Update
on
ISRO's International Cooperation

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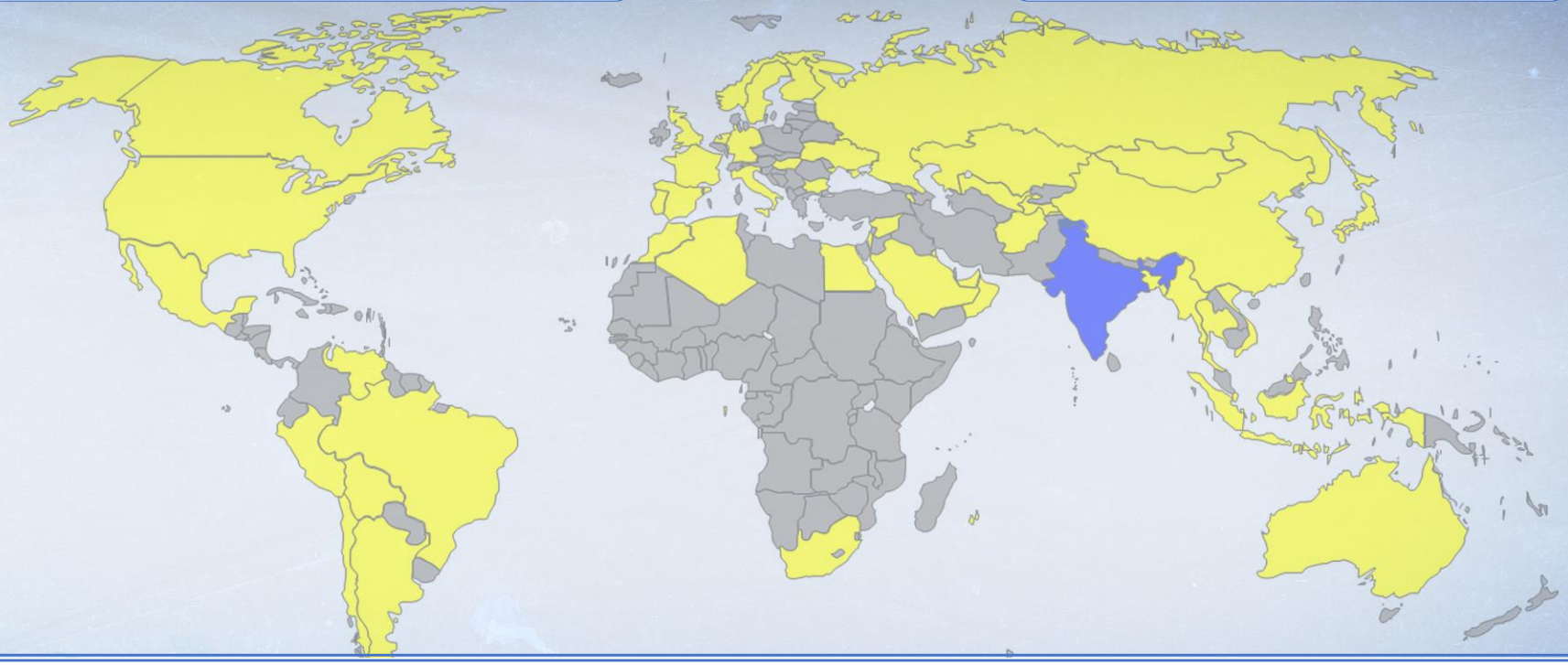
ISRO's International cooperation – the spread

Areas: RS, Satcom, SatNav, TTC, exploration, space law & capacity building

About 226 Agreements with 54 countries & 5 MN bodies



Countries: Afghanistan, Algeria, Argentina, Armenia, Australia, Bahrain, Bangladesh, Bolivia, Brazil, Brunei, Bulgaria, Canada, Chile, China, Egypt, Finland, France, Germany, Hungary, Indonesia, Israel, Italy, Japan, Kazakhstan, Kuwait, Mauritius, Mexico, Mongolia, Morocco, Myanmar, Norway, Oman, Peru, Portugal, Russia, Sao Tome & Principe, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sweden, Syria, Tajikistan, Thailand, The Netherlands, UAE, Ukraine, UK, USA, Uzbekistan, Viet Nam, Venezuela & Tunisia.

