

Nation's Prosperity & Innovative Leadership

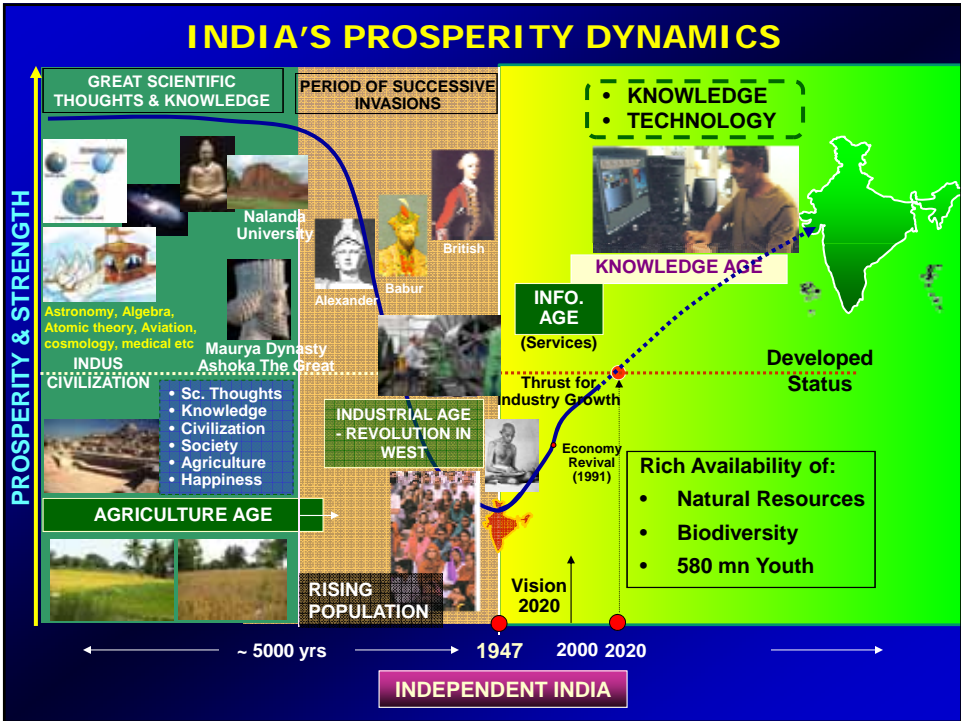
*Special Address in
21st Global Symposium on
Linking Project Mindset to Nations Prosperity*

