

PROCEEDINGS OF THE PRE-BID CONFERENCE HELD 27th Jan 2023 THROUGH WEBEX, TOWARDS "PROCUREMENT OF LITHIUM BATTERY SYSTEM".

The Pre-bid Conference was held and the following T&PC members attended the meeting: -


Sl. No.	Name & Designation		Role
1	Dr. M. Manjuprasad,	Chief Scientist, KTMD	Chairman
2	Mr. Dilip Kumar Sahu	Sr. Technical Officer-2, CAD	Member
3	Mr. Vineet Kumar	Chief Scientist, CAD	Member
4	Mr. R. Ravindiran	Sr. Principal Scientist/ELB	Specialist Member
5	Dr. Bandi Srinivas	COSP	Member - Convener (TPC)
6	Mr. Sai Kiran P. V. R	Pr. Scientist, ALD	Member - Convener (TSC)

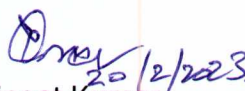
The list of Prospective bidders who attended the Pre-bid Conference is as per Annexure-I.

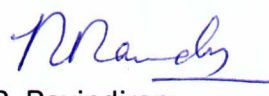
At the outset, the Chairman welcomed all the Members and the representatives of the Bidders and briefed in general the scope of the Project. The Indenting Officer to read out the clarification sought by the bidders and the replied there to as detailed in **Annexure-II (Part A: Technical Clarification and Part B: Commercial Clarification, if any).**

The representatives present were satisfied with the replies given and it was informed that the corrections / additions / clarifications given, as discussed during the Pre-Bid Conference would be hosted on the website of CSIR-NAL and all prospective bidders are required to take cognizance of the proceedings of the Pre-Bid Conference before formulating and submitting their bids as stipulated in bidding Documents.

The meeting ended with a vote of thanks to the Chair.



Dilip Kumar Sahu
Member


Vineet Kumar
Member


R. Ravindiran
Specialist Member


Sai Kiran P. V. R
Member- Convenor -TSC


Dr. Bandi Srinivas
Member- Convenor -TPC


Dr. M. Manjuprasad
Chairman-T&PC

CSIR-NATIONAL AEROSPACE LABORATORIES
BENGALURU - 560 017

TENDER NO.: NAL/PUR/STTD/368/20-Z
DATE & TIME : 27-Jan-2023 @ 11.00 AM
VENUE: THROUGH WEBEX

ANNEXURE - I

Pre-Bid Conference for Procurement of Lithium Battery System.

ATTENDANCE SHEET - T&PC MEMBERS

Sr. No.	Name		Signature
1	Dr. M. Manjuprasad, Chief Scientist, STTD <i>KTMD</i>	Chairman	<i>[Signature]</i>
2	Mr. J. Ramaswamy Setty, Sr. Principal Scientist, ACD	Member	
3	Mr. Dilip Kumar Sahu, Sr. Technical Officer-2, CAD <i>/RNCAC</i>	Member	<i>[Signature]</i>
4	Mr. Vineet Kumar, Chief Scientist, CAD	Member	<i>[Signature]</i> 27/1/2023
5	Mr. R. Ravindiran, Sr. Principal Scientist/ELB	Specialist Member	<i>[Signature]</i>
6	Mr. Kamalakannan G. M, Sr. Principal Scientist, CSMST	Specialist Member	
7	Mr. Sai Kiran P. V. R, Pr. Scientist, ALD	Member- Convenor -TSC	<i>[Signature]</i> P.V.R. Sai Kiran

**NATIONAL AEROSPACE LABORATORIES
BENGALURU - 560 017**

TENDER NO.: NAL/PUR/STTD/368/20-Z

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VENUE: THROUGH WEBEX, CSIR-NAL, HAL Airport Road, Kodihalli, Bengaluru-560017

ANNEXURE - I

Pre-Bid Conference for Procurement of Lithium Battery System.