Multi-national bodies: EC, ESA, ECMWF, SAARC & EUMETSAT

International Cooperation (IC) Strategy

IC for enhancing capacity of Indian space programme

- Advancing Programmatic priorities.
- Augmenting Database
- Widening ISRO's ground station networks
- Bettering the products and services
- Creating platforms for inflow of international expertise in newer areas
- Crafting commercial opportunities

IC for aligning with global perspectives

- Participating in formulation of global/ regional space policies

IC for contributing to other nations

- Strategic 'Space' in bilateral relations

ISRO's Growing International Relations

Now partnering with space-faring nations

2000 & beyond
PSLV full flight with AGILE/ Italy (2007); 6 Foreign instruments in Chandrayaan-1 (2008); Satellite building with Foreign partner – W2M (2008); Joint mission with French Space Agency (2011 Megha Tropiques; 2013 SARAL); Feb-2017: 104 satellites in a single mission

1990s
Launch of German and Korean satellites by PSLV (1999)

1980s
Launch of APPLE by France (1981); INSAT-1A by USA (1982)
First Indian in Space with USSR (1984); Launch of IRS-1A by USSR (1988)

1970s
Remote Sensing Experiment with USSR – USA (1972-76)
Launch of ARYABHATA by USSR (1975); SITE -Television Expt. with USA (1975-76) STEP - SATCOM Expt. with France – Germany (1977-79)

1960s
TERLS with USSR-USA-France (1962)

ISRO's International cooperation – Highlights (1/2)

	Achieved	Planned/Ongoing
Joint Missions	• France (Megha-Tropics, SARAL) • Russia (YOUTHSAT)	• USA (NISAR) • France (TRISHNA) • Japan (EO/ Lunar mission)
Payload Accommodation	• USA, UK, Germany, Sweden, Bulgaria (Chandrayaan-1) • Italy (OCEANSAT-2) • Canada (ASTROSAT)	• France (Argos in OCEANSAT-3) • USA (LRA, HySI, DFS)
Ground stations for ISRO	• Brunei (TTC) • Indonesia (TTC) • Mauritius (TTC & IRIMS)	•Chile, Panama (TTC) •Brunei, Indonesia, Australia, Russia, France, Japan (IRIMS)

ISRO's International cooperation – Highlights (2/2)

	Achieved/ On-going	Planned
Sharing of EO data	•Europe/EUMETSAT (Met. & Oceanographic data) •Brazil & USA (Resourcesat-2)	•EC (Resourcesat-2) •NASA/NOAA (ScatSAT-1) •Australia BOM
EO Experiment (Cal/Val)	•USA & Europe (Oceansat-2; OCM & OSCAT) •Australia & Canada (RISAT-1)	• USA (ScatSAT-1)
Professional Exchange & JWG	• USA (Airborne Campaign: AVRIS, SAR) France (Ka-band propagation) • PESEP; Caltech; • INPSWG; INHWG; INHSWG; • ICPEWG; ICLVEWG; ICHSPWG; IRHSJWG	

India – USA Space relations

On-going activities

- NASA-ISRO Synthetic Aperture Radar (NISAR)
- NASA's LRA in Chandrayaan-2
- Air-borne campaign with hyperspectral imager
- ISRO – NASA Working Groups on 'Planetary Sciences', 'Heliophysics' & 'HSP'
- DSN support for MOM & Chandrayaan-2
- Prof. Satish Dhawan Endowed Fellowships
- Professionals Exchange Programme
- LANDSAT 7/8 – RESOURCESAT-2 data exchange
- Launch of US satellites by Indian launch vehicle
- Discussions are on:
  - IDSN Cross support
  - Instrument development & accommodation in ISRO satellites (Hyperspectral, DFS, Trig-NG)

Regional Cooperation - Satellite for South Asia

South Asia Satellite Launched on May 5, 2017

Bangladesh Bhutan Maldives Sri Lanka Nepal

- **Announcement at 18th SAARC Summit in Kathmandu in Nov 2014.**
- **Conference on "Satellite for the SAARC region and Space Technology Applications" June 22, 2015 - New Delhi – full SAARC participation.**
- **Afghanistan, Bhutan, Bangladesh, Maldives, Nepal and Sri Lanka signed agreement for orbit frequency coordination.**
- **Carries 12 Ku-band transponders for dedicated services and common services.**
- **Applications possibilities: Television/ DTH service (12 to 15 channels), VSAT Services, eGovernance, Banking, Cellular backhaul, DMS, TM/ TE network**

