India's Strategic Intent & Competitiveness

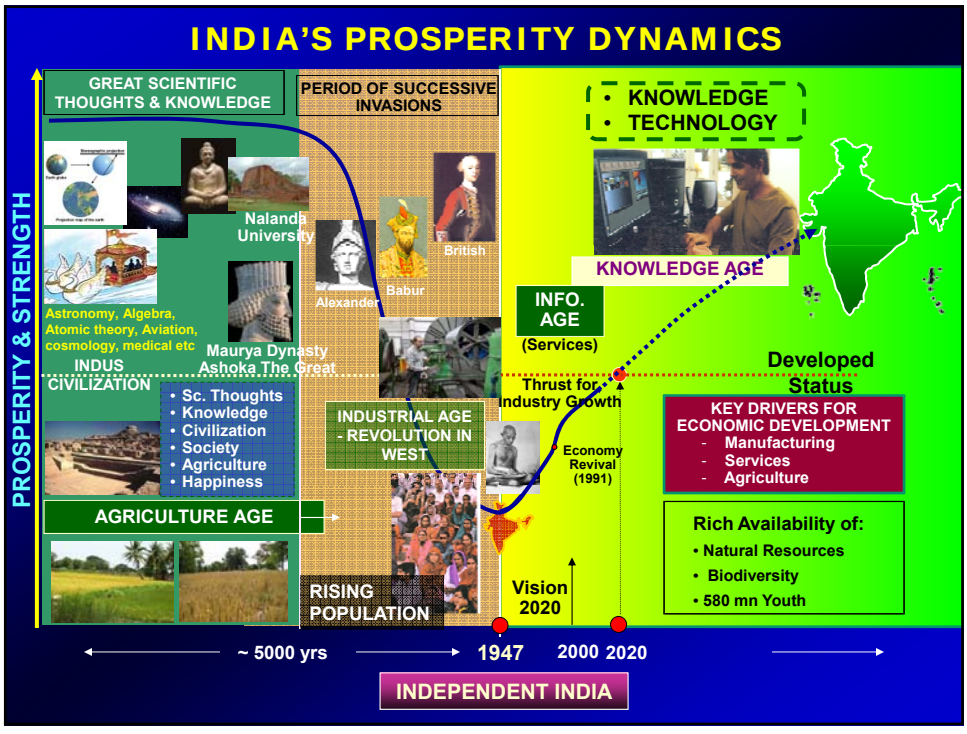
Lal Bahadur Shastri Institute of Management, Delhi
On the occasion of 15th Lal Bahadur Shastri National Award

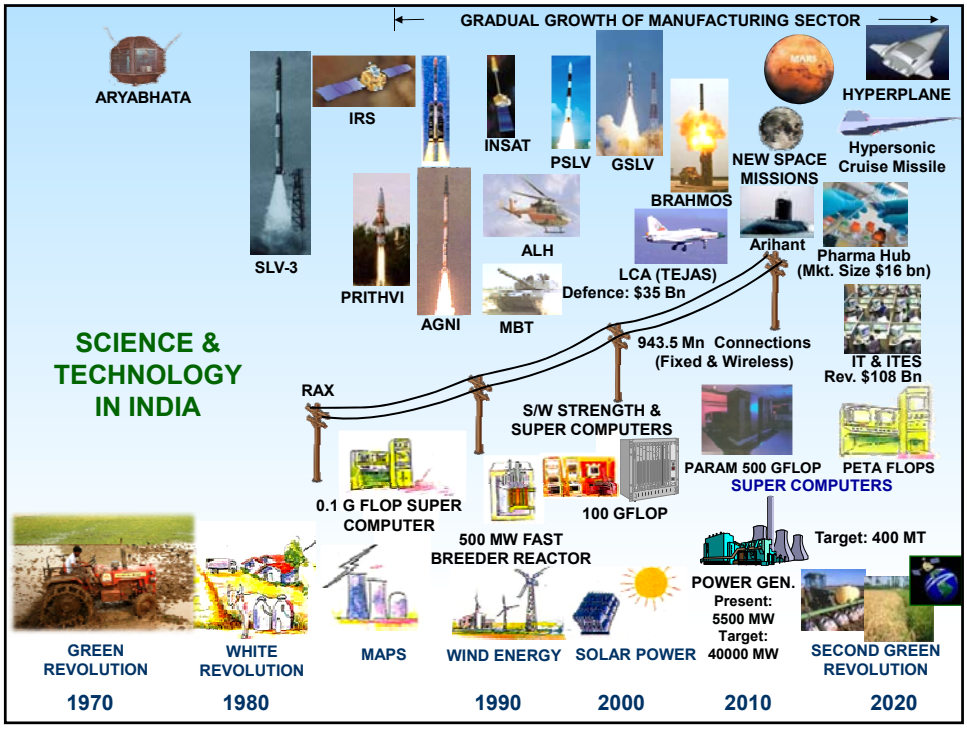
Presentation By

Dr. A. SIVATHANU PILLAI

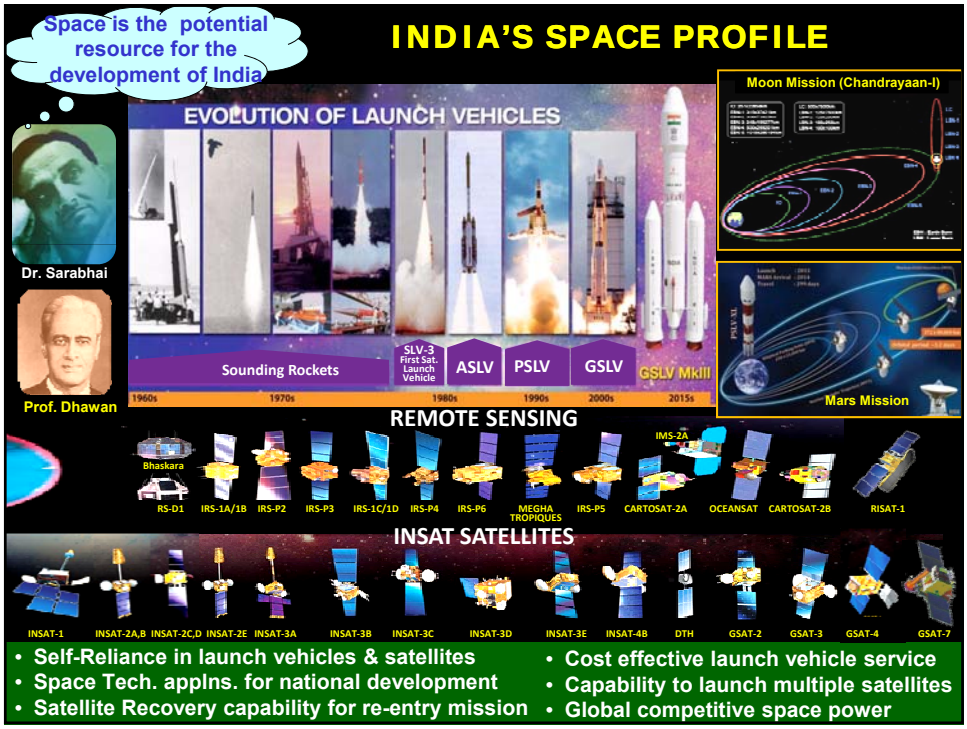
Former Chief Controller (R&D), DRDO
Founder , BrahMos Aerospace
Visiting Professor, Indian Institute of Science