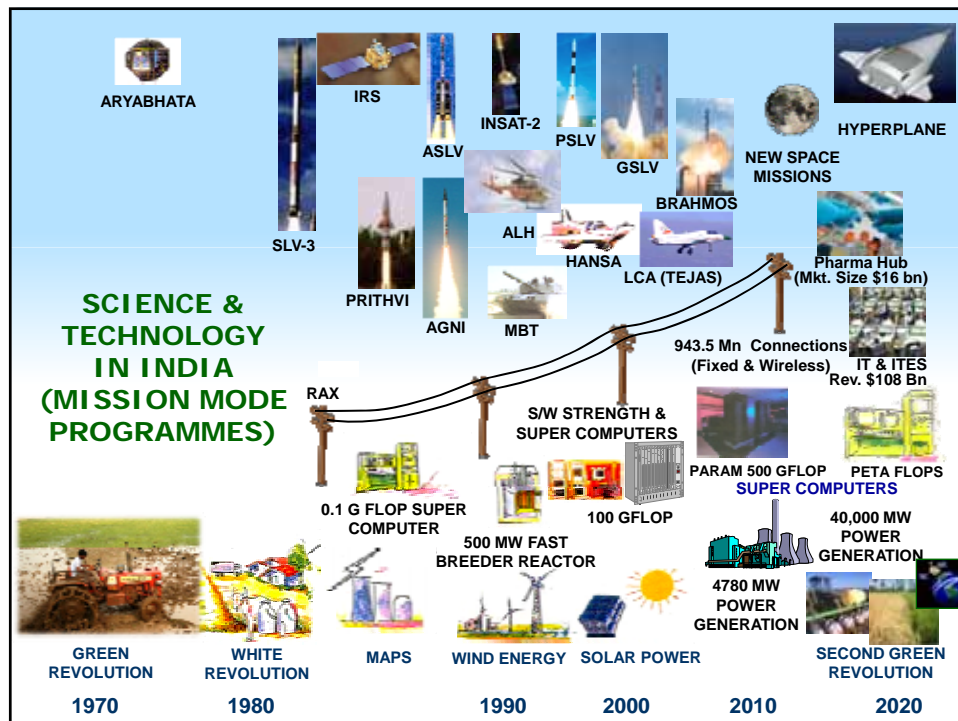
BY

Dr. A. SIVATHANU PILLAI


**Distinguished Scientist & Chief Controller (R&D) DRDO
Chief Executive & Managing Director, BrahMos Aerospace**

03 December 2013





GREEN REVOLUTION




C. SUBRAMANIAM


- VISIONARY LEADERSHIP FOR INDIA'S SELF-SUFFICIENCY IN FOOD GRAINS
- TWO MAJOR OBJECTIVES:
 - INTRODUCE S&T IN AGRICULTURE
 - ESTABLISH PRICING POLICY TO MOTIVATE FARMERS FOR ENHANCING PRODUCTION
- REORGANISATION OF AGRI. RESEARCH IN COUNTRY

OBJECTIVES

- CONTINUED EXPANSION OF FARMING AREAS
- DOUBLE CROPPING EXISTING FARMLAND
- USING SEEDS WITH IMPROVED GENETICS



NOBEL LAUREATE
PROF. NORMAN E BORLAUG




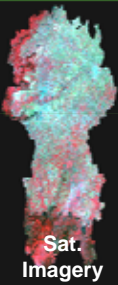


M.S. SWAMINATHAN

LEADERS

- HIGH YIELD, CROSS-BREED WHEAT & RICE VARIETIES DEVELOPED
- HIGH PRODUCTIVITY OF GRAINS

AGRICULTURE MISSION

FIRST GREEN REVOLUTION	AGRICULTURE MISSION	SECOND GREEN REVOLUTION
SEED		SOIL CHARACTERISATION
FERTILISERS		MATCHING THE SEED
WATER MANAGEMENT		FERTILISER MANAGEMENT
TRAINING FARMERS		WATER MANAGEMENT
CULTIVATION MANAGEMENT		CULTIVATION
HARVEST & POST HARVEST		POST HARVESTING (SILOS)
OUTPUT = GRAIN (TARGET: 230 MT PER ANNUM)		GRAIN PRODUCTION TARGET(2020) 400 MT PER ANNUM
PRODN.: 241.6 MT		FOOD PROCESSING (Value Addition)
		MARKETING
		INCREASED USE OF S&T

WHITE REVOLUTION



VARGHESE KURIEN

SCIENTIFIC & PROFESSIONAL MGMT. THAT ESTABLISHED DIRECT LINKAGE BETWEEN PRODUCER AND CONSUMER

- ACHIEVED SELF SUFFICIENCY THRO' COOPERATIVE MOVEMENT
- LARGEST PRODUCER OF MILK IN THE WORLD (127 mn. tonnes) 
- LARGEST POPULATION OF CATTLE IN THE WORLD
- FUTURE OF INDIAN DAIRY INDUSTRY: To establish long term export that benefit dairy industry:
 - maintain the current growth rate of milk production
 - remain globally competitive

INDUSTRY AND EDUCATION



Jamshetji Nusserwanji Tata

- FOUNDER OF STEEL INDUSTRY IN INDIA, BANKING, POWER AND MANY OTHERS
- ESTABLISHED INDIA'S MOST ADVANCED SCIENCE INSTITUTE (IISc)
- GUIDED THE DESTINY OF INDIA'S LARGEST BUSINESS HOUSE








NOW: TATA STEEL BUYS CORUS



INDIA - A STEEL GIANT




EVOLUTION OF NUCLEAR INDIA





H.J. Bhabha

1/3rd of World Reserves of Thorium in India




KOODANKULAM






Accelerator Driven System (ADS)


URANIUM SUPPLY FROM NSG



FUEL REPROCESSING PLANT



PRESSURISED HEAVY WATER REACTOR




FAST BREEDER TEST REACTOR

POWER GENERATION

PRESENT 4780 MW

BY 2020 40000 MW



POKHRAN II, PEACEFUL NUCLEAR EXPLOSION

NUCLEAR WEAPON STATE

NUCLEAR POLICY

- NO FIRST USE
- NO USE AGAINST NON-NUCLEAR COUNTRIES
- MINIMUM CREDIBLE DETERRENT

- NUCLEAR AGRICULTURE, FOOD IRRADIATION
- WATER MANAGEMENT
- NUCLEAR MEDICINE
- SPIN-OFF TECHNOLOGIES (SUPER COMPUTER, ROBOTIC SYSTEMS etc.)

