Special Notice N00014-21-S-SN05
Special Program Announcement for 2021 Office of Naval Research
Research Opportunity:
Advanced Crashworthy Self-Sealing (ACWSS) Fuel Bladders
AMENDMENT 0001

I. INTRODUCTION

The research opportunity entitled "Advanced Crashworthy Self-Sealing (ACWSS) Fuel Bladders" as described in this announcement specifically falls under the areas of Aviation, Force Projection, and Integrated Defense (Code 35) Future Naval Capabilities (FNC) program (https://www.onr.navy.mil/Science-Technology/Departments/Code-35/All-Programs/airwarfare-and-naval-applications-352/future-naval-capabilities). More specifically, it addresses the naval need for air platform survivability, total ownership cost, and operational availability under technology areas including Innovative Aerospace Materials; Advanced Manufacturing Technologies; and Reduced Maintenance Concepts. This opportunity is under the Office of Naval Research (ONR) Broad Agency Announcement (BAA) N00014-21-S-B001, Long Range BAA for Navy and Marine Corps Science and Technology, which can be found at https://www.onr.navy.mil/work-with-us/funding-opportunities/announcements. The submission of proposals, their evaluation, and the placement of research contracts will be carried out as described in that BAA.

The purpose of this announcement is to focus attention of the scientific community on (1) identifying and addressing the technical challenge as it applies to the topic, and (2) the planned timetable for the submission of full proposals.

II. TOPIC DESCRIPTION

The Office of Naval Research (ONR) is soliciting proposals for the development of Advanced Crashworthy Self-Sealing (ACWSS) fuel bladders, self-sealing non-crashworthy fuel bladders, and standard (non-self-sealing, non-crashworthy) fuel bladders manufactured using high quality/high throughput (e.g., automated, out-of-autoclave, fast curing, etc.) production processes. The program will consist of a single Base Period covering two (2) years and a contract option for an additional two (2) years. Program objectives include:

- Development of new, advanced fuel bladder materials and constructions that are compatible with modern manufacturing techniques.
- Reduction in weight while continuing to meet performance requirements detailed in Table 3.
- Increased manufacturing rates, with the goal of producing a MIL-DTL-27422F fuel bladder within 10 days, while maintaining quality of manufacturing (initial yields of 95% defect free bladders (i.e., requiring no additional re-work or repair)).
- Improvements in general robustness with a minimum 10-year operational life.

ONR expects that the proposed materials and manufacturing processes will be adaptable to the different types of bladder constructions (see Figure 1), so that the Navy can use qualification-by-similarity as much as practical. Qualification to each of the fuel bladder specifications is composed of two Phases: Phase I Qualification comprises tests on materials/coupons and tests on a standardized fuel-bladder cube geometry, and Phase II Qualification comprises tests on full-scale bladder prototypes.

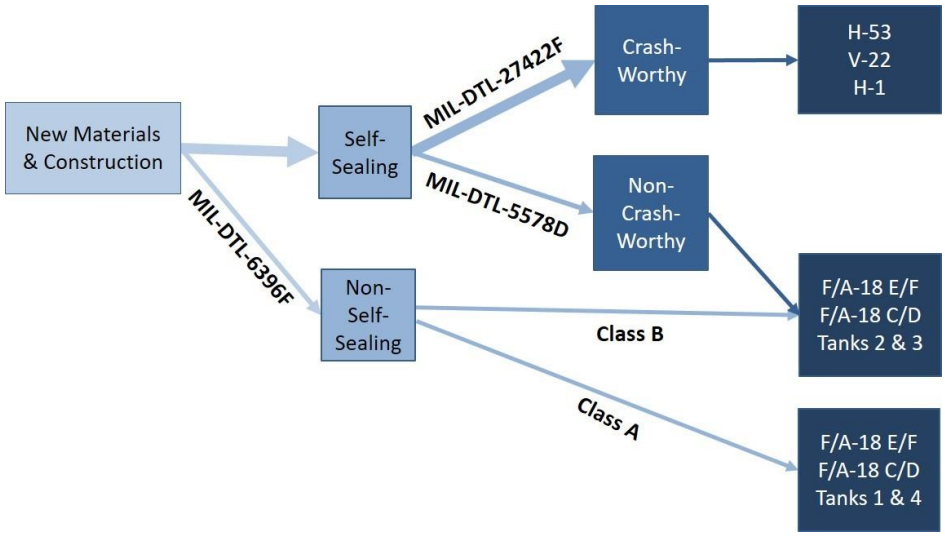

Figure 1. Flow diagram of fuel bladder specifications and aircraft fuel bladders. ***Note:*** *F/A-18 Tanks 2 and 3 have a self-sealing portion and a non-self-sealing portion.*

Key Technologies of Interest in this announcement include:

- Lightweight materials or system of materials
- Self-sealing material/system integral to bladder construction with a mechanism capable of mitigating fuel loss following ballistic penetration
- Improved composite tear, impact, and abrasion resistance
- Improved crashworthiness through improved structural fabrics and/or fitting tie-ins
- Aviation fuel resistant/low fuel permeability interior and exterior materials, with enhanced flexibility
- High throughput, high quality, and low defect manufacturing processes
- Low cost, adaptable molds/tooling
- Improved adhesive bond strength, if relevant
- Regulatory compliant, low environmental impact processes
- Technologies that allow for easy damage detection and potential for repair.

