

**SPECIFICATION FOR THE APPOINTMENT OF A SUPPLIER FOR THE SUPPLY AND  
DELIVERY OF EO-SAT1 PAYLOAD**

**10583-05301-703**

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## Acronyms

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a. ADCS	Attitude Determination and Control System
b. AIT	Assembly, Integration & Testing
c. API	Application Programming Interface
d. PCB	Printed Circuit Board
e. BL	Baseline
f. C&DH	Command and Data Handling
g. CoC	Certificate of Conformance
h. COTS	Commercial Off the Shelf
i. COMMS	Communications System
j. CSD	Central Supplier Database
k. ECSS	European Cooperation for Space Standardization
l. FAR	Assembly, Integration & Testing
m. FDR	Flight Design Review
n. FM	Flight Model
o. FMDD	Flight Model Detail Design
p. FMR	Flight Model Review
q. FRR	Launch Campaign
r. HCD	Human Capital Development
s. ICD	Interface Control Database
t. LEOP	Launch and Early Operations
u. MC	Major Component of a Satellite
v. MedRes	Medium Resolution Camera
w. ORR	Operational Readiness Review (Commissioning)
x. PCDR	Payload Imager Solution Critical Design Review
y. PLAR	Post-Launch Early Operations
z. PLR	Post-Launch Support and Review
aa. PMO	Project Management Office
bb. QFM	Qualification & Flight Model
cc. RFI	Request for information.
dd. RFP	Request for Proposal
ee. SARS	South African Revenue Service
ff. SEE	Single Event Effect
gg. SEL	Single Event Latch-up
hh. SFMPOR	Satellite Flight Model Project Overview Review
ii. SCoP	Supplementary Conditions of Purpose
jj. SOC	State Owned Company, as defined by the Companies Act
kk. TBW	Total Bytes Written

ll. TID		Total Ionizing Dose
mm. TRL	TRL	Technology Readiness Level
nn. TRR		Payload Test Readiness Review
oo. V1		Version 1
pp. V2		Version 2
qq. V3		Version 3

## 1 Introduction

Denel SOC Ltd invites service providers / Suppliers to submit bid proposal/s, timeline and request for proposal to supply the EO-SAT1 Payload Imager solution that aligns as close as possible to the EO - SAT1 Imager Specifications and Mission Objectives within a specified time frame agreed to with the organisation.

### 1.1 Mission and Objectives

The Satellite Payload tabled must satisfy the mission objectives defined below:

- a. **The primary objective will be to help characterize the state and evolution of vegetation over selected land areas and to support a range of applications that critically depend on the availability of high-quality information (e.g. monitoring crops, managing forest resources, contributing to the establishment of detailed land cover maps).**
- b. **The EO-SAT1 Payload is also expected to significantly support secondary objectives such as helping to monitor water and air quality, surveying natural resources, monitoring the built environment and in particular human settlements, as well as managing disasters.**
- c. **Enabling objectives are anticipated to include the calibration of the sensors, the validation of intermediary and final products, and minimizing the impact of atmospheric processes such as absorption and scattering by gases, clouds and aerosols on the final products.**

### 1.2 The purpose of this RFP document

- a. **Provide costing and timeline for the manufacturing, assembly, testing and supply of the Imager Payload that aligns with the EO-SAT1 Specification or as close as possible to it. Any deviation from the specification must be stated tabular format.**
- b. **Provide a detailed Statement of Work for the Imager Payload Solution.**
- c. **Complete the manufacture of the Imager Payload Solution and include the lead time from the placement of order.**
- d. **State if the payload solution has heritage and has a TRL9 qualification (Refer to Section 19 - Annexure C: Technology Readiness Levels for TRL definitions).**
- e. **State if the Payload solution includes the mechanical housing to handle the thermal requirements in-orbit during image capture.**
- f. **Provide the reliability data for the payload solution including full operation for a minimum of 5yrs.**
- g. **Design the Optical Bench to calibrate and align the camera solution (if required).**
- h. **Detail the storage, transport and handling requirements of the payload solution.**
- i. **Deliver the requisite data pack and CoC with the Imager Payload Solution.**
- j. **Include the requisite test software, manuals and all test documentation of Imager Payload solution.**
- k. **Provide a preliminary payload ICD Datapack with the Supplier's Bid response (as aligned to the Supplier's tailored ECSS Standard).**

## 2 Programme Costing

### 2.1 PRICE BREAK DOWN

#### 2.1.1 Imager Payloads

The Supplier is required to quote on the following a camera solution that aligns as close as possible to the EO-SAT1 Imager specifications defined in Section 17 Annexure B.

#### 2.1.2 Cost Structure

The cost structure can align with the project lifecycle for the production of the FM Imager Payload solution in accordance with program priorities similar to Table 1 below

Item	Description	Timeline (in Months)	Cost (inc VAT)
1	IMAGER FLIGHT MODEL DELIVERY AND COMMISSIONING:		
1.1	Imager Flight Model Overview Review – IFMOR		
1.2	Imager Flight Model Detail Design – IFMDR		
1.3	Imager Fabrication, Qualification – IFMR		
1.4	Imager Assembly, Testing and Delivery – IFAR		

**Table 1: Payload Imager Flight Model Lifecycle & Costing**

#### Notes:

- a. During the Imager Payload Project Overview Review, the supplier is required to deliver documentation aligned with this Phase Review. Refer to Table 3, 4 and Annexure A for expected documentation deliverables.
- b. The above includes all the necessary documentation for sign-off over each phase of the Imager Payload review.
- c. Detailed timeline from T0 start of the project to completion of the imager payload(s).
- d. Provide the Statement of Work & deliverable details.
- e. Detailed specification of each Imager Payload, operational heritage (in yrs), radiation tolerance level (TID [kRad] / SEL/SEE [MeV-cm<sup>2</sup>/mg]) and manufacturing source (where applicable).
- f. Payload image capture and storage specifications.
- g. Supplied documentation during each review process and sign-off. Refer to Table 3, 4 and 6.
- h. Details of local suppliers' interface to the Imager Payload manufacturing.

## 2.2 Pricing Requirements

The supplier's response must include:

- a. **Technical Proposal:** A detailed description of the proposed design, technology, and approach to meet the requirements.
- b. **Management Proposal:** Project organization, key personnel, risk management plan, and quality assurance plan.
- c. **Cost Proposal:** A fixed-price quotation (including VAT) for the entire scope, with a detailed breakdown.
- d. **Schedule Proposal:** A detailed project schedule, compliant with the phased milestone approach (tailored ECSS Standard).

