



# National Satellite Test Facility (NSTF)

## Facility Development Support Statement of Work

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<b>Document Prepared By:</b>	<b>Nigel Morris</b> Facilities Project Manager	Signature and Date:	
<b>Document Reviewed By:</b>	<b>Adam Hughes</b> Facilities Deputy PM	Signature and Date:	
<b>Document Approved By:</b>	<b>Jason Page</b> NSTF PA Manager	Signature and Date:	
<b>Document Approved By:</b>	<b>Graham Toplis</b> NSTF Project Manager	Signature and Date:	

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## CHANGE RECORD

Issue	Date	Section(s) Affected	Description of Change/Change Request Reference/Remarks
1.0	05/09/2017		First Release
1.1	24/08/17	All	Incorporation of comments from review process
1.2	30/08/17	All	Incorporation of more comments from review
2.0	05/09/17	All	Final tidy-up after review process



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## **1 INTRODUCTION**

### **1.1 SCOPE**

This document defines the work to be undertaken by an external company to provide a facility development support service to the NSTF project. The scope of the work will be limited to the environmental test facilities part of the NSTF project, but will include support concerning the interfaces between the test facilities and the building containing these facilities.

### **1.2 PURPOSE**

The purpose of this document is to allow potential bidders to prepare a costed proposal for the facility development support activities required by the NSTF project team.

### **1.3 APPLICABLE DOCUMENTS**

AD #	APPLICABLE DOCUMENT TITLE	DOCUMENT ID	ISSUE / DATE
1	Stakeholders Requirement Document	NSTF-MAN-RAL-RS-003	1.0
2			
3			

### **1.4 REFERENCE DOCUMENTS**

RD #	REFERENCE DOCUMENT TITLE	DOCUMENT ID	ISSUE / DATE
1			
2			

### **1.5 ABBREVIATIONS AND ACRONYMS**

BEIS	Business Energy and Industrial Strategy
CDR	Critical Design Review
DRB	Delivery Review Board
EMC	Electromagnetic
ESA	European Space Agency
EU	European Union
FAT	Factory Acceptance Test
HM	Her Majesty's
ITT	Invitation To Tender
NSTF	Nation Satellite Test Facility
OJEU	Official Journal of the European Union
PDR	Preliminary Design review



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RAL	Rutherford Appleton Laboratory
RF	Radio Frequency
RID	Review Item Discrepancy
SoW	Statement of Work
STFC	Science & Technology Facilities Council
TBD	To Be Determined
TRB	Test Review Board
TRR	Test Readiness Review
UK	
SBS	UK Shared Business Service
WBS	Work Breakdown Structure
WP	Work Package
WPD	Work Package Description



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## **2 NSTF DESCRIPTION**

### **2.1 BACKGROUND AND FUNDING STATUS**

The National Satellite Test Facility (NSTF) is a new national facility for the environmental testing of complete satellites (up to 7 tonnes mass). It is being funded by the UK Government in response to a study commissioned by UKSA into the status of existing space test facilities in the UK. The study report concluded that there are increasing numbers of small and large organisations requiring access to comprehensive space AIV/AIT facilities who currently have no facilities of their own. It goes on to say that the evidence suggests there is a case to establish a national AIV hub on the Harwell campus, as this location is becoming a centre of attraction for new and existing space companies.

The Science and Technology Facilities Council (STFC), through its RAL Space Department, submitted a final proposal to the Department for Business, Energy & Industrial Strategy (BEIS) in April 2017, and later the same month the Business Secretary Greg Clarke announced that, subject to business case approval, £99M from the Industrial Strategy Challenge Fund (ISCF) has been allocated to building the NSTF (ref <https://www.gov.uk/government/news/business-secretary-announces-industrial-strategy-challenge-fund-investments>). The business case was approved in full by HM Treasury on 22<sup>nd</sup> June 2017.

### **2.2 NSTF ENVIRONMENTAL FACILITIES OVERVIEW**

The top level requirements for the environmental test facilities can be found in AD1, but to summarise the following facilities will be included

- two large high-ceiling satellite integration and preparation cleanroom areas,
- spacecraft centre of gravity and moments of inertia measurement facility,
- large test facilities for vibration, shock and acoustic environmental testing,
- large thermal vacuum chamber (minimum 8m TBC diameter x 8m long in the baseline case) to support spacecraft thermal vacuum testing and sensor calibration activities,
- a suitably clean electro-magnetic-compatibility (EMC) facility for spacecraft level EMC testing,
- a near-field radio frequency (RF) test range for testing of communication and RF payloads and satellites.

