

Reference DES/NW/PSO/555/35

3 April 2007

IAB Sec

**Enriched Uranium Facility Initial Gate Business Case**

References:

- A. D/CSA/12/10 (043/06) dated 25 January 2006
- B. D/CSA/12/10 (462/05) dated 25 July 2005
- C. RRMP 23365 dated 21 October 2005
- D. D/CSA/12/10 (181/05) dated 29 March 2005
- E. D/SIT/10/1/6/12 dated 22 January 2007

**Summary**

An Enriched Uranium (EU) capability is required to maintain Trident in service, to provide successor warhead capability, submarine reactor fuel material and to safely withdraw warheads at the end of their service life. The current EU capability at AWE Aldermaston (the [redacted] complex) is over 50 years old and incapable of meeting future capability and regulatory requirements, although it continues to operate safely. [redacted]

[redacted] In accordance with the Nuclear Warhead Capability Sustainment Programme (NWCSP) Facility Approvals Information Note, initial gate approval is sought for the replacement EU facility project to proceed to the assessment phase at a not to exceed cost of £48.5M CDEL and £2M IRDEL.

**Issue**

- 1. To seek approval for the EU Project to proceed to assessment phase at a cost of £50.5M in accordance with Reference A.

**Recommendation**

- 2. The approving authority is invited to approve:
  - a. The EU Project proceeding with a single option to the assessment phase.
  - b. The "not to exceed" cost at outturn and inclusive of Fee but excluding VAT (as this is recoverable), for the assessment phase with AWE Management Limited (AWE(ML)) through the Management and Operation (M&O) contract at 60% confidence of consisting of:
    - o £48.5M capital expenditure (CDEL)
    - o £2.0M total indirect resource consumption (RDEL indirect)

And to note;

**SECRET UK EYES ONLY**

c. The 10% 50% and 90% confidence levels for the cost of the project phase capital expenditure (CDEL).

Project Phase		Capital Cost (£M)			
		10%	50%	NTE 60%	90%
Assessment Phase	IG Estimate	45.7	48.0	48.5	50.4
Demonstration and Manufacture (D&M)	IG Estimate	[REDACTED]			

d. The confidence limit curves at Annex A (excluding fee).

e. The emerging Key User Requirements (KURs) at Annex B.

f. An ISD at 10% 50% and 90% confidence levels of;

ISD	Confidence Levels		
	10%	50%	90%
IG Estimate	Jan 2016	July 2016	Feb 2017

g. The concept phase sunk cost of £6.8M.

h. The expected Total COO of [REDACTED] at Annex C.

i. The milestones and approval schedule at Annex D.

j. The key risks at Annex E and that the risk of extreme protestor action has been excluded from the risk provision.

k. The procurement strategy summarised at paragraph 26.

l. The EU project is affordable and within STP provision. Funding until FY 10/11 has been sought within the CSR 2007.

m. It has been agreed that project costs will be capitalised up to the end of the Demonstration and Manufacture phase, therefore no RDEL has been sought.

**Timing**

3. Routine.

**Background**

4. EU is a radioactive, toxic material used in nuclear weapons and submarine reactor fuel. Since 1956 the UK's EU capability has been provided by the [REDACTED] facility at AWE Aldermaston. This facility provided the capability for storage, casting, machining, inspection, surveillance, recycling, and waste treatment of EU components and material.

[REDACTED]  
[REDACTED] In order to maintain essential deterrent capability, the IAB endorsed the NWCSF (Reference B) funded programme of work, that included [REDACTED].

5. Whilst the [redacted] facility is operating safely [redacted] [redacted] the required full production capacity cannot be achieved by the current facility. The current Periodic Review of Safety (PRS), to be agreed by the Health and Safety Executive / Nuclear Installations Inspectorate (HSE/NII), plans for continued operation at a reduced level until 2016.

6. This business case addresses the [redacted] identified within the NWCSP Review Note (Figure 1) and sets out to achieve the full [redacted] [redacted]

**Figure 1 – Strengths and shortfalls in warhead capability identified in the NWCSP Review Note. (Capability improvements shown in bold.)**



Requirement

7. The EU facility is required to satisfy the KURs and acceptance criteria listed at Annex B. This includes manufacturing EU components for Trident, **Successor**, research and development, submarine reactor fuel, storage and materials analysis. The facility is not required to provide a capability for Uranium enrichment. These requirements are output based and are measurable and contractable.

