Designing the Fleet for Future Wars: A Sea Denial-Sea Control Force

Evolution of the Hybrid Fleet

Jeff Kline, CAPT, USN (Ret.)
Operations Research Faculty
Naval Postgraduate School

Discussion's Purpose

Consider tactical, technical, and strategic drivers that inform fleet design and fleet architecture

Characteristics of Modern Maritime Warfare

- *Offense* is the stronger form of naval tactical warfare

"Fire effectively first" (Hughes)

- *Defense* is the stronger form of naval operational warfare

Sea Denial is easier than Sea Control

We observe U.S. Navy is currently on the disadvantaged side in both these areas in warfighting and procurement

Measuring Quantity's value in Maritime Salvo Warfare

If they have twice the numbers, **we must have twice the offense, twice the defense, and twice the staying power per ship** (Hughes)

Given equal force ships, if they have k times more ships than us**, then they have k^2 the combat power** (Xiaoming, Yaofeng, and Wei)

Likewise, given equal force ships,

if they have k times more ships,

then **we must degrade their targeting**

by a factor of $1/k^2$ (Kline)

Naval Warfighting Ages

Ships/Fleets are design around their primary weapon

Ram

Long Time

Gun

1740-1940

Aircraft

1940 – 1970

Missile

1970 – 2010

Robotics

2010 -

Current Fleet

Hybrid Fleet

Marginal Advancements in Technology adoption

Amphibious Landing Iwo Jima 1945

Amphibious Landing exercise STEEL KNIGHT 2019

Carrier Operations 1950s

Carrier Operations 2020s

Embracing the Missile and Robotics Age

China’s sea denial capability
1956

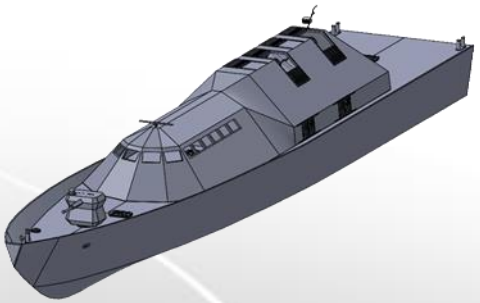
China’s sea denial capability
2020

Future Design and Architecture Opportunities

- Missiles, Robots and autonomy:
  - Less expensive and easier to change than big ships
  - Strengthens offensive warfare (kinetic and non-kinetic
  - Allows for greater numbers: power of quantity
- Network and Cyber enabling
  - Long ranges and/or robust local networking
  - Asymmetric impacts

Fleet Design Proposal for two fleets: Sea Denial and Sea Control

- Ask not the number of ships, but the number of weapons: shift to offense
- Focus on missile targeting and delivery systems, not platforms
- Small, many, and as unmanned as possible as forward as possible
- Enabled to fight alone, enhanced when networked
- Retain traditional fleet for sea control



A Hybrid Naval Force Construct for Competition and War

Sea Denial Force

- Crewed/uncrewed platforms built as systems, distributed, formed into local reconnaissance strike networks: tailored to area
- Offensive and forward
- Stealth long-range missile carriers distributed in contested regions
- Buy as systems to missions

Sea Control Force

- Protection forces
- Multi-mission Platforms
- Capital intensive/longer life ships and aircraft
- Power projection as environment allows
- Defense of shipping, SPODs, and APODS

←----------Undersea Assets (SSNs, UUVs, AUWS)----------→

Evolution of Hybrid bimodal Navy Concept

2003-2024 NPS Officers in Campaign Analysis, Wargaming and theses are challenged with peer competitors

2007 Hughes Publishes "A Bi-Model Force for the National Maritime Strategy" — NWCR

2009 "New Navy Fighting Machine" study by Hughes and others — NPS Tech Study

2012 "A Flotilla Study to support a Strategy of Off-shore Control" Kline and Hughes — NPS Tech Study

