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ADS-B UAT MOPS

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SUMMARY

This document represents the 2nd draft of Appendix A, Acronyms and Definitions of Terms.

APPENDIX A

ACRONYMS & DEFINITION OF TERMS

(Version 2, dated 3/16/01)

A.1 Acronyms

AC - Advisory Circular

ACARS - Aircraft Communications, Addressing and Reporting System

ACAS - Airborne Collision Avoidance System

ADS - Automatic Dependent Surveillance

ADS-B - Automatic Dependent Surveillance-Broadcast

AGC - Automatic Gain Control

AGL - Above Ground Level

AIP - Aviation Information Publications

A/V - Aircraft/Vehicle

ARINC - ARINC Incorporated (formally Aeronautical Radio Incorporated)

ASIC - Application Specific Integrated Circuit

ATCRBS - Air Traffic Control Radar Beacon System

ATC - Air Traffic Control

ATM - Air Traffic Management

ATS - Air Traffic Services

ATIS - Automatic Terminal Information Service

BCD - Binary Coded Decimal

BDS - Comm-B Data Selector

BER - Bit Error Rate

BNR - Binary Numbers

bps - Bits Per Second

BW - Bandwidth

C/A - Coarse Acquisition

CC - Clock Correction

CDI - Course Deviation Indicator

CF - Course-to-Fix

CPA - Closest Point of Approach

CNS - Communications, Navigation and Surveillance

CDTI - Cockpit Display of Traffic Information

CRC - Cyclic Redundancy Check

CTAS - Center TRACON Automation System

CW - Continuous Wave

dB - Decibel

dBm -

DME - Distance Measuring Equipment

DMTL - Dynamic Minimum Trigger Level

DOD - U.S. Department of Defense

DOP - Dilution Of Precision

DP - Datum Point

dps - Degrees Per Second

DR - Dead Reckoning

DRWP - Departure End of Runway Waypoint (associated with a departure procedure)

EC - Ephemeris Correction

ECEF - Earth Centered Earth Fixed

EFIS - Electronic Flight Instruments System

EL - Glidepath Angle (approach path elevation angle)

ELT - Emergency Locating Transmitter

EPU - Estimated Position Uncertainty

E/W - East/West

ERP - Effective Radiated Power

ETA - Estimated Time of Arrival

EUROCAE - European Organization for Civil Aviation Equipment

FAA - Federal Aviation Administration

FAF - Final Approach Fix

FAR - Federal Aviation Regulation

FAS - Final Approach Segment

FAWP - Final Approach Waypoint

FD - Fault Detection

FDE - Fault Detection and Exclusion

FEC - Forward Error Correction

FIS-B - Flight Information Services-Broadcast

FTE - Flight Technical Error

FMS - Flight Management System

f_0 - Nominal or Center Frequency

FPGA - Field Programmable Gate Array

fpm - Feet Per Minute

FSD - Full Scale Deflection

FSS - Flight Service Station

FTE - Flight Technical Error

GICB - Ground Initiated Comm-B

GL - Ground Level

GNSS - Global Navigation Satellite System

GPS - Global Positioning System

h - Modulation Index

HF - High Frequency

HIRF - High Intensity Radiation Fields

Hz - Hertz

IAC - Instantaneous Airborne Count

IAS - Indicated Airspeed

ICAO - International Civil Aviation Organization

IFR - Instrument Flight Rules

ILS - Instrument Landing System

IMC - Instrument Meteorological Conditions

INS - Inertial Navigation System

I/O - Input and/or Output

ITC - In-Trail Climb

ITD - In-Trail Decent

ITU - International Telecommunication Union

JAA - Joint Aviation Authorities

JAR - Joint Aviation Requirements

kHz - Kilohertz

L1 - 1575.42 MHz (a navigation frequency associated with GPS)

