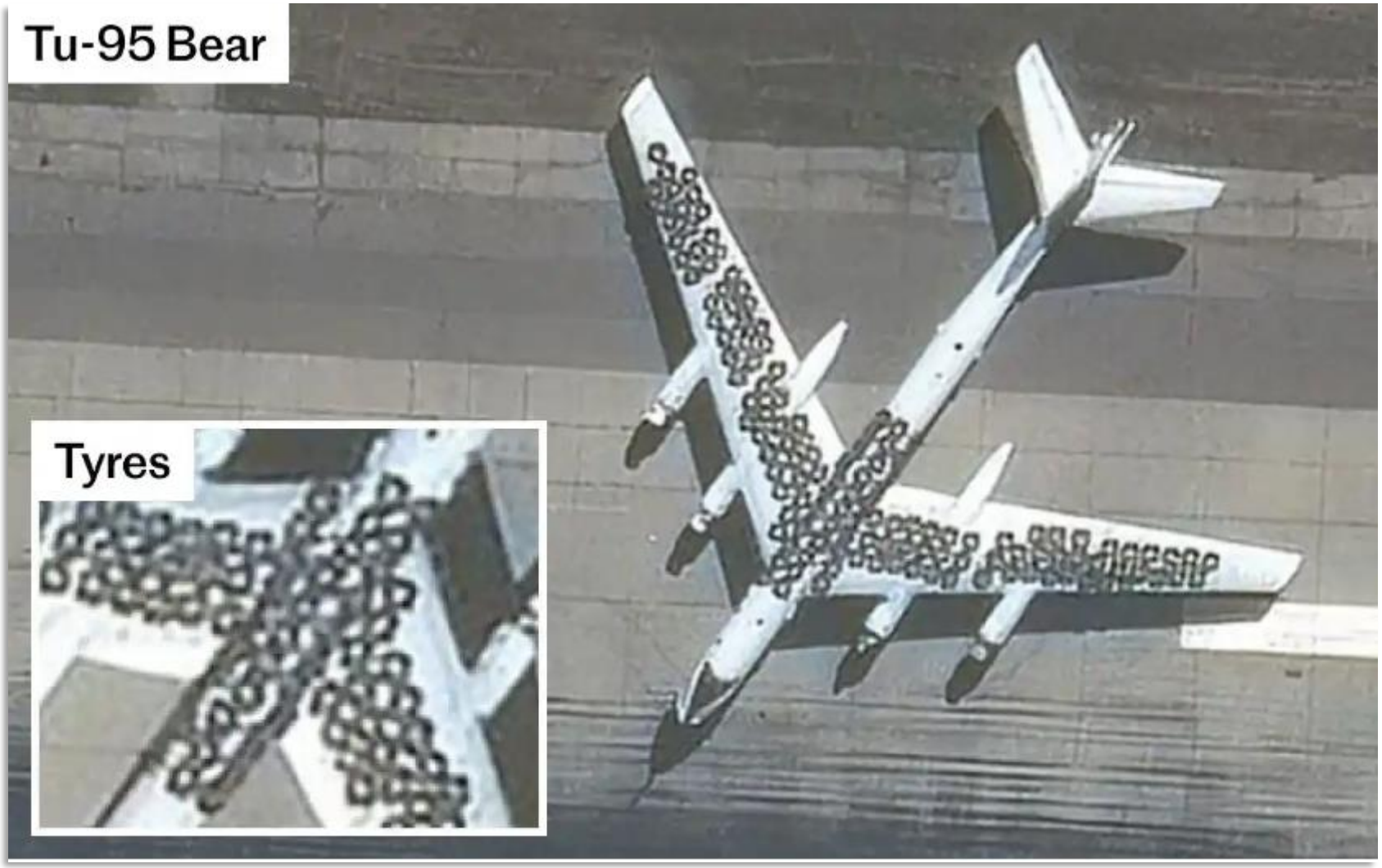
The overall classification of this brief is Unclassified

