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& competition

Department:
Trade, Industry and Competition
REPUBLIC OF SOUTH AFRICA



Aerospace Industry Support Initiative

an initiative of **the dtic**

Expression of Interest (Eoi)

Aerospace Industry Support Initiative (AISI)

Identifying Advanced Manufacturing Aerospace Integrators or Sub-Systems Suppliers and SMMEs to participate in the AISI Technology Based Supplier Development Programme

Eoi No: 001/13/05/22

Date of Issue:	13 May 2022	
Closing date and time:	03 June 2022, 16:30hrs	
Submission Type:	Submissions to be emailed to Livison Mashoko - lmashoko@csir.co.za	
Enquiries and Submission	CSIR Manufacturing Cluster	E-mail: Livison Mashoko - lmashoko@csir.co.za

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1 INTRODUCTION

The Council for Scientific and Industrial Research (CSIR) is one of the leading scientific research and technology development organisations in Africa. In partnership with national and international research and technology institutions, the CSIR undertakes directed and multidisciplinary research and technology innovation that contributes to the improvement of the quality of lives of all South Africans. The CSIR's main site is in Pretoria while it is represented in other provinces of South Africa through regional offices.

The Aerospace Industry Support Initiative (AISI) is an initiative of the Department of Trade Industry and Competition (**the dtic**). The AISI is hosted and managed by the CSIR and has a specific aim of industrial development. The AISI is a fully government-funded mechanism to support the local South African aeronautics, defence, space and marine industries. The initiative takes its strategic direction from government's objectives with emphasis on:

- Industrialisation of Technology;
- Industry Transformation; and
- Job Creation.

The purpose of this document is to outline the framework for the Expression of Interest (Eoi) and submission procedures with regards to identifying applicants who are involved in aerospace manufacturing and who qualify as integrators or sub-systems suppliers or Small Medium Micro Enterprises (SMMEs) to participate in the AISI's Technology Based Supplier Development Programme. It serves as a guideline to applicants interested in submitting Eoi proposals for consideration by the AISI technical review committee. The AISI is issuing an Eoi for proposals aligned to its goals and those of the South African Aerospace Industry.

2 AISI TECHNOLOGY BASED SUPPLIER DEVELOPMENT PROGRAMME

2.1 Background

The role of the AISI as an industry support mechanism is to:

- Increase the contribution of small enterprises in the economy;
- Significantly enhance Broad Based Black Economic Empowerment (B-BBEE);
- Raise the levels of direct investment overall, as well as in defined priority sectors;
- Increase market access opportunities for and export of South African goods and services;
- Contribute towards building skills and technology platforms;
- Improvement of the local industry competitiveness;

- Ensuring that new technologies are taken up by industry through an active process of industrialisation; and
- Enable new suppliers to enter the supply chain and develop new technologies, industries and SMMEs to enable market entry and global competitiveness through access to technology.

The AISI's Technology Based Supplier Development interventions provide enabling mechanisms to assist industry to improve its competitiveness, productivity and quality management systems. This will assist the industry to optimise its operations and procedures in order to ensure South African industry integration into global supply chains. The strategic focus remains on SMMEs with the objective of ensuring industry transformation, and the broadening of the economic base participating in the industry.

Economic benefits derived through supplier development projects include competitiveness improvement, productivity improvement, improved lead times, improved quality, cost savings, compliance to environmental standards, improved delivery performance, increased customer satisfaction and job creation and retention. The AISI's Technology Based Supplier Development Programme has three distinct interventions for support. These interventions were identified as priority to assist and enable the South African aerospace industry to grow and compete globally. These interventions are:

- **Technology Enhancement;**
- **Standards and Accreditation; and**
- **Supply Chain Optimisation.**

This EoI focuses on identifying aerospace companies (SMMEs or non-SMMEs) who will benefit from the aforementioned interventions.

3 TECHNOLOGY BASED SUPPLIER DEVELOPMENT INTERVENTIONS

The AISI selected three supplier development interventions to assist aerospace SMMEs as well as non-SMME companies (higher integrators or sub-systems suppliers) and contribute to the global aerospace manufacturing industry. The AISI will provide support for these interventions to be undertaken at SMMEs and Non-SMMEs alike.

NOTES:

1. All SMME or non-SMME companies applying for assistance must be involved in aerospace and defence advanced manufacturing.

2. Only SMMEs can apply for support in more than one area of intervention. Non-SMME companies can only apply for technology enhancement.
3. All applicants that are currently receiving support for similar interventions from other South African Government departments or international organisations will not be considered for support.