LAAS - Local Area Augmentation System

LADGPS - Landing Area Differential GPS

lb. - pounds

LORAN - Long Range Navigation

LSB - Least Significant Bit

LSR - Least Squares Residual

MASPS - Minimum Aviation System Performance Standards

Mbps - Million Bits Per Second

MFD - Multi-Functional Display

MHz - Megahertz

MOPS - Minimum Operational Performance Standards

MTBF - Mean Time Between Failure

MS - Mode Status

ms - Milliseconds

MSL - Minimum Signal Level

MSO - Message Start Opportunity

MTL - Minimum Trigger Level

MTOR - Message Time Of Receipt

MTTR - Mean-Time-To-Restore

MTR - Military Training Route

NAD-83 - North American Datum 1983

NAS - U.S. National Airspace System

NAV - Navigation

NAVAID - Navigation Aid

nmi - Nautical Mile

NOTAM - Notice to Airmen

N/S - North/South

NUC_P - Navigation Uncertainty Category - Position

NUC_R - Navigation Uncertainty Category - Velocity

OBS - Omni Bearing Selector

OC - On Condition

PIREP - Pilot Report

PPM - Pulse Position Modulation

PPS -

PRC - Pseudo range Correction

PRM - Precision Runway Monitoring

P_r - Probability of Receipt

PSR - Primary Surveillance Radar

PUC - Position Uncertainty Category

RA - Resolution Advisory

RAIM - Receiver Autonomous Integrity Monitoring

RCP - Required Communication Performance

RF - Radio Frequency

RMP - Required Monitoring Performance

rms - Root Mean Square

RNP - Required Navigation Performance

RS - Reed-Solomon

RSP - Required System Performance

rss - Root-Sum-Square

RVR - Runway Visual Range

RVSM - Reduced Vertical Separation Minimum

SA or S/A - Selective Availability

SAE - Standard Aerospace Equipment

SAR - Search And Rescue

SARPS - Standards and Recommended Practices

SID - Standard Instrument Departure

SNR - Signal-to-Noise Ratio

sps - Symbols per second

SPS - Standard Positioning Service

SSR - Secondary Surveillance Radar

STAR - Standard Terminal Arrival Routes

SUA - Special Use Airspace

SV - Satellite Vehicle

TA - Traffic Advisory

TAS - True Airspeed

TCAS - Traffic Alert and Collision Avoidance System

TCP - Trajectory Change Point

TERPS - Terminal Instrument Procedures

TIS - Traffic Information Service

TIS-B - Traffic Information Service-Broadcast

TMA - Terminal Maneuvering Area

TSD - Traffic Situation Display (see also CDTI)

TSDF - Time Slot Duty Factor

TSE - Total System Error

TSO - Technical Standards Order

TTG - Time to Go

UAT - Universal Access Transceiver

U.S. - United States

UTC - Coordinated Universal Time

VFR - Visual Flight Rules

VMC - Visual Meteorological Conditions

VNAV - Vertical Navigation

VUL - Vertical Uncertainty Level

VHF - Very High Frequency

VNAV - Vertical Navigation

VOR - VHF Omnidirectional Range

VUC - Velocity Uncertainty Category

W - Watts

WAAS - Wide Area Augmentation System

WGS-84 - World Geodetic System 1984

Xmt - Transmit

A.2 Definition of Terms

Accuracy - A measure of the difference between the A/V position reported in the ADS-B message field as compared to the true position. Accuracy is usually defined in statistical terms of either 1) a mean (bias) and a variation about the mean as defined by the standard deviation (sigma) or a root mean square (rms) value from the mean. The values given in this document are in terms of the two-sigma variation from an assumed zero mean error.

Active Waypoint - A waypoint to or from which navigational guidance is being provided. For a parallel offset, the active waypoint may or may not be at the same geographical position as the parent waypoint. When not in the parallel offset mode (operating on the parent route), the active and parent waypoints are at the same geographical position.

ADS-B Broadcast and Receive Equipment - Equipment that can transmit and receive ADS-B messages. Defined as Class A equipment.