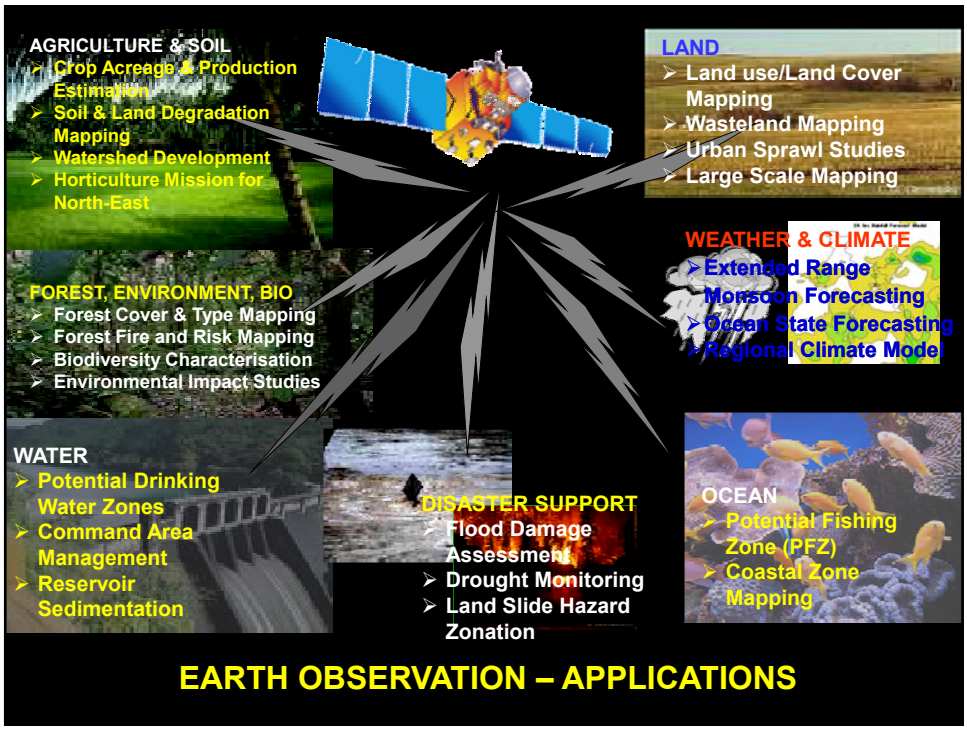
07 OCT 2014

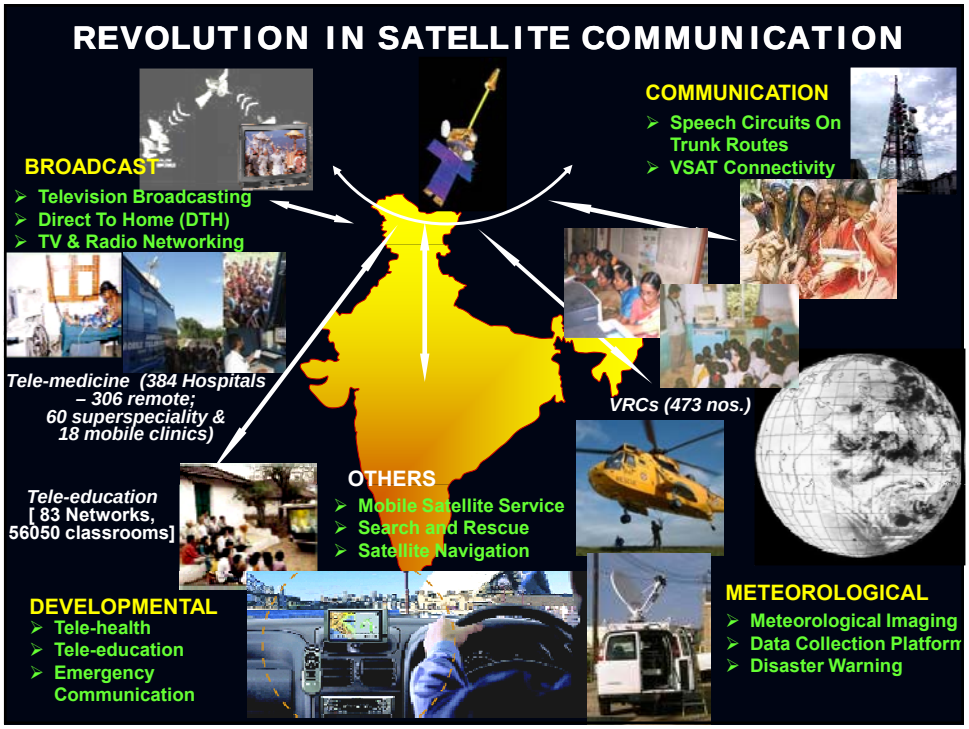


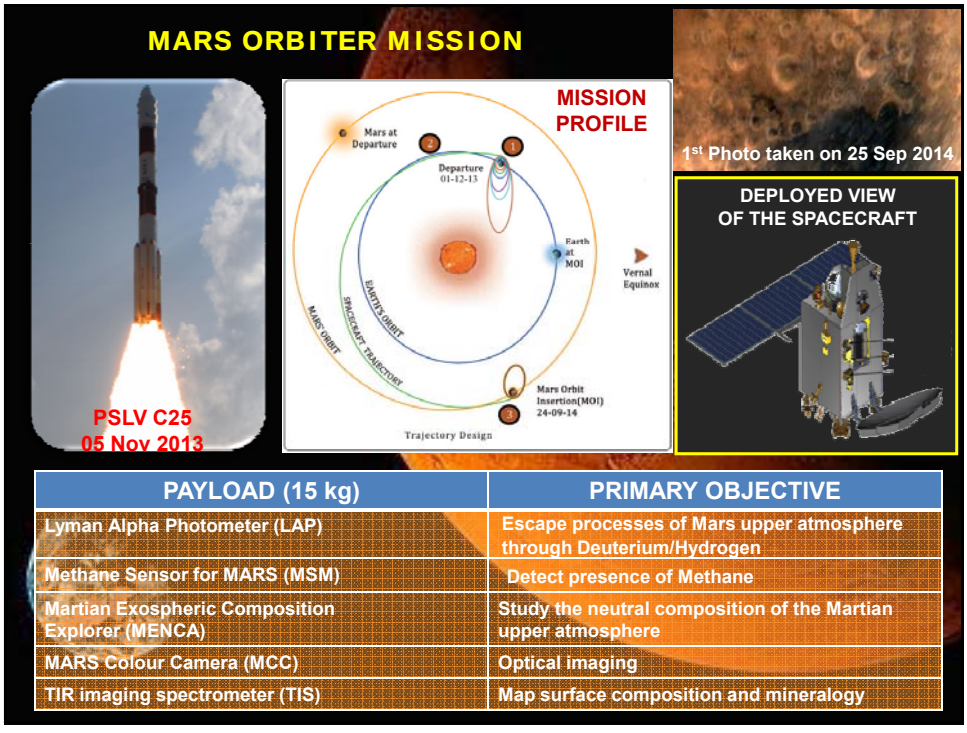

GRADUAL GROWTH OF MANUFACTURING SECTOR
SCIENCE & TECHNOLOGY IN INDIA
ARYABHATA
IRS
SLV-3
INSAT
PSLV
GSLV
BRAHMOS
HYPERPLANE
Hypersonic Cruise Missile
NEW SPACE MISSIONS
Arihant
Pharma Hub (Mkt. Size $16 bn)
ALH
LCA (TEJAS)
Defence: $35 Bn
PRITHVI
AGNI
MBT
943.5 Mn Connections (Fixed & Wireless)
IT & ITES Rev. $108 Bn
RAX
S/W STRENGTH & SUPER COMPUTERS
PARAM 500 GFLOP
PETA FLOPS
SUPER COMPUTERS
0.1 G FLOP SUPER COMPUTER
100 GFLOP
500 MW FAST BREEDER REACTOR
Target: 400 MT
POWER GEN.
Present: 5500 MW
Target: 40000 MW
GREEN REVOLUTION
WHITE REVOLUTION
MAPS
WIND ENERGY
SOLAR POWER
SECOND GREEN REVOLUTION
1970
1980
1990
2000
2010
2020


WORLD'S FIRST WAR ROCKET
TIPU'S WAR AGAINST BRITISH (SRIRANGAPATNA 1792)
Indian rocket barrage defeats British cavalry attack in 1792
• IRON CASE
• 2 KG GUN POWDER
• LENGTH : 250 MM
• DIAMETER : 60 MM
• GUIDER : SWORD BLADE (1 M LONG)
• RANGE : 1.0 KM
BIRTH OF ROCKET SCIENCE
Royal Artillery Museum, Woolwich
(Original Rockets used in War)


Space is the potential resource for the development of India
INDIA'S SPACE PROFILE
Dr. Sarabhai
Prof. Dhawan
EVOLUTION OF LAUNCH VEHICLES
Sounding Rockets
SLV-3 First Sat. Launch Vehicle
ASLV
PSLV
GSLV
GSLV MkIII
1960s
1970s
1980s
1990s
2000s
2015s
Moon Mission (Chandrayaan-I)
Mars Mission
REMOTE SENSING
Bhaskara
RS-D1
IRS-1A/1B
IRS-P2
IRS-P3
IRS-1C/1D
IRS-P4
IRS-P6
MEGHA TROPIQUES
IRS-P5
IMS-2A
CARTOSAT-2A
OCEANSAT
CARTOSAT-2B
RISAT-1
INSAT SATELLITES
INSAT-1
INSAT-2A,B
INSAT-2C,D
INSAT-2E
INSAT-3A
INSAT-3B
INSAT-3C
INSAT-3D
INSAT-3E
INSAT-4B
DTH
GSAT-2
GSAT-3
GSAT-4
GSAT-7
• Self-Reliance in launch vehicles & satellites
• Space Tech. applns. for national development
• Satellite Recovery capability for re-entry mission
• Cost effective launch vehicle service
• Capability to launch multiple satellites
• Global competitive space power

