Specification Document for

Infra Red Gimballed Tracking Seeker (IRGTS) Electronics

The Specifications given in this document may undergo minor changes during tender/PDR/CDR with mutual discussion between the vendor and IRDE.

In case of any clarifications, the vendor may contact the following:

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Abbreviations

Sr No.	Abbreviations	Detail
1.	IRGTS	Infra Red Gimballed Tracking Seeker
2.	SWIR	Short Wave Infra Red
3.	TI	Thermal Imager
4.	AVT	Automatic Video Tracker
5.	PGIP	Power Generation for Image Processing
6.	SCI	Servo Control and Interface
7.	IP	Image Processing
8.	PGA	Power Generation and Amplification
9.	MCG	Mission Control and Guidance
10.	SAM	Safety Arming Mechanism
11.	FCS	Fire Control System
12.	MP	Mission Power
13.	MTRX	Mission Transreceiver
14.	CAS	Control Actuation System
15.	SP	Sensor Package
16.	HUSB	High speed USB
17.	UART	Universal Asynchronous Receiver and Transmitter
18.	CCIR	Consultative Committee on International Radio
19.	RS422	Recommended Standard 422
20.	RS232	Recommended Standard 232
21.	JTAG	Joint Test Action Group
22.	I^2C	Inter Integrated Circuit
23.	ADC	Analog to Digital Converter
24.	DAC	Digital to Analog Converter
25.	MFD	Multi Functional Display
26.	DM	Data Memory
27.	PM	Program Memory
28.	SPI	Serial Peripheral Interface
29.	CGM	Control and Guidance for Mission

1. Scope of Document

This document describes the hardware configuration, specification, scope of work and deliverables required for the development of electronics for Infra Red Gimballed Tracking Seeker (IRGTS) gimbal. This document discusses the details of electronics hardware to be developed for IRGTS. Vendor will design and develop two sets for this electronics hardware.
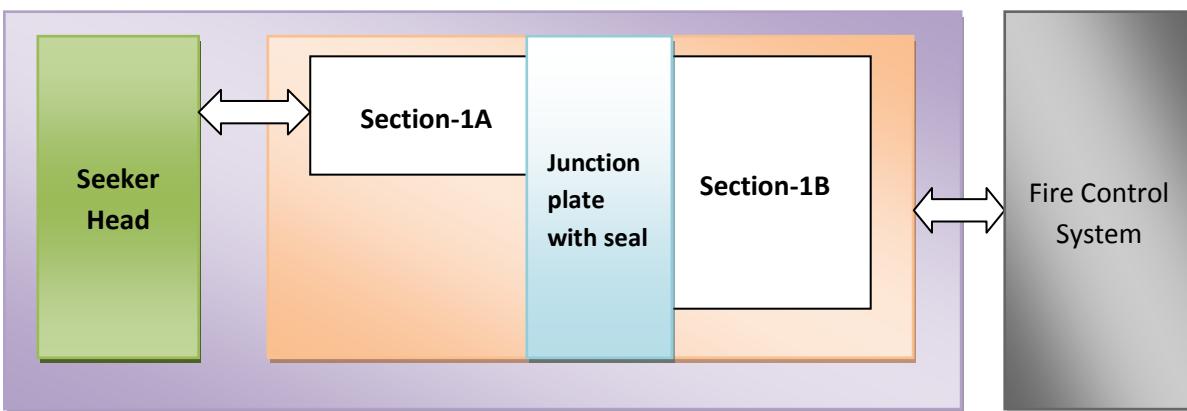
2. Configuration

2.1 Hardware Configuration

A gimbal will have Seeker Head mounted with electro-optical sensors as payload. The motion of the payload will be controlled using servo sensors and actuators.   The modules/components mounted on seeker head, which are to be interfaced with the electronics are as follows:

i.	SWIR camera
ii.	Thermal Imager (TI)
iii.	2-axis gyro
iv.	Azimuth encoder
v.	Elevation encoder
vi.	Azimuth torquer
vii.	Elevation torquer

The complete integrated electronic hardware has been divided in two sections viz. 'Section-1A' and 'Section-1B' electronics.
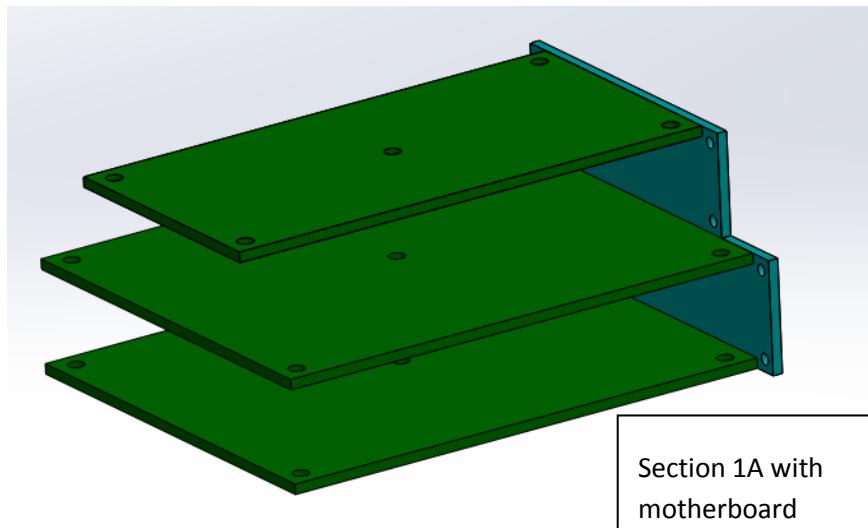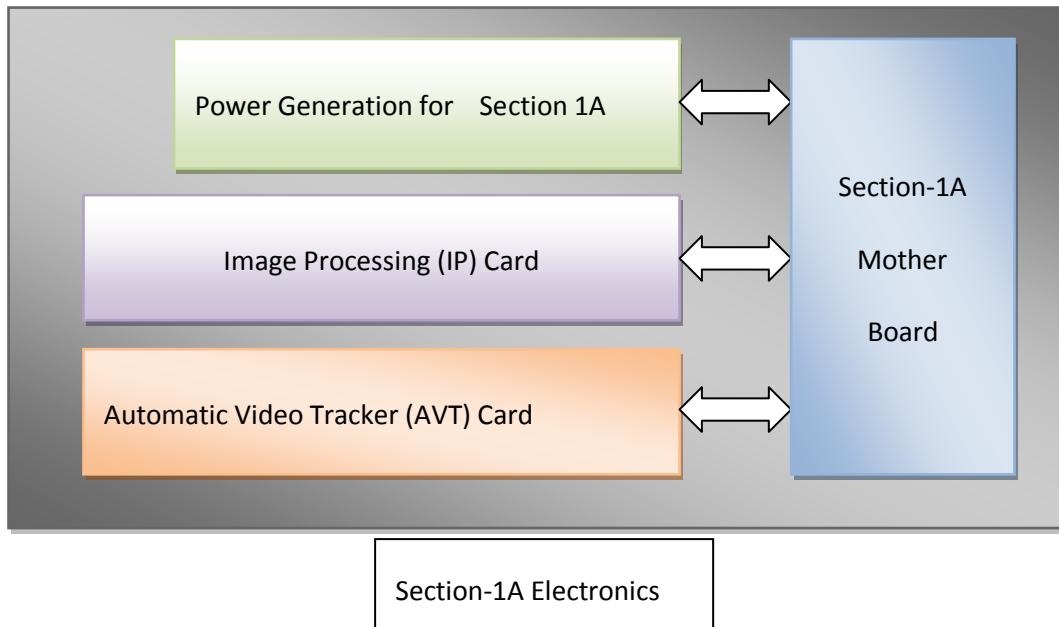
Electronics Hardware Configuration

Section-1A electronics will have following four electronics cards:
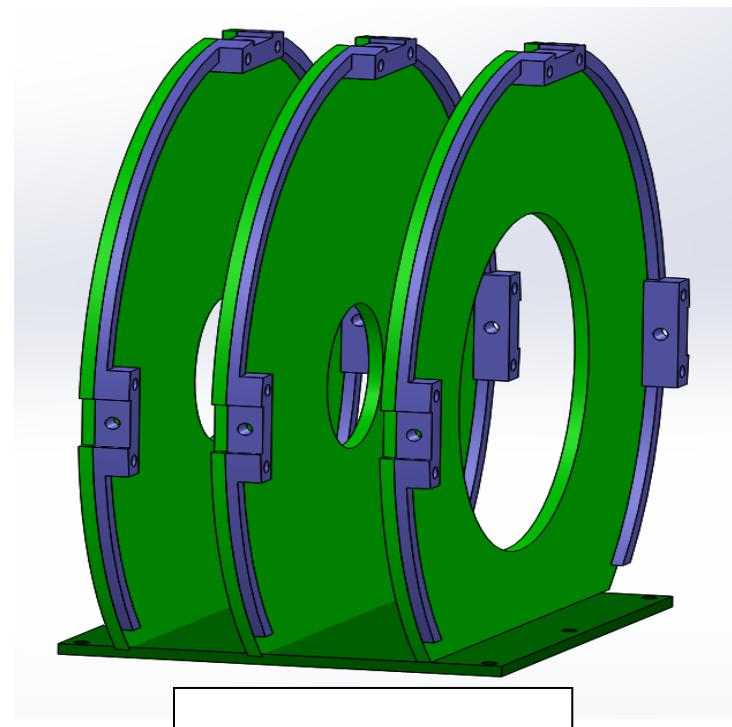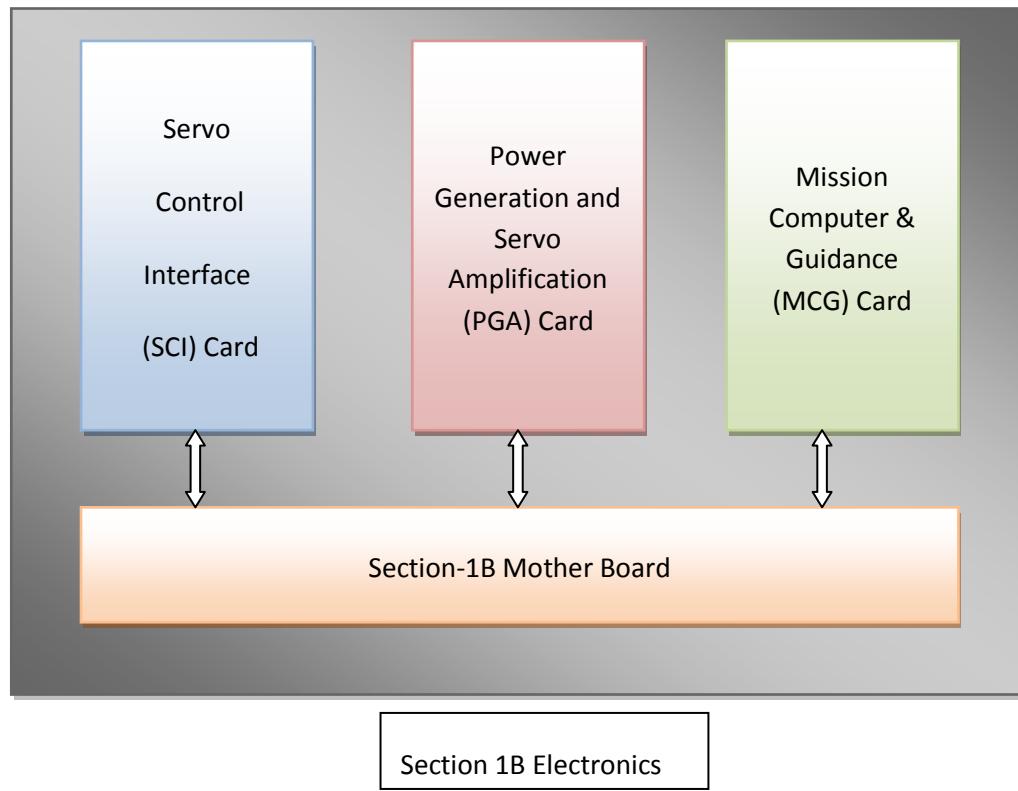
i. Power Generation for Section 1A card
ii. Image Processing Card (IP)
iii. Automatic Video Tracker (AVT) card
iv. Section-1A Motherboard card