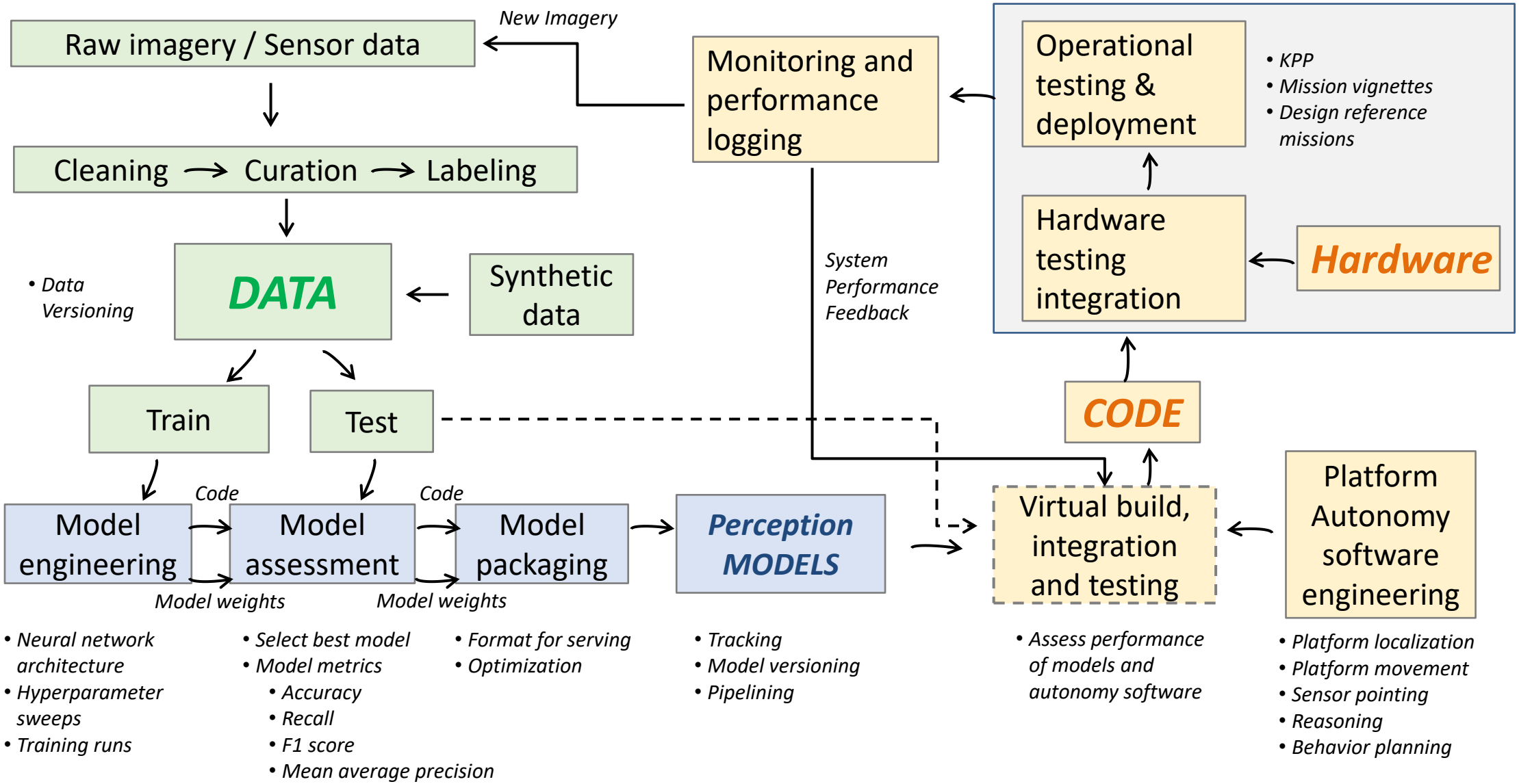
Fall 2024 Naval AI Summit

LtCol Jack Long, PhD
US Marine Corps
Office of Naval Research

AI in war today



Autonomy Scaffolding



Growing power of AI is driven by three things

Compute

Machines that can do massive amounts of math quickly and cheaply

Data

Huge volumes of data that can be used to train models in various use cases

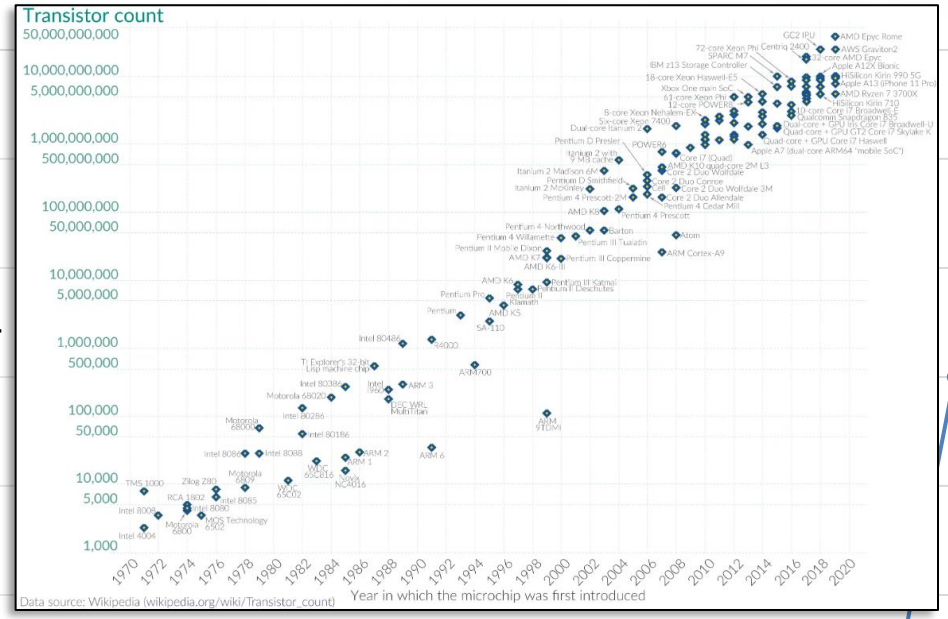
Algorithms

Very complicated but structured groups of equations that allow us to solve for complex tasks

The cost of compute continues to drop

In 1965, Gordon Moore, co-founder of Fairchild Semiconductor and later Intel quipped that the **number of components** on an integrated circuited was **doubling every year**

- Later pared back to a **doubling every 2 years**
- Since shifted from feature density to other metrics of processor and **computing power**



In 2018, Jensen Huang observed that GPU performance has grown faster than CPU performance, and will likely triple every 2 years

- Observed NVIDIA GPUs were 25x faster than 5 years ago
- Huang's Law, as it is known, is not without controversy

To understand AI, the true metric is the cost of computing

- Modern AI requires lots and lots of math—the cost of that math keeps dropping. Inflation adjusted cost of 1GigaFLOP:

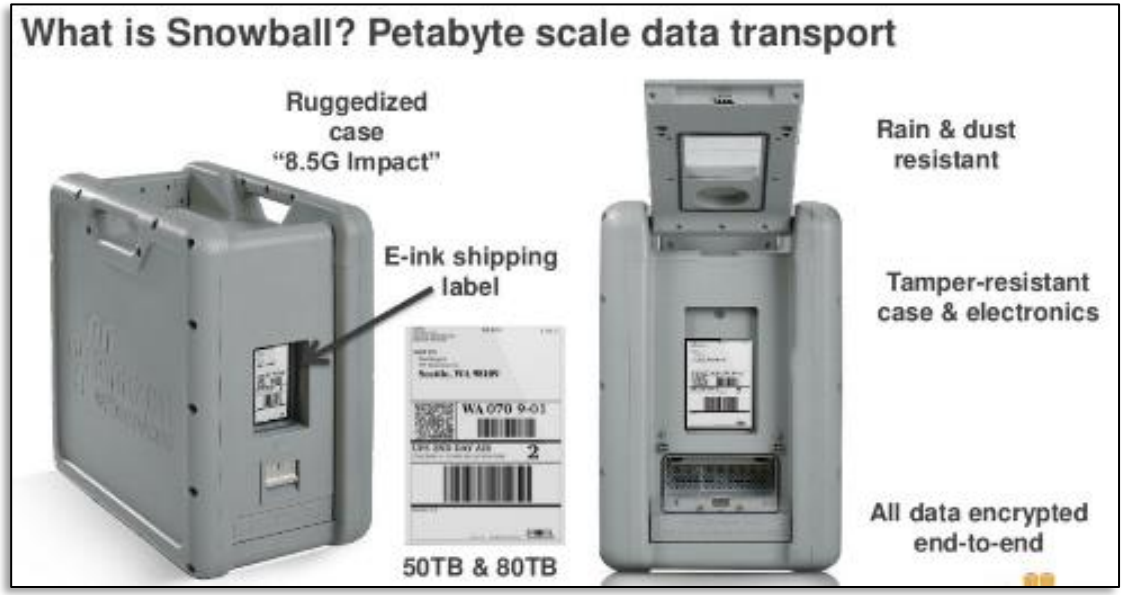
1945
ENIAC
$2 Quadrillion

40% drop per year for 78 years

May 2023
Radeon RX 7600
$0.01

90% of all the worlds data was captured in the past 2 years

Moore's is being outpaced by the rate of growth in the collection and storage of data, which is accelerating



Growth in data being driven by:

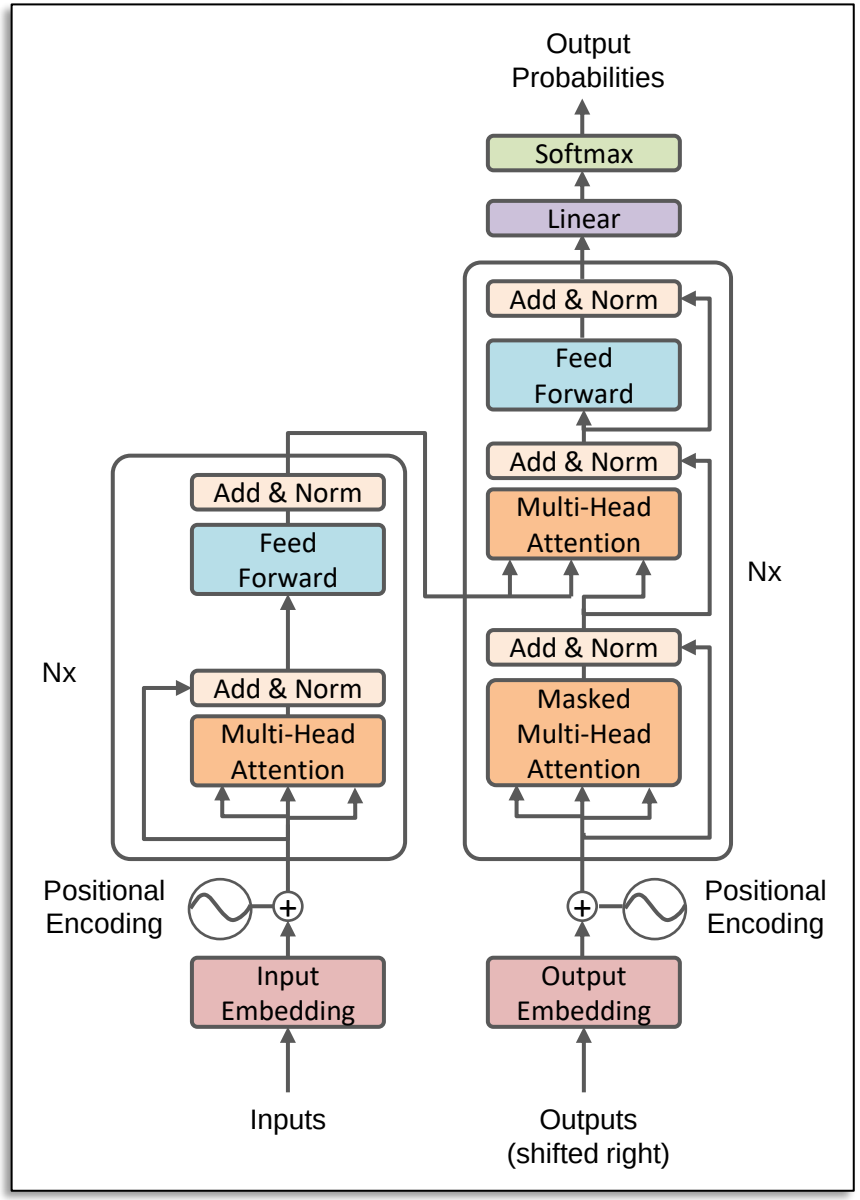
- Proliferation of low cost sensors (more sensors)
- Sensor improvement (more data per sensor)
- Cheaper bandwidth (more data moved to storage)
- Cheaper storage (more data being stored long-term)