Background:

Current crashworthy self-sealing (CWSS) fuel bladders are based on flexible multi-layer, elastomeric composite constructions located in fuel tank cavities on rotary wing aircraft. They differ from fixed wing aircraft self-sealing fuel bladders because they must also be crashworthy

(e.g., pass an unsupported 65 feet drop test per MIL-DTL-27422F) to prevent post-crash fuel leakage and subsequent fire risk. CWSS fuel bladders are categorized as critical application items (CAI) or critical safety items (CSI); rotary wing aircraft cannot fly without bladders or with degraded fuel bladders that do not meet performance requirements. The desired useful life of a fuel bladder is approximately 10 years. The annual market size is approximately $100 million.

In addition, CWSS bladders are labor intensive to manufacture. Manufacturers struggle to meet predicted production weights and rates due to defects and associated rework. Bladders can be susceptible to localized abrasion from airframe structure and defects, whether latent production or service-generated (i.e., handling, installation, preservation). This can compromise service life Current issues affecting operational life include elastomeric material degradation and pre-mature activation of the self-sealing layer, resulting in the average life of fielded bladders being much lower than desired.

Technical Description:
The objectives for the Base Period contract and the Option Contract are summarized in Tables 1 and 2. Detailed information on bladder thresholds and objectives (applies to all bladder constructions) is provided in Table 3. All tests are to be performed by the Offeror unless noted that the government will perform a test. Access to aircraft may be provided if necessary for the contract option period.

Each of the fuel bladder specifications covers multiple types, classes, styles, and protection levels. For this effort, the Navy will use the following for reference:

- Standard Bladder, Non-tear resistant - MIL-DTL-6396F Type II, Class A
- Standard Bladder, Tear resistant - MIL-DTL-6396F Type II, Class B
- Self-sealing Bladder - MIL-DTL-5578D Type II, Class A, Style 2, Protection Level C
- Crashworthy and Self-sealing Bladder - MIL-DTL-27422F Class A, Type I, Protection Level A

To support some of the unique test requirements, Offerors selected to participate in this program may request Computer Aided Design (CAD) files of the test fixtures. These CAD files are in addition to drawings provided in MIL-DTL-27422F, MIL-DTL-5578D, and MIL-DTL-6396F.

Base Year 1: The Navy anticipates that in the first year, Offerors shall successfully meet general fuel bladder threshold metrics such as weight, aging, and environmental resistance as well as the functional requirements of MIL-DTL-6396F (Table 3, Sections 1 and 2) and coupon level requirements of MIL-DTL-6396F. The Navy will assess manufacturing quality, and manufacturing speed (Table 3, Section 3) through descriptive reports, capability demonstrations, and the delivery of a large 4’x8’ MIL-DTL-6396F Class B panel. In addition to the above, Offerors shall initiate development of a self-sealing (Table 3, Section 4) capability, which is critical for Base Year 2.

Material assessment: The Offeror shall deliver a Quality and Manufacturing Reports to the Navy and conduct a formal progress review by the end of the first year. With the exception of government-approved exemptions, all requirements in Year 1 from Table 3, Sections 1 through 4 shall be successfully completed. Additionally, the reports shall include standard, self-sealing, and crashworthy self-sealing construction details, and coupon-level test results for the standard (non-crashworthy, non-self-sealing) application. Offerors shall also provide a Requirements Verification Matrix (RVM) of the progress to date.

Base Year 2: The Offeror shall complete the construction tests from MIL-DTL-27422F and additional mechanical property tests (Table 3, Sections 5 and 6). If changes to the general manufacturing concept previously outlined by the Offeror are required, the Offeror shall provide written justification of the need for these changes and must receive government approval before proceeding. The Navy shall use the construction and mechanical material property test data to help assess crashworthy (drop test) performance.

