VISION FOR
DEFENCE MANUFACTURING INDUSTRY

Presentation in
DEFTRONICS 2014

BY

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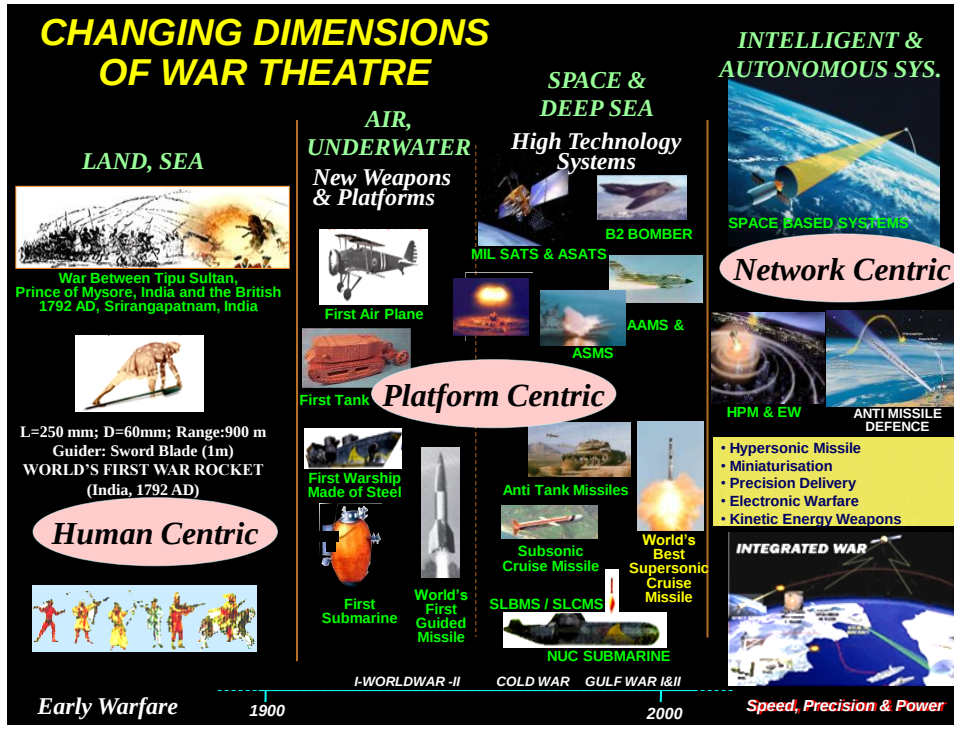
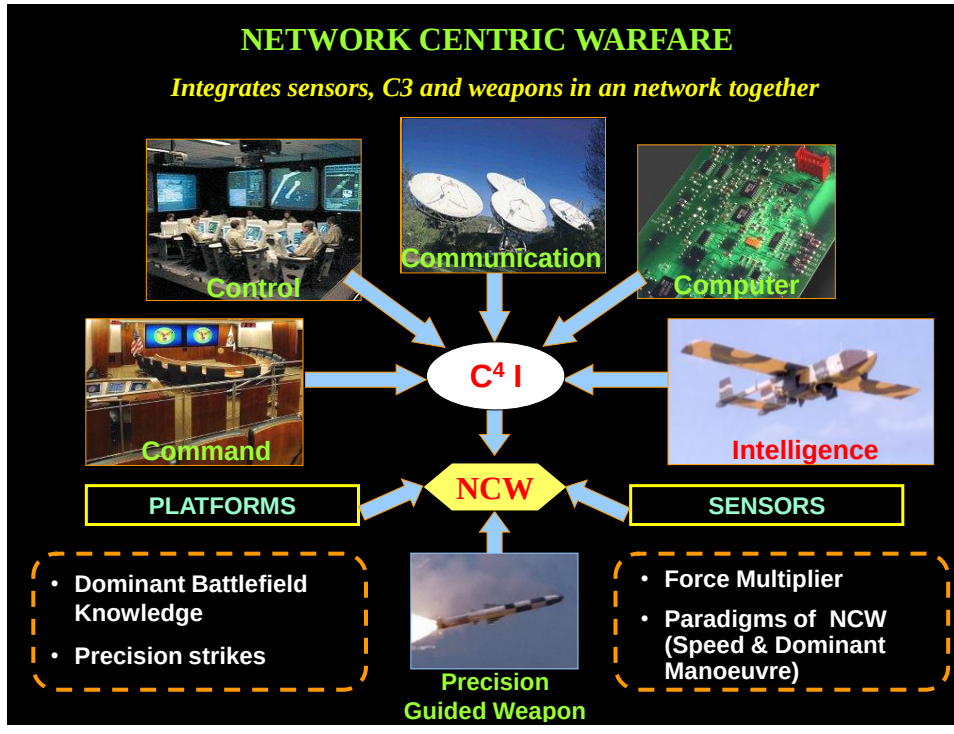
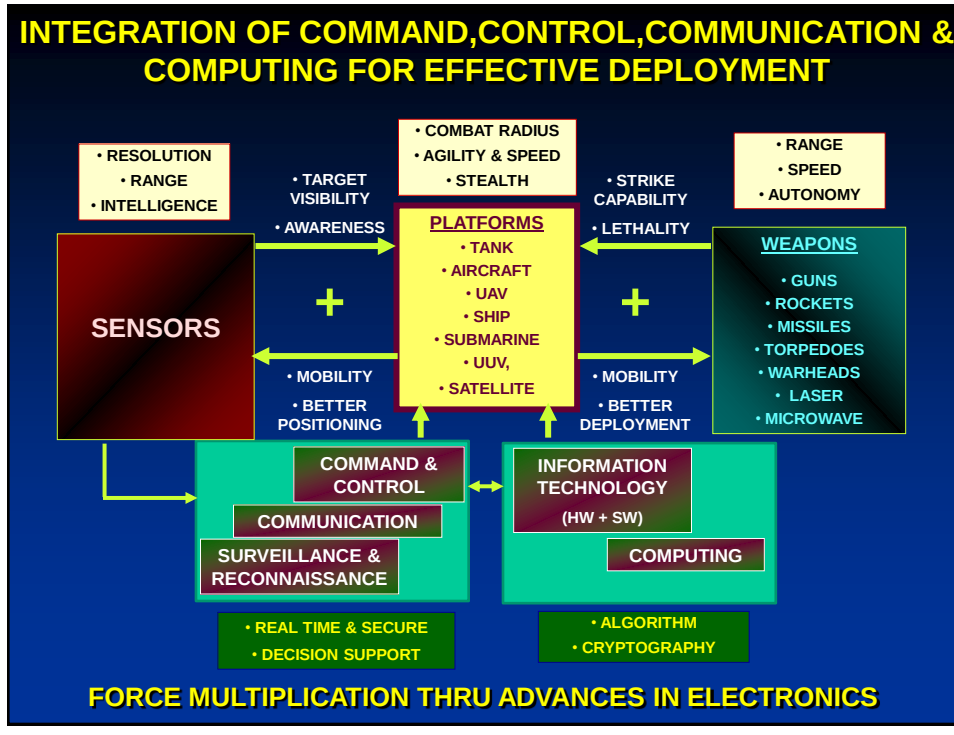
23 September 2014




NETWORK CENTRIC WARFARE
Integrates sensors, C3 and weapons in an network together
Control
Communication
Computer
Command
C4 I
Intelligence
NCW
PLATFORMS
SENSORS
• Dominant Battlefield Knowledge
• Precision strikes
Precision Guided Weapon
• Force Multiplier
• Paradigms of NCW (Speed & Dominant Manoeuvre)