All facilities will be sized to take the spectrum of satellite sizes up to a mass limit of 7 tonnes.

#### **2.2.1 Procurement Plan**

Whilst RAL Space Department has expertise in developing environmental test facilities, it does not have sufficient staff to develop in-house solutions and is therefore looking to procure turn-key solutions from suppliers who specialise in the type of equipment used for testing large satellites. STFC, through its procurement agent UK SBS, will procure each of the



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facilities listed in §2.2 through an open and competitive tender process that is compliant to the relevant legislation (including EU legislation). A detailed specification for each facility will be written by the NSTF project team, along with a statement of work (SoW) describing how the facility shall be designed and developed. A list of deliverable documentation and mathematical models will be included in these SoWs. These documents will be issued as an invitation to tender using the Official Journal of the European Union (OJEU) to elicit tenders from potential suppliers. Each tender return will be evaluated using pre-defined criteria, and the tender ranked the highest will be awarded the contract following a period of clarification (if needed), or after the mandatory notification period has elapsed. After contract award, each supplier will be closely managed by the NSTF project team. Responsibility for the overall management of the suppliers will remain with STFC.

To assist the NSTF project team in the management of the chosen suppliers, we are looking for facility development support from organisations that have built and/or operated similar satellite test facilities. The details of this support are outlined in the work packages contained in this document.



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### 3 WORK TO BE PERFORMED

#### 3.1 WORK BREAKDOWN STRUCTURE

The work breakdown structure for the required support is shown in Figure 3-1.

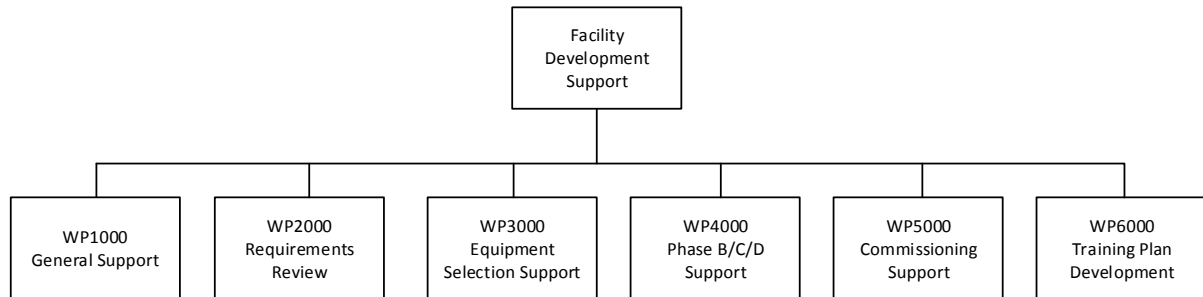


Figure 3-1 – Work Breakdown Structure

#### 3.2 WORK PACKAGE DICTIONARY

A top level description of each of the WBS elements is given in Table 3-1.

Table 3-1 WBS Dictionary

Level	WBS Code	WP Name	Definition
1	1000	General Support	Development of the NSTF facilities including layout of rooms and test flow
1	2000	Requirements Review	Review of requirements for all facilities and provide updates to equipment specifications
1	3000	Equipment Selection Support	Assessment and selection of facilities equipment, to include review of tenderer's documentation
1	4000	Phase B/C/D	Expert review of the facilities preliminary design, detailed design, manufacturing and factory acceptance testing phases.
1	5000	Commissioning Support	Definition of the commissioning plans for each facility. To include input to detailed test plans.
1	6000	Training	Develop training plans for training existing, and new staff, to operate the facilities.





