Updated 30.3.17

Potential 'Make Projects'

DISCLAIMER:

The contents of this web page are for informational purpose only, enabling companies/ public to have a quick and easy access to information. Information contained in this web page is for planning purpose only and should not be construed as a solicitation nor should be construed as an obligation on the part of Ministry to make any purchases.

1. Under the 'Make in India' initiative of the Government, a list of potential 'Make' Projects has been identified by the Service Head Quarters (SHQs) in consultation with the other stakeholders in the Ministry. These projects are being contemplated to be undertaken as per category Make-I or Make-II of new revised Chapter-III on Make Procedure of Defence Procurement Procedure-2016 which is available on MoD website at link **http://mod.gov.in/writereaddata/DPPnew16.pdf**

2. Brief summary of the identified items containing tentative quantities, broad specification/ QRs, expected timelines for induction of these items by the Services, are enclosed at **Annexure** to this notice.

3. Interested Indian companies are requested to carry out preliminary assessment regarding their technical capability to undertake these projects and economic viability of the project.

4. Following Nodal officers have been nominated for for any queries related to these proposals:

Organization	Name & Designation	Office Address	Contact Details
Army	Col Bhanu Khanna Dir PP(AoN & Cat)	GS Branch Dte Gen Perspective Planning (AoN & Cat) Room No-121, A Wing, Sena Bhawan, New Delhi	(P) - 011-23335517 (F) - 011-23332864
Navy	Capt Naresh Chhabra Dir, DoI	Dte of Indigenization SHQ (Navy) 5th floor, Chanakya Bhawan, Chanakayapuri New Delhi	(P) – 011-24104052 (F) – 011-24122689 Email: doi-navy@nic.in
Air force	Air Commodore H S Basra , AVSM VM PD(Plans)	Room No.426, Air Head Quarters (Vayu Bhawan) Rafi Marg New Delhi- 110106	(P) - 011-23010231 Ext. 5431 (F) - 011-23015164 Email: makeind.af@gov.in
DDP	Shri Ravin Kulshrestha Dir(P&C)	Dte of Planning & Coordination Room 16, H-Block New Delhi-110011	(P) - 011-23011420 (F) – 011-23793032 Email: dirpnc-ddp-mod@nic.in
DDP	Shri Chandandeep Singh Planning Officer	Dte of Planning & Coordination Room no-41, H Block	(P) & (F) -011-23016619 Email: poms-ddp-mod@nic.in

5. The project-wise contact details of Project managers are given below:

SHQ (ARMY)

Sr no	Proposal	Name & Designation	Office Address	Phone/Fax	E-mail
1.	125mm smooth bore gun barrel for T-72 & T-90 tanks with missile firing and improved ammunition	Col KK Singh, Dir Inservice Eqpt (AC), DGMF Dte	Room No 501, 5th Floor, Sena Bhawan, Inservice Eqpt (AC), Section IHQ of MoD (Army)	011-233-35093	-
2.	125mm APFSDS (Armour-piercing fin-stabilised discarding-sabot) Amn with Depth of Penetration (Dop) of 600mm (min) – 800mm for T-72 Tank	Col KK Singh, Dir Inservice Eqpt (AC), DGMF Dte	Room No 501, 5th Floor, Sena Bhawan, Inservice Eqpt (AC), Section IHQ of MoD (Army)	011-233-35093	-
3.	1000HP Engine with associated peripherals for T-72 Tank	Col KK Singh, Dir Inservice Eqpt (AC), DGMF Dte	Room No 501, 5th Floor, Sena Bhawan, Inservice Eqpt (AC), Section IHQ of MoD (Army)	011-233-35093	-
4.	Individual Under Water Breathing Apparatus (IUWBA) @ 04 per tank. – for T-90 Tank	Col VS Kahlon, Dir MoD	Room No 501, 5th Floor, Sena Bhawan, Mo (AC) of Mod (Army)	011-233-35094	-
5.	Environmental Control Unit– for T-90 Tank	Col VS Kahlon, Dir MoD	Room No 501, 5th Floor, Sena Bhawan, Mod (AC) of Mod (Army)	011-233-35094	-

6.	Auxiliary Power Unit (APU) for T-90 Tank	Col VS Kahlon, Dir MoD	Room No 501, 5th Floor, Sena Bhawan, Mod (AC) of Mod (Army)	011-233-35094	-
7.	Tracked Light Dozer (TLD)	Col Vikram Gulati, Dir CE (CE-5B)	Room No 91, Combat Engr Dte E –in -C Branch Kashmir House Rajaji Marg New Delhi	011-23019604 011-23019675	ce5-einc-army@ nic.in
8.	Assault Track Way- Cl 24 for movement of HMVs in Desert & Semi Desert	Col Vikram Gulati, Dir CE (CE-5B)	Room No 91, Combat Engr Dte E –in -C Branch Kashmir House Rajaji Marg New Delhi	011-23019604 011-23019675	ce5-einc-army@ nic.in
9.	APTA(Advance Pilotless Target Aircraft)	Col Harsion Verma, Dir(Mod) Armd AD	IHQ of MoD (Army), AAD Dte, Room No 606,D-1 Wing, Sena Bhawan,Delhi	Fax – 23333632	proc.aad-army@nic.in
10.	MEAT (Manoeuvrable Expendable Aerial Target)	Col Harsion Verma, Dir(Mod) Armd AD	IHQ of MoD (Army), AAD Dte, Room No 606,D-1 Wing, Sena Bhawan,Delhi	Fax – 23333632	proc.aad-army@nic.in
11.	AFV Protection and Counter measure system(APS)	Col VS Kahlon, Dir MoD	Room No 501, 5th Floor, Sena Bhawan, Mod (AC) of Mod (Army)	011-233-35094	-

SHQ (NAVY)

Sr no	Proposal	Name & Designation	Office Address	Phone/Fax	E-mail
1.	Diesel engine for Boats	Capt AK Chakrabarti, DME	IHQMoD(N), Directorate of Marine Engineering 305 C Wing, Sena Bhawan IHQ MoD(N), New Delhi 110010	011-23010302 011-23011352	dme-navy&nic.in
2.	Upper Air sounding system	Cdr A Vidyasagar, JDNOM	IHQMoD(N), Directorate of Naval Oceanography and Meteorology, 130 A Wing, Sena Bhawan IHQ MoD(N), New Delhi 110011	011-23010139 011-23011663	dnom-navy@nic.in
3.	High Speed Low flying Targets	Capt VS Harke, DSR (ASW)	IHQMoD(N), Directorate of Staff Requirements 56 A Block Hutments, Sena Bhawan IHQ MoD(N), New Delhi 110011	011-23010948 011-23010241	dsr-navy@nic.in
4.	Expendable Underwater Target	Capt VS Harke, DSR (ASW)	IHQMoD(N), Directorate of Staff Requirements 56 A Block Hutments, Sena Bhawan IHQ MoD(N), New Delhi 110011	011-23010948 011-23010241	dsr-navy@nic.in
5.	Deck Winches(for shipping applications)	Capt H Gurumani, DOH	IHQMoD(N), Directorate of Hydrography 5M, West Block IV, Wing 5 Sector 1, RK Puram New Delhi,	011-26181834 011-26181834	doh-navy@nic.in
6.	Diesel Engines for Propulsion	Capt AK Chakrabarti, DME	IHQMoD(N), Directorate of Marine Engineering 305 C Wing, Sena Bhawan IHQ MoD(N), New Delhi 110010	011-23010302 011-23011352	dme-navy&nic.in
7	Shafting & Propeller for ***IN*** Ships	Capt Anish MJ Nair DME	IHQ MoD(N), Directorate of Marine Engineering 302 C Wing, Sena Bhawan IHQ MoD(N), New Delhi 110010	011-23010302 011-23011352	dme-navy&nic.in
8.	RAS/FAS Equipment	Lt Cdr S C Joshi Dte of Naval Architecture	Dte of Naval Architecture (DNA) Room no. 423 C/DII	011-23010184	

		(DNA)	Sena Bhawan		

SHQ (Air Force)

Sr no	Proposal	Name & Designation	Office Address	Phone/Fax	E-mail
1.	Air to Ground Rockets	Wg Cdr S Swami JD ASR (F)	Room No. 459, Air HQ (VB), New Delhi	23010231 Extn: 7467	makeind.af@gov.in
2.	Chaff & flares	Gp Capt SK Das, JD ASR (EW & VE)	Room No. 453, Air HQ (VB), New Delhi	23010231 Extn: 7453	makeind.af@gov.in
3.	Long Range Glider Bomb	Wh Cdr Sajja Sunil, JD ASR(Wpns)	Room No. 452, Air HQ(VB), New Delhi	23010231 Extn: 5847 23060225	makeind.af@gov.in
4.	Imaging Search and Track System (IRST)	Gp Capt AP Saraph VSM D ProjSu-30	Room No. 402, Air HQ(VB), New Delhi	23010231 Extn: 5492 23060217	makeind.af@gov.in
5.	Air Combat Maneuvering Instrumentation(ACMI)	Wg Cdr P Ganguly JD C^4ISR	Room No. 422, Air HQ(VB), New Delhi	23010231 Extn: 7422	makeind.af@gov.in
6.	Medium Altitude Long Endurance (MALE) UAV	Wg Cdr Ratnesh Singh JD ASR (RPA)	Room No. 452 Air HQ (VB) New Delhi	011-23010231 Extn: 7448	makeind.af@gov.in
7.	7.62mm Ammunition for Galil sniper rifle (NATO)	Wg Cdr A Susheel Kumar JD ASR (T-M)	Room No. 451 Air HQ (VB) New Delhi	011-23010231 Extn: 7451	makeind.af@gov.in
8.	5.56mm Ammunition for Negev LMG (NATO belted)				makeind.af@gov.in
9.	5.56mm Ammunition for TAVOR Assault Rifle (NATO)				makeind.af@gov.in
10.	Design & Development of 125 kg bomb (akin to MK-81 bomb)	Wg Cdr D Sarfrozuddin	Room No. 451 Air HQ (VB) New Delhi	011-23010231 Extn: 5851	makeind.af@gov.in
11.	Aerial Fuse for Bomb				

Annexure

Brief summary of the identified Potential 'Make' Projects

SHQ(ARMY)

Project No.1& 2

125MM SMOOTH BORE GUN BARREL FOR T-72 & T-90 TANKS WITH MISSILE FIRING AND IMPROVED AMMUNITION

1. **Name of Project**. 125MM Smooth Bore Gun barrel for T-72 & T-90 tanks with missile firing and improved ammunition.