Analysis of Options

8. **Eight options have been considered and assessed against the concept of analysis. These are analysed in detail in the Options Analysis document and the Investment Appraisal (IA) DPA/NW/PGL/101/319/01/IA and summarised in Table 1 below.**

9. Options A1-A3 analysed variations of the Do Nothing / Do Nothing Extra / Stretch Capability. [redacted]

10. Option B analysed refurbishing [redacted] to provide an enduring capability [redacted]  
[redacted]

11. The recommended option (Option C) is to build a new EU facility on a brown-field site at AWE Aldermaston. [redacted]  
[redacted]

12. Option D considered the procurement of components from outside AWE. [redacted]  
[redacted]

13. Option E analysed the potential for efficiencies across the programme by combining the EU facility with other facilities. This has been under consideration since the initiation of the EU project but has been rejected as it offers no cost benefits. [redacted]  
[redacted]

14. Option F analysed the rationalisation of the EU capability with other sites across the UK. [redacted]  
[redacted]

**Table 1 Option Analysis**

Options		NPV £M	Comments
A1	Do nothing	[redacted]	Rejected. Fails KUR B, C, E & F.
A2	Do nothing extra	[redacted]	Rejected. Fails KUR B, C, E & F.
A3	Stretch current capability	[redacted]	Rejected. Fails KUR B, C, E & F.
B	Refurbish	[redacted]	Rejected. Fails KUR B, C, D, and E & F [redacted]
C	New build	[redacted]	Recommended Option.
D	Procure EU products from elsewhere.	Not costed.	Rejected.
E	Combine capability.	Not costed.	Rejected.
F	Rationalise UK EU	Not costed.	Rejected.

**Whole System Approach Defence Lines of Development (DL0D)**

15. The EU facility will provide one of the infrastructure elements required to support the equipment defence line of development for the nuclear warhead in support of UK deterrent capability. The preferred option has minimal impact upon logistics by maintaining EU capabilities on the Aldermaston site.



16. Nuclear Suitably Qualified Experienced Personnel (NSQEP) from the existing facility will be transferred to the replacement facility. Additional training to operate the replacement facility is to be provided by AWE.

### Assessment Phase Deliverables

17. The aim of the assessment phase is to optimise a facility design to meet the KURs and to seek the lowest cost compliant solution. The key deliverables of the assessment phase (Annex D2-2) are a facility design, completion of site preparation activities, HSE/NII approval of the Pre Construction Safety Case Report (PCSR), planning permission and the provision of contract quality data to enable the competitive selection of subcontractors for the demonstration and manufacture phase. In parallel the NW IPT will commission an independent financial review and will also task Pricing and Forecasting Group (PFG) to produce an independent analysis of cost "Should Cost Model". These will provide comparators against which the AWE proposal can be judged.

### Costs & Affordability

18. During the NWCSP AWE Plc identified the need to improve their competence in estimating. AWE Plc developed a strategic alliance with construction economists **Franklin and Andrews**, a subsidiary of **Mott MacDonald** to provide experienced estimators. AWE Plc has introduced a confidence modelling process which has been validated by PFG.

19. PFG conducted an independent analysis of AWE Plc's estimates and undertook independent confidence modelling. Due to the unique nature of the EU project there are no direct comparators. However PFG found that AWE Plc's estimates and uncertainties were based upon an appropriate combination of firm priced bids, historic data, and parametrics. Where appropriate, comparators with similar work conducted at AWE, project Orion and other representative UK sites such as Sellafield and D154 at Devonport were used. PFG developed independent cost and schedule models which produced similar results to AWE Plc's modelling. PFG's models have been used to support this business case.

20. Approval is sought at a cost confidence level of 60%. This is considered sufficient to manage all realistic combinations of risks.

Whilst effective mitigation actions have been identified and costed within the approval it is considered inappropriate to seek approval to include the consequence of a low probability high impact risk.