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## 4 WORK PACKAGE DESCRIPTIONS

Project:	NSTF Facilities	WP Ref.:	WP1000
Phase:		Sheet No.	1/1
WP Title:	General Support		
Contractor:	TBD		
Start date:		Start event (optional)	Contract Award
End date:		End event (optional)	Mar 2020
WP Manager:	TBD		
<b>WP objectives:</b>			
To provide a general level of support covering all aspects of the NSTF facilities not covered in other work packages. It should allow for members of the NSTF project team to communicate with relevant subject matter experts on an informal and ad hoc basis.			
<b>WP inputs:</b>			
NSTF Facilities top level requirements			
<b>WP activities:</b>			
Provide telephone and e-mail responses to questions from NSTF project team. The response time required will vary, but responses within 48 hours of the initial enquiry will be acceptable			
Review of NSTF building layout and provide input regarding work flow through the facility			
Provide inputs to requirements for storage and unloading areas			
Provide inputs to typical satellite test campaign durations			
Provide inputs to office space needed for typical satellite test campaign teams			
Provide contact details of potential suppliers			
Share lessons learned from Supplier’s own experiences			
Provide inputs on how to manage facility to building interfaces. In particular how responsibilities for the civil engineering elements of the facilities should be divided between the NSTF building contractor and the facility contractors.			
<b>WP outputs:</b>			
Storage and unloading requirements			
Details of satellite test work flow			
Typical test campaign information, such as test durations			
Office space requirements			
Procedures, or process, for managing building to facility interfaces			



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Lessons learned
Review of Industry competencies

Project:	NSTF Facilities	WP Ref.:	WP2000
Phase:		Sheet No.	1/1
WP Title:	Requirements Review		
Contractor:	TBD		
Start date:		Start event (optional)	Contract Award
End date:		End event (optional)	Oct 2017
WP Manager:	TBD		
<b>WP objectives:</b>			
To critique all the requirements related to the NSTF Facilities, and their interdependencies on the NSTF building, and provide recommended changes, or additions, to these requirements.			
<b>WP inputs:</b>			
NSTF Facilities top level requirements Vibration facility requirements Acoustic facility requirements EMC and Antenna facility requirement Large Space Test Chamber requirements Mass Properties facility requirements			
<b>WP activities:</b>			
Review all the facility requirements Provide corrections or additions to the requirements, with supporting information as to why the changes are needed. Review final versions of requirements to ensure all changes have been implemented correctly Attend up to 2 meetings at STFC-RAL to discuss requirement changes with the NSTF project team Respond to questions from the NSTF project team about requirements. Response time should be less than 48 hours. Identify critical dependencies between the facilities and the NSTF building. Provide preliminary requirement of the seismic masses for the vibration facilities. Provide design and construction details for the acoustic test facilities with particularly emphasis on the interfaces to the NSTF building Provide technical information to the building architects for the design of the building main slab and any protrusions and intrusions needed for the facilities. (Note: the			



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detailed design of the facilities, including interfaces to the building, will be a supplier responsibility).

**WP outputs:**

Requirement changes and additions

Technical support to define requirements

Detailed design information (e.g. mass, size, isolation system performance, etc.) for the vibration facility seismic bases

Detailed design information (e.g. room size, wall construction, isolation system performance, etc.) for the acoustic facility

Technical information regarding main slab design



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Project:	NSTF Facilities	WP Ref.:	WP3000
Phase:		Sheet No.	1/1
WP Title:	Equipment Selection Support		
Contractor:	TBD		
Start date:		Start event (optional)	Contract Award
End date:		End event (optional)	Feb 2018
WP Manager:	TBD		
<b>WP objectives:</b>			
To provide technical assessments of the proposal submitted by Bidders in response to Invitation To Tenders (ITTs) for the facilities.			
<b>WP inputs:</b>			
Facility requirements Facility statements of work Tender Documentation			
<b>WP activities:</b>			
Provide input to procurement questionnaires Provide technical assessments of the suppliers proposals to determine if they meet all the requirements, and to provide rankings Provide list of clarification questions to the NSTF team that are needed in case Bidders information is unclear Review suppliers proposed schedules and comment on their viability Attend 3 supplier selection meetings with NSTF staff at STFC-RAL Attend kick-off meetings with selected Bidders			
<b>WP outputs:</b>			
List of suppliers with contact details Definition of technical selection criteria (i.e. questions for suppliers to answer) Technical assessment of all Suppliers' proposals Response to Bidders' clarification questions received during the tender phase List of clarification questions to be answered by Bidders before the final selection is made.			