Sr. No.	Name of the Firm	Name & Designation of Representative	E-tender Registration (Yes/No)	Email ID
1	ENERTECT BATTERIES	Mr. Parasiya Jay, Mr. DIPAK GANDHI, Marketing Executives	YES	Dipak.Gandhi@rocketbatteries.net , marketing@enertectbatteries.com
2	Apex Comnet Pvt Ltd	Mr. Ashish Agarwal, Managing Director	YES	ashish@apexcomnet.com
3	MICRONEL GLOBAL ENGINEERS	Ms. V Geetha – Senior Manager (Sales), Ms. Priya Ashok – Manager Sales	YES	mp@micronel.net , sco@micronel.net , p30@micronel.net , p1@micronel.net
4				
5				

TECHNICAL QUERIES & CLARIFICATION

Sr. No.	Query / Clarification Sought	Clarification/Amendment
1.	<p>Queries from Apex comnet pvt ltd</p> <p>1. We are a supplier of MIL grade lithium batteries and have supplied to NAL in the past. Against your above mentioned TE please see attached MIL grade batteries we can offer. The same has been recently supplied to ADE Bangalore for a drone project. Kindly advise whether the same is suitable for your requirement. The user department can also see this battery in ADE.</p> <p>2. We have checked with our principals and they are supplying the batteries to the US military for some airborne applications. However they are not TSO approved. It seems that due to your insistence on using only TSO approved batteries and that too only Lithium Ion battery has resulted in a single vendor situation viz. True Blue Power USA. As per our understanding of the rules and regulations of the Govt of India, a single vendor situation should be avoided. At present since you are only developing the aircraft, hence spending a lot of money can be avoided by going to older battery technologies which have a long heritage with Boeing, Airbus, etc. Once your product goes into production then by that time there might be more companies who get TSO approval for lithium ion and you may get substantially more choices at a lesser cost. This opinion is strictly our own based on our more than 15 years of experience in supplying military grade and space grade batteries to DRDO, ISRO, TATA, etc. Your purchase committee can either accept or reject our opinion. (APEX comnet PVT ltd)</p>	<p>1. The suitability of the bid proposed to be supplied will be strictly compiled with chapter 4 of NAL tender document. If all the specification parameters are in the compliance with the Chapter 4 specifications than your bid will be considered for commercial bid opening.</p> <p>2. The SARAS MKII aircraft proposed to be certified by civil certification agency (DGCA) along with Military certification agency (Cemilac). As per NAL TE document requirement, TSO'd/ITSO'd lithium battery system is the mandatory compliance and hence, NON - TSO'd lithium battery cannot be accepted.</p>

P. P. Sai Kumar

Martin Naud
17/2/23



2.	<p>Queries from Enertect batteries</p> <p>1. Battery System 1- The rated capacity given is 60AH at 1c rating and Continuous Current 425 A and 1500A as power peak current.</p> <p>Here 60AH 1C cell cannot provide 425A and 1500A power peak current. We propose you 4C cell 100AH which fits for continuous current 425A and 1500A of Power peak current</p> <p>2. Battery System 2- The rated capacity given is 40AH at 1c rating and Continuous Current 525A and 1500A as power peak current.</p> <p>Here 40AH 1C cell cannot provide 525A and 1500A power peak current. We propose you 5C cell 100AH which fits for continuous current 525A and 1500A of Power peak current.</p> <p>3. Sorry for the miss understanding as per our company safety policy we cannot provide battery system inside the aircraft. But if you permit us for on ground level starting engine of the aircraft we can provide as per specification with the trolley it can connect through cable and after starting the aircraft you can remove it as shown in attachment. If you permit us we can provide you data sheet for it and ready to supply.</p>	<p>1 & 2. NAL TENDER document requirement is to be compiled with battery system level. Battery level configurations and cells have to be derived by the vendor. Note that, NAL tender document mandates the battery system specifications.</p> <p>3. The Bidder may assess the suitability of equipment for submitting its bid including the relevant data to fulfil the Tender requirements. CSIR-NAL will evaluate formally submitted bid.</p>
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P. R. Sai Kumar

