TITLE PAGE

INTERNSHIP REPORT

A report submitted in partial fulfilment of the requirements for the Award of Degree of

BACHELOR OF TECHNOLOGY
in
ELECTRICAL AND ELECTRONICS ENGINEERING

by
HAMSAAVARTHAN R
Roll No.: EE19B1020

Under Supervision of

Dr. Dr.K Baskar Reddy,
Scientist (E), **(SINT-E) RCI-DRDO**, **Hyderabad**

(Duration: 04th May, 2022 to 19th June, 2022)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY PUDUCHERRY
(An Institute of National Importance under Ministry of HRD, Govt of India)

Thiruvettakudy, Karaikal-609609

JULY 2022

COLLEGE CERTIFICATE PAGE

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NATIONAL INSTITUTE OF TECHNOLOGY PUDUCHERRY

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Thiruvettakudy, Karaikal-609609

CERTIFICATE

This is to certify that the "**Internship report"** submitted by **HAMSAAVARTHAN R (Roll No.:** EE19B1020) is work done by him and submitted during 2021 – 2022 academic year, as part of the **BACHELOR OF TECHNOLOGY regulation in ELECTRICAL AND ELECTRONICS ENGINEERING,** at Research Centre Imarat (RCI), Hyderabad.

Department Internship Coordinator **Head of the Department**

INTERNSHIP CERTIFICATE

RCI/HRD/PROJ_STUD/2022/38
Government of India, Ministry of Defence
Defence Research & Development Org (DRDO)
RESEARCH CENTRE IMARAT
Dr. APJ Abdul Kalam Missile Complex
VignyanaKancha, Hyderabad – 500 069
Phone No: 040-24306635 / 6384
Fax No. 040-24306014
Email : hrdg@rcilab.in

Date: 12.07.2022

TO WHOMSOEVER IT MAY CONCERN

This is to certify that R Hamsaavarthan bearing Roll No EE19B1020 pursuing B.Tech in EEE at Nit, Puducherry has successfully completed his / her Internship for the project, titled Design of Power Switching Circuits under the guidance of Shri Bhasker Reddy Scientist 'C' of this organization from May-2022 to June -2022.

(Tarun Mohindra)
Scientist 'G'
HEAD, HRD
For DIRECTOR

तरूण मोहिन्द्र / TARUN MOHINDRA
वैज्ञानिक 'जि' / Scientist 'G'
प्रधान, एच आर डी / HEAD, HRD
अनुसंधान केन्द्र इमारत / Research Centre Imarat
डॉ ए पी जे अब्दुल कलाम मिसाइल / Dr APJ Abdul Kalam Missile Complex
डी आर डी ओ, रक्षा मंत्रालय, भारत सरकार, हैदराबाद
DRDO, Min. of Def. Govt of India, Hyderabad-69.

ACKNOWLEDGEMENT

I'd like to take this page to simply appreciate and lend My gratitude to the souls I relied on during the period of internship and the individuals who guided me through a never fading technical experience.First and foremost, I am grateful to be a part of a finest organisation, **Defence Research and Development Organisation (DRDO)** as an intern.

Secondly, I'm glad to acknowledge **Dr.K Baskar Reddy**, **Scientist (E)**, **(SINT-E) RCI-DRDO**, who guided me all the way through my internship in both technical and non-technical aspects. It is grateful to work with dedicated and expert scientists who are perfect examples of role model for the youths of a developing country like India.

Third, It is important to thank **Dr. G Satheesh Reddy, Chairperson of DRDO, Scientist (G)** who is leading a great way and also encouraging bachelor graduates to gain practical knowledge by participating in internships.

Last but not the least, My sincere thanks to **Dr.K Navin Sam, Assistant Professor (EEE)**, who insisted every student of the department to gain practical knowledge by appearing to live internships.

Finally, A special hearty thanks to **Mr. Selveraj**, who supported me all the through the internship period and all the other aspects.

EXECUTIVE SUMMARY

An internship experience in one of the finest organisation like DRDO is a prestigious opportunity which plays a great role in building my profile. This internship experience at DRDO provided the scope to work on and study special military aircrafts and missiles which are hardly seen elsewhere on a day to day basis thus exposing the strength of Indian Defence Forces. This internship has given me a perspective about the research prospects unexplored in the field of Defence airborne ranged weapons and avionics. It is a profitable sector which directly effects global economy. Also I learnt to work in a particular field of specialisation rather being jack of all trades and master of none.

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1. INTRODUCTION

The development phase of Pralay began in 2015 and took four years to test the required technologies. DRDO will conduct four test flights before the missile system will enter into commission. Learning from the 2022 Russian invasion of Ukraine, India is now accelerating the development of Pralay missile.

In the project of developing an advance tactical missiles, it involves the need of knowledge from all possible engineering streams like computer science, communication, aviation, navigation, chemical engineering, aero-dynamics, mechanics, electronics, climatology, etc…
A student of interest is open to gain and develop knowledge in any of the streams and beyond under a single platform where all the resources come together to work on a particular research project.

The research and development of this missile is carried out at Research Centre Imarat (RCI), Research Centre Imarat (RCI) is a DRDO laboratory located in Hyderabad, Telangana. The lab is one of the DRDO laboratories responsible for Research and Development of Missile Systems, Guided Weapons and advanced Avionics for Indian Armed Forces. The Research Centre Imarat is a global frontrunner in developing avionics and navigation systems for missiles.

In an organisations like DRDO, all the developing projects in the field of research are highly confidential hence none of the official documents neither in the form of hard copy nor soft copy is allowed outside of the organisation. The communication within the organisation is also monitored and is maintained as an intranet facility which is only accessed by the authorities, scientists, scholars, technicians who are emphasised by the organisation.