## 3 Localization

One of the key objectives for the EO-SAT1 Imager Payload build is local supplier participation. In order to fulfil this obligation, the Supplier is required to complete the table below for each deliverable option defined in Section 3:

No	Local Company	Products/Services supplied	% participation	Cost (Rands Inc VAT)
1	(List all other companies)			
2				

**Table 2: Local Participation and Cost Distribution**

### Notes:

1. Include all local suppliers including smaller participants.
2. Specify what each supplier will provide (all products and/or services).
3. Suppliers must ensure that the majority of the MC (PCB Assembly Level), Testing and Payload Integration takes place locally either at their own facilities or at a local supplier.
4. Suppliers may also include existing experts of the EO-SAT1 Project at Denel (where possible). Key areas are: Satellite Mechanical Design, RF Design/Testing and Software Engineering (Mission Control Flight Software).

## 4 Programme Deliverable Details

### 4.1 Scope of Work

- a. Description of the Supplier's Imager Payload(s) is/are aligned as close as possible to the EO-SAT1 specifications.
- b. Requirements for the Imager Payload(s), manufacturing, testing, and support.
- c. Details of payload(s) and all interface requirements to a Satellite Framework, and ground segment requirements.
- d. Intended applications of the Imager payload solution (e.g., environmental monitoring, urban planning, disaster response) and operational goals (e.g., global coverage, frequent revisits).
- e. Warranty and reliability of the product (heritage data and/or TRL9).
- f. Optional: Cost and timeline of Payload Integration Support (if Denel requires this service).
- g. Additional info as deemed necessary aligning with the Supplier's tailored ECSS Standard.

### 4.2 Documentation

The supplier shall be responsible for the end-to-end delivery of the flight-ready Payload Imager Solution.

The scope includes, but is not limited to:

- a. **Phase A:** PDR (N/A – since it is already at TRL9)
- b. **Phase B:** Detailed Design
- c. **Phase C:** Manufacturing
- d. **Phase D:** Assembly and Testing
- e. **Phase E:** Final Data and Documentation Handover
- f. **Phase F:** Integration Support (Optional quote)
- g. **Phase G:** Support to Launch Campaign and In-Orbit Commissioning (Optional quote)

### 4.3 Payload Technical Specifications

The applicable Supplier shall define their Imager Payload specifications and highlight difference from the original specifications defined in Section 17: Annexure B. Below are the expected specification detail that should be provided for the Imager Payloads(s).

#### 4.3.1 Nominal Payload Imager(s) Orbit Specifications (most suitable based on heritage)

- a. Altitude, inclination, and any orbital tolerances.
- b. Altitude and inclination.

- c. Desired revisit time or frequency of imaging.

#### **4.3.2 Payload Imager(s) Specifications**

- a. **Sensor Type: Optical, hyperspectral, or multispectral.**
- b. **Sensor Radiation level (Heavy Ions, TID and SEL).**
- c. **Spatial Resolution: Required ground sampling distance (GSD), typically in meters.**
- d. **Spectral Bands: Specific bands (e.g., visible, near-infrared, thermal) and their resolution.**
- e. **Swath Width: Required width of coverage per image.**
- f. **Data Rate and Volume: Expected data generation rate and storage requirements.**
- g. **SNR for each band of the payload imager(s).**
- h. **ADCS Requirements for imager capture stability.**
- i. **Optimal thermal operating conditions.**

#### **4.3.3 Payload Imager(s) Operational Specifications**

- a. **Imaging modes (e.g., spot, strip, or area mode).**
- b. **Revisit frequency and coverage area.**
- c. **Mission Lifespan (Min 5yrs) for both the Imager Payload and the Qualified Satellite Framework.**

#### **4.3.4 Reliability & Redundancy**

The supplier is required to provide details on the reliability of the Payload Imager(s). A tailored ECSS reliability framework is also acceptable.

Specify how reliability architecture is used on the Imager Payload(s). Below is the framework that should be considered:

- a. Image Sensor Reliability (expected dead pixels over its lifespan)
- b. Electronic circuit redundancy
- c. Mitigation strategies used
- d. Flash storage reliability (TBW)
- e. Component operational temperature range (which are used: Commercial, Industrial, Military, Automotive, etc)

#### **4.3.5 Payload ADCS Requirements**

The supplier shall provide the ADCS requirements for the Imaging solution to ensure that Payload Solution will maintain reliable data capture in-orbit. Below is the example template that could be used.

No	Description	Parameter
1	Mode 1: Nadir Staring (Standard Imaging)	
1.1	Jitter (arcseconds)	
1.2	Drift Rate (arcsec/sec)	
2	Mode 2: Multi-Spectral Imaging	
2.1	Jitter (arcseconds)	
2.2	Drift Rate (arcsec/sec)	
3	Mode 3: Agile Pointing / Along-Track Stereo	
3.1	Slew Rate (deg/sec)	
3.2	Settling Time (sec)	
3.3	Retargeting Accuracy	
4	Mode 4: Off-Nadir / Target Mode	
4.1	Absolute Pointing Error	
4.2	Jitter (arcseconds)	
4.3	Drift Rate (arcsec/sec)	
5	(List other essential parameters)	

**Table 3: Payload ADCS Requirements**

#### 4.3.6 Design and Development Requirements

- a. Expected milestones and deliverables (Qualified Payload Imager Flight Model Project Overview Review, Flight Model Design Detail, Critical Design Review, etc.).
- b. Payload Imager Environmental testing requirements (e.g., thermal vacuum, vibration).
- c. Quality standards used (e.g., ISO, ECSS standards (tailored)).

#### 4.3.7 Ground Segment Support Services for the Payload Imager Solution (optional)

- a. Ground Control System: Details on Control Centre requirements, interfaces, and compatibility with existing ground stations (based on previous heritage satellite data).
- b. Data Processing and Management: Data handling, storage, and processing needs, including server integration if required.
- c. Training and Support: Specify the training, documentation, and operational support needs for ground staff.

## 5 Mandatory Requirements

The following documents must be submitted together with the bid proposal:

- rr. Adherence to national and international space standards (ECSS or EN9100, etc).
- ss. Payload Imager EMC Compliance.
- tt. Environmental standards for payload imager manufacturing.
- uu. Heritage information on the payload imager solution in satellites on launches vehicles.
- vv. List conformance to ECSS (tailored) or other standards.
- ww. Company profile demonstrating experience and capabilities to deliver on the bid requirements.
- xx. Three contactable references on a company letterhead and signed be provided, in similar services indicating:
  - i. Name of the client/s
  - ii. Contract period and Payloads/MCs supplied
  - iii. Contact details and e-mail address
- yy. A compulsory briefing session with the Supplier. Failure to attend the briefing session will disqualify the bid proposal.

Join Zoom Meeting

<https://us02web.zoom.us/j/85935935173?pwd=YTmdE3sgyTXWnbCTETyCmfsoK3inJ.1>

Meeting ID: 859 3593 5173

Passcode: 931947

### Notes:

- zz. The payload imager solution shall be a COTS Major Component and does not require an NCACR permit.

