Executive Overview:
U.S. Navy's Acquisition Safety Website

OPNAV Safety Liaison Office
For Questions: joy.erdman@navy.mil
http://www.safetycenter.navy.mil/acquisition

Summary

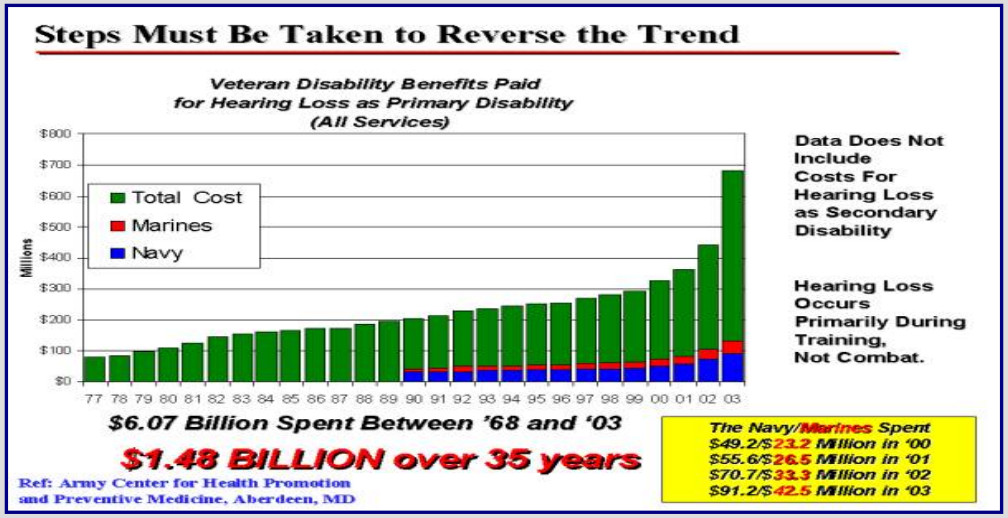
1. Acquisition Safety in Navy
2. Website: http://www.safetycenter.navy.mil/acquisition
   - Noise
   - Vibration
   - Ergonomics/Human Factors Engineering
   - Fall Protection
   - Confined Space Entry
   - Ventilation
   - Heat Stress
   - Radar
   - System Safety
   - Nanotechnology – Coming soon
   - Electrical – Coming soon
3. Summary

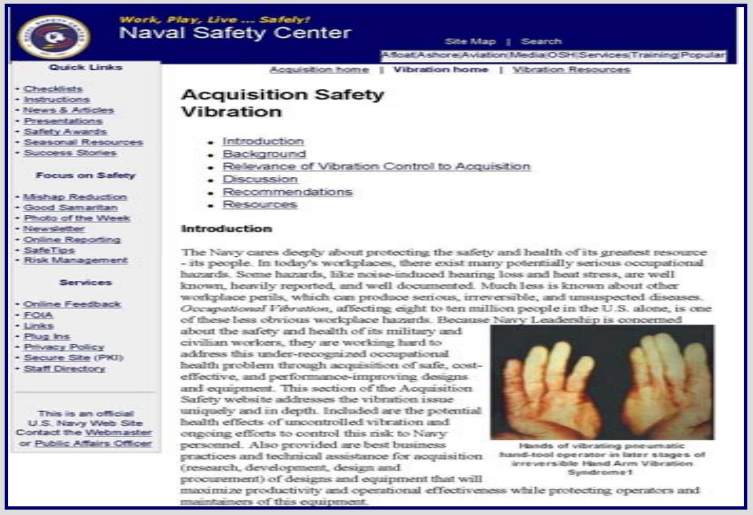
Acquisition Safety in Navy

- Goal: Save money through better design
  - Primary focus is on Ships
  - Consider construction, use, overhaul, dismantlement
  - Safety during ship use = productivity = readiness
- Tools:
  - Acquisition Safety Policy (OPNAVINST 5100.24 due out soon)
  - Performance Metrics (Disability Costs, Mishap Rates, Military Lost Time)
  - Website

- Significant safety problems really need solving
  - Describe the risks
  - Provide a compelling reason to change
    - A “Hook” in each section:
      - Noise: Increasing costs of military hearing loss ($150M/yr +)
      - Vibration: Gangrene fingers from too much vibration
- Safety is focused on the most important!

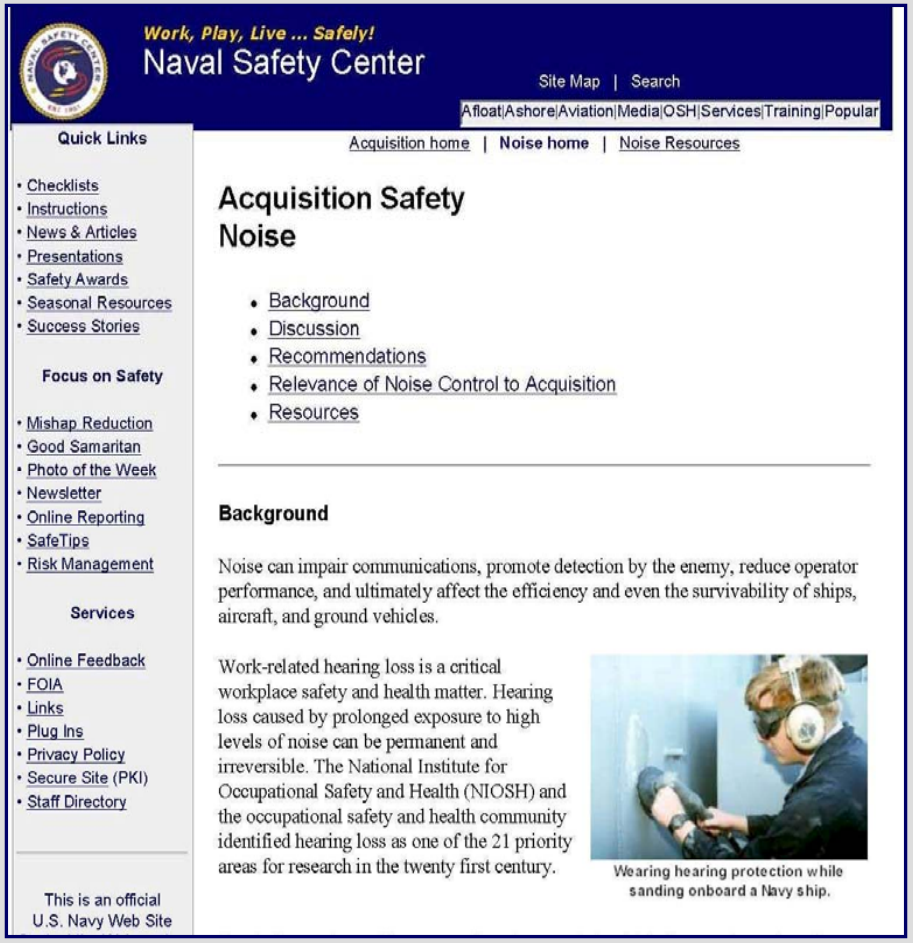
  Focus on our Top 10!!!
- Problems are solveable
  - Feasible, Cost Benefit…and compelling need





