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F-LAYER - See IONOSPHERE.

F-POLE - The distance between a missile-firing platform and its target at the instant the missile reaches the target. [10:27] Contrast with A-POLE.

FADE CHART - A plot of the field strengths at various ranges and altitudes. Also called a VERTICAL COVERAGE DIAGRAM. [] See also FADE ZONE .

FADE ZONE - An area in space where the reflected energy of a radar effectively cancels the direct-path energy of the radar. The degree of cancellation is affected by many variables, including antenna height, radar frequency, polarization of the signal, reflection coefficient of the earth at the point of reflection, angle of incidence at the point of reflection, etc. See also FADING. [] NOTE: This phenomenon has been exploited both by pilots in attempts to approach a radar site undetected as long as possible, and by radar operators who employed a "fade chart" consisting of a plot of the theoretical lobes and fade zones to estimate the altitude of approaching aircraft by noting the ranges at which the radar echo faded and reappeared.

FADING - The reduction in intensity or propagated power due to changes in parameters of the transmission media. [10:14] See also FADE ZONE.

FAIL-OPERATIONAL SYSTEM - A system designed for continued safe operation in the event of a malfunction. []

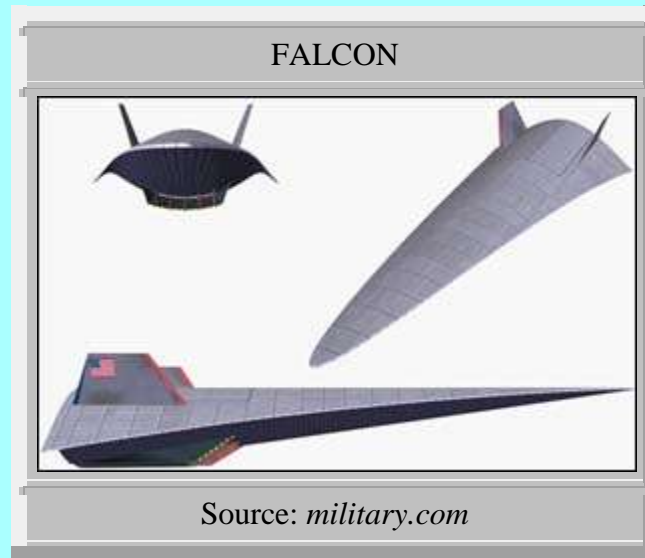
FAIL-SAFE - A designed property of an item which prevents its failures being critical failures. [3]

FAILURE - A FAULT TOLERANCE term. A failure occurs when the delivered service of a system deviates from conditions stated in the service specifications. [10:2701] See also SYSTEM ERROR, FAULT, FAULT LATENCY.

FAKER A strike force aircraft simulating a hostile aircraft during an air defense exercise and while in the strike route portion of the mission. []

FALCON - An acronym for the (*circa* 2004) program FORCE APPLICATION AND LAUNCH FROM CONUS that would give the United States a global prompt strike capability by using hypersonic sub-orbital launch platforms to deliver rocket powered sub-munitions to the target area. The heart of FALCON is the Hypersonic Cruise

Vehicle (HCV), an autonomous, remotely operated, reusable vehicle that will take off like a conventional aircraft yet have the speed and cargo capacity to transport 12,000 pounds of cargo (specifically a number of Common Aerial Vehicles (CAVs) or cruise missiles) 9,000 miles in less than two hours (Mach 12 or 9,100 mph at sea level). To achieve these speeds the HCV will utilize air-breathing, supersonic combustion ramjet (SCRAMJET) engines burning liquid hydrogen to push the platform as high up as 40 km. At this point the engines would shut down and the HCV would continue to climb ballistically until it reached an apogee of 60km whereupon it would nose over and glide back into denser air. As the HCV descends, lift would be generated which would enable the HCV to coast towards the target area. Once the vehicle reaches an altitude of 35km or so, the engines would re-ignite, pushing the aircraft back up to 40km, where the cycle would be repeated again. NOTES: (1) The top speed of the HCV is Mach 12; it will have a range of 9,000 miles with a flight time of 2 hours. The HCV will operate in a near-space environment (40-60 km up) and have a 12,000 pound payload capacity . (2) The primary purpose of the CAV is to provide a near term (2010) response capability to fill the void until the HCV comes on line (which is not expected until 2025). The COMMON AERO VEHICLE (CAV) will be capable of delivering up to 1,000 pounds of munitions or other cargo to targets 3,000 miles away. Like the HCV, the CAV will rely on advanced sub-orbital technology and hypervelocity gliding to reach the target area. In addition, the CAV will serve as a test bed and technology demonstrator for the HCV. The CAV would be capable of carrying current precision-guided munitions or cruise missiles. [10:3041]



FALSE ALARM - An erroneous target detection decision caused by noise or other interfering signal exceeding the detection threshold. [Patterned after false alarm (radar) in 3]

FALSE DOPPLER TARGET (FDT) JAMMING -- The use of a coherent repeater that produces a signal at a number of frequencies, spaced around the frequency of the

target echo. [] Also called MULTIPLE FREQUENCY REPEATER (MFR) JAMMING.

FALSE ECHO RETURN - [ACOUSTIC JAMMING term] The use of off-board decoys to generate false echo returns in order to defend against torpedo attack. [10:41]

FALSE-TARGET BMD COUNTERMEASURES - Actions taken to overwhelm ballistic missile defenses with large numbers of false targets and decoys, such as balloons. The false targets and decoys could be designed to resemble the actual warhead, or be painted different colors so that uneven heating by the sun would generate a number of different INFRARED signatures to confuse defensive sensors and seekers. [10:2609] See also EVASIVE MANEUVERS BMD COUNTERMEASURES, SHROUDING BMD COUNTERMEASURES, SUBMUNITION BMD COUNTERMEASURES, TRAJECTORY BMD COUNTERMEASURES.

FALSE TRACK CONTENT -- The number of tracks that do not correlate to real objects that are contained in the radar's local track file. []

FAR INFRARED - The portion of the infrared spectrum band between 6.00 and 15.00 microns. [10:27] Synonymous with LONG WAVE INFRARED. See also ELECTRO-OPTIC, NEAR INFRARED, MID INFRARED, EXTREME INFRARED. NOTE: Far infrared sensors can detect "warm" airframes (contrasted with the sky). [10:2547]

FARADAY CAGE - An electrically conducting cage, usually made of fine metallic mesh, used to protect devices and enclosed areas from radiation such as ELECTROMAGNETIC PULSE (EMP) . [] NOTES: (1) When an EMP hits this enclosure, its energy is absorbed by the conducting material of the cage, thus protecting its contents, such as when an airplane is struck by lightning; where the outer skin of an aircraft safely channels the energy away around the exterior without anyone or anything inside being affected. (2) Wires and conduits which are required to enter the Faraday cage must be "bonded" electrically to the protecting mesh to electrically seal the enclosure. An unbonded connection will allow energy to enter and defeat the protective effect of the Faraday cage.