2. **Brief**. The current T-72 & T-90 tank barrels are not capable of firing high penetration APFSDS rounds (above 600mm Depth of Penetration (DoP)) due to limitation of safety margin of 600 Mega Pascals (Mpa). There is a requirement to upgrade a common barrel system and ammunition for existing T-72 & T-90 tanks. Development of ammunition to provide capability of penetration and missile firing capability with these barrels also required to be developed together.

3. **Broad Specification**.

(a) **QRs - Barrel/ Gun Articles**.

S No	Parameter	Capability
(i)	Equipment	Barrel (including gun articles) and associated systems.
(ii)	Integration	With T-90 & T-72 tanks with existing Fire Control System (FCS)
(iii)	Capability	To fire ATGM(Anti tank guided missile) through gun barrel and APFSDS ammunition with DoP $\geq$ 600mm RHA.
(iv)	Ammunition	APFSDS, HE(Fragmentation), HEAT & ATGM.

(b) **QRs - Amn (APFSDS)**.

S No	Parameter	Capability

(i)	Lethality (DoP)	600 – 800mm of RHA.
(ii)	Effective Rg	3000 mtr
(iii)	Consistency	≤.35mils
(iv)	Adaptability	Existing FCS & AFVs Sights. Current/ new barrel or Gun Article of T-72 & T-90 tanks. Change in barrel metallurgy & designs (improved).
(v)	Permissible	Alteration auto loader, CLM and BCU/TPU of T-72 & T-90 tanks.

(c) **QRs-Msl**. Existing msl (9M119 – UBK20) to be integrated with the barrel system.

4. **Quantity**. 1000 Nos (minimum).

5. **Time Lines**. Prototype & trial eval by 2019. Production & sup by Dec 2020.

6. **Additional Info**. All future upgrades & improvements may be offered by vendor as part of contractual obligations (incl AMC & life time product support)

SHQ(ARMY)

Project No.3

1000HP ENGINE WITH ASSOCIATED PERIPHERALS

(FOR TANK T-72 & ITS VARIANTS)

1. **Name of Project**. 1000HP Engine with associated peripherals for T-72 tanks & its variants.

2. **Brief**. There is a need to upgrade the engine of the T-72 tanks, the power to weight ratio needs to be upgraded from the existing 17hp/ton. There is a need to integrate a newly developed power pack with associated peripherals in T-72.

3. **Broad Specifications**.

(a) **QRs**.

Ser No	Parameter	Capability
(i)	Power	1000HP ± 20HP
(ii)	Power to Wt Ratio	Not less than 20 HP/Ton
(iii)	Fuel consumption	Dunal Trn - 750 km X-Country - 650 km ± 10 On Rd - 500 km ± 10
(iv)	Ambient Temp for Ops	All environment condition in sub continent as per JSS/Mil Stds. For eval 40°C to 45°C
(v)	Life of Engine	650 hrs

(b) **Desirable**. Requisite changes to various sub systems like Cooling, Lubrication, Air Cleaning and Transmission System may be under taken to integrate the high powered engine.

4. **Quantity**. 1000 Nos (minimum).

5. **Time Lines**. Prototype development & trial evaluation by 2018. Production & supply by Dec 2019.

6. **Additional Info**. All future upgrades & improvements may be offered by vendor as part of contractual obligations (incl AMC & life time product support).

SHQ(ARMY)

Project No.4

INDIVIDUAL UNDER WATER BREATHING APPARATUS (IUWBA) FOR TANK T-90

1. **Brief Description**. During the course of their, the T-90 tanks are likely to negotiate a variety of terrain features including water obstacles. T-90 tanks have an ability to undergo deep fording at 5 meters depth under water channels of upto 5 knots. During deep fording, in the eventuality of the equipment stalling/ switching off, there is no alternative for the crew to escape from the fighting/driver compartment and reach the surface of the water, before the tank is completely flooded. Towards this end the IUWBA will ensure complete safety of the T-90 tank crew and ensure survivability.

2. **Broad QRs**.

(a) **Physical Chs**.

(i) The IUWBA (sets) should be able to be worn by tank crews during deep fording in the fighting compartment, in a manner that it does not restrain movement of the crew, foul with other moving parts or hinder functioning of the existing components.

(ii) The IUWBA should provide for positive buoyancy to each crew member during the emergency escape procedure which can be activated on demand.

(iii) The IUWBA should be compact enough to be stowed in the under stream crossing equipment (USCE) tool box of the tank when not in use.

(iv) The IUWBA should be separate for each crew member having a breathing inlet in the form of a Face Mask or Oral Respirator for each crew member.

(v) The weight of the IUWBA should not exceed 5 Kg.

(b) Op and Maint Chs.

(i) Operate in temperature ranges of $+4^0$Cto + 45^0 C.

(ii) The equipment should be capable of operating in environment conditions available in the Indian sub-continent and conform to JSS-55555 standards (as applicable to the equipment).

(iii) The equipment should be dust, moisture and leak proof and retain its efficiency when stored at temperature range from -5^0C to 55^0C.

(iv) The shelf life of IUWBA should be ≥ 7 years.

3. **Tentative quantity to be procured after successful prototype development**. 10,000 Nos.

4. **Tentative Time Line for Induction.** Two to three years.

SHQ(ARMY)

Project No.5

ENVIRONMENTAL CONTROL UNIT (ECU) FOR TK T-90

1. **Brief Description**. The T-90S/SK tank has state of the art features like Computerised Fire Control System, Thermal Imaging Night Sight, missile firing capability, carriage of missiles etc. This equipment is highly sensitive to adverse weather & dust conditions and get degraded under extreme heat and dust. Although, the tank is designed to operate in temperature conditions up to 50^0C, however, the ambient temperatures in our desert/semi-desert regions rises even beyond that. Resultant to the high temperatures obtaining in the crew compartment the electronic systems/ sub-systems are likely to get degraded. There is thus an imperative requirement of an Environmental Control System for T-90S/SK tanks to avoid detrimental effect to the onboard electronics and opto-electronics.

2. **Broad QRs**.

(a) **Physical Chs**.

(i) **Size and Shape**. The system should be compact and ergonomic **wherein the existing fitment items in the crew compartment should not be removed, however if relocated same should not compromise the operational efficiency of the tank**. The system should not foul with existing features on the tank.

(ii) **Power Supply**. The ECU should be able to operate from the mains, 24V output and also from APU output.

(iii) **Protection**. The system should be protected by **providing a metallic outer casing**.

(iv) **Robustness**. The system should be rugged enough to withstand the hazards of cross country mov in plains and desert terrain.

(v) **Preservation Desired**.The system should comprise sealed units and be water resistant upto tank depth of 1.5 meter while tank is carrying out medium fording operations.

(vi) The system should meet the MIL 461 **E** standards (as applicable for ground forces) **with regard to EMI/EM compatibility**.

(b) **Tech Parameters**.

(i)	AC Type	: Split.
(ii)	Air Circulation	: Closed cycle with air intake from crew Compartment.

(iii) Final inside temperature desired : 28^0 ±5 °C (hatches closed) **in an ambient temperature range from -5^0C ± 5^0 C to 45^0 C ± 5^0 C. For temperatures beyond 45^0 C ambient a minimum of 15^0 C drop in temperature within the tankmust be effected.**

(iv) **The system should be able to achieve the stipulated final temperature inside temperature within 30 minutes.**

(v) Compatibility : **As per JSS -55555 (As applicable).**

(vi) Relative Humidity of cooled air (%) : 30 to 75.

(vii) The system should have a digital counter to measure the temperature (in oC) and humidity. It should be located at an appropriate place in the crew compartment.

(c) **Op and Maint Characteristics**.

(i) The system should be able to operate efficiently in an ambient temperature range from -50^o C + 50^o C to 45^0 C + 50^o C.

(ii) Must be compatible with the main power supply of the AFV with a voltage range from 22V DC to 29V DC (Nominal Voltage 27V DC.

3. **Tentative quantity to be procured after successful prototype development**. 2108 Nos.

4. **Tentative Time Line for Induction.** Two to three years.

SHQ(ARMY)

Project No.6

AUXILIARY POWER UNIT (APU) FOR TK T-90

1. **Brief Description**. The engine of the tank T-90 is the main source of power for any function, however it is imperative to have an alternate source of power to cater for varied requirements to enhance the engine life of a tank. Therefore it is essential to install an APU (Diesel Generator) in the tank T-90, which would preserve the main engines life without compromising on the operational capability of the tank T-90.

2. **Broad QRs**.

(a) **Physical Characteristics**.

