Standard Simulation Variable Names

AIAA Modeling and Simulation Technical Committee

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This table is meant to contain simulation variables that are independent of the particular vehicle type being simulated. These variables are tailored towards aircraft simulation.

Visit
http://DaveML.nasa.gov
to suggest additional variables or changes to the exisiting list

Interpretation of the standard variable name table is best given by example. In general the table has 7 columns. These are described below using the rollEulerAngle as an example:
is standard variable defining the Roll Euler Angle, its axis system and positive sign convention (+ = RWD, or right wing down). Four name examples are provided:

1) The symbol for that variable Φ
2) The short name PHI
3) One of more full names using the standard units conventions**. Generally,** one full name with American convention units and one with SI units. Any suitable units may be used. In the example for rollEulerAnge both the _d for degrees and the _r for radians is given. The "Full Variable Name" column does not necessarily provide all acceptable unitsfor each variable.
4) A description of the variable, if applicable should always specify the axis system.
5) The POSITIVE sign convention of the variable RWD indicates that plus rollEulerAngle is right wing down
6) Minimum value, normally only specified for angles
7) Maximum values of the variable, normally only specified for angles

This example also illustrates the pitch and yaw Euler angles.

Some variables may be used to represent variables referenced to more than one axis system. In this case the axis system is specified as xx and any axis system reference (refer to the body of this standard) may be substituded for the xx.
For example, XxxVelocity_fs_1 may represent the X component of velocity as;

XEIVelocity_fs_1 for the EI axis sytem- Earth centered Inertial (also know as geocentric inertial) axis sytem
XECEFVelocity_fs_1 for the EF axis system- Earth centered earth Fixed (also known as Geocentric Earth [GE] axis system)
XVOVelocity_fs_1 for the VO axis sytem- Vehicle carried, Orbit defined axis system
etc.

Since roll, pitch and yaw may also conveniently be expressed as a vector, the shaded area is the standard definition of the Euler angle vector. Again, eulerAngle_r[3] would be the standard vector using radians as the units and is fully compliant with the standard.

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Min Value	Max Value
$\underline{\varepsilon}$	EUL[3]	eulerAngle_d[3] eulerAngle_r[3]	Vector of the roll, pitch, and yaw Euler angles comprised of the elements defined below. LL (locally level) axis system.			
Φ	PHI	rollEulerAngle_d rollEulerAngle_r	Roll Euler Angle, LL axis system.	RWD	-180,-π	180, π
θ	THET	pitchEulerAngle_d pitchEulerAngle_r	Pitch Euler Angle, LL axis system	ANU	-90, -π/2	90, π/2
ψ	PSI	yawEulerAngle_d yawEulerAngle_r	Yaw Euler Angle, LL axis system	ANR	-180,-π	180, π
		Green shading indicates addition examples of usage or user defined variables				

Another example that illustrates the use of reference point on the vehicle and the external reference frame. Refer to Sections 6.3.6 and 6.3.7 in the body of the standard for more information.

The most general definition of a variable describing motion is as follows, using a linear velocity as an example:

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XxxVelocityOfyyyWRTzzz_fs_1
YxxVelocityOfyyyWRTzzz_fs_1
ZxxVelocityOfyyyWRTzzz_fs_1
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This is the general expression for velocities along the X, Y and Z axes of the xx coordinate system. yyy indicates the reference point on the vehicle and the Ofyyy may be ommited if it is the CG. zzz represents the external frame that the vehicle is moving with repect to and the WRTzzz may be omitted if it is the inertial frame.

For example:
XFEVelocityOfCGWRTInetial_fs_1 is the X component of the CG velocity in the FE axis system. In this example it is with repect to the inertial external frame, so it is the inertial velocity of the CG. CG and Inertial are defaults, so this could also be expressed as XFEVelocity_fs_1.

Amother example:
XGEVelocityOfPilotEyeWRTTD_fs_1 is the X component of the pilot's eye point velocity in the GE axis system. In this example it is with repect to the ideal touchdown point on the runway.

A final example:
latitudeOfPilotEyeWRTWGS84_d is the latitude of the pilot's eye point. In this example it is with repect to the world geodetic system 84. (This might be an imput to an image generator)

Some examples of refernce points (the uer may add their own):
- OfCG (CG is the default, so "OfCG" may be omitted in any variable name)
- OfPilot
- OfIMU
- OfSensor
- OfMRC (for moment reference center)
- OfPilotEye (for the pilot eye point)
- OfRadAlt (for radar Altimeter)
- OfTerrain

Some examples of external reference frame usage (the user may add more reference points or frames):
- WRTInertial (WRTInertial is the default and may be omitted)
- WRTCG (this is commonly used to clarify definitions of positions)
- WRTMRC (moment reference center)
- WRTWGS84 (world geodetic system 84)
- WRTTD (ideal touchdown point)
- WRTWind (the instantaneous wind velocity)
- WRTMeanSL

The vaiable name table below does not specify which variables are states, state derivatives, inputs or initial conditions (see section 6.3.1). These specifications may be added to any appropriate variable. See the body of

