

## **Amendment 04**

### **Special Notice 12-SN-0028, entitled “2012 Basic and Applied Research in Sea-Based Aviation Aircraft Science and Technology”**

The purpose of Amendment 04 to this Special Notice is to provide the slides from the 28 Sep 2012 Proposer Workshop and an updated list of Questions and Answers.

**No changes are being made to the Special Notice as a result of this Amendment.**

# Sea-Based Aviation National Naval Responsibility (SBA NNR)

## Aircraft Research Opportunity

*Proposer Workshop  
28 Sept. 2012*

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## Purpose

Allow ONR to maintain the health, currency, and technical superiority of **Naval-unique** S&T by:

- Sustaining robust U.S. research capability to work on long term S&T problems of interest to the Department of the Navy
- Maintaining adequate pipeline of new scientists and engineers in disciplines of unique Navy importance
- Continuing to provide S&T products necessary to ensure future superiority in integrated Naval warfare.



# Sea-Based Aviation NNR Program Focused Approach

## Overall Challenge

Maintain the health, currency, and technical superiority of Sea-based Aviation S&T.

## Focused Technical Challenge Areas

**Aircraft**

**Structures**

**Propulsion**

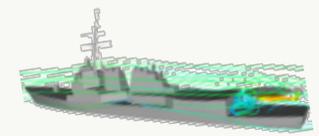
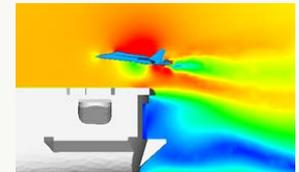
## Focused Investments

- Virtual Dynamic Interface
- Advanced Handling Qualities & Control
- Improved Fixed Wing High Lift Aerodynamics
- Enhanced Fixed Wing V/STOL Operations
- Autonomous Deck Operations

- Corrosion protection, detection, and mitigation.
- Structural Mode Characterization
- High-Loading, Lightweight Structural Materials
- Advanced Structural Concepts
- Materials Degradation/Corrosion
- Structural Protection /Maintenance

- Energy-Efficient Processes and Subsystems
- Turbomachinery and Drive Systems with Enhanced Maintainability
- Jet Noise Reduction for TACAIR
- Hot-Section Materials and Coatings
- Small UAV Propulsion

- Scope: Coupled aerodynamic / aeromechanical interaction of ship and aircraft
- Long Range S&T Goal: High-fidelity real-time piloted and fast non-piloted simulations for training, flight test support, design
- Initial Research Topic Areas
  - Applied Research
    - Fast, high-fidelity simulation of coupled maneuvering rotor / moving ship airwake
      - Innovative numerical methods
      - novel approaches to massively parallel computing
    - Fixed wing vehicle / ship airwake coupled dynamics simulation and experimentation
  - Basic Research
    - Fast, moderate fidelity aero methods
      - Post-computational representation of CFD and/or experimental results
      - Reduced-order physical models
    - Adaptive gridding of computational fields
      - Capture, resolve, and propagate ship airwake flow features downstream
      - Unsteady airloads of aircraft maneuvering in ship airwake during approach
    - Rotor wake modeling
      - Analysis of rotor wake properties over a non-uniform and non-stationary ground plane representing major ship features

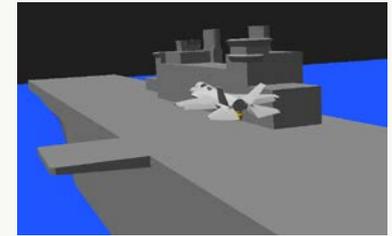


- Scope
  - Ship-relative navigation systems (aircraft carriers and small decks)
  - Approach and landing flight control
- Long Range S&T Goals
  - Precise, efficient UAV landings
  - Reduced workload piloted landings
  - Improved operations with towed minesweeping systems
- Initial Research Topic Areas (Applied Research)
  - Maritime rotary wing control laws
    - Control laws for precision landing control and reduced pilot workload in turbulent airwakes and deck motion
      - Effect of airwake and deck motion magnitude and predictability
    - Techniques and tools for control law verification / validation
  - Dynamics of towed systems
    - Modeling and testing of rotorcraft towing submerged vehicles
    - Control strategies for reduced workload and precise sweep pattern



