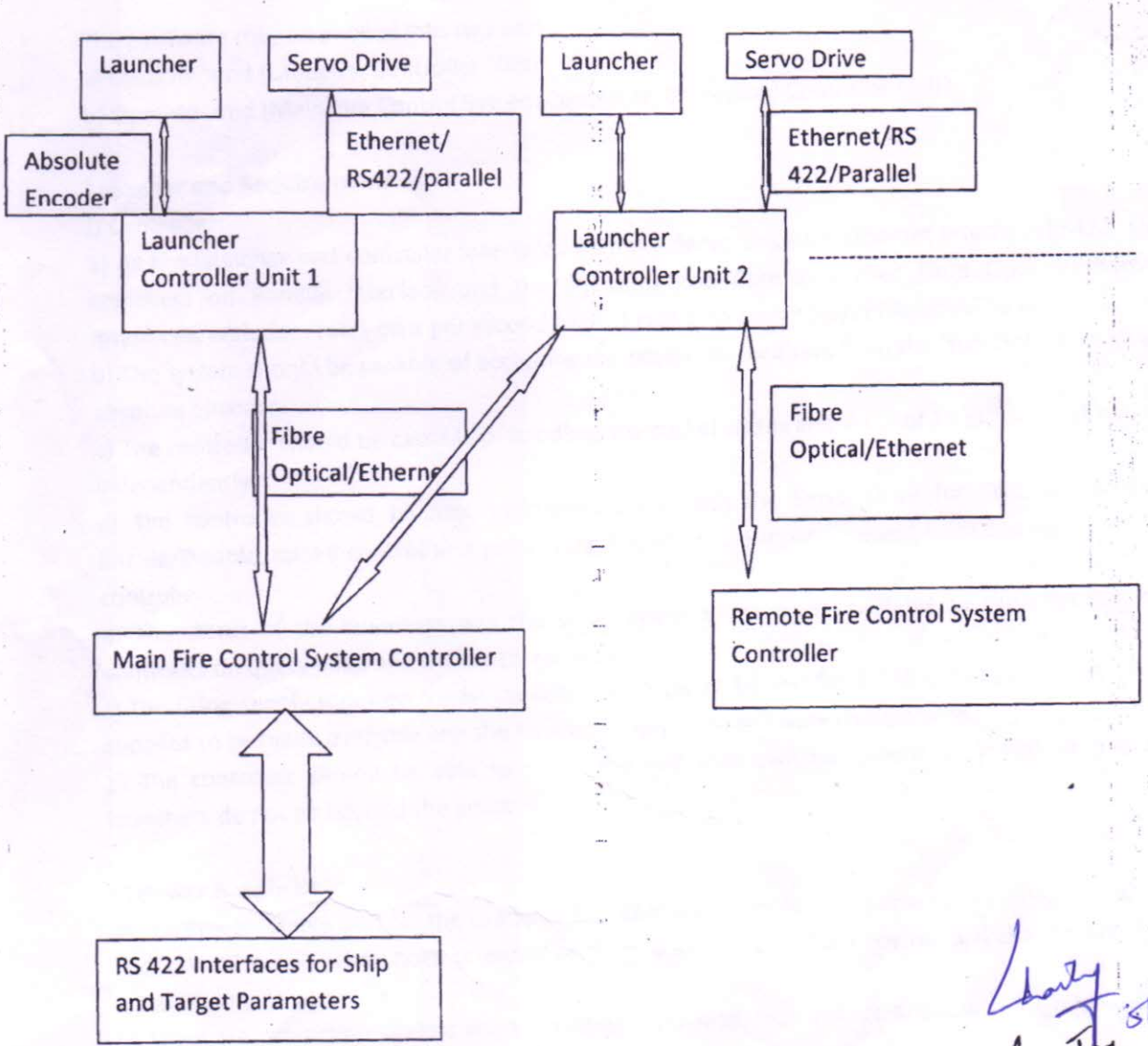
SPECIFICATIONS OF FIRE CONTROL SYSTEM

The Fire Control System of Kavach Mod II plays a pivotal role in controlling the rotation of the launchers and firing of selected chaff rockets from the launcher tubes. It is required to interface with other systems onboard the ship to collect various ship and target data on a continuous basis. The RPY effects of the ship have to be neutralized so that the chaff can be deployed at the desired location without any positioning errors.

The following is the block diagram of Fire Control System:



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Interface Requirements:

The interface requirements for the FCS are as under

a) Ship Data, Target data: RS 422

b) Servo Drive: Ethernet/RS422/Parallel

c) Main Fire Control System Controller to Launcher Controller Unit: Fibre Optical/Ethernet

d) Launcher Controller Unit to Launcher: Parallel

The part numbers for the panel end connectors to be selected based on the cable end connectors the details of which are attached as annexure-'A'.

