Health Hazards and HSI Considerations for Joint Capabilities Integration and Development (JCIDS) Process

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23 October 2018 at
NDIA Systems Engineering Conference, Tampa, FL

TERMINAL LEARNING OBJECTIVE

At the conclusion of the course students will be able to:

1. Gain a deeper appreciation of how an understanding of the HSI Domains (such as **Health Hazard Assessment**) can improve the ***JCIDS document development process***.

2. Understand how **Health Hazard Assessment** fits into ***Human-Systems Integration***, and the greater Materiel Systems Development Process and Acquisition Lifecycle.

3. ***Identify the Health Hazard (HH) categories*** as they apply to the Capability Developer and System Development during normal system use.

4. Select or craft ***"HH and HSI - Improved" capability document language*** appropriate for a specific materiel solution.

5. ***Integrate HH considerations*** into the requirements process of the Acquisition Life Cycle.

Health Hazard Assessment in HSI

HSI Program Mission: Optimize total system performance, reduce life cycle costs, and minimize risk of soldier loss or injury by ensuring a systematic consideration of the impact of materiel design on Soldiers throughout the system development process.

System Safety Engineering

Human Factors Engineering

Training

Personnel

DEEP DIVE - Health Hazard Assessment

Manpower

Soldier Survivability

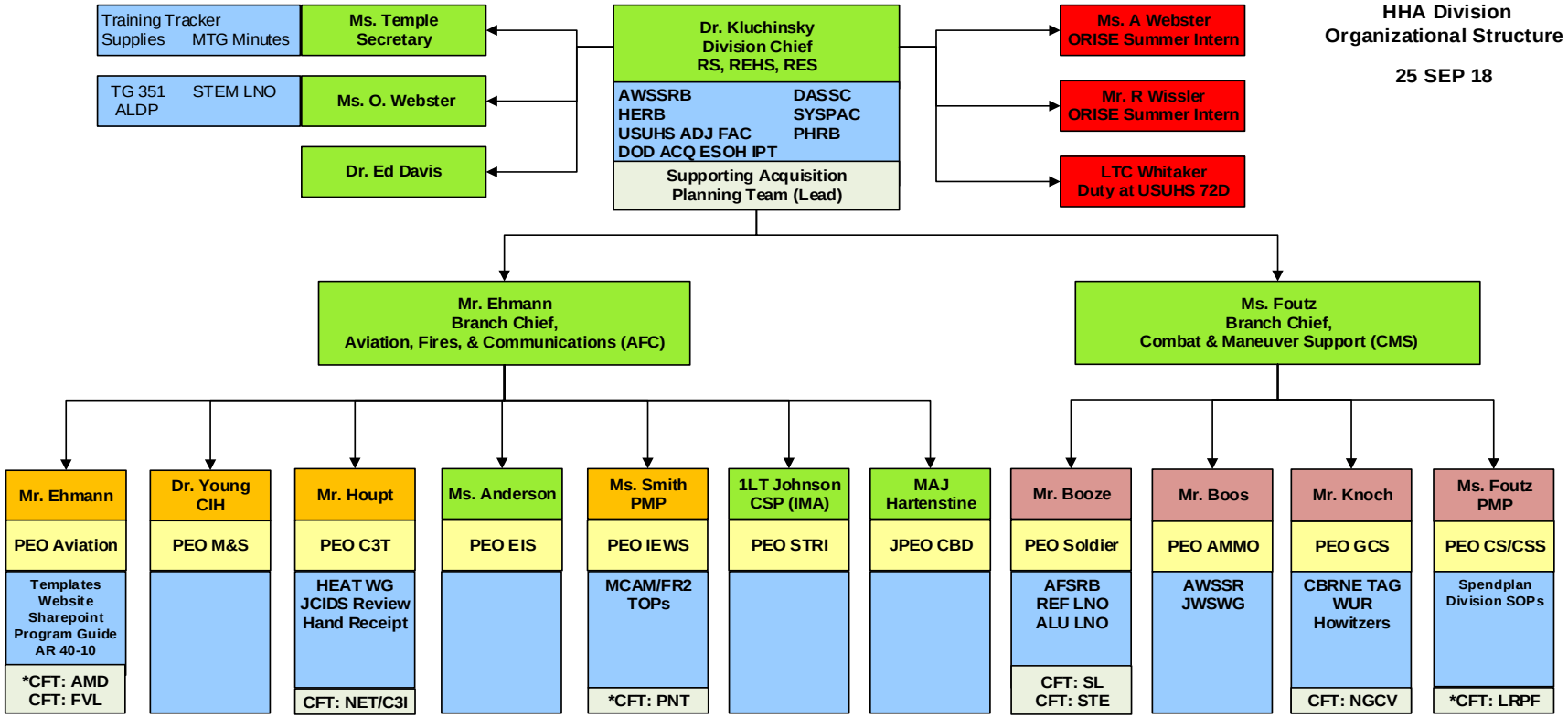
Health Hazard Assessment in HSI

Example: How different HSI Domains might look at a new High Mobility Multipurpose Wheeled Vehicle (**HMMWV**) door

- **Manpower**: Is more than one person required to operate the door?
- **Personnel**: Can the driver of the HMMWV operate the door with current skill set?
- **Training**: Is new door so complex it will require advanced aptitude and/or a new training program?
- **Human Factors Engineering**: Does "operating the door" accomplish what it was designed to do (e.g. see through the window)?
- **System Safety**: Is the door so heavy it ***accidentally*** shuts on its own and without warning, potentially injuring personnel?
- **Health Hazards**: Is the door ***designed correctly*** so that personnel can open it (once or repeatedly) without potentially causing injury ***under normal working conditions***?
- **Soldier Survivability**: Will the new door protect personnel from an attack?

APHC Organizational Structure

The Army HHA Division



AFSRB-Army Fuse Safety Review Board
ALDP-Aspiring Leader Development Program
ALU-Army Logistics University
AMCOM-Aviation and Missile Command
Ammo-Ammunition
AWSSRB-Army Weapon Systems Safety Review Board
C3T-Command Control Communications-Tactical
CBD-Chemical and Biological Defense
CECOM-Communications-Electronics Command
CIH-Certified Industrial Hygienist
CS/CSS-Combat Support/Combat Service Support
DASSC-Department of the Army System Safety Council
DOM-Division Operations Manager
EIS-Enterprise Information Systems
ESOH-Environment, Safety, and Occupational Health
FR2-Force Risk Reduction
GCS-Ground Combat Systems
HEAT-Health Hazard Assessment, Environmental Health Risk, Acquisition and Toxicology
HERB-Human Effects Review Board
HHA-Health Hazard Assessment
IEWS-Integrated Electronic Warfare Systems
IMA-Individual Mobilization Augmentee
JCIDS-Joint Capabilities Integration Development System
JM&L-Joint Munitions and Lethality
JPEO-Joint Program Executive Office
JWSWG-Joint Weapon Safety Working Group
LCMC-Life-cycle Management Command
LNO-Liaison Officer
M&S-Missiles and Space
MCAM-Medical Cost Avoidance Model
MIL-HDBK-Military Handbook
Nano-Nanotechnology
PEO-Program Executive Office
PHRB-Public Health Review Board
PMP-Project Management Professional
REF-Rapid Equipping Force
REHS-Registered Environmental Health Specialist
RS-Registered Sanitarian
STRI-Simulation, Training, and Instrumentation
SYSPAC-System Safety Policy Action Committee
JCIDS-Joint Capabilities Integration Development System
TACOM-Tank-automotive & Armaments Command
TOP-Test Operating Procedure
USUHS-Uniformed Services University of the Health Sciences
WUR-Weekly Update Report
* - Cross Functional Team (MEDCOM Lead)

- Supervised by Kluchinsky
- MANPOWER Constraint
- Additional Duties
- Supervised by Ehmann
- Supervised by Foutz
- PEO Supported
- Cross Functional Team Supported

HHA Proponent & Regulations

- **Proponent**: Army Surgeon General – Formally Designates **APHC** as "**Lead Agent**" in 1995.
- **HHA Reports are used and required by:**
  - The Program Manager (**PM**) fielding the Materiel System.
  - The Army Office of the Surgeon General (**OTSG**).
  - The **HSI** / MANPRINT community.
  - Safety Releases and Safety Confirmations in the **T&E Community**.
- **Governing Regulations:**
  - DODI 5000.02, Operation of the Defense Acquisition System.
  - AR 40-5, Preventive Medicine.
  - AR 40-10, Health Hazard Assessment Program in Support of the Army Acquisition Process.
  - AR 40-60, Army Medical Materiel Acquisition Policy.
  - AR 70-1, Army Acquisition Policy.
  - AR 385-10, The Army Safety Program
  - AR 602-2, Human Systems Integration in the System Acquisition Process.
  - AR 700-142, Type Classification, Materiel Release, Fielding, and Transfer.
- HHA Program has been operational since 1982.
- HHA Reports are kept for 30 years.

Health Hazard Assessment

Primary Objective of HHA Report: to assess and communicate potential Occupational Health Risk of a Materiel System to the Materiel Developer (PM) in order to *eliminate* or *control* the Hazards.

Process of the HHA Report:

1. *Understand Design* and *Normal-Use Scenario* of *Materiel System*,
2. *Identify* potential occupational *Health Hazards*,
3. *Test* and measure the normal extent of these hazards,
4. *Assess* T&E data against *Medical Criteria* using a *Medical Model*,
5. *Determine Risk* of a *Credible Medical Outcome* under *Normal Operating Conditions*,
6. *Provide Recommendations*.

