



**HMAS AE2 OPTIONS  
2008 WORKSHOP  
SCOPING PAPER**

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SIA/TINA Workshop on Future Management of HMAS AE2  
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## Some Options for the Future Management of HMAS AE2

### ***Introduction***

#### **Background**

1. After successfully breaching the Dardanelles defences on 25 April the Australian submarine HMAS AE2 was hit by shellfire from the Turkish torpedo boat Sultanhisar on 30 April 1915 and subsequently scuttled and sank after all of the crew escaped and were saved by Sultanhisar. AE2 lay on the bottom of the Sea of Marmora until it was located by the efforts of Selcuk Kolyay in July 1998 and positively identified by a joint Turkish and Australian diving expedition in October 1998. Since that time there has been much effort expended by many people to resolve a satisfactory way ahead for the management of AE2.<sup>1</sup>

#### **Objectives of the Project**

2. The AE2 Commemorative Foundation's (AE2CF) objectives are published on its website ([www.submarineinstitute.com](http://www.submarineinstitute.com)) and reflected in the constitution of the trust fund of the same name, operated by the Foundation. These objectives are reflected in the jointly agreed Memorandum of Understanding (MOU) entered into between the Turkish Institute of Nautical Archaeology (TINA) and the AE2CF in May 2006, a copy is included at Annex A to this paper. An extract is quoted below for ease of reference:

#### *"Purpose of Co-operation between the Parties*

##### ***The Objectives:***

- *To promote an understanding in Australia and Turkey of the submarine HMAS AE 2 role (1913-1915) in the Gallipoli campaign, as a basis for ongoing friendship and respect between the two nations.*
- *To achieve an outcome acceptable to both Parties as to how the wreck should be preserved and presented to the international public for the foreseeable future.*

*These Objectives are supported by activities to:*

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<sup>1</sup> For a more comprehensive background please consult the Strategy document on the AE2 website page of the Submarine Institute of Australia ([www.submarineinstitute.com](http://www.submarineinstitute.com))



- *Preserve, protect and promote the fragile archaeological AE2 wreck structure, with a view to engaging public knowledge of, and learning from, the role of AE2, the Dardanelles Campaign generally and the importance of the wreck to both nations involvement in the campaign.*
- *This work is to be undertaken in a professional manner, within the controls of the Turkish legal system and meet the highest international professional maritime archaeological standards, giving regard to the rules annexed to the UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001.*
- *Preserve the AE 2 wreck as far as practicable so that future generations can use it as a means of achieving the Objectives.*
  - *This includes surveys to ascertain the materiel state of the wreck and obtain comprehensive images of the wreck.*
  - *The results of the archaeological investigations and surveys should be presented with absolute transparency and with no underlying agendas.*
- *Establish public education opportunities, including developing interpretation centres in Turkey and Australia to tell the story of the engagement of AE 2 with Turkish defence forces and the conservation status of the wreck.*
  - *The intention is to have these centres available for celebration of the centennial of the landing in 2015.*
- *Provide protection to the wreck by:*
  - *Exploring opportunities to provide greater Turkish legislative protection to the wreck*
  - *Preventing inadvertent damage by fishing activities.*
  - *Possibly initiating anodic protection of the site to further physical retention.*
  - *Obtaining a comprehensive assessment of the site's conservation status through targeted studies, including an archaeological corrosion survey.”*

## **The Turkish/Australian Relationship**

3. The project builds on the extraordinary relationship established between Turkey and Australia arising from the Gallipoli experience. It offers an excellent opportunity to further build on the peace and friendship that is at the core of this relationship.



## Maritime Archaeological Assessment

4. One step along the way to achieving the objective was the joint Australian and Turkish Maritime Archaeological Assessment (MAA) expedition to report on the condition of the submarine. This was successfully concluded in September 2007. A separate report has been completed and issued on 11 February 2008. Major outcomes noted in the Report were:

### *“Key Outcomes*

*The following key outcomes were cited in the MAA Report:*

- *The objectives of the MAA were achieved.*
- *The submarine is lying in a particularly low corrosion environment.*
- *The pressure hull is in a remarkably good state of preservation though a more detailed survey would be required to both confirm this impression and support full scale recovery.*
- *Before either moving or raising additional data would be required.*
- *The remaining torpedo must be located and the risk from its warhead removed before any effort to move the submarine is made.*
- *The casing and fin have suffered significant deterioration arising from corrosion and impact by nets and anchors.*
- *Development of options for future management is now proceeding..*
- *The joint workshop in Istanbul in April 2008 is intended to provide a recommended way ahead.*
- *Irrespective of which option may be adopted the following immediate actions are recommended:*
  - *On going site monitoring.*
  - *Installation of site physical protection measures.*
  - *Installation of cathodic protection.*
  - *Implementation of Turkish cultural heritage controls at the site.*
  - *Support from all parties for the joint workshop.*



- *Education programs to be delivered in Australia and Turkey.”*

## **Discussion**

### **The Aim of the Workshop**

5. The aim of the Workshop is to make an agreed recommendation to the Australian and the Turkish governments as to the future management of the submarine and to encourage a cooperative enterprise by both Governments with both the SIA and TINA. The need for firm agreement on a recommendation should be understood as a pre condition for the workshop; without joint agreement on a course of action there is much less chance that the two Governments and their supporting bureaucracies will be able to also agree on action for the future management of AE2. It is appreciated that the selected recommendation may contain a number of facets of the options set out below.

