



# *An Overview of The Johns Hopkins University Applied Physics Laboratory*

2018

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TSX/TAS

# APL in Brief

*What are we?*



*Who are we?*



*Who are our sponsors?*



*What is our core purpose?*



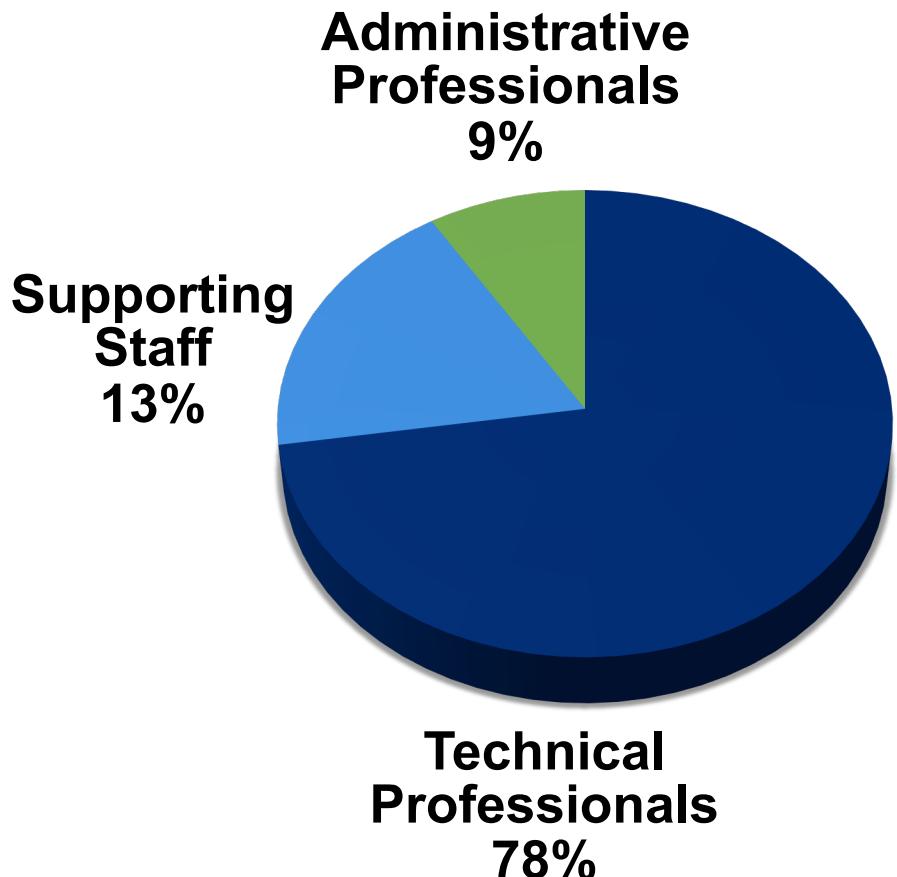
- Division of Johns Hopkins University
- University Affiliated Research Center (UARC)
- Non-Profit Organization

- Deep Technical and Operational Expertise

- DoD
  - NASA
- DHS
  - IC

- Critical Contributions to Critical Challenges

# Staff Demographics



## Technical Professionals

Degree Level	
19%	Doctorate
53%	Master
22%	Bachelor
6%	None

## Technical Professionals

Degree Field	
46%	Engineering
25%	Math, Computer Science
23%	Physics, Chemistry, Other
6%	None