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
Vehicle Positions and Angles									
$\underline{\varepsilon}$	EUL	eulerAngle_d[3] eulerAngle_r[3]	Vector of the roll, pitch, and yaw Euler angles defined below. LL (locally level) axis system.						
ϕ	PHI	rollEulerAngle_d rollEulerAngle_r	Roll Euler Angle, LL axis system.	RWD		-180	180	2	
θ	THET	pitchEulerAngle_d pitchEulerAngle_r	Pitch Euler Angle, LL axis system	ANU		-90	90	2	
ψ	PSI	yawEulerAngle_d yawEulerAngle_r	Yaw Euler Angle, LL axis system	ANR		-180	180	2	
$\sin\phi$	SPHI	rollEulerAngleSine	Sine Of Euler Roll Angle	RWD		-1.0	1.0		
$\cos\phi$	CPHI	rollEulerAngleCosine	Cosine Of Euler Roll Angle	RWD		-1.0	1.0		
$\sin\theta$	STHT	pitchEulerAngleSine	Sine Of Euler Pitch Angle	ANU		-1.0	1.0		
$\cos\theta$	CTHT	pitchEulerAngleCosine	Cosine Of Euler Pitch Angle	ANU		-1.0	1.0		
$\sin\psi$	SPSI	yawEulerAngleSine	Sine Of Euler Yaw Angle	ANR		-1.0	1.0		
$\cos\psi$	CPSI	yawEulerAngleCosine	Cosine Of Euler Yaw Angle	ANR		-1.0	1.0		
$\underline{T}_{FE/B}$		FEToBodyT[3,3]	The FE to Body transformation matrix composed of the elements defined below						
$T_{FE/B}(1,1)$	T11	FEToBodyT11	CTHT*CPSI (FE To B) axis transformation element						
$T_{FE/B}(2,1)$	T21	FEToBodyT21	SPHI*STHT*CPSI - CPHI*SPSI (FE To B) axis transformation element						
$T_{FE/B}(3,1)$	T31	FEToBodyT31	CPHI*STHT*CPSI + SPHI*SPSI (FE to B) axis transformation element						
$T_{FE/B}(1,2)$	T12	FEToBodyT12	CTHT*SPSI (FE to B) axis transformation element						
$T_{FE/B}(2,2)$	T22	FEToBodyT22	SPHI*STHT*SPSI + CPHI*CPSI (FE to B) axis transformation element						
$T_{FE/B}(3,2)$	T32	FEToBodyT32	CPHI*STHT*SPSI - SPHI*CPSI (FE to B) axis transformation element						
$T_{FE/B}(1,3)$	T13	FEToBodyT13	-STHT (FE to B) axis transformation element						
$T_{FE/B}(2,3)$	T23	FEToBodyT23	SPHI*CTHT (FE to B) axis transformation element						
$T_{FE/B}(3,3)$	T33	FEToBodyT33	CPHI*CTHT (FE to B) axis transformation element						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
γ_V	GAMV	flightPathAngle_r flightPathAngle_d	Flight Path Angle Above Horizon	ANU		-π/2 -90	π/2 90	3	
γ_H	GAMH	flightPathAzimuth_r flightPathAzimuth_d	Flight Path Angle In Horizon Plane, from North	CWFN		-π -180	π 180	3	
h	ALT	altitudeMSL_f altitudeMSL_m	Geometric altitude of vehicle altimeter above Mean Sea Level	UP					
	XLON	longitudeWRTzzz_r longitudeWRTzzz_d	Longitude of Vehicle CG with respect to the zzz reference frame.	WEST					
	XLAT	latitudeWRTzzz_r latitudeWRTzzz_d	Latitude of Vehicle CG with respect to the zzz reference frame.	NORTH					
	XLONIMU	longitudeOfIMUWRTzzz_r longitudeOfIMUWRTzzz_d	Longitude of Vehicle IMU with respect to the zzz reference frame.	WEST					
	XLATIMU	latitudeOfIMUWRTzzz_r latitudeOfIMUWRTzzz_d	Latitude of Vehicle IMU with respect to the zzz reference frame.	NORTH					
	Example:	longitudeOfIMUWRTWGS84 d latitudeOfIMUWRTWGS84_d	Longitude and latitude of the vehicle IMU in the World Grid System 1984 reference frame						
	HGTOFRWY	heightOfRunwayWRTMeanSL_f heightOfRunwayWRTMeanSL _m	Height Of Runway W/r/t mean Sea Level	Above					
		General Definition xxPositionOfyyyWRTzzz_f[3] xxPositionOfyyyWRTzzz_m[3] For Example: xxPosition f[3] is the same as xxPositionOfCG_f[3]	General Definition Vector of positions of yyy with respect to zzz (a user defined reference point or frame) in the xx axis system. The lengths of xx, yyy, zzz are not restricted to 2 and 3 characters respectively. The axis system, xx, must always be defined. If the yyy is not defined the definition defaults to the vehicle cg. If the zzz is not defined the reference point defaults to the origin of the axis system. Comprised of the three components as defined below.						
	XCG	XxxPositionOfyyyWRTzzz_f XxxPositionOfyyyWRTzzz_m or XxxPosition_f	X position of yyy with respect to zzz (a user defined reference point) in the xx axis system. Defaults to th CG and origin of the axis system.	(yyy –zzz)					
	YCG	YxxPositionOfyyyWRTzzz_f YxxPositionOfyyyWRTzzz_m	Y position of yyy with respect to zzz (a user	(yyy –zzz)					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		or YxxPosition_f	defined reference point) in the xx axis system. Defaults to th CG and origin of the axis system.						
