



GOVERNMENT OF INDIA , DEPARTMENT OF SPACE
INDIAN SPACE RESEARCH ORGANISATION



Dr. SV Sharma
Deputy Director ISAC/ISRO



Main Building



INSAT Building



ISITE

CATVAC

AIT - 1

ATF

SAG

LITF

HDI

MSA

AIT-2

SEG

CATF

Vision: Harness space technology for national development

Space Applications

- **Socio Economic Security:** Food, water, Energy, Health, Shelter, Infrastructure & Information
- **Sustainable Development:** Agriculture, Urban, Coastal ecosystem, Climate change...
- **Disaster Risk Reduction**
- **Governance:** Planning , Monitoring & Decision support

Space Infrastructure

- **Earth Observation:** Land, Water, Cartography, Oceanography, Atmosphere & Weather
- **Communication**
- **Navigation**
- **Space Science:** Exploration, Solar Physics, Astronomy, Astrophysics, Space Probes
- **Ground Segment**



Space Transportation

- **Polar Satellite Launch Vehicle (PSLV)**
- **Geosynchronous Satellite Launch Vehicle (GSLV)**
- **Advanced Launch Vehicle**
 - **Modular LV**
 - **Reusable LV**
 - **Human spaceflight**



Capacity Building

- **Human Resources**
- **Technical Infrastructure**
- **Enhanced Output (Outsourcing & TT)**
- **New Technologies Academia, Industries)**
- **Indigenization**
- **International cooperation**
- **Outreach**

ISRO : CURRENT SPACE ASSETS

CURRENT SPACE ASSETS : 44 MISSIONS

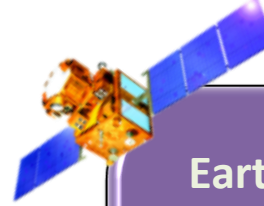


Communication & Meteorological Satellites

(INSAT- 3C, 4A, 4B, 4CR and GSAT-6, 7, 8, 10, 12, 14, 15, 16,18,19)

Transponders

Providing communication & Meteorological Services



Earth Observation Satellites

(INSAT-3D, Kalpana, INSAT-3A, INSAT-3DR

RESO- 2,2A; CARTO-1, 2, 2A , 2B & 2S,2S-2; RISAT-1 & 2; OCEAN-2; MEGHA-TROPIQUES; SARAL, SCATSAT-1)

providing application oriented services



Navigation Satellites

(NAVIC)

(IRNSS-1A,1B,1C,1D, 1E, 1F,1G)

Providing Navigation Services in the Country



Space Science Satellites

(Mars Orbiter Mission & ASTROSAT)

Providing valuable scientific data to the scientific community

FIVE DECADES OF INDIAN SPACE PROGRAMME ACCOMPLISHMENTS

- Applications driven, self-reliant programme, Focusing on supporting national development

Present Space Infrastructure : 44 Missions

Operational Satellites
Developmental Satellites
Experimental Satellites
Commercial Satellites

PSLV, GSLV
SLV, ASLV, RLV-TD, Scramjet
Sounding Rockets

Cubesats,
Nanosats, Commercial
Satellites, University Satellite



97 Spacecraft Missions
Incl. 9 Student Satellites



64 Launch Vehicle
Missions
2 Reentry Missions



206 Satellites from
other countries

SPACECRAFT MISSIONS ACCOMPLISHED

2015 [3]

2016 [8]

2017 [8]

