

Invitation to Quote

Invitation to Quote (ITQ) on behalf of UK Space Agency
Subject – Astrodynamics Software Library
Sourcing reference number – IT18031



UK Shared Business Services Ltd (UK SBS)
www.uksbs.co.uk

Registered in England and Wales as a limited company. Company Number 6330639.
Registered Office Polaris House, North Star Avenue, Swindon, Wiltshire SN2 1FF
VAT registration GB618 3673 25
Copyright (c) UK Shared Business Services Ltd. 2014

Table of Contents

Section	Content
1	<u>About UK Shared Business Services Ltd.</u>
2	<u>About the Contracting Authority</u>
3	<u>Working with the Contracting Authority.</u>
4	<u>Specification</u>
5	<u>Evaluation model</u>
6	<u>Evaluation questionnaire</u>
7	<u>General Information</u>

Section 1 – About UK Shared Business Services

Putting the business into shared services

UK Shared Business Services Ltd (UK SBS) brings a commercial attitude to the public sector; helping Contracting Authorities improve efficiency, generate savings and modernise.

It is our vision to become the leading service provider for Contracting Authorities of shared business services in the UK public sector, continuously reducing cost and improving quality of business services for Government and the public sector.

Our broad range of expert services is shared by our Contracting Authorities. This allows Contracting Authorities the freedom to focus resources on core activities; innovating and transforming their own organisations.

Core services include Procurement, Finance, Grants Admissions, Human Resources, Payroll, ISS, and Property Asset Management all underpinned by our Service Delivery and Contact Centre teams.

UK SBS is a people rather than task focused business. It's what makes us different to the traditional transactional shared services centre. What is more, being a not-for-profit organisation owned by the Department for Business, Energy & Industrial Strategy (BEIS), UK SBS' goals are aligned with the public sector and delivering best value for the UK taxpayer.

UK Shared Business Services Ltd changed its name from RCUK Shared Services Centre Ltd in March 2013.

Our Customers

Growing from a foundation of supporting the Research Councils, 2012/13 saw Business, Energy and Industrial Strategy (BEIS) transition their procurement to UK SBS and Crown Commercial Services (CCS – previously Government Procurement Service) agree a Memorandum of Understanding with UK SBS to deliver two major procurement categories (construction and research) across Government.

UK SBS currently manages £700m expenditure for its Contracting Authorities.

Our Contracting Authorities who have access to our services and Contracts are detailed [here](#).

Section 2 – About the Contracting Authority

UK Space Agency (UKSA)

The Agency is responsible for all strategic decisions on the UK civil space programme and we provide a clear, single voice for UK space ambitions. The UK Space Agency is at the heart of UK efforts to explore and benefit from space. The UK's thriving space sector contributes £9.1 billion a year to the UK economy and directly employs 28,900 members of staff with an average growth rate of almost 7.5%.

Collaboration lies at the core of the UK Space Agency ethos and applies across Government as well as to external organisations including European and global partners such as the European Space Agency (ESA), the European Union, national space agencies and the United Nations.

The Agency provides funding for a range of programmes via programmes such as the National Space Technology Programme and FP7 and works closely with national and international academic, education and community partners.

UK Space Agency achievements include:

- Implementing Government £10m National Space Technology Programme to support the development of UK technology and services/applications using space data. The first four flagship programmes totalled £6m, matched by £5m from industry.
- The Climate and Environmental Monitoring from Space facilities at the International Space Innovation Centre, supported by £400,000 funding, will make satellite data available to space businesses and institutions, particularly those which do not have the infrastructure to exploit Earth observation data.
- Chaired and led the International Charter 'Space and Major Disasters', to task Earth observation satellites quickly to provide data following a major disaster

www.BEIS.gov.uk/ukspaceagency

Section 3 - Working with UK Space Agency

In this section you will find details of your Procurement contact point and the timescales relating to this opportunity.