(i) **Size and Shape**. The system should be compact and ergonomic **wherein the existing fitment items in the crew compartment should not be removed, however if relocated same should not compromise the operational efficiency of the tank**. The system should not change the **overall dimensions of the tank in vertical and horizontal plane,** when viewed from the front. The system should not foul with existing features on the tank.

(ii) **Life**. The APU should be designed to last for minimum 1000 engine hours **for which vendor should provide a certificate**.

(iii) The system should meet the MIL 461 **E** standards (as applicable for ground forces) **with regard to EMI/EM compatibility**.

(iv) **AuxiliaryPower Unit (APU)**.

(aa) Power Rating : Not less than 10 KW at 27.5 ±1V DC

(ab) Compatibility : As per JSS -55555. **(As applicable).**

(b) **APU**.

(i) APU should also be able to concurrently operate the following systems of the tank in silent mode (Main engine of the tank switched off) for at least four hours.

(ii) Not foul with ground/trailer while mounting/ dismounting and lashing the tank on a tank transporter and on MBFU/MBWT.

(iii) The APU should be air cooled/water cooled and DHPP 'A' driven. The APU should preferably use 5W 50 grade engine oil or any other oil which is commercially available in India.

(iv) The APU should have an inbuilt overload protection system.

(v) The APU should have a standby starting system apart from the main starting system ie it should be able to be started by external power source, example another APU/tank.

(c) **Op and Maint Characteristics**.

(i) The systems should have a Built-in Test facility to isolate a defect that has occurred in the system..

(ii) The system should provide for a minimum Mean Time Between Overhaul (MTBO) of 1000 hours for APU for which vendor will give a certificate.

3. **Tentative quantity to be procured after successful prototype development**. 2108 Nos.

4. **Tentative Time Line for Induction.** Two to three years.

SHQ(ARMY)

Project No.7

TRACKED LIGHT DOZER

1. **Name of the Project**. Tracked Light Dozer.

2. **Brief of the Project**. Tracked Light Dozer is envisaged as an earth moving plant to be employed by the Indian Army Units in mountainous terrain for a variety of earth moving tasks such as track construction, levelling, land slide clearance & snow clearance etc.

3. **Broad Specifications**.

   (a) Capable of being lifted by in-service helicopters up to an altitude of 4000m.

   (b) Detachable Modular Parts of maximum 1.5 to 2 Ton.

   (c) Capable of being disassembled/ assembled in field with ease, without the need of any specialised equipment.

   (d) Minimum operating temperature up to (-) 20^0C.

4. **Tentative Quantity**. The quantity to be procured is approximately 180 with anticipated requirement of 15-20 per year of 10 years with complete spares and overhaul support.

5. **Tentative Timelines for Development/ Production**. Two-three years.

SHQ(ARMY)

Project No.8

ASSAULT TRACK WAY CL-24

1. **Name of the Projects**. Assault Track Way Class -24

2. **Brief of the Projects**. The Assault Track Way Class-24 is envisaged as a light weight track material to be employed in Desert/Semi Desert terrain for mobility of wheeled vehicles of the Indian Army with load class up to Class -24. It is proposed to replace the existing Aluminium Alloy based Assault Track Way Class-12.

3. **Broad Specifications**.

(a) Temp tolerance up to $+50^{0}$c.

(b) The surface finish should be able to blend with the terrain without any shiny surfaces.

(c) It should facilitate ease of laying and recovery with manual effort as well as mechanical aids.

(d) The expected life of the track material should be 10,000 passes of Class -24 vehicles.

(e) Weight of one roll of track material should not exceed 300kgs.

4. **Tentative Quantity**. The total requirement will be approximately 1000 km and the annual requirement will be 20-50 km per year.

5. **Tentative Timelines for Development/Production**. Two - three years.

SHQ(ARMY)

Project No.9

ADVANCED PILOTLESS TARGET AIRCRAFT (APTA)

1. **Brief Description**. Army AD has a variety of weapon platforms to include missiles of varying ranges and Gun Systems. There is a recurring regiment of suitable aerial target systems for providing realistic training to the crews during the annual field firing exercises.

2. **Broad QRs**.

SNo	Parameter	Capability
(a)	Max Speed	Not less than 0.6 Mach (550 m/s) speed at 6000m altitude in clean configuration (ie without tow body)
(b)	Max Endurance	Not less than 45 mins at 4000 m alt at 0.40M with one tgt towed
(c)	Min Altitude	Not less than 300m for clean configuration
(d)	Max Altitude	Not less than 8km for clean configuration
(e)	Manoeuvrability	Not less than 3.5 ‘g’
(f)	Launch Mode	By ground/sea
(g)	Radar Band for Detection	X, Ku and Ka Bands
(h)	Range	Radio control up to 60 Kms or more and Autonomous mode up to 100 Kms
(j)	Recovery	Ground based

3. **Tentative Quantity**. Approx 05 per year.

4. **Tentative Timelines for Development/Production**. Two-three years.

SHQ(ARMY)

Project No.10

MANOEUVRABLE EXPENDABLE AERIAL TARGET (MEAT)

1. **Brief Description**. Army AD has a variety of weapon platforms to include missiles of varying ranges and Gun Systems. There is a recurring reqmt of suitable aerial target systems for providing realistic training to the crews during the annual field firing exercises.

2. **Broad QRs**.

Ser No	Parameter	Capability
(a)	Max Speed	Not less than 400 Kmph or more (111 m/s).
(b)	Max Endurance	Not less than 30 minutes or more at Wide Open Throttle (WTOT) at sea level.
(c)	Min Altitude	Not less than 20m or less.
(d)	Max Altitude	Not less than 5000m or more.
(e)	Manoeuvrability	Not less than 2.0 ‘g’ or more in a sustained turn.
(f)	Launch Mode	Ground based.
(g)	Range	X, Ku and Ka Bands
(h)	Employability	Radio Control up to 75 Km or more.
(j)	Likely utilisation per year	Not less than 400 Kmph or more (111 m/s).

3. **Tentative Quantity**. Approx 50 per year.

4. **Tentative Timelines for Development/Production**. Two-three years.

SHQ(Army)

Project.11

AFV Protection and Counter measure system(APS)for armoured fighting vehicles

1. **Brief Description**. Contemporary combat vehicles have on-board protective cum warning systems to warn the crews of impending attacks and create physical interference between the vehicle and the hostile threat, thereby enhancing survival. The existing fleet of 'A' vehicles in service with the Indian Army does not offer the crew, these enhanced protection measures as on date. There is thus a need to install a modern active protection system on all Armoured Fighting Vehicles of the Mechanised Forces to significantly enhance their survivability.

2. **Broad QR/Specifications**. The broad QR/ Specification for the intended active protection system are as under:-

(a) **Physical Characteristics**.

(i) Should be light in weight and not adversely affect existing agility/mobility of the vehicle. The complete **weight added** due to fitting the system should be **less than1000 kg**.

(ii) Should be mountable on tanks without interfering with other systems or their functioning and ergonomics of the crew.

(iii) Should not necessitate the removal of essential fitment items.

(iv) Components fitted outside must be military grade and protected against splinters and small arms firing.

(b) **Operational Characteristics**.

(i) The system should deflect or destroy hostile attacks to protect against threats from guided missiles, RPG/RL and projectiles fired up to velocity of 1000 m/sec. The system should have provision for future upgrades to degrade KE projectiles. The percentage of protection against each type of ammunition must be at least as under:-

(aa) RPG/ **RL (From a min dist of 75 m**)-80%.

(ab) ATGM - 80%.

(ac) HEAT round from 125mm tank gun-70%.

(ii) Should function when static or on the move and should be capable of all weather, day and night operations.

(iii) Should give warning when lased on by incorporation of laser warning devices.

(iv) Should provide a protective arc in azimuth of 360 degrees and in elevation at minimum of minus 6^0 to plus 20^0.

(v) Should be capable of detecting **more than one direction of attack** in case near simultaneous hostile threat (**minimum of 0.4 second gap**) and neutralize up to two threats.

(vi) Should have multi launcher capability/ auto loading to address threats from different direction simultaneously.

(vii) The fitting of the system should **not affect sealing of combat vehicle for deep fording and NBC protection**. The sub system fitted externally should be waterproof for fording.

(viii) The system should be capable of continuous **operation for at least eight hours**.

(ix) Should withstand the climate and durability tests as per **JSS : 55555**.

(x) The system should have high safety against accidental activation and the dangerous zone for dismounted troops operating in the vicinity should **not exceed 50m radius** from the tank.

(xi) System should be capable of withstanding variation/ fluctuation of **electric voltages as per MIL 1275 B**.

(xii) The **normal power consumption** of the system (excluding peaks) **should not exceed 1 KW** and the operating voltage of the system should be compatible with tank batteries.