- Scope: fixed-wing vehicle aerodynamics in approach configuration (flaps and landing gear extended) and airspeeds
- Long Range S&T Goals
  - Reduced approach speed and high precision flight control in approach to ship
  - Direct Lift Control and reduced control surface area
- Initial Research Topic Areas
  - Applied research
    - Innovative passive / active flow control systems for high lift and control at low speeds
      - Emphasis on advanced tailless configuration effectors and active adaptive systems
    - Thrust vectoring for recovery operations
  - Basic research
    - CFD methods for highly nonlinear flow prediction
      - Support prediction of highly nonlinear and unsteady aerodynamic behavior in approach configuration for design use
      - Flow control device modeling
      - Validation data

- Scope: Lift fan and jet lift aircraft
- Long Range S&T Goals
  - Improved VTOL, transition, cruise aerodynamics for lift-fan aircraft
  - Robust, high-fidelity M&S for ship / aircraft coupled airwakes, including thermal effects
- Initial Research Topics Areas
  - Applied research
    - High fidelity predictive capability for V/STOL shipboard ops
      - Multiple jet mixing, aircraft/flow field interaction (reingestion, suckdown, etc.), deck heating, outwash, vehicle and ship dynamics and airwakes
  - Basic research
    - Improved fidelity CFD and computational aeroacoustics methodologies for V/STOL systems
      - Enhanced capability in component modeling to support integrated simulation



- Scope: Controlled automation for UAVs taxiing on aircraft carrier flight deck before launch and after landing
  - Demanding optical and electromagnetic environment
  - High intensity close coupled operations
- Long Range S&T Goals
  - Efficient, seamless integration of autonomous systems into mixed manned / unmanned carrier operations
  - Reduce manpower on flight deck



- Initial Research Topic Areas

- Applied research: Precision on-deck UAV navigation and tracking for intelligent, coordinated control
  - Combination of two approaches
    - Global: Navigation, tracking, networked coordinated control for taxi prior to launch and after recovery
    - Local: Sensing systems for UAV limited situational awareness
  - Technologies for existing flight deck operating concept (1-to-1 flight director control)
  - Future innovative deck movement strategies
- Basic research: Innovative technologies to aid human control and monitoring of unmanned assets on deck
  - Advanced sensors, navigation, autonomous control to support innovative deck movement strategies

- Special Notice 12-SN-0028, as amended from time to time
- Not a solicitation – all white papers and proposals to be submitted under ONR Long Range Broad Agency Announcement for Navy and Marine Corps S&T (BAA 13-001)
  - SN takes precedence if conflicting
  - BAA 13-001 to be posted soon; expected to be virtually identical to BAA 12-001
- Awards
  - Grants, contracts, cooperative agreements
  - Earliest: Apr (Grants) / Jun (Contracts)
  - FY14 starts; potential for some FY13 starts
- Multiple awards planned
  - Nominal duration 2 years + 1 year option
  - Basic research: single investigator grants
  - Applied research: 1-3 FTE

- Strongly encouraged
- Expected NLT Thursday, 1 November
- See BAA 13-001 and 12-SN-0028 for detailed requirements
- 4 pages or less (excluding cover page and PI resume)
- Essential elements:
  - PI name and contact info
  - Relevance (identify research topic area)
  - Technical baseline, objective, expected advancement in State of the Art
  - Technical approach
  - Summary of recent relevant technical breakthroughs
  - Funding plan by fiscal year
- Notification of Government interest (i.e. invitation to full proposal) on or about 3 December 2012

- White paper / proposal
  - Proposals invited based on white paper
  - Submissions evaluated against BAA objectives
  - Criteria:
    - 1) Scientific and technical merits
    - 2) Potential Naval relevance
    - 3) Offeror capabilities, experience, facilities, techniques
    - 4) Qualifications, capabilities, experience of PI and team
    - 5) Cost realism and funds availability
  - Evaluations by Navy and other Government Subject Matter Experts
  - Selection panel assembles final program
- Criteria 1-4 of equal value, significantly greater than Criterion 5

- Encouragement to propose:
  - based on white paper
  - does not ensure award
  - not necessary but strongly recommended.
- See BAA 13-001 and 12-SN-0028 for detailed requirements
- Expected NLT 17 January 2013
- Grant proposals *must* go through [www.grants.gov](http://www.grants.gov) (recommend submitting before final day)
- Evaluation process similar to white papers
- Funding decisions NLT 20 February 2013

- Please submit in writing by email
- Q&A list updated periodically as amendment to SN – watch [onr.navy.mil](http://onr.navy.mil), [grants.gov](http://grants.gov), and [fbo.gov](http://fbo.gov)
- For proposer workshop:
  - Review of questions received by COB 9/26
  - Additional questions as time permits – please use “chat” feature to submit.



