



ONR Cyber S&T Program

DOE Laboratory Technology Transfer Awareness Day

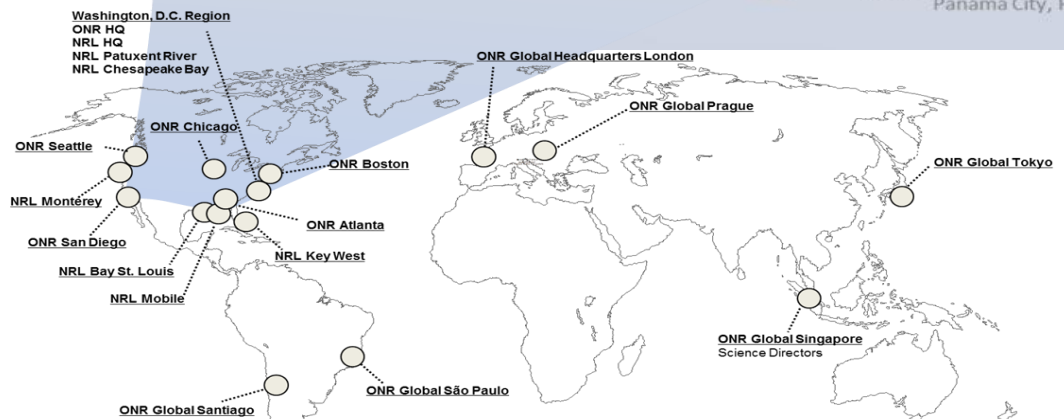
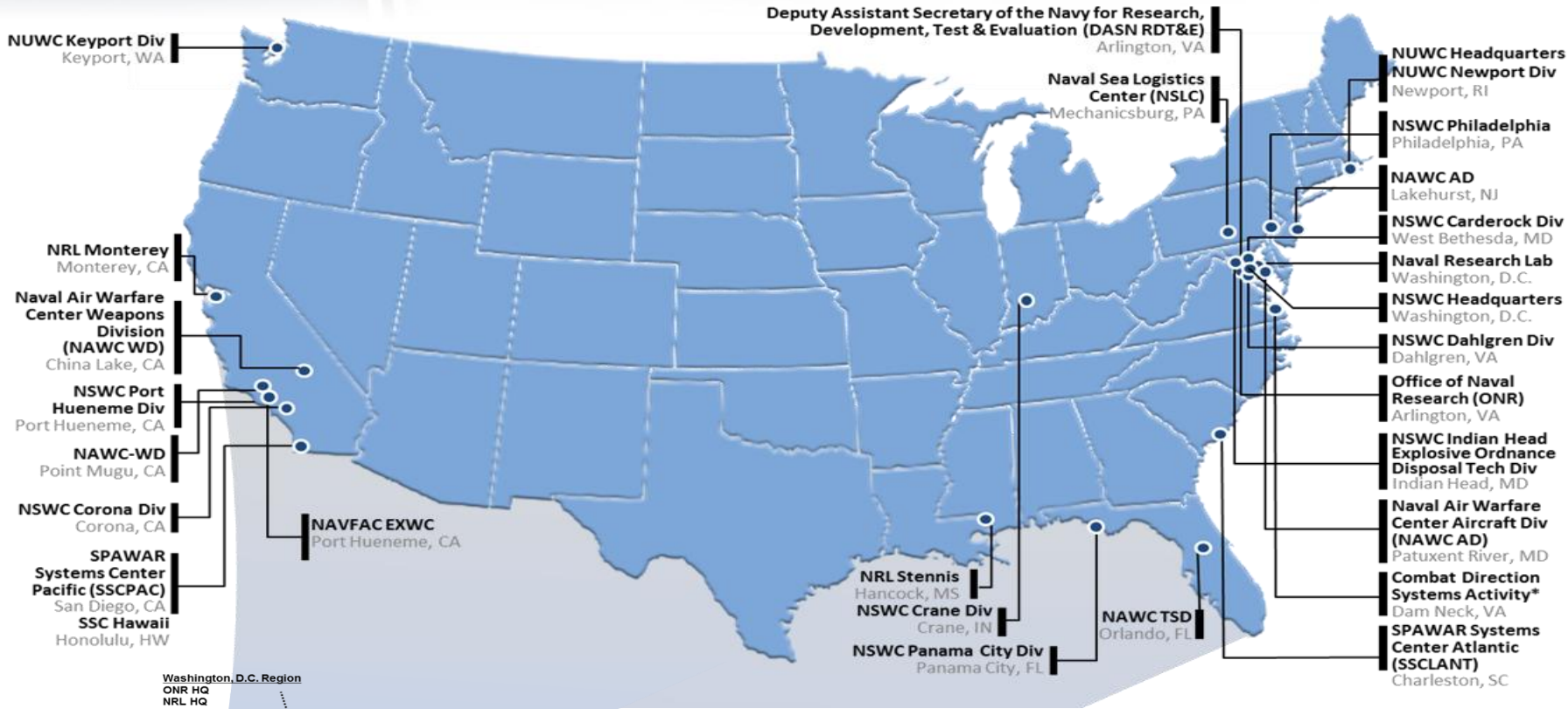
09 Mar 2021

