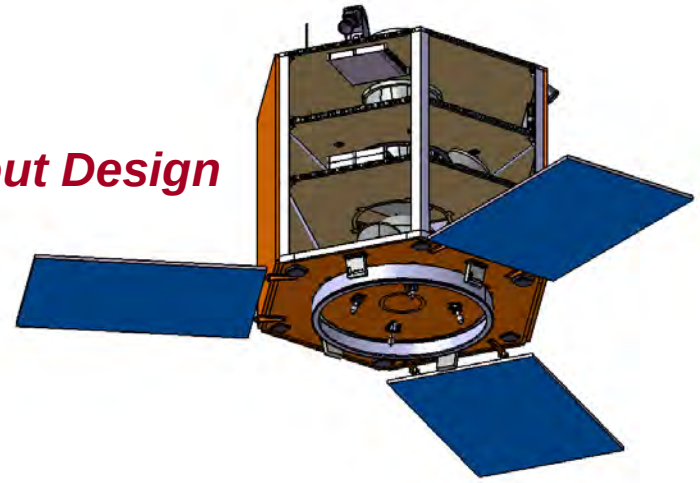
Thermica / SindaG

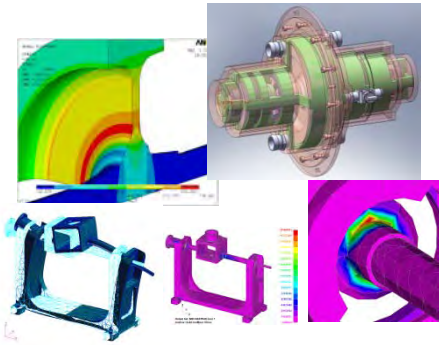
CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 11

Structural Engineering

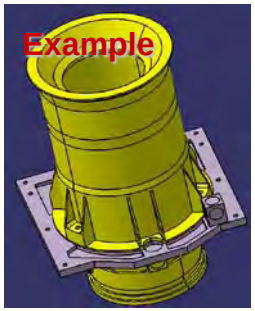


General Lay-out Design





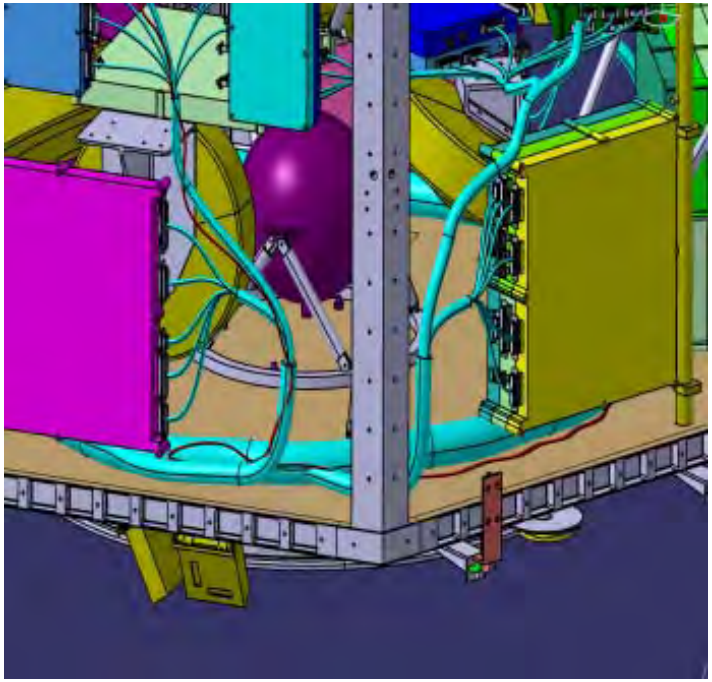
Component Design



- **Structrual 3D Modelling and General Layout (CATIA –UG)**
- **Structural Analysis (Nastran-Patran)**

CAPABILITIES OF TAI FOR SATELLITE DEVELOPMENT ACTIVITIES 12

Harness Design by LCable/Zuken
Harness Routing by Catia



Harness Routing

Harness Workshop

NATIONAL DEMANDS FOR SOCIO-ECONOMIC APPLICATION AREAS 1

- **Earth Observation Satellites**
  - **Defense and Security**
  - **Border Monitoring**
  - **Environment Monitoring**
  - **Maritime and Energy Sector**
  - **Monitor Resources at Global and Local Levels**
  - **Disaster Management**
  - **Agriculture and Ascertainment of Product**
  - **Urban Planning, Cartography, Terrain Classification**
  - **Forest Fire and Forest Control**

NATIONAL DEMANDS FOR SOCIO-ECONOMIC APPLICATION AREAS 2

- **Communications Satellites**
  - **Internet Services**
  - **Mobile Phone Services**
  - **Radio Communications**
  - **TV and Radio Services**
  - **Emergency Communications**
  - **Video Conference**
  - **Hybrid Satellite-Terrestrial Communications**

NATIONAL DEMANDS FOR SOCIO-ECONOMIC APPLICATION AREAS 3

- **GPS Satellites**
  - **Position Information**
  - **Timing Information**
  - **Monitor Vehicle (Ship, Train, Bus, Car, Aircraft)**
  - **Navigation Technologies**

- **Early Warning and Alert Satellites**
  - **Signals Intelligence (SIGNIT)**
  - **Alert and Early Warning Information**

- **Meteorological Satellites**

CONCLUSION

- **Through national satellite/space system and subsystems development projects, TAI is continuously improving its capabilities & capacities in space technologies for the benefit of National & International Society**
- **TAI is going to be a center for national space-AIT operations to support space technology developments for the growth of socio-economical activities**
- **TAI is ready to collaborate or to establish partnerships with national/international companies and institutions for;**
  - **Turkish satellite/space technology development projects,**
  - **Satellite/space projects carried out by the international companies and institutions in their own countries**

Aircraft will be, without any hesitation, the most effective weapon and vehicle in the future. Mankind, one day, will travel in the skies without aircraft, go to planets and possibly send messages to us from the Moon. For the realization of this miracle, there will be no need to wait till the year 2000. Actual technological improvements announce us such good news today. Our duty is to assure our nation not to stay far behind the West in this endeavor.

Citation from Atatürk's speech during his visit to Eskişehir Air Force Regiment in 1936.