STATE OF ISRAEL
MINISTRY OF SCIENCE & TECHNOLOGY
MINISTRY OF FOREIGN AFFAIRS

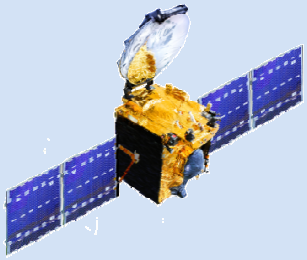
UNOOSA

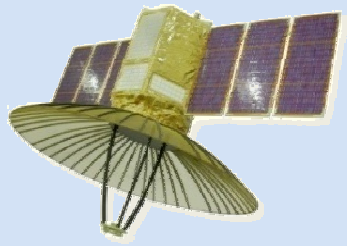
ISRAEL SPACE AGENCY

Israel Space Agency

Vision, Objectives, Activities

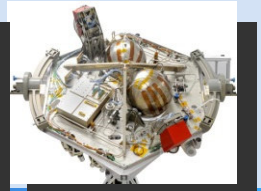
50th Session of COPUOS
Scientific and Technological Subcommittee 2013





Daniel Barok

International Collaborations' Adviser, Israel Space Agency


Acknowledgments

RAFAEL ADVANCED DEFENSE SYSTEMS LTD.

IAI

Elbit Systems Electro-optics - Elop

Asher Space Research Institute

AccuBeat

Gilat

elisra A Member of Elbit Systems

ImageSat International

IAI ELTA Systems Ltd. Group & Subsidiary of ISRAEL AEROSPACE INDUSTRIES LTD.

אוניברסיטת בן-גוריון בנגב Ben-Gurion University of the Negev

Semiconductor Devices

האוניברסיטה העברית בירושלים The Hebrew University of Jerusalem

שורק המרכז למחקר גרעיני - שורק

Orbit

BAE SYSTEMS

RAMON chips

Satix Fy

The New National Civil Space Program

The Objective

To evaluate and counsel

Israel's government

feasible solutions, providing achievement of a momentous and vital status in the global space market

by financing and leveraging

the National Space infrastructure

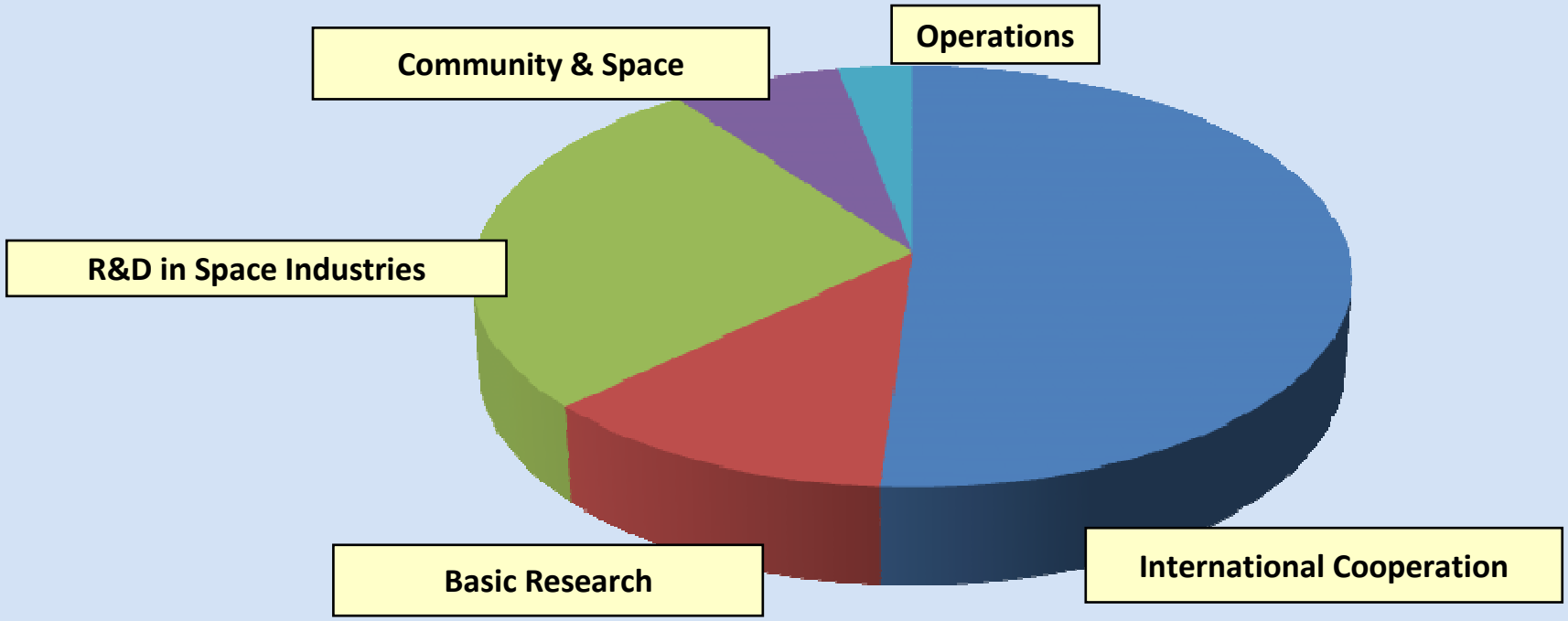
(June 2010)

Achievements and Comparative Advantages

- **Advanced lightweight satellites**
  (high performance /weight ratio)
- **Focus on earth observation field and miniaturization**
  (electro-optical, SAR, hyper - spectral)
- **Expertise in the areas of satellite communications**
- **Remarkable academic research capabilities**
- **Highly skilled and experienced human resources**
- **Extensive and documented record of verified success**
- **Advanced technical and engineering support system**
- **Hi-tech infrastructure and attributes**
- **Space collaboration with leading space-faring nations**