Types of Materiel that we look at:

- ***weapon platforms***
- ***small arms and crew served weapons***
- ***ammunition***
- ***artillery and mortars***
- ***shoulder fired weapons***
- ***Army aircraft and boats***
- ***munitions and explosives***
- ***clothing and equipment***
- ***Army missiles***
- ***training devices***
- ***electronics and sensors***
- ***other materiel systems***

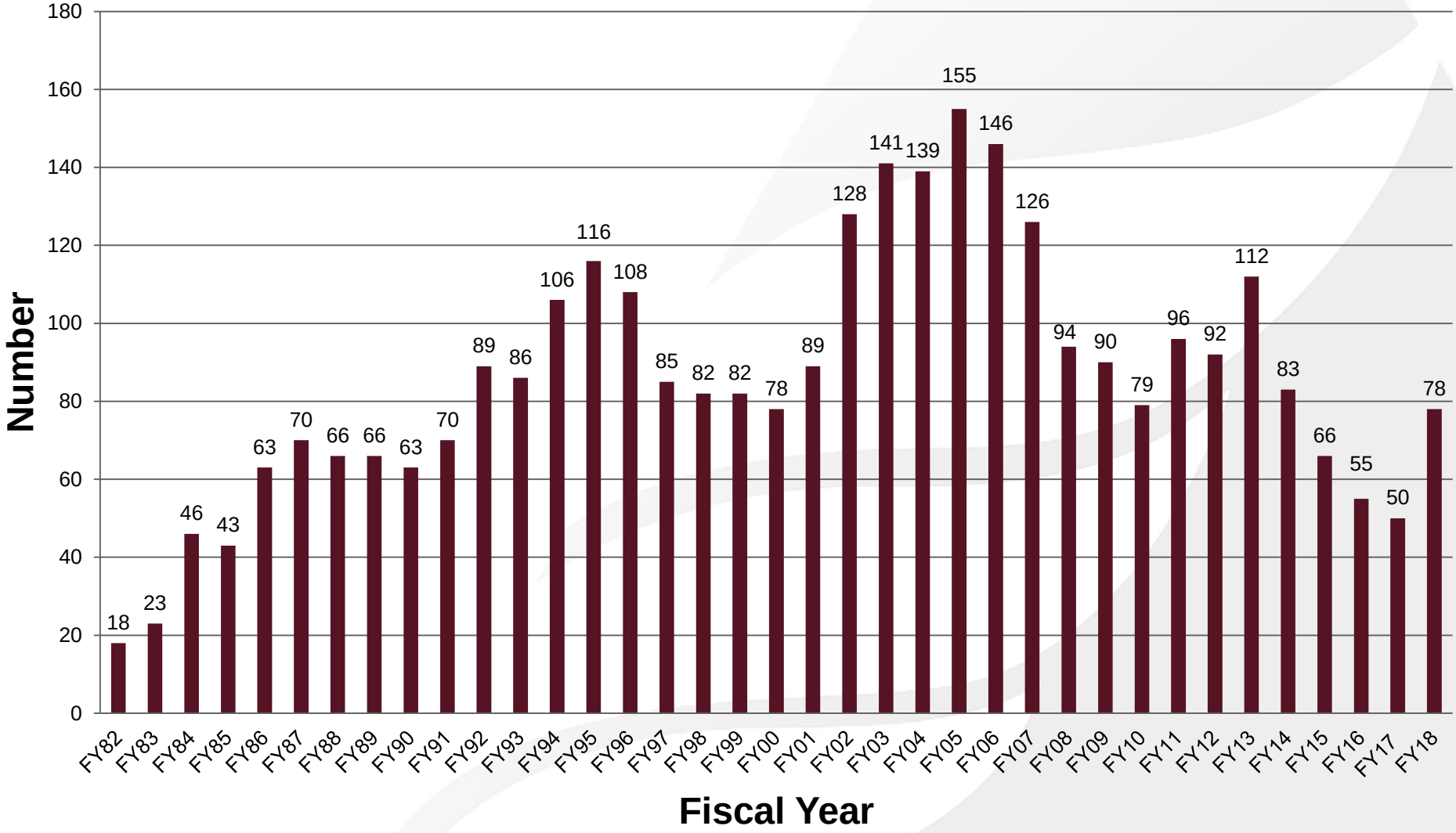
Health Hazard Assessment Reports do not address…

- System Safety Engineering
- Human Factors Engineering
- Soldier Survivability
- Environmental Issues
- System Performance/Effectiveness
- Other Services or National Guard
- System of System HH issues

Health Hazard Assessment Report

- Provides Materiel Developers (MATDEVs) and Capability Developers (CAPDEVs) an estimate of the Occupational Health (OH) **Risk associated with "normal use"**.
- ***Not*** intended to provide an **all-inclusive medical assessment** or USAMEDD approval to use an item.
- **Mishaps, accidents, or equipment failures** resulting in injuries, although sometimes health-related, do not fall within the scope of HHA (Safety).
- At the present, HHA is one of **32 Required Documents** needed for full materiel release (AR 700-142).
- **Urgent Materiel Releases (UMR) and Rapid (or Streamlined) Acquisitions** should receive HHA input and/or review.

Health Hazard Assessment Reports



Typical HSI / HHA Challenges and Trends

- Early Involvement (CAPDEV is the only person that has a real possibility of making a difference):
  - Otherwise only “admin controls and PPE.”
  - Test and Evaluation Planning and Data Requirements.
  - PM requesting HHA too late.
- Understanding System Design and Normal Use Scenario.
- Test and Evaluation Data Incorrect Format.
- Test and Evaluation Data Incomplete or Not Collected
- Calculating Probability:
  - Probability of Exposure/Mishap/Occurrence.
  - Probability of Credible Medical Outcome.
- “Total System” Activities “related” to Normal Use (maintenance, transport, personnel, training, etc.)
- Medical Models inadequate or nonexistent.
- Post-Fielding Assessments.
- Acceptance of Risk
  - Risk vs. Capability Tradeoff
  - De-Conflicting Differing Risks for Same Hazards from differing domains.
- “System of Systems”
- SOCOM – 8 more PEOs!
- Joint Service Items and Requirements.
- Rapid Fielding Items.
- Funding?
- Less hazards, but more dangerous items (e.g. autonomous and unmanned systems).
- Field Offices and Embedding?
- Evolving (new) Medical Evaluation Criteria and Models.

HH Capability Document Language Exercise

Process:

1. ***Select standard HH language*** appropriate for an ICD and CPD
2. ***Identify specific potential health hazards*** inherent in your system
3. Select additional specific ***HH language based on hazards*** identified in step 2
4. Add the specific language selected in step 3 to the standard language identified in step 2
5. Brief your HH-Improved capability document solution (ICD and CPD)

Initial Capability Document

- ICD - Concise and condensed input. ICD real estate is at a premium; therefore, a brief concise statement has a better chance of inclusion in the document.

- Place the following example of an acceptable HH ICD statement in **paragraph 6 or 7 of the ICD**:

  - "*Eliminate or mitigate health risks to ensure mission readiness, maximize operational suitability, and minimize total ownership cost of the solution so operators and maintainers can safely test, train, use, and dispose of the solution across its lifecycle in full compliance with appropriate US and host nation laws and regulations*."

  - Include "*AR 40-10, Health Hazard Assessment Program in Support of the Army Materiel Acquisition Decision Process*" in the **reference section**, Appendix B.

- Why? Places the needed traceability hooks for inclusion in CDD and CPD.

HH Considerations in Requirements Process

Why do we want HH language in the **CDD** and **CPD**?

From the JCIDS Manual: The content of the CDD is critical to development of the:

- **Systems Engineering Plan** (SEP), which documents technical performance measures necessary to achieve the KPPs, KSAs, and APAs.
- **Test and Evaluation Master Plan** (TEMP), which establishes parameters, criteria, and desired test and evaluation (T&E) strategy, and will be further refined during the EMD phase of acquisition and updated as necessary to support developmental and operational T&E.

- Ensures potential occupational health hazards are considered ***early*** in **design process** and the **T&E strategy development**

Capability Development Document

- The ***CDD is built on the ICD*** and is the next step in the JCIDS process.
- The Draft **CDD** must be prepared for **Milestone A** and finalized for **Milestone B**
- The **CDD** contains:
  - Key Performance Parameters (KPP) (HH unlikely),
  - Key System Attributes (KSA),
  - Other System Attributes,
  - Objective / Threshold Values
- HH considerations most likely found in **Section 16, "Other System Attributes"**
- ***See handout for standard language***. The CDD is more specific than the ICD. Make HH input consistent with the degree of specificity. If specific hazard categories can be identified, refer to your compliance criteria for inclusion in the CDD

Capability Production Document

- The ***CPD is built on the CDD*** and is the next step in the JCIDS process.
- The **CPD** is a required document for **Milestone C**.
- HH considerations are most likely found in **Section 15, "Other System Attributes"**
  - The HH input in the CPD should ***build on the previous HH language*** used in the CDD and provide increasing specificity and detail.
  - For example, if a new chemical is being introduced into the Army inventory, ensure language is included that specifically names the new chemical and calls out a requirement for a ***Toxicity Clearance***.
  - Based on any ***recent T&E efforts during the EMD phase of development***, include any additional known specifics when compared with the CDD, for example, the CDD may have identified ionizing radiation as a tank muzzle reference source; however subsequent designs have eliminated it; therefore it can be eliminated from the CPD
- Otherwise CPD language is very similar to CDD language