Section 3 – Contact details		
3.1	Contracting Authority Name and address	UK Space Agency Polaris House North Star Avenue Swindon Wiltshire SN2 1SZ
3.2	Buyer name	Sophie Mumford
3.3	Buyer contact details	ictprocurement@uksbs.co.uk
3.4	Estimated value of the Opportunity	The estimated value of this contract is up to £150,000.00 excluding VAT including any possible extensions, however there is no commitment to spend up to this amount.
3.5	Process for the submission of clarifications and Bids	All correspondence shall be submitted within the Emptoris e-sourcing tool. Guidance Notes to support the use of Emptoris is available here. Please note submission of a Bid to any email address including the Buyer <u>will</u> result in the Bid <u>not</u> being considered.

Section 3 - Timescales		
3.6	Date of Issue of Contract Advert and location of original Advert	05/02/2018 Contracts Finder
3.7	Latest date/time ITQ clarification questions shall be received through Emptoris messaging system	09/02/2018 10:00
3.8	Latest date/time ITQ clarification answers should be sent to all Bidders by the Buyer through Emptoris	12/02/2018 14:00
3.9	Latest date/time ITQ Bid shall be submitted through Emptoris	15/02/2018 14:00
3.10	Date/time Bidders should be available if written clarifications are required	20/02/2018 – 21/02/2018

3.11	Anticipated selection and the selections of Bids notification date	26/02/2018
3.12	Anticipated Award date	26/02/2018
3.13	Anticipated Contract Start date	01/03/2018
3.14	Anticipated Contract End date	31/03/2018 with the option to extend on an annual basis until 31/03/2021
3.15	Bid Validity Period	60 Calendar Days

Section 4 – Specification

1. Contract Proposal

This contract is for the supply of relevant astrodynamics and orbital mechanics software to support the development of new risk assessment tools.

2. Background

When placing satellites or spacecraft into orbit around the earth, there is a risk of an unexpected event, such as a collision with another spacecraft in a similar orbit. For the agencies that license these spacecraft and the governments that ultimately underwrite these activities, there is a clear financial risk should collisions occur.

As technology evolves and space becomes more accessible, new satellite systems, including so-called ‘mega-constellations’, formation flying and in-orbit servicing missions, are becoming more complex and numerous. Understanding the risk of collision events in orbit that have financial implications is even more important.

Currently UKSA’s Orbital Systems Group (OSG), under the Chief Engineers Office, is developing new risk assessment codes and tools to attempt to quantify the likelihood of unexpected events in orbit. These codes are to be developed as first principles capabilities, and as such require an underpinning ability to propagate orbiting objects accurately, robustly and efficiently. To accelerate the development of these tools, the use of existing astrodynamics software to provide this functionality is desired.

This contract is being placed to acquire a low-level library of supporting astrodynamics functionality, including orbital propagators, that can be integrated into the OSG developed software, and be used and developed and released by members of the Orbital Systems Group.

This software will be essential in the development of risk assessment tools to be used within the UK Space Agency to help inform regulatory and licensing decisions.

3. Aims and Objectives of the Project

The overall aim of this project is for the supplier to provide a validated, low-level astrodynamics library which can be implemented and used directly with existing UKSA source code, and meets all of the essential criteria described below.

Essential Criteria

The library must meet the following requirements.

- Provide an orbital propagator in the form of a numerical, analytical or semi-analytical model, which must be able to:
 - i. propagate states based on osculating or mean elements (which can be converted to osculating elements) over an arbitrary period
 - ii. account for a number of arbitrary perturbations, including
 1. Central gravity forces / potential to reasonable order
 2. Luni-solar
 3. Drag
 4. Solar radiation pressure
 - iii. account for low-thrust propulsion
 - iv. provide state description in either Cartesian, elliptical Keplerian or equinoctial parameters
 - v. offer a propagation option other than SGP4/SDP4 (this can be optional but cannot be the only propagation option).
- Provide data sources for perturbation models, including:
 - i. Solar Radiation Pressure Models
 - ii. Non-uniform gravity field
 - iii. Atmospheric and drag models
- Written in a high-level language, ideally C++, but modern fortran, Java, Python, or any equivalent/alternative language will be acceptable
- Provide API wrappers for C++ should the library/default API be written in a different language
- The library should be in an encapsulated, object-orientated form for ease of portability, maintenance and future development.
- Source code should have suitable documentation and comments for use and development by UKSA.
- Evidence of validation and verification.