	ZCG	ZxxPositionOfyyyWRTzzz_f ZxxPositionOfyyyWRTzzz_m or ZXxxPosition_f	Z position of yyy with respect to zzz (a user defined reference point) in the xx axis system. Defaults to the CG and origin of the axis system.	(yyy –zzz)					
		General Definition xxPositionOfMRCWRTzzz_f[3] xxPositionOfMRCWRTzzz_m[3] Example xxPositionOfMRC f[3]	General Definition Vector of positions of the moment reference center (MRC) with respect to zzz (a user defined reference point) in the xx axis system. The lengths of xx, yyy, zzz are not restricted to 2 and 3 characters respectively. The moment reference center is sometimes more convenient to locate a vehicle since the moment reference center is fixed in the vehicle, but the CG moves. zzz may be defaulted to the origin of the axis system. Comprised of the three components as defined below.						
	XREF	XxxPositionOfMRCWRTzzz_f XxxPositionOfMRCWRTzzz_m	X position of the moment reference center (MRC) with respect to zzz in the xx axis system.	(yyy –zzz)					
	YREF	YxxPositionOfMRCWRTzzz_f YxxPositionOfMRCWRTzzz_m	Y position of the moment reference center (MRC) with respect to zzz in the xx axis system.	(yyy –zzz)					
	ZREF	ZxxPositionOfMRCWRTzzz_f ZxxPositionOfMRCWRTzzz_m	Z position of the moment reference center (MRC) with respect to zzz in the xx axis system.	(yyy –zzz)					
		bodyPositionOfPilotEyeWRTCG_f[3] bodyPositionOfPilotEyeWRTCG f[3]	Vector of positions of the pilots eye with respect to the CG in the body axis system. Comprised of the three components as defined below.						
	XPLT2CG	XBodyPositionOfPilotEyeWRTCG_f XBodyPositionOfPilotEyeWRTCG_f	X Position Of Pilot eye point W/r/t C.g., in the body axis system	Eye FWD of CG					
	YPLT2CG	YBodyPositionOfPilotEyeWRTCG_f YBodyPositionOfPilotEyeWRTCG_f	Y Position Of Pilot eye point W/r/t C.g. , in the body axis system	Eye Right of the CG					
	ZPLT2CG	ZbodyPositionOfPilotEyeWRTCG_f ZbodyPositionOfPilotEyeWRTCG_f	Z Position Of Pilot eye point W/r/t C.g. , in the body axis	Eye below CG					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			system						
	Additional Examples:	Runway22Position f[3] indicates position of the CG with respect to the origin of the Runway22 axis system Runway22PositionOfFwdLeftMainWheelWRTTD_f[3] indicates position of the forward left main wheel with respect to the touchdown point in the Runway 22 axis system NOTE: All are user defined	Vector of positions of the vehicle CG relative to the Runway 22 (a user defined axis system) touchdown reference point. Comprised of the three components as defined below.						
	XCGTD	XRunway22PositionOfCGWRTTD _f XRunway22PositionOfCGWRTTDD m	C.g. X-position W/r/t Runway touchdown point in the specified (Runway22) axis system.	CG Down the runway from the reference point					
	YCGTD	YRunway22PositionOfCGWRTTD _f YRunway22PositionOfCGWRTTD_m	C.g. Y-position W/r/t Runway touchdown point in the specified (Runway22) axis system.	CG to the right of the reference point					
	ZCGTD	ZRunway22PositionOfCGWRTTD _f ZRunway22PositionOfCGWRTTD _m	C.g. Z-position W/r/t Runway touchdown point in the specified (Runway22) axis system. (this variable is normally negative)	CG below the TD point					
	RE	smoothEarthRadius_f smoothEarthRadius_m	Radius of Earth (center to smooth surface which is mean sea level), round earth model or oblate spheroid under the vehicle.						
	RALT	heightOfCGWRTTerrain_f heightOfCGWRTTerrain _m	height of the vehicle cg above the terrain	NSG					
	HTERRAIN	heightOfTerrainWRTSurfaceReference_f heightOfTerrainWRTSurfaceReference_m	Height of the terrain under the vehicle cg. It is the terrain height above the smooth surface of of the earth, regardless whether a flat, round or oblate spheroid model is used.						
Vehicle Velocities and Angular Rates									
$\underline{\omega_B}$	OMB	bodyAngularRate rs 1[3] bodyAngularRate ds 1[3]	Vector of body axis angular rates comprised of the three components as defined below. Motion is always with repect to the inertial frame unless otherwise specifed.						
p_B	PB	rollBodyRate_rs_1 rollBodyRate_ds_1	Vehicle Roll Velocity, Body Axis system	RWD				3	
q_B	QB	pitchBodyRate_rs_1 pitchBodyRate_ds_1	Vehicle Pitch Velocity, Body Axis system	ANU				3	
r_B	RB	yawBodyRate_rs_1	Vehicle Yaw Velocity, Body	ANR				3	