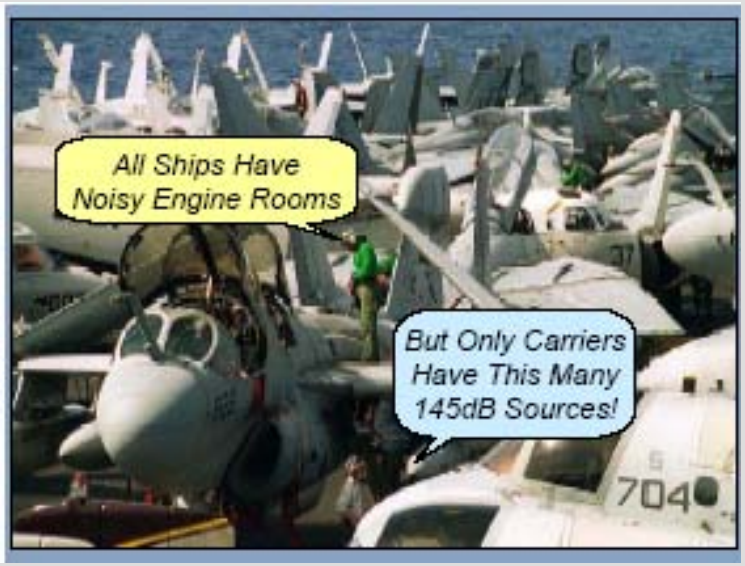
Noise – Why?

- Navy Hearing Loss to Vets is over $150M/ yr
- Negative impact to health
- Impact to readiness if can't hear important information



Noise Recommendations

- Minimize noise sources
- Select optimal sound absorbing material
- Keep people from noisiest areas
- Use acoustical engineer to maximize noise control through-out the acquisition



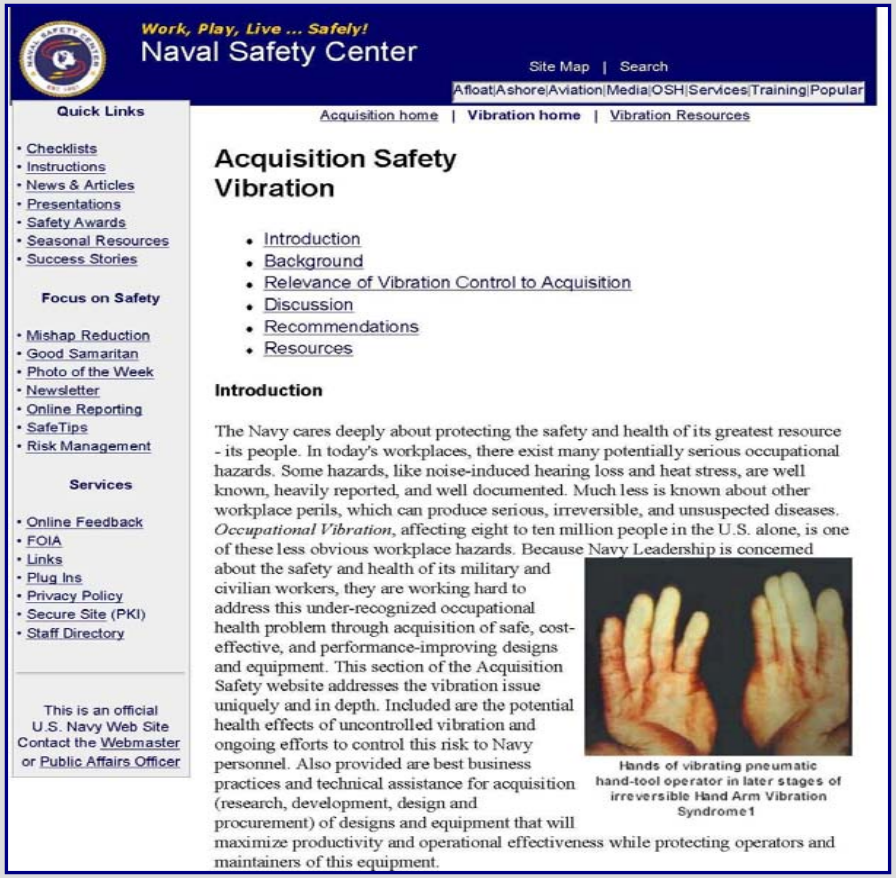
Noise

Example Web-Linked References:

- Noise Control Handbook – Excellent (good/bad designs)
- NIOSH Best Practices in Hearing Loss Prevention
- Military Handbook 2036, "Preparation of Electronic Equipment Specifications”

Vibration – Why?

- Hand Arm Vibration
  - Causes Hand Arm Vibration Syndrome
- Whole Body Vibration
  - Concentrates in lower back



Vibration

- Hand Arm Vibration
  - Hand Tools
- Whole Body Vibration
  - Trucks
  - Forklifts
  - Hovercraft
  - Aircraft
  - Ships

Rare case gangrene hands vibrating pneumatic hand-tool operator, terminal stage irreversible Hand Arm Vibration Syndrome. Copyright 1990, D.E. Wasserman, Inc.; Photo (not U.S. Navy worker) used with permission.

Full finger protected AntiVibration gloves meet ANSI//ISO standards

Whole Body Vibration can cause operator to lose control of a vehicle.

Whole Body Vibration occurs in workers who regularly operate or ride in helicopters.

Vibration

Recommendations

- Vehicles with isolating/floating cabs
- “Air Ride Seats” in vehicles
- “Air Ride Seats” in fixed workstation with floor vibration
- Isolators under machinery
- Low vibration tools

Regular exposure to WBV from heavy equipment can lead to lower back pain in equipment operators