INTEGRATION OF COMMAND,CONTROL,COMMUNICATION & COMPUTING FOR EFFECTIVE DEPLOYMENT
• RESOLUTION
• RANGE
• INTELLIGENCE
• TARGET VISIBILITY
• AWARENESS
• COMBAT RADIUS
• AGILITY & SPEED
• STEALTH
• STRIKE CAPABILITY
• LETHALITY
• RANGE
• SPEED
• AUTONOMY
SENSORS
PLATFORMS
• TANK
• AIRCRAFT
• UAV
• SHIP
• SUBMARINE
• UUV,
• SATELLITE
WEAPONS
• GUNS
• ROCKETS
• MISSILES
• TORPEDOES
• WARHEADS
• LASER
• MICROWAVE
• MOBILITY
• BETTER POSITIONING
• MOBILITY
• BETTER DEPLOYMENT
COMMAND & CONTROL
COMMUNICATION
SURVEILLANCE & RECONNAISSANCE
INFORMATION TECHNOLOGY
(HW + SW)
COMPUTING
• REAL TIME & SECURE
• DECISION SUPPORT
• ALGORITHM
• CRYPTOGRAPHY
FORCE MULTIPLICATION THRU ADVANCES IN ELECTRONICS

LCA TECHNOLOGIES

High performance Engine
- GE-F404-F2J3
- GE-F404-IN 20
- 'Kaveri' Engine

USMS

- Dual redundant processor

Zero-Zero Ejection Seat

- Martin Baker

Advanced Avionics
- Open architecture Avionics System
- Dual redundant MIL-1553 B Databus
- Dedicated Stores Data Buses
- Easy role change

Stealth
- Low RCS
- Low IR signature

Advanced sensors
- MMR
- HMDS
- LDP

Quad-digital FCS
- Low PLOC
- High MTBF

Glass Cockpit

- 3 MFDs
- HUD with MF-UFCP
- 2 SSDUs (EFI & GUH)
- Reduced pilot load

General Systems

- Carbon Brake Disc
- 4000 PSI Hydraulic System
- ECS for tropical climate
- In-flight refuelling

Advanced Materials
- Composite Wings, Fuselage, Doors & Hatches
- Co-bonded co-cured fin & rudder
- Reduced part count & weight
- Increased life
- Reduced signatures

Unstable configuration
- Fixed & scheduled gain CLAW
- High agility & maneuverability
- Advanced carefree maneuvering

Project VETRIVALE : Indigenous avionics for Sukhoi 30 MKI (DARE)

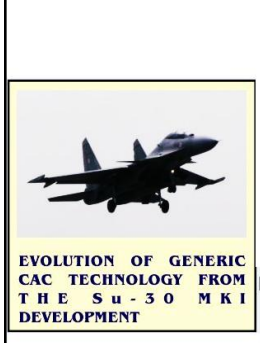
Mission computer

R118 High Accuracy Direction Finder

Display processor

Radar computer

INDIGENOUS UPGRADES FOR AIRCRAFT (DARE+Industry)



EVOLUTION OF GENERIC CAC TECHNOLOGY FROM THE Su-30 MKI DEVELOPMENT

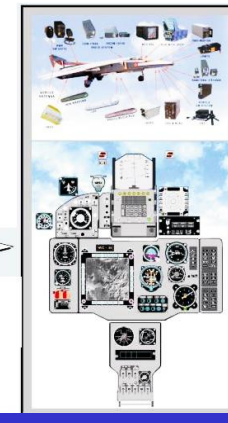
SUCCESSFUL ADOPTION OF CAC FOR JAGUAR UPGRADE PROGRAMME BY HAL

EVOLVED

ADOPTED

CURRENT

FUTURISTIC



FUTURE ADOPTION FOR MiG-29 UPGRADE & POSSIBLE USAGE ON MIRAGE 2000, ALH & IJT

MiG 27 Highlights

- Mission computing, Cockpit Displays & Weapon cueing
- Improved PVI & Night Flying capability

TARANG RWR – A STANDARD WARNER ON ALL AIRCRAFT (DARE+Industry)

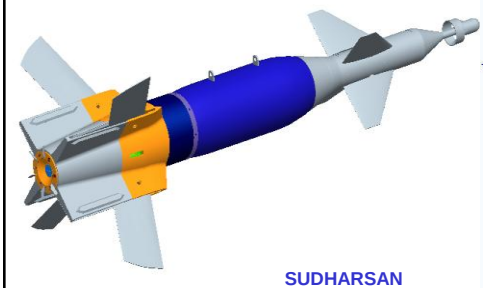
Airborne Early Warning & Control System (AEW&CS)

PARTNERS

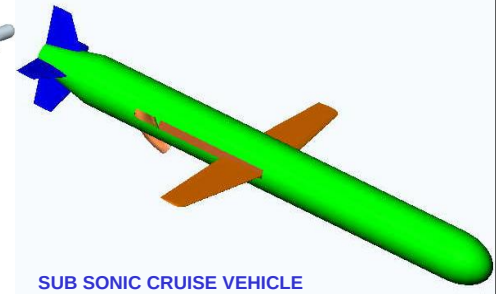
- CABS - Overall Program Mgmt, Integration & dev. of data handling system, displays, mission computers et al.
- LRDE and DEAL - Primary radar, and IFF
- DEAL - Communication Systems and Data Link
- DARE - Self Protection suite, EW & CSM
- DLRL - Self Protection suite (counter measures)

- Airborne Early Warning
- Sea Surveillance
- Airspace Management
- Electronic Intelligence
- Battle Management
- Identification Threat Assessment
- Search & Rescue

MAJOR ADE PROGRAMS : AIR VEHICLES BEING DEVELOPED

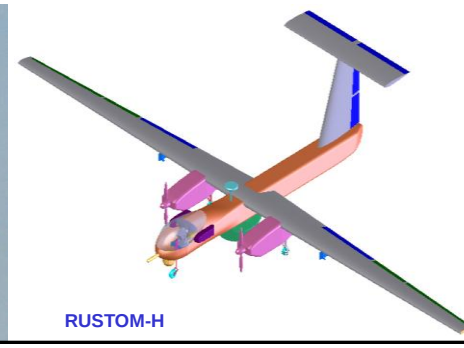


SUDHARSAN



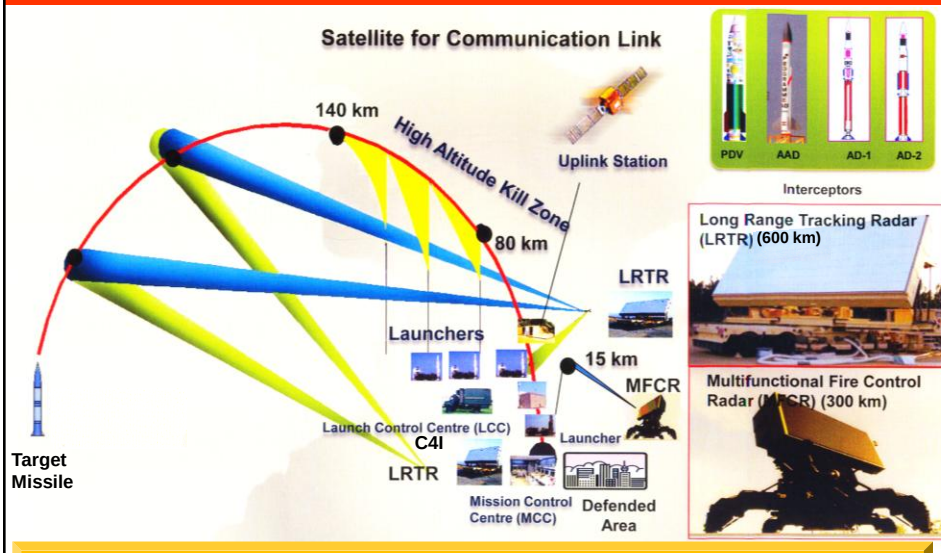
SUB SONIC CRUISE VEHICLE

RUSTOM-1



RUSTOM-H

BALLISTIC MISSILE DEFENCE



Neutralise Long Range Ballistic Missile threat

Twin Layered Defence System, Engage 6 Targets Simultaneously

RADARS & ELECTRONIC WARFARE SYSTEMS

- Integrated EW Programme
- Freq. coverage HF to MMW
- Recce of freq. spectrum, DF, Location Fix
- GIS & Vector Map presentation
- Total logistic support to User Services