Risk Acceptance Levels per DODI 5000.02, 8 Dec 08. Risk Assessment Levels & Definitions per Tables I, II and III of MIL-STD 882E, 11 May 12.					HAZARD SEVERITY			
					Catastrophic	Critical	Marginal	Negligible
		Specific Individual Item	Fleet or Inventory		Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or monetary loss equal to or exceeding $10M.	Could result in one or more of the following: permanent partial disability, injuries or occupational illness that may result in hospitalization of at least three personnel, reversible significant environmental impact, or monetary loss equal to or exceeding $1M but less than $10M.	Could result in one or more of the following: injury or occupational illness resulting in one or more lost work day(s), reversible moderate environmental impact, or monetary loss equal to or exceeding $100K but less than $1M.	Could result in one or more of the following: injury or occupational illness not resulting in a lost work day, minimal environmental impact, or monetary loss less than $100K.
					1	2	3	4
HAZARD PROBABILITY	Frequent	Likely to occur often in the life of an item (example: $P_O \geq 10^{-1}$).	Continuously experienced	A	1-A HIGH AAE	2-A HIGH AAE	3-A SERIOUS PEO	4-A MEDIUM PM
	Probable	Will occur several times in the life of an item (example: $10^{-2} \leq P_O < 10^{-1}$).	Will occur frequently	B	1-B HIGH AAE	2-B HIGH AAE	3-B SERIOUS PEO	4-B MEDIUM PM
	Occasional	Likely to occur sometime in the life of an item (example: $10^{-3} \leq P_O < 10^{-2}$).	Will occur several times	C	1-C HIGH AAE	2-C SERIOUS PEO	3-C MEDIUM PM	4-C LOW PM
	Remote	Unlikely, but possible to occur in the life of an item. (example: $10^{-6} \leq P_O < 10^{-3}$).	Unlikely, but can reasonably be expected to occur	D	1-D SERIOUS PEO	2-D MEDIUM PM	3-D MEDIUM PM	4-D LOW PM
	Improbable	So unlikely, it can be assumed occurrence may not be experienced in the life of an item (example: $P_O < 10^{-6}$).	Unlikely to occur, but possible	E	1-E MEDIUM PM	2-E MEDIUM PM	3-E MEDIUM PM	4-E LOW PM
	Eliminated	Incapable of occurrence. This level is used when potential hazards are identified and later eliminated.		F	Eliminated			

Note: P_O = Probability of Occurrence

Specific Hazard Analysis Process

- Understand System Design and Normal Use Scenario.
- Identify Potential Hazards.
- Independent Test of the System to Measure Potential Hazards.
- Assess Materiel System for the Potential for Credible Medical Outcome.
  - Evaluate Test Data Against a Medical Standard (not a Design Standard) using a Medical Model.
    - Determine Hazard Severity,
    - Calculate Hazard Probability.
  - Determine Risk.
- Make Recommendations to Reduce Risk:
  - Design Change.
  - Administrative Controls.
  - Personal Protective Equipment.

Health Hazard Categories Addressed by the HHA Program

ACOUSTIC ENERGY
- Impulse Noise
- Blast Overpressure
- Steady-state Noise

BIOLOGICAL SUBSTANCES
- Field Sanitation & Hygiene
- Poisonous Plants & Animals

CHEMICAL SUBSTANCES

RADIATION ENERGY
- Radio Frequency/Ultrasound
- Laser/Optical Radiation
- Ionizing Radiation

SHOCK
- Rapid Acceleration/Deceleration

TRAUMA
- Sharp/Blunt Impact
- Musculoskeletal Trauma

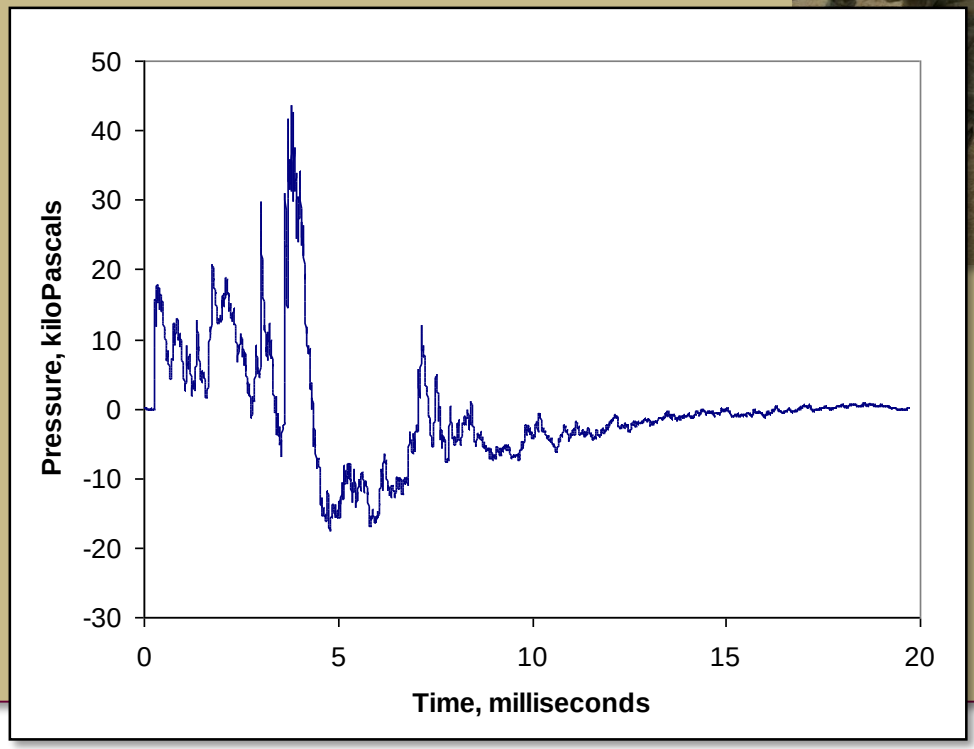
VIBRATION
- Whole-body (multiple shock)
- Segmental

TEMPERATURE EXTREMES
- Heat/Cold

OXYGEN DEFICIENCY
- High Altitude/Confined Spaces
- Ventilation

Acoustic Energy: Impulse Noise

Action Level per DA PAM 40-501/MIL STD 1474E is impulse noise at or above 140 dBP



Current HHA Criteria

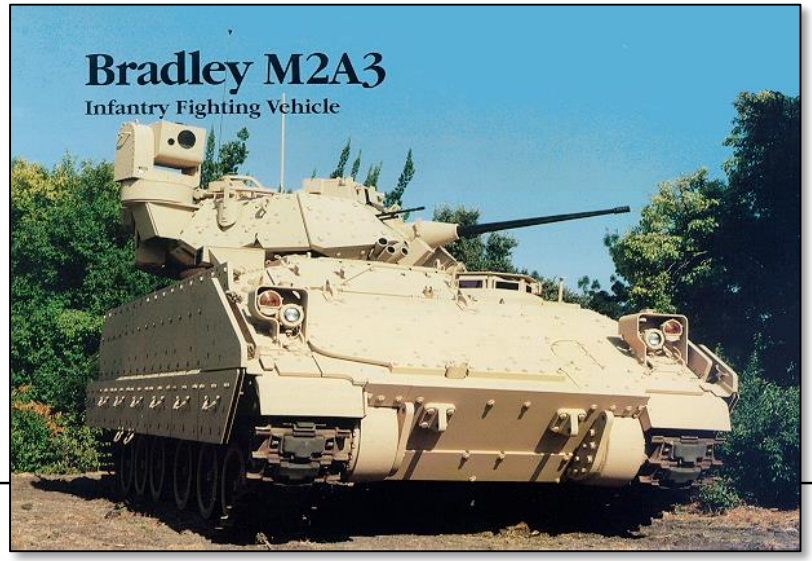
- MIL STD 1474 D has been replaced by new ***Version E*** design standard that incorporates an ear model (Auditory Hazard Assessment Algorithm for Humans - **AHAAH**) that is not yet accepted by the U.S. Army medical community.

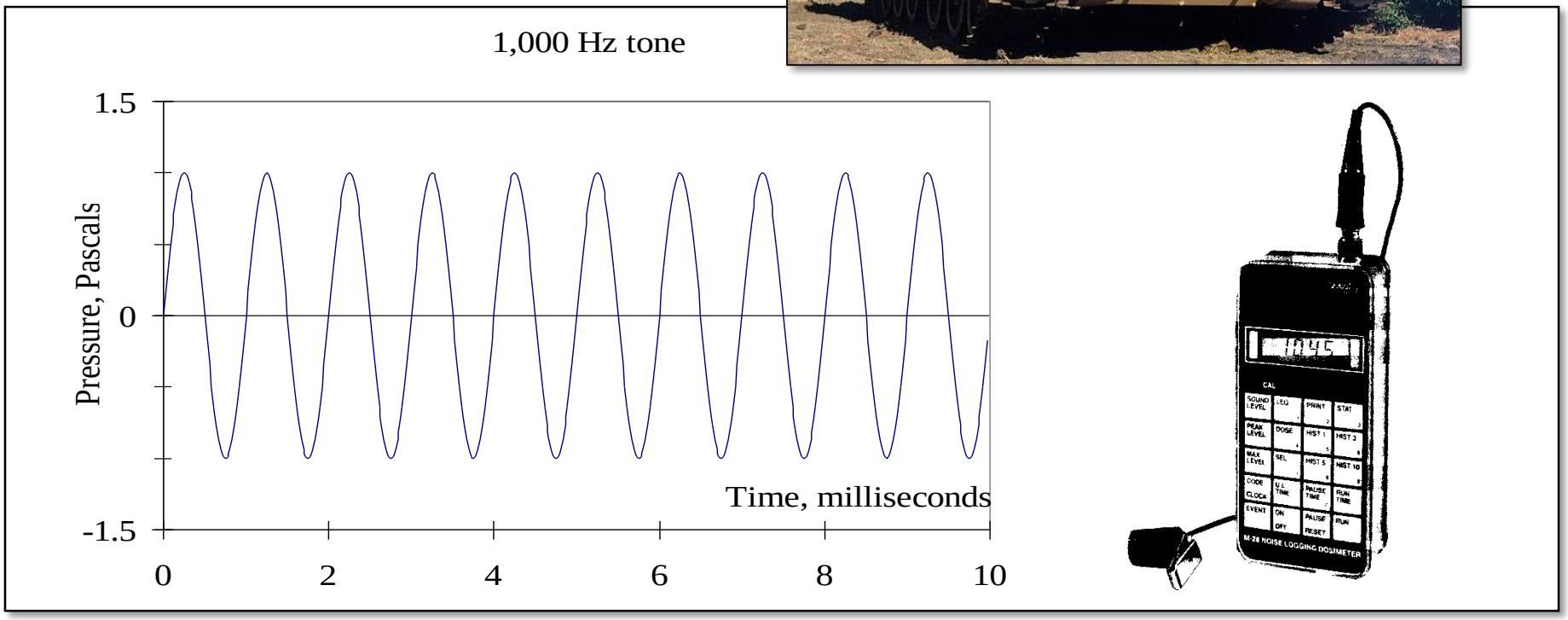
- The ***Army Hearing Conservation Program Interim Impulsive Noise Damage Risk Criterion (Interim Criterion)*** makes allowances for weapon fire made outdoors if the waveforms comply with specific requirements; updates the old MIL STD, bringing it more in line with new science findings.
- Interim criterion is modified equation for Allowed Number of Rounds from **MIL STD 1474"D"**.