Vibration

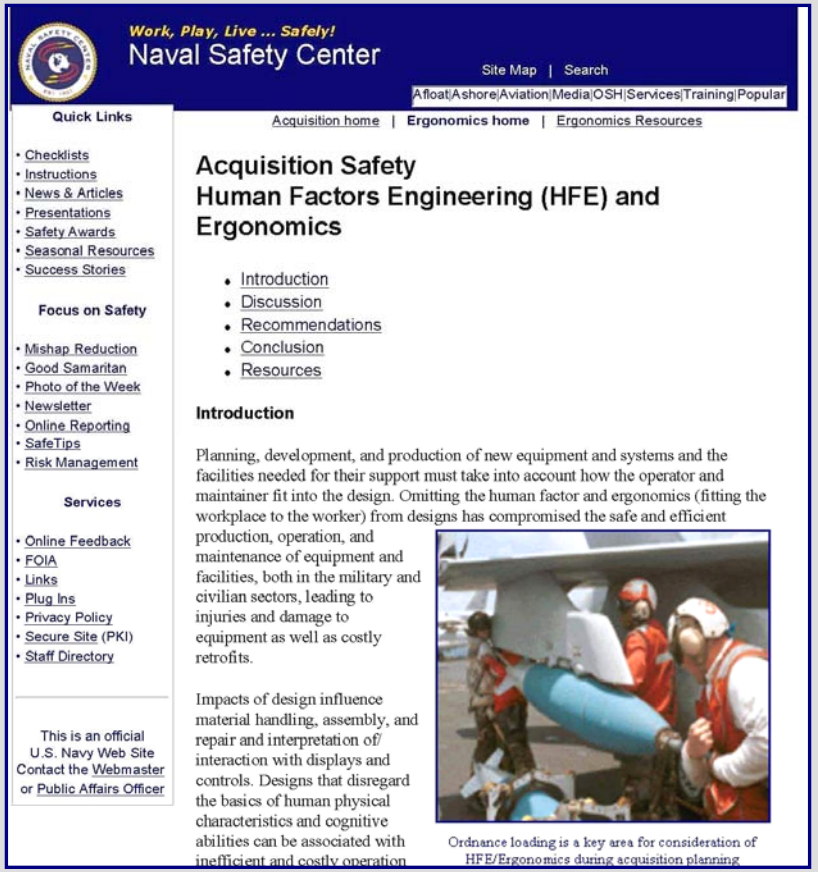
Example Web-linked References:

- NIOSH 97-141 “Musculoskeletal Disorders…”
- NIOSH #38 “Vibration Syndrome”
- NIOSH Report: “Puget Sound Shipyard’s Vibration Evaluation & Control Program”
- Standards:
  - ACGIH HAV TLV
  - ANSI S3.4o (Glove)
  - ANSI S3.34 (HAV)
  - ANSI S3.18 WBV

❑ Ergonomics/Human Factors Engineering (HFE) – Why?

- Ergonomics injuries are #1 most prevalent workplace injury in U.S. and U.S Navy
- All work processes have potential ergonomic issues:
  - Lifting
  - Carrying heavy items
  - Standing for long periods on hard surfaces
  - Working in cramped spaces
  - Using awkward postures (overreaching to work on valves, controls, etc.)
  - Overusing body because of repetitive motions
  - Poor lighting (displays & control panels)

- Ergonomically high risk operations
  - Ship construction
  - Ship operations (watch standing, maintenance ops)
  - Ship overhaul
  - Ship Dismantlement



❑ Ergonomics/HFE - Recommendations

- Design with the worker and operations in mind!
- Select correct height for range of workers:
  - Work tables
  - Counters
  - Equipment
- Avoid sharp contact points
- Provide correct lighting for tasks
  - Lower level for computers
  - Higher level for precision work
- Make controls, displays, warning signals user-friendly:
  - Automate & link to central control area
- For work areas that require extensive standing:
  - Use surfaces with anti-fatigue properties
  - Design in foot rails
  - Consider readily available sit-stand stools

Weapons department personnel push a target overboard

Flight deck crew pushes back F/A-18 *Hornet*

❑ Ergonomics/HFE - Recommendations Continued…

- Design with the worker and operations in mind!
- Position valves & controls for easy access.
- If can't position valves, design remote access
- Design to minimize lifting & carrying:
  - Optimize configuration to reduce movement
  - Provide padeyes or lifting points above ladders to allow use of pulleys.
- Replicate Cable Pulling Initiative
  - Mechanically assisted cable pulling installed
  - Reduced time and costs by 50% with 0 injuries.

Extended reaches, strain, and awkward postures can lead to WMSDs.

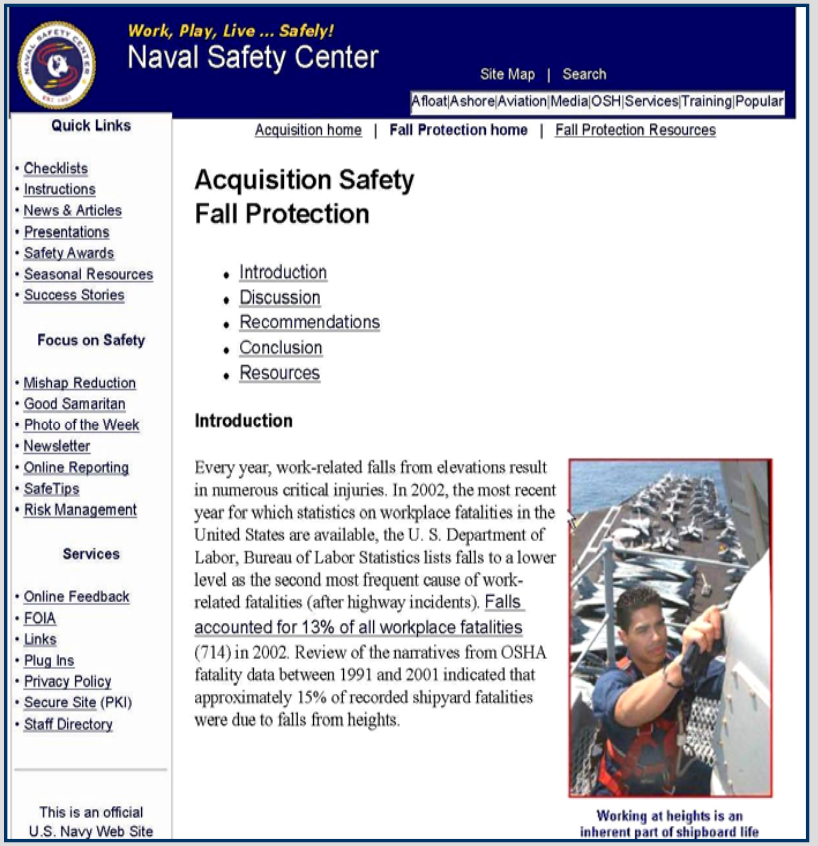
Ergonomics

Example References:

- American Bureau of Shipping (ABS) Guidance Notes for the Application of Ergonomics to Marine Systems.
- ASTM Standard F1166 Practice for Human Engineering Design for Marine Systems , Eqt & Facilities
- DoD Handbook for Human Engineering Design Guidelines Mil-HDBK 759C
- NIOSH Reports Ergonomic Solutions in Shipyards
- OSHA e-Tools:
  - Ergonomics
  - Shipyard Employment: Ship Repair
  - Construction
  - Baggage Handling
  - Beverage Delivery
  - Valves & Controls for Easy Access

Fall Protection – Why?

