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AWE Proposal for TP1 for the Implementation of the Nuclear Warhead Capability Sustainment Programme

VOLUME 1

ANNEX D



Considerations



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Executive Summary

This paper reports an initial assessment of [redacted] options that would be compatible with TDF [redacted]. Within the time available to conduct a review, only an initial feasibility assessment has been possible. This initial review culminated in a full day workshop [1] with knowledgeable subject matter experts at AWE.

This initial review indicates that there are several options which rank favourably against identified technical discriminators; however, there is no obvious prime candidate. Simple [redacted] are options which may have the potential to be suitable solutions, realisable in TDF [redacted] timeframes. To understand the issues associated with these requires some additional study. A more extended feasibility study is proposed within the TDF [redacted] programme, culminating in a design review in December 2007. None of the options being further considered impact current plans for facility re-kit / upgrades.

Definitions

[redacted] is where [redacted]

Note whilst the SRD [2] discusses [redacted] (SRD 8612), it does not define it.

[redacted]

[redacted]

[redacted]

[redacted]

The generic technical benefits and penalties of [redacted] are listed below with a more complete explanation of each at Appendix 1:



Benefits	Penalties
[REDACTED]	Increased [REDACTED]
[REDACTED]	Implications for [REDACTED]
Reduced operator dose	Functionality may not be [REDACTED]
[REDACTED]	[REDACTED] may be needed
Reduced storage requirements	Modest additional [REDACTED] costs
[REDACTED]	Potential for later year facility costs
[REDACTED]	No known precedent in a [REDACTED] system

Table 1 Benefits and Penalties associated with [REDACTED]

Operational Analysis Perspective

The Systems Assessment Group (SAG) is currently studying [REDACTED]
[REDACTED] [13].

Initial analysis is suggesting:

- [REDACTED]
- [REDACTED]
- [REDACTED]

The implications of this analysis are that a [REDACTED]
[REDACTED] with some capable of [REDACTED] could meet the
[REDACTED]. The statements are compatible with the concept of either a
[REDACTED]. This work would seem to indicate that the historic [REDACTED]
[REDACTED] could well be expected to continue in
[REDACTED] do not change dramatically. However,
this evolving analysis has not yet considered the preferred method of [REDACTED]
[REDACTED] therefore no views can be expressed at the current time.

[REDACTED]

[REDACTED]

[REDACTED]

From what is currently known about the [REDACTED] requirements and intended design, it [REDACTED] therefore the [REDACTED] does not currently appear to have the functionality to [REDACTED]. In addition this will mean the [REDACTED] does [REDACTED] setting and the communication protocols will [REDACTED] the additional information to be transferred to [REDACTED].

Taken at face value this would [REDACTED] however, this is [REDACTED] before the [REDACTED] and thus it is critical that [REDACTED] which provide potential functionality for [REDACTED].

If [REDACTED] requirements are not brought to the [REDACTED] community then, within a short period, it will be [REDACTED]. In which case the most likely outcome is that the [REDACTED].

To decrease the risk of the [REDACTED] AWE will be exploring [REDACTED] as part of the [REDACTED]. In addition, it is proposed that studies will be incorporated into Technology Demonstration Programme (TDF) [REDACTED] to assess the options of a UK [REDACTED] or using inherent [REDACTED] but in an [REDACTED] fashion. Examples of such options could be: [REDACTED], via an [REDACTED] or an [REDACTED] in an alternative way to the [REDACTED].

Options

Recent [REDACTED] Programme papers ref [3], [4] & [7] provide a list of [REDACTED] which represent all the currently known (and potentially credible) ways of [REDACTED]. Whilst some of these are [REDACTED] it is still an [REDACTED] of [REDACTED] and it is not appropriate for AWE to explore them all, or [REDACTED]. Therefore a simplified trade study was performed using [REDACTED] list of discriminators (see Appendix 2 for further details) to downselect to only the most credible solutions for TDF [REDACTED]. The discriminators used were:

- Function
- Physics
- [REDACTED]
- Engineering / Materials / Life / Reliability
- Facilities

Using these criteria the [redacted] options were reduced to [redacted]. These were then assessed in detail against the criteria and the topics regarding them discussed and recorded [1] [redacted].

[redacted]
[redacted]
[redacted]
[redacted]

Descriptions of the technical characteristics of these [redacted] can be found in Appendix 3 along with a brief discussion of the relative merits and disadvantages of each. The reader is directed to [1] for additional information.

This initial review indicates that there are several [redacted] which rank favourably against the identified technical discriminators; however, there is no obvious prime candidate. Simple [redacted] are [redacted] which may have the potential to be suitable solutions, realisable in TDF [redacted] timeframes. All of these are [redacted] which have little impact on AWE's facility plans.

Conclusions

Several [redacted] exist which [redacted] as they have the [redacted] and are potentially compatible with the demands of a [redacted]. These [redacted] do not have a significant impact on AWE's facility plans or warhead design / development capability plans although the additional burden in terms of qualification evidence needs to be quantified. It is initially considered that simple [redacted] and that these will be reviewed following the more detailed [redacted] within TDF [redacted]. In addition [redacted] needs to be actively pursued to understand what functionality may be [redacted] which will in turn affect the [redacted] on TDF [redacted]. These activities will allow AWE to undertake a design review in December 2007 and then be better positioned to advise MoD on the potential viability of [redacted].

Recommendations

As planned within the [redacted] Programme, it is recommended that the proposed detailed [redacted] be pursued, culminating in a Design Review in December 2007. The detailed work will:

- Develop the benefits and risks associated with [redacted] with the customer and stakeholders including:
 - [redacted]
 - Financial costs/ benefits
 - Resources required
 - Facilities required
 - Time required

These activities will need to be part of an integrated programme to develop the [redacted] and will thus enable effort to be focused on [redacted].

- Develop detailed [redacted] for some of the more promising [redacted]
- Confirm that [redacted]
- Further develop physics understanding / certification issues.
- Develop Operational Analysis issues relating to [redacted]
- [redacted]
- Determine the implications to [redacted]

[redacted] should be brought to the attention of the [redacted] community at the earliest opportunity and [redacted] should be explored with [redacted] as part of [redacted]

Studies should be conducted in TPD [redacted] to assess the options of a [redacted]
[redacted]

References & Related Documents

		Issue Date
1	Notes for [REDACTED] Workshop held on 13/3/07 - AWE/DWE11/07/B/H20002	April 07
2	Systems Requirements Document Issue 3, NWIPT/04/35/01	April 07
3	[REDACTED]	June 07
4	[REDACTED] For a UK [REDACTED] - An Engineering Appraisal	June 07
5	Calculations and capability assessment relating to [REDACTED] [REDACTED] TPN68/06	May 07
6	Calculations and capability assessment relating to [REDACTED] [REDACTED] TPN69/06	June 07
7	A Physics review of [REDACTED] [REDACTED] Volume 1. TPN72/06. September 2006	July 07
8	A Physics review of [REDACTED] [REDACTED] Volume 2. TPN73/06. September 2006	July 07
9	The [REDACTED] TPN70/06, November 2006	
10	Minutes Of The Design Review Of The [REDACTED] [REDACTED] Held At Awe Aldermaston On The 3rd Of November 2006, Awe Report 820/06, TPN 140/06,	
11	[REDACTED] Design Review Minutes, Awe Report 865/06, TPN 162/06	
12	[REDACTED] & Potential Benefits of [REDACTED] [REDACTED]	June 07
13	Performance Measure (Technical Capability) Milestone R11PA/8/02 - [REDACTED]	Sept 07

Appendix 1

The following is a generic list of the benefits and penalties associated with further amplifying the issues identified in Table 1.

Benefits

- [REDACTED]
- This could result in
 - [REDACTED]
 - Reduced operator dose (on both assembly and disassembly)
 - [REDACTED]
 - Reduced storage requirements
 - Reduced [REDACTED]
- Improved [REDACTED]
- [REDACTED] would not require [REDACTED]

Penalties

- Increased [REDACTED]
- [REDACTED]
 - [REDACTED]
- [REDACTED] (although it will produce a [REDACTED] and design solution).
- Additional [REDACTED] (by limiting design space this [REDACTED] could be modest & [REDACTED])
- Some later year facility costs may be incurred dependent on design solution.
- No known precedent in a [REDACTED] (there is no technical preclusion, the lack of precedence is a function of no state having a previous operational need for a [REDACTED])

Appendix 2

List of discriminators used for simplified trade study conducted at the workshop reported at [1]

- [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
- Physics
 - Can it be [REDACTED]
 - [REDACTED]
 - Availability of relevant data
 - Supercomputing
 - People
- [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
- Engineering / Materials / Life / Reliability
 - Can it be [REDACTED]
 - [REDACTED]
 - Environments
 - Qualification
 - Testability
 - Surveillance
- Facilities
 - Impact on scope of facilities
 - Current
 - New Build
 - Inclusions and exclusions in current scope
 - Hazardous materials/operations
 - Complex operations

Attendees and disciplines represented at the workshop were:

- [REDACTED] (Chairman)
- [REDACTED] Engineering/ Secretary)
- [REDACTED] Engineering)
- [REDACTED] Engineering)
- [REDACTED] (Secondary Physics)
- [REDACTED] (Secondary Physics)
- [REDACTED] (Secondary Physics)
- [REDACTED] (Materials)
- [REDACTED] (Materials)
- [REDACTED] (Explosives)
- [REDACTED] (Joining)
- [REDACTED] (Systems Integration)
- [REDACTED] (Systems Integration)
- [REDACTED] (Systems Integration/ Trade Studies)
- [REDACTED] (Systems Integration/ Trade Studies)
- [REDACTED] (Systems Assessment Group)

Appendix 3

The following sections give technical descriptions of each of the [redacted] and identifies some of the advantages and disadvantages of each.

[redacted]

Description

[redacted] and would comprise a mechanically driven [redacted]
 [redacted] These mechanisms could be [redacted]
 They can be designed to [redacted] These systems have [redacted]
 [redacted] By careful consideration of [redacted]
 [redacted]

[redacted]

Advantages / Disadvantages

	Advantages	Disadvantages
[redacted]	<ul style="list-style-type: none"> [redacted] [redacted] [redacted] [redacted] 	<ul style="list-style-type: none"> N/A
Physics	<ul style="list-style-type: none"> [redacted] [redacted] 	<ul style="list-style-type: none"> [redacted]
[redacted]	<ul style="list-style-type: none"> [redacted] 	<ul style="list-style-type: none"> Moving [redacted]
Eng/Mat/Life	<ul style="list-style-type: none"> Wide choice of [redacted] [redacted] 	<ul style="list-style-type: none"> [redacted] mechanism [redacted]
Facilities	<ul style="list-style-type: none"> Only requires conventional machining facilities 	<ul style="list-style-type: none"> N/A

Description

[Redacted]

[Redacted] are essentially the same as [Redacted] except there is [Redacted] instead the [Redacted] within the [Redacted] Unfortunately this system [Redacted] it was [Redacted] Although considerable engineering development [Redacted] this type of design is likely to be [Redacted] for this reason [Redacted]

[Redacted]

Advantages / Disadvantages

Due to the inherent difficulties with [Redacted] considered here.

	Advantages	Disadvantages
[Redacted]	• N/A	• N/A
Physics	• [Redacted]	• [Redacted]
[Redacted]	• N/A	• [Redacted]
Eng/Mat/Life	• Engineering [Redacted] • Potentially [Redacted]	• [Redacted]
Facilities	• N/A	• [Redacted] • May require addition equipment in [Redacted]

[Redacted]

Description

[Redacted]

Advantages / Disadvantages

	Advantages	Disadvantages
[Redacted]	<ul style="list-style-type: none"> [Redacted] 	<ul style="list-style-type: none"> Difficult to [Redacted]
Physics	<ul style="list-style-type: none"> [Redacted] also available 	<ul style="list-style-type: none"> N/A
[Redacted]	<ul style="list-style-type: none"> [Redacted] 	<ul style="list-style-type: none"> N/A
Eng/Mat/Life	<ul style="list-style-type: none"> [Redacted] technology compatible Can withstand [Redacted] 	<ul style="list-style-type: none"> [Redacted] development Complex assembly Integration of a [Redacted] may be challenging
Facilities	<ul style="list-style-type: none"> No facility implications if [Redacted] 	<ul style="list-style-type: none"> [Redacted] system test facility required [Redacted]

[Redacted]

Description


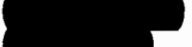
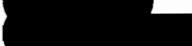
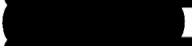
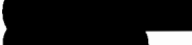
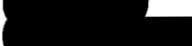

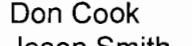

[Redacted description text]

Advantages / Disadvantages

	Advantages	Disadvantages
[Redacted]	<ul style="list-style-type: none"> [Redacted] [Redacted] 	<ul style="list-style-type: none"> N/A
Physics	<ul style="list-style-type: none"> [Redacted] 	<ul style="list-style-type: none"> N/A
[Redacted]	<ul style="list-style-type: none"> [Redacted] 	<ul style="list-style-type: none"> N/A
Eng/Mat/Life	<ul style="list-style-type: none"> [Redacted] Possibility of [Redacted] Straightforward [Redacted] Potential [Redacted] 	<ul style="list-style-type: none"> Need a [Redacted] [Redacted] Potential [Redacted] Development of a [Redacted] [Redacted] Complicates [Redacted] Needs [Redacted] May require [Redacted]
Facilities	<ul style="list-style-type: none"> Current scope of new [Redacted] 	<ul style="list-style-type: none"> [Redacted] facilities may require [Redacted] equipment.



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