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		yawBodyRate_ds_1	Axis system						
$\underline{\dot{\varepsilon}}$	EULD	eulerAngleRate_ds_1[3] eulerAngleRate_rs_1[3]	Vector of the roll, pitch, and yaw Euler angle rates defined below. LL (locally level) axis system						
$\dot{\phi}$	PHID	rollEulerAngleRate_rs_1	Euler roll rate, LL axis system	RWD					
$\dot{\theta}$	THETD	pitchEulerAngleRate_rs_1	Euler pitch rate, LL axis system	ANU					
$\dot{\psi}$	PSID	yawEulerAngleRate_rs_1	Euler yaw rate, LL axis system	ANR					
		General Definition XxxVelocityOfyyyWRTzzz_fs_1 XxxVelocityOfyyyWRTzzz_ms_1 YxxVelocityOfyyyWRTzzz_fs_1 YxxVelocityOfyyyWRTzzz_ms_1 ZxxVelocityOfyyyWRTzzz_fs_1 ZxxVelocityOfyyyWRTzzz_ms_1	General expression for velocities along the X, Y and Z axes of the xx coordinate system. yyy indicates the reference point on the vehicle and the Ofyyy may be ommited if it is the CG. zzz represents the frame that the vehicle is moving with repect to and the WRTzzz may be omitted if it is the inertial frame. So XFEVelocity_fs_1 is the inertial velocity of the vehicle CG along the X axis of the FE coordinate system and is the short version of XFEVelocityOfCGWRTInetial_fs_1.						
$\underline{V}_B$	VELB	bodyVelocityWRTWind fs 1[3] bodyVelocityWRTWind ms 1[3] can also be expressed as: bodyVelocityOfCGWRTWind_fs_1[3]	Vector of body axis velocities of the cg with respect to the instantaneous wind comprised of the three components as defined below.						
u_B	UB	UBodyVelocityWRTWind_fs_1 UBodyVelocityWRTWind_ms_1	X-velocity Body axis system.	FWD				3	
v_B	VB	VBodyVelocityWRTWind_fs_1 VBodyVelocityWRTWind_ms_1	Y-velocity Body axis system	RT				3	
w_B	WB	WBodyVelocityWRTWind_fs_1 WBodyVelocityWRTWind_ms_1	Z-velocity Body axis system	DWN				3	
$\underline{V}_{B_I}$	VELB	bodyVelocity fs 1[3] bodyVelocity ms 1[3] can also be expressed as: bodyVelocityOfCGWRTInertial_fs_1[3]	Vector of body axis inertial translational velocities of the cg comprised of the three components as defined below.						
u_{B_I}	UBI	UBodyVelocity_fs_1 UBodyVelocity_ms_1	X-velocity Body axis system.	FWD				3	
v_{B_I}	VBI	VBodyVelocity_fs_1 VBodyVelocity_ms_1	Y-velocity Body axis system	RT				3	
w_{B_I}	WBI	WBodyVelocity_fs_1 WBodyVelocity_ms_1	Z-velocity Body axis system	DWN				3	
$\underline{V}_{FE}$	VELFE	FEVelocity fs 1[3] FEVelocity_ms_1[3]	Vector of Flat Earth (FE) axis inertial translational velocities comprised of the three components as defined below.						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
V_N	VNFE	NFEVelocity_fs_1 NFEVelocity_ms_1	Northward Velocity Over Flat Earth (FE) axis system [flat, non-rotating earth]	NORTH					
v_E	VEFE	EFEVelocity_fs_1 EFEVelocity_ms_1	Eastward Velocity Over Flat Earth (FE) axis system [flat, non-rotating earth]	EAST					
V_D	VDFE	DFEVelocity_fs_1 DFEVelocity_ms_1	Downward Velocity Toward Earth Ctr,.(FE) axis system [flat, non-rotating earth]	DOWN					
$\underline{V}_{xx}$	VELxx	xxVelocity_fs_1[3] xxVelocity ms 1[3]	Vector of vehicle cg inertial translational velocities in the specified xx axis system comprised of the three components as defined below.						
$V_{X_{xx}}$	VXxx	XxxVelocity_fs_1 XxxVelocity_ms_1	X component of velocity with respect to the inertial reference frame in the specified (xx) axis system						
$V_{Y_{xx}}$	VYxx	YxxVelocity_fs_1 YxxVelocity_ms_1	Y component of velocity with respect to the inertial reference frame in the specified (xx) axis system						
$V_{Z_{xx}}$	VZxx	ZxxVelocity_fs_1 ZxxVelocity_ms_1	Z component of velocity with respect to the inertial reference frame in the specified (xx) axis system						
	Examples	XGEVelocity_fs_1	X inertial velocity in the geocentric earth (GE) axis system in ft/sec						
		ZRunway22VelocityOfFwdLeftWheelWRTTD_fs_1	Z axis velocity of the "forward left wheel" (user defined) in the "runway22" (user defined) coordinate system in f/s	Down					
V_T	VTzzz	TotalVelocityWRTzzz_fs_1 TotalVelocityWRTzzz_ms_1	Total Velocity with respect to the reference frame zzz						
V_G	VG	TotalVelocityWRTGround_fs_1 TotalVelocityWRTGround_ms_1 GroundSpeed_fs_1 GroundSpeed_ms_1	Vehicle velocity with respect to the ground under the vehicle cg						
M_N	XMACH	mach	Mach Number of the vehicle						
		xxVelocityWRTWind_fs_1[3] xxVelocityWRTWind_ms_1[3] or xxVelocityOfCGWRTWind fs 1[3]	Vector of translational velocities of the CG wrt the instantaneous wind in the specified (xx) axis system comprised of the three components as defined below.						
	VXRWxx	XxxVelocityWRTWind_fs_1 XxxVelocityWRTWind_ms_1	X Relative Velocity of the CG with respect to the	(CG velocity –					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			instantaneous wind in the xx axis system.	wind velocity)					
	VYRWxx	YxxVelocityWRTWind_fs_1 YxxVelocityWRTWind_ms_1	Y Relative Velocity of the CG with respect to the instantaneous wind in the xx axis system.	(CG velocity – wind velocity)					
	VZRWxx	ZxxVelocityWRTWind_fs_1 ZxxVelocityWRTWind_ms_1	Z Relative Velocity of the CG with respect to the instantaneous wind in the xx axis system.	(CG velocity – wind velocity)					
$\dot{h}$	ALTD	AltitudeRate_fs_1 AltitudeRate_ms_1	Geometric altitude time rate of change.	DOWN					
	XLOND	longitudeRateWRTzzz_r longitudeRateWRTzzz_d	Rate of change of longitude of Vehicle CG with respect to the zzz reference frame.	WEST					
	XLATD	latitudeRateWRTzzz_r latitudeRateWRTzzz_d	Rate of change of latitude of Vehicle CG with respect to the zzz reference frame.	NORTH					
	XLONDIMU	longitudeRateOfIMUWRTzzz_r longitudeRateOfIMUWRTzzz_d	Rate of change of longitude of Vehicle IMU with respect to the zzz reference frame.	WEST					
	XLATDIMU	latitudeRateOfIMUWRTzzz_r latitudeRateOfIMUWRTzzz_d	Rate of change of latitude of Vehicle IMU with respect to the zzz reference frame.	NORTH					