3.1 Intervention 1: Technology Enhancement

Technology Enhancement is a critical aspect for aerospace companies both SMME and Non-SMME as it is a source of growth and new markets. The development and enhancement of new technologies, processes, and manufacturing methods is fundamental to remain competitive on a global scale. The technology enhancement intervention is divided into two categories as shown in the diagram below:

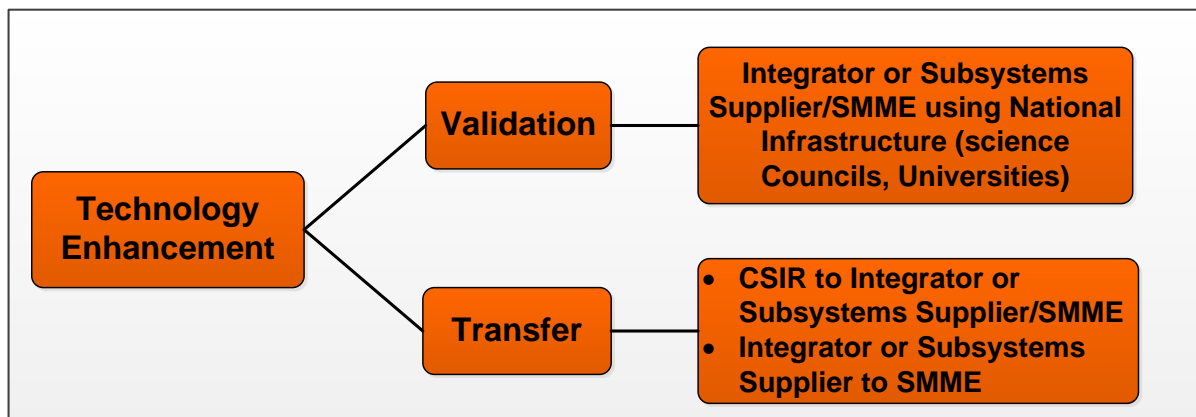


Figure 1: Technology Enhancement Interventions

Technology validation focuses on technologies that require the potential beneficiary (integrator, sub-systems or component supplier) to utilise national infrastructure to develop and enhance the specified technologies. The national infrastructure could be in the form of testing or validation services that are required by the potential beneficiary. This may be any form of assistance that national infrastructure could provide to them within the specified thematic areas as indicated in Section 3.1.2. Technology validation may also include assisting organisations in meeting industry certification requirements both locally and internationally.

Technology transfer focuses on two aspects; the transfer of an aerospace technology from the CSIR to a potential beneficiary or the transfer of technology from the integrator or sub-systems supplier to an SMME. Both aspects will entail actual technology development and the transfer of skills and knowledge. All technology transfer projects must fall within the specified thematic areas as indicated in section 3.1.2.

Projects under Technology Enhancement will be identified through **Technology Roadmapping workshops**. The workshops will be attended by the participating organisation (SMME/non-SMME), the AISI and any other technical expert(s) that maybe agreed upon between AISI and the potential beneficiary.

3.1.1 Technology Roadmapping

Technology Roadmapping is a need driven technology planning approach that helps to identify, select and develop technology alternatives in order to satisfy a market need through enhanced products or capabilities. It ensures the alignment of technology investments and development of new capabilities in order to meet future market needs. The methodology takes into account the relationship between technologies, their products and services and the target markets. Technology roadmaps are used for a number of applications such as the following:

- Product planning
- Capability planning
- Strategic planning
- Long-range planning
- Knowledge asset
- Programme planning
- Process planning

3.1.2 Thematic Areas

The thematic areas selected are at the discretion of the AISI and are seen as those most relevant for technology advancement in the South African Aerospace sector. These are:

- Aerostructures including advanced manufacturing and processing (digital manufacturing, surface treatment technologies, additive manufacturing, etc);
- Space;
- Avionics;
- Propulsion and
- Surveillance and Sensor Systems

All technology validation and transfer projects must fall within one of the thematic areas in order to be approved for support.

3.1.3 Technology Readiness Levels (TRLs)

All projects supported through the technology enhancement intervention must be at a **TRL value of 4 or higher** at the start of the project. Preference will be given to higher TRL projects. Evidence of this will need to be provided with the application. Refer to Annexure A for TRL.