FAST FEATURE-RECOGNIZING OPTOELECTRONIC SYSTEM - A NEURAL NETWORK-based system which recognizes features and classifies images by processing the outputs of photo-sensors. [10:102]

FAST FOURIER TRANSFORM (FFT) - Efficient algorithms which solve Fourier Transforms of large bandwidth signals in near real time. [] See also WAVELET.

FAST INFRARED SNIPER TRACKER (FIRST) - An INFRARED LASER based system for detecting and tracking bullets in three dimensions at up to a range of 1000

meters. It includes a computer-generated sniper location feature with an accuracy of less than three meters. [10:2732]

FAST SEQUENTIAL JAMMING -- The **ELECTRONIC JAMMING** of predefined spot frequencies in an arbitrary sequence or in a continuous , band-like sequence called **SWEEP JAMMING**. [10:2869]

FAST-TIME CONSTANT (FTC) CIRCUIT - A circuit with short time- constant used to emphasize signals of short duration to produce discrimination against extended clutter, long-pulse jamming, or noise. [3]

FAST TRANSISTOR - A super fast (switching rate of 74 billion times per second at room temperature), ultra-small (channel length of 80 nanometers) silicon-on-insulator transistor that operates at 1.5 volts. [10:2434]

FAST WALKER - A military space mission to detect orbiting spacecraft by sensing sunlight reflected from their solar arrays and external surfaces. [10:2509] See also **JOGGER**, **SLOW WALKER**.

FAT PIPE - Broadband (*e.g.*, communications).

FATSAT - A low-cost satellite payload characterized by minimal expensive miniaturization, making it heavier and larger. [10:72] See also **LIGHTSAT**.

FAULT - A **FAULT TOLERANCE** term. The judged or hypothesized phenomenological cause of an **ERROR**. [10:2701] See also **FAILURE**, **FAULT LATENCY**.

FAULT LATENCY - A **FAULT TOLERANCE** term. The elapsed time between the occurrence of the **FAULT** and the first **ERROR**. [10:2701]

FAULT TOLERANCE - The built-in capability of a system to provide continued correct execution in the presence of a limited number of hardware or software **FAULTS**. [3] Fault tolerant techniques include...[10:2651]

<i>FAULT TOLERANT TECHNIQUES</i>	
Fault Containment	Prevents propagation of erroneous or damaged information in the system after a fault occurs and before it is detected.

Fault Detection	Use of hardware and software mechanisms to determine the occurrence of a failure. Fault detection mechanisms include concurrent fault detection, stepwise comparison, and periodic testing to determine whether computers or communication links are operating correctly.
Fault Diagnosis	Locates and identifies the faulty module responsible for a detected error.
Fault Masking	Concurrent masking and correction of generated errors.
Fault Recovery	Corrects the system to a state acceptable for continued operation.
Repair/reconfiguration	Eliminates or replaces the faulty module, or provides means to bypass it.

FEDERATED ARCHITECTURE - A hierarchical system architecture involving a master computer and asynchronously operated slave computers and satellite microprocessors to control the sub-elements of the system. [10:9]

FEED-THRU (FEED-THROUGH) - See VIA.

FERRET - An aircraft, ship, or vehicle especially equipped for the detection, location, recording, and analyzing of electromagnetic radiation. [1.1]

FERRET RECEIVER - A receiver used to receive specific systems with great detail, or used to explore new sections of the electromagnetic spectrum previously unused for military purposes in order to discover emerging enemy capabilities. [10:2] See also **ELECTRONIC WARFARE SUPPORT MEASURES**.

FERROELECTRIC RANDOM ACCESS MEMORY (FRAM) - A non-volatile random access memory (RAM), FRAM uses a ferroelectric storage capacitor having hysteresis states corresponding to logic states where there are no half-selects for "read" and "write" addressing. The FRAM is a modification of the dynamic random access memory (DRAM). It takes less power than a DRAM, has comparable density, can be made radiation-hardened, and can be turned off without loss of data. [10:2515]

FERROMAGNET - A magnetic material having the property of becoming hot when magnetized and cool when demagnetized. [10:2910]

FIBER OPTIC GUIDED MISSILE (FOG-M) -- A guided missile connected to its controlling source with as much as 60 kilometers of fiber optic cable with which the weapon transmits target images to the operator, and the operator is able to transmit commands to the weapon. [10:2891] NOTE: Fiber optic guided missiles are said to be accurate to within 10 centimeters, and are relatively impervious to jamming and interference because signals are carried by light waves, rather than radio frequencies.

FIBER OPTICS - The branch of optical technology concerned with the transmission of radiant power through fibers made of transparent materials such as glass, fused silica, or plastic. [3]

FIBER OPTIC THREAT DETECTION AND PROTECTION NET - A security mesh (still under development in 2004), on or just below the water surface, consisting of two elements: fiber optic lines and high-strength fibers. The fiber optic lines send a warning when an intruder cuts or otherwise tampers with the net; an optical time-domain reflectometer (a computerized device to trace and locate breaks) on the net determines the location of the breach and a light source aids in pinpointing security breaches. The fibers, made of materials such as carbon or aramid (a high-performance industrial fiber), are strong enough to deter infiltration to an area. [10:3040]

FIELD EFFECT DETECTOR - A handheld device used to find human beings hiding behind barriers such as concrete walls and dense foliage, even at hundreds of feet distant. The unit employs a passive detection system not vulnerable to types of countermeasures that might spoof **INFRARED** or **THERMAL IMAGERS**. The device detects the electrostatic field given off by a human being and, like a divining rod, pulls the device in the user's hand and points toward the strongest field rather than providing an audio or video indication. [10:2587]

FIELD EMISSION DISPLAY (FED) - (1) A display that depends, not on **THERMIONIC EMISSION** from a **CATHODE**, as in **CATHODE RAY TUBES** (CRTs), but on an array of millions of microscopic field emitters which propel electrons directly to the screen. [10:2624a] (2) A display composed of an array of carbon **NANOTUBE**-based emitters. A cluster of nanotubes at each emitter acts as a cathode to produce electrons via field emission. Each pixel is composed of three (red, green, and blue) subpixels. A gate electrode in each subpixel creates the electric field for emission. Emitted electrons are swept through a vacuum toward a phosphor by an anode placed between the phosphor and the glass surface of the display. [10:3012] NOTES: (1) As no beam deflection is needed, the distance between the cathodes and the screen

need be only a millimeter or so. (2) Field emission displays are flat-panel displays that consume less power than a flat-panel plasma display (almost by two orders of magnitude).

FIELD OF REGARD -- The angular area within which the sensor can detect targets for a specified search rate.

FIELD OF VIEW (FOV) - The maximum solid angle visible by an electro-optic system. []

FIFTH GENERATION LANGUAGE (5GL) - A computer language that incorporates the concepts of **EXPERT SYSTEMS**, inference engines, and natural language processing. [3] See also **FIRST GENERATION LANGUAGE**, **SECOND GENERATION LANGUAGE**, **THIRD GENERATION LANGUAGE**, **FOURTH GENERATION LANGUAGE**.

