



# Turkey's Space Endeavour:

## Brief Background & Possible Collaborations

UN/Malaysia Expert Meeting on Human Space Technology  
14-18 November 2011, Putrajaya, Malaysia

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TUBITAK, Ankara, Turkey



# Dreaming for Real



- Every revolutionary idea seems to evoke three stages of reaction. They may be summed up by the phrases:
  1. It's completely impossible.
  2. It's possible, but it's not worth doing.
  3. I said it was a good idea all along.

Arthur C. Clarke  
(1917-2008)

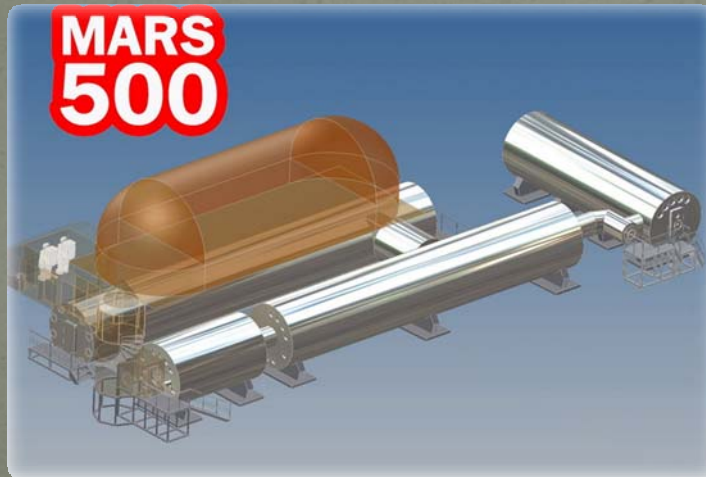






# Dreams of Human Race

- Mars Experiment: 520 days in isolation (on food tables)
- About 6000+ applied from over 40 countries
- **Started:** 3 June 2010; **Ended:** 4 November 2011
- Previous 2 stages:
  - 1. Nov 2007 (15-day); 2. March-July 2009 (105-day)





# Purpose and Agenda

- Purpose

- Introducing space activities and players in Turkey
- Seeking possible collaboration within HSTI

