

Industrial Hygiene Afloat: A focus on IH concerns and responsibilities aboard a U.S. Navy Aircraft Carrier

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Industrial Hygiene Officers in the U.S. Navy

- CDR/CAPT: Policy Guidance (Pentagon; Bureau of Medicine and Surgery; Armed Forces Medical Intelligence Center; Defense Threat Reduction Agency)
- Program Direction (Navy and Marine Corps Public Health Center; Naval Safety Center; Uniformed Services Univ. of Health Sciences)
- Management of Regional IH Program Offices (Large Military Treatment Facilities [MTFs]; Environmental & Preventive Medicine Units [EPMUs])
- LT/LCDR: Research Support-Toxicology (Navy Medical Research Units)
- Fleet Support (Aircraft Carriers; Submarine Tenders; Type Commands; EPMUs; Naval Sea Systems Command; In-Service Board of Inspection)
- Marine Corps Support (Marine Air Wings and Logistics Groups)
- Industrial Maintenance Facility Support (MTFs)

Profile of an Aircraft Carrier

- Dimensions (Length: 1040 feet; Width: 252 feet; 18 decks; 100K tons)
- 4500 officers and sailors (when air wing is embarked)
 - Males and Females (mostly male)
 - 18 – 50 years of age (75% below 25)
- 185 industrial work centers; 3 aircraft hanger bays; 4 acre flight deck
- 80 aircraft (72 fixed wing and 8 rotary)
- Accompanied by 5-7 additional ships and submarines in Carrier Strike Group that provide support (i.e. refueling) and a perimeter defense
- 3-phase deployment cycle (6-8 months per phase): sea trials and pre-deployment training; deployment; maintenance availability period

Carrier Based Industrial Hygiene

- Safety Department
 - Safety Officer (CDR): Aviator; predominantly concerned with flight deck safety
 - Industrial Hygiene Officer (LT/LCDR): Manages occupational health and safety (OSH) programs; coordinates/conducts exposure assessments and OSH training; determines medical surveillance requirements; provides limited sample analysis
 - 9 Enlisted (experienced tradesman representing each major shipboard industry)
 - Serve as: Industrial Hygiene Technicians; Industrial Trade Safety SMEs; Workplace Monitors
 - 60-70 collateral duty (part time) Safety Petty Officers attached to the industrial work centers, but tasked by Safety to provide oversight, training, and feedback
- Medical Department (31 Medical Surveillance Programs)
 - > 2000 annual audiograms
 - > 1000 respirator physicals
 - Hundreds of surveillance exams for numerous chemical and physical stressors

Aircraft Carrier Industrial Operations

- Flight Operations
 - steam catapults (launch) and arresting gear (recovery)
 - Aircraft arming, fire fighting, fueling, and handling
- Power Generation
 - Two nuclear reactors powering four turbines (194 MW/each) and four shafts
 - Four 8-MW emergency diesel generators
- Aircraft Maintenance
 - Airframes, Avionics, Composite, Fuel Testing, Jet Engine Repair, and NDI Shops
- Ship Maintenance
 - Carpentry, Machine, Sheet Metal, and Welding Shops
 - Corrosion and damage control (painting, paint removal, hot work, etc.)
 - Machinery: arresting gear; fuel and water pumps; electrical generators; water evaporators; hydraulic elevators; steam catapults; propulsion and steering; ventilation systems; and, windlasses (anchors, underway replenishment, etc.)

Hazardous Materials Management

- Hazardous Materials
 - Storerooms: Segregated by chemical compatibility and ventilation, fire suppression, and spill containment requirements
 - Issue Points: Central issue (1st deck); 2 deep stock (5th/7th deck); 2 paint issue rooms (FWD/AFT); and, approximately fifty (7-day) storage lockers
- Hazardous Waste
 - Single collection point called “The Mountain” between Hanger Bay 3 and the fantail
 - Waste consolidated for offload at next suitable port visit
- Pollution Prevention
 - 2 sewage (CHT) treatment systems (FWD/AFT)
 - Recycling systems
 - OPA/OWS
 - Trash Incinerator
 - Plastic Processor