3.2 Intervention 2: Standards and Accreditation

Quality management in the aerospace industry is an important factor. It may provide the distinction between financial success and costly errors within an organisation. AS/EN9100 is the common quality management standard for the aerospace industry. It is used and supported by the world's leading aerospace companies and throughout their respective supply chains. AS/EN9100 can standardise the way the aerospace industry works thereby ensuring the industry gains an excellent reputation.

NOTE: The Standards and Accreditation intervention is only available to SMMEs.

This intervention will assist the SMMEs with implementing and attaining certification for the following standards:

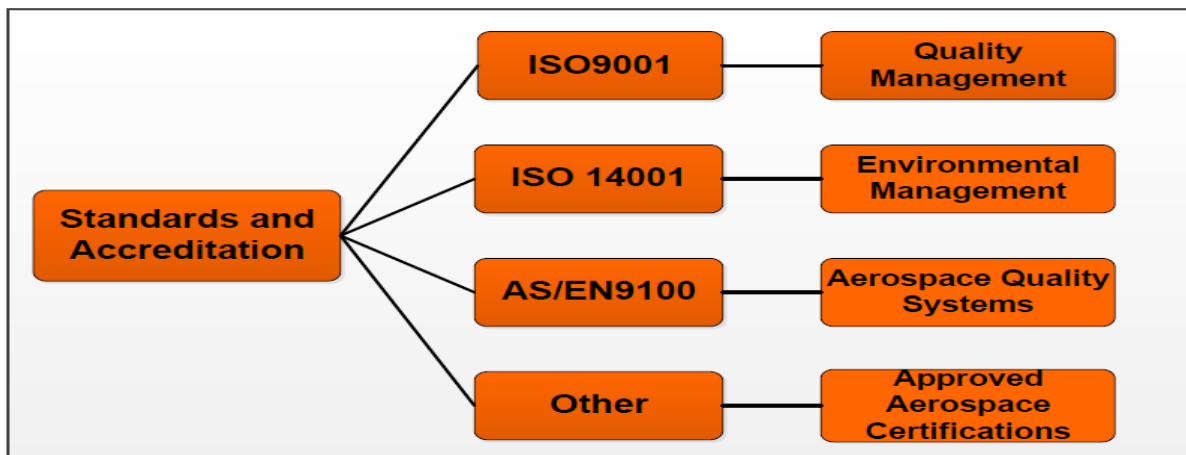


Figure 2: Standards and Accreditation Interventions

3.3 Intervention 3: Supply Chain Optimisation

Supply chain optimisation has been identified as a key aspect to efficient manufacturing operations. Process optimisation will focus on supply chain and production optimisation.

NOTE: The Supply Chain Optimisation intervention is only available to SMMEs.

This will cover concepts such as:

- Lean manufacturing
- Theory of constraints
- Facility layout planning
- Production planning and control
- Quality management systems

4 INVITATION FOR EXPRESSION OF INTEREST

This call is aimed at Aerospace Companies (both SMME and non-SMMEs) that require technology based supplier development interventions that will contribute towards improving their global competitiveness.

NOTE: Successful applicants that applied for support through previous Eols (001/29/06/21 and 002/22/09/21) do not have to submit a new proposal, unless if they want to add other intervention(s) which were not included in the previous application. The intervention(s) that were approved as part of these previous Eols are still valid.

A manufacturing SMME is defined in accordance with the Revised Schedule 1 of the National Definition of Small Enterprise in South Africa published on 15 March 2019 by the Department of Small Business Development. According to this schedule a manufacturing SMME is defined as having less than:

- 250 full time employees; and
- R170 million annual turnover

In most cases, SMMEs work with higher tier integrators (Tiers 0, 1 and 2) as part of their supply chain but in some cases, they are integrators for their own products and systems. Companies that do not meet the definition for SMMEs are classified as non-SMMEs for the purposes of this Eol. Figure 3 shows the aerospace technology streams and tier levels.