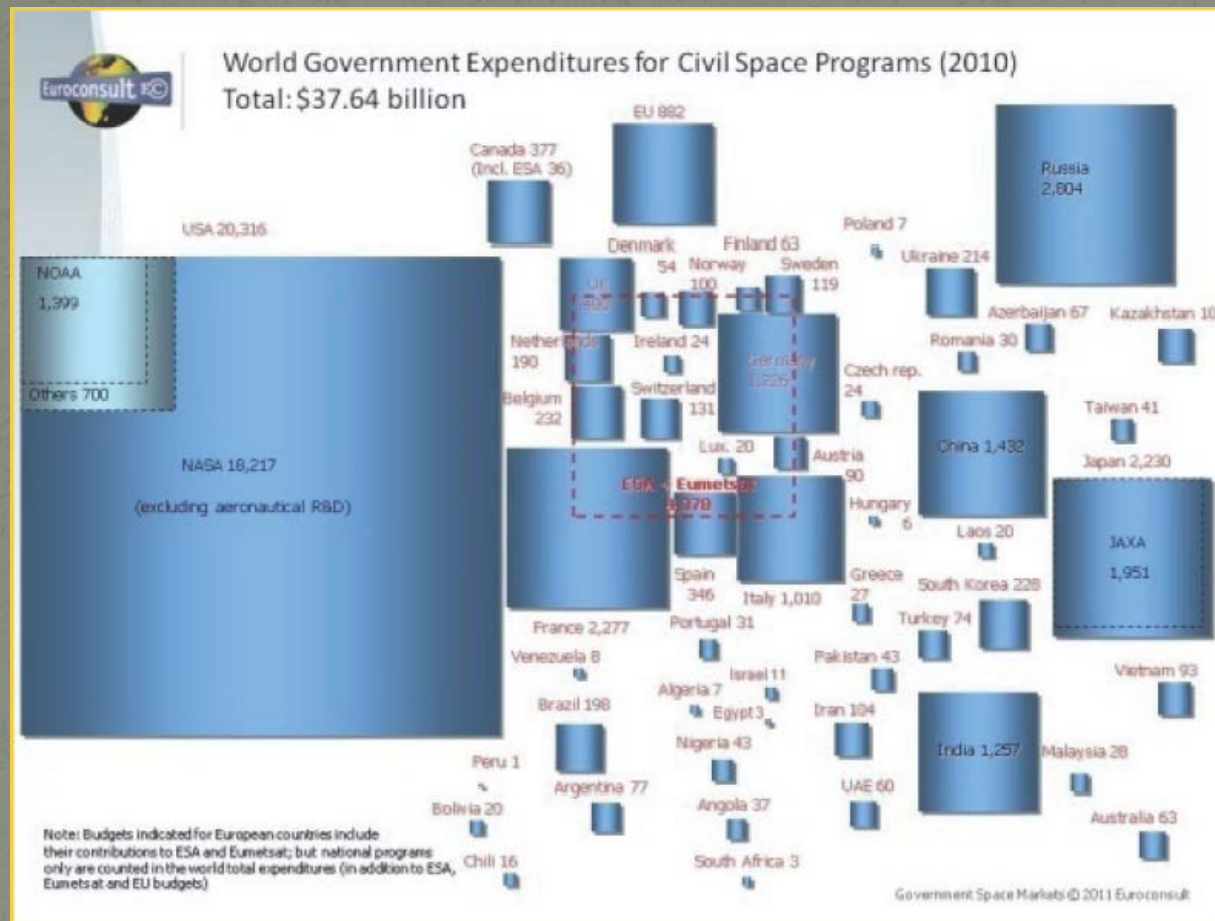
- Agenda

- Space expenses in the world and in Turkey
- Overview of space actors in Turkey
- Space policies in Turkey
- Turkish institutions and companies in space
  - Satellites and projects
- Concluding remarks