Present 2020

WORLD'S FIRST WAR ROCKET

TIPU'S WAR AGAINST BRITISH (SRIRANGAPATNA 1792)



Indian rocket barrage defeats British cavalry attack in 1792






Royal Artillery Museum, Woolwich (Original Rockets used in War)

- 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

INDIA'S SPACE PROFILE

Space is the potential resource for the development of India




Dr. Sarabhai




Prof. Dhawan

EVOLUTION OF LAUNCH VEHICLES




Sounding Rockets SLV-3 First Sat Launch Vehicle ASLV PSLV GSLV GSLV MkIII


Moon Mission (Chandrayaan-I)



Mars Mission

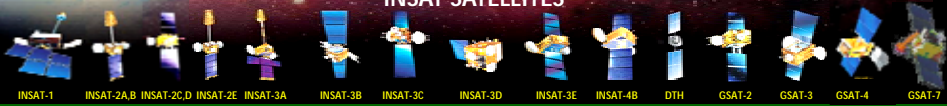


REMOTE SENSING



Bhaskara RS-D1 IRS-1A/1B IRS-P2 IRS-P3 IRS-1C/1D IRS-P4 MEGHA TROPICUES IRS-P5 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
- Cost effective launch vehicle service
- Space Tech. appls. for national development
- Capability to launch multiple satellites
- Satellite Recovery capability for re-entry mission
- Global competitive space power

EVOLUTION OF INDIA AS A MISSILE POWER

(IGMDP - JULY 1983)



Dr. APJ Abdul Kalam

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.
- CUSTOMER DELIGHT




PRITHVI
(SRBM)




AGNI
(IRBM)



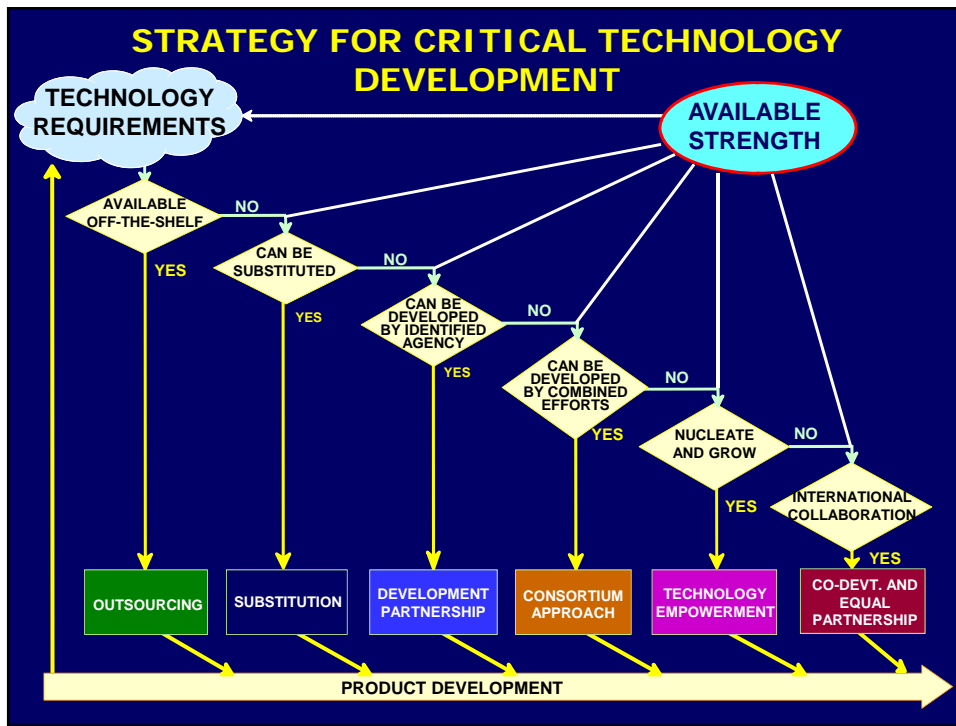
NAG
(3RD GEN. ATGM)