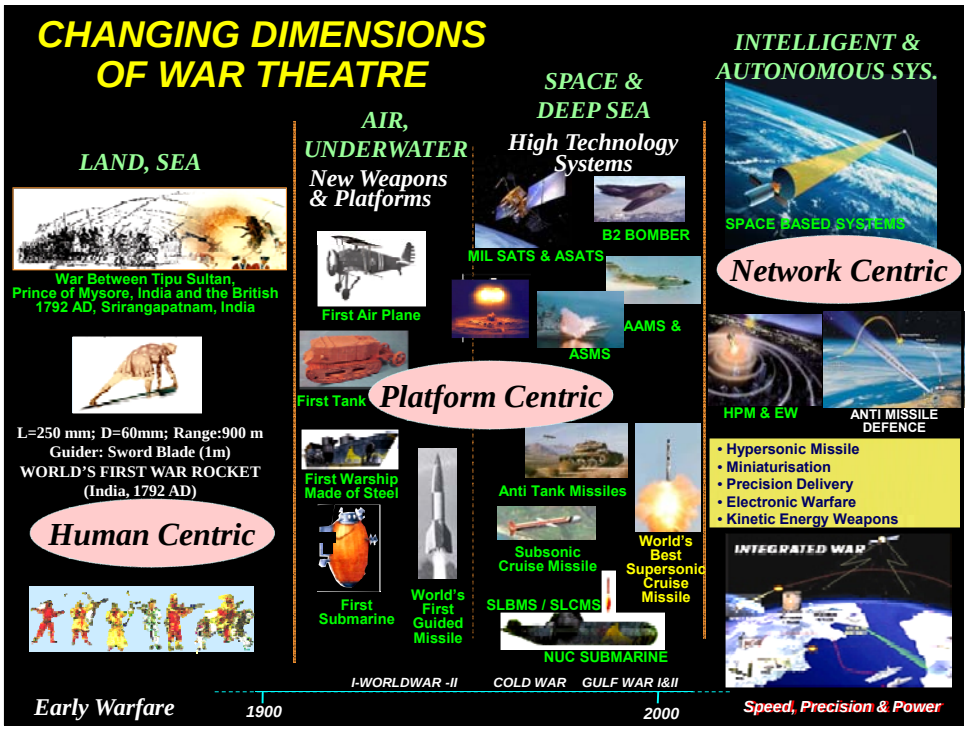

AGRICULTURE & SOIL
➢ Crop Acreage & Production Estimation
➢ Soil & Land Degradation Mapping
➢ Watershed Development
➢ Horticulture Mission for North-East
LAND
➢ Land use/Land Cover Mapping
➢ Wasteland Mapping
➢ Urban Sprawl Studies
➢ Large Scale Mapping
WEATHER & CLIMATE
➢ Extended Range Monsoon Forecasting
➢ Ocean State Forecasting
➢ Regional Climate Model
FOREST, ENVIRONMENT, BIO
➢ Forest Cover & Type Mapping
➢ Forest Fire and Risk Mapping
➢ Biodiversity Characterisation
➢ Environmental Impact Studies
WATER
➢ Potential Drinking Water Zones
➢ Command Area Management
➢ Reservoir Sedimentation
DISASTER SUPPORT
➢ Flood Damage Assessment
➢ Drought Monitoring
➢ Land Slide Hazard Zonation
OCEAN
➢ Potential Fishing Zone (PFZ)
➢ Coastal Zone Mapping
EARTH OBSERVATION – APPLICATIONS





PAYLOAD (15 kg)	PRIMARY OBJECTIVE
Lyman Alpha Photometer (LAP)	Escape processes of Mars upper atmosphere through Deuterium/Hydrogen
Methane Sensor for MARS (MSM)	Detect presence of Methane
Martian Exospheric Composition Explorer (MENCA)	Study the neutral composition of the Martian upper atmosphere
MARS Colour Camera (MCC)	Optical imaging
TIR imaging spectrometer (TIS)	Map surface composition and mineralogy


Helium3:
The Future
INDIAN LUNAR FACTORY
Mining the Lunar Dust
Regolith, the loose soil on the moon's surface, contains more than 1 million tons of helium 3. In theory, this nonradioactive isotope could provide an abundant source of clean nuclear energy. How it might be done:
1 Bucket wheel: Moves the regolith onto a lifting belt to sift out large stones and keep only grains smaller than one millimeter in diameter.
2 Fluidized chamber: Removes all grains larger than 100 microns. Excess regolith is returned to the surface.
3 Heater: Brings regolith to 700° C by flowing it over solar-heated pipes. This causes the helium 3 and other gases to be released from the regolith.
4 Gas storage: Collects the helium 3 and other gases for transport to a moon base where the gases are separated. The helium 3 is shipped to Earth.
Solar collector
Solar power
Depleted regolith
Electrostatic separator
Gas storage tanks
Pivoting arm
Heater
Fluidized chamber
Lunar regolith
Bucket-wheel excavator
HUMAN RACE WILL GET OUT OF THEIR CRADLE – THE EARTH, TO EXPLORE NEW FRONTIERS IN SPACE, AS THE CHILD GETS OUT OF ITS CRADLE


CHANGING DIMENSIONS OF WAR THEATRE
LAND, SEA
War Between Tipu Sultan, Prince of Mysore, India and the British 1792 AD, Srirangapatnam, India
L=250 mm; D=60mm; Range:900 m
Guider: Sword Blade (1m)
WORLD'S FIRST WAR ROCKET
(India, 1792 AD)
Human Centric
AIR, UNDERWATER
New Weapons & Platforms
First Air Plane
First Tank
First Warship Made of Steel
First Submarine
World's First Guided Missile
Platform Centric
SPACE & DEEP SEA
High Technology Systems
B2 BOMBER
MIL SATS & ASATS
AAMS & ASMS
Anti Tank Missiles
Subsonic Cruise Missile
World's Best Supersonic Cruise Missile
SLBMS / SLCMS
NUC SUBMARINE
INTELLIGENT & AUTONOMOUS SYS.
SPACE BASED SYSTEMS
Network Centric
HPM & EW
ANTI MISSILE DEFENCE
• Hypersonic Missile
• Miniaturisation
• Precision Delivery
• Electronic Warfare
• Kinetic Energy Weapons
INTEGRATED WAR
Early Warfare
1900
I-WORLDWAR -II
COLD WAR
GULF WAR I&II
2000
Speed, Precision & Power

NETWORK CENTRIC WARFARE

Integrates sensors, C3 and weapons in an network together

C^4I

NCW

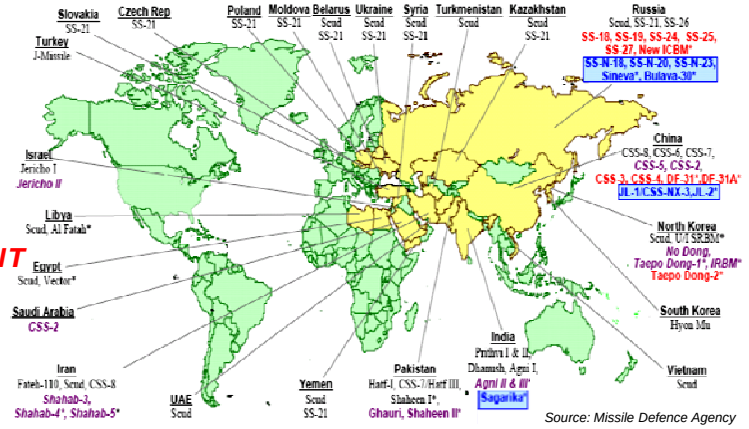
PLATFORMS

SENSORS

- Dominant Battlefield Knowledge
- Precision strikes

- Force Multiplier
- Paradigms of NCW (Speed & Dominant Manoeuvre)

BALLISTIC MISSILE ENVIRONMENT



Source: Missile Defence Agency

Deployed ICBMs of 5 Declared Nuclear-Weapon States

Country	Missile	Range (km)
China	DF-5	13,000
France	M45 SLBM	6,000
	M4 SLBM	6,000
Russia	SS-18	11,000
	SS-19	10,000
	SS-24	10,000
	SS-25	10,500
	SS-27	10,500
	SS-N-18SLBM	6,500/8,000
	SS-N-20 SLBM	8,300
	SS-N-23 SLBM	8,300
U.K	Trident II/D-5 SLBM	7,400
U.S	Minuteman II	9,650
	MX Peacekeeper	9,650
	Trident I/C-4 SLBM	7,400
	Trident II/D-5 SLBM	7,400

Missiles with ranges exceeding 1,000 km in 6 Countries of Proliferation Concern

Country	Missile Name	Range (km)
India	Agni II	2,000
	Agni V	5,000
Iran	Shahab III	1,300
Israel	Jericho II	1,500
North Korea	No Dong	1,300
	Taepo Dong I	2,000
	Taepo Dong II	5,500
Pakistan	Ghauri I/No Dong	1,300
	Ghauri II	2,000
Saudi Arabia	CSS-2	2,600

SRBM
MRBM/IRBM
ICBM
SLBM
* System under development

24 Countries have ballistic missiles with ranges < 1,000 km

Carnegie Endowment for International Peace, *Deadly Arsenals* (2002), **www.ceip.org**

Dr. APJ Abdul Kalam

INTEGRATED GUIDED MISSILE DEVELOPMENT PROGRAMME

(JULY 1983)

CONSTRAINTS

- 20-30 YRS. OF TECHNOLOGY GAP
- CONSTRAINTS ON FLOW OF TECH. (MTCR)
- RAPID TECH. OBSOLESCENCE
- CHANGE OF USER REQMNTS DUE TO
  - NEWER SYSTEMS AVAILABLE IN THE MARKET
  - WAR STRATEGY
- LACK OF INDL. INFRASTRUCTURE

TECH. OBJECTIVES

- CONTEMPORARY PERFORMANCE AT THE TIME OF DEPLOYMENT
- MULTI-ROLE & MULTI-USER
- QUALITY & RELIABILITY
- COST EFFECTIVENESS
- SELF-RELIANCE

REQUIREMENT

- FUTURISTIC TECH. & NEWER CONCEPTS
- DESIGN ADAPTABILITY
- PROG. MGMT. LEADERSHIP
- NETWORKING OF INSTITUTIONS FOR CRITICAL TECH DEV.
- CUSTOMERDELIGHT

PRITHVI (SRBM)

AGNI (IRBM)

NAG (3RD GEN. ATGM)

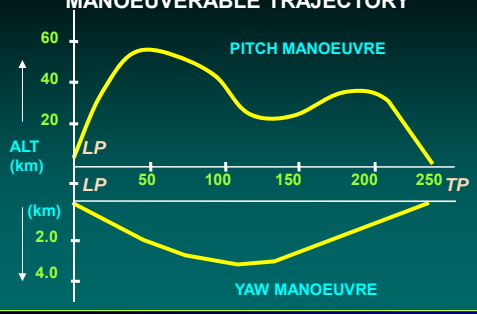
AKASH (AREA DEFENCE SYS.)

