Naval Shipbuilding Expansion: The World War II Surface Combatant Experience

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Introduction

- The post-Cold War “Peace Dividend” era is over
- “Overt challenges to the free and open international order and the re-emergence of long-term, strategic competition between nations.” (DoD 2018)
- Possibility of non-nuclear, industrial-scale war has re-emerged.

What Can We Learn From the Last Time We Engaged in Industrial-scale War?

U.S. Destroyer Acquisition Eras

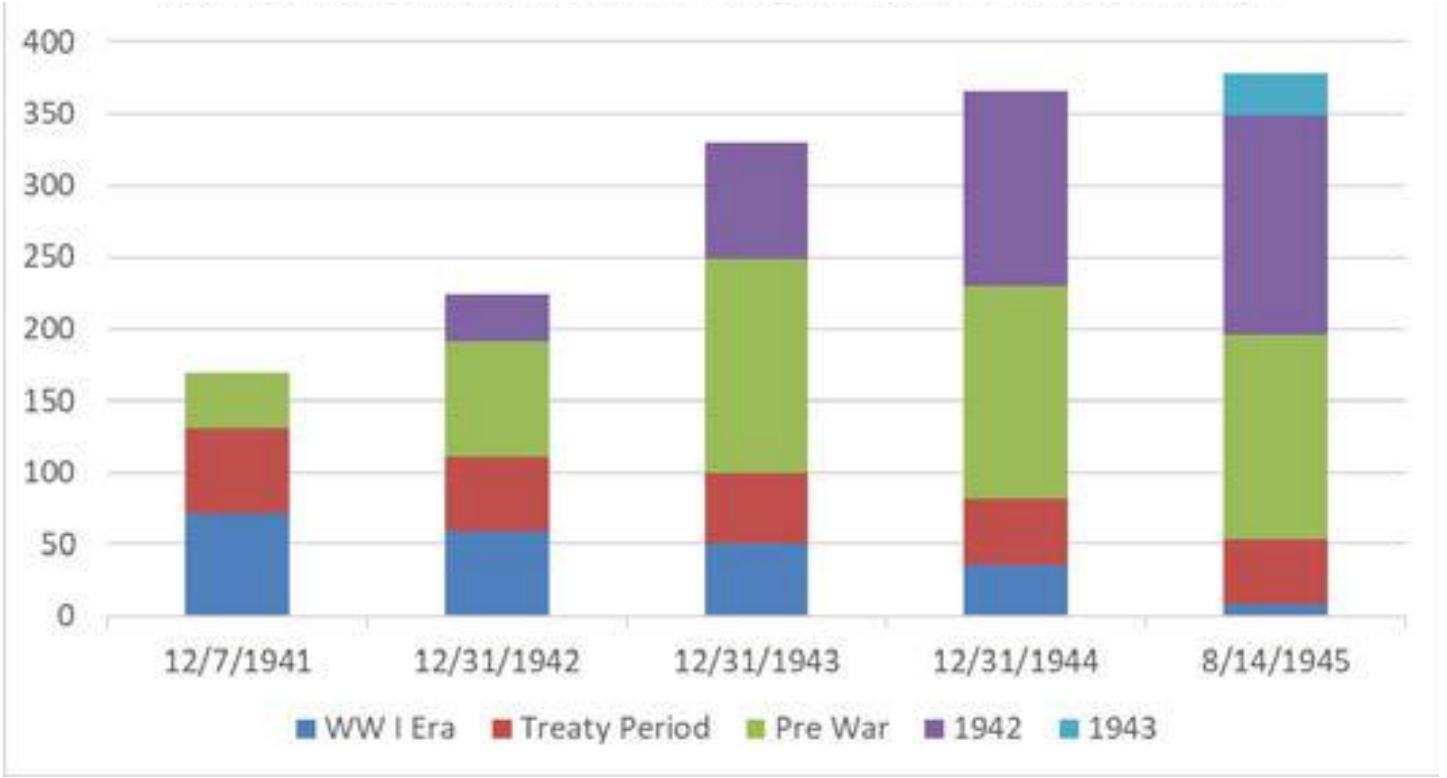
- World War I Era (up to 1922)
  - 68 destroyers had been commissioned prior to U.S. entry into WW I
    - 1 would serve in WW II
  - 273 “Flush-Deckers” acquired in response to U.S. entry into WW I
    - Only 41 commissioned prior to end of hostilities
    - Remainder commissioned after WW I
    - 105 would be lost or scrapped prior to WW II, remainder served in WWII
- Treaty Period (1922-1936)
  - Limitations placed on displacement, weapons, and number
  - Torpedo Tubes and 5 inch guns were the primary weapon systems
  - 61 destroyers in seven classes procured
- Pre-War (1936-1941)
  - Designs modified to reflect experiences of foreign navies in combat
    - Lend-Lease prepared industry for production ramp-up
  - 182 destroyers in four classes authorized
  - 39 in commission upon U.S. entry in WW II
- World War II (1941-1945)
  - Industrial Production of destroyers
  - Predominately *Fletcher* class and *Sumner* class
  - *Gearing* class started to arrive in mid-1945

