AERONAUTICAL DEVELOPMENT AGENCY
REQUEST FOR EXPRESSION OF INTEREST

Ref: ADA/COM/IND/EOI/HSSM/2017-2018/SU Date: 03/11/2017

1. Aeronautical Development Agency is an autonomous Body setup under Ministry of Defence, Government of India for research and development of Indigenous Light Combat Aircraft (LCA), Tejas.
2. ADA is looking for vendors who can take up **"Design, Development and Supply of High End Accurate Hydraulic System Simulation Model as per Scope of Work"**
3. The subject Advertisement and following documents can be viewed and downloaded from ADA website www.ada.gov.in.
   (a) ***Annexure 'A'*** – Scope of Work
   (b) ***Annexure 'B'*** – Standard Conditions to EOI
   (c) ***Annexure 'C'*** – Vendor qualification requirements
   (d) ***Annexure 'D'*** – Vendor Summary Form
4. This request for Expression of Interest is issued for pre-qualification of Firms for the above requirement.
5. ADA now invites eligible vendors to indicate their interest in carrying out the above task indicating that they are qualified to perform the job duly providing Brochures, description of similar assignments and experience in similar field in the format as enclosed.
6. For any technical clarifications, please contact Mr. Likhendra Prasad, Sc 'C' +91 80 2508 7262, Mobile : 9483634983 and Email: likhendra@jetmail.ada.gov.in.
7. Interested vendors may send their EOI and confirmation to the abovelisted Terms and Conditions in Clause 3 (a) to (d), duly superscribed with our reference no. **ADA/COM/IND/EOI/HSSM/2017-2018/SU** to reach **"Director (MM), Aeronautical Development Agency, P.B. No. 1718, Vimanapura Post, Bangalore – 560017".**
8. ADA reserves the rights to accept or reject any EOI without assigning any reason.
9. Formal Request for Proposal along with detailed RFP with specifications shall be provided only to those who are considered qualified by ADA after completion of screening process based on "EOI" and the supporting certificate / details.
10. Your response should reach us on or before 1600 Hrs on 25/11/2017 at the above address.

Director (Materials Management)

Annexure - A

Subject: Design and Development of Accurate Mathematical Simulation Model for Aircraft Hydraulic System

1. **Requirement :**

There is a requirement to develop the accurate mathematical simulation model for aircraft hydraulic system, which will facilitate to design the precise hydraulic system for future aircraft. In this regard, the commercially available simulation tools like **Dymola** (product of Dassault System), **AmeSim** (product of Seimens), **Flowmaster** (Product of Mentor Graphics) etc., have been evaluated by us, for the level of its accuracy to represent the physics of each hydraulic component. The hydraulic component includes pipe line, fitting and Line Replaceable Unit (LRU) such as pump, filter, valve and etc.

The evaluation of above mentioned simulation tools were performed by assessing the governing equations of each hydraulic component, which are kept in background of software. Based on our assessment, we understand that these governing equations do not consider all functional, operational and dimensional parameters such as medium, pressure, temperature, aircraft vibration, aircraft acceleration and physical dimension. Hence, we understand that the simulation results of hydraulic system, using above mentioned simulation tools will be less accurate. Therefore in the current task, we emphasize on the derivation of accurate mathematical equations for various hydraulic components. Subsequently, develop the mathematical model for each component, which will be used to build the mathematical simulation model of complete hydraulic system.

1.1.1. **Functional Parameters:** Parameters within the hydraulic system/hydraulic component (Example-Pump) such as oil temperature, oil pressure and pump RPM etc, which affects the performance of the system/component

1.1.2. **Operational Parameter:** Parameters outside the hydraulic system/component, such as aircraft acceleration, aircraft mechanical vibration and ambient temperature etc, which affects the performance of system/component

1.1.3. **Dimensional Parameters:** The dimensional parameters of a component is classified in two modes to arrive different level of accurate characteristics

i. Internal Dimensional Parameters
ii. Overall Dimensional Parameters

1.1.3.1. **Internal Dimensional Parameters:** The internal dimensional parameters of a component like pump plunger diameter, pitch circle diameter and swash plate angle, etc will assist to arrive its accurate characteristics. These parameters will be known to the pump designer and will assist to optimize the design. But, these parameters will not be available to the hydraulic system designer, however the dimensional parameters indicated in the component installation drawing/catalogue is available.

1.1.3.2. **Overall Dimensional Parameters:** The overall dimensional parameters of a component like pump outer diameter, length from mounting face and port size for a given flow rate & speed will assist to arrive the approximate above mentioned internal parameters. The parameters, which are normally indicated in

the component installation drawing/catalogue are considered as overall dimensional parameters.

2. **Definition**
   2.1. **Shall:** The word "SHALL" in the text, express the mandatory requirement. Deviating from such requirement is not permitted, without formal agreement between ADA and Supplier.
   2.2. **Should:** The word "SHOULD" in the text, expresses the recommendation or advice to the Supplier for implementing such requirement. The ADA expects that such a recommendations and advice to be implemented, unless valid justification is provided by Supplier for not implementing.
   2.3. **Will:** The word "WILL" in the text, expresses the intension of the ADA's activity in connection with implementing the requirement.
   2.4. **May** : The word "MAY" in the text, expresses the acceptable practice or action. It is not a mandatory requirement for implementing.