Desirable Criteria

The library would ideally meet the following requirements:

- Time/Geometry/State conditions ideally would include the following:
 - High accuracy absolute dates, with options for range of different time-scales (e.g. UTC, GPS etc.)
 - A range of reference frames and coordinate systems, including global and local orbit (e.g. spacecraft frames), as well as coordinate transforms
 - Cartesian, elliptical Keplerian, circular and equinoctial parameters with conversions between parameters
 - Two-line elements

- Propagators) – ideally would include the following:
 - Analytic models: A validated high order GP
 - Numerical Models, including:
 - i. Customisable force models (central, arbitrary order gravity models, atmospheric drag, luni-solar third body, solar radiation pressure with eclipses, solid and ocean tides, artificial perturbations and defined manoeuvres- see Arbitrary manoeuvring below)
 - ii. Modern efficient, robust and accurate ODE integrators
 - Semi-analytical models (DSST or equivalent with modifiable force models)
 - Taylor differential algebra options for all propagators with force models, for fast uncertainty propagation
 - Parallelisation/Concurrency options, including threading and vectorisation and massively parallel computation of multiple propagations
 - Efficient data handling and movement for large problems
 - Arbitrary manoeuvring, including
 - i. Analytical models for small manoeuvres
 - ii. Impulsive manoeuvring
 - iii. Low thrust continuous manoeuvres (e.g. long period transfers)

4. Deliverables

- a) The deliverable will be a self-contained, low-level astrodynamics library, in the form of source code in an agreed high-level language, with associated documentation, tutorials, examples, and QA test problems. **This must be provided to UKSA by March 30th 2018.**
- b) An illustration of the library should be provided on delivery. This will include illustration of simple test problems and solutions, example use of the library (for example, within another code), a review of the library's accuracy, and justification of the models and algorithms used within the library.

In addition to providing the library as a compiled object and source files, a one-day training session is required to provide a detailed overview on how the library can be set up and used for UKSA applications, including worked examples and tutorials. The training will be for at least one but up to four staff members. Training can be undertaken at either the

supplier's chosen site or UKSA facilities at Harwell, Atlas Centre, Fermi Avenue, Harwell Campus, Didcot, Oxfordshire, OX11 0QX.

5. Optional Requirements

Technical support will be required subject to budget availability as per the following:

- Assistance with setting up, compiling and installation on UKSA hardware
- Support through e-mail, phone and the option of face-to-face discussions where required
- An online issue tracking system would also be desirable

The option to extend will be utilised to cover this support element (if required) for up to an additional three years on an annual basis (1+1+1). This is subject to budget availability and will be discussed annually.

Terms and Conditions

Bidders are to note that any requested modifications to the Contracting Authority Terms and Conditions on the grounds of statutory and legal matters only, shall be raised as a formal clarification during the permitted clarification period.

Variant bids / options are not permitted and will not be accepted.

Section 5 – Evaluation model

The evaluation model below shall be used for this ITQ, which will be determined to two decimal places.

Where a question is 'for information only' it will not be scored.

The evaluation team may comprise staff from UK SBS, and the Contracting Authority ----- and any specific external stakeholders the Contracting Authority deems required. After evaluation the scores will be finalised by performing a calculation to identify (at question level) the mean average of all evaluators (Example – a question is scored by three evaluators and judged as scoring 5, 5 and 6. These scores will be added together and divided by the number of evaluators to produce the final score of 5.33 ($5+5+6 = 16 \div 3 = 5.33$))