**N.B:** Failure to submit all the above documents will lead to disqualification of your bid proposal.

## 6 Cost and Payment Terms

- a. Term and conditions.
- b. Payment milestones tied to project phases. List the cost and payment terms for the Payload Imager solution.

### 6.1 Project Schedule and Timeline

- a. Expected project timeline from contract signing to payload imager solution and delivery.
- b. Key milestones and review phases (CDR, QFM, FAR, etc.) [where applicable]. Suppliers can define their milestones if different but aligned with the ECSS Standard.

### 6.2 Legal and Contractual Terms

- a. Intellectual property rights and data rights.**
- b. Liability, indemnity, and risk management.**
- c. Confidentiality requirements.**
- d. Adhere to the conditions of the bid specifications as defined in the document.**
- e. Acceptance to all decisions made by Denel on this bid.**

## **7 Minimal Documentation for Each Review Phase (Payload Imagers)**

Refer to the Table 3, 4 and Section 16: Annexure A which serves as a template for details on the documentation required for this Programme. Suppliers can base their deliverable documentation on this template or customise it as long as they supply the minimum document requirements approved by the Client.

**Note:** *A Preliminary payload ICD Datapack shall be supplied with the Supplier's Bid response (as aligned to the Supplier's tailored ECSS Standard).*

### **7.1 Qualified Payload Imager Flight Model Project Overview Review**

- a. **Payload System Requirements Document (SRD):** High-level mission requirements that the payload solution adheres to.
- b. **Concept of Operations (ConOps):** Describes how the payload solution will operate in the satellite.
- c. **Preliminary Mission Analysis (Heritage data from payload operational in other satellites):** Orbital parameters, launch requirements, mission duration.
- d. **Risk Management Plan:** Initial identification of mission risks.
- e. **Interface Control Document (ICD):** Details of interfaces between the payload solution and a Satellite platform.
- f. **Preliminary Test Plan:** Initial test plan for verifying design compliance.
- g. **Risk Assessment Update:** Update of risk management with mitigations.

### **7.2 Payload Imager Solution Critical Design Review (PCDR)**

- a. **Detailed Design Document:** Comprehensive design for the payload solution.
- b. **Final Interface Control Document (ICD):** Fully defined payload solution interfaces.
- c. **Manufacturing and Test Plans:** Detailed plans for manufacturing, integration, and testing of the payload solution.
- d. **Qualification and Acceptance Test Plans:** Finalized tests for payload system verification.
- e. **Updated Risk Management Report:** Current risks and resolutions.

### **7.3 Payload Test Readiness Review (PTRR)**

- a. **Payload Test Procedures and Scripts:** Detailed steps for executing payload tests.
- b. **Payload Test Readiness Report:** Confirms the system is ready for testing.
- c. **Compliance Matrix:** Shows compliance with EO-SAT1 requirements.
- d. **Risk Management Update:** Review and update of risks before testing.

### **7.4 Payload Flight Readiness Review (PFRR)**

- a. **Flight Operations Manual:** Procedures for operating the Imager Payload solution in orbit.

- b. **Final Test Report: Results from all qualification and acceptance tests.**
- c. **Min Integration Support Plan: Details of the Supplier Support Plan including support hours for integrating the Supplier Payload Imager(s) into a Qualified Satellite.**
- d. **Final Risk Assessment: Assessment of any remaining risks before launch.**

## **7.5 Post-Launch Support and Review (PLR) – Payload Imager Solution**

- a. **State support hours to complete the Post-Launch Review.**
- b. **Initial Operations Report: Overview of satellite performance immediately after launch.**
- c. **Post-Launch Analysis: Any deviations or issues during launch and early orbit phase.**
- d. **Lessons Learned: Summary of any issues encountered and how they were resolved.**

### **Notes:**

- a. **Each phase's documentation is intended to ensure the payload solution meets the mission requirements and passes through rigorous checks to mitigate risks before launch.**
- b. **The above phases serve as the template for the Supplier RFP. It can be tailored according to the ECSS Standard if required.**

## 8 Formal Review Deliverables

### 8.1 Formal Review Deliverables for the Payload Imager Solution

The summarized table below can serve as a template (tailored from the ECSS Standard) for the formal review deliverable documentation required for the EO-SAT1 Payload Solution build.

No	Product/MC	CDR	QR	FAR
1	Payload Imager Product Specification	BL		
2	Qualification Test Procedure (MC)	V1	BL	
3	Qualification Test Report (MC)		BL	
4	Acceptance Test Procedure (Integrated) <sup>1</sup>		V1	BL
5	Acceptance Test Report (Integrated)			BL
6	Payload Assembly instructions (to Satellite)	V1	BL	
7	User manual	V1	BL	
8	SW Test Programs / Tutorials / Drivers <sup>2</sup>	V1	V2	BL
9	Build history		BL	
10	Calibration Procedure and Results <sup>3</sup>		V1	BL
11	CoC <sup>4</sup>			BL

**Table 4: Summarized Review Deliverables for the Payload Imager Solution**

#### Notes:

- a. <sup>1</sup> Acceptance Test Procedures (Integrated) is valid if Denel requests Payload Integration Support Activities into a Satellite.
- b. <sup>2</sup> Payload Solution requires additional documentation, software drivers, and program examples to communicate with generic Satellite framework onboard CPU and OS. Software driver support is required for standard Windows 11, Embedded Linux and other common Satellite OBC OS's. The Supplier is required to list what drivers are available.
- c. <sup>3</sup> Payload calibration procedure documentation and software (testbed and in-orbit) shall be supplied.
- d. <sup>4</sup> CoCs shall be accompanied for each imager with Test Procedures and Test Results as objective evidence.
- e. Refer to Section 16: Annexure A for a more detailed breakdown of the requisite deliverable documentation required for each phase review.

## **9 Administrative Bid Requirements**

- a. SARS Tax Pin.
- b. Completed and signed SCM compliance documents.
- c. Updated and valid certified copy of the B-BBEE certificate (or an original affidavit signed by a Commissioner of Oaths regarding the B-BBEE status).
- d. CSD registration summary report indicating your Master Registration Number (CSD supplier number).
- e. Supplier Declaration Form: Unethical Relationships.
- f. Supplier Declaration Form: POPI.
- g. Completed SBD1 document.
- h. SCoP (Supplementary Conditions of Purpose).
- i. Certified ID Copies of all directors.