	Example:	longitudeRateOfIMUWRTWGS84_ds_1 latitudeRateOfIMUWRTWGS84_ds_1	Rate of change of longitude and latitude of the vehicle IMU in the World Grid System 1984 reference frame						
p_s	PS	rollSARate_rs_1 rollSARate_ds_1	Roll about the X axis in the SA (stability) axis system, also known as stability axis roll rate.	RWD					
r_s	RS	yawSARate _rs_1 yawSARate_ds_1	Yaw about the Z axis in the SA (stability) axis system, also known as the Stability Axis yaw rate	ANR					
Vehicle Linear and Angular Accelerations									
$\dot{\underline{\omega}}_B$	OMBD	bodyAngularAccel_rs_2[3] bodyAngularAccel_ds_2[3]	Vector of body axis angular accelerations comprised of the three components as defined below.						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
$\dot{p}_B$	PBD	rollBodyAccel_rs_2 rollBodyAccel_ds_2	Vehicle Roll Acceleration, Body axis system	RWD					
$\dot{q}_B$	QBD	pitchBodyAccel_rs_2 pitchBodyAccel_ds_2	Vehicle Pitch Accel, Body axis system	ANU					
$\dot{r}_B$	RBD	yawBodyAccel_rs_2 yawBodyAccel_ds_2	Vehicle Yaw Acceleration, Body axis system	ANR					
		bodyAccel fs 2[3] bodyAccel ms 2[3]	Vector of accelerations of the cg of the vehicle wrt the interital frame in the body axis system. Therefore does not include the gravity vector. Comprised of the three components as defined below.						
$\dot{u}_B$	UBD	UBodyAccel_fs_2 UBodyAccel_ms_2	Lonngitudinal acceleration (along the X-body axis)	FWD					
$\dot{v}_B$	VBD	VBodyAccel_fs_2 VBodyAccel_ms_2	Right Sideward Acceleration, (along the Y Body axis)	RT					
$\dot{w}_B$	WBD	WBodyAccel_fs_2 WBodyAccel_ms_2	Downward Acceleration, Body axis	DOWN					
$\dot{v}_T$	VTD	totalAccel_fs_2 totalAccel_ms_2	Rate of change of total velocity of the CG in the inertial frame						
$\underline{\dot{V}}_{xx}$		xxAccel_fs_2 xxAccel ms 2	Vector of vehicle cg inertial translational accelerations in the specified (xx) axis system comprised of the three components as defined below.						
$\dot{V}_{X\,xx}$	VXD	XxxAccel_fs_2 XxxAccel_ms_2	Acceleration along the X axis						
$\dot{V}_{Y\,xx}$	VYD	YxxAccel_fs_2 YxxAccel_ms_2	Acceleration along the Y axis						
$\dot{V}_{Z\,xx}$	VZD	ZxxZAccel_fs_2 ZxxAccel_ms_2	Acceleration along the Z axis						
$\underline{\dot{V}}_{FE}$		FEAccel_fs_2 FEAccel_ms_2	Vector of vehicle cg translational accelerations in the FE (Flat Earth) axis system comprised of the three components as defined below.						
$\dot{V}_{X\,FE}$	VND	NFEAccel_fs_2 NFEAccel_ms_2	North Acceleration Over flat earth	NORTH					
$\dot{V}_{Y\,FE}$	VED	EFEAccel_fs_2 EFEAccel_ms_2	East Acceleration Over flat earth	EAST					
$\dot{V}_{Z\,FE}$	VDD	DFEZAccel_fs_2 DFEAccel_ms_2	Down Acceleration Toward flat earth surface	DOWN					
		bodyAccelSensedOfCG_fs_2[3] bodyAccelSensedOfCG_ms_2[3]	Vector of accelerations sensed at the cg (including the effects of the gravity vector) in the body axis system. Comprised of the three components as defined below.						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
	AX	XBodyAccelSensedOfCG_fs_2 XBodyAccelSensedOfCG _ms_2	X Acceleration Of A/c C.g. (body axis) Includes the gravity vector.	FWD					
	AY	YBodyAccelSensedOfCG _fs_2 YBodyAccelSensedOfCG _ms_2	Y Acceleration Of A/c C.g. (body axis) Includes the gravity vector.	RT					
	AZ	ZBodyAccelSensedOfCG _fs_2 ZBodyAccelSensedOfCG _ms_2	Z Acceleration Of A/c C.g. (body axis) Includes the gravity vector.	DOWN					
		bodyAccelOfPilot_fs_2[3] bodyAccelOfPilot_ms_2[3]	Vector of accelerations at the pilot reference point, in the body axis system, comprised of the three components as defined below.						
	AXP	XBodyAccelOfPilot_fs_2 XBodyAccelOfPilot _ms_2	X Acceleration Of Pilot reference point (body axis)	FWD					
	AYP	YBodyAccelOfPilot _fs_2 YBodyAccelOfPilot _ms_2	Y Acceleration Of Pilot reference point(body axis)	RT					
	AZP	ZBodyAccelOfPilot _fs_2 ZBodyAccelOfPilot _ms_2	Z Acceleration Of Pilot reference point(body axis)	DOWN					
	G	localGravity_fs_2 localGravity_ms_2	Acceleration Due To Gravity (at the vehicle altitude)	DOWN					
Vehicle Air Data									
α	ALFA	angleOfAttack_d angleOfAttack_r	Angle Of Attack, Body axis	ANU		$-\pi$,-180	$+\pi$,+180		
β	BETA	angleOfSideslip_d angleOfSideslip_r	Sideslip Angle, Body axis	ANL		$-\pi$,-180	$+\pi$,+180		
$\dot{\alpha}$	ALFD	angleOfAttackRate_rs_1	Angle Of Attack Rate, Body axis	ANU					
$\dot{\beta}$	BETD	angleOfSideslipRate_rs_1	Sideslip Angle Rate	ANL					
$\sin\alpha$	SALPH	sineAngleOfAttack	Sine Of Angle Of Attack	ANU		-1.0	1.0		
$\cos\alpha$	CALPH	cosineAngleOfAttack	Cosine Of Angle Of Attack	ANU		-1.0	1.0		
$\sin\beta$	SBETA	sineAngleOfSideslip	Sine Of Sideslip Angle	ANL		-1.0	1.0		
$\cos\beta$	CBETA	cosineAngleOfSideslip	Cosine Of Sideslip Angle	ANL		-1.0	1.0		
V_{CAL}	VCAL	calibratedAirspeed_nmih_1	Calibrated Air Speed, knots	FWD					
V_{EQ}	VEQ	equivalentAirspeed_nmih_1	Equivalent Air Speed	FWD					
V_{IND}	VCAL	indicatedAirspeed_nmih_1	Calibrated Air Speed,	FWD					
V_{RW}	VRW	trueAirspeed_fs_1 trueAirspeed_ms_1 trueAirspeed_ nmih_1	Vehicle Velocity relative to the local wind (true airspeed)	FWD					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
$\overline{q}$	QBAR	dynamicPressure_lbff_2 dynamicPressure_Nm_2	Dynamic Pressure	NSC					
$\overline{q}_c$	QBARC	impactPressure_lbff_2 impactPressure_Nm_2	Inpact Pressure	NSC					
ρ	RHO	airDensity_lbmf_3 airDensity_kgpm_3	Air Density, At Altitude of the vehicle	NSC					
	DENALT	densityAltitude_f densityAltitude_f	Density altitude						
a	SOUND	speedOfSound_fs_2 speedOfSound_ms_2	Velocity Of Sound At Altitude of the vehicle	NSC					
T_{TOT_R}	TR	totalTempRatio_C totalTempRatio_K	Total Temperature Ratio	NSC					
