Anti Satellite Weapons (ASAT)

A Status Review and Perception For an Indian ASAT

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Agenda

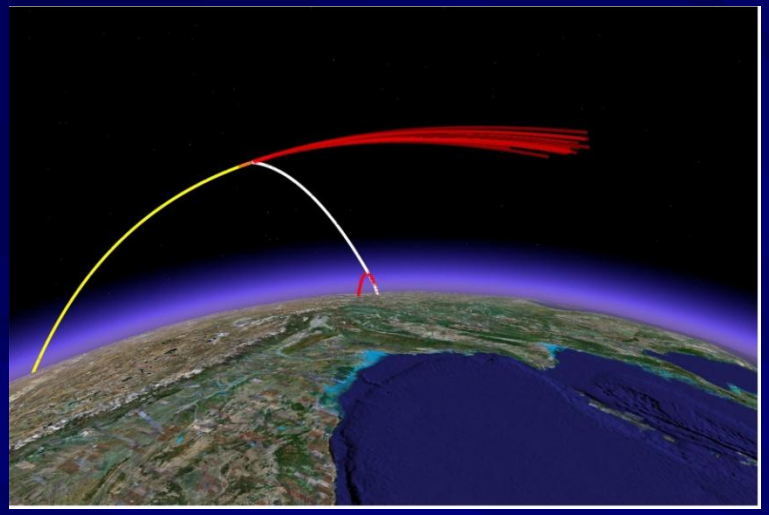
- Introduction
- Evaluation of Various Technologies
  - Direct Ascent
  - Stand Off Weapons
  - Electronic Attack on Communications, Data and Command links
  - Non-Directed Nuclear ASAT
- Space Debris due to ASAT and its impact
- India’s Interest and Capability in ASAT systems
- Conclusion

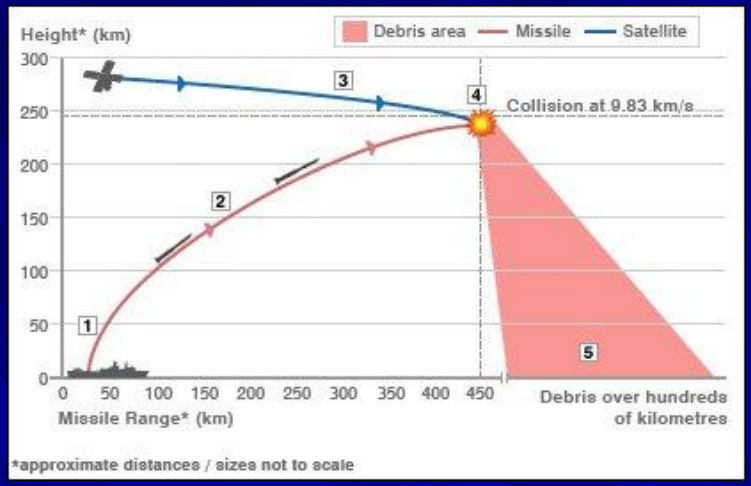
Introduction

- The primary use of space has been for the advancement of human race through peaceful civilian application. However there has been a steadily increasing trend in the use of space for military applications as well.
- Anti-satellite weapons (ASAT) are developed to defend against the enemy military satellite,by making it inactive or by destroying it for strategic military purposes and to protect home satellites as well

