September 2026

Valid till December 2026

Research Problems for DIA-CoEs

Directorate of Futuristic Technology Management

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Introduction

DRDO is funding multi-institutional and multi-disciplinary directed research projects to Academia and National Research Institutes to develop cutting edge defence technologies. The funding is focused on translational research for developing the crucial and futuristic technologies in defined research domains through a network of DRDO Industry Academia – Centre of Excellences (DIA-CoEs) at premier and capable academic institutes and universities in the country.

To foster the research in academia, DFTM invites project proposals on problem statements in multiple areas, that will be taken up through DIA-CoEs for directed research. Received proposals will be scrutinized by DFTM and forwarded to respective DIA-CoEs as per research verticals for further evaluation.

Forms for submission are provided at ***https://www.drdo.gov.in/drdo/en/offerings/schemes-and-services/dia-coes***

Fully furnished project proposals shall be submitted to DFTM through ***techforesight.drdo@gov.in***

ADE

Sensitivity / Survivability analysis of Stealth Unmanned Combat Aircraft under heavily contested airspace

Research Vertical
Wargaming

Thrust Area
Flight Simulation

Brief of the Research Problem
- Sensitivity / Survivability analysis of the High performance Unmanned Combat Aircraft is required to converge towards the missions which are survivable under different war gaming scenario. This analysis will also include the risk quantification and risk mitigation strategies with respect to change in scenarios.
- It is proposed that analysis to carried out through high fidelity mathematical modelling & simulation of adversaries' various assets like - Air defence radar network, Air defence Guns, Surface to Air missiles batteries etc.
- It is proposed to consider the stealth attributes of the Unmanned Combat Aircraft as per open literature data which will be refined with original inputs at appropriate stage of the study.
- A detailed analysis report along with the simulation model to be submitted.

Major Objectives
To refine the tactics of own ship operations in dynamics and contested airspace where probability of survival can be quantified

Expected Deliverables
Detailed technical report and developed software tool/s for analysis

Applications
Futuristic Projects

Technologies for Low Observable High Temperature Radar Absorbing Structure

ADE

Research Vertical
Ultra- High Temperature Materials for Hypersonic Applications (UHTM)

Thrust Area
High Temperature Coatings

Brief of the Research Problem
Nozzle of aircraft is one of the critical component which contributes significantly to rear aspect RCS of an aircraft. There is a requirement of broadband RCS reduction of aircraft from rear aspect. Technologies are available on band specific RCS reduction as on today which works up to 200 degrees Centigrade. Aircraft nozzle experience ~600 degrees Centigrade temperature. In order to meet the RCS requirement at rear aspect, high temperature Radar Absorbing Material needs to be designed and developed. Further details on requirements will be provided by ADE.

Major Objectives
Design and development of high temperature radar absorbing structure for aircraft nozzle

Expected Deliverables
Nozzle with additional of high temperature radar absober on it

Applications
Aircraft nozzle

Figures of Merit

S No.	Parameter	Value
1	Foam Expansion	Minimum 7
2	Foam 25% drainage time	<3.5 min
3	Maximum Extinguishing time	60s
4	Minimum Burn back time	240s
5	PFAS	Free

ADE

Low Observable Optical and IR Window

Research Vertical

Advanced Electro Optic Technologies (EOT)

Thrust Area

Optronic Sensor Shield Next Generation EO Sensors

Brief of the Research Problem

IR and Optical windows works at different frequency bands. Few systems in aircraft consist of sensors which works on both IR and Optical frequencies. There are only a few materials available (like sapphire) which transmit on both IR and optical frequencies. These materials are radar transparent and hence, it impacts the RCS of the aircraft due to the internal reflection from the sensors and structural components. In order to reduce the RCS of IR and optical window, the window needs to be coated with special material which has optical and IR transparent and radar reflecting behaviour. However, any additional coating will impact the optical and IR performance. An optical/IR window (details will be provided by ADE) with low observable performance to be designed and developed. Also, the trade-off between optical/IR and RCS performance, if any, to be evaluated.