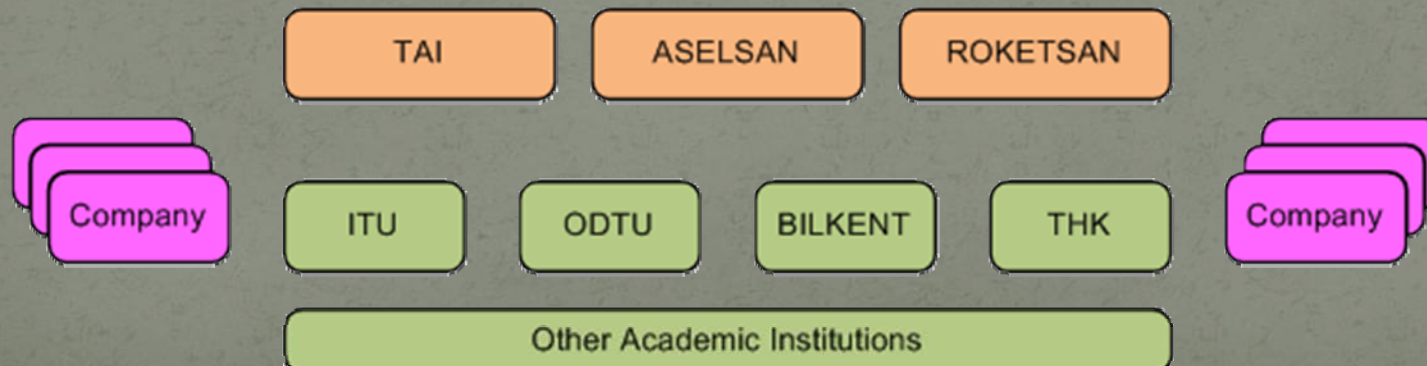


# Governments' Expenses on Space



Turkey: 1990's: procurement → 2010's: system/subsystem development

# Space Actors in Turkey





# Space Policies In Turkey



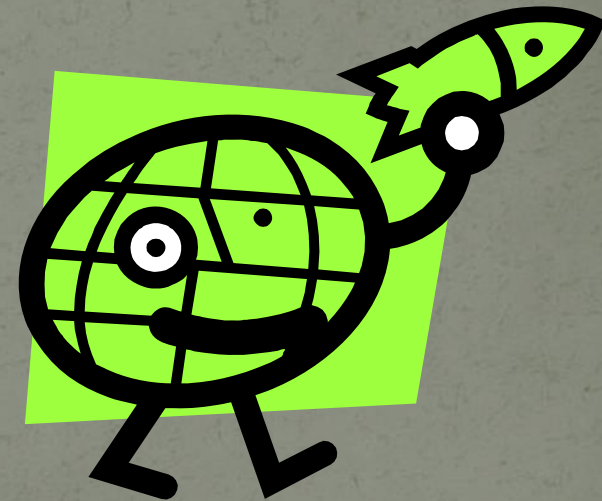
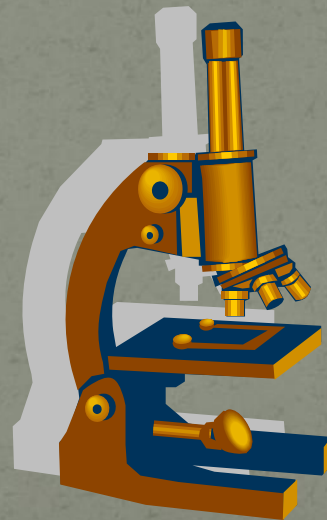
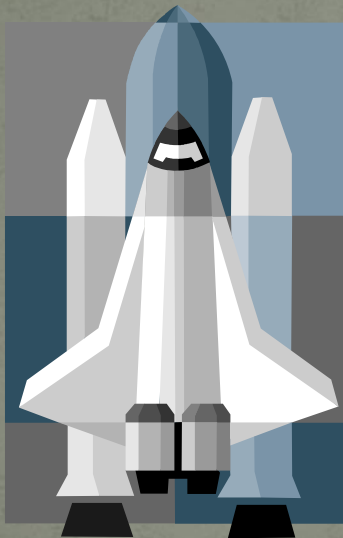
- 2004: Government decision: identifying space as priority area in science and technology development
- Space Working Group led by TUBITAK
- 2005: Higher Science and Technology Council approval (covering 2005-2014)
- Allocated funds of about 1 billion dollars
  - Aggressive move with economical conditions
- Many space projects originated by these actions
- HSTI oriented ambitions exist in plans
- Missing: a unilateral progression towards the same goal
  - Turkish Space Agency yet to come



# MINISTRY OF TRANSPORTATION



- New unit: 2 November 2011
- Aviation and Space Technologies Directorate
  - Will lead to Turkish Space Agency



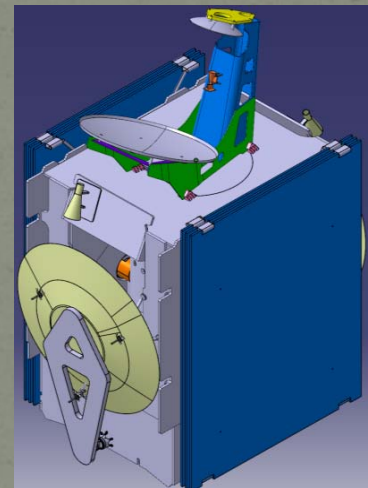


# TURKSAT

## Communication Satellite Operator



- A state owned satellite and Cable TV operator
- First Satellites (Spacebus 2000)
  - Turksat 1A: 1994 (Ariene 4 failure)
  - Turksat 1B: 1994-2006
  - Turksat 1C: 1996-2010
- Turksat 2A: SB3000; 2001-date
- Turksat 3A: SB4000; 2008-date
  - Extensive Technology Transfer Prog.
- Turksat 4A: DS-2000; ELD: 2013
- Turksat 4B: DS-2000; ELD: 2014
  - Direct Participation Program
- Turksat 3USAT: UHF/VHF Amateur Comm.; ELD: 2012 (ITU)
- Turksat 5A: Planned to be built/assembled in Turkey (TAI)
- AIT Center to be built in Turkey at TAI premises
- Satellite Apps: National Justice & Telemedicine