These cards will be mounted in a section-1A motherboard card as shown in the block diagram below:

Section-1A Electronics

Section 1A with motherboard

Section-1B electronics will have following four cards:

- i.   Servo Control and Interface (SCI) card
- ii.   Power Generation and Servo Amplification (PGA) card
- iii. Mission Computer & Guidance Card (MCG)
- iv.   Section-1B motherboard card

Section 1B Electronics

Section 1B with motherboard
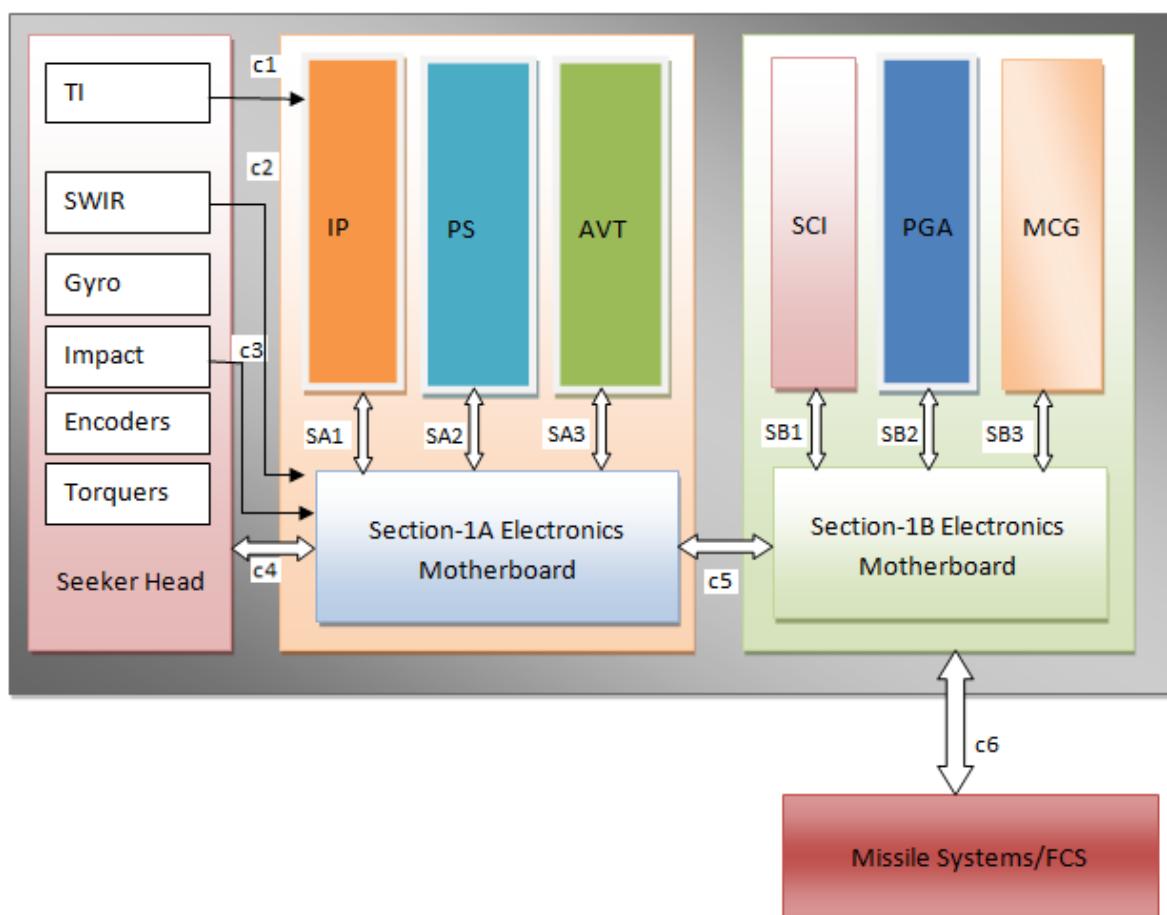
2.2 Deliverable Cards

Vendor will be responsible to deliver two sets of electronics with four sets of spare connector (each type) with mating parts. One set of electronics will consist of following:

i.   Automatic Video Tracker (AVT) card
ii.   Power Supply card
iii.   Section-1A Motherboard card

iv.   Servo Control and Interface (SCI) card
v.   Power Generation and Servo Amplification (PGA) card
vi.   Mission Computer & Guidance Card (MCG)
vii.   Section-1B motherboard card
viii.   High end video processing terminal

2.3 Signal Flow

Signal Flow diagram is shown below:

The modules/components of Seeker head are connected to Section-1A electronics by four connectors:

1. **Image Processing connector (C1)**
2. **SWIR connector (C2)**
3. **Impact Sense connector (C3)**
4. **Servo connector (C4)**

The signals between Section-1A motherboard electronics and Section 1-B motherboard electronics are connected through C5 connector:

5. **Section connector (C5) (interface between both motherboards)**

   External FCS will be connected with C6 connector

6. **Mission Connector (C6) (external system interface)**

3. Details of Connector Signal

3.1 Signals of C1(IP Card)

Sr. No.	Signals of C1
1	power supply
2	power supply gnd
3	TI_TX+
4	TI_TX-
5	TI_RX+
6	TI_RX-
7	TI_Shield
8	TI_Video
9	TI_Video_Return
10	TI_Video_return_Shield

3.2 Signals of C2 (SWIR)

Sr. No.	Signals of C2
1.	power supply
2.	power supply gnd
3.	SWIR_TX+
4.	SWIR_TX-
5.	SWIR_RX+
6.	SWIR_RX-
7.	SWIR_Shield
8.	SWIR_Video
9.	SWIR_Video_Return
10.	SWIR_Video_Shield

3.3 Signals of C3 (Impact Sense Connector)

Sr. No.	Signals of C3
1	Impact Sense Hi
2	Impact Sense Lo

3.4 Signals of C4 (Servo Connector)

Sr. No.	Component	Function	Analog(a) /Digital (d)
1.	STIM Gyro	power supply 5V	a
2.		5V power supply gnd	a
3.		gyro_RX+	d
4.		gyro_RX-	d
5.		gyro_TX+	d
6.		gyro_TX-	d
7.		gyro_shield	a
8.	Azimuth Encoder	5 V power supply	a
9.		5V power supply ground	a
10.		Az_Encoder_data+	d
11.		Az_Encoder_data-	d
12.		az_clk+	d
13.		az_clk-	d
14.		az_shield	a
15.	Elevation Encoder	5V power supply	a
16.		5V power supply ground	a
17.		el_Encoder_data+	d
18.		el_Encoder_data-	d
19.		el_clk+	d
20.		el_clk-	d
21.		el_shield	a
22.	Azimuth Torquer	Az_Hi	a
23.		Az_Hi	a
24.		Az_Lo	a
25.		Az_Lo	a
26.	Elevation Torquer	El_HI	a
27.		El_Hi	a
28.		El_Lo	a
29.		El_Lo	a

3.5 Signals of C5 (Section Connector MB1 & MB2)

Sr. No.	Component	Function of C5	Analog(a) /Digital (d)
1.	STIM Gyro	power supply	a
2.		power supply gnd	a
3.		gyro_RX+	d
4.		gyro_RX-	d
5.		gyro_TX+	d
6.		gyro_TX-	d
7.		gyro_shield	a
8.	Azimuth Encoder	power supply	a

9.		power supply ground	a
10.		Az_Encoder_data+	d
11.		Az_Encoder_data+	d
12.		az_clk+	d
13.		az_clk-	d
14.		az_shield	a
15.	Elevation Encoder	power supply	a
16.		power supply ground	a
17.		el_Encoder_data+	d
18.		el_Encoder_data+	d
19.		el_clk+	d
20.		el_clk-	d
21.		el_shield	a
22.	AVT Video	power supply	a
23.		power supply gnd	a
24.		AVT_Video	d
25.		AVT_Video_Return	a
26.		AVT_Video_Shield	a
27.	AVT_SCI_RS422	AVT_SCI_TX+	d
28.		AVT_SCI_TX-	d
29.		AVT_SCI_RX+	d
30.		AVT_SCI_RX-	d
31.		AVT_Shield	d
32.	AVT_SCI_RS232	AVT_TX	d
33.		AVT_RX	d
34.		AVT_Gnd	d
35.	Azimuth Torquer	Az_Hi	a
36.		Az_Hi	a
37.		Az_Lo	a
38.		Az_Lo	a
39.	Elevation Torquer	El_HI	a
40.		El_Hi	a
41.		El_Lo	a
42.		El_Lo	a
43.	IP_SCI	IP_SCI_TX+	d
44.		IP_SCI_TX-	d
45.		IP_SCI_RX+	d
46.		IP_SCI_RX-	d
47.	IP_Gen_card_power_supply	High	a
48.		low	a

3.6 Signals of C6 (Mission Connector)

C6 will have four connectors;

    I.   C6-Comm
   II.   C6-Video
  III.   C6-data
  IV.   C6-Power

The details are as follows:

3.6.1 C6-Comm Connector details

Sr. No.	Component	Function	Analog(a) /Digital (d)
1.	Safety Arming Mechanism(SAM)	SAM_TX+	D
2.		SAM_TX-	D
3.		SAM_RX+	D
4.		SAM_RX-	D
5.	Mission Transceiver(MT)	MT_TX+	D
6.		MT_TX-	D
7.		MT_RX+	D
8.		MT_RX-	D
9.	Control Actuation System (CAS)	CAS_TX+	D
10.		CAS_TX-	D
11.		CAS_RX+	D
12.		CAS_RX-	D
13.	Sensor Package Communication	SPC_TX+	D
14.		SPC_TX-	D
15.		SPC_RX+	D
16.		SPC_RX-	D
17.	SPARE1_RS422	S1_TX+	D
18.		S1_TX-	D
19.		S1_RX+	D
20.		S1_RX-	D
21.	SPARE2_RS422	S2_TX+	D
22.		S2_TX-	D
23.		S2_RX+	D
24.		S2_RX-	D
25.	Umbilical Cord	U_TX+	d
26.		U_TX-	d
27.		U_RX+	d
28.		U_RX-	D

3.6.2 C6-Video Connector details

Sr. No.	Component	Function	Analog(a) /Digital (d)
1.	TI raw video	TI_raw	A
2.	TI raw video gnd	TI_raw_g	A
3.	TI raw video sheild	TI_v_s	A
4.	SWIR raw video	SWIR _raw	A
5.	SWIR raw video gnd	SWIR _raw_g	A
6.	SWIR raw video sheild	SWIR _v_s	A
7.	AVT raw video	AVT_raw	A
8.	AVT raw video gnd	AVT_raw_g	A
9.	AVT raw video sheild	AVT_v_s	A

3.6.3 C6-data Connector details

Sr. No.	Component	Function	Analog(a) /Digital (d)
1.	USB_FCS	USB_sheild	a
2.		USB_Power	a
3.		USB_Data+	d
4.		USB_Data-	d
5.		Gnd	a
6.		Super_TX+	d
7.		Super_TX-	d
8.		Super_RX+	d
9.		Super_RX-	d
10.		Ground_drain	a
11.	JTAG	EMU	d
12.		TMS	d
13.		TCK	d
14.		TRST	d
15.		TDI	d
16.		TDO	d

3.6.4 C6-Power Connector details
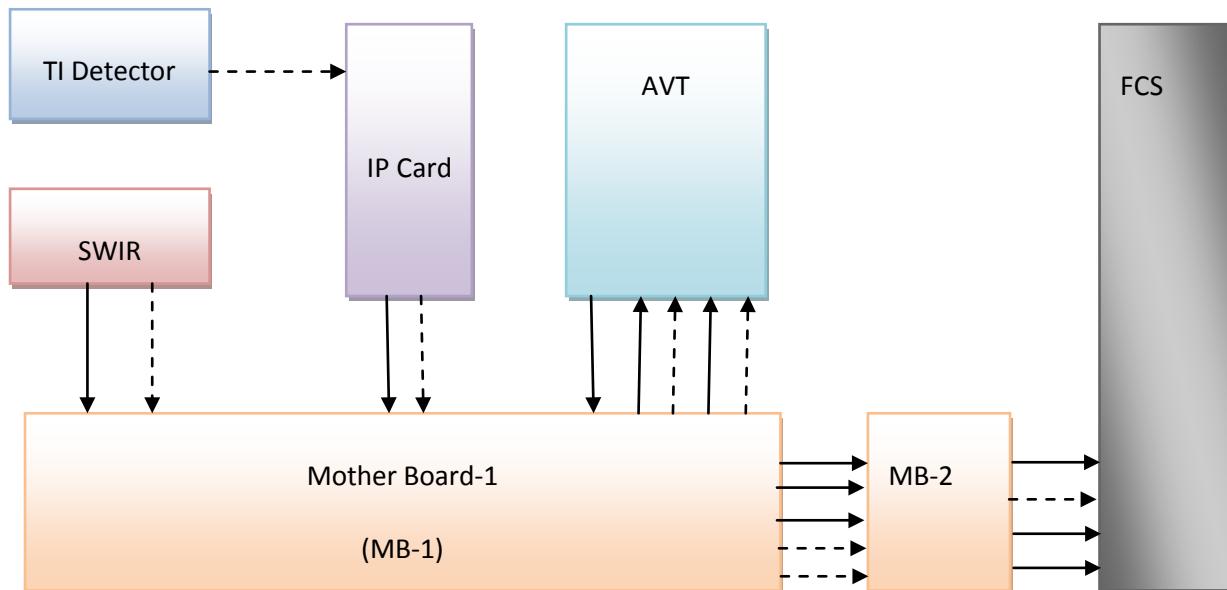
Sr. No.	Component	Function	Analog(a) /Digital (d)
17.	+28V Power supply	28V	A
18.	+28V Power supply gnd	28V_Gnd	A

4. Details of Section-1A Electronics

4.1 Image Processing Card
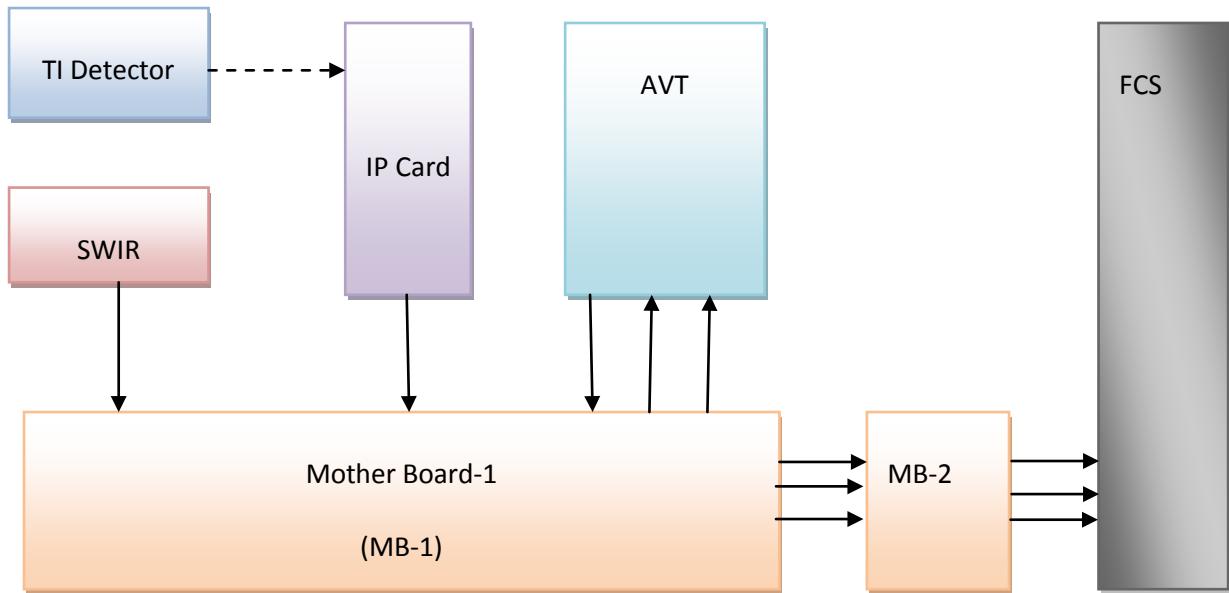
This card will be provided by IRDE.

Image processing card will accept TI detector digital video output and control interfacing signals. IP card will convert this digital TI video into analog TI video. Servo Control and Interface (SCI) card will communicate to the IP card through RS 422 link. Two video outputs (analog and digital) from IP card will be routed to AVT card through motherboard of section-1A electronics.


Solid line: analog video

Dashed line: digital video

4.2 Automatic Video Tracking (AVT) Card

AVT will track the target and send the tracking error signal to the SCI card through RS422 link. AVT will carry out the tracking function as per the commands received from SCI card over RS 422 link. It will support various tracking algorithms.

Solid line: analog video

Motherboard-1A to motherboard-1B will carry following three video signals

- One analog input Composite video 1.0Vp-p, 625 Line, CCIR from SWIR camera
- One analog input Composite video 1.0Vp-p, 625 Line, CCIR from IP
- One analog CCIR video output from AVT to FCS
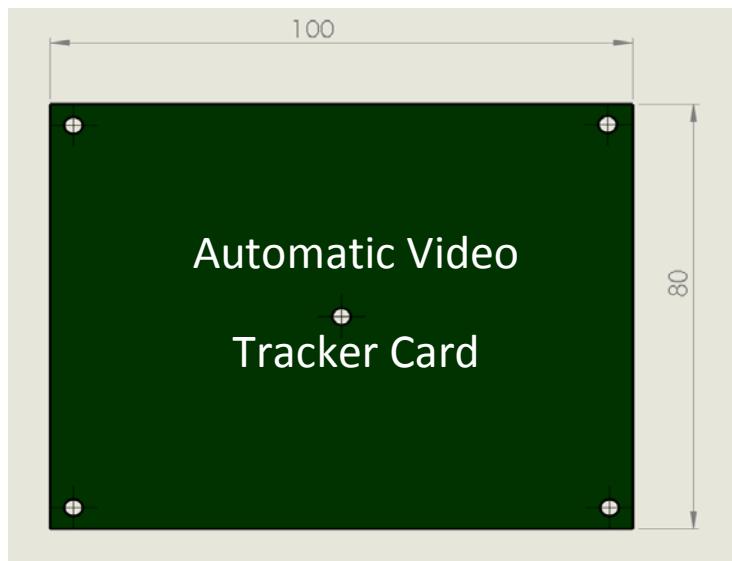
Input/Output to AVT:

- One analog video input Composite video 1.0Vp-p, 625 Line, CCIR from SWIR camera
- One analog video input Composite video 1.0Vp-p, 625 Line, CCIR from TI camera
- One analog CCIR video output from AVT to FCS
- RS 422 and RS232 link with SCI card for command & control
- Power signals

Connectors

• Analog Video 4 x MMCX jack

• RS232 Serial: 2 mm pitch 2 row x 3 pin header. Keyed and lockable

• RS422 Serial: 2 mm pitch 2 row x 5 pin header. Keyed and lockable

– Power: 2 mm pitch 1 row x 4 pin header. Keyed and lockable

Dimension:

4.2.1 Specifications of AVT Card

Following are the specifications of video tracker card:

| TRACKER CAPABILITIES	
Target	Modern Tanks & standard NATO targets
Target size	≤ (2.3 m x 2.3 m)
Minimal Target size in Image	5 x 3 pixel
Minimal Target Contrast	5%
Tracking Rate	≥ 5 pixels/ field in both directions
Gate position and size	should be updated automatically depending upon target size and location
Detection	Auto Detection Capability upto 5 target
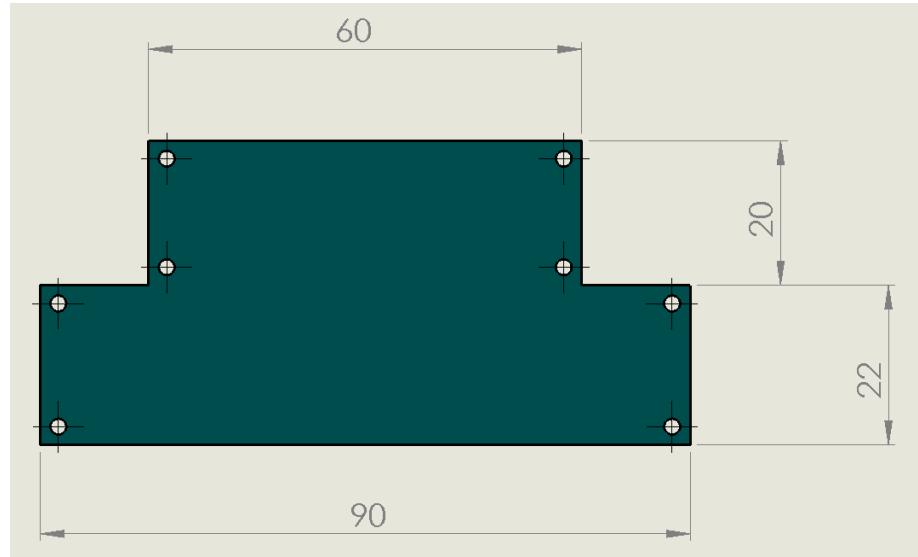
Direction	Approaching/ Receding/ Crossing.
Occlusion	Occlusion handling Capability upto 6 seconds
Additional Requirements	After launch few frames may be obscured / disturbed up to 0.5 seconds. This aspect needs to be considered in the design of IP & tracking algorithms.
Error Signal generation	Error signal generation & feedback to servo control electronics
Error Update Rate	50 Hz with accuracy of ± 1pixel
Tracking Algorithms	▪ Centroid ▪ Edge ▪ Correlation ▪ Combined(Combination of two or more algorithms) ▪ Scenelock ▪ Other Algorithms suitable for above mentioned scenario

4.3 Section 1A Motherboard card

Purpose:

This will provide connectivity among all the three cards of section 1A electronics, seeker head modules/components and section 1B electronics mother board. The mother board card will have two miniaturized connectors to communicate with Section-1A and Section-1B electronics.

**TOP View Drawing of Section-1A Mother Board Card:**
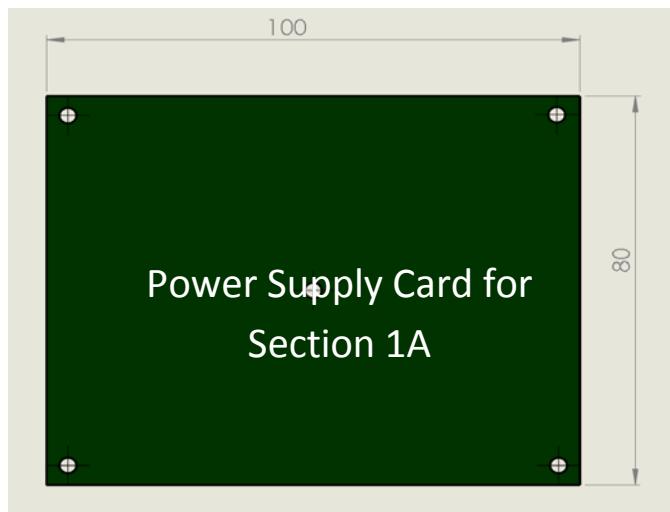
4.4 Power Supply Card for Section 1A

This card will take 24V DC input and generate following voltages:

- SWIR power supply of +12V DC (1 Amp)
- Thermal Imager power supply of +5V (1A)
- Image Processing card power supply of +5V (1A)

The dimensions are as follows:

Dimension:

Power Supply Card for Section 1A
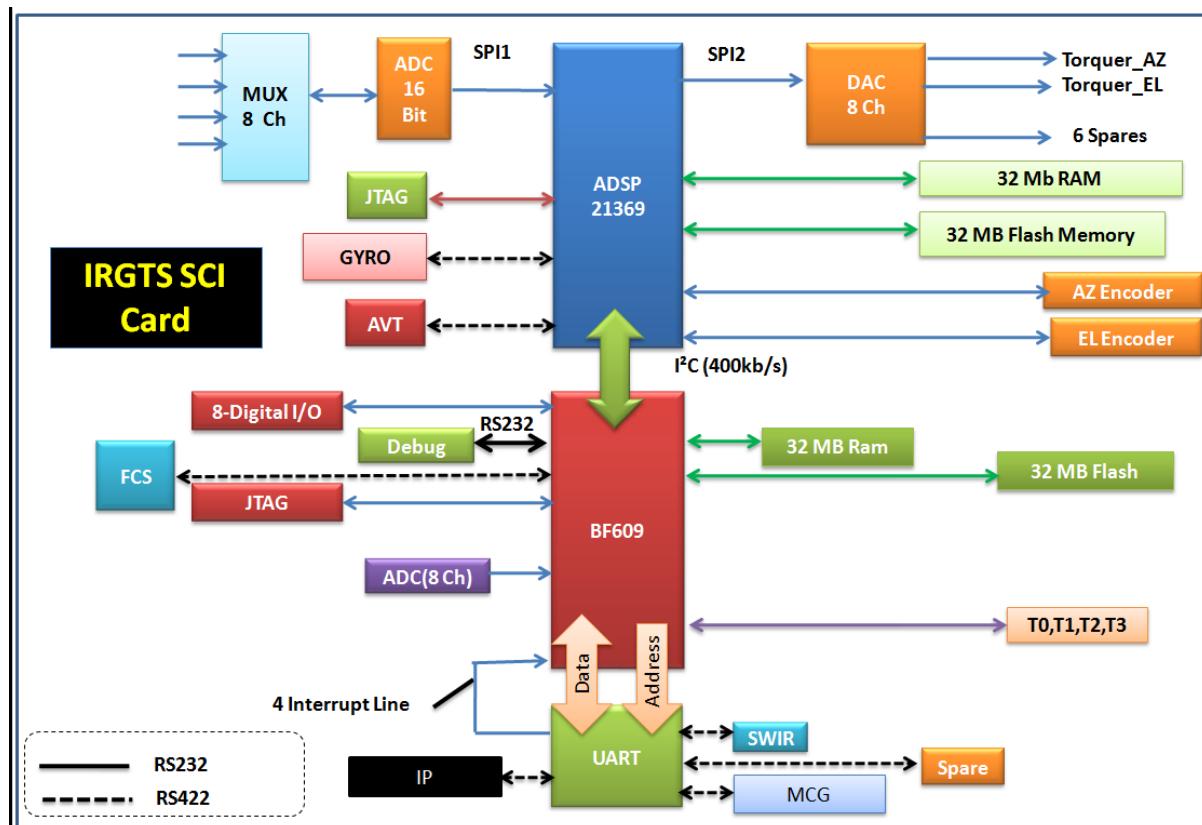
5. Details of Section-1B Electronics

5.1 Servo Control and Interface (SCI) Card

The block level description of SCI card is shown below:

This card will be designed around SHARC and BlackFin 609 processors.

SHARC Processor

ADSP21369 SHARC processor will be used for implementing control laws. This processor must have a working temperature range of -40° C to +85° C. This will communicate with BF609 microcontroller using I^{2}C interfacing.

BlackFin 609 Processor

This processor will be used for the mode changeover and peripheral interfacing. This will communicate with ADSP21369 using I^{2}C interfacing.

Communication links

Standard baud rate for RS422/RS232 will be used for a minimum rate of 115200 bps. Following communication links will be available with Servo Control Interface Card:

Sr. No.	Type of Link	Port	Terminal-1	Terminal-2
1	RS422	SHARC	SCI Card	Gyro
2	RS422	SHARC	SCI Card	AVT_422
3	RS232	BF609	SCI Card	Debug Personal Computer
4	RS422	BF609	SCI Card	Fire Control System
5	RS232	UART	SCI Card	IP Card
6	RS232	UART	SCI Card	MCG Card
7	RS232	UART	SCI Card	SWIR
8	RS232	UART	SCI Card	AVT_232

A typical bill of material is provided for this card for reference.

Sr. No.	Item	Function
1.	ADSP 21369 SHARC	Processor
2.	AD7671	ADC
3.	AD5664	DAC
4.	LM139DT	COMPARATOR
5.	LM369	COMPARATOR
6.	ADG1406	ANALOG MULTIPLEXER
7.	LM139	QUAD COMPARATOR

5.1.1 Interfacing with ADSP21369 SHARC Processor

Various sub-blocks are described below which are interfaced with ADSP21369

- **Fast Data Acquisition Channel on ADSP21369**

There will be a multiplexer of eight by one channel for selecting desired analog input. A fast data acquisition circuitry will digitize these sixteen analog inputs (16 bit and ±10V dynamic range). Among these eight channels, four of them will have provision for scaling, filtering and bypassable notch filter stages. One channel will be connected with the impact sensor output. Rest three channels are for testing and debugging.

- **Digital to Analog Channel on ADSP21369**

An eight channel DAC will be interfaced with the ADSP21369 processor. One channel will be used to drive motor in azimuth direction and other channel to drive in elevation direction. Six spare channels will be reserved for testing purpose.

- **JTAG Port**

JTAG port will be used for software development and debug purpose.

- **RAM Memory**

32 MB RAM Memory will be interfaced with the SHARC processor.

- **Flash Memory**

32 MB Flash Memory will be interfaced with the SHARC processor.

- **SSI Interfacing with Encoders**

Two encoders of azimuth and elevation channels will be interfaced with SHARC using using SSI port.

- **Gyro interfacing with RS422**

Gyro will be interfaced using RS422 channel of ADSP21369. This channel must support atleast 921600 bits/sec rate.

- **AVT interfacing with RS422**

The communication between ADSP21369 and Automatic Video Tracker will be established using RS422 interfacing with the ADSP21369 with minimum 115200 bps rate.

5.1.2 Interfacing with BF609 Processor

Various sub-blocks are described below which are interfaced with BF609 processor.

- **Digital I/O interface**

Eight general purpose digital I/O TTL lines will be used for logic decision.

- **Debug**

BF609 software will be debugged through RS232 Debug port using PC.