- Risk of falling is prevalent with ships & aircraft:
  - Scaffolds
  - Platforms
  - Auxiliary eqt.
  - Confined spaces
- Working at heights takes more time and can impair quality or frequency of the work
- Falls from heights result in:
  - Down time
  - Medical costs
  - Negative publicity
  - Costly retrofits
  - Decreased morale
  - Reduced readiness
- Cost of fall fatality estimated as $.8M – $2.4M



❑ Fall Protection

High Risk Areas:

- Ship working over the Side
- Ship working aloft (climbing masts)
- Confined Spaces, Tanks, and Voids
- Ladders
- Scaffolding
- Aircraft (maintenance)

Shipboard maintenance often means climbing masts or kingposts

❑ Fall Protection Recommendations

- Ladders: Add secure handrails at tops of ladders
  - Control Panels & Displays: Put at ground level
  - Design to minimize the need to climb
  - Hatch guards with circular openings
  - Use man lifts instead of ladders, scaffolds where possible
  - Design in deck and edge protection
  - Design good traction on working surfaces & ladders (high coefficient of friction)

Note the steep incline of ships' ladders

Fall Protection Recommendations

Continued…

- Design in safe means to raise tools & eqt to elevated work platforms (conveyors, etc.)
- Design to minimize maintenance (long life paint, etc.)
- Design in readily accessible anchorages for scaffolding and fall arrest systems
- Design for remote inspection (robots in fuel tanks, etc.)

Fall Protection

Summary:

- Eliminate need to work at height
- If must work at height, make it safer and more efficient

“Thin skinned” aircraft don’t accommodate anchorages for fall arrest gear.

Fall Protection

Example References:

- Navy Fall Protection Guide for Ashore Facilities (useful reference even though not focused on maritime)
- OSHA Maritime standards: 29 CFR 1915
- OSHA Longshoring standards 29 CFR 1918
- ANSI Z359 series Fall Protection

Confined Space Entry – Why?

- Ships and submarines are loaded with confined spaces (150 or more per vessel!)
- Confined spaces are potential death traps during construction, use, repair & overhaul, and ship salvage & dismantlement.

Confined Space Entry – Why? (Continued)

- Confined spaces can:
  - Be hard to enter & exit
  - Contain hazardous air contaminants
    - Oxygen deficient
    - Toxic
    - Flammable
    - Explosive
  - Include communication problems
  - Have fall hazards
  - And the List Goes On……
  - Be a one way trip (fatal)
- Confined spaces in tanks have additional problems monitoring fluid levels

Confined Space Entry Recommendations

- Use remote monitoring to eliminate need to enter confined space
  - Non-intrusive radar tank level indicators, mounted on outside of tank (accurate within 1” of fluid in tank).
  - Tank monitoring systems that measure tank corrosion by monitoring changes in electric potential.
    - Can do condition-based maintenance rather than time-based maintenance.
- Use automated cleaning systems to eliminate need to enter confined space
  - Use filters and external pumps to mix water in tanks and automated self-cleaning to prevent sludge build-up.
  - Use of self-propelled video inspection units, telescopic video inspection units, or telescopic valve stems to eliminate need to drain, purge, or enter since inspection is remote.

Naval Research Lab’s new Tank Monitoring System Sensor

Example of a robot inspection unit *(courtesy of Inuktun ServicesLtd)*

❑ Confined Space Entry Recommendations Continued…

- When confined space entry is necessary:
  - Provide ventilation, isolation of supply and drain lines, control of hazardous energy, ladders, anchorage, and walkways. [Anticipate the need of the worker]
  - New IMO SOLAS (Safety of Life at Sea) requirement for “permanent means of access (PMA)” to cargo and fuel storage areas. Design in safe, permanent means of access.

❑ Confined Space Entry Recommendations

Continued…

- Use Materials that Reduce Maintenance
  - Coating systems that reduce maintenance & increase service life:
    - Sea Water Tanks increase service life from 5 to 20 yr
    - CHT Tanks from 2 to 8 yr
    - Fuel Tanks from 5 to 20 yr
    - Potable Water Tanks from 5 to 20 yr
  - Use mechanical seals for pump applications that last longer and are easier to install & maintain.

Corrosion is a common problem in shipboard tanks

Confined Space Entry Recommendations

Continued…

- Improve ventilation design in and around confined spaces:
  - Locate supply air away from flammable and toxic air
  - Locate exhaust fan outlets to avoid re-circulation
  - Design ventilation to effectively and efficiently replace the contaminated air
  - Prevent diesel exhaust emissions from re-circulating into confined spaces
  - For fuel oil separators, prevent overpressure which prevents oil vapors from discharging into confined spaces

Confined Space Entry Recommendations

Continued…

- Design safe entry and exit:
  - Two hatches for worker entry plus “butterworth hole” for ventilation.
- Fall Hazard Prevention
  - Fixed ladders, platforms, guardrails, and anchor points for personal fall arrest systems.
  - NSY Puget designed device for bulkheads to accommodate a safety boot for climbing and attach anchorage point.
- Emergency Rescue
  - Big enough holds to remove the injured on a stretcher
  - Handle various stretcher types
  - Anchor points needed for high angle rescue
  - Hoisting points needed for movement of materials & equipment.

Anchor Point Assembly in training mock-up

❑ Confined Space Entry

Summary:

- Priority #1: Design with goal of eliminating need to enter confined space
  - Remote monitor, long service life, automated cleaning, etc.
- Priority #2: When must enter confined space, design for safe, efficient entry
  - Prevent contaminant incursion
  - Provide adequate ventilation, fall protection, lighting, rescue, communication, and ergonomics.
- Bottom Line: Save lives, increase productivity, save time, and reduce life cycle $.

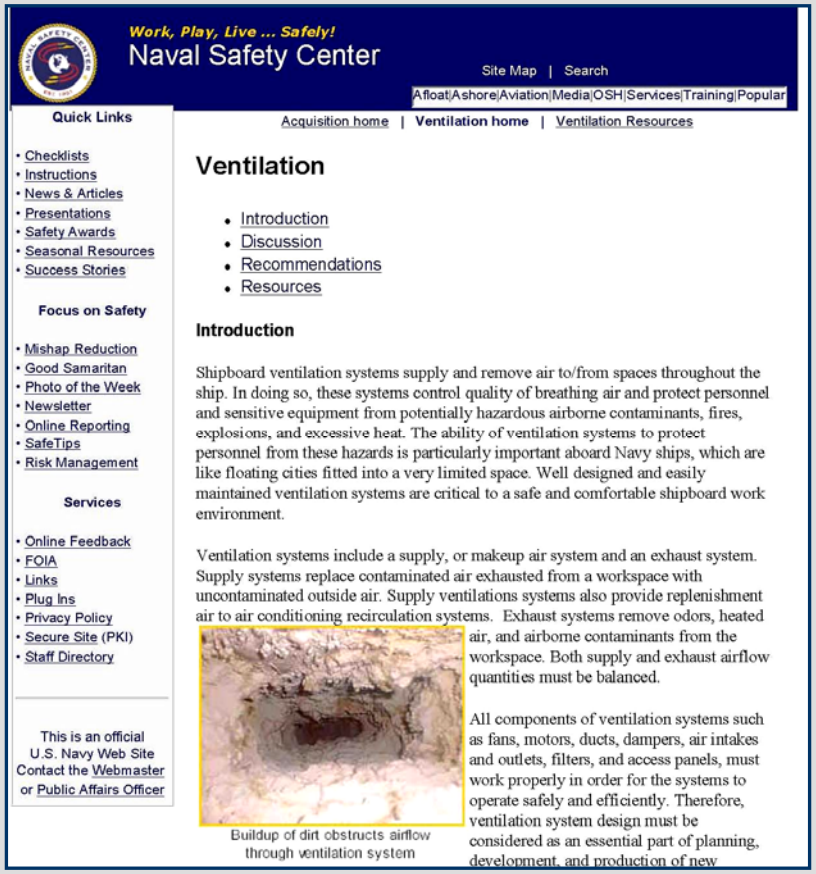
Ventilation – WHY?