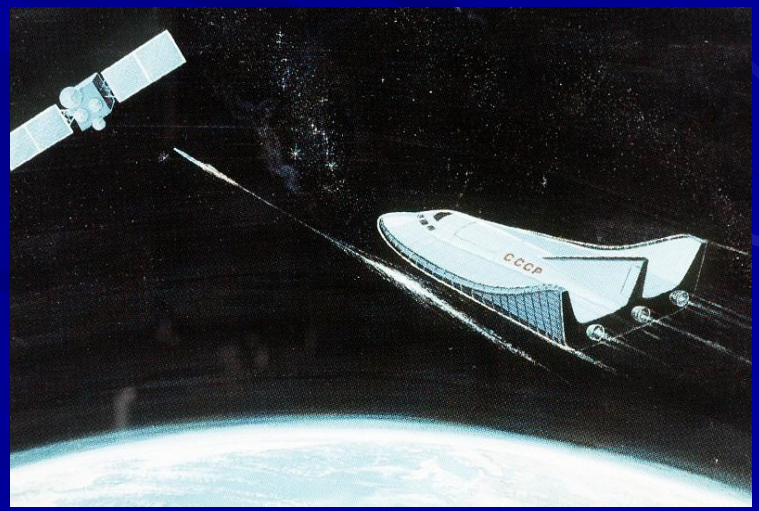
- ASAT system has been the bastion of three countries viz. USA, Russia and China
- The 2007 Chinese anti-satellite missile test was conducted by China on January 11, 2007. This has reignited International interest in ASATs

Interceptor ASAT Weapons

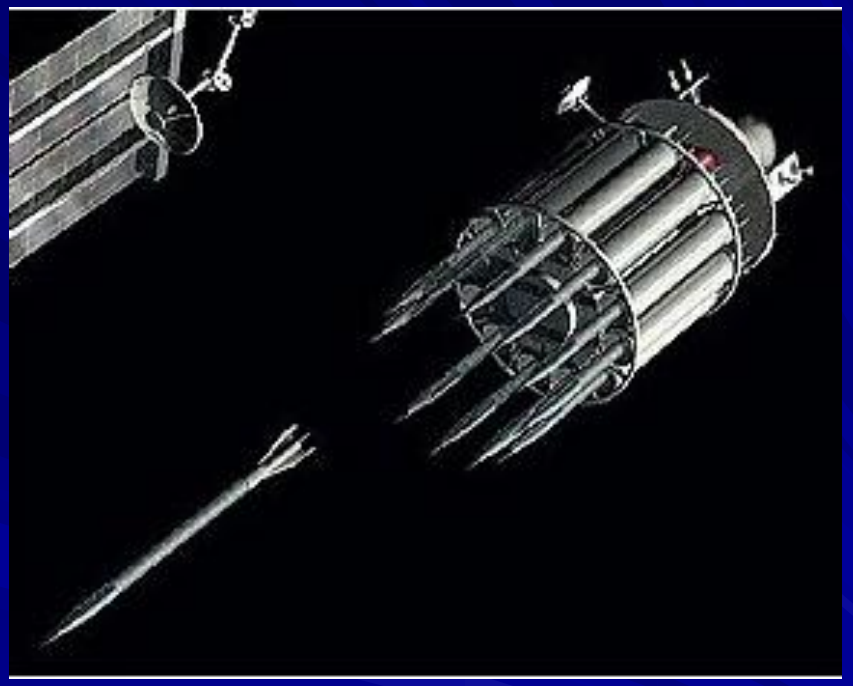




- Low-Altitude Direct-Ascent ASAT Interceptors
- Low- and High-Altitude Short-Duration Orbital ASAT Interceptors