Pass / fail criteria		
Questionnaire	Q No.	Question subject
Commercial	SEL1.2	Employment breaches/ Equality
Commercial	FOI1.1	Freedom of Information Exemptions
Commercial	AW1.1	Form of Bid
Commercial	AW1.3	Certificate of Bona Fide Bid
Commercial	AW3.1	Validation check
Commercial	AW4.1	Contract Terms
Price	AW5.5	E-Invoicing
Price	AW5.6	Implementation of E-Invoicing
Quality	AW6.1	Compliance to the Specification
Quality	AW6.2	Confirmation of Delivery Deadline
Commercial	SEL3.11	Compliance to Section 54 of the Modern Slavery Act
Commercial	SEL3.12	Cyber Essentials
-	-	Invitation to Quote – received on time within e-sourcing tool

Scoring criteria			
Evaluation Justification Statement			
In consideration of this particular requirement the Contracting Authority has decided to evaluate Potential Providers by adopting the weightings/scoring mechanism detailed within this ITQ. The Contracting Authority considers these weightings to be in line with existing best practice for a requirement of this type.			
Questionnaire	Q No.	Question subject	Maximum Marks
Price	AW5.2	Price	20%
Quality	PROJ1.1	Library Format and Interactivity	20%
Quality	PROJ1.2	Library Capability	40%
Quality	PROJ1.3	Resources and Timescales	20%

Evaluation of criteria

Non-Price elements

Each question will be judged on a score from 0 to 100, which shall be subjected to a multiplier to reflect the percentage of the evaluation criteria allocated to that question.

Where an evaluation criterion is worth 20% then the 0-100 score achieved will be multiplied by 20%.

Example if a Bidder scores 60 from the available 100 points this will equate to 12% by using the following calculation:

$$\text{Score} = \{\text{weighting percentage}\} \times \{\text{bidder's score}\} = 20\% \times 60 = 12$$

The same logic will be applied to groups of questions which equate to a single evaluation criterion.

The 0-100 score shall be based on (unless otherwise stated within the question):

0	The Question is not answered or the response is completely unacceptable.
10	Extremely poor response – they have completely missed the point of the question.
20	Very poor response and not wholly acceptable. Requires major revision to the response to make it acceptable. Only partially answers the requirement, with major deficiencies and little relevant detail proposed.
40	Poor response only partially satisfying the selection question requirements with deficiencies apparent. Some useful evidence provided but response falls well short of expectations. Low probability of being a capable supplier.
60	Response is acceptable but remains basic and could have been expanded upon. Response is sufficient but does not inspire.
80	Good response which describes their capabilities in detail which provides high levels of assurance consistent with a quality provider. The response includes a full description of techniques and measurements currently employed.
100	Response is exceptional and clearly demonstrates they are capable of meeting the requirement. No significant weaknesses noted. The response is compelling in its description of techniques and measurements currently employed, providing full assurance consistent with a quality provider.

All questions will be scored based on the above mechanism. Please be aware that the final score returned may be different as there may be multiple evaluators and their individual scores will be averaged (mean) to determine your final score.

Example

Evaluator 1 scored your bid as 60

Evaluator 2 scored your bid as 60

Evaluator 3 scored your bid as 40

Evaluator 4 scored your bid as 40

Your final score will $(60+60+40+40) \div 4 = 50$

Price elements will be judged on the following criteria.

The lowest price for a response which meets the pass criteria shall score 100.

All other bids shall be scored on a pro rata basis in relation to the lowest price. The score is then subject to a multiplier to reflect the percentage value of the price criterion.

For example - Bid 1 £100,000 scores 100.

Bid 2 £120,000 differential of £20,000 or 20% remove 20% from price scores 80

Bid 3 £150,000 differential £50,000 remove 50% from price scores 50.

Bid 4 £175,000 differential £75,000 remove 75% from price scores 25.

Bid 5 £200,000 differential £100,000 remove 100% from price scores 0.

Bid 6 £300,000 differential £200,000 remove 100% from price scores 0.

Where the scoring criterion is worth 50% then the 0-100 score achieved will be multiplied by 50.

In the example if a supplier scores 80 from the available 100 points this will equate to 40% by using the following calculation: $\text{Score/Total Points multiplied by 50}$ ($80/100 \times 50 = 40$)

The lowest score possible is 0 even if the price submitted is more than 100% greater than the lowest price.

Section 6 – Evaluation questionnaire

Bidders should note that the evaluation questionnaire is located within the **e-sourcing questionnaire**.

