

NOTICE OF CHANGE

METRIC

MIL-STD-1908
NOTICE 1
30 July 1993

MILITARY STANDARD

DEFINITIONS OF HUMAN FACTORS TERMS (METRIC)

TO ALL HOLDERS OF MIL-STD-1908:

1. THE FOLLOWING PAGES OF MIL-STD-1908 HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
13	24 DECEMBER 1992		REPRINTED WITHOUT CHANGE
14	30 JULY 1993	14	24 DECEMBER 1992
15	30 JULY 1993	15	24 DECEMBER 1992
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2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-1908 will verify that page changes and additions indicated above have been entered. The notice pages will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the Military Standard is completely revised or cancelled.

Custodians

Army - MI
Navy - AS
Air Force - 11

Preparing activity:
Army - MI

(Project HFAC-0067)

Review activities:

Army - AR, AT, AV, CR, EA, ER, GL, MD, ME, MR, TE, TM
Navy - EC, MC, OS, PE, SH, TD
Air Force - 13, 14, 15, 19, 24

User Activities:

Army - AL
Navy - YD

Civilian agencies:

DOT - FAA
EPS
NASA - MSF
NIST
DOL - OSHA

AMSC N/A

AREA HFAC

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dBp *snv.* The unit used to express peak pressure level as measured with a peak-reading sound level meter or combination of instruments with equivalent characteristics, without weighting networks, and with total rise time not exceeding 1/20 of the measured A-duration.

Dead-man control *gen.* A control which requires a continuous pressure or contact by the operator to maintain machine, equipment component, subsystem, or system operation. Such operation automatically returns to a noncritical state once operator pressure or contact is removed.

Decibel (dB) *snv.* A unit to express sound pressure level. The decibel is the unit of level when the base of the logarithm is the tenth root of ten, and the quantities concerned are proportional to power. The dB has meaning only when the referenced quantity is known. The internationally accepted reference pressure in acoustics is 20 micropascals (μPa) which corresponds to 0 dB. See "Sound pressure level."

Decibel (dB) reference level (0dB) *snv.* The level that corresponds to an RMS pressure of 20 micropascals (μPa) or 20 micronewtons per square meter ($\mu\text{N}/\text{m}^2$) or 0.0002 μbar or 0.0002 dyne/cm^2 .

Decontamination *gen.* Use of chemical solution or physical processes to absorb, destroy, neutralize, or remove nuclear, chemical, or biological agents from persons, objects, or areas.

Dedicated key *uci.* A key which produces one code and is never affected by the position of either the CTL or SHIFT keys.

De-emphasis *snv.* The inverse of pre-emphasis, employed to restore original vowel-consonant amplitude relationships in pre-emphasized speech; primarily useful in maintaining the "natural" sound quality. (See "Pre-emphasis.")

Default value *uci.* A predetermined, frequently-used value for a data field or control entry, intended to reduce required user entry actions.

Delimiter *uci.* A character marking the beginning or end of a unit of data.

Demonstrate *acq.* When used relative to test and evaluation, "demonstrate" implies a qualitative test that does not require comparison of test results to an applicable requirement(s). (See "Confirm.")

Depot level maintenance *acq.* Maintenance performed on material requiring major overhaul or a complete rebuild of parts, assemblies, subassemblies, and end items, including the manufacture of parts, modification, testing, and reclamation as required.

Determine *acq.* When used relative to test and evaluation, implies a quantitative test that does not require comparison of test results to an applicable requirement(s). (See "Evaluate.")

Developmental test and evaluation (DT&E) *acq.* Test and evaluation performed to (1) identify potential operational and technological limitations of the alternative concepts and design options being pursued, (2) support the identification of cost-performance trade-offs, (3) support the identification and description of design risks, (4) substantiate that contract technical performance and manufacturing process requirements have been achieved, and (5) support the decision to certify the system ready for operational test and evaluation.

Dialogue (or dialog) *uci.* A structured series of interchanges between a user and a computer. Dialogues can be computer initiated, e.g., question and answer, or user initiated, e.g., command languages.

