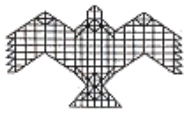


FUTURE TECHNOLOGICAL AND BUSINESS INNOVATIONS FOR INDIAN SPACE

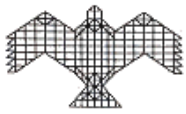
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4th GSDM International Symposium
Innovation, Space Technology, and Policy Making
University of Tokyo
February 8, 2017



Indian Space- past 40 years

- Past 40 years, cumulative budget allocated INR 930 billion; utilisation INR 612 billion.
- Realised 145 missions (84 Spacecraft; 59 LV; 2 RE). India has presently successful missions in Space exploration (MOM & ASTROSAT), Satellite Navigation (IRNSS & GAGAN), Satellite communication (14 satellites; ~260 transponders), Earth observation (12 LEO + 3 GEO) in orbit.
- Independent access to space and World class satellite capability
- Wide use of INSAT communications systems and growth of large-scale DTH and VSAT data communication business.
- IRS images usage for governance and national building activities.
- Weather and ocean services have derived a great boost from the availability of INSAT and Oceansat images/data.
- Forays in planetary missions through Chandrayaan-1 and MOM-1 for advanced scientific studies.
- Global commercial operations 83 commercial/foreign satellites on its PSLV; sale of IRS images and value-addition services and



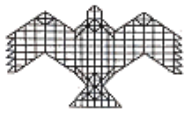
Next 20 years



- Increased national demand for space AND global space market access
- Need for ~20-30 missions per year capability (present ~8-10 missions)
- Total of ~ 300-400 space missions would manifest
- Estimated space investment of INR 2 to 2.5 trillion

Needs of New Technological Regime

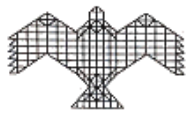
- Transparency of governance***
- Paths for inclusivity in society***
- Empowering enterprise***
- Guaranteed public delivery***
- Total Quality Management***
- Citizens' participation***



Innovations and Game-changers

SPACE AGENCY-INDUSTRY- ACADEMIA TRIAD

- **Game Changer-1: A long term National Space Policy (NSP)**
- **Game Changer-2: 2022 Goal - National commitment to procure or “buy-back” all domestic communications satellites (aka INSAT), domestic EO satellites (aka IRS) and respective PSLV launch services from Indian space industry**
- **Game Changer-3: New Governance Structure for Indian Space under NSP**
- **Game Changer-4: Futuristic Direction for National Space Agency**
- **Game Changer-5: Massive drive for R&D thrust for future space technology and applications**
- **Game Changer-6: Continued thrust for Space for National Development**



NATIONAL SPACE ECO-SYSTEM SHIFT IN ORGANISATIONAL FRAME

IFFF IN NEXT 20 YEARS.... ANYWHERE AROUND

~300-400 MISSIONS

~INR 2 TRILLION INVESTMENT

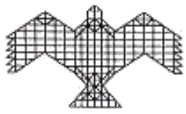
DOM SERVICES ~INR 5-6 TRILLION

INDIANS IN SPACE-FLIGHT

++PLANETARY/ SCIENCE MISSIONS

++ GLOBAL MKT ACCESS





1. Policy and law

- Space policy and legal regime coordination

2. Japan-India joint space missions

- Exploring joint mission by supplementing space capabilities with each other

3. Satellite navigation

- Planning, operating, and developing regional joint satellite positioning systems

4. ISS utilization and space exploration

- ISS utilization – Collaboration in Japan's initiative "KIBO-ABC" program under APRSAF
- Planetary exploration - Shared interests in space science and planetary exploration

5. Space application for disaster management

- Future cooperation: space in all-phase disaster management and climate change studies

6. Space robotics

- Future space science and planetary mission will require mastery of robotic technology

7. Maritime Domain Awareness and Space Situational Awareness

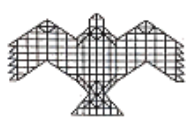
- Japan-India MDA and SSA information sharing

8. Regional contribution in the Asia Pacific region

- Jointly promoting space activities in the Asia Pacific region

9. Industrial collaboration

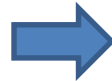
- New space businesses and services by using/building space assets of/for Japan and India



What will drive these game-changers

- Demand vs Supply – Bridging Gap
- Intense thrust for “Make in India”
 - Cost vs Performance efficiency
- Engage Indian skills & human resources
 - Successful Indian innovations

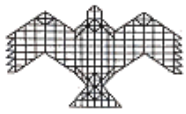
Long term goals



Transition strategies

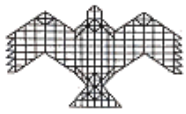
- License and buyback
- Govt. procurement policy
- Information Infrastructure – RS/GIS
- Risk sharing – policies and regulations
- Incentives for Competitiveness

- Synergies of aeronautical, space and defense industry
- Regulatory support and institutional support
- Policy on International collaboration, FDI
- National Security guidelines



To conclude.....

- Enable a major thrust for space for domestic and global markets:
 - it has to position “new rules of the game”
 - It has to position a National Space Policy (NSP)
 - transition space activities into a New Space Eco-system
 - Initiate advanced space technology and applications development
 - Thrust Indian private space industry and intense space R&D
 - Increase global foray for Indian space – cooperation and commercialization



Thank you