FILM-FORMING POLYMERS - A cohesive surfactant mixed with an evaporation reducer, one use of which is to produce a detectable area on the surface of a body of water. [10:2544] See **OCEAN MARKING**.

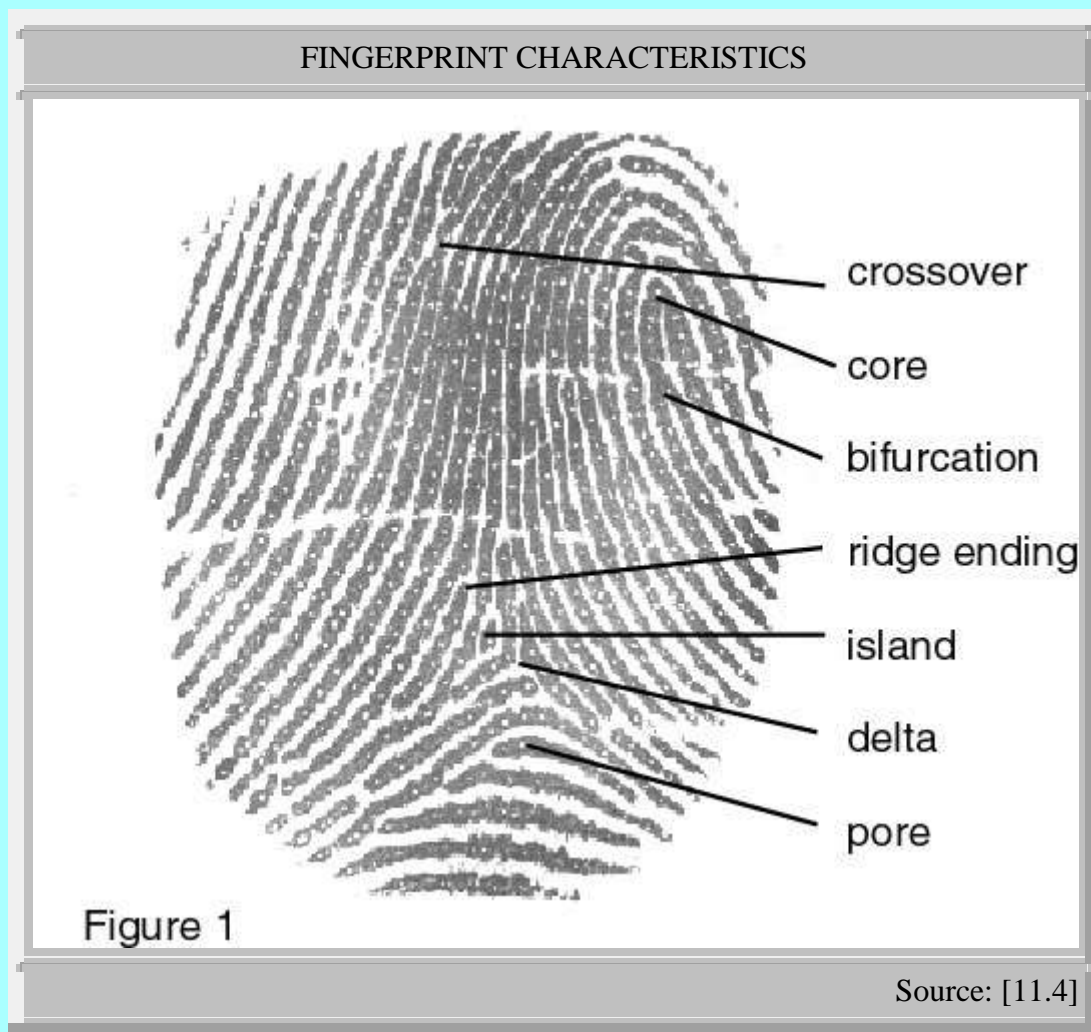
FILTER - In electronics, a device which transmits only part of the incident energy and may thereby change the spectral distribution of energy: a. High pass filters transmit energy above a certain frequency; b. Low pass filters transmit energy below a certain frequency; c. Band pass filters transmit energy of a certain **BANDWIDTH**; d. Band stop filters transmit energy outside a specified frequency band. [1.1]

FINGER - A simple Internet protocol used to retrieve information about a web site. Finger can be used to retrieve information about a user on a specific host (the provider). Typical results from the use of finger are: last login time, whether the user is currently logged on and, if so, which terminal, etc. [] See also **PACKET INTERNET GROPER (PING)**. NOTE: Finger works only if the specified host supports it. Results can differ from host to host, inasmuch as a user can change the information.

FINGER-MOUNTED LASER - A finger-mounted **LASER** spotlight consisting of a nine-volt battery, a power supply, a laser diode, a focusing element and connecting cables. The device can project up to a 10-foot-wide laser beam as far as 300 feet. The beam is invisible to the naked eye and can be seen only with **NIGHT-VISION** equipment. []

FINGERPRINT - The human fingerprint is comprised of various types of ridge patterns, traditionally classified according to the decades-old Henry system: left loop, right loop, arch, whorl, and tented arch. Loops make up nearly 2/3 of all fingerprints, whorls are nearly 1/3, and perhaps 5-10% are arches. These classifications are

relevant in many large-scale forensic applications, but are rarely used in biometric authentication. The fingerprint shown in Figure 1 below is a right loop.



Referring to Figure 1, the discontinuities that interrupt the otherwise smooth flow of ridges, are the basis for most finger-scan authentication. Codified in the late 1800's as Galton features, minutiae are at their most rudimentary ridge endings, the points at which a ridge stops, and bifurcations, the point at which one ridge divides into two. Many types of minutiae exist, including dots (very small ridges), islands (ridges slightly longer than dots, occupying a middle space between two temporarily divergent ridges), ponds or lakes (empty spaces between two temporarily divergent ridges), spurs (a notch protruding from a ridge), bridges (small ridges joining two longer adjacent ridges), and crossovers (two ridges which cross each other).

Other features are essential to finger-scan authentication. The core is the inner point, normally in the middle of the print, around which swirls, loops, or arches center. It is frequently characterized by a ridge ending and several acutely curved ridges. Deltas are the points, normally at the lower left and right hand of the fingerprint, around which a triangular series of ridges center.

The ridges are also marked by pores, which appear at steady intervals. Some initial attempts have been made to use the location and distribution of the pores as a means of authentication, but the resolution required to capture pores consistently is very high. []

FINGERPRINT IDENTIFICATION UNIT (FIU) - A device which can independently enroll, compare, and verify the fingerprint of a finger placed at its sensor. The FIU contains a biometric sensor that can reject phony fingers, duplicate fingerprint images, or other ersatz digits. The system can be used for security applications, such as access control to files and machinery. [10:2610]

FIN-LINE ANTENNA -- An antenna consisting of a printed circuit inserted into an open-ended waveguide. The printed circuit contains a fin line that extends a quarter wavelength beyond the waveguide aperture and feeds a pair of dipole-like elements. The dipole antenna thus maintains a wide and nearly constant beam width, low voltage standing wave ratio (VSWR), and a circular symmetric radiation pattern for use in electronic warfare direction finding and surveillance applications. [10:2646]

FIRE-AND-FORGET (F&F) - A weapon capability due to its having an on-board active terminal seeker that can guide the weapon to a target. Also called **LAUNCH-AND-LEAVE**. [] **NOTE:** A fire-and-forget weapon does not need monitoring nor course guidance by the launching platform, thus allowing the launching platform to maneuver or depart the area after weapon launch.