2012 Kline and Hughes publish "A War At Sea Strategy" — ONA Study

2014 Hughes publishes "Use Single Purpose Warships in the Littoral" — ONA Study

2016 Kline Publishes "A Tactical Doctrine for Distributed Lethality" — NWCR

2017 Kline publishes "Impact of Robotics Age on Force Design" — USNI

2018 Hughes publishes "Build a Green Water Fleet"

2021 Wirtz publishes "The Bi-model Navy & Maritime Deterrence"

2021-2022 NPS campus wide study "Hybrid Fleet 2045" — NWCR

2022 Wirtz, Kline, and Russell "The U.S. Navy's Generational Challenge"

2023 Kline "Naval Warfare's Robotics Age: Realizing its Full Potential" — USNI

2023 Kline "Sea Power and the Operational Level of War: Linking Means with Strategic Ends" — USNI

2023 Kline "Revamping Fleet Design and Maritime Strategy: An Integrated Naval Campaign"

2024 Wirtz, Kline, Russell *The U.S. Navy and the Rise of Great Power Competition*

Distributed Logistics Fleet

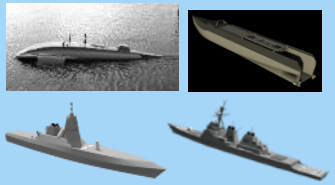
Traditional Logistics Fleet in Convoy

Highly Contested Logistics Region

Sea Control Force Region

Sea Denial and Port Security Systems
Some are coalition owned and operated

Highly Contested Logistics Region



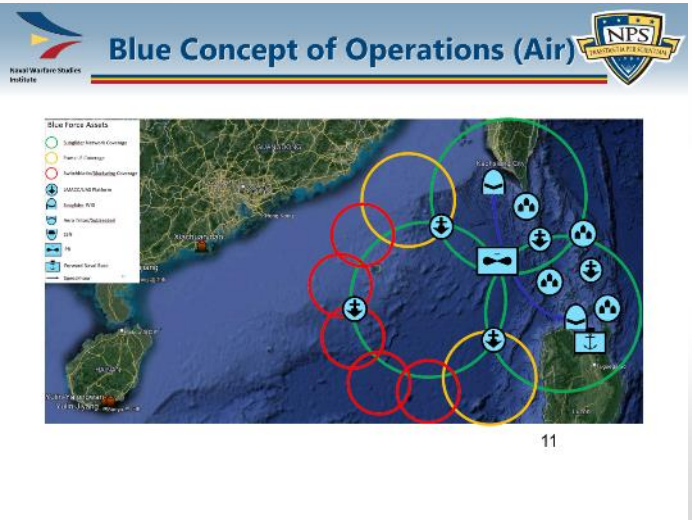
Distributed Logistic Forces

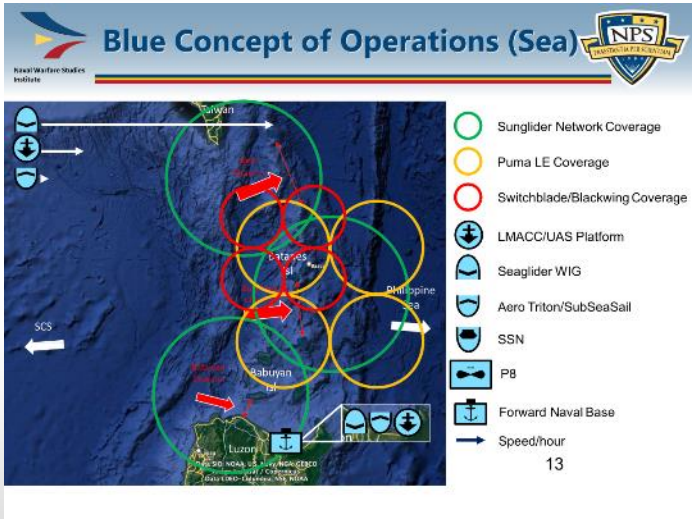
2000 km

N

A Sea Denial Concept of Employment

- Sea Denial (offense) forward, distributed, working with shore-based systems and undersea forces to form Local Reconnaissance Strike networks (LRSN)
- "Connected" when able, fighting separate when necessary
- Accelerated cumulative sea denial – area by area
- Think traditional submarine warfare operations--with many missile, mine, and undersea launch systems
- Traditional Sea Control Forces (defense) to defend sea lines





Bimodal Fleet composition Luzon Strait

Luzon Strait multi-domain crewed-uncrewed sea denial system:

- 2 Skydweller HALE ISR
- 4 ORCA XLUUV
- 6 LMACC (lightly crewed missile combatant with 8 LRASMs)
- 40 Sail Drone
- 30 Low Visibility USVs (ISR and strike)
- 200 Hammerhead Mines
- 4 Kratos Valkyrie
- 4 MQ-25 Stingray

Actual composition is location specific

Integrated forces not included on this slide:

USMC land-based ASCM and air defense systems with Fire Direction Center

U.S. SSNs where appropriate

Modified CVW for Sea Control

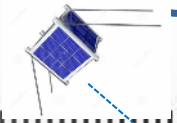
Mission	Aircraft	Crewed (y/n)	Proposed	% of CVW
AAW/ASuW	F-35C	Y	24	27%
Refueling/C2 AWAC	MQ-25	N	5	6%
AAW/ASuW	Collaborative Combat Aircraft (CCA)	N	48	55%
ASW	MQ-9 w/ASW package	N	6	6%
ISR/C2	Global Observer	N	5	6%

