The Energy Challenge

Overall Energy Consumption

- Tactical: ~73%
- Shore: ~27%

Overall Energy Sources

- Tactical: 54%
- Shore: 23%

- Petroleum: 16%
- Nuclear: 3%
- Electricity, Natural Gas, Other: 3%
- Petroleum Ashore: 1%
- Renewables: 1%

Surface Combatant Total Ownership Cost (1991–2009)

- Acquisition: 45%
- Energy: 13%
- Manpower: 27%
- Maintenance: 15%

- CPI increased by 59% from 1991-2009
- Private sector depot port rates increased 49%... *Slightly less than CPI*
- Military Manpower costs increased 114%... *Almost double CPI*
- Energy Costs increased 292%... *Five times CPI*
Jevons’ Paradox

- 19th Century England
  - Coal mines were being depleted
  - Concern existed on resourcing and moving heavy materials
  - Industrial productivity was being expanded

- In 1865, the English economist William Stanley Jevons observed:
  - We were becoming more efficient
  - But we used more coal
  - Argued that, contrary to common intuition:
    - Technological improvements did not help solve resource limitations

Paradox: As efficiency improved, we used more energy
• Paradox: as energy machines became more efficient, consumers consumed more.
• Efficiency alone will not help....if energy is cheaper, people will not save, they will use more.
• Jevons’ Logical Conclusion:
  – Improved business efficiencies do not yield the complete answer
  – Government intervention and changes in culture and awareness may be necessary
• Same dynamics observed today by modern economists looking at the impact of energy efficiency on consumption rebound

The Real Challenge: Reducing consumption
Behavior changes are a force multiplier

- Needed to overcome paradox
- Value energy as a strategic resource
**Efficient Ship Systems**

Example: Solid State Lighting

- Utilizes Light Emitting Diodes (LEDs) for platform illumination
- LED lights in commercial applications:
  - Last almost 6 times longer than Incandescent and Fluorescent lights
  - Provide the same illumination requiring 25% of the energy
- Currently testing on DDG-108 and LSD-52
- Payback estimated at approximately 2 years, depending on model

**Improved Hydrodynamics**

Example: Stern Flaps and Hull Coatings

- Stern flaps are shown to have an average payback period of <1 year on FFG/CG/DDG platforms
  - Currently undergoing testing on L-class ships to
- Easy release hull coating system allows Navy ships to shed hull bio-fouling once underway
  - Reduces costly periodic hull cleanings

**DDG-51 Hybrid Electric Drive**

USS TRUXTUN Test Platform

- Land based prototype to begin testing at end of 2010
- USS TRUXTUN (DDG 103) scheduled to be first operational installation in FY12 as an afloat test platform
- Estimated fuel savings at 8,500 Bbls/ship/year
  - Fuel savings by securing LM2500 propulsion turbines at low speed while loading gas turbine electric generators to more efficient operating condition

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**Technology Change**

**Culture**
Aviation initiatives expand tactical reach by improving efficiency of existing platforms and reducing midair refuelings.
Biofuel Testing

• Tested algae based biofuel on a much larger scale
• Test was 100% successful, the craft had same performance as petroleum counterpart
• Speeds exceeded 40 knots

NAS PATUXENT RIVER
April 22, 2010

• The Navy’s F/A-18 Green Hornet, flew a maximum speed profile as part of the test and certification process
• In this successful test the aircraft achieved nearly MACH 1.2, demonstrating the viability of biofuel as an off ramp to petroleum while preserving full combat capability of the aircraft

RCB-X
October 22, 2010

MH-60
November, 2010

• First test flight to be conducted the last week of NOV 2010
• Will be flying on Camelina based biofuel
• Once asset has completed testing satisfactorily will use asset to fly for a full year on biofuel
Changing Paradigms ➔ Tactical Advantage