FIRES - Actions using lethal and nonlethal weapons to produce a specific effect on a target. [1.2]

FIREWALL - A security product designed to prevent access by hackers, crackers, or other unauthorized entities. It is a collection of components placed between two **NETWORKS**. All traffic from inside to outside, or outside to inside, must pass through this security mechanism. Only authorized traffic as defined by a security policy, is allowed to pass. [10:2582] A firewall guards and isolates an inside (private) network -- an intranet -- from its **WILD SIDE**, an outside (hence untrusted) network -- the **INTERNET**, for instance. A firewall may also guard some parts of an internal network from other parts. [10:2619] **NOTE:** A firewall can be set up to allow only two-way communications, blocking only dangerous commands. It also can be customized to allow only outward-bound communications, with no inward-bound access. Another option is to set up the firewall to allow only incoming communications with no outgoing access. Functions also can be customized within these general configurations.

FIREWIRE - An extremely fast electronic serial bus, described by IEEE Standard 1394, with rates about 400 Mb/s. Firewire can carry independent streams of digital video and digital audio. [10:2596]

FIRM KILL - Infliction of **EFFECTIVE DAMAGE**, short of physical destruction, on an inbound missile through the employment of electronic counter- measures techniques. [] Contrast with **HARD KILL**, **SOFT KILL**. See also **FRONT-DOOR SYSTEM PENETRATION**, **BACK-DOOR SYSTEM PENETRATION**, **DIRECTED ENERGY WEAPON**. NOTE: An example of a **FIRM KILL** is the destruction of a missile's guidance electronics.

FIRST GENERATION LANGUAGE (1GL) - A language that can be recognized by the processing unit of a computer. Such a language usually consists of patterns of 1s and 0s, with no symbolic naming of operations or addresses. [3*] Synonymous with **MACHINE LANGUAGE**.

FIRST GENERATION RADAR SIGNAL - A generic classification of radar signal sophistication. First generation radar signals have rudimentary features such as simple pulsed radio frequency, constant pulse repetition interval, mechanical beam scanning, frequencies in the A to I bands of the **ELECTROMAGNETIC SPECTRUM**, and numerous **MINOR LOBES** in the radiation pattern. [10:34] See also **SECOND GENERATION RADAR SIGNAL**, **THIRD GENERATION RADAR SIGNAL**, and **FOURTH GENERATION RADAR SIGNAL**.

FIXED VERY LOW FREQUENCY (FVLF) - A submarine broadcast system which is (2001) the primary command and control link to the submarine force. It allows submarines to remain submerged and still receive operational communications. [SPAWAR] See also **EXTREMELY LOW FREQUENCY (ELF)**. NOTE: The high power FVLF transmitter systems operate at 14.0 to 30.0 kHz, providing long range ocean area coverage.

FLAMELESS EXPULSION GRENADE - A **NONLETHAL WEAPON** consisting of a rubber ball grenade body that contains pulverized chemical agents (CN or CS). No pyrotechnics are involved - a CO₂ cartridge at the center of the grenade disperses the irritant through ports at the sides of the grenades. [10:2745]

FLAMING - Expressing strongly-held opinions with emotion, usually on the **INTERNET**. []

FLAMING DATUM - A **DATUM** whose location is the target damaged by a submarine attack. []

FLAMING RECEIVER - An expendable combination infrared and RF decoy. []

FLAPERON - An aircraft control surface that serves both an aileron and a flap. []

FLARE - In countermeasures, a **PYROTECHNIC** device launched from ships and aircraft to serve as a target and lure infrared homing and optical devices away from their true targets. [8] **NOTE:** Pyrotechnic flares may be characterized by the following parameters:

<i>FLARE PARAMETERS</i>
Flare size (volume)
Peak intensity
Spectral energy distribution
Altitude dependence (performance at high altitudes)...
Strong: Degraded performance
Slight: Satisfactory performance
Rise time (time before which flare becomes the preferred target)
Burn time
IGNITION SPIKE
Trajectory
Spatial extent (apparent emitting area in the IR SPECTRAL REGION)

FLARE REJECTION - The ability of a missile to recognize and disregard **PYROTECHNIC** countermeasures. []

FLASH BLINDNESS - Impairment of vision resulting from an intense flash of light. It includes temporary or permanent loss of visual functions and may be associated with retinal burns. See also **DAZZLE**. [1.1]

FLASH MEMORY - High-density non-volatile computer memory designed for rugged applications. The advantages of flash memory are non-volatility and a simple and inexpensive cell structure. The major disadvantages are that individual bytes cannot be erased and overwritten, but instead, sections of the device or the entire

device are erased. Also, erase/write cycles are much slower than read operations and may require complex erase and write algorithms to insure the device is not damaged during these operations. [10:2525] NOTE: 2005 -- as technology has developed, flash memory, which retains data after electrical power is removed, can be used like any other media; indeed, it is used in cameras and portable memory storage (for example, I have a 64 MB flash memory with a UBS port in my Swiss Army knife.)

FLEX-CUFFS - Lightweight disposable restraints (hand-cuffs) to immobilize individuals. They can be carried in large quantities by soldiers. []

FLEX TARGETING - The ability (*e.g.*, of bombers) to change targets while en route. []

FLEXIBLE LIGHT ELECTRONIC ATTACK SYSTEM (FLEAS) - An advanced mobile jamming system intended to provide a SOFT-KILL response against handheld radios and cellular telephones. FLEAS acquires and analyzes signals and can either perform high-power directional JAMMING, INTRUSION or long-range DECEPTION. [10:3015] NOTE: FLEAS is designed for use by a variety of forces, including police and border guard units.

FLOATPLANE - A seaplane (*i.e.*, an airplane designed to take off and touch down on water) whose fuselage is supported by struts attached to two or more pontoon floats. [] Contrast with the **flying boat**, a seaplane with its fuselage formed into a boat hull (with possibly wing-support pontoons), having the buoyancy and strength necessary to take off, touch down, and float on water.

FLOPTICAL DISK - A very high density floppy disk which uses an optical servo system to position the magnetic read-write head with great accuracy. [10:2538]

FLUENCE - A measure of microwave energy strength. Specifically, a time-integrated power density. [10:16]

FLUIDICS - A control technology that uses a fluid medium - liquid or gas - to perform sensing, amplification, logic, and control functions based on the medium's internal fluid dynamics. [10:103] NOTE: Fluidic controls employ streams of fluid to deflect other streams and make sensing, controlling and computing devices operable under conditions where others may fail. Fluidic controls have been found to be extremely reliable, easy to maintain and highly resistant to radiation and dust. [10:2746]

FLUORESCENT NANOCLUSTER - A binary storage technique that provides 3-dimensional storage, creating a dense storage medium that can be written to or read in parallel. [10:2891] NOTE: A compact disk currently holding 650 megabytes of data could, using fluorescent nanocluster techniques, hold 650 megabytes squared of data.