### **Objective of This Paper**

6. This paper is intended to provide a starting point for the Workshop to be held in Istanbul 26/27 April 2008 to develop an agreed recommended option for the future management of HMAS AE2. This version incorporates comments received on the interim version dated 25 February 2008.

### **Project Team Expertise**

7. To achieve the aim of its AE2 project the AE2CF has assembled a team of volunteers with a range of expertise to conduct the MAA and manage the project going forward. The MAA team list is included in the Personnel Lists at Annex C. Additional support has been drawn from volunteer experts providing peer review and a range of experts providing commentary and advice based on their experience. TINA has also assembled a team of volunteers with a range of expertise. The personnel attending the workshop in Istanbul are listed at Annex C. They will be supported by the full capacity of all team members listed.

8. Whilst much of the details such as costings are based on judgements, it is intended to provide sufficient accuracy for orders of magnitude to be understood in developing the options. Sinclair Knight Merz (SKM), an Australian engineering consultancy with international coverage and expertise in naval architecture, infrastructure and estimating has assisted by the provision of 'in kind' sponsorship to develop the costings. The AE2CF team has drawn on individual team members experience and consulted a range of expertise in their respective areas in providing their input.



## **Australian Support**

9. The Australian Government has agreed to the AE2CF leading the conduct of the Assessment Phase currently underway. The report to be provided on completion of the workshop will complete this phase and a fresh mandate will then be required for the conduct of subsequent phases.

10. The Australian Government has recently approved Deductible Gift Recipient (DGR) status for the AE2CF's Trust and recognised it as a tax exempt charity, facilitating access to philanthropic foundations for funding of the education and plaques projects. To date the AE2CF has been successful in attracting sponsorship from Australian Industry, principally ASC Pty Ltd, to match that provided by the Government for the conduct of the Assessment Phase.

## **Methodology**

11. SKM has worked with the AE2CF team to develop the matrix setting out the issues surrounding the various options at Annex D. A diagrammatic summary of these options is at Annex E.

## **Process Envisaged To Accomplish The Recommended Option**

12. It is envisaged that TINA and the AE2CF will report separately to their respective governments on completion of the workshop advising of the selected recommendation and seeking their governments' approval to implement it. This process will include seeking a fresh mandate for the AE2CF to act as the leader and manager of the Australian components of the next phase of the project.

13. The AE2CF and TINA are free to pursue related projects in their respective countries in support of the agreed Objective, eg the AE2CF is pursuing education and plaques projects directly, seeking non government sponsors to fund them. These projects may therefore proceed independently of the approval process envisaged for other activities to protect, preserve and tell the story of AE2. The need to achieve a significant and visible outcome for the Centenary of the loss of AE2 on the 30th of April 2015 will be a key factor in implementation of the selected option.

## **Status of the SM**

14. The legal ownership of AE2 could be open to contention. As this is a joint and cooperative project by both the Australian and Turkish governments and the AE2CF and TINA, this is not an issue which should be allowed to intrude. The practical way ahead on this issue is to ensure that both Governments agree on the course of action to be undertaken and that such actions are jointly undertaken by Turkish and Australian parties. This should



provide the requisite level of certainty that the project can not be derailed by a third party at some point in the execution of the selected option.

15. At the workshop held in Istanbul, in May 2004, the then Australian Ambassador made a public statement to the effect that the Australian Government would not seek the return of AE2 to Australia should it be recovered. The AE2CF supports this position; AE2 should remain in Turkey where it achieved its moment of fame.

### **Government Approval Process**

16. There are a number of Australian Government Departments with an interest in the AE2 project. These are represented on the Interdepartmental Working Group, chaired by Royal Australian Navy that has been managing the issue on behalf of the Australian Government. It is envisaged that:

- the AE2CF will manage relations with this Group,
- it will continue to be the mechanism for official coordination in Australia and
- the final decision will be a matter for the Australian Government.

17. On the Turkish side it is envisaged that TINA will provide the coordination and facilitation entailed in obtaining Turkish Government approvals for the selected option.

### **Funding Model**

18. Time has not allowed the development of a business case for each option. A funding model for the selected option should be agreed as part of a workshop process and included in the final recommendation. A recommendation that is not demonstrably economically viable is less likely to be taken up by the two Governments. Some observations are included here as a starting point for these considerations:

- The number of visitors to the Gallipoli region (which includes Troy) is estimated to be half a million per year.
- Assuming 5% of these being attracted to the site at \$10 per person means an annual potential income of \$250,000.
- If AE2 was moved somewhere where it has a greater base to draw from, eg Istanbul, then the visitor numbers could be increased substantially.
  - An Istanbul location would require appropriate interpretation in setting up the exhibitions to overcome its distance from the SM wreck site.
- Single exhibit museums are significantly less successful in attracting visitors.
- Attracting and retaining suitable staff can be a significant issue.



- The risks arising from relocating AE2 to a more accessible position and then not providing the ongoing necessary security to control access or preservation measures should be considered in the options 3-5.

19. Given the example of projects such as the U 534, which is now in a poor state of repair, with no funding for upkeep, the operating trust having been placed in receivership in February 2006<sup>2</sup>, it is considered imperative that the resources necessary to conduct the recommended option are to hand before initiating any action to move AE2 from her current site.