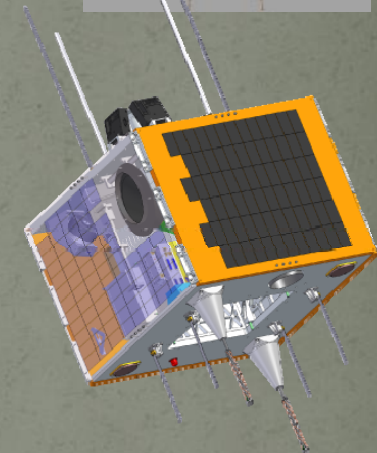
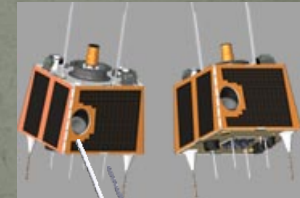


# TUBITAK UZAY

Space Technologies Research Institute



- Satellite systems, sub-systems, ground station, AIT
- BILSAT: Technology Transfer via SSTL
  - Started: 1999; Launched: 2003; EOL: 2006; SSO
  - Part of DMC – disaster monitoring constellation
  - GEZGIN: JPEG2000 image compression hardware
  - COBAN: 8-channel optical camera
- RASAT: In house design after TTP of BILSAT
  - Started: 2004; Launched: 2011; EEOL: 2016; SSO
  - BILGE: New flight computer system w/ Spacewire
  - GEZGIN-2: JPEG2000 image compression hardware
  - X-Band Transmitter; S-Band Transmitter/Receiver
- Gokturk-2 Project
  - Jointly developed with TAI; ELD: 2012; SSO
- Facilities:
  - TVAC; Clean Rooms; Ground Station; ESA certification





# TUBITAK



- Turkish Scientific and Technical Research Council
- Space Research Group
  - FP7 Programs in coordination w/ ESA
    - Active Projects (GMES-Global Monitoring for Environment and Security)
      - MyOcean: METU Institute of Marine Sciences
      - OPEC: METU Institute of Marine Sciences
      - OSS2015: DEU Institute of Marine Sciences & Technology
      - PreEarthquakes: TUBITAK MAM
      - Sirius: EA-TEK (SME)
    - Active Projects (SSF-Strengthening Space Foundation)
      - P2-Rotect: TUBITAK UZAY
      - Rahdhiffs: TUBITAK UZAY
      - Deorbit Sail: METU Aerospace Engineering

# TUBITAK



Projects	Number of Projects
<b>Science</b>	<b>95</b>
Astrophysics	37
Astronomy	8
Near Space	7
Earth Science and Observation	43
<b>Technology</b>	<b>73</b>
Space Technologies	48
Rocket	11
Advanced Aerospace	11
Space Infrastructure	3
<b>Application</b>	<b>145</b>
Remote Sensing and GIS	89
Global Navigation Systems	7
Meteorology	14
Satellite Communication	35
<b>Human&amp; Public Awareness</b>	<b>9</b>
<b>Overall</b>	<b>322</b>

## BILATERAL RELATIONS

• **Roscosmos (Federal Russian Space Agency)**

- **DLR (German Aerospace Center)**
- **UK Space Agency (BNSC)**
- **NSO (Netherlands Space Office)**

## MULTILATERAL RELATIONS

**On Behalf of Government of Turkey**

- **ESA (European Space Agency)**
- **APSCO (Asia-Pacific Space Cooperation Organization)**