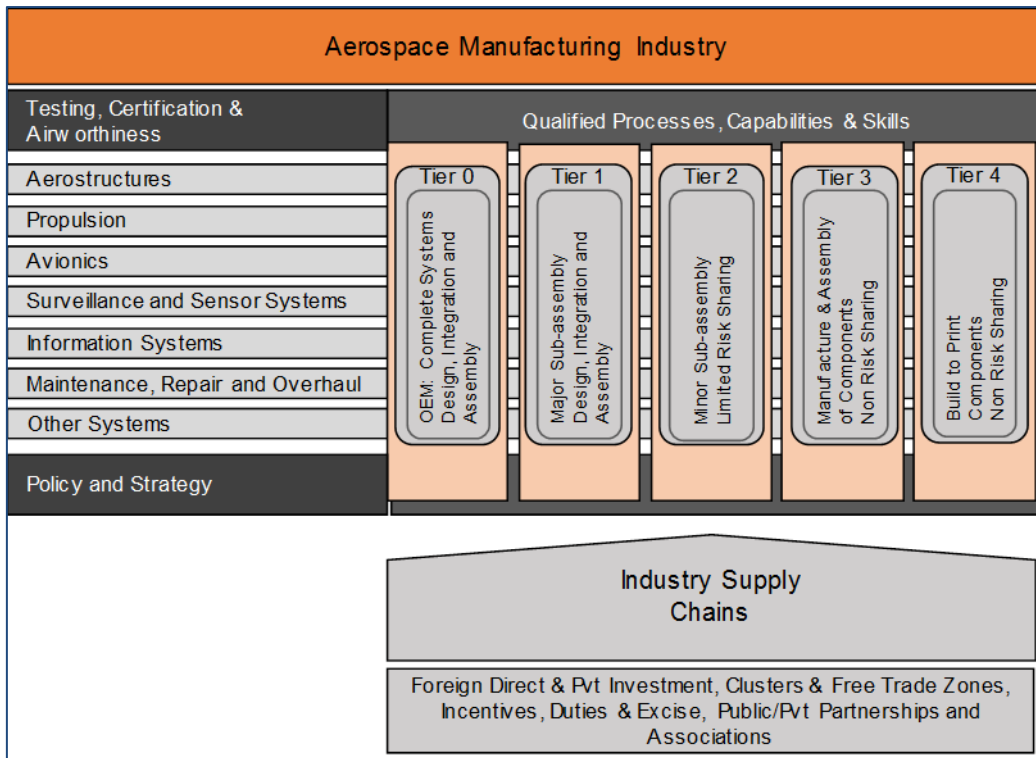


Figure 3: Aerospace Technology Streams and Industry Supply Chain Details

Only companies involved in aerospace advanced manufacturing will be considered.

NOTE: Non-SMMEs only qualify for support under the Technology Enhancement intervention as indicated in Section 3.1.

NOTE: All applicants are required to include their B-BBEE certificate and proof of Compliant Tax Status in their response to the EoI. The B-BBEE level is required to be maintained or improved throughout the duration of the project.

The EoI process is shown in Figure 4.

- Any aerospace company is invited to complete and submit the relevant template ([Section 21 - EoI Templates](#)) to the AISI based on the size and status of the company.
- All EoI submissions will initially be reviewed to ensure that they fulfil the Elimination (see Section 9), qualification and critical evaluation factors (see Table 1 and Table 2) for identifying the correct size and status of the company. If the application fails this review, the EoI application proposal will be disqualified, and the applicant will be informed thereof.
- If the applicant is successful, the AISI will prioritise and initiate interventions at its own discretion.

- The AISI will monitor progress of all the interventions for the duration of the project.

The call for EoI and assessment process is shown in Figure 4.