TRISHUL

QUICK REACTION, AIR DEFENCE MISSILE

PRITHVI

INNOVATIVE CONCEPT OF MANOEUVERABLE TRAJECTORY



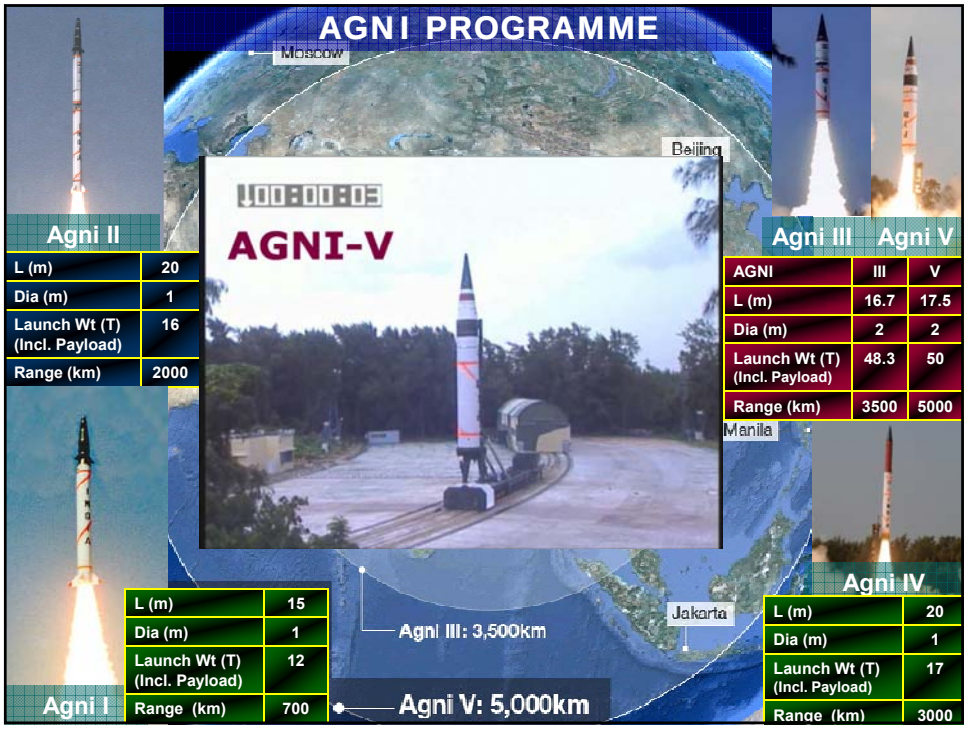
MULTIPLE WARHEADS

PREFRAG | BOMB LET | INCENDIARY | BCES

	P-I	P-II	P-III (DHANUSH)
RANGE (KM)	150	250 / 350	350
USER	ARMY	AIRFORCE, ARMY	NAVY

FEATURES

- MANOEUVERABLE TRAJECTORY
- HIGH ACCURACY
- MULTIPLE, FIELD INTERCHANGEABLE, WARHEADS WITH HIGH LETHALITY



RE-ENTRY DESIGN

SUPER COMPUTER FOR COMPUTATIONAL FLUID DYNAMICS (CFD)

NEED FOR CFD

- HYPERSONIC FLOW INVOLVING NON-EQUILIBRIUM CHEMISTRY NOT AMENABLE TO CONVENTIONAL METHODS
- EXPERIMENTATION REQUIRES LARGE SIZE HYPERSONIC WIND TUNNEL FACILITY
  - NON AVAILABILITY

REQUIREMENT

- SUPER COMPUTER
- FAST CFD CODES

100,000 Grid Points

TECHNOLOGY CAPABILITY FOR SUPER COMPUTER & ADV. CFD S/W

CODES

(EULER, BHEEMA, VEEMA, KAREESHMA, Navier Stroke Solution)

CFD CENTRE (IISc) + COMPUTING LAB (ANURAG)

PARALLEL PROCESSING (8 / 32 / 128 NODES)

(5 min. / iteration)

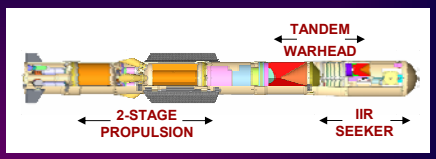
Conventional Main Frame Computers (9 days/iteration)

PACE+ WITH 1.7 G.FLOP IS 20 TIMES FASTER THAN CRAY-XMP

YOUNG MINDS TAKE CHALLENGES

NAG

(THIRD GENERATION ANTI-TANK GUIDED MISSILE)



RANGE : 4 KM

- FIRE & FORGET CAPABILITY
- TOP ATTACK CAPABILITY
- CAPABILITY TO DEFEAT COMPOSITE & REACTIVE ARMOUR

YOUNG MINDS FIND UNCONVENTIONAL METHODS

REALISATION OF CRITICAL TECHNOLOGIES TO COMBAT MTCR


RE-ENTRY / CFD


RL GYRO

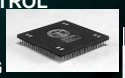

GUIDANCE & CONTROL


SEEKER

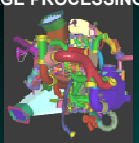

IMAGE PROCESSING


SUPER COMPUTER


ANUSIG


ANUPAMA PROCESSOR


SAGAR


VIRTUAL REALITY


COMPONENTS & DEVICES


GATEC


SITAR


RAJENDRA

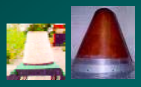

3D CAR


PROPULSION


FLOATING POINT DSP

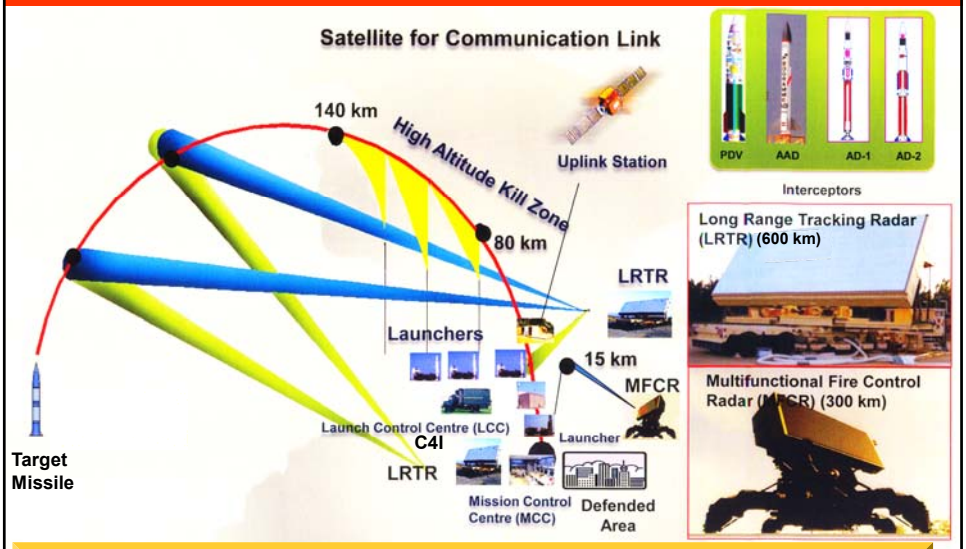

HYDROPHONE


SONAR


CERAMIC RADOME MATERIALS / COMPOSITES

TECHNOLOGY DENIED IS TECHNOLOGY GAINED

BALLISTIC MISSILE DEFENCE

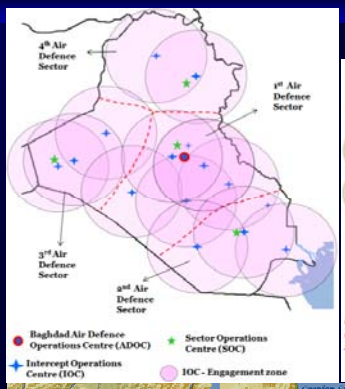


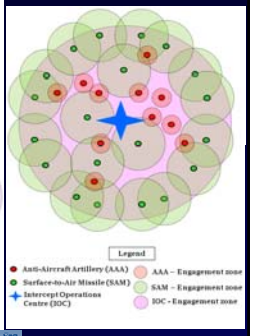
Neutralise Long Range Ballistic Missile threat

Twin Layered Defence System

CRUISE MISSILES IN IRAQ WAR (1991 & 2003)

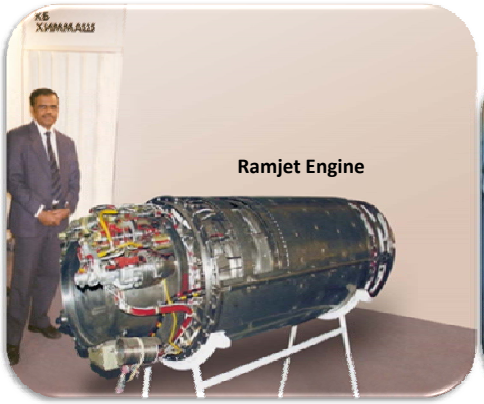
- 1092 TOMAHAWK MISSILES DEPLOYED IN IRAQ WAR & 112 MISSILES IN LIBYA WAR
- PRECISION WEAPON DELIVERY FROM MULTIPLE PLATFORMS
- MASSIVE DESTRUCTION OF STRATEGIC TARGETS & INSTALLATIONS