ADS-B Broadcast Only Equipment - Equipment that can transmit but not receive ADS-B messages. Defined as Class B equipment.

ADS-B Message - A modulated packet of formatted data which conveys information used in the development of ADS-B reports.

ADS-B Report - Specific information provided by the ADS-B user participant subsystem to external applications. Reports contain identification, state vector, and status/intent information. Elements of the ADS-B Report that are used and the frequency with which they must be updated will vary by application. The portions of an ADS-B Report that are provided will vary by the capabilities of the transmitting participant.

ADS-B Subsystem - The set of avionics or equipment that performs ADS-B functionality in an aircraft or for ground-based, non-aircraft, participants.

ADS-B System - A collection of ADS-B subsystems wherein ADS-B messages are broadcast and received by appropriately equipped participant subsystems. Capabilities of participant subsystems will vary based upon class of equipage.

Advisory - An annunciation that is generated when crew awareness is required and subsequent crew action may be required; the associated color is unique but not red or amber/yellow. (Source: Advisory Circular AC 25 - 11).

Aircraft Address - The term “address” is used to indicate the information field in an ADS-B message that identifies the ADS-B unit that issued the message. The address provides a continent means by which ADS-B receiving units—or end applications—can sort messages received from multiple issuing units.

Aircraft/Vehicle (A/V) - Either 1) a machine or service capable of atmospheric flight, or 2) a vehicle on the airport surface movement area. In addition to A/Vs, ADS-B equipage may be extended to temporarily uncharted obstacles (i.e., obstacles not identified by a current NOTAM).

Air Mass - Air mass data includes barometric altitude and air speed.

Alert Zone - In the Free Flight environment, each aircraft will be surrounded by two zones, a protected zone and an alert zone. The alert zone is used to indicate a condition where intervention may be necessary. The size of the alert zone is determined by aircraft speed, performance, and by CNS/ATM capabilities.

Along-Track Distance - The distance along the desired track from the waypoint to the perpendicular line from the desired track to the aircraft.

Applications - Specific use of systems that address particular user requirements. For the case of ADS-B, applications are defined in terms of specific operational scenarios.

Barometric Altitude - Geopotential altitude in the earth's atmosphere above mean standard sea level pressure datum surface, measured by a pressure (barometric) altimeter.

Barometric Altitude Error - For a given true barometric pressure, P_o, the error is the difference between the transmitted pressure altitude and the altitude determined using a standard temperature and pressure model with P_o.

Call Sign - The term "aircraft call sign" means the radiotelephony call sign assigned to an aircraft for voice communications purposes. (This term is sometimes used interchangeably with "flight identification" or "flight ID"). For general aviation aircraft, the aircraft call sign is normally its national registration number; for airline and commuter aircraft, it is usually comprised of the company name and flight number (and therefore not linked to a particular airframe); and for the military, it usually consists of numbers and code words with special significance for the operation being conducted.

Caution - An annunciation that is generated when immediate crew awareness is required and subsequent crew action will be required; the associated color is amber/yellow. (Source: Advisory Circular AC25 - 11).

Closest Point of Approach (CPA) - The minimum horizontal distance between two aircraft during a close proximity encounter, a.k.a. miss distance.

Cockpit Display of Traffic Information (CDTI) - A function which provides the pilot/flight-crew with surveillance information about other aircraft, including their position. The information may be presented on a dedicated multi-function display (MFD), or be processed for presentation on existing cockpit flight displays. Traffic information for the CDTI function may be obtained from one or multiple sources (including ADS-B, TCAS, and TIS) and it may be used for a variety of purposes. Requirements for CDTI information will be based on intended use of the data (i.e., application).

Collision Avoidance - An unplanned maneuver to avoid a collision.

Conflict - Any situation involving two or more aircraft, or an aircraft and an airspace, or an aircraft and ground terrain, in which the applicable separation minima may be violated.