- **Recognition of the value of the data and the importance of using it for AI**

Algorithmic size and complexity continues to increase

$$y = mx + b$$

- Algorithmic **size and complexity** has been **growing** rapidly
- Larger and more complex algorithms **allow more complex information processing**
- Exponential growth in number of researchers in this field leading to rapidly expanding investigation space
- Growth in computing allows for larger and more complex (and math-intensive) algorithms to be feasible



"Frankenstein Monster Designed by Navy That Thinks"[1]

"The Navy revealed the embryo of an electronic computer that it expects will be able to walk, talk, see, write, reproduce itself and ***be conscious of its existence****"*

*"****Learned*** *to differentiate between left and right after 50 attempts"*

"Dr. Frank Rosenblatt, designer of the Perceptron…said the machine would be the first device to ***think as the human brain****. As do human beings, Perceptron will make mistakes at first, but will* ***grow wiser*** *as it gains experience"*

NEW NAVY DEVICE LEARNS BY DOING

Psychologist Shows Embryo of Computer Designed to Read and Grow Wiser

WASHINGTON, July 7 (UPI) —The Navy revealed the embryo of an electronic computer today that it expects will be able to walk, talk, see, write, reproduce itself and be conscious of its existence.

The embryo—the Weather Bureau's $2,000,000 "704" computer—learned to differentiate between right and left after fifty attempts in the Navy's demonstration for newsmen.

The service said it would use this principle to build the first of its Perceptron thinking machines that will be able to read and write. It is expected to be finished in about a year at a cost of $100,000.

Dr. Frank Rosenblatt, designer of the Perceptron, conducted the demonstration. He said the machine would be the first device to think as the human brain. As do human beings, Perceptron will make mistakes at first, but will grow wiser as it gains experience, he said.

Dr. Rosenblatt, a research psychologist at the Cornell Aeronautical Laboratory, Buffalo, said Perceptrons might be fired to the planets as mechanical space explorers.

Without Human Controls

The Navy said the perceptron would be the first non-living mechanism "capable of receiving, recognizing and identifying its surroundings without any human training or control."

The "brain" is designed to remember images and information it has perceived itself. Ordinary computers remember only what is fed into them on punch cards or magnetic tape.

Later Perceptrons will be able to recognize people and call out their names and instantly translate speech in one language to speech or writing in another language, it was predicted.

Mr. Rosenblatt said in principle it would be possible to build brains that could reproduce themselves on an assembly line and which would be conscious of their existence.

In today's demonstration, the "704" was fed two cards, one with squares marked on the left side and the other with squares on the right side.

Learns by Doing

In the first fifty trials, the machine made no distinction between them. It then started registering a "Q" for the left squares and "O" for the right squares.

Dr. Rosenblatt said he could explain why the machine learned only in highly technical terms. But he said the computer had undergone a "self-induced change in the wiring diagram."

The first Perceptron will have about 1,000 electronic "association cells" receiving electrical impulses from an eye-like scanning device with 400 photo-cells. The human brain has 10,000,000,000 responsive cells, including 100,000,000 connections with the eyes.

"Later Perceptrons will be able to recognize people and call out their names and instantly translate speech in one language to speech or writing in another language"

New York Times, 7 July 1958, page 25

1: Headline in newspaper in Oklahoma

History of AI for military and intelligence applications

Period	Missions and uses		Prevailing AI techniques	
1950s-1960s	• Pattern recognition	• Strategic planning	• Logic based reasoning • Rule-bases systems	• Perceptrons and artificial neural networks
1970s-1980s	• Decision-making • Threat assessment	• Planning	• Expert systems • Inference engines	• Symbolic AI
1990s	• Improved target identification	• Automated text analysis • Intelligence information processing	• Natural language processing (NLP)	• Computer vision (CV) • Reinforcement learning (RL)
2000s	• Autonomous systems • Cybersecurity	• Machine-learning driven data analysis • Uncrewed aerial vehicles	• Robotics • Data analysis	• Agent-based modelling • Support vector machines (SVMs)
2010s	• Object detection • Autonomous systems • Predictive maintenance	• Logistics for military equipment • Natural language processing • Image and speech recognition	• Machine learning (ML) • Generative adversarial networks (GANs)	• Deep learning (DL) • Convolutional neural networks (CNNs)
2020s	• Deepfake propaganda • Spacecraft maneuver detection • Automatic security classification	• Malware detection (and creation) • High-quality language translation • Object recognition from satellite imagery	• Transformers • Multimodal AI • Explainable AI	• Generative AI (GenAI) • Large language models (LLMs) • Retrieval Augmented Generation (RAG)

Source: AI for Defense and Intelligence, p 14

Growing power of AI is driven by three things

Compute

Moore's Law
- Has held for 60 years
- Oft-predicted demise
- Law gets restated at each barrier

Cost of Computation
- Better way to think about the Law
- Shift focus to 'so what' from measure of physical features
- No sign of slowing down

Bottom Line
- Math continues to get cheaper
- Trend will continue for next 10+ years, likely longer

Data

Internet of Things
- Cheap and connected sensors
- 90% of data created in last 2 years
- Trend is accelerating, not slowing