Apart from the assigned work, in order to accomplish the provided internship period, an intern will be able to acquire ample knowledge in and out of the assigned topic and will be allowed to explore the functioning and work flow in developing an advance tactical missile with the help of well-experienced scientists. In the field of research and development it involves adequate amount of time and resources in order to accomplish a particular project successfully. To understand this, an intern will be allowed to observe the work flow in designing, implementing, executing, testing and finally manufacturing of a unit.

Though theoretical knowledge is important, building an advance project in working platform requires experience and a lot of practical understanding which is excepted from major industries, organisations and companies. To meet the need of experience, the organisation also provides adequate practical knowledge by providing an opportunity to work in the field with various levels of scientists and technicians who are holding an experience of minimum 8-12 years from different educational backgrounds and streams

2. INTERNSHIP OBJECTIVE

As an intern from department of Electrical and Electronics Engineering, I was assigned under the topic, 'Design of Power Switching Circuits' in the branch of Electrical and Electronics Engineering. The main course or internship objective is to study and understand the woking of a particular Power electronic switching circuit equipped within a component called 'Pyro-current monitoring module', which is installed to monitor the pyro-bolt functioning of a surface-to-surface short range tactical missile PRALAY.

The module internally is designed using power electronic switches and other electronic components such as amplifiers, op-amps, etc. hence it is necessary to develop knowledge in the field of power electronics as well as analog studies.

Since the module has undergone the industrial testing process is already in the fabrication stage, an intern can also acquire practical experience with the scientists and technicians in installing the module and observing the functioning of the particular module.

The Internship objectives are al follows:

- Understanding the workflow in a research based government organisations
- Electrical and electronic importance for technology advancement
- Power switching circuits
- Pyroelectricity in defence technology
- Studying a complex network of circuit chart
- Cable bunching, packing and laying techniques
- Wire colour code scheme
- Practical working experience with expert scientists, technicians and scholars
- Synchronised working of all components in a missile
- Working on an advance defence development of India

3. OVERVIEW OF ORGANISATION

3. 1. Defence Research and Development Organisation (DRDO)

The Defence Research and Development Organisation (DRDO), an esteemed and one of the most respectful government organisation which is the premier agency under the Department of Defence Research and Development in Ministry of Defence of the Government of India, charged with the military's research and development, headquartered in Delhi, India.

Under the DRDO, there exists a full functioning network of numerous laboratories like ANURAG, ASL, DRDL, DSL, DMRL, RCI, etc… all over India working on different streams such as avionics, aeronautics, missile and strategic systems, metallurgy, explosives, combat vehicles, ballistics, etc…

With a network of 52 laboratories, which are engaged in developing defence technologies, covering various fields, like aeronautics, armaments, electronics, land combat engineering, life sciences, materials, missiles, and naval systems, DRDO is India's largest and most diverse research organisation.

3.2. Research Centre Imarat (RCI)

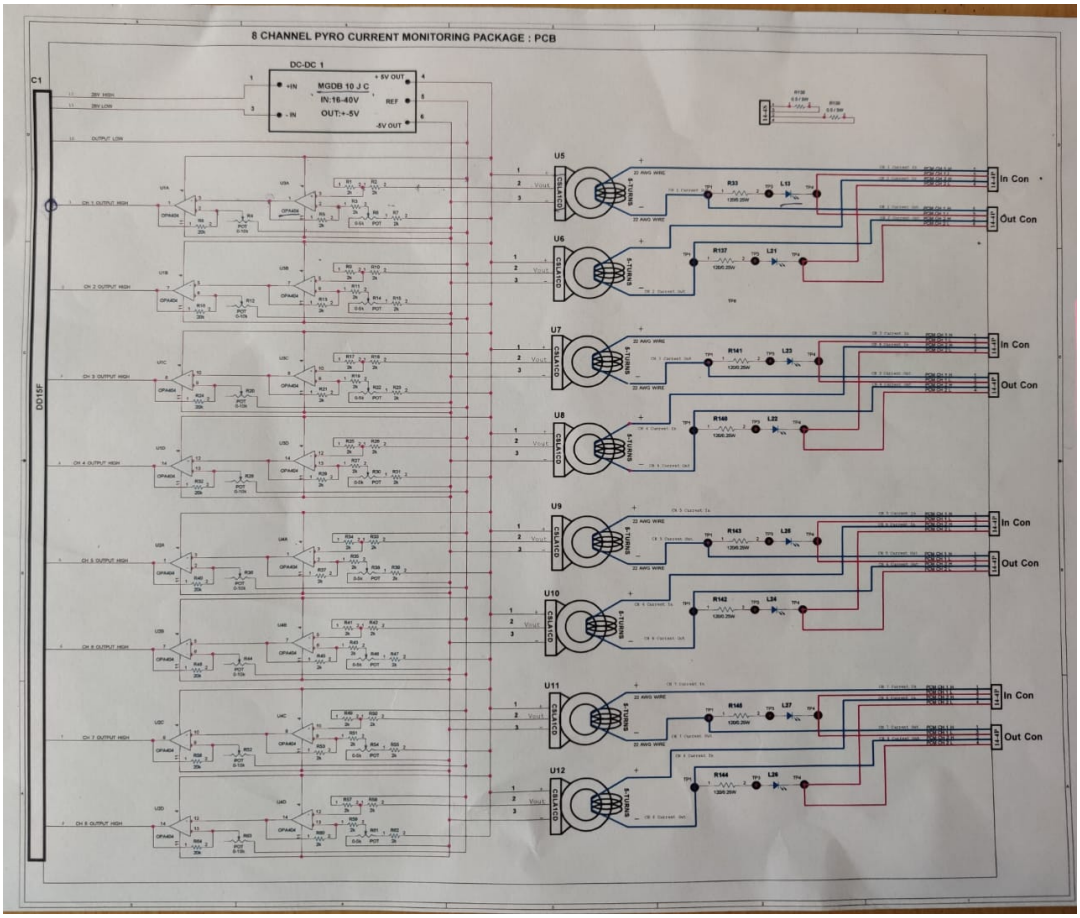
Research Centre Imarat (RCI) is a DRDO laboratory located in Hyderabad, Telangana. The lab is one of the DRDO laboratories responsible for Research and Development of Missile Systems, Guided Weapons and advanced Avionics for Indian Armed Forces. The Research Centre Imarat is a global frontrunner in developing avionics and navigation systems for missiles.