3. **Scope of the Work :**
   The scope of the work is to arrive at accurate mathematical equation and develop mathematical model preferably in Dymola/AmeSim software for all hydraulic components, considering its functional, operational and dimensional parameters. The mathematical model of a component **shall** have two options of feeding the dimensional parameters, either internal or overall. When it is fed with overall dimensional parameters, the approximate internal parameters should be arrived with a correlation between them. The component simulation result with internal dimensional parameters **shall** be better than 95 percentage & **should** be better than 90 percentage with overall dimensional parameters, in comparison with its (hardware) test results. Subsequently, build the complete hydraulic system simulation model for LCA-Tejas with the component overall dimensional parameters, which **shall** represent system performance better than 80 percentage of accuracy in comparison with Iron Bird/aircraft test results.

4. **Input Data :**
   4.1. 2D schematic drawing of aircraft hydraulic system of LCA-Tejas
   4.2. 2D fabrication drawings of components, which are design & developed within India
   4.3. Technical details of components provided by the supplier along with the Part No/Model No, which are design & developed outside India

5. **Development Approach:**
   The below is the recommended approach, however any better approach /methodology will be appreciated and accepted.
   5.1. Derive the generic mathematical equation for all components (as mentioned in **Table-1**), which represent its performance at various functional, operational and internal dimensional parameters. Also, derive the correlation between internal dimensional and overall dimensional parameters, which **should** facilitate to arrive at approximate internal dimensional parameters from overall dimensional parameters.

5.2. Using above generic mathematical equation, develop the generic mathematical model with two options of feeding the dimensional parameters such as internal and overall, for all components mentioned in **Table-1**. The model **shall** be prepared preferably in Dymola/AmeSim software.

5.3. From the above generic mathematical model, arrive the mathematical model for each LCA component, which is given in **Table-2**. This model **shall** be arrived either by feeding the internal dimensional parameter for components designed within India or overall dimensional parameter for components designed outside India.

5.4. 3D CATIA modeling of all hydraulic system pipe lines (~470 assemblies) using CATIA V5 & Enovia VPM environment

5.5. 3D CATIA modeling of all hydraulic system LRUs (~85 LRUs) using CATIA V5 & Enovia VPM environment

5.6. Static (steady state) & dynamic (transient) characterization of all pipelines using CFD software i.e., FloEFD.

5.7. Static & dynamic characterization (pressure drop Vs flow rate & crack opening/closing time) using CFD software i.e., FloEFD & Simerics PumpLinx.

5.8. Indentify the test parameters for each component and prepare the test procedures to capture these parameters.

5.9. Carry out the testing of all components (hardware) mentioned in **Table-3** to generate its characteristics at different oil temperatures (-40 °C, -15 °C, 0°C, 30 °C, 90°C, 135°C)

5.10. Fine tune the CFD model (input parameters, initial & boundary conditions and mesh size etc.) such that the results of CFD matches with the hardware test results of the LRUs & pipelines

5.11. Fine tune the mathematical equations & mathematical model to match with the hardware test result of each component.

5.12. Create the joint to joint model in hydraulic system library of Dymola/Amesim software with unique identification code

5.13. Create the complete hydraulic system architecture in Dymola/Amesim software using joint to joint model

5.14. Identify the test parameters for complete system and prepare the test procedure for testing hydraulic system at iron bird/aircraft to capture these parameters

5.15. Perform the Iron Bird/aircraft test as per the above said test procedures and record the test parameters

5.16. Perform the hydraulic system simulation under same operating conditions of services in Dymola/Amesim software

5.17. Compare the Dymola/Amesim simulation results with Iron Bird/aircraft results to validate the mathematical simulation results

5.18. In case of mismatch of results obtained from Dymola/Amesim simulation & Iron Bird/aircraft test beyond the acceptable limit (± 20%), perform the necessary modification in mathematical equation & model in Dymola/Amesim to match with test results

5.19. Document the entire simulation work and generate the final report.

6. Deliverables:

6.1. Generic mathematical equations for all hydraulic components, as mentioned in Para 5.1

6.2. Generic mathematical model (preferably in Dymola/Amesim) for all hydraulic components as mentioned in Para 5.2
6.3. Characteristics of LCA hydraulic components from rig test
6.4. Validated mathematical model preferably in Dymola/Amesim for all LCA hydraulic components, as mentioned in Para 5.3 and 5.11
6.5. Validated Mathematical Hydraulic System Simulation Model preferably in Dymola/Amesim
6.6. Detailed report of LCA hydraulic system simulation results

7. **Expected duration of project completion:** 48 months from date of purchase order (PO)

8. **Mode of Working:**
8.1. Activities mentioned in Para 5.1, 5.2 , 5.3 and 5.11 **may** be executed outside of ADA premises
8.2. Remaining work **shall** be carried out within ADA premises
8.3. Activities mentioned in Para 5.1, 5.2, 5.3, 5.11 and activities mention from Para 5.4 to 4.10 **May** be executed in parallel
8.4. The required software and hardware **will** be provided at ADA
8.5. The working days (5 days/week) and timings **Will** be as per ADA

