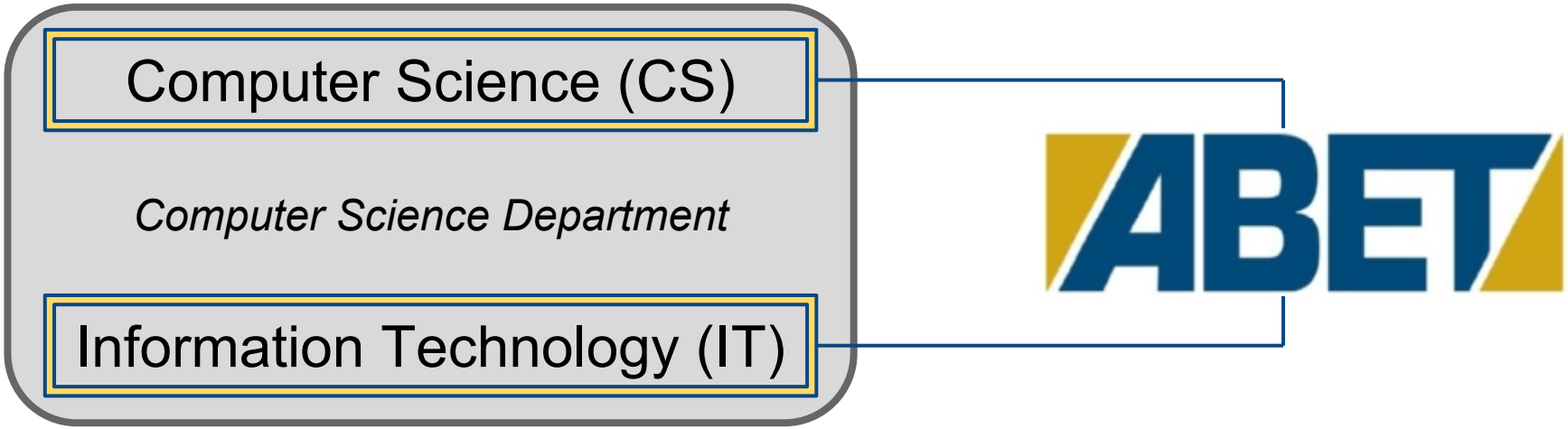
Computer Science Department
United States Naval Academy

"With Knowledge we Serve our Friends...

With Knowledge we Defeat our Enemies"

Two ABET Accredited Majors

Computer Science is the traditional computing degree and encompasses algorithms, artificial intelligence, robotics, and graphics.