Conflict Detection - The process of projecting an aircraft's trajectory to determine whether it is probable that the applicable separation minimum will not be maintained between the aircraft and either 1) another aircraft or vehicle, 2) a given airspace, or 3) ground terrain. The level of uncertainty in the projection is reduced with increased knowledge about the situation, including aircraft capabilities, flight plan, short term intent information, etc.

Conflict Management - Process of detecting and resolving conflicts.

Conflict Probe - The flight paths are projected to determine if the minimum required separation will be violated. If the minima are not [projected to be] violated, a brief preventive instruction will be issued to maintain separation. If the projection shows the

minimum required separation will be violated, the conflict resolution software suggests an appropriate maneuver.

Conflict Resolution - The process of identifying a maneuver or set of maneuvers that, when followed, do not cause a conflict or reduce the likelihood of conflict between an aircraft and either 1, another aircraft or vehicle, 2, a given airspace, or 3, ground terrain. Maneuvers may be given to multiple aircraft to fully resolve a conflict.

Conformance - The condition established when the surveillance report of an aircraft's position at some time "t" (established by the Automated Tracking function) is within the conformance region constructed around that aircraft at its nominal position at time "t", according to the agreed upon trajectory.

Cooperative Separation - This concept envisions a transfer of responsibility for aircraft separation from ground based systems to the air-crew of appropriately equipped aircraft, for a specific separation function such as In-trail merging or separation management of close proximity encounters. It is cooperative in the sense that ground-based ATC is involved in the handover process, and in the sense that all involved aircraft must be appropriately equipped, e.g., with RNAV and ADS-B capability, to perform such functions.

Cross-link - A cross-link is a special purpose data transmission mechanism for exchanging data between two aircraft—a two-way addressed data link. For example, the TCAS II system uses a cross-link with another TCAS II to coordinate resolution advisories that are generated. A cross-link may also be used to exchange other information that is not of a general broadcast nature, such as intent information.

Desired Course - Can be either 1) True - A predetermined desired course direction to be followed (measured in degrees from true north), or 2) Magnetic - A predetermined desired course direction to be followed (measured in degrees from local magnetic north).

Effective Update Interval - The time interval between successful message receipt with at least 98% probability of successful reception. For example, if ADS-B messages are sent at one second intervals in signal-to-noise conditions with 75% probability of success per transmission, then the probability of obtaining at least one message in three tries is $= 1. - (0.25)^3 \sim 98.4\%$. Thus the effective update interval for this case = 1 sec x 3 = 3 sec.

Effective Update Rate - The reciprocal of effective update interval, e.g. rate = 1/3 ~ 0.33 Hz for the example above.

En Route - A phase of navigation covering operations between departure and termination phases. En route phase of navigation has two subcategories: en route domestic/continental and en route oceanic.

Event Driven - Messages that are broadcast periodically for a duration of the operational condition. Examples of event driven messages include emergency status *(ref.*

RTCA/DO-242, Section 2.1.2.3.1) and aircraft intent *(ref. RTCA/DO-242, Section 2.1.2.3.2).*

Field - The elements of ADS-B message payload. Most of these elements are enumerated in RTCA Document DO-242 (e.g., Latitude, Longitude, Velocity, etc.)

Final Approach Fix (FAF) - A point in space used to indicate the position at which an aircraft on a standard approach should be stabilized with appropriate guidance being supplied for the Final Approach Segment. (Source: FAA)

Flight Technical Error (FTE) - The accuracy with which the aircraft is controlled as measured by the indicated aircraft position with respect to the indicated command or desired position. It does not include blunder errors.

Free Flight - Free Flight is a safe and efficient flight operating capability under IFR in which the operators have the freedom to select their path and speed in real time.[TF3, Oct. 1995].

FRUIT - Transponder replies unsynchronized in time. See Garble, Non-synchronous.

Garble, Non-synchronous - Reply pulses received from a transponder that is being interrogated from some other source. Also called FRUIT.