USS *Fletcher* (DD 445) underway off New York, 18 July 1942 (www.history.navy.mil – 19-N-31245)

USS *Compton* (DD 705) off New York, 25 October 1944. (www.history.navy.mil – 80-G-288078)

Fleet composition is based on past decisions

Number of destroyers in commission on specific dates

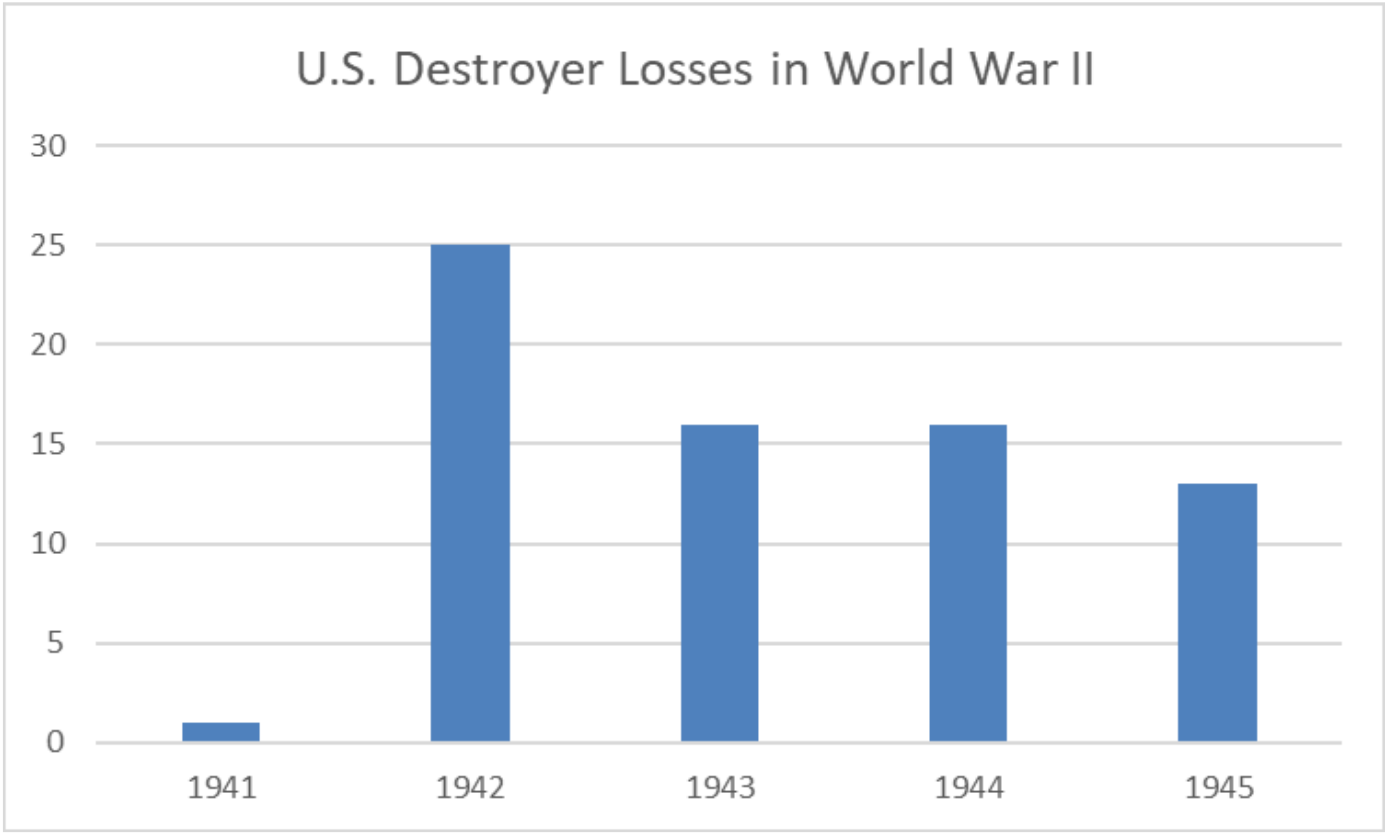


Era / Year Authorized

"As you know, you go to war with the army you have, not the army you might want or wish to have at a later time."
- Donald Rumsfeld in 2004