- EMERGING ISSUE/SITUATION: reflections in alleyways, tunnels, caves, rooms, etc.

Acoustic Energy: Steady-state Noise

Permissible Exposure per DA PAM 40-501/MIL STD 1474E is a Time Weighted Average of 85 dBA over an 8 hour day.





Current Steady-State HHA Criteria

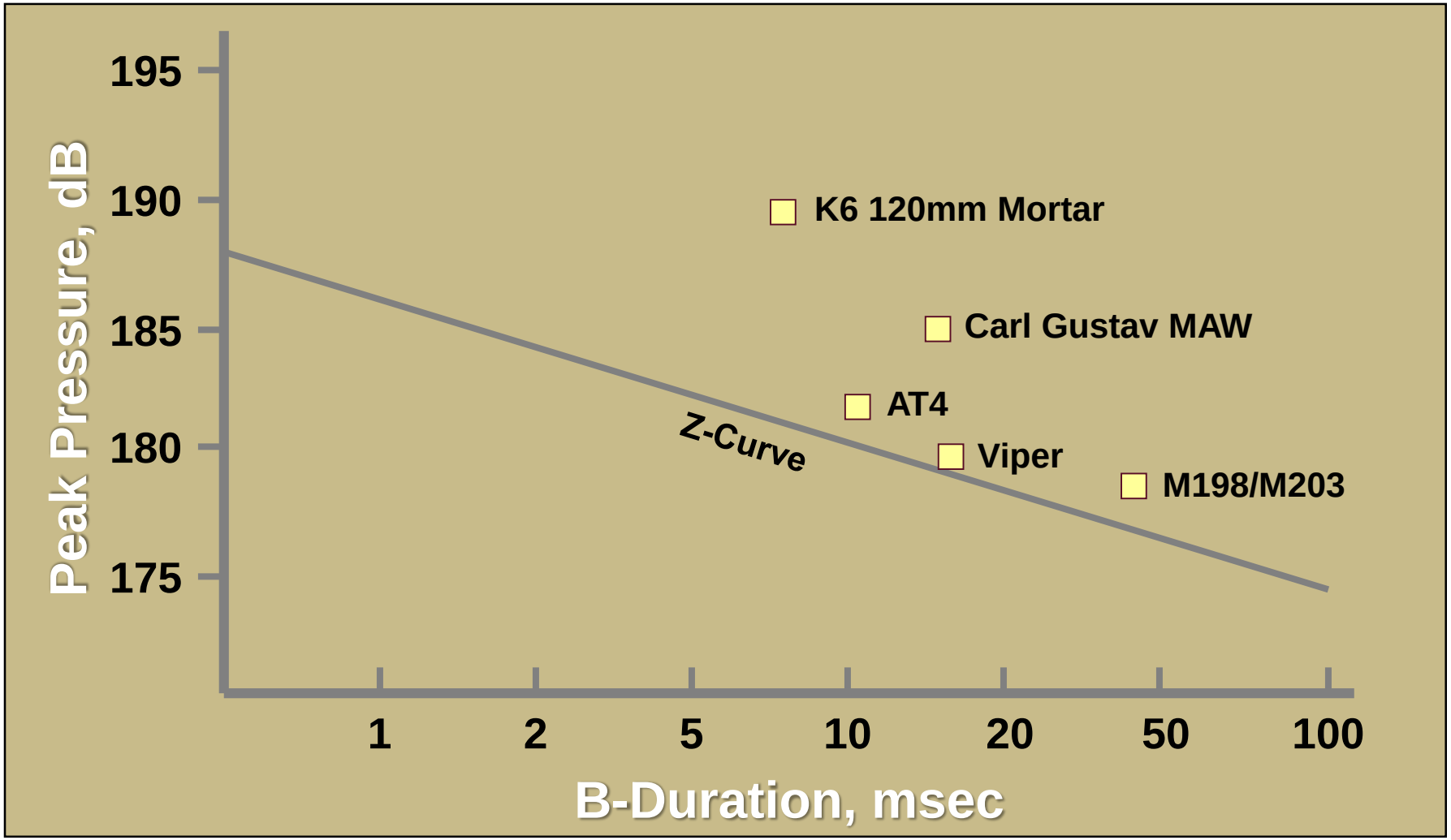
- DA PAM 40-501 and MIL STD 1474E include an action level of 85 dBA (for any length of time) and define that level as noise hazardous.
- Exposure in excess of 85 dBA require warning signs and hearing protection, but additional requirements are imposed if the TWA is 85 dBA or higher (including annual screening audiometry).
- Testing requirements are contained in MIL-STD-1474E.

Acoustic Energy: Blast overpressure

- BOP-HHA assesses occupational health risk from BOP exposures.
- Army limits occupational exposure to the number of exposures that will produce **less than 1% incidence of any lung injury with one day**.
- Data collection and format is contained in USAPHC Technical Information Paper 88-001-0411

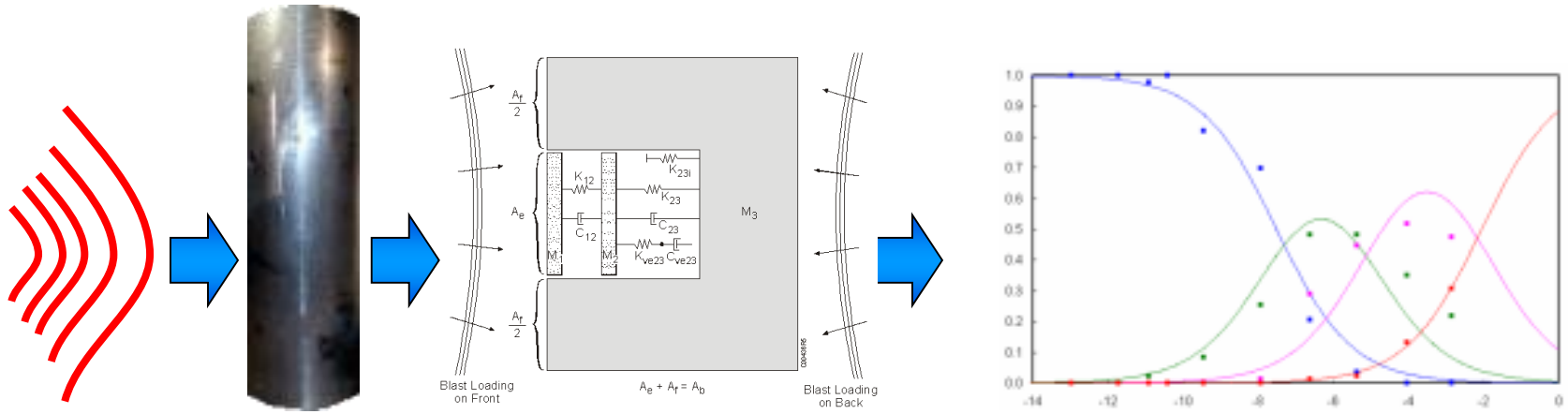
Acoustic Energy: Blast overpressure

Legacy Method to Determine Primary Threat Is Above the Z-Curve



BOP Effects of Some Weapons With Respect to Z-Curve

Development of the BOP Assessment Model



The BOP-HHA software analyzes time/pressure data from a Blast Test Device exposed to blast during a weapon test and generates injury probabilities and severities in the fashion described in AR 40-10.