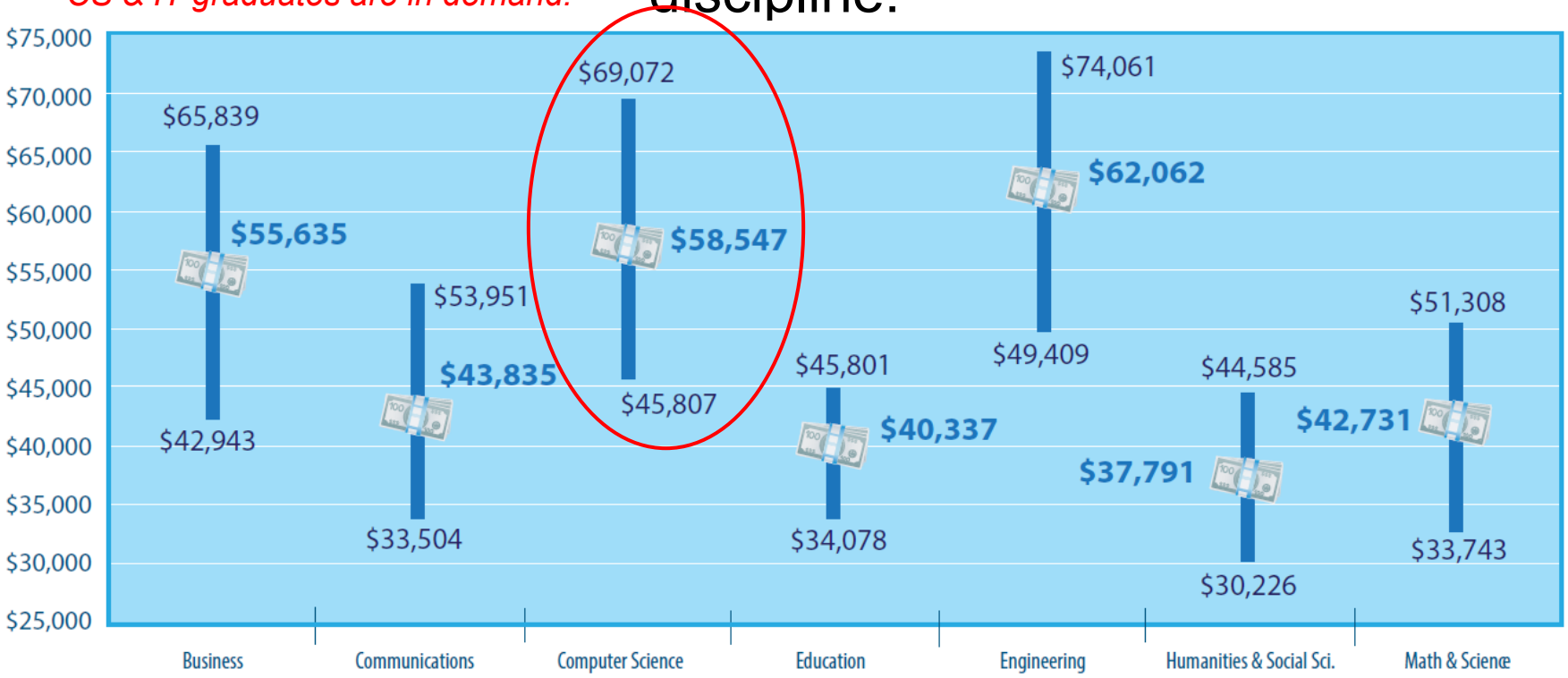
Information Technology is a more applied computing degree and encompasses web technology, databases, and computer security.

See http://www.abet.org/why-accreditation-matters/ *to learn more about the importance of accreditation!*

NACE Salary Survey

The following represents the average starting salary & salary ranges for Class of 2013 graduates, ordered by discipline:

CS & IT graduates are in demand!



Source: NACE, *Salary Survey - September 2013 Executive Summary*, http://www.naceweb.org/salary-survey-data/

U.S. News 100 Best Jobs

The top-10 rankings below take into account employment opportunity, salary, work-life balance, and job security:

1. Dentist
2. Registered Nurse
3. Pharmacist
4. Computer Systems Analyst
5. Physician
6. Database Administrator
7. Software Developer
8. Physical Therapist
9. Web Developer
10. Dental Hygienist

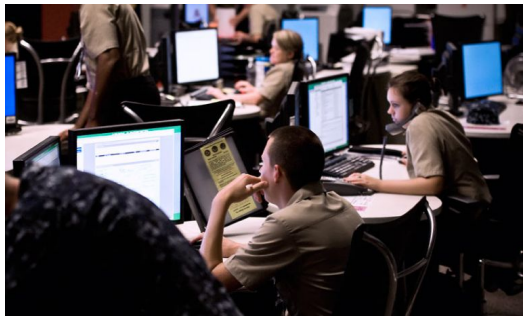
In other words…
if you're not in the medical or dental professions,
you belong in Computer Science & Information Technology!

Source: US News Careers, *The 100 Best Jobs*, http://money.usnews.com/careers/best-jobs/rankings/the-100-best-jobs

Growth, Pay, Relevance

- Fastest growing segment of our economy: CS & IT consistently dominate lists of highest paying, fastest growing and most rewarding jobs.
- Skills learned are essential both in the fleet and on the joint cyber battlefield.
- Computing is everywhere – in phones, cars, ships, aircraft, etc. Understand and harness this power in a technical setting while at USNA.