Ventilation Performance Assessments

- Hazardous Material Storerooms
- Cryogenic Plant (O₂/N₂)
- Laundry Facility
- Mechanical Shops
- Battery Charging Rooms
- Abrasive Blasting Booths
- Jet Engine Repair Shop
- Diesel Generators
- Welding and Plating Shops
- Jet Fuel Pump Rooms
- Sewage Treatment Plants
- Medical and Dental Labs
- Chemistry and Radiography Labs
- Gas Cylinder Storerooms
- Paint Booths
- Galley Hoods
- Propulsion Spaces
- Electronics Repair Shops

Exposure Monitoring

Chemical Stressors

- Heavy Metals: Beryllium; Cadmium; Hexavalent Chromium; Nickel; Lead
- Strippers: Methylene Chloride; Phenol
- Jet Engine Exhaust: Aldehydes; [Polycyclic] Aromatic Hydrocarbons; VOCs
- Minerals: Asbestos; Crystalline Silica
- Coatings: Isocyanates; Heavy Metals
- Sewage: Hydrogen Sulfide; Sulfur Dioxide
- Miscellaneous: CO; Composite Fibers; Jet and Diesel Fuels; Halogenated Gases and Solvents; Organophosphates; Phosgene; Synthetic Resins; Welding Fumes; etc.

Physical Stressors

- Hazardous Noise (SPLs up to 150 dB)
- Human Factors and Ergonomics:
 - Heat Stress (and sometimes Cold Stress)
 - Flight Deck, Catapult and Engineering Spaces; Galleys
 - Hand Vibration from using pneumatic tools
 - Heavy Lifting (equipment; ordnance; parts)
 - Repetitive Motions (Controllers; Food Prep)
 - Illumination
- Radiation
 - Non-Ionizing: ELF/radar transmitters; lasers
 - Ionizing: monitoring outside reactor spaces; radiography equipment; radionuclides
- Slips, Trips, and Falls