9. **Conditions**
9.1. All deliverables **should** be completed within 48 months from the date of PO
9.2. Vendors **shall** have skilled resources with strong understanding of basics/ first principle on hydraulic system & its components
9.3. Vendors **shall** have the proficient resources to work with the following tools
9.3.1. CATIA V5 & Enovia VPM environment
9.3.2. Components simulation tool like FloEFD, Simerics PumpLinx and Fluent etc.
9.3.3. System simulation tools like Dymola and Amesim
9.4. Representation and format of each report **shall** be, as per the guidance indicated in SAE Aerospace Technical Report Style Manual, Nov 2005 or whichever the latest
9.5. ADA technical team **shall** review the technical correctness and progress of each activity in weekly basis in ADA.
9.6. Along with the technical bid, the vendor **shall** submit the mathematical model for a sample LRU, which is enclosed in **Annexure-2.**
9.7. Vendors **shall** make presentation to Technical Evaluation Committee to showcase their expertise & resources as claimed in technical bid.
9.8. The formation of technical team to execute the subject activities shall be performed with the participation of ADA coordinator. The note/report indicating the name of each team member and their roles & responsibility, **shall** be signed by vendor & ADA coordinator. The team member **shall** be replaced, if ADA coordinator finds unsuitable to perform this activity. The team should not be disturbed unless the member leaves the organization or on vocation due to the personal reasons.
9.9. Each methodology report and estimation report shall be accepted by ADA, subsequent to the detailed presentation and technical explanation to convince the ADA technical team
9.10. Vendors **shall** submit the milestone based roadmap for execution of entire work, which **shall** clearly indicate the timeline for each activity (i.e., derivation of mathematical

equation & its modeling, CATIA modeling of pipeline & components, CFD analysis, testing of components at test rig and system simulation & its validation).

9.11. In technical bid, Vendor **shall** provide their plan to perform the rig testing of components with probable test facility/workcentres/institutes. The test faculty **shall** be as per relevant aerospace standards.

9.12. The vendor **shall** provide the cost break up for each activity as mentioned in Para 5.

9.13. The milestone based roadmap of the entire work **shall** clearly indicate that the projected time in the technical bid is within the project duration (48 months from date of P.O.).

9.14. Payment **shall** be made only after the completion of activity mentioned in Para 5. The part payment **may** be made as per the percentage indicated in below Table-4 against the acceptance of reports duly signed by technical team.

Table-4

S/N	Para No	Percentage
1	5.1	5
2	5.2	5
3	5.3	10
4	5.4	5
5	5.5	5
6	5.6	5
7	5.7	10
8	5.8, 5.9	15
9	5.10, 5.11	5
10	5.12, 5.13	5
11	5.14, 5.15	10
12	5.16, 5.17, 5.18	10
13	5.19	10

9.15. The vendor **shall** show the progress by completing the minimum percentage of tasks as indicated in below Table-5. If the task does not progress as per the Table-5, ADA has right to cancel the order with the part payment for the activities, which has been accepted by ADA.

Table-5

S/N	Months	% of task to be completed
1	6	10
2	12	20
3	18	30
4	24	40
5	30	55
6	36	70
7	42	85
8	48	100

Table-1

List of hydraulic components to derive mathematical equation and build mathematical model

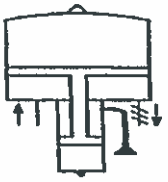
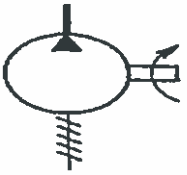
S/N.	Name of Component	Component Symbol (As per SAE AS 1290A)
1	Straight Tube	
2	Bend Tube	
3	Tee and Cross Joint	
4	Boot Strap Reservoir	
5	Gas Pressurized Reservoir	
6	Pump: Fixed displacement with one direction of flow and with case drain internally connected to pump inlet	

Table-1 (Contd.)

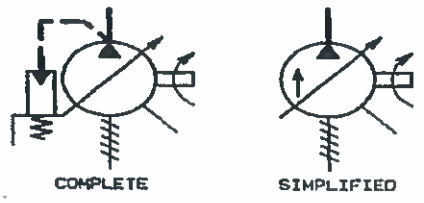
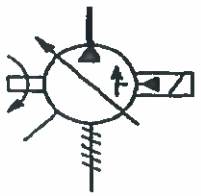
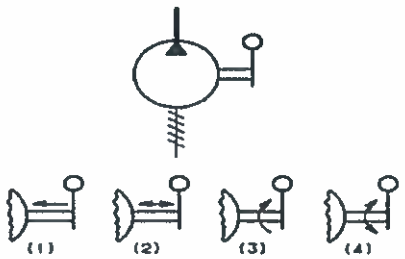
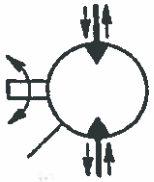
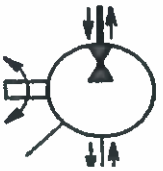
7	Pump: Variable displacement, pressure compensated with one direction of flow and with case drain	
8	Pump: Variable displacement, pressure compensated with Solenoid operated depressurization valve and one direction of flow & with case drain	
9	Hand pump: (1) Linear single acting (2) Linear double acting (3) Rotary single acting (4) Rotary double acting	
10	Fixed displacement, bi-directional hydraulic motor with case drain	
11	Pump motor: It operates as a pump in one direction and in other direction as a motor	

Table-1 (Contd.)

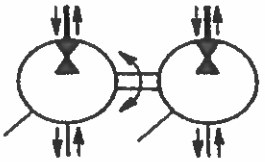
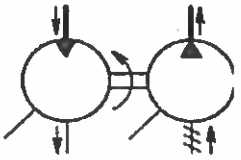
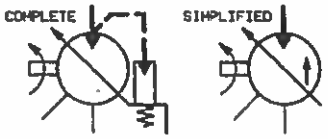
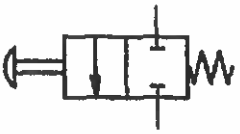
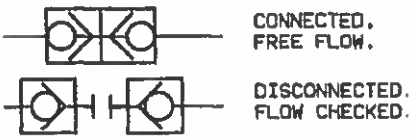
12	Power transfer unit: The half of power transfer unit with greater energy input operates as a motor and drives the other half as a pump	
13	Power transfer unit: Single direction of power transfer and single direction of rotation	
14	Variable delivery pressure compensated motor with one direction of flow and case drain	
15	Accumulator with gas pre-charge	
16	Gas charging valve	
17	Push button valve: Spring return, normally closed	
18	Quick Disconnect Coupling	

Table-1 (Contd.)