- Clean, breathable air is a necessity to human life
- Clean air on ships/subs is not always optimal:
  - Construction

    Grinding, painting, sanding, welding, etc.
  - Ship Use

    Laundries, galleys, hazardous material storerooms, ventilation maintenance
  - Ship Dismantlement

    Cutting, sawing, grinding, etc.



❑ Ventilation Recommendations

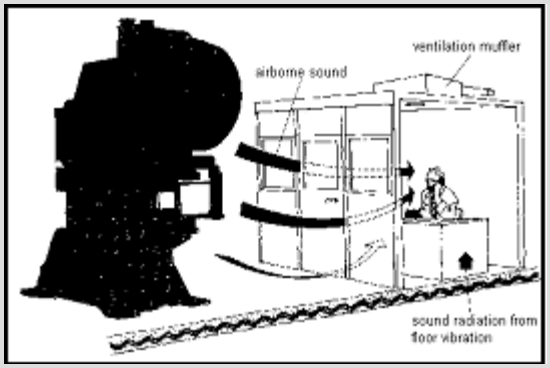
- Design in local exhaust ventilation for hazardous processes like welding & paint mixing.
- Food Service Areas:
  - Use new technology for food service to simplify & improve ventilation for heat & moisture control.
  - Use high efficiency grease interceptor hoods to eliminate heat, grease, dust, lint, and odors, which are both a fire hazard and maintenance problem. Front supply types offer cooling to the cook. UV technology can be added to break down the grease.
- Reduce ventilation corrosion problems that cost time and money by designing in moisture separators, corrosion resistant materials, and advanced coatings at the ventilation system's air intakes.

Simple ventilation systems can result from reduced amount of equipment galleys

Innovative commercial cruise ship kitchen ventilation design with grease interceptor and air hoods *(Graphic created by Halton)*

❑ Ventilation Recommendations Continued…

- Design control booths for high heat areas where workers need to be cooled, but it's unnecessary to cool the entire space (propulsion spaces).]
- Another option for high heat areas (such as watch standing ops) is spot cooling ventilation (a 'cone of air'), preferably from below, which is more comfortable.



Control booths built into shipboard spaces can provide a temperature and noise controlled environment

❑ Ventilation Recommendations Continued…

- Disposable filters are generally preferred over filters that require cleaning. They save time, make maintenance easier and are higher quality.
- Use new textile ductwork (made of NOMEX fire retardant material) to provide more even air distribution. The entire length of the duct disperses air evenly into the space, eliminating “hot” spots and “noisier” areas. Ducting can be removed and washed in a washing machine. It’s also lighter than metal.
- Above false ceilings, perforated ductwork provides even distribution to air conditioned spaces.

❑ Ventilation Recommendations Continued…

- Eliminate ventilation problems by proper ventilation system design. How?
  - Plan and design early in acquisition process
  - Use qualified Industrial Ventilation Engineers
  - Mandate use of Industrial Ventilation Manual

Ventilation

Example References:

- ACGIH Industrial Ventilation Manual
- ASHRAE Standard 26-1996
- Product Technical Information Weblinks provided for Best Technology
  - http://www.navsea.navy.mil/maintenance/Sea04M/CILabor/TextileDucting.asp
  - http://www.navsea.navy.mil/maintenance/Sea04m/CILabor/MachinerySpaceVentilation.asp
  - http://www.navsea.navy.mil/maintenance/Sea04m/CILabor/Ventilation.asp

Heat Stress – Why?

- Because heat stress is prevalent:
  - Laundries - Galleys
  - Sculleries - Weather Decks
  - Engineering Spaces
- Result is:
  - Lower performance
  - Lower morale
  - Lower mental alertness
  - Heat stroke, heat exhaustion, heat cramps, heat rash

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  - Increases risk of accident
  - Decreased readiness
  - Increases shipboard manning requirements

❑ Heat Stress

- Designers can reduce crew size by reducing heat stress conditions:
  - Prevent steam and water leaks
  - Ensure high quality insulation on steam piping, valves and machinery. Where can't insulate, paint with low emissivity paint
  - Improve ventilation design to reduce heat loss
  - Design to lower temperature & humidity as much as possible (80 degrees not 100 degrees)
    - 90 degrees & 100 % humidity – 4 hr work max
    - 80 degrees & 100% humidity – 8 hr allowed
    - Flight decks, allowable time can be less than 30 min!!
  - Provide remote monitoring outside overheated areas (Automated Heat Stress System (AHSS))
  - Plan for use storage, use of ice vests.

The Automated Heat Stress System (AHSS) measures dry bulb temperature, globe temperature and relative humidity, calculates the WBGT and displays PHEL stay times.

Fireman performs a heat index survey in the auxiliary machinery room aboard mine countermeasure ship USS Dextrous (MCM-13).

Heat Stress

- Designers can reduce crew size by reducing heat stress conditions:
  - Laundries, Galleys and Sculleries:
    - Improve ventilation design (supply and exhaust & entire system)
  - Fire-rooms, Engine Rooms, & Steam Catapult Rooms:
    - Usually not feasible to fully control temperature in the whole space
    - Prevent steam and water leaks
    - Use control booths
    - Use remote monitoring
    - Use spot cooling
  - Process to supply fresh water and boiler-feed water:
    - Instead of Flash Type Distilling Units, use Reverse Osmosis Units, which don't generate the heat
  - Weather decks and shipyards:
    - Provide protective cover from sunlight

Controlling heat and humidity in ship-board galleys presents a design challenge.

❑ Heat Stress

Successes in the Making:

- New Littoral Combat Ships and new destroyers are being designed for interior air conditioned temperatures of 78 degrees (dry bulb), 65 degrees (wet bulb) and 50% relative humidity.
  - This change will result in big payoff in terms of increased worker comfort and productivity and improved work quality.
  - Computer aided design has been added to assist ship insulation designers (Finite Element Analysis)

Heat Stress

Summary:

- Priority #1 Eliminate heat generation like the Reverse Osmosis Water system
- Priority #2 Control heat generation like better ventilation and insulation
- Priority #3 Keep workers out of heat like control rooms, remote monitoring
- Priority #4 Give workers heat reducing tools like spot cooling, ice vests.

Radio Frequency Radiation (RFR) – Why?