Main Objectives

Multi-year Program Breakdown



International cooperation

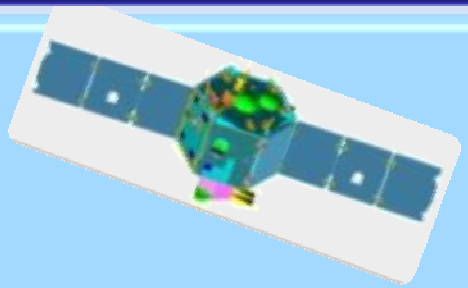
- NASA – ULTRASAT / LIMSAT ,research
- CNES - Venμs, modules and Technologies
- ASI - SHALOM
- ESA – systems, modules and Technologies
- Others

Venµs

Vegetation and **E**nvironment **N**ew **µS**atellite

- **Collaboration with the French Space Agency (CNES)**
- **Scientific mission of earth monitoring from space** *(mainly for agriculture and water needs)*
- **Develop and validate unique high resolution multi-spectral system**
- **Develop and demonstrate high performance electric propulsion system**
- **Foundation for the future advanced developments for global usage**

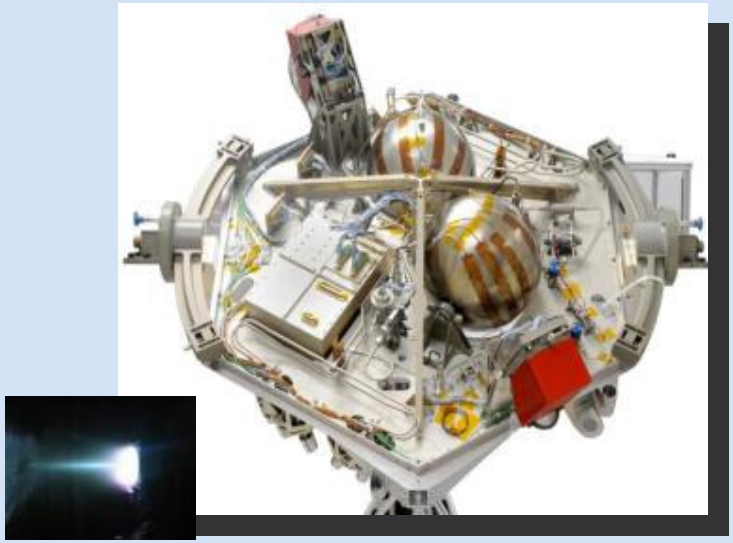
VENUS
Super-spectral satellite



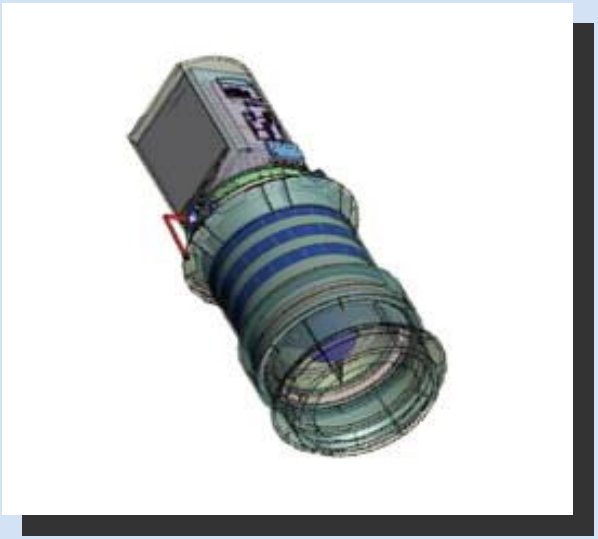
Israel Space Agency

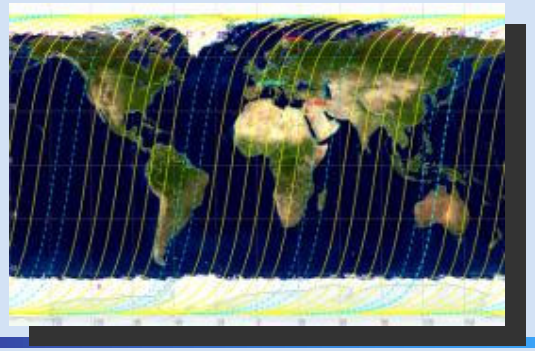
Venμs: Vegetation and Environment New μSatellite

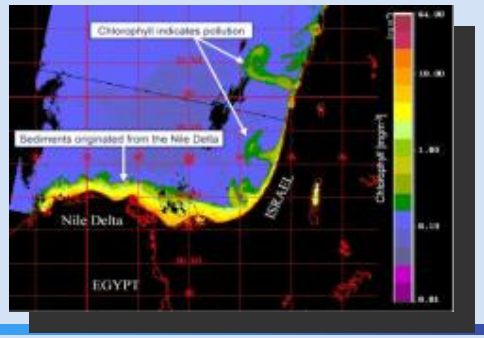
Technology Mission – Electric Propulsion



Scientific Mission – Super spectral camera







Elbit Systems
Electro-optics - Elop

RAFAEL
ADVANCED DEFENSE SYSTEMS LTD.

Electrical Propulsion System - EPS for LEO Satellites

- **Collaboration with CNES**

  Phase A: *System requirements, and architecture of the EP system*

  Phase B: *Development and qualification of the processes (EM level)*

  Phase C: *Qualification of the EPS (QM level) system*

- **Applications development for:**

  LEO Satellite Platforms - based on Medium Power HETs (~500W)

- **Unique System in its capabilities**

  Gaining superior orbit maintenance and de-orbit capabilities enabling an extension of the mission life