SHQ (NAVY)

Project No.1

1.	**Name of Potential Project**
	Diesel engines for boats
2.	**BRIEF SPECS**
	▪ For propulsion of various boats used in ***IN*** ▪ The engine is to be supplied with its associated ancillary equipment, pipes, fittings, instrumentation which broadly include the following:- • All piping and fittings forming integral parts of the engine like flywheel, governor, lub oil and fw cooler, engine driven fresh water pump, lub oil pump, sea water pump, hand operated sump drain pump, filters (air, lub oil and fuel oil). • 24 V electric starting equipment along with suitable battery catering to minimum 40 starts of the engine with provision for alternative mechanical / hand start • Exhaust system comprising silencer, manifold (water cooled type) • Engine driven fresh water, fuel oil and lube oil pumps • Instrumentation consisting of ammeter, push button for starting, lo pressure gauge, Low temperature gauge, engine cooling water temp gauge, tachometer with drive, hour meter, gearbox oil temp gauge. The instrumentation panel should be water proof. • The engine should be fresh water cooled which in turn should be cooled by sea water.
3.	**Tentative quantity to be procured after successful prototype development**
	▪ Approx 40 for 2016-17
4.	**Tentative timeline for induction**
	03 to 05 years

SHQ (NAVY)

Project No.2

1.	**Name of Potential Project**
	Upper Air Sounding System (UASS)
2.	**Brief Specs:**
	To Record:- ▪ Upper Air Profile for Weather Prediction ▪ Generation of Aviation Met Reports ▪ Assessment of Anomalous Propagation Conditions ▪ Ballistic Correction for Ammunition Firing *Complete system is Integral Part of all Capital Ships, Aircraft Carriers And Air Stations*
3.	**Tentative Quantity to be Procured After Successful Prototype Development**
	Ground Station (Fixed) : 25 Units For ***IN*** Radiosonde (Consumable) : Approx 14000 Per Annum
4.	**Tentative Timeline for Induction**
	24 Months

SHQ (NAVY)

Project No.3

1.	**Name of Potential Project**
	High Speed Low Flying Targets
2.	**Brief Specs:**
	Broad Requirement:- ▪ High speed low flying aerial target ▪ Expendable in nature and launched from ship upto Sea State 3 ▪ Speed greater than or equal to 350 Knots ▪ Endurance greater than or equal to 25 min at max speed and 40 min at Economical speed ▪ Flight Altitude 10m to 6000m ▪ Pre-programmed autonomous flight using way point navigation ▪ Target should be capable of being controlled upto 75 Km based on clear Line of sight
3.	**Tentative Quantity to be Procured After Successful Prototype Development**
	▪ 40 per year
4.	**Tentative Timeline for Induction**
	▪ 03 years

SHQ (NAVY)

Project No.4

1.	**Name of Potential Project**
	Expendable Under Water Target(EUT)
2.	**Brief Specs:**
	▪ Self-propelled expendable target body ▪ Control console capable of programming trajectory and signature EUT, and undertake testing of EUT prior launch ▪ Hydrodynamic design and battery operated ▪ Lightweight less than 30 kg, capable of being launched manually by lowering from ship's side ▪ Capable of operating between 1 to 8 knots of speed ▪ Operate within depth from 10 m to 150 m ▪ Endurance of more than 4 hrs ▪ EUT should be capable of operated upto Sea State 4
3.	**Tentative Quantity to be Procured After Successful Prototype Development**
	▪ 60 per year
4.	**Tentative Timeline for Induction**
	▪ 02 years

SHQ (NAVY)

Project No.5

1.	**Name of Potential Project**
	Winches - Deep Sea Side Scan Sonar Towing Winch
2.	**BRIEF SPECS**
	▪ A self-contained, electro-hydraulic or electro-mechanical, variable speed cable handling system. ▪ Stainless steel hardware protected for marine environment. ▪ Capable of withstanding load on the winch in sea state 3-4 at ship speed of 10 knots. ▪ Size – not more than 5 ft w x 4 ft h x 4ft l ▪ Total weight – less than 1500 kg ▪ Automatically align cable during retraction to avoid fouling of cable. ▪ Remote control operation in addition to local control and manual. ▪ Suitable electrical motor capable of operating on ship's power supply 415 v/ 3 phase/ 50 hz. ▪ The drum should leave atleast 2" in clearance on flange
3.	**Tentative quantity to be procured after successful prototype development**
	▪ Qty – 04 Nos
4.	**Tentative timeline for induction**
	02 years

SHQ (NAVY)

Project No.6

1.	**Name of Potential Project**
	Diesel Engines For Propulsion
2.	**BRIEF SPECS**
	▪ The Diesel Engines are required for propulsion onboard Ships. The Engines with Power Rating of 5-10 MW are required to be indigenously developed. ▪ The maximum speed of the ship would be required to be achieved at 85% MCR of the Engine. The Engines are to be capable of 10% overload for a minimum duration of one hour in 12 hours at extreme tropical conditions without incurring any undue wear, maintenance and risk of damage. ▪ The Engine is to be supplied with its associated Ancillary Equipment, Pipes, Fittings, Instrumentation etc. ▪ The materials used in the engine should comply to Defstan 02-313. The broad specifications will be provided on request. ▪ The Engines should be class approved and certified by lRs/ABs or any other suitable agency. The first of the Engine will be type tested. ▪ The Engine emission should meet the latest Nitrogen Oxides (NOX) and Particulate Matter (PM) standards as promulgated by IMO for new Diesel Engines. The Diesel Engine will as a minimum comply with IMO Tier II emission norms.
3.	**Tentative quantity to be procured after successful prototype development**
	▪ The Quantities would be finalised post discussions and based on Induction Plan of Ships for 5-10 MW Power Rating Engines. ▪ Tentative Quantities are 15 Per Year 2020 onwards
4.	**Tentative timeline for induction**
	03 To 05 Years

SHQ (NAVY)

Project no. 7

1	**Name of Potential Projects**
	Shafting & Propeller for ***IN*** Ships
2	**Brief Specs**
	Presently shaftlines and components including propellers, stern tube bushes, "A" bracket bushes, plummer block bearing, thrust block and seals largely of import nature the import content is much higher. Therefore, it is proposed to develop in-house expertise for "Shafting and Propellor" for ***IN*** ships.
3	**Tentative quantity to be procured after successful prototype development**
	For projects that include Fleet Support Ships, Landing Platform Dock, Large Survey Vessel, Diving Support Vessel, Multipurpose Vessel, Next Generation Missile Vessel etc. for a propulsion of approximately 1.2 to 18.0 MW, it is envisaged that approximately **37 Nos** shafting system would be required.
4	**Tentative timeline for induction**
	04 to 05 years

detailed specification as per draft PSQR placed at Appendix below:-

Directorate of Marine Engineering
IHQ MOD(N)

DRAFT PRELIMINARY SERVICE QUALITY REQUIREMENTS (PRELIMINARY SQRs)

SHAFTING & PROPELLER

CONTENTS

1. INTRODUCTION

1.1 This preliminary SQR related to the proposal for manufacture and supply of one ship set of Shafting & Propellers, complete with accessories, such as Thrust Block, Plummer Blocks, CPP Pumps & Motors (as applicable), coolers, associated piping & valves, control system, instrumentation, mounting arrangements, associated components, necessary couplings for integration of the Shafting & Propellers to the ship's main propulsion and the platform. The design must ensure high reliability, economy of weight/ space, resistance to shock and vibration.

2. GENERAL CONDITIONS & REQUIREMENTS

2.1 The manufacturer of the Shafting & Propellers shall be responsible for the exchange of sufficient information between various OEMs, concerned agencies, propulsion system integrator and the shipyard to enable the propulsion system to meet the specified performance requirements.

2.2 Although the instant SQR is preliminary, however, subsequently on finalization of the SQR, in case of conflict between the various documents, the order of precedence is as follows in descending priority :-

(a) SQR

(b) Attachment of the General Conditions and Requirement specifications

(c) Applicable standards/ specifications

3 SCOPE OF BASELINE DESIGN

3.1 Propulsion System Integration (PSI). A PSI study involves all aspects of the propulsion system to achieve the correct integration of the various components of the propulsion system, their interfaces with each other and with the ship structure, in order to perform as per the 'agreed objectives' assigned to the propulsion system. PSI consultant should provide adequate procedures for successful alignment and installation of the propulsion plant, setting to Work, HAT and SATs.

3.2 Arrangement of Main Propulsion Machinery.

3.2.1 The general arrangement of Main Propulsion machinery is as as follows :-

(a) Main Propulsion Plants will be located in the Engine Rooms.

(b) Shaftline extends from aft end of gearbox in engine rooms to propellers located outboard.

(b) The system shall be designed to transmit power continuously.

3.3 Scope of Shafting & Propeller

3.3.1 The scope of this preliminary SQR covers the supply of Shafting system and propeller (Fixed pitch propeller (FPP)/ Controllable pitch propeller (CPP)) comprising of following major components :-

(a) FPP/ CPP with its own mechanical, hydraulic and pitch control system, as applicable

(b) Intermediate shafts, Thrust block shaft, Propeller/ Tail shaft

(c) Oil distribution (OD) box & hydraulic system with associated controls for CPP

(d) Coupling between the shafts

(e) 'A' bracket bearing, 'P' bracket bearing and sea water lubricated stern tube bearing

(f) Plummer bearings

(g) Bulkhead seals

(h) Stern tube seals

(j) Thrust Block

(k) Shaft locking arrangements

(l) Torsionmeter

(m) Shaft turning gear

3.4 **Basic Requirement**

3.4.1 All components which constitute the shaftline from the gearbox output flange to the propeller are to be designed and dimensioned, to confirm with the requirements of standards and specifications as under :-

Shafting	NES 304, Part 1
Shafting auxiliaries	NES 304, Part 2
Propeller	NES 304, Part 3
Air Borne Noise (ABN) levels	MIL STD 1474D
Structure Borne Noise (SBN) levels	MIL STD 740-2
Shock	BR 3021/ *IN* Shock Grade A
Mechanical Vibrations	MIL STD 167-1

Class Rules	LRS rules & regulations for classification of ships
Valves	NES 360
Documentation	DME specifications 452

IETM-4 format	MIL-DTL-87268D MIL-DTL-87269D JSG 0852:2001
Tally / Diagram plates	NES 723

3.4.2 The designer is to be aware of and take account of factors which will emerge due to unique Navy operational requirements with respect to :-

(a) Astern operations

(b) Thrust loads

(c) Transient overloads

(d) Manouvering loads

(e) Multi-engine and combined power configurations

(f) Idling and towing

(g) Cross connection gears and shafting

(h) Emergency operation

Note : This is not an exhaustive list and additional influences resulting from different operational requirements will emerge.