Overarching Regulation is AR 40-5

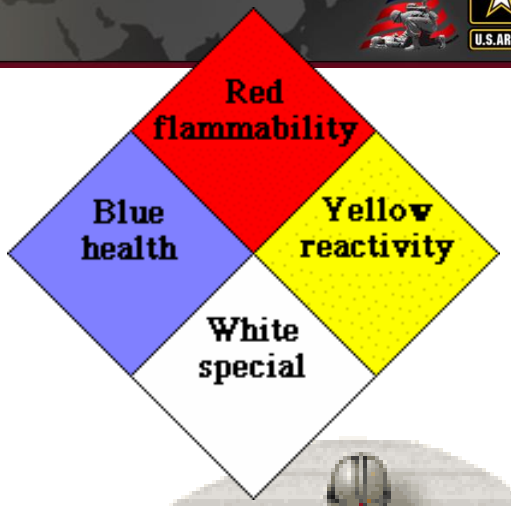
Types of hazards

- Bacteria, virus, fungus, protozoa, mold, insects

Examples:

- Food Service Sanitation
- Field Sanitation
- Water Supply Equipment
- Field Laundry
- Solid and Liquid Wastes
- Pest Control

Chemical Substances



Current HHA Criteria

- Occupational Safety and Health Administration PELs.
- American Conference of Governmental Industrial Hygienists TLVs ®.
- Military Unique Criteria.
  - MIL-STD-1472G DoD Design Criteria Standard Human Engineering.
  - NRC Committee on Toxicology Guidelines.

Chemical Testing Requirements

- Developmental Test Command: **Test Operations Procedure (TOP) 2-2-614** Toxic Hazard Tests for Vehicle and Other Equipment.
- Specialized Detailed Test Plans.

Toxicity Clearance: Definition

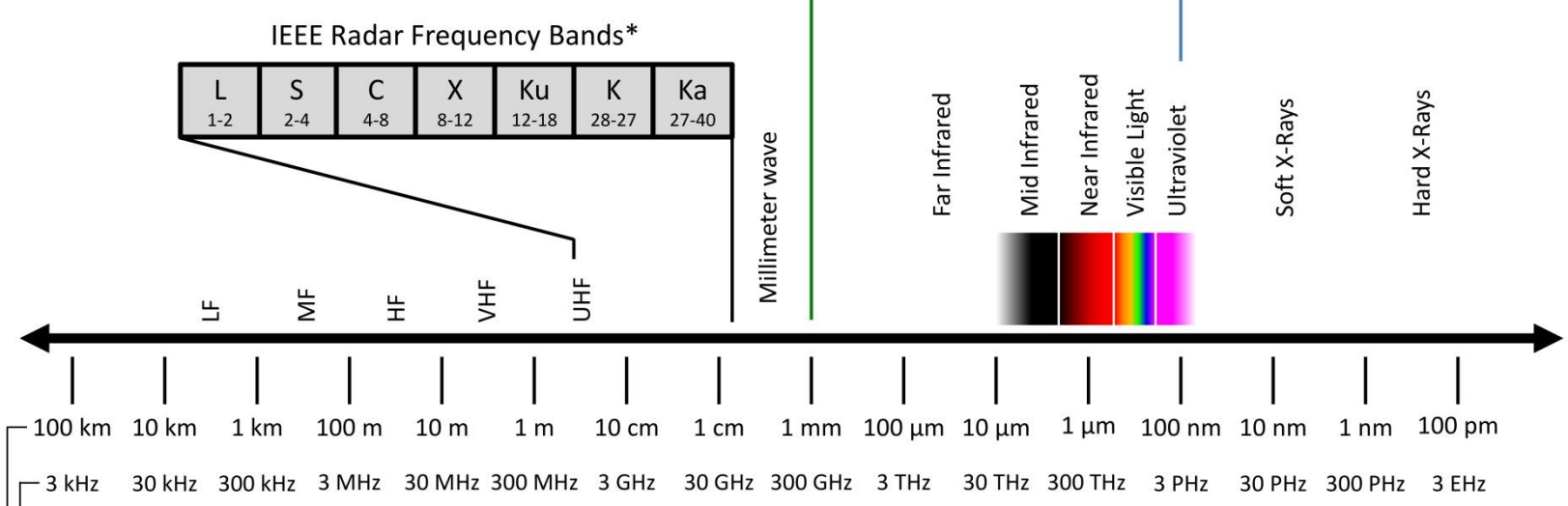
- "Process whereby a decision, from a toxicological standpoint, is formulated concerning an article or component thereof which may be introduced into the Department of Army's supply system".

- Examples: Arthropod Repellents, Protective Clothing, Solvents, Refrigerants, Fire Extinguishants, etc.

Nonionizing Radiation Electromagnetic Spectrum

Nonionizing Radiation | **Ionizing Radiation**

IEEE Band Designation*
LF: Low Frequency
MF: Medium Frequency
HF: High Frequency
VHF: Very High Frequency
UHF: Ultra High Frequency



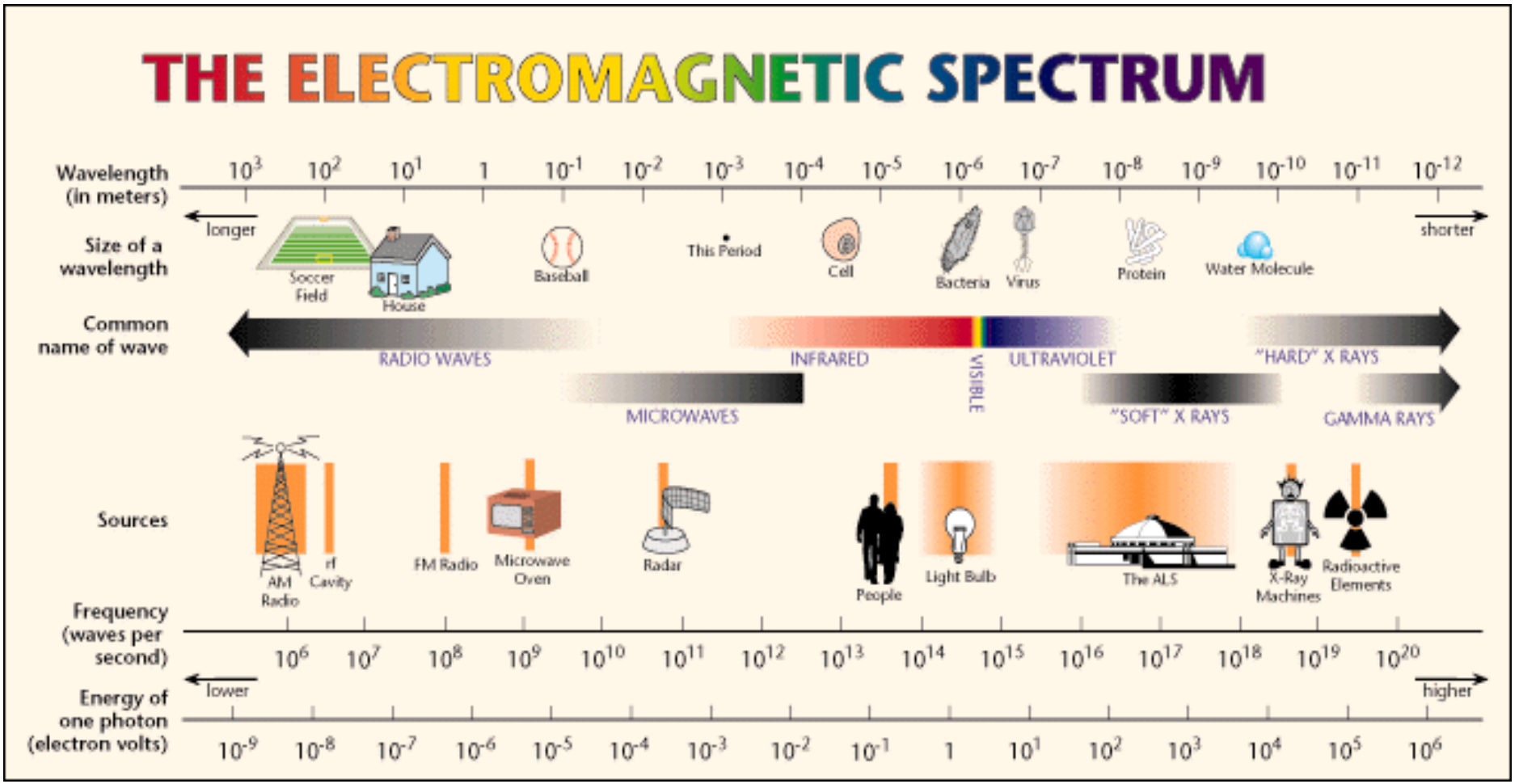
$$\lambda = \frac{c\ (^{m}/_{s})}{f\ (Hz)} = \frac{3 * 10^{8}\ (^{m}/_{s})}{f\ (Hz)}$$

c = speed of light in vacuum

Key Wavelengths:
Far Infrared: 15 µm to 1 mm
Mid Infrared: 1.4-15 µm
Near Infrared: 700-1400 nm
Visible Light: 400-700 nm
Ultraviolet: 100-400 nm

* IEEE: Institute of Electrical and Electronics Engineers

Nonionizing Radiation Electromagnetic Spectrum



Radiation Energy: Radio Frequency Sources

Radiation Energy: Radio Frequency Data Requirements

- Transmitter's Operating **Frequency** (MHz, GHz): basis for the standard, MPE in the C95.1-2005
- Transmitter Output **Power** (Watts)
  - Average power output
  - Peak power output + duty cycle
- Transmitter **Duty Cycle** (%) – Continuous Wave (100 %) or Pulsed (0 to 100 %)
- Transmission Line Length and Losses (dB/100m).
  - Worst-case assumption is that all power transmitted goes to antenna
- **Antenna Type** – dipole, parabolic reflector, monopole.
  - Coaxial Cable-fed or waveguide-based?
- Antenna Physical Size and **Gain** (dBi)

Radiation Energy: Optical (Light) Sources

UV Germicidal Disinfection lamp

High Intensity Broadband Sources like Flashlights and Search lights

High Intensity Light Sources (Pyrotechnics) and Flash-Bang Grenades

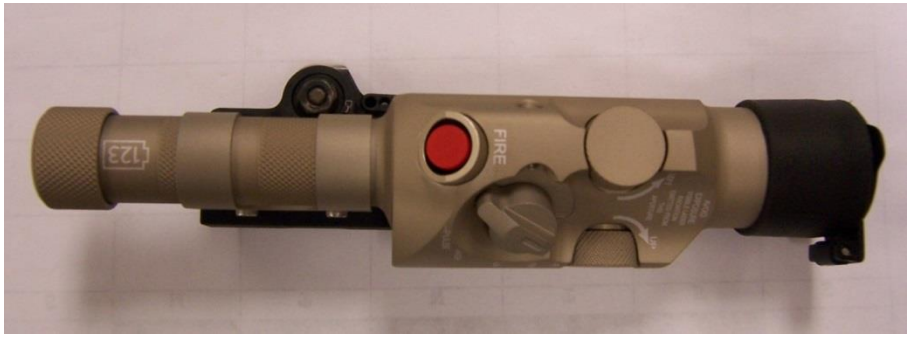
Radiation Energy: Optical Radiation Data Requirements

- The **duration** of the flash/light (duty cycle), and **exposure** to personnel
- The integrated luminance data
- The **efficacy** of radiation data (how efficient is the source at producing visible light?)
- The **integrated radiance** (total beam radiance)
- The **spectral irradiance** (wavelength-dependent)
- The source **size** (how does it illuminate the skin/cornea and image on the retina of the eye?)