Research Centre Imarat (RCI) was established by APJ Abdul Kalam in the year 1988 and is also called as Dr.APJ Abdul Kalam Missile Complex.

RCI is the leading laboratory which has successfully spearheaded the Indo-Israel joint development Medium Range Surface to Air Missile (MRSAM) programme and had hat-trick success in its first three consecutive missions and still lighting up in the field of missile systems undergoing research and development on missiles equipped with advanced technologies and functions.

4. OVERVIEW OF INTERNSHIP ACTIVITIES

Though the assigned work was concise, in order to accomplish the provided internship period, an intern will be able to acquire ample knowledge in and out of the assigned topic and will be allowed to explore the functioning and work flow in developing an advance tactical missile with the help of well-experienced scientists.



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5. INTERNSHIP DISCUSSION

5.1. PRALAY

Pralay (Pralay means 'destruction') is a canisterised tactical, surface-to-surface, and short-range ballistic missile (SRBM) for battlefield use developed by the Defence Research and Development Organisation (DRDO) of India. The missile is the amalgamation of technologies developed for exoatmospheric interceptor missile Prithvi Defence Vehicle (PDV) from Indian Ballistic Missile Defence Programme and Prahaar tactical missile.

Specifications:

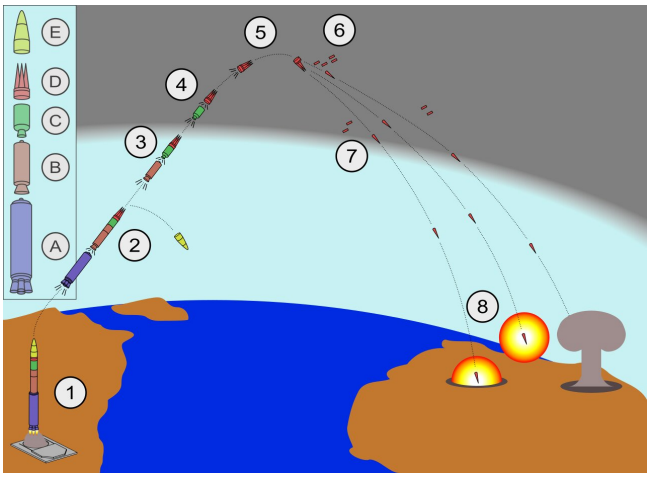
Mass	5 tonnes (4.9 long tons; 5.5 short tons)
Warhead	High explosive preformed fragmentation (PCB, RDPS
Warhead weight	370 kg (820 lb) - 700 kg (1,500 lb)
Engine	Two stage rocket motor with third stage MaRV
Propellant	Solid
Operational range	150–500 km (93–311 mi)
Maximum speed	**Terminal velocity:** Mach 1 (1,200 km/h; 760 mph; 0.34 km/s) to Mach 1.6 (1,960 km/h; 1,220 mph; 0.544 km/s)
Guidance system	Inertial navigation system
Accuracy	<10 metres (33 ft) CEP
Launch platform	8 x 8 BEML-Tatra transporter erector launcher

5.2. SURFACE-TO-SURFACE

A **surface-to-surface missile** (**SSM**) or **ground-to-ground missile** (**GGM**) is a missile designed to be launched from the ground or the sea and strike targets on land or at sea. They may be fired from hand-held or vehicle mounted devices, from fixed installations, or from a ship. They are often powered by a rocket engine or sometimes fired by an explosive charge, since the launching platform is typically stationary or moving slowly. They usually have fins and/or wings for lift and stability, although hyper-velocity or short-ranged missiles may use body lift or fly a ballistic trajectory.

5.3. BALLISTIC MISSILES

A **ballistic missile** uses projectile motion to deliver warheads on a target. These weapons are guided only during relatively brief periods—most of the flight is unpowered. Short-range ballistic missiles stay within the Earth's atmosphere, while intercontinental ballistic missiles (ICBMs) are launched on a sub-orbital flight.



An intercontinental ballistic missile trajectory consists of three parts: the powered flight portion; the free-flight portion, which constitutes most of the flight time; and the re-entry phase, where the missile re-enters the Earth's atmosphere. The flight phases for shorter-range ballistic missiles are essentially the first two phases of the ICBM, as some ballistic categories do not leave the atmosphere.

5.4. SHORT-RANGE BALLISTIC MISSILE (SRBM)

A **short-range ballistic missile** (**SRBM**) is a ballistic missile with a range of about 1,000 kilometres (620 mi) or less. In past and potential regional conflicts, these missiles have been and would be used because of the short distances between some countries and their relative low cost and ease of configuration. In modern terminology, SRBMs are part of the wider grouping of theatre ballistic missiles, which includes any ballistic missile with a range of less than 3,500 km.

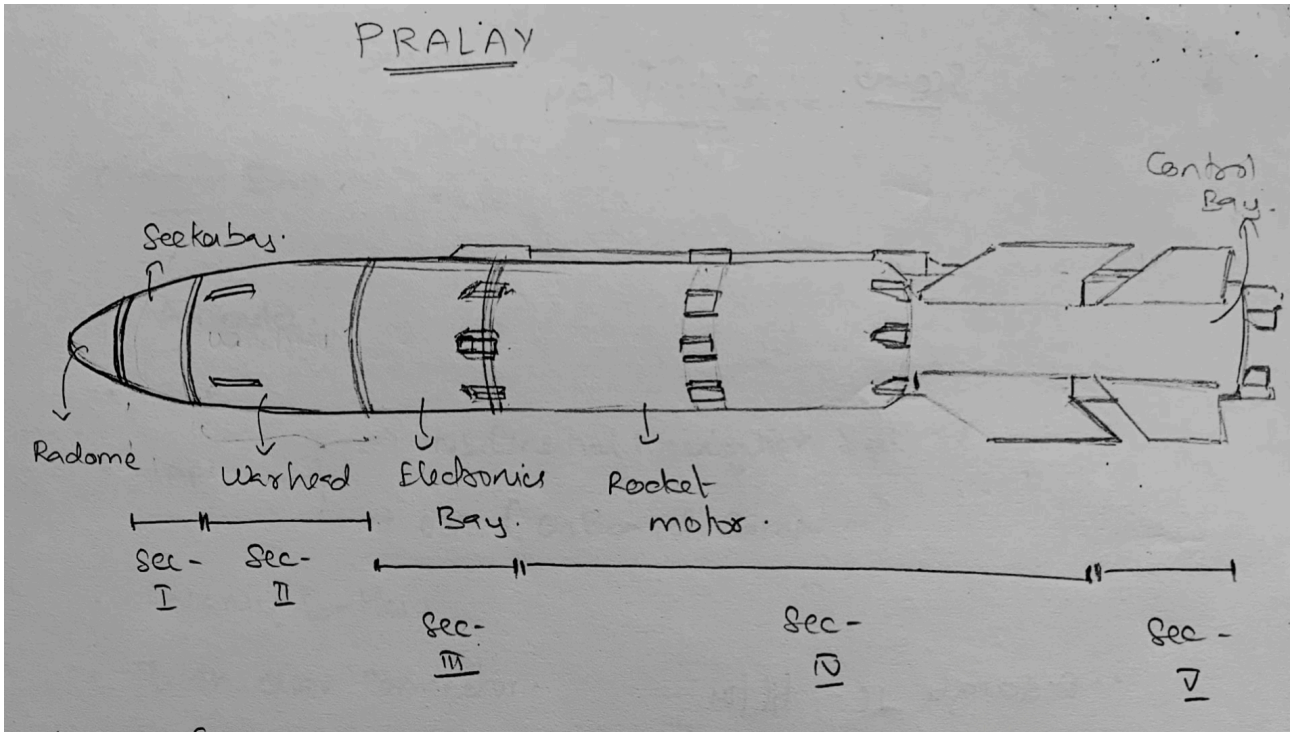
5.5. TACTICAL BALLISTIC MISSILE (TBM)

A **tactical ballistic missile** (**TBM**), or **battlefield range ballistic missile** (**BRBM**), is a ballistic missile designed for short-range battlefield use. Typically, range is less than 300 kilometres (190 mi). Tactical ballistic missiles are usually mobile to ensure survivability and quick deployment, as well as carrying a variety of warheads to target enemy facilities, assembly areas, artillery, and other targets behind the front lines. Warheads can include conventional high explosive, chemical, biological, or nuclear warheads.

5.6. THE DESIGN

Pralay is essentially a derivative of the PDV exoatmospheric interceptor with commonality of airframe and some of the avionics as well. Like the PDV, Pralay's propulsion system too uses solid fuels that can function in a wide range of temperatures and allow the missile to have a long shelf-life. As such, Pralay is a canisterised system that will be able to strike targets out to 500 km with a payload of around 800 kg. The canister itself is probably designed by DRDO's Advanced Systems Laboratory.

While Pralay's on-board inertial navigation system (INS) is capable of receiving multi-constellation satellite updates, the missile is believed to have an accuracy of sub-10 metre CEP even without updates to remove accumulated errors. With its PDV heritage, Pralay will be rather manoeuvrable and capable of quasi-ballistic flight profiles.



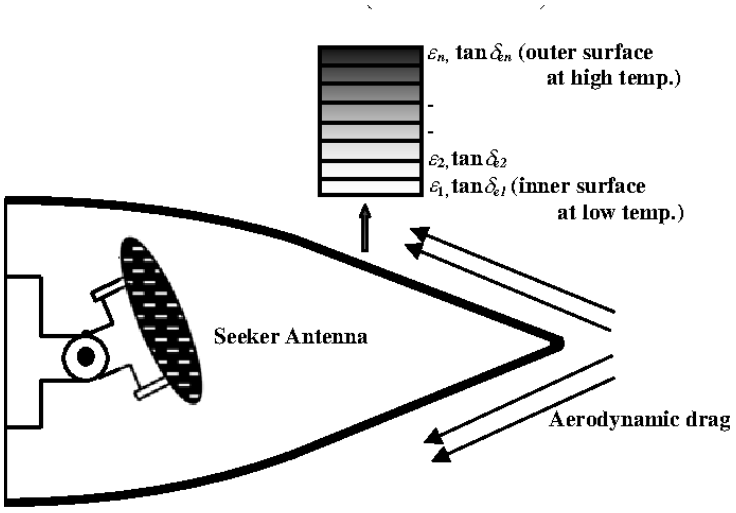
The missile Pralay by the design and functioning is segregated into five major sections as shown in drawing above:

- SECTION - I
- SECTION - II
- SECTION -III
- SECTION -IV
- SECTION - V

Comprising of all five sections and united functioning brings a successful design of a working missile. In order to achieve a successful design, it involves the contribution of various scientists from diverse streams of engineering working to together.