21. The assessment phase work is funded to the end of FY 08/09. Funding until FY10/11 has been sought within the Comprehensive Spending Review (CSR) 2007 which goes beyond the expected main gate date. During the CSR process figures for the whole of NWCSP to FY 24/25 have been submitted to Treasury. This included provision for the remainder of the EU programme. The costs are within the affordability figures (August 2006) against the EU facility funding line during the assessment phase and up to the in service date and beyond.

### Through Life Management

22. The EU project is managed within the NW IPT through life management system. This was assessed by Technical and Enabling Services (TES) in November 2006 and achieved provisional maturity assessment level 4.

### Governance

23. The EU project was initiated in 2003 and has passed through AWE Plc's project approval gateway process. The EU project is managed by an integrated AWE Plc/NW IPT team with over 50 Suitably Qualified Experienced Personnel (SQEP). SQEP MoD personnel and regulators from the HSE/NII and Environment Agency (EA) have also been engaged throughout the programme. The project is subject to the existing NWCSP governance arrangements. Programme progress will be reported to the NWCSP Senior Responsible Owner at the Nuclear Warhead Sustainment Steering Group (NWSSG). Programme progress will be monitored and reported against the milestones identified in Annex D2.

24. The contract with AWE Management Limited (AWEML) mandates the use of Earned Value Management (EVM) for all major facility projects. TES have assessed the NW IPT EVM strategy as being mature and in line with DPA policy. AWE Plc has developed EVM processes which are currently in use on other major construction projects. EVM will be implemented on the EU project during the assessment phase. The Integrated Baseline Review (IBR) is planned for April 2007 with EVM reporting commencing in May 2007.

### Optimism Bias

25. The EU project passed an Optimism Bias review conducted by PFG. The OB date of July 2016 and cost of [REDACTED] (ex fee cost to in service date) both below the required 90% confidence level and indicate that the estimates includes an appropriate provision for risk and uncertainty. This review used the criteria for equipment projects, this was considered more appropriate than the non-standard building criteria due to the nature of the process equipment and building design.

### Technology / System Readiness Levels

26. The technologies required are well understood through previous or equivalent operations. The proposed storage and material transport systems are adaptations of a proven design that is in service in the US. The assessment phase will develop these designs to fully meet UK regulatory requirements.

### Procurement Strategy Assessment Phase

27. The IAB approved the procurement strategy for NWCSP in Reference D. This provided for the continuation of the contract with AWE Management Limited (AWEML) under a firm target cost incentive fee price (subject to maximum price), with revisions to the terms and conditions for a 3-year period to March 2008. The EU project assessment phase will be conducted under this contract within the existing price.

28. The contractual arrangements beyond March 2008 for NWCSP were addressed in a Review Note at Reference E. This review note recommends the continuation of the contract with AWEML albeit with further revised and focused arrangements related to fee and overall activity being undertaken with, where appropriate, a suitable retention built into

the milestone arrangements. This review note has been approved by the IAB and is awaiting Ministerial and HM Treasury endorsement.

29. The NWCSF approval provided for the demonstration and manufacture phases of selected major projects to be separately priced within the existing contract. Post main gate approval, the EU demonstration and manufacture phase will be placed with a discrete target cost basis with its own maximum price with specific incentivisation.

30. AWE Plc sought bids through competition from industry to support the NWCSF and selected AMEC (NNC), RWE Nukem and WS Atkins as framework suppliers for complex regulated facility projects. AMEC (NNC) was selected as the EU facility design contractor on the basis of their skills and resource profile. AWE Plc will demonstrate Value For Money (VFM) through extensive (some 90% by value) competitive selection of their subcontractors.

31. Private Finance Initiative (PFI) has been rejected as the requirement cannot be delivered as a standalone project and there are no commercial synergies. As AWE Plc would remain the nuclear site licensee there would be no opportunity to transfer risk to a PFI contractor.

32. Defence Estates have endorsed the procurement route of this facility as an equipment based hybrid project.

### **Support Strategy**

33. Once complete the EU facility will replace the existing [redacted] facility. AWE Plc will be incentivised to deliver VFM throughout the facility life through the M&O contract.