CS & IT



See http://www.usna.edu/CS/academics/why.htm *for more details on why CS and IT are so important!*

Military And Civilian Faculty

An accomplished and highly motivated group of educators draw on unique experiences both from the Fleet and from traditional academic pursuits:

- Military
  - Hold Masters degrees or better and have completed one or more operational tours, bringing real Fleet experience to the classroom
  - Come from many communities across multiple services including the Navy, the Marine Corps, and the Air Force
- Civilian
  - Hold Doctoral degrees and contribute professional knowledge in the classroom and through exciting research
  - Include Distinguished Visiting Professors, Professor Emeriti, and a Visiting Professor from the National Security Agency (NSA)

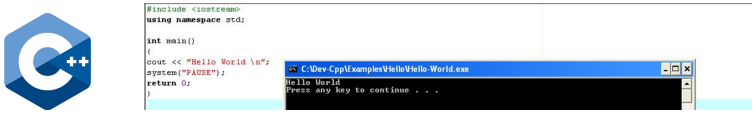
Michelson Hall

After completing a drastic renovation in December 2004, Michelson Hall stands as the high-tech home of the Computer Science Department, providing:

- Eight reconfigurable computer labs running Windows- and/or Linux-based operating systems
  - Each state-of-the-art lab is capable of providing an internet-enhanced learning experience to more than twenty students per section
  - A dedicated and professional team of support staff enable a highly adaptive environment for both students and faculty
- Lounge and research spaces for use by midshipmen
  - A student lounge on third deck provides a comfortable and engaging environment for both group and individual study
  - Wireless internet access is available in all classrooms and lounges
  - Designated research space for Bowman and Trident Scholars

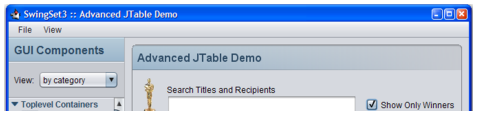
CS & IT Required Courses

- IC210 - Intro to Computer Science



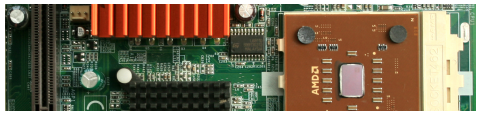
How do you tell a computer what to do? This course serves as an introduction to algorithmic development, problem solving and software design. Key principles and concepts are covered to provide foundational knowledge and experience upon which later computing courses will build.

- IC211 - Object-Oriented Programming



How can I build and utilize collections of "objects" to solve a problem? This course builds on the procedural programming skills developed in the prerequisite course and introduces the student to object oriented programming and design principles using Java.

- IC220 - Computer Architecture and Organization



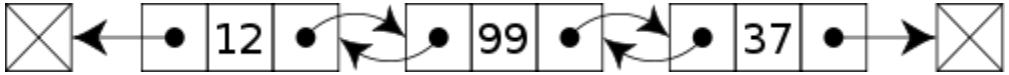
How does my computer really work and why does it matter? This course introduces students to performance metrics, instruction set architectures, assembly language, logic design, memory hierarchies, and pipelining.

CS & IT Required Courses

- IC221 - Systems Programming

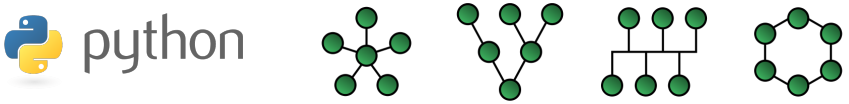
I've got a program, but how does it actually do work? This is the study of an application's interface with the operating system. The operating system is treated as an information resource, and as a facilitator for information flow between processes, including those executing on separate machines.

- IC312 - Data Structures



What is the best way to organize and access my information? This course examines abstract data types (ADT), data structures, data representation and information management including storage structures, allocation and collection.

- IC322 - Computer Networks



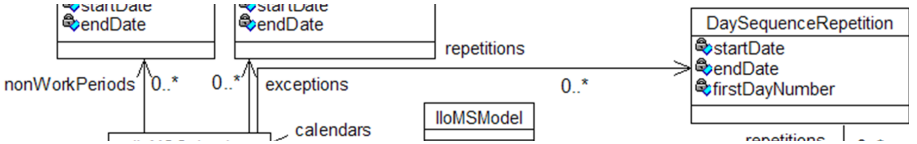
How does the internet transmit data? This course presents the fundamental theoretical concepts, characteristics and principles of computer communications and computer networks, and analyzes and assesses these foundational concepts with respect to network performance and design.