- Equivalent Cost/Manning to current CVW
- 750 nm sea control range (find-fix-finish)
- Assigns off-board nano-satellite launch to surface combatant or ashore
- COD ashore
- SAR to surface combatant aviation
- Reqs Off-board queuing for long range ASW contact
- Reqs LWT for MQ-9

Sea Control CVW CONOPS Review

Increase OODA loop speed by decreasing human in the loop

- Observe: Nano Satellite, Global Observer
- Orient: MQ-25 AWACS
- Decide: C2 / Autonomous
- Act (Atk): F-35 + CCA (Collaborative Combat Aircraft), MQ-9



Legend:
Find: ISR
Fix: Communication
Finish: Engagement

"Loyal Wingman"

AWACS/Refueler

External Cueing
(Ex: P-8)

"Loyal Wingman"

Electronic Attack

750NM

Strategic/Technical Fleet Metrics

- Reactivity
- Robustness
- Resilience
- Recover

On strategy for implementation

- Engage coalition partners near critical seaways and littorals with offer of enhancing their maritime security systems collaboratively.
- Involve host-nation's industry with U.S. industry, and navy-to-navy to design, develop, and employ these crewed/uncrewed multi-domain surveillance and response systems: create local recon strike network.

Instead of being technologically “smarter,” get “dumber” in a smart way*

Failed traffic light

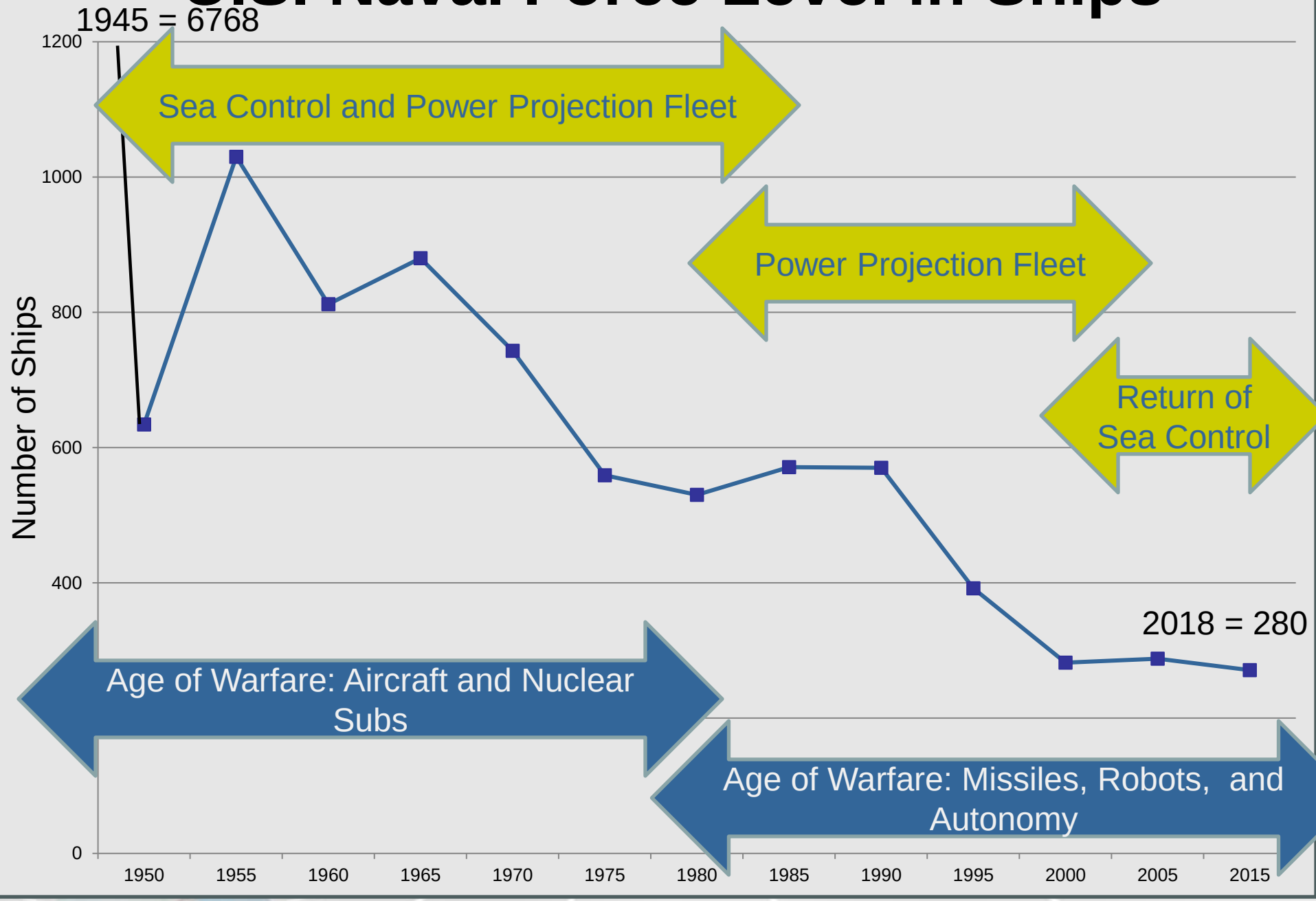
No traffic light to fail

*Dr. David Alderson, Professor of Operations Research

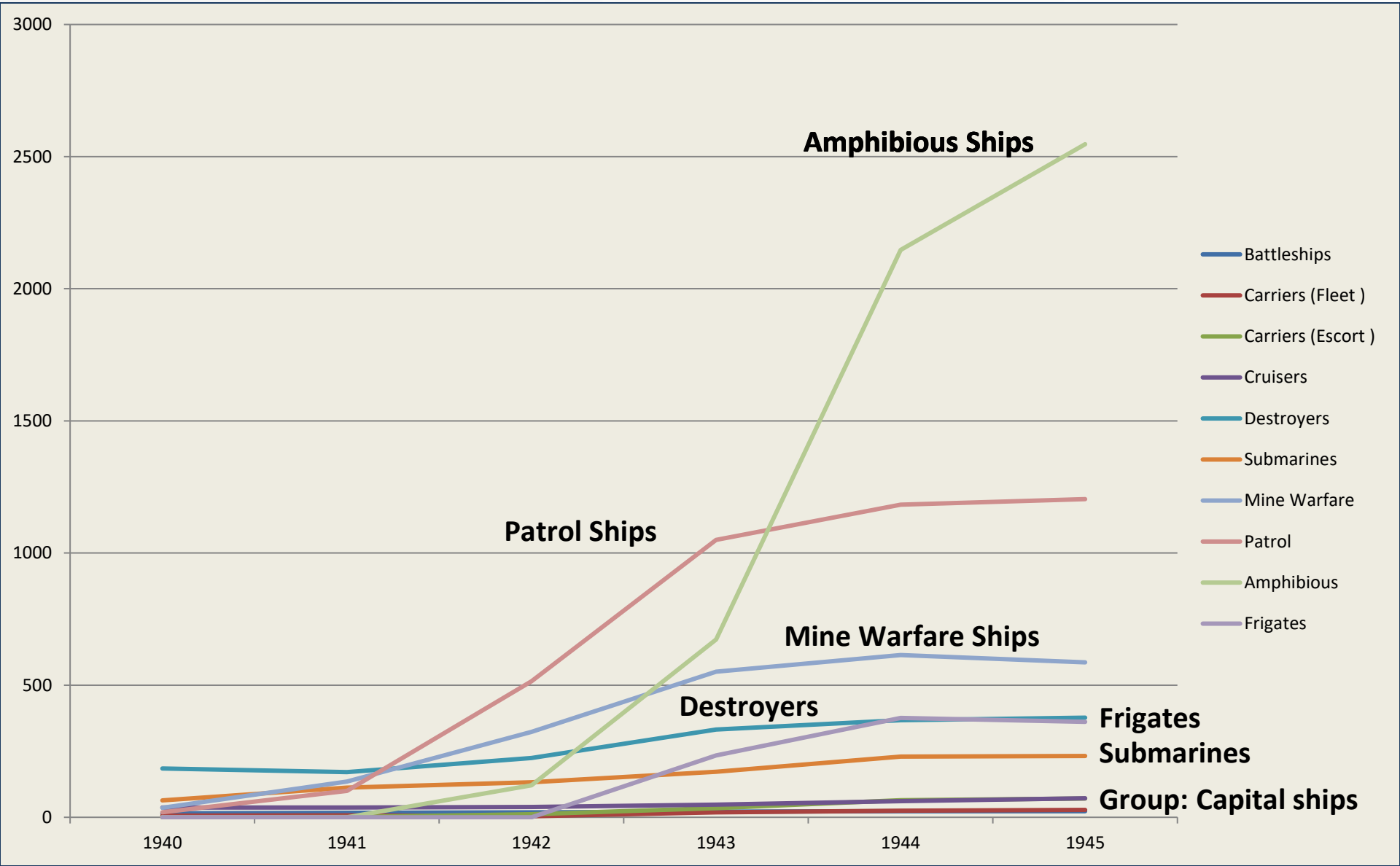
Look for basic, local solutions to increase resilience and decrease vulnerability