P_{TOT_R}	PR	totalPressureRatio_C totalPressureRatio_K	Total Pressure Ratio	NSC					
T_{AMB}	TAMB	ambientTemperature_C ambientTemperature_K	Ambient Temperature at altitude	NSC					
P_{AMB}	PAMB	ambientPressure_lbff_2 ambientPressure_Nm_2	Ambient Pressure at altitude	NSC					
P_{AMB_R}	PAMBR	ambientPressureRatio	Ratio Of ambient pressure at altitude to sea level ambient pressure	NSC					
T_{AMB_R}	TAMBR	ambientTemperatureRatio	Ratio Of ambient temperature at altitude to sea level ambient temp.	NSC					
T_{TOT}	TTOT	totalTemp_C totalTemp_K	Total Temperature at altitude	NSC					
P_{TOT}	PTOT	totalPressure_lbff_2 totalPressure_Nm_2	Total Pressure at altitude	NSC					
	TAMB_R	ambientTemperatureAtAlt_K ambientTemperatureAtAlt_R ambientTemperatureAtAlt_C	Ambient temperature, at the altitude of the CG						
	TTOT_R	totalTemperatureAtAlt_K totalTemperatureAtAlt_R totalTemperatureAtAlt_C	Total temperature at the altitude of the CG						
	ALT_SET	InstrumentAltimeterSetting_inchMercury	Cockpit Altimeter setting (Kohlsman window)	29.92 is standard day					
	P_ALT	pressureAltitude_f pressureAltitude_m	Pressure altitude at the CG						
	RHO_SL	seaLevelAirDensity_lbfpf3	Air density at sea level						
	TAMB_SL	seaLevelAmbientTemp_K seaLevelAmbientTemp_R seaLevelAmbientTemp_C	Ambient temperature at mean sea level						
	PAMB_SL	seaLevelAmbientPressure_lbff2 seaLevelAmbientPressure_Nm2	Ambient pressure at sea level						
Atmospheric Disturbances and Turbulence									
	WIND_SPEED	steadyStateWindVelocity_fs_1 steadyStateWindVelocity_ms_1	Total velocity of steady wind						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
	WIND_DIRECTION	steadyStateWindDirection_d	Steady wind heading (blowing FROM true North)	Wind blowing from					
$\underline{V}_{B_{Turb}}$	VELBT	bodyTurbulenceVelocity_fs_1[3] bodyTurbulenceVelocity_ms_1[3]	Vector of body axis translational turbulence velocities comprised of the three components as defined below.						
$u_{B_{Turb}}$	UBTURB	UbodyTurbulenceVelocity_fs_1 UbodyTurbulenceVelocity_ms_1	X-velocity Turb. Component, Body axis	FWD					
$v_{B_{Turb}}$	VBTURB	VbodyTurbulenceVelocity_fs_1 VbodyTurbulenceVelocity_ms_1	Y-velocity Turb. Component, Bodyaxis	RT					
$w_{B_{Turb}}$	WBTURB	WbodyTurbulenceVelocity_fs_1 WbodyTurbulenceVelocity_ms_1	Z-velocity Turb. Component, Body axis	DWN					
$\underline{V}_{W_{XX}}$	VWxx	xxWindVelocity_fs_1[3] xxWindVelocity_ms_1[3]	Vector of wind velocities velocities in the specified (xx) axis system comprised of the three components as defined below. Only applies to earth fixed axis systems.						
W_N	VNWxx	NxxWindVelocity_fs_1 NxxWindVelocity_ms_1	North component of wind velocity in xx axis system	To the North					
W_E	VEWxx	ExxWindVelocity_fs_1 YxxWindVelocity_ms_1	East component Of wind velocity in xx axis system.	To the East					
W_D	VDWxx	ExxWindVelocity_fs_1 ExxWindVelocity_ms_1	Down Component Of Wind Velocity in xx axis system.	To Downward					
$W_{T_{XX}}$	VTWxx	xxTotalwindVelocity_fs_1 xxTotalwindVelocity_ms_1	Total Wind Velocity, in xx axis system.	NSC					
		netWindVel fs 1[3] netWindVel_ms_1[3]	Vector of the net wind velocities impinging on the vehicle. Comprised of the three components as defined below.						
	VTWN	netWindVelFromNorth_fs_1 netWindVelFromNorth_ms_1	Net wind velocity from North. Net wind is the steady state winds plus any turbulences and shears.	From the North					
	VTWE	netWindVelFromEast_fs_1 netWindVelFromEast_ms_1	Net wind velocity from East. Net wind is the steady state winds plus any turbulences and shears.	From the East					
	VTWD	netWindVelFromBelow_fs_1 netWindVelFromBelow_ms_1	Net wind velocity from below. Net wind is the steady state winds plus any turbulences and shears.	From below					
		turbulence_fs_1[3] turbulence_ms_1[3]	Vector of the wind turbulence velocities impinging on the vehicle. Comprised of the three components as defined below.						
	VNTURB	turbulenceFromNorth_fs_1 turbulenceFromNorth_ms_1	North component of turbulence	From the North					
	VETURB	turbulenceFromEast_fs_1 turbulenceFromEast_ms_1	East component of turbulence	From the East					
	VDTURB	turbulenceFromBelow_fs_1	Vertical component of	From					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		turbulenceFromBelow_ms_1	turbulence	below					
		bodyAngularTurbulence_ds_1[3] bodyAngularTurbulence_rs_1[3]	Vector of angular turbulence velocities comprised of the three components as defined below. Body axis system.						
	PTURB	rollBodyTurbulenceRate_ds_1 rollBodyTurbulenceRate_rs_1	Body axis roll turbulence	The turbulence would move the vehicle right wing down					
	QTURB	pitchBodyTurbulenceRate_ds_1 pitchBodyTurbulenceRate_rs_1	Body axis pitch turbulence	The turbulence would move the vehicle nose up					
	RTURB	yawBodyTurbulenceRate_ds_1 yawBodyTurbulenceRate_rs_1	Body axis yaw turbulence	The turbulence would move the vehicle nose right					
Vehicle Physical Characteristics									
I		bodyMomentOfInertia_slugf2[3,3] bodyMomentOfInertia_kgm2[3,3]	Matrix of the total moments of inertia of the vehicle. This is wrt the CG and includes everything in or attached to the vehicle (stores, passengers, crew, fuel, etc.) . It is comprised of the components below. I_{XX} $-I_{XY}$ $-I_{ZX}$ $-I_{XY}$ I_{YY} $-I_{YZ}$ $-I_{ZX}$ $-I_{YZ}$ I_{ZZ}						
I_{xx}	XIXX	bodyXXMomentOfInertia_slugf2 bodyXXMomentOfInertia_kgm2	Vehicle Roll Moment Of Inertia about Cg, body axis system	NSC					
I_{xx}	XIYY	bodyYYMomentOfInertia_slugf2 bodyYYMomentOfInertia_kgm2	Vehicle Pitch Moment Of Inertia about Cg, body axis system	NSC					
I_{zz}	XIZZ	bodyZZMomentOfInertia_slugf2 bodyZZMomentOfInertia_kgm2	Vehicle Yaw Moment Of Inertia about Cg, body axis system	NSC					