3.4.3 The shaftline design where possible should meet the following :-

(a) Shafting is to be designed for a fatigue life equal to the life of the ship, with maintenance free periods as prescribed.

(b) Shafting material must conform with specified standards/ specifications.

(c) Shafting is to be supported in plummer bearings inboard and in bracket bearings or stern tube bearings outboard.

(d) The bearings are to be arranged as far apart as possible consistent with satisfactory bearing loads, bending stresses and whirling characteristics, to minimise the sensitivity of the shafting system to misalignment.

(e) Provision is to be made in each line of shafting for the accommodation of a torsionmeter or other shaft torsion measuring equipment.

(f) Each length of shafting is to be interchangeable with corresponding lengths of shafting in the vessel and in other vessels of the Class. Spare shafting is to be interchangeable with corresponding fitted shafting.

3.4.4 The equipment shall meet the shock requirements as stated in BR 3021, or as amended by the *IN* as Shock Grade A. Design shall be suitable to withstand shock

loading without significant effect on the performance and without any portion of the equipment coming adrift or creating a hazard to personnel or to others.

3.4.5 Torsional, Axial & Lateral Vibration

(a) The vibration characteristics of the shafting system are to be analysed and documented.

(b) Calculations are to be made for the system consisting of the prime mover, flexible couplings, gearing, shafting and propeller, including cross connections. Maximum vibratory stresses must be confirmed to be within the endurance limit of the material used in each component of the propulsion system.

(c) The primary source of axial vibration is thrust fluctuation generated by rotation of the propeller in a non-uniform wake. Thrust fluctuations occur at blade-passing frequency and to a lesser extent at twice blade-passing frequency. The shaft designer is to carry out an estimate of critical shaft speed and blade frequency excitation at the critical speed to determine if resonance is likely to occur.

3.4.6 The shafting and propeller have to be designed for low weight, compact design, high reliability, availability and maintainability.

3.5 Main Characteristics and Performance

3.5.1 Power/ rpm characteristics (pitch ahead)

(a) Maximum power at the engine should be calculated considering 2.5% transmission losses through the gearbox and 1% transmission losses in the shafting system.

(b) Shaft strength calculations are to be based on shaft power and propeller speed.

(c) A combinator curve should define the power and rpm characteristics of a controllable pitch propeller. Aspects of maximum speed and cavitation needs to be considered in arriving at combinator law.

3.5.2 Power/ RPM characteristics (pitch astern) : Propeller is to be designed so that a maximum astern power of 40% maximum ahead power can be absorbed by the propeller during a crash stop manoeuvre.

3.5.3 Torque withstanding capacity of the shafting & CPP (as applicable) shall be in accordance with NES 305, as applicable.

BASELINE DESIGN

4.1 Shafting

4.1.1 Shafting Arrangement

Shafting arrangement adapted to ship's hull will be frozen by the *IN*, and location of the 'A' and 'P' brackets, stern tubes, bulkhead glands and gearbox output point will be indicated by the *IN*. However, the location of shafting components such as plummer blocks, thrust block, auxiliary thrust block, couplings, lengths of shaft pieces are to be proposed by the supplier. Consideration should be given to optimise the length of the individual shaft segments for removal and assembly.

4.1.2 Shafts

(a) CPP. All shafts should be hollow bored to facilitate passage of fluids.

(b) Shaft outer diameters and shaft bores shall be calculated in accordance with NES 304/ Section 4 of LRS guidelines/ equivalent standard. The calculations along with all particulars are to be submitted.

(c) The following is to be indicated by the OEM:-

(i) Material

(aa)	Chemical composition	:
(ab)	Mechanical properties	:
(ac)	Tensile strength (min)	:
(ad)	Yield strength (min)	:
(ae)	Elongation (min)	:

(ii) Geometry, for each shaft

(aa)	Outside diameter	:
(ab)	Bore diameter (CPP)	:
(ac)	Length	:
(ad)	Actual Span & Length	: to be indicated for each shaft piece, plummer bearings, liners, couplings, flanges etc.
(ae)	Coating length	:

(iii) Mass

4.1.3 Liners

(a) Shrunk on liners of corrosion resistant Bronze (of either material PB-2 or LG-4C only) are to be fitted in way of 'A' & 'P' bracket bearing, stern tube bearing & seal, and adjacent of outboard sleeve couplings, which shall enable removal of such items without the need to disturb the shaft corrosion protection coating.

(b) The chemical composition of the selected liner (indicated above) along with its mechanical properties is to be indicated.

4.2 **Shaftline Accessories**

4.2.1 Seawater lubricated bearings

(a) The 'A' and 'P' as well as stern tube must have sea water lubricated bearings.

(b) Each sea water lubricated bearing shall be designed for removal/ installation without removing the shaft line or the bearing carrier.

(c) 'A' bracket bearing, 'P' bracket bearing and stern tube bearing carrier shall be of Bronze and compression head with each bearing housing OD designed for resin chokfasting inside the bearing housing.

(d) The following information is to be given by the supplier :-

(i)	Bearing inner diameter	:	mm
(ii)	Bearing length	:	mm
(iii)	Bearing carrier outside diameter	:	mm
(iv)	Bearing carrier length	:	mm
(v)	Mass of bearing carrier	:	kg

(e) Suitable provision for measurement of weardown of bearings in afloat condition through poker gauge/ strain gauge/ suitable alternate method may be provided.

(f) Flowmeter with suitable indicator/ read out facility to measure the flow of sea water through the stern tube bearings, as required, are to be provided.

4.2.2 Plummer Bearing

(a) The preferred type of bearing is the hydrodynamic, oil lubricated type. Alternatively a rolling contact type of bearing may be used if required by a special duty.

(b) Plummer bearing is to be suitably designed and installed on the shaftline.

(c) Following information is to be given by the supplier :-

(i)	Bearing diameter	: mm
(ii)	Bearing length	: mm
(iii)	Housing material	:
(iv)	Mass (with oil) (for hydrodynamic Plummer bearing)	: kg
(v)	Required sea water flow for cooling (for sea water cooled plummer bearing)	: cubic m/h (max & min)

4.2.3 Bulkhead Seal

(a) The bulkhead seal should accommodate angular shaft displacement as well as transverse movements between shaft and bulkhead resulting from vibrations, whirl, shock or bulkhead flexure.

(b) The following is to be indicated by the supplier :-

(i)	Make	:
(ii)	Type	:
(iii)	Diameter	:
(iv)	Weight	:

4.2.4 Stern Seals

(a) Stern seals are to be designed to limit the ingress of seawater to a specified leakage rate. This leakage rate is to be achieved under the most adverse conditions with the shaft rotating in either direction at any speed between zero and the maximum speed specified.

(b) Each stern seal is to incorporate an air-operated inflatable seal at its aft end to allow maintenance and repair to be carried out without the need for docking the vessel. Permanent facilities are to be provided for inflation of this seal and its design is to be such that it is clear of the shaft when not in use. The required air pressure for operation of the inflatable seal is to be specified by the seal designer.

(c) Stern seals must function under all specified shaft misalignments including those encountered between new and fully worn outboard bearings. Stern seals are to be designed to accommodate all axial, transverse and angular shaft movements during normal operation and under shock conditions without damage or loss in efficiency.

(d) Stern seals are to be designed to allow refit of the sealing and other wearing elements with the shaft in place.

(e) Weardown gauge is to be provided on the stern seal.

4.2.5 Thrust Block

(a) The function of a thrust block is to transmit propeller thrust to the hull of the ship and to control shaft axial movement.

(b) The thrust block may be integral with the main gearbox of propulsion machinery or independently mounted on the ship’s structure.

(c) The thrust blocks are to satisfy all requirements as per specified standards.

4.2.6 Auxiliary Thrust Block. In the event of damage to gearbox/ main thrust block, an auxiliary thrust block must be able to withstand the maximum thrust coming from the trailing propeller when the ship is running at her maximum achievable speed with power on the other shaft. The auxiliary thrust block is required to be designed accordingly.

4.2.7 Shaft Brake And Locking Gear

(a) Where two or more propulsion shafts are installed, each propulsion system is to be provided with shaft brakes and locking arrangements.

(b) The function of the shaft brake is to slow down and restrain the shaft whilst the ship is being manoeuvred at slow speed and to hold the shaft while the shaft locking gear is being engaged. Shaft brakes are to be capable of functioning in a compartment that is flooded.

(c) The function of the propeller shaft locking gear is to immobilise the shaft whilst the ship is underway either powered by its remaining shafts or being towed-and during shaft maintenance or inspection.

(d) The locking gear is to be made integral with the main turning gear or incorporated in the shaft brake housing but it must be capable of independent operation.

(e) If locking the shaft through the turning gear involves risk to the gearing, especially when the ship is underway, then an alternative locking arrangement is to be made by providing a mechanical tie between the shaft and the ship's structure.

4.2.8 Shaft Turning Gear. Suitable shaft turning gear is to be provided for rotating the shaftlines.

4.2.9 Torsionmeter. The torsionmeter should be capable of measuring continuously the actual thrust of the shaft when running ahead or astern. One each fixed torsionmeter, with local indication and interfacing with IPMS for remote indications, and portable torsionmeter are to be supplied for each shaftline.