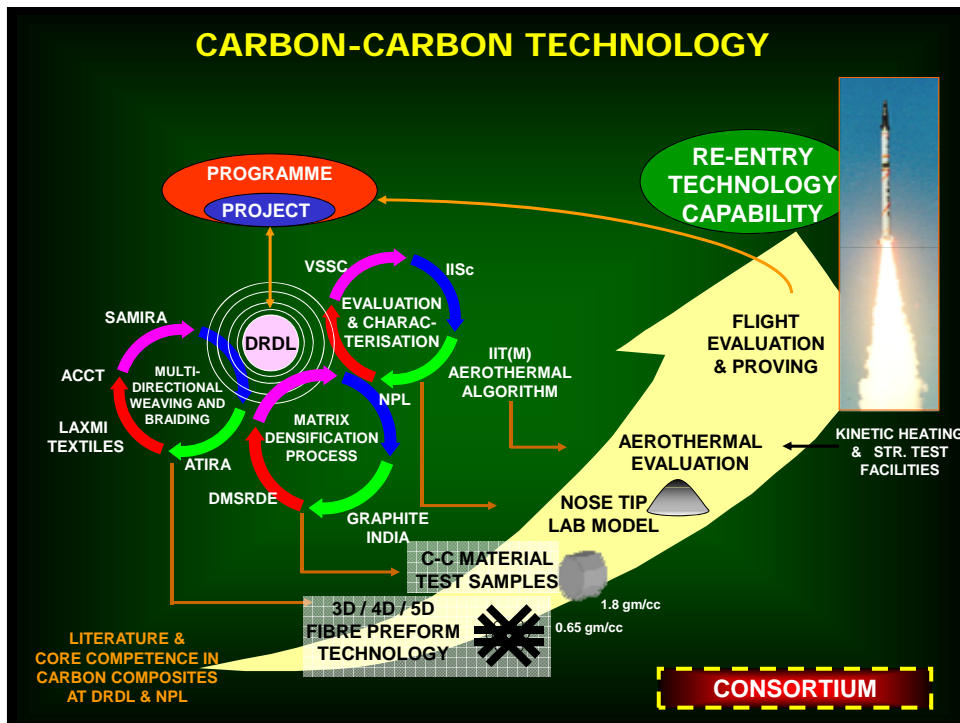
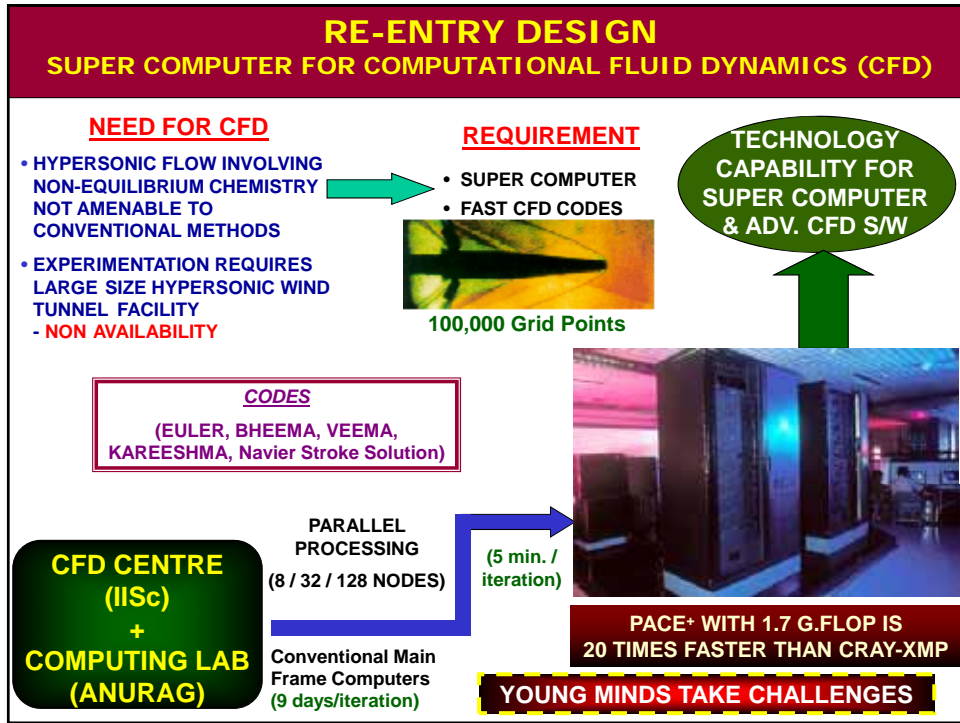


AKASH
(AREA DEFENCE SYS.)