Geometric Dilution of Position (GDOP) - The ratio of position error of a multi-lateration system. More precisely, it is the ratio of the standard deviation of the position error to the standard deviation of the measurement errors, assuming all measurement errors are statistically independent and have a zero mean and the same standard distribution. GDOP is the measure of the "goodness" of the geometry of the multi-lateration sources as seen by the observer; a low GDOP is desirable, a high GDOP undesirable. (See also PDOP, HDOP and VDOP.)

Geometric Height - The minimum altitude above or below a plane tangent to the earth's ellipsoid as defined by WGS84.

Geometric Height Error - Geometric height error is the error between the true geometric height and the transmitted geometric height.

Global Navigation Satellite System (GNSS) - GNSS is a world-wide position, velocity, and time determination system, that includes one or more satellite constellations, receivers, and system integrity monitoring, augmented as necessary to support the required navigation performance for the actual phase of operation.

Global Positioning System (GPS) - A space-based positioning, velocity and time system composed of space, control and user segments. The space segment, when fully operational, will be composed of 24 satellites in six orbital planes. The control segment consists of five monitor stations, three ground antennas and a master control station. The user segment consists of antennas and receiver-processors that provide positioning, velocity, and precise timing to the user.

GNSS Altitude (MSL) - The height of the aircraft (or of its GNSS antenna) above the *geoid*, which is the surface that represents mean sea level. The term *geoid,* as defined by the National Geodetic Survey's *Geodetic Glossary*, is the equipotential surface of the Earth's gravity field which best fits, in the least squares sense, mean sea level.

Graticule - A network of lines on a map representing geographic parallels and meridians.

Ground Uplink Message -

Height Above Touchdown (HAT) - Specifically, the height above the Runway Intercept Waypoint. In using this term for airborne equipment specifications, care should be taken to define the point on the aircraft (GPS antenna, wheel height, center of mass) that applies.

Horizontal Dilution of Precision (HDOP) - The ratio of user-referenced horizontal position error to measurement error of a multi-lateration system. (See GDOP for a more detailed description.)

In-Trail Climb - In-trail climb (ITC) procedures enables trailing aircraft to climb to a more fuel-efficient or less turbulent altitude.

In-Trail Descent - In-trail descent (ITD) procedures enables trailing aircraft to descend to a more fuel-efficient or less turbulent altitude.

Interactive Participants - An ADS-B network member that is a supplier of information to the local ADS-B subsystem and a user of information output by the subsystem. Interactive participants receive messages and assemble reports specified for the respective equipage class.

Latency - The latency of an ADS-B transmission is the time period from the time of applicability of the aircraft/vehicle position ADS-B report until the transmission of that ADS-B report is completed.

Latency Compensation - High accuracy applications may correct for system latency introduced position errors using ADS-B time synchronized position and velocity information.

Message - The actual RF transmission on the UAT channel. There are fundamentally two message types: ADS-B messages and Ground Uplink messages. (See ADS-B Message.)

Message Payload - The portion of the message that carries data (user information) that will be consumed by application systems outside the UAT system.

Message Overhead - The portion of the message which supports the physical layer transfer of the data.

MBA World - As in "those [*expletive added here*] people in the MBA World"; a derogatory expression—typically made by senior avionics design engineers—to stress the fact that, once again, an elegant technical approach/solution has been overridden by a decision made by over-paid bean-counters.

Navigation Mode - The navigation mode refers to the equipment operating to meet the requirements for a specific phase of flight. The navigation modes are: oceanic/remote, en route, terminal, non-precision approach, and precision approach. The oceanic/remote mode is optional; if it is not provided, the en route mode can be substituted for the oceanic mode.

Navigation Uncertainty Category (NUC) - Uncertainty categories for the state vector navigation variables are characterized by a NUC data set provided in the ADS-B sending system. The NUC includes both position and velocity uncertainties.

