Request for proposals to join the "TACOS" consortium to undertake case studies to demonstrate the benefit of high accuracy Earth Observation data: Enabled by the TRUTHS[1,2,3] satellite mission.

1. Overview

This call is for up to 6 case studies to explore and illustrate satellite derived Earth Observation (EO) applications resulting from the improved accuracy and/or traceability and trust stemming from the UK-led ESA **TRUTHS**[1,2,3] satellite mission *(Traceable Radiometry Underpinning Terrestrial- and Helio- Studies).*

As part of **TACOS** (*TRUTHS Accompanying Consolidation towards Operational Study*), an ESA funded project supporting TRUTHS, we are looking for projects between **£25,000-40,000** to be delivered in a **3–6-month timeframe**.

Case studies should be focused on demonstrating the quantitative benefits of potential secondary applications in an engaging format.

- **Application timescales:** Final submission due 28 February 2025 and notification of outcome mid-March 2025.
- **Delivery timescales:** Kick-off in March 2025 – with project duration running until October 2025 latest, but in all cases there is a key delivery date associated with the ESA Living Planet Symposium 2025[4].
- **Expected budget:** Up to a maximum of **£40,000.00** (excluding VAT).
- **Nature of commercial arrangement:** A subcontract agreement with NPL's standard terms and conditions. Projects selected for direct negotiation funding will be reviewed by an expert review board using criteria with an emphasis on ability to demonstrate impact in a creative manner, timeliness of deliverables and of course relative overall societal benefit of the application.

Note: *TRUTHS mission will not be operational until 2030. It is recognised that there may need to be some additional algorithmic developments to fully realise its potential in practice.*

2. Background on TRUTHS Mission

TRUTHS is a UK-led, climate-focussed mission delivered by ESA:

- TRUTHS provides spectrally continuous hyperspectral reflectances and radiances of the top and bottom of the atmosphere (from 320 to 2400 nm in bandwidths of ~ 2-6 nm). Effectively this means continuity from the ultra-violet, through the visible and short-wave infra-red. It samples the entire globe at 50 m spatial resolution, although global information will be delivered at least 200 m for oceans and 100 m for most land masses. It can point and image off-nadir upon special request and similarly deliver full 50 m resolution subject to mission planning considerations. In general, this mode is reserved for calibration purposes but at this stage application ideas where this mode may be needed on an occasional basis are considered in scope.
- Uniquely, TRUTHS has an on-board calibration system that allows it to self-calibrate in-flight, direct to a primary standard of the international system of units (SI). This is achieved at unprecedented uncertainties (goal 0.3% k=2 equivalent to 95% confidence), 10x better than other satellite imagers.

- This improved accuracy can also be used to upgrade the calibration of other satellite imagers (up to a factor of ten), improving the quality and performance of the data from the global EO ecosystem.
- The primary products are expected to be: L1B, L1C Top of Atmosphere (ToA) spectral radiances and incoming solar irradiances (although ToA reflectances will be readily derived), L2 surface reflectance and a gridded climate radiance dataset. The L2 surface reflectance is in effect a hyperspectral, analysis-ready data product.

Although the mission has clear climate and radiative forcing objectives, we recognise that the improved data quality enabled by TRUTHS has many additional applications. For example, we anticipate TRUTHS to complement very high spatial resolution 'New Space' missions (multi- & hyper- spectral), both as a performance enhancer of individual satellites and constellations through reference 'certified' calibration and also through potential synergy products.

This call is intended to initiate and explore ideas where the potential of TRUTHS' enhanced radiometric performance across all observed wavelengths may lead to additional secondary benefits. As examples (but not intended to be exhaustive) topics might include: Agriculture, land classification, cryosphere, biosphere (land & ocean) Atmosphere properties, mineral prospecting, Solar impact on energy infrastructure etc

3. Requirements for case studies

The case studies can consider (1) direct utilisation of TRUTHS data **OR** (2) data from other satellites enhanced through TRUTHS in-flight calibration. Case studies should relate to direct science questions, public policy and/or commercial applications. To note:

- Deliverables should focus on telling a clear story to a non-specialist community, illustrating the impact of access to improved data. We would like to encourage applications with deliverables in creative formats (e.g. apps, posters, web pages, presentations, Puffer Fish[4] apps etc). This call is not aimed at funding reports.

- Proposals are especially encouraged from SMEs and start-ups and "New Space" developers (data provider and users) as well as established EO service providers and academics.

- Proposals should focus on the impact of benefits enabled by TRUTHS. Quantitative improvements to existing applications and any new ideas would be considered added value.
- Proposals should explain how they will create an evidence base for use of TRUTHS data, e.g. translation from ground sensors, development of model methods, test with current multi-spectral or hyperspectral data.

References:

1/ TRUTHS - Space4Climate

2/ ESA - TRUTHS

3/ TRUTHS - NPL

4/ PufferTouch - Pufferfish (pufferfishdisplays.com)

5/ Data characteristics to be assumed for case studies – see below:

For the purpose of case-studies, the general characteristics of the data products of the TRUTHS mission can be found here**:** TRUTHS for Climate Workshop (eventsair.com).