Figure 1 & 2 – U 534 Prior to Being Cut into 4 Pieces and Moved to a New Location 6Feb08<sup>3</sup>

<sup>2</sup> <http://www.bignotion.co.uk/~kemble/uboa534.html>

<sup>3</sup> [http://news.bbc.co.uk/2/hi/in\\_pictures/7230098.stm](http://news.bbc.co.uk/2/hi/in_pictures/7230098.stm)

## Evaluation of Options

20. Four major approaches have been selected for development:

- Do nothing,
- Preserve in situ,
- Relocate or
- Recover.

21. There are numerous variations possible and a total of 5 options are considered. These should be further refined during the workshop process. Each option and some of the major variations are briefly discussed below. Each should be evaluated against the overall objective, to tell the story and a number of practical considerations set out in the matrix at Annex D. These considerations are:

- Risks before mitigation.
- What risk mitigation measures can be applied?
- Remaining risk after mitigation measures.
- Protection to AE2.
- Preservation of AE2.
- Legislative Approvals
- Environmental factors.
- Ethical considerations.
- Tells the AE2 story?
- Tells the Turkish side of the story;
- Significant progress by 2015?
- Political risks.
- Self funding potential.
- Establishment costs.
- Running costs.

## Timescales to Complete Recommendations

22. The recommendations to be made by the Workshop will be based on these options and considerations. It is suggested that these recommendations should also be placed in the three categories for timescales of implementation to assist the two Governments in planning for implementation of the selected course of action:

- Immediate Actions
- Medium Term Actions; and
- Longer Term Actions



## **Neutralising the Explosive Risk**

23. It is considered highly likely that AE2 has one remaining torpedo on-board, most probably loaded in the after (stern) torpedo tube. Advice from the Royal Navy and MOD (UK) arising from their practical experience of handling gun cotton explosives from this era is that there is a possibility of the warhead being highly unstable and capable of a second order detonation as a result of a sufficient jolt. The issues surrounding this situation are discussed further in the paper at Annex F

24. Neutralising the risk from this explosive is assumed as a pre-requisite for options 3-5. The risks are considered in the matrix at Annex D as part of Option 3. Neutralisation will entail locating the torpedo on the submarine via remote survey and gaining access to flush the explosive from the warhead under controlled conditions. In the worst case, this could require cutting a series of 3 precisely located and angled holes; the first in the pressure hull; a second hole in the wall of the torpedo tube and third hole in the warhead, in order to gain access to the gun cotton. Divers could not be used for this task given the risk of an inadvertent explosion; it would require a leading-edge ROV capability with appropriate surface vessel support and Turkish Government archaeological approvals. This is a significant undertaking at 73 m depth. It entails significant program and cost risks and success can not be guaranteed.

25. An inadvertent explosion whilst rendering the weapon safe constitutes a substantial risk to the archaeological integrity of the site. The internal archaeological assessment should be completed prior to undertaking this activity to mitigate the impact of such an event. An estimated cost of A\$5 million has been allocated for this activity.

## **Consideration of Options**

26. Each option set out in the matrix at Annex D is now considered and briefly analysed. Costs are in Australian \$. Adjustment for the cost of delivery of services in Turkey should be considered during the workshop.

### **Option 1 -- Do Nothing**

#### **Description**

27. This option envisages no further interaction or expenditure on fresh initiatives relating to AE2. Current activities to tell the story, such as the documentary, education project and plaques projects would continue.



## Issues

28. A predictable outcome from the documentary, education and plaques projects would be public pressure on the Australian and Turkish Government to do something to protect and preserve AE 2. This option is therefore unlikely to be more than a delaying phase, en route to one of the other solutions. It will do nothing to mitigate the continued damage from local fishing operations or arrest the natural decay of AE 2, particularly the possibility of heightened corrosion arising from the accidental damage inflicted by the divers' shot line during the MAA; this is discussed in detail in the paper at Annex G.

## Costs

29. There are no additional costs incurred against this option. If it serves merely as a delay, then the option finally selected is likely to be more expensive because of the additional decay and damage incurred during delay.

## Risks

30. This option raises a significant risk of potential catastrophic impacts with the site that might accelerate its breakdown and exposure of internal archaeological relics, or environmental damage arising from possible fuel leaks, together with the low probability of an inadvertent explosion of the remaining torpedo. Significant political risks can be envisaged once the poor state of the submarine and the Governments' inaction becomes a matter of public interest.

31. This option scores poorly against the consideration of the risks, protection, preservation and telling the story of AE2. Since the site has been determined to be of national heritage significance to Australia and a focal point of Turkish commemoration of their involvement in the Dardanelles campaign it warrants a commensurate level of protection and interpretation.