- **FCS interfacing with RS422**

External Fire Control System (FCS) will be interfaced with RS422 Channel of BF609.

- **JTAG port**

JTAG port of BF609 will be used for development of software.

- **USB2.0**

USB2.0 port will be provided for data downloading and uploading.

- **Spare RS422**

One spare RS422 channel in BF609 will be used for future need.

- **Flash Memory**

A 32MB flash memory will be used to store various calibration data and program.

- **Inbuild 10 bit ADC eight Channel**

To monitor the health parameters inbuilt 10 bit ADC of 8 Channel will be used. Following signals will be digitized:

| Channel Number	Signal
1.	+15V
2.	-15V
3.	+5V
4.	-5V
5.	+28V
6.	Torquer_az_current
7.	Torquer_el_current
8.	spare
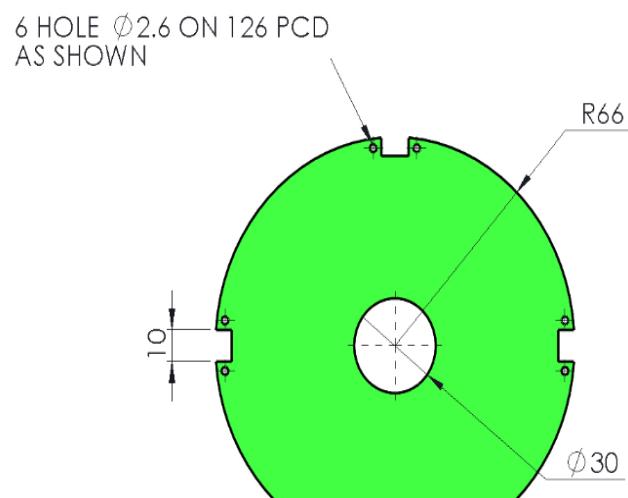
- **RAM Memory**

A 32 MB RAM will be used as a scratch pad during programming.
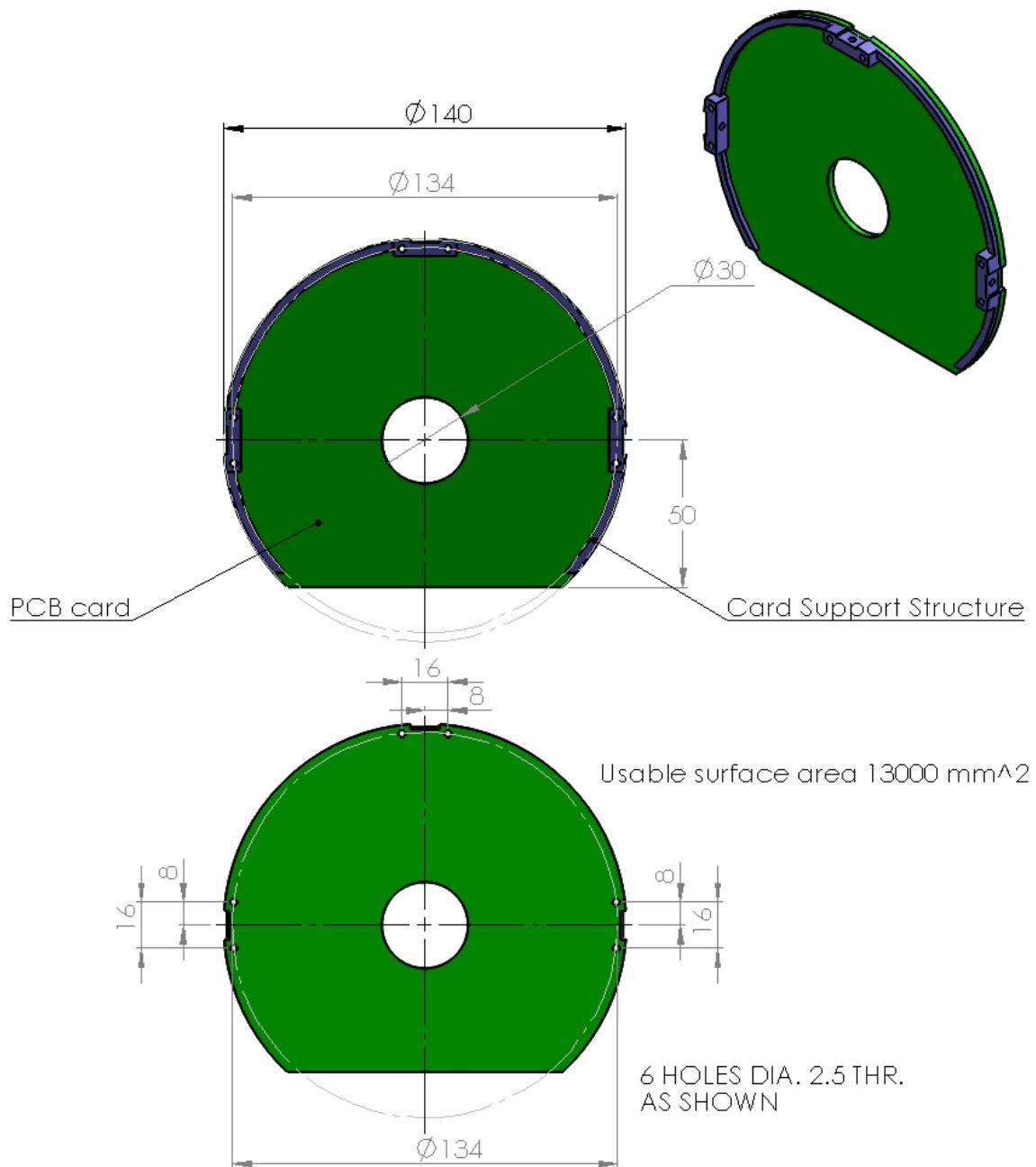
- **Timer interrupt**

Four timer interrupts (T0,T1,T2,T3) will be made available T0,T1,T2.T3.

Drawing of SCI card:

6 HOLE ⌀2.6 ON 126 PCD
AS SHOWN

R66

10

⌀30

USABLE AREA: 10000 mm^2

Ø140

Ø134

Ø30

50

PCB card

Card Support Structure

16

8

Usable surface area 13000 mm^2

8

16

8

16

6 HOLES DIA. 2.5 THR.
AS SHOWN

Ø134

5.2 Power Generation and Servo Amplification (PGA) card

Purpose:

This card will supply required power supply to following cards:
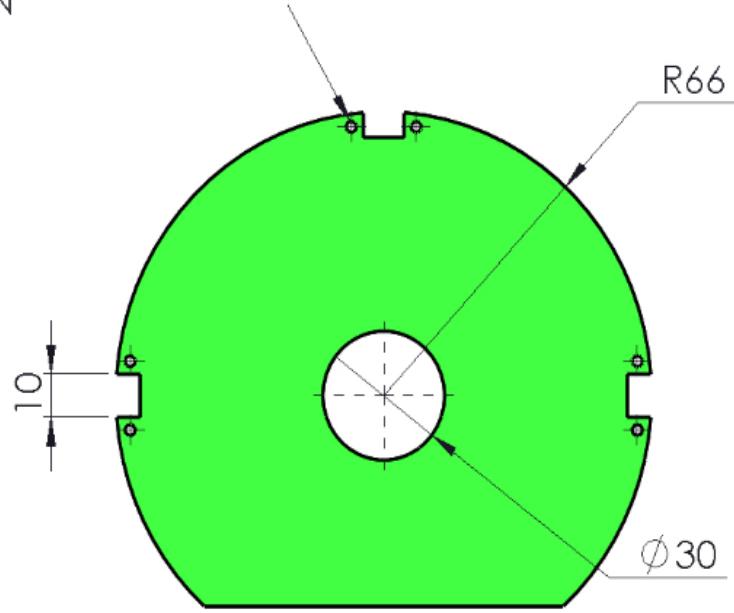
- Servo Control and Interface Card (±5V, ±15V ; 0.5 Amp)
- Mission Control and Guidance Card(±5V, ±15V ; 0.5 Amp)
- Power supply to Gyro (5 Volt ;0.5 A)
- Azimuth torquer servo amplifier (24V; 2A)
- Elevation torquer servo amplifier (24V; 2A)
- Azimuth encoder (5V; 0.5A)
- Elevation encoder (5V; 0.5A)
- Supply to AVT Card (5V; 0.5A)

Servo Amplifier:
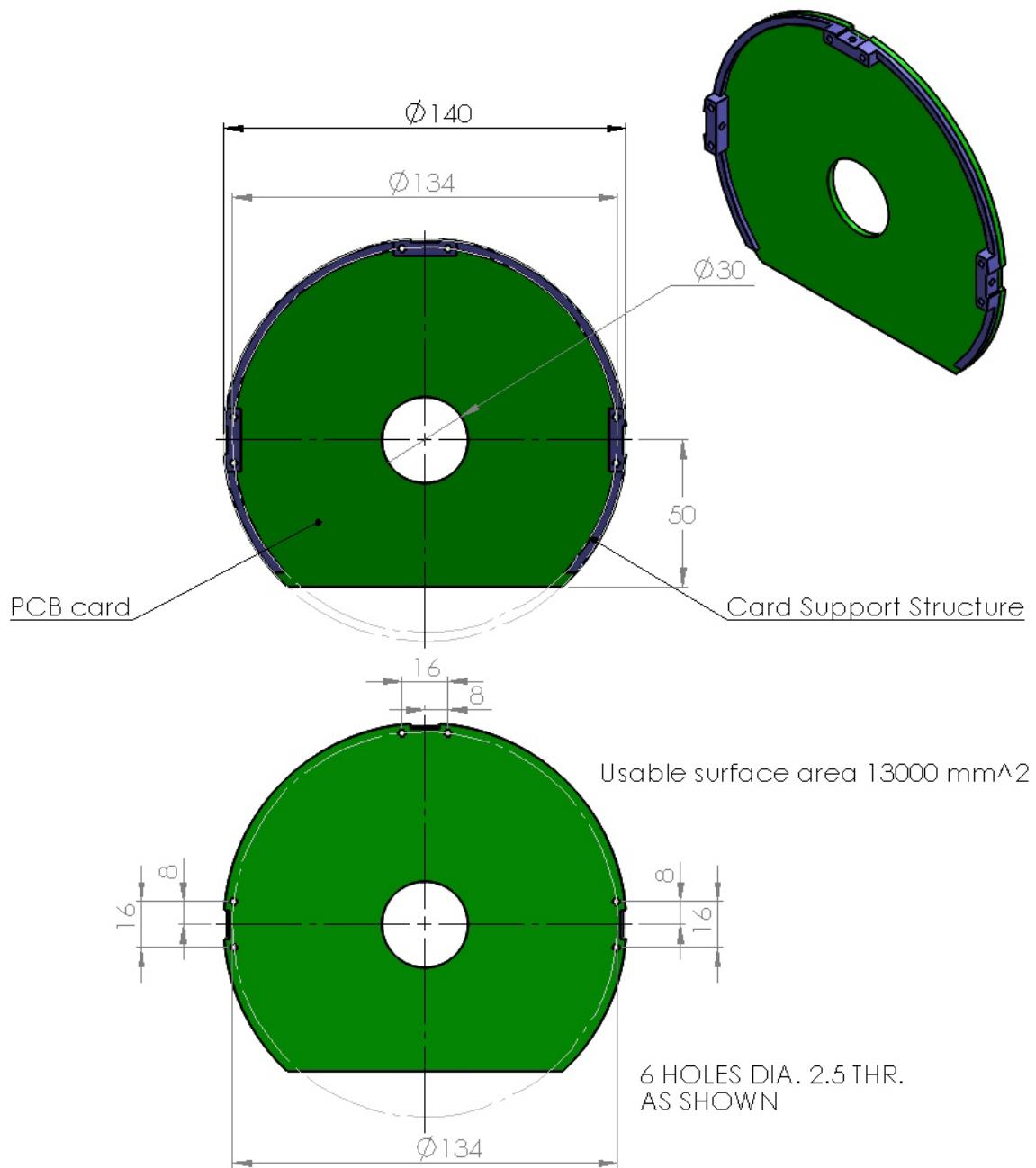
Two servo amplifiers MSK4206H (Mil Grade) will be used to drive motors in azimuth and elevation channel. Also Four MSK4206H chips will be supplied as spare.