TRUTHS is designed with very high radiometric accuracy, driven by its climate focus. Unlike conventional climate missions, however, TRUTHS does not adopt a conventional sun-synchronous orbit. TRUTHS instead precesses to span the diurnal cycle, repeating every 61 days. This orbit allows the TRUTHS observations to regularly match, in time, those of other sensors at different parts of the globe and scene types and subsequently transfer its calibration to the other sensor'

Note: The SWATH and spatial resolution typically still allows monthly coverage at the equator, and more regularity at mid-latitudes. For applications where relatively frequent temporal sampling is required, proposers should focus on data of missions potentially enhanced by TRUTHS either through calibration or synergistic combination.

For direct TRUTHS data applications, consider:

- Spatial resolutions of 50 to 100 m over land/coastal zones and 200 m over the ocean as a baseline for TRUTHS data. (note that applications requiring regular 50 m resolution acquisitions will need very strong justifications as this is not currently in the baseline of the mission)
- Spectrally continuous hyperspectral analysis ready data (ARD) incoming and Earth reflected data (2-6 nm bandwidth) Uncertainties of 0.3-1.0 % (k=2) at Top of the Atmosphere (ToA) spectral radiance/reflectance (and incoming irradiance) and 1.0-2.0 % (k=2) Bottom of the Atmosphere (BoA) surface reflectance.

For applications primarily utilising TRUTHS enhanced satellite data e.g. from missions such as Sentinel 2, 3, Chime and future high spatial resolution 'New Space' imagers:

- Assume that these all have robust harmonised traceability with uncertainties approaching <1 to 2% at ToA (k=2_ and <3% at BoA (k=2), i.e. a factor of at least 2x improvement over the best existing missions.
- In practise the best achievable uncertainties will depend in part on the mission being calibrated but for the purposes of these case studies we assume that these are optimised. For some missions where high spatial resolution imagery is not critical, e.g. those with a strong long-term climate focus, the attainable uncertainties may reduce further, towards the best achievable by TRUTHS.
- For some applications, benefits may stem from increased confidence in knowledge of radiometric performance and ability to harmonise between different sensors and data sets as opposed to lower uncertainties. It is anticipated that TRUTHS and associated ground segment, may be able to provide 'certified' data to more readily facilitate applications where formal data integrity may be required.

Note: *Advice on expected performance and assumptions that can be used in preparing proposals can be obtained from NPL. During the proposal phase this advice/information will be limited and made available to all potential proposers. However, selected projects will be able to have more direct confidential dialogue with the TRUTHS team to ensure a maximal outcome.*

4. Requirements for deliverables

The exact nature and format of deliverables should be specified within the proposal. As a minimum, we require:

D1: A final agreed activity plan (KO + 2 weeks)

D2: Draft case study (KO+ 3months)

D3: Attendance and presentation at Living Planet Symposium (LPS) (23-27 June)

D4: Presentation at a UK event (TBC in Sep/Oct)

D5: Report/publication/Media including roadmap for implementation related to exploitation of TRUTHS as a 'case study' expressly including quantitative benefits (study end)

D6: Presentation slides suitable for international community and presentation by ESA/TACOS team (study end)

- The cost of attendance to LPS and at least one other UK meeting should be included in the proposal and should not exceed 10% of the project value, deviations should be justified.

Note: *Potential for further work to develop the case study further and/or to extend to other applications will be considered on successful conclusion of the project and associated developments within the wider TRUTHS project.*

5. Eligibility criteria

The following eligibility criteria apply:

- Applicants must comply with the outlined delivery timescales and requirements within the maximum budget, meeting the full scope of work.
- Applicants must be led by a UK registered organisation with at least 70% of the work undertaken by UK residents.
- Applicant organisations must be willing to travel to Living Planet Symposium, with a travel budget of no more than **10%** of the total budget.

Proposals which do not meet the eligibility criteria will be rejected.

6. Application process and assessment criteria

Applicants must fill out the Proposal Template (Appendix A in this document) with any additional appendicies and submit electronically to truths@npl.co.uk

Appendix A should not exceed 10 pages. CVs, a risk register and project plan can optionally be submitted separately as a further appendix. Please identify any additional attachments clearly in your email.

Proposals should be submitted by 28th February 2025 with a notification of outcome mid-March 2025.

Projects will be selected by a panel based on the following evaluation criteria:

- **Anticipated degree of impact/benefit of the proposed application**
- **Likelihood of viability (based on evidence within proposal and independent judgement)**
- **Creativity of communication deliverable**
- **Evidential strength/quality of proposing team**
- **Cost & timeliness of delivery**

Please use Appendix A in your response. Proposers may be asked for clarifications to aid selection.

The exact number of projects awarded will depend on the sum of the project costs and the quality of proposals. NPL reserves the right to refuse all proposals.

Once a proposal is selected, a direct award process (led by NPL) will be triggered with ESA to join the TACOS consortium.