AUG
SEP
OCT
NOV
DEC

JAN
FEB
MAR
APR
MAY

JUN
JUL
AUG
SEP
OCT
NOV
DEC

JAN
FEB
MAR
APR
MAY
JUN
JUL

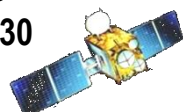
JAN
FEB
MAR
APR
MAY
JUN
JUL



ASTRO
SAT

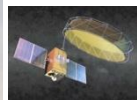
Sep 28
PSLV-C30

GSAT-15



Nov 10
Ariane

GSAT-6



Aug 27
GSLV-D6



IRNSS-1F

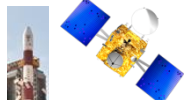
Mar 10
PSLV-C32

IRNSS-1G



Apr 28
PSLV-C33

IRNSS-1E



Jan 20
PSLV-C31



INSAT-3DR

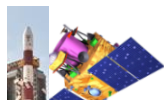
Sep 08
GSLV-F05

SCATSAT-1



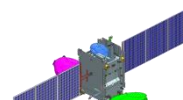
Sep 26
PSLV-C35

CARTO-2C



Jun 22
PSLV-C34

GSAT -18



Oct 4
Ariane



RESOURCE
SAT-2A

Dec 7
PSLV-36

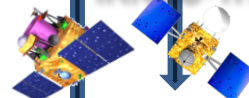
CARTO-2D

INS-1A
INS-1B



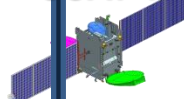
Feb 15
PSLV-C37

CARTO-2E



IRNSS-1H

GSAT-19
GSAT-17

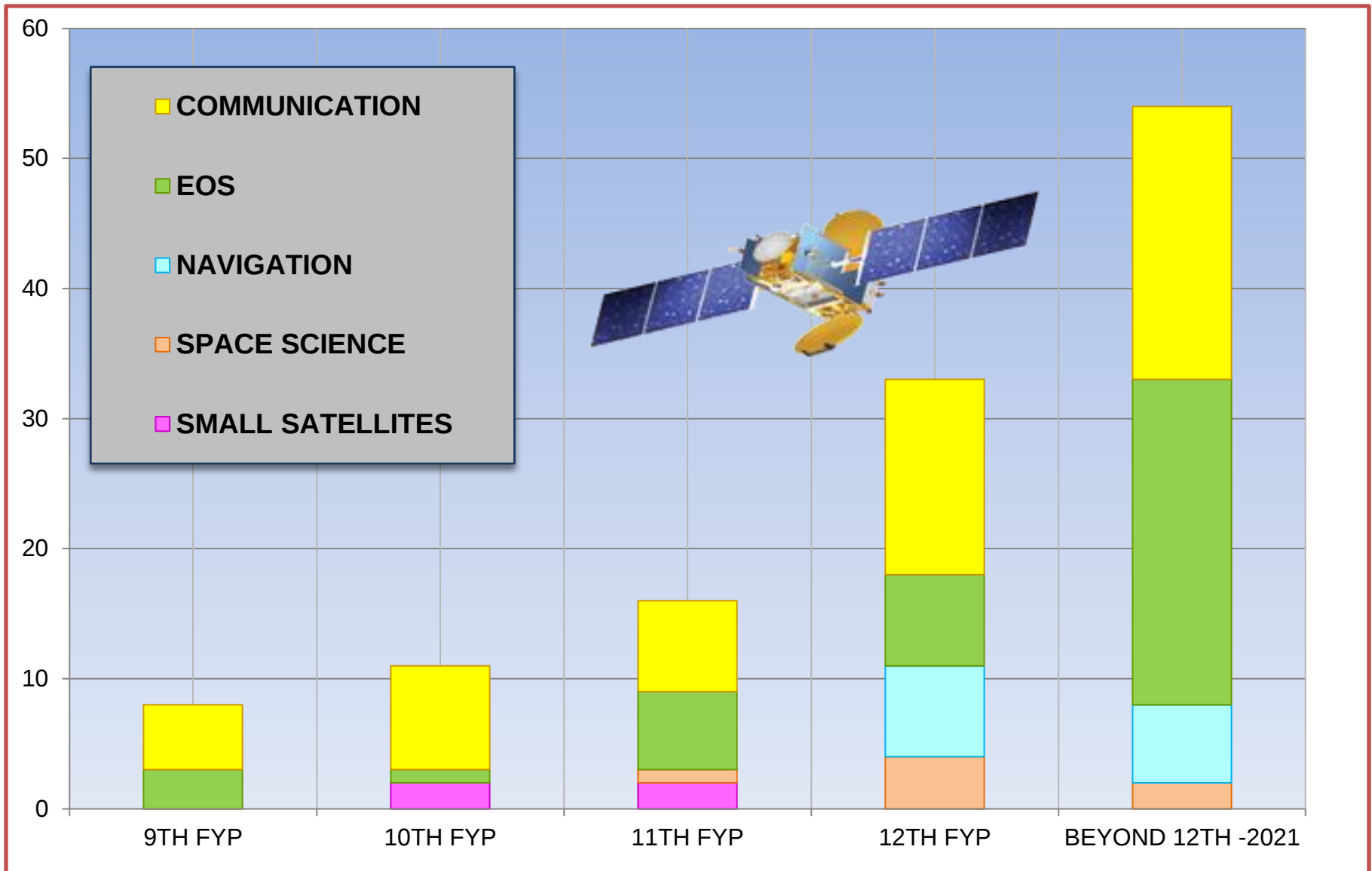


GSAT-9



May 05
GSLV-F06

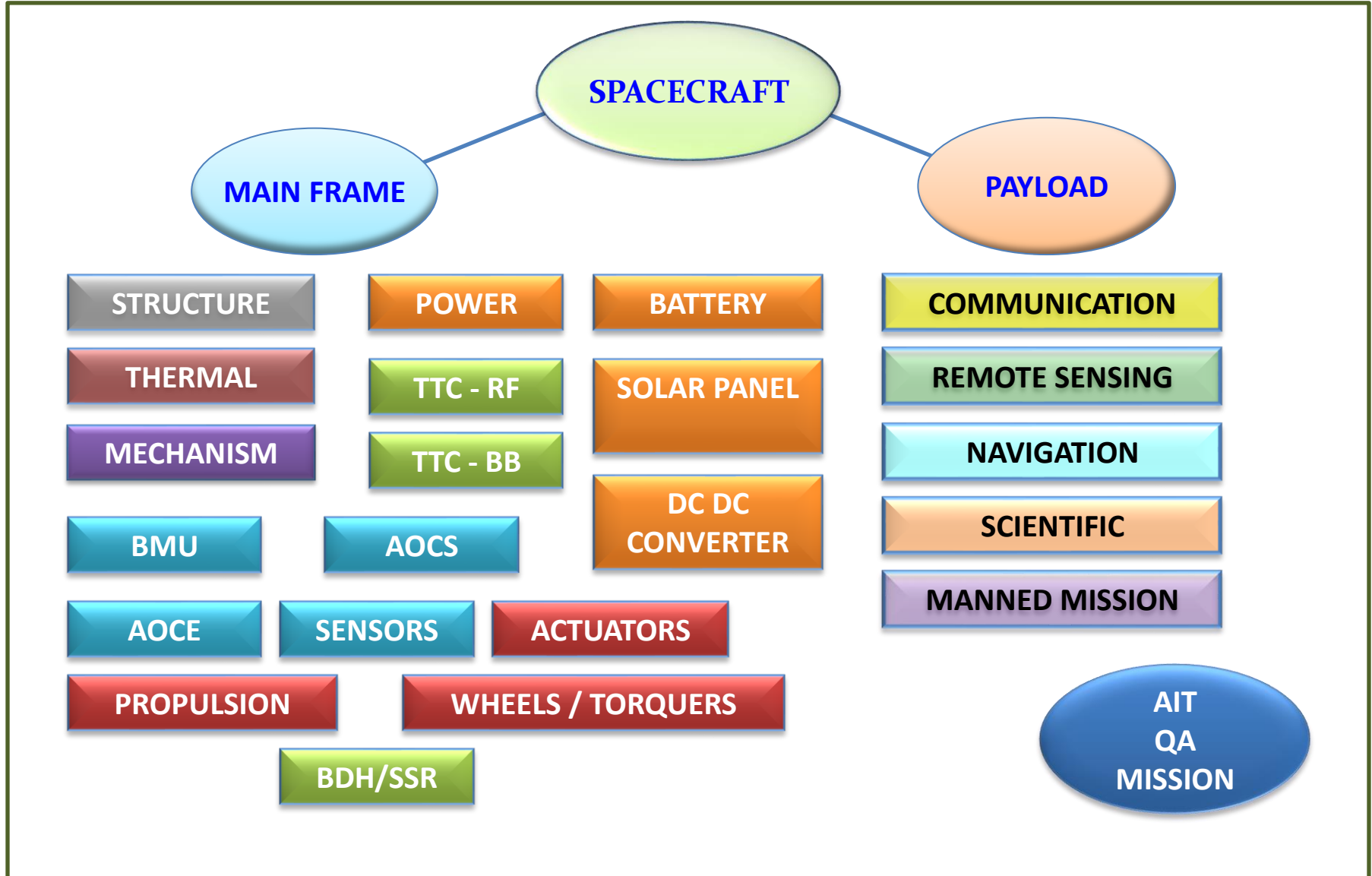
ISAC - TWO DECADES AND PLUS – S/C Growth Trajectory