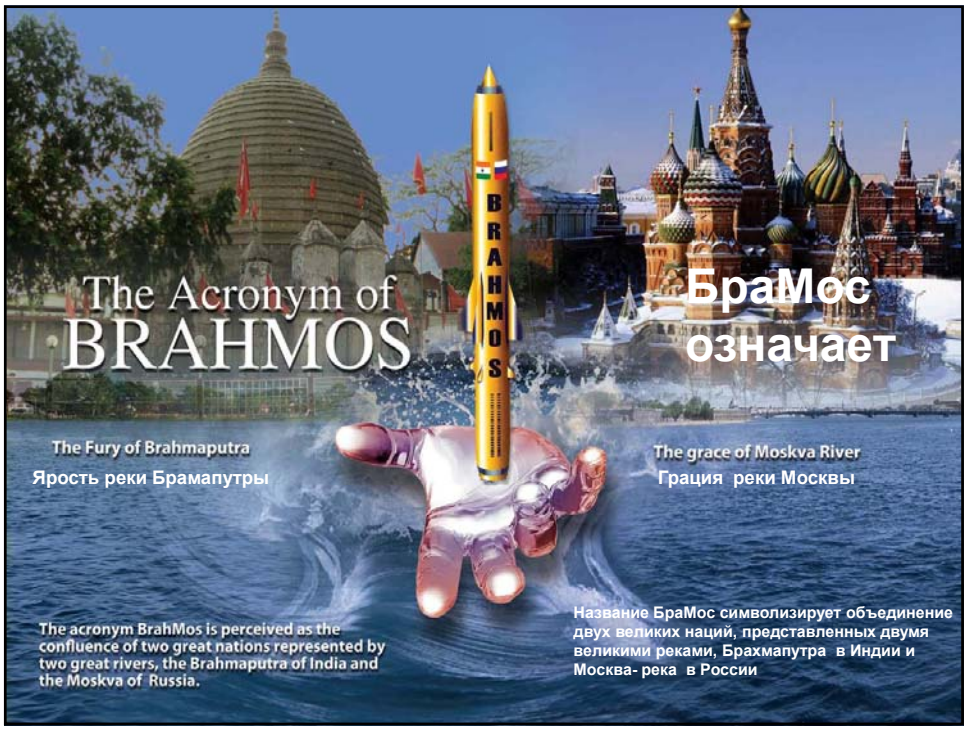
DEPLOYMENT OF CRUISE MISSILES RESULTED MINIMUM LOSS TO ALLIED FORCES

FORMATION OF BrahMos JV



Triggering point for joint Venture (1993)

Signing of Agreement for JV (1995)



TECHNOLOGY COLLABORATION PARTNERSHIP

India
DRDO (50.5%)

- Resources
- Capabilities
- Core Competencies

IGA Signed on 12 Feb 1998

Russia
NPOM (49.5%)

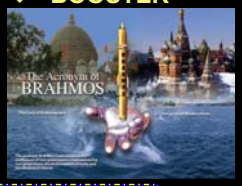
- Resources
- Capabilities
- Core Competencies

JV
Joint Design, Development, Manufacture and Marketing
(MIND TO MARKET)

PROCESS STOCK (INDIA)
- INS
- OBC
- FCS
- PLATFORM SYS.
- TEST & EVALN.

COMMON SYSTEMS
Airframe, Warhead, S/w

PROCESS STOCK (RUSSIA)
- RAMJET
- SEEKER
- BOOSTER



BRAHMOS SUPERSONIC CRUISE MISSILE

BRAHMOS UNIVERSAL MISSILE SYSTEM

MULTI PLATFORM

Aircraft

Silo

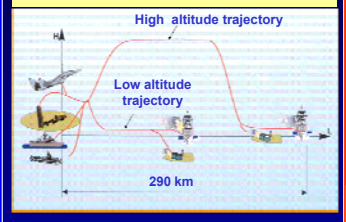
Submarine

Naval Warship

Mobile Land Complex

SPECIFICATION
Range : 300 Km
Speed : 3 Mach

MULTI TRAJECTORY



DIVERSE ENVIRONMENT

- SNOW/MOUNTAIN
- DESERT
- TROPICAL

MULTI TARGET

SEA TARGETS

Corvette

Frigate

LAND TARGETS

Ammunition Dump

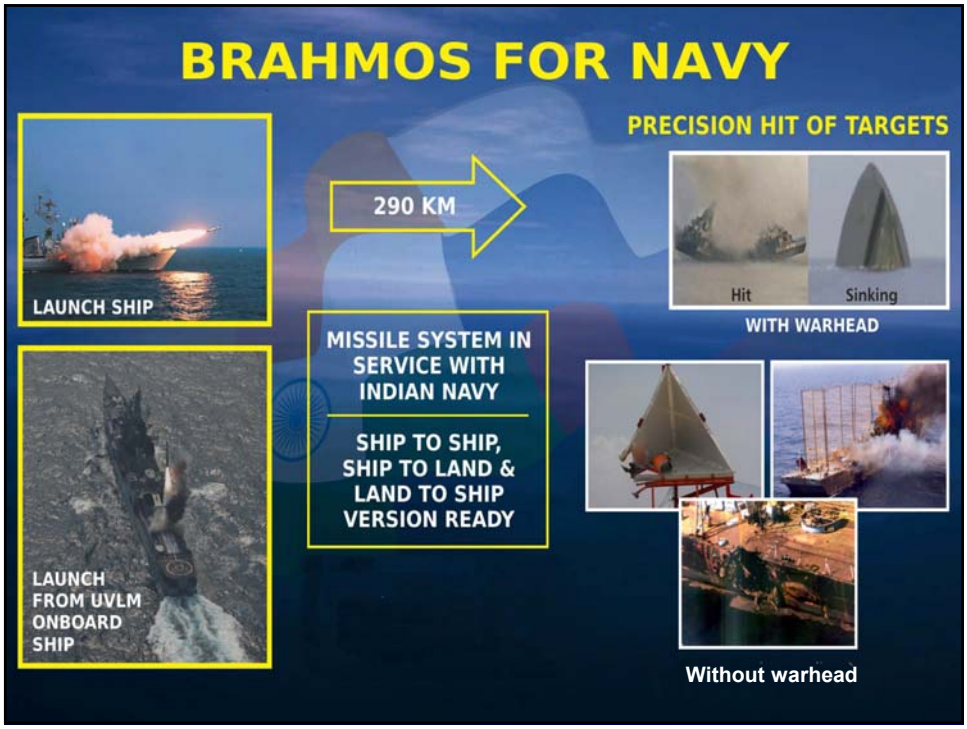
Command Centre

Railway Yard

Airbase

Bridges

ONLY OF ITS KIND IN THE WHOLE WORLD


BRAHMOS FOR NAVY
LAUNCH SHIP
290 KM
PRECISION HIT OF TARGETS
Hit
Sinking
WITH WARHEAD
MISSILE SYSTEM IN SERVICE WITH INDIAN NAVY
SHIP TO SHIP, SHIP TO LAND & LAND TO SHIP VERSION READY
LAUNCH FROM UVLM ONBOARD SHIP
Without warhead


BRAHMOS LAUNCHES
AGAINST LAND TARGET
UNDERWATER LAUNCH
Launch from INS Rajput
Launch from Pontoon

BRAHMOS LAND ATTACK CAPABILITY

PRECISION HIT ON LAND TARGETS

2 REGIMENTS INDUCTED IN ARMY

CONTINUOUS CAPABILITY ENHANCEMENT

BRAHMOS BLOCK-I

Precision strike on high value single target

Applications:
Sea to Sea ASM
Land to Sea
Land to Land
Desert Warfare

BRAHMOS BLOCK-II

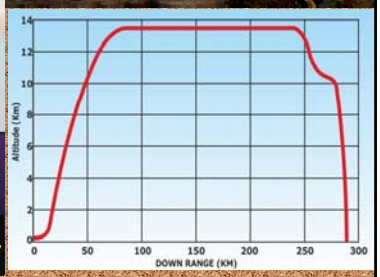
Land Target with Discrimination and Surgical Strike Capability

Applications:
Land to Land
Desert Warfare and Urban Warfare

BRAHMOS BLOCK-III

High Manoeuvrability and Supersonic Steep Dive

Applications:
Land to Land
Mountain Warfare
Surgical Strike Capability



UNIVERSALITY WITH S/W & H/W ADAPTABILITY FOR SEA AND LAND TARGETS

DEPLOYMENT OF BRAHMOS ON SU-30

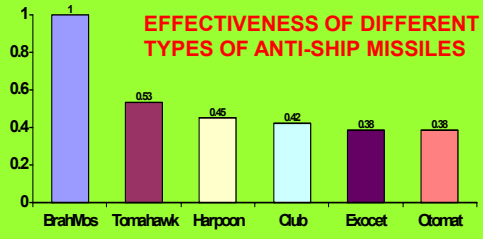
Air Launched BRAHMOS

BASIC SPECIFICATIONS

Number of missiles per Aircraft	-	1
Range	-	up to 290 Km
Velocity	-	up to 2.8 Mach
Altitude		
- cruise phase	-	up to 14000 m
- terminal phase	-	5-15 m
Take off mass	-	2500 Kg
Length	-	8500 mm