FLY-ALONG FLARE - An infrared countermeasures (IRCM) flare which, after launch, will fly along at a distance from the launching aircraft to act as a decoy against the IR seeker of an incoming missile equipped with a FORWARD-BIAS COUNTERMEASURES. [10:2818] Also called KINEMATIC FLARE.

FLY-BY-LIGHT (FBL) -- An aircraft control technology designed to replace electronic data transmission, mechanical control linkages, and electronic sensors with optical components and subsystems. Fly-by-light systems are inherently lightweight and impervious to electromagnetic radiation. [10:2673] See also POWER-BY-WIRE. NOTE: FBL is the use of optical components and subsystems to control flight. FBL technology will replace electronic data transmission, mechanical control linkages, and electronic sensors.

FLY-BY-WIRE (FBW) CONTROL - Electronic control of aircraft control surfaces using redundant channels having dissimilar computer algorithms and communications, so that each channel operates independently of the others. [10:50] NOTE: FBW control replaces the mechanical cable/quadrant/pushrod system on aircraft.

FLYING PEANUT - A remotely-controlled unmanned vertical take-off and landing reconnaissance vehicle capable of real-time transmission of infrared imagery. [10:73]

FLYING RADAR TARGET (FLYRT) - A chaff-launcher ejected flying decoy that emulates the radar cross-section and motion of a ship. [JED "Washington Report 5/93]

FLY ON THE WALL - A MICRO AIR VEHICLE (MAV) with bulging hex-covered "eyes" which can fly to and place itself on a target and emit a low energy code, allowing a homing weapon to guide in on its position. [10:2751] Also called ROBO-BUG. See also MICROMECHANICAL FLYING INSECT (MFI). NOTE: The fly would be operated via remote control by on-site special operations personnel to the designated mean point of impact (DMPI).

FLYWHEEL BATTERY - A system consisting of a flywheel, a motor-generator (MG), and control electronics. Input power, say from a solar array, powers the motor which converts electrical energy to mechanical energy by spinning the flywheel (which speeds up as it accumulates energy). When the connected load requires electrical energy, the flywheel drives the generator, converting mechanical to electrical energy (the flywheel slows down as energy is expended to the load). NOTES: (1) The flywheels are designed to rotate at speeds ranging from 10,000 to over 50,000 revolutions per minute (rpm), and must be constructed of extremely strong material such as carbon fiber, to keep from flying apart. Friction losses are minimal because the flywheels are supported by magnetic bearings. Windage losses are handled by mounting the flywheels in air-evacuated housings. (2) Although currently (2002) more expensive (price per kilowatt-hour) than lead-acid batteries, flywheel batteries have important advantages, such as high efficiency (> 95%) and long service life (>20 years compared to a few years for lead-acid batteries); thus, they

have promising potential for use in space applications. (3) The gyroscopic aspects of the flywheel battery can be exploited in space for attitude control, etc.... [10:2934]

FOCAL PLANE - In an optical system, a plane through the focal point perpendicular to the principal axis of the system, such as a lens or mirror. [10:14]

FOCAL PLANE ARRAY (FPA)- See **STARING DETECTOR**.

FOCUSED LOGISTICS - The fusion of information, logistics, and transportation technologies to provide rapid crisis response, to track and shift assets even while enroute, and to deliver tailored logistics packages and sustainment directly at the strategic, operational, and tactical level of operations [10:2941]

FOE-AS-FRIEND IDENTIFICATIONS -- The percentage of friendly tracks in the system that correlate with hostile real objects. [] Contrast with **FRIEND-AS-FOE IDENTIFICATIONS**.

FOLIAGE PENETRATION RECONNAISSANCE, SURVEILLANCE, TRACKING and ENGAGEMENT RADAR - See **FORESTER**

FORCE PROJECTION (FP) - The employment of military ground forces and combat power. [U.S. Army field manual *FM 55-10*] NOTES: A. Field Manual *FM 100-5* describes force-projection operations in eight stages: (1) mobilization, (2) predeployment activity, (3) deployment, (4) entry operations, (5) operations, (6) war termination and post-conflict operations, (7) predeployment and reconstitution, and (8) demobilization. B. The term "FORCE PROJECTION/DOMINANT MANEUVER" is sometimes used, and is defined in the *NAVWAR Joint Warfighting Science and Technology Plan (circa 2000)* as "Fast deployment and timely employment and maneuver of joint forces to rapidly dominate the full range of military operations."

FOLLOWER JAMMING - A form of **ELECTRONIC JAMMING** that jams each hop in a **FREQUENCY HOPPING** communications system. [10:3027]

FORCE STRUCTURE - The component of **MILITARY CAPABILITY** that relates to numbers, size, and composition of the units that comprise the force; e.g., divisions, ships, air wings. [1.1]

FORCIBLE ENTRY OPERATIONS (FEO) - An "enabling concept" that sets the conditions for a major contested invasion of enemy territory that will help achieve decisive strategic victory. Forcible Entry Operations may be an element of or a follow-on to **RAPID DECISIVE OPERATIONS (RDO)**. Like RDO, Forcible Entry Operations require elements of all the other supporting concepts to be successful: Focused Logistics, Enabling Early Decisive Operations (FEEDO), Attack Operations

Against Critical Mobile Targets, Joint Interactive Planning, Common Relevant Operational Picture (CROP), and Adaptive Joint Command and Control, Strategic Deployment, and Information Operations. [U.S. Army manual *FM 100-15*] NOTE: The Forcible Entry Operations concept differs from the Rapid Decisive Operations concept in that RDO is an end-to-end concept that results in decisive operational-level victory.

FORCENET - (1) An operational construct and architectural framework that integrates the SEA POWER 21 concepts of Sea Strike, Sea Shield and Sea Basing by connecting warriors, SENSORS, NETWORKS, command and control, platforms, and weapons; providing accelerated speed and accuracy of decision; and integrating knowledge to dominate the BATTLE SPACE. Forcenet provides the following capabilities: Expeditionary, multi-tiered, sensor and weapon grids; Distributed, collaborative command and control; Dynamic, multi-path survivable networks; Adaptive/automated decision aids; and Human-centric integration. [10:2960] (2) The operational construct and architectural framework for naval warfare in the information age that integrates warriors, sensors, networks, command and control, platforms, and weapons into a networked, distributed combat force that is scalable across all levels of conflict from seabed to space and sea to land. [Chief of Naval Operations' Strategic Studies Group] NOTES: Also called FORCenet. FORCenet implements the theory of network-centric warfare.