Special Notice 12-SN-0028

“2012 Basic and Applied Research in Sea-Based Aviation Aircraft Science and Technology”

**Questions and Answers**

**Updated 12 October 2012**

All questions regarding the Special Notice must be provided in writing by email to the Technical Points of Contact and/or Business Point of Contact listed in the Special Notice.

Questions 1–12 were added in Amendment 1.

**1. Can a white paper/proposal propose work comprising both Basic (6.1) and Applied (6.2) research?**

No. Please submit separate white papers and proposals for the two elements of the project. Each should stand alone but may reference the other.

**2. Can ONR decide to reclassify a proposed project to align better with budget activity (6.1/6.2)?**

Yes.

**3. Can one white paper/proposal contain tasking applicable to more than one research thrust area?**

No. Please submit separate white papers and proposals for the two elements of the project. Each should stand alone but may reference the other.

**4. Can ONR decide to reclassify a white paper from one research thrust area to another?**

Yes.

**5. What are suggested size and duration of projects?**

Please refer to Section V of the Special Notice, which provides nominal duration and scope of awards for planning purposes. These are notional based on anticipated budget availability. White papers and proposals may propose projects of different duration and/or scope, if appropriate; however large departures from the notional duration and scope are discouraged.

**6. If teaming on a 6.1 project, can multiple PIs be accommodated?**

Yes – multiple PIs can be funded under a 6.1 project. See also question 5.

**7. Can a 6.1 project include extra work above and beyond the notional scope stated in the Special Notice, for example to accommodate use of special experimental facilities?**

Yes, however see also question 5.

**8. How should technical questions be submitted?**

Submit technical questions in writing by email to John Kinzer, [john.kinzer@navy.mil](mailto:john.kinzer@navy.mil), and Judah Milgram, [judah.milgram@navy.mil](mailto:judah.milgram@navy.mil). Questions related to the Autonomous Deck Operations research thrust area should also be submitted to Marc Steinberg, [marc.steinberg@navy.mil](mailto:marc.steinberg@navy.mil).

**9. Is teaming with Government labs allowed?**

Yes. Funding allocated to the Government lab will be issued directly to that lab.

**10. Interaction and collaboration is “encouraged” – is it required, does it improve our chances of selection?**

Interaction and collaboration are encouraged based on the expectation that in many cases it will lead to the best possible technical outcome. There is no requirement to collaborate, nor will it be a direct factor in the evaluation of white papers or proposals. Collaboration should only be undertaken when it may be expected to improve the project outcome.

**11. Some research topic areas seem already to be addressed by current Government-funded efforts. Is the goal here to extend and/or leverage these other efforts?**

Proposers may leverage ongoing efforts to the degree they feel appropriate, but there is no requirement for them to do so. The Special Notice is not specifically intended to extend currently funded efforts.

**12. When is the proposer workshop?**

Friday, 28 September 2012, 1300-1500 EST. This will be a web-based workshop. Registration is required. Register at

<https://secure.onr.navy.mil/events/regdetail.asp?cid=899>

Registered participants will be provided with connection instructions a few days before the workshop.

Questions 13–17 were added in Amendment 2

**13. Where is BAA 13-001?**

BAA 13-001 will be released within the next few weeks. We don't expect significant changes from BAA 12-001, which can be found at <http://www.onr.navy.mil/~media/Files/Funding-Announcements/BAA/2012/12-001-Amendment-0001.ashx> . However, proposers are expected to obtain and comply with BAA 13-001 when it becomes available.

**14. Would a live data collection study to help develop and validate the simulated environment be appropriate for the Virtual Dynamic Interface thrust area?**

The VDI roadmap identifies "Innovative experimental methods" as a future topic area. However if the proposed study supports validation efforts we'll consider it now.

