Presentation

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for

NALSAR University of Law, Hyderabad

on

March 21, 2021 (1400 to 1600h, Virtual Talk), *M.A. Sem II*

Indian Space Security

- What is Space Security?
- What is there for India to secure?
- What are the possible threats?
- How could these threats be aggressed?

- ***Space Systems***: Vital to enhancing national security, foreign policy, science and economic interests

- Space is becoming an increasingly contested medium, because space systems and their supporting infrastructure meet a range of natural and man-made threats

- Such threats possibly deny, degrade, deceive, disrupt, or destroy space systems

- Hence there is a need to ensure stability in space

Space and Security have a Connect

- Space security is a wide-ranging issue and could have different interpretations

- It could be about……

➢ Protecting space assets in the outer space

or

➢ Using space assets to enable human security on the earth

Since the beginning of the space age, two basic principles in regards to the relationship of space activities to international law are known to have dominated the discourse, it is about…..

- The right of access to space

&

- Freedom of navigation in space

Broadly, space security could be viewed as the ***efforts made to ensure the long-term sustainability of Earth orbit for a range of valuable uses***

Strategic Area of Interest

India Space Story

A Socioeconomic Narrative and more

Space Vision

- Articulated by Dr. Vikaram Sarabhi

"A civilian programme with focus on application of space technology as tool for socio economic dvelopment of the country"

Questioning Indian Investments in Space

- *Should a third world country dream big?*

- *Why money should be spend to run a sophisticated space programme? Should it be not spend for various social needs?*

bread vs guns……..

- Aim was to surmount illiteracy, get help in education, health care, disaster management, meteorology (agriculture economy), land and water resources management……

- Developing S & T is essential for country's overall growth

The beginning…..

- The Indian Commission for Space Research (INCOSPAR) was set up in 1962 under the Department of Atomic Energy (DAE)
- Indian Space Research Organization (ISRO) was created in 1969
- ISRO was brought under the Space Commission (Department of Space) in 1972
- Functions directly under the PM

A Humble Beginning

- 1962: Thumba Equatorial Rocket Launching Station (TERLS). Major focus on experimental and low capability projects. Aim to gain experience in the construction and operation of satellite and launch vehicles

- Between 1970 and 1974, space research establishments in India had developed and tested
  - Inertial guidance and Telemetry equipment
  - Onboard computers, Gyroscopes, Heat shields
  - Electronic payload systems
  - Various high specific-impulse solid & liquid propellants

First Two Decades :Learning phase

- **Aryabhata**(1st satellite, 1975) was launched from a Soviet cosmodrome using a Molniya rocket
- First indigenous satellite launched July 1980 Rohini 1 with the help of *SLV rocket*…became the ***space-faring*** **nation**

A Decade of Consolidation

(*Mid 80s to 90s)*

The Decade of ***rapid*** Progress

post 1995…

Midcourse Correction

post 2005…

Launch Vehicles

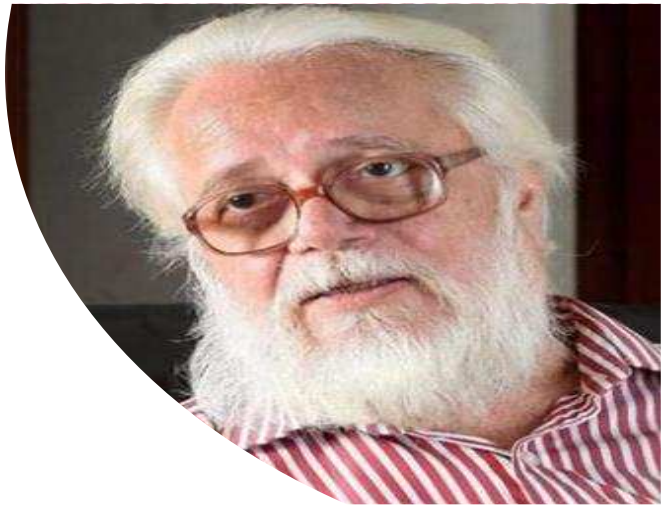
- *SLV*
- *ASLV*
- PSLV
- GSLV
- *SSLV*

GSLV…*the* Challenge Continues …

- GSAT 1….GSLV D1…2001
- Total 12 launches….three unsuccessful
- 12th flight….GSLV -F08 / GSAT-6A Mission was launched on Thursday, March 29, 2018
- GSLV Mk III …4 ton class of satellites into GTO or about 10 tons to LEO, which is about twice the capability of GSLV Mk II