Regional Cooperation - India-ASEAN space cooperation

- To provide IRS data and Training to ASEAN
- New station in HCM & augmentation in Biak
- Heads of Agencies Meet in June 2012 at Bangalore
- RF Noise Survey in Oct 2015
- Framework Agreement with Vietnam in Sep 2016
- Training on ‘Small Satellites Engineering’ in Nov -Dec 2016
- ISRO-NRSD/MONRE meeting in Jan 2017
- ISRO-NRSD IA in Jan 2018

Indonesia | Thailand | Malaysia | Singapore | Philippines | VietNam | Laos | Cambodia | Myanmar | Brunei

BRICS RS Satellite Constellation

STEP1: Virtual constellation with existing RS satellites

STEP 2: Actual constellation

Agency-level cooperation agreement is under finalization.

Planned contributions:

- **AEB and CNSA : CBERS-04**
- **AEB : Cuiaba Station**
- **Roscosmos: Kanopus-V1.**
- **ISRO: Resourcesat-2; Shadnagar station**
- **CNSA : GF-1 and ZY-3/02; Sanya Station**
- **SANSA: Hartebeesthook Station**

CBERS 04						Kanopus-V1		Resourcesat-2			GF-1			ZY-3/02	
5	10	20	40	80	73	2.5	12	5.8	23.5	56	2	8	16	27 25	6

Multi-lateral relations

- UNCOPUOS – Office bearers; LTSSA; UNISPACE+50
- International Charter Space and Major Disasters
- APRSAF's Sentinel Asia – Data provider and Analyser node; APRSAF 14 & 24 (2017)
- IAF – Committee members; 58th IAC in 2007
- IAA – Commission members; Subsidiary office; HSP Symposium Jan-2020
- COSPAR–Scientific Assembly in 2012 at Mysore
- CEOS – Plenary in October 2012 at Bangalore; contributes for various virtual constellations
- CGMS – Member since 2015; Plenary in 2018
- ISEF, IADC, GEO, ISECG, ICG, EC…

Weather observation network in Bhutan, Nepal & Bangladesh as part of the "Severe Thunderstorms: Observations and Regional Modeling (STORM)" of SAARC

Search and rescue support (>20 years) to Bangladesh, Bhutan, Maldives, Nepal, Seychelles, Sri Lanka and Tanzania under COSPAS-SARSAT programme

Capacity building

Indian Institute of Remote Sensing (IIRS) at Dehradun

- Offers 8-weeks course on RS & GIS under MEA's Indian Technical Economic Cooperation (ITEC)

UN affiliated Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), Dehra Dun (Nov 1, 1995)

- Short-term and 9-months PG Diploma Courses
- 5 Themes: RS & GIS; SATCOM, SATMET, Space Science & GNSS
- Uses facility & expertise of IIRS, SAC, PRL

More than 2800 officials from 109 Countries are offered training by IIRS & CSSTEAP

UNNATI Programme Batch 1 at URSC - INDIA

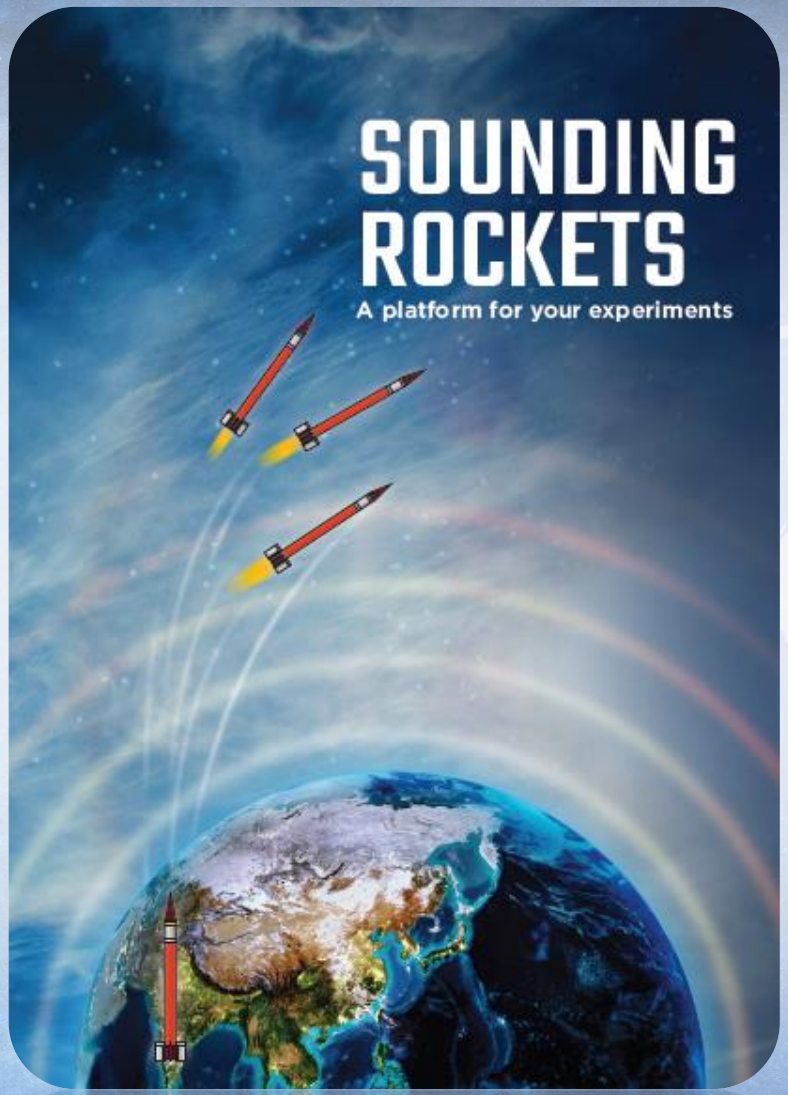
Online applications for 2nd Batch:
June 01-July15, 2019
Registrations opened