Near Term - Near-term applications are defined as those that can be supported by an initial ADS-B implementation and that may be operationally feasible within the context of a current ATC system or the ATC systems of the near future.

Normal Maneuver - Any maneuvers within the aircraft's approved flight-loads envelope that does not exceed 60 degrees angle of bank, or results in an abrupt change in the aircraft's attitude or accelerations. Abrupt changes in accelerations are those which exceed the values shown below. *Note that g = acceleration of gravity = 9.8 m/s^2.*

Horizontal Acceleration	Vertical Acceleration	Total Jerk
0.58 g	0.5 g	0.25 g/s

Passing Maneuvers - Procedures whereby pilots use: 1) onboard display of traffic to identify an aircraft they wish to pass; 2) traffic display and weather radar to establish a clear path for the maneuver; and 3) voice communication with controllers to positively identify traffic to be passed, state intentions and report initiation and completion maneuver.

Planned Primary Means - Use of ADS-B for Planned Primary Means will be possible for selected airspace operations based upon predictable conditions, e.g., GNSS constellation, type of operation, and extent of ADS-B equipage for participating aircraft. That is, ADS-B will be available as a primary means of surveillance for particular periods of time in particular geographical regions for approved operations.

Phase of Flight - The phases of flight are defined as follows:

1. Oceanic/Remote - Radio updating is not viable due to either very limited navigation aid coverage or no navigation aid coverage.

2. En Route/Domestic - Aircraft sequences above 15,500 feet while not actively flying a SID, or is above 15,500 and sequences the last waypoint of a SID, or the phase of flight is Oceanic and radio updating is viable.

3. Terminal - Aircraft sequences below 15,000 feet; or when the aircraft is in Approach and exceeds 3,000 feet above arrival airport elevation if there is no missed approach holding point, or the missed approach holding point is sequenced; or the aircraft is in Takeoff and exceeds 3,000 feet above departure airport elevation if no SID exist in active flight plan, or the last waypoint of the SID is sequenced below 15,500.

4. Approach - The first waypoint on the active approach or approach transition is sequenced, or the aircraft sequences below 2,000 feet above arrival airport elevation. Approach flight phase will not be active when a VFR approach is in the active flight plan.

Position Uncertainty Category (PUC) - The position uncertainty category (PUC) is needed for surveillance applications to determine whether the reported position has an acceptable level of position uncertainty. The category is based on the aircraft's estimate of position uncertainty (EPU), as defined in 3.1.2 of the RNP MASPS[9]

Primary Means of Navigation - The airborne navigation equipment that meets the requirements of radio navigation for the intended phase of flight (route to be flown). These requirements include satisfying the necessary level of accuracy, integrity, continuity, and availability for a particular area, route, procedure, or operation. Examples of systems which provide a primary means of navigation include:

a. VOR for domestic en route, terminal, and non precision approach where it is available;

b. VOR/DME for domestic en route above flight level 240, terminal, and non precision approach where it is available;

c. OMEGA for Oceanic Operation;

d. INS for Oceanic Operation;

Protected Zone - In the Free Flight environment, each aircraft will be surrounded by two zones, a protected zone and an alert zone. The protected zone must remain sterile to assure separation. It can be envisioned as a distance-based "hockey puck" with radius equal to half the horizontal separation minimum and vertical extent equal to $\pm$ half the vertical separation minimum. The size of the protected zone is a direct reflection of the position determination accuracy.

Received Update Rate - The sustained rate at which periodic ADS-B messages are successfully received, at a specified probability of reception.

Reliability - The probability of performing a specified function without failure under given conditions for a specified period of time.

Resolution - The smallest increment reported in an ADS-B message field. The representation of the least significant bit in an ADS-B message field.

Report - The encapsulated payload of received messages that is forwarded to on-board application processors. (See ADS-B Report.)

Required Navigation Performance (RNP) - A measure of the navigation system performance within a defined airspace, route, or procedure, including the operating parameters of the navigation's systems used within that airspace. (Source: Adapted from the ICAO Separation Panel).