Cryogenic Technology Transfer

- 1991/93 Boris Yeltsin….buckled to the US pressure
- Cryogenic sale violated the guidelines of the MTCR formed in 1987…reason to deny technology transfer
- PM Rao took a bold decision India to build its own cryogenic engines
- However, the project suffered inordinate delay



Birds in the Sky

Satellite Systems

- INSAT…multipurpose systems (early days)
- Main focus on remote sensing satellite systems
- Meteorological satellites
- Communication satellites…..transponders is an issue
- Navigational network
- Education/Universities, Astronomy, Small satellites (mini/micro/nano/pico)
- Strategic Systems

Remote Sensing

- 1st Gen: 1988-IRS 1A, 1B (Res-72.5m-36m)
- 2nd Gen: 1995-IRS 1C, 1D (Res-70m-5.8m)
- Resourcesat1:2003 (Res- 5m)
- Cartosat *(Res-2.5 & <1m)*

Indian Earth Observation (EO) Satellites

- Land/water resources applications (RESOURCESAT series and RISAT series)
- Ocean/atmospheric studies (OCEANSAT series, INSAT-VHRR, INSAT-3D, Megha-Tropiques and SARAL)
- Large scale mapping applications (CARTOSAT series)

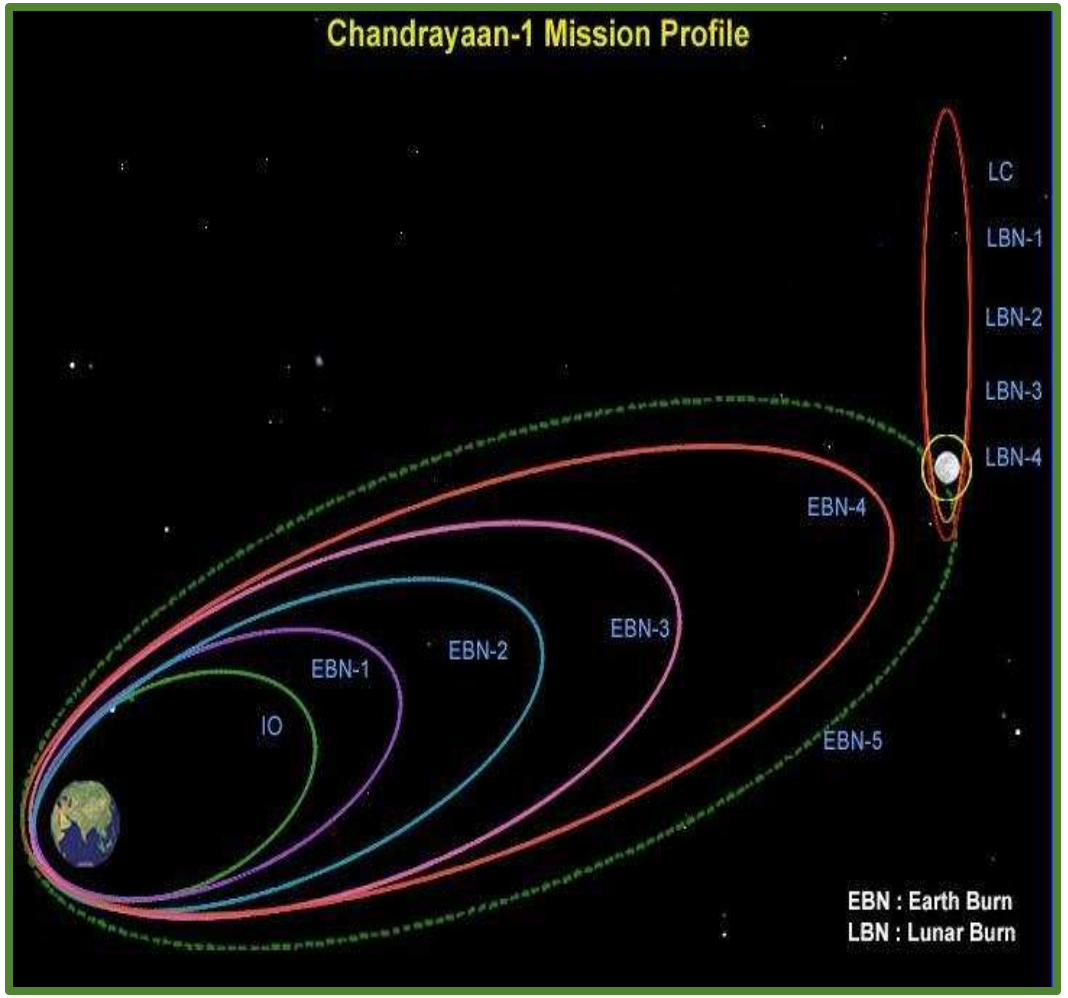
Imaging capabilities in visible, infrared, thermal and microwave regions of the electromagnetic spectrum, including hyper-spectral sensors