3-D CAR


WEAPON LOCATING RADAR


SUPER VISION 2000 MARITIME PATROL RADAR


SAMYUKTA


SANGRAHA


BHARANI


BFSR


CNR


RAJENDRA


SUJAV

UNDERWATER SENSORS

SHIP BASED

HUMSA / APSOH

NAGAN

HUMVAD

SUBMARINE BASED

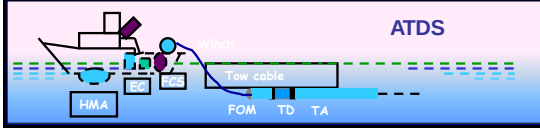
USHUS

PANCHENDRIYA

MIHIR

Sonobuoys

SIMHIKA



LFDS

SEA BED ARRAYS

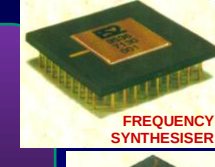
ADVANCED COMPUTING SYSTEMS & COMPONENTS

ANUPAMA PCI CARD

ANUSIG

PACE ++ 128 NODE

- Parallel Processing Tech.
- System engg, integration
- General purpose microprocessors
- 1-μ CMOS fabrication Tech.
- Design & dev. of VLSI chips & SOC dev.
- Processor related technology
- System s/w dev. for custom made processors



FREQUENCY SYNTHESISER

CMUL
(Complex Multiplier)

PARAM SUPER COMPUTER

LNPR
(Low Noise Pre Amplifier)

MMAC
(Multichannel Multiplier Accumulator)

FMAC
(Fast Multiplier Accumulator)

MICRO ELECTRONIC DEVICES

- Secure Supercomputing Grid : CHITRA Facility 40 Teraflops
- Indigenous Processor based Systems

- Semiconductor devices for Infrared, Microwave, Millimeter wave, laser etc
- Smart Sensors

E-Nasika

- Microwave Tubes MPM for AKASH& EW Systems
- Helix TWT for TEMPEST EW
- High Power Microwave Sources & Directed Energy Weapons

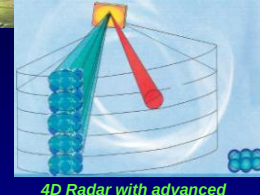
T/R module

SITAR

- Silicon Foundry for ASICs & MEMS
- Pressure & Acceleration Sensor
- Gallium Arsenide Foundry for amplifiers & TR modules

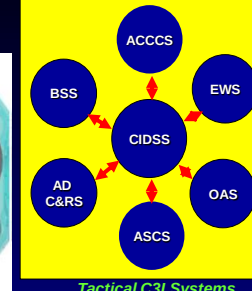
NEW GENERATION SYSTEMS – *ELECTRONICS*

Fire Control Radar for Fighter Aircraft



4D Radar with advanced Phased Array techniques

EO Surveillance System Concept



Tactical C3I Systems

Medium Power Radar (MPR)