## Option 2 -- Protect and Preserve In Situ

### Description

32. This option envisages leaving AE2 in its current position and conducting activities to:

- Install a cathodic protection system.
  - Two options are being considered; fixed anodes or an impressed current system.
  - A supplier is undertaking some initial designs of both.
  - It appears doubtful that the power supply required for the impressed current system could be provided by renewable energy systems on buoys moored above the submarine.
  - Costings are for the fixed anode system until this can be resolved.
- Provide underwater shielding from drop and drag damage and site intrusion.
  - The recommended option envisages the positioning of 2 lit wreck buoys able to support renewable energy systems such as wind or solar power panels to power the intruder systems and navigational lights.
  - These would also be designed to provide a mooring system for maintenance vessels, reducing the risk of damage from anchors during maintenance/surveys etc.
  - The buoys would prevent vessels trawling over the site and alert passing shipping to the presence of a wreck, reducing the risk of inadvertent damage from anchoring.
  - The ground tackle for the buoy(s) would provide additional protection against damage from trawling.
- Conduct an additional internal archaeological examination using ROVs with camera to map and document the interior and determine its internal condition and preservation factors.
- High resolution digital images obtained from cameras on the ROV during examination of the interior of the SM would provide unparalleled access to unrecorded historic information.
- This could also assist in locating the remaining torpedo.
- If agreed, to recover and conserve selected artefacts for research and display.

33. It has been suggested that construction of a number of scale/sectioned replicas for use in display sites in Turkey and Australia could be undertaken:

- For the purposes of this consideration it is suggested that these could be 1/3 – 1/5 full size, ie 15 - 18m long and vertically sliced down the centreline to enable the public to 'look inside' the full length from one side of the model.



- Holograms and modern computer generated imagery could be used to display the internal fittings and crew, providing movement and information.
- Viewing from the other side would provide the external appearance of AE2.

## Issues

34. The protection of archaeological sites underwater in their original context adheres to standard international archaeological practice and the international UNESCO Convention for the Protection of the Underwater Cultural Heritage (2001). A standard agreed to by TINA and the AE2CF in their MOU. As recorded in the MOU, TINA and the AE2CF have aligned their archaeological activities to the spirit of the UNESCO Convention and its associated Rules (noting that both Turkey and Australia are not current signatories to the Convention).

35. It is envisaged that the programmed activities for this option can be managed to avoid the risk of causing an inadvertent explosion of the remaining torpedo. This option does not therefore entail the technical and financial challenges of dealing with the torpedo risk.

36. Preservation against corrosion is provided by installation of a cathodic protection system. This has dual benefits; arresting the natural deterioration of the AE2 structure should the submarine be left in situ; addressing the inadvertent damage caused to the aft hull during the MAA and providing a real-time in-water conservation treatment should a recovery option be considered.

37. Australian scientists are leading practitioners in the application of cathodic protection to historic cultural sites located underwater. The method does not involve substantial financial outlay, other than initial set up and periodic monitoring and replacement of system components.

38. Physical protection could be provided by the deployment of site barrier protection systems to provide immediate protection to AE2 from inadvertent damage from local fishing operations or anchoring:

- The design of any seabed barrier will be complicated by the soft silt - at least 3.5 m is believed to be present at the site. This will not provide a good foundation for placing barriers on the bottom.
- Alternatively, the mooring arrangements for the wreck buoys suggested above would provide an adequate physical barrier against fishing boats and passing ships.

Appropriate Turkish Government approvals would be required prior to disturbing the seabed.

39. Insertion of the ROV borne camera for an internal archaeological assessment will require the mechanical opening of the upper conning tower



hatch. This is highly likely to result in localised damage to the hatch, necessitating a replacement to be fitted once the examination is completed. This would have the additional benefit of allowing AE2 to be better protected against possible illegal, uncontrolled recovery of internal relics. The practice has international precedents and the level of disturbance to the archaeological site could be argued as acceptable for the body of quantitative site data that would be obtained via a planned archaeological interrogation program. Such activity would require the formal approval of the Turkish Government through appropriate Archaeological Permit Approvals.

40. Recovery of artefacts will assist in telling the AE2's story – particularly that of the crew and could be programmed over subsequent expeditions using commercial divers and/or ROV's. Appropriate archaeological controls, including a research design and recovery methodology would be mandatory to capture standard archaeological information (eg context and spatial layering). Appropriate professional conservation support would need to be sourced prior to undertaking these activities.

- All reasonable efforts should be made to ensure that any recovered materials are conserved in Turkey by either contract or Turkish conservators.

41. Management and protection of AE2 in situ preserves a key historical value of the site – its location in its original 1915 battle context. Retention of AE2 in situ also acknowledges the special local environmental parameters which have created its present state of preservation – partial burial in a unique low oxygen environment.

42. Protection against pilfering could be further enhanced by provision of an anti intruder system powered by the renewable energy systems on the buoys. The system could be used to alert the appropriate Turkish authority to the presence of vessels or divers in the vicinity of AE2 via an automated link.

## Costs

43. The total cost for the installation of each component of option 2 and 5 years operating costs are:

- Cathodic protection system A\$1.7 million.
- The provision of two buoys to provide protection against ships and intruders A\$2.7 million. 4
- Internal archaeological assessment is A\$3.3 million,
- Recovery and conservation of selected artefacts A\$17.3 million.
- Construction of 5 scaled/sectioned replicas is estimated at \$5.7M.

44. The total cost for all activities under option 2 with 5 years operating costs is therefore estimated at A\$ 31 million. This includes an allowance of

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<sup>4</sup> AE2CF members have been involved in fitting a similar system to protect the wreck of the World War II Japanese submarine lying in 54 m off Sydney.



10% for project management costs. Should the artefacts not be recovered this cost falls to A\$13.4 million. Annual operating costs to conduct annual ROV inspections and maintain the buoys and cathodic protection system are estimated at A\$250,000. This allowance is included in the totals above. It is envisaged that there would be limited potential to recover the capital costs; however, display of the artefacts and the replicas could generate an offset to the annual operating costs.