I_{xz}	XIZX	bodyZXProductOfInertia_slugf2 bodyZXProductOfInertia_kgm2	Vehicle ZX Cross Product Of Inertia about Cg, body axis system	NSC					
I_{xy}	XIXY	bodyXYProductOfInertia_slugf2 bodyXYProductOfInertia_kgm2	Vehicle XYy Cross Product Of Inertia about Cg, body axis system	NSC					
I_{yz}	XIYZ	bodyYZProductOfInertia_slugf2	Vehicle YZ Cross Product	NSC					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		bodyZProductOfInertia_kgm2	Of Inertia about Cg, body axis system						
		bodyPositionOfCG_f[3] bodyPositionOfCG_f _m[3]	Vector of the CG position of the vehicle in the body axis system. Comprised of the three components as defined below.						
	XCGREF	XBodyPositionOfCG_f XBodyPositionOfCG_m	C.g. Position W/r/t L.e. Of the mean aerodynamic chord	CG AFT of LEMAC					
	YCGREF	YBodyPositionOfCG_f YBodyPositionOfCG_m	C.g. Position W/r/t the centerline of the vehicle	CG Right of the a/c centerline					
	ZCGREF	ZBodyPositionOfCG_f ZBodyPositionOfCG_m	C.g. Position W/r/t the waterline reference of the vehicle (usually WL 0, see ZBodyWaterline_)	CG below the a/c waterline reference					
		bodyPositionOfCGWRTMRC_f[3] bodyPositionOfCGWRTMRC_m[3]	Vector of the distance from the Moment Reference center to the CG position of the vehicle in the body axis system. Comprised of the three components as defined below.						
ΔX_{cg}	DXCG	XPositionOfCGWRTMRC_f XPositionOfCGWRTMRC _m	Cg Displacement From the aerodynamic force and moment reference center, + is CG fwd of the Moment Reference Center (MRC). The MRC is the reference point that the aero model forces and moments act upon the vehicle.	FWD					
ΔY_{cg}	DYCG	YPositionOfCGWRTMRC _f YPositionOfCGWRTMRC _m	Cg Displacement From the aerodynamic force and moment reference center, + is CG to the right of the ARC	RT					
ΔZ_{cg}	DZCG	ZPositionOfCGWRTMRC_f ZPositionOfCGWRTMRC_m	Cg Displacement From the aerodynamic force and moment reference center, + is CG below the the ARC	DWN					
		bodyPositionOfMRC f[3] bodyPositionOfMRC_m[3]	Vector of the location of the moment reference center (MRC) of the vehicle in the body axis system. Comprised of the three components as defined below.						
	XMRC	XBodyPositionOfMRC_f XBodyPositionOfMRC_m	X MRC Position W/r/t L.e. Of the mean aerodynamic chord	MRC AFT of LEMAC					
	YMRC	YBodyPositionOfMRC_f YBodyPositionOfMRC_m	Y MRC Position W/r/t the centerline of the vehicle	MRC Right of the a/c centerline					
	ZMRC	ZBodyPositionOfMRC_f ZBodyPositionOfMRC_m	Z MRC Position W/r/t the waterline reference of the vehicle (usually WL 0, see ZBodyWaterlinePosition_)	MRC below the a/c waterline reference					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
	ZWL	ZBodyWaterlinePosition_f ZBodyWaterlinePosition_m	The waterline (vertical) reference position on the a/c body. This is a constant used to locate the vertical cg and MRC postion to the vehicle. Waterline reference position is normally 0 but does not have to be.	NSC					
M	XMASS	totalMass_slug totalMass_kg	Total Mass Of Vehicle (including Fuel, crew, cargo, stores, passengers, etc.)	NSC					
W	WEIGHT	grossWeight_lbf grossWeight_N	Vehicle Gross Weight (mass*gravity), including all fuel, occupants, stores, etc.	NSC					
A	AREA	referenceWingArea_f2 referenceWingArea_m2	Reference Wing Area	NSC					
b	SPAN	referenceWingSpan_f referenceWingSpan_m	Reference Wing Span	NSC					
c	CHORD	referenceWingChord_f referenceWingChord_m	Mean Aerodynamic Chord (reference wing chord)	NSC					
		engineMomentOfInertia slugf2 engineMomentOfInertia_kgm2	Matrix of the moments of inertia of the Rotating engine, for an engine with the propeller, includes the propeller, gearbox and drivetrain. This convention is for rotation of the engine about the X axis. For a propeller driven aircraft it is for rotaton of the propeller about the X axis. For multi-engine vehicles is for one engine. It is comprised of the components below. $\begin{matrix} I_{RXX} & -I_{RXY} & -I_{RZX} \\ -I_{RXY} & I_{RYY} & -I_{RYZ} \\ -I_{RZX} & -I_{RYZ} & I_{RZZ} \end{matrix}$					
I_{Exx}	IEXX	engineXXMomentOfInertia_slugf2 engineXXMomentOfInertia_kgm2	Moment of inertia about the X-axis Of Rotating Eng, for an engine with the propeller, includes the propeller This is wrt the rotational axis of the engine						
I_{EYY}	IEYY	engineYYMomentOfInertia_slugf2 engineYYMomentOfInertia_kgm2	Moment of inertia about the Y-axis Of Rotating Eng, for an engine with the propeller, includes the propeller This is wrt the rotational axis of the engine						
I_{EZZ}	IEZZ	engineZZMomentOfInertia_slugf2 engineZZMomentOfInertia_kgm2	Moment of inertia about the Z-axis Of Rotating Eng, for an engine with the propeller, includes the propeller This is wrt the rotational						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			axis of the engine						
I_{EXZ}	IEXZ	engineXZProductOfInertia_slugf2 engineXZProductOfInertia_kgm2	Product of inertia about the XZ-axis Of Rotating Eng, for an engine with the propeller, includes the propeller This is wrt the rotational axis of the engine						
I_{EXY}	IEXY	engineXYProductOfInertia_slugf2 engineXYProductOfInertia_kgm2 [engine_xy_product_of_inertia_slugf2]	Product of inertia about the XY-axis Of Rotating Eng, for an engine with the propeller, includes the propeller This is wrt the rotational axis of the engine						
I_{EYZ}	IEYZ	engineYZProductOfInertia_slugf2 engineYZProductOfInertia_kgm2 [engine_yz_product_of_inertia_slugf2]	Product of inertia about the YZ-axis Of Rotating Eng, for an engine with the propeller, includes the propeller This is wrt the rotational axis of the engine						
		fuelInTank_lbm[number of fuel tanks] fuelInTank_kg[number of fuel tanks]	Vector of fuel weight by tank. Each vehicle tank is normally numbered and the vector should be ordered according to fuel tank number. In the absence of tank numbering the convention of port to starboard, upper to lower, then front to rear should be used.						