Interceptor ASAT Weapons



- Long-Duration Orbital Interceptors

Stand off Weapons

- Laser ASAT Weapons

Stand off Weapons and Others

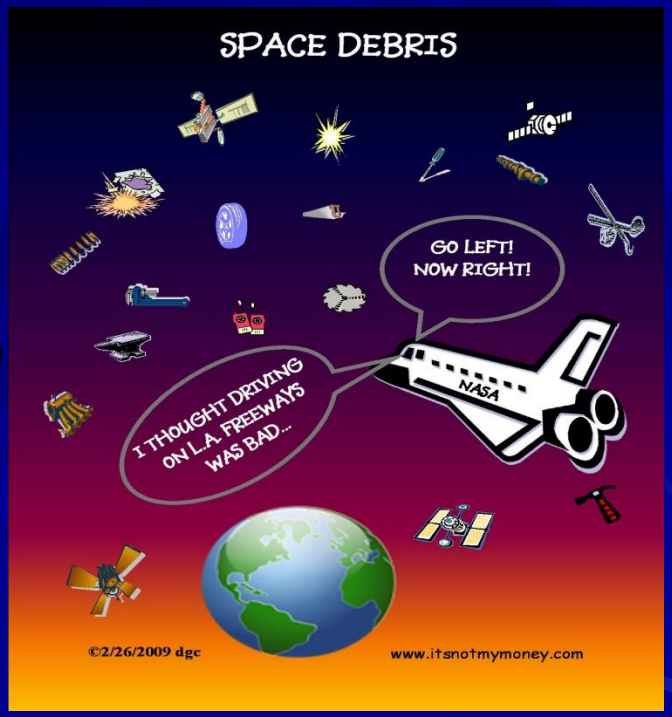
- Radio Frequency (RF) ASAT Weapons
- Particle-Beam ASAT Weapons