5.6.1. RADOME

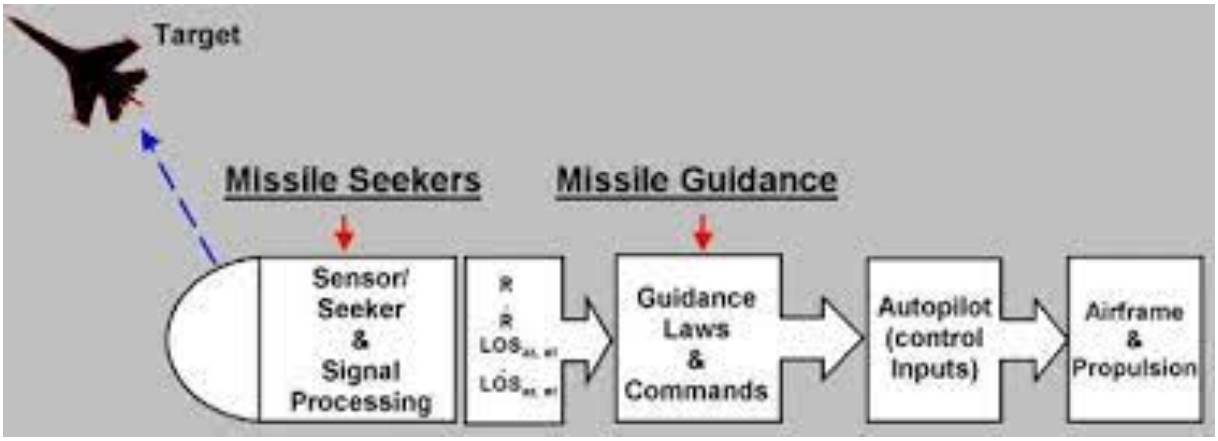
The radome is a protective interface between the missile tracking system and the atmosphere. It is aerodynamically efficient and minimally obstructive to radar tracking signals in the radio frequency band.



Radome are large dome-shaped structures which protect the radars from the bad weather conditions but at the same time allow the electromagnetic signals to be received by the radar without any distortion or attenuation.

5.6.2. SECTION - I

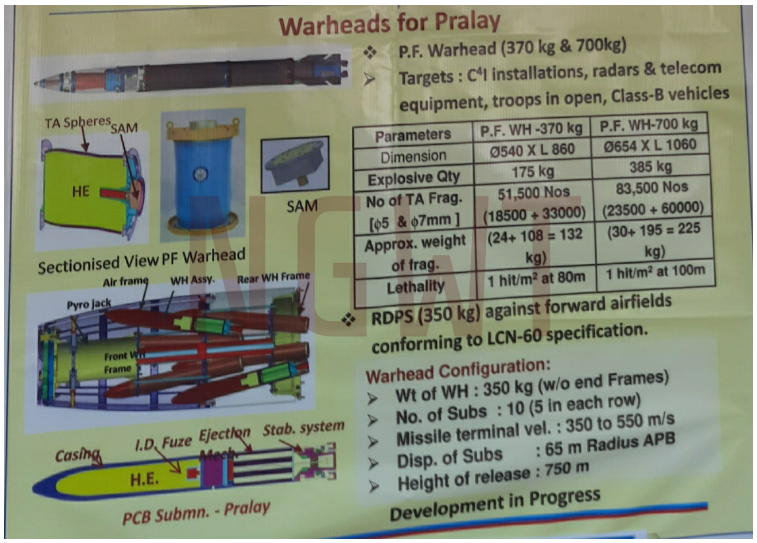
Section - I is also called the **SEEKER BAY** which used in missiles that are employed in destructing mobile targets which are equipped with a direction changing ability according to the movement of target. Missile seekers are the systems used in missiles to guide them on the right trajectory to accurately hit the desired targets. Recent technological developments in defence systems, including guided missiles, have led to the increased demand for more efficient missile seekers.



The Missile Seekers are usually not equipped in all missile as these products involves complex components as a result, seekers are also expensive in the market.

5.6.3. SECTION -II

Section - II is essential part of a ballistic missile as they carry the explosives that are for the destruction of the target sight. This section is also known as the **WARHEAD** of the ballistic missile. A warhead is the explosive or toxic material that is delivered by a missile, rocket, or torpedo. It is a type of bomb.



Using radar, sound waves, a magnetic sensor, or a laser the warhead is detonated when the target is within a specified distance. It is often coupled with directional explosion control system that ensures that the explosion sends the fragmentation primarily towards the target that triggered it. The warhead used in the missile pralay are of two types:

- Blast warheads
- Fragmentation warheads

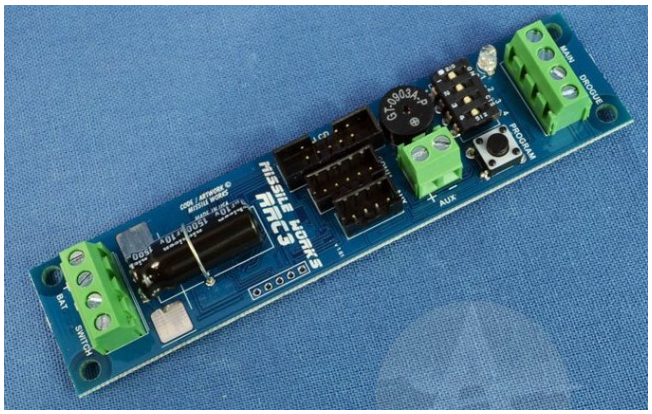
5.6.4. SECTION - III

The most important part of the Pralay missile which acts as the brain of the missile is this SECTION - III which also known as the **AVIONICS BAY** or **ELECTRONICS BAY** that involves all the electronics components and signal processing received from the satellite or launching station. The major electronics components present in the Avionics bay are:

- Altimeter
- Inertial Navigation system (INS)
- On Board Computer (OBC)
- Avionics Battery
- Hatch door connectors and other components

Altimeter

An altimeter is a device that measures altitude, the distance of a point above sea level. Altimeters are important navigation instruments for aircrafts, spacecrafts, missiles and launchers in order to monitor the missile's height above the Earth's surface.

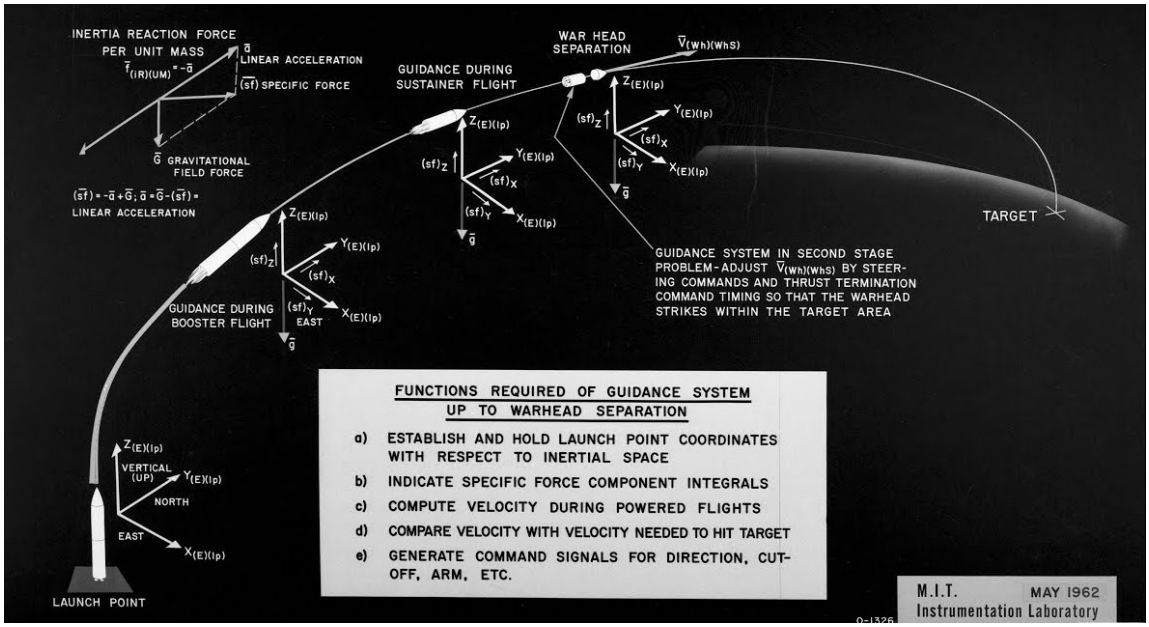


Altitude readings can also change due to weather, as air pressure decreases during storms. A simple barometric altimeter includes a sealed metal chamber, a spring, and a pointer that shows altitude in meters or feet. The chamber expands as air pressure decreases and contracts as it increases, bending the spring and moving the pointer.

Intertial Navigation System (INS)

The Inertial Navigation System (INS) is a self-contained navigation technique in which measurements provided by accelerometers and gyroscopes are used to track the position and orientation of an object relative to a known starting point, orientation and velocity. INS typically contain three orthogonal rate-gyroscopes and three orthogonal accelerometers, measuring angular velocity and linear acceleration respectively. By processing signals from these devices it is possible to track the position and orientation of a missile on which the INS device is mounted.

Often the inertial sensors are supplemented by a barometric altimeter and sometimes by magnetic sensors (magnetometers) and/or speed measuring devices.



Inertial navigation systems in simple terms are said to be an alternate for Global Positioning System (GPS) that are widely used in the latest technologies and electronic devices. An inertial navigation system (INS) provides more accurate heading information than the GPS, but its position data is less reliable than that of the GPS. It can be seen that the GPS and INS do complement each other leading to various research works on integrated INS/GPS navigation systems for the past two decades.

On-Board Computer (OBC)

The On-Board Computer (OBC) present in the avionics bay is the most important component of a missile which acts as a **brain** of the missile. OBC is responsible for implementation of control law, processing associated with payload, data packeting activities associated with communication, monitoring load health status, handling of data storage etc. The processor needs to interface with various sensors, actuators present onboard to acquire data to perform its activities and responds accordingly through actuators. Scheduling of the activities of the processor is essential due to the number of tasks it has to perform.

The signals generated from all the other sections are processed in the OBC which in-turn provides responsive signals to which the control and monitoring components of other sections (actuators, control vanes, antenna fins, sensors) acts accordingly. The missile OBC is specially working with an individual software program using C programming language programmed by a dedicated team from computer science background.

The missile OBC plays a vital role right form the time of prelaunch to the point of target impact in receiving signals and controlling the missile accordingly until the missile hits the target and delivers the warhead successfully on the target. During the time of prelaunch, the OBC receives signal from the launching platform (8 x 8 BEML-Tatra transporter erector launcher) which internally installed with external Power Supply, Launch Pad Computer, and other components that receives the geographic location of the target time-to-time from the satellite radars. The missile provided with the target details during the prelaunch is then set ready for the final stage of launching from the launching platform.

It is important to note that once after the missile is launched from the launch pad, manual control of the missile is completely lost, where as the OBC entirely comes into picture in monitoring and controlling of the missile.

Avionics Battery

All missiles and aircrafts incorporate an electrical system. In the vast majority of cases, the primary electrical system incorporates one or more batteries. Any functioning of electronic components inside the missile requires an electric power, the electric power requirements within the missile met by these avionics batteries. Avionics batteries are used right from the prelaunch to power up the electrical system and to start the Auxiliary Power Unit (APU) or the Rocket motors.

The type of batteries used in this missile are the **Thermal batteries.**

Thermal battery allows energy available at one time to be temporarily stored and then released at another time. The basic principles involved in a thermal battery occur at the atomic level of matter, with energy being added to or taken from either a solid mass or a liquid volume which causes the substance's temperature to change. Some thermal batteries also involve causing a substance to transition thermally through a phase transition which causes even more energy to be stored and released due to the delta enthalpy of fusion or delta enthalpy of vaporisation.

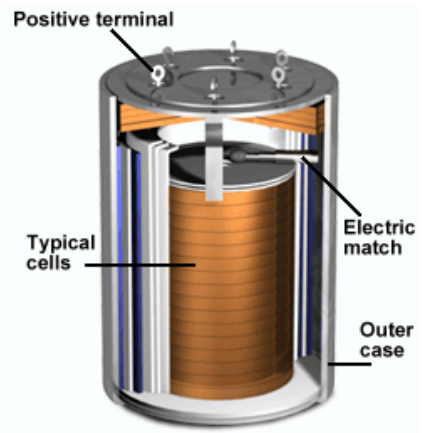


Figure 1

Thermal batteries offer relatively high energy density versus volume. They can be stored for about 20 years and above without performance degradation; they perform without preparation in the most external environments; and they begin providing power almost immediately. Thermal battery technology is comprised of stacked series cells. Each cell consists of a cathode, an electrolyte, an anode and a pyrotechnic thermal energy source.

Thermal batteries are widely chosen for missiles because of

- The highest capacity per unit volume
- Substantial power density
- Low, uniform internal impedance while active
- Adaptability to a broad array of environments

5.6.5. SECTION - IV

Section - IV of the missile is the **Rocket engine** (Two stage rocket motor with third stage MaRV*) Fuelled by composite propellant and developed by Pune-based High Energy Materials Research Laboratory (HEMRL), The rocket engine uses stored rocket propellants as the reaction mass for forming a high-speed propulsive jet of fluid, usually high-temperature gas. Rocket engines are reaction engines, producing thrust by ejecting mass rearward, in accordance with Newton's third law. The Rocket engine uses the combustion of reactive chemicals to supply the necessary energy, but non-combusting forms such as cold gas thrusters and nuclear thermal rockets also exist. Rocket vehicles carry their own oxidiser, unlike most combustion engines, so rocket engines can be used in a vacuum to propel ballistic missiles and spacecrafts.

Compared to other types of jet engine, rocket engines are the lightest and have the highest thrust, but are the least propellant-efficient (they have the lowest specific impulse). The ideal exhaust is hydrogen, the lightest of all elements, but chemical rockets produce a mix of heavier species, reducing the exhaust velocity. Rocket engines become more efficient at high speeds, due to the 'Oberth effect'.

Pralay Booster Motor Features:

- Composite propellent with 86% solid loading
- Burn rate - 5.5 @ 5Mpa
- Propellent Grain length - 5 m
- Calibre - 740 mm
- Propellant weight - 2940 kg

*[The **Maneuverable Reentry Vehicle** (**MaRV**) is a type of ballistic missile whose warhead is capable of autonomously tracking ground targets. It often requires some terminal active homing guidance to make sure the missile does not miss the target, because of the frequent trajectory shifts.]

5.6.6. SECTION - V

The last section present at the tail of the missile is the SECTION - V which is also known as the **Control Bay**. As the name suggests, the direction control of the missile is taken care in the control bay section by changing the direction of fuel thrust and fluid flow.

The internal components of Section - V are:

- Rectangle LC Filters
- Digital Servo Control Electronics Unit
- Actuators
- Polytetra Fluoroethylene (PTF) Cables

Control Surfaces

The control actions are governed by missile control surfaces such as Tandem fins and Jet vanes. Tandem fins are movable plates used to change the fluid (air) flow so that the variation in air pressure created on the surface of Tandem fins forces the missile to change the direction accordingly. Jet vanes are present at the thrust nozzle outlet which can change the direction of jet exhaust.

Actuators

These control surfaces are attached to the Actuators through a piston rod that move in-and-out according to the command signal received by the Digital Servo Control Electronics Unit from Section - III. The actuators are provided with a DC power source of 32V.