Communication Satellites

- Established in 1983 with commissioning of INSAT-1B
- INSAT Series: Initially multipurpose payloads (INSAT 1 series)
- INSAT 2 Series: Multipurpose & Communication
- INSAT 3 and 4 Series: Communication
- 15 in operation INSAT-3A, 3C, 4A, 4B, 4CR and GSAT-6, 7, 8, 9, 10, 12, 14, 15, 16 and 18
- *Transponders*….presently more than 200 and ambition of **500** transponders

Deep Space & other programmes

Deep Space Missions

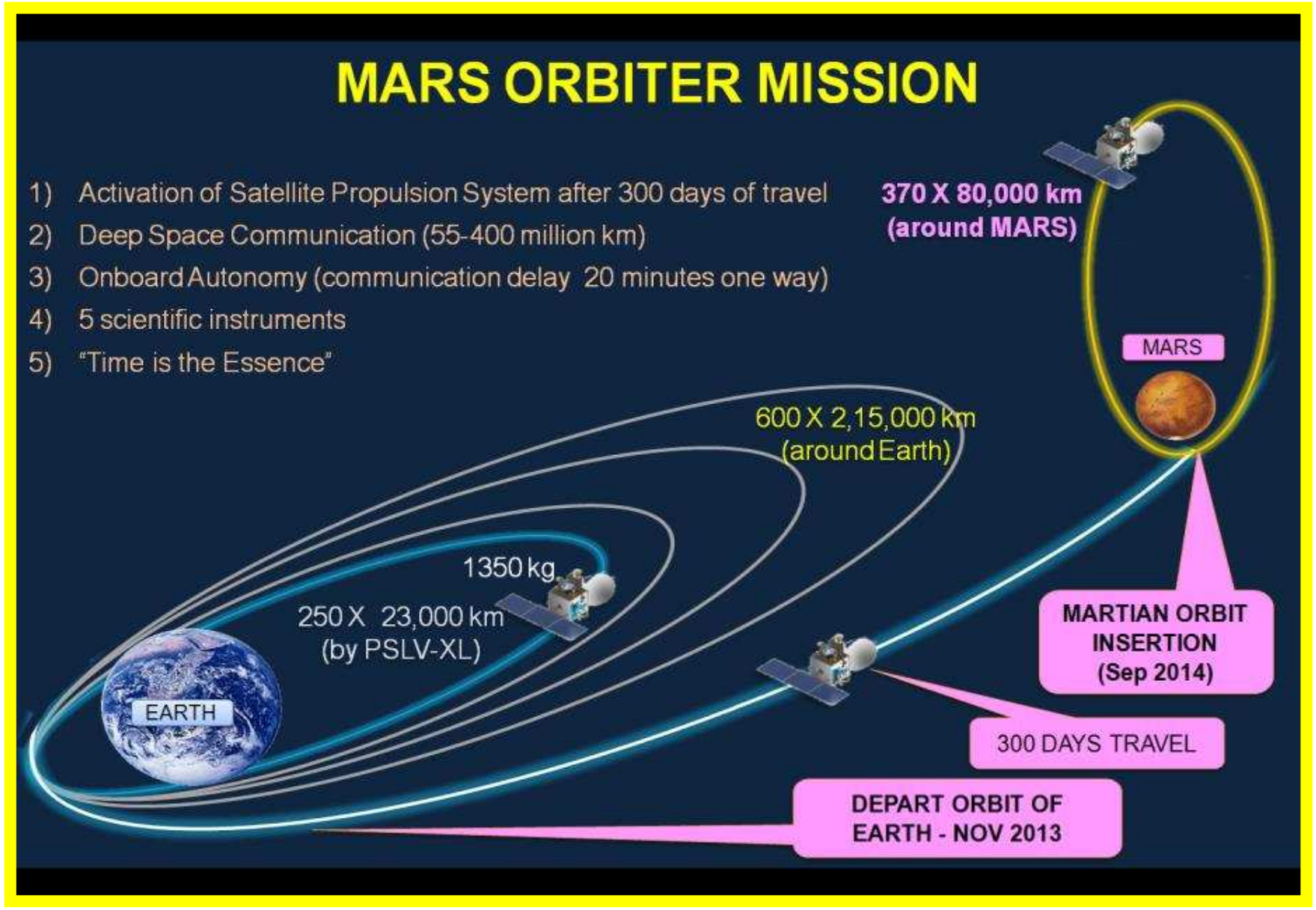


Moon Mission

- Chandrayaan 1…..(2008) success
- Chandrayaan 2….(2014)

  Joint mission with Russia…did not happen

  ISRO mission…July 22, 2019….rover-lander part failed



ISRO's mission took off on 5 November 2013…total success

Autonomous Regional Satellite Navigation System

- IRNSS project approved (May 2006) for completion by 2016…2018
- IRNSS…developed ***parallel to*** the GAGAN (GPS Aided GEO Augmented Satellite Navigation) programme, the ISRO SBAS (Satellite Based Augmentation System) version of an overlay system for GNSS signal corrections. Accuracy of 3 m. Payload on-board GSAT-8
- IRNSS, a constellation of seven satellites and a supporting ground segment. Three satellites…geostationary orbit and the four… geosynchronous. This arrangement allows continuous radio visibility with Indian control stations

Indian Navigational System/NavIC

- IRNSS provides two types of services
- Standard Positioning Service (SPS) all the users
- Restricted Service (RS), an encrypted service provided only to the authorised users
- The IRNSS System is expected to provide a position accuracy of better than 20 m in the primary service area

Satellites with mil utility

