BAA 09-031
Amendment 0001

The purpose of this amendment is to provide a list of the questions asked to date and the responses.

1. On page 6 of the BAA, the notional schedule for Task 3 reads "Develop passively cooled DTMS." After reviewing the BAA this was the only indication that the DTMS needs to be passive. Is it a requirement for this effort that the DTMS be a passive system?

> Response: A passive system is certainly preferred since getting power aboard ship may be problematic.

2. The research opportunity description states that ONR "…is soliciting alternatives to heat pipes for arresting the thermal impact…" Can you please expand on ONR's definition of heat pipes, ie., does this definition include pipe loops or simply enclosed pipes?

> Response: Heat pipes use the principle of heat pipes that contains a system that promotes evaporation including that of capillary action and the direct transfer of fluid between cold spots and hot spots as its primary system. Enclosed simple pipes would not be construed as heat pipes.

3. In the BAA the heat rate was provided. Can you also provide the average heat flux? If not, can you provide the average deck area affected by one of the impinging exhaust jets?

> Response: We do not have an average heat flux – that information is tightly protected, yet it is agreed that it is important to know to quantify the magnitude of the problem.

4. Is ONR willing to let contractors develop new high performance non-skid coatings as part of this effort?

> Response: No. That is part of another ONR program.

5. Is the buckling phenomenon a plastic or elastic deformation? After the deck has cooled to what extent does the buckling persist?

> Response: This appears to be an elastic phenomenon as the deck returns to flatness after sufficient cooling. That said, calculations have been made that predict premature deck failure from thermal fatigue.

6. I noted from your presentation during the Flight Deck Thermal Management Workshop that you are requesting a temperature limit of the deck of 300^{o}F. However, in

the report issued by Carderock, "Structural Evaluation of an LHD-Class Amphibious Ship Flight Deck Subjected to Exhaust Gas Heat from a MV-22 Osprey Aircraft," they note that deck buckling occurs at a temperature of 160^{o}F to 170^{o}F. Where does the 300^{o}F limit originate?

> Response: The 300 degree F is derived from the temperature limit of the tires on aircraft.

7. Regarding heat pipe technology from the DARPA project (Page 2), can you provide a link or additional information so we can review the appropriate DARPA work? We assume that a relatively thin and innovative heat exchanger cooling design with structural performance would be considered if meeting other requirements. Please confirm.

> Response: ONR is considering all technologies to mitigate the heat loads generated by the aircraft onto the deck structures with the exception of heat pipes. There is no link or additional information available.

8. Is the 200,000 kg (page 13) the correct mass to assess impact damage resistance requirement? Can you provide the patch area and dimensions for the 200,000 kg mass for the impact requirement?

> Response: The weight would be spread over lading structures of the relevant aircraft to the deck.

9. Are there any briefing materials from Industry Day that can be provided or accessed electronically?

> Response: No materials from Industry Day are releasable.

10. Is the 1" height requirement a firm requirement or can solutions be considered slightly taller than this (say under 2")?

> Response: One inch is the maximum allowable metric ONR has been given. If testing and modeling indicate that 1: would not mitigate but a slightly high pad would, that would have to be decided by others in the Navy.

11. When will white paper submitters be notified of acceptance regarding the opportunity to submit a full proposal assuming the August 6th white paper submission due date? This information will help to better understand how much time can be expected between white paper acceptance and proposal due date.

> Response: Those recommended for proposals would be notified after the evaluation team reviewed all white papers. An estimate is provided on page 18 of the BAA.

12. Would thermal management be applied to the entire deck surface, or designated areas only?

Response: That has not been definitively decided. The severity of the thermal loads will have some fixed hot spots and variable warm to semi-hot spots. It will depend on costs and extent of problem after more testing.

13. How concentrated is the heat flux, how large an area is involved in the 24,000BTU/min heating? I have had difficulty getting any numbers and the information heat flux given in the BAA did not include an area component.

Response: A range of 3-foot to 10-foot diameter is suggested.

14. I assume that the "below deck" option means a system that would be installed during ship construction to provide some thermal management from the underside of the flight deck. Is that correct?

Response: Yes, the thermal management system would be in contact with the underside of the deck to provide the thermal management.

15. Damage resistance is estimated at 200,000 kg from aircraft landings. Over what area would that load be applied? (e.g., xx kg/m^2 or xx N/m^2)

Response: The load would be spread over the loading points of the aircraft, either MV22 or F35B.

16. What is the heat flux distribution? What is the peak heat flux?

Response: That information is not available.

17. Are you looking for modular approach or single plate approach?

Response: Modular would likely be preferred.

18. Will you expect the ambient temperature to reach subzero temperatures or freezing of water?

Response: The ships probably could operate in subzero temperatures at times.

19. What will be the ultimate heat sink?

Response: That is what ONR is looking for from offerors.

20. What is the size limitation in terms of secondary heat exchangers for closed loop condensers?

Response: Height limitation is one inch high.

21. Are there any power limitations?

Response: Do not expect lots of power from the ship service.

22. What is the magnitude of vibration/shock you are expecting the solution should withstand?

Response: Unknown. Loading for landing is 200,000kg. The speed of landing/descent likely would be somewhat variable.

23. Is fresh water available on board for ships? If yes, what will be the maximum flow rate available for thermal management?

Response: Do not expect fresh water availability.

24. Max exhaust temperature anticipated?

Response: This is tightly controlled. A range of max temperatures could be 1000 – 1700 deg. F.

25. Max exhaust air velocity anticipated?

Response: This is not publically releasable.

26. Max exhaust heating time anticipated?

Response: This depends on the actual operations – I would suggest about 15 to 30 seconds, although other ops may have a more severe effect over time.