Matt Mickelson

ACCELERATING TO THE NAVY & MARINE CORPS AFTER NEXT



Naval R&D Community



Who We Are:

- Diverse and highly educated workforce with 25,000 scientists, engineers, and technicians (with more than 2,000 Ph.D.s)
- 20 commands across the NAVWAR/NAVAIR/NAVSEA Warfare Centers and the Naval Research Enterprise (NRE).
- Conducts RDT&E for the DoN to discover, develop, transition and field technologically superior naval warfighting capabilities.
- The Chief of Naval Research commands the NRE consisting of ONR HQ, ONR Global, and the Naval Research Laboratory.

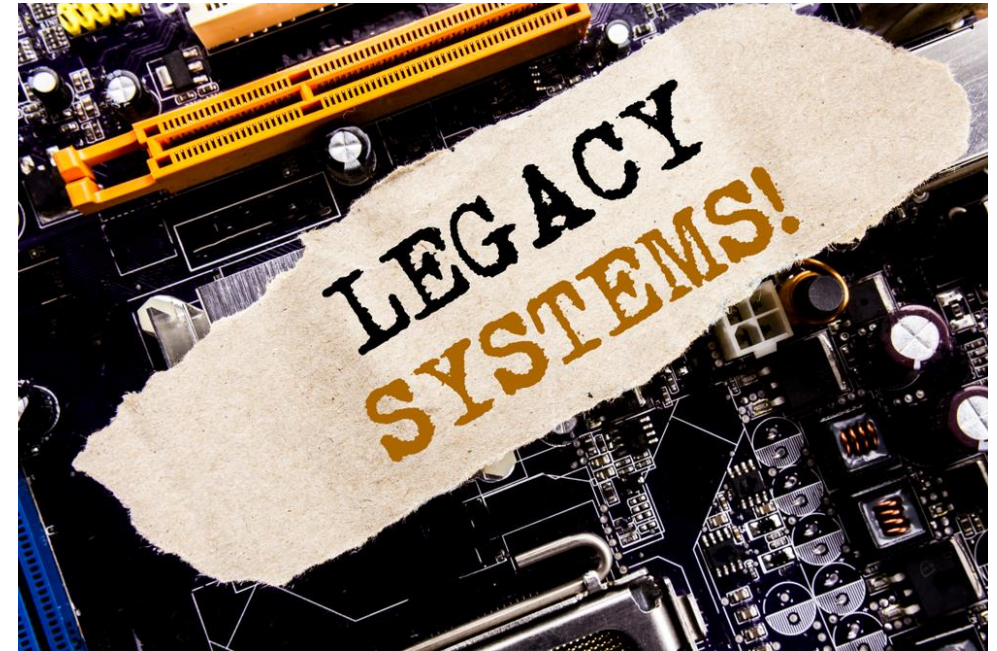






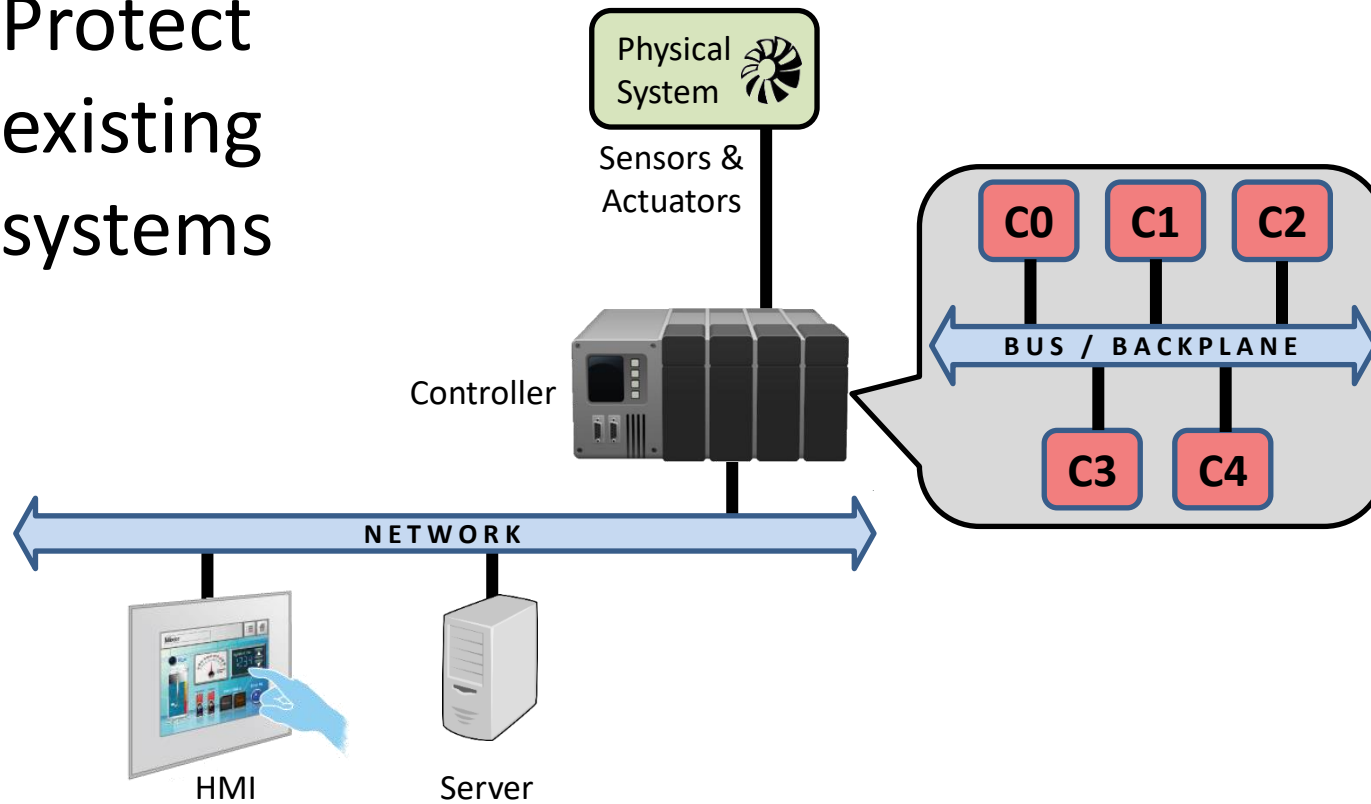
Power of “Legacy” in our S&T strategy

- Naval platforms have long life-spans
- Need to work with what we’ve got
- Drives us to think creatively and tackle hard but fun S&T challenges
- Result:
 - Fresh tech directions (papers, etc.)
 - Productive output in uncrowded areas
 - Quickly get to real-world impact



Resilient Cyber Physical Systems

- For CPS, physics rules
 - Goal is to maintain control over the physics, not “cyber perfection”
- Protect existing systems



SW Complexity and Bloat

- Modern software is exceedingly complex and bloated
- Practices and market encourage it:
 - Maximize code reuse to increase programmer productivity
 - One-size-fits-all feature sets

▪ In every application we looked at, an enormous amount of activity was executed to accomplish simple tasks.