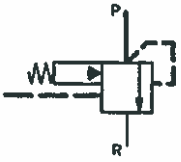
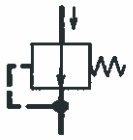
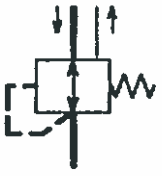
19	Pressure Relief Valve	
20	Pilot operated pressure relief valve	
21	Balanced relief valve: Component is pressure compensated at outlet side to open at a constant inlet pressure irrespective of outlet pressure	
22	Priority valve: It is a balanced relief valve with added free reverse flow	
23	Pressure Reducing valve: Two port, direct acting- Constant outlet pressure is maintained with variable inlet pressure.	
24	Pressure Reducing valve:(Mil-V-7909) Three port, direct acting- Excess downstream pressure will get relieve to return and downstream pressure will be maintained at a level close to the reduced pressure setting	

Table-1 (Contd.)

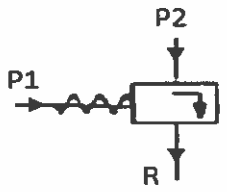
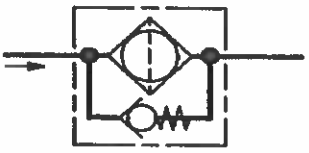
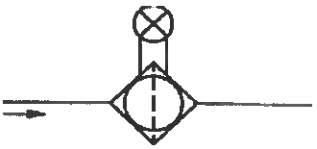
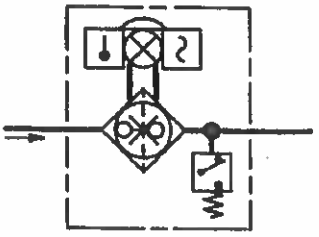
25	Hydraulic release valve: Normally closed under force due to P1 and spring	
26	Filter: With non removable element	
27	Filter: With removable element	
28	Filter: With removable element and bypass	
29	Filter: With removable element and pressure differential indicator	
30	Filter: With removable element, with automatic line shut off on bowl removal, with ΔP indicator having thermal lockout with integral pressure switch	

Table-1 (Contd.)

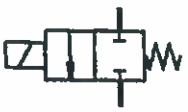
31	One Way Fixed Restrictor	
32	One way Variable Restrictor	
33	Two Way Fixed Restrictor	
34	Two Way Variable Restrictor	
35	Check valve	
36	Pilot operated check valve: Pilot pressure opens the valve	
37	Pilot operated check valve: Pilot pressure closes the valve	
38	Solenoid operated shut off valve (SOV): Direct operated, normally closed solenoid valve/ Isolation valve	

Table-1 (Contd.)

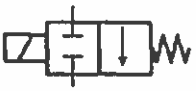
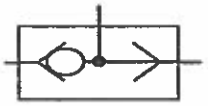
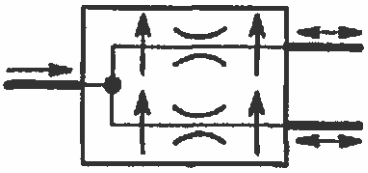
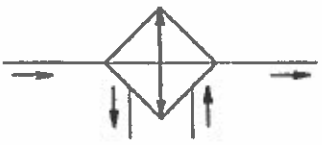
39	Solenoid operated shut off valve (SOV): Direct operated, normally closed solenoid valve / Isolation valve	
40	Direct acting solenoid valve: Normally closed	
41	Direct acting solenoid valve: Normally open	
42	Shuttle valve	
43	Flow divider: Flow in either directions is proportioned with accuracy	
44	Heat exchanger: Hydraulic fluid to fuel heat exchanger	
45	Single and double acting actuator	

Table-1 (Contd.)

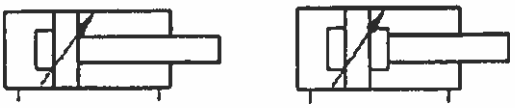
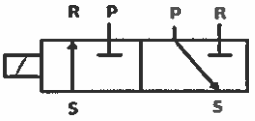
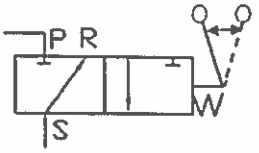
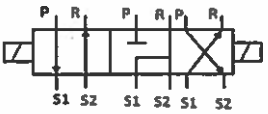
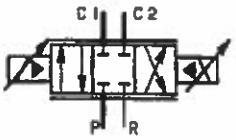
46	Single acting actuator with spring return	
47	Double ended actuator with piston rod of equal or unequal diameters	
48	Double acting actuator with variable damping at one end & both ends	
49	3 way, 2 position solenoid operated selector valve	
50	3 way, 2 position lever operated pressure control selector valve: Delivery pressure (S) is a function of the lever travel	
51	4 way, 3 position solenoid operated selector valve	
52	Electro hydraulic, pilot controlled flow control servo valve	

Table-1 (Contd.)

