

PERSPECTIVE ON TORPEDOES

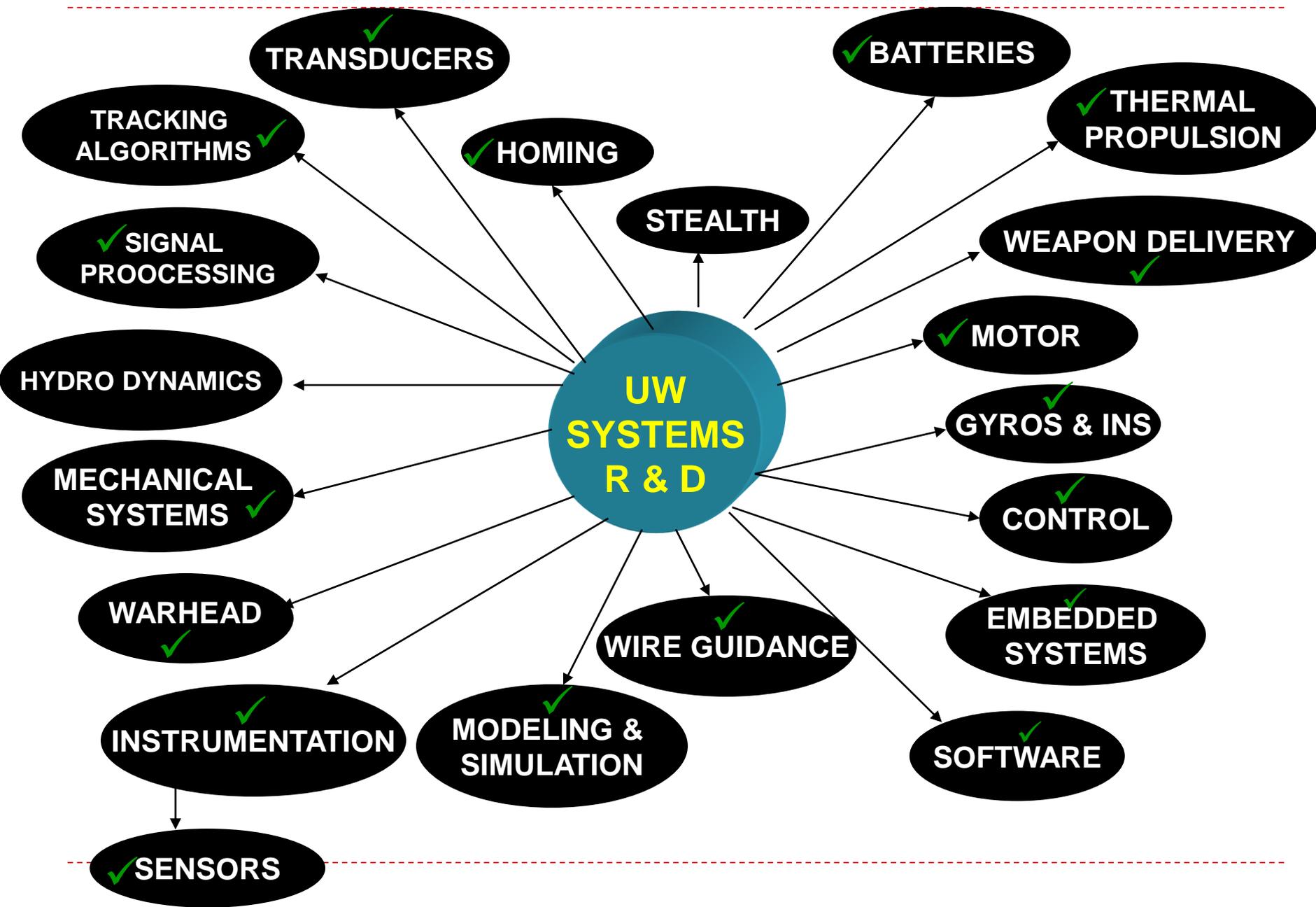


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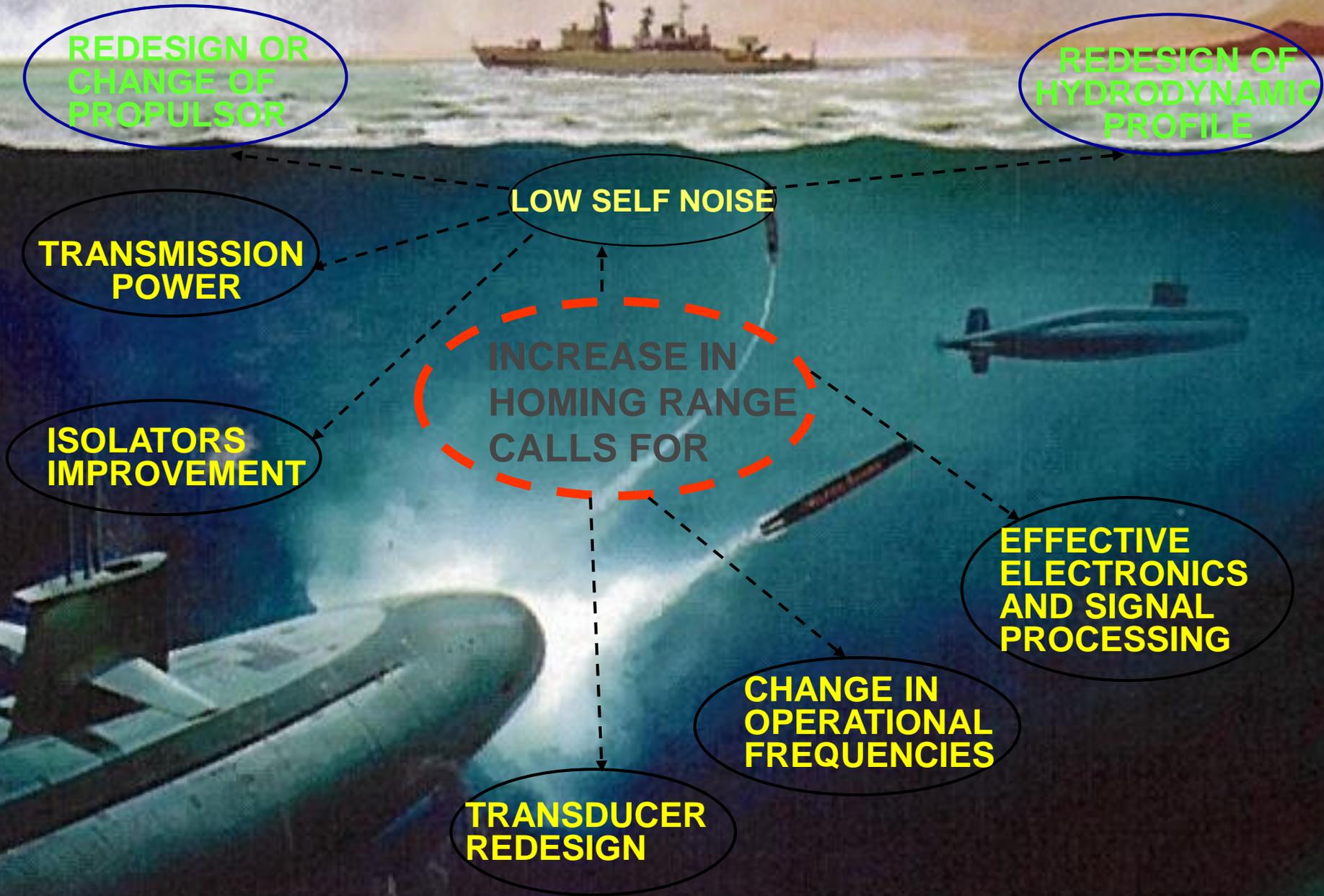
TORPEDO SYSTEMS DEVELOPMENT



Torpedoes –Wish list

- Maximise Range (Thermal Prop; CCTS)
- Depth Operation : 800 m + (New Materials)
- Maximise speed without compromising homing
- Maximising homing range with ACCM
- Homing capability for littoral waters
- Torpedo stealth (IMP, Hydrodynamic profile)
- Wire guidance (Long Range fibre optic communications)
- Improved Sonars
- Insensitive , light weight & more lethal warhead.
- Super cavitating u/w missiles
- Torpedo integration with network centric ASW
- Use of COTS & Open architecture