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Dichotic *snv*. The condition in which the sound stimulus presented at one ear differs from the sound stimulus presented at the other ear. The stimulus may differ in sound pressure, frequency, phase, time, duration, bandwidth, or other characteristics.

Dimension *uci*. A scale or categorization along which data may vary, taking different values at different times. For example, relevant dimensions for an aircraft might include its heading, speed, and altitude.

Direction designation *uci*. User entry of directional data (azimuth, bearing, heading) on a display.

Display format *uci*. The organization of different types of data in a display, including information about the data such as labels, and other user guidance, such as prompts of error messages.

Display framing *uci*. User control of display coverage by display movement, including paging, scrolling, offset, and expansion.

Display generation *uci*. The means of specification of data outputs, either by a user or automatically by the computer.

Display tailoring *uci*. Designing displays to meet the specific task needs of a user, rather than providing a general display which can be used for many purposes.

Display update *uci*. Regeneration of changed data to show current status, by user request or automatically by the computer.

Duty *acq*. See "Task analysis."

Effective temperature *gen*. An empirically determined index which combines into a single value the effect of temperature, humidity, and air movement on the sensation of warmth or cold felt by the human body. The numerical value is that of the temperature of still, saturated air which would induce an identical sensation.

Eight-hour time-weighted average sound level (TWA) *snv*. A measurement of the employee's workday noise environment. The TWA is that constant noise level, in dBA, slow response, which may cause hearing loss in 8 hours to the same extent as the exposure to the actual workday noise. The workday noise environment may or may not last for 8-hours, but the TWA is always computed as if the TWA level was present for an 8-hour work shift. Implicit in the TWA is a stipulated exchange rate between sound level and doubling of exposure time.

$$TWA = \frac{Q}{\log_{10} 2} \log_{10} \left\{ \frac{1}{8} \int_0^T 2^{L(t)/Q} dt \right\}$$

where: T = total workshift time in hours

t = varying time

L(t) = the time varying A-weighted sound pressure level

Q = exchange rate, usually 3, 4, 5, or 6 dB.

The TWA value can be calculated from the following alternate expression when the sound level takes on a sequence of N constant levels, L_i , each lasting for a time period of C_i hours:

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$$TWA = 85 + \frac{Q}{\log_{10} 2} \log_{10}(D)$$

$$\text{where: } D = \sum_{i=1}^N \frac{C_i}{T_i}$$

$$T_i = \text{Limiting exposure time at each A-weighted sound pressure level} = \frac{8}{2^{(L_i - 85)/Q}}$$

$L_i = i^{\text{th}}$ A-weighted sound pressure level.

The exchange rate must be specified when referring to TWA. *Note: TWA is identical to $Leq8$, utilized by U.S. and international sound and noise standards.*

Electroluminescent device (EL) gen. A device that produces light through electrical excitation of a phosphor.

Electronic attitude director indicator (EADI) gen. The EADI is a replacement for the standard ADI, but with no moving parts other than controls and switches. The EADI presents the symbols on a display using either a CRT or direct view flat plate technology. Basic symbology consists of an aircraft symbol; vertical and horizontal director indices (when applicable); heading information; and line, sky-ground color, or shading separation for horizon reference. If desired, other symbols can be generated and displayed by mode selection, such as instrument landing system (ILS) window, collective, cyclic and yaw command, airspeed deviation, altitude, flight path, predicted flight path, range, or other flight data. Specific symbols and formats can be selectable for a given mode of operation. Modes may consist of take-off, landing, hover, cruise, weapon delivery, and off.

Enter uci. An explicit user action that effects computer processing of user entries. For example, after typing a series of numbers, a user might press an ENTER key that will add them to a data base, subject to data validation.

Entry uci. See "Data entry" or "Control entry."

Environment gen. The aggregate of all the conditions and influences including physical location and operating characteristics of surrounding equipment and occupants, including temperature, humidity, and contaminants or surrounding air; operational procedures, acceleration, shock, vibration, and radiation.

Equipment gen. General term designating any item or group of items.