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Project:	NSTF Facilities	WP Ref.:	WP4000
Phase:		Sheet No.	1/1
WP Title:	Phase B/C/D Support		
Contractor:	TBD		
Start date:		Start event (optional)	Mar 2018
End date:		End event (optional)	Sep 2019
WP Manager:	TBD		
<b>WP objectives:</b>			
Technical support during the primary design, detailed design, manufacturing and testing phases. In particular attendance at SRR, PDR, CDR, TRR, TRBs and DRBs will be required.			
<b>WP inputs:</b>			
Facilities requirements documents PDR documentation for each facility CDR documentation for each facility TRR documentation for each facility TRB documentation for each facility DRB documentation for each facility Commissioning plans Schedules			
<b>WP activities:</b>			
Review all documentation 2 weeks before formal design reviews and provide Review Item Discrepancies (RIDs) Attend reviews at the selected Bidders premises to confirm, or otherwise, that the proposed designs are technically compliant. Raise actions to mitigate non-compliances. Review responses to RIDs and close out, or request further information Review minutes of meetings and provide corrections or additions Attend Factory Acceptance Test (FATs) Provide critique of commissioning plans			
<b>WP outputs:</b>			
Closed-out RIDs Actions needed to mitigate non-compliances Technical guidance Support for problem resolution (see §7.0 for the approach to be applied for costing			



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this work).

Project:	NSTF Facilities	WP Ref.:	WP5000
Phase:		Sheet No.	1/1
WP Title:	Commissioning Support		
Contractor:	TBD		
Start date:		Start event (optional)	Sep 2019
End date:		End event (optional)	Mar 2020
WP Manager:	TBD		

**WP objectives:**

To provide technical support during commissioning tests of each facility.

**WP inputs:**

Commissioning plans  
Detailed test procedures  
ESA VAST-12 antenna (test item) plus associated equipment  
Satellite mass simulator (test item)

**WP activities:**

Provide detailed input into the test procedures for each test to be run on the facilities  
Support with procurement (or loan) of the test items listed above  
Identification of any additional test items needed to commission the facilities  
Attend test planning meetings at STFC-RAL  
Provide expert support during the tests  
Process and examine test data  
Support with preparation of test reports  
Support to identify and resolve any test anomalies

**WP outputs:**

Inputs to test procedures  
Test reports for each of the facilities comparing achieved performance against requirements  
Technical support during the commissioning tests



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Project:	NSTF Facilities	WP Ref.:	WP6000
Phase:		Sheet No.	1/1
WP Title:	Training Plan Development		
Contractor:	TBD		
Start date:		Start event (optional)	Contract KO
End date:		End event (optional)	Mar 2020
WP Manager:	TBD		
<b>WP objectives:</b>			
To work with the NSTF project team to develop a training plan for the training of existing and new staff.			
<b>WP inputs:</b>			
Facility user manuals			
Facility equipment lists			
<b>WP activities:</b>			
Identify number of operators needed for each facility and their roles			
Identification of operator skills needed for each facility			
Identification of minimum formal qualifications needed for each role			
Identify where skill shortages exist			
Identify ways and means of providing skills training and experience			
Provide inputs to training plan			
Review of final training plan			
<b>WP outputs:</b>			
Training plan that details how operators for each of the facilities described in §2.2 can be identified and trained to run the facilities after installation and commissioning is completed.			



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## **5 MILESTONES**

### **5.1 DURATION**

The duration of the work shall not exceed 30 months from kick-off to end of the activity (commissioning of facilities).

### **5.2 MILESTONES**

The following milestones shall apply;

<b>MS#</b>	<b>Description</b>
MS 1	End of WP2000 – Requirements review
MS 2	End of WP3000 – when all contracts have been awarded to suppliers
MS 3	All PDRs for the facilities are complete <sup>1</sup>
MS 4	All CDRs for the facilities are complete <sup>1</sup>
MS 5	All TRRs for the facilities are complete <sup>1</sup>
MS 6	All DRBs for the facilities are complete <sup>1</sup>
MS 7	All facility commissioning tests are complete and reports issued. The Training Plan is issued.

<sup>1</sup> – Milestone for each of the facilities will be acceptable, as it is unlikely all review will be completed within a few days of each other. For example MS 3a could be completion of the vibration facility PDR, MS 3b for completion of the Acoustic facility PDR, etc. The same applies for the other reviews.

### **5.3 SUPPLIER REVIEWS**

As the contract is for on-going development support throughout the project life of the NSTF, all milestone payments are linked to completion of WPs, or to significant NSTF events such as facility reviews. The Suppliers' performance in the conduct of the work defined herein will be evaluated on an on-going basis and will use metrics as listed in §5.3.1.