Storage
- Cost dropping exponentially
- Increasing connectivity makes data accessible for model training
- Portion machine-readable growing

Bottom Line
- Training data getting cheaper
- Trend will likely continue for a generation or two

Algorithms

Community Growth
- 10x growth in researchers working in algorithmic development field
- Expanding areas of investigation

Knowledge Growth
- Positive feedback loop from increase in data, people, and compute creating much faster growth in algorithm effectiveness

Bottom Line
- Algorithm complexity increasing--ability to solve more complex tasks
- Trends will continue for decades

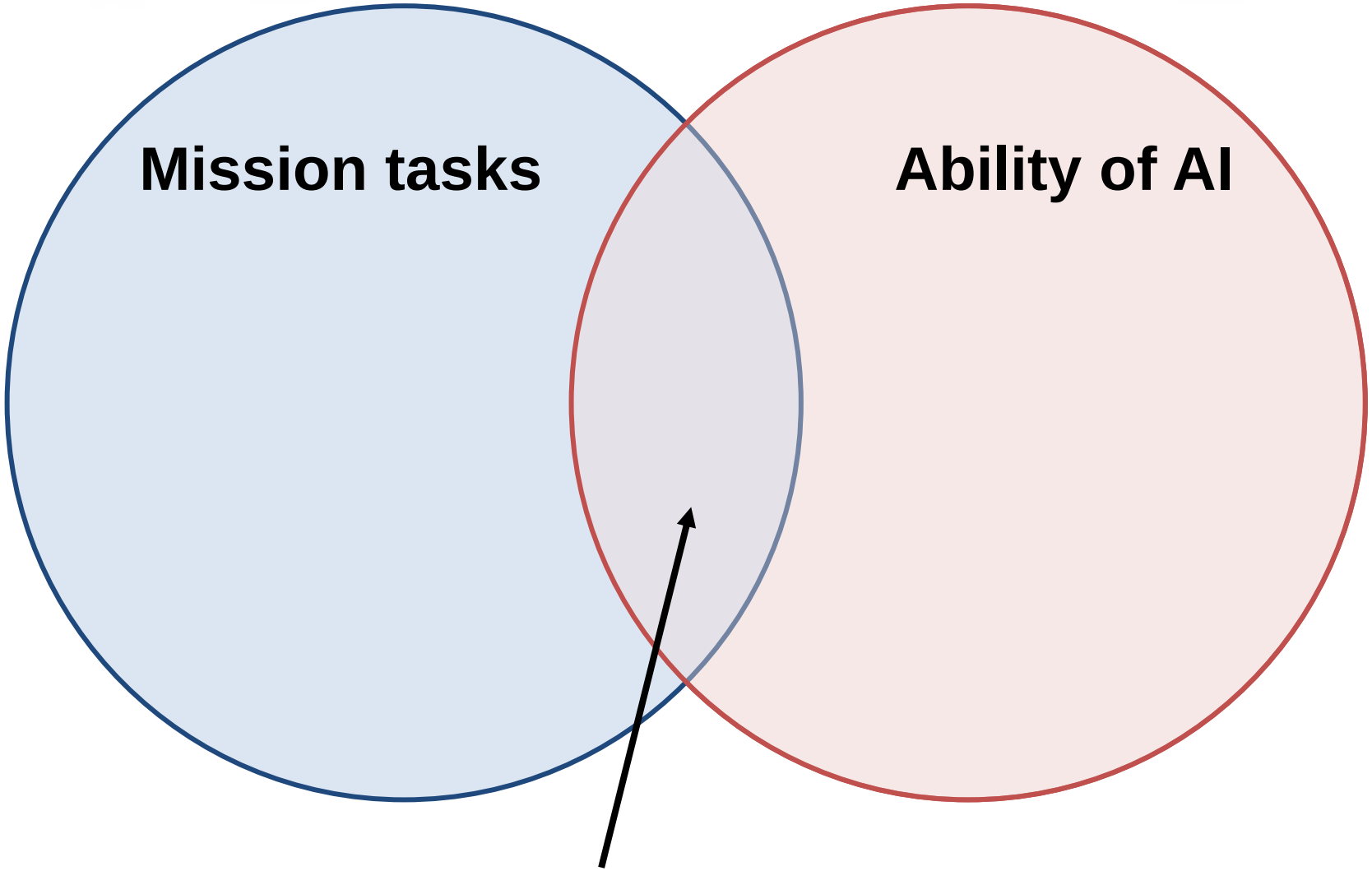
The three drivers of the increasing power of AI will not slow down any time soon
The power of AI is going to continue to increase for the foreseeable future

Innovation

"It is likely that the most transformative AI-enabled capabilities will arise from experiments at the "forward edge," that is, discovered by the users themselves in contexts far removed from centralized offices and laboratories"

- Summary of the 2018 Department of Defense Artificial Intelligence Strategy

Linking AI to Mission



Where AI can be used to accomplish the mission

Avenger AI Grand Challenge

Streamline Contracting

Acquisition professionals need a transparent, auditable process to effectively accelerate acquisitions and streamline management across a contract life cycle