### **Risks**

45. If fully implemented, the option rates well in addressing the various risks.

### **Timeline**

46. All facets of this option can be completed relatively quickly once the go-ahead is given. This option can therefore be completed in time for the 2015 Centenary.

### **Evaluation**

47. This option scores well against all considerations. It is practical and implementable and entails many of the essential preparations for options 3-5. This option also provides the best option for long-term preservation of the fragile elements of submarine life that currently reside inside the vessel.

48. Retention of AE2 underwater provides a range of opportunities to innovatively interpret the site: e.g. through future underwater video links to shore-based museum facilities, for controlled recreational diver visitation, or even submarine tourism. The AE2CF Board has proposed this as the baseline option against which the cost/benefit of the other options should be evaluated.

## **Option 3 - Relocate AE2 To Shallower Water In A Prepared Site**

### **Description**

49. This option envisages relocating AE2 to a prepared shallow water site where preservation and protection will be cheaper and more effective and limited public display possible. Option 2 and neutralisation of the remaining torpedo are assumed as pre-requisites to successfully implement option 3.

### **Issues**

50. The risks associated with neutralising the torpedo inject a level of uncertainty in programming, cost and overall project risk. The necessity for these two prerequisites is an issue to be considered at the workshop.



51. The structural assessment following the MAA concluded that:
- The hull appears to retain sufficient girder strength to allow it to be picked up using two sets of slings, provided the submarine remains underwater throughout.
  - Specialist lifting arrangements, utilising a suitable lifting vessel will be required to facilitate adjustment of the sling tensions, particularly important as the submarine is lifted clear of the suction effects of the silt in which it is lying.
  - A custom designed catamaran lifting barge dimensioned to accommodate the size of AE2 is proposed and costs for its construction are included.
  - This vessel could then provide an ongoing and flexible platform for a conservation and display site.
  - Additional measurements of the hull thickness will be required to finalise these arrangements.
52. Whilst reconstruction of the submarine's casing and fin would make the submarine more acceptable for public display, adding new materials is likely to significantly complicate the preservation task. Although electrically passive material such as fibre glass may reduce this risk, the task of removing the old material and fastening the new is a significant one. A project of this scale is beyond the capacity of a volunteer organisation to manage and execute. Commercial project management would be required.

### **Costs**

53. In addition to the costs of options 2 and neutralising the remaining torpedo per earlier estimates, it is assessed that A\$10 million will be required to recover AE2 to the selected site, A\$5 million estimated for the floating underwater observatory with a suitable museum for artefacts, a further \$10 million is allocated for the shore facilities such as road access etc to accommodate visitors. The cost estimate for option 3 with 5 years operating costs is therefore A\$79 million. An allowance of 15% is included in these figures for commercial project managers.

54. Five years annual operating costs estimated at 10% of project capital cost, A\$9.7 million is included in the figures above. The capacity to recover the capital cost of the project and cover the running costs is considered to be limited, given the scale of these costs.

### **Risks**

55. The risks and unknowns associated with neutralising the remaining torpedo inject a level of uncertainty that must be considered in adopting this option.



## Timeline

56. It is assessed that there is sufficient time to complete this option prior to the Centenary provided an early decision to proceed is made.

## Evaluation

57. This is a more ambitious option and entails acceptance of the risks and uncertainties associated with dealing with the remaining torpedo. It would involve significant disturbance to the archaeological site and surrounding debris field in preparation of the relocation. The AE2's original historical and archaeological context will be lost requiring suitable interpretation at the new location site and shore-based gallery facility.

58. The present protective sediments off Karaburun Point would be potentially lost, unless a similar local inshore display site is obtained and partial hull burial reinstalled or comprehensive cathodic protective measures introduced. Relocation to a shallow water environment removes the current site security obtained because of the depth of water by moving the submarine to water depths accessible to recreational SCUBA divers. The associated shore facility would require 24/7 hour security support.

59. The new environmental conditions (eg water quality, change in temperature, dissolved oxygen content, etc) would have to be evaluated to ensure that relocation to a new and different environment does not negatively effect archaeological site preservation. Turkish agency control and monitoring of the relocation site would be a prerequisite, to ensure suitable site stabilisation processes and protection from human impacts.

60. Relocation to a shallow water inshore environment would assist ongoing site analysis and scientific investigation of fabric and associated relic collections via periodic controlled inspection and potentially invasive surveys. The project would require the construction of suitable viewing arrangements and above-water infrastructure.

61. Relocation would greatly assist maintenance requirements of cathodic protective systems by eliminating more costly deep diving commercial teams and ROV activities. Whilst preservation, protection and public display are improved the workshop must assess whether the improvements achieve justify the costs and risks.

## Options 4 – Recover To A Shore Display Site (Wet Preservation)

### Description

62. This option entails the recovery of AE2 for display ashore in a wet preservation site. It will entail completion of neutralising the remaining torpedo and options 2, and 3 as pre-requisites.

### Issues

63. It is assessed that the pressure hull lacks the girder strength to withstand being lifted clear of water by the two sling method proposed to lift it clear of the bottom, even when pumped clear of water. This can be dealt with by additional slinging arrangements prior to lifting clear of the water. Costs include the provision of a full length cradle. Development of the final slinging/cradle arrangement would require further measurement and professional advice.