HARDWARE REQUIREMENTS:

The hardware may be divided into two parts:

a) Launcher end (Launcher Controller Unit)

b) Operator end (Main Fire Control System Controller, Embedded Controller Unit).

Launcher end Requirements:

i) Controller:

a) As the launcher end controller interfaces with the Servo Drive on Ethernet interface/RS422, the launchers on Parallel Interface and the Operator end Controller over Fibre Optical/Ethernet interfaces, with data rates on a per second basis, a real time controller/FPGA would be required.

b) The system should be capable of accepting the positional feedback from the launchers through an absolute encoder.

c) The controller should be capable of handling the rocket status and firing of 16 numbers of barrels independently.

d) The controller should be able to communicate with the Servo Drive for BITE, Diagnostics, Enable/Disable, speed control and positioning based on the input received from the operator end controller.

e) The status of the launchers and the servo drives to be made available to the operator end controller on query basis and fixed interval basis.

f) The firing supply required for SR rockets is 12V±1% @ 1A and for LRMR is 24V±1% @ 1A. Both supplies to be made available and the desired supply to be software configurable.

g) The controller should be able to sense the end limit switches (electrical limits) so that the launchers do not go beyond the limits.

ii) Power Supply Unit:

a) The Power Supply Unit for the Launcher End Controller should be capable of operating @ 230V AC and 24V DC supply when both or either of them is available without any manual change over from AC to DC or vise versa

b) Adequate protection against short circuiting, over load, high voltage and low voltage have to be provided.

c) Standard power supply units which are readily available in the market off the shelf to be used instead of custom built power supplies.

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Operator end (Main Fire Control System Controller, Embedded Controller Unit).

i) Controller:

a) Embedded Controller with high clock speeds upto 2 GHz for real time applications

b) Memory storage not less than 8 GB

c) Should be capable of interfacing other ship systems for data on RS 422 and the launcher end controller on Fibre optical/Ethernet Interface.

d) Standard Embedded Controller cards to be used instead of custom designed cards for easy availability of spares.

e) The Embedded Controller Card may have a plug-in for additional hardware i.e RS422 to RS232 and Fibre Optical to RS 232 or Ethernet extension

f) Should be capable of handling data from the ship systems and the launcher end controllers simultaneously.

ii) Power Supply Unit:

a) The Power Supply Unit for the Operator end Controller should be capable of operating @ 230V AC and 24V DC supply when both or either of them is available without any manual change over from AC to DC or vice versa

b) Adequate protection against short circuiting, over load, high voltage and low voltage have to be provided.

c) Standard power supply units which are readily available in the market off the shelf to be used instead of custom built power supplies.

Operator Console and Display

a) 20 inch LCD Display (min)

b) Backlit key board

c) Operator Panel to be similar to DMFC, with a small touch screen, night light, illuminated push button switches, flap based firing switch etc.

Software Requirements

a) RTOS based operating system preferably Linux

b) The User Interface GUI should be User Friendly, Modular, Menu based spread across multiple windows.

c) Logs of firing to be made available.

d) Configuration based software to be developed instead of hard coding.

e) Multi threading, Event based and interrupt driven approaches to be followed.

f) All the diagnostics of the Servo Drive and the launchers to be made available in different screens during BITE as well as on query

g) Should be capable of loading the bit file into the respective launcher end controllers from the operator end console.

h) All Warnings regarding MOL, Blind Sectors should be indicated by software as well as a LED on the operator hardware console

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Functional and Operational Requirements of the Fire Control System:

a) The launcher positioning error should be less than 1 degree

b) Should be capable of firing the rockets in 3 modes

i) Centroid-SR

ii) Distraction-MR

iii) Confusion-LR

c) Update rate is 1 second or less.

Qualification requirements:

a) EMI/EMC as per MIL 461C/D or higher

b) ESS as per DQAN guidelines issued in 2013 (enclosed)

List of Deliverables.

a) Fire Control System

b) Simulators for various ship inputs

c) Firing test jig

d) Manuals

List of Spares:

a) Embedded Controller Unit-1 no

b) Power supply unit-CU-1no

c) Data Aquisition and Interface Unit-1no

d) Launcher Controller unit-2 nos

e) Power supply unit-LCU-2nos

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SCOPE OF WORK FOR MANUFACTURE AND SUPPLY OF FIRE CONTROL SYSTEM OF KAVACH MOD II

1. Firm should submit the ATP, BOM and Drawings to MPF/Navy for approval of the same. The additional compliances mentioned by Navy will have to be addressed by the firm in total.

2. Wastages (like prototype, models, test jigs, tools and equipment's and other intellectual property documents including test reports) generated will be proprietary property of MPF and the firm will have to supply the same to MPF free of cost without any financial liability. The list of wastages after compliance of point no 1, to be submitted to MPF and to be included in the list of deliverables.