CS & IT Required Courses

- IC411 - Operating Systems

Who controls the computer's memory and files? Learn about the operating system as a resource manager. Topics include process management, interrupt processing, memory management, deadlock handling, file systems, multiprogramming, multiprocessing, data security and protection.

- IC470 - Software Engineering



How do teams build large, complex, and reliable software? Discover the basic principles of software engineering. Structured, object-oriented, and formal approaches are studied, with emphasis on life cycles, object-oriented techniques and team-oriented software development.

- IC480 - Research Seminar / Capstone

How can my team and I apply technical knowledge to make something exciting? This is a capstone course that ties together concepts from the information technology and computer science curricula to solve a practical problem.

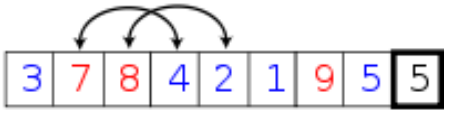
CS Required Courses

- SI340 - Theory of Computing

Are there any problems that can't be solved efficiently or at all? This course presents the theoretical foundations for computing, including the study of formal languages, finite state machines, pushdown automata, Turing machines and computability.

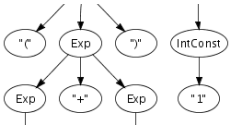
- SI335 - Computer Algorithms

```
function quicksort(array)
    if length(array) ≤ 1
        return array  // an
    select and remove a piv
```



How can my program solve a problem in the quickest manner? This course presents techniques for designing and analyzing computer algorithms including divide and conquer, dynamic programming and greedy methods.

- SI413 - Programming Languages and Implementation



What makes a particular programming language useful, and how does it really work? This course examines basic concepts underlying the design of modern programming languages: types, control structures, abstraction mechanisms, inheritance, concurrency and constructs for programming.

IT Required Courses

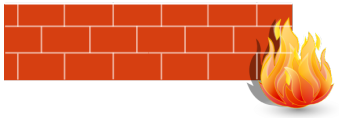
- IT350 - Web and Internet Programming

What are some tools and techniques for designing the next killer web site? This course covers web site design and management, clients and servers, client and server side scripting languages, web transmission protocols.

- IT360 - Applied Database Systems

How can I make data universally accessible? This course introduces the principles underlying Database Management Systems (DBMS) with a special emphasis on database management system structure and function when integrated with web-based database applications.

- IT430 - Information Assurance and Network Security



How can I rest at night knowing my information is protected? This course is an introduction to the theoretical and practical facets of Information Assurance (IA) to include: governmental policies and directives, Cryptography, Information Warfare, and Network Security, among others.

Sample Elective Offerings

- SI420 - Artificial Intelligence
- SI455 - Advanced Computer Networks
- SI460 - Computer Graphics
- SI475 - Intelligent Robotics
- SI485I - Natural Language Processing

CS Electives

Many of these courses may be taken by either CS or IT majors, depending on prerequisites.

Follow these links for more details!

- IT432 - Advanced Information Assurance and Network Security
- IT452 - Advanced Web and Internet Systems
- IT462 - Advanced Database Systems
- IT486C - Malware Analysis
- IT486D - Mobile OS Development

IT Electives

Academic Matrices

Computer Science Matrix

Fall 3/C		Spring 3/C		Fall 2/C		Spring 2/C		Fall 1/C		Spring 1/C	
NE203 Ethics/Moral Reasoning	3	NN210 Basic Navigation	2	NN310 Advanced Navigation	2	NL310 Leadership: Theory/App.	3	NL400 Law for the J.O.	2	NS43X J.O. Practicum	2
SP211 General Physics I	4	SP212 General Physics II	4	EE301 Electrical Fund. & App.	4			EM300 Principles of Propulsion	4	ES300 Naval Weapon Systems	3
SM223 Calculus III	4			SM242 Discrete Math & Prob.	4	HM SS1 Humanities Elective I	3	HM SS2 Humanities Elective II	3	ES360 Control Systems Lab	1
HH215 Premodern History	3	HH216 West in Modern World	3			FR EL Free Elective	3			EA/N4XY Intro to Aero./Ship Perf.	4
IC210 Intro to Computing	4	IC211 Obj. Oriented Prog.	3	IC312 Data Structures	3	IC411 Operating Systems	3	IC470 Software Engineering	3	IC480 Research/Capstone	3
		IC220 Computer Architecture	3	IC322 Computer Networks	3	SI335 Computer Algorithms	3	SI413 Programming Lang.	3		
		IC221 Systems Programming	3	SI340 Theory of Computing	3	MJ EL1 Major Elective I	3	MJ EL2 Major Elective II	3	MJ EL3 Major Elective III	3
	18		**18**		**19**		**18**		**18**		**16**

