Department of the Navy SBIR/STTR Transition Program

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Topic # N19A-T020
Data Analytics and Machine Learning Toolkit to Accelerate Materials Design and Processing Development
CFD Research Corporation

WHO

SYSCOM: ONR

Sponsoring Program: Basic Research Challenge (BRC) Program

Transition Target: PEO Aviation Common Systems and Commercial Services, PEO Tactical Aircraft Program, PEO Unmanned and Weapons

TPOC:
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Other transition opportunities:
NAVSEA, AFRL/RX, NASA GRC, NASA MSFC, DOE/NETL, DoD
Primes: Lockheed Martin, GE, Boeing, Northrop Grumman

https://www.navair.navy.mil/news/First-Navy-V-22-arrives-Patuxent-River/Wed-02052020-1141

WHAT

Operational Need and Improvement: Navy has adopted a general strategy for enhancing the efficiency of power generation systems, such as gas turbine engines. Increased efficiency of gas turbine engines will result in increased payload capacity, higher flight speed, greater range and shorter response times

Specifications Required: Developed computational tool-kit for prediction high temperature strength and oxidation resistance for advanced alloys. Design novel alloys that meet the specification of next generation high efficiency gas turbine engines using the toolkit. Validate the design prediction against experimental results.

Technology Developed: Efficiency of the gas turbine engines are primarily limited by the development of materials for ultra-high operations and highly oxidizing environment. The technology assists in accelerating the development of such materials. Refractory High Entropy Alloy (RHEA) is a promising class of alloys for this application. Their development has been slow due to difficulty in exploring the vast compositional space. Our artificial intelligence and machine learning driven technology coupled with experimental validation provide promising results for identifying right RHEA composition from billions of possibilities that meet the target material property requirements.

Warfighter Value: Warfigthers will benefit from reduced response time due increased speed and greater range of Navy aircraft. Increased payload will reduce number of sorties.

WHEN

Contract Number: N68335-20-C-0402 **Ending on:** May 31, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prediction of Yield Strength, Ductility and Oxidation resistance	Low	Accuracy 5-10%	3	1st QTR FY22
Identifying RHEA with Inverse Optimization	Med	Accuracy 5-10%	4	1st QTR FY22
Software Development	Low	Exact reproduction of R&D results	5	2nd QTR FY22
Validation and Verification by Customer (Real Environment)	Low	Exact reproduction of R&D Results	6	2nd QTR FY22
Transition and Deployment	High	3x reduction of development time	7	3rd QTR FY22
Fully Integrated into Program of Record	High	Material processed and deployed	8	3rd QTR FY23

HOW

Projected Business Model: CFD Research uses a Products + Services = Solutions business model where the software toolkit provides a capability that is a differentiator for scientific/engineering services. The Solutions-oriented business model allows CFD Research to offer unique value to its clients. Technical services provide insight into applications of the technology, which in turn fosters product innovation, which leads to greater value. CFD Research will work with its customers to develop new promising materials and protect IP by filling patents.

Company Objectives: CFD Research Corporation specializes in engineering simulations, advanced prototypes, and innovative designs for aerospace, defense, life sciences, materials, energy, and other industries. Using our software and experimental capabilities, we develop new hardware concepts, innovative designs, and superior solutions for our customers with lower risk, reduced costs, and less time

Potential Commercial Applications: Dual use applications could include ships, land vehicles, materials processing entities. The technology can be applied to design any materials where one needs to identify compositions that provide required material property specification. One such material is shape memory alloy which is finding applications in aerospace and auto industries. Property and performance improvement of superalloys and traditional refractory alloys can also be performed using the technology. Rational design of high-temperature coating is another application of area of this technology. Overall, this technology will find applications in commercial aerospace, auto and power generation industries.

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