Small Unit Maneuver

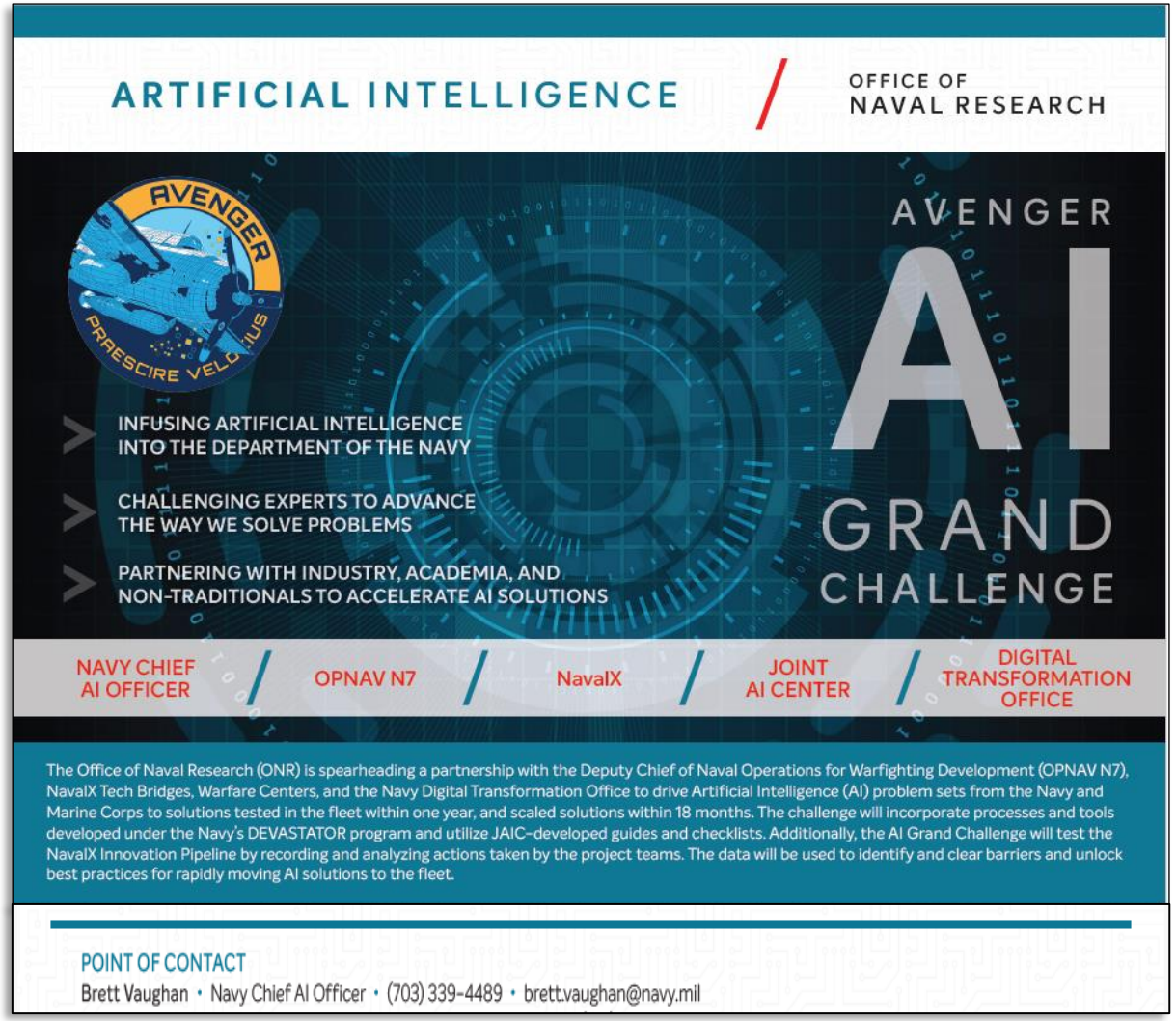
Naval Special Warfare needs a way to identify talent among personnel that will support small unit tactical maneuvers and swarming tactics

Maintenance Data

The Navy needs a way to predict maintenance actions in order to optimize maintenance schedules, manpower, and logistics

Base Access

NAS Whidbey Island Visitor Control Center requires a means to rapidly process personnel requiring installation access



Knowledge Management

Second Fleet needs a way to rapidly filter, synthesize, and prioritize After Action Reports in order to produce lessons learned and inform future decisions

Installation Protection

USMC Base Sentries need a way to rapidly and accurately assess personnel and vehicles entering base to allow authorized personnel onto base in a timely manner