Major Objectives

RCS reduction of window working in IR and optical Band

Expected Deliverables

Panel of 300mmx300mm coated with special material for RCS reduction of window working in IR and optical Band

Applications

EOTS windows

Low observable Radome

ADE

Research Vertical
Sensing, Stealth and Surface Protection Using Nano Materials and Meta Materials (SSSP)

Thrust Area
Multi-Spectral Stealth and Cloaking

Brief of the Research Problem
Radome are used to protect antennae on aircraft while it also takes aerodynamic/structural loads. These radome are radar transparent and hence, it impacts the RCS of the aircraft due to the internal reflection from the antenna and structural components. In order to reduce the RCS of antenna and structural components, the radome needs to designed with low observable technology. In this project, it is expected to design and develop a radome which is transparent to electromagnetic for in-band of frequencies and behave as absorber and/or reflector for the out of band frequencies. Specific frequency details will be provided by ADE.

Major Objectives
Transparent Radome as absorber in-band of frequencies (X-Band) and behave as reflector (S, C, and Ku) for the out of band frequencies.

Expected Deliverables
Radome with absorber in-band of frequencies (X-Band) and behave as reflector (S, C, and Ku) for the out of band frequencies

Applications
Radome for X-Band SAR antenna

ADE

Low Observable Broadband (2-18GHz) Air Intake duct

Research Vertical
Sensing, Stealth and Surface Protection Using Nano Materials and Meta Materials (SSSP)

Thrust Area
Multi-Spectral Stealth and Cloaking

Brief of the Research Problem
Air intake duct is one of the critical component which contributes significantly to frontal RCS of an aircraft. There is a requirement of broadband RCS reduction of aircraft. Technologies are available on band specific RCS reduction as on today. It has already been demonstrated. Also, multiband RCS reduction of air intake duct is demonstrated. The RCS reduction of air intake duct at lower frequencies are challenge in combination of RCS reductions at higher frequencies. In this work, optimal (minimum impact on weight due to RAS) air intake design to be carried out, followed by realization and RCS measurement of air intake duct. The CAD details of the air intake duct will be provided by ADE.

Major Objectives
Broad band RCS reduction of air intake duct of unmanned aircraft

Expected Deliverables
Low observable air intake working in 2-18GHz of frequencies

Applications
Air intake duct of UCAV

Algorithms for Integrated Vehicle Health Management (IVHM)

ADE

Research Vertical
Aerospace Systems Design and Characterization (ASDC)

Thrust Area
Integrated Vehicle Health Management

Brief of the Research Problem
IVHM is used to monitor, diagnose, and prognosticate the health of UAV, and it also estimates the Remaining Useful Life (RUL). It incorporates sensors, data analytics, and software tools to detect, predict, and manage vehicle performance, maintenance needs, and failure risks.

Major Objectives
Algorithm development, data set generation, model training and testing for diagnostic and prognostic analysis of UAV systems, that includes airframe, environment control system, hydraulic system, landing gear system, fuel systems, Li-Ion battery, electronic systems, actuators and electrical systems.

Expected Deliverables
- Trained and tested algorithms and models, source code that performs diagnostic and prognostic analysis of UAV systems.
- Test report, analysis report

Applications
Future UAVs

Figures of Merit

S No.	Parameter	Value
1	Accuracy of the model	>85 %

ADE

Terrain Aided Navigation System

Research Vertical
Artificial Intelligence and Autonomous Systems (AIAS)

Thrust Area
Sensor Processing for Autonomous Systems

Brief of the Research Problem
Terrain Aided Navigation (TAN) can be defined as technique for determination of the position location of an airborne vehicle with respect to terrain over which the vehicle is flying. TAN uses Barometer, Radio Altimeter, and referenced terrain data stored onboard. Onboard sensors observes terrain features in the vicinity of the vehicle. By comparing these features with the one stored in memory, the TAN algorithm constructs an estimated position and altitude error. In the event of GPS jammed/spoofed, Terrain Aided Navigation based position is used for updating a mid -course guidance system.

Major Objectives
- Design and Development of TAN Algorithm for localization of vehicle using Terrain contour.
- Optimization of a mission plan for maximization of TAN system output availability.

Expected Deliverables
- Detail Design, Model, Source Code of TAN algorithm.
- Analysis reports, Test results of TAN algorithm for various type of natural terrain.

Applications
Cruise missile navigation in GPS denied environment

Scene Aided Navigation system

ADE

Research Vertical

Artificial Intelligence and Autonomous Systems (AIAS)

Thrust Area

Sensor Processing for Autonomous Systems

Brief of the Research Problem

Scene Aided Navigation (SAN) can be defined as a technique for estimate the position location of an airborne vehicle with respect to the imaged scene by EO (Visible & IR) camera. SAN system is loaded with processed satellite MAPS before flight. During flight, SAN takes a sequence of short-exposure frames from low altitude, nominally along nadir, with a video camera. Each frame are matched with on-board stored MAP to estimate sensor position. SAN based position can be used for updating a INS based guidance system in the event of GPS denied/spoofed.

Major Objectives

- Design and Development of SAN Algorithm for localization of vehicle.
- Modelling and simulation for sensor configuration for SAN system for various air vehicles.

Expected Deliverables

- Detail Design, Model, Source Code of SAN algorithm.
- Analysis reports, Test results of SAN algorithm for various type of various scene.
- SAN Sensor configurations for cruise missile, UAVs

Applications

Cruise missile, UAV navigation in GPS denied environment

FPGA IP Core for Eigen Vector Decomposition and Singular Value Decomposition

DLRL

Research Vertical
Electronics and Computational Systems

Brief of the Research Problem
Super resolution algorithms for DOA Estimation like MUSIC , ESPRIT or their variants require Eigen Vector and Singular Value Decomposition of Data Covariance Matrix estimated using signal samples acquired from multiple antennas. In EW, each channel has to be processed in parallel and therefore there is a need for efficient FPGA IP Core for EVD and SVD. Number of Antennas could be 2, 5, 6 or 7. It is also expected that number of sources to be estimated in the IP Core using the computed Eigen Values making use of Information Theoretic Criteria like AIC and MDL.

Major Objectives
Development of FPGA IP Core for Eigen Vector Decomposition and Singular Value Decomposition capable of Real Time Performance.

Expected Deliverables
FPGA IP Core along with Profiling Results, Test Results, Technical Report and Computational Requirements for Xilinx Kintex Ultra scale, Intel Stratix 10 or Xilinx Versal Computation Engines.

Application
Futuristic COMINT DF Systems for various platforms and ground applications

Figures of Merit
Parameter: Time taken for Eigen Value Eigen Vector Decomposition.

Single Station Location Algorithm for HF DF using Azimuth Bearing, Elevation Bearing and Ionospheric Model Software

DLRL

Research Vertical

Electronics and Computational Systems

Brief of the Research Problem

In High Frequency Direction Finding (HF DF) Stations, geolocation of distant HF transmitters need to be carried out using estimated Azimuth and Elevation bearings. The mode of propagation assumed is Ionospheric or Sky Wave. The Virtual Height of Ionospheric Layer that caused total internal reflection of Sky Wave signal is dependent on Location, Time of the Day, Season of the Year, Sun Spot Number, Frequency of Signal etc. Scope of Work is to identify and procure Ionospheric Model Software. Further use information like Frequency of Signal, Azimuth Bearing, Elevation Bearing and Virtual Height obtained using Ionospheric Model Software for estimating the geolocation of HF Transmitter.

Major Objectives

Development of Single Station Location Algorithm for HF DF using Azimuth Bearing, Elevation Bearing and Ionospheric Model Software.

Expected Deliverables

Ionospheric Model Software, Simulation Results with Profiling of Execution Time, Tool for test signal generation, Technical Report and Geolocation Algorithm Description along with Computational Requirements and Code.

Applications

Futuristic COMINT DF Systems

Figures of Merit

Parameter: Accuracy of Single Station Location of HF Emitter.

Geolocation of Terrestrial Radio Emitters from RF Payloads on LEO Satellites

DLRL

Research Vertical
Electronics and Computational Systems

Brief of the Research Problem
3D Hawk Eye from USA, is a "Data as a Service" Product, that is made recently available to subscribers for Situational Awareness through Space Based EW. It consists of constellations of satellites in Formation Flying in LEO & it is projected that with multiple constellations in multiple orbits, revisit time for surveillance of a given area of interest would be close to 15 minutes in the foreseeable future. Targets include AIS, ADS-B, Military Radio/Radars. Performance data with respect to geo location accuracies is not publically available in the open domain. Similar systems (Kleos etc.) are being commissioned by some other countries in Europe. Difference is number and geometry of satellites in Formation Flying. Some use three Satellites in Triangular Geometry whereas, others use four satellites in Rectangular Geometry. These systems work on the principle of Joint TDOA and FDOA and require precise Time/Frequency Synchronization across multiple satellites and multiple constellations. The spacecraft move at a speed of approximately 50 Kms/s. Knowledge of precise location of spacecraft's that carries these payloads with respect to a common frame of reference is mandatory apart from synchronization requirements listed above. The digitized IQ data of the signals received would have to be recorded when spacecraft is moving with area of interest in the field of view. The recorded data would have to be relayed back to Ground Control Station (GCS) when it is in field of view of the spacecraft's. All the signal detection and parameter estimation would have to be done on the ground to perform geolocation of the potential emitters. DLRL seeks solutions with Academic Institutions to develop and implement the Algorithms.

Major Objectives
Development of Practically Implementable Algorithms for Geolocation of Terrestrial Radio Emitters from RF Payloads on LEO Satellites that will be enabling technology for future Projects

Expected Deliverables
System Design Document specifying Satellite Geometry, Trajectory, Data Link Throughput, RF Payload Capabilities, Signal Processing Algorithms for Payload, Ground Station for Geolocation Computation along with Profiling of Execution Time, Simulation Results for Statistical Performance Evaluation, Tool for signal generation, Technical Report, Algorithm Description and Computational Requirements.

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Applications

Surveillance of RF Emitters beyond traditional LOS from Space

Figures of Merit

Parameter: Accuracy of Geolocation, Minimum number of Satellites.

Conduction cooled light weight electronics chassis for Man portable mountaineering

DLRL

Research Vertical

Electronics and Computational Systems

Brief of the Research Problem

Four PC Boards (6U) each dissipating of 75W is placed vertically in 4 slot conduction cooled chassis for Man portable mountaineering. All the PCBs are plugged in to the horizontal mother board. The heat of the components will be transferred from PCB to chassis edge through wedge locks. Chassis edge temperature should be maintained at 71Deg C in the ambient of 55 DegC. The chassis may be designed with suitable innovative and advanced concepts in materials/cooling techniques. Constraints: i. Operational condition: -20 DegC to 55 DegC ii. Mechanical Weight of the chassis including cooling solution: ≤ 4 Kg iii. Noise level of the system at 1m distance: ≤ 50dB. iv. Size of the chassis with cooling system: 300 (W) X 300 (D) X 240 (H) mm. (Max.) v. Man portable for mountaineering Test details: Sl No. Test Specification Remarks 1 Physical inspection : Dimensional test 2 High temperature test: High Temperature test at 55 Deg C to be carried out with dummy heater loads and edge temperature to be measured. Duration: 4 hours 3 Random Vibration Frequency 20 Hz to 2000 Hz , PSD 0.02g²/Hz, Test Duration: 15 min in X & Y axes. Heaters will be ON during test

Major Objectives

To develop conduction cooled light weight electronics chassis which dissipate 300W and to maintain 71 Deg C at chassis edge temperature

Expected Deliverables

- Conduction cooled light weight electronics chassis (Hardware)
- Classical Design and simulation reports
- Functional test reports
- ESS reports (Test conditions are given at brief of the research problem) 1) a) Physical inspection report b) Random vibration test report c) High temperature test report

Figures of Merit

S no	Parameter	Value
1	Chassis edge temperature	<71Deg C
2	Chassis weight	≤ 4 Kg

DYSL CT

On-Chip Analog To Information Converter (AIC) for minimum 2GHz Bandwidth

Research Vertical
Emerging RF Technologies for Application in Defence Communications (RFT)

Thrust Area
Development of On-Chip Analog To Information Converter (AIC) for minimum 2GHz Bandwidth

Brief of the Research Problem
Future radar/EW systems must handle multi-GHz bandwidth to detect small, fast, and low RCS targets. Conventional High Speed ADC's become power-prohibitive and data-heavy at this bandwidths, limiting true potential. Analog-to-Information Converter could provide sub-Nyquist sampling by exploiting sparsity in radar returns, dramatically reducing data rate and power without any compromise on system performance.

Major Objectives
- Develop on-chip Analog to Information Converter (AIC) capable of handling >= 2GHz signal bandwidth.
- Achieve sub-Nyquist sampling by leveraging sparsity in radar echoes, thereby reducing data rate, power requirement, and ADC speed.
- Demonstrate accurate signal reconstruction and target detection performance.

Expected Deliverables
- Circuit level simulation models
- On-Chip AIC Prototype design including schematics, timing constraints, and interface specification for CMOS implementation.
- Digital Reconstruction and Signal Processing pipeline
- Performance comparison reports

Applications
- Compact Radars - low power, high resolution
- EW / Spectrum Monitoring Receivers - Wideband sensing and rapid signal classification
- UAV payload synthetic aperture radar

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Figures of Merit

S No.	Parameter	Value
1	Effective Input Bandwidth	>= 2GHz
2	Compression Ratio - Nyquist Sampling to Actual AIC sampling rate	> 25x
3	Reconstructed SNR	> 20 dB
4	Clock Jitter Tolerance (RMS Jitter)	<80-100 fs
5	Power Consumption (Frontend + ADC + DSP)	<10x
6	Latency of Reconstruction Pipeline	< few ms

Radar Waveforms for Low Probability of Intercept (LPI) Radar

LRDE

Research Vertical

Next Generation Communication and Networking Technologies

Brief of the Research Problem

Design, Development and Simulation of the waveforms for Pulse Doppler Radars, which are: 1. Difficult to detect/identify by Radar Warning Receiver (RWR) 2. Difficult to regenerate (by Jammer) in the battlefield i.e. random in nature (Ex: Noise or pseudorandom signals etc.) 3. Doppler tolerant in nature for detection and tracking of targets like Fighter Aircrafts, UAVs, Drones etc. (Max target speed up to 1000 m/s (> 03 Mach) 4. Waveform bandwidth can be up to 5/10 MHz 5. Minimum deterioration in radar's performance in comparison to conventional radar waveforms such as Frequency (LFM) / Phase (P4 codes) Modulation.

Major Objectives

- Identification and Simulation of LPI waveforms
- Simulation and Analysis of the identified LPI waveforms on the radar's performance with respect to the existing waveforms such as LFM and P4 codes
- Comparison of Receiver Operation Characteristics (ROCs) for various target characteristics and velocity

Expected Deliverables

Software programs (Example: MATLAB/ Octave/ any Open Source S/w codes) for generation, simulation and analysis of LPI waveform's coefficients

Figures of Merit

S no	Parameter	Value
1	Receiver Operating Characteristic (RoC) for various target characteristics (such as Swerling models) including target velocity	NA
2	Range Doppler Characteristics in comparison with existing waveforms	NA

LRDE

Design and Development of Hybrid Rotary Joint for RADAR applications

Research Vertical

Power Electronics and its Thermal Management (PETM)

Brief of the Research Problem

Design and Development of Hybrid Rotary Joint with Integrated subsystems consisting of. 175-Way Slip Rings 20-Channel Fiber Optic Rotary Joint (Single Mode) 2-Channel Fluid Rotary Joint I -Channel Dry Air Rotary Joint Size and form fit as per radar platform requirement.

Major Objectives

Design and Development of Hybrid Rotary Joint for Ground based rotating Radars

Expected Deliverables

- Comprehensive Design and manufacturing documents of Mechanical, Electrical and Optical subsystems with BOMs (Including materials, Specifications, process and CAD files).
- Four Numbers (04) Hardware of the Rotary joint for functional testing and validation.
- One of the Four Hybrid Rotary joints developed shall be subjected to Qualification.
- Final hardware in the developed 04 Nos. will be integrated with the actual radar platform and evaluated Manufacturing drawings at part and assembly level.

Application

Hybrid rotary joint will be used in all the Rotating Antenna Radar platforms in DRDO.

Figures of Merit

S no	Parameter	Value
1	2.0 bar Pressure drop per channel will be minirnised	< 1.5 Bar
2	Insertion loss of 4.5 dB during rotation (@l550nrn) will be improved	< 3.5 dB
3	Stafting Friction Torque of 125 Nm will be reduced	<l10Nm
4	I I 15 mm Total Height of HRJ will be reduced	<1050 mm

Design simulation and prototype development of Double Sided Linear Induction Motor (DSLIM) drive

R&DE(E)

Research Vertical
Power Electronics and its Thermal Management (PETM)

Brief of the Research Problem
Linear Induction Motor(LIM) Drive system is used to control the speed and thrust of the motor by varying the relevant parameters such as frequency and voltage supplied to its primary coil. In case of high power motor, the design is critical because of high power electronics, thermal management, manufacturing and integration issues. Additional control challenges of driving segmented Double Sided Linear Induction Motors (DSLIM) are its open architecture, fast switching of segmented DSLIM modules in ms, design of stable DC link bus and system specific configurable functional and safety features etc. In this research work, the target is to design DSLIM DRIVE, simulation and analysis of optimized control technique, lab level prototype development and final engineering porotype realization. The final output is 2.3 KV, 150 HZ, 5 MVA indigenous DSLIM Drive. The primary tasks are **a)** Design and simulation of drive topology (Comparative Study) **b)** Control Architecture (open and closed loop) **c)** Implementation of safety interlocks, fault detection and health monitoring **d)** Lab level prototype development **e)** Testing of engineering prototype at full scale **f)** Testing with Linear Induction Motor
and DC energy storage.

Major Objectives
- Design, Simulation and selection of appropriate drive topology
- Prototype development and design validation at Laboratory level
- Full scale Drive modules-5MVA

Expected Deliverables
- Design reports
- Simulation and test Results
- Full scale drive modules along with documentation and software

Application
Electromagnetic article launching system

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Figures of Merit

S no	Parameter	Value
1	Efficiency	>85%
2	Transient Overload capacity	>85%
3	Frequency	>=150 Hz

SSPL

II-VI Quantum dots based Infrared Detectors

Research Vertical

Compound Semiconductor Technologies (CSCT)

Thrust Area

High Frequency Electronics

Brief of the Research Problem

Infrared detectors have been an important research topic because of their extremely diverse yet important technological applications in environment monitoring, local remote-control technologies, defence and missile tracking systems, night vision enhancement, space observations technologies, medical diagnostic among many others. The traditionally used materials in this domain required cryogenic cooling and epitaxial film growth. The synthesis of these materials also requires either high temperature or ultra-high vacuum setup. With the advent of quantum dots having absorption in the infrared domain, route for scalable, cost effective yet highly sensitive IR detection is possible. The ease of utilizing theses quantum dost on a wide variety of substrates and temperatures sets them apart from traditional materials. Telluride quantum dots, especially HgTe and Ag2Te have been the frontrunner in the race of materials utilized in IR detection. These quantum dots as well have synthesis usually using organic telluride precursors in the organic solvents that produces a highly toxic reactant residue. The synthesis of colloidal quantum dots in aqueous media will help in further reducing the toxicity of reaction residuals, improving cost efficiency and reduce the dependency of complete inert environment. Additionally, it will also improve control over band gap tunability due to its excellent size and composition command of solution processing. The utilization of aqueous colloidal quantum dots can significantly provide much eco-friendly cost-effective wavelength tunable and sensitive IR detectors.

Major Objectives

- Development of scalable route for synthesis of telluride quantum dots in aqueous medium without extensive use of inert environment.
- Optimize size tunability of the quantum dots by controlling process parameters.
- Optimize absorption range by binary group II telluride quantum dots.
- Optimization of uniform film formation parameters on various substrate such as Glass, Si, SiO2/Si, ITO, FTP etc.
- Design of Film based IR detectors using the optimized colloidal quantum dots.
- Optimization of device structure and design for improving IR sensitivity.
- Implementation of detectors in real application scenario.

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Expected Deliverables

- Complete description of quantum dot synthesis with detailed parameter variation control.
- 50 to 100 mL of optimized aqueous compound telluride quantum dots that are highly stable in ambient condition over a long period time (typically 6-12 months).
- Few devices (4 to 5) for different IR wavelength range sensors.

Application

- Remove control systems
- Security and alarm systems
- Secure optical communication
- Industrial and commercial automation systems
- Bio-medical diagnostics

Figure of Merit

S No.	Parameter	Value
1	Sensitivity	1-5 mA/W
2	Detectivity	~ 105 Jones
3	Response Time	30 secs
4	External Quantum Efficiency	2-5%
5	Wavelength Selectivity	SW&MW

Proximity Sensing Technology For Fuzes

TBRL

Brief of the Research Problem

The efficacy of the warhead/ ammunition would be greatly enhanced by detonating them at an optimum distance from the target wherein most of the energy generated will do useful destruction. The fuze is one of the critical parts of the ammunition which not only provide the initial safeties but detonates the ammunition at right time thereby enhancing its effectiveness against the intended target. An ideal fuze would detonate the ammunition at the most favorable position to inflict maximum damage to the target. In such cases the fuze senses its distance from the target and initiates the ammunition at an optimum distance set using proximity sensing technique. In such application the proximity sensor continuously senses its altitude from the ground and generates the firing command.