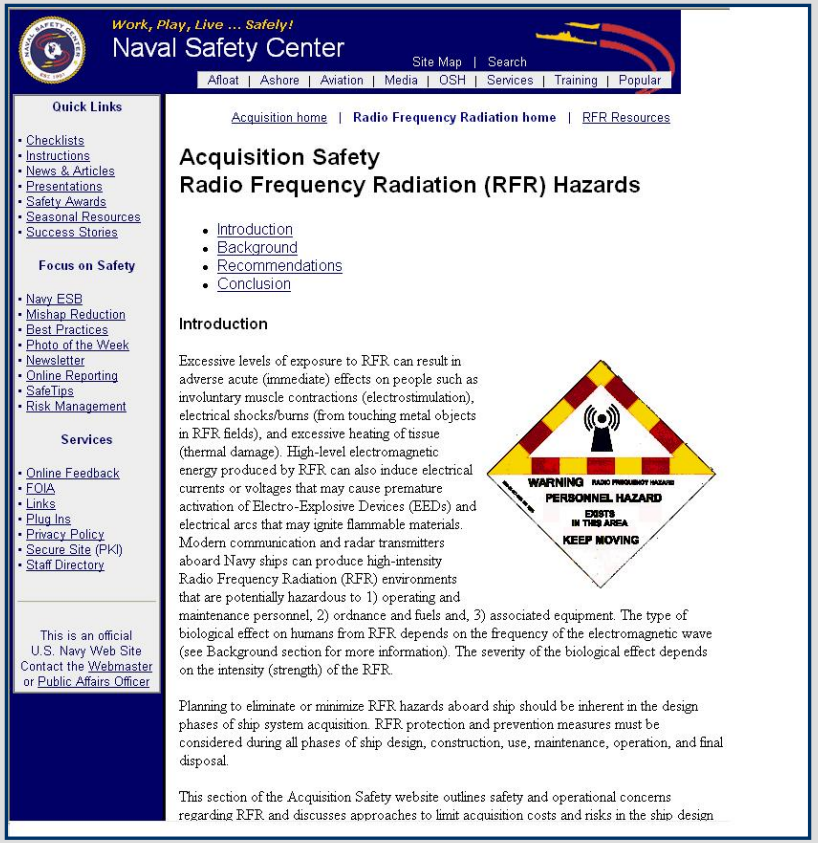
High-intensity Radio Frequency Radiation (RFR) exposure can create:

Adverse Effects to People:

- Involuntary muscle contractions
- Electrical shocks/burns
- Excessive heating of tissue

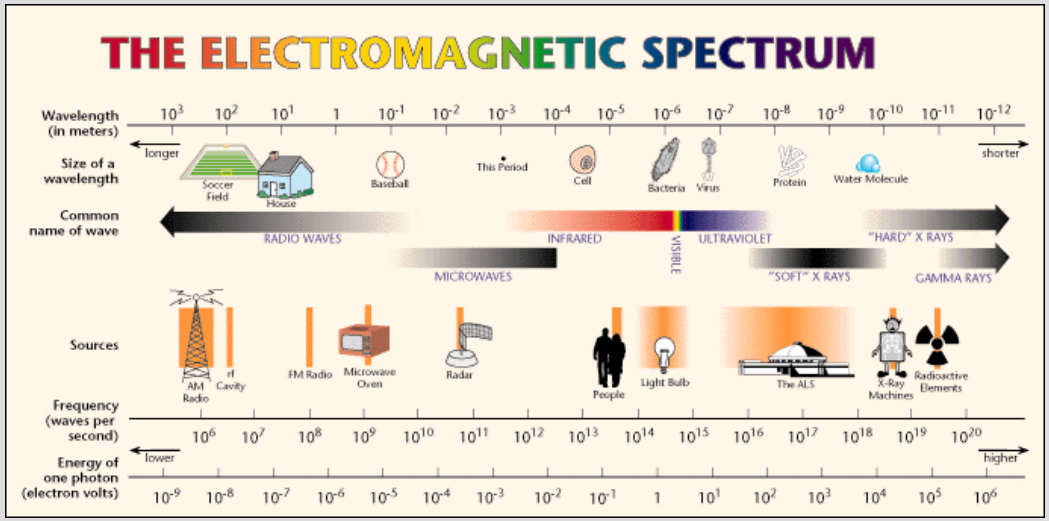
Explosive Risks to Ordnance and Fuel:

- Premature activation of Electro-Explosive Devices
- Electrical arcs that may ignite fuel vapor



Common RFR Sources

- Communication Devices
- Radar transmitters



"Radiofrequency" radiation (RFR) includes Radio waves and microwaves emitted by transmitting antennas.

RFR Recommendations:

1. Protection Methods for Navy Personnel

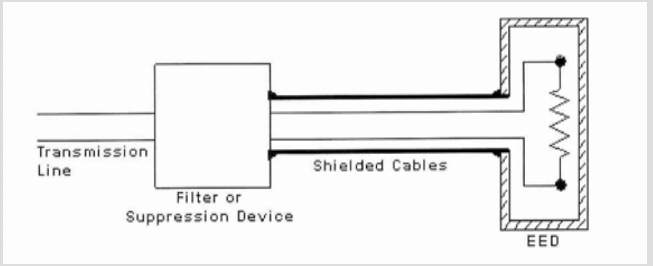
- RFR Engineering Controls
  - Use shielding material
  - Design equipment for remote operation
  - Use nonmetallic materials
  - Provide grounding and/or insulating metallic structures
  - Install safety disconnect switches
- RFR Administrative Controls
  - Establish controlled procedures
  - Identify Access Restriction/Controlled Areas

Radar and Communication Systems Aboard Navy Aircraft Carrier

RFR Recommendations:

2. Protection Methods for Ordnance

- Enclose all electrically initiated devices within a continuous electromagnetic interference shield.
- Compartmentalize the ordnance system into shielded subsystems to exclude RF energy.
- Use EMI filter to exclude electromagnetic energy from a shielded enclosure.
- Provide RF Arcing Protection.



Shielded Enclosure with an EMI Filter

RFR Recommendations:

3. Protection Methods for Fuel

- Use less volatile fuels such as JP-5.
- Introduce pressurized fueling systems on aircraft.
- Locate transmitting antennas away from fueling stations and vents.

A Marine Corps MV-22B Osprey prepares to refuel while another Osprey approaches the flight deck of the amphibious assault ship USS *Wasp* (LHD 1) for landing.