7. **Queries**

Please submit queries via truths@npl.co.uk

Answers to queries from all interested partners will be posted publicly here.

Appendix A Proposal Template

[Appendix A: TACOS Proposal Template, TRUTHS case studies]

***[Guidance for applicants:** Please fill the template in full. When the proposal is ready for submission, please remove all captions in red and NPL headers, adding in your organisation's logo and attaching a cover page to the proposal.*

Proposals must be submitted electronically in a searchable PDF format to truths@npl.co.uk, with nigel.fox@npl.co.uk and liam.mullen@npl.co.uk in CC, by 28th February 2025.

Proposals should be limited to 10 pages in length (not including Appendices).

A project plan, risk register and CVs can optionally be attached separately as searchable PDFs in addition to Appendix A. Appendices should be appended to Appendix A to form one PDF document.

Please indicate in Section X "Appendices" and in your submission email, the title and number of supplementary appendices.]

1. **Project title**

[Project Title]

2. **Proposer details**

Organisation name	*Legal name of entity*		
Organisation type	*i.e. SME/Private company/Academic institution*		
UK VAT number	*UK VAT Number*		
ESA entity code	*"N/A" if not yet an ESA-star registered supplier*		
	Name	**Email**	**Telephone**
Lead contact			
Secondary contact			

3. **Compliance with eligibility criteria**

I herby declare that this proposal is in compliance with the eligibility criteria listed in the Request for Proposal: ☐

[Eligibility Criteria]

- *Applicants must comply with the outlined delivery timescales and requirements within the maximum budget, meeting the full scope of work.*
- *Applicant organisations must be willing to travel to Living Planet Symposium, with a travel budget of no more than **10%** of the total budget.*

4. **Organisational background and relevant experience**

[Present the background of your organisation and briefly describe relevant experience to delivery of this project.]

5. **Overall team composition and proposed key personnel**

[Please briefly describe the overall team composition. A "Key Person" is a person who substantially contributes to the proposal in terms of effort and knowledge and is explicitly nominated to perform those duties.

Please list which CVs are attached to this proposal in this section.]

6. Expected high-level impact and benefit of proposed case study

[Please briefly outline the potential high-level benefits of the proposed TRUTHS application in the case study being proposed.

The benefits should be described in an accessible way for non-scientists, whilst clearly linking back to the TRUTHS technical capabilities. Include the nature of the potential benefit and impact (e.g. financial, societal, regulatory).

Benefits defined in quantitative terms are advantageous].

7. Description of how TRUTHS enabled data will be expected to enable the proposed application case study and how the team proposes to establish the evidence

[Please specify the data characteristics from TRUTHS directly or otherwise that will enable the proposed application in the case study. Ideally, indicate the sensitivity of this application to the key data characteristic (i.e. if there is a threshold to the utility, or a linear improvement). Please also highlight any other development which may be needed to achieve the intended benefits (e.g. algorithm improvement) and the novelty of this application.]

8. Risks and limitations to the proposed application case study

[Please briefly highlight any potential risks which may hinder the benefits of the proposed TRUTHS application case study, e.g. performance limitations in TRUTHS current design, existing data/retrieval models being insufficient in the timelines needed for project delivery]

9. Data/information/facility needs

[Please state any resources you are likely to need that NPL, through ESA or other UK public funded projects, may be able to provide you with to minimise your costs and time to deliver the project outcomes: for example, access to specific data sets, computational tools etc.]

10. Current ideas/plans for communicating project outputs

[Please briefly highlight how you intend to format and deliver the case studies, including any creative or novel presentational methods]

11. Project planning

[Please detail your project and risk management processes to ensure timely delivery of the project. Include a project plan and risk register as an appendix to this proposal]

12. Finances

[Please fill in the finance table below with costs broken down by labour, consumables (if any), travel. Add extra rows as necessary.]

Labour Cost					
Grade or Code	**Description or named individual**	**No. Hours Required**	**Gross hourly rate (£)**	**Deliverables contribution**	**Total (£)**

i.e. grade designation/ code (N/A for direct cost of named individual)	*Job title OR named individual*	*Hours required for this grade or named individual*	*Fully burdened hourly rate, inclusive of overheads, according to General Accepted Accounting Principles*	*List deliverables contributed to and the hourly allocation for each deliverable* *e.g. (1. TRUTHS small-sat user basis and benefits analysis – 100 hours):* *etc.*	*Total cost of labour centre or named individual in GBP*
				Total Labour Cost (£)	*Total cost of labour in GBP*

Non-labour costs

Cost type	**Justification**	**Total (£)**
Travel	*Please provide justification of the cost. Where possible, include a short breakdown of contributing costs. (Note this should include a trip to present at LPS and a UK meeting and be not more than 10% of the total project cost)*	*Total cost in GBP*
Equipment		
Consumables		
External services		
Other (specify)		
	Total non-labour costs (£)	*Total cost of labour in GBP*
	Total Price for NPL (£)	*Total price of proposal in GBP*