Drawing of PGA card:

Ø140

Ø134

Ø30

50

PCB card

Card Support Structure

16

8

Usable surface area 13000 mm^2

8

16

8

16

6 HOLES DIA. 2.5 THR.
AS SHOWN

Ø134
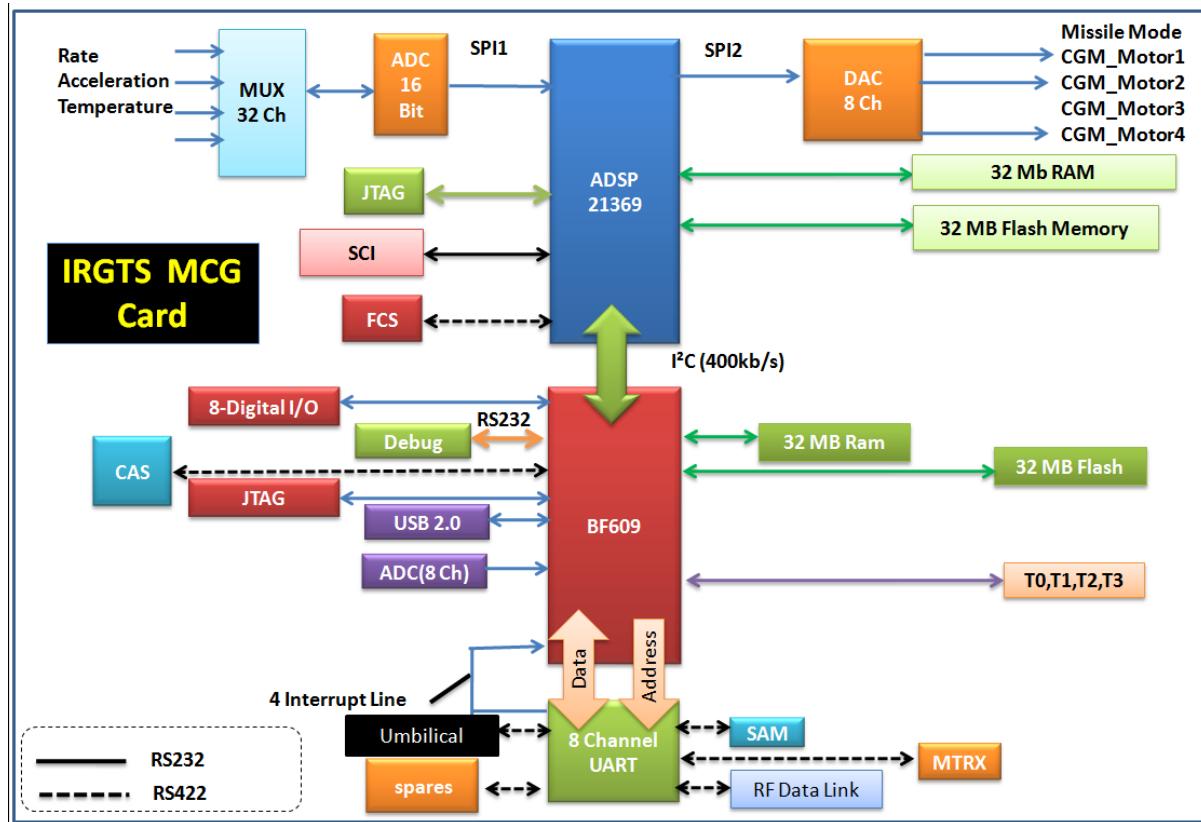
5.3 Mission Control and Guidance Card

Purpose:

This card will have a SHARC processor to implement the guidance and control algorithms. This card will also communicate with FCS and SCI card.

The block level description of MCG card is shown below:

This card will be designed around ADSP21369 SHARC processor and BlackFin 609 processor.

SHARC Processor

ADSP21369 SHARC processor will be used for implementing control and guidance laws. This processor must have a working temperature range of -40° C to +85° C. This will communicate with BF609 microcontroller using I^2C interfacing.

BF609 Processor

This processor will be used for the mode changeover and peripheral interfacing. This will communicate with ADSP21369 using I^2C interfacing.

Communication

Standard baud rate for RS422/RS232 will be used for a minimum rate of 115200 bps. An Eight channel UART will be interfaced in this card.

Following communication links will be available with MCG Card:

Sr. No.	Type of Link	Port	Terminal-1	Terminal-2
1	RS232	SHARC	MCG Card	SCI Card
2	RS422	SHARC	MCG Card	FCS
3	RS422	BF609	MCG Card	Control Actuation System
4	RS422	BF609	MCG Card	Telemetry
5	RS422	UART	MCG Card	Sensor Package
6	RS232	UART	MCG Card	Debug PC
7	RS422	UART	MCG Card	Umbilical
8	RS422	UART	MCG Card	Safety and Arming Mechanism
9	RS422	UART	MCG Card	Mission tranceiver
10	RS422	UART	MCG Card	RF Data Link
11	RS422	UART	MCG Card	Spare
12	RS422	UART	MCG Card	Spare

A typical bill of material is provided for this card for reference.

Sr. No.	Item	Function
9.	ADSP 21369 SHARC	Processor
10.	AD7671	ADC
11.	AD5664	DAC
12.	LM139DT	COMPARATOR
13.	LM369	COMPARATOR
14.	XC9572	CPLD
15.	ADG1406	ANALOG MULTIPLEXER
16.	LM139	QUAD COMPRATOR
17.	XR16V554-IV80-F	QUAD UART

5.3.1   Interfacing with ADSP21369 SHARC Processor

Various sub-blocks are described below which are interfaced with ADSP21369

- **Fast Data Acquisition Channel on ADSP21369**

There will be a multiplexer of Thirty Two by one channel for selecting desired analog input. A fast data acquisition circuitry will digitize these analog inputs (atleast 16 bit and ±10V dynamic range). Among these thirty two channels, four of them will have provision for scaling, filtering and

bypassable notch filter stages. One channel will be connected with the impact sensor output. Other two channels will be used to steer the payload in azimuth and elevation direction using an analog joystic with azimuth and elevation channels. Following are the analog signals to be monitored:

Sr. Number	Analog Input Signal
1.	Impact Signal
2.	Mission Lift Off
3.	Pitch Rate (Q)
4.	Roll Rate (P)
5.	Yaw Rate (R)
6.	Pitch Latex (Fy)
7.	Yaw Latex (Fz)
8.	Forward Acceleration (G4)
9.	Backward Acceleration (G5)
10.	Mission Battery Voltage
11.	Control System Battery Voltage Positive
12.	Control System Battery Voltage Negative
13.	Temperature 1
14.	Temperature 2
15.	Temperature 3
16.	Temperature 4
17.	Temperature 5
18.	Temperature 6
19.	CGM Motor1 Feedback
20.	CGM Motor2 Feedback
21.	CGM Motor3 Feedback
22.	CGM Motor4 Feedback
23.	SLR Azimuth
24.	SLR Azimuth Bias
25.	SLR Elevation
26.	SLR Elevation Bias
27.	FPA Temperature
28.	Spare Analog 1
29.	Spare Analog 2
30.	Spare Analog 3
31.	Spare Analog 4
32.	Spare Analog 5

- **Digital to Analog Channel on ADSP21369**

An eight channel DAC will be interfaced with the ADSP21369 processor. Four channels will be used to drive four motors. One channel will be used for mission mode. Three spare channels will be reserved for future purpose.

- **JTAG Port**

JTAG port will be used for software development and debug purpose.

- **RAM**

 32 MB RAM will be interfaced with the SHARC processor.

- **Flash Memory**

32 MB Flash Memory will be interfaced with the SHARC processor.

- **SCI interfacing with RS422**

Servo Control and Interfaced card will be interfaced using RS422 channel of ADSP21369.

- **FCS interfacing with RS422**

The communication between ADSP21369 and FCS will be established using RS422 interfacing with the ADSP21369.

5.3.2   Interfacing with BF609 Processor

Various sub-blocks are described below which are interfaced with BF609:

- **Digital I/O interface**

Eight general purpose digital I/O TTL lines will be used for logic decision.

- **JTAG port**

JTAG port of BF609 will be used for development of software.

- **USB2.0**

USB2.0 port will be provided for data downloading and uploading.

- **Flash Memory**

A 32Mb flash memory will be used to store various calibration data and program.

- **RAM Memory**

A 32 Mb RAM will be used as a scratch pad during programming.

- **Timer interrupt**

Four timer interrupts (T0,T1,T2,T3) will be made available.

- **Inbuild 10 bit ADC eight Channel**

To monitor the health parameters inbuilt 10 bit ADC of 8 Channel will be used. Following signals will be digitized:

Channel Number	Signal
1.	+15V
2.	-15V
3.	+5V
4.	-5V
5.	+28V
6.	spare
7.	spare
8.	spare

5.3.3   Interfacing with Quad UART

A four channel UART will be used to interface other external systems. All the four interrupts will be connected to the BF609 with dedicated interrupt lines. The details of the channels are as below:

- **SAM Interface**

SAM will be interfaced through RS422 for command and control.