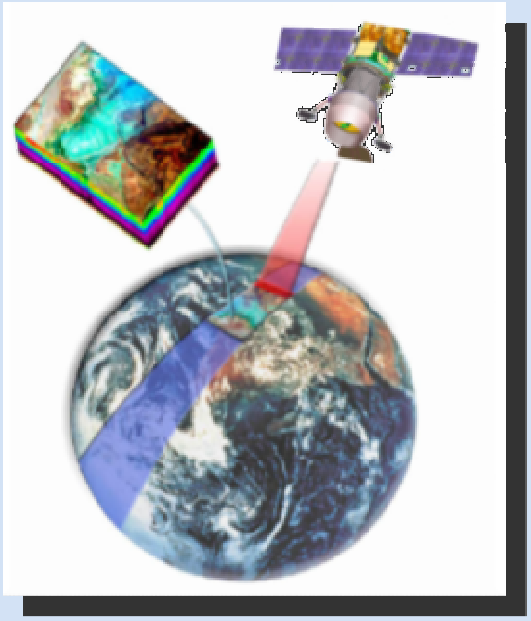
LEO
Electric Propulsion System

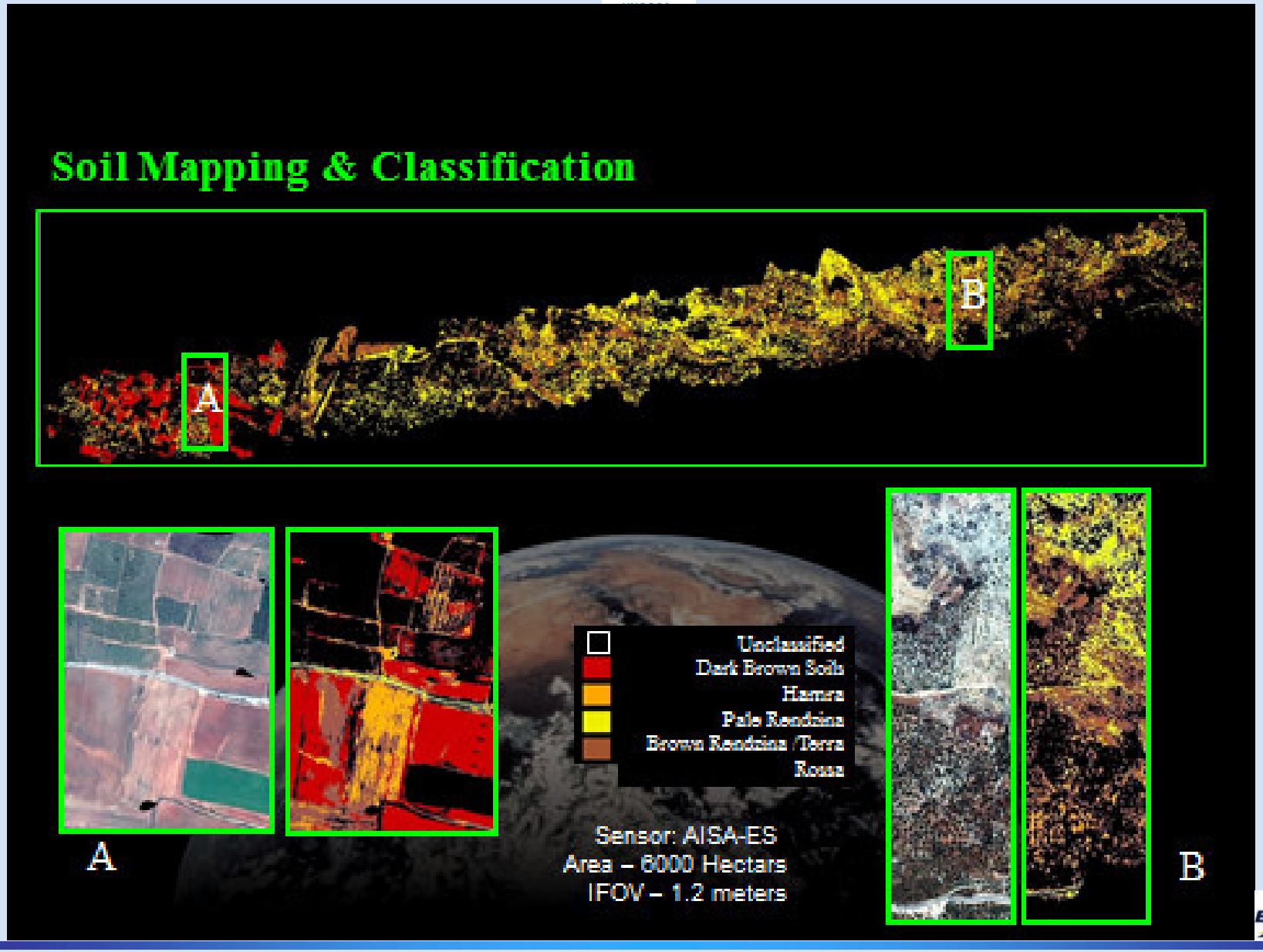
SHALOM

Space borne Hyperspectral Atmosphere, Land & Ocean Mission

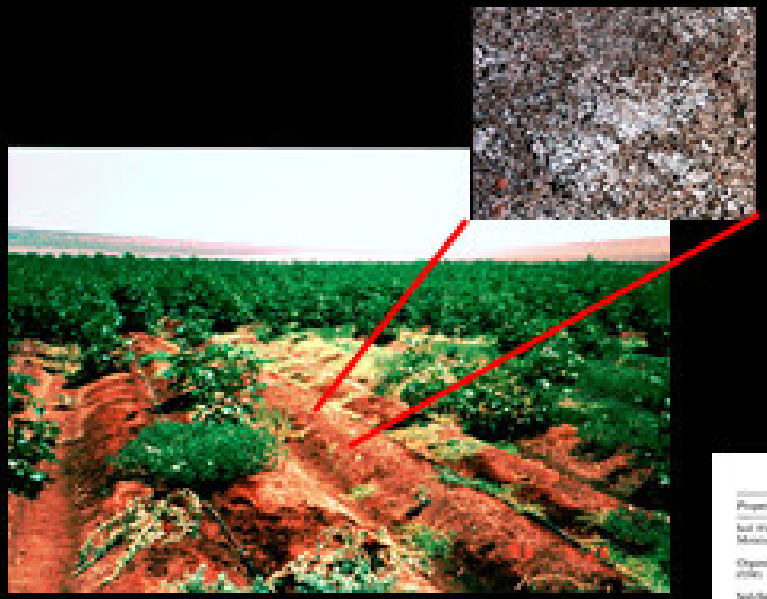
- **Collaboration with the Italy Space Agency (ASI)**
  - ***Phase A:*** *Feasibility Study for Space-borne System in wave lengths of μ0.4-2.5m & Airborne demonstrator for μ 3-12m.*
  - ***Phase B:*** *Implementation of the Space-borne System in wave lengths of μ0.4-2.5m*
  - ***Phase C:*** *Implementation of the Space-borne System in wave lengths of 3 -12μm (optional).*
- **Applications Development for:**
  Precision Agriculture, Environmental Monitoring, Minerals Detection, Water bodies Monitoring & more
- **Unique System in its Capabilities**
  (spatial & spectral resolutions) and in its concept (commercial applications)