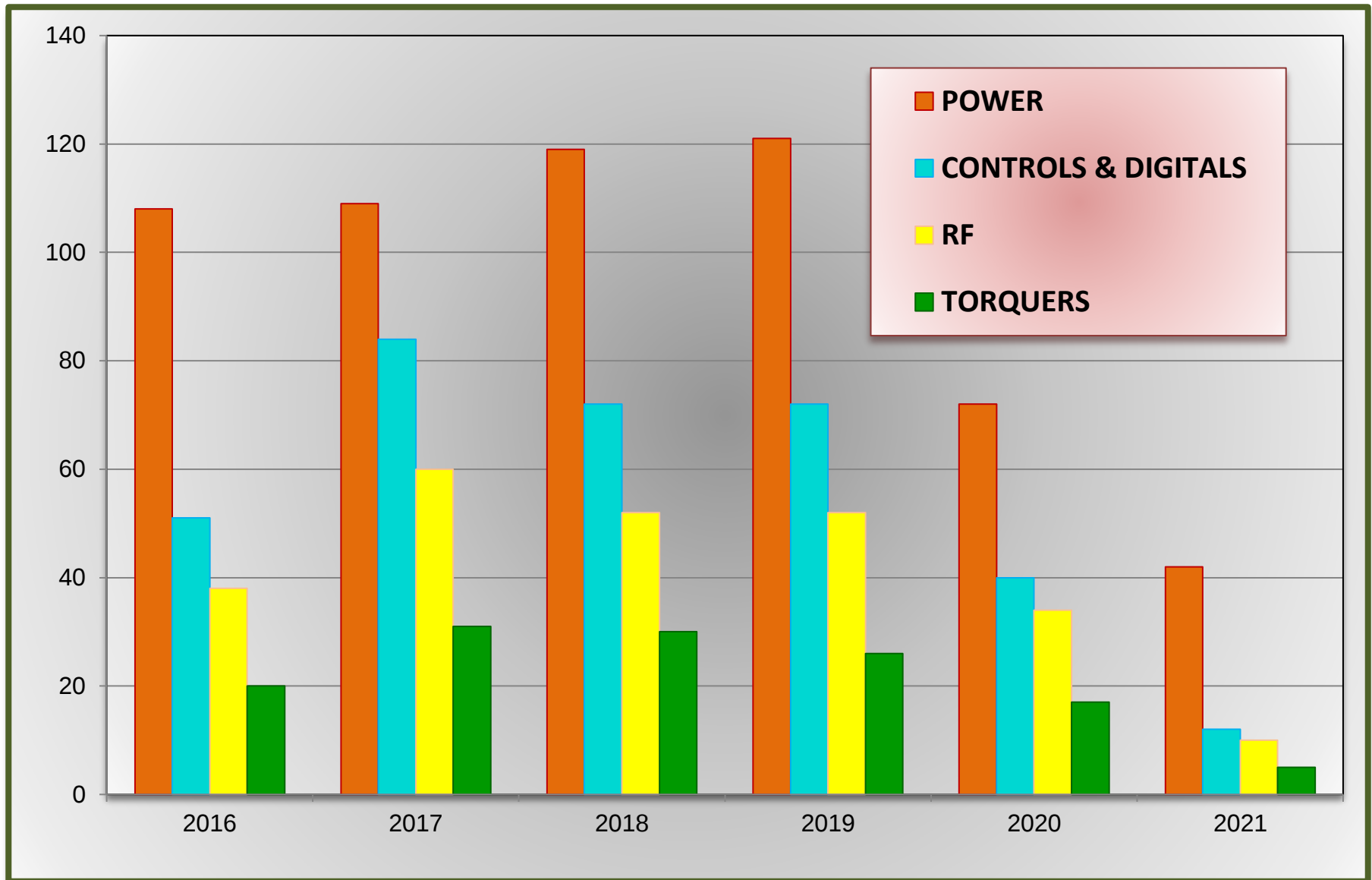
ESTIMATED PROGRAMME PROFILE 2015-2021 (71 Satellites)

Programme	2015 (Q3...)	2016	2017	2018	2019	2020	2021
Communication	GSAT-15	GSAT-18 SAARCSAT GSAT-19	GSAT-11 GSAT-7A GSAT-17	INSAT-4AR GSAT-9 Ka-Multi Ku-48 S band 12m Ku-24	User Funded-1 Ka/Ka-1 Ku-24 Ext ComSat-1 Ka/Ka-2 User Funded-2 GSAT-11R	Ku-48 GSAT-6A Ext ComSat-2 IDRSS-1	IDRSS-2 Ext ComSar-3 Ka/Ka-3 GSAT-7R
Navigation	IRNSS-1E IRNSS-1F	IRNSS-1G IRNSS-1H	IRNSS-1I IRNSS-1J	IRNSS-1K	IRNSS-S1	IRNSS-S2	IRNSS-S3
Earth Observation		INSAT-3DR SCATSAT-1 CARTO-2C RES-2A EMISAT	GISAT-1 CARTO-2D MICROSAT CARTO-2E	GISAT-2 CARTO-3 OCEAN-3	INSAT-3DS HySIS CARTO-3A RISAT-1A SPADEX RES-3S OCEAN-3A RISAT-1B RES-3MX	Adv. GISAT CARTO-3B RISAT-2A RES-3SA OCEAN-3B RES-3AMx NISAR	RES-3SB RES-3BMx
Space Science	ASTROSAT		CHAND-2		ADITYA-L1		
TOTAL	4	10	10	10	18	12	7