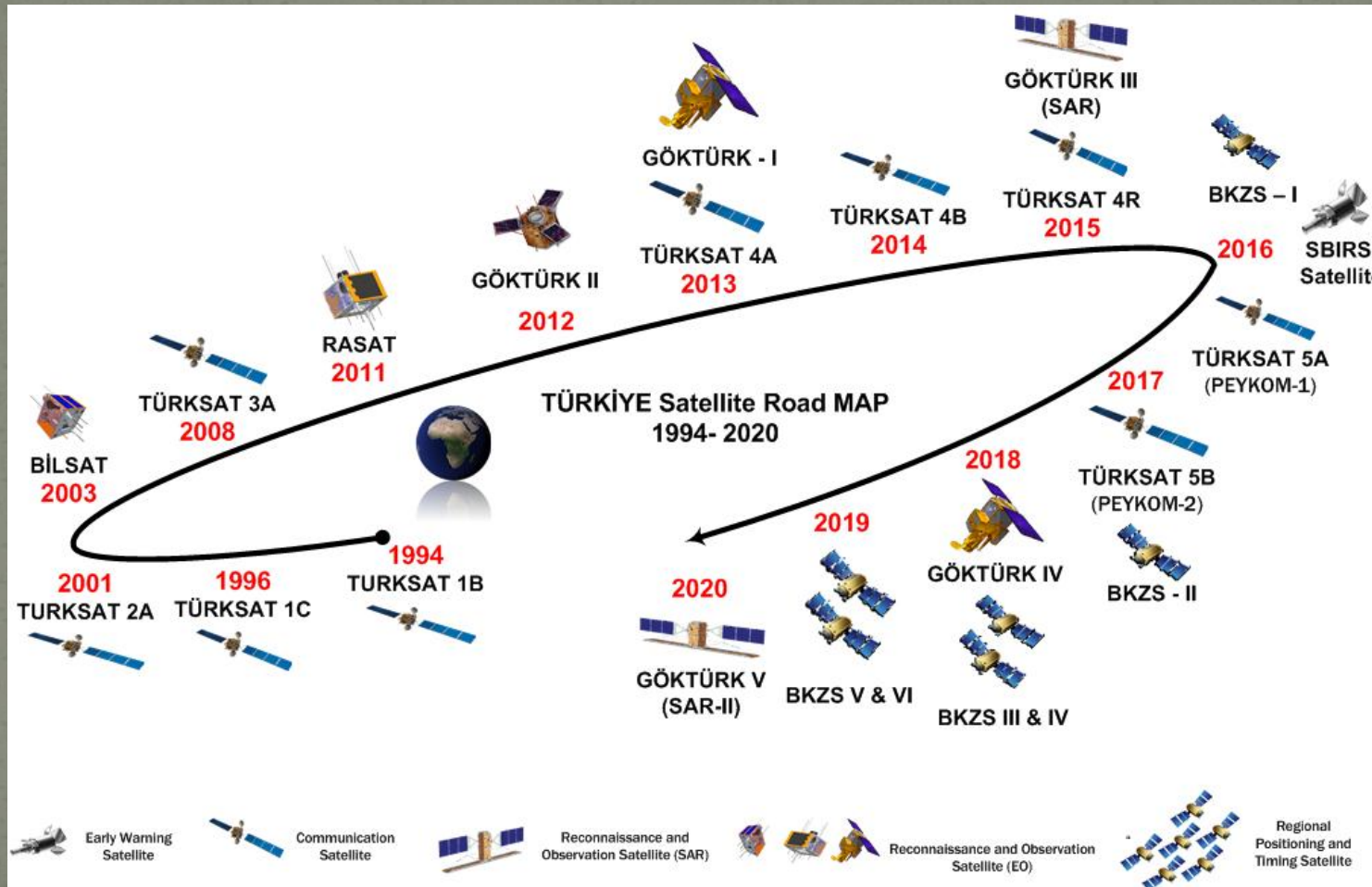
### Institutional Relations

- **IAF (International Astronautical Federation)**
- **GEO (Group on Earth Observation)**
- **EURISY**
- **CEOS**
- **UN OOSA (United Nations)**