M. N. N. 17/12/25

3.	<p>Queries from Nash Industries (I) Pvt. Ltd.</p> <p>This with reference to subject tender, we need a clarification on the Battery System specification which are listed below.</p> <ul style="list-style-type: none"> The capacity of cell specification is 60 Ah, but the mentioned power output 425A continuous current is required, request your suggest/input required with 60Ah cell. Need clarity on how the 425A continuous discharge with 60Ah battery system? The continuous charging requested at 400A which is required 7C charging rate, request your suggest/input required with 60Ah- Battery System. Charger current (amp) output specification and battery Current (amp) specification is not matching, 	<ol style="list-style-type: none"> The specification given is for the battery system and for an individual cell. Specification parameter of Power output 425 Amp continuous current is more technically explained in the below point. The mentioned current output of 425 A continuous is not for any specific time duration. If a battery system can supply current of 60Amp for 1 hour that implies of giving 480 (8c) for 7 min and 30 seconds. That is one of reason why the specification is insisting of LIFEPO4 chemistry, which is capable of providing high discharge rate of more than (25 C). kindly note it is clearly given as a maximum of 400 Amp charging current that the battery system can withstand and consume during the charging phase. The battery system will be in float charge when it is connected to the aircraft. During the float charge, the battery system will take a high current to reach 100% SOC in less time. However, the battery charger need not provide that much high current during the charging phase on the ground for safe operation to the operating technicians. Due to above reason, Charger current (amp) output specification and battery charging Current (amp) specification is not the same.
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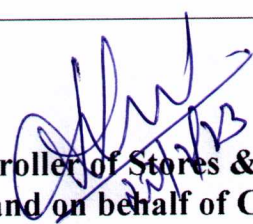


**CSIR-NATIONAL AEROSPACE LABORATORIES
BENGALURU**

COMMERCIAL QUERIES & CLARIFICATION

Tender No. : NAL/PUR/STTD/368/22-Z
Item Description : Procurement of Lithium Battery System.

Sr. No.	Query / Clarification Sought	Clarification/Amendment
1.	The Delivery FOB/FCA – Goods manufactured abroad will have FOB delivery and FOB mode which means including Packing and exclusive of Freight, Forwarding, Insurance, Custom Duty & Custom clearance charges and necessary license.	Delivery Term FOB/FCA: As per INCOTERM - FOB/FCA should be Gateway Airport at the Destination (County of Export). Where, FOB/FCA includes Packing, handling, Inland charges [from works to Gateway Airport] and Export license excluding Freight charges, Insurance and Custom Duty and Clearance.
2	Please refer NAL BOQ (Excel file) quantity mentioned for Battery System 2 is only 1 No whereas the RFQ list of deliverables mentioned as 2 Nos. kindly confirm.	Change in quantity in BoQ (Excel File) for Battery System 2: In the BoQ (Excel File) quantity mentioned is One and it is typographical error. The quantity to be considered as Two Nos. as per List of Deliverables. As, BoQ (Excel File) cannot be edited in the Portal, it is requested to attach a pdf document as per the quantity in the List of Deliverables for our evaluation/comparison.


Controller of Stores & Purchase
For and on behalf of CSIR-NAL

CHAPTER 4

SPECIFICATIONS AND ALLIED TECHNICAL DETAILS FOR LITHIUM BATTERY SYSTEM

4.1 End Use:

SARAS MK II AIRCRAFT is designed for a commuter role with a seating capacity of up to 19 excluding two crew members. The aircraft will be propelled by twin turboprop engines and certified under FAR 23 certification rules by Indian certification authority. The aircraft will be capable of operating from high elevations airfields, Approx. 3000 m AMSL. Ambient conditions to be met are as per ISA+20 °C and service ceiling will be 30000 ft. The aircraft is expected to have a normal rate of climb up to 2000 fpm and maximum speed 250 KTAS.

4.2 Detailed Specifications

CSIR-NAL Bangalore now intends to design and develop CSIR-NAL SARAS-MK2 aircraft for commercial operation. This aircraft is required to be fitted with Lithium Iron phosphate (LiFePO_4) battery for engine starting and backup emergency electrical supply duly certified by CEMILAC/FAA/EASA/DGCA.

Moreover, Civil aviation market in India is witnessing an unprecedented growth. CSIR-NAL SARAS-MK2 aircraft finds a great potential in getting utilized in regional connectivity. Therefore, the likely requirement of Lithium Iron phosphate (LiFePO_4) for 100 aircraft may exist in near future.