SATELLITE TYPICAL MAJOR HARDWARES



ANTICIPATED FUTURE REQUIREMENTS - A SNAPSHOT



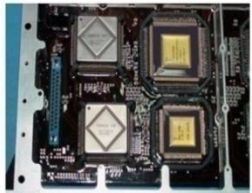
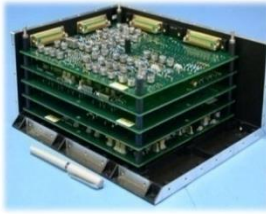
SPA -SPACECRAFT PROGRAMME PROFILE 2016-2017 (23 s/c)

	2016 (13 s/c)												2017 (10 s/c)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
GEOSAT PROGRAMME				217 INSAT-3DR GSLV Mk-II				37/601 GSAT-19 GSLV Mk-III					25/600 GSAT-9 GSLV Mk-II					30/199 GISAT-1 GSLV Mk-II						
				532 GSAT-18 PROCURED		89/1378 GSAT-11 PROCURED					547 GSAT-17 PROCURED				11/308 GSAT-7A GSLV Mk-II			~600 INSAT-4AR PROCURED				~600 GSAT-22 GSLV Mk-III D2		
IRS & SSS PROGRAMME	470 CARTOSAT-2C PSLV							24/535 RES-2A PSLV					39/396 CARTOSAT-2D PSLV									70/282 CARTOSAT-2E PSLV		
		160 SCATSAT-1 PSLV						33/196 EMISAT PSLV										3/39 MICROSAT PSLV				38/387 CHANDRA-2 GSLV		
NAVIGATION PROG.	291 IRNSS-1F PSLV		360 IRNSS-1G PSLV							291 IRNSS-1H PSLV			291 IRNSS-1I PSLV					~291 IRNSS-1J PSLV						

*** All dates indicated above are spacecraft readiness schedules**

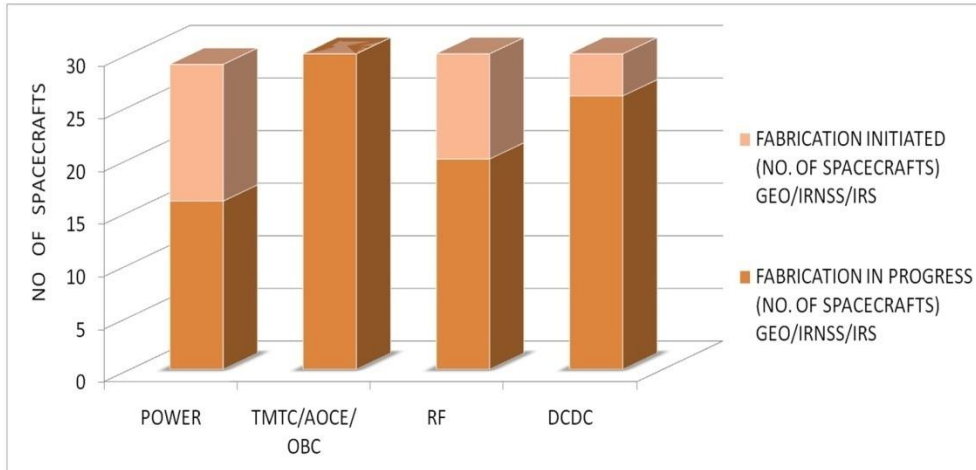
23rd Nov 2015

REPRESENTATIVE HARDWARE PACKAGES

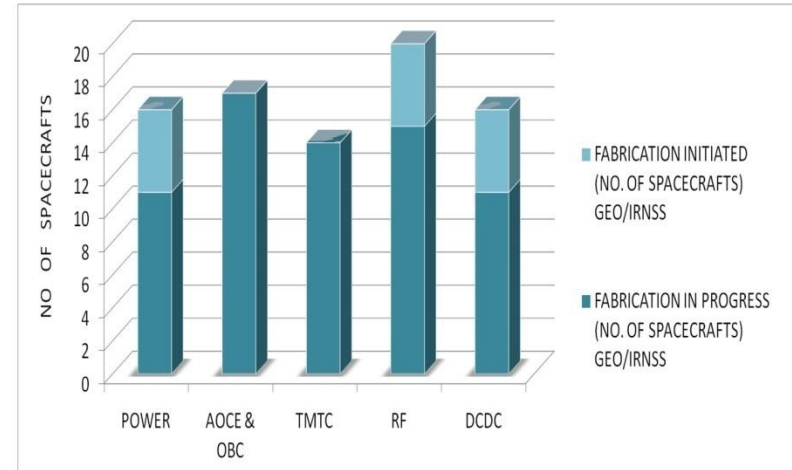


SEG PRODUCTION HARDWARE REALISATION PLAN UPTO OCT 2018 USING RATE CONTRACT

PRODUCTION HARDWARE REALISATION PLAN UPTO OCT 2018
(GEOSAT/IRNSS/IRS PROJECTS)



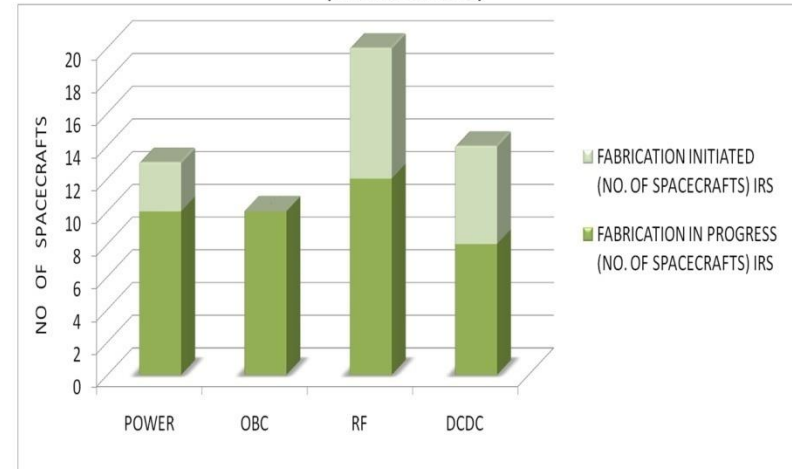
PRODUCTION HARDWARE REALISATION PLAN UPTO OCT 2018
(GEOSAT/IRNSS PROJECTS)