Equipment, powered ground (PGE) acq. An assembly of mechanical components including an internal combustion engine or motor, gas turbine, or steam turbine engine mounted as a single unit on an integral base or chassis. Equipment may pump gases, liquids, or solids; or produce compressed, cooled, refrigerated or heater air; or generate electricity and oxygen. Examples of this equipment: portable cleaners, filters, hydraulic test stands, pumps and welders, air compressors, air conditioners. Term applies primarily to aeronautical systems.

Equipment failure gen. Cessation of the ability to meet the minimum performance requirements of the equipment specifications. Further, equipment failure shall imply that the minimum specified performance cannot be restored through permissible readjustment of operator controls.

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Equipment grades *snv.* Categories of equipment undergoing measurements of airborne sound measurements of shipboard equipment to classify usage-driven acceptance criteria. Equipment grades are defined below:

Grade A3. Equipment to be installed in spaces where direct speech communication must be understood with minimal error and without repetition over a distance of 2 meters (6-1/2 ft) or less.

Grade A12. Equipment to be installed in spaces where direct speech communication must be understood with minimal error and without repetition over a distance greater than 2 meters (6-1/2 ft).

Grade B. Equipment to be placed in spaces where comfort of personnel in their quarters is the principal consideration.

Grade C. Equipment to be placed in the sonar room, sickbay, library, or other spaces requiring low sound levels and which are not covered in other categories.

Grade D. Equipment to be placed in spaces where avoidance of hearing loss is the prime consideration and intelligible speech communication is not normally required.

Grade E. Equipment to be placed in high sound level areas where voice communication is accomplished with high vocal effort and where amplified speech and telephones are normally available.

Equivalent A-weighted sound level *snv.* Equivalent A-weighted sound level is the level equivalent to the octave-band levels for the equipment being measured. It is not the weighted sum of the individual octave-band levels, but an equivalent level based on experience with spectral shapes of actual shipboard equipment and shipboard spaces.

Error management *uci.* Interface design to facilitate the detection and correction of user errors.

Evaluate *acq.* When used relative to test and evaluation, "evaluate" implies a quantitative test that requires comparison of test results to an applicable requirement(s). (See "Determine.")

Facilities *acq.* A physical plant, such as real estate and improvements thereto, including building and equipment, which provides the means for assisting or making easier the performance of a system function. The facilities to which this standard apply are those in which personnel perform system operational or maintenance duties.

Fail-safe design *gen.* Design where a failure will not adversely affect the safe operation of the system, equipment or facility.

Feedback *gen.* Product response (e.g., visual, aural, or tactile) which indicates the extent to which the operator's desired effect was accomplished. Feedback can be either intrinsic or extrinsic. Intrinsic feedback (feel) is that which the individual senses directly from the operation of the control devices (e.g., clicks, detents, resistance, response ratios, stops, control displacement). Extrinsic feedback is that which is sensed from an external source that indicates the consequences of the control action (e.g., aural tones, display changes, indicator lights).

Field *uci.* See "Data Field."

Field maintenance *gen/acq.* That maintenance authorized and performed by designated maintenance activities in direct support of using organizations. It is normally limited to replacement of unserviceable parts, subassemblies, or assemblies.

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Speech-to-noise ratio (peak speech-to-rms noise) *snv*. The ratio between the arithmetic mean of peak amplitudes of speech and the root mean square (rms) amplitude of background noise.

Standard tools *acq*. Standard tools (normally hand tools) used for the assembly, disassembly, inspection, servicing, repair and maintenance of equipment, and which are manufactured by two or more recognized tool manufacturing companies and listed in those companies' catalogs.

State-of-the-art *acq*. The highest level of scientific and technical knowledge existing at the time of contract award.

Status information *gen/dsi*. Current condition information about the system and its surroundings.

Steady-state noise *snv*. A periodic or random variation in atmospheric pressure at audible frequencies. It may be continuous, intermittent or fluctuating, with the sound pressure level varying over a wide range, provided such variations have a duration exceeding 1 second.

String *uci*. In the user's context, a word, phrase, or number (string of characters) in the test or file. Normally employed in the context of causing the computer to search for, find, or replace a desired "string."

Stroke-written CRT display *gen*. A CRT in which the character generator generates a succession of short strokes in sequence that are combined to form a character or symbol.