Table 1. Technical Specifications for Battery system 1

Lithium Iron Phosphate (LiFePO_4) Battery system 1		
SL. NO	Description	Specifications
1	Voltage	26.4 Vdc nominal (Max)
2	Capacity	60Ah @ 1C rate battery nominal at 23°C/73.4°F
3	Power Output	26.4 volts DC Nominal, Continuous Current 425 A; Power Peak Current (IPP) 1500A (at 18.5V CV discharge);
4	Charge Voltage And Charging Current	28.0 to 30.0 VDC nominal , 400A Max,

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5	Environment Rating (Resistance To Water Intrusion)	IP 66 (wash down with a high-pressure washer)
6	Operating Temperature	-40°C to +70°C (-40°F to 158°F)
7	FAA Standard Order	TSO-C179b
8	Design Assurance Level (Dal)	C (major)
9	Flammability Rating (Case And Vent Tube)	14CFR 25.853 (a)
10	Performance	<ul style="list-style-type: none"> ➤ To support three engine consecutive starts ➤ 15 minutes for complete recharge when the battery is fully discharged on a typical aircraft. ➤ Performance at extremely high temperature (up to 70°C/158°F) should not affect its output current giving capability or State of charge (SOC)
11	Internal Heater	Automatic internal heater
12	Protection	Overcharge, Over-discharge, Over current, Short circuit, Over-temperature and under-temperature
13	Communication	ARINC 429 data to the cockpit
14	Weight	Less than 25 kg
15	Dimensions(In Inch)	Less than 13" L x 12" W x 10" H
16	Mounting	with hold-down tie rods
17	Certification	FAA TSO certified to C179b ETSO certified to C179b RTCA DO-160G qualified (As per Appendix A) RTCA DO-311A qualified UNDOT/IATA qualified
18	Maintenance	2-year maintenance interval minimum
19	Service Life	8 Year
Vent Kit		
20	Vent Tube	Less than 1.60 in. diameter vent tube along with vent tube clamps
Connector Kit		
21	Comm/Service Connector	Suitable circular pin MIL connector for Arinc 429 protocol
	RTD Temperature	Suitable Circular pin MIL connector for RTD sensor

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	Power Connector Quick Disconnect Receptacle	2-pin per MIL-PRF-18148/3 form factor
FAA Form 8130		
22	Airworthy Certificate	FAA approved form 8130 for aircraft installation ref: Note 3

Table 2. Technical Specifications for Battery system 2

Lithium Iron Phosphate (Lifepo4)Battery system 2		
SL.NO	Description	Specifications
1	Voltage	26.4 Vdc nominal (Max)
2	Capacity	40Ah @ 1C rate battery nominal at 23°C/73.4°F
3	Power Output	26.4 volts DC Nominal, Continuous Current 525 A; Power Peak Current (IPP) 1500A (at 18.5V CV discharge);
4	Charge Voltage And Charging Current	28.0 – 30.0 VDC nominal , 400A Max,
5	Environment Rating (Resistance To Water Intrusion)	IP 66 (wash down with a high-pressure washer)
6	Operating Temperature	-40°C to +70°C (-40°F to 158°F)
7	FAA Standard Order	TSO-C179b
8	Design Assurance Level (Dal)	C (major)
9	Flammability Rating (Case And Vent Tube)	14CFR 25.853 (a)
10	Performance	<ul style="list-style-type: none"> ➤ To support three engine consecutive starts ➤ 15 minutes for complete recharge when the battery is fully discharged on a typical aircraft. ➤ Performance at extremely high temperature (up to 70°C/158°F) should not affect its output current giving capability or State of charge (SOC)
11	Internal Heater	Automatic internal heater

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12	Protection	Overcharge, Over-discharge, Over current, Short circuit, Over-temperature and under-temperature
13	Communication	ARINC 429 data to the cockpit
14	Weight	Less than 16.7 kg
15	Dimensions(In Inch)	Less than 9.2" L x 14.8" W x 8.9 " H
16	Mounting	with hold-down tie rods
17	Certification	FAA TSO certified to C179b ETSO certified to C179b RTCA DO-160G qualified (As per Appendix A) RTCA DO-311A qualified UNDOT/IATA qualified
18	Maintenance	2-year maintenance interval minimum
19	Service Life	8 Year
Vent Kit		
20	Vent Tube	Less than 1.60 in. diameter vent tube along with vent tube clamps
Connector Kit		
21	Comm/Service Connector	Suitable circular pin MIL connector for Arinc 429 protocol
	RTD Temperature	Suitable Circular pin MIL connector for RTD sensor
	Power Connector	2-pin per MIL-PRF-18148/3 form factor
	Quick Disconnect Receptacle	
FAA Form 8130		
22	Airworthy Certificate	FAA approved form 8130 for aircraft installation ref: Note 3