PROJECTS UNDER CONSIDERATION

YEAR	GEO	IRNSS	IRS
2018	GSAT-29 GSAT-20 / 22 / 23 / 24 INSAT-3DS GSAT-7A GISAT-1	IRNSS-11 IRNSS-Ext1 IRNSS-Ext2	CYN-2 RISAT-1A / 2A CARTO-3 / HYSIS OCEANSAT-3
2019	GSAT-25 / 26 / 27 GSAT-30 GISAT-2 GISAT-7C	IRNSS-Ext3 IRNSS-Ext4	HRSAT-1 / 2 / 3 / 4 RES-3S/3/3A OCESANSAT-3A
TOTAL	14	5	15

PRODUCTION HARDWARE REALISATION PLAN UPTO OCT 2018
(IRS PROJECTS)

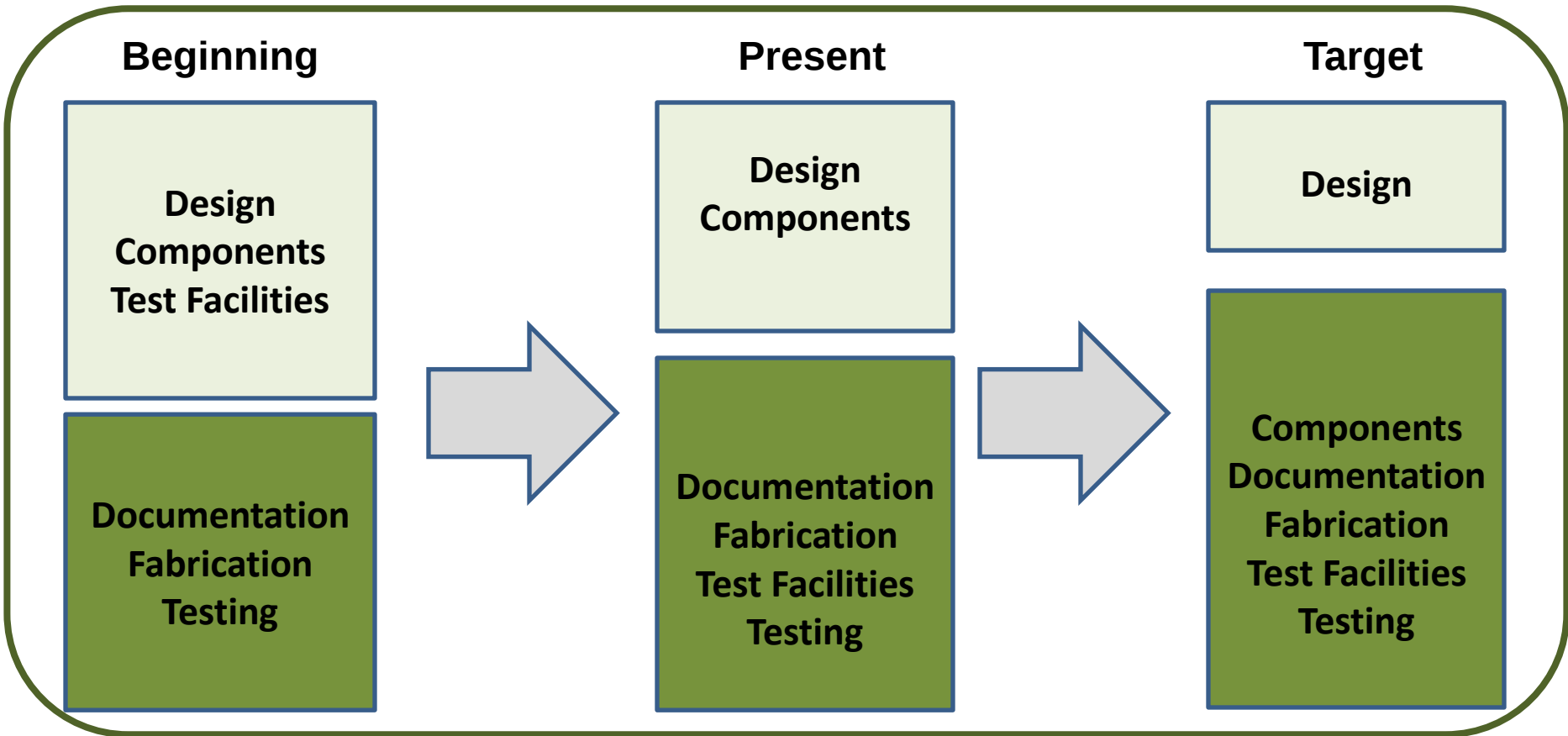


Subsystem	NO. OF PACKAGES REQUIRED PER SPACECRAFT		
	GEO	IRNSS	IRS
POWER	10	8	9
DIGITAL &	10	8	13
RF	15	9	15
TOTAL	35	25	37



Package Handing Over November 2015 to March 2016

Subsystems end-to-end Production Model



Target Outsourcing end-to-end Spacecraft AIT

Target Realization of 350 to 400 Packages per year

PRODUCTION MODELS

Example of Present Contracts

Fabrication & Testing In-house

- Distribution packages
- Control system packages: BMU & ADE
- Digital system packages: SSR& BDH
- Communication packages (S-band)
- Antenna elements

ISAC/SITE

Fabrication In-house & Testing by Vendor

- Communication packages
- Power packages
- DC-DC Converters & Relays
- Control system packages

M/s Aidin
M/s Ananth Tech
M/s Newtech Solutions
M/s Keltron &
M/s SGS etc

Fabrication & Testing by Vendors @ISAC/SITE

- Power packages except Distribution
- DC-DC Converters
- Magnetic Torquers
- Thruster Zener packages

M/s Newtech Solutions
M/s Ananth Tech
M/s High Tech magnetics & M/s
Aidin etc

PRODUCTION MODELS.....continue

**Fabrication & Testing
by Vendors @
vendors site**

- Power Packages DC-DC Converters
- Telemetry, Telecommand Package

M/s Multitech
M/s Newtech Solutions
M/s Ananth Tech etc

**End-to-End
Productionisation
(Excluding EEE
Components)**

- Telemetry, Telecommand Package

M/s Data Pattern
M/s Ananth Tech etc

Advanced mode of realization

Mode -6

Mode 1

- Fabrication of cards
- Vendor facility
- Consumables by vendor

Mode 2

- Card level testing
- Package level testing
- Equipments and test jig by ISAC

Mode 3

- Fabrication of cards
- wiring of packages
- Card level testing
- Package level testing
- Consumables by ISAC
- Equipments and test jig by ISAC