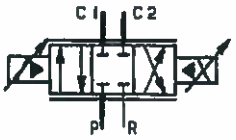
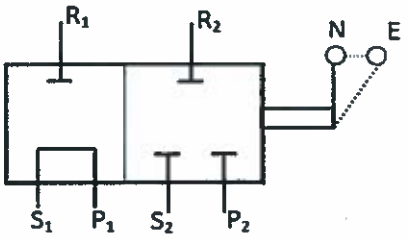
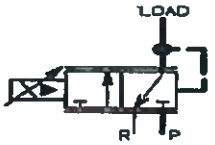
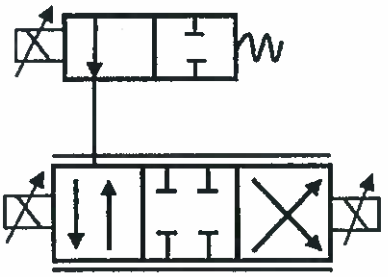
53	Electro hydraulic, pilot controlled flow control servo valve	
54	6 way, 2 position lever operated valve: Normally, when lever is at N position, normal system pressure (P_1) is connected to service (S_1) and R_1, P_2 and S_2 are blanked off. Pulling the lever to emergency position (E) connects the emergency system pressure (P_2) with service S_2 and R_2 is blanked off. At the same time, P_1 is blanked and R_1 is connected with S_1	
55	Electro hydraulic, pilot controlled pressure control servo valve	
56	Nose wheel steering (NWS) manifold: It comprises of one flow control Servo valve and a two stage shut off valves. When shut off valve is energized by NWS selection, fluid flows into manifold, which controls the hydraulic power supplied to NWS actuator	

Table-1(Contd.)

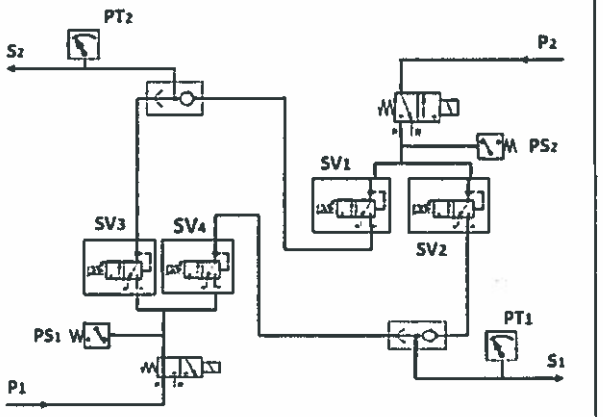
57	Anti-skid brake manifold: It is a dual electro-hydraulic, pressure control anti skid valve. It consists of two Shut Off Valves (SOV1 & SOV2) for selecting the hydraulic systems (P1 & P2) and four pressure control servo valves i.e., SV3 & SV4 for LH side wheel brake (S2) & SV1 & SV2 for RH side wheel brake (S1). The brake manifold also incorporates two shuttle valves to ensure redundancy of hydraulic power for wheel braking	

Table-2

List of Hydraulic Components in LCA

S/N.	Name of LRU	Description of LRUs	Type	No. of sizes	Designed & Developed
1	Reservoir	It stores the hydraulic fluid and provides fluid to pump and also collects the fluid returning from the system	Boot strap	1	Within India
2	Quick disconnect coupling	It facilitates for easy connection & disconnection of hose with pipeline	Nipple & Socket	4	Within India
3	Hydraulic Pump	It provides the hydraulic power to hydraulic system, which is converted from mechanical power	Variable displacement, Pressure compensated, axial piston, one direction flow with drain port	3	Outside India
4	Non return valve / Check Valve	It allows hydraulic fluid flow in single direction and eliminates the chance of flow in reverse direction	Poppet	6	Within India
5	Filter	It separates the contaminations from the hydraulic fluid	1. With removable element, without bypass port, automatic line shut off on bowl removal and thermal lockout 2. With removable element, with bypass port, automatic line shut off on bowl removal and thermal lockout	3	Within India
6	Pressure Relief Valve / Direct/pilot Pressure operated Relief Valve	It relieves the hydraulic system pressure when pressure rises beyond a limit	Direct/Pilot pressure operated	1	Within India
7	Fuel cooled oil cooler / Heat exchanger	It cools the hydraulic fluid returning from the services by using fuel	Plate and fin	1	Within India

8	Accumulator with gas pre- charge	It stores the hydraulic energy and absorbs pump's pulsation	Piston	2	Within India
9	Hand pump	It provides hydraulic power operated by hand	Linear double acting	1	Outside India
10	Hydraulic motor	It converts the hydraulic power in to mechanical power to drive various accessories	Piston type with fixed displacement, one direction	2	Outside India
11	Isolation valve	It is a normally open and closed when solenoid is energized, thereby stopping the hydraulic flow through this valve	Solenoid operated shut Off valve, Normally open	1	Within India
12	LG selector valve	It allows the pressurized hydraulic fluid from hydraulic system to enter into landing gear jack for extension or retraction of landing gear based on the energization of the any one of two solenoids.	4 way, 3 position solenoid valve	1	Within India
13	Landing gear door selector valve	It allows the pressurized hydraulic fluid from hydraulic system to enter into landing gear door jack for extension or retraction of landing gear door based on the energization of the any one of two solenoids.	4 way, 3 position solenoid valve	1	Within India
14	Normal/Emergency landing gear selector valve	It allows the pressurized hydraulic fluid from emergency hydraulic system to enter into landing gear jack & landing gear door jacks for emergency extension, in case of failure of normal hydraulic system	Lever operated, 6 way, 2 position valve	1	Within India
15	Fuel pump selector valve	It allows pressurized hydraulic fluid from hydraulic system to enter into hydraulic motor to drive fuel pump	3 way , 2 position solenoid valve	1	Within India
16	Airbrake Selector valve	It allows the pressurized hydraulic fluid from hydraulic system to airbrake jacks	4 way, 3 position solenoid valve	1	Within India