Radiation Energy: Laser Radiation Sources

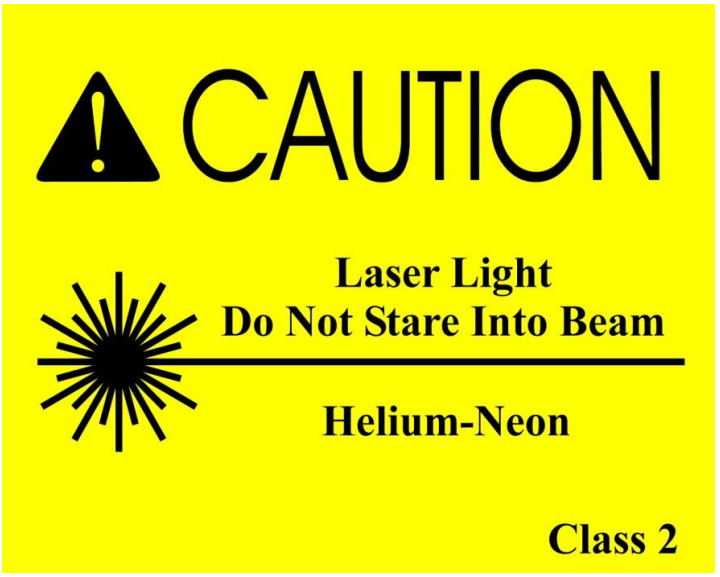
AN/PEQ-2A Rifle-mounted pointer and illuminator

High Energy Laser Mobile Demonstrator (HELMD)



Green Laser Interdiction System (GLIS)
GLARE MOUT Plus

Radiation Energy: Laser Radiation Sources

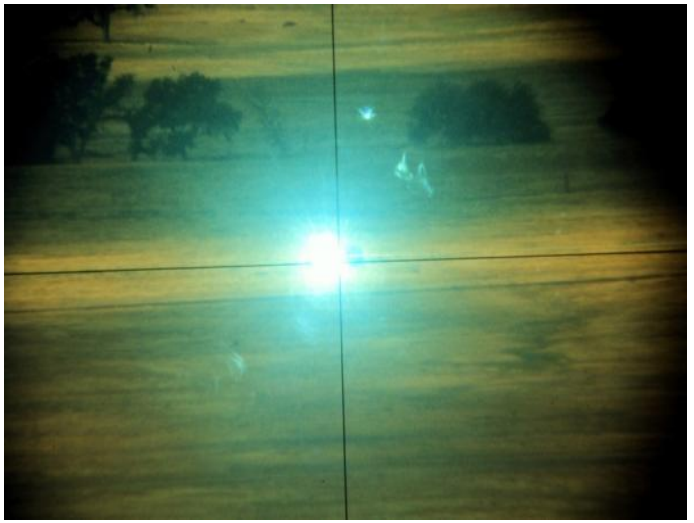


Radiation Energy: Laser Classification

- **Class 1 & 1M**
  - No hazards
  - 1M some aided viewing hazard
- **Class 2 & 2M**
  - Visible
  - Blink reflex protection
  - 2M some aided viewing hazard
- **Class 3**
  - Class 3R and 3B
  - Direct viewing hazard
  - Specular viewing hazard
- **Class 4**
  - Direct viewing hazard
  - Specular viewing hazard
  - Diffuse viewing hazard
  - Fire and plasma hazards

Radiation Energy: Laser Radiation Data Requirements

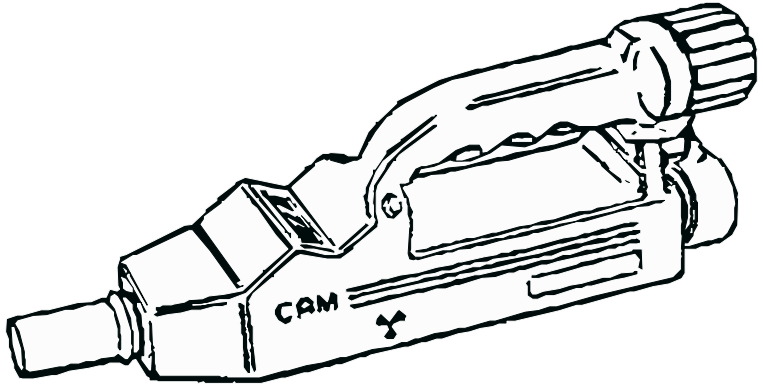
- Wavelength(s)
- Beam size and shape
- Divergence
- Exposure duration



- For pulsed lasers:
  - Total energy per pulse
  - Pulse duration
  - Pulse repetition frequency (PRF)
- For continuous wave lasers:
  - Average power output
- For extended source lasers:
  - Viewing angle subtended by the source

Ionizing Radiation Sources

- LORAD Industrial X-ray
- Chemical Agent Monitor (CAMs) - Ni-63
- Tank muzzle reference source (MRS) - H-3



Types of Ionizing Radiation

- Alpha Particles (e.g., smoke detectors).
- Beta Particles (e.g., Tritium Exit signs).
- Gamma Rays (e.g., moisture density gauge).
- X-rays (e.g., medical x-ray).
- Neutrons (e.g., nuclear fuel rods).

Trauma: Musculoskeletal

Lifting

Force

Non-neutral Posture

Repetition

Trauma: Musculoskeletal

Lifting

Force

Non-neutral Posture

Repetition

Musculoskeletal Trauma Factors

- Most common MS Trauma hazard is from lifting, lowering, pushing, pulling objects.
- Heavy objects, unbalanced loads, inadequate number of lifters, & improper handholds can lead to Soldier injury.
- Maximum design weight limits for lifting with two hands are provided in TABLE XXXVIII in MIL-STD-1472G, 5.8.6.3.1.
- Assessments require data including object weights, dimensions and vertical lift heights.

Shock

- Rapid acceleration or deceleration—the rapid delivery of mechanical impulse or impact to an individual
- Examples include parachute openings and weapon recoils
- No current medical criteria

Whole-body Vibration (WBV)

- Prolonged exposure to vehicles or equipment that exhibit vibration to the entire body can be harmful to users.
- WBV looks at adverse health effects/injury from exposure, not ride quality & performance.
- USAARL created JOLT program for APHC to assess WBV.

Segmental Vibration

- Vibration exposure to specific regions of the body, the most prevalent areas are the hands and arm.
- Segmental vibration reduces blood flow to the affected region of the body. Prolonged exposure can harm nerves and tissue.
- Triaxial accelerometers are used to collect measurements IAW procedures outlined in ANSI S2.70-2006 (R2011).
- Daily 8-hr Exposure Calculation: $A(8) = Ahv\sqrt{\sum_{i=1}^{n} A_i^2}$ (8)
  - Daily 8-hr Exposure Limit Value (DELV) is 5.0 m/sec^2, frequency weighted, vector sum measurements.
  - Daily 8-hr Exposure Action Value (DEAV) is 2.5 m/sec^2, frequency weighted, vector sum measurements.

Heat and Cold Injury

Criteria Documents

- MIL-STD-1472G
- SAE J1503
- ANSI/ASHRAE Standard 55-2013
- ACGIH TLVs

Heating and Cooling System Design

Designing systems to maximize heating & cooling distribution to minimize heat & cold injuries

Crew & Confined Space: Ventilation

- Oxygen deficiency occurs when oxygen is displaced from a confined space such as a fuel storage tank.
- Ventilation criteria for occupied spaces is found in MIL-STD-1472G.
- Inadequate ventilation may result in:
  - Death or serious illness due to oxygen deficiency.
  - Death or serious due to exposure to chemical substances such as carbon monoxide.
  - Reduction of crew efficiency due to decreased oxygen levels and/or increasing carbon dioxide levels.

Crew & Confined Space: Ventilation

- A typical ventilation problem is the inability to adequately remove engine or weapon combustion products resulting in a chemical exposure.
  - A prime example is an armored vehicle with an open breech weapon and insufficient ventilation to adequately exhaust weapon combustion products.
  - Direct effects on insufficient ventilation include elevated levels of carbon monoxide and low levels of oxygen (less than 19.5%).

Questions?