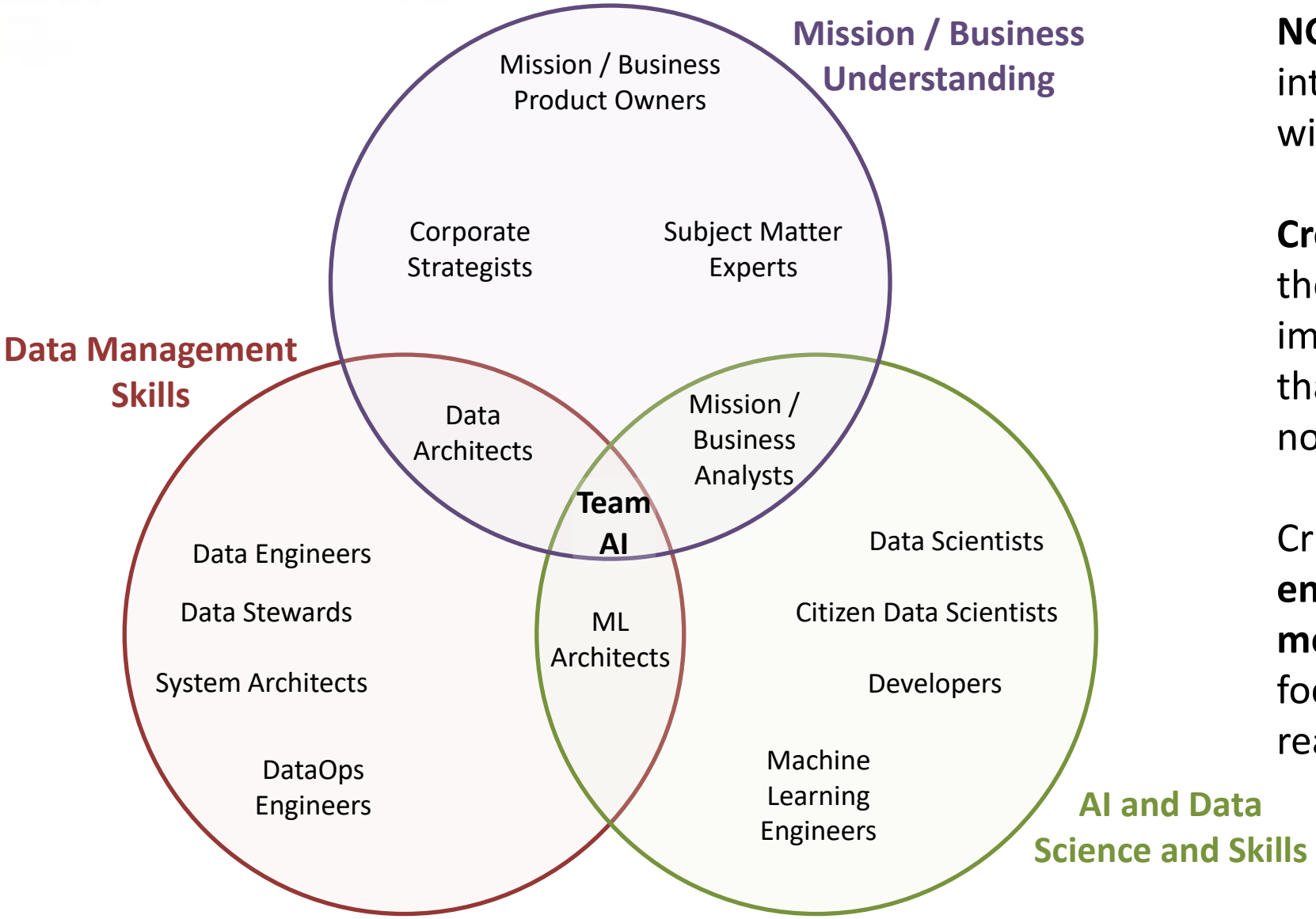
Readiness

How can the Navy consolidate and streamline the tracking and reporting process to accurately report the manning and readiness level of the Navy?

Human Resources

The Navy needs a way to integrate and manage all types of MyNavyHR and external data in order to properly manage human resources

Integrated Mission Understanding



NGA has taken a holistic approach to integrated mission understanding with Data and AI skill sets

Cross-functional teams that contain the entire skillset required to implement AI are more successful than siloed teams or those that do not have end to end capability

Critical to linking AI to mission—**ensuring the solutions developed meet mission needs** while also focusing on those use cases that are ready for an AI solution

Navy AI Task Forces

Growing the Naval AI Ecosystem

First → **Tenth**

Controlled Unclassified Information

1430-1530 **Task Force Station HYPO**
Location: GL-109
Mr. Grohe

1530-1630 **Task Force Ellyson**
Location: GL-109
CAPT Baller

1630-1730 **Group discussion of needs, requirements, r**
Location: GL-109

1730-1900 **Trident Room**

Friday, January 28th

0730-0800 **Overview of NPS' capability wrt Data Analyt**
Location: GL-109
Presenters: CAPT Sunvold, CAPT McCabe, Capt

0800-0900 **Consortium for Intelligent Systems Educati**
Location: GL-109
Presenters: CAPT Sunvold, CAPT McCabe, Capt

0900-1000 Group discussion of opportunities for collabor
Location: GL-109
Presenters: CAPT Sunvold, CAPT McCabe, Capt

1030-1040 Transit to MRY airport

1135 **Depart MRY**

END

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2

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NAVAL POSTGRADUATE SCHOOL

AS OF 9/23/2024 9:41:00 PM
POC: CAPT DAN SUNVOLD
E-MAIL: DANIEL.SUNVOLD@NPS.EDU
PHONE: 831-656-3360

Naval AI Task Force "NPS Shura"
January 27th-28th, 2022

Visiting Party
TF Hopper (Surface Warfare)
CAPT Pete Kim
Ms. Rebecca Boxerman
TF Station HYPO (Information Warfare)
Mr. Edwin "Begwi" Grohe
CDR Jackie Crook
Ms. Joanne Pilcher
TF Ellyson (Naval Aviation)
CAPT Brian "Rina" Baller
Naval AI Lead/Deputy, ONR
Mr. Brett Vaughan
Dr. Jack Long, USMCR

NPS Participants
CAPT Dan Sunvold
CAPT Ed "Tick" McCabe
CAPT Rob Hight
Col Randy Pugh, USMC
Dr. Sheila Vaidya
Mr. Chris Manuel
Ms. Megan Schlessinger
Dr. Peter Denning
Dr. Bret Michael

Objective: The Navy's major warfare communities have all established Artificial Intelligence Task Forces in order to explore ways to apply artificial intelligence and machine learning to their peacetime and wartime missions. The stated intent is "to improve readiness and effectiveness in a measurable way." Three of the Task Force leads would like to see if there is an opportunity for NPS to help them with developing solutions for their identified AI needs.