RFR:

Example References:

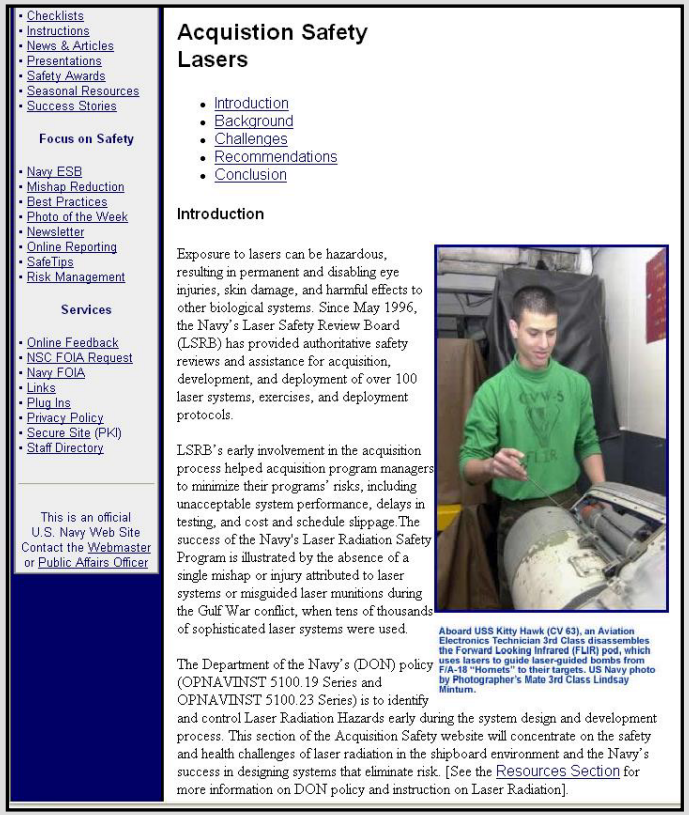
- NAVSEA OP 3565/NAVAIR 16-1-529/NAVELEX 0967-LP-624-6010/Volume I, Electromagnetic Radiation Hazards (U)(Hazards To Personnel, Fuel And Other Flammable Material) (U).
- NAVSEA OP 3565/NAVAIR 16-1-529/NAVELEX 0967-LP-624-6010/Volume II, Electromagnetic Radiation Hazards (U) (Hazards to Ordnance) (U).
- NAVSEA OD 30393, Design Principles And Practices For Controlling Hazards Of Electromagnetic Radiation To Ordnance (Hero Design Guide)
- MIL-STD-1310, Standard Practice For Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility and Safety
- Naval Shore Electronics Criteria Handbook, NSWSG 0101, 106, Electromagnetic Radiation Hazards for guidance on Hazards of Electromagnetic Radiation to Personnel (HERP), Ordnance (HERO), or Fuel (HERF) shielding.

Laser Radiation – Why?

- Laser exposure can cause:
  - Severe eye injuries
  - Skin damage
  - Harm to other organs

- The Navy Laser Radiation Safety Program resulted in 0 laser mishaps or injuries during the Gulf War conflict, when tens of thousands of sophisticated laser systems were used.

- The successful Laser Safety Program must be maintained throughout the acquisition process.



- Checklists
- Instructions
- News & Articles
- Presentations
- Safety Awards
- Seasonal Resources
- Success Stories

Focus on Safety

- Navy ESB
- Mishap Reduction
- Best Practices
- Photo of the Week
- Newsletter
- Online Reporting
- SafeTips
- Risk Management

Services

- Online Feedback
- NSC FOIA Request
- Navy FOIA
- Links
- Plug Ins
- Privacy Policy
- Secure Site (PKI)
- Staff Directory

This is an official U.S. Navy Web Site
Contact the Webmaster or Public Affairs Officer

Acquistion Safety Lasers

- Introduction
- Background
- Challenges
- Recommendations
- Conclusion

Introduction

Exposure to lasers can be hazardous, resulting in permanent and disabling eye injuries, skin damage, and harmful effects to other biological systems. Since May 1996, the Navy's Laser Safety Review Board (LSRB) has provided authoritative safety reviews and assistance for acquisition, development, and deployment of over 100 laser systems, exercises, and deployment protocols.

LSRB's early involvement in the acquisition process helped acquisition program managers to minimize their programs' risks, including unacceptable system performance, delays in testing, and cost and schedule slippage.The success of the Navy's Laser Radiation Safety Program is illustrated by the absence of a single mishap or injury attributed to laser systems or misguided laser munitions during the Gulf War conflict, when tens of thousands of sophisticated laser systems were used.

Aboard USS Kitty Hawk (CV 63), an Aviation Electronics Technician 3rd Class disassembles the Forward Looking Infrared (FLIR) pod, which uses lasers to guide laser-guided bombs from F/A-18 "Hornets" to their targets. US Navy photo by Photographer's Mate 3rd Class Lindsay Minturn.

The Department of the Navy's (DON) policy (OPNAVINST 5100.19 Series and OPNAVINST 5100.23 Series) is to identify and control Laser Radiation Hazards early during the system design and development process. This section of the Acquisition Safety website will concentrate on the safety and health challenges of laser radiation in the shipboard environment and the Navy's success in designing systems that eliminate risk. [See the Resources Section for more information on DON policy and instruction on Laser Radiation].

Laser Radiation

- Types:
  - Ultraviolet
  - Visible

  ==========
  - Laser-guided weapons
  - Laser Target identification devices
- Navy uses ANSI Z136.1-2000
- Most Laser mishaps are caused:
  - During alignment of laser beams
  - By misaligned optics
  - By lack of laser eye protection
- Mishap Root Causes:
  - Inadequate training
  - Incorrect Laser Safety Officer conduct
  - Inadequate oversight
  - Failure to wear protective equipment

Sailors assigned to the Weapons Department attach a laser guidance unit to a BLU-111 500-pound general-purpose bomb in an ammunition magazine aboard USS *Kitty Hawk* (CV 63).

❑ Laser Radiation Recommendations

- Laser Safety Design and Review:
  - Mandatory "*Laser Safety Design Requirement Checklist*" in OPNAVINST 5100.27.
  - Navy's Laser Safety Review Board reviews and approves/disapproves design of each future laser system.

❑ Laser Radiation Recommendations (cont.)

- Laser Engineering Controls include:
  - Protective Housing and Interlocks.
  - Remote Firing and Monitoring.
  - Barriers, Beam Stops/Beam Attenuators, and Enclosures.
  - Viewing Windows.
  - Service Access Panel, or requiring removal tool with appropriate warning label.
  - Master Switches (master switch may allow key or coded access (such as a computer code) to operate the laser.
  - Laser Warning Systems such as alarm/buzzer or warning light.
- Laser Administrative Controls
  - Access Restriction
  - Controlled Area

Room size protective laser housing enclosure

❑ Laser Radiation Recommendations (cont.)

Other Acquisition Laser Requirements:

- Define Laser System Safety Officer (LSSO) Roles, Responsibilities, and Training Requirements.
- Provide Appropriate Laser Safety Training and Equipment for Laser Operators/Maintainers.
- Perform Annual Laser Safety Evaluations, Inspections, and Surveys.
- Enforce Laser Safety Personal Protective Equipment
  - Eyewear
  - Skin Protection
  - Laser Event Recorder (LER)

Laser event recorder (LER) warns aviators of potential for eye injury from radiation.

❑ Laser Radiation Summary

- Laser safety design is strict: All Navy Laser Acquisitions must get approval from the Laser Safety Review Board (LSRB).
- Goal is 0 Mishaps
- Technology exists to eliminate all mishaps
- Laser Safety Training and personal protective equipment compliment laser safety design.

Aviation Electrician's mate 2nd Class maneuvers an AQS-24 mine locator, which is designed to use sonar and laser technology to photograph underwater mines.