U.S. Destroyer Losses in World War II

- 71 destroyers lost
- Heaviest losses early in the war
  - All from Pre-war or earlier
- 20 destroyers lost between November 1944 and end of the war
  - 14 from Kamikaze
  - 3 from typhoon
  - 1 from gunfire
  - 1 from torpedo attack
  - 1 from mine

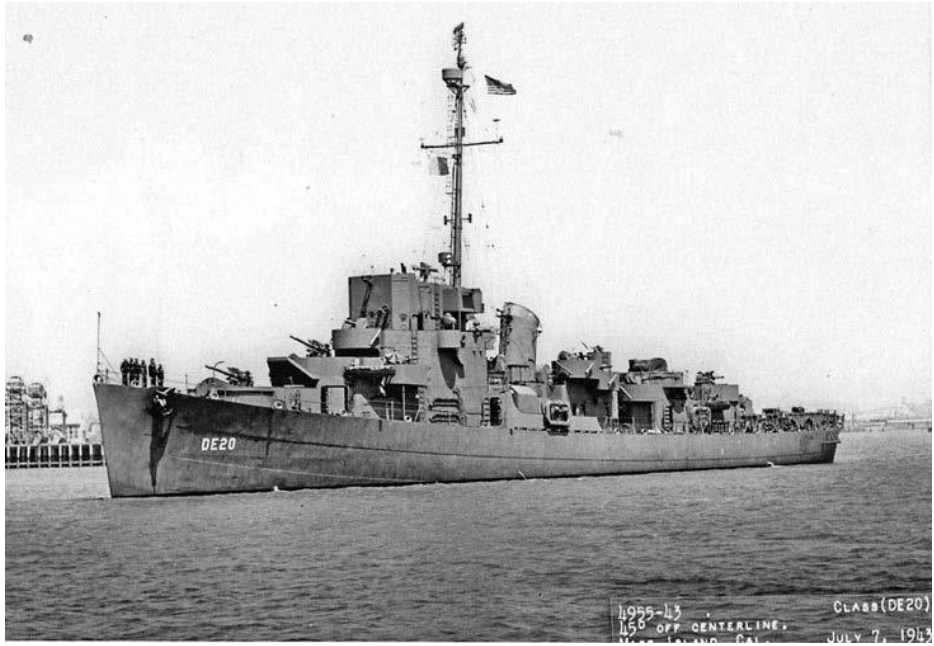


"All warfare is a race between belligerents to correct the consequences of the mistaken beliefs with which they entered combat."

- Gray (2006)

World War II Observations

- Ships designed during the war were not commissioned in time to participate in combat or were cancelled.
  - Notable exception were the LSTs
- Construction of Battleships limited by production capacity of armor
  - May have contributed to the rise of the Aircraft Carrier
  - 4 Battleships and 18 aircraft carriers constructed during WW II
  - Industrial Base production capacity is closely related to tactics employed
- Destroyer armament adapted to changes
  - Pre-war: Torpedoes considered the primary weapon
  - Early war: Combat Information Centers (CIC) formed to fuse sensor data
  - Early war: .50 cal machine guns replaced by 20 mm. 1.1 inch guns by 40 mm.
  - Late war: Torpedo tubes replaced with 40mm Anti-aircraft guns in response to Kamikaze.
- Destroyer escort acquisition adapted to industrial base capacity
  - Reflected in six distinct classes with radically different propulsion plants
    - Diesel electric, Steam turbine electric, diesel reduction gear, steam turbine reduction gear
  - Of 563 completed, 254 only had the half the designed horsepower with a loss of 3 knots (21 vice 24 knots).



USS LeHardy (DE 20) in the Mare Island Channel, 1943. (http://www.navsource.org/archives/06/images/020/0602016.jpg accessed 28 May 2018). This ship is of the Evarts class, which was fitted with diesel-electric drive of half the originally designed shaft horsepower (Silverstone 1965).