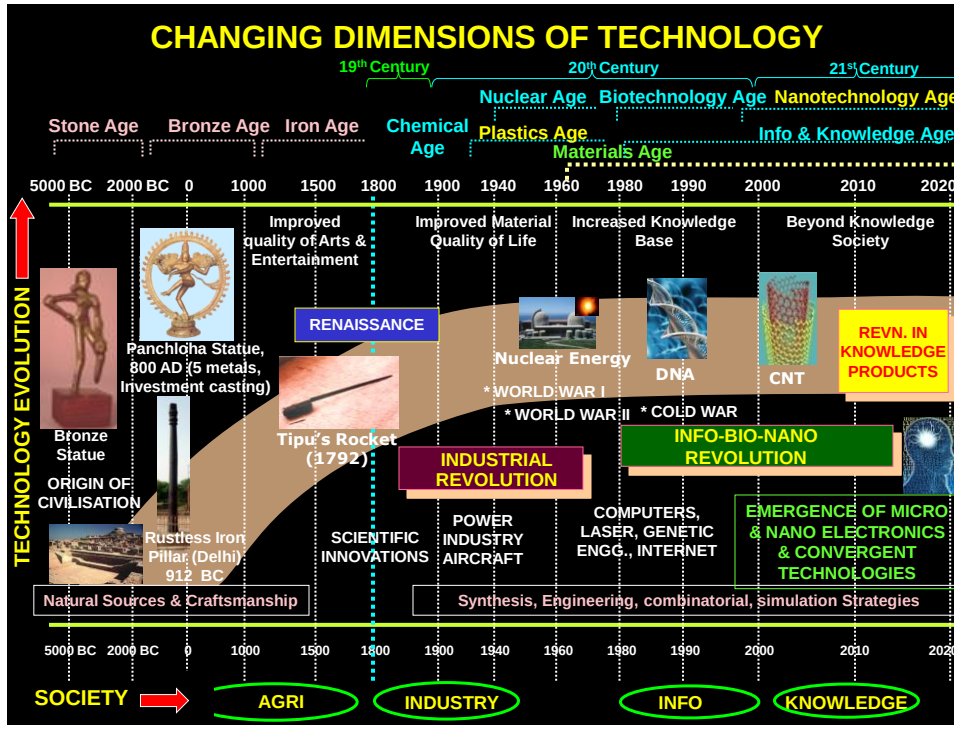
3D Tactical Control Radar

Planned 50 KW coil

SAMYUKTA MK-II

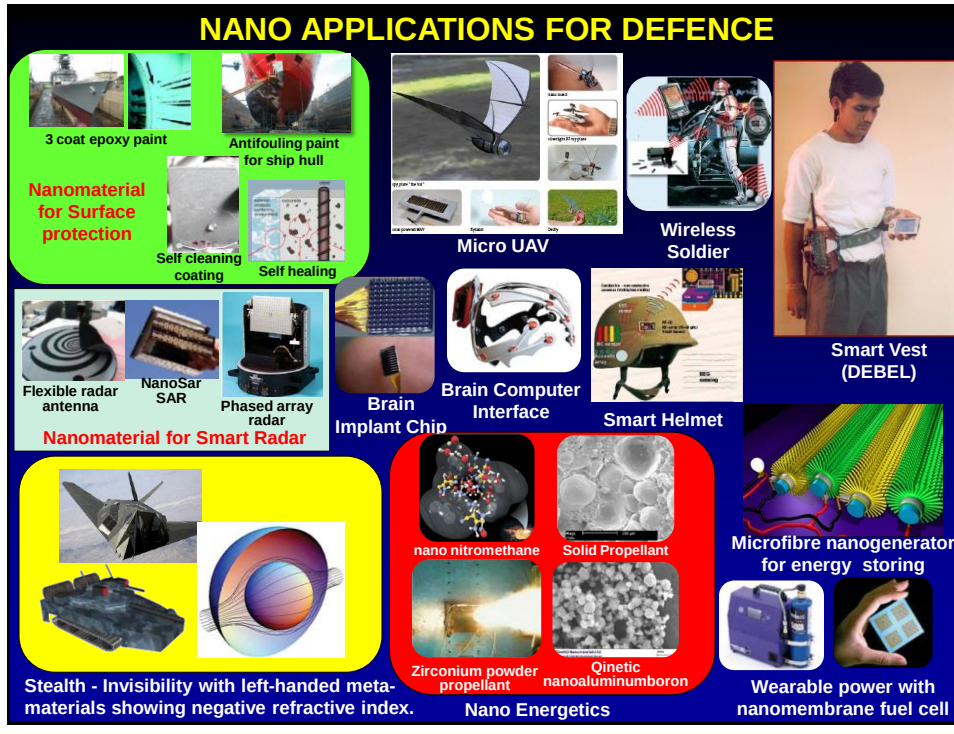
SANGRAHA VARIANTS

Integrated SATCOM Terminal Development Programme


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


Nanotechnology Applications
Electronics & Computing
• Smaller, faster, more energy efficient and powerful computing and other IT-based systems
Energy
• More efficient and cost effective technologies for energy production
– Solar cells
– Fuel cells
– Batteries
– Bio fuels
Medicine
• Cancer treatment
• Bone treatment
• Drug delivery
• Appetite control
• Drug development
• Medical tools
• Diagnostic tests
• Imaging
Consumer Goods
• Foods and beverages
– Advanced packaging materials, sensors, and lab-on-chips for food quality testing
• Appliances and textiles
– Stain proof, water proof and wrinkle free textiles
• Household and cosmetics
– Self-cleaning and scratch free products, paints, and better cosmetics
Defense & Security
• Miniaturised Electronics
• Nanofibres for Lighter Materials
• Active/reactive Ballistic Protection
• Environmental Protection
• Chem/Bio Detection and Protection
• Exoskeleton Components
Sources: Presentations of K. Varahramyan (IUPUI) & Dr. Gernot S. Pomrenke (AFOSR)

NANO APPLICATIONS FOR DEFENCE



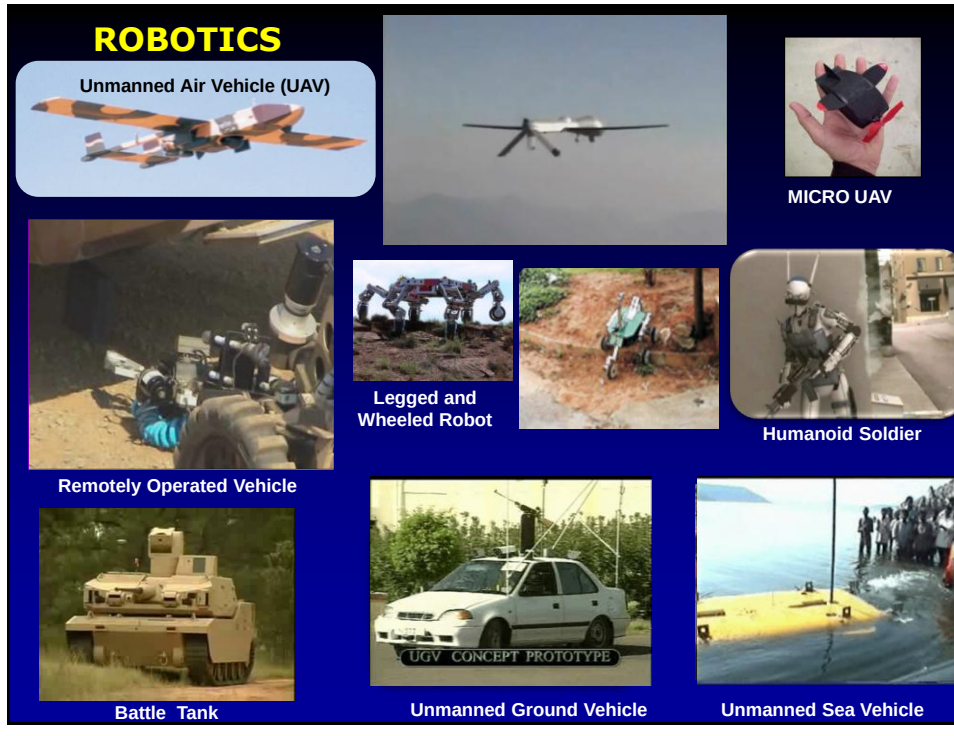
NANO SPY FOR RECONNAISANCE

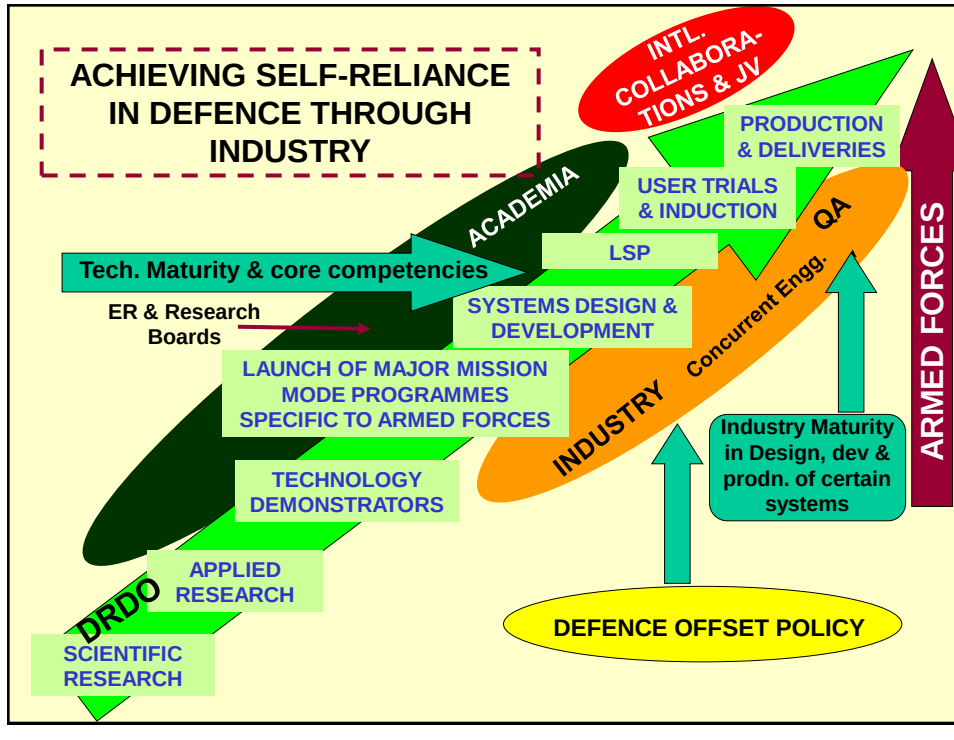
Artificial hummingbird

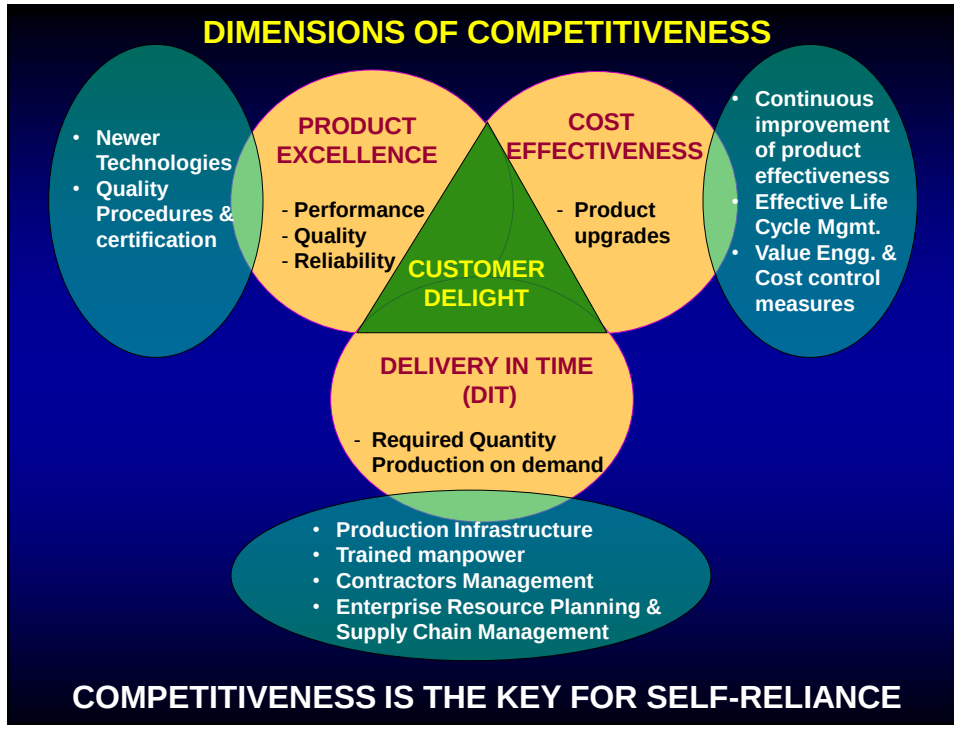
- Wingspan : 16 cm;
- Weight: 19 gms (less than an AA battery)
- Speed: 17 km/h (Three axes)

