



**PRESENTATION  
ON**

**NATIONAL COMPETENCE IN  
MARINE PROPULSION  
THE ROAD AHEAD**



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*From time immemorial the people of India have had very intimate connections with the sea.*

*They had trade with other countries and they had also built ships.*

*In the bygone era Indian Shipbuilders with their skill and proficiency, ardour and exertions etched an indelible mark in the field of shipbuilding in India.*

*The vessels built at Bombay at that time were superior to those built elsewhere; a reality exploited by all, realised by many, accepted by few but acknowledged by none....*

# CONTENTS

- ❖ **Aim**
- ❖ **Introduction**
- ❖ **Overall Need for “Make in India” Paradigm in Defence Manufacturing**
- ❖ **The Road Ahead for “Make in India” in Marine Propulsion**
- ❖ **'Make in India' Initiative in the Conventional Propulsion Domain**
- ❖ **Upcoming Areas of Interest in Marine Propulsion**
- ❖ **Conclusion**
- ❖ **Way Ahead**

**AIM**

- ❖ **To dwell on existing indigenised capabilities with respect to Naval Marine Propulsion and underline scope for its further strengthening in consonance with focus on 'Make in India'**
- ❖ **Recommend steps for building foreign collaboration to develop Marine Propulsion technology, with consideration for *'cost of doing business in India'***

# INTRODUCTION

**1612**

- **History of the Indian Navy**
- **Captain Best encountered and defeated the Portuguese**

**1686**

- **British commerce shifted to Bombay, the force was called Bombay Marine**
- **Involved in combat against the Marathas and the Sidis**

**1892**

- **Consisted of over 50 vessels**
- **Participated in action with a fleet of minesweepers, patrol vessels and troop carriers during the First World War**

1934

- During Second World War, the Royal Indian Navy consisted of eight warships
- Strength had risen to 117 combat vessels and 30,000 personnel by end of war

1947

- 32 ageing vessels suitable only for coastal patrol, along with 11,000 officers and men
- Five decades back Indian Navy's foray into indigenisation began

2016

- Forty eight state-of-the-art ships/submarines under construction in Indian shipyards both public and private
- Time for launching into phase of self-reliance by manufacturing technologically advanced equipment within India



# **NEED FOR “MAKE IN INDIA” PARADIGM IN DEFENCE MANUFACTURING**

**2001 - Defence manufacturing came out of stranglehold of Public Sector Undertakings-Ordnance Factories monopoly with major liberalisation**

**Defence industry is a subset of a nation's concern to ramp up manufacturing capability**

**Defence Procurement Policy 2013 have created a level playing field for private sector**

**Capability of our defence industry in terms of value addition, self reliance in critical technology and policy initiatives so far and their impact needs to be examined**