PERFORMANCE IMPROVEMENT - IMPLICATIONS

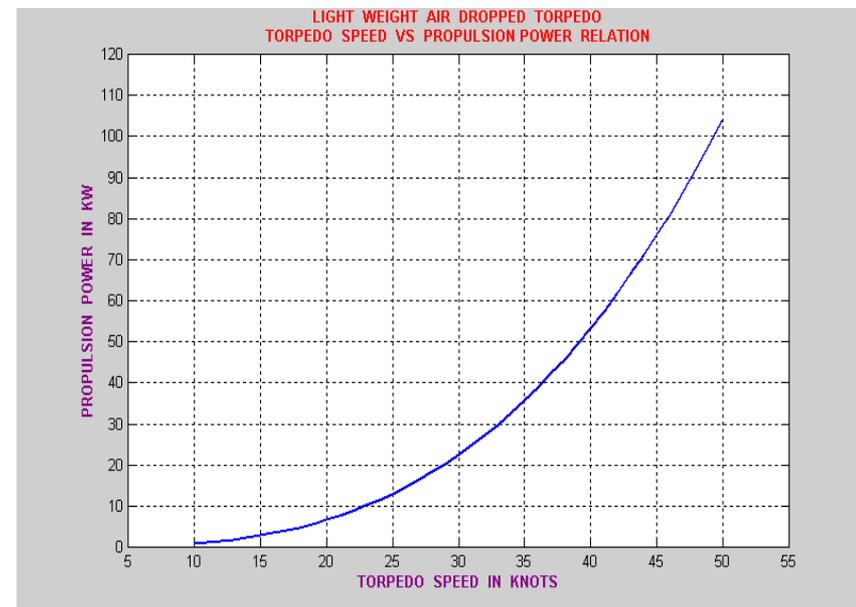
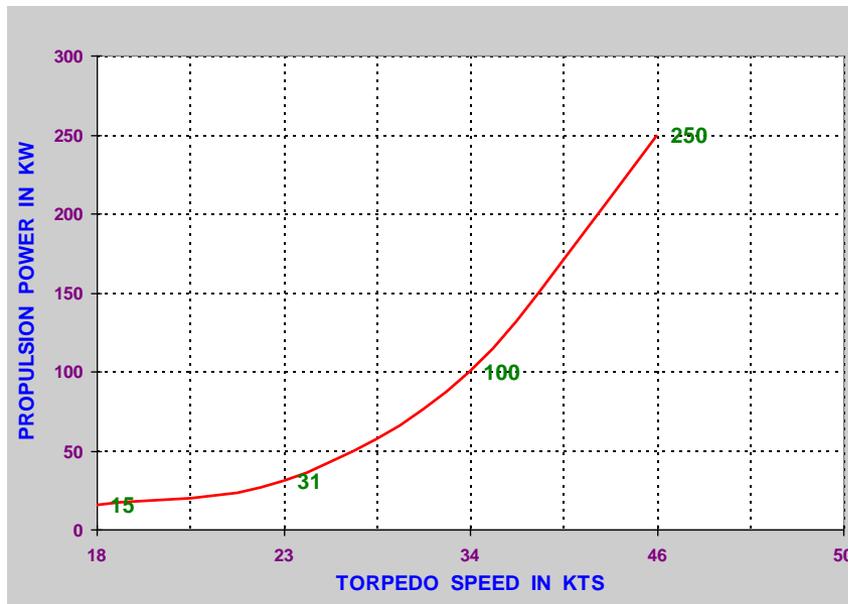


Torpedo Propulsion Battery

Determines the Following Torpedo Parameters

- Torpedo Speed
- Torpedo Range
- Torpedo Endurance

As the Biggest Sub-system of the Torpedo by virtue of its Weight and Dimensions ,determines the Torpedo Weight and Length



Thrust areas

- ▶ Drag reduction techniques to be employed
- ▶ Increased Propeller efficiency
- ▶ Profile compliant motors
- ▶ Weight reduction of the battery
- ▶ Shells : weight reduction
- ▶ Reduction of self noise
- ▶ Incorporation of multi resonant sensors
- ▶ Light weight secondary battery technologies

Propulsion Motor : Requirements

- ▶ High endurance
- ▶ High Starting Torque
- ▶ Direct Switching from battery
- ▶ Higher Power to Weight Ratio
- ▶ High Efficiency
- ▶ Quick acceleration
- ▶ Incremental Speed Change
- ▶ Low Radiated Noise