- Gsat-7 (Rukmini), launched on Sept 29, 2013. IOR…nearly 2,000 nautical mile 'footprint' and provides real-time inputs to Indian warships, submarines and maritime aircraft
- Gsat-7A, for IAF launched during Dec 2018, will interlink ground radar, airbases and AWACS
- Various remote sensing satellites, ISRO has own SAR system…

Milestones….

- SRE (Space Recovery Capsule Experiment) Jan 2007, *Re-entry technology has proved its worth*
- Successfully launched 10 satellites in a single mission (2010)…104 satellites on Feb 15, 2017. Launch in different orbits
- *ASTROSAT (astronomical satellite)* multi wavelength space observatory….Sept 28, 2015
- Proposed human mission by 2022

Commercial Aspects

- Antrix: 1992 ISRO sets up its commercial outlet, NewSpace India Limited (NSIL) during March 2019
- Steady and significant progress…data, satellite manufacture, development of infrastructure and launch facilities. **Fresh boost…with NSIL**
- Sales turnover exceeding $ 100 million already, NSIL getting new contracts
- ***Focus on Launch business: 342 launches for other agencies since 1999***
- ***SSLV test launch in few months, PSLV proposed to go commercial…….***
- Private Industry in nascent stage…..handholding has began

Space Vision India 2025

- Com & Nav systems for rural connectivity, security needs and mobile services
- Enhanced imaging capability for natural resource management, weather & climate change studies
- Missions to know more about the solar systems and universe
- Planetary exploration
- Development of heavy lift launcher
- Reusable Launch vehicle technology
- Human space flight

Essentially, India has a major space infrastructure…around 50 operational satellites…need to be protected, there are increasing business interests….