# Example of APL's Defining Contributions

- **Variable Time Proximity Fuze (VT Fuze)**



- **TRANSIT Satellite Navigation (precursor to GPS)**



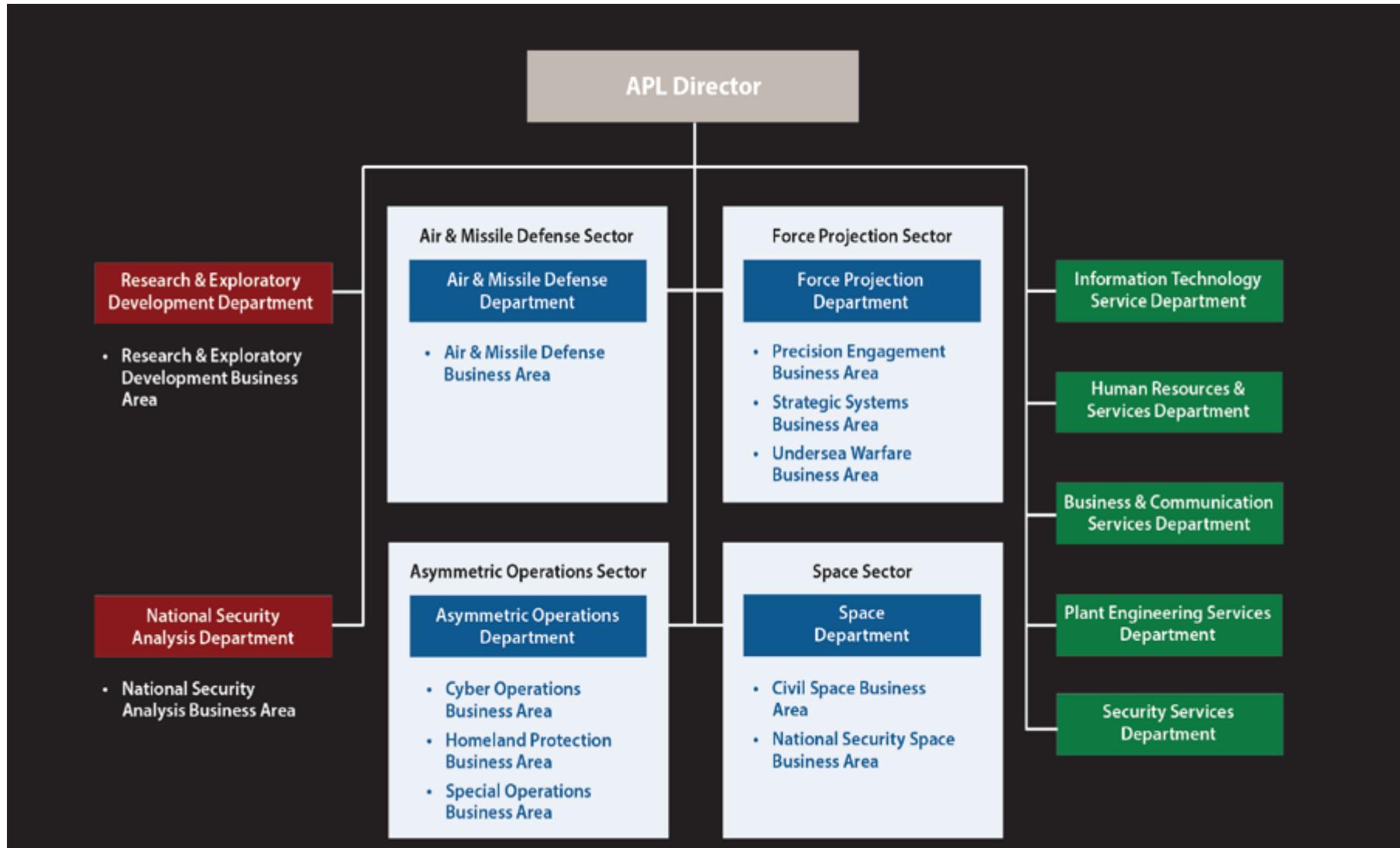
- **Neurally controlled modular prosthetic arm**