Back Up & Reference Slides

Version 5.4 15 June 2010

Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System

DoD Decision Support Systems Effective Interaction is Essential

Following the Materiel Development Decision, the Milestone Decision Authority may authorize entry into the acquisition process at any point, consistent with phase-specific entrance criteria and statutory requirements

This chart is a classroom aid for Defense Acquisition University students. It provides a notional illustration of interfaces among three major decision support systems used to develop, produce and field a weapon system for national defense. Defense acquisition is a complex process with many more activities than shown here and many concurrent activities that cannot be displayed on a two-dimensional chart. Supporting information is on back of this chart. For more information, see the Defense Acquisition Portal (http://dap.dau.mil).

Materiel Solution Analysis Phase

Complete Analysis of Alternatives to assess potential materiel solutions to capability need, identify key technologies and estimate life cycle costs. Consider commercial-off-the-shelf and solutions from both large and small business. Identify materiel solution to capability need. Complete Technology Development Strategy.

Technology Development Phase

Reduce technology risk, determine and mature appropriate set of technologies to integrate into full system, demonstrate critical technology elements on prototypes, and complete preliminary design. Identify an affordable program or increment of militarily useful capability, demonstrate technology in relevant environment, and identify and assess manufacturing risks. Provide for two or more competing teams producing prototypes of system and/or key system elements prior to or through Milestone B.

Engineering & Manufacturing Development Phase

Develop a system or increment of capability; complete full system integration, develop affordable and executable manufacturing process; ensure operational supportability; reduce logistics footprint; implement human systems integration; design for producibility; ensure affordability; protect critical program information; and demonstrate system integration, interoperability, safety, and utility.

Production & Deployment Phase

Achieve operational capability that satisfies mission needs. Low-rate initial production (limited deployment for software intensive systems with no development hardware) and full-rate production (full deployment for software intensive systems). Deliver fully funded quantity of systems and supporting material and services for program or increment to users.

Operations & Support Phase

Execute support program that meets material readiness and operational support performance requirements and sustains system in most cost-effective manner. Overlaps Production and Deployment Phase.

Decision Points/Milestones: MDD | MS A | MS B | Post-CDR A | MS C | FRP DR | IOC | FOC | Disposal

Integrated System Design | System Capability & Manufacturing Process Demonstration | Low-Rate Initial Production | Full-Rate Production/Deployment | Life Cycle Sustainment

Joint Capabilities Integration & Development System (need-driven)

Strategic Guidance | Joint Operations Concepts | Capabilities-Based Assessment | ICD | DCR

Initiate Evolutionary Acquisition Strategy | Evolutionary Acquisition Strategy

Increment 2 | Increment 3

Total Life Cycle Systems Management

Oversight & Review

DAB/ITAB | MDA | ADM | Exit Criteria | FSR | TLCSM | AoA Study Guidance | AoA Study Plan | AoA

Contracting

Study Contracts | Acq Plan | Source Selection Plan | Draft RFP | RFP & Proposals | Source Selection | Contract Management | ECPs/Changes | Contract Closeout | IBR | EVM Surveillance

Major Products

Alternative Materiel Solutions | Materiel Solution | Prototypes | System Performance Spec | Prototypes | Initial Product Baseline | Production Representative Articles | Initial Product Baseline (verified) | Low-Rate Initial Production Systems | Final Product Baseline | Full-Rate Production Systems

Logistics/ Sustainment

Define Supportability Objectives | Evaluate Product Support Capabilities | Refine Supportability Objectives/ Constraints | Develop Initial Product Support Strategy | Initiate Product Support BCA (Define Ground Rules & Assumptions) | Set Product Support Strategy | Product Support Plan | Demonstrate Product Support Capability | Product Support Package/PBL Implementation | Product Support/PBL Management | Operations and Sustainment

Post-CDR A | Performance-Based Logistics (PBL) Strategy | Pre-IOC and Post IOC Supportability Assessments

Defense Acquisition System (event-driven)

MDD | A | B | C | FRP DR

INPUTS | OUTPUTS

Technical Systems Engineering Test and Evaluation Supportability

ITR | ASR | SRR | SFR | PDR | CDR | TRR | FMECA | CLA | RCM | LORA | MTA | FCA | PCA | SVR | PRR | IOT&E | FOT&E | LFT&E | OTRR | AOTR | Full-Up System Level LFT&E | Joint Interoperability Certification Testing | MTC Joint Interoperability Test Certification

Financial Management

Cost Estimation Methods: Parametric | Analogy | Engineering | Actual Costs

Types of Funds: RDT&E – Advanced Technology Development | RDT&E – Advanced Component Development and Prototypes | RDT&E – Systems Development & Demonstration | RDT&E – Management & Support | Procurement | Operations and Maintenance

PMO POM Input | PMO Budget Estimate

Economic Analysis (MAIS) | Manpower Estimate (MDAP) | CARD | CCE | CCP | ICE | Affordability Assessment | MDAP/MAIS | MDAP | MAIS Phase Fully Funded | TD Phase Fully Funded | Full Funding 1x FYDP

Appropriated Funds To Support Contracts

Planning, Programming, Budgeting & Execution Process (annual-calendar-driven)

Military Departments and Defense Agencies | Office of the Secretary of Defense and Joint Staff | White House

POM/Budget Formulation | POM/Budget Submit | July | Defense Planning & Programming Guidance | Fiscal Guidance | April | Fiscal Guidance | March | National Military Strategy | National Defense Strategy | National Security Strategy | National Strategy Documents (updated as necessary) | FYDP updated | Issue Nominations/Disposition | Integrated Program/Budget Review | August - November | Decisions | November | SECDEF Option | MBI | December | DoD Budget | OMB | January | President's Budget to Congress | February (1st Monday) | FYDP updated | DoD Testimony | DoD Appeals | Allocation | Apportionment | Budget Committees | Authorization Committees | Appropriation Committees | Authorization/ Appropriation Acts Passed | Congressional Budget Process | February – September

Planning, Programming, Budgeting, and Execution Acronyms: FYDP – Future Years Defense Program; NBC – Major Budget Issues; OMB – Office of Management and Budget; PBD – Program Management Office; POM – Program Objectives Memorandum

For a single copy of this chart, send a request to daspubs@dau.mil | Send recommendations to improve the content of this chart to wallchart@dau.mil

Final, ver. 1.3, December 17, 2014

Generic Acquisition Process (Pre-Tailoring)

Acquisition Decision Points and Phases

This chart illustrates the sequence of events in a generic program, which could be a Defense program or, except for the unique DoD terminology , a commercial product. DoD Instruction 5000.02 milestones, other decisions, phases and major phase activities are shown in relation to the generic sequence of events.

Need Identification (DoD: Materiel Development Decision)

The decision that a new product is needed and that activities to analyze alternative solutions will occur.

Solution Analysis

DoD: Materiel Solution Analysis Phase

- Conduct analysis and other activities needed to choose the concept for the product that will be acquired.
- Begin translating validated capability gaps into system-specific requirements including the Key Performance Parameters (KPPs), Key System Attributes (KSAs).
- Conduct planning to support a decision on the acquisition strategy for the product.
- Analysis of Alternative (AoA) solutions, key trades between cost and performance, affordability analysis, risk analysis, and planning for risk mitigation are key activities in this phase.
- Component Acquisition Executive selects a Program Manager and establishes a program office to plan the acquisition program with emphasis on the next phase.

Risk Reduction Decision (DoD: Milestone A)

An investment decision to pursue specific product or design concepts, and to commit resources required to mature technology and/or reduce risks that must be mitigated prior to decision committing the resources needed for development leading to production and fielding

Technology Maturation and Risk Reduction

DoD: Technology Maturation and Risk Reduction Phase

- Includes a mix of activities intended to reduce specific risks associated with the product to be developed.
- Includes additional design trades and requirements trades necessary to ensure an affordable product and executable development and production programs.
- Normally includes competitive sources conducting technology maturation and risk reduction activities and preliminary design activities up to and including Preliminary Design Review prior to source selection for the EMD phase.

Requirements Decision Point (DoD: CDD Validation)

The point at which major cost and performance trades have been completed and enough risk reduction has been completed to support a decision to commit to the set of requirements that will be used for preliminary design activities, development, and production (subject to reconsideration and refinement as knowledge increases).

Development RFP Release Decision

The point at which planning for development is complete and a decision can be made to release an RFP for development (and possibly initial production) to industry.

Development Decision (DoD: Milestone B)

The decision that commits resources (authorizes proceeding to award of the contract(s)) needed to conduct development leading to production and fielding of the product.

Development Decisions

Development

DoD: Engineering and Manufacturing Development Phase

- Complete all hardware and software detailed design.
- Retire any open risks.
- Build and test prototypes or first articles to verify compliance with capability requirements.
- Prepare for production or deployment.
- Successful completion of adequate developmental testing to support entering low-rate initial Production or Limited deployment.

Initial Production Decision (DoD: Milestone C)

The production decision, usually based on developmental test results, commits the resources (i.e., authorizes proceeding to award the contract(s)) required to enter production and begin fielding of the product. The commitment to enter production is very difficult and expensive to reverse.

Low-Rate Initial Production [LRIP] or Limited Deployment and Operational Test

DoD: Production and Deployment Phase

- LRIP establishes the initial production base for the system, provides operational test articles, provides an efficient ramp up to full rate production, and maintains continuity in production pending completion of operational test and evaluation.
- LRIP equivalent for software systems is typically limited deployment or limited fielding.
- While this portion of the phase should be of limited duration so that efficient production rates and/or full fielding can be accomplished as soon and as economically as possible, it should be of sufficient duration to permit identification and resolution of any significant deficiencies prior to full rate production.

Full-Rate Production/Full Deployment (DoD: Full-Rate Production/Full Deployment Decision)

The decision, following completion of operational testing of representative initial production products, to scale-up production and/or fielding.