BACK UP MATERIAL

U.S. Naval Force Level in Ships



What we build in war: 1940 - 1945



Initial Conditions for Presentation

Warfare Analysts come to a problem with two characteristics: “unbiased and ignorant or biased and informed” Kline is the latter

Sea Denial CONOPS Local Networking Options

Local Burst Mesh Networking

- Wireless Mesh Network (WMN)/Mobile Ad-Hoc Network (MANET)
  - Self-Forming/Self-Healing
  - Link Adaptation
  - Adaptive Routing
  - Small crewed combatant or Land-based managed
- Optical Time Slot Interchange (OTSI) and Optical Packet/Burst Switching (OPS/OBS)
  - OTSI and OPS/OBS can be used to overcome contention
- Limits of OTSI and OPS/OBS:
  - Not yet mature, but assumed by 2045 timeline

- Low probability of detection/intercept (LPD/I)
  - LPD/I achieved through distributed sensors
- Limits of LPD/I communications
  - Wide spectrum resembling white noise

Future Design and Architecture Change Challenges

- Future United States' "Grand Strategy" ?
- Navy as a long-term capital investment
- Constraining budget and expensive ships
- Long acquisition times (5- 8 years for ships)
- Extremely high operations tempo with fewer ships
- Potential Adversaries capabilities and capacities
- Natural conservative tendencies of senior naval leaders—the fleet's strategic value

bimodal Force Circ 2007 Hughes

- Fleet for “high end fight”
- Fleet for “low intensive conflict”
- Aligned to meet National Maritime Strategy goals
- Suggests “ a more distributed fleet that is offensively disposed yet can suffer losses and fight on, for no defense at sea can be perfect against a skilled opponent.”

New Navy Fighting Machine 2009 Hughes and NPS team

- Aligned to Navy Functions:
  - Safeguard movement of goods on the sea
  - Deliver goods from the sea (projection)
  - Deny enemy movement on the sea
  - Deny enemy deliver of goods from the sea

Begins to suggest a fleet design based on sea denial and sea control

- Creates “green” and “blue” water fleets—doubles fleet Many more focused-mission ships
- Same topline SCN as 2009 projections

2012 Flotilla Study for ONA (LIMDIS)

- Proposes a flotilla concept to support a Strategy of Offshore control (T.X. Hammes)
- Reviews analytical literature showing quality of quantity in missile warfare
- Proposes clear offensive role for smaller combatants in sea denial with numbers providing a resilient force
- Integrates unmanned systems

2012 War at Sea Strategy Kline-Hughes

- Strategy to contain, deter and limit escalation:
  - Ends: deter China maritime aggression or if war, deny sea inside first island chain (create no man's land)
  - Ways: Distance blockade; SSN, Flotilla, Mining, and USMC ASCM in First Island Chain
  - Means: Revised force structure
- Leverages strength in undersea warfare
- Proposes use of flotilla as offensive sea-denial system

2017 Impacts of Robotics Age on Force Design, Kline

- Reviews challenges for large navies to change
- Proposes unmanned systems/weapons provide flexible political, acquisition and change potential opportunities
- Clearly proposes a bi-model force build for “sea denial” and one for “sea control” to realize distributed maritime operations
- Provides concept of operations (fleet design)
- Proposes fleet metrics: reactivity, robustness, and resilience

2021 Bimodal Navy and Maritime Deterrence, Wirtz

- Reviews need for bi-model navy in today's environment and its deterrence value
- Discusses current political, analytical, and organizational weaknesses to achieve a sea denial force
- Calls for action to make the organizational and enterprise changes and to transform the emerging technologies into operational capabilities.

Bimodal Fleet composition Luzon Strait

Luzon Strait multi-domain crewed-uncrewed sea denial system:

- 2 Skydweller HALE ISR
- 4 ORCA XLUUV
- 6 LMACC (lightly crewed missile combatant with 8 LRASMs)
- 40 Sail Drone
- 30 Low Visibility USVs (ISR and strike)
- 200 Hammerhead Mines
- 4 Kratos Valkyrie
- 4 MQ-25 Stingray

Actual composition is location specific

Integrated forces not included on this slide:

USMC land-based ASCM and air defense systems with Fire Direction Center

U.S. SSNs where appropriate