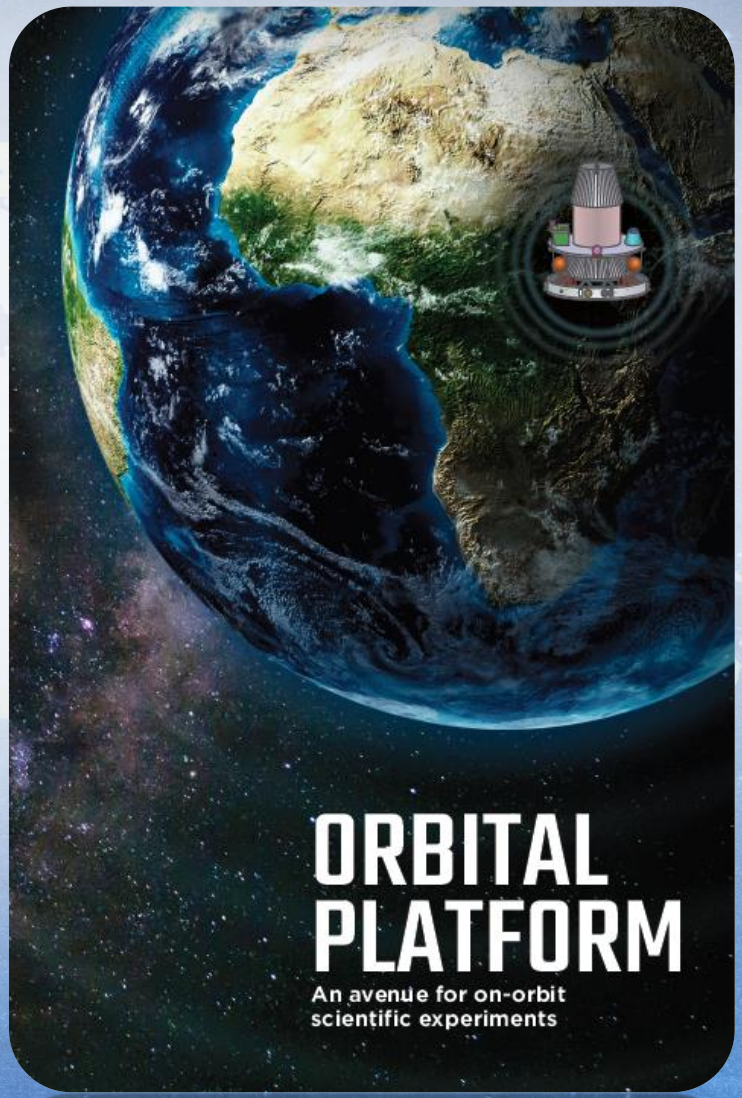
Visit: https://www.isac.gov.in/indounssp/index.jsp

30 Participants from 17 Countries:

Algeria, Argentina, Azerbaijan, Bhutan, Brazil, Chile, Egypt, Indonesia, Kazakhstan, Malaysia, Mexico, Mongolia, Morocco, Myanmar, Oman, Panama, Portugal