Information Technology Matrix

Fall 3/C		Spring 3/C		Fall 2/C		Spring 2/C		Fall 1/C		Spring 1/C	
NE203 Ethics/Moral Reasoning	3	NN210 Basic Navigation	2	NN310 Advanced Navigation	2	NL310 Leadership: Theory/App.	3	NL400 Law for the J.O.	2	NS43X J.O. Practicum	2
SP211 General Physics I	4	SP212 General Physics II	4	EE301 Electrical Fund. & App.	4			EM300 Principles of Propulsion	4	ES300 Naval Weapon Systems	3
SM223 Calculus III	4			SM242 Discrete Math & Prob.	4	HM SS1 Humanities Elective I	3	HM SS2 Humanities Elective II	3	ES360 Control Systems Lab	1
HH215 Premodern History	3	HH216 West in Modern World	3					FR EL Free Elective	3	EA/N4XY Intro to Aero./Ship Perf.	4
IC210 Intro to Computing	4	IC211 Obj. Oriented Prog.	3	IC312 Data Structures	3	IC411 Operating Systems	3	IC470 Software Engineering	3	IC480 Research/Capstone	3
		IC220 Computer Architecture	3	IC322 Computer Networks	3	IT360 Applied Database Sys.	3				
		IC221 Systems Programming	3	IT350 Web & Internet Prog.	3	IT430 IA and Network Security	3				
						MJ EL1 Major Elective I	3	MJ EL2 Major Elective II	3	MJ EL3 Major Elective III	3
	18		**18**		**19**		**18**		**18**		**16**

Dual Major

Get more from your education with a dual major in CS & IT;
only 5 additional courses required!

Delve into both foundational...

...and practical computing topics!

Computer Science

Information Technology

Graduate Education

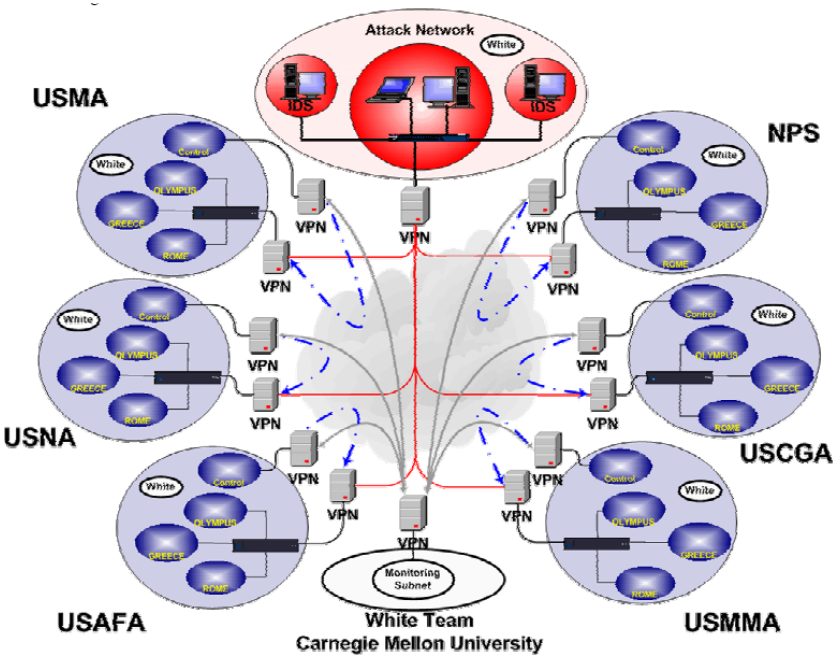
- VGEP at Johns Hopkins University
  - Attend graduate school locally during Spring 1/C year at JHU Applied Physics Laboratory
- IGEP at Naval Postgraduate School
  - Secure admission to NPS for follow-on graduate education in Monterey, CA
- Navy or Marine Corps Burke Program
  - Earn a Masters degree after completing your first Navy operational or Marine FMF tour
  - Typically completed at NPS or Air Force Institute of Technology in 1 to 2 years
- Find your own program!
  - Midshipmen have studied at MIT, Penn, and numerous other schools following graduation