- Electronic Attack on Communications, Data and Command links

- Non-Directed Nuclear ASATs

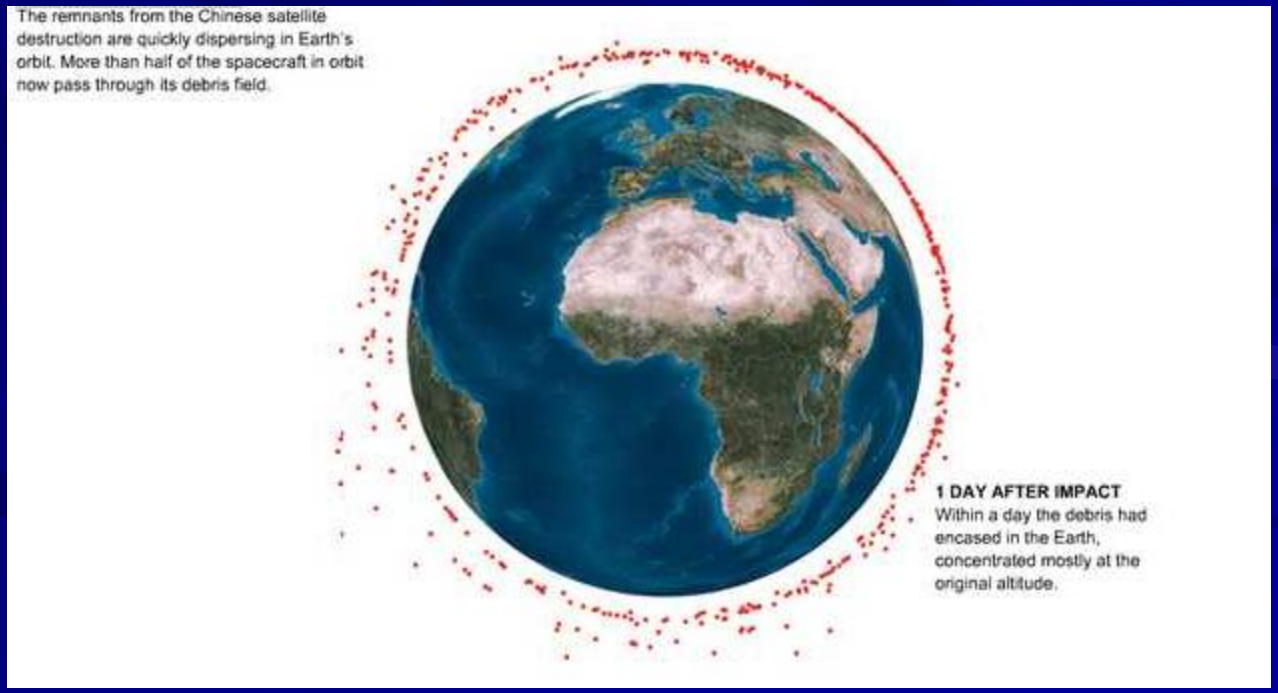
Space Debris – Major Risk of ASAT

- Space debris is any human made object in orbit that no longer serves an useful purpose.
- As they have very high speed, even relatively small mass can damage or destroy satellites in a collision.
- Debris at high altitudes can stay in orbit for decades or longer and tends to accumulate as more is produced
- For e.g., the Chinese ASAT destroyed an old weather satellite creating enormous amount of space debris
- This satellite breakup represents the most serious fragmentation in space in the 50 years of space ops



Space Debris – Major Risk of ASAT

- ASAT weapons could therefore significantly increase the cost of using space and could hinder using regions of space that are widely used today
- Below shows the graphic of the Space debris created by the Chinese ASAT missile test.



Indian Imaging Capability

Geo stationary

Sun Synchronous

1990
INSAT-1D
VHRR

1992
INSAT-2A
VHRR

1993
INSAT-2B
VHRR

1999
INSAT-2E
VHRR, CCD

2002
KALPANA-1
VHRR

2003 INSAT-3A
VHRR,CCD

1988/91
IRS-1A &
1B LISS-
1&2

1996
IRS-P3
WiFS, MOS
X-Ray

1995/97
IRS-1C/1D
LISS-3, PAN
& WiFS

1999
OCEANSAT-1
OCM & MSMR

2001
TES
Step& Stare
PAN

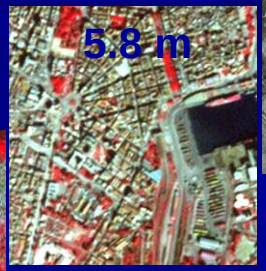
2003
RESOURCESAT-1
LISS 3; LISS 4;
AWiFS