## **10 Terms and Conditions**

- a. All costs and expenses incurred by the potential service providers relating to their project proposal will be borne by the respective service provider. DENEL is not liable to pay such costs and expenses or to reimburse or compensate service providers in the process under any circumstances, including the rejection of any proposal or the cancellation of this project.
- b. DENEL reserves the right to request new or additional information regarding each bidder and any individual or other persons associated with its proposal.
- c. DENEL may require responsive bidders to present and discuss their proposals in person.
- d. DENEL reserves the right not to make any appointment from the proposals submitted.
- e. Bidders shall not issue any press release or other public announcement pertaining to details of their project proposal without the prior written approval of DENEL.
- f. Bidders are required to declare any conflict of interest they may have in the transaction for which the bid is submitted or any other potential conflict of interest. It is compulsory that bidders declare their conflict of interest through completion of the relevant attached forms.
- g. DENEL reserves the right to not give any further consideration to any bid where such a conflict of interest exists or where such potential conflict of interest may arise.
- h. Any and all project proposals shall become the property of DENEL and shall not be returned.
- i. The bid offers and proposals should be valid and open for acceptance by DENEL for a period of 120 days from the date of submission.
- j. Bidders are advised that submission of a proposal gives rise to no contractual obligations on the part of DENEL.
- k. DENEL reserves the right not to award the bid to the bidder that scores the highest points.
- l. Disputes that may arise between DENEL and a bidder must be settled by means of mutual consultation, mediation (with or without legal representation) or, when unsuccessful, in a South African court of law.

- m. In addition to adherence to the specific terms and conditions of proposals as provided in this document, the bidder shall be bound by the provisions of the General Conditions of Contract attached hereto, an original signed copy of which must be submitted together with all other bid documentation.
- n. All returnable bid documents must be completed in full and submitted together with the bidder's proposal. Should the returnable documents not be completed, the bid will not be considered any further.
- o. The successful bidder will be subject to the supplier clearance process as prescribed by the DENEL. This process includes the verification of a supplier and its shareholders/directors/members' status on the list of defaulters and restricted suppliers.
- p. After the successful service provider has received the purchase order, they must be able to deliver in full compliance with South African approved standards and in compliance to the specifications provided.

The proposal must include a company profile/ organization profile, comprising a description of the organization of the bidder, its primary business activity, client management etc, including at least three references from companies, to whom the service provider has supplied the same service. **Failure to submit these documents will disqualify your bid proposal.**

## 11 Conditions of the bid

### 11.1 Preamble: No Obligation to Award

This bid requirement is an invitation for the submission of offers and does not, in any way, constitute a tender or a binding offer by Denel (hereinafter "the Company") to purchase any goods or services. The Company is not obligated to accept the lowest-priced quotation, any quotation, or to proceed with the procurement process described herein. The Company reserves the absolute right to:

- a. Cancel this bid process at any time and for any reason, without incurring any liability towards any Supplier.
- b. Reject any and all quotations received, in whole or in part.
- c. Suspend, delay, or modify the procurement process.
- d. Negotiate with any one or more Suppliers, or with no Suppliers at all.

### 11.2 Non-Binding and Indemnity

The submission of a quotation by a Supplier (hereinafter "the Bidder") shall not create any contract, agreement, or legitimate expectation between the Bidder and the Company, unless and until a formal written contract is executed by both parties. By submitting a quotation, the Bidder expressly agrees to indemnify and hold harmless the Company, its directors, employees, and agents from and against any and all claims, losses, damages, costs (including legal costs on an attorney-client scale), and expenses arising from or in connection with the Bidder's participation in this RFP process, including but not limited to any

claim arising from the announcement of a preferred supplier or the ultimate award, or non-award, of any contract.

### **11.3 Announcement of Preferred Supplier & No Grounds for Litigation**

The announcement of a "preferred supplier" or "successful bidder" is a preliminary step in the process and is not a final award of a contract. It signifies the Company's intention to potentially enter into further negotiations with that party, leading towards a formal contract. Such an announcement is made without prejudice and creates no legally enforceable rights for the preferred supplier until a final written agreement is signed.

Bidders expressly acknowledge and agree that they shall have no cause of action, and hereby waive any right to institute any legal proceedings (including, but not limited to, review proceedings in terms of the Promotion of Administrative Justice Act (PAJA), No. 3 of 2000, or any application for interdictory relief) against the Company arising from:

- a. **The evaluation of quotations.**
- b. **The scoring and ranking of Bidders.**
- c. **The announcement of a preferred supplier.**
- d. **The disqualification of any Bidder.**
- e. **Any alleged deviation from the evaluation criteria set out in this RFP.**
- f. **The ultimate decision to award or not to award a contract to any party.**

### **11.4 Process and Evaluation Criteria**

The Company will evaluate quotations based on the pre-determined criteria outlined in this RFP document, which may include price, Broad-Based Black Economic Empowerment (B-BBEE) status, functionality, technical capability, and financial stability. The Company's decision in this regard is final. Bidders accept that the evaluation process involves a degree of commercial judgment and discretion on the part of the Company, and they waive any right to challenge the exercise of that discretion, provided it was not exercised in a manner tainted by corruption or fraud.

### **11.5 Costs of Participation**

Bidders participate in this bid request process entirely at their own cost. The Company will not be liable for any costs, expenses, or losses incurred by any Bidder in the preparation and submission of their quotation, or in any subsequent negotiations or clarifications, regardless of the outcome of the process.

### **11.6 Entire Understanding**

This bid request document, together with any formal written clarifications issued by the Company, constitutes the entire understanding between the parties regarding the subject matter hereof and

supersedes all prior discussions, representations, and agreements. No representation, warranty, or undertaking not explicitly contained herein shall be binding on the Company.

### 11.7 Governing Law and Jurisdiction

This bid request process and any non-contractual obligations arising from or in connection with it are governed by and shall be construed in accordance with the laws of the Republic of South Africa. The Bidder irrevocably agrees that the courts of South Africa shall have exclusive jurisdiction to settle any dispute which may arise out of or in connection with this bid request process, subject to the Bidder's prior waiver of the right to litigate as set out in Clause 3.

### 11.8 Supplier Acceptance

By submitting a quotation in response to this bid request, the Bidder is deemed to have read, understood, and unconditionally accepted all the terms and conditions set out in this disclaimer, without qualification or exception.