Is there a threat?
Possibly yes,
India has no luxury for getting into any debate about exact possibilities, need to prepare……

What could be the nature of threat? Who could be threat posers…….

Caveat

- China's **Space Strategy and Modernization** should not be viewed only through militaristic prism
- Space technologies have various civilian and scientific usages
- Space is much relevant for the Chinese society
- Commercial aspects
- ***Military, only one of the aspects (but, very important and India can't overlook)***

China Dream of National Rejuvenation

- 2000-2020…. Period of Strategy Opportunity
- Domestic development and the expansion of China's "comprehensive national power"
- To establish a powerful and prosperous China. Space is one of the tenets of China's grand strategic objective

Strategic Support Force (SSF)

- The SSF centralizes the PLA's space, cyber, and EW missions
- There is a growing prominence for SSF in the PLA and the priority of its assigned missions
- China has major space agenda and has been very successful

China's Space Programme

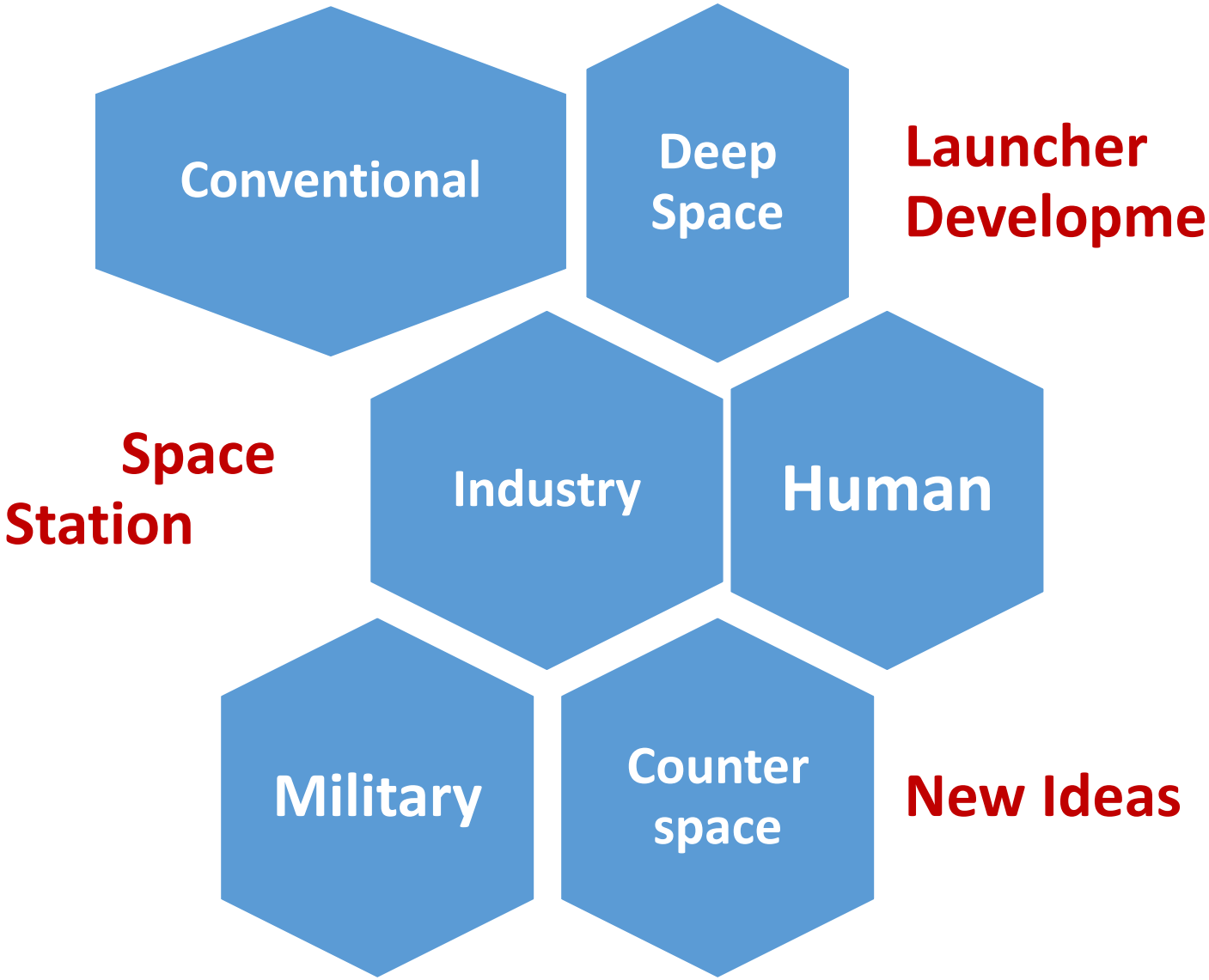
- A mystery within a maze
- Chinese space programme is large, complex, and closed
- Has a long history...mostly a success story…leapfrog
- Caters for both civilian and strategic requirements
- Has significant role in its military modernization programme