Table 3. Technical Specifications for Battery charger cum tester

Battery charger cum tester		
SL.NO	Description	Specifications
1	Input Voltage	180 – 264 VAC (switch selected) 47 – 63 Hz
2	Input Power	Less than 2 KW

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3	Output current	Less than 12.6 amps charge (nominal)
4	Battery Charge Voltage	Lithium-ion; 28.8V (maximum) with ripple voltage of 1.5 V (maximum)
5	Operating Temperature	0°C to +55°C (32°F to 131°F)
6	Storage Temperature	-40°C to +80°C (-40°F to +176°F)
7	Measurement accuracy	To 0.1 volts, 0.1 amps
8	Display Accuracy	±0.2 volts, ±0.2 amps
9	Weight	Less than 20 Kg
10	Dimensions	Less than 7" W x 15" H x 16" D
11	Battery Connectors	Should be Compatible with ring terminals, alligator clamps and temperature cables
12	Protection and Monitoring	Overcharge, over-temperature and time out for failed batteries, auto shut off after top charge is complete and audible alerts for low voltage and reverse polarity
13	Discharge	60 amps discharge (maximum)

4.2.1 Functional requirements and operation of lithium battery in the aircraft

The Lithium Battery system should be designed to deliver high current capability to start piston and light turbine aircraft engines and subsequently, provide power to the aircraft 28 V DC generation electrical bus in the event of generator function loss.

Engine Start

The lithium battery should be able to provide upto a peak current of 1500A for the purpose of aircraft engine starting.

Providing Aircraft Power

When the aircraft's power generation systems are offline or fail, the lithium battery should provide immediate power to the equipment/loads on the associated power bus. As the battery system capacity is used, the voltage will begin to drop until the unit is fully depleted. Depending on the load, the battery will provide an average of approximately 25.5 volts for the duration of discharge.

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Heating

The battery should be designed to support an engine start from as low as -5°C (23°F), depending upon the engine start profile without pre-heat requirement. Below this temperature, the performance of the any lithium battery begins to decrease in current, energy delivery as the electrolyte in the cells begins to thicken, and the internal impedance increases to retard ion flow. In order to address this, each battery module should contain an individual heater, which is powered by the cells themselves, even at very low temperatures. The battery should have the ability to pre-heat itself at temperatures up to - 40°C (-40°F) utilizing the internal, self-powered heaters, bringing the battery up to full operational capability. Pre-heat time may vary depending on temperature but shall be fully warmed in 15 minutes or less after turning the heaters on. The heaters should only provide heat when active and when the battery temperature is sensed below 15°C. The heaters should stop heating when the internal battery temperature is above 20°C.


4.2.2 Functional requirements and operation of lithium Battery charger cum tester

The lithium battery charger cum tester has functionality for ground operation of aircraft lithium battery. The charger cum tester should charge a battery to 100% state of charge. It should also perform a capacity check, discharge the battery at 1C rate.

4.2.3 General requirements:

General requirements of the System as follows:

- a) System shall be designed with electronics as per standards mention in DO311A.
- b) System shall have adequate filtering scheme to meet the EMI/EMC requirements mentioned in Environmental requirements of DO160G.
- c) The cable link shall ensure the signal integrity as well as take care of shielding requirements where necessary.
- d) All wiring precautions shall be taken to avoid coupling between power signals, measurements.
- e) The gauge of the wires shall be selected to carry the maximum load current.
- f) For each ground wire, gauge shall be identical to the gauge of the wire of the supply.



4.2.4 Packaging

The unit shall be provided with a suitable packing container for protection during transportation & storage.

4.2.5 PROJECT DELIVERABLES

List of Deliverables (BOQ):

S. No.	Item Description	Quantity (Nos)
Battery type: LiFEPO₄ Battery System		
1	Battery system 1(refer table 1)	
	a) LifePo ₄ battery system 1	3
	b) vent kit	3
	c) Connector kit	3
	d) FAA form 8130	3
2	Battery system 2 (refer table 2)	
	a) LifePo ₄ battery system 2	2
	b) vent kit	2
	c) Connector kit	2
	d) FAA form 8130	2
3	Battery charger cum tester (refer table 3)	2

4.2.6 Vendor/Bidder Scope of Work for Supply of Battery System

Vendor shall take full responsibility for Supply, Testing & Certification of system.