TRISHUL
QUICK REACTION,
AIR DEFENCE MISSILE





MISSILE POWER

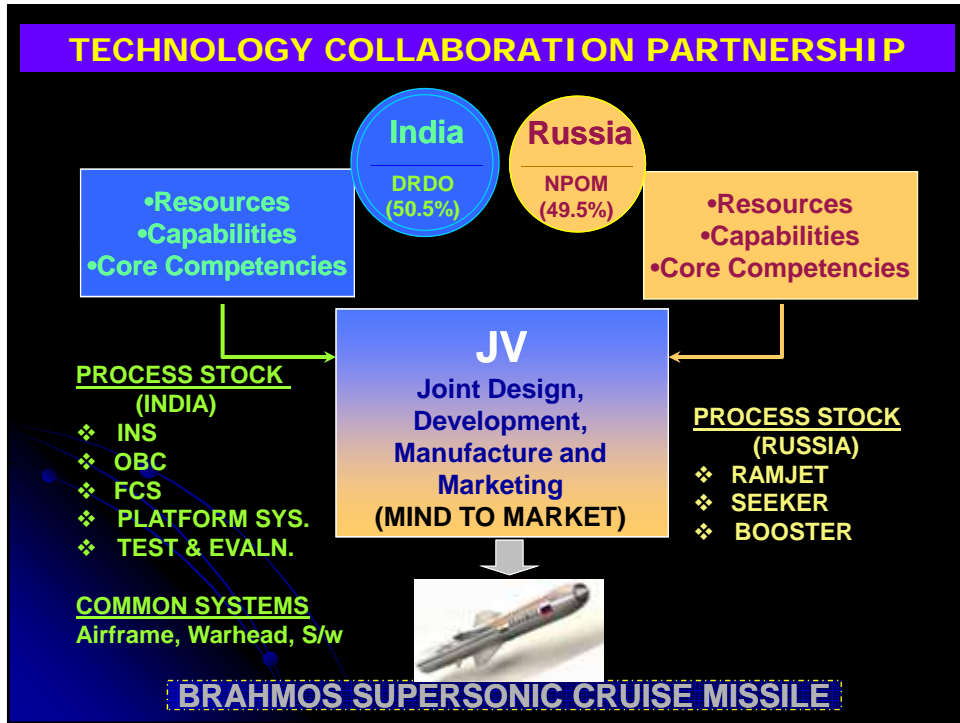
<p style="text-align: center; color: yellow;">LONG RANGE BALLISTIC MISSILES</p>  <p style="text-align: center;">700 TO 5000 KM</p>	<p style="text-align: center; color: yellow;">CRUISE MISSILE (STRIKE WEAPON)</p>    <p style="text-align: center; color: white;">BRAHMOS</p> <p style="text-align: center; color: white;">LAND TO LAND LAND TO SEA SEA TO SEA SEA TO LAND UNDER WATER AIR TO GROUND</p>	<p style="text-align: center; color: yellow;">AIR DEFENCE</p>  <p style="text-align: right; color: white;">AKASH</p> <p style="text-align: center; color: yellow;">BALLISTIC MISSILE DEFENCE</p>  <p style="text-align: center; color: white;">AAD</p>  <p style="text-align: center; color: white;">PAD</p> <p style="text-align: center; color: yellow;">TACTICAL MISSILES</p>  <p style="text-align: center; color: white;">ASTRA</p>  <p style="text-align: center; color: white;">NAG</p>  <p style="text-align: center; color: white;">NIRBHAY</p>  <p style="text-align: center; color: white;">PRAHARIC</p>
<p style="text-align: center; color: yellow;">SHORT RANGE BALLISTIC MISSILES</p>  <p style="text-align: center;">300 TO 700 KM</p>		

FORMATION OF BrahMos JOINT VENTURE

- JV formed thru' an IGA on 12th Feb 1998 with DRDO & NPOM as Shareholders with authorised capital of \$250 million at the ratio of 50.5:49.5.



- Tripartite Agreement signed between DRDO, NPOM & BrahMos identifying the share of work & Process Stocks based on the core technological strength



BRAHMOS

NAVAL VERSION





Launch from Surface Ship U/W Launch

System Installed in 8 Ships **Sea to Sea** **Sub Sea to Sea**
Sea to Land **Land to Sea**