FOREIGN INSTRUMENTATION AND SIGNALS INTELLIGENCE (FISINT) - Technical information and intelligence information derived from the intercept of foreign instrumentation signals by other than intended recipients. Foreign instrumentation and signals intelligence is a category of SIGNALS INTELLIGENCE (SIGINT). [1.1] See also TELEMETRY INTELLIGENCE. NOTE: Foreign instrumentation signals include but are not limited to signals from telemetry, beaconry, electronic interrogators, tracking/fusing/arming/firing command systems, and video data links.

FORESTER Acronym for Foliage Penetration Reconnaissance, Surveillance, Tracking and Engagement Radar. A sensor designed to detect and track moving dismounted soldiers and vehicles at a range of 30 kilometers in the open or through light foliage. [10:3090]

FORWARD-BIAS COUNTERMEASURES - An infrared counter-countermeasures (IRCCM) technique used by an infrared-homing missile against a decoy infrared countermeasures (IRCM) flare in which the IR missile seeker is turned off momentarily allowing the IRCM flare to fall away from the seeker's field of view (FOV). [10:2818] Also called PUSH-AHEAD COUNTERMEASURES. See also FLY-ALONG FLARE.

FORWARD ERROR CORRECTION (FEC) - A coding technique designed to clean up signals damaged by channel CROSSTALK, noise, and other interference common to space communication links. FEC codes detect and correct data errors at the receiver (forward) end of the transmission. [10:2568]

FORWARD LOOKING INFRARED (FLIR) - INFRARED sensors used aboard fixed wing aircraft and helicopters for intelligence gathering and to provide real-time sensors for pilots to improve their ability to fly at night and in inclement weather conditions. [10:6]

FORWARD PASS - Transferring control of a fired weapon to another platform. This is a facet of COOPERATIVE ENGAGEMENT. [10:128]

FORWARD SCATTERING - SCATTERING of an electromagnetic wave into directions that are at acute angles to the direction of propagation of the incident wave. [3]

FORWARD TELLING - Transferring information to a higher level of command. [1.1] See also BACK TELLING, CROSS TELLING, OVERLAP TELLING, RELATERAL TELLING, TRACK TELLING.

FOTOFIGHTER - A highly maneuverable plane (conceptual) equipped with an array of diode lasers that would allow the plane to engage multiple targets simultaneously. At low powers, the arrays can function as transmitters and receivers for LPI communications. [10:2749]

FOURTH GENERATION LANGUAGE (4GL) - Fourth generation productivity tool. A programming tool characterized by a reduction of numbers of instructions required by THIRD GENERATION LANGUAGEs by a factor of 10 (or provides an equivalent improvement in productivity if its interface with the programmer is not a language per se). Additions in the 4GL include direct manipulation of databases, and screen-manipulation ability, including windowing. [10:93] See also FIRST GENERATION LANGUAGE, SECOND GENERATION LANGUAGE, FIFTH GENERATION LANGUAGE.

FOURTH GENERATION PROGRAMMING - See FOURTH GENERATION LANGUAGE.

FOURTH GENERATION RADAR SIGNAL - A generic classification of radar signal sophistication. Fourth generation radar signals have sophisticated features reflecting the most modern technology available. [10:34] See also FIRST, SECOND, and THIRD GENERATION RADAR SIGNAL.

FRACTAL - Formally, A curve whose Hausdorff-Besicovitch dimension is larger than its Euclidean dimension. Fractals are a natural way of representing many of the shapes in nature. One application of fractals is in simulation systems. [10:120] NOTE: A fractal is any image or object that can be constructed using an iterative mathematical formula. A fractal is characterized as a curve having a fractional, versus integral, dimension. Fractals are sometimes referred to as "visual representations of chaos". Examples of fractal curves are the Phoenix Curve, Mandelbrot Set, Julia Set, Hilbert Curves, Von Koch Snowflake, and Gosper Curve.

FRACTAL ANTENNA - An antenna comprised of elements patterned after self-similar designs (i.e., any arbitrarily small region of a fractal looks like the entire fractal). It is capable of many resonances, depending upon the iterations. [10:2601] See also **GENETIC ANTENNA**.

FRACTIONAL BANDWIDTH (FBW) - The ratio of the instantaneous bandwidth to the carrier bandwidth. [10:2571] NOTE: For example, an S-band radar operating at 3 GHz with a bandwidth of 300 MHz would have a fractional bandwidth of $0.3/3 = 0.1$.

FRAGILITY - The inherent inability of a force or organization to respond to changes in external conditions. [10:2760] NOTE: Fragility may be affected by overt actions of the adversary or by natural occurrences which sap energy and resources.

FRAGMENTARY ORDER (FRAGO) - An abbreviated form of an **OPERATION ORDER (OPORD)**, usually issued on a day-to-day basis, that eliminates the need for restating information contained in a basic operation order. It may be issued in sections. [10:2764]

FRAME FREQUENCY - The inverse of **FRAME TIME**. []

FRAME TIME - The time required by a **SCANNING** sensor (active or passive) to execute one complete search scan. [] See also **SCANNING DETECTOR**.

FRANGIBLE PROJECTILE - A **NONLETHAL WEAPON** projectile which disintegrates (e.g., turns to iron dust) upon striking a hard object. The usual purpose is to limit collateral damage, such as behind a door or wall struck by the projectile. []

FREE-ELECTRON LASER (FEL) - A directed energy weapon which employs accelerator technologies known as induction accelerators and radio frequency accelerators. [5:1] See also **BEAM-PLASMA DEVICE**; **VIRTUAL-CATHODE OSCILLATOR** ; **CHEMICAL LASER**; **EXCIMER LASER**; **HIGH ENERGY LASER**, **X-RAY LASER**. NOTES: (1) Free-electron lasers work by first depositing large amounts of energy in gases and then extracting some fraction of that energy in a collimated

beam. (2) A free-electron laser can be controlled better than conventional lasers to perform a variety of militarily useful tasks

FREQUENCY - The number of periods per unit time. Specifically, the number of identical cycles per second. [3] See also **HERTZ**.

FREQUENCY AGILE RADAR - A pulse radar in which the transmitter carrier frequency is changed between pulses or groups of pulses by an amount comparable to or greater than the pulse bandwidth. [3] NOTE: The frequency agile radar is considered to be a **LOW PROBABILITY-OF-INTERCEPT (LPI) RADAR**.

FREQUENCY AGILITY - The ability of an electronic transmitting system to quickly change operating frequencies, generally on a pulse-to-pulse basis while the frequency remains stable during the pulse. These frequencies are automatically selected and successive transmissions may be random or determined according to some programmed algorithm. [] See also **SNIFFING**.

FREQUENCY DECONFLICTION - A systematic management procedure to coordinate the use of the electromagnetic spectrum for operations, communications, and intelligence functions. Frequency deconflition is one element of electromagnetic spectrum management. [7:CJCS MOP 6, APPENDIX B]

FREQUENCY DOMAIN REFLECTOMETRY (FDR) - A **REFLECTOMETRY** technique using sine waves. FDR directly measures the phase difference between the incident and reflected waves; any faults in the line will generate resonances between the two signals, which are detected by the frequency domain reflectometer. [10:2871] See also **SMART WIRE**, **STANDING WAVE REFLECTOMETRY (SWR)** and **TIME-DOMAIN REFLECTOMETRY (TDR)**.