		for its extension or retraction, based on the energization of the any one of two solenoids.			
17	Shuttle valve	It allows the pressurized hydraulic fluid to landing gear jacks during normal & emergency extension	Spool & sleeve	3	Outside India
18	Hydraulic release valve / relief valve with two inlet pressure (P1 & P2), where P2 gets connected with Return in absence of P1 by overcoming spring force	It release the hydraulic fluid from the return side of the jack of landing gear & its doors to the ambient (or reservoir) during the emergency extension of landing gear when return line pressure increases beyond a limit.	Spring loaded	1	Within India
19	One way restrictor	It restricts the flow in only one direction and allows free flow in opposite direction.	Fixed	4	Within India
20	Two way restrictor	It restricts the flow in forward & backward directions	Fixed	5	Within India
21	Flow synchronizer/ flow divider	It divides one input flow in to two equal output flow	Spool and sleeve	1	Within India
22	Progressive pressure control valve operated by Cable and Lever	It allows the pilot (by cable & lever) to control the hydraulic pressure from brake accumulator during emergency and parking braking of main wheels	3 way, 2 potion manually operated pressure control valve	1	Outside India
23	Gas Charging valve	It is used to charge the nitrogen chamber of the accumulators and it does not allow the back flow	Without backflow	1	Outside India
24	Nose wheel steering (**NWS**) manifold	It controls the hydraulic power supplied to nose wheel steering actuator	-	1	Outside India
25	NWS Free caster valve	It interconnects the both sides of the	Direct acting , solenoid valve	1	Outside India

		steering cylinder to return line to allow free steering of nose wheel by differential braking	normally closed		
26	Antiskid Brake Manifold	It controls the pressure applied to the brakes to avoid skidding of wheel	Dual Electro-hydraulic, pressure control anti skid valve	1	Outside India

List of hydraulic LRUs to be tested

Type of test : (Pressure drop Vs flow rates, Crack opening & closing time etc. as applicable for LRUs)
Max flow rate : As mentioned below for each LRUs
Hyd. oil temperature : -40 °C, -15 °C, 0°C, 30 °C, 90°C, 135°C

Table -3.

S/N	LRUs	Details of LRUs	Part Number	Max. flow rate (lpm)	Connector/Adapter size
1	Filter	HP filter - RH	FIL-01-0001	110	MJ22x1.5 (inlet and outlet)
		HP filter - EDP	FIL-02-0001	30	MJ18x1.5 (inlet and outlet)
		HP - EMDP	FIL-03-0001	11.5	MJ14x1.5 (inlet and outlet)
		Case Drain - LH	FIL-04-0001	10	MJ12x1.5 (inlet and outlet)
		Case Drain - EDP	FIL-05-0001	5	MJ12x1.25 (inlet and outlet)
		LP - LH	FIL-06-0001	120	MJ27x1.5 (inlet & outlet)
		HP - LH	FIL-07-0001	110	MJ22x1.5 (inlet and outlet)
		Case Drain - RH	FIL-08-0001	10	MJ12x1.5 (inlet and outlet)
		LP - RH	FIL-09-0001	120	MJ27x1.5 (inlet & outlet)
2	Selector	LG	107800000	40	MJ18x1.5 (P), MJ12x1.25 (S1, S2) and MJ16x1.5 (R)
		LG Door	106900000	40	MJ18x1.5 (P), MJ12x1.25 (S1, S2) and MJ16x1.5 (R)
		U/C Emergency	C24453200	40	
		Airbrakes	10700000	40	MJ18x1.5 (P), MJ14x1.5 (S1, S2) and MJ16x1.5 (R)
		Fuel Pump	10710000	5	MJ18x1.5 (P), MJ12x1.25 (S) and MJ14x1.5 (R)
3	Valve	Isolation	10720000	60	MJ18x1.5 (inlet and outlet)
		Shuttle Valve - 6 mm	A1K.I7.1110.000.000	15	MJ10x1.25 (inlets) and M12x1 (Banjo bolt at outlet)
		Shuttle Valve - 8 mm	A1K.I7.1125.000.000	20	MJ12x1.25 (inlets) and manifold with dia 13.97 at outlet
		Shuttle Valve - 8 mm	A1K.I7.1126.000.000	20	MJ12x1.25 (inlets) and manifold with dia 13.97 at outlet
		NRV - 6 mm	A1K.I7.1140.000.000	15	MJ12x1.25 (inlet and outlet)
		NRV - 8 mm	A1K.I7.1150.000.000	30	MJ14x1.5 (inlet & outlet)
		NRV - 10 mm	A1K.I7.1160.000.000	40	MJ16x1.5(inlet & outlet)
		NRV - 12 mm	A1K.I7.1170.000.000	60	MJ18x1.5(inlet & outlet)
		NRV - 16 mm	A1K.I7.1180.000.000	110	MJ22x1.5(inlet & outlet)
		NRV - 20 mm	A1K.I7.1190.000.000	120	MJ27x1.5 (inlet & outlet)
		QDC, 14 mm (Nipple assembly)	A1K.I7.1235.000.004		
		QDC, 14 mm (socket assembly)	A1K.I7.1232.000.004		
		QDC, 25 mm (Nipple assembly)	A1K.I7.1220.000.003		