READY FOR DEPLOYMENT

AIR VERSION



DEVELOPMENT COMPLETED




Nose Cap Fins



Booster



Launcher

FLIGHT TRIALS IN 2014

BRAHMOS BLOCK-II

Land Target with Discrimination and Surgical Strike Capability



Applications:
Land to Land
Desert Warfare and Urban Warfare

BRAHMOS BLOCK-III

High Maneuverability and Superior Steep Dive



Applications:
Land to Land
Mountain Warfare
Surgical Strike Capability

ARMY VERSION



Steep Dive Capability Established

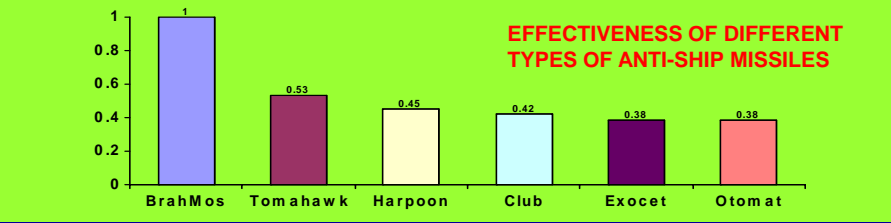
2 REGIMENTS OPERATIONAL

READY FOR DEPLOYMENT

TOMAHAWK Vs. BRAHMOS

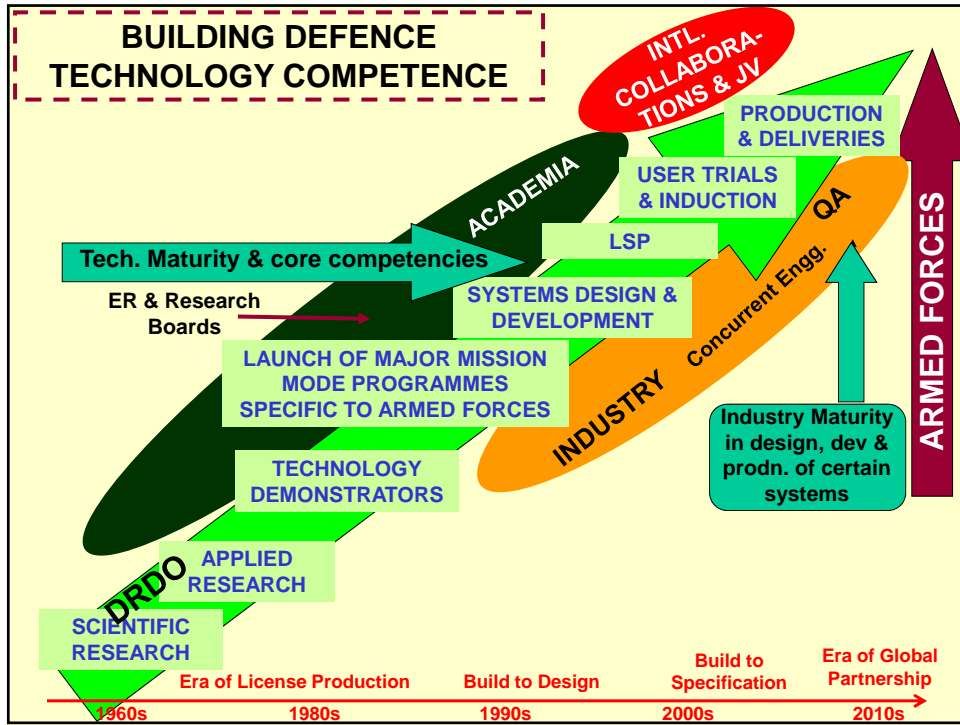
	TOMAHAWK	BRAHMOS
Speed	0.8 Mach	2.8 Mach
Time to hit the target	1 unit	1/3 rd (Faster engagement)
Kinetic Energy	1 unit	9 times. (High Destructive Power)
Target Dispersion (Moving targets)	1 unit	1/3 rd (Probability of hit is high)
Reaction Time	1 unit	1/3 rd (Pierces the Defence)
Universality	Nil	Same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

EFFECTIVENESS OF DIFFERENT TYPES OF ANTI-SHIP MISSILES



Missile Type	Effectiveness
BrahMos	1.0
Tomahawk	0.53
Harpoon	0.45
Club	0.42
Exocet	0.38
Otomat	0.38

BRAHMOS – WORLD LEADER IN CRUISE MISSILE FAMILY



BRAHMOS MISSILE INDUSTRY CONSORTIUM A BLEND OF PUBLIC – PRIVATE ENTERPRISES

Wing **Fins**

Air Frame **Nose Cap**

GODREJ

C.P.H.S.