## 12 Evaluation Criteria

### 12.1 Phase approach

All proposal offers received shall be evaluated based on the following phase out approach:

- a. **Phase one: Compliance to the administrative requirements.**
- b. **Phase Two: Compliance to the mandatory requirements.**
- c. **Phase Three: Compliance to the Technical Functionality evaluation criteria.**
- d. **Phase Four: Price evaluation and specific goals.**

**NOTE:** The bidder must qualify at each stage to be eligible to proceed to the next stage of the evaluation.

### 12.2 Technical Evaluation Criteria

No	Criteria	Weight
1	Supplier Experience – 1-5yrs min space payload design experience (TRL9) in the industry.	10
2	Proven relevant track record/experience in Space Payload Design & Supply at TRL9 (Operational in Satellites proof)	20
3	Localization - Supplier source components and payload assembly	20
4	Payload Spec alignment to original EO-SAT1 Specs	25
5	Cost and Lead Times	25
	<b>Total Points</b>	<b>100</b>

**Note:** A minimum of 75 points is required to go through to the next phase.

### 12.3 Supplier Experience

<b>Detailed Functionality Evaluation Criteria:</b>		<b>Weighting Allocated</b>
<b>1. Supplier Experience</b>		
<p>History of supplier designing, testing and delivering Space Payloads and Major Components for 1-5yrs.</p> <p>Contact person (Company Experience and Project Team Experience) who is knowledgeable of the supplied payload(s) is supplied with the contact telephone number, cell phone number and e-mail address.</p> <p>Evaluate Company and Project Team Experience.</p>		
<p>10 Points to be allocated to a bidder who can provide proof designing payloads for more than 5 years and is at TRL9. Payloads that were offered and supplied spanning 5 years and proof of design.</p> <p>1 x locally designed payload &gt; 5yrs and active in space for 3yrs = 9pts</p> <p>Contactable Person Specified – 1 Pt</p>	10	10
<p>7-9 Points to be allocated to a bidder who can provide proof designing payloads for more than 3 years. Payloads that were offered and supplied spanning 4 years and proof of design.</p> <p><b>Evaluation Matrix:</b></p> <p>1 x locally designed payload &gt; 4yrs &amp; operational in space 1yr = 8pts</p> <p>1 x locally designed payload &gt; 3yrs &amp; operational in space 1yr = 7pts</p> <p>1 x locally designed payload &gt; 2yrs &amp; operational in space 1yr = 6pts</p> <p>Contactable Person Specified – 1 Pt</p> <p><b>Range: 7-9</b></p>	7-9	
<p>5 Points to be allocated to a bidder who can provide proof designing payloads for more than 1 years. Payloads that were offered and supplied spanning 1 year and proof of design.</p> <p><b>Evaluation Matrix:</b></p> <p>1 x locally designed payload &gt; 1yr = 4pts + proof of operation in space + 1 = 5</p> <p>Contactable Person Specified – 1 Pt</p> <p><b>Range: 4-6</b></p>	5	

<p>3 Points to be allocated to a bidder who can provide proof designing payloads for more than 1 years. Payloads that were offered and supplied spanning 1 year and proof of design.</p> <p><b>Evaluation Matrix:</b></p> <p>1 x locally designed payload &gt; 1yr = 3pts + proof of operation in space + 1 = 4</p> <p>Contactable Person Specified – 1 Pt</p> <p><b>Range: 3-5</b></p>	3	
<p>2 Points to be allocated to a bidder who can provide proof designing payloads for less than 1 year. Payloads that were offered and supplied spanning less than 1 year and proof of design.</p> <p><b>Evaluation Matrix:</b></p> <p>1 x locally designed payload &lt; 1yr = 1pts + proof of operation in space + 1 = 2</p> <p><b>Range: 1-2</b></p>	2	

## 12.4 Proven relevant track record/experience in Space Payload Design

<p><b>Detailed Functionality Evaluation Criteria:</b></p> <p><b>2. Proven relevant track record/experience</b></p>	<p><b>Weighting Allocated</b></p>	
<p>History of supply and delivering Space Payloads and Major Components to other companies. Supplier has their own satellite payload/major component assembly, integration and test facilities. The awarding of this bid is subject to the sound-related profile of the bidder. To this end, the bidder is to provide contactable (e-mail or phone/fax), letters of recommendation of clients to which they supplied satellite payloads and/or Major Components to. The letter must be from the client and has to include the following information: Name of the business (client’s company location and the payload(s) supplied).</p> <p>Contact person who is knowledgeable of the supplied payload(s) that was done with the contact telephone number, cell phone number and e-mail address.</p>		
<p>20 Points to be allocated to a bidder who can provide 5 contactable (e-mail or phone/fax) and letters of recommendation of clients to which they supplied payload that was designed, assembled and tested at the supplier’s premises and it is active in a satellite. Sample Imagery verifying its performance from the payload in a satellite must be supplied.</p> <p><b>Evaluation Matrix:</b></p> <p>5 Contactable References = 10 (2 points each)</p>	20	

5 Letters of Recommendation = 5 (1 points each) 5 Sample imagery from Satellites = 5 (1 points each)		20
16 Points to be allocated to a bidder who can provide 4 contactable (e-mail or phone/fax) Letters of recommendation of clients to which they supplied payloads/Major Components designed, assembled and tested at the supplier's premises. <b>Evaluation Matrix:</b> 4 Contactable References = 8 (2 points each) 4 Letters of Recommendation = 4 (1 points each) 4 Sample imagery from Satellites = 4 (1 points each)	16	
12 Points to be allocated to a bidder who can provide 3 contactable (e-mail or phone/fax) Letters of recommendation of clients to which they supplied payloads designed, assembled and tested at the supplier's premises. <b>Evaluation Matrix:</b> 3 Contactable References = 6 (2 points each) 3 Letters of Recommendation = 3 (1 points each) 3 Sample imagery from Satellites = 3 (1 points each)	12	
8 Points to be allocated to a bidder who can provide 2 contactable (e-mail or phone/fax) Letters of recommendation of clients to which they supplied payloads designed, assembled and tested at the supplier's premises. <b>Evaluation Matrix:</b> 2 Contactable References = 4 (2 points each) 2 Letters of Recommendation = 2 (1 points each) 2 Sample imagery from Satellites = 2 (1 points each)	8	
0 Points to be allocated to a bidder who cannot provide contactable references and letters of recommendation of clients to which they supplied payloads designed, assembled and tested at the supplier's premises.	0	

### 12.5 Localization - Supplier source components and payload assembly

Detailed Functionality Evaluation Criteria:	Weighting Allocated
3. Localization	

The Payload Supplier is required to prove that most of the components are sourced and/or manufactured locally. These include but not limited to electronic components, PCBs, board assemblies, housings, harness, etc.

The bidder is required to provide contactable (e-mail or phone/fax) of suppliers used during the past 5 years or more on a continuous basis.

Also provide letters of acknowledgement from the suppliers summarizing the number of years served as a provider and the components or services they provided.