Important Decisions and Accomplishments

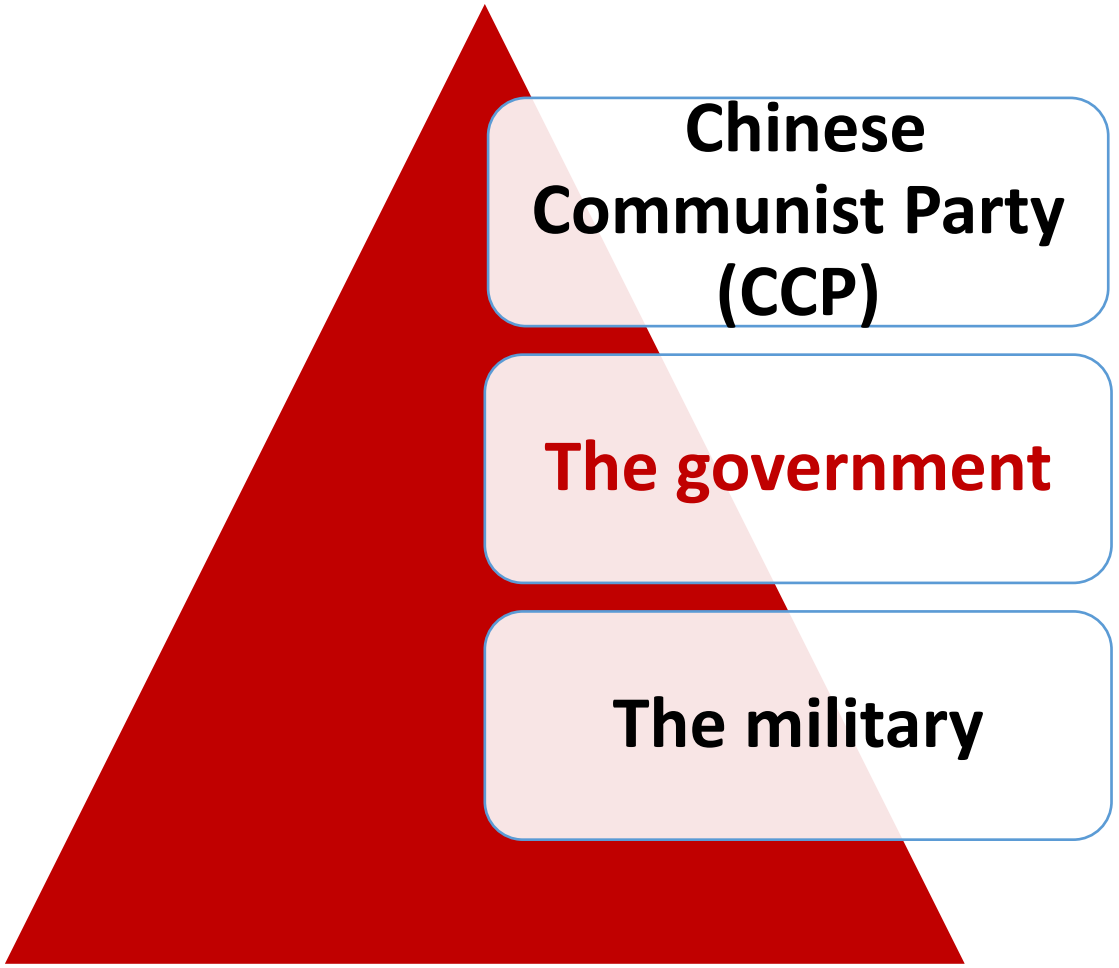
- The launch of China’s first satellite in 1970
- The launch of China’s first communications satellite in 1984
- China’s first human spaceflight in 2003
- ASAT test by China during January 2007