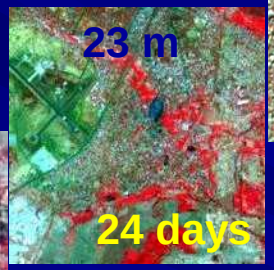
2005
CARTOSAT-1
PAN, F/A

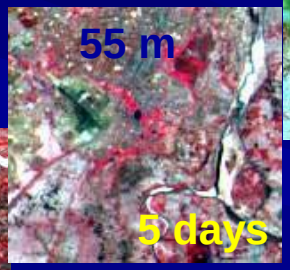
2007/ 08
CARTOSAT-2 & 2A
PAN

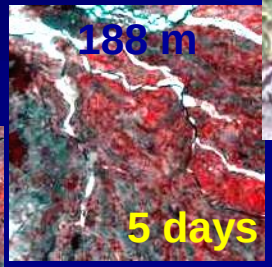
2009
RISAT-2
X-SAR

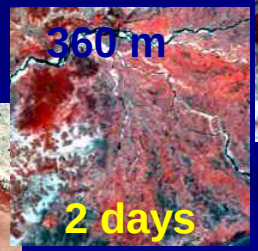
2009
OCEANSAT-2
OCM, SCAT &
ROSA

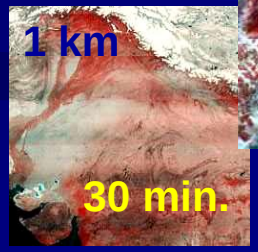


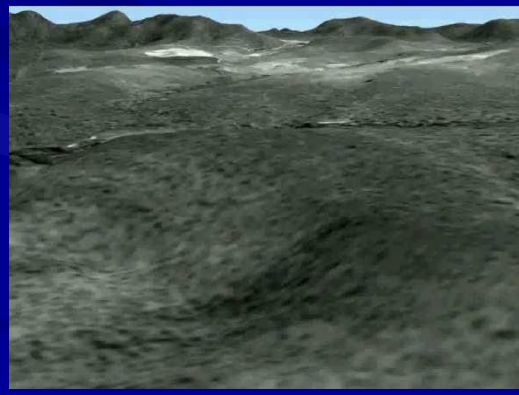




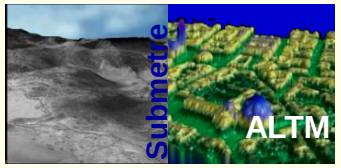








Aerial

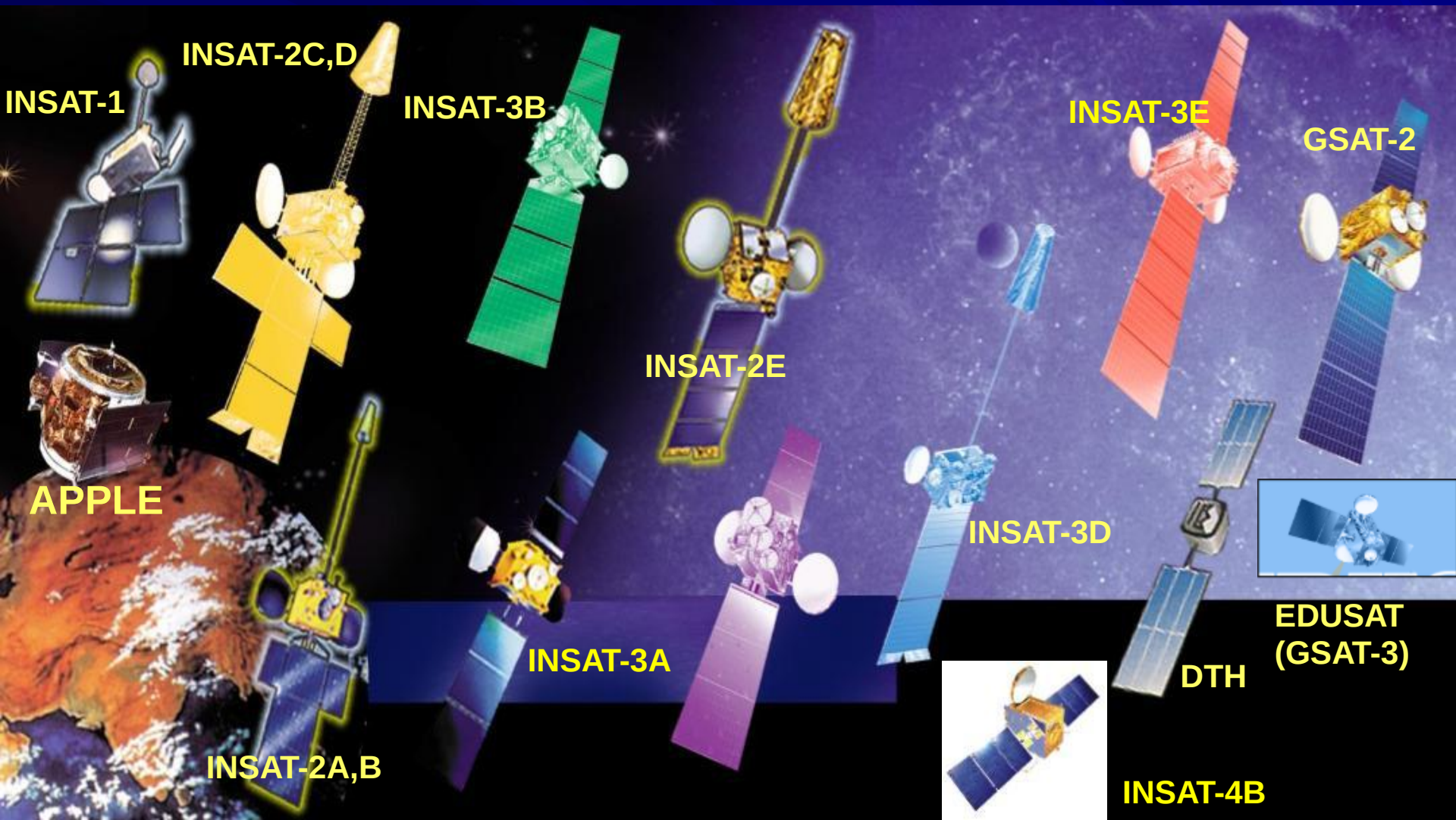


Digital Camera
Laser Terrain Mapper

A Valuable infrastructure in Space for monitoring NR & Environment

INSAT FAMILY

* ONE OF THE LARGEST DOMESTIC SATCOM SYSTEMS - Ku, C, S BANDS
•MULTI-PURPOSE : TELECOM, TV, METEOROLOGY
•200 TRANSPONDERS, GLOBAL/DOMESTIC BEAMS



INDIAN IMAGING SYSTEMS

1979

BHASKARA

1982

RS-D1

1988/91

IRS-1A/1B LISS-1&2 (72/36M, 4 BANDS; VIS & NIR)

1994

IRS-P2
LISS-2

1996

IRS-P3
WiFS MOS
X-Ray

1995/1997

IRS-1C/1D LISS-3 (23/70M, STEERABLE PAN (5.8 M); WiFS (188M)

1999

INSAT-2E CCD (1KM RESOLUTION; EVERY 30 MNUTESS)

1999

IRS-P4
OCEANSAT OCM, MSMR

2003

RESOURCESAT-1
LISS3 - 23 M; 4 XS
LISS4 - 5.8 M; 3-XS
AWIFS - 70 M; 4-XS

2005

CARTOSAT - 1
PAN - 2.5M, 30 KM,
F/A

2010+

CARTOSAT-2,2A,2B
PAN - 1M

MEGHA-TROPIQUES
SAPHIR
SCARAB &
MADRAS

IMAGING IMPROVEMENTS

- 1KM TO <1.0 M RESOLUTION
- GLOBAL COVERAGE
- APPLICATION-SPECIFIC

India’s Interest and Capability