Lessons for Today

- Much of the fighting will be done by the ships in the fleet at the start of hostilities.
- With few exceptions, ships designed during wartime will not enter the fleet in numbers prior to the end of the fighting. “Only equipment in production can pass into mass production” (Friedman 2004).
- High volume production will not happen without expansion in industrial capacity, both in the shipyards and in their supply chains. This will delay high rates of ship delivery.
- Shortages of key components and materiel will likely require rapid design modifications. Flexible relaxation of key performance parameters will likely be necessary in order to incorporate substitutions.

Lessons for Today (continued)

- Speed of construction and battle damage repair will in large part determine fleet composition and thus the tactics that can be employed.
- Useful ships that can be procured fast and then promptly sent to sea, will have more relevance than exquisitely capable vessels requiring a protracted design-build-testing effort.
- Ships, weapons, and tactics will evolve rapidly and unexpectedly once the bloodshed starts. Speed of adaptability is of the essence.
- Modernization of a ship class is time consuming. Ships in modernization are not available for combat; hence upgrades must be phased in over time (not done in blocks) to enable enough ships to remain in the fight.

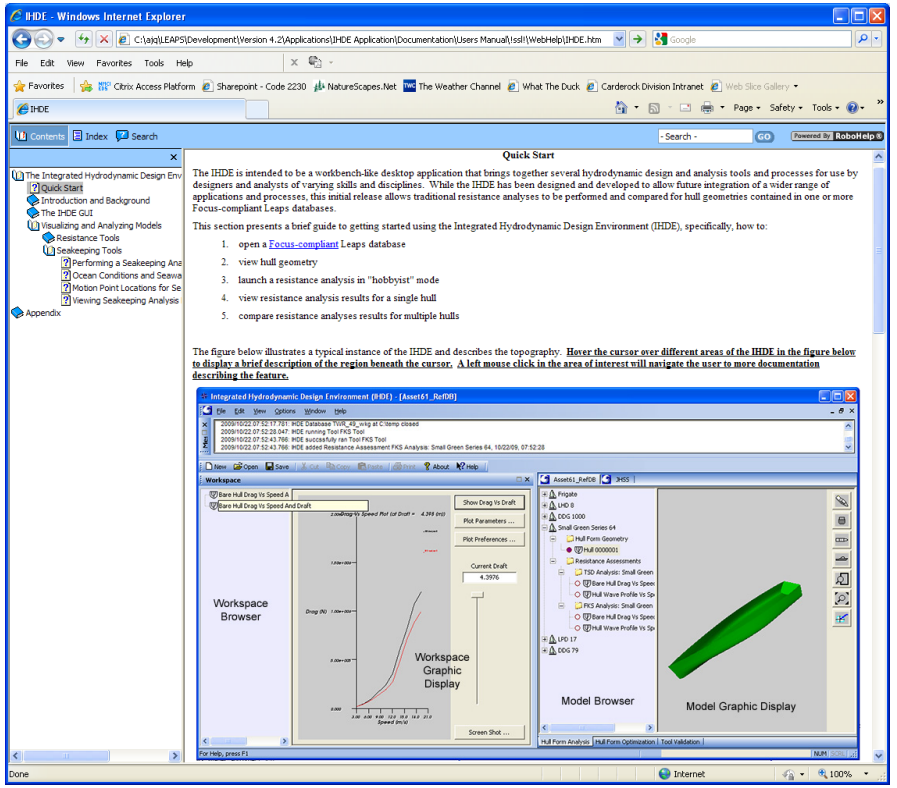
Implications on mobilization

- First year of conflict may see very intensive combat
  - High losses (perhaps 2+ destroyers a month)
  - Rapid learning
  - Need for fast Adaptation
- Requires an order of magnitude increase in destroyer production rate.
  - Replace losses
  - Build up numbers to dominate an adversary
  - If possible, the ship construction ramp up and the expansion of shipyard and supply chain production facilities should start prior to the start of hostilities, as was done in World War II.

The future USS RALPH JOHNSON (DDG 114) launched at the Huntington Ingalls Industries shipyard (Photo courtesy of Huntington Ingalls Industries).