Options

- ▶ Single shaft
- ▶ Contra rotating
- ▶ BLDC

Homing System – Current Technologies

- ▶ Mode of operation
 - ▶ Active
 - ▶ Passive
 - ▶ Mixed
- ▶ Detection based on digital signal processing techniques
- ▶ ACCM features
- ▶ Conformal Array with Wider look angle
- ▶ High Source level
- ▶ Online selection of PRI & PW
- ▶ **Search for target**
- ▶ **Detection of target**
- ▶ **Echo validation**
- ▶ **ACCM**
- ▶ **Generate target parameters**



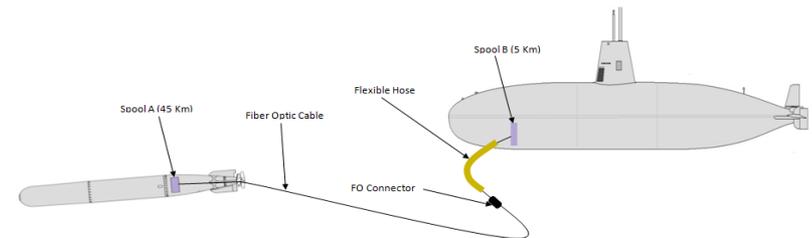
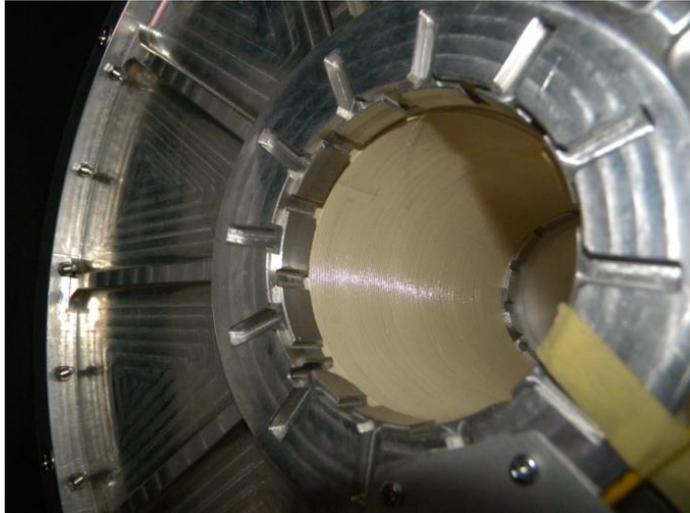
Homing System - Options

- Frequency of operation—space availability
 - Area of coverage – Array design
 - Signal design – Long range detection, ACCM
 - Source level --- Acq. Range, Cavitation limit
 - Active mode detection
 - Passive mode detection
 - Post detection schemes
 - Adaptive threshold - CFAR algorithms
- ▶ **Conformal array**
 - ▶ **Advantages**
 - ▶ Look angle is more
 - ▶ **Disadvantages**
 - ▶ Ranges are lesser than Planar array
 - ▶ Reverberation problem due to more vertical beam width
 - ▶ **Planar array**
 - ▶ Look Angle is less (< 100 deg horizontally)
 - ▶ Grating lobes in extreme beams
 - ▶ To avoid grating lobes, frequency is to be changed from center beam to extreme beam which demands higher bandwidth of sensors

Challenges in Homing system design

- ▶ Reduction of self noise
- ▶ Detection of target in presence of high reverberation levels
- ▶ Intelligent data processing to take online decision for better acquisition of target/ discrimination of target echo against decoys
- ▶ High probability of detection in an intense ACM environment
- ▶ Long range detection and classification of quiet, anechoic target submarine transiting at slow speeds.
- ▶ Multiple signals for optimal detection of target in Deep/Shallow waters and in the presence of decoys

Fiber Optic Communication System



- ▶ Development of Fiber Optic System
 - ▶ Bend insensitive fibers
 - ▶ Polymer based jacketing
 - ▶ Winding technique
 - ▶ Packaging of the spool