# SSM

## Undersecretariat for Defence Industries



# TAI

Turkish Aerospace Industries





# ASELSAN

# aselsan

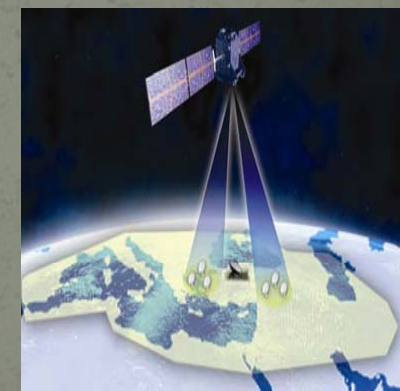
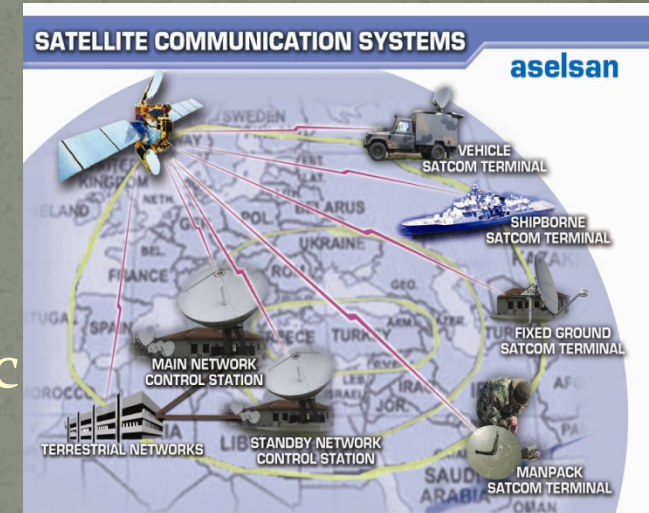


- X-Band Com via Turksats
- Capabilities
  - SatCom system design
  - SatCom HW and SW
  - Network, portable, submarine, etc
- Projects:
  - Flyaway; Shipborne; Submarine; Portable X-Band SatCom stations
  - Partner in EHF – Extra High Frequency transponder with BILUZAY
  - Subcontractor in GOKTURK satellite ground station development

Contact:

Dr. Taner Ozdemir

C. Tufekci: Turkey's Space Endeavour 17-Nov-11



# ITU

## Istanbul Technical University



- Offering Aeronautical Engineering degrees
- ITUpSAT1: In-orbit since 2009 (cubesat)
  - Launched: PSLV C-14 (23 Sep 2009)
- Turksat 3USAT: Com Payload mission
- Student space mission contests
- QB50: International consortium
  - 50 satellites to perform research in thermosphere (100-300km)
  - Re-entry tests
  - 2 satellites (ITU & METU) → LoI
- UNIFORM (Japan)
- UTEB: Union of Turkish Universities for Space (w/ YTU)



Contact:

Dr. Rustem Aslan @ ITU



# BILKENT UZAY

## Space Technologies Research Center



- Established: 2006
- Receivers & RF Frequency Converters
- Power Distribution and Regulation Systems
- Solid State Power Amplifiers
- RF Subsystems for Satellite Ground Terminals
- Partner in EHF – Extra High Frequency transponder with ASELSAN

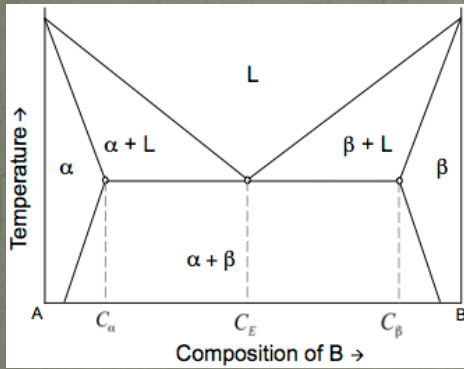


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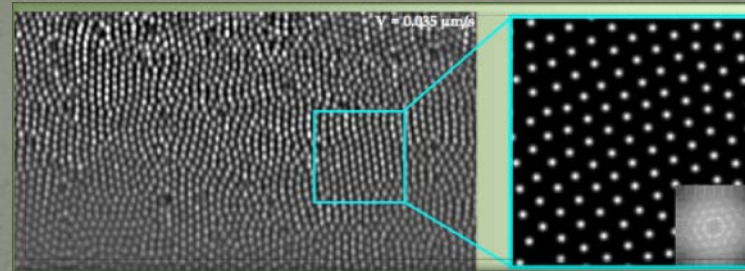