Mode 4

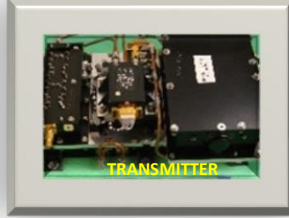
- Fabrication of cards
- wiring of packages
- Card level testing
- Package level testing
- Consumables by Vendors
- Equipments and test jig by Vendors
- Vendor facility
- Equipments and test jig by Vendors

Mode 5

- PCB
- Mechanical housing
- spares accessories, fasteners
- Fabrication of cards
- wiring of packages
- Card level testing
- Package level testing
- Consumables by Vendors
- Equipments and test jig by Vendors
- Vendor facility
- Equipments and test jig by Vendors

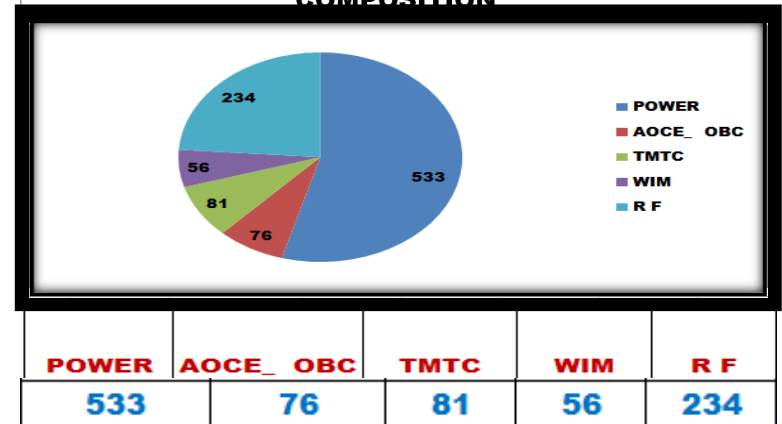
Mode 6 definition

Mode5 + EEE Components



	QUARTER	POWER_	AOCE_						
QUARTER YEAR	NOS.	PKGS	OBC	TMTC	WIM	R F	DC_DC	RELAY	
2019 -	1	1	82	11	7	12	28	160	67
	2	2	14	4	0	0	16	64	35
	3	3	8	2	6	0	9	12	0
	4	4	58	9	8	6	24	159	2
2020 -	1	5	87	8	9	12	24	173	1
	2	6	28	5	6	0	20	93	2
	3	7	8	2	6	0	9	12	0
	4	8	58	9	8	6	24	159	2
2021 -	1	9	87	8	9	12	24	173	1
	2	10	28	5	6	0	20	93	2
	3	11	10	3	7	1	9	4	2
	4	12	65	10	9	7	27	175	5
QUANTITY			533	76	81	56	234	1277	119