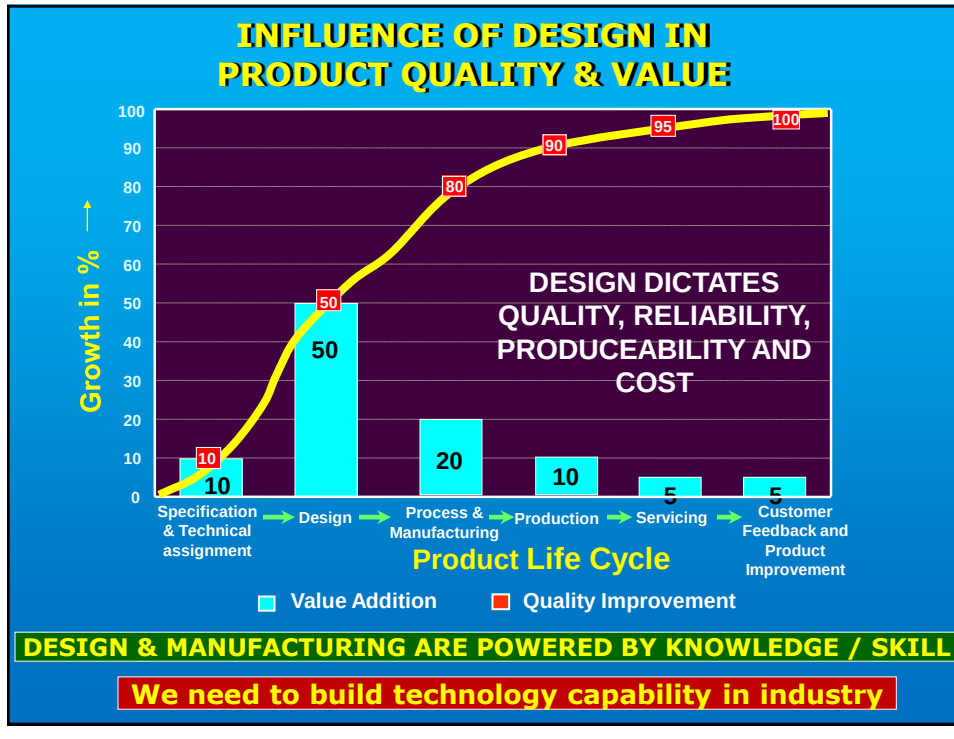
- **Contains Nano batteries, motors, & communications systems; as well as the video camera payload**
- **Can climb and descend vertically; fly in all directions**
- **Manoeuvres using its flapping wings for propulsion and attitude control**
- **Could be deployed to perform reconnaissance and surveillance in urban environments or on battlefields**

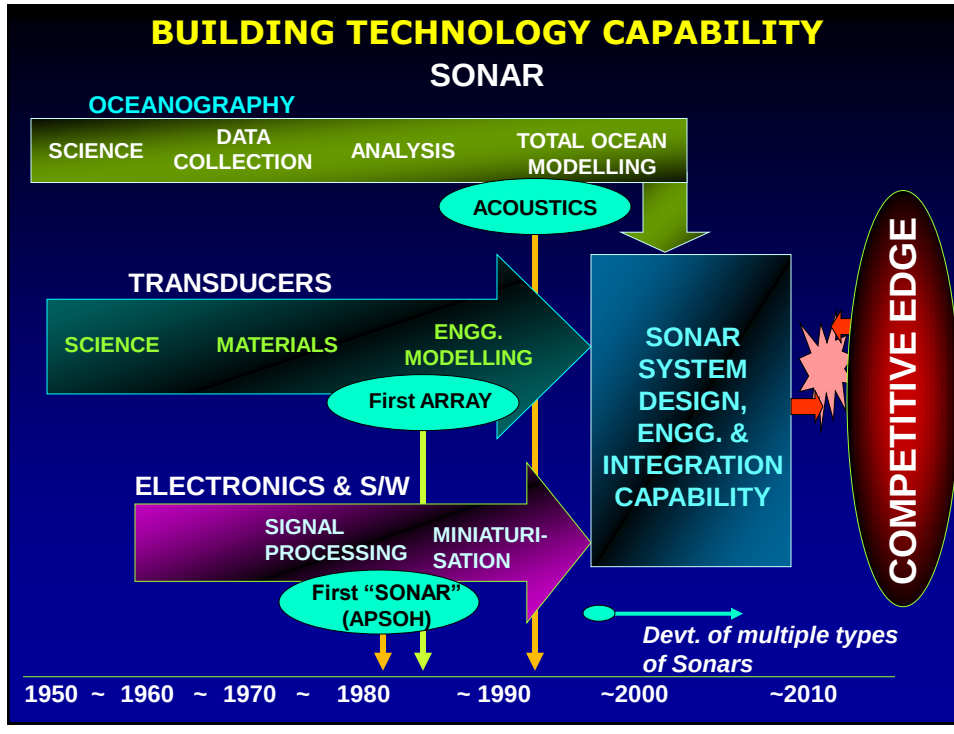
Source: DARPA

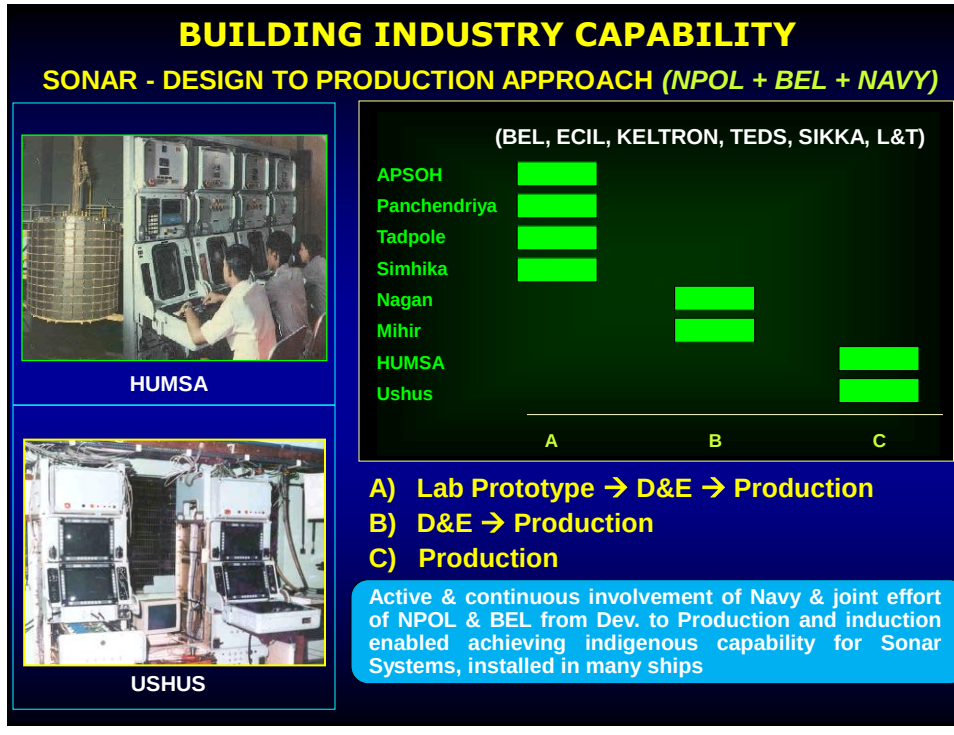

ROBOTICS
Unmanned Air Vehicle (UAV)
MICRO UAV
Legged and Wheeled Robot
Humanoid Soldier
Remotely Operated Vehicle
Battle Tank
UGV CONCEPT PROTOTYPE
Unmanned Ground Vehicle
Unmanned Sea Vehicle