34. Following a presentation to the TES Supportability Assurance Group it was concluded that the IPT's processes were consistent with the guiding policies of the Support Solutions Envelope (SSE) but due to the regulated nature of the IPT's work there would be limited value in aligning with the SSE. This approach is supported by DLO D Sec Scrutiny.

### **Disposal**

35. Under current accountancy practices a Nuclear Provision will be established at the time of active commissioning, this will be classified as Annually Managed Expenditure (AME) outside of STP control totals. During operation the facility will generate a number of waste streams which will be managed by AWE Plc to meet the requirements of the HSE/NII and the EA regulators.

### **Risk & Opportunities**

36. AWE Plc and the NWIPT have developed a joint risk and opportunity management process for the EU project. All stakeholders including DG Strat Tech have been engaged in workshops to identify risks, opportunities and mitigation actions. All mitigation actions have been resourced within the assessment phase plan and the costs are included within the approval sought.

37. The assessment phase plan seeks to mitigate those risks identified to the demonstration and manufacture phase. Planning approval was assessed as a key risk to



the in-service date and the mitigation identified is to seek approval some two years earlier than originally planned. Ground issues including contamination are also now planned to be addressed during the assessment phase within the site enabling work package.

38. This project has taken the opportunity to reduce construction costs by the use of a site enclave to lower the level of security clearance for site preparation workers. This potentially permits the use of non-UK nationals and allows construction work to be conducted under conventional rather than HSE/NII rules. AWE have also considered the use of [REDACTED] as a potential building to house the capability, this however has been rejected on technical risk and cost grounds.

39. Significant risks from the Joint AWE Plc/NWIPT risk register are detailed in Annex E. This is in two sections to show risks applicable to the assessment phase and those relevant to the demonstration and manufacture phase.

40. The EU project achieved level 3 in both risk and estimating maturity during an assessment conducted by TES-PM-Risk 1 in January 2007.

### Legal Implications

41. Aspects of the project such as the processes, substances, volumes and production rates are classified. The release of such information into the public domain would have implications for national security. It is therefore not possible to fully comply with the statutory Environmental Impact Assessment (EIA) as required under the Town and Country Planning EIA (England and Wales) Regulations 1999. Therefore it will be necessary to obtain a defence EIA exemption direction. The method has been agreed with Defence Estates and an application for exemption will be made through the SofS for Defence, to the Department for Communities and Local Government (DCLG) in mid 2007.

42. Should the Local Planning Authority (LPA) subsequently fail to determine the planning application this would trigger a public inquiry. If the LPA grant approval the validity of the decision could be challenged and subjected to judicial review. For this reason it is intended to seek planning approval some 2 years before main gate approval.

### Presentation and Handling

43. This project is consistent with previous announcements on NWCSP. No further announcements are planned.

[Signed on Original]

M J JENKINS  
Director Nuclear Weapons

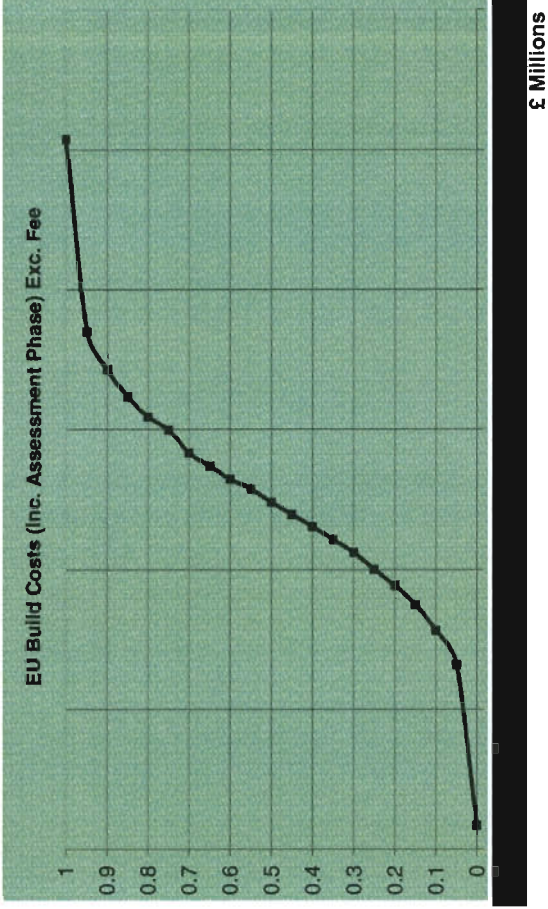
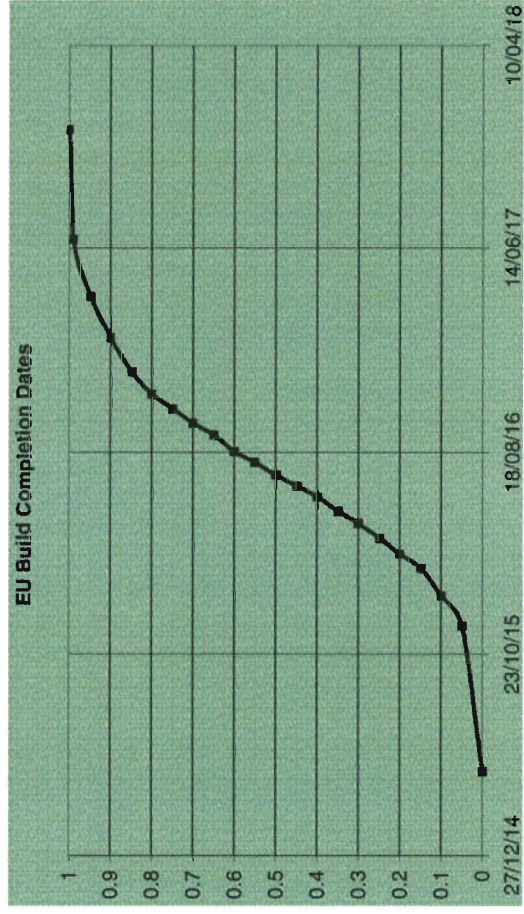
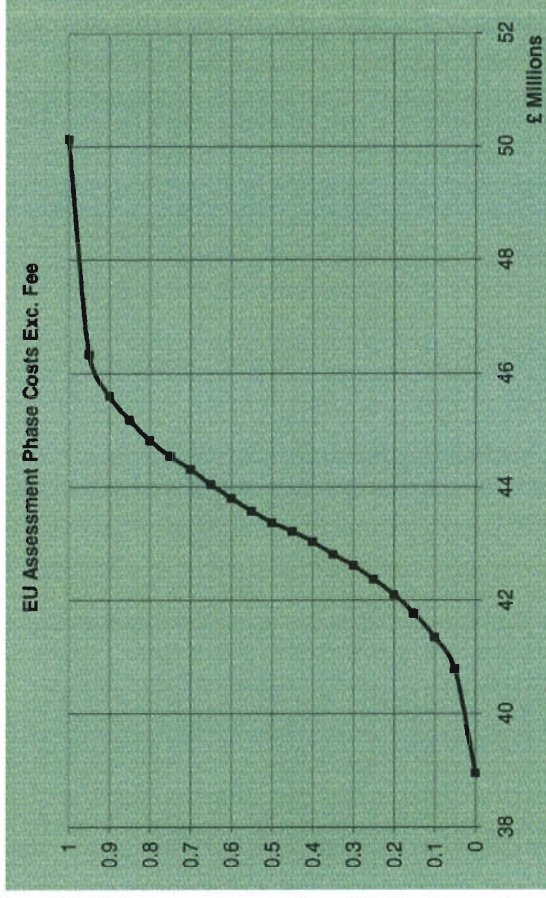
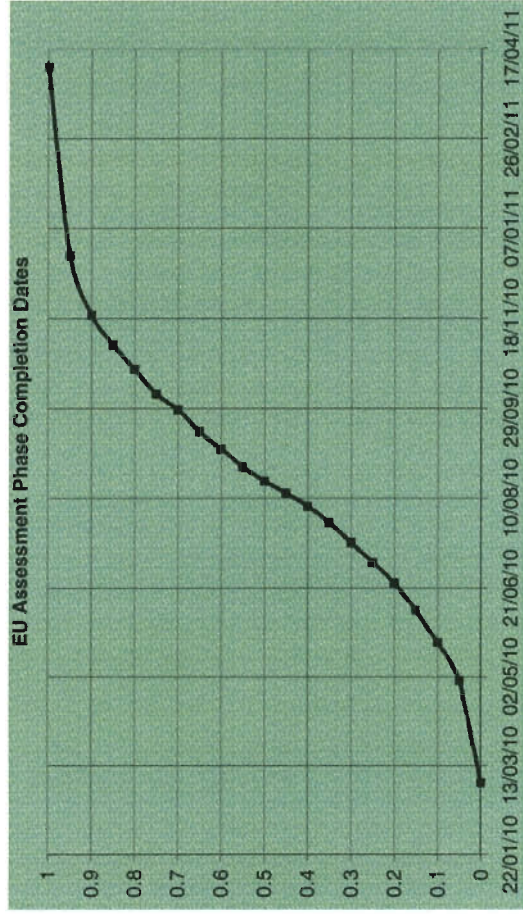
N J BENNETT  
DG Strat Tech

### Annexes

- A. Time and Cost Confidence Limits.
- B. Key User Requirements.
- C. Cost of Ownership.
- D. Programme Overview and Assessment Phase Milestones.
- E. Key Risks.



Annex A Time and Cost Confidence Limits





Assessment Phase Cost Summary

Element	Most Likely EM	Uncertainty	Cost Drivers
Facility Design Contract		-10 / +30 %	HSE/NII Agreement: Should the final design fail to achieve HSE/NII agreement due to change in legislation or interpretation, rework may be required. Planning Approval: Should the final design fail to achieve planning approval, rework may be required. Also the outcome of the Environmental Impact Assessment exemption is not yet known and has the potential to impact planning approval. Requirement/Scope changes: Any significant requirement or assumption changes during the design phase will lead to rework. Specialist Skills: Availability of specialist skills with the EU project team lead to increased rates and/or planned activity durations.
EU Project Team		-5 / +10 %	EU Project Team: In addition to the uncertainty identified, should high impact corporate risks, e.g. public inquiry impact the programme, the project team would be retained and depending on the stage of the project may lead to increased project duration. The EU team currently consists of around 50 SQEP staff.
Project Support Activities		-15 / +30 %	Specialist Skills: Availability of specialist skills lead to increases rates and/or planned activity durations. Security requirements: [REDACTED]
Site Enabling Work		-10 / +30 %	Unknown Ground Issues: Chemicals, asbestos, radioactive material, buried objects and discovery of ecological objects will impact spoil removal and utilities supply. Planning Approval: The spoil removal involves removing around 11000 cubic metres of material from the proposed site and requires planning permission, should the project encounter delays, costs will rise.
Sub-Total			
Risk & Uncertainty			
Fee			
IRDEL			Cost of Capital
Total	50.5		

<sup>1</sup> Project Support. Activities includes directly attributable Assurance and Safety work and Site Engineering Management.

Annex B Key User Requirements

Systems Requirements Module	Justification	Verification Method	Acceptance Criteria	URD <sup>2</sup> Ref
<p>A. The EU Project shall provide an EU operational store suitable for material types, forms and quantities as detailed in AWE/DSM/CS/061/04. (Secret Atomic - SA)</p>	<p>AWE stores the national stockpile of EU.</p>	<p>System audit by NW IPT Nuclear Materials Audit and Accountancy section.</p>	<p>Satisfactory audit.</p>	<p>2.1</p>
<p>B. The EU Project shall provide an Enriched Uranium facility capable of [REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>
<p>C. The EU Project shall provide an Enriched Uranium facility capable of [REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>
<p>D. The EU Project shall provide an Enriched Uranium facility capable of [REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>	<p>[REDACTED]</p>

<sup>2</sup> Nuclear Warhead Capability Sustainment Programme URD Version 6. SIT/10/1/6/4, dated September 2006.  
<sup>3</sup> AWE/DSM/HM/CS/013/03 'Uranium Facility Strategy Project Manufacturing, Processing & Storage Capacities (SA)



E. The EU Project shall provide an Enriched Uranium facility capable of [REDACTED]

F. The EU Project Shall provide an Enriched Uranium facility capable of [REDACTED]



Annex C Cost of Ownership

Financial Years	Prior Years	07/08	08/09	09/10	10/11	15/16	20/21	25/26	30/31	35/36	40/41	45/46	50/51
	£(M)	£(M)	£(M)	£(M)	£(M)	£(M)	£(M)	£(M)	£(M)	£(M)	£(M)	£(M)	£(M)
RDEL													
CDEL													
TOTAL IRDEL													
YEARLY COSTS (Exc IRDEL)													
CUMULATIVE COSTS (Exc IRDEL)													

Please note:

- All figures quoted are from the Whole Life Cost Model for the EU New Build Project
- All figures have been inflated by 2.5% from 07/08 onwards
- 
- IRDEL comprises cost of capital and depreciation of the new facility only (which commences in FY16/17).
- RDEL increases post 2016 due to facility operation costs

Assessment Phase Affordability

	07/08	08/09	09/10	10/11	TOTAL
<b>CDEL</b>					
Defence Programme Provision	17.0	23.8	13.8	3.0	57.6
Forecast at Initial Gate at 60% confidence	15.1	16.1	14.3	3.0	48.5
Forecast at Initial Gate at 50% confidence	15.1	16.1	13.8	3.0	48.0
Variation [profile minus forecast at 50% confidence]	1.9	7.7	0	0	9.6

	07/08	08/09	09/10	10/11	TOTAL
<b>IRDEL</b>					
Defence Programme Provision	0.1	0.6	1.1	0.2	2.0
Forecast at Initial Gate	0.1	0.6	1.1	0.2	2.0
Variation [profile minus forecast]	0	0	0	0	0

• These figures do not include sunk costs from the Concept phase of £13.8M spread across FYs 05/06-06/07.

• All costs are capitalised up to the end of the D/M phase, therefore there is no RDEL forecast.

• The additional IRDEL provision to FY10/11 is identified in the STP 07 bid and is affordable.



Demonstration and Manufacture Phase Affordability

	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	TOTAL
CDEL									
Defence Programme Provision									
Forecast at Initial Gate at 50% confidence									
Variation [profile minus forecast]									

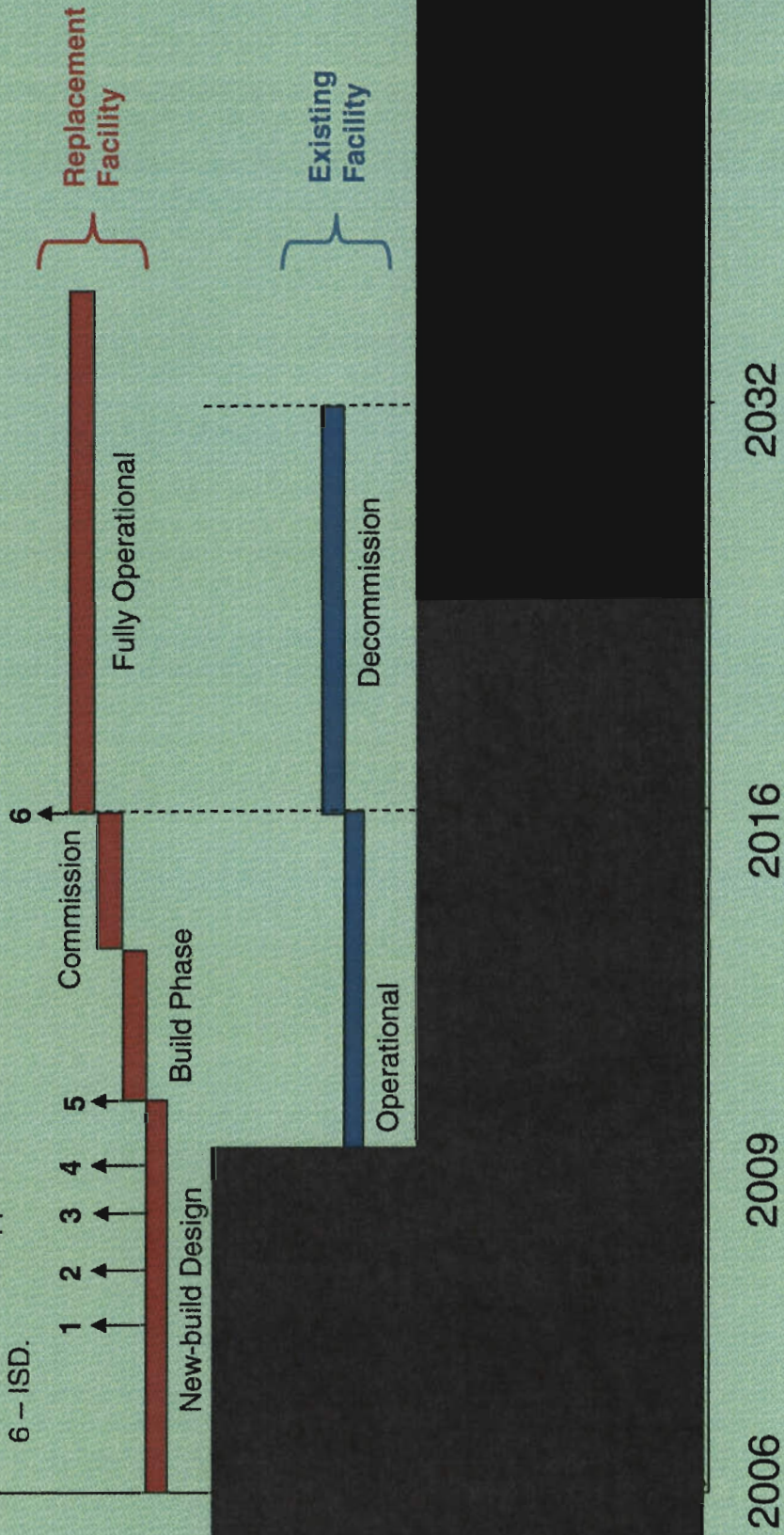
	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	TOTAL
IRDEL									
Defence Programme Provision									
Forecast at Initial Gate									
Variation [profile minus forecast]									

All costs are capitalised up to the end of the D/M phase, therefore there is no RDEL forecast.

IRDEL to FY10/11 is identified in the STP 07 bid and is affordable.

Annex D Programme Overview

- 1 – Planning Approval (exterior design / location finalised).
- 2 – Tenders Received (Note: Invitations to Tender will take place in the lead up to the planning approval).
- 3 – NII Agreement to Pre-Construction Safety Report.
- 4 – Site Enabling Works Complete.
- 5 – Main Gate Approval 2010.
- 6 – ISD.





Assessment Phase Milestones

Task Name	Finish	2008				2009				2010											
		Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4							
	Tue 16/12/08																				
	Mon 08/12/08																				
	Fri 19/12/08																				
	Fri 02/01/09																				
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	Thu 24/04/08																				
	Tue 22/09/09																				
	Fri 09/04/10																				
	Fri 13/09/10																				
General Purpose Equipment Design Complete																					
Building Design Complete																					
Building Services Design Complete																					
Planning Approval Granted																					
Completion of Enabling Works / Site Preparation																					
Gate 3 Approved																					
IAB Approval																					



Annex E Key Risks – Assessment Phase

Ref No	Description, Cause and Consequence	Mitigating Actions	Prob	Actual Estimated Cost £k	Time	Perf
36						
22	As a result of market competition there is a risk that SQEP resource (all disciplines) cannot be matched to the programme leading to an extension of time and payment of premium rates.	Early planning and recruitment	L		M	VI
29	Due to lack of agreement of final location and definition of [redacted] facility there is a risk that the design layout of the building cannot be completed or may require to be changed resulting in programme delays.	Seek clarification from site development [redacted]	L		M	VI
34						
3/C32						
16	As a result in a change of contract strategy there is a risk that there may be changes in tender documentation leading to significant rework and delay	Early freeze of procurement strategy	L		M	VI
40/C25	As a result of regulator requirements there is a risk that the PCSR and detailed design may not be accepted by the regulators leading to significant rework and delay	Integration of assurance and design on current programme. Progressive informal acceptance by Regulators (HSE/NII, EA, NWR). Implementation of the hold point control plan between Initial and Main Gate.	VI		M	NII

	VL	L	M	H	VH
PROBABILITY %					
COST £k					
SCHEDULE Months					
PERFORMANCE					