FREQUENCY HOPPING (FH) - A **SPREAD SPECTRUM** technique in which the transmitted frequency is pseudorandomly changed at a rate called the "hopping rate". [4:13] Contrast with **DIRECT SEQUENCE SPREADING**, **TIME HOPPING**. NOTE: In Frequency Hopping, the total available bandwidth is the spread bandwidth; however, the instantaneous bandwidth is less than the spread bandwidth. This technique is used in communications, radar, jamming, and other applications. **HISTORICAL NOTE**: Austrian-born Hedy Kiesler Markey, known as movie star Hedy Lamarr (1913-2000) and Polish-born composer George Antheil (1900-1959) invented and patented a secret communications system, U.S. Patent 2,292,387 issued August 11th, 1942 . The purpose of the system was to provide reliable and jam proof control of long range torpedoes. The system involved the use of the frequency hopping principles of Spread Spectrum radio.

FREQUENCY MODULATION (FM) - A form of **ANGLE MODULATION** in which the instantaneous frequency of a sine-wave **CARRIER** is caused to depart from the carrier frequency by an amount proportional to the instantaneous value of the

modulating wave. See also AMPLITUDE MODULATION (AM), PHASE MODULATION (PM).

FREQUENCY REUSE - The simultaneous use of a frequency for two or more purposes. []

FREQUENCY SEARCH-AND-LOOK JAMMING - The employment of NARROWBAND JAMMING that is tuned automatically over a broad frequency band and automatically locked onto a particular frequency. []

FREQUENCY SELECTIVE SURFACE (FSS) -- (1) An adjustable plastic screen used in RADOMEs or ADVANCED ENCLOSED MASTs (AEMs) that allows certain frequencies to pass while blocking others. [] (2) FSS consists of low-cost engineered electromagnetic material used to control surface currents in antenna applications; it features an array printed inductors and capacitors on a planar surface on the antenna. Two advantages of FSS are the size reduction of the physical antenna (by nearly a factor of 2) and the reduction of detuning effects by objects in the antenna's near field. [Antenna FSS Info Sheet IS002-A 5/23/2003] NOTES: (1) The Ohio State University Center for Intelligent Transportation Research (CITR) used an FSS embedded in a road stripe as a lane locator for an autonomous vehicle demonstration system. [The OSU Autonomous Vehicle Website, Ohio State University Center for Intelligent Traffic Research (CITR), eewww.eng.ohio-state.edu/citr/Demo97/osu-av.html] (2) In addition to RADAR CROSS-SECTION (RCS) augmentation, recent applications of FSS include: Radio Frequency Identification (RFID) tags; Collision avoidance; RCS augmentation; robotic guided paths; ELECTROMAGNETIC INTERFERENCE (EMI) protection; PHOTONIC BAND-GAP structures; waveguide or cavity controlled coupling; LOW PROBABILITY OF INTERCEPT (LPI) systems (*e.g.*, "stealth") [Ansoft Corporation Presentation #4 www.ansoft.com/Empower/Frequency_Selective_Surfaces.pdf]

FREQUENCY SHIFT KEYING (FSK) - A form of FREQUENCY MODULATION (FM) in which the modulating signal shifts the output frequency between predetermined values, and the output WAVE has no discontinuities. [3] LISTEN to a Frequency Shift Keying (FSK) signal.

FREQUENCY SPECIFIC JAMMING - [ACOUSTIC JAMMING term] Acoustic jamming of a defined acoustic sensor. [10:41]

FREQUENCY SPECTRUM - See ELECTROMAGNETIC SPECTRUM

FREQUENCY SYNTHESIZER - A device which translates the stable frequency of a precision frequency standard, such as a crystal-controlled oscillator, into a number of frequencies over a spectrum range. There are two types of frequency synthesis: DIRECT SYNTHESIS (DS) and INDIRECT SYNTHESIS (IS). [10:2616]

FRIEND-AS-FOE IDENTIFICATIONS -- The percentage of hostile tracks in the system that correlate with friendly real objects. [] Contrast with **FOE-AS-FRIEND IDENTIFICATIONS**.

FRONT-DOOR COUPLING - See **FRONT-DOOR SYSTEM PENETRATION**.

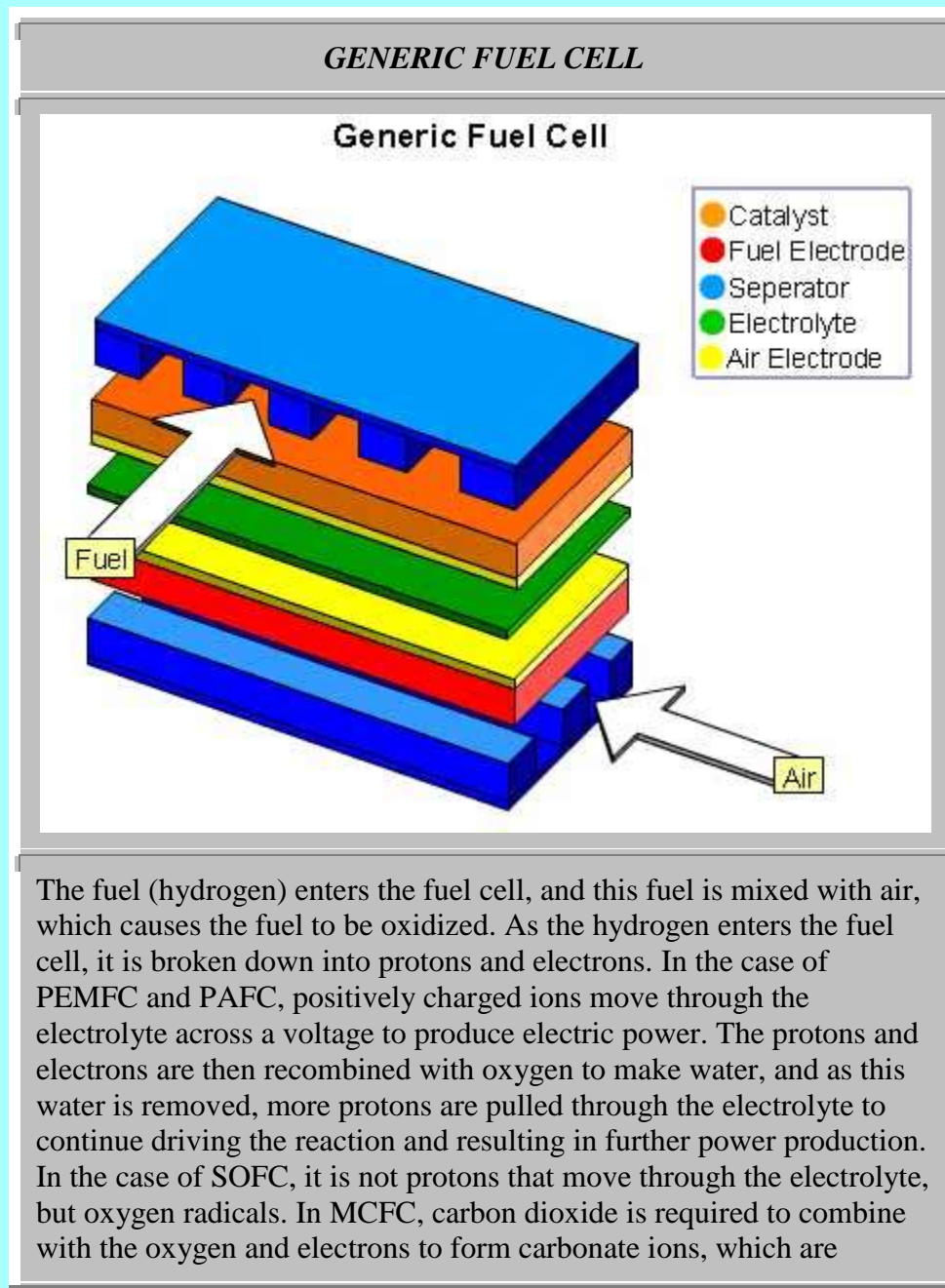
FRONT-DOOR SYSTEM PENETRATION - A **DIRECTED ENERGY WEAPON** term for energy entering a target system through its antenna. [10:16] Synonymous with **FRONT-DOOR COUPLING**. Contrast with **BACK-DOOR SYSTEM PENETRATION**. NOTE: Front-door system penetration is most effective at the target system's antenna design frequency.