- **New Horizons Flyby of Pluto**

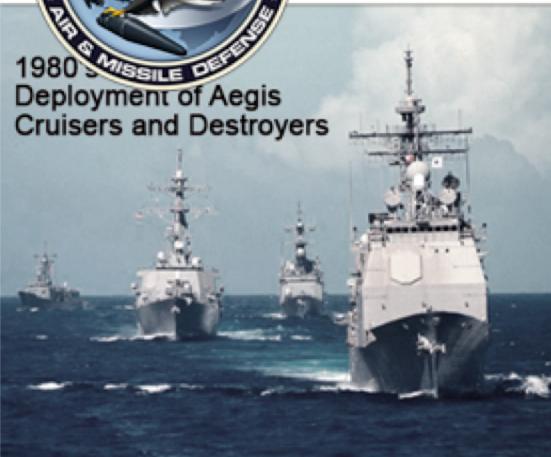


# APL Organization

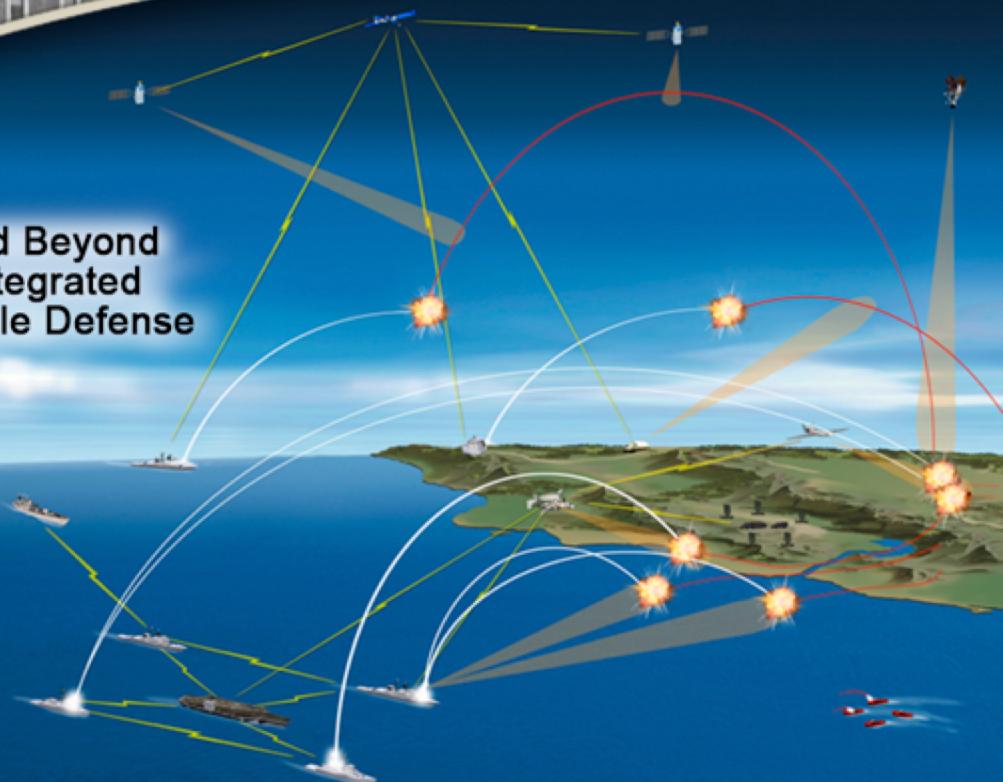




# Air & Missile Defense Heritage



2010 and Beyond  
Joint Integrated  
Air & Missile Defense



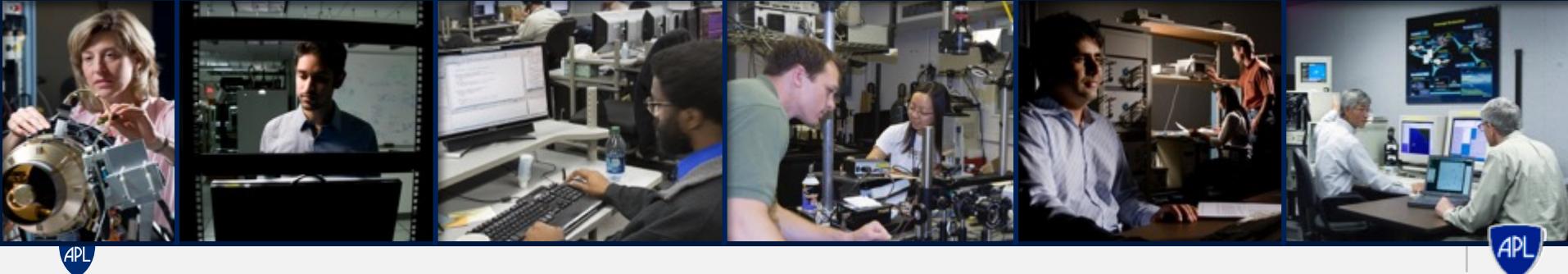
A Continuing Challenge: Staying Several Steps Ahead Of Our Adversaries



# APL Air & Missile Defense Mission

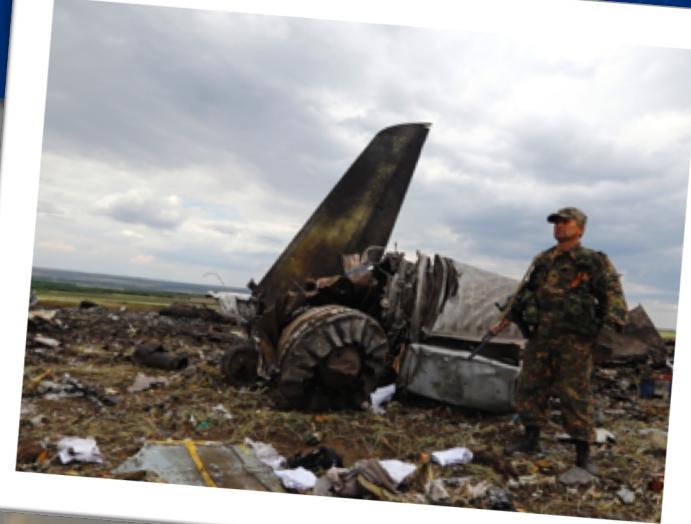
**Our mission is to advance the ability of our nation & its military services to defend themselves & others against cruise & ballistic missiles & threat aircraft.**

**We will achieve this through innovative, effective, & affordable system solutions to the most difficult challenges posed by evolving air & missile threats.**





We Make This Happen ...



**... So This Doesn't Happen!**

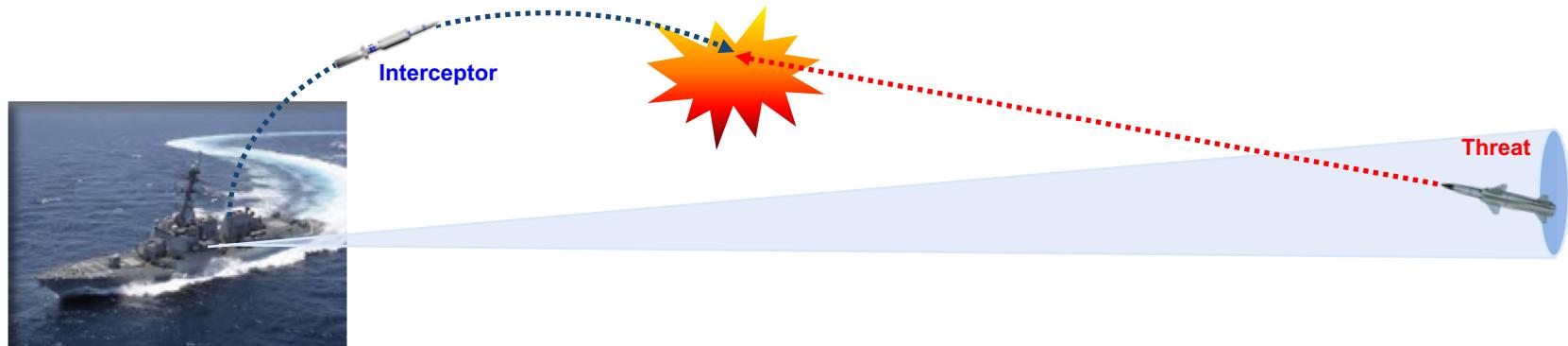
# What's the Challenge?