AVIONICS HARDWARE -> REQUIREMENT COMPOSITION



- In the context of Indian Satellite Program

**Systems Assembly , Integration & Testing
Contract – Satellite level**

EVOLUTION OF OUTSOURCING

**Fabrication & Testing Contracts -
Subsystem level at Vendors premises**

**Fabrication & Testing Contracts - Package
level at ISAC**

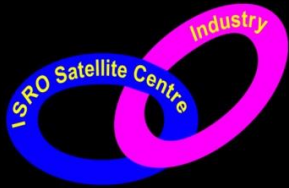
**Fabrication Contract
– PCB Level**

**Manpower
Contract**

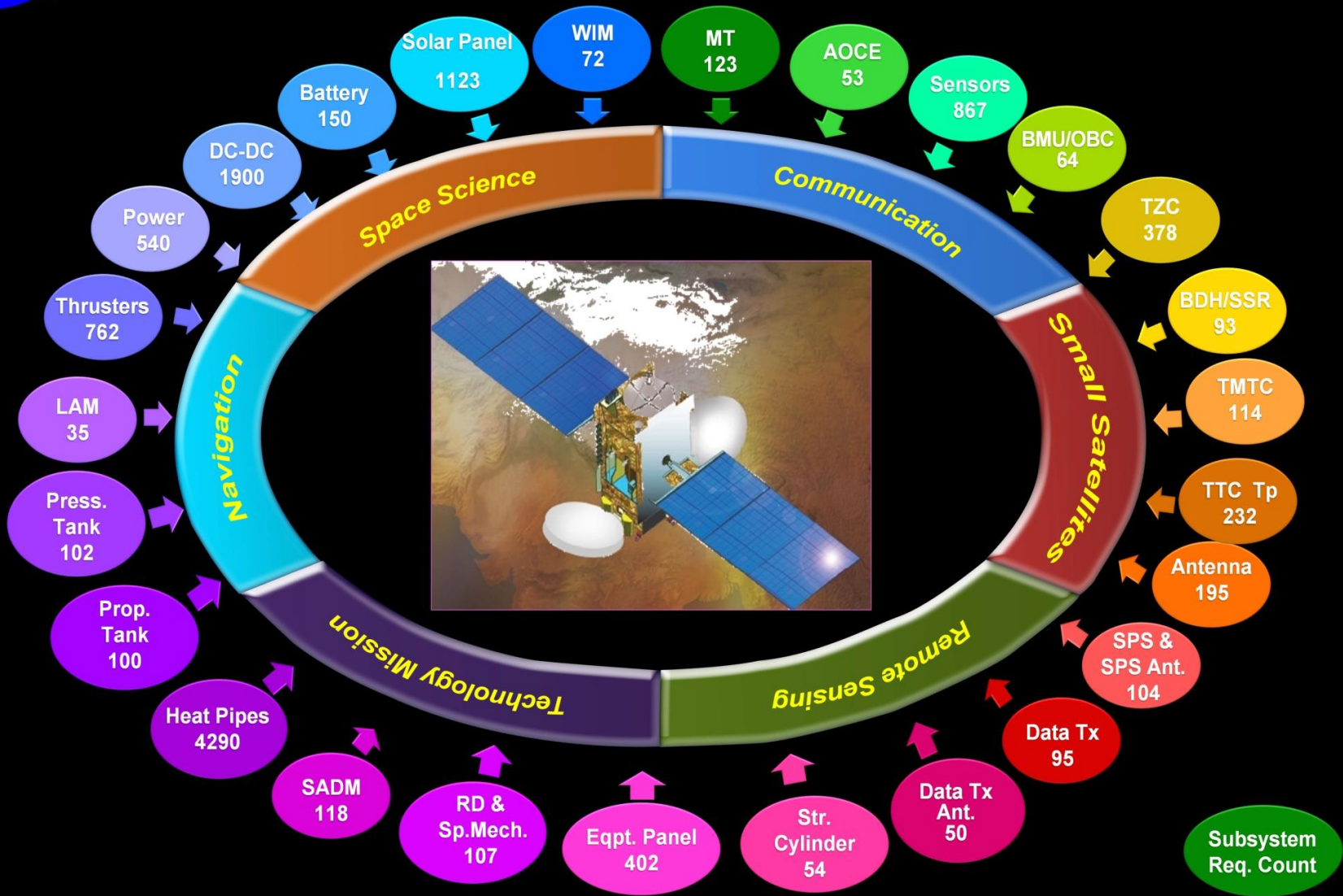


Development and Qualification Approach





JOINING HANDS TO REACH EVERY ONE





Our Partners

ANANTH TECHNOLOGIES LIMITED
"Forging innovative results through Technologies"



QUALITY. TECHNOLOGY. INNOVATION.



JAI JAWAN SERVICES
Vacuum pumps, Vacuum chambers,
All vacuum related Services and
Maintenance



SPACE SCIENCE & PLANETARY MISSIONS

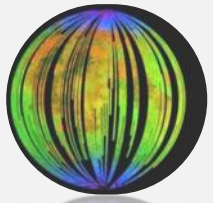
Missions Launched

CHANDRAYAAN-1

India's First mission to Moon

With the participation of International Space Agencies

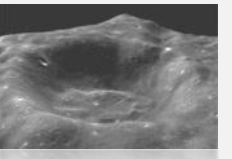




DISCOVERY OF WATER



TRI COLOUR ON MOON



CRATERS ON MOON

MARS ORBITER MISSION

India's First mission to Mars

Unique Achievement with many Firsts in Contemporary Mission to Mars





Mars Full Disc coverage



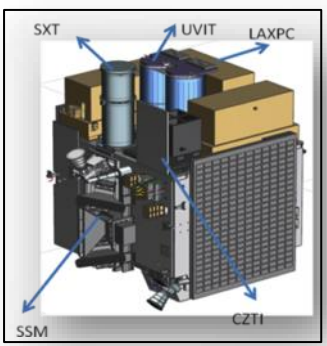
3D View -Valles Marineris Canyon

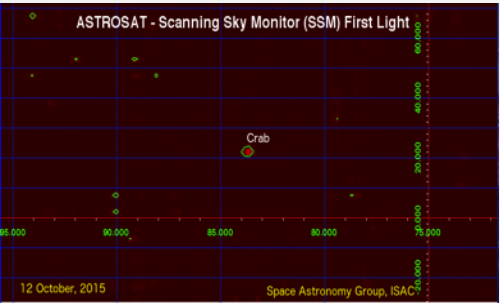
ASTROSAT

India's First multi wavelength space observatory mission

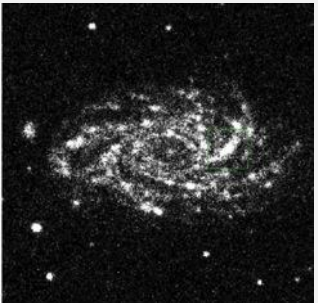
Supported for participation Of External Scientific Institutes