"SHALOM"
Hyperspectral Satellite
For commercial applications



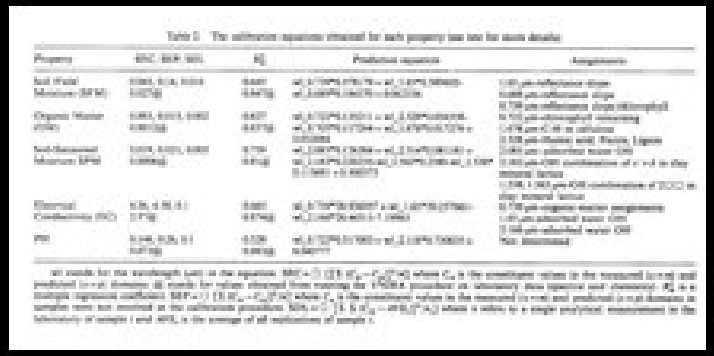

Soil Mapping & Classification
A
B
Unclassified
Dark Brown Soils
Hamra
Pale Rendzina
Brown Rendzina /Terra Rossa
Sensor: AISA-ES
Area – 6000 Hectars
IFOV – 1.2 meters
A
B

Precision Agriculture – Soil Salinity



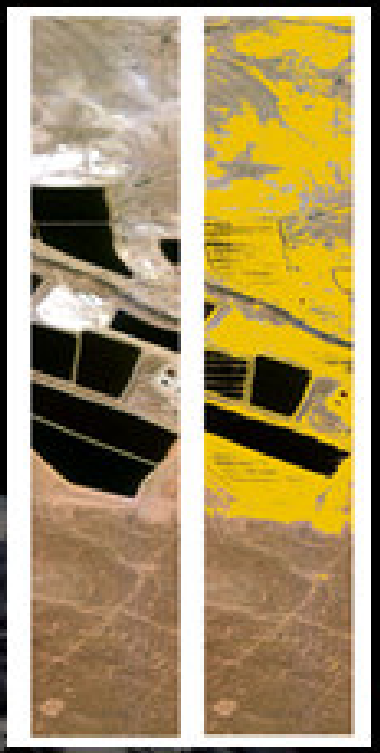
Jezreal Valley (Israel)

Spectral Model



Atmospheric Pollution

- Detection of emissions of hazardous materials
- Enables real-time incident monitoring.

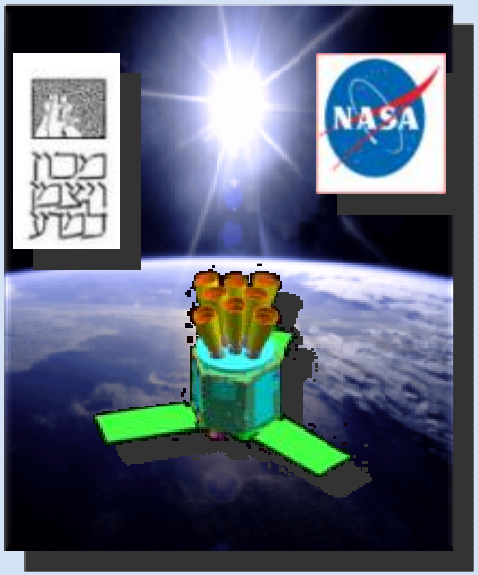


Polluted Atmosphere

ULTRASAT / LIMSAT

- Collaboration with NASA, USA
- Satellite usage for early detection of Supernovae phenomenon for ground sensors guidance
- Innovative approach which facilitate optimized utilization of ground observation measures
- Contemporary research approach from space, led by international scientists consortia – "low cost" science from space

LIMSAT – Less Is More
Detect and tracking Supernova



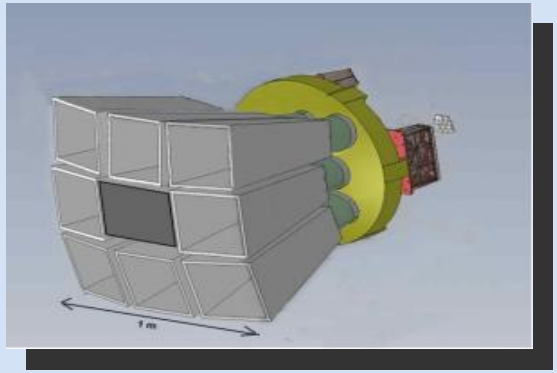
ULTRASAT / LIMSAT(cont.)

Ultraviolet - the First of Wide-Field Survey

- **Might discover phenomena never seen before -** *the merger of neutron stars, the stars falling into black holes ...*
- **Radiation detection of gravitational waves from being discovered by modern detectors**
- **Great potential for unexpected discoveries**

Scientific Outputs

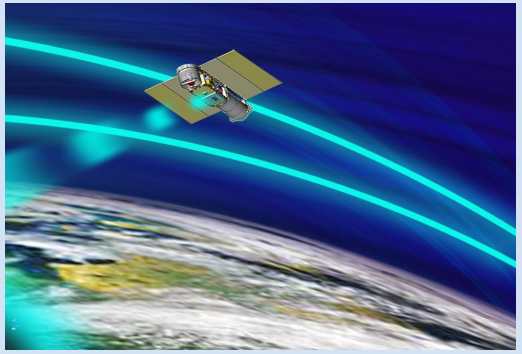
- **Study of exploding stars in real time:** *New understanding why and how stars exploding*
- **Discovery and understanding of planets' formation processes**
- **Measuring the rate of powerful solar storms** *in UV that might affect the habitability of distant planets.*