FRONTLIGHT - A lamp that reflects off the front surface of a reflective display. It is used when ambient light is insufficient or, in the case of a reflective field-sequential color display, to sequentially illuminate the display with red, green, and blue light. [10:2600] Contrast with **BACKLIGHT**.

FUEL AIR EXPLOSIVE (FAE or FAX) - A **THERMOBARIC WEAPON** that dispenses an aerosol fuel cloud which ignites as it descends (assuming that it is a submunition launched from a **CLUSTER BOMB UNIT (CBU)**). The overpressure from the explosion flattens objects underneath the cloud. [10:2908] NOTE: FAEs may also be delivered by other means, such as a planted aerosol dispenser with a delayed fuze, *etc.*).

FUEL CELL - A source of energy for engines and electrical batteries that have the potential to replace current power supplies of batteries and diesel generators, or supply essential reliable power in the battlefield. Fuel cells are similar to electrical batteries in that an electro-chemical reaction is used to create electric current. The charge carriers can be released through an external circuit via wire connections to anode and cathode plates of the battery or the fuel cell. The major difference between fuel cells and batteries is that while batteries carry limited supplies of fuel internally in the form of electrolytic solution and solid materials (such as the lead acid battery that contains sulfuric acid and lead plates) or as solid dry reactants such as zinc carbon powders found in a flashlight battery, fuel cells generate similar reactions using gases (hydrogen and oxygen) that are combined in a catalytic process. Since the gas reactants can be fed into the fuel cell and constantly replenished, the fuel cell will never run down like a battery. Fuel cells are named according to the type of electrolyte and materials used (See NOTE 1 below). The fuel cell electrolyte is sandwiched between a positive and a negative electrode. Because individual fuel cells produce low voltages, fuel cells must be stacked together to generate the desired output. The fuel cell stack is integrated into a fuel cell system with other components, including a fuel **REFORMER**, power electronics, and controls. Fuel cell systems can convert chemical energy from fossil fuels directly into electricity. The image below

shows the basic components of a generic fuel cell. [Source: California Energy Commission - August 19, 2003] NOTES: (1) There are four fuel cell technologies currently under development: "high-temperature" technology fuel cells: molten carbonate fuel cells (MCFC) and solid oxide fuel cells (SOFC); and "low-temperature" technology fuel cells: phosphoric acid fuel cells (PAFC) and proton exchange membrane fuel cells (PEMFC). (2) Natural gas (methane) is considered to be the most readily available and the cleanest fuel (next to hydrogen) for distributed generation applications, so most work is focused on natural-gas-powered fuel cells. However, fuel cells need hydrogen gas to operate, so the key is converting natural gas into a hydrogen-rich gas.



transmitted through the electrolyte.

Source: California Energy Commission - August 19, 2003

FULL AUTHORITY DIGITAL ENGINE CONTROL (FADEC) - The regulation of engine power and efficiency by integrating, in **REAL TIME**, the flight control computer with the variables (sensed parameters, specified schedules, control logic, ...) coupled with mission requirements. [12]

FULL-DIMENSIONAL PROTECTION - Protecting our own forces from the very technology we are exploiting. [10:2941]

FULLERENE - A **NANOMETER** material composed of 60 carbon items and a third form of carbon after graphite and diamond. Also called **BUCKY BALL**. [10:3006]
See also **BUCKMINSTERFULLERENES**, **BUCKY TUBE**, **DENDRIMERS**, **MOLECULAR ELECTRONICS**, **NANOWIRE**, **QUANTUM DOTS**. **NOTES**: (1) The term "bucky ball" refers to the resemblance of fullerenes to the geodesic domes of architect R. Buckminster Fuller. (2) **FULLERENE**, when formed into a flat sheet and rolled into a cylinder, becomes an extremely strong material of nanoscale dimensions: a carbon **NANOTUBE**. [10:3006]

FULL SPECTRUM INFORMATION OPERATIONS - A U.S. Army integrating strategy merging the following disciplines: [10:2710]

<i>FULL SPECTRUM INFORMATION OPERATIONS</i>	
Deception	Psychological Operations (PSYOPS)
Operations Security (OPSEC)	Electronic Warfare (EW)
Physical Strikes	Civil Affairs
Counterdeception	Counterpropaganda
Counterintelligence	Computer Network Defense
Computer Network Attack	Public Affairs

FUNCTIONALLY SIGNIFICANT ITEM (FSI) - A shipboard item which performs a function and is significant to the performance of the system of which it is a part. A functionally significant item can be a system, subsystem, equipment, component, or any combination of these. [NAVSEAINST 4790.1A]

FUTUREMAP - A Defense Advanced Research Project Agency (DARPA) Total Information Awareness (TIA) program to develop market-based techniques to avoid surprise and predict future events of world futures markets. [10:2969] NOTE: FUTUREMAP received severe congressional criticism (July 2003) when Senator Ron Wyden (D-Oregon) lambasted it as a "Tax-Funded 'Terror Market' Scheme Defense Program" and "terrorism lottery."

FUZE JAMMING - A generic term relating to fuze countermeasures that will pre-detonate missile fuzes. [4:1]

FUZE SERRODYNE MODULATION - A fuze jamming technique employed to produce the Doppler shift that will trigger a Doppler fuze. [4:1]

FUZZY LOGIC - An approach to computing based on "degrees of truth" rather than the usual "true or false" (1 or 0) Boolean logic on which the modern computer is based. Fuzzy logic includes 0 and 1 as extreme cases of truth, but also includes various states of truth in between. [10:2768]