❑ Laser

Example References:

- Laser Safety for Medical Facilities
- Medical Management of Non-Ionizing Radiation Casualties
- Protection of DoD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers
- Navy Laser Hazards Control Program
- NAVOSH Program Manual for Forces Afloat
- ANSI Z136.1-2000, Safe Use of Lasers
- ACGIH Documentation of the TLVs for Physical Agents
- US Department of Energy, Special Operation Report: Laser Safety
- OSHA Safety & Health Topics Web Page on Non Ionizing Radiation

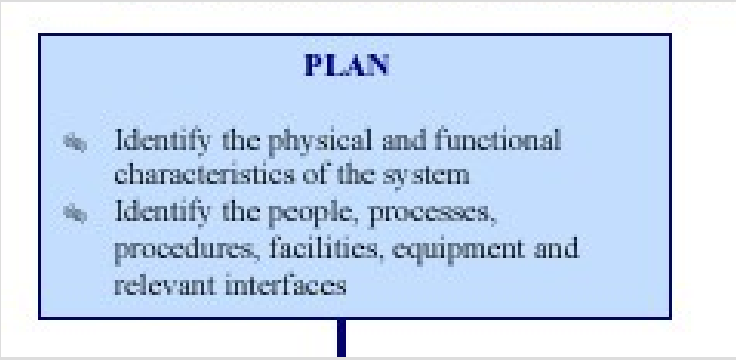
System Safety Overview

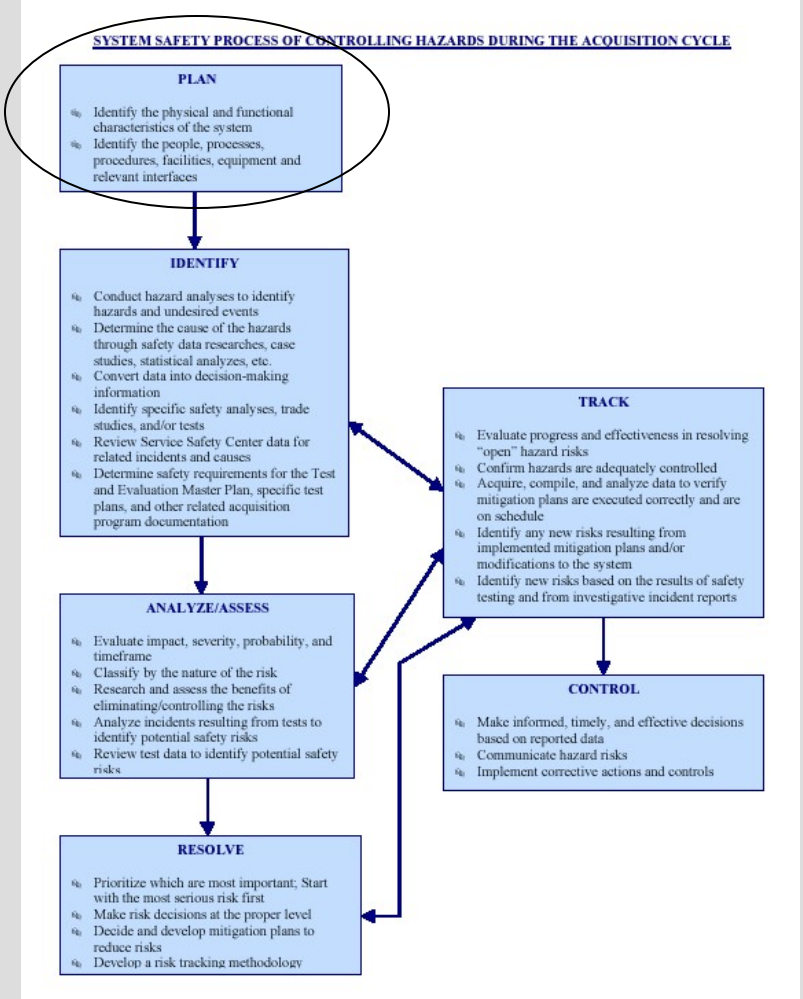
System Safety is the accepted methodology for:

- Identifying and addressing potential hazards during the design process
- Managing safety threats to program viability and cost
- Tracking and resolving potential hazards
- Reducing hazards overlooked during design process (Systems or Sub-systems already acquired)

System Safety Approach

- Safety should NOT be considered an “Add On”
  - Incorporate health and safety requirements at the beginning of the acquisition process
  - Early investment ensures reduction of Total Ownership Cost (TOC) throughout the life of the ship, aircraft, weapon system, etc.





System Safety Process

System Safety Approach

Continued

Department of Defense

- Views system safety as a means of reducing risk through early identification, analysis, elimination, and control of hazards
- Mil Std 882 (Series) specifically identifies the system safety approach
- Department of Defense Instruction (DODI 5000.2)
  - Requires that Project Managers “have a comprehensive plan for Human Systems Integration early in the acquisition process…”

System Safety Approach

Continued

- Secretary of the Navy Instruction (SECNAVINST) 5000.2C
  - States that "the program manager (PM) is accountable for accomplishing program objectives for total life-cycle systems management, including sustainment…"
- OPNAVINST 5100.24B, Navy System Safety Program Policy
  - Provides policy for implementation of system safety in Department of the Navy. Policy objectives are to eliminate or reduce associated mishap risks, improve operational readiness, reduce life cycle cost, and increase environmental, safety and occupational health for all acquisition programs, over entire program life cycle.

Program Manager's Role

- Must make safety a priority in system design
- Responsible for ensuring system safety is integral to the systems engineering process
  - Identify a government lead system safety engineer
- Prepare Programmatic Environmental, Safety, and Health Evaluation (PESHE)
  - PESHE identifies system safety, environmental and occupational health risks, how they are mitigated, and how compliance with regulatory requirements are achieved throughout the life cycle of the system

Occupational Safety & Health Professionals' Role

- Safety and Occupational Health professionals can assist the Program Manager ensure safety during design, development, and testing by means of
  - Hazard Analysis
  - Health Hazard Assessments
  - Safety Assessments
  - Risk Management

System Safety Engineer's Role

- Optimizes the acquisition process from development to disposal
  - Primary point of contact for all aspects of the system
  - Develops a system safety management approach for the acquisition program and documents the approach in the Government's System Safety Management Plan (SSMP)
  - Ensures the contractor has a System Safety Program Plan (SSPP) for development of the system
  - Establishes a System Safety Working Group (SSWG) made up of Government and contractor representatives

Summary : Acquisition Safety Improves Readiness

- Safer Ships will:
  - Help military recruiting
  - Improve military retention
  - Increase productivity
  - Improve war fighter capability
  - Provide a military competitive advantage

❑ Summary : Acquisition Safety Saves Money

During concept design -------- If it costs $1

At the final drawing stage --------- It will cost $10

As a construction modification ----- It will cost $100

During start-up and testing ------- It will cost 1,000

During maintenance phase -------- It will cost $10,000

❑ Summary : Design is the Future for Safety

Design for Safety is the cutting edge of readiness