Missiles are a big business and plentiful, ... fast, highly maneuverable, stealthy ... and effective!

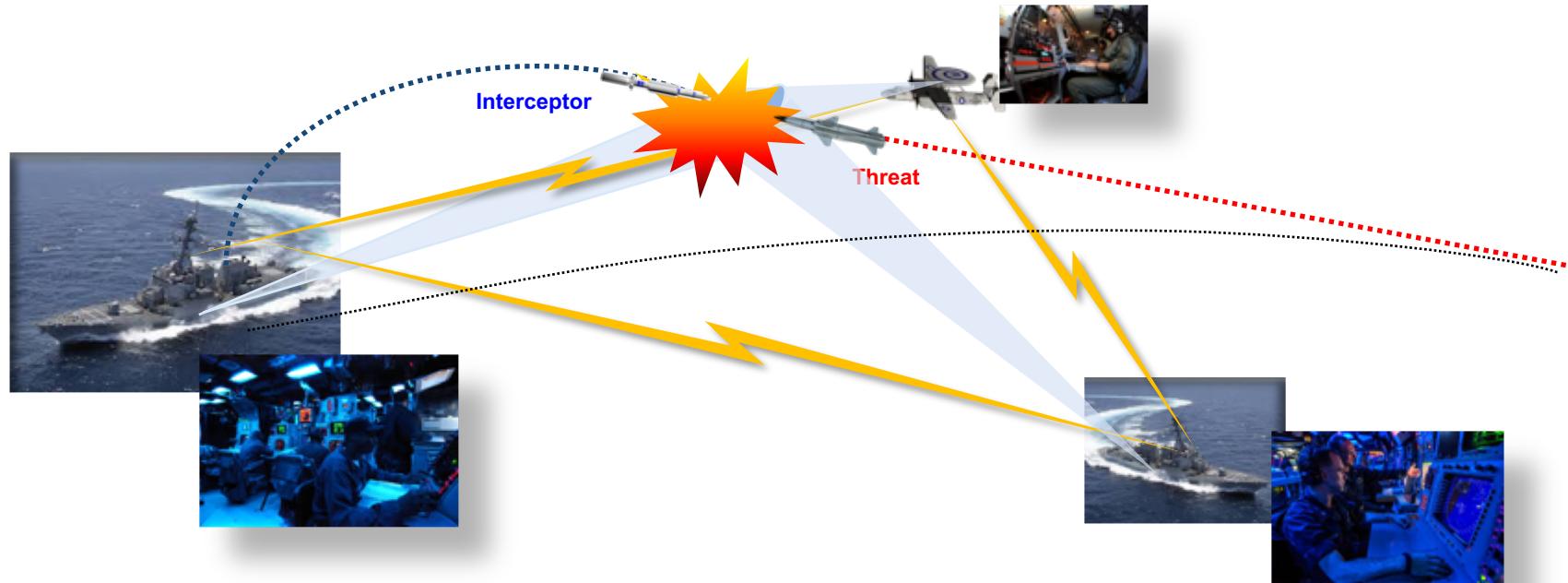
How Do We Negate Threats Before They Can Do Damage?

# General Problem: Shoot Down the Threat



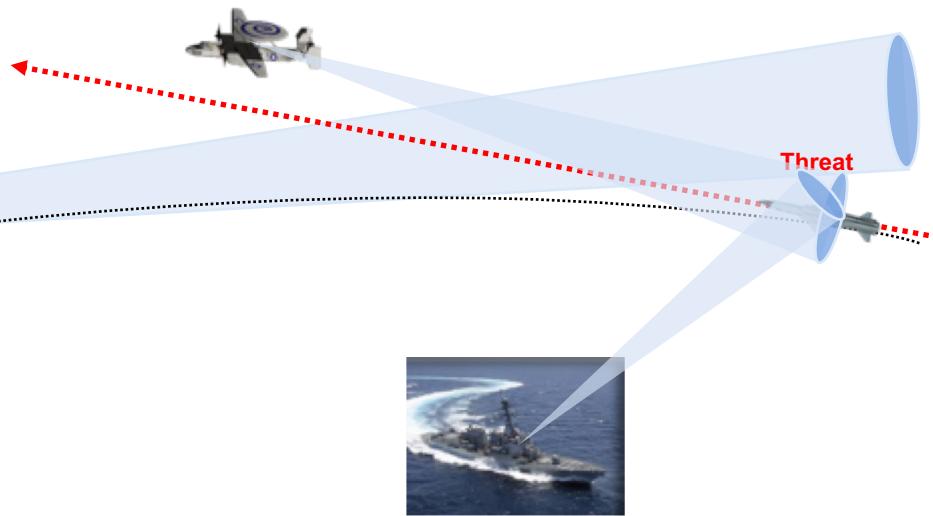
Basic steps: Detect, Control, Engage, Intercept

# Science and Engineering to the Rescue



Missiles are fast and lethal, so we need sensors to DETECT the threat as far away as possible  
Radar is often used to detect the threat – but the physics may not be there  
So sometimes we need a little help from our buddies  
Communications and information sharing is a necessity  
A CONTROL structure allows for efficient coordination between platforms  
ENGAGE the threat with the best options  
INTERCEPT with effective weapons

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# What Do We Do?