Assessment of China's Space Capabilities

- Well developed launcher services….Long March Series
- Communications, remote sensing/reconnaissance, navigation, and meteorological satellites
- Indigenous systems and also access to foreign platforms or services
- SIGINT/ELINT platforms, electro-optical and SAR imagery, radar sat
- ASAT programme
- Manned space programme, space station
- Deep space agenda-Moon and Mars programme


Conventional
Deep Space
Launcher Development
Space Station
Industry
Human
Military
Counter space
New Ideas

People's Republic of China (PRC)



Space Silk Road

- Beidou system. Also, GLONASS. Idea is to launch Russian-Chinese receivers for sat nav on the Silk Road Economic Belt (SREB) and the Eurasian Economic Union (EEU) markets. The budget for this project would be approximately US$10 million

- Aug 2014 have initiated the “Space Silk Road” programme to coordinate international cooperative research in space-based satellite technology for the 'Silk Road Economic Belt' strategy

- Seamless internet connectivity is the necessity for the success of B & R initiative. Small satellites, launch of other satellites using Ka-band frequency (offers higher speeds and requires a smaller satellite dish for operations)

Sino-US Rivalry in Space: Asymmetrical Deterrence?

- China normally cooperates with the EU, but not the US…in space
- 2001 Rumsfeld Commission warns of 'Pearl Harbor in space'. The US regards China as the most likely threat to its satellites
- The US spends almost 10 times more than China in space
- By investing more in counterspace arena is China looking for Asymmetric Advantage???.....*concerns Taiwan, Hong Kong*…….

Regional Space Rivalry

- Japan and India may have space capabilities matching China's but, not the "political will" to use them the way China has
- China can excel in an area that Japan & India cannot: an independent military capability, empowered by space
- So far India has more pragmatic approach…..but is the 2022 human mission is indicative of some new realities?

Pakistan….

- Do not have a major space programme
- Have a good missile programme……ASAT is not impossible
- Cyber capabilities for counter-space could be developed
- China is there to help….

What are soft options to address the threat….they can’t be only India centric……*universality*…….
Since, for India there is a threat at doorstep….***need to be more proactive***……

Space Legal Architecture

Space Treaties: A Brief Overview

Potential…

- Capabilities in space have a potency to influence the international balance of power equations
- Space is a strategic resource for civilian (societal), commercial and military utility
- Form geostrategic prism today space is increasingly being viewed as a

✓Tool for foreign policy

✓Force multiplier for the militaries

✓Fourth medium of the warfare

Desirable…

- Peaceful uses of Outer Space…should be ensured. Outer space belongs to everybody and is viewed as a ‘global commons’
- Sustainability…an accepted way forward for… Maintaining balance between Economics, Society & Environment….
- Space Technology for Sustainable Development
- To ensure that various activities in space can be carried out efficiently and are governed by a Transparent Global Space Architecture

Problematic…

- “Congested, Contested and Competitive Medium”
- Reference to the notion of self-defence…. it could allow for the justification of the use of force in outer space
- Thin line between militarization and weaponization of space
- At the global level, issues related to space security are not restricted to weaponization of space; they also involve issues like *missile defence*. The formation of any broadly accepted space regime is possible only when some agreement emerges on missile defence

How the world is addressing such challenges?