Guidance on completion of the questionnaire is available at <http://www.uksbs.co.uk/services/procure/Pages/supplier.aspx>

PLEASE NOTE THE QUESTIONS ARE NOT NUMBERED SEQUENTIALLY

Section 7 – General Information

What makes a good bid – some simple do's 😊

DO:

- 7.1 Do comply with Procurement document instructions. Failure to do so may lead to disqualification.
- 7.2 Do provide the Bid on time, and in the required format. Remember that the date/time given for a response is the last date that it can be accepted; we are legally bound to disqualify late submissions. Unless formally requested to do so by UK SBS e.g. Emptoris system failure
- 7.3 Do ensure you have read all the training materials to utilise e-sourcing tool prior to responding to this Bid. If you send your Bid by email or post it will be rejected.
- 7.4 Do use Microsoft Word, PowerPoint Excel 97-03 or compatible formats, or PDF unless agreed in writing by the Buyer. If you use another file format without our written permission we may reject your Bid.
- 7.5 Do ensure you utilise the Emptoris messaging system to raise any clarifications to our ITQ. You should note that we will release the answer to the question to all Bidders and where we suspect the question contains confidential information we may modify the content of the question to protect the anonymity of the Bidder or their proposed solution
- 7.6 Do answer the question, it is not enough simply to cross-reference to a 'policy', web page or another part of your Bid, the evaluation team have limited time to assess bids and if they can't find the answer, they can't score it.
- 7.7 Do consider who the Contracting Authority is and what they want – a generic answer does not necessarily meet every Contracting Authority's needs.
- 7.8 Do reference your documents correctly, specifically where supporting documentation is requested e.g. referencing the question/s they apply to.
- 7.9 Do provide clear, concise and ideally generic contact details; telephone numbers, e-mails and fax details.
- 7.10 Do complete all questions in the questionnaire or we may reject your Bid.
- 7.11 Do check and recheck your Bid before dispatch.

What makes a good bid – some simple do not's Ⓜ

DO NOT

- 7.12 Do not cut and paste from a previous document and forget to change the previous details such as the previous buyer's name.
- 7.13 Do not attach 'glossy' brochures that have not been requested, they will not be read unless we have asked for them. Only send what has been requested and only send supplementary information if we have offered the opportunity so to do.
- 7.14 Do not share the Procurement documents, they are confidential and should not be shared with anyone without the Buyers written permission.
- 7.15 Do not seek to influence the procurement process by requesting meetings or contacting UK SBS or the Contracting Authority to discuss your Bid. If your Bid requires clarification the Buyer will contact you. All information secured outside of formal Buyer communications shall have no Legal standing or worth and should not be relied upon.
- 7.16 Do not contact any UK SBS staff or the Contracting Authority staff without the Buyers written permission or we may reject your Bid.
- 7.17 Do not collude to fix or adjust the price or withdraw your Bid with another Party as we will reject your Bid.
- 7.18 Do not offer UK SBS or the Contracting Authority staff any inducement or we will reject your Bid.
- 7.19 Do not seek changes to the Bid after responses have been submitted and the deadline for Bids to be submitted has passed.
- 7.20 Do not cross reference answers to external websites or other parts of your Bid, the cross references and website links will not be considered.
- 7.21 Do not exceed word counts, the additional words will not be considered.
- 7.22 Do not make your Bid conditional on acceptance of your own Terms of Contract, as your Bid will be rejected.