ACHIEVING SELF-RELIANCE IN DEFENCE THROUGH INDUSTRY
INTL. COLLABORA-TIONS & JV
PRODUCTION & DELIVERIES
USER TRIALS & INDUCTION
QA
ACADEMIA
LSP
Tech. Maturity & core competencies
ER & Research Boards
SYSTEMS DESIGN & DEVELOPMENT
Concurrent Engg.
ARMED FORCES
LAUNCH OF MAJOR MISSION MODE PROGRAMMES SPECIFIC TO ARMED FORCES
INDUSTRY
Industry Maturity in Design, dev & prodn. of certain systems
TECHNOLOGY DEMONSTRATORS
APPLIED RESEARCH
DRDO
SCIENTIFIC RESEARCH
DEFENCE OFFSET POLICY


DIMENSIONS OF COMPETITIVENESS
• Newer Technologies
• Quality Procedures & certification
PRODUCT EXCELLENCE
- Performance
- Quality
- Reliability
COST EFFECTIVENESS
- Product upgrades
• Continuous improvement of product effectiveness
• Effective Life Cycle Mgmt.
• Value Engg. & Cost control measures
CUSTOMER DELIGHT
DELIVERY IN TIME (DIT)
- Required Quantity Production on demand
• Production Infrastructure
• Trained manpower
• Contractors Management
• Enterprise Resource Planning & Supply Chain Management
COMPETITIVENESS IS THE KEY FOR SELF-RELIANCE


INFLUENCE OF DESIGN IN PRODUCT QUALITY & VALUE
Growth in %
100
90
80
70
60
50
40
30
20
10
0
10
50
20
10
5
5
10
50
80
90
95
100
DESIGN DICTATES QUALITY, RELIABILITY, PRODUCEABILITY AND COST
Specification & Technical assignment
Design
Process & Manufacturing
Production
Servicing
Customer Feedback and Product Improvement
Product Life Cycle
Value Addition
Quality Improvement
DESIGN & MANUFACTURING ARE POWERED BY KNOWLEDGE / SKILL
We need to build technology capability in industry


BUILDING TECHNOLOGY CAPABILITY
SONAR
OCEANOGRAPHY
SCIENCE
DATA COLLECTION
ANALYSIS
TOTAL OCEAN MODELLING
ACOUSTICS
TRANSDUCERS
SCIENCE
MATERIALS
ENGG. MODELLING
First ARRAY
ELECTRONICS & S/W
SIGNAL PROCESSING
MINIATURI-SATION
First "SONAR" (APSOH)
SONAR SYSTEM DESIGN, ENGG. & INTEGRATION CAPABILITY
COMPETITIVE EDGE
Devt. of multiple types of Sonars
1950 ~ 1960 ~ 1970 ~ 1980 ~ 1990 ~2000 ~2010


BUILDING INDUSTRY CAPABILITY
SONAR - DESIGN TO PRODUCTION APPROACH (NPOL + BEL + NAVY)
HUMSA
USHUS
(BEL, ECIL, KELTRON, TEDS, SIKKA, L&T)
APSOH
Panchendriya
Tadpole
Simhika
Nagan
Mihir
HUMSA
Ushus
A
B
C
A) Lab Prototype → D&E → Production
B) D&E → Production
C) Production
Active & continuous involvement of Navy & joint effort of NPOL & BEL from Dev. to Production and induction enabled achieving indigenous capability for Sonar Systems, installed in many ships

DESIGN TO PRODUCTION OF SAMYUKTA EW SYSTEM

(DLRL + BEL + ECIL +ARMY)

DRDO

DARE, SAG, LRDE, CABS, CASSA, R&D(E), VRDE, NPOL, MTRDC

Prime Production Agency

BEL, Hyd

PSU's

ECIL, HAL, CMC, CEL, BEML, etc.

DLRL

Academic Institutions

IISc, Bangalore
IIT, Chennai & Delhi
Osmania University, Hyd
NIT, Warangal

Industries

ASTRA MW, ARM, BADAWE, L&T, DAS HITACHI, DYNALOG, ENERTEC, TATA POWER

QA / Mant. Agencies

- Strengths of development & production partners, academia and QA agencies Synergised
- Effective quality monitoring
- Product support through equipment life cycle
- Regular steering committee meetings & continuous participation by Army

COMPONENTS & DEVICES (CODE)

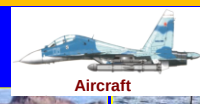
CODE

LRDE	RCI	DLRL	DEAL	NPOL	NSTL	DLRL
Integration Comp	Special Comp	RF / MW Comp	MMW Comp	Power Electronics	Thermal Batteries	Antenna

- 190 Super Components developed and qualified
- Intensive industry participation
- 40 industries developed with qualified parts list

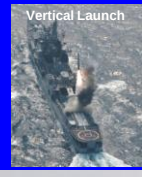
BRAHMOS UNIVERSAL MISSILE SYSTEM

MULTI PLATFORM


Aircraft


Silo

Submarine


Vertical Launch


Mobile Autonomous Launcher


Inclined Launch

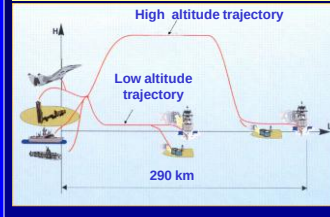
Naval Warship

SPECIFICATION

Range : 300 Km

Speed : 3 Mach

MULTI TRAJECTORY

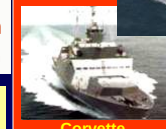


DIVERSE ENVIRONMENT

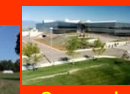
- SNOW/MOUNTAIN
- DESERT
- TROPICAL

MULTI TARGET


Frigate


Corvette


Ammunition Dump


Command Centre


Railway Yard


Airbase


Bridges

BRAHMOS

NAVAL VERSION


Inclined Launch


Vertical Launch


U/W Launch

Launch from Surface Ship

System Installed in Multiple Ships

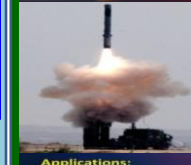
Sea to Sea
Sea to Land

Sub Sea to Sea
Land to Sea

AIR VERSION

BRAHMOS BLOCK-II

Land Target with Discrimination and Surgical Strike Capability

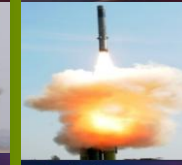


Applications: Land to Land

Desert Warfare and Urban Warfare

BRAHMOS BLOCK-III

High Manoeuvrability and Supersonic Steep dive



Applications: Land to Land

Mountain Warfare Surgical Strike Capability

ARMY VERSION


Supersonic Steep Dive Capability Established

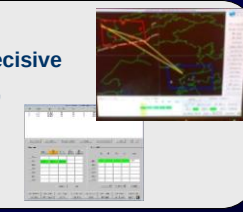
Multiple Regiments Operational

Critical Technologies Achieved in Weapon Complex

1. C4I

Situation Aware Decisive Command Control,

- ➢Interoperability
- ➢Scalability
- ➢Survivability



2. Mobile Autonomous Launcher

Single Vehicle Autonomous Launcher
Electronic Controls
Sensors & Interlocks

3. Multi layer Communication

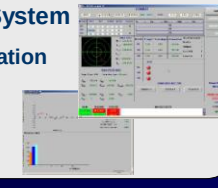
Secured Encrypted Commn.