4.3 **Propeller**

4.3.1 General Data

(a)	Type	FPP/ CPP
(b)	Propeller diameter	As per design
(c)	Number of blades	As per design
(d)	Design ahead (reference) pitch	*mm
(e)	Expanded area ratio	*
(f)	For CPP, hub and blade assembly Attachment	Hub & blade assembly attached to the propeller shaft which always runs in the same direction
(g)	Direction of rotation	To be specified
(h)	Mass of the propeller (for CPP without oil)	*kg
(j)	Mass of one blade	*kg
(k)	Mass of the hub (for CPP without oil)	*kg
(l)	Mass moment of inertia of propeller	*kg sq m
(m)	Mass moment of inertia of entrained water	*kg sq m

(n)	Maximum power absorbed by the propeller	*
(p)	Propeller performance curves	*

Note : data marked with '*' to be indicated by the supplier

4.3.2 Design & Operating Principle. Reference may be made to Section 2, Para 2.1 of Volume 2, Part 4, Chapter 1 of LRS Rules, Jan 2016.

4.3.3 Propeller Model Test. The supplier is required to demonstrate that the design meets the efficiency, cavitation and other performance requirements including resistance test propeller, open water test, self propulsion test and cavitation inception test through hydrodynamic model test.

4.3.4 Propeller Hub. General data :-

(a) The hub assembly provides mounting for the propeller blades.
(b) CPP. The hub also houses the blade turning mechanism for changing and holding blade pitch.
(c) The hub body shall be cast in one piece.
(d) The hub is secured to the tail shaft by flange bolts.
(e) Hub diameter : *mm
(f) Hub body material : *
(g) Markings on the hub for Blade angle : Reference position for Ahead & Astern blade angles to be indicated on the hub

4.3.5 Blades

(a) Blades are to be interchangeable in all respects between hub positions on the same propeller and with hubs of other vessels of the same Class.

(b) Blade material : to be indicated by the supplier

(c) Provision must be considered for a noise reduction system using air blowing through small holes along the leading edges of propeller blades (so called Prairie System) which can be decided for installing at a later date.

4.4 **Blade Turning Mechanism and Associated Hydraulic System (For CPP)**

4.4.1 General Data

(a) Under the high pressure of hydraulic oil (power) flow, the blade turning mechanism installed in the propeller hub translates an axial motion of a valve rod into a rotary motion that changes propeller pitch. A non-return valve can be used for maintaining pitch in position.

(b) Each propeller is operated by its own independent hydraulic system. There is no provision for cross-connecting both systems.

(c) The hydraulic power system mainly consists of one main gear/ shaft driven pump (reduction gearbox mounted) and one electric driven pump supplying oil to the pitch actuating device through a shaft mounted OD box.

(d) The motor driven pump acts as a 100% stand by pump. It is arranged to cut in automatically when the shaft driven pump fails or during rapid changes of pitch at low shaft speed, when output flow from the shaft driven pump may be inadequate for quick manoeuvring.

(e) The hydraulic systems must be suitably designed to take suction from requisite tanks.

(f) A gravity head tank must connect the system via the OD box to maintain pressure on the hub and shaft when the hydraulic pumps are shut down. The pressure shall prevent sea water from leaking into the hub.

(g) An emergency pump is to be provided as an onboard special tool to enable the pitch of the blades to be changed, with the shafts at rest, under emergency or maintenance conditions. It might be either a hand pump or a pneumatic pump.

(h) In the event of complete breakdown of the hydraulic system, it should be possible to lock the blades in position by hydraulic means and to increase pitch by the emergency pump.

4.4.2 Type of oil for the system : OMD 113 (NATO 0-277)

4.4.3 Performance

(a) The system shall be designed for maximum pitch adjusting speed so that specified response is achieved with either motor driven pump or shaft driven pump running.

(b) The system shall be capable of running the motor driven pump and the GB driven pump in parallel with a pitch adjusting speed of atleast 2 deg/ sec for the whole speed range.

(c) Ahead over pitch capability : ≥ design pitch + 2 deg

(d) Maximum pitch astern : to be indicated by the supplier

(e) Pitch settings shall range in a continuous way from full ahead through zero pitch to full astern.

(f) Pitch setting accuracy & repeatability : to be indicated by the supplier, for both mechanical & electronic feedback options.

4.4.4 OD Box. In this baseline design, the OD box is mounted on the shaft line/ on its own shaft.

4.4.5 Hydraulic System. For each shaftline, the hydraulic system shall include :-

(a) One hydraulic power pack with main components on a resiliently mounted module, including :-

(i) Main tank
(ii) Valves, filters, suction strainer
(iii) Instrumentation

(iv) Sea water cooler
(v) Electric motor driven pump
(vi) Necessary control devices

(b) One header tank

4.4.6 Hydraulic Tanks. General data to be indicated by supplier :-

(a) Main tank capacity : *cubic m
(b) Header tank capacity : *cubic m
(c) Minimum required head above OD box : *m
(d) The header tank shall be provided with external pipes connections, low level switch, breather, filling connection and dipstick.

4.4.7 Power-take-off (PTO) driven pump set

(a) A gearbox PTO driven pump set is to be included in the scope of the CPP system to supply oil to the pitch actuating device during normal operation.

(b) Gearbox, PTO speed should correspond to the maximum shaft speed RPM.

(c) The following shall be indicated by the supplier :-

Shaft Speed (rpm)	**Pump Speed (rpm)**	**Pump flow (cubic m/ sec)**	**Pitch adjusting Speed (deg/ sec)**

Note : Shaft speed will be indicated by the PSI consultant after discussions with *IN*.

4.4.8 Electric motor driven pump set

(a) An electric motor driven pump set is to be included in the scope of the CPP system to supply oil to the pitch actuating device.

(b) Type/ specifications

(i) Type of motor : Squirrel cage induction motor, 3ϕ,415V,50 Hz, IP 54, Class F
(ii) Motor power : *kW
(iii) Pump speed : *rpm
(iv) Type of pump : *

(v) Pump pressure : *kg/sq.cm
(vi) Pump flow : *cubic m/ sec

(c) Pump and motor to be connected through a flexible coupling.

(d) Starter for the motor shall be provided with provision for local, remote, manual and auto start/ stop.

(e) Starter type : direct online

Note : The CPP pump for the PTO driven and motor driven configuration should be the same (i.e. the make and model should be the same) and interchangeable. Suitable coupling configuration and distance piece for mating with the motor flange/ gearbox PTO flange should be provided.

4.4.9 Sea water cooler. General data :-

(a) Max. Water inlet temperature : *degree C
(b) Type : *
(c) Sea water flow : *cubic m/ sec

Note 1 : data marked with '*' to be indicated by the supplier
Note 2 : Plate type heat exchanger (PHE) to be provided

4.4.10 Filters

(a) Duplex filters to be used

(b) Filter specs : To be indicated by the supplier

Note : Same filter configuration for both the MD as well as PTO driven pump should be provided. Further, the filter of a given mesh size in the complete CPP system should be the same for purposes of standardisation.

4.5 **Monitoring &Safety Devices**. Suitable warning devices/ cutouts for low system pressures, high temperatures, insufficient flow rates, automatic cut in of standby arrangement etc. are to be provided.

5 **Maintenance Envelopes**. The manufacturer is required to adequately cater for and indicate the maintenance envelope for the shafting system components, for ease of maintenance during operations, repairs and refits.

6 **Documents to be provided by the supplier**

6.1 The supplier shall submit following documents :-

(a) Shaftline arrangement

(b) Shaftline design, alignment and calculation report

(c) Calculations for shaft diameter and bore (CPP) & bearing span

(d) ‘A’ & ‘P’ bracket bearing position analysis

(e) Bearing loads analysis

(f) Complete weight breakdown (excluding and including oil for CPP)

(g) Hydraulic diagram (for CPP)

(h) Transmission efficiency for both shaftlines, on the basis of power & speed curve, propeller characteristics and related data, corresponding pitch RPM schedule/ data

(j) Prediction of cavitation inception speed based on model test results

(k) Recommendations for the seating design and characteristics (plummer bearings and thrust block)

(l) Shaft whirling calculations

(m) Torsional vibration analysis

(n) Performance prediction

(p) Prediction of radiated noise at design pitch for various speeds

(q) Indicative RAM (Reliability, Availability & Maintainability)

(r) Instrumentation fit definition (IFD)

(s) Recommendation for online condition and trend monitoring system

(t) Description of the proposed scope and limits of supply

(u) Proposed inspection plan

(v) Proposed workshop testing plan

(w) Indicative maintenance envelope for main tasks

(x) Proposed two year onboard spares and tools holdings

(y) Proposed five year base & depot spares and tools holdings

(z) Statement of compliance to this SQR and to the general conditions and requirement specifications

6.2 The documentation is to be provided in accordance with DME specifications 452.

6.3 The documents are also to be provided in Interactive Electronic Technical Manual (IETM-4) format, conforming to MIL-STD-87268D, MIL-STD-87269D and JSG 0852:2001.

SHQ (NAVY)

Project no. 8

1	**Name of Potential Projects**
	RAS/FAS Gear for ***IN*** Ships
2	**Brief Specs**
	(a) The objective of underway replenishment is to permit fleet ships to remain at sea for prolonged periods. The fleet tankers and auxiliaries are equipped to replenish ships underway with fuel, provisions, stores and spare parts to achieve this goal. This process of replenishment is termed at 'Replenishment at Sea (RAS)'. (b) The RAS/FAS equipment onboard ships can be broadly classified under two groups, as follows:- (i) Equipment for delivery ships. (ii) Equipment for receiving ships. (c) The RAS/FAS equipment are procured from the manufactured as a combined package which includes several items such as fuelling probes, hose assemblies, fueling rigs, heavy jackstay, light jackstay high points, rigging assemblies, deck fittings and associated connections. The items required onboard vessels vary as per ship's role of delivery or receiving ship. (d) The equipment of RAS FAS however, needs to mandatorily comply to International standards of NATO(ATP-16) specification for uniformity and compatibility with other vessels.
3	**Tentative quantity to be procured after successful prototype development**
	4 Ship sets for 4 Naval Ships
4	**Tentative timeline for induction**
	2018-2020

PSQR RAS/ FAS EQUIPMENT

1. **Introduction**The objective of underway replenishment is to permit fleet ships to remain at sea for prolonged periods. The fleet tankers and auxiliaries are equipped to replenish ships underway with fuel, provisions, stores and spare parts to achieve this goal. This process of replenishment is termed at 'Replenishment at Sea (RAS)'.

2. **Standards** The applicable specifications and standards for RAS FAS equipment are DEF STAN 07-279 (latest revision) and NATO (ATP – 16) standards.

3. **Present Source** Presently the RAS FAS equipment is procured from equipment manufacturers on OTE basis. Some of the manufactures of these equipment are:

(a) M/s Rolls Royce, UK.

(b) M/s Goldring, UK.

4. **Indigenization of RAS/FAS Equipment**

(a) The RAS/FAS equipment onboard ships can be broadly classified under two groups, as follows:-

(i) Equipment for delivery ships.

(ii) Equipment for receiving ships.

(b) The RAS/FAS equipment are procured from the manufactured as a combined package which includes several items such as fuelling probes, hose assemblies, fueling rigs, heavy jackstay, light jackstay high points, rigging assemblies, deck fittings and associated connections. The items required onboard vessels vary as per ship's role of delivery or receiving ship.

(c) The equipment of RAS FAS however, needs to mandatorily comply to International standards of NATO(ATP-16) specification for uniformity and compatibility with other vessels.

5. **Generic performance specifications as per DEFSTAN 07-279**

(a) Receiving Rate

(i) Solids:

(aa) By Heavy Jackstay a minimum of 25 loads per hour in fair weather with Ships 30m apart

(ab) By Heavy Jackstay a minimum of 20 loads per hour in rough weather with Ships 45m apart.

(ii) Liquids:

(aa) To avoid hazards due to static electricity, the rate of fuel transfer is not to be greater than 7 m/s. Thus the maximum permitted volume flow rates are:

Hose Size	Maximum Volume Flow Rate
177mm(7")	626 M^3/Hr

153mm(6”)	460 M^3/Hr
64mm(2.5”)	80 M^3/Hr

(b) RAS Capstans

(i) The RAS capstan shall be rated for a duty of 1.5 tonnes SWL and is to be tested iaw. BR3027.

(ii) Capstan shall be sized to accommodate a 21mm dia. braidline outhaul and shall be capable of following:

(aa) Raising and lowering a load of 0.75 tonne at approximately 75m per min and 1.5 tonne at approximately 35m per min.

(ab) Brake to hold 2.25 tonne.

(c) Automatic Tension Winches

(i) Automatic Tension Winches which prevent the Jackstay tension rising above 8 tonne, but would be expected to work at approximately 6 tonne.

(aa) Transfer of solids up to a maximum of 2 tonnes in Sea State 6.

(ab) Deploying a liquid transfer rig in up to Sea State 7.

(d) Delivering Ship (Liquids)

(i) Fresh Water Lubricating Oil, Dieso and Avcat shall be transferred from a Delivering Ship using one or more of the following methods:

(aa) Jackstay Fuelling Rig
(ab) Jackstay Probe Fuelling Rig
(ac) Large Derrick Rig
(ad) Crane Rig
(ae) Astern Fuelling Rig
(af) Sliding Padeye

(ii) All rigs and equipment are to be tested in accordance with clause 8.16 of DEFSTAN 07-279.

(e) Delivering Ship (Solids)

(i) Automatic Tensioning Winches shall be fitted on the Delivering Ship for Heavy Jackstay transfer of stores in conjunction with one of the following systems:

(aa) Fixed Highpoints
(ab) Moveable Highpoints
(ac) MK 1A System
(ad) Sliding Padeye Rig

(f) Receiving Ship (Liquids)

(i) Rig Methods

(aa) The Receiving Ship shall be capable of accepting any one of the rigs specified for Delivery Ship.

(ab) Unless the Probe Receiver is kept permanently rigged, and to avoid the duplication of eyeplates, it is possible to accept any of the abeam rigs at a single station by adopting the Multi Rig Reception arrangement. The Multi Rig Reception point shall be used wherever possible.

(ii) When a probe is not used the connection between the Delivery Ship outboard end and the Receiving Ship for 153mm Dleso hoses shall be made either by a Breakable Spool or a Quick Release Coupling.

(g) Receiving Ship (Solids) The arrangement shall consist of following:

(i) Heavy Jackstay
(ii) Eyeplates
(iii) Drop Reel Traveller and Latch Arm Assembly
(iv) Light Jackstay

(h) Tests and Trials

(i) RAS arrangements including all reception stations and their facilities shall be trialed at sea after the completion of building, modernization or conversion preferably during or as soon as possible after the working up period.

(ii) Where a Jackstay is used for fuelling or storing, the Eyeplate or in the case of Probe Fuelling the Swivel Arm connection shall be tested to 16.256 tonne.

(iii) Outhaul block, lead block or Hanging Off Pendent Eyeplates for Derrick or Jackstay Rigs shall be tested to 4.064 tonne.

(iv) Receiver Swivel Arm and Joint shall be tested to 16.256 tonne and the outhaul block and securing pendant in case of probe fuelling shall be tested to 4.064 tonne.

(v) All materials used on RAS equipment shall be compatible with the marine environment and exposed weather deck positions of the equipment.

(vi) Notch tough materials with Charpy impact value of 47 joules at -20^{o}C shall be used for structure load bearing items.

(vii) Wire ropes for rigging shall have FoS of 6 for standing rigging and a FoS of 8 for running rigging.

(viii) The height of highpoint on a Delivery ship shall be approximately 20m above waterline.

(ix) Clear areas and routes for handling the pallets, stores and hoses shall be provided on the Delivery and Receiving Ship.

6. **Vendors identified for indigenization** Following Indian vendors have been identified based on experience, for indigenization of RAS FAS equipment

(a) M/s Yeoman Marine

(b) M/s Geeta Engineering

(c) M/s H&H Precision Pvt Ltd

7. **Present status** Generic performance requirements are under formulation at the Directorate in consultation with the firms. Post formulation of requirements, the firms would be intimated to ascertain the feasibility of manufacturing the items iaw. requirements. Based on the inputs of the firms a feasibility study would be undertaken for the make project.

SHQ (Air Force)

Project No.1

1.	**Name of Potential Project**
	Air to Ground Rockets — 70 mm Calibre
2.	**Brief about the project**
	MoD, Gol intends to procure Air to Ground rockets for large number of delivery platforms. The rockets are proposed to be developed and manufactured under the 'Make' category of the DPP. As a preliminary step, Air to Ground Rockets of 70 mm Calibre are intended to be indigenously developed and produced.
3.	**Broad specifications / PSQRs which can be shared with the Industry**
	(a) 70 mm rockets must be compatible and capable of being fired successfully without any deterioration in parameters. (b) Types of warhead - HE, AP, AP-T, TP, TP-T etc. (c) High dispersal accuracy. (d) High shelf life (e) Operation, Transportation and storage in Indian conditions.
4.	**Tentative quantity to be procured after successful prototype development**
	(a) Immediate requirement: Around 30,000. (b) Recurring requirement: Around 20,000 per year.
5.	**Tentative timeline for induction**
	2018-21
6.	**Any other relevant information**
	(a) A detailed RFI on the subject would be issued shortly. (b) On successful development of such capability, other similar weapons are also intended to be indigenised.
7	**Vendors' Response expected by:** 31 May 17

SHQ (Air Force)

Project No.2

1.	**Name of Potential Project**
	Chaff & Flares
2.	**Brief about the project**
	Chaff is a form of volumetric radar reflecting material that is composed of distributed metalized radar reflecting reflector material. Flares are T designed to be effective against infrared (IR Seeking missile). Presently Chaffs and Flares are being imported for use on various fighter, transport & helicopter fleet of IAF. These are proposed to be developed and manufactured under the 'Make' category of the DPP.
3.	**Broad specifications / PSQRs which can be shared with the Industry**
	(a) Chaffs intended to be developed are under three sizes viz 26mm, 50mm & 1"X1 "X8". (b) Flares are to be developed under three sizes viz 26mm, 50mm & 2"x1"x8"
4.	**Tentative quantity to be procured after successful prototype development**
	Around One lakh Chaffs and Two Lakh Flares per year
5.	**Tentative timeline for induction**
	Recurring requirement from year 2019 onwards

SHQ (Air Force)

Project No.3

1.	**Name of Potential Project**
	Long Range Glide Bombs
2.	**Brief about the project**
	MoD, GoI intends to procure Long Range Glide Bombs (LRGBs) to be delivered from different aircraft platforms. The LRGBs are proposed to be developed and manufactured under the 'Make' category of the DPP. As a preliminary step, two classes of LRGBs_viz 125 Kg and 500 Kg, compatible with Su-30 MKI aircraft are intended to be indigenously developed and produced.
3.	**Broad specifications / PSQRs which can be shared with the Industry**
	(a) Mai Range should be around 100 km when released from 42000 ft. (b) Types of warhead - Blast fragmentation and Penetration. (c) High accuracy. (d) High shelf life (e) Operation, Transportation and storage in Indian conditions.
4.	**Tentative quantity to be procured after successful prototype development**
	Appr a thousand per year.
5.	**Tentative timeline for induction**
	As soon as trials are successfully completed.
7	**Vendors' Response expected by:** 31 May 17

SHQ (Air Force)

Project No.4

1.	**Name of Potential Project**
	Long Range Dual Band Infrared Imaging Search and Track System (IRST)
2.	**Brief about the project**
	MoD, GoI intends to procure IRST for its fighter aircraft. The IRST systems are proposed to be developed and manufactured under the 'Make II' category of the DPP-2016. As a preliminary step, IRST is intended to be indigenously developed under Make II category for Su-30 MKI aircraft and produced.
3.	**Broad specifications / PSQRs which can be shared with the Industry**
	(a) IRST should be able to perform long range IR detection in a large field of view (FoV) (b) IRST should be able to display super narrow IR and EO FoV images to Pilot associated with an automatic tracking of Air-air and Air-Ground targets. (c) IRST should support 3D localization by an eye-safe Laser Range Finder. (d) Should be compatible with existing similar system fitted in Su-30MKI aircraft in terms of mechanical and electrical requirements. (e) IRST should be able to operate as per Su-30 MKI aircraft operating envelope. (f) Transportation and storage in Indian conditions.
4.	**Tentative quantity to be procured after successful prototype development**
	(a) Immediate requirement: Approx 100. (b) Recurring requirement: Spares sets and individual spares as per requirement.
5.	**Tentative timeline for induction**
	2018-21
6.	**Any other relevant information**
	(a) A detailed RFI on the subject would be issued shortly. (b) On successful development of such capability, similar systems can be developed for other platforms in future.

SHQ (Air Force)

Project No.5

Air Combat Manoeuvring Instrumentation (ACMI) pods

1.	**Name of Potential Project**
	Air Combat Manoeuvring Instrumentation (ACMI) pods. It is proposed to acquire additional Air Combat Manoeuvring Instrumentation (ACMI) pods and its associated equipment though the 'Make-II(Industry Funded)' route as per DPP-16.
2.	**Brief about the project**
	Air combat forms a vital part of air operations. Situations during air combat are extremely dynamic with rapid changes in speed, height and position of each fighter aircraft relative to other aircraft. Air Combat Manoeuvring Instrumentation (ACMI) equipment provides an electronic replay of the entire combat sortie thereby ensuring thorough and effective post-flight debriefings. IAF has in the past procured these systems/pods for limited fleet through the 'Buy (Global)' route. However a need has been felt for long term indigenous substitute of ACMI for all fighter squadrons in the IAF.
3.	**Broad specifications / PSQRs which can be shared with the Industry**
	The ACMI pods fitted on the aircraft constantly transmits aircraft flight path information to the ground station. On ground, when replayed along with the inputs from other pods, it reproduces an accurate and a complete picture of the air combat exercised.Real time monitoring of a combat air situation is possible through ACMI system by the ground based supervisors and if required, corrective instructions can be passed to the pilots on radio. This avoids repetition of missions for better assimilation of an air situation.ACMI systems provide the precise bomb scores based on aircraft parameters and trigger press without the actual bomb release.
4.	**Tentative quantity to be procured after successful prototype development**
	The IAF presently requires 165 ACMI Pods, associated systems, ground debriefing stations, testers, documentation, spares and GHE/GSE as MRLS for its fighter squadrons. The new system being procured should be backward compatible with existing ACMI pods and its associated systems available in the IAF inventory.
5.	**Tentative timeline for induction**
	2019-21
6.	**Any other relevant information**
	The Indian industry, at present does not have any vendor who can provide the ACMI equipment, which is compatible with the ACMI equipment already inducted in IAF.IAF has planned to inducted new ACMI systems, manufactured by Indian Industry though the 'Make-II(Industry Funded)' Route of DPP-16. The aim of the exercise is to find capable vendors in the Indian Industry willing to undertake the project. Presentations and consultations in order to resolve the concerns would be

	welcome. It is envisaged that the Indian Industry shall showcase its abilities to manufacture a prototype for the testing and certification purposes. This shall aid in the process of import substitution. The questionnaire annexed along with this shall help in resolving the concerns of the Indian Industry.
7	**Vendors' Response expected by:** 31 May 17

SHQ (Air Force)

Project No.6

1.	**Name of Potential Project**
	Medium Altitude Long Endurance (MALE) Unmanned Aerial Vehicles (UAVs) for IA, IN and IAF
2.	**Brief about the project**
	The Ministry of Defence, Government of India, is considering procurement of Medium Altitude Long Endurance (MALE) Unmanned Aerial Vehicle for use by three defence services. This will be under the "Make in India" initiative from Indian Companies. The UAVs are proposed to be developed and manufactured by the Indian industry under an appropriate category of the DPP like Buy & Make (Indian) etc. The project would be based on proven or matured technologies where fundamental research is not required. The development and manufacture of the equipment could also be undertaken by Indian Industry / Consortia.
3.	**Broad specifications / PSQRs which can be shared with the Industry**
	Broad operational requirements for MALE UAVs and its allied systems are attached.
4.	**Tentative quantity to be procured after successful prototype development**
	60 MALE UAVs
5.	**Tentative timeline for induction**
	05 years
6.	**Any other relevant information**
	RFI for procurement of MALE UAV has been issued on 27 June 2016.
7	**Vendors' Response expected by:** 31 May 17

SHQ (Air Force)

Project No.7, 8 & 9

1.	**Name Of Potential Project**
	7.62mm & 5.56 mmNATO ammunition
2.	**Brief About The Project**
	Procurement of 7.62mm & 5.56 mm NATO ammunition for Garud Force
3.	**Broad Specifications/ PSQRs which can be shared with the Industry**
	(a) 7.62mm NATO Armoured piercing rounds compatible with Galil Sniper Rifle (b) 7.62mm NATO Subsonic rounds compatible with Galil Sniper Rifle (c) 5.56 mm NATO Ammunition compatible with Tavor Assault Rifle (d) 5.56 mm NATO belted/linked Ammunition compatible with Negev LMG
4.	**Tentative Quantity to be procured after successful prototype development**
	(a) 7.62mm NATO Armoured piercing rounds- Appx qty 113000 per year (b) 7.62mm NATO Subsonic ammunition – Appx qty 30000 per year (c) 5.56 mm NATO Ammunition – Appx qty 18,50,000 per year (d) 5.56 mm NATO belted/linked Ammunition – Appx qty 15,00,000 per year
5.	**Tentative timeline for induction**
	2018-2019
6.	**Any other relevant information**
	(a) Indian Vendor has to obtain ToT and certification from the OEM (in case of foreign) for indigenous manufacture under licence.
7	**Vendors' Response expected by:** 31 May 17

SHQ (Air Force)

Project No. 10

1.	**Name of Potential Project**
	125 kg bomb (akin to MK-81 Bomb)
2.	**Brief about the project**
	125 kg Bomb is intended to be used for bombing against targets viz industries, fortifications and light armoured vehicle etc. It should be adaptable on existing aircraft of IAF as well as futuristic aircraft. The bomb should have both Retarded Tail Unit (RTU) as well as Non-Retarded Tail Unit (NTU).
3.	**Broad specifications / PSQRs which can be shared with the Industry**
	(a) The bomb should have facility for nose fusing as well as tail fusing of the store with fuse AVU-ETM/ETMA and any futuristic fuse. (b) The store should be compatible with Russian as well as Western suspension systems. (c) Shelf life of the bomb should be more than 30 years (d) The bomb should have Pre-fragmented and Thermo-baric variants of warhead. (e) Weight of the bomb should not exceed 125 kg. (f) Net Explosive Quantity should not be less than 40 kg. (g) Store should be compatible for carriage on existing Bomb Racks available with IAF. (h) Bomb should be capable to be stored in open.
4.	**Tentative quantity to be procured after successful prototype development**
	500 per year
5.	**Tentative timeline for induction**
	Immediate
6.	**Any other relevant information**
	Nil
7	**Vendors' Response expected by:** 31 May 17

SHQ (Air Force)

Project No.11

1.	**Name of Potential Project**
	(a) Electronic Fuzes with either impact, delay and impact cum delay settings for Aerial Bombs. (b) Proximity Fuze for Aerial Bombs.
2.	**Brief about the project**
	Fuze is the most critical element of any explosive train and hence it should be highly reliable under various conditions to ensure the desired performance of the weapon on its delivery from any weapon platform.
3.	**Broad specifications / PSQRs which can be shared with the Industry**
	(a) Should be capable to withstand high speed and 'G' forces during carriage and should be activated only when desired 'G' forces are attained. (b) Should have in built safety measures to take care of any mishandling during transportation and handling of the fuze. Indication system should be available on the body to assess whether the fuze is unsafe or safe. (c) Shelf life of at least 10 years and exposed life of one year when stored at a temperature of 25± 2° C and RH up to 70%. (d) Should be safe for transportation by all modes of transport. (e) For Electronic Fuze, delay mechanism and instantaneous functioning should coexist. Delay mechanism should have a multiple choice (minutes to 48 hours). (f) For Proximity Fuze, the fuze should function at nominal height of 10 metres. The fuze should function in impact mode in case of failure in proximity mode. (g) Electronic fuzes should be adaptable to all conventional bombs of IAF. Proximity fuze should be adaptable to pre fragmented bomb of IAF. (h) Should be EMI/EMC compliant.
4.	**Tentative quantity to be procured after successful prototype development**
	(a) Electronic fuze 3000/Year. (b) Proximity fuze 100/Year.
5.	**Tentative timeline for induction**
	(a) Electronic fuze:- Within 2 years (b) Proximity fuze:- Within 3 years
6.	**Any other relevant information**
	Nil
7	**Vendors' Response expected by:** 31 May 17