- Dr.V.K.Saraswat, Director DRDO “India is working to ensure space security and protection of our satellites. At the same time, we are also working on how to deny the enemy access to its space assets. Surely, Indian forces have to work in that direction. India, like all countries with their own space assets, is aware that ASAT is a double-edged sword and that if they embark on a program; they will legitimize the Chinese program and endanger their own national satellites. Space security involved a gamut of capabilities including the protection of satellites, communication and navigation systems and denying the enemy the use of his own space systems. These technologies would be developed as part of the country's totally indigenous Ballistic Missile Defence Programme”

Technological Capability

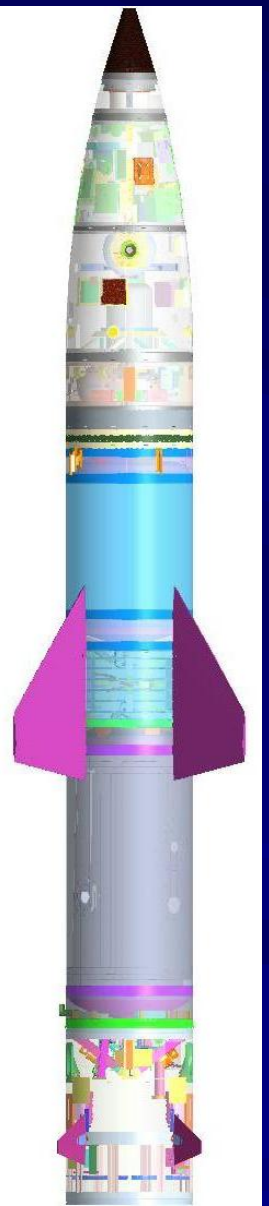
- Also “With the successful testing of Agni-III, we have the propulsion system which can be used to propel a kill vehicle in the orbit. We have the capability required to guide a kill vehicle towards the satellite. We have the capability for interception of satellite. But we do not have to test because it is not our primary objective. There are repercussions of satellite interception like debris flying in the space. Today we can validate the anti-satellite technology on ground through simulation. There will be no direct hit of satellite. If the nation wants, we can have it ready.[25]We have the building blocks. What is needed is technology to track the movements of enemy satellites, for instance before making a kinetic kill, we are trying to build a credible deterrence capability. Many of these technologies may never be used.”