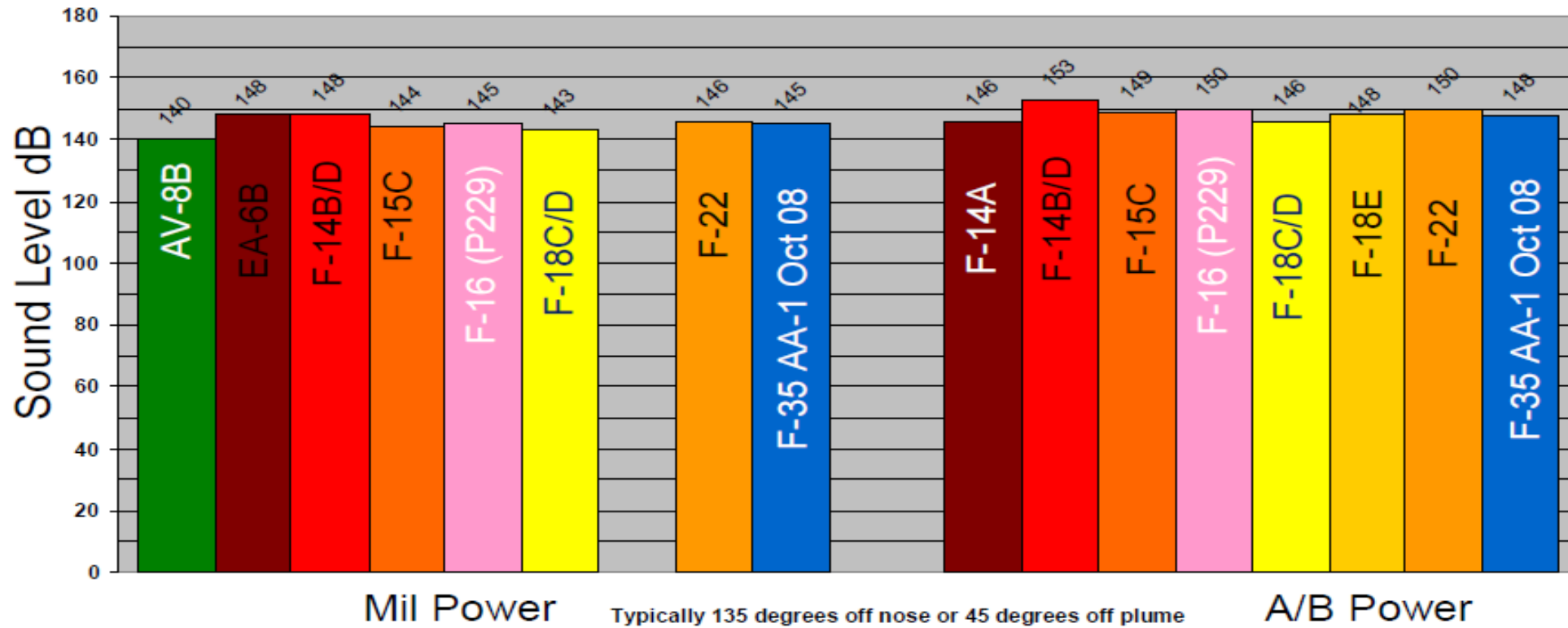
Noise

- Hearing loss is the #1 VA disability claim by Navy veterans by orders of magnitude
- 70% of crew is exposed to hazardous noise on a daily basis (≥ 85 dBA; 8-Hr TWA)
- Technology does not exist to attenuate flight deck noise below hazardous levels
- Inhalation of jet fuel vapors (ototoxicity) may increase hearing loss vulnerability
- Noise from an aircraft catapult launch can be heard six decks below the flight and is often at hazardous exposure levels deck within two decks (>50% of berthing)
- All hands enrolled in the Hearing Conservation Program
 - Annual audiograms and surveillance
 - Training and hazard communication
 - Provision of adequate PPE or to technological limits
- New R&D to mitigate exposures