Recommendations

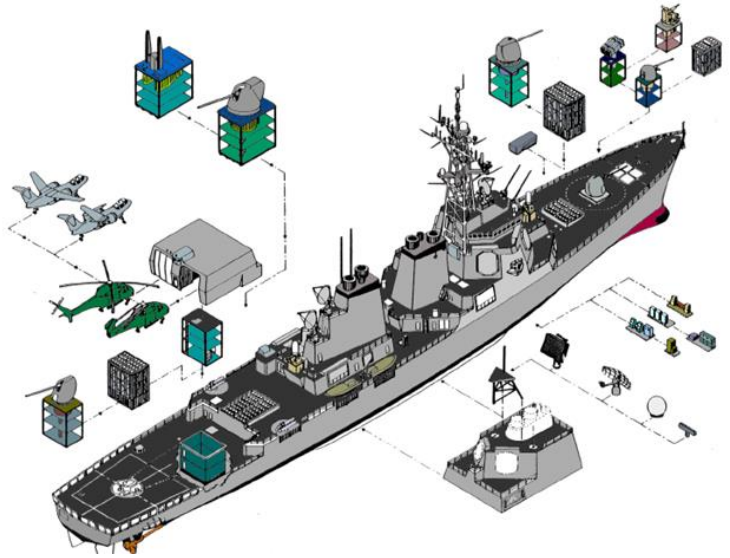
- Use modern digital modeling and simulation for ship design. Maintain digital models of all ships.
- Build digital simulation models of the industrial base and use them to evaluate product designs, bottlenecks, and capital improvements in the shipyards and in the critical supply chain production facilities.
- Run the digital ship preliminary designs through the digital industrial base simulation models prior to freezing the key performance parameters.
- Implement rigorous design-for-production and link it to industrial base modeling and simulation, to ensure that the designs are producible.
- Configure the ship design to enable substitution of key components that may have limited availability.



Courtesy Adrian Mackenna

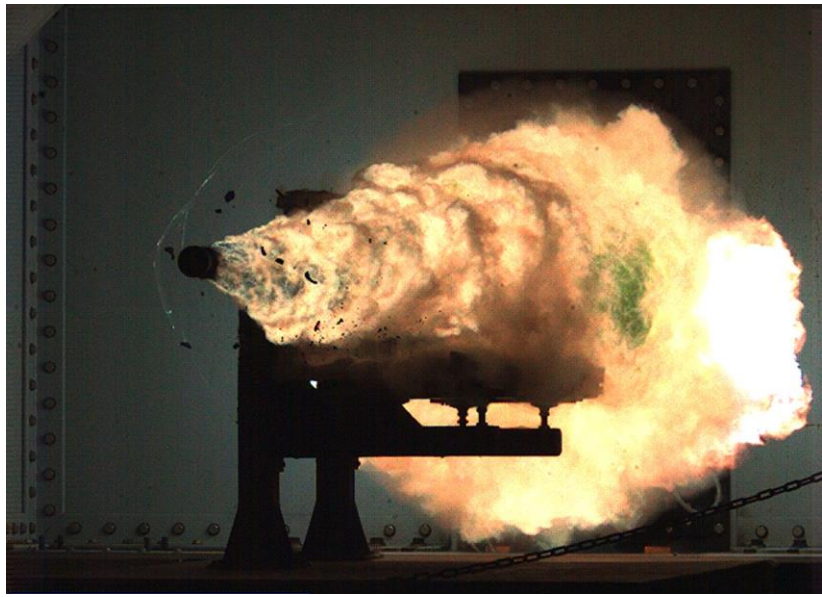
Recommendations (continued)

- Provide for integration of the combat systems in a facility other than the shipyard. Dis-aggregate the payload from the hull, mechanical, and electrical (platform) work.
- Incorporate modularity and adaptability in warship designs.
- Take advantage of modularity and adaptability to incorporate major changes in ship weapon systems
- Incrementally modify the ship design to reflect feedback from the fleet.
- Design warships to be survivable; to preserve the force structure in the face of enemy action.



Conclusions

- Naval ship acquisition processes have evolved during nearly three decades of a post-Cold War era marked by the absence of a threat of peer-level naval combat.
- Reorientation towards meeting the challenges of potential peer level, non-nuclear, industrial-scale war will require new thinking.
- In some key respects, the new geopolitical/naval strategic environment confronting the U.S. Navy more closely resembles that of the pre-World War II era than the more recent post-Cold War era.



U.S. Navy Photo