<p>20 Points to be allocated to a bidder who can provide 5 contactable (e-mail or phone/fax) and letters from Suppliers used during the past 5 years or more on a continuous basis.</p> <p><b>Evaluation Matrix:</b></p> <p>5 Contactable References = 10 (2 points each)</p> <p>5 letters of acknowledgement from the suppliers = 10 (2 points each)</p>	20	20
<p>16 Points to be allocated to a bidder who can provide 4 contactable (e-mail or phone/fax) and letters from Suppliers used during the past 5 years or more on a continuous basis.</p> <p><b>Evaluation Matrix:</b></p> <p>4 Contactable References = 8 (2 points each)</p> <p>4 letters of acknowledgement from the suppliers = 8 (2 points each)</p>	16	
<p>12 Points to be allocated to a bidder who can provide 3 contactable (e-mail or phone/fax) and letters from Suppliers used during the past 5 years or more on a continuous basis.</p> <p><b>Evaluation Matrix:</b></p> <p>3 Contactable References = 6 (2 points each)</p> <p>3 Letters from Suppliers = 6 (2 points each)</p>	12	
<p>8 Points to be allocated to a bidder who can provide 2 contactable (e-mail or phone/fax) and letters from Suppliers used during the past 5 years or more on a continuous basis.</p> <p><b>Evaluation Matrix:</b></p> <p>2 Contactable References = 4 (2 points each)</p> <p>2 Letters from Suppliers = 4 (2 points each)</p>	8	

<p>4 Points to be allocated to a bidder who can provide 1 contactable (e-mail or phone/fax) and letters from Suppliers used during the past 5 years or more on a continuous basis.</p> <p><b>Evaluation Matrix:</b></p> <p>1 Contactable References = 1 (2 points each)</p> <p>1 Letters from Suppliers = 1 (2 points each)</p>	4	
<p>0 Points to be allocated to a bidder who cannot provide contactable (e-mail or phone/fax) and letters from Suppliers used during the past 5 years or more on a continuous basis.</p>	0	

## 12.6 Payload Spec alignment to original EO-SAT1 Specs

Detailed Functionality Evaluation Criteria:	Weighting Allocated	
<p style="text-align: center;"><b>4. Payload Spec alignment to original EO-SAT1 Specs</b></p> <p><b>Description:</b></p> <p>The Payload Supplier is required to provide a Payload that aligns as close as possible or better to the EO-SAT1 specification and preferably at TRL9 (Space heritage). Proof imagery is required for TRL 9.</p> <p>Refer to the Table 5: Payload Imager Specification Alignment below.</p>		
<p>25 Points to be allocated to a bidder who aligns the spec according to the scale defined below. Max 100% of the original specification (or better) and all the spectral bands and GSD are met.</p> <p>The Payload is at TRL 9 (space heritage) and proof is provided.</p> <p><b>Evaluation Matrix:</b></p> <ol style="list-style-type: none"> <li>1. <b>Table 5: No 1 – 14 all align = 14 (Each Item non-alignment, subtract 1 point)</b></li> <li>2. <b>Table 5: No 15: 10 = 100%. (Apportion range 0-100% = 0-10 points)</b></li> <li>3. <b>1 Sample imagery from payload from an operational satellite = 1. Min: 1 image required</b></li> </ol> <p>Max: 25.</p>	25	25
<p>24 Points to be allocated to a bidder to be allocated to a bidder who aligns the spec according to the scale defined below.</p> <p>The Payload is at TRL 9 (space heritage) and proof is provided.</p> <p><b>Evaluation Matrix:</b></p>	24	

<p>Table 5: No 1 – 14 all align = 14 (Each Item non-alignment, subtract 1 point)</p> <p>Table 5: No 15: 9 = 90%. (Apportion range 0-100% = 0-10 points)</p> <p>1 Sample imagery from payload from an operational satellite = 1. Min: 1 image required.</p> <p>Max: 24.</p>		
<p>23 Points to be allocated to a bidder to be allocated to a bidder who aligns the spec according to the scale defined below.</p> <p>The Payload is at TRL 9 (space heritage) and proof is provided.</p> <p><b>Evaluation Matrix:</b></p> <p>Table 5: No 1 – 14 all align = 14 (Each Item non-alignment, subtract 1 point)</p> <p>Table 5: No 15: 8 = 80%. (Apportion range 0-100% = 0-10 points)</p> <p>1 Sample imagery from payload from an operational satellite = 1. Min: 1 image required.</p> <p>Max: 23.</p>	23	
<p>22 Points to be allocated to a bidder to be allocated to a bidder who aligns the spec according to the scale defined below.</p> <p><b>Evaluation Matrix:</b></p> <p>Table 5: No 1 – 14 all align = 14 (Each Item non-alignment, subtract 1 point).</p> <p>Table 5: No 15: 7 = 70%. (Apportion range 0-100% = 0-10 points)</p> <p>1 Sample imagery from payload from an operational satellite = 2 (1 point each). Min: 1 image required</p> <p>Max: 22.</p>	22	
<p>0 Points to be allocated to a bidder who cannot meet the EO-SAT1 specifications in Table 5: Line Item 1 - 14.</p> <p>These are critical min specifications parameters that must be met.</p>	0	

### 12.6.1 EO-SAT1 Payload Imager Specification Alignment

No	Characteristic	Value / Description					Pre-req	Comply?
1	Optical Configuration	Astrograph or equivalent					Required	
2	Focal plane	Flat focal plane containing four sensors: 4 x 7 Band Linear TDI sensors or similar setup achieving the desired bands.					Required	
3	Spectral bands	7 spectral bands or better					Required	
4	Swath	30km (700km orbit) or 22km (500km orbit)					Required	
5	Pan Band	P1 = 480nm – 690nm or better					Required	
	MS Bands	Band	$\lambda$ c (nm)	Required	HiRes GSD	MedRes GSD	Required	
6	MS Bands	Deep Blue	425	Required (or better)	10m	60m		
		Blue	490		10m	60m		
		Green	560		10m	60m		
		Yellow	605		10m	60m		
		Red	660		2.5m	15m		
		Red Edge-1	703		2.5m	15m		
		Red Edge-2	745		10m	60m		
		NIR-1	783		10m	60m		
		NIR-2	856		10m	60m		
		NIR-3	910		10m	60m		
7	GSD PAN	2m @ 700km (or 500km) orbit height or better					Required	
8	GSD MS	2m or 4m binned @ 700km (or 500km) orbit height or better					Required	
9	Re-focus Mechanism	Yes					Required	
10	Mode of operation	Line Scan (TDI sensors) / Forward Motion Compensation (FMC)					Required	
11	Downlink Transfer Speed	1Gbits or higher					Required	
12	Lifespan:	5yrs (fully operational)					Required	
13	Max Mass	45kg					Required	
14	Max Power	50W					Required	
15	% Documentation in Table 6	Supplier provide documentation in table 6 (level proportioned). 100% = All Documentation. Calc percentage: (No of supplied documents in Table 6 / 48) x 100					Refer to formula	