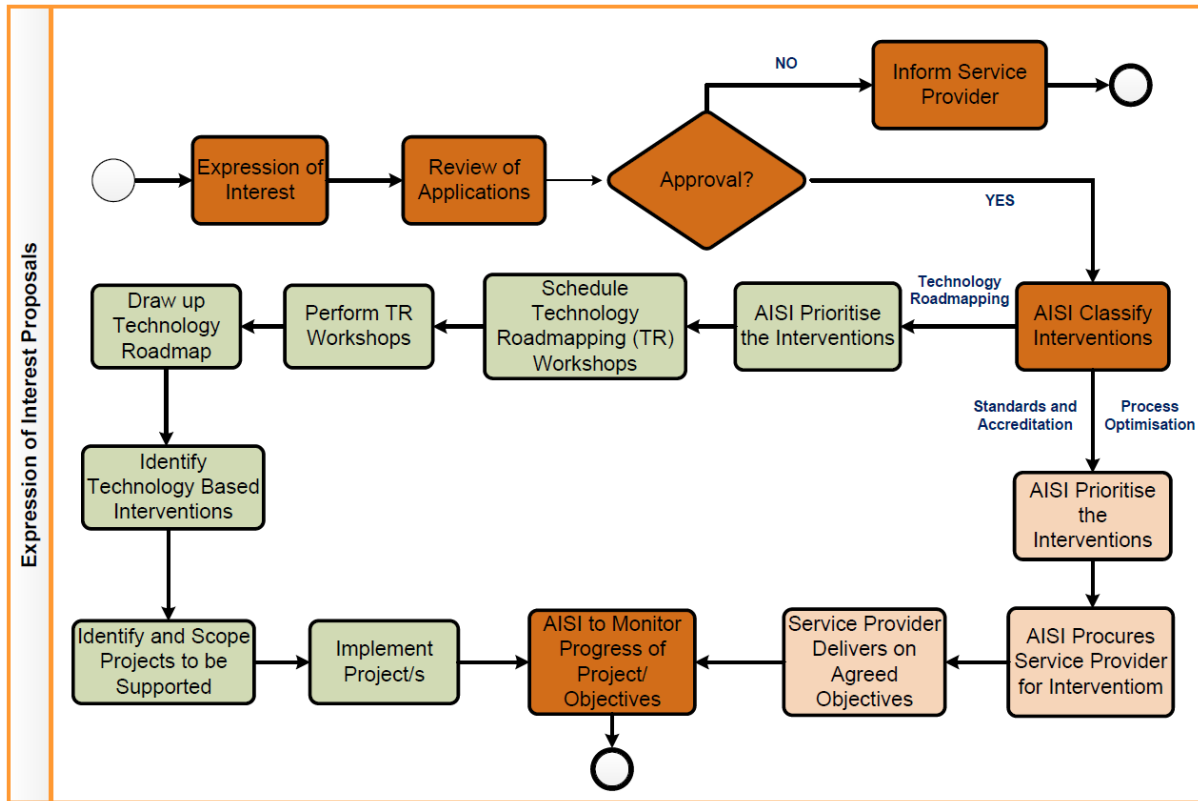


Figure 4: EoI process

5 TIMELINE FOR INTERVENTIONS

The first set of priority interventions are expected to start from 01 July 2022 and are expected to be completed no later than 30 June 2023. The Expression of Interest results will be valid until 31 March 2025.

6 SUBMISSION OF EoI

ONLY electronic copies will be accepted and must be submitted via email to Livison Mashoko - lmashoko@csir.co.za. All EoI documents must be received no later than the stipulated closing date and time. Any EoI submitted after the stipulated time and date will be automatically disqualified.

All queries pertaining to the EoI must be forwarded for attention: Livison Mashoko - lmashoko@csir.co.za with **AISI Technology Based Supplier Development Programme** as the subject.

7 EoI PROGRAMME

The Programme, as currently envisaged, incorporates the following key dates:

- Issue of EoI documents: 13 May 2022
- Submission closing date and time: 03 June 2022, 16:30hrs
- Validity of EoI Until 31 March 2025

8 DEADLINE FOR SUBMISSION

Proposals shall be submitted via email no later than **03 June 2022 at 16:30hrs**. Where a proposal is not received by the AISI by the due date and time, it will be regarded as a late proposal. Late proposals will not be considered.

9 ELIMINATION CRITERIA

EoI proposals will be eliminated under the following conditions:

- Submission after the deadline date and time;
- Incomplete submissions;
- Proposal templates ([Section 21 - EoI Proposal Templates](#)) not completed, signed and submitted;
- EoI compliance checklist not signed and submitted (page 18);
- Declaration of Conflict of Interest not signed and submitted (page 19);
- Declaration of Conflict of Financial Interest not signed and submitted (page 19);
- Final Declaration not signed and submitted (page 20);
- No B-BBEE certificate; and non-Compliant Tax Status.

10 EVALUATION PROCESS AND CRITERIA

10.1 Evaluation of proposals

All EoI proposals will be evaluated by a technical review committee for functionality. The proposal template ([Section 21 - EoI Proposal Templates](#)) which is also published with this EoI is required to be completed and submitted. The evaluations of the EoI will be based on the information provided in the proposal template ([Section 21 - EoI Proposal Templates](#)) and any additional documentation requested. The qualification, critical and differentiation evaluation will be done for all applications.

10.1.1 Qualification and Critical Evaluation Factors

The assessment criteria for the evaluation of all project proposals are firstly divided into qualification evaluation factors (based on the beneficiary) and critical evaluation factors (based on the proposal). These are shown in Table 1 for non-SMME companies and Table 2 for SMMEs. For the qualification and critical factors, any **No** answer immediately disqualifies the proposal. This evaluation will be done by the review committee.