**15. Is the basic/applied funding mix different for any particular topic in the solicitation?**

There is no specific 6.1/6.2 funding mix envisioned for individual topic areas. In the proposer workshop briefing, topic areas have been designated notionally as "basic" or "applied," however this is more of an initial assessment of where the research lies than a rigid requirement.

**16. What level of focus to do you expect on basic and applied aspects? For example, in topic area #2 under the "Autonomous Deck Operations," would a proposal targeting this area need to focus on actual deck operations, or would it be OK to propose basic research using scenarios (physical and simulated) that mimic deck operations?**

Basic research needs to be relevant to the naval problems defined in the special notice. We encourage creative design of appropriate experiments that can be done in a cost effective manner to address the research questions of interest. There are no specific requirements for what those need to be. It will be up to proposers to make the case for the value and relevance of experiments proposed.

**17. In topic area #2 of "Autonomous Deck Operations" does "high level human direction and supervision" imply a specific level of human involvement? Will you be willing to consider varying levels of human supervision depending on task complexity and human expertise?**

We are open to different ideas for how humans would interact with these systems as long as they are appropriate to the unique challenges of autonomous naval deck operations.

Questions 18-24 were added in Amendment 3

**18. How many awards does ONR anticipate?**

We anticipate multiple awards across all research thrust areas. The actual number will be based on funding availability and the quality of the proposals received.

**19. For budgeting, what is meant by "scope of a single investigator grant?" What is the approximate dollar amount that ONR applies to a "full time equivalent?"**

A "single investigator grant" is nominally a professor directing a graduate research assistant. A "full time equivalent" is nominally a researcher working full time or nearly so. ONR does not propose target costs for these budgeting elements.

**20. Is [our technical approach] of interest?**

Any approach that effectively addresses research topic goals is of potential interest. White papers should establish the relevance of the proposed technical approach to the research topic goals described in the Special Notice.

**21. Can the same prime submit multiple white papers for different topics?**

Yes.

**22. Is teaming allowed with government agencies other than Navy Labs (for example, AFRL, AFOSR, AFDD)?**

Yes.

**23. In the "Enhanced Fixed Wing V/STOL Operations" research thrust area, are you interested in vehicular concepts that could support some of the topics, like high speed VSTOL, or are you focusing on technology that could enable those concepts?**

The latter – in particular, the two topic areas presented in that research thrust area.

**24. Can Government labs submit white papers and full proposals?**

Yes. White paper requirements are identical to those for other proposers. However, rather than submitting full proposals under BAA 13-001, PIs will submit Project Execution Plans (PEPs) by email to the Technical Points of Contact, in format to be provided.

Questions 25 – 54 were submitted at the Proposer Workshop on 28 Sept. 2012 and added in Amendment 3 of the Special Notice

**25. Are you interested in V&V approaches for "active adaptive systems" for FW high lift aero? Is this more focused on UAS or piloted operations?**

Any approach that effectively addresses research topic goals is of potential interest – see also Question 20. This research thrust area directs no specific focus on either UAS or piloted operations.

- 26. A Government lab and a private company are interested in developing related technologies, sharing their technologies and doing experiments independently. Both organizations plan to submit each proposal independently. Do you see any problems with this collaboration?**

Collaboration with Government labs is permitted. If the two efforts are distinct and stand alone, please submit two white papers. They may reference each other. If the performers are working closely together on a single effort, submit a single white paper. This would apply as well to a collaborative effort between a Government lab and a university.

- 27. The Special Notice suggests that new sensor development is out of scope, but the Basic Research discussion for Carrier Deck Operations mentions advanced sensors. Can you clarify the extent to which development of advanced sensing technologies is of interest?**

Existing and emerging sensors may be required for a particular research project, but we are not interested in funding sensor development.

- 28. What GFE would be made available (e.g. ship access for a demo)?**

There are no specific plans for making GFE available. This could be arranged directly with a collaborating Government lab. We would do our best to facilitate access but any costs would have to be included in the project cost estimate.

- 29. Are there any classification restrictions on submissions?**

Responses should in general be unclassified. We do not anticipate making awards for classified projects.

- 30. Are projects limited to participation by US citizens only?**

Proposers are responsible for their own compliance with the applicable export control regulations. If in doubt, talk to the ITAR POCs in your own organization. We may offer an opinion after we see the white papers.