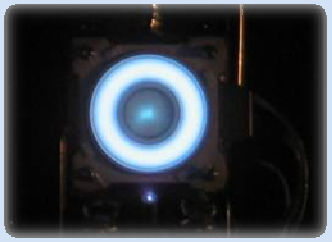


Micro Electrical Propulsion System - MEPS for Micro Satellites

- **Collaboration with ESA**
  - ***Phase A:*** *System requirements, and architecture Satellite EP, Development of the technologies and qualification of the processes*
  - ***Phase B:*** *Manufacture, Assembly and Qualification of the EPS*
- **Applications development for:**
  - ***Micro Satellite Platforms based on LOW Power HETs (~100W)***
- **Unique System in its capabilities**
  - ***Orbit maintenance and a working against the drag in very low orbits dedicated for Micro satellites***

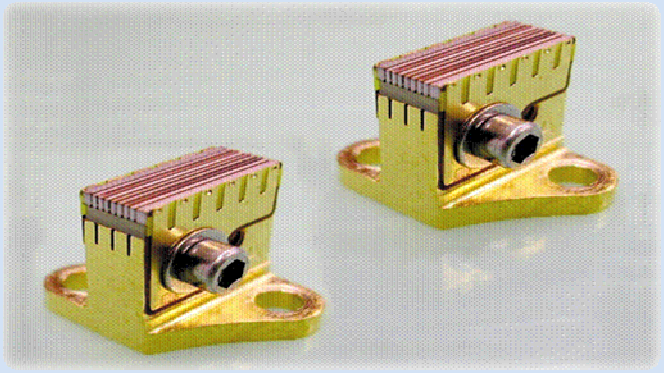
Micro Satellite
Electric Propulsion System

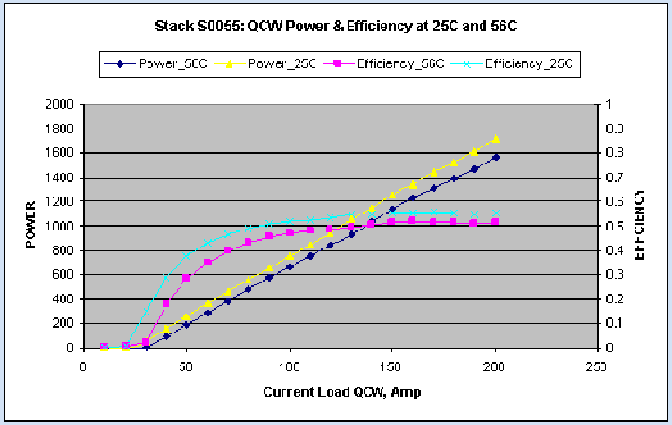




SCD Laser Diodes for Space Applications

- Collaboration with ESA/ESTEC
- Conduct series of tests to approve and qualify SCD's new generation Ruby laser diodes for Space missions
- To be integrated in the Zeiss altimeter and use in the Bepicolombo mission to Mercury in 2015, ESA/JAXA program
- Applications:
  - *Designator pump laser for marking*
  - *Proximity Sensor, Range Finder*



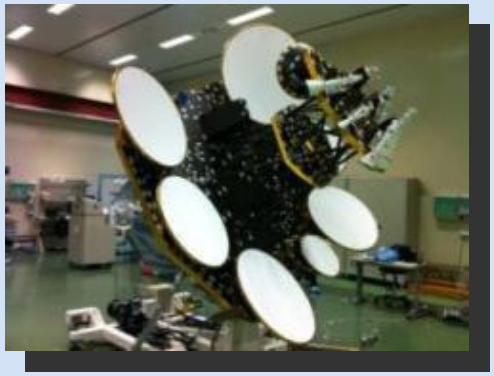
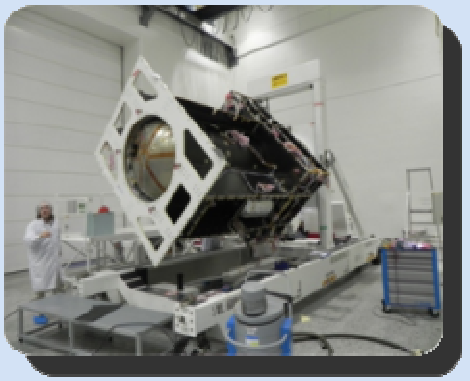


R&D in Space industries

- Communication satellites modules
- Electric propulsion
- Space computer components
- Beam generators
- Miniaturized assemblies
- ONBORD signal processor
- Nano and Micro satellites
- GPS
- Others

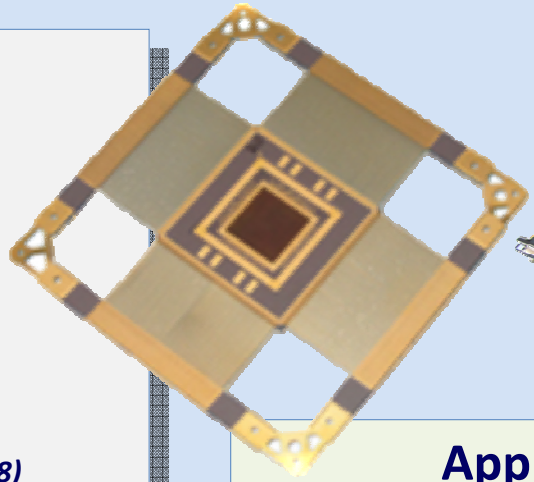
SATCOMS

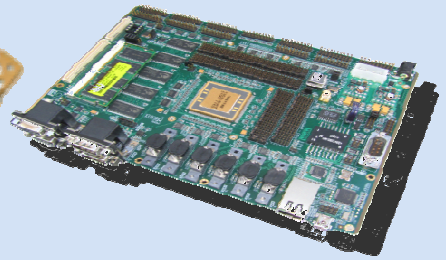
- Supports Israel Industries efforts to achieve and gain advantages in the global space communication markets
- Channeling the advantages and gains into scientific and technological developments, in the academia and in the industries, for improvement and enhancement of services and new applications

RC64: Next-Gen DSP Computer for Space

- **Rad-Hard ASIC**
- **Parallel computer**
  64 cores on-chip (1-4 cores today)
- **Very high compute strength**
  50+ Giga operations/sec
  10+ Giga FLOPS (1 GFLOPS planned by ESA for 2018)
- **Low electric power**
  Up to 3 watts
- **Planned for 2015-2016**
- **Benefits from advanced Israeli industries**
  Microelectronic Chips, Space Comp.