**Notes:**

1. Bidders must comply with line items 1 – 14.
2. Line Item 15: Minimum: 70% is required.

**Table 5: Payload Imager Specification Alignment**

## 12.7 EO-SAT1 Cost and Lead Times

Detailed Functionality Evaluation Criteria: <b>5. EO-SAT1 Payload Cost and Lead Times</b>	<b>Weighting Allocated</b>	
<b>Description:</b> The Payload Supplier is required to provide a reasonable price for the payload as well as the lead time preferably within 9 months at TRL 9. If no supplier can deliver within the set period, adjust to the lowest supplier lead time. Proof of manufacture (historical) within 9 months provided.		
25 Points to be allocated to a bidder with lowest costing and lead time and TRL9.  <b>Evaluation Matrix:</b>  Lowest Costing = 10 (2 <sup>nd</sup> lowest costing = 8, 3 <sup>rd</sup> = 6, 4 <sup>th</sup> = 4, 5 <sup>th</sup> = 2)  Lowest Leadtime = 10 (Subtract 1 point for every month from lowest supplier lead time).  Proof of manufacture within 9 Months = 5 Points	25	25
21 Points to be allocated to a bidder with 2 <sup>nd</sup> lowest cost and lead time.  <b>Evaluation Matrix:</b>  2 <sup>nd</sup> Lowest Costing = 8  2 <sup>nd</sup> Lowest Leadtime = 8 (Subtract 1 point for every month from lowest supplier lead time if supplier has 2 <sup>nd</sup> lowest costing but not 2 <sup>nd</sup> lowest lead time).  Proof of manufacture within 9 Months = 5 Points	21	
17 Points to be allocated to a bidder with 3 <sup>rd</sup> lowest cost and lead time.  <b>Evaluation Matrix:</b>  3 <sup>rd</sup> Lowest Costing = 6  3 <sup>rd</sup> Lowest Leadtime = 6 (Subtract 1 point for every month from lowest lead time if supplier has 3 <sup>rd</sup> lowest costing but not 3 <sup>rd</sup> lowest lead time).  Proof of manufacture within 9 Months = 5 Points	17	
13 Points to be allocated to a bidder with 4 <sup>th</sup> lowest cost and lead time.  <b>Evaluation Matrix:</b>  4 <sup>th</sup> Lowest Costing = 4	13	

<p>4<sup>th</sup> Lowest Leadtime = 4 (Subtract 1 point for every month from threshold if supplier has 4<sup>th</sup> lowest costing but not 2<sup>th</sup> lowest lead time).</p> <p>Proof of manufacture within 9 Months = 5 Points</p>		
<p>9 Points to be allocated to a bidder with 5<sup>th</sup> lowest cost and lead time.</p> <p><b>Evaluation Matrix:</b></p> <p>5<sup>th</sup> Lowest Costing = 2</p> <p>5<sup>th</sup> Lowest Leadtime = 2 (Subtract 1 point for every month from threshold if supplier has 5<sup>th</sup> lowest costing but not 5<sup>th</sup> lowest lead time).</p> <p>Proof of manufacture within 9 Months = 5 Points</p>	9	
<p>7 Points or less to be allocated to bidders with the 6<sup>th</sup> lowest cost and lead time will be disqualified.</p> <p><b>Evaluation Matrix:</b></p> <p>6<sup>th</sup> Lowest Costing or lower = 0</p> <p>6<sup>th</sup> Lowest Leadtime or lower = 0</p> <p>Proof of manufacture within 9 Months = 5 Points</p>	7	

### 13 PRICE (Vat included)

The quotation is required to be as detailed as possible indicating the cost for each milestone in the manufacturing of the payload solution amount inclusive of VAT.

**NOTE: Bidders are requested to provide a proposal with a clear break down of costs where applicable.**

### 14 Submission Of Bid Proposals

Bid proposal/s must be submitted in a sealed envelope, marked as confidential and for the attention of Supply Chain Management Office

Bid No:

Bid Description

Bid proposals must be placed in the Tender Box located at:

DENEL SOC LTD / DENEL DYANAMICS RECEPTION

Nellmapius Drive,

IRENE

0157

**IMPORTANT NOTICE:** Submit one (1) fully completed and signed original bid document.

Submit one (1) copy in PDF or copy on a USB. **Failure to adhere to this bid condition will disqualify your bid proposal.**

### 15 Contactable Persons

For any supply chain management and technical questions, email: [procadmin@denel.co.za](mailto:procadmin@denel.co.za).

## 16 Annexure A: Payload Imager Solution Documentation

The table below can serve as a template (tailored from the ECSS Standard) for the Imager Payload Solution documentation required for the EO-SAT1 Satellite build. Suppliers are required to assess and provide the minimal documentation at the requisite review phase.

No	Deliverables	CDR	QR	FAR	Supplied (Y/N)	Doc No
<b>1</b>	<b>Programmatic &amp; Requirements Management</b>					
1.1	Payload Statement of Work (SOW)	BL				1
1.2	Payload Requirements Specification Document	BL				2
1.3	Payload Verification and Validation (V&V) Plan	BL				3
1.4	Payload Interface Control Document (ICD)	BL				4
1.5	Payload Management Pla	BL				5
<b>2</b>	<b>Design &amp; Engineering (Technical Specifications)</b>					
2.1	Payload System Design Document (SDD)	BL				6
2.2	Optical Subsystem Design Report:					7
2.3	Focal Plane Assembly (FPA) Specification	BL				8
2.4	<b>Electronics Design Documentation</b>	BL				
2.4.1	Front-End Electronics (FEE) Specification	BL				9
2.4.2	Payload Processing Unit (PPU) Design Document	BL				10
2.4.3	Power Supply Unit (PSU) Design Document	BL				11
2.5	<b>Mechanical/Thermal Design Data &amp; Analysis Report (DAR):</b>	BL				
2.5.1	Thermal Model documents					12
2.5.2	Reduced Structural FEM Documents					13
2.5.3	3D STEP File Envelope					14
2.5.4	BOM breakdown with Materials and COG					15
2.5.5	Mechanical Interface Control Document					16
2.5.6	Mechanical Handling Instructions					17
2.5.7	Mechanical Integration Instructions					18
2.5.8	Structural/Thermal Model (STM) Analysis Report:	BL				19

2.5.9	Thermal Control System Design Document	BL				20
2.6	Radiometric Model & Performance Budget	BL				21
2.7	Geometric Model & Performance Budget	BL				22
3	<b>Verification &amp; Testing (Test Documentation)</b>					
3.1	Payload Test Plan & Test Procedures	BL				23
3.1.1	Component-Level Test Plans/Procedures	BL				24
3.1.2	Payload Subsystem Test Plans/Procedures	BL				25
3.1.3	Payload Assembly, Integration, and Test (AIT) Plan	BL				26
3.1.4	Specific procedures for: Vibration, Acoustic, Thermal Vacuum (TVAC), EMC/EMI, and Alignment testing.	BL				27
3.2	<b>Payload Test Reports</b>		V1	V2		
3.2.1	Development/Engineering Model Test Reports		V1			28
3.2.2	Qualification Model Test Reports (demonstrating design survival under worst-case environments).		V1			29
3.2.3	Flight Model Test Reports (verifying the actual flight unit's performance).			V1		30
3.3	Pre-Shipment Review (PSR) Package		BL			31
3.4	Payload Verification Control Document (VCD) or Verification Matrix	BL				32
4	<b>Calibration &amp; Performance Characterization</b>					
4.1	Ground Calibration Plan & Report		BL			33
4.1.1	Radiometric Calibration Report		BL			34
4.1.2	Spectral Calibration Report		BL			35
4.1.3	Geometric Calibration Report		BL			36
4.2	On-Board Calibration Plan	V1	V2	V3		37
5	<b>Operational &amp; Support Documentation</b>					
5.1	Payload User Manual		V1	V2		38
5.1.1	Operational modes and commands	V1				39
5.1.2	Data formats (Level 0, Level 1A)	V1	V2	V3		40
5.1.3	Payload performance parameters (for input into data processing algorithms)	V1	V2	V3		41
5.1.4	Calibration parameters and how to apply them	V1	V2	V3		42