Thursday, January 27th

1051 Flight arrives in MRY
1100-1200 Transit and hotel check-in

Dress: Military – Khakis or Service Equivalent
Civilian - Business Casual

1230-1300 **Introductions and overview of objectives**
Location: GL-109
Presenters: Mr. Grohe, CAPT Kim, and Capt Baller

1300-1330 **Organizing Naval R&D for AI**
Location: GL-109 / MS Teams
Briefers: Brett Vaughn or Dr. Jack Long (ONR)

1330-1430 **Task Force Hopper**
Location: GL-109
CAPT Kim

1

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Fall Naval AI Summit

The Naval Postgraduate School
& Office of Naval Research

Hosted by the US Naval Academy

Col(ret) Randy Pugh and Dr. Jack Long
Annapolis, MD
23-26 September 2024

UNCLASSIFIED

Current as of: 20 Sep 2024

Morning		• Leadership dashboards (30m) • The history of Maven (30m) • CAIMANS (40m)	• AI2C Overview (25m) • Alfred (25m)	• Raven Sentry (30m) • Iron Bounce (30m)
Lunch	Open 1130-1300	Open 1145-1300	Open 1130-1300	Open 1120-1250
Afternoon	• AI for Knuckledraggers	• PNPS remarks (10m) • Dead Center (40m) • CamoGPT (40m) • CDAO USNA Interns (30m) • LabelLogic / Ignition (30m) • Report Modernization (30m)	• BMS (30m) • Pioneer (30m) • Dreamcatcher (30m) • Harbinger (30m) • Battering Ram (30m) • USNA DS/AI Internships (30m)	• Kraken (35m) • Emerging and Disruptive Threats (35m) • TF Hopper (30m) • ADAPT (25m) • SMDII / PASS (25m) • GenAI for Navy 2ks (30m)
Evening	*No host social at Fran O'Brien's*	*No host social at McGarvey's*	*No host social at The Choptank*	*Open / Travel*

Legend
Unclassified | Classified | Tentative

UNCLASSIFIED

Innovation is a 3 step process

1

Identify better way of doing things

- Ideation and innovation theater
- More and better ideas are rarely the problem

2

Stop doing things the old way

- Rate limiting step
- Defined by stickiness of old idea, not brilliance of new idea

3

Start doing things the new way

- Can’t get to step three if we don’t complete step 2

This is our problem

Assessing and measuring risk incorrectly

Running with scissors

vs

Not running with scissors

when you're in a burning building

Actions that lower risk

For one part of the organization while shifting the risk to another part

Net change to risk = Zero

Investing in people to build a modern workforce

What if we train and educate our people and they leave?

What if we don’t and they stay?

To be successful, organizations must...

- Identify use cases that align to mission
- Deploy enterprise infrastructure (Hardware and Software)
- Build an AI Competent workforce
- Update organizational governance
- Build partnerships to increase leverage
- Drive holistic cultural change

Navy AI Task Forces

Fall 2024 AI Summit – Agenda

Day	Monday | 23 September	Tuesday | 24 September	Wednesday | 25 September	Thursday | 26 September
Morning	• AI for Knuckledraggers	• USNA welcome (10m) • Overview of AI (50m) • Leadership dashboards (30m) • The history of Maven (30m) • CAIMANS (40m)	• SigInt AI (105 m) • GenAI Challenges (25m) • AI2C Overview (25m) • Alfred (25m)	• IRIS and CITADEL (40m) • CyberCom AI Task Force (40m) • Raven Sentry (30m) • Iron Bounce (30m)
Lunch	Open 1130-1300	Open 1145-1300	Open 1130-1300	Open 1120-1250
Afternoon	• AI for Knuckledraggers	• PNPS remarks (10m) • Dead Center (40m) • CamoGPT (40m) • CDAO USNA Interns (30m) • LabelLogic / Ignition (30m) • Report Modernization (30m)	• BMS (30m) • Pioneer (30m) • Dreamcatcher (30m) • Harbinger (30m) • Battering Ram (30m) • USNA DS/AI Internships (30m)	• Kraken (35m) • Emerging and Disruptive Threats (35m) • TF Hopper (30m) • ADAPT (25m) • SMDII / PASS (25m) • GenAI for Navy 2ks (30m)
Evening	*No host social at Fran O'Brien's*	*No host social at McGarvey's*	*No host social at The Choptank*	*Open / Travel*

Legend
Unclassified | Classified | Tentative

Upcoming events

Spring 2025 AI Summit

24-27 March 2025

Naval Postgraduate School

Monterey, CA

POCs:

Dr. Jack Long john.g.long.mil@us.navy.mil

Randy Pugh rpugh@nps.edu

NWSI@nps.edu

NAML

24-27 February 2025

NIWC – Pacific

San Diego, CA

POCs: Dr. Katie Rainey

kate.e.rainey.civ@us.navy.mil

naml@us.navy.mil

Website: go.mil/naml

Flankspeed join code: mmyz6c4

Naval Data & AI Workshop

19-21 November 2024

NIWC – Atlantic

Charleston, SC

POC: Adam Tyson

adam.s.tyson.civ@us.navy.mil

navaldataandaiworkshop@us.navy.mil

Data & AI Workshop

DCOPE code: xzgbvce

Naval AI Hackathon

13-17 December 2024

Naval Postgraduate School

Monterey, CA

POC: Prof Mathias Kolsch

kolsch@nps.edu

AI NIX:

AI Naval Innovation Exchange