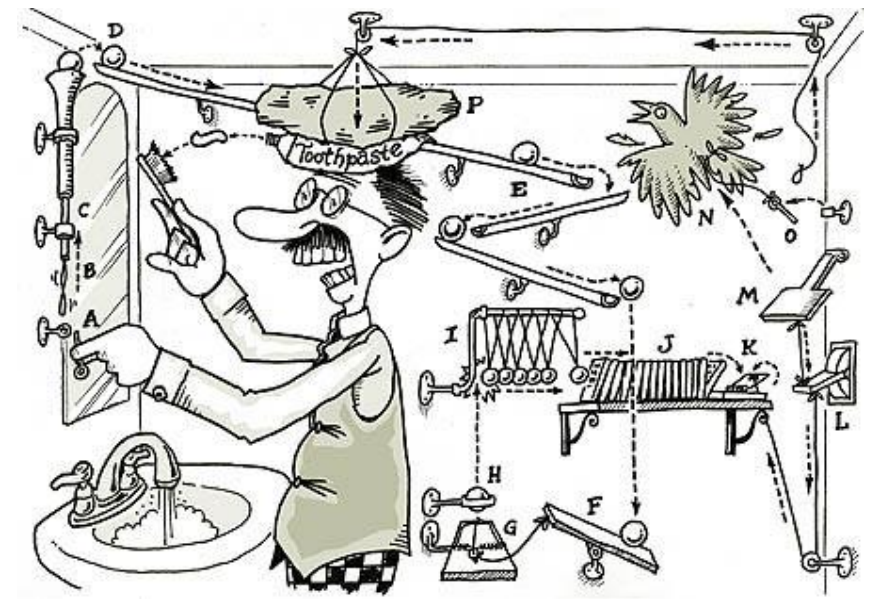
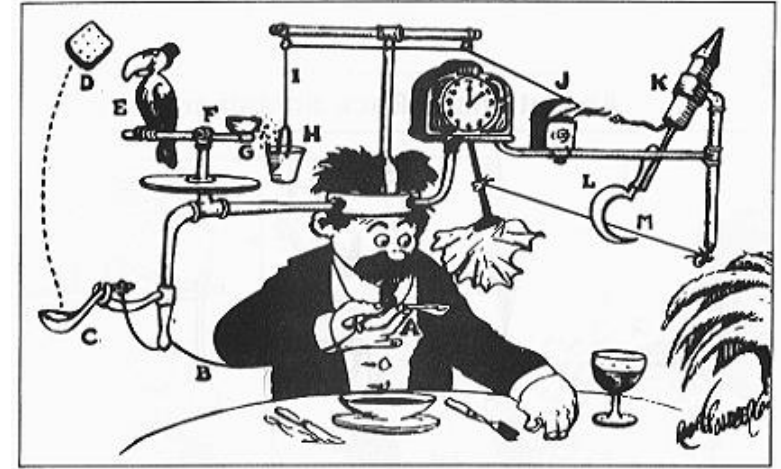
▪ For example, a stock brokerage benchmark executes **268 method calls** and creates **70 new objects** just to move a *single date field* from SOAP to Java.

Sevitsky et. al. (http://lcsd05.cs.tamu.edu/papers/sevitsky_et_al.pdf)

Growth of `true` command:

1983 Unix: **18 bytes** → 2014 Ubuntu: **27,168 bytes**

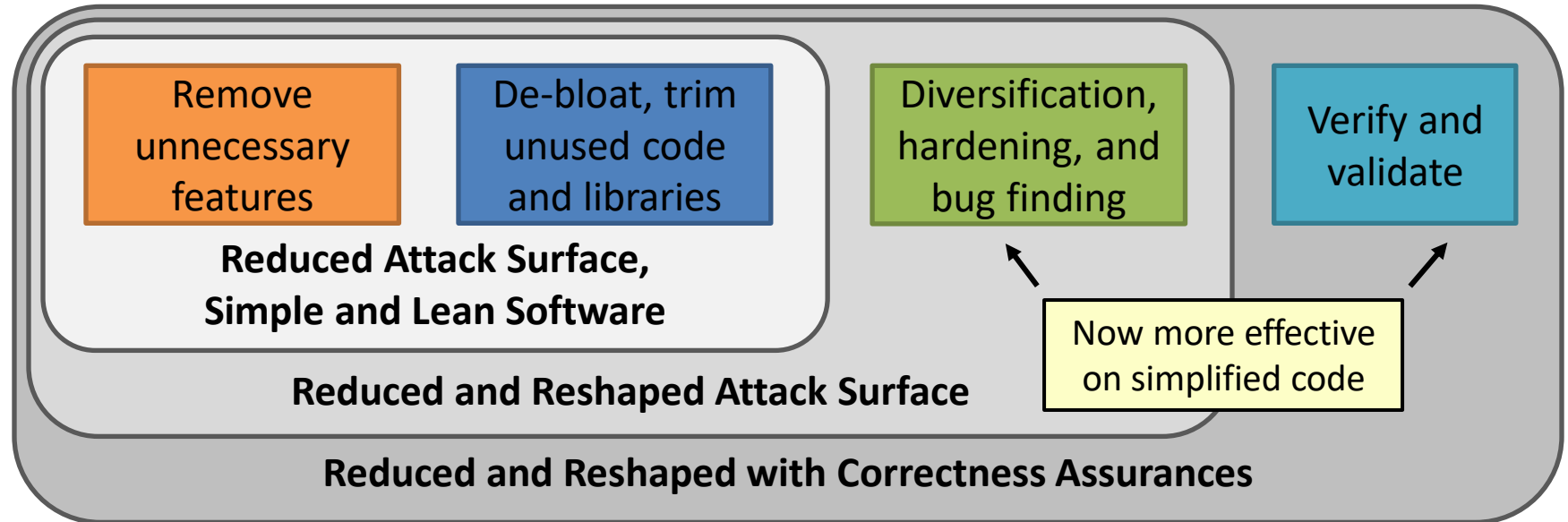
Self-Operating Napkin





Late-Stage Software Customization

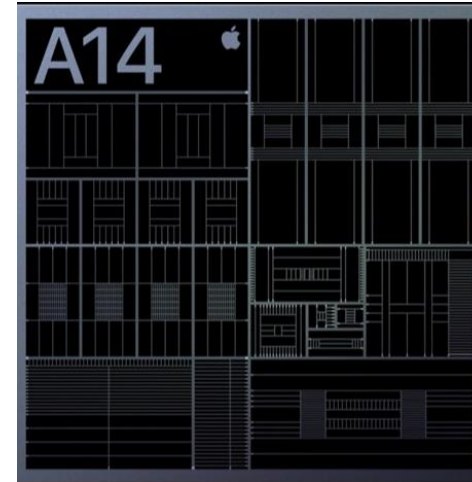
SOFTWARE TRANSFORMATIONS FOR SECURITY:
(ONR work is enabling such a pipeline)



- Eliminate bugs before the 0-day / CVE
 - Skip patches, save \$\$\$
- Execute lean software
- Diverge attack surface from source
 - More flexible software dev processes
 - Easier use of open-source

The Future is Heterogenous...

- Programmers' free lunch is over!
 - Single thread performance of general-purpose compute is stuck
 - Already played the multi-core card
- Future performance gains can only come from ***domain-specific architectures***
- Orders-of-magnitude performance boosts to be found --> "Golden Age"



“Vertically integrated companies are finding big opportunities”



...but today's code is not!