Conclusion

- “Space Control” will be an important aspect to define the strength of a nation in the future
- The USA and Russia, which were developing ASATs intensively, had almost abandoned the activity a decade ago. China has demonstrated its ASAT capability and reignited ASAT interests

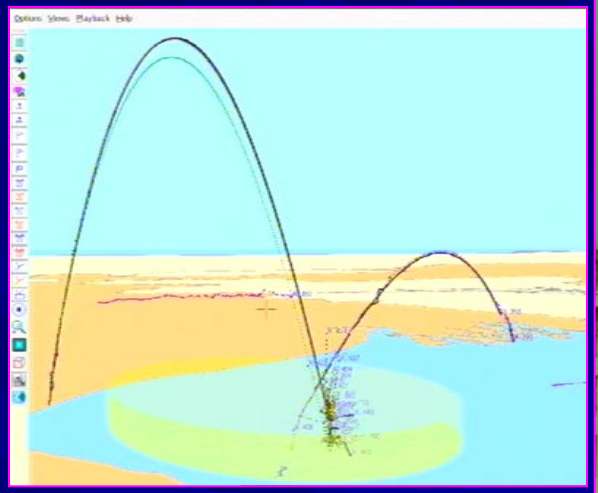
- India has significant space assets which need to be safe guarded. Hence a deterrent is needed.
- Most of the technologies needed for ‘Hit to Kill’ ASAT exist in India as they have been developed and proven under various missile programs, especially in ABM program
- India should develop ASAT with ‘Hit to Kill’ capabilities using these existing technologies as a short term measure for deterrence. To avoid space debris It should continue to develop advanced technologies such as directed energy or beam weapons, jamming of data links etc
- Developing such capability and restraining it from first use will enhance National Security.

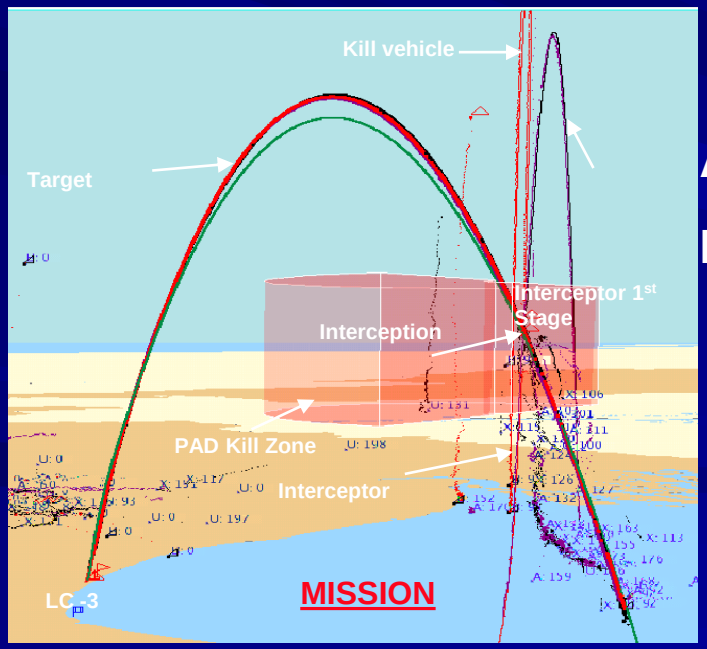
Ballistic Missile Defence



PAD-Exo-atmospheric

Interception alt 50 km





AAD-Endo-atmospheric

Interception alt 15 km