5.1.5	"Health and Status" monitoring parameters.	V1	V2	V3		43
5.2	Payload Operational Procedure		V1	V2		44
5.3	Payload Data Handling Plan		V1	V2		45
6	<b>Final Deliverables for Flight</b>			BL		
6.1	Payload As-Built Documentation		V1	V2		46
6.2	Payload Certificate of Flight Worthiness (CoC)		BL			47
6.3	End-of-Life Disposal Plan	BL				48

**Table 6: Payload Imager Solution Documentation**

**Note:**

- a. In certain instances, the documentation above applies to infrastructure and build processes aligned to the EN 9100 or ISO 9001 Standard which is generic to all Imager Payloads built previously at the Suppliers premises. Minimal documentation aligned with the standard should be available if requested.
- b. Adhere to the required document table and state any deviation. If there is a combined set, specify it as well.
- c. List the above table in the Tender reply and specify the deliverables that can be supplied and not.
- d. Adhere to the ECSS Standard (tailored) and TRL 9 level of documentation and software requirements.

## 17 ANNEXURE B: EO-SAT1 SPECIFICATION – Page 1

# EO-Sat1

## HIGH PERFORMANCE EARTH-OBSERVATION SATELLITE

EO-Sat1 is a high performance Earth-Observation satellite designed to produce data for a broad range of Earth observation applications. The satellite features two imaging payloads – one narrow angle, high resolution and one wide angle, medium resolution – capable of providing true diffraction limited imagery from 2.5 m GSD and 30 km swath, to 60 m GSD and 184 km swath. Both instruments cover the same 10 spectral bands in the visible to near-infrared spectrum. An agile, fully dual-redundant bus allows imaging in continuous nadir coverage, spot and stereoscopic modes.

EO-Sat1 is ideally sized for launching in quantities of three to five, significantly improving the economy of deploying a constellation for increased imaging coverage and reduced revisit intervals.

### SYSTEM SPECIFICATIONS EO-Sat1

SYSTEM SPECIFICATIONS	EO-Sat1
Reference orbit	700 km, sun-synchronous
Instruments	HiRes, MedRes
Swath	HiRes: 30 km MedRes: 184 km
GSD	HiRes: 2.5 m, 10 m MedRes: 15 m, 60 m
Spectral bands	HiRes: 10 MedRes: 10
SNR	150–350 (band dependent)
Pointing accuracy (without GCPs)	Knowledge: 43 m (3σ) Control: 98 m (3σ)
Off-nadir imaging	±30°
Radiometric quantization	12-bit
Data storage	384 GByte (+384 GByte redundant)
Downlink	400 Mbps (X-band)
TT&C	VHF/UHF and/or S-Band
Mass	400 kg
Redundancy	Dual-redundant bus
Design lifetime	5 years



### Applications

The unique combination of high resolution and medium resolution instruments, both imaging in the same 10 spectral bands, cater for a broad range of applications, including:

- Monitoring the state and evolution of vegetation in agricultural lands and forests (MedRes)
- Detailed land cover mapping (MedRes & HiRes)
- Monitoring built environment and in particular human settlements (HiRes)
- Disaster management (HiRes)

EO-Sat1 data is processed to Level 1B (band aligned and radiometrically calibrated), and delivered in standard GeoTIFF format.

# EO-Sat1

HIGH PERFORMANCE  
EARTH-OBSERVATION SATELLITE

## PAYLOAD

EO-Sat1 carries two imaging instruments: a high resolution (HiRes) and a medium resolution (MedRes) instrument. The HiRes consists of a modified Ritchey-Chrétien astrograph front end, while the MedRes consists of a Double Gauss refractive front end. Both instruments provide large focal planes and low optical aberrations, while delivering true diffraction limited performance over the full spectral range from 400 to 930 nm. Two identical sets of Time Delayed Integration (TDI) capable sensors provide 10 spectral bands for each instrument. The number of TDI stages are in-flight configurable to allow optimisation of the dynamic range and signal to noise ratio per band.

The HiRes swath is centred within the MedRes swath, and the two instruments can be operated simultaneously or separately.



The dual-redundant on-board data storage can store up to 700 square scenes, which equates to 23.7 million km<sup>2</sup> of MedRes imagery, or 0.7 million km<sup>2</sup> of HiRes imagery.



SPECTRAL BANDS EO-Sat1 at 700 km orbital altitude

Band	$\lambda_c$ (nm)	$\lambda_w$ (nm)	HiRes GSD	MedRes GSD
Deep Blue	425	50	10 m	60 m
Blue	490	65	10 m	60 m
Green	560	35	10 m	60 m
Yellow	605	40	10 m	60 m
Red	660	60	2.5 m	15 m
Red Edge-1	703	25	2.5 m	15 m
Red Edge-2	745	25	10 m	60 m
NIR-1	783	40	10 m	60 m
NIR-2	865	40	10 m	60 m
NIR-3	910	40	10 m	60 m

In a lower orbit, EO-Sat1 will gain GSD at the cost of swath. At 500 km, for example, the HiRes has GSDs of 1.8 and 7.2 m with a swath of 22 km, while the MedRes has GSDs of 11 and 43 m with a swath of 131 km.

## **19 ATTACHED: Technology Readiness Levels (TRL) for Space systems**

The TRL for space systems, developed by NASA, assesses the technology's maturity from basic research (TRL1) to proven mission success (TRL 9) in real space conditions/environment in order to reduce the risk.

- **TRL 1 – Basic research**
- **TRL 2 – Technology concept Formulated**
- **TRL 3 – Proof of Concept**
- **TRL 4 – Component Validation in Lab**
- **TRL 5 – Component tested/Validated in relevant environment**
- **TRL 6 – System Prototype Demo in relevant environment**
- **TRL 7 – System Prototype Demo in actual operational environment**
- **TRL 8 – MC/System Qualified (Test & Demo), Actual MC/System completed and qualified through testing**
- **TRL 9 – MC/System Proven in Mission (Proven to work in actual space environment)**