- **MTRX Interface**

SWIR will be interfaced through RS422 for command and control.
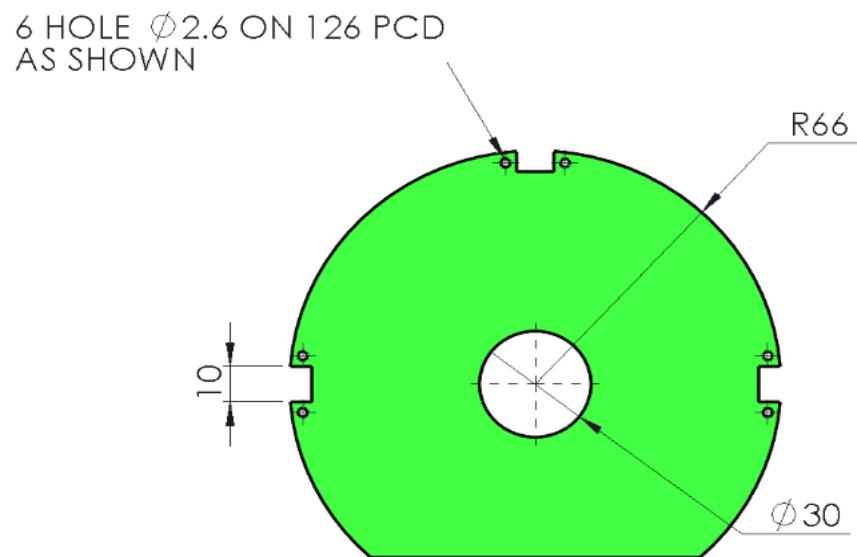
- **RF Data Link Interface**

One RS422 channel will be used to communicate with the MCG card.
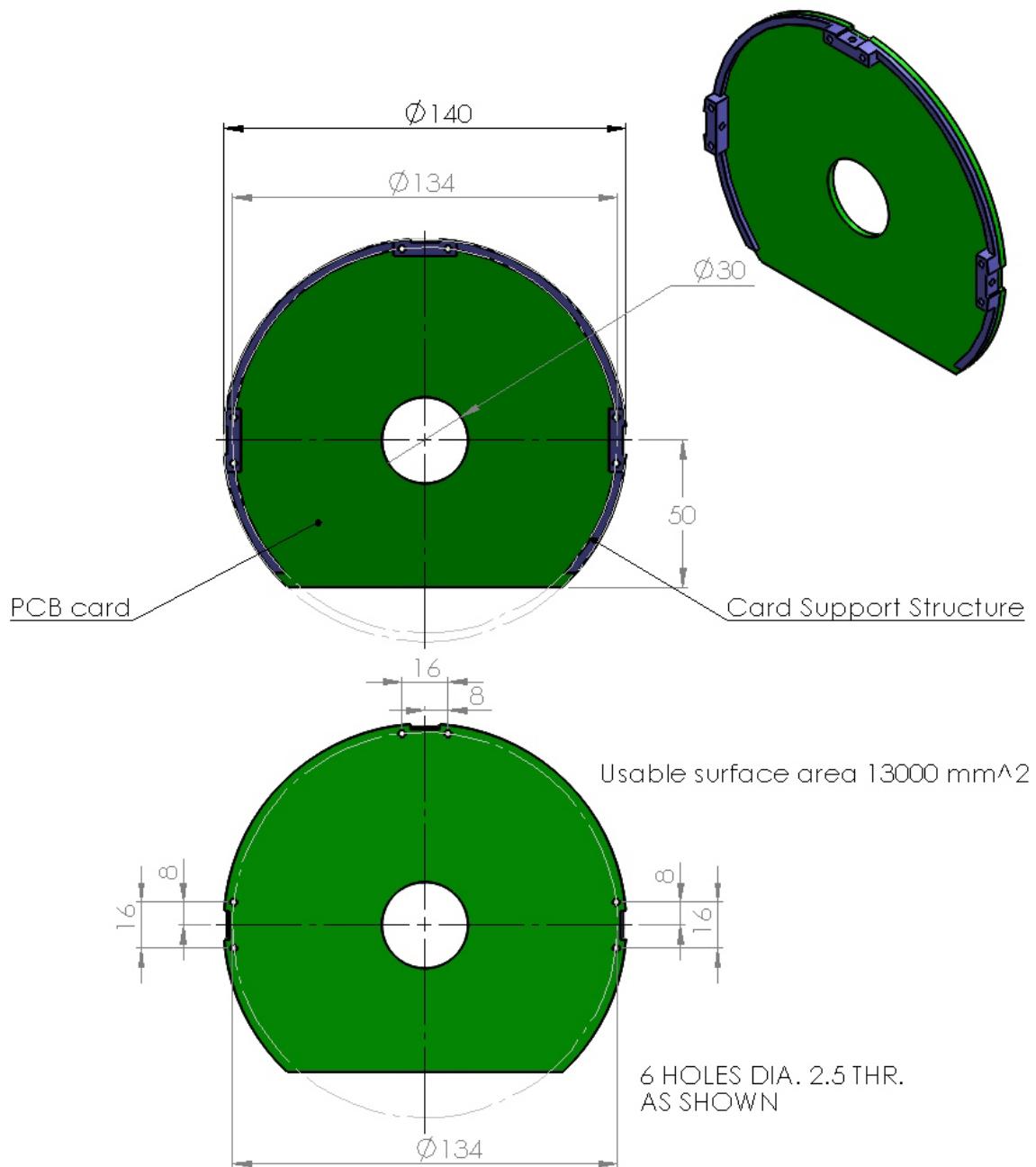
- **Umbilical Chord Interface**

One spare RS422 channel will be used for future use.

Drawing of SCI card:

6 HOLE ∅2.6 ON 126 PCD
AS SHOWN

R66

10

∅30

USABLE AREA: 10000 mm^2

Ø140

Ø134

Ø30

50

PCB card

Card Support Structure

16

8

Usable surface area 13000 mm^2

8

16

8

16

6 HOLES DIA. 2.5 THR.
AS SHOWN

Ø134
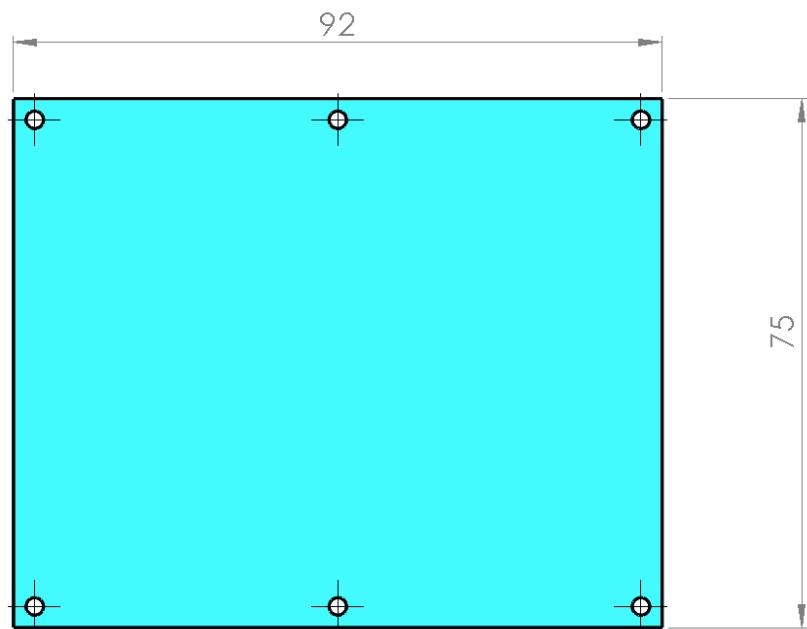
## 5.4 Section-1B Mother Board Card

Mother board will have four cards mounted on it through connectors. This will act as a communication channel for the cards.

**Dimension of Section-1B Mother Board card:**
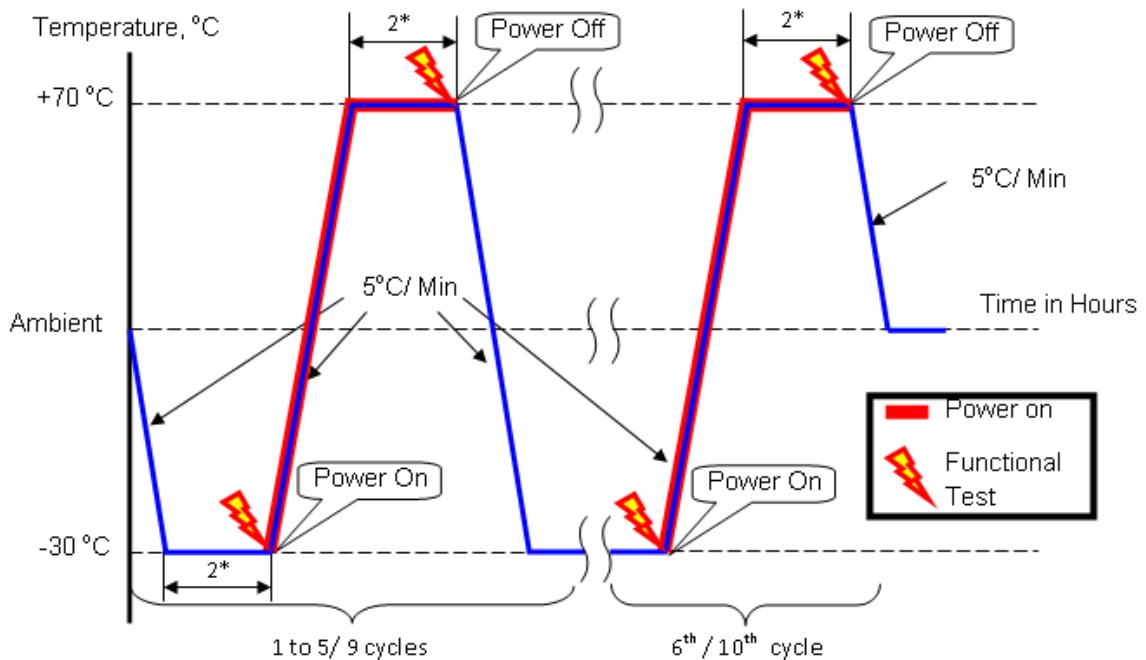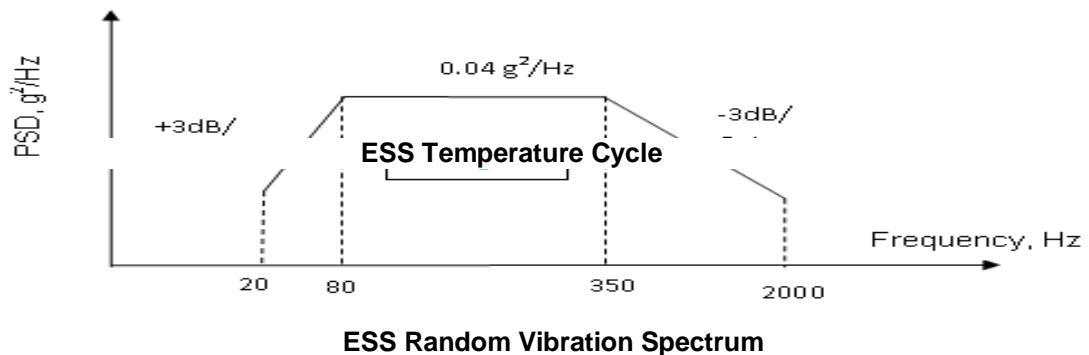
6. Environmental Stress Screening

All the cards will be subjected to the ESS test. Vendor will design and ensure for the ESS qualification of these electronics.