#### **5.3.1 Metrics for evaluating Supplier Performance**

The following list of metrics shall be used to evaluate the Supplier's performance in the execution of the work. If at any time the supplier's performance is judged as poor, they will be notified in writing and given the evidence of why their performance is considered poor. The supplier must then respond in writing within 14 days stating any reasons for the poor performance, or disputing the evidence, and what remedial actions, if any, will be taken to improve the situation.





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Metric	Good Performance	Poor Performance	Comment
Telephone or e-mail response time	Within 24 hours	Within 72 hours	Response must address questions asked rather than just acknowledging request
Availability for meetings away from Supplier's site	Can attend within 5 days of meeting request	Can attend within 15 days of meeting request	This applies to ad-hoc meetings where a quick response is needed.
Quality of written documentation	Has the appropriate level of detail and is written in English using a clear layout. Document should be under configuration control and approved by someone other than the main author	Does not contain enough detail and is unclear. Not written in English and has no configuration control. Document is not approved.	All issued documentation must be easy to understand and approved by a senior manager or QA person.
Quality of technical support	Clear rationale provided for why something must be done a certain way. Quality of support demonstrated by facility equipment meeting its requirements	No rationale and/or no clear direction provided. Facilities don't meet their requirements and remedial actions are required.	Poor technical decisions will be costly, so good justification must always be provided.
Flexibility and willingness to adapt to changes	Understands that change may be needed to keep project within costs or schedule, and is willing to adapt their workflow within contract scope.	Is resistant to any changes away from initial baseline and will not adapt workflow until contract has been re-negotiated.	The budget for the NSTF is fixed and it may be necessary to de-scope some of the facilities to stay within this cap. This will require the Supplier to be more flexible in their approach to their work.



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## 6 SCHEDULE

A provisional schedule for the NSTF is given in Figure 6-1. Completion by March 2020 is a hard deadline driven by the HM Treasury's funding profile.



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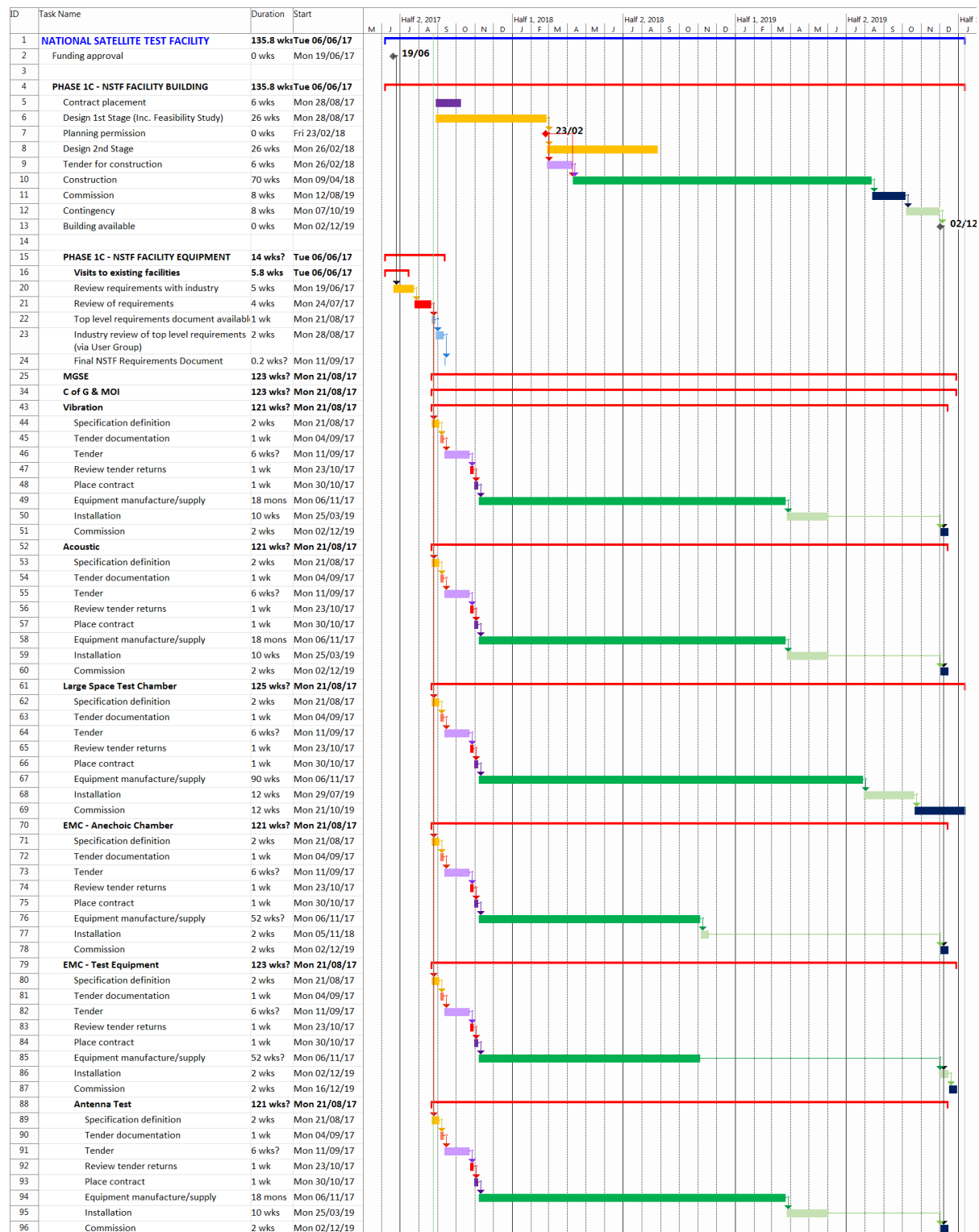