64. Reconstruction of the submarine's casing and fin would be required to make it fit for public display. A project of this scale is beyond the capacity of a volunteer organisation to manage and execute. Commercial project managers would be required.

### Costs

65. Allowing A\$79 million to neutralising the remaining torpedo, complete options 2 and 3, A\$2 million for the move ashore, A\$10 million for an a functional museum, A\$0.8 million for lifting cradle, 15% for project management costs and 5 years operating costs, this option is estimated to cost \$97 million.

66. Annual operating costs would be significant; a recurrent funding stream would be required to maintain the interpretative facility and ongoing in-water conservation treatments, 15% of capital costs is allowed, ie a total of A\$14.5 million over 5 years. This amount is included in the total cost above.

67. Whilst the commercial earning potential of this option is improved, the capacity to recover the capital cost of the project and cover the running costs is considered to be very limited against the scale of these costs. Visitor income would be insufficient alone to recoup facility running costs and this income stream is dependent on final interpretative location.

### Risks

68. The uncertainty arising from the need to neutralise the torpedo remains an issue to be considered with this option.



69. Internationally there has been no similar project involving the recovery, long term conservation and museum interpretation of an iron or steel shipwreck site (all wet displays have been part of a process in treatment leading to dry display, eg *Mary Rose*, *Holland 1*, *HL Hunley*). The treatment would be innovative and the long term stabilisation and retention of the archaeological structure cannot be guaranteed.

### Timeline

70. Completion of this project prior to the Centenary is considered tight, but achievable provided an early decision to proceed and funding is available.

### Evaluation

71. This is an ambitious option. It entails acceptance of the risks and uncertainties associated with dealing with the remaining torpedo and requires additional infrastructure and operational costs. Whilst preservation, protection and public display are improved the workshop must assess whether the improvements achieve justify the costs and risks.

## Options 5 – Recover To A Shore Display Site (Dry Preservation)

### Description

72. This option entails the recovery of AE2 for display ashore, progressing through a process of wet preservation to a dry preservation site. It will entail neutralising the remaining torpedo, completion of options 2, 3 and 4 as pre-requisites. Whilst it will be exhibited dry, it is not envisaged that the fabric of the submarine will be sufficiently robust to enable members of the public to routinely gain access to the submarine. It would be possible for limited access by bona-fide researchers to be managed by the museum staff.

### Issues

73. In addition to the issues raised in option 4, this option will entail a prolonged period of treatment in the wet preservation situation, estimated to be **at least** 13 years using current technology, prior to dry display in a controlled environment viewing hall. A project of this scale requires professional commercial project management and could not be undertaken by volunteers.

### Costs

74. Allowing A\$97 million to neutralising the remaining torpedo, complete options 2, 3 and 4, A\$7 million for the controlled environment viewing hall, 15% for project management costs and 5 years annual operating costs the



total cost of this option is estimated at A\$124 million. Recurrent operational running costs for the facility would be higher than option 4, say A\$21 million allowing for the additional facilities requiring maintenance and recurrent conservation costs.

75. Whilst the commercial earning potential of this project is improved, the capacity to recover the capital cost of the project and cover the running costs is considered to be limited, given the scale of these costs. The conservation facility would need to reflect the original context of the AE2 submarine, its move for conservation and display from its original location (particularly if an Istanbul location was determined).

### **Risks**

76. The uncertainty arising from the need to neutralise the torpedo remains an issue to be considered with this option. There are significant other unknowns in this option; the real long term internal excavation, conservation and display costs and timelines are unknown and are dependent of the determined condition of the AE2 once recovered, the success of the treatment systems and the capacity to deliver a permanent conservation and monitoring program with relevant expertise. The prolongation of the project raises significant political and project risks – that the project fails due to a loss of ongoing support.

### **Timeline**

77. Completion of this project prior to the Centenary is considered impracticable. It may be possible to complete the project up to the completion of option 4 prior to the Centennial.

### **Evaluation**

78. This is a very ambitious option, in addition to the risks and uncertainties associated with dealing with the remaining torpedo there are a number of unknowns surrounding the treatment and stabilisation of the hull for dry display. The timescales and costs for doing so are best regarded as educated guesses. Whilst preservation, protection and public display are improved the workshop must assess whether the improvements achieve justify the additional costs and risks. Complete stabilisation of the engineering elements such as the engine would require total disassembly and reconstitution following conservation treatment.

### **Activities Common to Options 2-5**

79. The following activities are common to options 2 – 5:
- Cathodic Protection.
  - Physical Protection.



- Drop and drag protection ie protection from fishing boat activities and vessels' anchors.
- Anti intruder protection.
- Completion of the Maritime Archaeological Assessment, an internal examination, entailing the removal of the conning tower hatch and replacing the hatch and securing the SM on completion.
- Possible recovery of Artefacts
- Construction of scaled/sectioned replicas.

### **The Urgency of Cathodic Protection**

80. The scraping of the divers shot weight during the MAA has removed a significant area of concretion from the casing and ballast tanks of the submarine. There is significant potential for differential corrosion to take place on the cleared area, until the protective concretion is restored in some years time. This will shorten the life of AE2 and could raise structural complications in any effort to relocate or recover the submarine. The issues are discussed further in a paper at Annex G.

### **Conclusions**

81. This paper provides a starting point for the considerations of the workshop to arrive at a consensus on a recommended course of action. Selecting an option requires the balancing of a number of considerations relating to risks, practicalities and potential costs.

82. The cost estimates contained in the paper should be considered as indicative costs, giving the order of magnitude, based on best judgement, rather than a commercial or engineering cost developed from a detailed breakdown and consideration of the activities to be undertaken.

83. A number of judgements have been made in developing the options. These are identified in the paper and matrix and should be considered and validated as part of the Workshop process.

### **Recommendations**

84. To provide the best opportunity for a successful workshop outcome, that is, one agreed option, the following recommendations are made:
- Option 2 should be considered the baseline option or starting point. It is assumed that all parties would agree that this is the minimum that should be undertaken.



- Based on this assumption, the following timescales are proposed for the activities listed in this option:
  - Immediate Actions
    - Place drop and drag and anti pilfering protection.
    - Install cathodic protection.
  - Medium term Actions
    - Complete the internal maritime archaeological assessment.
    - Recover and conserve agreed artefacts.
  - Longer Term Actions
    - Construct scale/sectioned replicas.
    - Establish displays in Australia and Turkey

85. Costings should be refined in preparation for the workshop, efforts should be made to further detail, evaluate and cost the options and to develop the business case for displays of AE2 in Turkey:

- In the interests of consistency this should be done in concert with SKM and the AE2CF team who developed the current estimates.

86. Outcomes from this process should be made available to all workshop participants as part of an open dialogue between parties, to ensure everyone has a common starting point for the workshop. Unless agreed by both TINA and the AE2CF, fresh options should not be introduced at the workshop.

**P Briggs AO CSC  
RADM RAN Rtd  
Chairman AE2CF**



## Annexes

- A. Memorandum of Understanding between the AE2CF and TINA.
- B. Nondisclosure agreement between the AE2CF and TINA. Personnel
- C. Personnel Lists
- D. Matrix of Options
- E. Bulls Eye Diagram of Options
- F. An Update to the Summary of the Risk to Future Operations  
Associated with the Unexpended Torpedo in HMAS AE2 by Capt  
Roger Turner BSc CEng FIMarEST RN Rtd
- G. Potential for Differential Corrosion Arising from the Impact of the Divers  
Shot Line by Dr Ian MacLeod

**Table C 1 - Team Members – Turkey**

Family Name	1 <sup>st</sup> Name	Title	Position
<b>AYDEMİR</b>	Oğuz	Mr	Chairman TINA
<b>EDES</b>	Enis	Mr	Detek Offshore, Diving Support Vessel
<b>KARAKAŞ</b>	Savaş	Mr	Media Liaison, Electric Pictures
<b>KOLAY</b>	Selçuk	Mr	Advice and Liaison, Support Vessel and Side Scan Sonar
<b>POLAT</b>	Ayshen	Dr	Hyperbaric Physician, Istanbul University
<b>TOKLU</b>	Akın	Dr	Hyperbaric Physician, Istanbul University

**Table C 3 - Documentary Crew – UK & Australia**

<b>AYRTON</b>	Richard	Mr	Diver, Camera Operator, Mallison Sadler Productions
<b>BATTt</b>	Ian	Mr	Cameraman, Electric Pictures
<b>GRANDILE</b>	Rose	Ms	Documentary Project Manager
<b>OGILVIE</b>	Andrew	Mr	Producer, Electric Pictures Australia based
<b>SADLER</b>	Crispin	Mr	Diver, Camera Operator, Mallison Sadler Productions
<b>STEVENSON</b>	Dan	Mr	Diver, Camera Operator, Mallison Sadler Productions
<b>WESTH</b>	Steve	Mr	Director, Electric Pictures
<b>WOODS</b>	Norman	Mr	Diver, Camera Operator, Mallison Sadler Productions

**Table C 4 - Turkish Navy Liaison Officers:**

<b>AKÇAY</b>	Burak	LCDR	Liaison Istanbul
<b>ORHAN</b>	Salih	LEUT	Liaison ashore – Karabiga
<b>SEN</b>	Cemil	LEUT	Liaison afloat- DETEK SALVOR

**Table C 2 - Team Members – from Australia:**

<b>Family Name</b>	<b>1st Name</b>	<b>Title</b>	<b>Position</b>
<b>ALHAFITH</b>	Samir	Mr	Diver
<b>BAŞARIN</b>	Vecihi (John)	Mr	Turkish Media Management
<b>BRENCHLEY</b>	Elizabeth	Ms	Co-Author Stoker's Submarine
<b>BRENCHLEY</b>	Fred	Mr	Co-Author Stoker's Submarine
<b>BRIGGS</b>	Peter	RADM	Chairman AE2CF
<b>CANNON</b>	Stuart	Dr	Dive Supervisor & NA Adviser
<b>CANNON</b>	Helena	Ms	Diver/Paramedic
<b>FOCK</b>	Andrew	Dr	Team Medical Officer/Hyperbaric Physician
<b>GARSKE</b>	Paul	Mr	Diver & 2ic Dive Supervision
<b>GRAHAM</b>	Peter	Mr	ROV Pilot
<b>HARRIS</b>	Richard	Dr	Diver & UW Photographer
<b>HOWELL</b>	Craig	Mr	Director UW Photography & Diver
<b>HUGHES</b>	Jeff	Dr	Diver
<b>MacLEOD</b>	Ian	Dr	Corrosion Adviser
<b>MAHER</b>	Mervyn	Mr	Diver
<b>NEILL</b>	Roger	Dr	Director Scientific & Data Management
<b>PEARSON</b>	Steve	Mr	Diver
<b>RIKARD-BELL</b>	Michael	Mr	Naval Architect & Engineer Adviser
<b>ROACH</b>	Terence	CDRE	Director Operations
<b>SMITH</b>	Tim	Mr	Director Maritime Archaeology
<b>WYND</b>	Mike	Mr	Diver