Production Decisions

Production, Deployment and Sustainment

DoD: Production and Deployment Phase, continued...

- Remaining production or deployment of the product is completed, leading to Full Operational Capability or Full Deployment.
- Except as specifically approved by the MDA, critical deficiencies identified in testing will be resolved prior to proceeding beyond LRIP or Limited Deployment.

Sustainment | **Disposal**

DoD: Operations and Support Phase

- The product support strategy is executed to satisfy materiel readiness and operational support performance requirements, and sustain the system over its life cycle.
- At the end of its useful life, system is demilitarized and disposed of in accordance with all legal and regulatory requirements and policy relating to safety (including explosives safety), security, and the environment.

Tailoring of Milestones, Decision Points, and Phases

The generic milestones and decision points illustrated on this chart are standard for DoD; however, Milestone Decision Authorities (MDAs) have full latitude to tailor programs in the most effective and efficient structure as much as needed to accommodate the characteristics of the product being acquired, and to the totality of circumstances associated with the program including operational urgency and risk factors.

- MDAs will tailor program strategies and oversight, including program information, acquisition phase content, the timing and scope of decision reviews and decision levels, based on the specifics of the product being acquired, including complexity, risk factors, and required timelines to satisfy validated capability requirements.
- When there is a strong threat-based or operationally driven need to field a capability solution in the shortest time, MDAs are authorized to implement streamlined procedures designed to accelerate acquisition system responsiveness. Statutory requirements will be complied with, unless waived in accordance with relevant provisions.

Development RFP Release Decision

The development contract award is the critical decision point in an acquisition program because it commits the organization's resources to a specific product, budget profile, choice of suppliers, contract terms, schedule, and sequence of events leading to production and fielding. In practice however, almost all of these decisions have to be made prior to the release of the RFP to industry in order to inform the bidders' proposals.

For DoD, the RFP release decision point is the point at which plans for the program must be most carefully reviewed to ensure all risks are understood and under control, the program plan is sound, and that the program will be affordable and executable.

The Development RFP Release Decision is described by the USD(AT&L) as, ***"the most important single decision point in the entire life cycle because the release of the Engineering and Manufacturing Development RFP sets in motion everything that follows in a products life cycle."***

Legend

- ▲ = Decision Point
- CDD = Capability Development Document
- RFP = Request for Proposal

This chart illustrates the sequence of decision events in a generic program. It is not intended to reflect the time dedicated to associated phase activity.

Pre-materiel Solution Analysis Phase

Key HHA activities during the Pre-materiel Solution Analysis Phase:

- Provide a medical review of the draft Initial Capabilities Document (ICD) to support Integrated Concept Development Team (ICDTs) and Capability Developers (CAPDEVs).
- Provide a medical review of the Analysis of Alternatives (AOA) Study Guidance.
- Encourage submission of an Initial HHA Report (IHHAR) request.

Materiel Solution Analysis Phase

Key HHA activities during the Materiel Solution Analysis Phase:

- Provide a medical review of the draft Capabilities Development Document (CDD) to support ICDTs/CAPDEVs.
- Provide a medical review of the AOA Study Plan.
- Provide a medical review of the draft Test & Evaluation Master Plan.
- Provide a medical review of the System Engineering Plan (SEP).
- Provide a medical review of the Preliminary System Specification.
- Identify applicable health hazard medical criteria, health effects, and data requirements.
- Communicate the requirement of including IHHAR hazard data in the Preliminary Hazards List for transmittal to the program safety officer.
- Participate in System Safety Working Groups (SSWGs)
- Participate in Human Systems Integration Working Groups (HSIWGs)
- Complete an IHHAR to support Milestone A based on HHA lessons learned from predecessor and similar systems.

Technology Maturation & Risk Reduction Phase

Key HHA activities during the Technology Maturation & Risk Reduction Phase:

- Provide a medical review of the Test Evaluation Master Plan (TEMP).
- Provide a medical review of the Programmatic Environmental, Safety, and Occupational Health Evaluation (PESHE) to ensure it includes potential health hazards identified in the IHHAR.
- Provide a medical review of the CDD to support CAPDEVs.
- Provide a medical review of the System Safety Analysis.
- Provide a medical review of the System Performance Specification.
- Provide a medical review of the Human Systems Integration Plan (HSIP) or other management tools being used.
- Provide input to Safety Releases.
- Participate in SSWGs.
- Participate in HSIWGs.
- Complete an updated HHAR to support Milestone B.

Engineering & Manufacturing Development Phase

Key HHA activities during the Engineering & Manufacturing Development Phase:

- Provide a medical review of the detailed Test Plans.
- Provide a medical review of updated PESHE.
- Provide a medical review of the HSIP.
- Provide a medical review of the Capabilities Production Document (CPD).
- Obtain health hazard test results and health risk management decisions.
- Review Hazardous Material Management Plans (HMMPs).
- Review system user and maintenance manuals.
- Provide input to Safety Releases.
- Review Developmental Test Reports.
- Participate in SSWGs.
- Participate in HSIWGs.
- Complete an updated HHAR to support Milestone C.

Production and Deployment Phase

Key HHA activities during the Production and Deployment Phase:

- Provide a medical review of the Detailed Test Plans designed to evaluate any unresolved health hazards identified in the HHAR.
- Provide a medical review of the PESHE.
- Provide a medical review of the HSIP.
- Review the health hazard test results and health risk management decisions to support completion of a definitive HHAR.
- Review the System Safety Analysis.
- Participate in SSWGs.
- Participate in HSIWGs.
- Complete a definitive HHAR to support type classification and/or materiel release actions.

Operations and Support Phase

- The formal HHA activities end once the system is type-classified standard and has had a successful materiel release. The health information generated in the HHAR can be used by the Materiel Developer to support occupational health decisions associated with materiel fielding and ultimate disposal. Post-fielding testing will be coordinated with the HHA Program for those systems or items where unresolved health hazard issues exist.

- Modifications or changes to the system or use scenario may result in the need for an updated HHA.

- Soldier Occupational Health Assessment (SOHA) activities may be initiated.

Health Hazard Assessment Report Assessment Standards

- Apply OSHA 29 CFR 1910 and other non-DOD regulatory health standards to military-unique equipment, systems, and operations, insofar as practicable.

- OSHA Standards are generally designed for 8-hr exposures and may not be applicable for 24-hr exposures, multiple exposures, or short duration exposures typical of military-unique applications.

Health Hazard Assessment Report Assessment Standards

- When military design, specification, or deployment requirements render compliance with existing OH standards infeasible or inappropriate, or when no standard exists for military-unique applications, the Army will use the health risk management process or develop a military-unique OH standard.

Requesting a Health Hazard Assessment Report

https://usaphcapps.amedd.army.mil/MSRV_MVC/

- Click on "Request Services"
- Complete the "Request for PHC Products and Services" form
- Upload/submit a signed memorandum on letterhead
- Upon acceptance, the HHA-PjM:
  - contacts Client
  - develops project plan
  - sends SOW, ICE, MOA, & 1144 (if ACAT I, II, JPEO, SOCOM)
  - opens an official HHA project
- Provide all required funding, data/test results and materiel system information relevant to HHA at least 90 days in advance of the anticipated publication date.

Health Hazard Assessment Process

- Review historical Health Hazard (HH) data on similar items.
- Review health surveillance & safety data.
- Review designs, use scenarios, & test data.
- Assess the above information & assign a RAC to the Soldier HHs.
- Make recommendations to control or eliminate HH.
- Assign a residual RAC when applicable.
- Establish priorities for control actions.
- Support acquisition Milestone Decision Reviews, safety releases, materiel releases, and other events.
- Will soon provide an estimate of Medical Cost Avoidance using the Medical Cost Avoidance Model (MCAM).

RISK ASSESSMENT CODE MATRIX				
SEVERITY / PROBABILITY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	High	High	Serious	Medium
Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Low
Remote (D)	Serious	Medium	Medium	Low
Improbable (E)	Medium	Medium	Medium	Low
Eliminated (F)	Eliminated			

SEVERITY CATEGORIES		
Description	**Severity Category**	**Mishap Result Criteria**
Catastrophic	**1**	Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or monetary loss equal to or exceeding $10M.
Critical	**2**	Could result in one or more of the following: permanent partial disability,injuries or occupational illness that may result in hospitalization of at least three personnel, reversible significant environmental impact, or monetary loss equal to or exceeding $1M but less than $10M.
Marginal	**3**	Could result in one or more of the following: injury or occupational illness resulting in one or more lost work day(s), reversible moderate environmental impact, or monetary loss equal to or exceeding $100K but less than $1M.
Negligible	**4**	Could result in one or more of the following: injury or occupational illness not resulting in a lost work day, minimal environmental impact, or monetary loss less than $100K.

PROBABILITY LEVELS			
Description	**Level**	**Specific Individual Item**	**Fleet or Inventory**
Frequent	**A**	Likely to occur often in the life of an item.	Continuously experienced.
Probable	**B**	Will occur several times in the life of an item.	Will occur frequently.
Occasional	**C**	Likely to occur sometime in the life of an item.	Will occur several times.
Remote	**D**	Unlikely, but possible to occur in the life of an item.	Unlikely, but can reasonably be expected to occur.
Improbable	**E**	So unlikely, it can be assumed occurrence may not be experienced in the life of an item.	Unlikely to occur, but possible.
Eliminated	**F**	Incapable of occurence. This level is used when potential hazards are identified and later eliminated.	Incapable of occurence. This level is used when potential hazards are identified and later eliminated.

Health Hazard Assessment Program Web Page Hits

http://phc.amedd.army.mil/topics/workplacehealth/hha/Pages/default.aspx