Although the Navy typically assesses self-sealing capability at the cube-level, as per MIL-DTL-27422F, evaluation in the Base Period will be through panel test results. Two ballistic tests shall be performed – one by the Offeror and one by the government. The Offeror shall conduct a preliminary ballistic test, witnessed by the government, by the middle of Year 2 on the MIL-DTL-27422F construction. At the end of the third quarter of Year 2, the Offeror shall supply six flat panels (MIL-DTL-27422F construction), 16" by 16" (Table 3, Section 8), for ballistic testing to be performed by the government. The panels supplied to the government shall self-seal within 2 minutes against a 0.50 caliber straight-in round and 0.50 caliber three-quarter to fully-tumbled round (Table 3, Section 8) during the ballistic test conducted by the government.

Also, in the second year, Offerors shall manufacture a MIL-DTL-6396F Type II, Class A fuel cube (Table 3 Section 7) and successfully complete a slosh test in accordance with MIL-DTL-6396F.

Technical Data Packages (TDPs): The Offeror shall provide a TDP to the government for the Phase I qualification of MIL-DTL-6396F Class II, Type A construction for potential use in non-self-sealing, non-crashworthy applications.

Progress Review / Final Report: The Offeror shall conduct a formal review of progress with Preliminarily Design Review (PDR) and provide an updated RVM.

Contract Option – Year 3: If the Navy chooses to exercise the Option, then in Year 3, the Offeror shall produce a minimum of four MIL-DTL-27422F cubes made from the previously tested panel construction and one MIL-DTL-5578D cube with partial MIL-DTL-6396F Type II Class B construction for gunfire testing in the first quarter. The objective is to produce each cube in under 10 days (Table 3, Section 9) and to update the manufacturing assessment report, as required. The MIL-DTL-27422F cubes shall successfully pass the crash impact, slosh and

vibration, and gunfire resistance tests (Table 3, Section 10). Offerors shall perform the Phase I fuel cube tests for all constructions this year (Table 3, Section 10). The Navy expect Offerors to use Qualification by similarity for certain tests. For example, the fuel resistance test should apply to all constructions if the materials that are exposed to fuel do not vary between construction types. The contractor shall also provide a Transition Report (Table 3, Section 11) to assess the geometric and fitting challenges in manufacturing bladders as opposed to the cube.

Technical Data Packages (TDPs): The Offeror shall provide Phase I TDPs to the government for each construction.

Progress Review: The Offeror shall conduct a formal review of progress. Offerors shall provide a Scalability plan (Table 3, Section 11) demonstrating how technology will transition into Year 4 for full construction of prototype bladders and an updated RVM.

Contract Option – Year 4: In the final year of the contract, the Offeror shall produce a minimum of three MIL-DTL-27422F fuel bladders from five different aircraft positions (fifteen bladders total). The five locations of interest are CMV-22 WAT #4, CMV-22 WAT #5, AH-1Z FWD Fuel Cell, and CH-53K RH AFT and FWD. These full-size bladders shall successfully undergo MIL-DTL-27422F qualification testing with Phase II Manufacturing and Quality requirements outlined in Table 3, Section 12 and the Phase II Bladder tests outlined in Table 3, Section 13.

Technical Data Packages (TDPs): The Offeror shall provide a TDP to the government for the Phase II qualification of MIL-DTL-27422F bladders.

Final Review: The Offeror shall conduct a formal review of progress in conjunction with a Critical Design Review (CDR) and Final RVM.

The developed material or material system shall be sufficiently flexible to accommodate installation into aircraft cavities (by folding and strapping) and the manufacturing process shall be sufficiently adaptable to meet the unique geometries of aircraft fuel bladders within a variety of Navy rotary and fixed wing aircraft. For example, the H-1 has relatively small (~110-gallon), cube-like fuel bladders that need to be folded to fit inside of the aircraft fuselage cavities, while the H-53K has large (~875-gallon), oblong fuel bladders in fuselage sponsons. Other, more complicated geometries also exist; the AH-1Z forward tank has a rectangular protrusion that cantilevers off a cube, and F/A-18 tanks have multiple protrusions.

Notional Program Outline:
The program will consist of a single Base Period covering two (2) years and a contract option for two (2) years. The Navy will select Offerors to participate based on white papers and full proposals submitted in response to this Special Notice. The Navy will exercise contract options for Offerors to participate in a potential Future Naval Capabilities program based on results from the Contract base period.

Base Contract (24 months):

Offerors shall develop Advanced Crashworthy Self-Sealing (ACWSS) Fuel Bladder materials and characterize material performance using standard laboratory methodologies and those specified in MIL-DTL-27422F, MIL-DTL-5578D, and MIL-DTL-6396F. The Navy may request small batch samples from each Offeror for independent testing and evaluation of the ACWSS Fuel Bladder products.