CS, IT & CY Comparison

	Computer Science (CS)	Information Technology (IT)	Cyber Operations (CY)
Summary	Focus on scientific foundations of computing, including design & implementation of programming languages, program efficiency, and limits of computation.	Focus on applications of computing including web & internet programming, databases, and computer & network security.	Provides a foundation of computers, programming, and networks, and then broadens out to a view of cyber which includes legal issues, policy, hacktivism, social factors.
Tradeoffs	Deeper foundational material on computing (in exchange for less coverage of applications)	More depth on applications (in exchange for less foundational material on computing)	Favor breadth of topics over depth (e.g., control systems, EM spectrum, ethics, policy, law, and human factors)
In-major Courses	Technical: 15 to 16 courses Non-technical: 0 to 1 courses	Technical: 15 to 16 courses Non-technical: 0 to 1 courses	Technical: 10 to 12 courses Non-technical: 3 to 5 courses
Electives	Artificial Intelligence, Robotics, Natural Language Processing, Graphics, Cryptography, Network Attack & Defense	Mobile computing, Forensics, Advanced Web, Advanced Information Assurance, Network Attack & Defense	Cyber-Physical Systems, History of Cyber-warfare, Cyber Defense Strategies, Applied Cryptography, Applied Forensics
Internship Options	NSA, DISA, NRO, Draper Labs, NPS, NRL, Cyber Warfare Dev. Group, CYBERCOM, CACI		

Cyber Defense Exercise (CDX)

- Intense 96-hour event
  - Live attack/defense between NSA and cadets/mids from all services.
- Fierce inter-academy rivalry
  - Help us win the next competition!



Training, Internships

Students can receive professional level training at exciting venues that costs thousands of dollars, all at no cost to midshipmen!

Want to work at the NSA with a Top Secret clearance before you graduate? Many CS/IT midshipmen do just that every summer!

acm International Collegiate Programming Contest

IBM event sponsor

SANS

GIAC

Capstone Projects

The current CS/IT Capstone list is not an accurate representation of your future project choices. *Why?*

Because yours will be new and exciting!

- Work with a team of your peers from CS and IT to research and solve a real-world problem
- Complete all phases of software development from analysis and planning to testing and deployment
- Apply knowledge learned from both disciplines while sharpening communication and decision-making skills

See http://www.capstone-proposals.cs.usna.edu/index.php?title=Main_Page *for the most current listing!*

Information Dominance Corps

Information Warfare (IW)

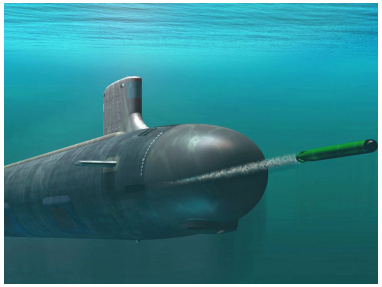
Information Warfare officers execute the full spectrum of cyberspace operations to include cryptology, information operations and electronic warfare in the electromagnetic and space domains.

Information Professional (IP)

Information Professional officers use expertise in information, C2 and space systems to operate, maintain, secure, plan and acquire the Naval network and the systems that support Naval operations.

Every Community Needs CS/IT

Whether it's controlling today's complex military hardware…



...or designing the next generation of unmanned vehicles…

...the Navy <u>needs</u> technology-minded officers!

Still Unsure About CS & IT?

Come visit us on the third deck in Michelson Hall

-or-

contact any of the helpful faculty and staff found here.

"We can only see a short distance ahead, but we can see plenty there that needs to be done."

-Alan Turing

"Computer science is no more about computers than astronomy is about telescopes."

-Edsger Dijkstra