Experimental Opportunities





Commercial relations

Building Satellites

Two satellite contracts from Europe in alliance with EADS Astrium

W2M, 2008

HYLAS, 2010

Global reach of IRS

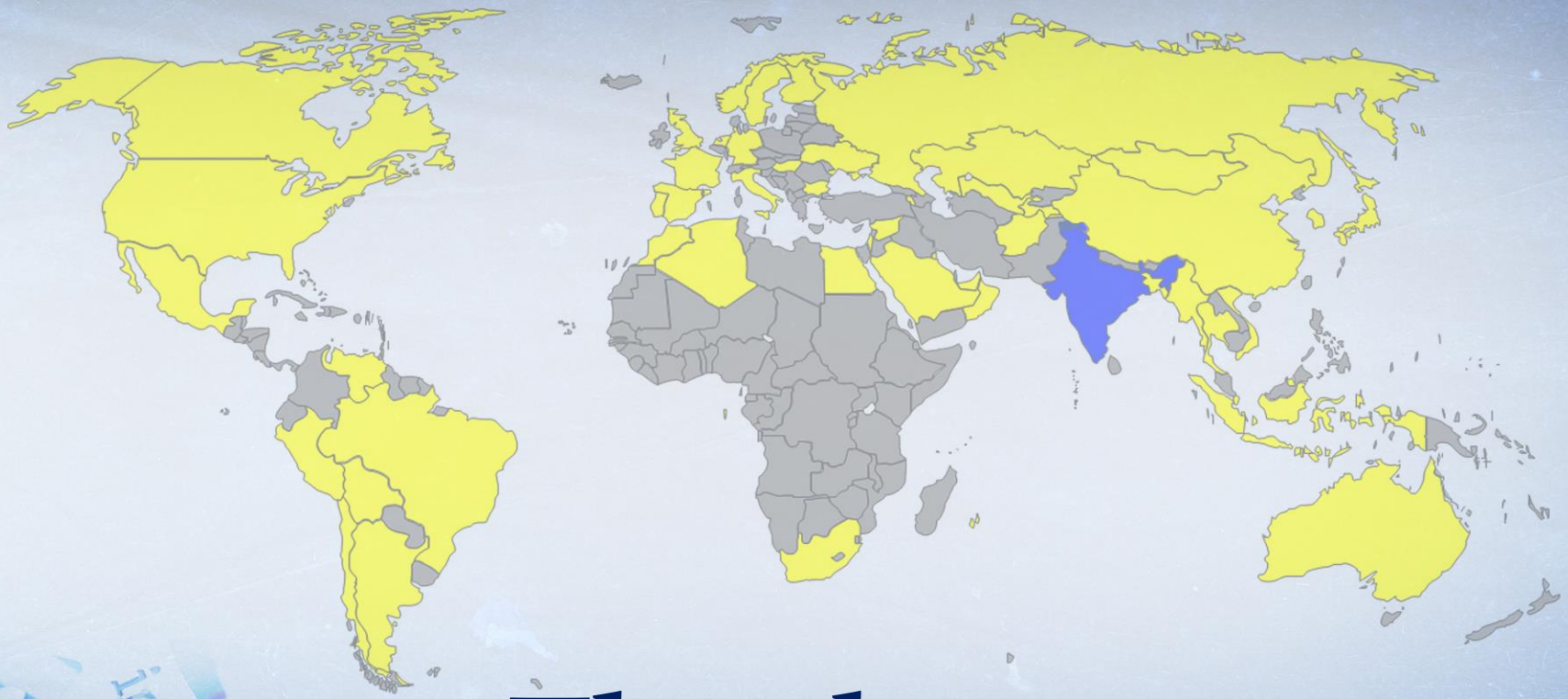
IRS data marketed through Foreign Stations & Resellers

Launch Services

PSLV Launches;

297 satellites of 33 countries

Countries	No.of Satellites
USA	190
Canada & UK	12 each
Germany	11
Singapore	8
South Korea	6
Algeria, Belgium, France, Italy, Japan, Switzerland	4 each
Austria, Indonesia, Finland, Lithuania & Netherlands	3 each
Denmark, Israel & Spain	2 each
Argentina, Australia, Chile, Colombia, Czech R, Kazakhstan, Latvia, Luxembourg, Malaysia, Norway, Slovakia, Turkey & UAE	1 each



Thanks

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