Structureborne vibratory acceleration level (La) *snv*. La, in decibels (dB) is 20 times the logarithm to base 10 of the ratio of the measured structureborne vibratory acceleration to a_0 ; this is:

$$L_a \text{ in dB} = 20 \log_{10} \frac{\text{measured acceleration in } \mu\text{m/s}^2 \text{ (rms)}}{10 \mu\text{m/s}^2 \text{ (rms)}}$$

Subassembly *acq*. Two or more units which form a portion of an assembly or a unit replaceable as a whole, but having a part or parts which are individually replaceable. (Examples: gun mount stand, window recoil mechanism, floating piston, telephone dial, IF strip, mounting board with mounted parts, power shovel dipper stick.)

Subtask *acq*. See "Task analysis."

Support equipment (SE) *acq*. All equipment required to perform the support function, except that which is an integral part of the mission equipment. SE includes tools, test equipment, automatic test equipment (ATE) (when the ATE is accomplishing a support function), organizational, intermediate, and related computer programs and software. It does not include any of the equipment required to perform mission operations functions.

Suppression *uci*. User control of display coverage by temporary deletion of specified data categories.

Suspense file *uci*. A temporary collection of data saved by the computer for later use.

Symbol *dsi*. A geometric form or alphanumeric information used to represent the state of a parameter on a display.

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Symbol size *dsi*. Actual symbol size at the display, based on design eye distance from the display, can be calculated using the following formula:

$$L = 2D \tan (a/2)$$

where: L = size of symbol at the display
D = design eye distance from the display
a = symbol subtense (degrees) at D

Example: The breakaway symbol is 100 mrad long. What is the size of the symbol at the display in cm, if the design eye distance is 71 cm (28 inches)?

$$a = 100 \text{ mr} \times \frac{0.0573}{\text{mr}} = 5.73 \text{ degrees}$$

$$L = 2(71) \tan (5.73/2) = 7.11 \text{ cm}$$

This formula does not apply for head-up displays. Computer ray traces for HUD optics trains are required to determine symbol size on HUD CRTs.

System *acq*. A composite of equipment, skills, and techniques capable of performing or supporting an operational role, or both. A complete system includes all equipment, related facilities, material, software, services, and personnel required for its operation and support to the degree that it can be a self-sufficient unit in its intended operational environment. (Examples: STINGER, AEGIS, F-15.) When GFE is required for system operation, whether or not operation with GFE occurs in all cases of system operation, that GFE is part of the system.)

Systems engineering *acq*. An interdisciplinary approach to evolve and verify an integrated and life-cycle balanced set of system product and process solutions that satisfy customer needs. Systems engineering: (a) encompasses the scientific and engineering efforts (including human engineering) related to the development, manufacturing, verification, deployment, operations, support, and disposal of system products and processes, (b) develops needed user training equipments, procedures, and data, (c) establishes and maintains configuration management of the system, (d) develops work breakdown structures and statements of work, and (e) provides information for management decision making. Representative human engineering activities in systems engineering may include the following:

- a. Preparation of operationally-realistic mission profiles and mission scenarios.
- b. Preparation of functional flow block diagrams for the system.
- c. Functional analysis of each flow block and definition of operational and support equipment and facilities requirements.
- d. Preparation of system and subsystem schematic block diagrams.
- e. Study of detailed functions, environment and technical design requirements to allocate assignment of tasks to personnel, equipment, software, or some combination thereof.
- f. Preparation of operations and maintenance timeline analyses to determine system reaction time.
- g. Preparation and analysis of operational and maintenance task data to determine equipment quantities, personnel loads, and system down-time for scheduled and unscheduled maintenance.
- h. Training implications.

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- i. Conduct of trade studies.
- j. Participation in preparation of specifications for the system.

Tailoring *acq.* The process by which individual requirements (paragraphs or sentences) of the selected specifications, standards, and related documents are evaluated to determine the extent to which they are most available for a specific system and equipment acquisition and the modification of these requirements to ensure that each achieves an optimal balance between operational needs and cost. The tailoring process must, however, conform to provisions of existing regulations governing human factors engineering program and take care not to exclude those requirements which are determined as essential for meeting minimum operational needs.