- •Access & Key Exchange
- •Bit-stream

Software controlled

4. Fire Control System

Trajectory Computation
Built-in Simulation



5. Reusable Integrated Weapon System

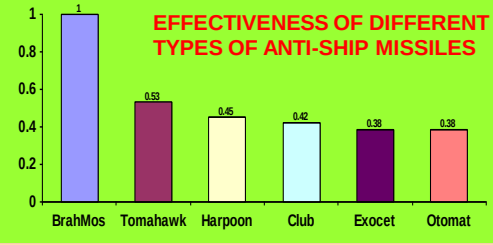
- •Maintainability
- •Simulation
- •Training
- •Documentation

6. High Availability

Redundancy
Fault Tolerance

TOMAHAWK Vs. BRAHMOS

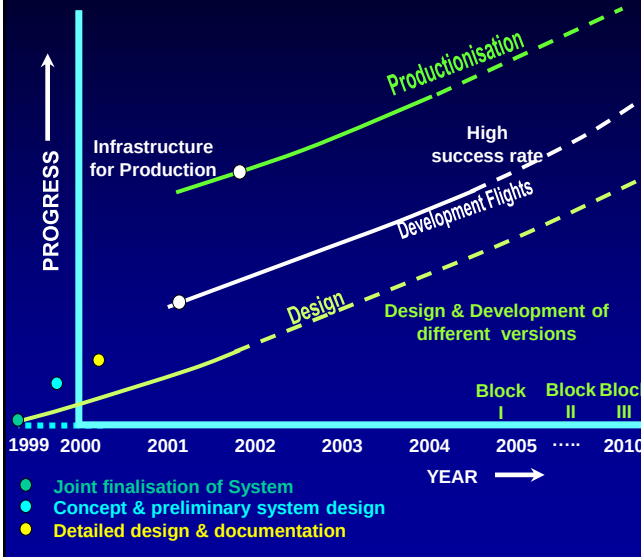
	TOMAHAWK	BRAHMOS
Speed	0.8 Mach	2.8 Mach
Time to hit the target	1 unit	1/3rd (Faster engagement)
Kinetic Energy	1 unit	9 times. (High Destructive Power)
Target Dispersion (Moving targets)	1 unit	1/3rd (Probability of hit is high)
Reaction Time	1 unit	1/3rd (Pierces the Defence)
Universality	Nil	Same 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)

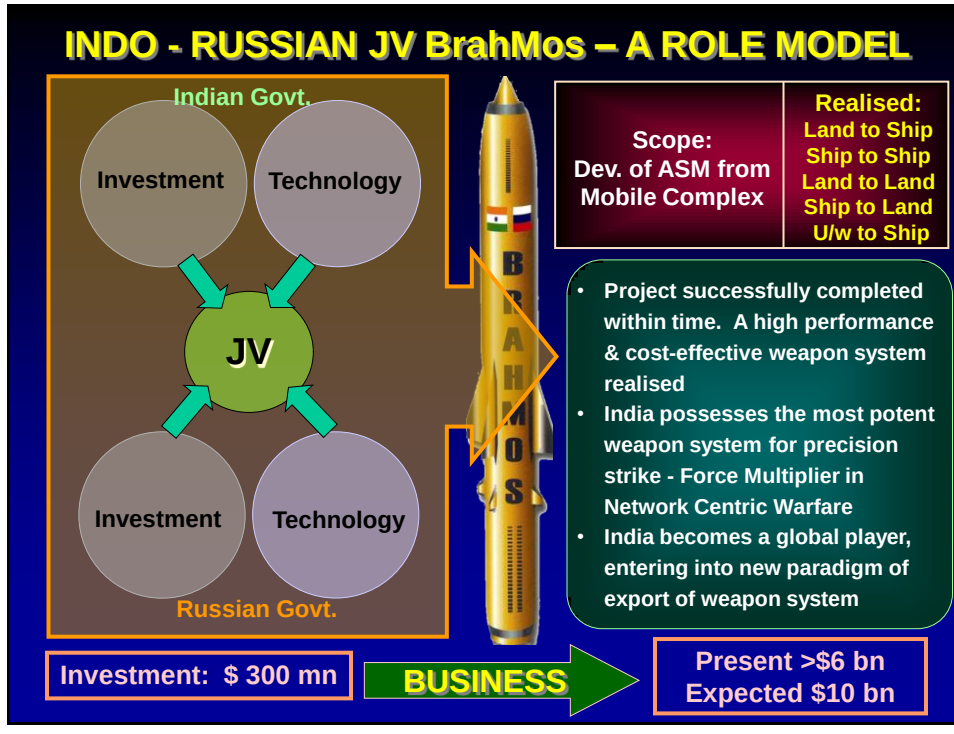
BRAHMOS – WORLD LEADER IN CRUISE MISSILE FAMILY

BRAHMOS
– CONCURRENT DESIGN, DEV. & PRODUCTIONISATION



- Joint design and development
- Technology sharing of critical systems for production of all systems in both countries
- Large scale industrial partnership – Both Public and Private as Consortium
- Holding System Design, System Engineering, System Integration and System Management with core JV
- Common Inspection Standards for product acceptance
- Customer Focus

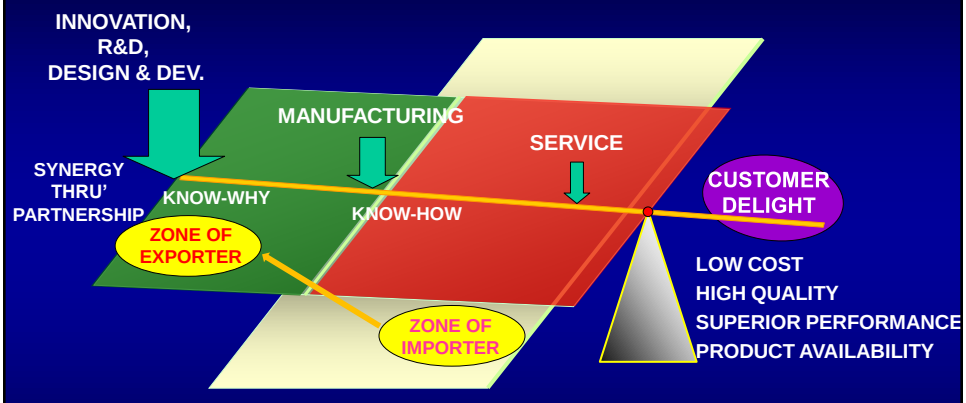
BRAHMOS MISSILE INDUSTRY CONSORTIUM
A BLEND OF PUBLIC – PRIVATE ENTERPRISES


INDO - RUSSIAN JV BrahMos – A ROLE MODEL
Indian Govt.
Investment
Technology
JV
Investment
Technology
Russian Govt.
BRAHMOS
Scope:
Dev. of ASM from Mobile Complex
Realised:
Land to Ship
Ship to Ship
Land to Land
Ship to Land
U/w to Ship
• Project successfully completed within time. A high performance & cost-effective weapon system realised
• India possesses the most potent weapon system for precision strike - Force Multiplier in Network Centric Warfare
• India becomes a global player, entering into new paradigm of export of weapon system
Investment: $ 300 mn
BUSINESS
Present >$6 bn
Expected $10 bn