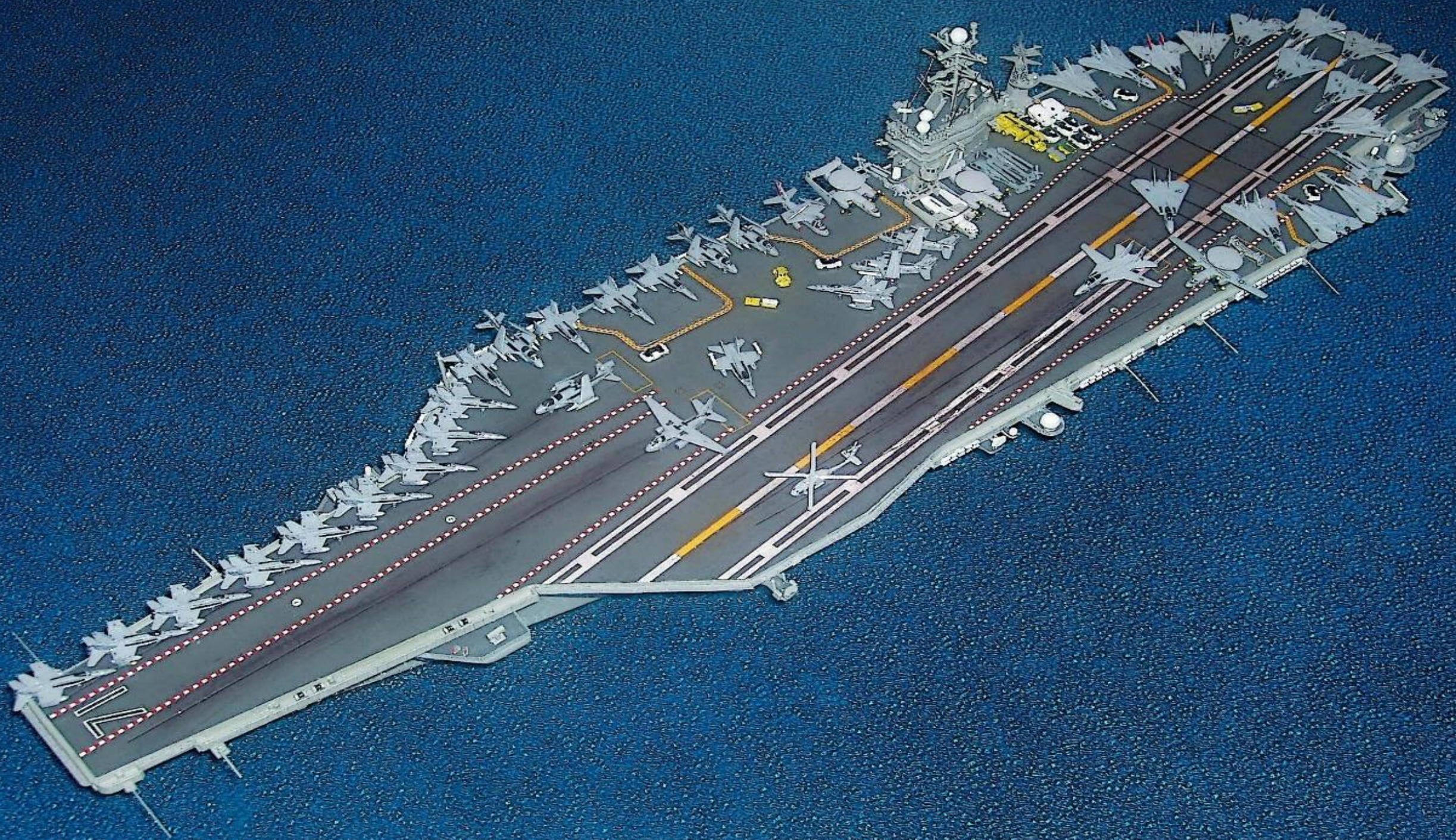
Jet Noise Levels

Best Data Available
(Source JSF Vibroacoustics IPT)