TOMAHAWK Vs. BRAHMOS

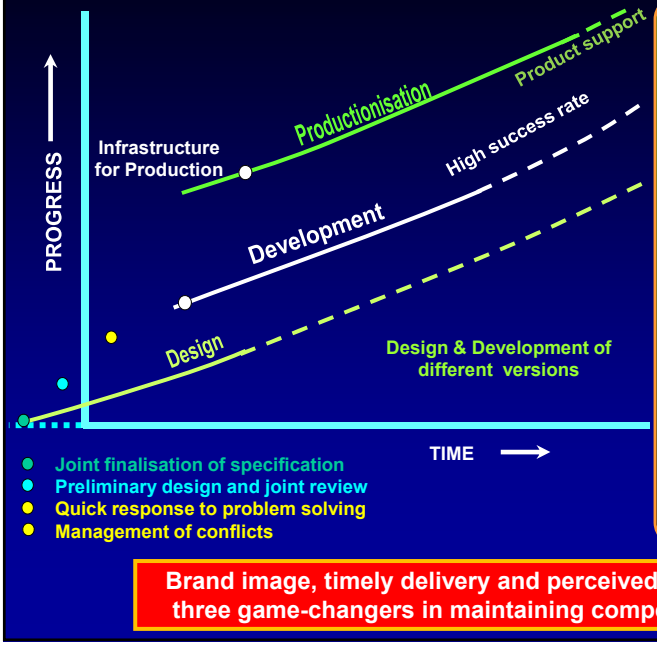
	TOMAHAWK	BRAHMOS
Speed	0.8 Mach	2.8 Mach
Time to hit the target	1 unit	1/3rd (Faster engagement)
Kinetic Energy	1 unit	9 times. (High Destructive Power)
Target Dispersion (Moving targets)	1 unit	1/3rd (Probability of hit is high)
Reaction Time	1 unit	1/3rd (Pierces the Defence)
Universality	Nil	Same system for sea & land targets
Salvo	3 sec	2.5 - 3 Second interval on multiple targets (Land and Sea)



Supersonic Cruise Missiles: Competitors	
Europe	"Perseus" (by 2030)
USA	Projects underway
Russia	Anti ship developed (Onix, Moskit)
China	Under development
S. Korea	Under development
Taiwan	Prototype developed (120 Kms)

BRAHMOS – WORLD LEADER IN CRUISE MISSILE FAMILY

CONCURRENT DESIGN, DEV. & PRODUCTIONISATION - NETWORKING INDUSTRIES & COMPETENCIES



- Joint design and development (R&D + Industry)
- Large scale industrial partnership – Both Public and Private as Consortium
- Technology sharing for manufacturing of critical systems
- Common Inspection Standards for product acceptance

- Faster realization of Product & entry to market
- Brand Image
- Customer Focus

Brand image, timely delivery and perceived quality are three game-changers in maintaining competitiveness

BrahMos Missile Industry Complex

A Blend of Public – Private Enterprises

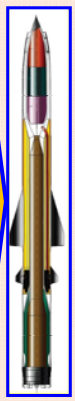
DRDO – System Engg, Missile integn, Flight Testing
L&T, Mumbai – Radome, Composite Airframe, Canister, Launcher, FCS
G&B, Mumbai - Metallic Airframes, Pneumo-Hydraulics, Mobile Autonomous Launcher
HAL,Hyd. & Korwa – INS
Ananth Tech – OBC, MIU, PCM Encoder
Astra M/W –Transmitter
Data Patterns – FCS, COE
ECIL, Hyd – Commn. Eqpt. & MCP
BHEL – Launcher
BEML –Vehicles
OFB/DRDO – Warheads, Propellants, Pyros
BATL – Pneumatics, Control, Airframes, Booster, Integration
HEB, Trichy – Batteries

INDUSTRIAL GAIN

- Participation of Consortium of Pub. and Pvt. industries
- Cutting edge manufacturing technologies & processes
- Expertise in precision manufacturing
- High quality & reliable systems/subsystems mfg.

Human Resources:
20000 Specialists
Industries : > 205

INTEGRATION COMPLEXES



DELIVERIES TO USER (ARMY, NAVY & AIR FORCE)

BRAHMOS - GLOBALLY COMPETITIVE PRODUCT

- Simultaneous R&D & Prodn Mgmt.
- Industry Consortium
- Commitment

NETWORKING OF STAKEHOLDERS

- Novel JV concept
- One step higher than state of the art technology

CREATIVITY

World Class Product

BRAHMOS

Highly demanded Product
-by Indian Armed Forces
- by other countries

BEST PRACTICES

- Can we leap-frog?
- Mind to Market
- Brand

Concept

INNOVATION

LEADERSHIP

TECHNOLOGY & RESOURCES

- Technology sharing
- Resource Pooling
- Mutual Learning

- Speed
- Precision
- Power

DICTATED BY FUTURE WAR

- Thinking ahead
- Managing complexities

JV helps to realise advanced Technology product in a cost effective manner, produced in shortest time giving competitive edge to the Nation

INDIA - RUSSIA JV BrahMos – A ROLE MODEL

Scope:
Dev. of ASM from Mobile Complex

Realised:
- Land to Ship
- Ship to Ship
- Land to Land
- Ship to Land
- U/W to Land

Indian Govt.

Investment | Technology

BrahMos

Investment | Technology

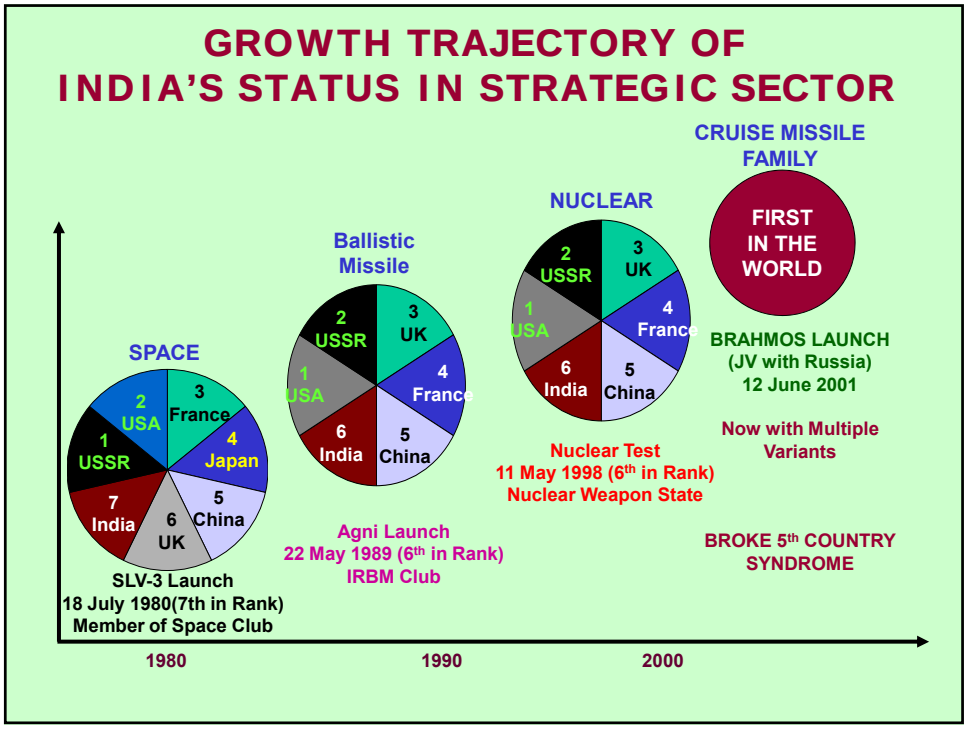
Russian Govt.

- Naval & Army versions successfully completed within time. Produced, Delivered & Operational
- Indian Army is the only Land Force in the world to have Supersonic Precision Strike Cruise Missile
- Universality for multi platform, multi target and multi mission achieved.