	Valve	QDC, 25 mm (Socket assembly)	A1K.I7.1240.000.003		
		Progressive pressure control valve			
		Gas charging valve			
4	Flow Synchronizer		6101212	40	MJ14x1.5 (inlet & outlet)
5	One Way Restrictor	8 x 0.7	A1K.I7.2000.000.301	6	MJ14x1.5 (inlet & outlet)
		8 x 1.1	A1K.I7.2000.000.380	15	MJ14x1.5 (inlet & outlet)
		8 x 1.3	A1K.I7.2000.000.401	20	MJ14x1.5 (inlet & outlet)
		8 x 2.0	A1K.I7.2000.000.600	45	MJ14x1.5 (inlet & outlet)
6	Two Way Restrictor	6 x 0.5	HS 3007 / 6 x 0.5		MJ12x1.25 (inlet and outlet)
		6 x 0.7	HS 3007 / 6 x 0.7		MJ12x1.25 (inlet and outlet)
		6 x 1.0	HS 3007 / 6 x 1.0		MJ12x1.25 (inlet and outlet)
		6 x 2.0	HS 3007 / 6 x 2.0		MJ12x1.25 (inlet and outlet)
		8 x 0.5	HS 3007 / 8 x 0.5		MJ14x1.5 (inlet & outlet)
		8 x 1.0	HS 3007 / 8 x 1.0		MJ14x1.5 (inlet & outlet)
7	Heat Exchanger	System 1	60162-000	120	
		System 2	60163-000	120	
8	Accumulator	Main accumulator	107300000		
		Brake accumulator	107400000		
9	NWS manifold		CD1108		
10	Free caster valve		6415U000 Rev A		
11	Antiskid brake manifold		E020-101B		
12	Hydraulic pump	Main pump		115	
		Backup pump		30	
13	Reservoir				

Annexure 'B'

Standard Conditions to EOI

Ref: ADA/COM/IND/EOI/HSSM/2017-2018/SU Date: 03/11/2017

SUBJECT	**Design, Development and Supply of High End Accurate Hydraulic System Simulation Model as per Scope of Work**

1. Please indicate the above mentioned title, the enquiry number and date on the sealed cover to avoid the proposal being declared invalid.

2. The proposal shall be addressed to the **Director (Materials Management) Aeronautical Development Agency, Post Box No.1718, Vimanapura Post, Bangalore – 560 017, India.** Please superscribe reference number on the envelope as ADA/COM/IND/EOI/HSSM/2017-2018/SU and your response should reach us on or before **4 PM, 25 November 2017** at the above address.

3. The proposal is being issued with no financial commitment and ADA reserves the right to:

   (a) Change or vary any part thereof at any stage,

   (b) Withdraw the proposal, should it become necessary at any stage or

   (c) Accept or reject any offer without assigning any reason.

4. Late proposals received beyond the scheduled time and date shall not be considered unless formally extended by ADA.

5. The proposal shall be in English language and shall be kept valid for a period of 180 days from the last date of submission.

6. Those who require clarifications regarding the contents of scope of work (refer ***Annexure 'A'***) shall notify ADA in writing about the clarifications sought not later than 7 days prior to the date of closure.

7. Company's profile indicating the ownership, registration as per law of the land, areas of expertise, range of services offered along with list of references/buyers to whom similar services were provided, copies of major orders executed, etc.

8. All information provided by ADA shall remain the property of ADA and shall not be divulged or cause to be divulged to any third party or otherwise made public for which confidentiality agreement need to be signed by the Supplier.

9. Vendor Summary Form enclosed herewith as ***Annexure 'D'*** duly filled in should be sent along with EOI.

10. The proposal forwarded by the firms will be evaluated by a Technical Evaluation Committee and would short list the firms.

Director (Materials Management)

Annexure 'C'

Vendor Qualification Requirements

Ref : ADA/COM/IND/EOI/HSSM/2017-2018/SU Date: 03/11/2017

1) The main vendor should provide copy of registration of the company in India.

2) Vendor shall have skilled resources with strong understanding of basics / first principle on hydraulic system and its components

3) Vendor shall have the proficient resources to work with the following tools :

   a) CATIA V5 and ENOVIA VPM Environment
   b) Components simulation tool like FloEFD, Simerics PumpLinx and Fluent etc.
   c) System simulation tools like Dymola and Amesim

4) Registration detail with DRDO or any other Govt. Institutions/Autonomous Bodies/PSUs etc. if any, should be enclosed with EOI.

5) Vendor shall enclose with its EOI an affidavit stating that the company is / has not been black listed by Central / State Government / PSU.

Director (Materials Management)

Annexure – 'D'

VENDOR SUMMARY FORM

NAME AND YEAR OF ESTABLISHMENT OF THE ORGANIZATION / FIRM:

	ADDRESS	TELEPHONE / MOBILE	FAX	CONTACT PERSON(S) WITH DESIGNATION	JURISDICTION OF POLICE STATION
REGIS-TERED OFFICE					
ADMINIS-TRATIVE OFFICE					
LABORA TORIES					
BRANC-HES ABROAD					

YEAR AND TYPE OF REGISTRATION OF THE ORGANIZATION / FIRM (INDIAN COMPANY ACT 1956 , INDIAN PARTENERSHIP ACT 1932, INDIAN FACTORIES ACT 1950, SMALL, MEDIUM OR LARGE SCALE INDUSTRY ETC. (PLEASE ATTACH COPY OF MEMORANDUM, ARTICLE OF ASSOCIATION AND OTHER RELATED DOCUMENTS IN SUPPORT)

BREIF DESCRIPTION OF THE ORGANIZATION / FIRM (HISTORY, AREA, SET UP, VISION & MISSION STATEMENTS ETC). (PLEASE ATTACH SEPARATE SHEET, IF REQUIRED):

TYPE OF COMPANY (PLEASE ✓ AS APPLICABLE)