Applications

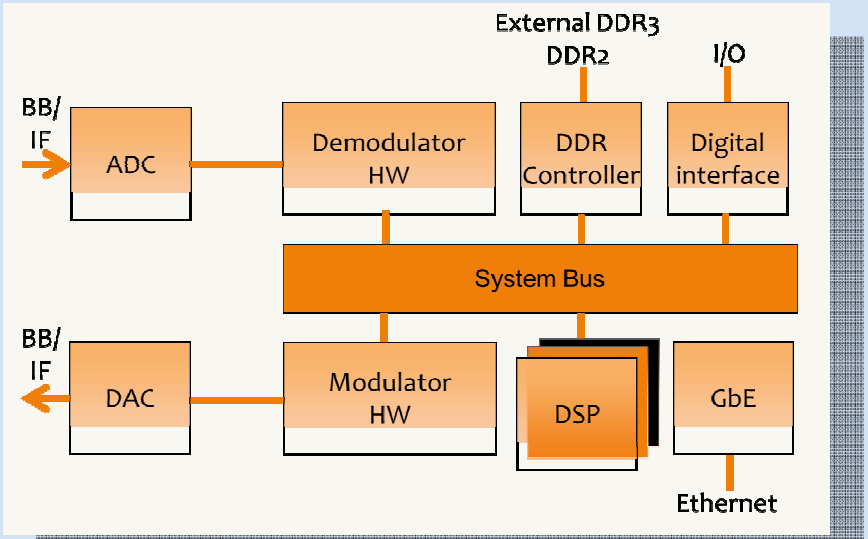
- **Imaging satellites**
  Compression, analysis
- **SAR satellites**
  Image processing in space
- **Telecomm satellites**
  Modems, routing, signal processing
- **Nano-satellites**
  Small, light super-computing

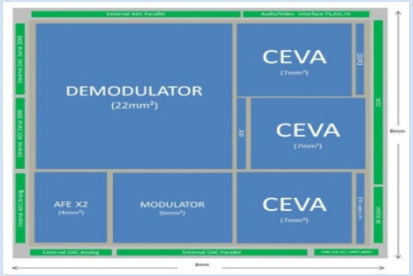
RAMONchips

SatixFy - VSAT SoC for Consumer Broadband

- A dedicated VSAT on a chip
- Increase throughputs x10
- Flexible software defined radio
- Reduce satellite terminal cost dramatically

SatixFy - An Israeli Semiconductor company, developing products for Satellite Communication markets.





Floor plan

InKlajn - 1

- Development of Nano-Sat for in space technologies validation
- Collaboration with Israel's Nano-Sats Association (INSA) & IAI
- Verification of Israel's new and unique space technologies *(GPS, Atomic Clock)*
- Students' involvement in the development and operation of the satellite

Basic Research

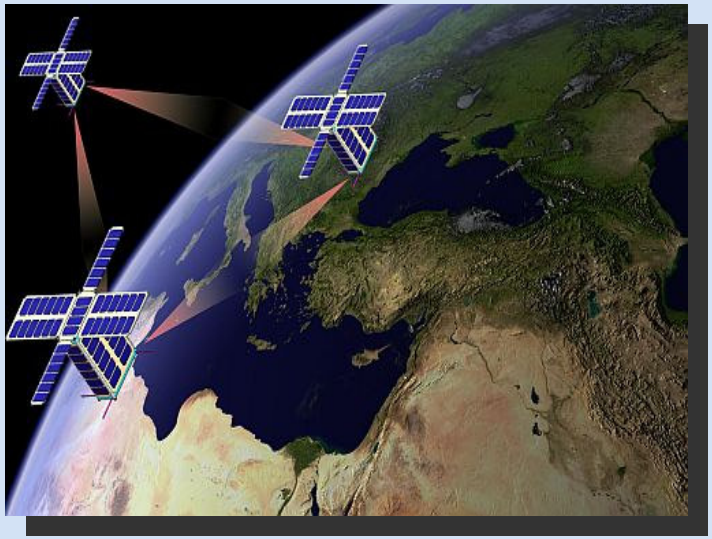
- **SAMSON**
- **Knowledge centers**
- **Space exploration projects**

SAMSON

Space **A**utonomous **M**ission of **S**warming & ge**O**locating **N**anosatellites

Primary Goal - Demonstrating one year of an autonomous structure of three Nano-satellites, in low orbit

Secondary Goal - High precision pinpointing signals, for Search And Rescue type missions



Modus Operatus

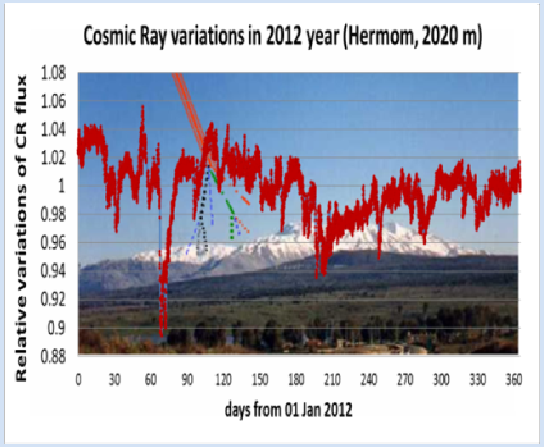
- Design and integration satellites by students at the Technion and the "Asher" Institute
- Implementation of formation flying control algorithms, developed by Technion's scientists
- Commercial launch by 2015
- Support of Israel's aerospace companies: IAI, Rafael, Elbit Systems, Specialist

Asher Space Research Institute

National Center of Knowledge in Cosmic Ray and Space Weather

Israel Space Agency, Tel Aviv University and Golan Research Institute

- **Research**
  - ***Origin of Cosmic Ray (CR) and space weather Impacts***
  - ***Modeling of CR propagation and the interaction with the Earth environment***
- **Experimental facilities**
  - ***CR Observatory on the Mount Hermon***
  - ***Neutron super-monitor*** *(for control CR radiation activity)*
  - ***Two 3-D magnetometers*** *(for control magnetosphere activity)*
  - ***VLW-ELW antennas*** *(for control of ionosphere activity)*
- **Applications**
  - ***Permanent real time monitoring of CR***
  - ***Detecting of impact's precursors***
  - ***Forecasting of possible negative effects on the Earth***



Community & Space

- SPACEIL
- Knowledge centers /exhibitions
- Education and Scholarships
- Schools and community enrichment

SPACEIL

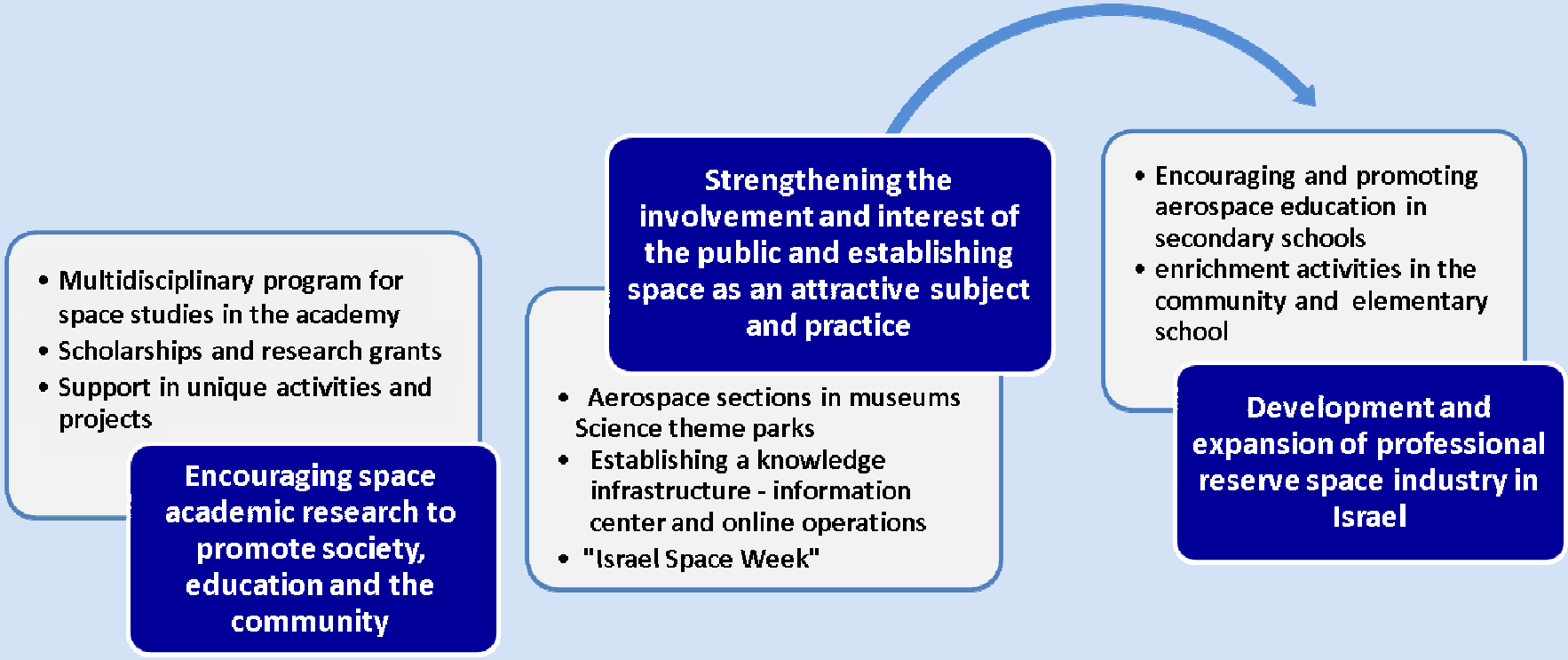
The Mission: Landing the First Israeli Spaceship on the Moon by 2014

Objectives

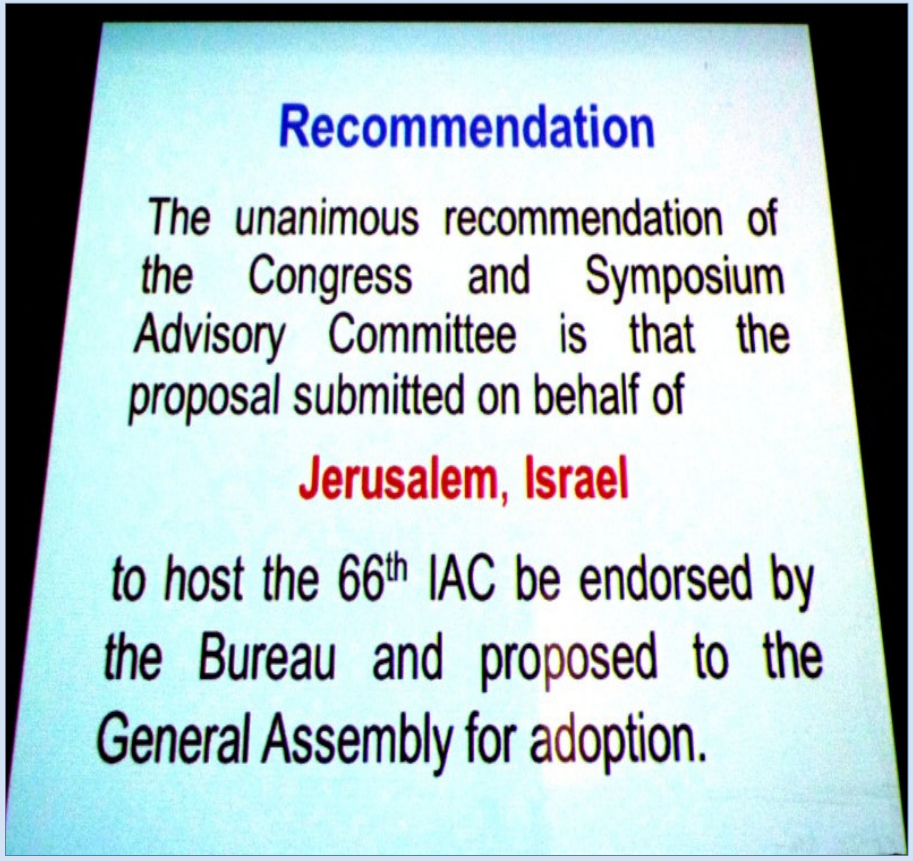
- **Inspire and attract the next generation of scientists and engineers,** while promoting the learning of science, technology, engineering and sciences
- **Promoting Scientific Research**
- **Increasing the State of Israel's image** as a global leader in science, technology and space research
- **Winning Google's Lunar X-Prize**

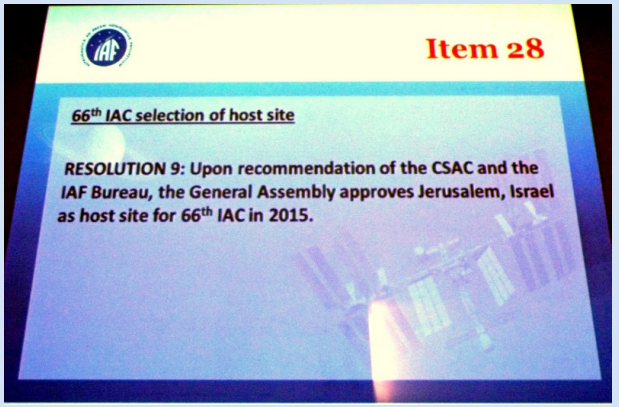
Ones in a lifetime opportunity to "Make History"…

Community & Space



The 66th International Astronautic Congress IAF-IAC2015 in Jerusalem, ISRAEL



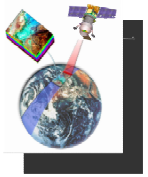
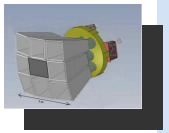


The Eighth Ilan Ramon Annual International Space Conference – 29-31 Jan 2013

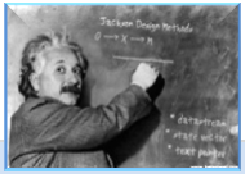
http://www.fisherinstitute.org.il/Eng/?CategoryID=7&ArticleID=34&Archive=1

Highlights of Near Future Activities

- "Venus" - Accomplishment of the integration for launch
- "Shalom" - Exercise successfully the study phase and decide on FSD
- "LimSat" - Win the competition, exercising Phase A and decide on next phase
- Expanding cooperation agreements with other Space agencies and organizations
- Expanding R&D projects in the domestic Space industries
- Finalize list of projects of international cooperation and kickoff
- Activation of the 2013 research projects in the academia and research institutes
- Enhancing the involvement of the community in space activities
- Organizing and setting the mode for IAF- IAC2015 conference in Jerusalem





Thank You for Your Attention

Daniel Barok
daniel.ext@most.gov.il

Multi-Year Program Breakdown

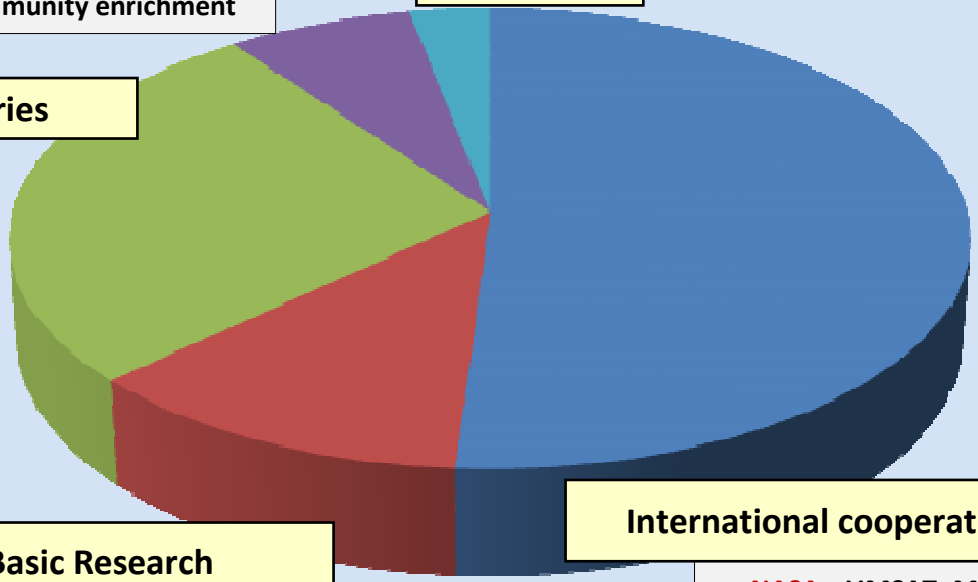
Community & Space

- SPACEIL
- Knowledge centers / exhibitions
- Education and Scholarships
- Schools and community enrichment

Operation

R&D in Space industries

- Communication satellites modules
- Electric propulsion
- Space computer components
- Beam generators
- Miniaturized assemblies
- ONBORD signal processor
- Small satellites
- GPS
- Others



International cooperation

- NASA - LIMSAT ,MUSAR ,research
- CNES - Venus, modules and Technologies
- ASI - SHALOM
- ESA – systems, modules and Technologies
- Others

Basic Research

- SAMSON
- Knowledge centers
- Space exploration projects