Optimize the development and integration of multiple  
Sensor, Command & Control, Communication and Weapon Systems



Radar  
Electro-Optics  
Infra-Red  
Electronic Support



Naval Combat Systems  
Joint Tactical Systems  
Intelligence, Surveillance &  
Reconnaissance



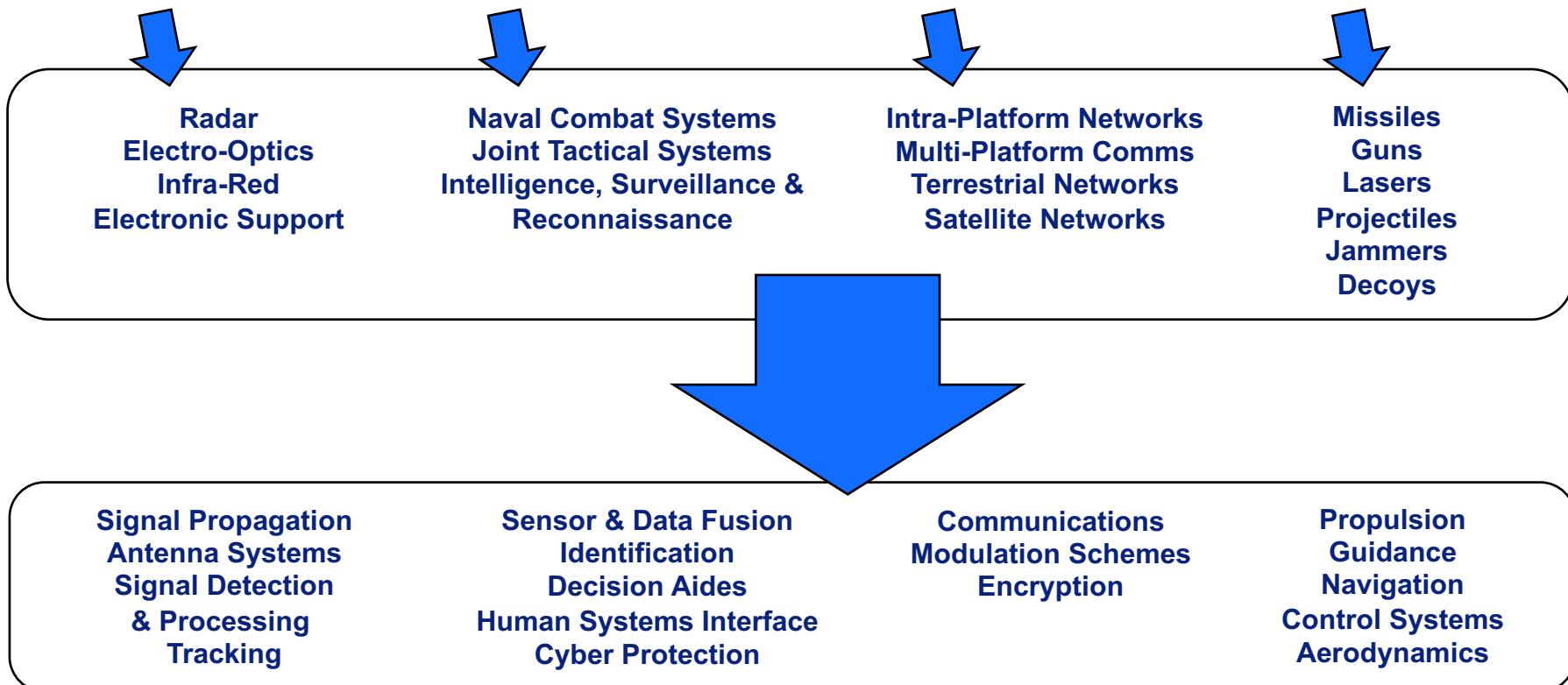
Intra-Platform Networks  
Multi-Platform Comms  
Terrestrial Networks  
Satellite Networks