Task *acq.* See "Task analysis."

Task analysis *acq.* A systematic method used to develop a time-oriented description of personnel-equipment/software interactions brought about by an operator, controller or maintainer in accomplishing a unit of work with a system or item of equipment. It shows the sequential and simultaneous manual and intellectual activities of personnel operating, maintaining or controlling equipment, in addition to sequential operation of the equipment. It is a part of system engineering analysis where system engineering is required. The following taxonomy is used to inventory or analyze tasks, with mission and scenario conditions stated by the procuring activity and the remaining levels dependent on the current phase of system development and purpose (e.g., gross analysis of tasks, analysis of critical tasks) for which the analysis is being conducted:

Mission. What the system is supposed to accomplish, e.g., combat reconnaissance.

Scenario/conditions. Categories of factors or constraints under which the system will be expected to operate and be maintained, e.g., day/night, all weather, all terrain operation.

Function. A broad category of activity performed by a system, e.g., transportation.

Job. The combination of all human performance required for operation and maintenance of one personnel position in a system, e.g., driver.

Duty. A set of operationally-related tasks within a given job, e.g., driving, weapon servicing, communicating, target detection, self protection, operator maintenance.

Task. A composite of related activities (perceptions, decisions, and responses) performed for an immediate purpose, written in operator/maintainer language, e.g., change a tire.

Subtask. Activities (perceptions, decisions and responses) which fulfill a portion of the immediate purpose within the task, e.g., remove lug nuts.

Task element. The smallest logically and reasonably definable unit of behavior required in completing a task or subtask, e.g., apply counterclockwise torque to the lug nuts with a lug wrench."

Task definition *acq.* The process of preparing a task inventory.

Task element *acq.* See "Task analysis."

Task inventory *acq.* A comprehensive listing (prepared in accordance with MIL-STD-1388-1 and documented in accordance with MIL-STD-1388-2) of all tasks performed upon system hardware by operations, maintenance, and support personnel.

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Task performance analysis *acq.* A process performed on tasks, subtasks, and task elements selected from a task inventory by the procuring activity. The component steps of a task performance analysis are selected by the procuring activity (based on the nature of the acquisition, the complexity of the human performance requirements, and the stage of design maturity).

Temporal sequence *uci.* The order in which information (for example, words, or data) corresponding to a sequence of events is phrased or arranged to maintain a meaningful relationship.

Terminal *uci.* An input/output device used to enter and display data. Data are usually entered via a keyboard, and are usually displayed via a video screen ("soft copy") or a printer ("hard copy").

Text entry *uci.* Initial entry and subsequent editing of textual material, including messages.

Throughput *uci.* The total amount of productive work performed by a data processing system during a given period of time.

Time-weighted average level (L_{avg}) *snv.* The time-weighted sound level dBA that is derived from the actual varying sound level of the source during a given sample time (T). Implicit in this derivation is an exchange between sound level and time of 0 dB per doubling of time. The criterion level is 85 dBA for a duration of 8 hours.

$$L_{avg} = \frac{Q}{\log_{10} 2} \log_{10} \left\{ \frac{1}{T} \int_0^T 2^{L(t)/Q} dt \right\}$$

where: T = total time in hours

t = varying time

L(t) = the time varying A-weighted sound pressure level

Q = exchange rate, usually 3, 4, 5, or 6 dB.

The L_{avg} value can be calculated from the following alternate expression when the sound level takes on a sequence of N constant levels, L_i , each lasting for a time period of C_i hours:

$$L_{avg} = 85 + \frac{Q}{\log_{10} 2} \log_{10} \left(\frac{8D}{T} \right)$$

where: $D = \sum_{i=1}^N \frac{C_i}{T_i}$

T_i = Limiting exposure time at each A-weighted sound pressure level = $\frac{8}{2^{(L_i-85)/Q}}$

L_i = i^{th} A-weighted sound pressure level.

The exchange rate must be specified when referring to L_{avg} .

Touch panel *uci.* A control device that allows the user to communicate with the computer by touching the screen. Especially useful for menu driven systems.