Some additional guidance notes

- 7.23 All enquiries with respect to access to the e-sourcing tool and problems with functionality within the tool must be submitted to Crown Commercial Service (previously Government Procurement Service), Telephone 0345 010 3503.
- 7.24 Bidders will be specifically advised where attachments are permissible to support a question response within the e-sourcing tool. Where they are not permissible any attachments submitted will not be considered as part of the evaluation process.
- 7.25 Question numbering is not sequential and all questions which require submission are included in the Section 6 Evaluation Questionnaire.
- 7.26 Any Contract offered may not guarantee any volume of work or any exclusivity of supply.
- 7.27 We do not guarantee to award any Contract as a result of this procurement
- 7.28 All documents issued or received in relation to this procurement shall be the property of the Contracting Authority. / UKSBS.
- 7.29 We can amend any part of the procurement documents at any time prior to the latest date / time Bids shall be submitted through Emptoris.
- 7.30 If you are a Consortium you must provide details of the Consortiums structure.
- 7.31 Bidders will be expected to comply with the Freedom of Information Act 2000 or your Bid will be rejected.
- 7.32 Bidders should note the Government's transparency agenda requires your Bid and any Contract entered into to be published on a designated, publicly searchable web site. By submitting a response to this ITQ Bidders are agreeing that their Bid and Contract may be made public
- 7.33 Your bid will be valid for 60 calendar days or your Bid will be rejected.
- 7.34 Bidders may only amend the contract terms during the clarification period only, only if you can demonstrate there is a legal or statutory reason why you cannot accept them. If you request changes to the Contract terms without such grounds and the Contracting Authority fail to accept your legal or statutory reason is reasonably justified we may reject your Bid.
- 7.35 We will let you know the outcome of your Bid evaluation and where requested will provide a written debrief of the relative strengths and weaknesses of your Bid.
- 7.36 If you fail mandatory pass / fail criteria we will reject your Bid.
- 7.37 Bidders are required to use IE8, IE9, Chrome or Firefox in order to access the functionality of the Emptoris e-sourcing tool.
- 7.38 Bidders should note that if they are successful with their proposal the Contracting Authority reserves the right to ask additional compliancy checks prior to the award of

any Contract. In the event of a Bidder failing to meet one of the compliancy checks the Contracting Authority may decline to proceed with the award of the Contract to the successful Bidder.

- 7.39 All timescales are set using a 24 hour clock and are based on British Summer Time or Greenwich Mean Time, depending on which applies at the point when Date and Time Bids shall be submitted through Emptoris.
- 7.40 All Central Government Departments and their Executive Agencies and Non Departmental Public Bodies are subject to control and reporting within Government. In particular, they report to the Cabinet Office and HM Treasury for all expenditure. Further, the Cabinet Office has a cross-Government role delivering overall Government policy on public procurement - including ensuring value for money and related aspects of good procurement practice.

For these purposes, the Contracting Authority may disclose within Government any of the Bidders documentation/information (including any that the Bidder considers to be confidential and/or commercially sensitive such as specific bid information) submitted by the Bidder to the Contracting Authority during this Procurement. The information will not be disclosed outside Government. Bidders taking part in this ITQ consent to these terms as part of the competition process.

- 7.41 The Government is introducing its new Government Security Classifications (GSC) classification scheme on the 2nd April 2014 to replace the current Government Protective Marking System (GPMS). A key aspect of this is the reduction in the number of security classifications used. All Bidders are encouraged to make themselves aware of the changes and identify any potential impacts in their Bid, as the protective marking and applicable protection of any material passed to, or generated by, you during the procurement process or pursuant to any Contract awarded to you as a result of this tender process will be subject to the new GSC. The link below to the Gov.uk website provides information on the new GSC:

<https://www.gov.uk/government/publications/government-security-classifications>

The Contracting Authority reserves the right to amend any security related term or condition of the draft contract accompanying this ITQ to reflect any changes introduced by the GSC. In particular where this ITQ is accompanied by any instructions on safeguarding classified information (e.g. a Security Aspects Letter) as a result of any changes stemming from the new GSC, whether in respect of the applicable protective marking scheme, specific protective markings given, the aspects to which any protective marking applies or otherwise. This may relate to the instructions on safeguarding classified information (e.g. a Security Aspects Letter) as they apply to the procurement as they apply to the procurement process and/or any contracts awarded to you as a result of the procurement process.

USEFUL INFORMATION LINKS

- [Emptoris Training Guide](#)
- [Emptoris e-sourcing tool](#)
- [Contracts Finder](#)
- [Equalities Act introduction](#)
- [Bribery Act introduction](#)
- [Freedom of information Act](#)