It is important to take note of this before articulating any (national) legal regime for space

Formal Agreements…

- The 1967 OST
- 1968 Rescue Agreement
- 1972 Labiality convention
- 1974 Registration Convention
- 1979 Moon Agreement

UN Bodies

- 1959: The Committee on the Peaceful Uses of Outer Space (COPUOS)
- The CD not been able to agree on the formation of an Ad Hoc Committee with a mandate for outer space since 1994
- Prevention of an Arms Race in Outer Space (PAROS): On UN agenda since 1982 but…

COPUOS Declarations/Resolutions

- 1963: Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space
- 1982: Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting
- 1986: Principles Relating to Remote Sensing of the Earth from Outer Space
- 1992: Principles Relevant to the Use of Nuclear Power Sources in Outer Space
- 1996: Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries.

Recent Initiatives

Russia-China Draft Treaty

- In 2006, China and Russian introduced the draft text "preventing the placement of weapons in outer space and prohibiting the use of anti-satellite weapons" to the CD. ASAT by using missiles (land based) is not discussed….
- Allows, Russia & China to dominate international public diplomacy and paint the US as the irresponsible driver of a new arms race!!! *The second draft of PPWT (2014) is also not much assuring….*
- India is ready to debate this treaty draft under the UN

International CoC

- In 2008 the EU suggested a more explicit CoC to bring more sagacity in regards to space activities
- This CoC was revised further in 2010, 2012, 2013…
- On Jun 6, 2012 the EU has officially launched a multilateral diplomatic process to discuss and negotiate International CoC for Outer Space
- Negotiations began during Oct 2012 (New York) and …… **UNIDIR is in loop…fourth draft (Sep 2013)…31 Mar 2014…dying its own….**

The Real Test…

- TCBMs could foster cooperation, but are no substitute for legally binding norms. GGEs recommends TCBMs universal participation….
- No voluntary measure could entirely reflect the complexities of outer space security
- It is in the best interests of the international community to start negotiations on a legally binding instrument (at some point in time)

Space Regime: Problem Areas

- Almost anything can be used as a ‘space weapon’. It is a problem with defining weapons in outer space
- Complex nature of verification of outer space activities. Technical and financial constraints of verification
- Authority to punish
- Do viable response options exist in the event that cheating or breakout is detected?

Problem Areas contd

- "One-size-fits-all treaty" could be impractical (*complex regional situations).* Also, *'intent'* verification not possible

- FMCT: Held "hostage"….is it correct?....now no longer…now a *proposal by Russia & China for GGE on PAROS*….again trying to link FMCT….

- May restrict the experimentation towards handling issues like asteroid strike

Plausible Near & Long term Challenges

‘Rickety’ Region…

- Two principal and obvious sources of threat to India’s space assets are China and Pakistan
- China has proven ASAT capability, which it could use against some of India’s space assets. Also, could help Pakistan
- China is procuring state-of-the-art technology to improve its intercept, direction finding, and jamming capabilities. A possible target for jammers could be the receivers in the GPS satellite constellation
- Any other state or non-state threats?

Space Sustainability…

- Space Situational Awareness (SSA)
- Space weather is one of greatest space hazards that will impact long-term space Debris management
- Space-Based Space Surveillance (SBSS) satellite
- Issues related in-orbit servicing and other issues

- **Applying Space Science & Technology to the core challenges of development**

India Needs to Think…

- Is our Space Strategy proactive or reactive?
- Need not catch-up with China…… but Space market…need to compete
- Spell the military requirements openly
- Mission Shakti…..need to take further steps…..
- Have India specific space agenda…..

Conclusion

- Chinese space journey is a success story for them, but a major strategic challenge for the rest.. Mainly India and the US
- Pakistan could be the dark horse,
- At present China’s Space investments is not an attractive indicator of Beijing's commitment to multilateralism. They believe going solo
- Instead of becoming the new strategic battleground…space could provide a lesson for ***cooperation on Earth***…at various UN and other forum India needs to work towards this…push for rule based and legally binding mechanism…….