☐ PVT. LTD. ☐ PUBLIC LTD. ☐ PARTNERSHIP
☐ PROPRIETORY ☐ GOVT. ORGANISATION
☐ SEMI GOVT. ORGANISATION

TYPE OF BUSINESS (PLEASE ✓ AS APPLICABLE)

☐ MANUFACTURER ☐ AGENT ☐ DISTRIBUTOR
☐ STOCKIST ☐ TRADER ☐ SUPPLIER
☐ DEALER ☐ RETAILER ☐ CONTRACTOR

NAME & ADDRESS OF DIRECTORS, MANAGING DIRECTOR, PROPERIOTOR, MANAGERS, PARTNERS ETC. (AS APPLICABLE)

PERSON TO BE CONTACTED FOR ANY FURTHER INFORMATION:

NAME & DESIGNATION:
CONTACT NOs. : OFFICE RESIDENCE
ADDERSS :

LIST OF PRINCIPAL CUSTOMERS & THEIR ADDRESES, WHETHER REGISTERED WITH DEFENCE / DRDO LABS / DGS&D / GOVT. DEPARTRMENTS? IF YES, GIVE DETAILS ALONG WITH DOCUMENTARY PROOF. PLEASE ATTACH SEPARATE SHEET, IF REQUIRED:

ARE YOU PROVIDING AFTER SALES SERVICE?
IF YES, GIVE DETAILS OF (a) POST WARRANTY SERVICE: (b) SCOPE OF SERVICE:

DETAILS OF PATENTS / COPY RIGHTS OWNED BY THE ORGANIZATION / FIRM:

INCOME TAX REGN. NO. UNDER SECTION 12AA		S.T. REGN. NO.		C.S.T. REGN. NO.	
PAN NO. OF THE ORGANIZATION		SERVICE TAX REGN. NO.		TOTAL CAPITAL EMPLOYED	
DGFT'S IMPORTER / EXPORTER CODE NO. & DT.			RBI CODE NO. & DT.		

TYPE OF WORK / JOBS EXECUTED BY THE ORGANIZATION / FIRM IN LAST 05 YEARS			
YEAR	DETAILS OF SIMILAR JOBS UNDERTAKEN	CLIENT's NAME AND ADDRESS	START AND END DATE OF JOB
REMARKS			

DETAILS OF PLANTS, MACHINERIES, TEST EQUIPMENTS / FACILITIES, ETC. OWNED BY THE ORGANIZATION / FIRM:

DETAILS OF ASSISTANCE FROM EXTERNAL AGENCIES:

HAS YOUR PRODUCTS BEEN TESTED BY ANY AGENCY? IF SO, INDICATE DETAILS WITH COPIES OF TEST CERTIFICATE / REPORT)

DETAILS OF FOREIGN COLLABORATIONS IF ANY (INDICATE PRODUCT, NAME & ADDRESS OF COLLABORATOR, YEAR OF COLLABORATION, WHETHER CURRENT OR NOT ETC:

WHETHER THE FIRM IS HAVING ISO / CMM / ISI OR ANY OTHER CERTIFICATION? IF YES, GIVE DETAILS WITH PROOF:

TOTAL NO OF MANAGERIAL / TECHNICAL PERSONNEL WORKING IN THE ORGANIZATION / FIRM					
ADMINISTRATIVE	TECHNICAL	QC INSPECTOR	SKILLED / UNSKILLED	FOREIGNER	OTHERS

ANNUAL SALES TURNOVER FOR LAST 03 YEARS (IN LAKHS)			
YEAR	TURNOVER (Rs.)	NET PROFIT (Rs.)	REMARKS

BANKER'S NAME, ADDRESS & A/C NO.:

ANY FUTURE PLANS? (EXPANSION PROGRAMME, INSTALLATION OF NEW MACHINERY, ADDITIONAL TEST FACILITIES ETC.):

ANY OTHER RELEVANT INFORMATION? (COLLABORATIONS / ASSOCIATES ETC.):

DETAILS OF ENCLOSURES (PLEASE ✓ AS APPLICABLE)

- ☐ CERT. OF INCORPORATION
- ☐ CERTIFICATE OF REGISTRATION
- ☐ SSI UNIT REGISTRATION
- ☐ AUTHORISATION FROM PRINCIPAL FOR AGENCY
- ☐ ATTESTED COPIES OF PURCHASE / WORK ORDERS / LETTER FOM CUSTOMERS
- ☐ AN AFFIDAVIT AS PER SL. NO. 10 (VENDOR'S QUALIFICATION)
- ☐ OGANIZATION'S BROCHURES, CATALOGUES CERTIFICATES, ETC
- ☐ INCOME TAX CLEARANCE CERT. FOR LAST 5 YRS.
- ☐ COPY OF PAN CARD
- ☐ AUDITED COPY OF BALANCE SHEETS FOR LAST 3 FINANCIAL YEARS

DECLARATION:

1. I / We _____ (Name of Director / Partners/Proprietor / Share Holders) do hereby declare that the information fumished above is correct to the best of my / our knowledge and that I / we shall be bound by the acts of duly constituted attorney.
2. I / We also hereby declare that all information related to ADA / DRDO shall be treated as CONFIDENTIAL and no information shall be passed on to any unauthorized person without written permission by ADA.
3. I / We also undertake the responsibility to inform all subsequent changes in the constitution OR working of firm, affecting the accuracy of the answers now given will be promptly communicated to ADA.
4. Mr. _____ whose signature are given below is an authorized representative of this firm.

(1) _____ (2) _____ (3) _____
(Specimen signatures of firm's authorized representative)

SEAL OF THE COMPANY
DATE:

SIGNATURE OF AUTHORISED SIGNATORY:
NAME:
DESIGNATION: