4. ALTERNATIVES AND DESIGN EVOLUTION

4.1 Introduction

This chapter of the Defence Exempt Environmental Appraisal (DEEA) outlines the design evolution of the Proposed Development. Detailed planning permission is being sought for a replacement hydrodynamics research facility, hereafter referred to as the 'Proposed Development' known as Hydrus. It outlines the alternatives that were considered, and describes the considerations that affected the development of the design. This chapter has been written by the AWE Hydrus project team and URS Corporation.

4.2 AWE Modernisation Programme Context

In 2002 AWE produced a Site Development Strategy Plan (SDSP) (Ref. 4-1) which detailed the proposals for the future of the AWE sites at Aldermaston and Burghfield. It was intended at that time that all activity was to transfer from Burghfield to Aldermaston with the ultimate aim that the Burghfield site would close.

In July 2005 the then Secretary of State for Defence announced a programme of investment into the facilities at AWE with the aim of refurbishing and replacing facilities that were principally constructed in the 1950s and 1960s. Following a comprehensive review, the Ministry of Defence endorsed AWE's assessment that there would be a continuing need for both the Aldermaston and Burghfield sites to deliver nuclear capability in the future.

A Site Development Context Plan (SDCP05) (Ref. 4-2) and associated Illustrated Framework Plan was published in November 2005 to describe the approach to the development of both the AWE Aldermaston and Burghfield sites. An update was published in May 2008 (SDCP08) (Ref. 4-3). The key aims of this approach were stated as:

- To improve the standards of design;
- To enhance the environmental performance;
- To reduce the environmental impact;
- To manage traffic; and
- To maximise the benefits to the community.

A key consideration in the development and planning of the modernisation works was that the refurbishment and replacement of facilities had to be achieved whilst maintaining continuity of AWE's capability. This requirement, when viewed in the context of the modernisation works having to comply with the various safety, security and environmental requirements, is particularly constraining and in many cases limited the range of options available.

4.3 Options Considered

Four broad alternatives were originally considered for hydrodynamics research, these were:

- "Do nothing";
- Refurbish existing facilities;
- Relocation of the Facility "offsite"; and
- New Build / Replacement Facility.

4.3.1 "Do Nothing"

The existing facilities are reaching the end of their operational life. The existing facilities could not continue in their present function without refurbishment. Therefore, this option would not allow AWE to fulfil its contractual obligations to the MoD in the longer-term. The Hydrus Facility is required by the Defence Nuclear Safety Regulator (DNSR) and the Nuclear Installations Inspectorate (NII) to underwrite the safety and reliability of the UK nuclear deterrent. The 'do nothing' option was therefore rejected.

4.3.2 Refurbish Existing Facilities

The extent of the work required to bring the material condition of the existing facilities up to a modern standard suitable for operation over the next 25 years was judged to be impracticable and not cost effective. It was also considered that the refurbishment of existing facilities would not satisfy regulatory requirements in the longer term. Therefore, this option was considered to be unacceptable.

4.3.3 Relocation of the Facility "Offsite"

Historically, hydrodynamics research has been carried out at both AWE Aldermaston and at AWE Foulness (near Southend, Essex). However, the facilities at Foulness were restricted in the type of experiments that could be undertaken and hydrodynamics experiments were discontinued and the facilities closed in 1997. Hydrodynamics experiments have never been carried out at AWE Burghfield due to operational and safety reasons and remains unfeasible at AWE Burghfield for this reason. Due to the sensitivity of the research to be undertaken at the proposed Hydrus Facility, a non-AWE site could not be considered. Therefore, only AWE Aldermaston was considered to be appropriate for ongoing hydrodynamics research.

4.3.4 New Build / Replacement Facility

The construction of a new build replacement facility was selected because it would enable AWE to meet the technical, safety and environmental performance requirements for the future research programme. This option would enable the existing facilities to be completely replaced by an efficient, purpose built facility at one location, within the AWE Aldermaston site. This option has the following advantages:

- By adopting modern technologies the activities will be performed with increased efficiency and significant reductions in waste generation;
- Additional advantages in the pooling and sharing of expertise, equipment and resources will also have long term operational and environmental benefits; and
- The construction of a single facility on a "brownfield" site will make the best use of the land available at AWE Aldermaston.

4.4 Siting Considerations

4.4.1 Alternative Sites within AWE Aldermaston

The AWE Aldermaston site can generally be divided into three broad functional areas. That part of the site to the east of the main north-south access road (known as Griffin Road) is principally devoted to activity associated with conventional explosives. These activities are licensed by the Health and Safety Executive (HSE). The western part of AWE Aldermaston splits generally into two areas: (i) the Nuclear Storage and Processing Area (NSPA), located in the north-western part of AWE Aldermaston, which is devoted mainly to the nuclear aspects of AWE's activities and is subject to additional levels of security; and (ii) the south-western area which is principally characterised by business support activities.

The hydrodynamics facilities and staff have historically been located in the north eastern corner of the AWE Aldermaston site, to the north of the explosives area. However, the long term strategy for the accommodation for hydrodynamics staff not directly involved with experiments is to house them within the New Office Accommodation (NOA) (also known as Gemini) which has recently been completed in the south-western area of the AWE Aldermaston site.

The location of the proposed Hydrus Facility was subject to detailed consideration, given the complexity of the requirements for the facility and its possible effects on surrounding buildings. A number of alternative sites were identified, all of which were on the AWE Aldermaston site.

A number of these potential sites were rejected for operational reasons. A potential site located within the west of the Aldermaston site, adjacent to the West Gate was rejected because of its distance from the existing hydrodynamics facilities and from the operational explosives areas, which would have increased the transport route for assembled explosives experiments. This site has since been adopted by Orion (a recently constructed laser research facility). The remaining alternative sites were located within the explosives area, but these were again rejected for operational and safety reasons.

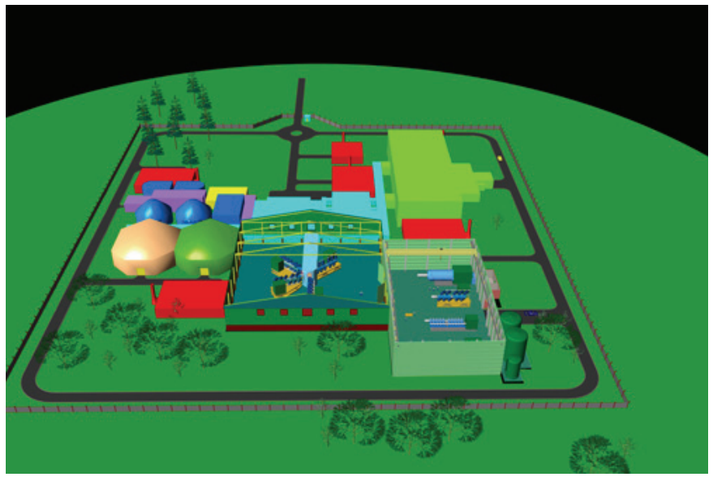
The selected Development Site was chosen because it was large enough to accommodate the proposed Hydrus Facility with sufficient separation from sensitive neighbouring operational facilities. It is also near enough to the existing hydrodynamics facilities to be beneficial during the transition of the research programme from the existing facilities to the Hydrus Facility.

4.5 Site Layout and Design Evolution

The position, orientation and size of the proposed Hydrus Facility have changed several times during the evolution of the project due to alterations to the internal layout, experiment schedule and equipment specification.

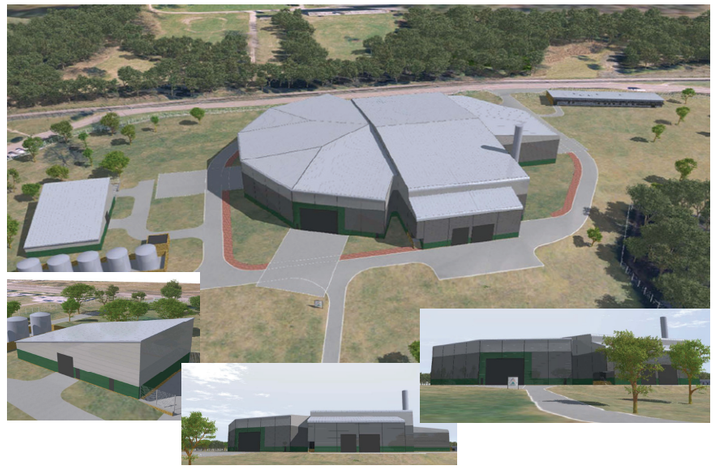
Early in the design process, a concept known as the Hydrodynamics Research Facility (HRF) was developed and is shown in Figure 4-1. The HRF design consisted of a large group of buildings, the footprint of which would have been considerably larger than the proposed design. This concept for the facility was considered to be impracticable and further iterations of design were undertaken.

Figure 4-1: Concept Scheme showing Hydrodynamics Research Facility Design



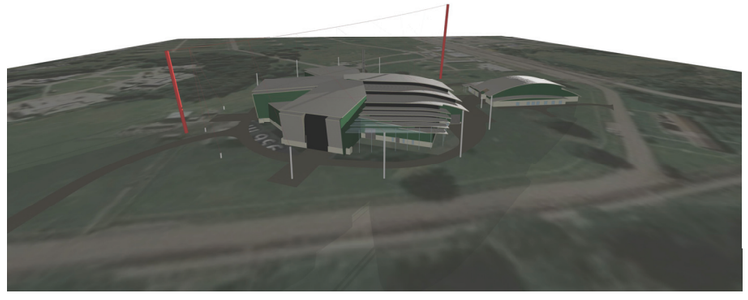
The first significant architectural scheme is shown in Figure 4-2. This incorporated a comprehensive arrangement of five Induction Voltage Adder (IVA - x-ray machine) halls within the main Operations Building and a Support Building which split into separate functions (welfare, maintenance, and energy centre). This scheme underwent an affordability review which resulted in a revised scheme with a smaller Operations Building containing three IVA halls to be developed as a phased scheme.

Figure 4-2: Concept Scheme showing Operations Building and Support Building



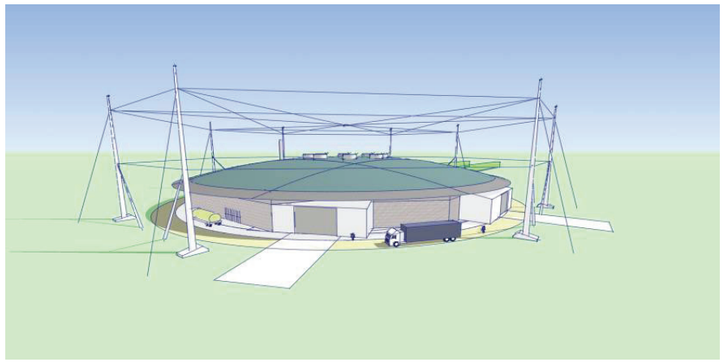
A phased development was later rejected for feasibility reasons, resulting in the development of a non-phased scheme. An example of a non-phased architectural concept is shown in Figure 4-3.

Figure 4-3: Concept Scheme showing Operations Building with a Lightning Protection System and adjacent Support Building



As the design evolved further, the size of the Operations Building increased and prompted the overall design concept to be re-evaluated. This process clarified the basis for an acceptable architectural solution including a simplified roof design, as shown in Figure 4-4.

Figure 4-4: Concept Design of Operational Building with simplified roof design



Consultation with English Heritage and West Berkshire Council recognised the need to take account of the potential impact of the Proposed Development on Aldermaston Court Registered Park and Garden and Listed Building (see *Chapters 13: Landscape and Visual* and *14: Cultural Heritage and Archaeology)*. Several design options were considered in order to minimise the potential impacts on Aldermaston Court.

Within the grounds of Aldermaston Court, an existing avenue of oak trees runs from Aldermaston Manor towards the Development Site. This avenue of trees was originally truncated during the Second World War by the development of the airfield and it was argued that this should not be reinstated within AWE Aldermaston.

However, the axial positioning of the permanent features of the Proposed Development in relation to the treed avenue was considered extensively, to ensure that the final layout of the Proposed Development was the most appropriate for the surrounding historic setting. The final axial positioning of the Operations Building in particular, allows a direct and clear relationship with the elements of the surrounding historic setting. Attempts to conceal the Operations Building to the left or right of the axis were counterproductive due to the scale of the building and the constraints associated with the eastern and western extents of the Development Site i.e. topography. Offset positions were considered but revealed a partial view of the building from the avenue, resulting in a misalignment and an awkward visual imbalance. The final positioning utilises a direct alignment providing a solid, balanced proportion of architecture within the landscape contextual setting of the oak avenue. The positioning of the Operations Building on the Development Site was further refined by the need to avoid sloping ground and critical service routes. The Support Building and the Electrical Substation are located to either side of the Operations Building (to the east and west, respectively), removing their visual influence on, or association with, the avenue axis.

4.5.1 Operations Building

Having established a clear rationale for the position of the buildings, forms were developed which sought to diminish the massing and scale of the facilities by the use of recessive and continuous shapes, minimising silhouettes and skyline impacts. An early decision to use a single primary roof form for the Operations Building was the key to this philosophy (See Figure 4-4). The roof form, a shallow dome, brings the scale and massing down towards the ground, encompassed by a smooth circular edge. This smooth continuous over-sailing roof acts as a counterfoil to the complexities and demands of the building's plan form below. Based on an octagon, the footprint has several projections for functional reasons, all of which are unified by the sinuous roof form above.

Emissions from the exhaust stack on the Operations Building were subject to detailed dispersion modelling to support the choice of stack height and location, see *Chapter 10: Air Quality* of this DEEA. The overall extent of the building was determined in part by the size of major components, such as the three X-ray machines. However, it was also driven by the need to incorporate equipment required for safe operation and the proper environmental management of waste materials arising from the research experiments.

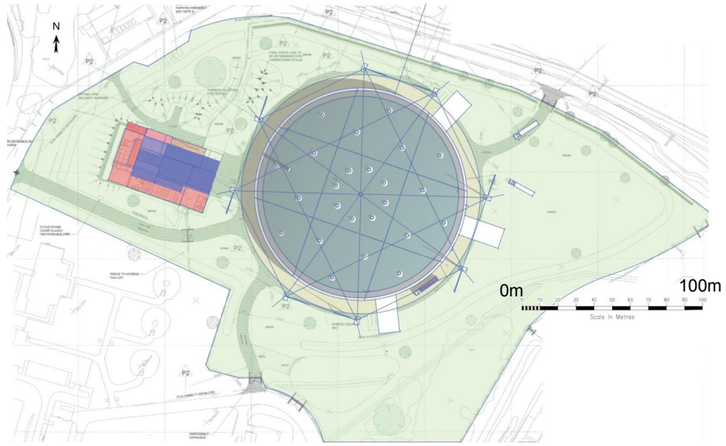
Installation of a Lightning Protection System is required (by JSP 482, Safety Standards For Electrical Installations And Equipment In Explosives Facilities, in accordance with BS EN 62305:2006, Protection Against Lightning) to protect the Operations Building from lightning strike. The primary Lightning Protection System for the Hydrus Facility is an external system physically isolated from the facility. Two design options were prepared: (i) had a catenary mast centred on the visual axis from Aldermaston Court along the oak avenue; and (ii) had catenary masts to either side of the visual axis. Officers of West Berkshire Council expressed a preference for the second option, and this design has been selected for visual and operational reasons.

The eight masts are arranged in four pairs, each 'locked' onto alternate facets of the octagon. Two pairs are aligned with the historic avenue axis to produce a strong and deliberate relationship with the historic landscape context. Whilst this is a powerful interaction with the avenue it is also a visually stable and balanced relationship. The masts were initially considered as lattice towers which enabled a traditional engineering response also being characteristic of the traditional approach to lightning towers at AWE, but it was immediately apparent the volume of visual clutter would have significant greater visual impact. The solution was to design and engineer circular section masts with a gently tapering shape, diminishing to the smallest dimension at the tip as could reasonably be achieved. The level of isolation between the Lightning Protection System and the Operations Building has been determined to reduce the probability of dangerous flash-over to acceptable levels for NII compliance as a safety system.

4.5.2 Support Building

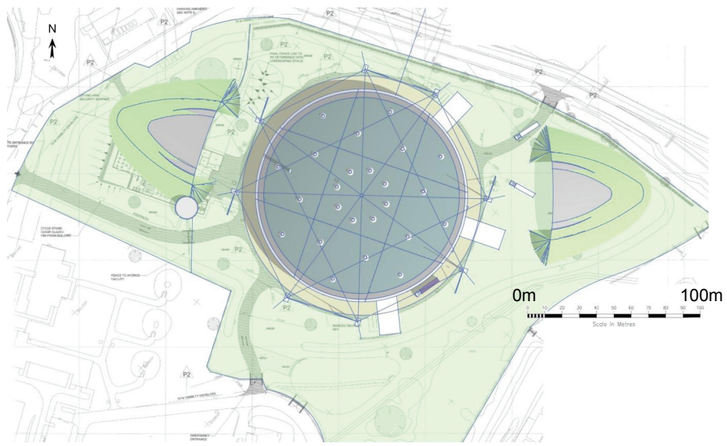
The location of the Support Building has fluctuated in response to the orientation and relative location of the Operations Building. At one point, the individual elements of the Support Building; support facilities, maintenance and power/energy centre were designed as individual free-standing structures. In an attempt to rationalise architectural design and building form, these three individual buildings were combined to form a single architectural unit which was located to the west of the Operations Building, as shown in Figure 4-5.

Figure 4-5: Operations Building with Single Support Building to West



An increase in the size of the Operations Building created pressure on the site occupied by the Support Building. To resolve this and reinforce the individual functionality of the main building components, the Support Building was split into i) maintenance building, and ii) welfare / Work Control Centre (WCC) building. Each half was located either side of the Operations Building (west/east), as shown in Figure 4-6.

Figure 4-6: Operations Building with Two Support Buildings to East and West



Detailed consultation with West Berkshire Council, on the proposed design and layout of the revised design took place in May and June 2009. The Support Building(s) options were discussed in relation to the overall layout and the potential impact to views from Aldermaston Court. West Berkshire Council expressed a preference for the option of a single Support Building, which would enable the Operations Building to be located on the axis of the oak avenue within Aldermaston Court. Views of the Support Building would also be better screened by existing woodland.

The Proposed Development and site layout design, which is described and illustrated in *Chapter 5: The Proposed Development,* was subsequently developed from this arrangement. The Support Building is arranged as a mainly single storey building in order to minimise the visual impact on Aldermaston Court to the north. Initially, the building was designed as a simple rectangular footprint aligned roughly east-west. Subsequently it was redesigned as a "chevron" footprint and rotated slightly in order to reduce the cross-sectional area of the building facing Aldermaston Court, thereby reducing the visual and landscape impact.

The roof height throughout has been kept to a minimum but is dictated by the size of assemblies that need to be housed within the building – principally the IVA X-ray machines. The smaller scale Support Building utilises a functional three-stepped roof form with the greater part of the mass and height stepping away from the Operations Building. The need for an overhead travelling crane in the workshop has dictated the highest roof level over the workshop. The building has a mezzanine floor over part of its central section to accommodate plant. The size of the Support Building was also kept to a minimum by locating all non-operational staff in the NOA (also known as Gemini) development located towards the western edge of AWE Aldermaston. NOA is already completed and located some 1400 metres to the south west of the Hydrus Development Site.

4.5.3 Electrical Substation

The Electrical Substation is a single storey building and is located as far as possible to the west of the Operations Building to minimise the visual impact on Aldermaston Court.

4.5.4 Surface Water Control Features

The detention basin was initially designed as a concrete-lined culvert. However, as a primary aim of Sustainable Drainage Systems (SuDS) is to provide a water treatment, this was developed into a grassed attenuation basin. The grassed attenuation basin forms part of the comprehensive landscape scheme that enhances appearance of the Proposed Development whilst providing habitats for invertebrates, amphibians and reptiles. The landscape scheme is described in more detail in *Chapter 5: The Proposed Development*.

4.6 References

Ref. 4-1 AWE (2002) Site Development Strategy Plan (SDSP). AWE Aldermaston

Ref. 4-2 AWE Aldermaston & Burghfield Site Development Context Plan (SDCP) 2005-2015 (November 2005)

Ref. 4-3 AWE Aldermaston & Burghfield Site Development Context Plan (SDCP) 2005-2015 (2008)