Table 1: Qualification and Critical evaluation factors for non-SMME suppliers

Qualification Evaluation Factors	Yes	No
South African registered company		
Compliant Tax Status		
Valid B-BBEE Certificate (Level 1-8)		
Critical Evaluation Factors	Yes	No
Tier 0-3supplier		
Designing, manufacturing/integration of aeronautics, space and defence related systems		
Assistance to current SMME supplier base		

Table 2: Qualification and Critical evaluation factors for SMMEs

Qualification Evaluation Factors	Yes	No
South African registered company		
Compliant Tax Status		
Satisfies definition of a manufacturing SMME (as defined in Section 4)		
Valid B-BBEE Certificate (Level 1-8)		
Critical Evaluation Factors	Yes	No
Aeronautics, space and defence sector SMME		
Provision of engineering services that support the aerospace and defence industry		
Designing, supplying and/or manufacturing of aeronautics, space and defence related components to higher tier integrators locally or internationally		

10.1.2 Differentiation Evaluation Factors

The differentiation factors for the evaluation of all project proposals are shown in Table 3 for non-SMMEs and Table 4 for SMMEs. Each differentiation factor is assigned a score (maximum 10) which is then weighted according to the importance of the factor. Please note:

- A minimum total weighted score of **65** must be achieved. If this is not achieved the proposal will be disqualified.

Table 3: Differentiation Evaluation factors for assessing project proposals for non-SMME suppliers

Differentiation Factors	Score	Weight	Weighted Score
Factor Description	(/10)	(%)	
Experience in Aerospace Advanced manufacturing as an integrator or sub-system or component manufacturer (Number of years) More than 10 years (assigned score 10) 5 – 10 years (assigned score 8) Less than 5 years (assigned score 5)		10	
Percentage of black ownership in the business (Please provide proof e.g BBBEE certificate. If using an affidavit, ensure this information is included) ≥ 50% Black Ownership (assigned score 10) 1 – 49% Black Ownership (assigned score 7) No Black Ownership (assigned score 5)		25	
BBBEE Level 1-2 (assigned score 10) BBBEE Level 3-4 (assigned score 8) BBBEE Level 5-8 (assigned score 5) BBBEE Level Non-Compliant- Disqualified		20	
Design, manufacture or integration of sub-systems or components for South African and International aerospace OEMs, integrators or sub-systems suppliers. Manufacturing for: More than 5 integrators/sub-systems suppliers (assigned score 10) 3-5 integrators/sub-systems suppliers (assigned score 8) Less than 5 integrators/sub-systems suppliers (assigned score 5)		20	
Level of support for current SMME supplier base. Support for SMMEs: More than 5 SMMEs (assigned score 10) 3-5 SMMEs (assigned score 8) Less than 3 SMMEs (assigned score 5)		25	
Total		100	/100

Table 4: Differentiation Evaluation factors for assessing project proposals for SMMEs

Differentiation Factors	Score	Weight	Weighted Score
Factor Description	(/10)	(%)	
Aerospace or defence related manufacturing SMME in the advanced manufacturing sector (Number of years) More than 10 years (assigned score 10) 5 – 10 years (assigned score 8) Less than 5 years (assigned score 5)		10	
Percentage of black ownership in the business (Please provide proof e.g BBBEE certificate. If using an affidavit, ensure this information is included) ≥ 50% Black Ownership (assigned score 10) 1 – 49% Black Ownership (assigned score 7) No Black Ownership (assigned score 5)		30	
BBBEE Level 1-2 (assigned score 10) BBBEE Level 3-4 (assigned score 8) BBBEE Level 5-8 (assigned score 5) BBBEE Level Non-Compliant- Disqualified		30	
Design or manufacture of components for South African and International aerospace integrators/sub-systems suppliers and SMMEs. Supplying to: More than 5 higher tier entities or other SMMEs supplied (assigned score 10) 3-5 higher tier entities or other SMMEs supplied (assigned score 8) Less than 3 higher tier entities or SMMEs supplied (assigned score 5)		30	
Total		100	/100

10.2 Guidelines and Key Points

All South African aerospace and defence manufacturing companies (SMME/non-SMME) are invited to submit EoI proposals in support of this call. Please note the following:

- Complete the EoI proposal template ([Section 21 - EoI Proposal Templates](#)) for either SMMEs or Non-SMMEs and submit it with relevant documentation. (This is dependent on whether the applying organisation is an SMME or not based on Section 4)
- All submissions relevant documentation, data and information will be treated as confidential.