Time delays - Solutions

Over claim by
R&D Agency

Confidence of
User on Production

Trials

No. of Trials

**Availability
of slots**

T O T

**Design
Changes**

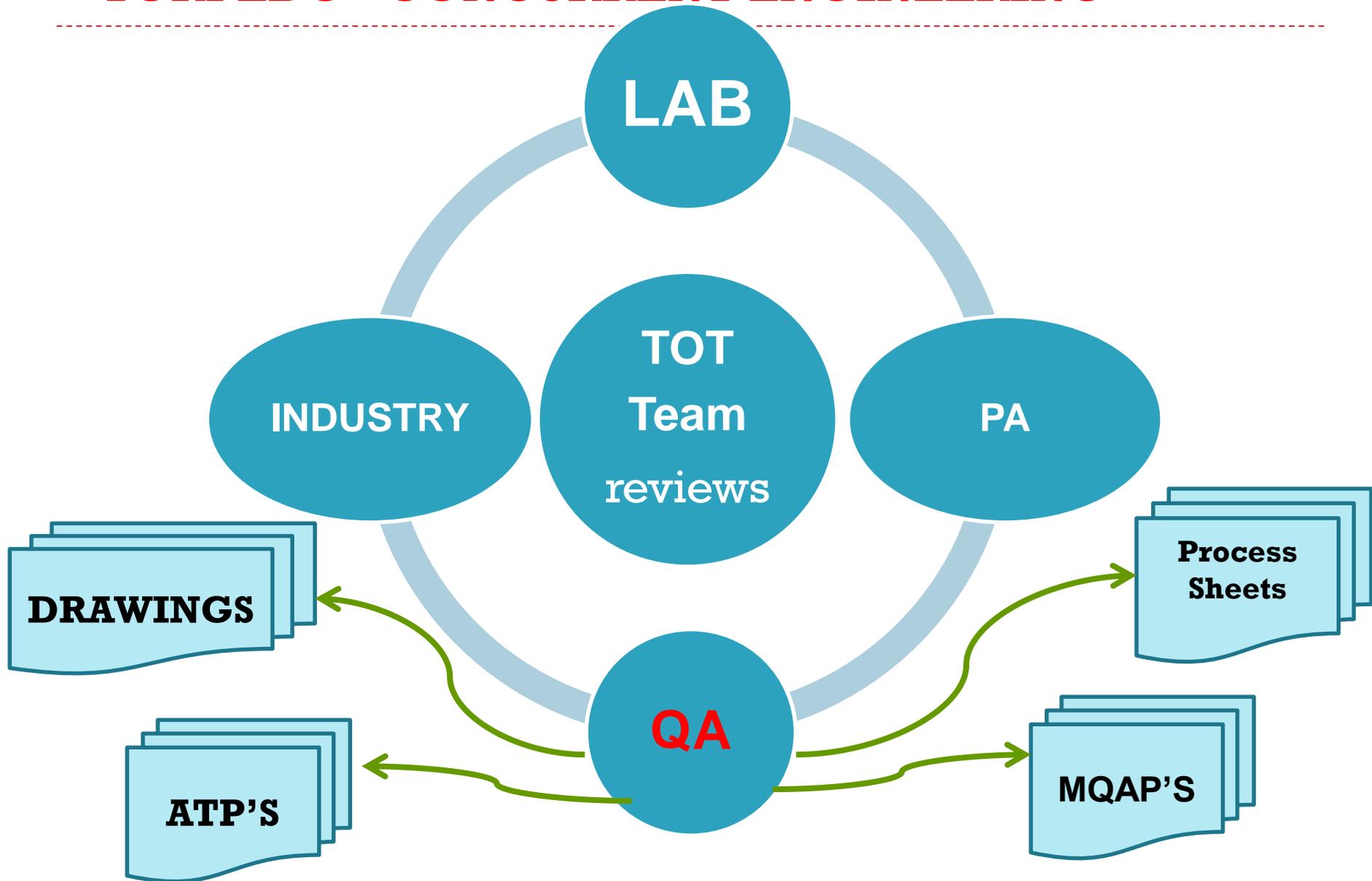
**Change of
Contractors**

**Test
Facilities**

**Production
issues**

- R & D Projects for Technology Development
- Dedicated Test Ranges
- More Simulation based trials
- Appreciation of product / technology by user
- Concurrent Engineering association of PA during R & D
- Pre-processing of Production order by User
- Training

TORPEDO- CONCURRENT ENGINEERING



Light weight torpedoes

- ▶ Torpedo Advanced Light (TAL)
 - ▶ Air and ship launched
 - ▶ Completed all user trials satisfactorily
 - ▶ Inducted to Indian Navy



THANK YOU