- 31. For autonomous deck ops, are there any constraints on navigation sensing being active (potentially detectable by enemy forces - lidar/radar) or passive (vision)?**

Both active and passive sensing are acceptable. If active, some consideration needs to be given to compatibility with EMCON restrictions.

**32. Can you please clarify again what is the PI/Co-PI limit on 6.1 vs. 6.2 type research?**

There is no limit. The examples given (e.g. “professor directing a graduate student”) are notional and provided for scoping guidance only.

**33. Will there be publication restrictions on research grants to universities?**

All 6.1 and most 6.2 performed at universities is “contracted fundamental research.” DOD policy is generally not to restrict disclosure of the results of such efforts. Proposers are responsible for their own compliance with export control regulations.

**34. Do you want to use the high fidelity physics based simulation of aircraft/ship interaction to be used directly for pilot training?**

Ultimately, yes. We do not however expect to achieve this within the scope of a single effort funded under this opportunity.

**35. Are cost-sharing options available for working with Navy labs, or is all funding to be covered under these grants?**

Cost sharing (for example under a CRADA) with Navy or other Government labs is permitted.

**36. With regard to the ship wake impact on aircraft. Can you comment on the impact these effects have on the pilot/crew? That is, for a helicopter and fighter jet what would the pilot/crew experience?**

Crew comfort is a consideration, especially for helicopters, which have a higher vibration environment and can be subjected to ship airwake for some time.

**37. Would interaction between meso-scale atmospheric flow features and ship/aircraft aerodynamics be of interest?**

Yes. We intend to initiate work in this area in a future effort, but will accept proposals now if there is particular merit to the approach. Note that we are not interested in researching maritime meteorology or atmospheric physics per se. However, integration of Atmospheric Boundary Layer models and wind and wave effects etc. into the dynamic interface simulations would be of interest.

**38. Are autonomous deck ops only for taxiing UAV to takeoff and back from landing, or do they also include other equipment on deck such as tow tractors?**

Principal focus is on taxiing UAV to takeoff and from landing. Applicability of the technology to tow tractors or other equipment is a plus, but not required and should not restrict the capability of the UAV system.

- 39. Is a project that focuses on safety of deck ops (assuming local and global positioning and tracking exist) of interest? Example, a system to notify UAV of personnel that they may collide or move into unsafe area.**

Safety should be a consideration in the design of a system for UAV movement, but does not stand alone.

- 40. Are data on EMI of the carrier environment publicly available and are there limitations stated anywhere on allowable frequencies/signals?**

We will investigate to see what data can be provided. But assume for now that we will not be able to provide specific information on this.

- 41. Are there limitations to where sensors may be located onboard the UAV?**

It's important to consider that deck movement is a very limited function, and that aircraft designers will be reluctant to make compromises just for that. Thus the sensors must be designed to have minimal impact on important aircraft design features, such as aerodynamic performance, radar signature, structural robustness, reliability and maintainability, and size/weight/power/cost.

- 42. Can some level of data connectivity be assumed between ship and UAV?**

If connectivity is needed, some explanation must be provided as to how it could be obtained.

- 43. Will there be further opportunities for Q&A before the date that white papers are requested?**

Yes. Submit questions in writing up to two weeks before the requested white paper submission date (i.e. up until Oct. 18). Answers will be posted as amendments to the SN. Questions may be submitted after that date but will be answered only if time available.

- 44. What do you mean by fixed wing vehicle/ship airwake experimentation (slide 4 of the Proposer Workshop briefing)? Are you talking about physical experiments or computational experiments? Or both?**

Both.

- 45. On the "Autonomous Deck Operations" topic, what kind of deck would the UAVs land on? Carriers?**

Carriers.

- 46. Could you please confirm that for each topic the offeror should select whether he is submitting a basic research or applied research proposal?**

Yes. In some cases we may amend this selection for better alignment with budget activity.

**47. What TRL do you expect to start and end for the Autonomous Deck Operations topic?**

Starting with TRL 2-3, ending with TRL 4

**48. What kind of environmental conditions should we assume for the deck ops scenario?**

Environmental scenarios could include any condition that would normally be experienced on a ship deck at sea. This would include all degrees of light / dark, heavy rain, snow, fog, and steam from catapults.

**49. Is human-machine interface (HMI) a desirable aspect of autonomous deck ops?**

HMI should be addressed, but should not be a major cost element.

**50. Could you please comment on demonstration requirements for autonomous deck ops?**

A lab or “parking lot” demonstration is acceptable. Ship demonstrations are not required.

**51. If a corporation wants to submit a proposal for a 6.1 research topic, is the size of the project still limited to a single investigator grant? Can a corporation obtain a contract rather than a grant for 6.1 research?**

Contracts for 6.1 research are permissible. For scoping a 6.1 project at a company we would suggest something analogous to a university single investigator grant.

**52. It was mentioned that the interaction of a ship's wake with a fixed wing aircraft on approach is less important than the effects felt by a rotorcraft on approach or during landing. So is it important to investigate the effects of a ship's wake on a fixed wing aircraft during approach?**

Yes, we are interested in airwake effects on fixed wing aircraft. It would be interesting to explore the sensitivity of fixed wing landing precision to the range of airwake effects to truly understand its importance.

**53. On slide 5 of the Proposer Workshop briefing, are you looking for a CFD solution of the rotorcraft and towed system together?**

We don't know that it has to be CFD and not some other analytical or experimental approach, but “together” is important.

**54. Is experimental work on Improved FW High Lift Aerodynamics limited only to applied research? It appears that basic research is limited to CFD.**

Basic research in this area not limited to CFD and may include experimental efforts.

**55. When submitting a proposal with Co-PIs should we include a 1 page resume for each or should we squeeze all resumes onto a single page?**

At proposer's option, use up to one full page for each PI/Co-PI. These pages will not be counted against the 4-page white paper limit.

**56. The Virtual Dynamic Interface area has two long-range goals. Does a white paper have to cover both aspects or can it focus on just one of the long-range goals?**

The long term goals in the SN are presented to help establish context for the specific topic areas. White papers should address the specific topic areas listed for each research thrust area. For example, in the Virtual Dynamic Interface research thrust area, there are five specific topic areas of interest listed.

Question 57 was posed in the Sept. 28 Proposer Workshop and added in Amendment 4 to the Special Notice

**57. Will preference be given to proposals that leverage other DOD development efforts, such as CREATE-AV (Air Vehicles), or that utilize open-source tools?**

Proposers should select those software tools that allow them to address the research topic areas most effectively. Note that where projects involve development of analytical methodologies implemented in software, a complete description of the methods including theory manual, user documentation, and source code should be provided to the Government under license with Unlimited Rights (see Section V of the Special Notice).

Questions 58 – 60 were added in Amendment 4 to the Special Notice

**58. Our team has been working on [a specific technology]. Which category does this fall under – Basic or Applied Research? According to the relevant thrust area description slide presented at the proposer workshop, research in this area seems to be Applied [or Basic] Research.**

We suggested Applied [or Basic] Research in this area because that is where we anticipate the Naval unique S&T problems will be addressed. But if your work addresses these problems, we would be interested in a white paper, regardless of the basic/applied distinction. See also Questions 1 and 2.

**59. Can someone on a H1 visa be a PI or does it have to be a permanent resident, or a citizen? Are there any restrictions on nationalities of students who could work on this project?**

Assuming the topic is not classified, there are no restrictions, provided these personnel are able to work legally. However, some topics may cover export controlled technologies.

Research in these areas is limited to “U.S. persons” as defined in the International Traffic in Arms Regulations (ITAR), 22 CFR § 120.1 et seq. Proposers are responsible for their own compliance with the applicable export control regulations. If in doubt, talk to the ITAR POCs in your own organization. We may offer an opinion after we see the white papers. See also Question 30.

**60. Please clarify the terms, “research thrust area,” “long-range S&T goal,” and “research topic area” as used in the Special Notice**

Research thrust areas are broad technology areas associated with Naval Unique S&T challenges. Each research thrust area is directed at specific long-range S&T goals, and incorporates a number of research topic areas that are intended to lead to progress towards achieving these goals.

The five subsections (“Virtual Dynamic Interface,” “Advanced Handling Qualities and Control,” etc.) each describe a research thrust area. Each subsection lists both long-range goals and research topic areas.

White papers and proposals should focus on the specific research topic areas. However, proposers should remain mindful of the long-range goals when planning their projects.