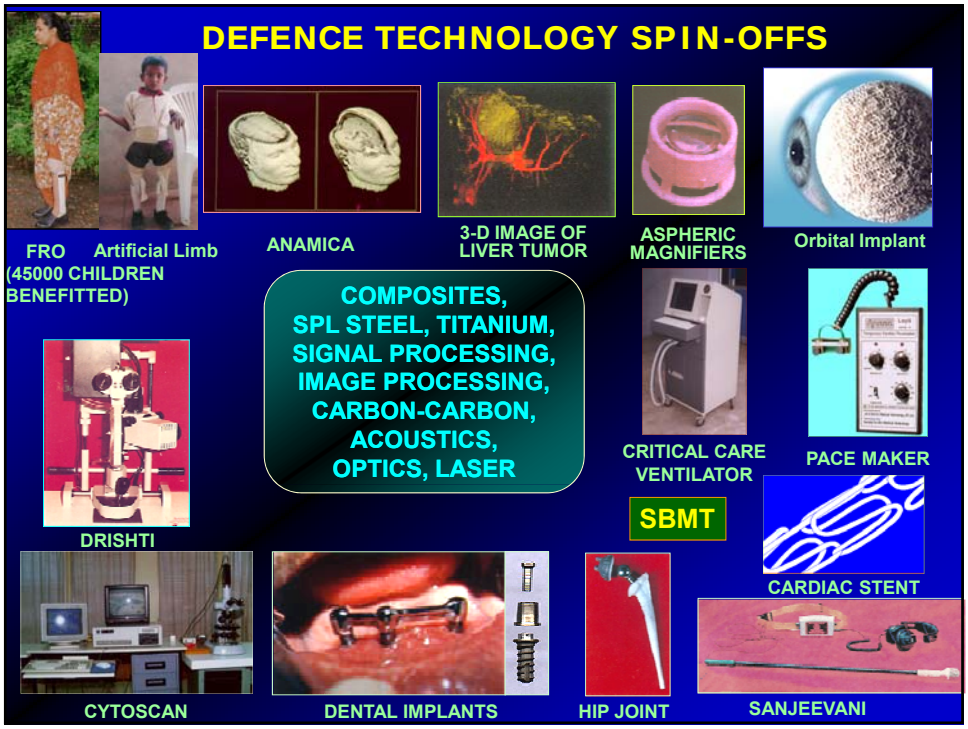
Investment:
$ 300 mn

BUSINESS

Present Order : ~ $6 bn
Target : $10 bn


GROWTH TRAJECTORY OF
INDIA'S STATUS IN STRATEGIC SECTOR
SPACE
2 USA
3 France
4 Japan
1 USSR
7 India
6 UK
5 China
SLV-3 Launch
18 July 1980(7th in Rank)
Member of Space Club
Ballistic Missile
2 USSR
3 UK
4 France
1 USA
6 India
5 China
Agni Launch
22 May 1989 (6th in Rank)
IRBM Club
NUCLEAR
2 USSR
3 UK
1 USA
4 France
6 India
5 China
Nuclear Test
11 May 1998 (6th in Rank)
Nuclear Weapon State
CRUISE MISSILE FAMILY
FIRST IN THE WORLD
BRAHMOS LAUNCH
(JV with Russia)
12 June 2001
Now with Multiple Variants
BROKE 5th COUNTRY SYNDROME
1980
1990
2000


MISSILE POWER
LONG RANGE BALLISTIC MISSILES
700 TO 5000 KM
SHORT RANGE BALLISTIC MISSILES
300 TO 700 KM
CRUISE MISSILE (STRIKE WEAPON)
BRAHMOS
LAND TO LAND
LAND TO SEA
SEA TO SEA
SEA TO LAND
UNDERWATER
AIR TO GROUND
AIR DEFENCE
AKASH
BALLISTIC MISSILE DEFENCE
AAD
PAD
TACTICAL MISSILES
ASTRA
NAG
NIRBHAY
PRAHAAR



BrahMos Aerospace CSR Programme
Catalyzed by VK-nardep

I. Solar electrification to hamlets near Dhanushkodi village –Rameswaram

The total capacity of the project activity: 4 kWp


Solar Panels

4-Watts LED supplied to eighty houses.


Four watts led lighting up the thatched hut

25 Watts LED Street Lights (6)


Galvanized Iron pipe (with Spl. Anti Corrosive Aluminium Paint) fitted in concrete

Solar Power Station housed in Mandapam Panchayat Middle School


24W 500 AH- 4 Batteries Back-up for 12 Hrs.

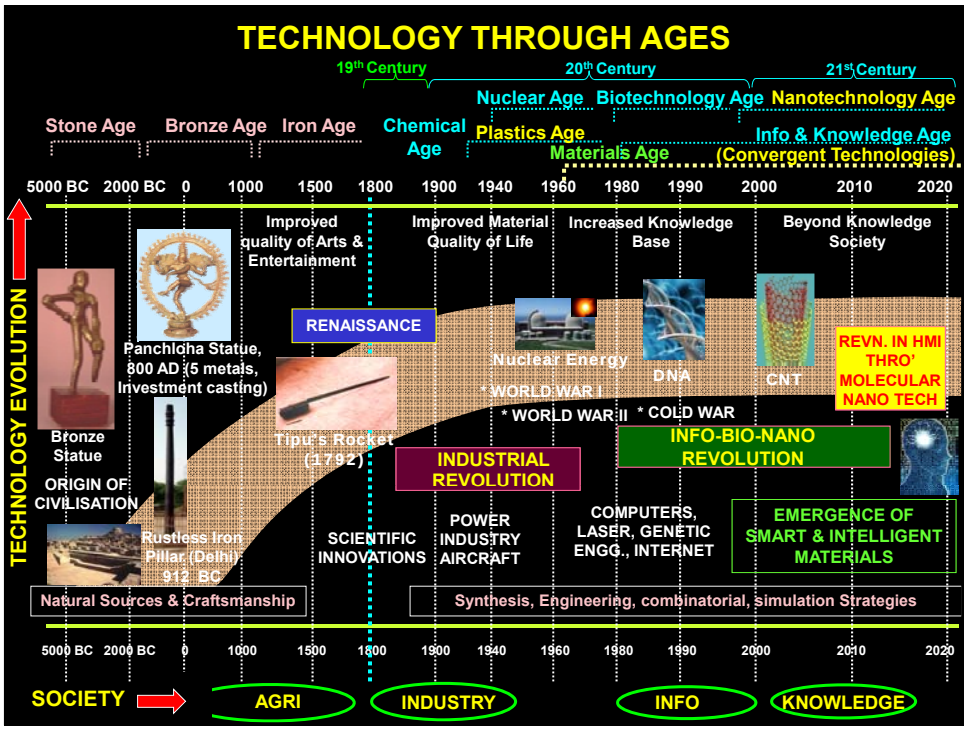

Battery Charger with proper cables


Maintenance of batteries by Local stakeholders

II. Renewable Energy (Installation of Solar energy & Bio-Methanation plants) & Renovation of Ramar Teertham

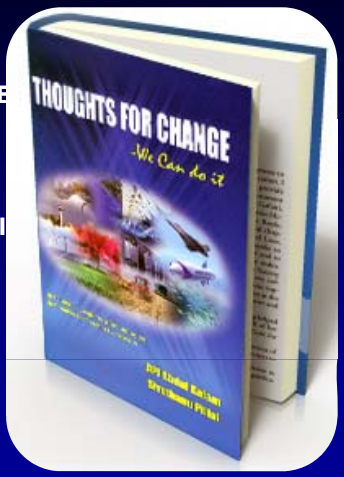
Project Cost: Rs.1.02 Crs. ; Project Duration: 6 months


BRAHMOS
SUDHARSHAN CHAKRA
Venturing into the Hypersonic World
...where Speed is the POWER !
There is nothing like a dream to create the future.


TECHNOLOGY THROUGH AGES
19th Century
20th Century
21st Century
Stone Age
Bronze Age
Iron Age
Chemical Age
Nuclear Age
Plastics Age
Biotechnology Age
Nanotechnology Age
Materials Age
Info & Knowledge Age (Convergent Technologies)
5000 BC
2000 BC
0
1000
1500
1800
1900
1940
1960
1980
1990
2000
2010
2020
TECHNOLOGY EVOLUTION
Improved quality of Arts & Entertainment
Improved Material Quality of Life
Increased Knowledge Base
Beyond Knowledge Society
Panchloha Statue, 800 AD (5 metals, Investment casting)
RENAISSANCE
Nuclear Energy
DNA
CNT
REVN. IN HMI THRO' MOLECULAR NANO TECH
Bronze Statue
ORIGIN OF CIVILISATION
Tipu's Rocket (1792)
* WORLD WAR I
* WORLD WAR II
* COLD WAR
INDUSTRIAL REVOLUTION
INFO-BIO-NANO REVOLUTION
Rustless Iron Pillar (Delhi) 912 BC
SCIENTIFIC INNOVATIONS
POWER INDUSTRY AIRCRAFT
COMPUTERS, LASER, GENETIC ENGG., INTERNET
EMERGENCE OF SMART & INTELLIGENT MATERIALS
Natural Sources & Craftsmanship
Synthesis, Engineering, combinatorial, simulation Strategies
SOCIETY
AGRI
INDUSTRY
INFO
KNOWLEDGE

FUTURISTIC THRUST AREAS

- ROBOTICS & AUTONOMOUS SYSTEMS
- SPACE BASED INTELLIGENCE, SURVEILLANCE RECONNAISANCE
- KINETIC ENERGY WEAPONS
- PRECISION DELIVERY SYSTEMS – SUPERSONI MISSILES
- STEALTH SYSTEMS – INVISIBILITY
- SMART MATERIALS
- NANO DEVICES / SENSORS
- PHOTONICS
- CYBER SECURITY



ROBOTICS

Unmanned Air Vehicle (UAV)

MICRO UAV

Remotely Operated Vehicle

Legged and Wheeled Robot

Humanoid Soldier

Battle Tank

Unmanned Ground Vehicle

Unmanned Sea Vehicle

DIMENSIONS OF COMPETITIVENESS

- Innovation in product design & manufacturing process
- Leap-Frog Technologies
- Quality Standards, Procedures & Certification

PRODUCT EXCELLENCE
- Performance
- Quality
- Reliability

COST EFFECTIVENESS
- Product upgrades

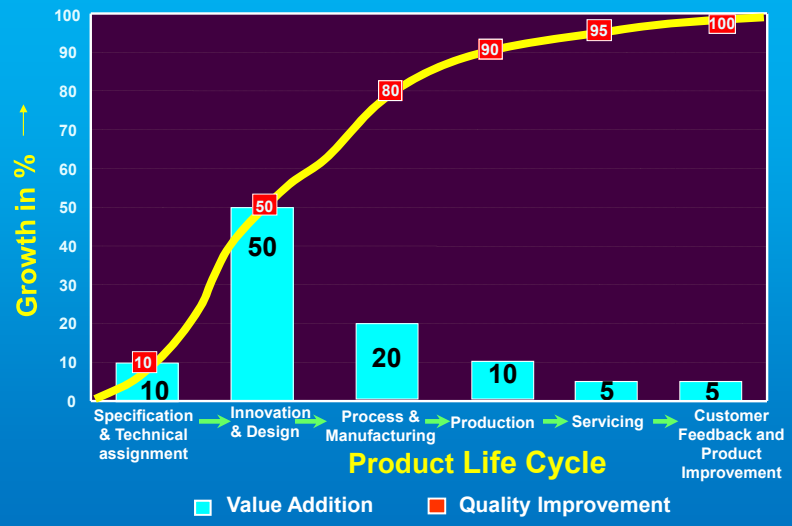
BRAND IMAGE

- Continuous upgradation of product performance
- Value Engg. & Cost control measures
- Effective Life Cycle Mgmt.