During the performance period of the first year, each Offeror will be required to provide the following deliverables:

- Annual Program Review (Technical and Financial)
- General and Functional Test Reports (Test Data and Supporting Documents)
- Quality and Manufacturing Process Definition Reports
- One 4'x 8' panel of the MIL-DTL-6396F Type II Class B construction
- Self-sealing Mechanism Definition Report
- Initial Requirements Verification Matrix (RVM) showing progress to date

During the second year of the Base contract, Offerors shall provide the following deliverables:

- Combined Annual Program Review and Preliminary Design Review (PDR) (Technical and Financial)
- Construction, Mechanical Properties, Slosh, and Ballistic Test Reports (Test Data and Supporting Documents)
- Phase I Qualification TDP for MIL-DTL-6396F Type II Class A construction
- Six MIL-DTL-27422F panels for a ballistic test performed by the government
- MIL-DTL-6396F Type II Class A fuel cube (after testing)
- Interim RVM showing progress to date

Contract Option (24 Months):

During the first 12 months of the option, Offerors shall provide the following deliverables:

- Combined Annual Program Review (Technical and Financial)
- Manufacturing Report
- Phase I Cube Tests Reports
- Scalability Plan – Transition from Cube to Full Size Bladder
- Phase I Qualification TDPs for MIL-DTL-6396F Type II Class B, MIL-DTL-5578D, and MIL-DTL-27422F
- Interim RVM showing all requirements have been completed for Phase I tests

For the final 12 months of the Contract Option, Offerors shall provide the following deliverables:

- Final Program Review and Critical Design Review (Technical and Financial)
- Manufacturing Report
- Phase II Qualification Test Reports
- Phase II TDP
- Final RVM showing all requirements have been completed for Phase II MIL-DTL27422F

Table 1 - Summary of Base Period Objectives				
	Task	**Table 3 Section**	**Bladder Construction(s)**	**Deliverables**
Year 1	General Requirements Tests	1	All (Expecting majority of tests on MIL-DTL-6396F Type II, Class A construction and qualification by similarity to other constructions)	Test report
	Functional Tests	2	All (Expecting majority of tests on MIL-DTL-6396F Type II, Class A construction and qualification by similarity to other constructions)	Test report
	Coupon Manufacturing and Quality	3	All	Quality report Manufacturing report One 4' x 8' panel (MIL-DTL-6396F Type II Class B)
	Self-Sealing	4	MIL-DTL-27422F	Mechanism definition report
	Progress Review			Formal Review of Progress and Initial RVM
Year 2	Construction Tests	5	MIL-DTL-27422F MIL-DTL-6396F	Test report
	Mechanical Property Tests	6	MIL-DTL-27422F	Test report

Table 1 - Summary of Base Period Objectives				
	Task	**Table 3 Section**	**Bladder Construction(s)**	**Deliverables**
	Phase I Cube Slosh Test	7	MIL-DTL-6396F Class II, Type A	One Phase I Test cube MIL-DTL-6396F Type II Class A Technical Data Package (TDP)
	Ballistic Tests	8	MIL-DTL-27422F	Test report (Offeror test)
				Six 16” x 16” panels (MIL-DTL-27422F construction) for government test
	Progress Review and SETR Assessment			Formal Review of Progress/PDR, and Interim RVM

Table 2 - Summary of Option Contract Objectives				
	Task	**Table 3 Section**	**Bladder Construction**	**Deliverables**
Year 3	Phase I Cube Manufacturing and Quality	9	MIL-DTL-27422F MIL-DTL-5578D MIL-DTL-6396F Type II Class B	Manufacturing report Four 27422 Phase I cubes One MIL-DTL-5578D cube with partial MIL-DTL-6396F Type II Class B construction for gunfire testing
	Phase I Cube Tests	10	All	Test report
	Transition	11	All	Scalability Plan MIL-DTL-5578D Phase I TDP MIL-DTL-6396F Type II Class B Phase I TDP MIL-DTL-27422F Phase I TDP
	Progress Review			Formal Review of Progress and Interim RVM
Year 4	Phase II Construction Manufacturing and Quality	12	All	Manufacturing report Fifteen MIL-DTL-27422F bladders
	Phase II Prototype Bladder Tests	13	All	Test reports Phase II TDP

Table 2 - Summary of Option Contract Objectives				
	Task	**Table 3 Section**	**Bladder Construction**	**Deliverables**
	Final Review and SETR Assessment			Formal Review of Progress/CDR Final RVM

Advanced CWSS Fuel Bladder Requirements:

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Section 1 - General Requirements - Applies to all bladder constructions			
Weight	ASTM D751 Section 10 - report in lbs./sqft	MIL-DTL-27422F: 1.2 lbs./sqft MIL-DTL-5578D: 0.85 lbs./sqft MIL-DTL-6396F Type II, Class B: 0.65 lbs./sqft MIL-DTL-6396F Type II, Class A: 0.4 lbs./sqft	MIL-DTL-27422F 0.72 lbs./sqft MIL-DTL-5578D: 0.51 lbs./sqft MIL-DTL-6396F Type II, Class B: 0.39 lbs./sqft MIL-DTL-6396F Type II, Class A: 0.24 lbs./sqft
Thickness		Report thickness	MIL-DTL-27422F: 0.22" MIL-DTL-5578D: 0.16" MIL-DTL-6396F Type II, Class B: 0.13" MIL-DTL-6396F Type II, Class A: 0.10"
Aging	Analysis	Identify susceptibility and define preservation requirements	No preservation requirements
Environmental Resistance	Humidity test required per MIL-DTL- 6396F, section 4.5.10	Meet MIL-DTL-6396F (Non-self-sealing, non-crashworthy fuel cell specification) Requirement	
Environmental Safety		Meet State and Local Environmental, Safety, and Occupational Health (ESOH) requirements	Limited use of VOCs, isocyanates, amines, and fluoropolymers
Temperature Resistance	Will be required in Phase II Qualification 4.7.9 of MIL-DTL-27422F	-65F to 160F	

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Operational Temperature Stability	See Cold Temperature Toughness (in Section 6) and will be required in Phase I & II Qualification	-25F to 160F (MIL-DTL-27422F) -65F to 160F (MIL-DTL-5578D) -65F to 160F (MIL-DTL-6396F)	-65F to 160F for all constructions
Section 2 - Functional Tests - Applies to all bladder constructions. Tests are common to all 3 specifications.			
Non-Volatile Gum Residue	MIL-DTL-6396F Section 4.5.13.1	Meet Mil-spec requirements	
Stoved Gum Residue	MIL-DTL-6396F Section 4.5.13.2	Meet Mil-spec requirements	
Inner Liner Strength	MIL-DTL-6396F Section 4.5.15	Meet Mil-spec requirements	
Permeability	MIL-DTL-6396F Section 4.5.12	Meet Mil-spec requirements	
Seam Adhesion	MIL-DTL-6396F Section 4.5.16	Meet Mil-spec requirements	Seamless designs
Slit Resistance	MIL-DTL-6396F Section 4.4.5.5	Meet Mil-spec requirements	
Inner Liner Adhesion	MIL-DTL-6396F Section 4.4.5.6	Meet Mil-spec requirements	
Stress Aging	MIL-DTL-6396F Section 4.4.5.7	Meet Mil-spec requirements	
Section 3 - Coupon Manufacturing and Quality - Applies to all bladder constructions			
Quality	As Defined in MIL-STD-801E and the Manufacturing speed Requirement	Meet MIL-STD-801E and define inspection criteria in Quality Report	No rework required per MIL-STD-801E

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Manufacturing Assessment		Define manufacturing process from start to finish with all steps included from material prep, dry times, to final curing. Define mold/tooling manufacturing and adaptability to fuel bladder geometry changes. Extend this out to all constructions for Phase I cube manufacturing.	
Manufacturing Speed		Produce one flat 4' by 8' panel per proposed process for MIL-DTL-6396F Type II Class B and record build time	
Curing			No Autoclave Required
Section 4 - Self Sealing			
Self-Sealing Mechanism	Analysis/ Description	Report mechanism(s) of self-sealing (e.g. fuel swelling, chemical reaction, mechanical rebound, etc.) and demonstrate the contribution of each mechanism to self-sealing performance	Reported/demonstrated self-sealing mechanism does not require aromatic fuel content for activation
Section 5 - Construction Tests - Applies to specified bladder constructions			
Puncture Resistance	MIL-DTL-6396F 4.5.17	Meet Mil-spec requirements. Only required for MIL-DTL-6396F constructions. Tests on MIL-DTL-6396F Type II Class A may be used to qualify MIL-DTL-6396F Type II Class B by similarity.	
Fitting Tests	MIL-DTL-6396F 4.5.28	Meet Mil-spec requirements. Only required for MIL-DTL-6396F constructions. Tests on MIL-DTL-6396F Type II Class A may be used to qualify MIL-DTL-6396F Type II Class B by similarity.	

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Constant Rate Tear	MIL-DTL-27422F 4.5.1	Meet Mil-spec requirements (Only for MIL-DTL-27422F construction)	Minimum energy for complete separation shall be 600 foot-pounds
Impact Penetration	MIL-DTL-27422F 4.5.2	Meet Mil-spec requirements (Only for MIL-DTL-27422F construction)	
Impact Tear	MIL-DTL-27422F 4.5.3	Meet Mil-spec requirements (Only for MIL-DTL-27422F construction)	
Panel Strength Calibration	MIL-DTL-27422F 4.5.4	Meet Mil-spec requirements (Only for MIL-DTL-27422F construction)	
Fitting Strength	MIL-DTL-27422F 4.5.5	Meet Mil-spec requirements (Only for MIL-DTL-27422F construction)	Greater than 250% elongation
Impact Resistance	MIL-DTL-27422F 4.5.6	Meet Mil-spec requirements (Only for MIL-DTL-27422F construction)	
Abrasion Resistance	MIL-DTL-27422F 4.5.7	Meet Mil-spec requirements (Only for MIL-DTL-27422F construction)	Perform Mil-spec abrasion twice on the same sample (i.e. move the chisel over the same line twice) before fuel exposure
Section 6 - Mechanical Material Properties - Applies to MIL-DTL-27422F Bladder constructions			
Toughness	ASTM D412 or D751 Breaking Strength - Cut Strip Test Method	750 lb.*in/in^3 and report stress-strain curves	2250 lb.*in/in^3 and report stress-strain curves. Greater than 250% elongation.
Cold Temperature Toughness	ASTM D412 or D751 Breaking Strength - Cut Strip Test Method at low temperature condition	Report stress-strain curves at -25F	Report stress-strain curves at -40F

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Flexural Modulus	ASTM 7264 - Procedure A (Three Point Bend)	Maximum 4.5 ksi if seams are required to build the fuel cell or 6.75 ksi if seams are not required to build the fuel cell	Maximum 3 ksi if seams are required to build the fuel cell or 4.5 ksi if seams are not required to build the fuel cell
Shear Modulus	ASTM D5379, ASTM D4255, ASTM D7078, or ASTM D3518	Report shear stress-strain curve and modulus	
Section 7 - Phase I Cube Manufacturing			
Phase I Cube and Slosh Test	MIL-DTL-6396F	Manufacture a Phase I cube in accordance with MIL-DTL-6396F Type II Class A and MIL-STD-801E. This cube shall pass the slosh tested in accordance with MIL-DTL-6396F.	
Section 8 – Ballistic Tests - Applies to MIL-DTL-27422F Bladder construction			
Ballistic 1	Normal temperature risk reduction test conducted by contractor on MIL-DTL-27422F construction. Perform three 0.50 caliber straight in shots in separate material panels. Fuel head behind wound shall be greater than 1 foot. Government witness required for test.	Deliver written gunfire test report to the government.	

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Ballistic 2	Government Gunfire Test of 0.50 caliber straight in round and 0.50 caliber 3/4 tumbled round.	Contractor shall provide six 16" by 16" test panels (MIL-DTL-27422F construction). Panels should self seal against straight in round with a leak rate no greater than 10mL/min at 2 minutes after penetration. Panels should self seal against a 3/4 tumbled round with a leak rate no greater than 80mL/min at 2 minutes after penetration.	Damp or dry seal at 2 minutes.
Section 9 - Phase I Cube Manufacturing and Quality			
Quality	As Defined in MIL-STD-801E and the Manufacturing Speed requirement	Meet MIL-STD-801E and define inspection criteria in Quality Report	No rework required per MIL-STD-801E
Manufacturing Assessment		Update manufacturing assessment report for Phase I cubes defined in Manufacturing Speed requirement from start to finish with all steps included from material prep, dry times, to final curing.	
Manufacturing Speed		Produce four MIL-DTL-27422F Phase I cubes. Produce one MIL-DTL-5578D cube with partial MIL-DTL-6396F Type II Class B construction for gunfire testing. Report production time for major steps in the updated Manufacturing Assessment Report.	Meet the threshold requirements and each cube shall be produced within 10 days from start to finish.

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Section 10 - Phase I Cube Tests - Qualify by similarity where applicable			
Fuel Resistance	MIL-DTL-27422F 4.5.8.1 MIL-DTL-5578D 4.5.5.1 MIL-DTL-6396F 4.5.11	Meet Mil-spec requirements. Test on the MIL-DTL-27422F cube may be used to qualify the other constructions by similarity, if the exterior/interior materials are the same.	
Slosh Resistance	MIL-DTL-27422F 4.5.8.3 MIL-DTL-5578D 4.5.5.2 MIL-DTL-6396F 4.5.8	Meet Mil-spec requirements, but test temperature shall be 135°F. Test on MIL-DTL-6396F Type II Class A construction may be used to qualify the MIL-DTL-6396F Type II Class B and MIL-DTL-5578D constructions by similarity, pending construction details.	
Stand Test	MIL-DTL-27422F 4.5.11 MIL-DTL-5578D 4.5.5.5 MIL-DTL-6396F 4.5.9	Meet Mil-spec requirements. Test on MIL-DTL-6396F Type II Class A construction may be used to qualify the MIL-DTL-6396F Type II Class B and MIL-DTL-5578D constructions by similarity, pending construction details.	
Crash Impact	MIL-DTL-27422F 4.5.8.2	Meet Mil-spec requirements	
Low Temperature Gunfire	MIL-DTL-27422F 4.5.8.4.2	Meet Mil-spec requirements and use 0.2 psig ullage pressure	Meet Mil-spec requirements and use 1.5 psig ullage pressure
Aging Following Low Temperature Gunfire Resistance	MIL-DTL-27422F 4.5.10	Meet Mil-spec requirements	

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Normal Temperature Gunfire	MIL-DTL-27422F 4.5.8.4.3 MIL-DTL-5578D 4.5.5.3 MIL-DTL-6396F 4.5.19	Meet Mil-spec requirements.	MIL-DTL-27422F: 1.5 psig ullage pressure MIL-DTL-5578D with MIL-DTL-6396F Type II Class B portion: 0.5psig ullage pressure
Aging Following Normal Temperature Gunfire Resistance	MIL-DTL-27422F 4.5.10 MIL-DTL-5578D 4.5.5.4	Meet Mil-spec requirements	
Section 11 -Transition - Applies to all bladder constructions			
Full Size Fuel Cell Prototype and TDPs		Contractor shall provide a Scalability Plan showing how they will transition to full size Phase II bladders with unique geometries. Technical Data Packages for MIL-DTL-6396F Class B, MIL-5578D, and MIL-DTL-27422F Phase I Qualifications	
Section 12 - Phase II Manufacturing and Quality			
Quality	As Defined in MIL-STD-801E and the Manufacturing Speed requirement	Meet MIL-STD-801E and define inspection criteria in Quality Report	No rework required per MIL-STD-801E

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Manufacturing Assessment		Update manufacturing assessment report for a MIL-DTL-27422F Phase II bladder from start to finish with all steps included from material prep, dry times, to final curing. Show differences between MIL-DTL-27422F, MIL-DTL-5578D, and MIL-DTL-6396F manufacturing processes. Update mold/tooling manufacturing and adaptability to fuel bladder geometry changes.	
Manufacturing Speed		Produce three Phase II bladders for each of the 5 identified positions (15 bladders total) in the Weight requirement (below). Report production time for major steps in the updated Manufacturing Assessment Report.	Meet the threshold requirements and each bladder shall be produced within 10 days from start to finish.
Installation	MIL-DTL-27422F 4.7.1	Meet Mil-spec requirements.	

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Weight	MIL-DTL-27422F 4.6.2.1.3	CMV-22 WAT #4: 50.7 lbs. CMV-22 WAT #5: 42.5 lbs. AH-1Z FWD Fuel Cell: 95 lbs. CH-53K RH Aft: 204.6 lbs. CH-53K RH FWD: 133.6 lbs.	40% reduction from current NTE weights: CMV-22 WAT #4: 30.4 lbs. CMV-22 WAT #5: 25.5 lbs. AH-1Z FWD Fuel Cell: 57 lbs. CH-53K RH Aft (cell #3): 122.8 lbs. CH-53K RH FWD: 79.8 lbs.
Capacity	MIL-DTL-27422F 4.7.4	Meet Mil-spec requirements.	
Section 13 - Phase II Bladder Tests			
Slosh and vibration resistance	MIL-DTL-27422F 4.7.6	Meet Mil-spec requirements	
Aging and low temperature leakage	MIL-DTL-27422F 4.7.9	Meet Mil-spec requirements	

Table 3			
Requirement	**Evaluation Method**	**Threshold**	**Objective**
Dissection	MIL-DTL-27422F 4.7.10	Meet Mil-spec requirements	
Gunfire resistance	MIL-DTL-27422F 4.7.12	Damp seal with aircraft corresponding pressures. CMV-22 WAT #4: 1.5 psig CMV-22 WAT #5: 1.5 psig AH-1Z FWD Fuel Cell: 1.5 psig CH-53K RH Aft (cell #3): 0.2 psig CH-53K RH FWD (cell #3): 0.2 psig	Damp seal with corresponding pressures CMV-22 WAT #4: 1.5 psig CMV-22 WAT #5: 1.5 psig AH-1Z FWD Fuel Cell: 1.5 psig CH-53K RH Aft (cell #3): 0.2 psig CH-53K RH FWD: 0.2 psig
Crash Impact Test	MIL-DTL-27422F 4.7.18.1	Meet Mil-spec requirements	

III. DISTRIBUTION OF GOVERNMENT FURNISHED INFORMATION – WORKSHOP - INDUSTRY DAY

ONR does not plan to hold any workshops, industry days, webinars, etc. in support of this announcement.

IV. WHITE PAPER SUBMISSION

Although not required, white papers are strongly encouraged for all Offerors seeking funding. Each white paper will be evaluated by the Government to determine whether the technology advancement proposed appears to be of particular value to the Department of the Navy. Initial Government evaluations and feedback will be issued via e-mail notification from the Technical Point of Contact. The initial white paper appraisal is intended to give entities a sense of whether their concepts are likely to be funded.

Detailed Full Proposal (Technical and Cost volumes) will be subsequently encouraged from those Offerors whose proposed technologies have been identified through the above referenced e-mail as being of "particular value" to the Government. However, any such encouragement does not assure a subsequent award. Full Proposals may also be submitted by any Offeror whose white paper was not identified as being of particular value to the Government or any Offeror who did not submit a white paper.

For white papers that propose efforts that are considered of particular value to the Navy but either exceed available budgets or contain certain tasks or applications that are not desired by the Navy, ONR may suggest a full proposal with reduced effort to fit within expected available budgets or an effort that refocuses the tasks or application of the technology to maximize the benefit to the Navy.

White papers should not exceed 5 single-sided pages, exclusive of cover page, references, and resume of principal investigator, and should be in 12-point Times New Roman font with margins not less than one inch. White papers shall be in Adobe PDF format (preferred) or in Microsoft Word format compatible with at least Microsoft Word 2016.

The Cover Page can be found at https://www.onr.navy.mil/work-with-us/how-to-apply/submit-contract-proposal for contract submissions.
The 5-page body of the white paper should include the following information:

- Technical Concept: A description of the technology innovation and technical risk areas.
- Future Naval Relevance (where applicable) – A description of potential Naval relevance and contributions of the effort to the agency's specific mission.
- Operational Naval Concept (where applicable) – A description of the project objectives, the concept of operation for the new capabilities to be delivered, and the expected operational performance improvements.
- Operational Utility Assessment Plan (where applicable) – A plan for demonstrating and evaluating the operational effectiveness of the Offeror's proposed products or processes in field experiments and/or tests in a simulated environment.
- Rough Order of Magnitude (ROM) cost estimate

A resume of the principal investigator, not to exceed 1-page, should also be included after the 5page body of the white paper.

White papers must be submitted through Fedconnect at www.fedconnect.net in accordance with Section D. Application and Submission Information, sub-section 2. Content and Form of Application Submission, paragraph d. White Paper Requirements, ii. White Paper Submission in N00014-21-S-B001.

To ensure full, timely consideration for funding, white papers should be submitted **no later than 26 February 2021**. White papers received after that date will be considered as time and availability of funding permit.

The planned date for completing the review of white papers is **5 March 2021**.

V. FULL PROPOSAL SUBMISSION AND AWARD INFORMATION

Full proposals should be submitted under ONR BAA N00014-21-S-B001 by 0**8 April 2021 17:00 Eastern Daylight Time (EDT)**. Full Proposals received after that date will be considered as time and availability of funding permit.

Proposals will be evaluated in accordance with the criteria set forth in ONR BAA N00014-21-SB001. Full proposals for contracts should be submitted in accordance with the Appendix 2 of the N00014-21-S-B001.

Anticipated start date of the projects is July 2021. The period of performance will be four years (two years base and two years option) from the award date.

Although ONR expects the above described program plan to be executed, ONR reserves the right to make changes.

Funding decisions should be made by 23 April 2021. Selected projects will have an estimated award date of 23 July 2021.

VI. SIGNIFICANT DATES AND TIMES

Event	Date	Time
Recommended White Paper Submission Date*	26 February 2021	17:00 EST
Notification of White Paper Evaluation*	12 March 2021	
Recommended Full Proposal Submission	8 April 2021	17:00 EDT
Notification of Selection: Full Proposals *	23 April 2021	
Awards *	23 July 2021	

Note: * These are approximate dates**.**

VII. POINTS OF CONTACT

In addition to the points of contact listed in N0014-21-S-B001 the specific points of contact for this announcement are listed below:

Technical Points of Contact:
Dr. Anisur Rahman
Program Officer,
Code 351 - Aerospace Science Research
Office of Naval Research
anisur.rahman@navy.mil

Business Point of Contact/Contracting Officer:
Mr. James Farnsworth
Office of Naval Research
James.Farnsworth@navy.mil

VIII. SUBMISSION OF QUESTIONS

Any questions regarding this announcement must be provided to the Technical Points of Contact and/or the Business Point of Contact listed above. All questions shall be submitted in writing by electronic mail.

Answers to questions submitted in response to this Special Notice will be addressed in the form of an Amendment and will be posted to the following web pages:

- Beta.same.gov Webpage –Contract Opportunities – https://beta.sam.gov/
- Grants.gov Webpage – http://www.grants.gov/
- ONR Special Notice Webpage - http://www.onr.navy.mil/Contracts-Grants/FundingOpportunities/Special-Notices.aspx

Questions regarding **Full Proposals** should be submitted NLT two weeks before the dates recommended for receipt of Full Proposals. Questions after this date may not be answered.