**Possible synergy between "Make in India" policy and defence industry capability needs to be brought about**

# DEFENCE MANUFACTURING & CHALLENGES IN SELF-RELIANCE

**Defence  
services  
A/c for 2.5  
% of the  
GDP**

**CHALLENGES  
IN  
SELF  
RELIANCE**

**Capital  
acquisition  
budget has  
grown  
around 20  
% per year**

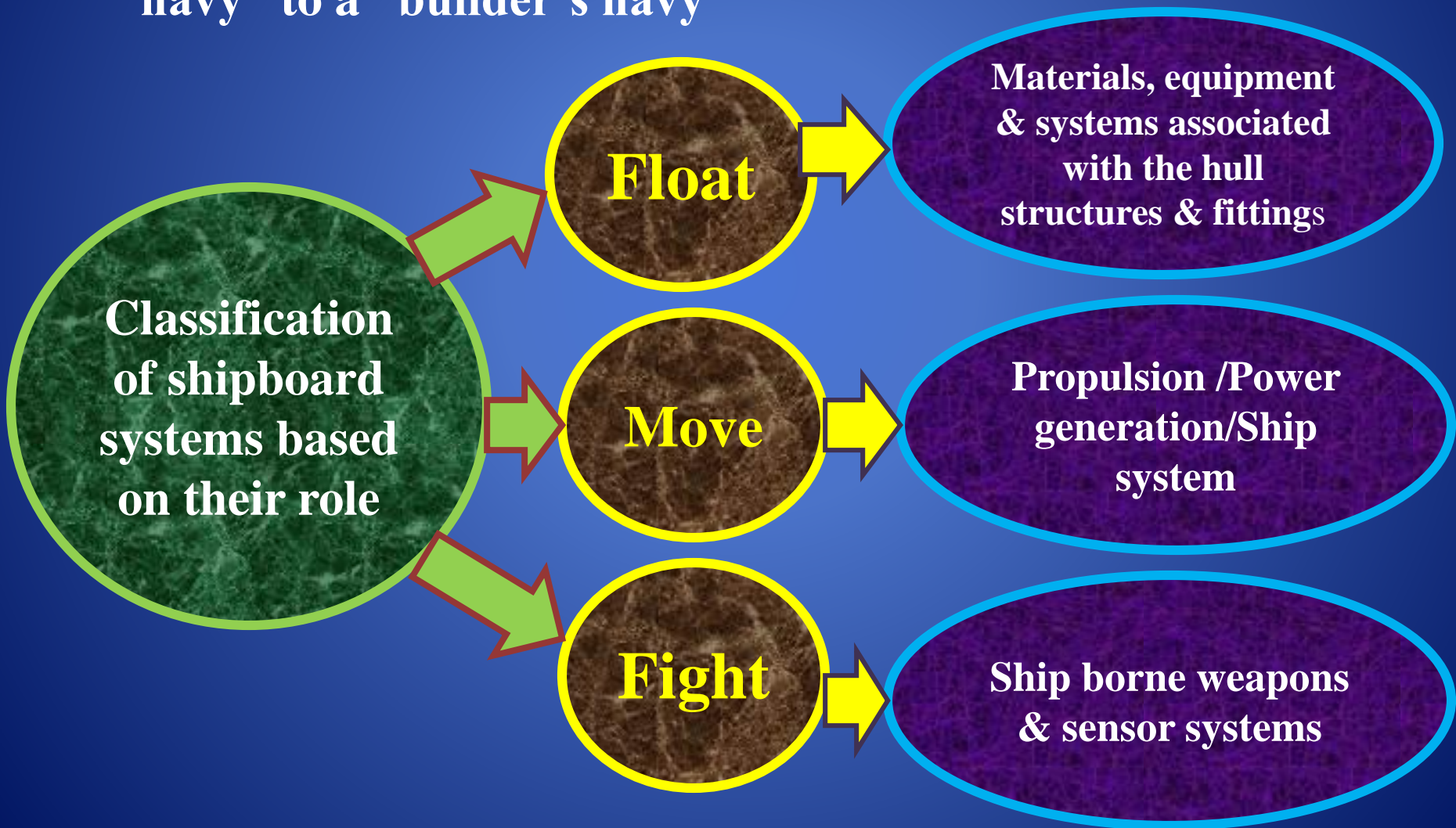
**Some  
Indigenous  
developments  
by the DRDO**

**Technology  
through licence  
agreements from  
Russia & some  
from Western  
countries**

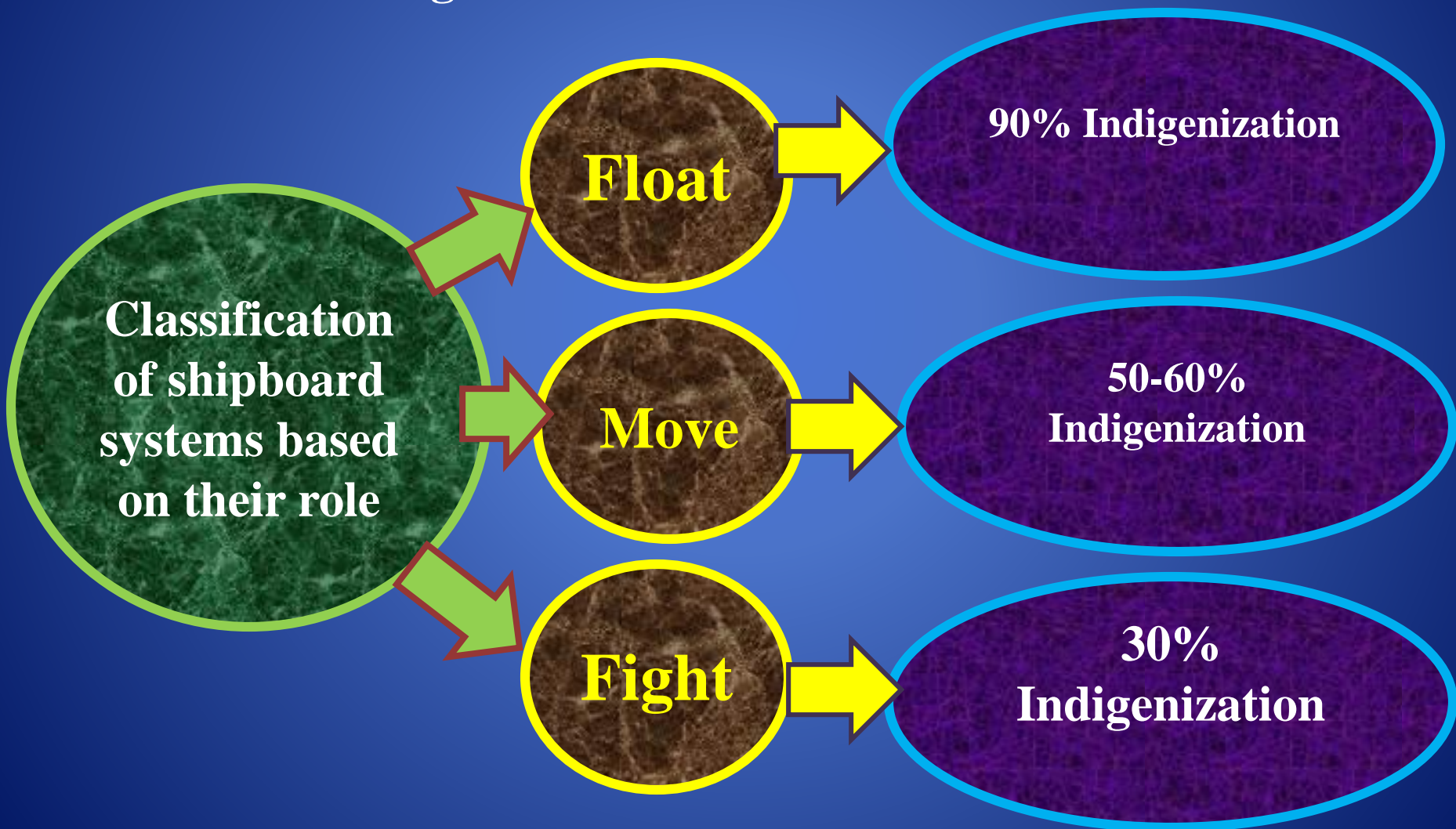
**Self Reliance  
Index has  
remained  
stagnant  
at around  
30 %**

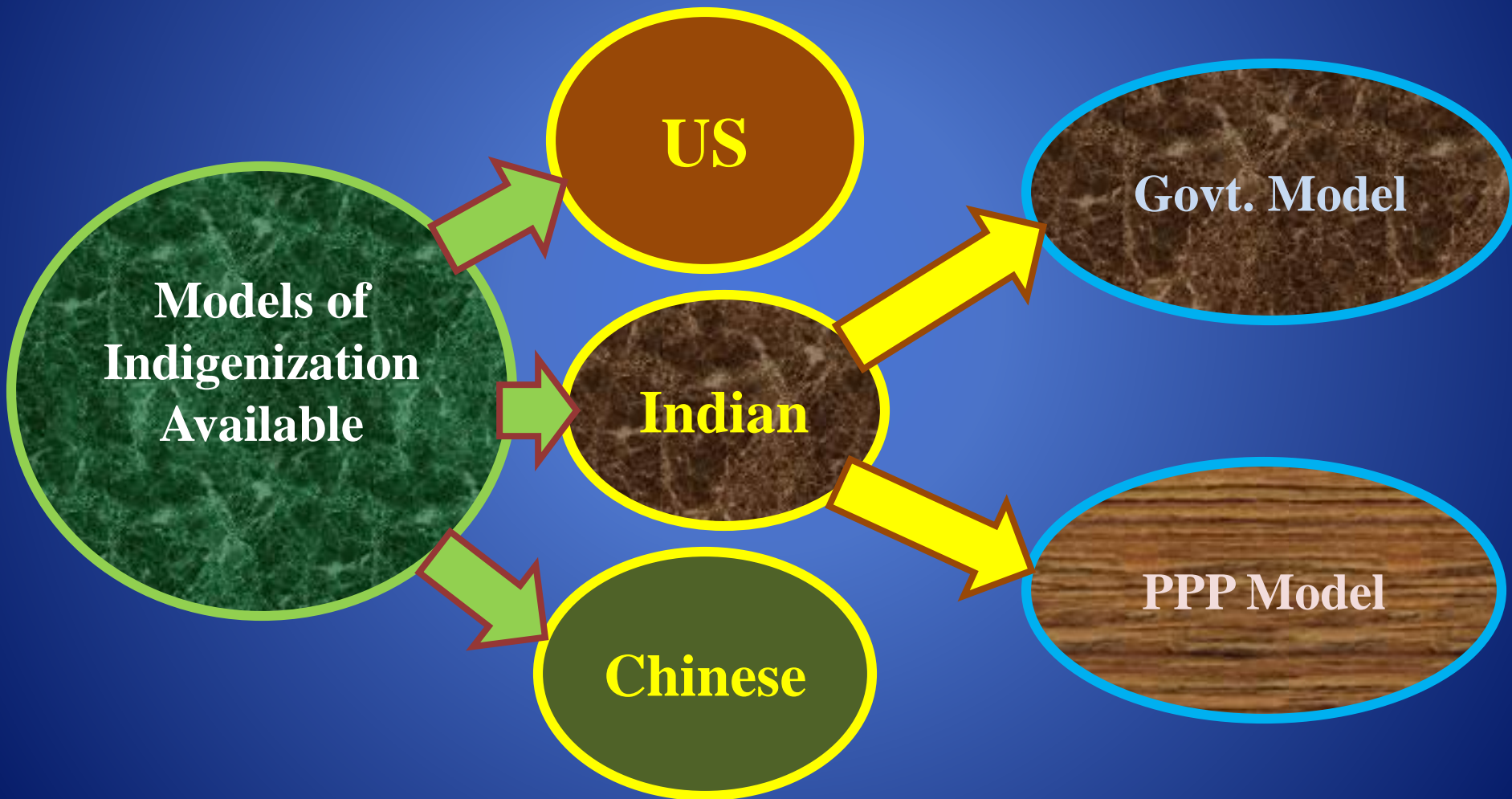
# **The Road Ahead for “Make in India” in Marine Propulsion**

- ❖ Indian Navy is gradually transforming from a “buyer’s navy” to a “builder’s navy”



## ❖ Status of Indigenization





**Models of  
Indigenization  
Available**

**US**

**Indian**

**Chinese**

**Govt. Model**

**PPP Model**



Fixed time based contracts is need of the hour to salvage shipbuilding industry from inordinate delays

Shortest delivery period & contract implementation period should carry due weightage in award of contracts

PPP model for indigenisation is best suited in Indian environ

JV is provided with necessary Govt. policy assistance to participating private firms, both Indian and Foreign



## ➤ **Potential Partnership for Building National Competence in Marine Propulsion**

- ❖ **International Industry possesses requisite technology for building infrastructure in the country for undertaking production in the field of Marine Propulsion**
- ❖ **May be willing to invest/ share the cost**
- ❖ **Development contracts based on collaborative approach between Indian Navy / Developing agency and Industry both as equal partners aiming at optimum results**

- ❖ **Industrial houses like Tatas, Mahindras, Reliance, Kirloskar, L&T, Godrej have collaboration with foreign vendors for production of defence equipment within the country yielding great success**
- ❖ **Success of Arihant, with intensive participation of numerous large and small private players has given lot of confidence to IN**
- ❖ **Successful indigenous development in hydraulic system /Stabilisers/ Steering gears indicates willingness and ability of Private players to partner with IN in 'Make in India' developmental efforts in Marine Propulsion**

**MAKE IN INDIA INITIATIVE IN  
CONVENTIONAL PROPULSION DOMAIN**

# Propulsion modes used in India

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graph TD; A[Propulsion modes used in India] --> B[Steam Plants]; A --> C[Diesel Engines]; A --> D[Gas Turbines]; B --> E[Indigenous manufacture of steam turbines by M/s BHEL]; C --> F[Indigenous manufacture by M/s KOEL]; D --> G[Foreign Origin];
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**Steam  
Plants**

**Indigenous  
manufacture of  
steam turbines by  
M/s BHEL**

**Diesel  
Engines**

**Indigenous  
manufacture by  
M/s KOEL**

**Gas  
Turbines**

**Foreign  
Origin**

➤ **Main Areas of 'Move' Where India is Facing Capability Gaps**

**Move**

**Gas  
Turbines  
(11-15 MW  
and 20-25  
MW)**

**Marine  
Gearboxes  
(1-50  
MW)**

**High Power  
Main  
Propulsion  
Diesel  
Engines**



# Gas turbines

- ❖ Indigenization initiatives includes development of Kaveri Marine Gas Turbine at GTRE, Bangalore, tested to a sustained output of 12 megawatt with considerable amount of success
- ❖ Kaveri engine has potential to replace the Russian GTs in the foreseeable future
- ❖ India has bought foreign vessels largely from Britain and former Soviet Union with integral foreign engines

## **GT Manufacturing-Focus Areas for 'Make in India'**

- ❖ **Need for “Make in India” initiatives in gas turbines in the range of 11-15 MW and 20-25 MW for fitment on future ships**
- ❖ **Inter-cooled Recuperated WR 21 Gas turbine developed by Rolls Royce and Northrop Grumman offers a 30% reduction in fuel consumption**
- ❖ **These GTs combine best of diesel and Gas turbines, i.e., low Specific Fuel Consumption (SFC) at part loads and high power density and fulfils the role of both Cruise and Boost Gas turbines**

## GT Manufacturing-Focus Areas for 'Make in India'

- ❖ **Gas Turbines, with reduced IR signatures due to their low exhaust temperature have to be developed view stealth consideration**
- ❖ **Development of gas turbines with enhanced aero-thermo-dynamics**
- ❖ **Developments in the field of advanced materials for combustion chamber and turbine blades**





# Diesel Engines

- ❖ **Primary requirement for diesel engines with low noise levels and high availability and reliability**
- ❖ **Self-reliance in lower power range has been achieved, however high power diesel engines are largely imported or assembled in India**

# **Diesel Engines Manufacturing-Focus Areas for 'Make in India'**

- **Thrust areas wherein diesel engine manufacturing under the 'Make in India' model can be explored**
  - **Diesel engines meeting stringent environmental regulations , multi-fuel operation and long service life**
  - **Reduced emissions and improved combustion efficiency**
  - **Development of technology for Rheological smart fluids for torsional damping to achieve better power to weight ratios**
  - **South Korean major Hyundai Heavy Industries (HHI) and public sector Hindustan Shipyard Limited, Visakhapatnam, joining hands to build warships**

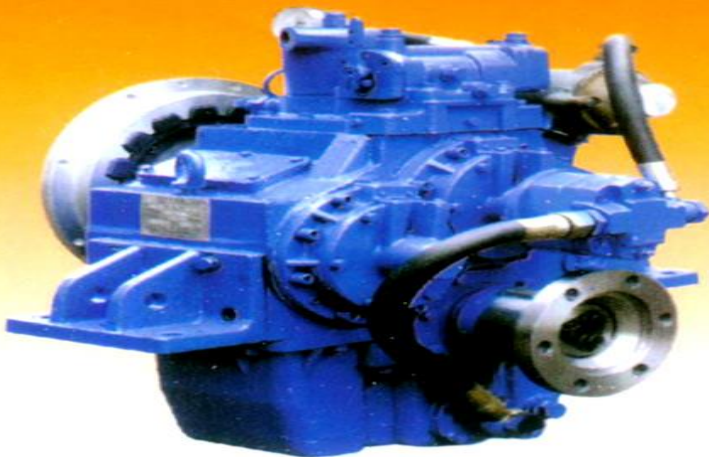
# Diesel Engines Manufacturing-Focus Areas for 'Make in India'

- Hyundai has designed and developed the HiMSEN engine which is part of Hyundai's ongoing efforts to provide the most practical and highest quality engines
- Samsung, will be collaborating with Kochi Shipyard to make liquefied natural gas (LNG) tankers. This can be further extended towards developing Marine Diesel Propulsion aggregates in India



# Reduction Gear (RG)

- ❖ Warship gearbox require consideration for noise and vibration with features viz.
- ❖ **Higher hardness of pinion and gear materials to cater higher gear tooth loadings**
- ❖ **High efficiency by ensuring lower transmission losses and reliability**
- ❖ **Long life**



## **RG Manufacturing-Focus Areas for 'Make in India'**

- ❖ Gearboxes with greater indigenous content in range of 1-50 MW**
- ❖ Development of techniques to design compact and silent gearboxes**
- ❖ Advanced manufacturing techniques, metallurgical processes and materials**
- ❖ Develop technology to manufacture silent marine propulsion gearbox**
- ❖ Presently some gearboxes of ships are being manufactured in India by M/s Elecon, under joint ventures with foreign firms such as M/s MAAG Switzerland & M/s Renk Germany**

# **UPCOMING AREAS OF INTEREST IN MARINE PROPULSION**

- **IN has primarily COGAG and CODOG**
- **Globally thrust is on Combination of Diesel Electric and Gas (CODLAG) propulsion**
  - **Combines the diesel engines used for propulsion and for electric power generation greatly reducing service cost**
  - **Electric motors work efficiently over a wide range of revolutions and can be connected directly to the propeller shaft so that simpler gearboxes can be used**
  - **Diesel generators can be decoupled acoustically from the hull of the ship, making it less noisy**

- **MTU Friedrichshafen along with GE Marine System provided the German type 125 Class Frigate CODLAG propulsion module**
- **Paxman has provided diesel power modules for CODLAG propulsion system in new Type 23 Antisubmarine Warfare frigates of British Royal Navy**
- **Paxman (diesel), GE (LM2500) and MTU are established suppliers for IN and possibility of Make in India through JV for CODLAG Propulsion can be explored**



- **Large number of ships being inducted under indigenous ships building programme**
- **Need is for Indian industry to acquire adequate expertise and in-house competence in Propulsion system machinery selection, design and integration**
- **Propulsion System Integration is considered a key thrust area for 'Make in India' in marine propulsion**

- **Nuclear power offers an ultimate AIP solution for high speed, mobility, autonomy and submerged endurance**
- **With Arihant experience through model of introspection and lessons learnt, India can further develop this technology through indigenous capabilities and undertake “Make/Made in India” developmental model**
- **India’s second indigenous aircraft carrier (IAC-2) can utilise indigenous experience of development and complex installation of nuclear propulsion**

- **Electrical propulsion a fast maturing technology for marine applications**
- **Advanced navies like US Navy, Royal Navy and French Navy have in place major programmes for adoption**
- **Involvement of domestic shipyards, in building LPDs powered with electric propulsion systems**
- **Private shipyards with huge investments in developing modern state-of-the-art shipyards will be able to prove their credentials for undertaking larger and more sophisticated projects**

# Growing Industry- An Invitation for “Make in India”

Warship  
building

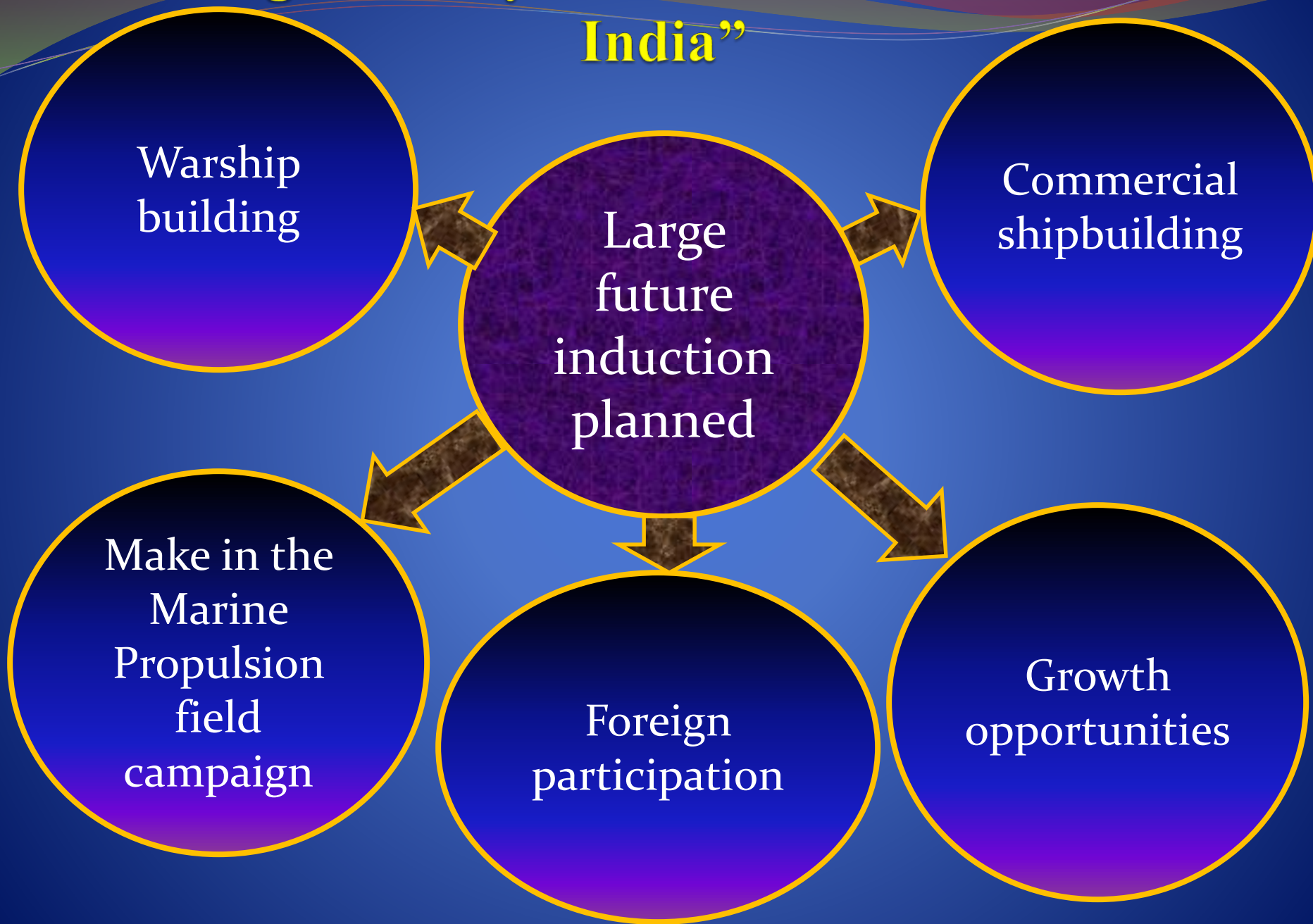
Commercial  
shipbuilding

Large  
future  
induction  
planned

Make in the  
Marine  
Propulsion  
field  
campaign

Foreign  
participation


Growth  
opportunities




# CONCLUSION



Defence industry, be it public sector or private, has to be part of the national manufacturing policy mosaic



Bridging of capability gap in development of Main propulsion system can be achieved through 'Make in India' with collaborative approach between Indian Navy / Developing agency and Industry aiming at optimum results



Participation of foreign firms in development of propulsion systems for large IN ships and submarines on anvil with paradigm of Make in India can act as the launch pad for indigenisation

**WAY AHEAD**



Make in India in Marine propulsion sector must be also seen as Design in India



Procurement procedure which is not only looking after financial correctness but also caters to technology needs



Complementarity in systems used for aerospace and shipbuilding sectors by same OEMs to be utilised for getting key technologies



Continuation of favourable policies by all governments in the future for sustainable outputs





Liberalise FDI policy for foreign OEMs for setting up business in India in partnership with public/ private players



Investment in R&D in field of Marine Propulsion by making enhanced allocation to defence technology fund



Conducive policy in field of export to ensure 'Make in India' in marine propulsion is also lucrative from export point of view for a foreign firm investing/ setting up a manufacturing facility in India



Q.





**THANKS**