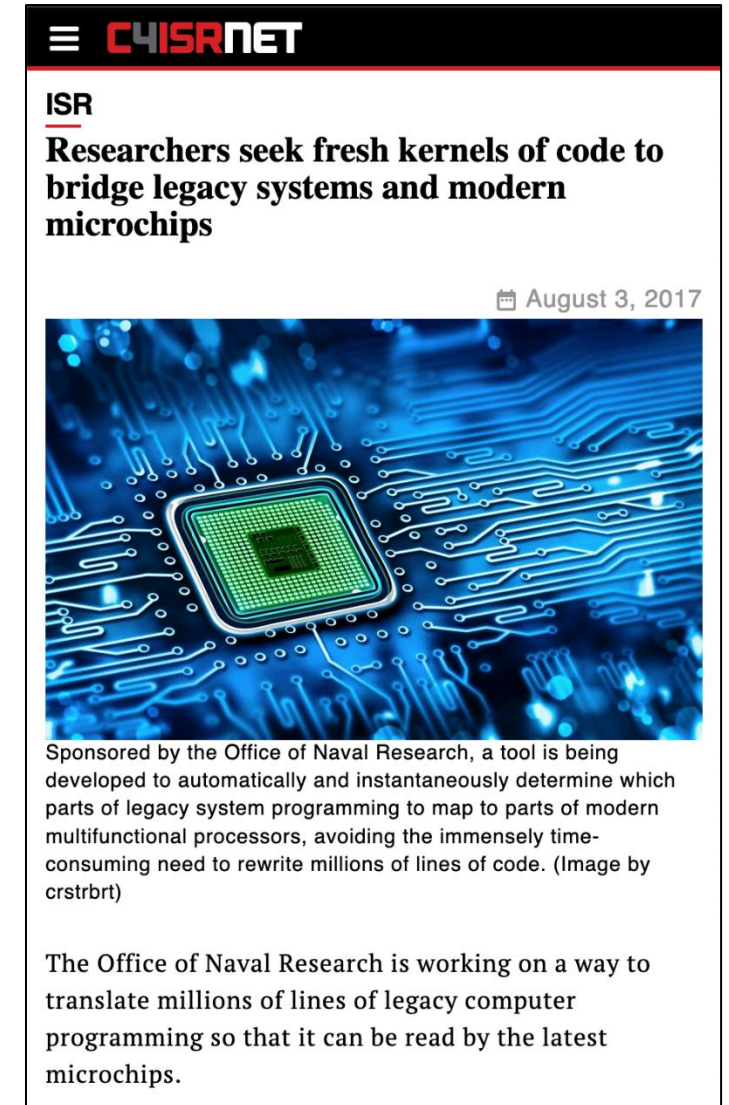
- Taking advantage requires rewriting code to make use of specialized libraries

Freedom to innovate with heterogenous / domain-specific architectures



Software ecosystem

- Upstreaming status: initial components of Popcorn OS hit the Linux kernel mailing list in April 2020 as RFC



C4ISRNET

ISR
Researchers seek fresh kernels of code to bridge legacy systems and modern microchips

August 3, 2017

Sponsored by the Office of Naval Research, a tool is being developed to automatically and instantaneously determine which parts of legacy system programming to map to parts of modern multifunctional processors, avoiding the immensely time-consuming need to rewrite millions of lines of code. (Image by crstrbrt)

The Office of Naval Research is working on a way to translate millions of lines of legacy computer programming so that it can be read by the latest microchips.



How to monitor funding opportunities

Office of Naval Research
Science & Technology

ONR Global ▶ Marine Corps Warfighting Laboratory ▶ U.S. Naval Research Laboratory ▶

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NAVAL SCIENCE AND TECHNOLOGY FUTURE FORCE™ VOL. 6, NO. 4, 2020

The latest Future Force magazine—focusing on education, training and STEM initiatives in the DoN—is available! Includes original articles from the ASN (RDA), the Hon. James "Hondo" Geurts; Chief of Naval Research Rear Adm. Lorin Selby; NPS President Ann E. Rondeau; DON's Director of Small Business Programs Mr. Jimmy Smith; and more.


[Learn more >>](#)

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Departments

- 31 Information, Cyber and Spectrum Superiority ▶
- 32 Ocean Battlespace and Expeditionary Access ▶
- 33 Mission Capable, Persistent and Survivable Naval Platforms ▶
- 34 Warfighter Performance ▶

Naval STEM Internship Opportunities

 ONR and the DoN's Naval STEM education and outreach program are offering two Navy and Marine Corps science and technology internships.

[Read press release](#)

Quick Links

- Get shortcuts to commonly requested topics below:
- Explore research funding opportunities ▶**
- Watch a video about the role of naval research ▶
- Download the Naval R&D Framework ▶
- Learn about U.S. Navy Task Force Ocean ▶
- Read Future Force magazine ▶

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Thanks for listening!