Air Frame Sections **Radome** **Internal Nose cap**

LAUNCHERS **L&T** **FCS**

ENGINE PRODUCTION **MOBILE AUTONOMOUS LAUNCHER**

CANISTER

Transmitter

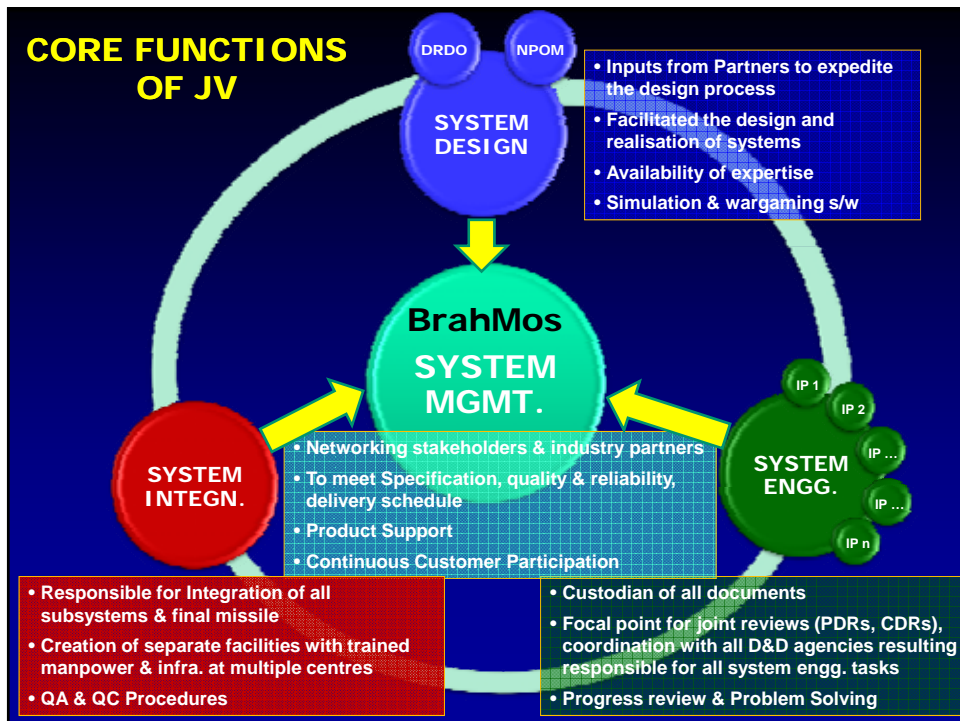
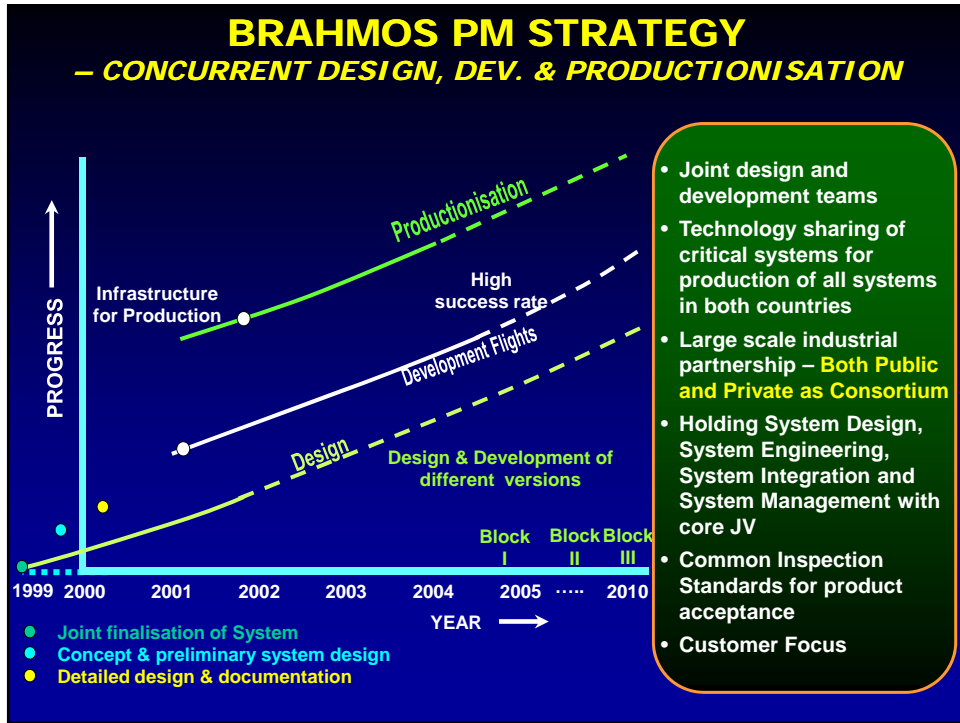
Telemetry **INS Electronics** **INS**