Requirement

The development of technologies for futuristic Electronic Safe & Arm fuzes for service ordinance and warheads. For the same, proximity module having specifications as given below needs to be developed.

Objective

The aim is to design and develop a proximity fuze to determine altitude. The system should effectively work in a fast moving platform.

The system should works on short ranges and low power since very limited power is available during flight and it should be as miniaturized as possible due to its application in space constrained environment.

Expected Deliverables

modular and easily integrated with the fuze

1. comply with mechanical/thermal constraints related to the gun firing environment and to the ballistic flight of projectile.
2. The module should have advance signal processing capabilities for exact height of burst measurement.
3. The developed module should be immune to jamming.
4. **Preparation of Test jig**: Portable and rugged field operable test jig to test the system on ground during environmental testing.

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Application

Proximity sensing technology is widely used in fuzes to improve the effectiveness of the ammunition.

The Challenge

1. Miniature and rugged/ hardened RF electronic circuits
2. Miniature patch antenna
3. Signal processing circuitry with high accuracy and fast processing capability
4. Radome (Fuze Nose cone)

Radome

The outstanding electrical mechanical and thermal characteristics.

Figure of Merit

S No.	Parameter	Value
1	Range (Height of Burst)	2m to 20m
	Accuracy	± 1m
2	Height of burst programmability	Required
3	Angle coverage	Upto 60° from vertical
4	Interference	Immune to Jamming
5	Operating time	≥ 25 secs
6	Shelf life	15 years
7	Output	TTL pulse on reaching HOB
8	Size	As per drawings provided below
9	Power requirement	6V/9V, 300mA max.
10	Target	Ground

TBRL

Power sources for fuzing application

Brief of the Research Problem

One of the critical technologies for the development of futuristic fuzing technologies for service ordnance and warheads is the power source. The minimum shelf life requirement of fuze is 15 years. Hence the power source to be developed should have at least 15 years shelf life and can withstand the environmental conditions the fuze has to undergo.

Major Objectives

Development two different type of power sources (Batteries) depending upon the end use.

Expected Deliverables

1. **Launch activated ampoule battery for artillery fuze**

   In case of fuze for artillery shells a passive/inert power source which can get activated only by launch environment is required. Artillery fuzes world over use launch activated ampoule battery for powering the fuze electronics. The broad specifications of the battery required is as given below;

Specification

S.No	Parameter	Requirement
1	Output voltage Open circuit voltage	 6V±1V @ 80mA load
2	Output current	Continuous 80mA Pulse current of 900mA for 2s at 80s,150s, 190s
3	Operational life	200s
4	Activation method Activation threshold Activation time	Gun launch 1500g or higher ≤ 0.5s
5	Operating temperature	-40°C to +71°C
6	Storage temperature	-55°C to +71°C
7	Shelf life	15 years or more
8	Maximum Size	Diameter : 35mm Height : 32mm
9	Electrochemistry	Li/SOCl2/ equivalent

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Long shelf life primary battery

Development of Long shelf life primary battery with following specifications:

Specification 1

S.No.	Parameter	Requirement
1	Open circuit voltage (OCV)	4.0V ± 0.5V
2	Close circuit voltage @ 0.25A load	3.7V ± 0.2V
3	Capacity	≥75mAh
4	Output current	Continuous 40mA Pulse current of 500mA for 50ms
5	Cell Impedance	≤ 300mΩ
6	Operating temperature	-40°C to +71°C
7	Shelf life	15 years or better
8	Maximum Size	Diameter : 15mm Length : 20mm
9	Electrochemistry	Lithium based

Specification 2

S.No.	Parameter	Requirement
1	Open circuit voltage (OCV)	7.8V ± 0.3V (May be 2 cells in series in a single pack)
2	Close circuit voltage @ 0.25A load	≥7.0V
3	Capacity	≥ 200mAh
4	Output current	Continuous 100mA Pulse current of 1 A for 3s
5	Cell Impedance	≤ 300mΩ
6	Operating temperature	-40°C to +70°C
7	Shelf life	15 years or better
8	Maximum Size	Diameter : 15mm Length : 35mm
9	Electrochemistry	Lithium based

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