Peak Jet Noise Levels of Modern High Performance Aircraft are Fairly Consistent

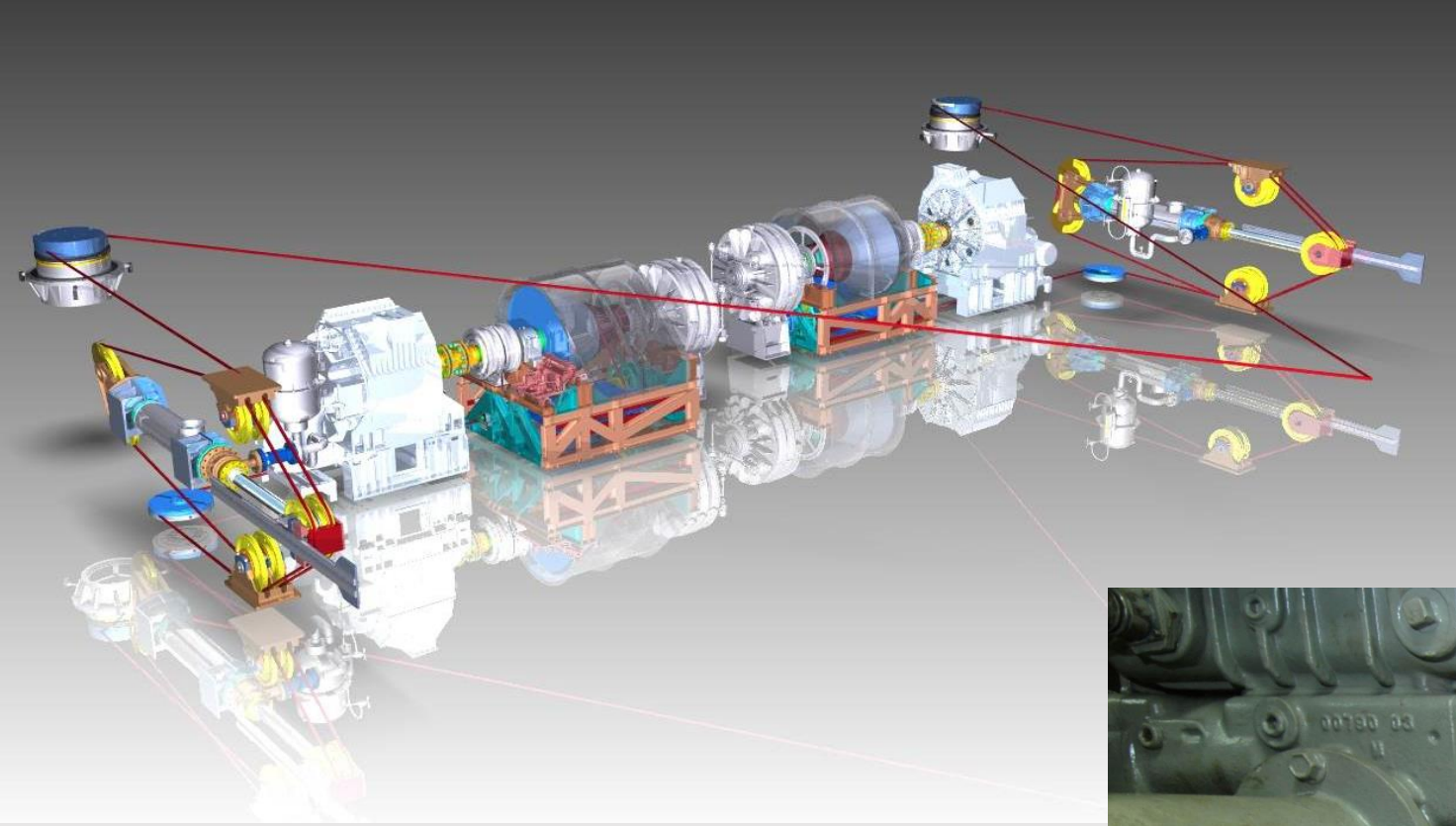










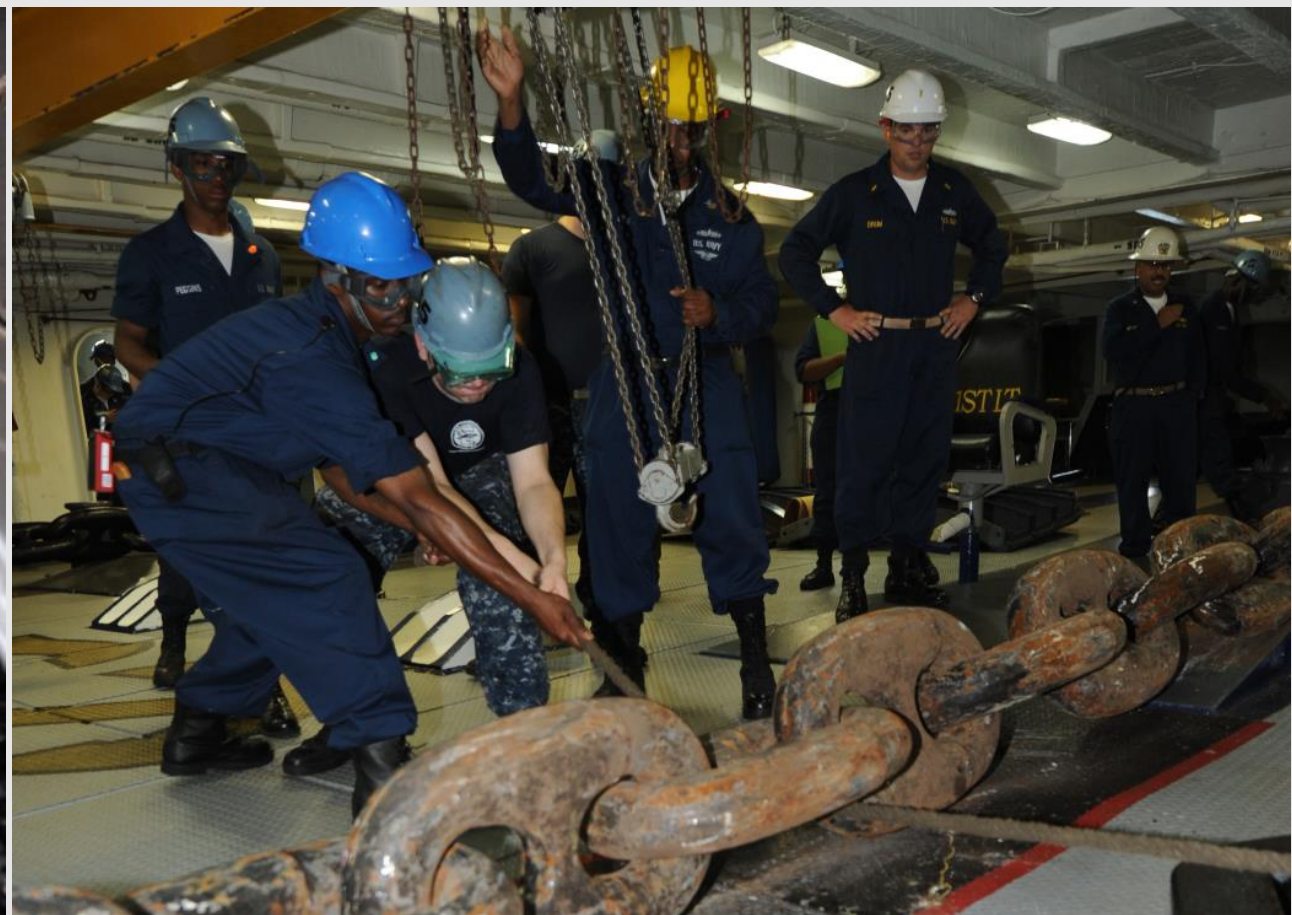


















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Questions?