1. Vendor/bidder shall understand the system requirements.
2. Vendor/bidder shall deliver all supporting hardware and software reports to CSIR-NAL for software development activities.
3. Vendor/bidder shall provide the technical support for Aircraft integration & flight testing of system to CSIR-NAL as and when required.
4. Vendor/bidder shall provide Test certificate confirming to specifications before dispatch of items.

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5. Vendor/bidder shall bid for whole system
6. Bid for **partial** technical specification shall be rejected without any explanation.
7. Vendor/bidder are advised to provide compliance statement with proper justification against each technical specification.

4.3 SCOPE OF SUPPLY

Scope of Supply includes the following:

- (i) Supply of the items as specified in Section 4.2.5
- (ii) Training as specified as in section 4.6
- (iii) Acceptance criteria as per section 4.4.2
- (iv) Incidental and warranty related as per section 4.5
- (v) Delivery schedule as per section 4.7

4.4 INSPECTION

General

- (i) The Vendor on their own expense and at no cost to the Purchaser shall carry out all such tests and/or inspections of the Goods and Related Services that are specified in this tender document. The Vendor shall on their own expense and at no cost to CSIR-NAL shall carry out all such tests and/or inspections of the Goods and Related Services as are specified in the chapter 4 or as discussed and agreed to during the course of finalization of contract.
- (ii) The inspections and tests may be conducted on the premises of the Vendor or its subcontractor(s), at the point of delivery and/or at the Goods final destination at no charge to CSIR-NAL.
- (iii) Whenever the Vendor is ready to carry out any such test and inspection, they shall give a reasonable advance notice, including the place and time, to the Purchaser. The Vendor shall obtain from any relevant third party or manufacturer any necessary permission or consent to enable the Purchaser or its designated representative to attend the test and/or inspection.
- (iv) CSIR-NAL or its representative shall have the right to inspect and/or to test the Goods to confirm their conformity to the Contract specifications at no extra cost to CSIR-NAL and what inspections and tests CSIR-NAL requires and where they are to be conducted. CSIR-NAL shall notify the Vendor in writing in a timely manner of the identity of any representatives retained for these purposes.

- (v) Should any inspected or tested Goods fail to conform to the specifications, the purchaser may reject the goods and the Vendor shall either replace the rejected Goods or make alterations necessary to meet specification requirements free of cost to the Purchaser.
- (vi) The Purchaser's right to inspect, test and, where necessary, reject the Goods after the Goods' arrival at final destination shall in no way be limited or waived by reason of the Goods having previously been inspected, tested and passed by the Purchaser or its representative prior to the Goods shipment.
- (vii) With a view to ensure that claims on insurance companies, if any, are lodged in time, the bidders and /or the Indian agent, if any, shall be responsible for follow up with their Principals for ascertaining the dispatch details and informing the same to the Purchaser and he shall also liaise with the Purchaser to ascertain the arrival of the consignment after customs clearance so that immediately thereafter in his presence the consignment could be opened and the insurance claim be lodged, if required, without any loss of time. Any delay on the part of the bidder/ Indian Agent would be viewed seriously and he shall be directly responsible for any loss sustained by the purchaser on the event of the delay.
- (viii) Before the goods and equipment are taken over by the Purchaser, the Vendor shall supply operation and maintenance Manuals together with Drawings of the goods and equipment built. These shall be in such details as will enable the Purchase to operate, maintain, adjust and repair all parts of the works as stated in the specifications.
- (ix) The Manuals and Drawings shall be in the ruling language (English) and in such form and numbers as stated in the Contract.
- (x) Unless and otherwise agreed, the goods and equipment shall not be considered to be completed for the purposes of taking over until such Manuals and Drawing have been supplied to the Purchaser.
- (xi) On successful completion of acceptability test, receipt of deliverables, etc. and after the Purchaser is satisfied with the working of the equipment, the acceptance certificate signed by the Vendor and the representative of the Purchaser will be issued. The date on which such certificate is signed shall be deemed to be the date of successful commissioning of the equipment.
- (xii) Training to be arranged by the Vendor and the same is to be done within 15 days of the arrival of the equipment at site.

