*Sections I would like to see added:*

## Acronyms

|  |  |
| --- | --- |
| ACID | Aircraft Call Sign |
| AGL | Above Ground Level |
| AMSL | Above Mean Sea Level |
| IP | Internet Protocol |
| ISA | International Standard Atmosphere |
| MSL | Mean Sea Level |
| N/A | Not Applicable |
| NED | North, East, Down Cartesian Coordinate System |
| TBD | To Be Defined |
| TCP | Transmission Control Protocol |
| UDP | User Datagram Protocol |
| WGS84 | World Geodetic System 1984 |

## Data Types

The following table specifies the base data types used in the data exchange:

|  |  |  |
| --- | --- | --- |
| **Data Type** | **Description** | **Range** |
| boolean | 8-bit unsigned integer, >= 1 is true, == 0 is false | 0 to 255 |
| char | 8-bit character (signed) | -128 to 127 (Standard ASCII character codes) |
| double | *IEEE 754* double-precision floating-point format (64-bit) | ± 2-1022 to (2-2-52)×21023 |
| float | *IEEE 754* single-precision floating-point format (32-bit) | ± 2-126 to (2-2-23)×2127 |
| sint8 | signed, 8-bit integer | -128 to 127 |
| sint16 | signed, 16-bit integer | -32768 to 32767 |
| sint32 | signed, 32-bit integer | -2147483648 to 2147483647 |
| sint64 | signed, 64-bit integer | -9223372036854775808 to  9223372036854775807 |
| uint8 | unsigned, 8-bit integer | 0 to 255 |
| uint16 | unsigned, 16-bit integer | 0 to 65535 |
| uint32 | unsigned, 32-bit integer | 0 to 4294967295 |
| uint64 | unsigned, 64-bit integer | 0 to 18446744073709551615 |

## Standard Units

All data will be in United States Customary Units unless otherwise noted.

|  |  |
| --- | --- |
| **Data** | **Standard Unit Type** |
| Acceleration | Feet per SecondSquared |
| Altitude | Feet |
| Angles | Degrees |
| Angular Rates | Degrees per Second |
| Distance | Feet |
| Frequencies | Unsigned 64-bit Hz (eg.118.00 MHz = 118000000) |
| Map Datum | WGS 84 |
| Percentage | Part of a hundred (e.g. 89.3% = 89.3) |
| Position | Latitude and Longitude in Degrees |
| Pressure | Pounds per Square Inch (PSI) |
| Rotational Speed | Rotations per minute |
| Speed | Feet per Second |
| Temperature | Degrees Celsius |
| Vertical Speed | Feet per Minute |

# BASIC DEFINITIONS AND CONCEPTS

## Altitude

*Barometric* – measure by changes in atmospheric pressure as defined by the ISA model.

*Geometric* – measure by a ruler to the reference surface

## Coordinate Systems

### Geodetic Coordinate System

The aircraft’s reference point (center of gravity) is defined in terms of geodetic coordinates. The geodetic coordinate system uses an ellipsoidal earth model and specifies a location in terms of latitude, longitude, height and altitude. The Earth Reference Model as defined by the World Geodetic System 1984 (WGS84).

#### Position

*Latitude -* is the size of the angle formed between a vector connecting the center of the earth and the aircraft’s reference point and the equatorial plane. This is measured in degrees north (positive) or south (negative) of the Equator and is limited to ±90°.

*Longitude -* is the angle of the arc along the ellipsoid surface from the Prime Meridian to the point on the Equator closest to the aircraft’s position. This is measured in degrees east (positive) or west (negative) of the Prime Meridian and is limited to ±180°.

*Height -* is the distance from aircraft’s reference point to the point of intersection between the WGS84 ellipsoid surface and the normal vector. Negative values indicate that the aircraft is below the ellipsoid, or inside the reference ellipsoid, and positive values indicate the aircraft is above the ellipsoid, or outside the reference ellipsoid.

*Altitude -* is the geometric distance from aircraft’s reference point to the equipotential gravitational surface representing Mean Sea Level (MSL) as defined by the WGS84.

#### Orientation

The orientation of the aircraft object with respect to the geodetic coordinate system is specified relative to a reference plane that is parallel to an ellipsoid-tangential plane. The reference plane passes through the aircraft’s reference point. A right-hand coordinate system can be defined so that the three axes correspond to North, East and Down (toward the ellipsoid), respectively. The standard order of rotation about the NED axes are: yaw, pitch and then roll.

*Yaw* - is the measure of the angle formed from True North to the aircraft’s **+x** body axis. This angle is specified in degrees and is positive clockwise from North.

*Pitch* - is the measure of the angle between the reference plane and the aircraft’s **+x** body axis. This angle is specified in degrees and is positive above (away from the ellipsoid) the reference plane (nose up).

*Roll* - is the measure of the angle between the reference plane and the aircraft’s **+y** body axis along a plane perpendicular to the aircraft’s **x** body axis. Roll is specified in degrees and is positive clockwise from the point of view of looking along the **+x** body axis (right wing down).

### Body Coordinate System

The standard definition for the “body” coordinate system shall be a right-hand coordinate system with the origin at the aircraft’s center of gravity. The positive **x** axis extends out of the front of the aircraft. The positive **y** axis extends out of the right side, and the positive **z** axis extends out of the bottom of the aircraft.

## Magnetic Variation

The magnetic variation is the difference between true north and magnetic north and is positive if the magnetic north is west of true north. The conversion of true heading to magnetic heading is given by:

Magnetic Heading = True Heading + Magnetic Variation

The magnetic variation at any given position is computed using an Earth Magnetic Model utilizing the IGRF-11 coefficients.

# APPLICABLE DOCUMENTS

## Other Documents

1. NIMA TR8350.2, Third Edition, “Department of Defense World Geodetic System 1984”, 3 January 2000
2. NASA, “U.S. Standard Atmosphere 1976”, October 1976.
3. ANSI/AIAA, “Recommended Practice for Atmospheric and Space Flight Vehicle Coordinate Systems”, R-004-1992.