**Table C 6 - Team Members –Australia based**

<b>GREIG</b>	Ken	CAPT	Project Manager
<b>MUSSARED</b>	Jane	MS	Strategic Communications and Media Adviser
<b>NOBLE</b>	Ian	CAPT	Risk Manager
<b>TURNER</b>	Roger	CAPT	Unexpended Torpedo Investigation, MODUK Liaison
<b>REKKERS</b>	Peter	Mr.	Australian Media Liaison



## **TINA/AE2CF Joint Workshop Attendees**

The following personnel will make up the TINA/AE2CF officials at the workshop:

### **Workshop Officials**

<b>Role</b>	<b>TINA</b>	<b>AE2CF</b>	<b>Remarks</b>
Convenor	Mr Orğuz AYDEMİR Chairman TINA	Rear Admiral Peter Briggs, RAN Rtd, Chairman AE2CF	
Co-Chairman		Dr Michael White QC	
Deputy Co-Chairman		Mr Max Dingle, Acting Director, Australian National Maritime Museum	Invited Representative of the Australian National Maritime Museum
Deputy Co-Chairman		Dr Michael McCarthy, Curator of Maritime Archaeology Western Australian Maritime Museum	Invited Representative of the West Australian Maritime Museum
Deputy Co-Chairman		Associate Professor John Hall, Deakin University Business School, Faculty of Business and Law	
Director of Operations		Commodore Terence Roach RAN Rtd, Director AE2CF	
Coordinator	Mr Savaş KARAKAŞ	Captain Ken Greig RAN Rtd, Secretary AE2CF	
Media Relations	Mr Savaş KARAKAŞ	Mr Vecihi Başarın	Mr Trevor Rowe will manage Media relations in Australia during the workshop



In addition, the following AE2CF team members will attend:

**Table C 6 - AE2CF Team**

<b>Family Name</b>	<b>Other Names</b>	<b>Title</b>	<b>Position</b>
<b>SMITH</b>	Tim	Mr	Maritime Archaeology Director
<b>MacLEOD</b>	Ian	Dr	Corrosion Adviser
<b>NEILL</b>	Roger	Dr	Scientific Director
<b>RIKARD-BELL</b>	Michael	Mr	Naval Architecture & Engineering Adviser
<b>TURNER</b>	Roger	CAPT	Unexpended Torpedo Investigation

The following have been invited to attend the workshop:

**Table C7 – Invited Guests**

<b>Serial</b>	<b>Family Name</b>	<b>Other Names</b>	<b>Title</b>	<b>Position</b>
<b>1</b>	<b>Rudd</b>	Kevin	The Honourable	Australian Prime Minister, or his representative
<b>2</b>	<b>Shepherd</b>	Geoff	Air Marshall	Chief of Air Force, Australia, senior Australian Defence Force Representative attending Anzac Day service 2008
<b>3</b>	<b>Shalders</b>	Russ	Vice Admiral	Chief of Navy, Australia or his representative.
<b>4</b>	<b>Gower</b>	Steve	Major General	Director, Australian War Memorial, or his representative
<b>5</b>	<b>Stevens</b>	Paul	Major General	Representing Department of Veterans Affairs
<b>6</b>	<b>Doyle</b>	Peter	Mr	Australian Ambassador to Turkey or his representative.
<b>7</b>	<b>Rennert</b>	Peter	Mr	Australian Consul, Cannakale, Turkey
<b>8</b>	<b>Fleming</b>	Wayne	Colonel	Australian Defence Adviser, Turkey
<b>9</b>	<b>Mealings</b>	Bob	Mr	Curator and Deputy Director, Royal Navy Submarine Museum
<b>10</b>	<b>Frame</b>	Tom	Bishop	Naval historian, Anglican Bishop to the ADF
<b>11</b>	<b>Atac</b>	Muzaffer	Admiral	Chief of Turkish Navy or his representative
<b>12</b>	<b>Fewster</b>	Kevin	DR	Director, National Maritime Museum, UK
<b>13</b>	<b>Mardikian</b>	Paul	Mr	Head Conservator, HL Hunley Project
<b>14</b>	<b>Delgado</b>	Jim	Mr.	President International Nautical Archaeology
<b>15</b>	<b>Hodges</b>	Clive	Colonel	The Defence Attaché British Embassy, Ankara
<b>16</b>	<b>Robbins</b>	Jeremy	Brigadier	Defence & Naval Advisor British High Commission
<b>17</b>	<b>Snook</b>	Ray	Commander	The Naval Attaché British Embassy, Ankara
<b>18</b>	<b>Davies</b>	Morgan	Mr	Chief Salvage Officer United Kingdom