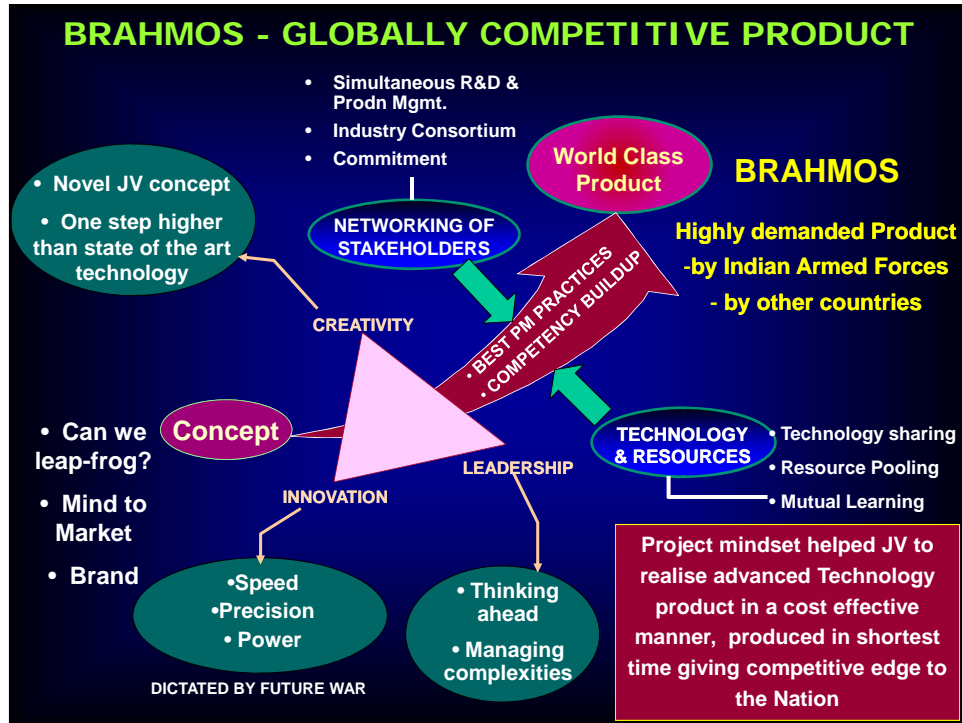
HAL & ANANTH TECH.

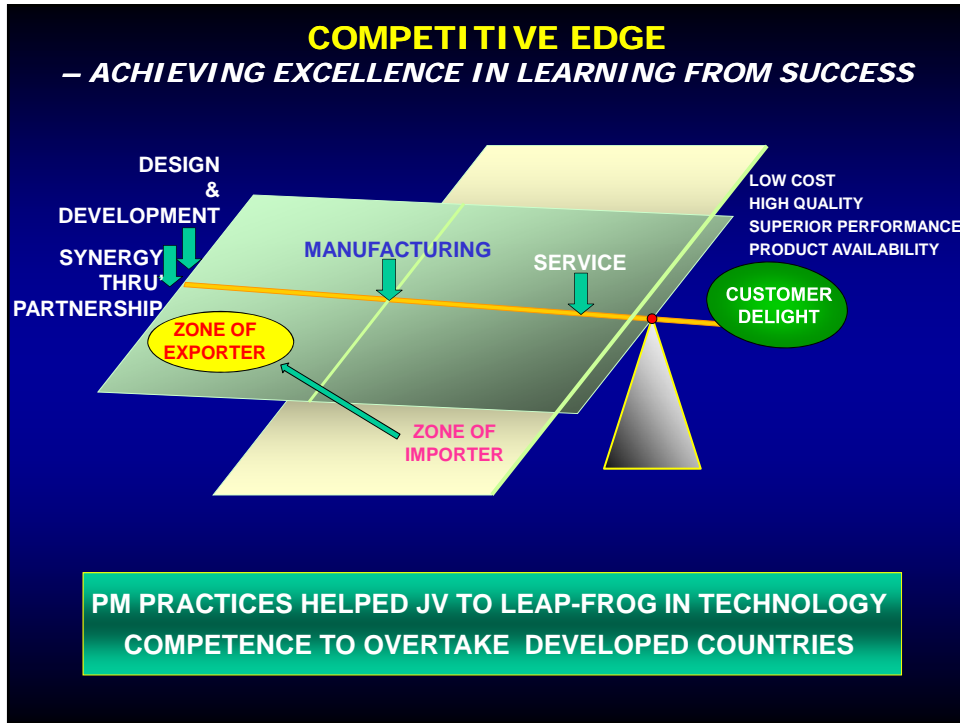
Astra Microwave **Fire Control System (Land version)**

Data Patterns

OBC & MIU







Thank you

aspillai@brahmos.com