S. No	Level	Remarks
1	Random Vibration 20 - 80 Hz.; +3 dB / Octave 80 - 350 Hz.; 0.04 g^2/Hz. 350 - 2000 Hz.; -3 dB / Octave Overall 6.06g_{rms} Duration: 5 min./axis in 2 axes	PREET, INSET as per Figure below, POET . Note: In case of failure, defect to be rectified and test to be continued for duration of 5 min./axis, without any re-appearance of defect. Total test duration not to exceed 15 min./axis.
2	Thermal Cycling -30° C for 60 min. +71° C for 60 min. Rate of change of Temp: 5° C / min. No. of Cycles: 10 for the first unit for Design qualification & Later reduce to 6 cycles.	PREET at Ambient, INSET as per Figure below POET at. Ambient. Note: (a) Last three cycles should be failure free. (b) In case failure is observed before the stated defect-free (last three) cycles, the defect is to be rectified and test continued until three defect-free cycles have been carried out. (c) In case failure is observed during the last three cycles, detailed failure investigation including process and design review is to be carried out to establish the cause of failure prior

			to commencement of production. Thereafter, the test is to be repeated from the beginning.
3	**EMI/EMC** CS101, CE101, CE102, RE101, RE102, CS114, CS115, RS103 ESD		For RS103: 10 KHz– 1 GHz, 20 V/m 1 -40 GHz 60 V/m

ESS Random Vibration Spectrum

7. High End Video Processing Terminal

To develop and test the high end video tracking algorithms, a high end video processing terminal is required.

Following are the specifications of high end video processing terminal device:

S.No.	Features	Qualifying Minimum Requirement
1	Processor	Two Intel XEON E5- 2690 v3 2.6 GHz 30MB Cache Memory 12 Core
2	Chipset	Intel Chipset C612
3	RAM	32GB DDR4-2133 ECC (4x8GB) RAM with support Up to 64GB memory
4	Storage	600 GB SAS (15000 rpm) 1.2 TB SAS (10000 rpm)
5	Optical Drive	Super-Multi DVDRW SATA
6	Bays	2 external 5.25-inch bays 4 internal 3.5-inch HDD bays 1 External Slim-line Optical bay
7	Slots	- Slot 1: PCIe Gen3 x4 - Slot 2: PCIe Gen3 x16 - Slot 3: PCIe Gen3 x8 - Slot 4: PCIe Gen3 x16 - Slot 5: PCIe Gen3 x8 - Slot 6: PCIe Gen3 x16 - Slot 7: PCIe Gen2 x1
8	Ports	Front: 4 USB 3.0 1 Combo Headset 1 Microphone Rear: 4 USB 3.0 2 USB 2.0 1 Serial - PS/2 keyboard and mouse 2 RJ-45 to integrated Gigabit LAN 1 Audio Line-In (can be retasked as microphone) 1 Audio Line-Out

9	Warranty	3 Years
10	Graphic card	NVIDIA Quadro K620 2GB Graphic card or better
11	Form Factor	Rackable minitower
12	Operating System	Microsoft Windows 8.1 Professional Edition 64bit OS with Factory Image Recovery
13	Audio	Integrated Intel/Realtek HD ALC262 Audio; Creative Recon3D PCIe Audio Card or better
14	Network	Integrated Intel I218LM PCIe GbE Controller, Intel 7260 802.11 a/b/g/n PCIe WLAN NIC
15	Keyboard	2.4GHz Wireless Keyboard, same make as workstation
16	Mouse	2.4GHz Wireless Mouse, same make as workstation
17	Monitor	24" LED IPS Monitor. Monitor should be of the same make of the workstation
18	Security	Chassis Intrusion Sensor; Security Cable with Kensington Lock
19	Integration & testing	Full configuration as listed above should be tested and integrated at OEM manufacturing plant which includes all major components, power supply, cooling fan, cabinet etc. A certificate from the manufacturer should be enclosed with this effect.
20	Manuals/ Driver CDs	1. All documents manuals/driver CDs should be provided by the OEM. 2. Product brochure, clearly indicating make and model no. etc, should be provided with the offer. 3. Fan and Front card guide kit

This terminal device will not be tested for ESS/EMI-EMC. This will have three year warranty against any malfunctioning. Vendor will have to replace the unit if any problem is observed within three years of supply without any travelling/packaging or any other type of charges.

8. Scope of Work

- Design, Development, fabrication, populating with components, software and hardware integration and testing of following electronics cards
    - i.   Section-1A Motherboard card
    - ii.   Power Supply Card
    - iii.   Automatic Video Tracker Card
    - iv.   Servo Control and Interface (SCI) card
    - v.   Power Generation and Servo Amplification (PGA) card
    - vi.   Mission Computer & Guidance Card (MCG)
    - vii.   Section-1B motherboard card
- Drivers & test routines for all Processing units of above mentioned cards to enable testing of all the resources on the cards
- Integration of complete electronic hardware (including the electronics hardware provided by IRDE) and interfacing of integrated electronics with external modules (or their simulators)
- ATP of all cards as per a mutually agreed procedure.
- Environmental Stress Screening of all cards.
- EMI/EMC testing
- Four sets of spare connectors with their mating part.
- Four sets of spare MSK4206H chips.

9. Electronics Hardware to be provided by IRDE for testing

Following components/modules will also be provided for the interfacing & testing of the integrated electronics at the IRDE premises;

- Interfacing with Image Processing Card
- Servo Sensors (Gyro, Encoders)
- Servo actuators (Torquers)
- All interfaces with simulators (if external hardware is not available)

10.   Deliverables

Vendor will supply two sets of following cards. One set of card will include:

1. Automatic Video Tracker Card
2. Power Supply Card
3. Motherboard for section-1A
4. Power Generation and Amplification Card
5. Section-1B Mother Board card
6. Servo Control and Interface (SCI) Card
7. Mission Computer & Guidance Card

- Vendor will supply all connectors with their mating parts.

- Four spare set of connectors with mating parts will also be provided.
- Four MSK4206H Chips will be provided as a spare.
- Documentation (as per applicable MIL Std) as per the following list:
  - Design documents including the following
    - Hardware design document
    - Software Design Document (for all test routines)
    - Interface Control Document
    - Device Driver Document
    - Circuit Diagrams, PCB layouts, connector details
    - Data sheets of all components
    - Test modules along with the source code for demonstrating all functions simultaneously along with hardware drivers
    - Device driver software codes
  - BOM
  - Functional , EMI/EMC ,ESS and all other test report etc.

11.   Grading of Components

All components must be MIL grade or Industrial grade.

12.   Design Change Factor

Vendor must ready to incorporate 10% changes in the design and form factor during the design, manufacturing or delivery state.

13.   Warranty

Vendor will provide one year full warranty for any replacement and rectification of electronics and three years for high end video processing terminal without any extra charges. Vendor will collect the electronics and will send to IRDE without any charges.

14.   Compliance Matrix for Vendor

Vendor must fill this compliance matrix in their quotation, otherwise their technical bids will deemed cancelled without any communication.

Sr. No.	Item	total sets/ total number	Compliance /Non-Compliance
1.	Design, Development, fabrication, populating with components, software and hardware integration and testing of IRGTS electronics as per the specification document and qualify ESS (including EMI/EMC) tests.	02 sets	
2.	Design , development, ESS testing of Automatic Video Tracker (AVT) card	02 no.	
3.	Design , development, ESS testing of Power Supply card	02 no.	
4.	Design , development, ESS testing of Section-1A Motherboard card	02 no.	
5.	Design , development, ESS testing of Servo Control and Interface (SCI) card	02 no.	
6.	Design , development, ESS testing of Power Generation and Servo Amplification (PGA) card	02 no.	
7.	Design , development, ESS testing of Mission Computer & Guidance Card (MCG)	02 no.	
8.	Design , development, ESS testing of Section-1B motherboard card	02 no.	
9.	Vendor will supply all the mating parts of connectors used	02 sets	
10.	Vendor will supply four sets of Spare connectors with their mating parts	04 sets	
11.	Vendor must ready to incorporate 10% changes in the design and form factor during the design, manufacturing or delivery state without any extra cost.	--	
12.	ATP of all cards as per a mutually agreed procedure.		
13.	Vendor will provide all the source code, device drivers, test routines , simulation software and GUI etc.	02 sets	
14.	Design of all electronics will be approved by IRDE before fabrication. Vendor representatives will come to IRDE for all the approvals.	--	
15.	AVT card will be tested in actual field conditions for all the target types in all conditions especially in zoom-in and zoom-out condition.	02 sets	
16.	Integration of complete electronic hardware (including the electronics hardware provided by IRDE) and interfacing of integrated electronics with external modules (or their simulators)	02 sets	
17.	Four sets of spare MSK4206H chips will be provided by vendor	04 sets	
18.	High end video processing terminal with three year warranty	02 sets	
19.	Documentation (as per applicable MIL Std) as per the following list:	02 sets	

	• Design documents including the following • Hardware design document • Software Design Document (for all test routines) • Interface Control Document • Device Driver Document • Circuit Diagrams, PCB layouts, connector details • Data sheets of all components • Test modules along with the source code for demonstrating all functions simultaneously along with hardware drivers • Device driver software codes • BOM • Functional , EMI/EMC ,ESS and all other test report etc.		
20.	All mechanical fixtures used for testing will be provided by vendor	02 sets	
21.	All components must be MIL grade or Industrial grade	--	
22.	Vendor will visit IRDE for any integration & testing etc. IRDE will not give any payment for this. Vendor will be given onetime payment, based upon the quoted tender price bid.	--	