4.4.1 MANUFACTURER'S INSPECTION CERTIFICATE

After the goods are manufactured and assembled, inspection and testing of the goods shall be carried out at the Vendor's plant by the Vendor, prior to shipment to check whether the goods are in conformity with the technical specifications. Manufacturer's test certificate with data sheet shall be issued to this effect and submitted along with the delivery documents. The purchaser reserves the options to be present at the Vendor's premises during such Pre- dispatch inspection and testing. all the costs associated with the deputation of NAL staff will be borne by NAL.

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4.4.2 ACCEPTANCE PROCEDURE

✚ Battery system

- FAA Form 8130
- Physical inspection
- Battery voltage level checks

✚ For charger cum tester, NAL will accept it through


- Manufacturer Certificate of Conformance
- Check the capability of charging the battery with charger.

4.5 INCIDENTAL AND WARRANTY RELATED TERMS AND CONDITIONS

- **2 Year** from date of successful Installation & Commissioning and date of acceptance.
- In case the Equipment / System remains non-operational for more than 15 days then warranty period will be extended for the equivalent period for which Equipment / System remained non-operational. Warranty extension in such case shall be done without prejudice to any other Term & condition of the contract.
- Comprehensive Warranty of **2 years** shall be provided by Vendors for complete system developed as part of this project.
- Warranty shall start after successful inspection by CSIR-NAL and from the date of acceptance.
- Logistic and replacement of non-working System shall be borne by the Vendor only.
- Technical support shall be provided by vendor till the service life of the battery system.

4.6 TRAINING

1)	Location	CSIR-NAL, Bangalore
2)	Number of persons	05
3)	Period of Training	2 weeks
4)	Nature of Training	Integration/ Installation for functional test .



4.7 DELIVERY SCHEDULE

Delivery of the item		Installation & Commissioning		Training , If any	Acceptance of the item
Days/weeks/ months	Location	Days/weeks/months from the date of delivery of equipment	Location	Days/weeks/months from the date of delivery of equipment	Days/weeks/months from the date of delivery of equipment and training
Within 45 days from the date of purchase order	CSIR-NAL	Not applicable	Not applicable	Should start the training within 15 days from the date of delivery of equipment	Within 5 days from the completion date of training.

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Appendix A

DO-160 ENVIRONMENTAL QUALIFICATION FORM REQUIREMENT

DESCRIPTION	SECTION	Category Requirement
Temperature and Altitude	4.0	Category C4
Temperature Variation	5	Category B
Humidity	6	Category C
Operational Shock and Crash Safety	7	Category B
Vibration	8	Fixed wing: Category S:curves M
Explosive Atmosphere	9	Category H
Waterproofness	10	Category Y
Fluid Susceptibility	11	Category X
Sand and Dust	12	Category X
Fungus	13	Category F
Salt Fog	14	Category X
Magnetic Effect		Category A
Power Input	16	Category B(RX)
Voltage Spike	17	Category A
Audio Frequency Conducted Susceptibility	18	Category B
Induced Signal Susceptibility	19	Category ZCE (E is not required for metallic case)
Radio Frequency Susceptibility	20	Category R(conducted) (0.6 to 30mA) Category R(Radiated) (100v/m)
Radio Frequency Emission	21	Category L
Lightning Induced Transient Susceptibility	22	Category A3(pin injection) Category E3L3(Cable bundle) or A3E3L3 or A3XXXX as per DO-160G
Lightning Direct Effects	23	Category X
Icing	24	Category X
Electrostatic Discharge	25	Category A
Fire Flammability	26	Category X

Note 1: Category requirement should be same or better than the mentioned category for each section of environmental condition.

Note 2: Category C4 : (Operating Low temperature : - 40 deg C , Ground Survival Low temperature : -40 deg C, Operating High Temperature : +55 deg C , Ground Survival High Temperature : + 71 deg C ,Short Time Operating High Temperature: +55 deg C, Altitude :30,000 feet)

Note 3: FAA approved form 8130 / EASA form 1 /certificate from Indian certificating authority for aircraft installation is acceptable.

K. S. Srinivasan

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P. R. Srinivasan