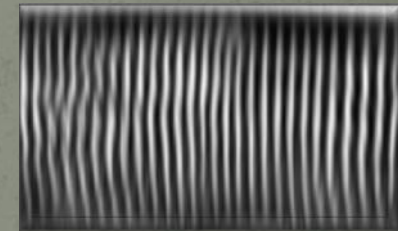
# Koc University



## Rod eutectics



## Lamellar eutectics



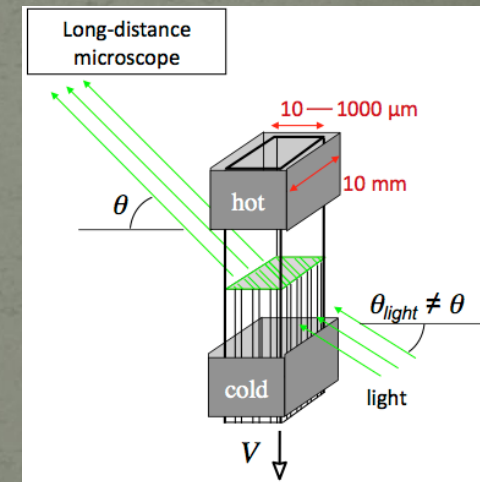
## Crystal Growth Experiments in Microgravity

By employing microgravity experiments in space, thermo-solutal convection will be eliminated.

End of 2011: ISS trial

Contact:

Dr. Melis Serefoglu @ Koc University



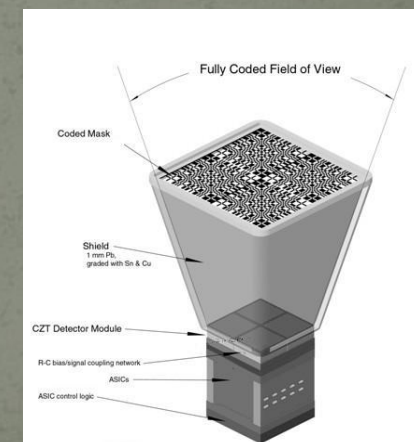


# Sabancı University

Sabancı  
Üniversitesi



- Detector design for high energy sources (X & Gamma-rays)
- Material: CdZnTe or Si-based
- Electronics: FPGA along with ASIC
- Research Accomplishments:
  - Characterization of semiconductor crystals
  - Modeling charge motion in crystals
  - Determining optimal design parameters
  - Integration of detector electronics
  - Production and testing
- Mission: MIRAX (Brazilian/US satellite)



Contact:

Dr. Emrah Kalemci @ Sabancı University

C. Tufekci: Turkey's Space Endeavour

17-Nov-11

# Space Camp Turkey



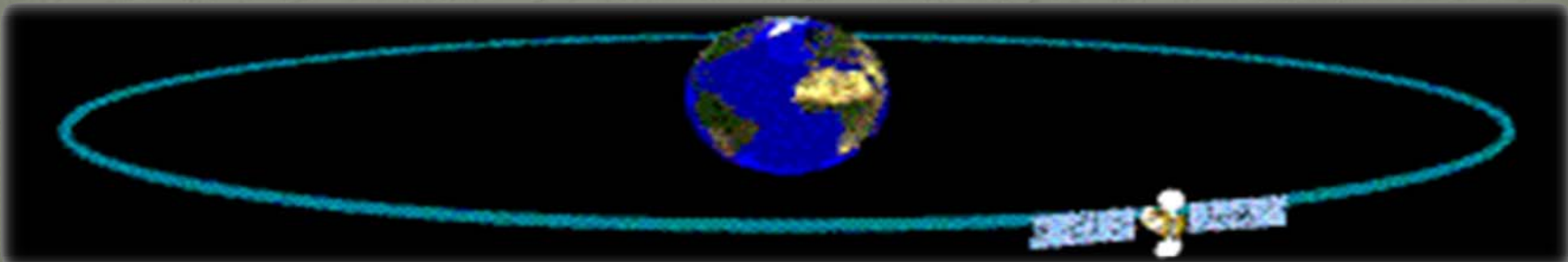
Izmir, Turkey





# Conclusions

- Turkey has potential and progressing in space
- Seeking:
  - Access to space: possible involvement in ISS
  - Possible Regional Center within UNOOSA HSTI
- National Astronaut Program
- Microgravity Research Center
- Suggestions appreciated



# Thanks

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**TÜBİTAK**