Seamless - A "chock-to-chock" continuous and common view of the surveillance situation from the perspective of all users.

Self-licking Ice Cream Cone - A system, device, or service that provides undefined capabilities or functionalities that serve no current purpose, other than to exist, until such time as a need or requirement can be invented.

Sole Means of Navigation - An approved navigation system for a given operation or phase of flight that must allow the aircraft to meet, for the operation or phase of flight, all four navigation system performance requirements: accuracy, integrity, availability, and continuity of service.

Station-keeping - Station-keeping provides the capability for a pilot to maintain an aircraft's position relative to the designated aircraft. For example, an aircraft taxiing behind another aircraft can be cleared to follow and maintain separation on a lead aircraft. Station-keeping can be used to maintain a given (or variable) separation. An aircraft that is equipped with an ADS-B receiver could be cleared to follow an FMS or GNSS-equipped aircraft on a GNSS/FMS/RNP approach to an airport. An aircraft doing station-keeping would be required to have, as a minimum, some type of CDTI.

State Vector - An aircraft or vehicle's current kinematic state.

Supplemental Means of Navigation - An approved navigation system that can be used in controlled airspace of the NAS in conjunction with a sole means of navigation.

Tactical Parameters - Tactical information may be used to enhance the performance of designated applications. System designs should be flexible enough to support tactical parameters; however, it is not required to provide the parameters in all implementations.

Terminal Area - A general term used to describe airspace in which approach control service or airport traffic control service is provided.

Total System Error (TSE) - Generic: The root-sum-square of the navigation source error, airborne component error, display error and flight technical error. Specific: The root-sum-square of the position fixing error, display error, course selection error and flight technical error.

Track Angle - Instantaneous angle measured from either true or magnetic north to the aircraft's track.

Transmission Epoch - The interval within which any required ADS-B message is transmitted at least once. This corresponds to 4 UAT frames (or seconds).

Transmission Rate - The sustained rate at which periodic ADS-B messages are transmitted.

Traffic Situation Display (TSD) - A TSD is a cockpit device that provides graphical information on proximate traffic as well as having a processing capability that identifies potential conflicts with other traffic or obstacles. The TSD may also have the capability to provide conflict resolutions.

Trajectory Change Point (TCP) - TCPs provide tactical information specifying space/time points at which the current trajectory of the vehicle will change. This change in vehicle trajectory could be in the form of a change in altitude (climb/descent), a change in heading, a change in airspeed (increase/decrease), or any combination thereof.

UAT Frame - In the UAT system, the *frame* is the most fundamental time unit. Frames are one second long, and begin at the start of each UTC (or GPS) second. Each frame is divided into two segments: one segment in which Ground Uplink messages occur, and another segment in which ADS-B messages occur.

Velocity Uncertainty Category (VUC) - The velocity uncertainty category (VUC) is needed for surveillance applications to determine whether the reported velocity has an acceptable level of velocity uncertainty.

Vertical Profile - A line or curve, or series of connected lines and/or curves in the vertical plane, defining an ascending or descending flight path either emanating from or terminating at a specified waypoint and altitude, or connecting two or more specified waypoints and altitudes. In this sense, a curve may be defined by performance of the airplane relative to the airmass.

Warning - An annunciation that is generated when immediate recognition and corrective or compensatory action is required; the associated color is red. (Source: Advisory Circular AC25 - 11)

World Geodetic Survey (WGS) - A consistent set of parameters describing the size and shape of the earth, the positions of a network of points with respect to the center of mass of the earth, transformations from major geodetic datums, and the potential of the earth (usually in terms of harmonic coefficients).

World Geodetic System 1984 - A set of quantities, developed by the U.S. Department of Defense for determining geometric and physical geodetic relationships on a global

scale, based on a geocentric origin and a reference ellipsoid with semi-major axis 6378137 and flattening 1/298.257223563.