- The process of evaluating all submissions will be conducted in a fair and confidential manner.
- All technical experts in the review committee are also bound by an obligation of confidentiality.
- Only applications received before or on the due date will be considered for this call.
- Subject to the nature and scope of a project, a Project Manager from the AISI shall be the primary technical contact between the AISI and the recipient.

The applicant must prepare for a possible presentation should the AISI require such. The applicant will be notified thereof no later than 4 (four) days before the actual presentation date.

11 GENERAL TERMS

- a. AISI reserves the right not to engage further with the participants should the EoI not meet or address the AISI's needs.
- b. Email enquiries must be sent to Livison Mashoko - lmashoko@csir.co.za.
- c. Failure to comply will render your submission non-responsive and disqualified.
- d. Contact by any means whatsoever with AISI personnel is not permitted during the EoI process other than as required through existing service arrangements and/or as requested by the AISI as part of the EoI process.
- e. Any form of canvassing by an applicant to any member of staff or supplier, for purposes of influencing the process, will automatically disqualify the applicant from the evaluation process.
- f. Applicants shall not offer or give any consideration of any kind to any employee or representative of the AISI as an inducement or reward for doing, or refraining from doing, any act in relation to the obtaining or execution of this or any other contract with the AISI.
- g. The AISI will nominate the applicants' who's EoI are determined to be the most advantageous to the AISI, taking into consideration the technical suitability of the shortlisted participant.
- h. The AISI reserves the right to cancel this EoI, or not to appoint any participant should the business condition warrant such a move. This will be done in line with the spirit of PPPFA and its associated regulations.
- i. The term participant, applicant and SMME will be used interchangeably and must be read in context with the sentence in which they are used.

- j. The applicant accepts that the results of any analysis of their business will be shared with the AISI and that CSIR staff may be involved on-site as part of the audit teams in addition to independent audit staff.

12 MEDIUM OF COMMUNICATION

All documentation submitted in response to this EoI must be in English.

13 COST of EoI

Applicants are expected to fully acquaint themselves with the conditions, requirements and specifications of this EoI before submitting their EoI. Each applicant assumes all risks for resource commitment and expenses, direct or indirect, of proposal preparation and participation throughout the EoI process. The AISI is not responsible – directly or indirectly for any costs incurred by applicants in the preparation and submission of the EoI.

14 VALIDITY AND CORRECTNESS OF RESPONSES

The applicant confirms satisfaction regarding the correctness and validity of its proposal.

15 RESPONSIBILITY TO EXECUTE, AND FAILURE TO COMPLY

The successful applicant hereby accepts full responsibility for the proper execution and fulfilment of all obligations and conditions devolving on him/her under this EoI.

The respondent hereby offers to render all the services described in the attached document (if any) to the AISI on the terms and conditions and in accordance with the specifications stipulated in this EoI documents.

16 VERIFICATION OF DOCUMENTS

- a. Applicants should check the numbers of the pages to satisfy themselves that none are missing or duplicated. No liability will be accepted by the AISI in regard to anything arising from the fact that pages are missing or duplicated.
- b. Telegraphic and telefax submissions will not be accepted.

16.1 The AISI reserves the right to:

- a. Amend any EoI conditions, validity period, specifications, or extend the closing date and/or time of EoI before the closing date. All applicants, to whom the EoI documents have been issued, will be advised in writing of such amendments on time;
- b. Verify any information contained in an EoI;
- c. Request documentary proof regarding any EoI issue;
- d. Not appoint any applicant;
- e. Vary, alter, and/or amend the terms of this EoI, at any time prior to the finalisation of its adjudication hereof;
- f. Cancel or withdraw this EoI at any time, without attracting any liability;
- g. Cancel or withdraw from this EoI as a whole or in part without furnishing reasons and without attracting any liability; and
- h. Request an applicant to do a presentation to the technical review committee.

17 DISCLAIMERS

- The AISI has produced this EoI in good faith. However, the AISI, its agents and its servants do not warrant its accuracy or completeness. To the extent that the AISI is permitted by law, the AISI will not be liable for any claim whatsoever and howsoever arising (including, without limitation, any claim in contract, negligence or otherwise) for any incorrect or misleading information contained in this EoI due to any misinterpretation of this EoI.
- This EoI is a request for EoI only and not an offer document; answers to it must not be construed as acceptance of an offer or imply the existence of a contract between the parties.
- The AISI makes no representation, warranty, assurance, guarantee or endorsements to any applicant concerning the EoI, whether with regard to its accuracy, completeness or otherwise and the AISI shall have no liability towards the respondent or any other party in connection therewith.