Missiles  
Guns  
Lasers  
Projectiles  
Jammers  
Decoys

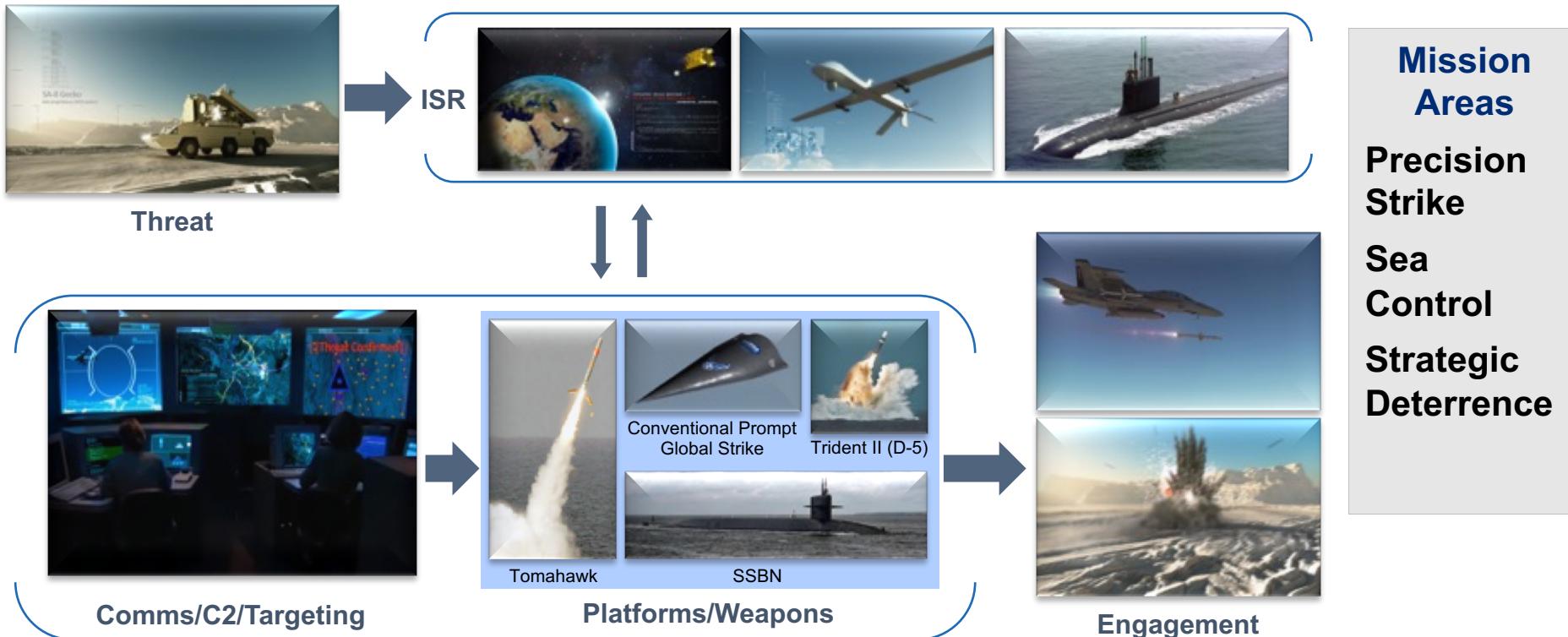
# What Type of Expertise Do We Need?

Optimize the development and integration of multiple  
Sensor, Command & Control, Communication and Weapon Systems



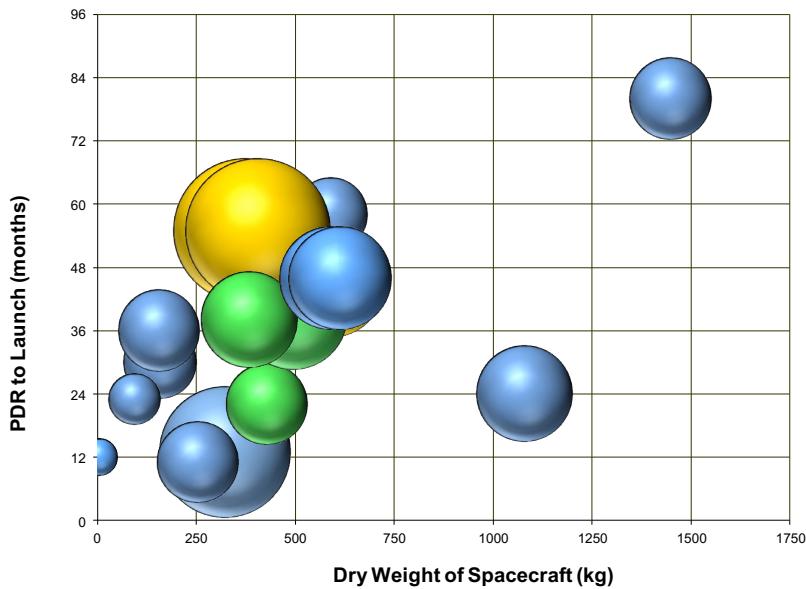
# Force Projection Sector

Provide decisive offensive capabilities enabled by timely, assured response for deterring, engaging, and defeating adversaries in the maritime domain