Figure 6-1 Provisional Schedule



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## 7 GUIDE DURATIONS FOR EACH WORK PACKAGE

To assist bidders with costing each work package the amount of hours support expected is given in Table 7-1. Also a travel plan is provided in Table 7-2 to assist with costing of the travel and subsistence element of the work. It should be stressed that these are only guidelines and bidders should submit their own assessment of the time needed with reasoning.

Bidders should also identify gaps in the work requested and submit costs for this additional work along with a justification for why it is needed.

Table 7-1 Estimated hours for each work package

WP No.	Tasks	Hours	Justification
1000	All	240	2 hours per week for 30 months
2000	All	621.6	6 experts each spending two weeks on review of requirements. Plus 2 days travel for each expert per meeting
3000	All	488.4	6 experts each spending one week on review of supplier bids. Plus 2 days travel for each expert per meeting
4000	All	740	6 experts for one week per review for review of documentation and RID generation. Plus 2 days travel for one expert to attend each of the 5 reviews. Plus one expert to attend FATs
5000	All	888	One expert per facility spending up to 4 weeks for commissioning activities
6000	All	296	Two months of effort in total
	Total	3274	

Notes:

1. A working week is assumed to be 37 hours.

### 7.1 COSTING METHOD FOR UNKNOWN AMOUNTS OF WORK

For adhoc works, or where the amount of work needed is currently unknown, a schedule of grades and charge rates for the personnel shall be supplied. During the execution of the contract, the time and grade of personnel needed to complete any adhoc work shall be agreed with STFC-RAL and a price calculated using the charge rates provided.



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Table 7-2 Travel Plan

WP No.	Destination	Purpose of Trip	Means of Transport	No. of trips	No. of people	Duration of trip (days)
1000	STFC-RAL	Kick-off meeting	Air/Rail/Car	1	2	1
2000	STFC-RAL	Requirements review	Air/Rail/Car	2	6	1
3000	STFC-RAL	Evaluation of Supplier bids	Air/Rail/Car	3	6	1
4000	TBD	PDR for each facility	Air/Rail/Car	6	1	1
	TBD	CDR for each facility	Air/Rail/Car	6	1	1
	TBD	TRR for each facility	Air/Rail/Car	6	1	1
	TBD	DRB for each facility	Air/Rail/Car	6	1	1
	TBD	FAT for each facility	Air/Rail/Car	6	1	1
5000	STFC-RAL	Commissioning of test facilities	Air/Rail/Car	6	1	20
6000	n/a	Training Plan	n/a	n/a	n/a	n/a



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## **7.2 TRAVEL POLICY**

Travel and hotels shall be chosen subject to the overriding consideration of value for money.

## **8 SPECIFIC EXCLUSIONS**

The work associated with the design and construction of the NSTF building is explicitly excluded from this requirement on the basis that STFC-RAL will employ its own contractors for this work. The exceptions to this are the specific facility to building interfaces called out in the WPDs in §4 of this document. Also excluded is the NSTF Facility User Requirements definition, as this analysis has already been carried out by the NSTF Project Team. However, a review of these requirements is within the scope of this consultancy.