Seven Peer-reviewed Publications





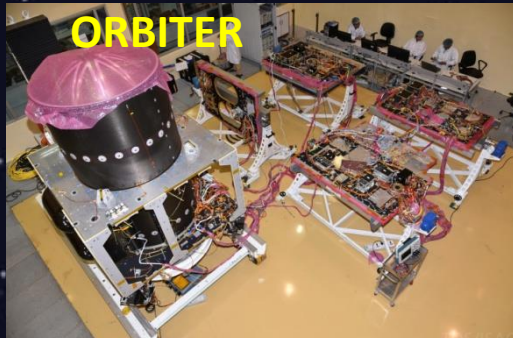
CRAB as seen by SSM Payload



NUV image of NGC 2336 GALEX

CHANDRAYAAN-2 GLIMPSES

ROVER

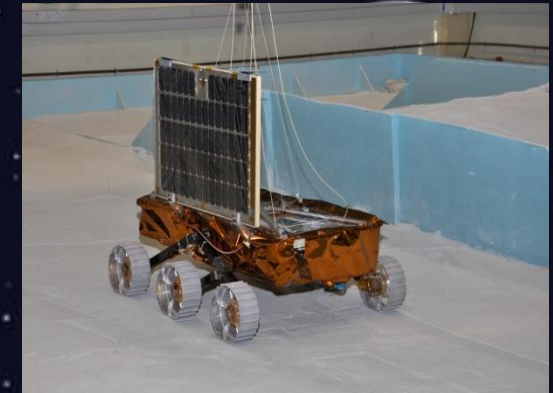


ORBITER

Orbiter Integration & Testing Activities



Indigenously built Rover(EM) Mobility Test



LANDER

**Indigenously built
Lander Structure (EM)**



**Lander Simulation Test
in LTTF**



**Lander Actuator Performance
Test (LAPT)**

**System Demonstration model
test**



**LSPT Phase-2 Test – Craters
added at Chitradurga**



**(LSPT) Structure mounted
on Aircraft**



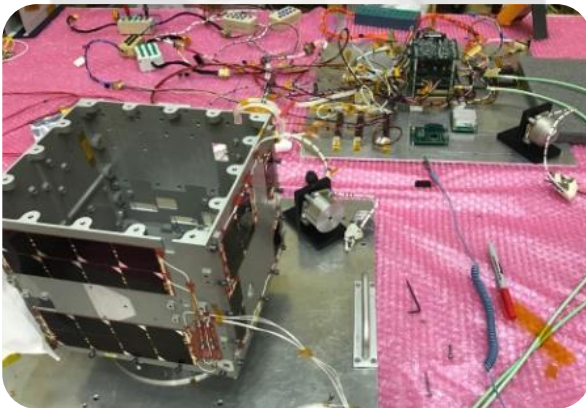
ISAC CLEANROOM : PROJECT GLIMPSES



CARTOSAT 2S STRUCTURE



MICROSAT INTEGRATION

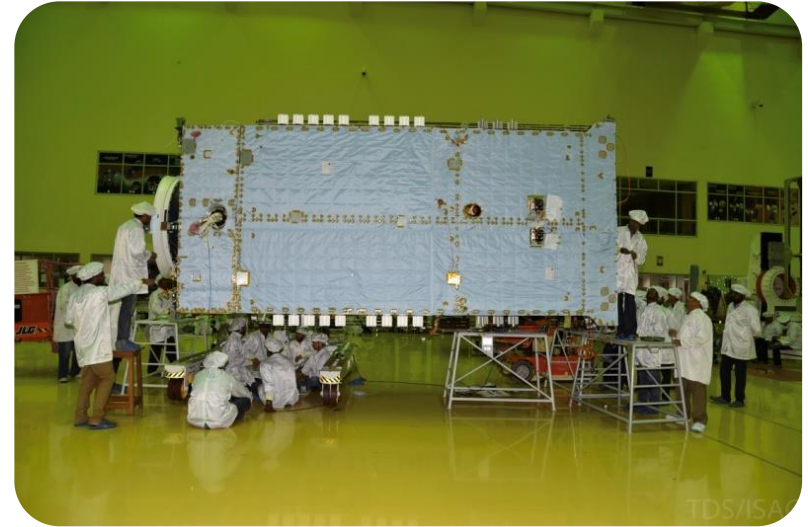


INS-1C INTEGRATION



EMISAT AIT ACTIVITIES

ISITE CLEANROOM : PROJECT GLIMPSES



GSAT-11 INTEGRATION ACTIVITIES



IRNSS-1I STRUCTURE IN NEW CLEANROOM



GSAT-6A UFA TESTING

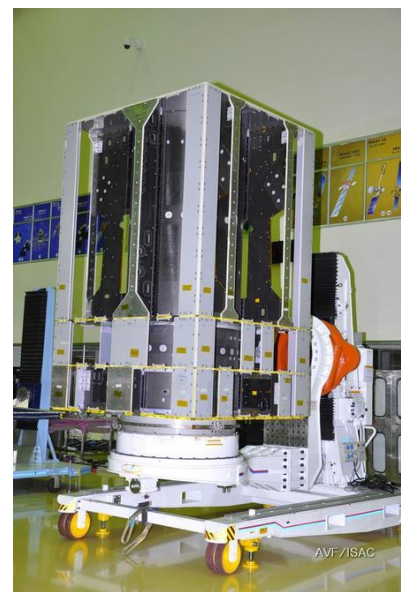
SPACECRAFT ASSEMBLY & INTEGRATION FACILITIES



Electronic Subsystem fabrication activities



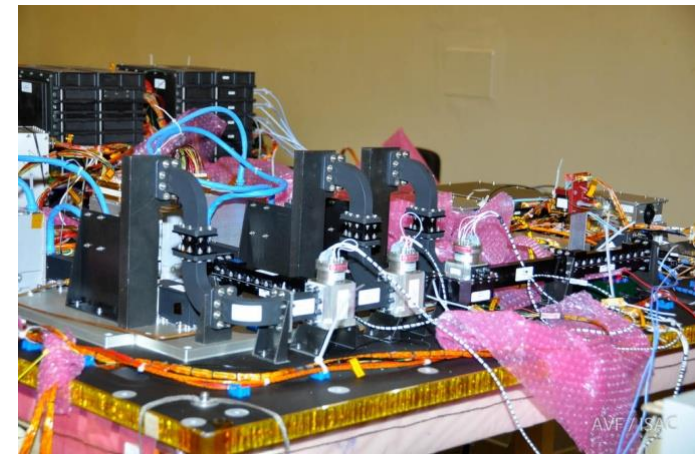
Subsystem HILS Testing



**Structure Assembly at
Clean Room**



**Propulsion integration in Clean
room**



Disassembled mode IST

SPACECRAFT ASSEMBLY & INTEGRATION FACILITIES



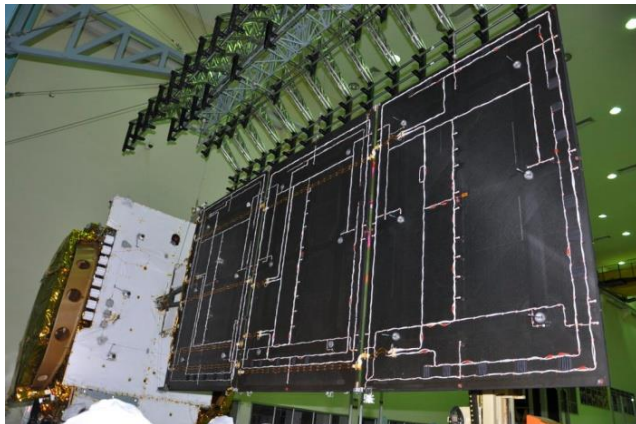
S/C Panel Closure



Thermovac Chamber



Dynamic Balancing



Solar panel Deployment - Zero g facility



Vibration Test



Acoustic Test



CATF Test

CONCLUSION

- ISAC/SPA focusing on Production and Productivity.
- Infrastructure expansion already in place.
- processes for productivity and reliability
- SPA gearing up with test systems consoles, ATE, Automated fabrication processes for productivity and reliability.
- Strategies for next 5 years well mapped.
- ISAC/SPA will closely work with industries to realise all required hardwares to meet the goals.
- RFQs for realisation of hardwares required has been floated for industry response. For meeting next 2 to 3 years of requirement.

A photograph of a modern, two-story building with a light beige facade and large glass windows. The building features a prominent entrance with a covered walkway supported by thick columns. In front of the building is a green lawn with several potted plants and a young tree. A tall, silver lamppost stands on the right side of the frame. The text "AVIONICS FACILITY, ISITE" is overlaid in the upper center, and "THANK YOU" is overlaid in large blue letters across the middle.

AVIONICS FACILITY, ISITE

THANK YOU