# Space Exploration Sector

## Support of civil and national security programs

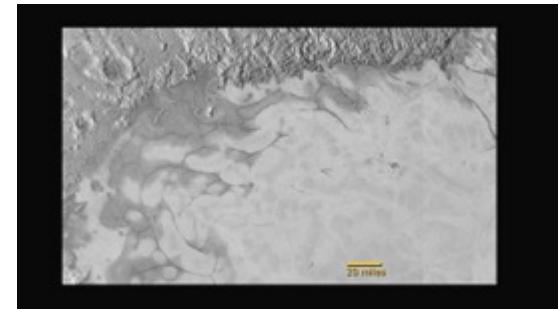
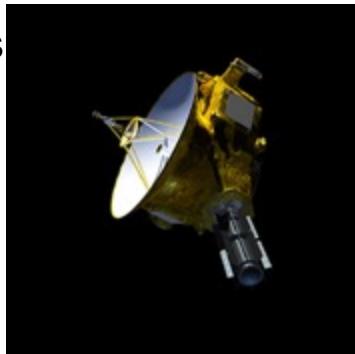


- 68 spacecraft
- More than 150 sensors and payloads
- Short time to space
  - Tight requirements process
  - Disciplined development
  - Unparalleled cost/schedule performance
- 150 science grants in progress continuously
- Trusted-agent studies in support of NASA, NOAA, and DoD

# New Horizons Flyby of Pluto

- Launched on January 19, 2006
  - Fastest ever manmade object
- Gravity assist from Jupiter on February 28, 2007
- Flew by Pluto on July 14, 2015 travelling at > 30,000 mph
- During closest approach, the S/C, by design, halted communication with the Earth for 22 hours
- S/C flawlessly executed a >30,000 command autonomous command sequence that included ~150,000 thruster firings to collect the maximum amount of data
- Data will be returned to Earth over following 16 months
- Will require rewriting the book on Pluto

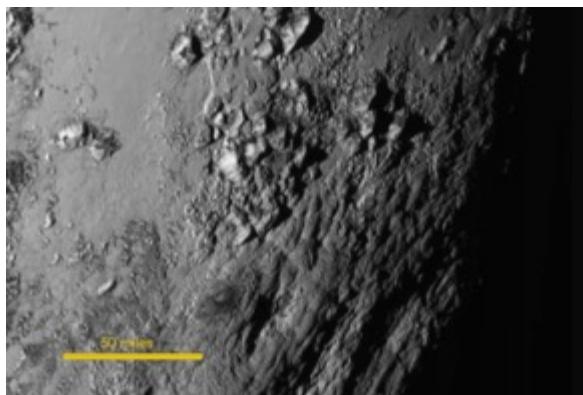
New Horizons  
Spacecraft



Flowing nitrogen ice



Enhanced color image of Pluto



Pluto's water ice mountains



Charon's youthful terrain

# Asymmetric Operations Sector

Protect against and employ asymmetric operations  
for national security in a post-9/11 world



# Sample Lab—LIVELab

- APL's LIVE Lab provides direct access to real-time cyber data, enabling enterprise scale experiments and a live environment for experimentation and prototyping.



- **Situational awareness for Mission Readiness**

# National Security Analysis Department

## Identifying the Critical Challenges of the Future

**Lead studies and analyses, and develop areas of research and collaborative and gaming tools for innovative and affordable solutions to critical challenges**

**Studies, analyses, and systems engineering efforts for national security**



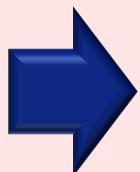
- Hard kill and soft kill for OPNAV N81
- Countering anti-access area-denial (A2/AD) capabilities for OUSD(AT&L)
- Comprehensive review of the future role of the Reserves for SECDEF

**Developing new areas of research**



- Health care process efficiency for naval medicine
- National leadership command and control systems engineering for processes and capabilities

**Applying new collaborative and gaming tools**



- Competitive influence gaming to explore multi-organizational solutions to regional challenges in NORTHCOM, AFRICOM, and NATO
- Cyber technical exchange for 10th Fleet

# Research and Exploratory Development Department

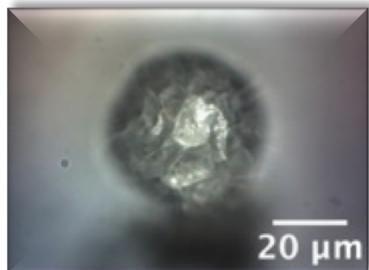
Science and Technology Breakthroughs for APL's Future