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

COMPETITIVE EDGE

PRODUCT LEADERSHIP THROUGH INNOVATION



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

EXPECTED INDIA'S DEFENCE SYSTEM REQUIREMENT FOR NEXT 5-7 YEARS

($150 Billion Business)

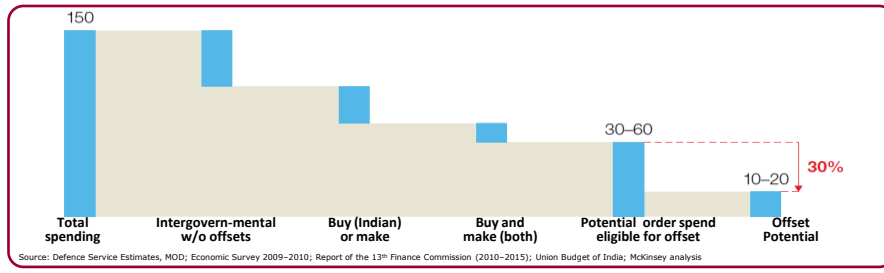
Plat form		Spending ($bn)	Main orders expected
Air	Combat / trainer	26.3	Medium multirole combat aircraft and other fifth-generation aircraft, Mirage upgrade, MiG-29 upgrade, Jaguar engine upgrade, basic trainer
	Support	15.8	Transport aircraft, aerial tankers, long-range maritime patrol aircraft, midrange maritime reconnaissance aircraft, Phalcon AWACS, mini AWACS
	Rotary	9.1	Light-utility helicopters replacing Chetaks for Navy, multirole helicopters for Navy, attack, heavy lift, light utility, light combat
LAND	Fighting Veh.	15.8	Arjun main battle tank (MBT), T-90 MBT, light tank, futuristic ICV
	Artillery	4.2	155 mm towed guns, 155 mm ultra light guns, 155 mm self-prop. tracked guns, 155 mm self-prop. wheeled guns
	Missiles	3.4	Antitank missiles, CBU-105 sensor-fuzed weapon, short- to medium-range SAM, Agni-V, MICA
	Infantry Sys	1.1	Futuristic Infantry Soldier as a System (eg, weapons, helmet, visor, clothing)
SEA		20.8	A/c carrier: P-71; Destroyer: P-15B; Frigates: P-17A &17B; corvette: P-28A
		46.7	Nuclear: Arihant follow-on, Scorpene, P-75I, spl midget
		4.1	Landing platform dock, landing ship tank, landing craft utility
C4I2SR		0.3	Navy 3-D radar, radar-jamming integrated electronic warfare systems

Source: Literature search; McKinsey analysis

Indian Manufacturing sector must capture a large portion of this domestic defence requirement for achieving self-reliance & enter into export market of similar products

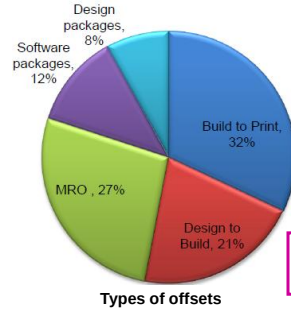
DEFENCE SYSTEM REQUIREMENT FOR NEXT 5-7 YEARS

($150 Billion Business)



Source: Defence Service Estimates, MOD; Economic Survey 2009–2010; Report of the 13th Finance Commission (2010–2015); Union Budget of India; McKinsey analysis

Offset Opportunities for Manufacturing



Types of offsets

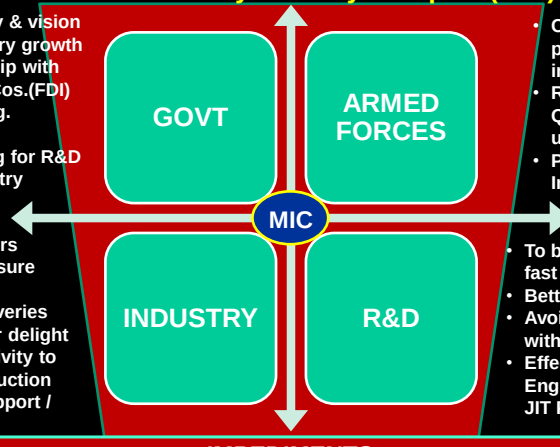
More than $100 Bn available for Indian Manufacturing sector

REQUIREMENTS TO BRIDGE THE DISCREET RELATION BETWEEN THE STAKEHOLDERS (DEFENCE)

- Need for Military Industry Complex (MIC)

- Long term strategy & vision for Defence Industry growth
- Industry Partnership with renowned global Cos.(FDI) for flow of new mfg. techniques
- More Govt. funding for R&D in Pub & Pvt Industry

- Common acceptance procedures for indigenous systems
- Realistic standards for QR formulation and for upgradation
- Pride in using Indigenous System



- More Private Players participation to ensure competitiveness
- Ensure timely deliveries resulting customer delight
- Increased productivity to lower cost of production
- Better Product Support / Service

- To be more adaptive to the fast moving technologies
- Better control on Schedule
- Avoid getting handicapped with procedures
- Effective Concurrent Engineering Practice for JIT Production

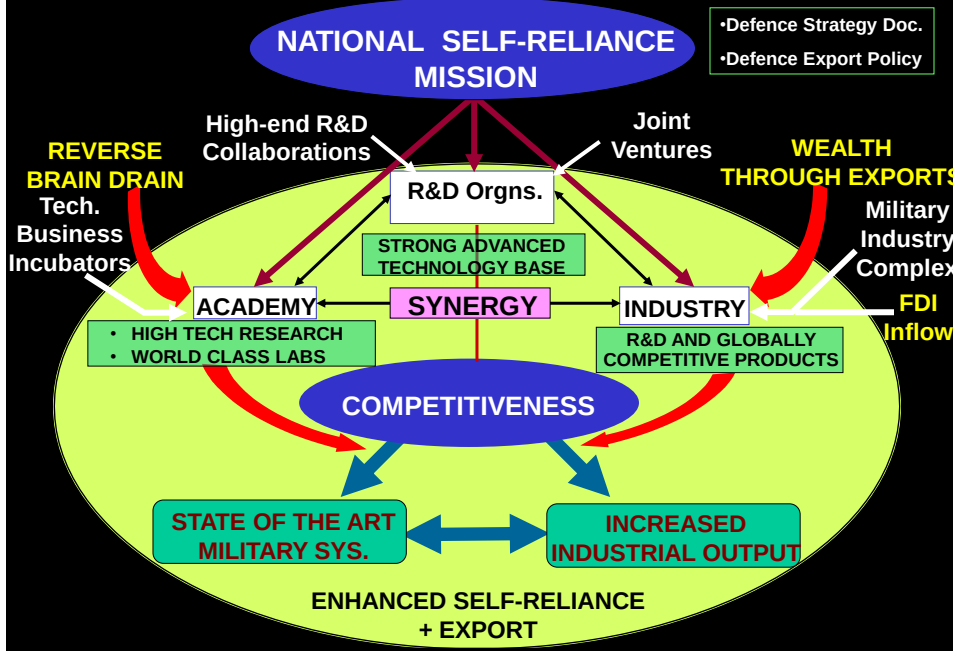
IMPEDIMENTS

- LARGE IMPORT OF WEAPONS & EQPT.
- CONTINUOUS DEPENDENCE ON OTHER COUNTRIES FOR SPARES / EQPT.
- NO EFFECTIVE COORD. BETWEEN R&D & INDUSTRY AS A SINGLE ENTITY
- OUT OF TURN PREFERENCE TO PSUs
- ABSENCE OF "MIND TO MARKET"

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

SELF RELIANCE IN DEFENCE THROUGH SYNERGY




Thank you
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