DELIVERY IN TIME
- Required Quantity Production on demand

- Production Infrastructure
- Adequate skilled manpower
- Networked Contractors Management with tight control on quality, schedule & cost
- Enterprise Resource Planning & Supply Chain Management

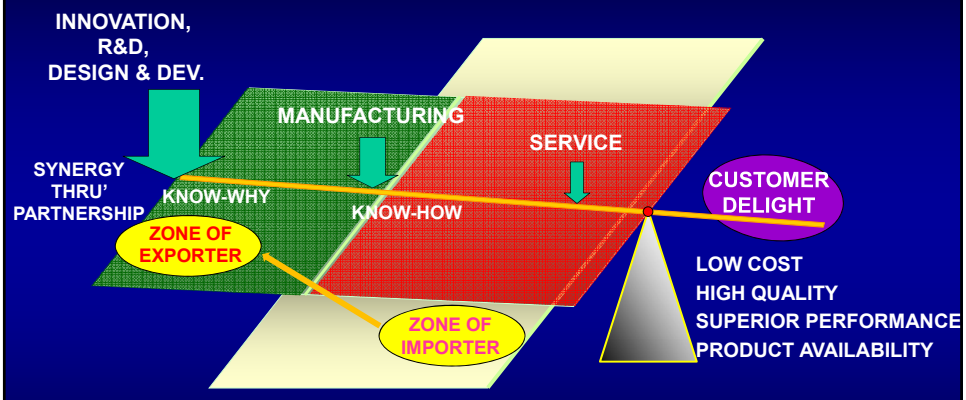
ACHIEVING COMPETITIVENESS



DESIGN & MANUFACTURING ARE POWERED BY INDUSTRIAL INFRASTRUCTURE, SKILLED HUMAN RESOURCE AND CORE COMPETENCE

COMPETITIVE EDGE

PRODUCT LEADERSHIP THROUGH INNOVATION



Indian Manufacturing sector must give a shift from the zone of importer to zone of exporter

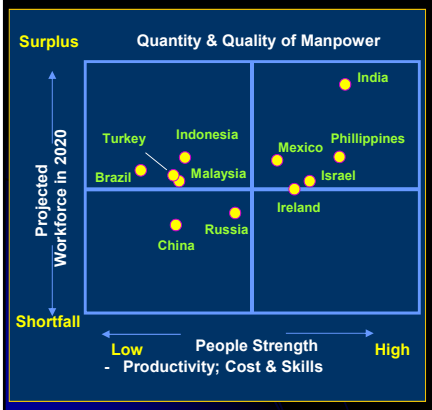
INDIA'S KNOWLEDGE POTENTIAL

Presently India has 600 Mn youngsters below 35 years

Large Number of talented Youth with higher education are required Globally

India Advantage

- Over 610 Univ. & 32000 colleges
- 1 Mn highly qualified Professionals / Year
- Large English speaking population



Source: World Competitiveness Yearbook 2001; Britannica Yearbook; Literature search; BCG analysis

Universities and Education with Value System revolves around

TWO GLOBAL HUMAN RESOURCE CADRE

World Class Skill

Higher Education with Research

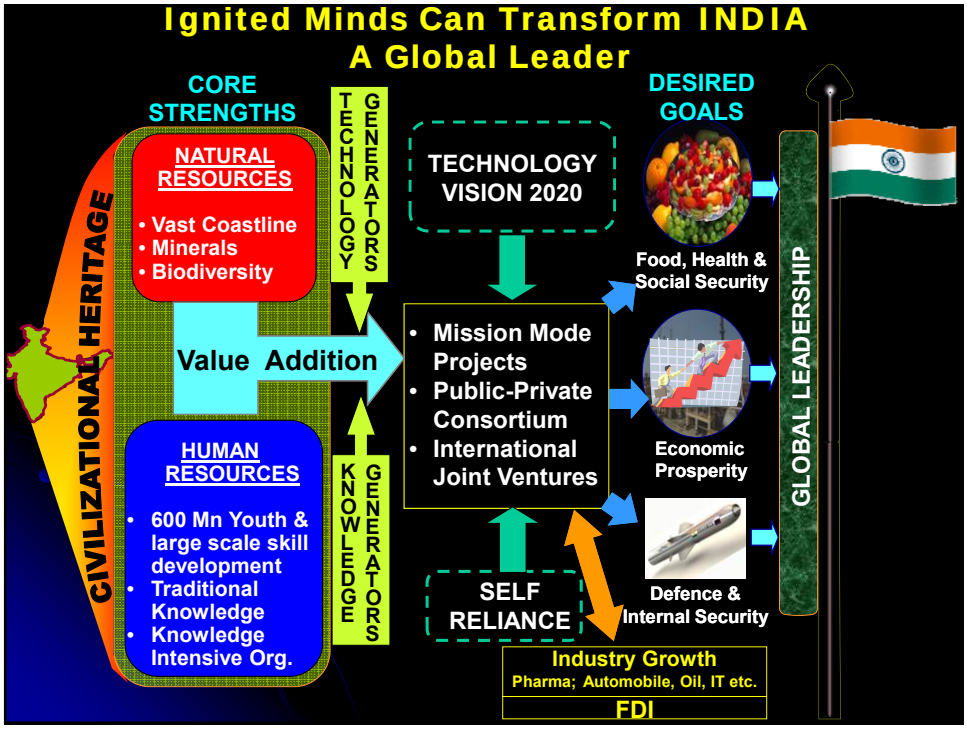
Manufacturing Sector

Services Sector

Knowledge based Products & systems

ACTION PLAN FOR SELF RELIANCE IN DEFENCE SYSTEMS

- **Establish Military Industry Complex (MIC)**
  - *Enlisting large, medium & clusters of industries to be partners along with Defence PSUs as members of MIC*
  - *Formulating procedures which will enable participation of cluster of industries to respond to RFP to design, develop and produce the systems (Irrespective of Private or Public)*
  - *Govt. funding for R&D (Also to Private companies)*
  - *Bring regulations and control procedures like USA managing private industries for manufacturing of defence systems*
  - *Create an MIC Authority to oversee building up production capability and capacity within India*
- **Govt. policy to encourage maximum indigenous systems in Armed Forces**
- **Encourage high technology tie-ups / JVs between Indian and other global defence industries for achieving competitiveness & for export**
- **Formulation of policy for export of high technology systems**


Ignited Minds Can Transform INDIA
A Global Leader
CORE STRENGTHS
CIVILIZATIONAL HERITAGE
NATURAL RESOURCES
• Vast Coastline
• Minerals
• Biodiversity
HUMAN RESOURCES
• 600 Mn Youth & large scale skill development
• Traditional Knowledge
• Knowledge Intensive Org.
TECHNOLOGY GENERATORS
KNOWLEDGE GENERATORS
Value Addition
TECHNOLOGY VISION 2020
• Mission Mode Projects
• Public-Private Consortium
• International Joint Ventures
SELF RELIANCE
DESIRED GOALS
Food, Health & Social Security
Economic Prosperity
Defence & Internal Security
GLOBAL LEADERSHIP
Industry Growth
Pharma; Automobile, Oil, IT etc.
FDI


NATIONAL SELF-RELIANCE MISSION
•Defence Strategy Doc.
•Defence Export Policy
High-end R&D Collaborations
Joint Ventures
WEALTH THROUGH EXPORTS
R&D Orgns.
REVERSE BRAIN DRAIN
Tech. Business Incubators
Military Industry Complex
FDI Inflow
STRONG ADVANCED TECHNOLOGY BASE
ACADEMY
SYNERGY
INDUSTRY
• HIGH TECH RESEARCH
• WORLD CLASS LABS
R&D AND GLOBALLY COMPETITIVE PRODUCTS
COMPETITIVENESS
STATE OF THE ART MILITARY SYS.
INCREASED INDUSTRIAL OUTPUT
ENHANCED ECONOMIC PROSPERITY& SECURITY
NATION IS BIGGER THAN INDIVIDUAL


THANK YOU
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