18 EoI COMPLIANCE CHECK LIST

To be completed by the applicant:

- I/We hereby undertake to render services described in the attached EoI documents as and when requested to the AISI in accordance with the requirements stipulated in EoI Number: **001/13/05/22**.
- The following documents will be deemed to form and be read and construed as part of this EoI. The documents are:
 - EoI Terms of Reference
 - The response to the EoI
 - Declaration of Interest
 - EoI Templates ([Section 21 - EoI Proposal Templates](#))
- I/We confirm that I/we have satisfied myself/ourselves as to the correctness and validity of my/our EoI proposal and that the proposal cover all the services specified in the documents.
- I/We declare that I/we have no participation in any collusive practices with any other applicant or third party regarding this or any other EoI.
- I/we confirm that I/we am duly authorised to sign this document.

NAME (PRINT)

CAPACITY

SIGNATURE

NAME OF FIRM

DATE

WITNESSES	
1
2

19 DECLARATION OF CONFLICT OF INTEREST FORM (APPLICANT)

This declaration of interest must be completed and submitted with the Eol. Failure to do so may result in the elimination of the Applicant's Eol.

Declaration of Interest - AISI Eol Number: 001/13/05/22

Are any staff members, from your company involved in this Eol process, connected or have any relationship with anyone employed by the AISI/CSIR?

Yes		No	
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If yes, please state particulars:

Declaration of Conflict of Financial Interest - AISI Eol Number: 001/13/05/22

Is the integrator or sub-systems supplier/SMME receiving support for similar interventions from any other South African government department or international organisation?

Yes		No	
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If yes, please state particulars:

20 DECLARATION

I, _____ (THE UNDERSIGNED), DULY AUTHORISED, CERTIFY THAT THE INFORMATION FURNISHED IN THIS EoI IS CORRECT. I ACCEPT THAT THE CSIR MAY TAKE APPROPRIATE ACTIONS, DEEMED NECESSARY, SHOULD THIS DECLARATION PROVE TO BE FALSE.

Signature

Date

Position

Name of applicant

END OF EoI

21 EoI PROPOSAL TEMPLATES

- [Non-SMME Proposal Template](#)
- [SMME Proposal Template](#)

ANNEXURE A: TECHNOLOGY READINESS LEVELS

TRL 1 Basic principles observed and reported: Transition from scientific research to applied research. Essential characteristics and behaviours of systems and architectures. Descriptive tools are mathematical formulations or algorithms.

TRL 2 Technology concept and/or application formulated: Applied research. Theory and scientific principles are focused on specific application area to define the concept. Characteristics of the application are described. Analytical tools are developed for simulation or analysis of the application.

TRL 3 Analytical and experimental critical function and/or characteristic proof-of concept: Proof of concept validation. Active Research and Development (R&D) is initiated with analytical and laboratory studies. Demonstration of technical feasibility using breadboard or brass board implementations that are exercised with representative data.

TRL 4 Component/subsystem validation in laboratory environment: Standalone prototyping implementation and test. Integration of technology elements. Experiments with full-scale problems or data sets.

TRL 5 System/subsystem/component validation in relevant environment: Thorough testing of prototyping in representative environment. Basic technology elements integrated with reasonably realistic supporting elements. Prototyping implementations conform to target environment and interfaces.

TRL 6 System/subsystem model or prototyping demonstration in a relevant end-to-end environment (ground or space): Prototyping implementations on full-scale realistic problems. Partial integrated with existing systems. Limited documentation available. Engineering feasibility fully demonstrated in actual system application.

TRL 7 System prototyping demonstration in an operational environment (ground or space): System prototyping demonstration in operational environment. System is at or near scale of the operational system, with most functions available for demonstration and test. Well integrated with collateral and ancillary systems. Limited documentation available.

TRL 8 Actual system completed and "mission qualified" through test and demonstration in an operational environment (ground or space): End of system development. Fully integrated with operational hardware and software systems. Most user documentation, training documentation, and maintenance documentation completed. All functionality tested in simulated and operational scenarios. Verification and Validation (V&V) completed.

TRL 9 Actual system "mission proven" through successful mission operations (ground or space): Fully integrated with operational hardware/software systems. Actual system has been thoroughly demonstrated and tested in its operational environment. All documentation completed. Successful operational experience. Sustaining engineering support in place.