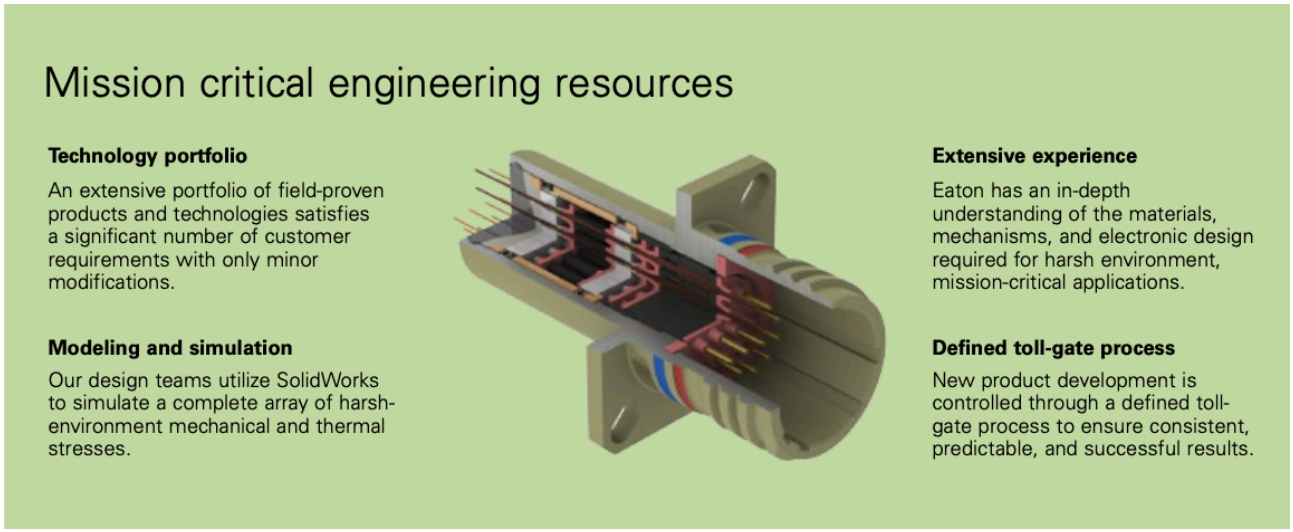
They must have the best possible design configuration for the intended speed of the missile. The control surfaces must move with enough force to produce the necessary change of direction. The adjustments they make must maintain the balance and centre of gravity of the missile. The control surfaces must also be positioned to meet variations in lift and drag at different flight speeds. All these actions contribute to the in-flight stability of the missile. Missile Control Bays have been, and are arguably still, the most efficient means of controlling a missile and guiding it to a target. They can efficiently generate the required maneuvering force by a direct action near the centre of gravity.

As the electronics components of control bay are present between the missile outer shell and the jet nozzle, they are expected to withstand intense heat and heavy vibrations that occur during the propulsion of rocket motor. In order to withstand the heat generated at the jet nozzle the cables are designed with **Polytetra Fluoroethylene (PTF)** material so they don’t melt under high temperature.

5.7. WIRING & CABLE LAYING

Electrical cables are a vital part of any missile system. They are used to carry the signals that control, monitor, test and fire the missile. The reliability of the whole system is dependent on the reliability that is achieved in these interconnecting cables. The cable manufacturer can build reliable cable but unless the system designer selects the proper cable to fit the application, this reliability may not be attained.

The cables used in this missile are not available in the market for commercial purposes and these cables are entirely custom built for its specific requirement at the sight sight with the help of electrical technicians



Custom cables and wiring harnesses

These custom built cables and wiring harnesses for turnkey design, collaborative co-development, or build-to-print programs. End-to-end connectivity capabilities include:

- Application-specific solutions for high currents and voltages, Ethernet, and RF and acoustic-signal applications
- Single and multiple-layer foil and braided EMI/RFI shielding
- Extreme temperatures, shock/vibration, radiation, corrosive media, vacuum and pressures up to 20,000 PSI
- Integrated mechanical tow, fluid delivery, and cable separation and release capabilities
- NAVSEA S9320-AM-PRO-020 certified overmolding
- Water blocked and pressure balanced oil filled subsea cables
- Harnesses with up to 2,800 wires, over 20-feet long.

Micro-military connectors

Dual-Start Threads

- 1.5 turns full mate
- Shell sizes 6, 7, 9, & 10
- 1 to 26 contacts
- 55 dB EMI shielding

Triple-Start Threads

- 1 turn full mate
- Shell sizes 8, 9, 11, & 12
- 4 to 26 contacts
- 85 dB EMI shielding

Custom Capabilities

- Cables assemblies and wiring harnesses
- Space-rated solutions
- Custom contact arrangements
- Ethernet and MIL-DTL-1553

MIL-DTL-38999 Series III & IV

Lanyard-Release Plugs

- QPL D38999/29, / 30 and / 31
- Series III 22° off-axis-pull outperforms D38999 requirements
- Series IV 15 ° off-axis-pull with as low as 90 pounds force

Filtered Receptacles

- Meets D38999 shock/ vibration without any deratings
- C, L, T and Pi filter configurations
- Custom solutions available for any voltage, frequency, and filtering requirements

Hermetic Receptacles

- Helium leakage less than 1 E-7 CC / S per EIA-364-02
- -65°C to 200°C operating temperatures
- Hardware and weld/solder mount configurations

Wing-Lok™ Plugs

- Reduces effort needed for rapid and repetitive engagements
- Ergonomic designs are especially beneficial when wearing bulky military and space-grade gloves

Space Rated

- Series III NATC meets NASA SSQ 21635
- Series IV designs are space flight approved by NASA GSFC
- Ergonomic Wing-Lok™ plugs are ideal EVA & IVA solutions

Up to 900 Amps

- Shell sizes 33 – 57
- Rugged, Series IV derived breech-lock-coupling mechanisms
- Peacekeeper ICBM qualified
- 2800 VRMS service ratings

6. CONCLUSION

The 45 days of My internship at Defence Research and Development Organisation (DRDO), Hyderabad has been of great impact. This internship has helped me in acquiring various skills like understanding the workflow in a research based government organisations, studying a complex network of circuit chart, practical working experience with expert scientists, technicians and scholars and working on an advance defence development of India. This has also enhanced my existing knowledge about softwares like Altium PCB designer and PSIM.

Dream is not which you see while sleeping. It is something that doesn't let you sleep.

- Dr. A P J Abdul Kalam

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