3. Inspection of the system is to be carried by Naval Inspectors.

4. Firm to support in the commissioning of the system during FATs, HATs and SATs.

5. Firm to send Qualified Manpower to MPF/Ship for commissioning manpower as per availability of ship and on short notice i.e 24 hours.

6. Any repair during Guarantee/Warranty period should be carried out by the firm with qualified manpower free of cost and on short notice as per availability of ship.

7. Non-Disclosure Agreement and Non Competitive agreement in Kavach or equivalent is to be signed by the firm with MPF, as the item would be Proprietary of MPF.

8. For the entire Kavach Project MPF is the OEM and the full or part is Proprietary of MPF.

9. Firm should confirm availability of spares of their designed system during operational life of Kavach as approved by Navy Point 1 and if required must have capacity for Obsolescence Management.

10. Delivery Period: 4 months from the date of placement of supply order

11. Guarantee/Warranty: 48 months from the date of receipt of store at MPF or 24 months from the date of commissioning of the system onboard the ship whichever is earlier.

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VENDOR QUALIFICATION CRITERIA FOR MANUFACTURE AND SUPPLY OF FIRE CONTROL SYSTEM OF KAVACH MOD II

1. Firm should have supplied any Weapon Fire Control System to the Navy with an order valuing more than 1 Cr.

2. Firm should have expertise/relevant experience in undertaking quality verification for the desired system as prescribed for EMI/EMC and JSS 55555.

3. Firm should have expertise/experience in RTOS based Operating Systems

4. Firm should have expertise/experience in Front End Application Softwares like VB, C# etc

5. Firm should have expertise/experience in Microcontroller/FPGA/Embedded Controller Programming Softwares.

6. Firm's to submit documentary evidence for Compliance to the above points (1) to (5). Firms not complying with the above requirements will be disqualified.

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LIST OF PLANT AND MACHINERY FOR MANUFACTURE AND SUPPLY OF FIRE CONTROL SYSTEM OF KAVACH MOD II

1. DC-Regulated Power Supply
2. Laptop
3. Soldering Station
4. Multimeter
5. Oscilloscope
6. Various converters viz RS422-RS232, Optical-RS232
8. Flash Programmers.
9. Proficiency in Linux/RTOS based Operating Systems
10. Proficiency in Front End Application Softwares like VB, C# etc
11. Proficiency in Microcontroller/FPGA/Embedded Controller Programming softwares
12. Dedicated team for Software Testing.

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S.no	Test	Specification	Test condition	Remarks
a	High Temp	JSS 55555-Test 17	55±3 Degree C for 16 hours Procedure 5 Test condition G	
b	Damp Heat	JSS 55555-Test 10	40 ±2 Degree C at 95 RH for 16 hours	
c	Drip Proof	JSS 55555-Test 11	Vertical Water droplet 1 meter height for 15 minutes	
d	Mould growth	JSS 55555-Test 21	29 Degree C, 90% RH mould growth chamber for 28 days	On test coupons only
E	Bump	JSS 55555-Test 5	4000±10 bumps, 40g, 6msec, 1 to 3 bumps/sec	
F	Shock/Impact	JSS 55555-Test 24	As per laid down specifications	
G	Low Temp	JSS 55555-Test 20	0 Degree for 16 hours as per procedure 4	
H	Tropical Exposure	JSS 55555-Test 27	As per laid down specifications	
I	Vibration test	JSS 55555-Test 28 (Conducted for 5 to 33Hz)	As per laid down specifications	Equipments on shock mounts as in use

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S.no	Test		Authority
A	Thermal Shock	-40 Degree C/0 Degree C (For commercial Grade components)- 90 min 70 Degree C-90 Min Change over to take place within 5 min No of cycles-06	100% on all PCB
	Thermal Cycling	OR -30 to 55 Degree C Change at 1 Degree C/Min , 3 Cycle dwell Upto 20 Kg – 2 hrs 20 – 40 Kg – 3 hrs Above 40 Kg – 4 hrs	Sub unit / Equipment with power on
B	Vibration Test	Random Vibration freq 20-2000Hz power density 02g2 Hz 10 min Each in three axis OR i. Sinusoidal vibration 10-150 Hz sweep 2g/ 5 min in each of the three mutually perpendicular direction ii. 300 Bump 40g, 6 millisecond in one axis only	Fully wired card cages, Power amplifiers, power supplies, modules, subassemblies. -do-
C	Burn-in	168 Hrs at room temperature under maximum load OR 48 hrs at full load at 55 Degree C	Complete system set

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Appendix-C

S.no	Test	Specification
A	Conducted Emission	CE 01
B	Conducted Emission	CE 03
C	Conducted Susceptibility	CS 01
D	Conducted Susceptibility	CS 02
E	Conducted Susceptibility	CS 06
F	Radiated Emission	RE 01
G	Radiated Emission	RE 02
H	Radiated Susceptibility	RS 01
I	Radiated Susceptibility	RS 02
J	Radiated Susceptibility	RS 03

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