Imagine: The Possibilities

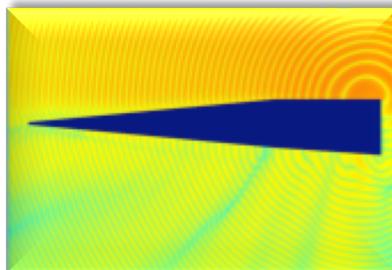
Solve: The Science Problems

Design: The Systems

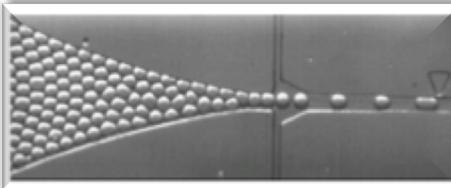
Build: The Prototypes



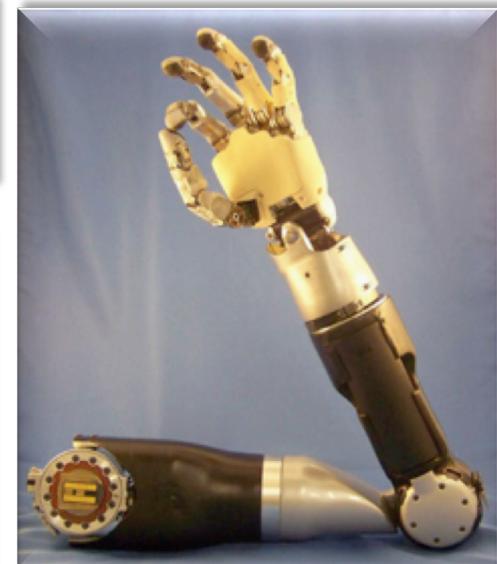
New Materials



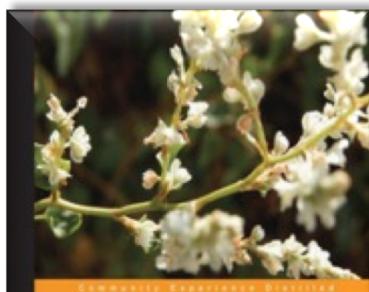
Computational Physics



Synthetic Biology



Neuroscience and Robotics



Elgg 1.8  
Social Networking

Create, customize, and deploy your very own social networking site with Egg

Foreword by Dave Tisch, Elgg co-founder

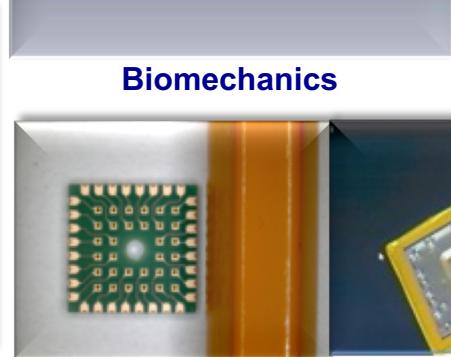
Cash Costello

PACKT open source

Information Sciences



Hyperspectral Imaging



Design and Fabrication



# The People We Hire

## ***Problem Solvers and Independent Thinkers***

APL prizes leadership and dedication as personal attributes.

## ***Team Players***

Thinking outside the box is an asset, but teaming to accomplish objectives is how we get things done.

## ***Hands-on Technologists***

We build prototypes in our own facilities, and we test equipment where it has to operate.

## ***Good Communicators***

Staff members forge close working relationships with their program sponsors and peers from other organizations. Communications skills are highly valued at APL.

**Note:** Security clearances are necessary for many positions. Holding U.S. citizenship is part of the requirements for obtaining a clearance.

# Discovery Program – Overview

- Participants reside in a central home group in REDD
  - Concentration on networking, early professional skills, and guided career development
  - Fixed program length of 2 years, starting in early July
  - Recent college graduates only
  - Participants rotate through 4 groups
  - Selection process for final placement



- Six month assignments in groups across APL
  - Collaborate with people from multiple groups
  - Learn about technology and applications in different sectors/departments
  - Experience group culture

# Summer Internship Program

- Over 460 Summer Interns/Co-ops in 2018
- Interns work in diverse projects in every technical department working with scientists and engineers, conducting research, developing leadership skills, and growing professionally.
- Interns have the opportunity to network throughout the summer at lab-wide receptions, social events, tours of the lab and workshops.
- Competitive pay rates/holiday pay
- 8-12 weeks, flexible start & end dates
- Transportation to MD is paid to students who are not local.

## Program Requirements

- Minimum overall GPA of 3.0
- Technical major or major related to your internship
- US Citizenship / Able to get DOD clearance
- Typically interns are rising Juniors and Seniors; however, freshman to PhD students are eligible
- **Apply after 9/1 – Application closes March 31, 2019**

# APL Benefits

## Work/Life Balance

Pension Plan



Paid Leave



Beneflex Program



Fitness/Wellness

Health Coverage Options

Scholarship Program

Continuing Education

# APL Environment

In many respects, APL is a self-contained community. We often refer to our 400-acre facility as a "campus." We have more than 40 buildings, including the following:

- ✓ More than 400 state-of-the-art laboratories and technical facilities
- ✓ APL's Innovation Space "Central Spark" includes a maker space, design thinking, communities, augmented and virtual reality, and more.
- ✓ Classrooms and computer labs for the on-site JHU graduate programs
- ✓ Full-service cafeterias, several smaller snack bars and visiting food trucks!
- ✓ A 500-seat auditorium and conference facility
- ✓ Our own medical office, fire station, rescue squad, and security force
- ✓ An employee-owned credit union
- ✓ Recreation areas including an exercise facility, a picnic pavilion, baseball fields, volleyball courts, and tennis courts



# Activities & Interest Groups

Our staff members have diverse interests, and the Laboratory offers a number of activities to appeal to those interests:

- African American Culture Club
- Allies in the Workplace
- Hispanic Awareness Club
- Astronomy
- APL Gospel Choir
- Basketball
- Cycling
- Asian Heritage Club
- Chess
- Softball
- Musical Arts
- Drama Club
- Poetry Reading
- Tennis
- Volleyball
- Women's Club
- Young Professionals Network
- SWE Chapter
- Allies in the Workforce
- .....and others





**JOHNS HOPKINS**  
APPLIED PHYSICS LABORATORY