		fuelTankCentroid_f[number of fuel tanks,3] fuelTankCentroid_m[number of fuel tanks,3]	Matrix used to locate the centoids of the fuel tanks. Each vehicle tank is normally numbered and the matrix should be ordered according to fuel tank number. The second component is the x, y and z moment arms from the moment reference center to the tank centroid in the body axis. In the absence of tank numbering the convention of port to starboard, upper to lower, then front to rear	Tank centroid behind, right, and below the moment reference center.					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			should be used.						
Vehicle Control Positions									
		pilotLongControlPos_d pilotLongControlPos_r	Longitundal control position of the pilot.	AFT					
		pilotLatControlPos_d pilotLongControlPos_r	Lateral control position of the pilot.	RT					
		pilotPedalControlPos_d pilotPedalControlPos_r	Net Directional control position of the pilot. Nornally, Right pedal – left pedal.	Pedal in or clockwise twist of a sidestick.					
		pilotRightPedalControlPos_d pilotRightPedalControlPos_r	Right Directional control position of the pilot.	Pedal in.					
		pilotLeftPedalControlPos_d pilotLeftPedalControlPos_r	Left Directional control position of the pilot.	Pedal in.					
		pilotCollectiveControlPos_d pilotCollectiveControlPos_r	Pilot collective control position.	UP					
		pilotAvgThrottleControlPos_d pilotAvgThrottleControlPos_r	Average pilot throttle control position.	FWD					
		pilotThrottleControlPos_d[number of engines] pilotThrottleControlPos_r[number of engines]	Individual pilot throttle control positions. Order is outboard port (left) to outboard starboard.	FWD					
		copilotLongControlPos_d copilotLongControlPos_r	Longitundal control position of the copilot.	AFT					
		copilotLatControlPos_d copilotLongControlPos_r	Lateral control position of the copilot.	RT					
		copilotPedalControlPos_d copilotPedalControlPos_r	Net Directional control position of the copilot. Nornally, Right pedal – left pedal.	Pedal in or clockwise twist of a sidestick.					
		copilotRightPedalControlPos_d copilotRightPedalControlPos_r	Right Directional control position of the copilot.	Pedal in.					
		copilotLeftPedalControlPos_d copilotLeftPedalControlPos_r	Left Directional control position of the copilot.	Pedal in.					
		copilotCollectiveControlPos_d copilotCollectiveControlPos_r	Copilot collective control position.	UP					
		copilotAvgThrottleControlPos_d copilotAvgThrottleControlPos_r	Average copilot throttle control position.	FWD					
		copilotThrottleControlPos_d[number of engines] copilotThrottleControlPos_r[number of engines]	Individual copilot throttle control positions. Order is outboard port (left) to outboard starboard.	FWD					
		avgThrottleControlPos_d avgThrottleControlPos_r	Average pilot and copilot throttle control position.	FWD					
		throttleControlPos_d[number of engines] throttleControlPos_r[number of engines]	Individual throttle control position (pilot and copilot average). Order is outboard	FWD					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			port (left) to outboard starboard.						
		avgPropControlPos_d avgPropControlPos_r	Average pilot and copilot propeller blade pitch control position.	FWD					
		propControlPos_d[number of engines] propControlPos_r[number of engines]	Individual propeller blade pitch control position. Order is outboard port (left) to outboard starboard.	FWD					
		trailingEdgeFlapDeflection[number of leading edge flap control surfaces]	Vector of trailing edge flap positions, one for each surface deflected. Order is outboard port (left) to outboard starboard.	LED					
		avgTrailingEdgeFlapDeflection_d	Trailing edge flap deflection. Average for all trailing edge flap surfaces.	TED					
		differentialTrailingEdgeFlapDeflection_d	Measure of roll control due to trailing edge flap deflection differences in vehicles with multiple control surfaces, usually (left deflections-right deflections)	RWD control					
		leadingEdgeFlapDeflection[number of leading edge flap control surfaces]	Vector of leadng edge flap positions, one for each surface deflected. Order is outboard port (left) to outboard starboard.	LED					
		avgLeadingEdgeFlapDeflection_d	Leading edge flap/slat deflection. Average for all deflected leading edge flap/slat surfaces.	LED					
		differentialLeadingEdgeFlapDeflection_d	Measure of roll control due to leading edge flap deflection differences in vehicles with multiple control surfaces, usually (left deflections-right deflections)	RWD control					
		spoilerDeflection[number of spoiler control surfaces]	Vector of spoiler control positions, one for each surface deflected. Order is outboard port (left) to outboard starboard.	TEU					
		avgSpoilerDeflection_d	Spoiler deflection. Average for all deflected spoilers	TEU					
		differentialSpoilerDeflection_d	Measure of roll control due	RWD					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			to spoiler deflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)	control					
		aileronDeflection[number of aileron control surfaces]	Vector of aileron control positions, one for each surface deflected. Order is outboard port (left) to outboard starboard.	TEU					
		avgAileronDeflection	Differential aileron deflection, right-left	Right aileron TEU					
		rudderDeflection_d[number of rudder control surfaces]	Vector of rudder control positions, one for each surface deflected. Order is outboard port (left) to outboard starboard.	TEL					
		avgRudderDeflection_d	Average rudder deflection	TEL					
		differentialRudderDeflection_d	Measure of yaw control due to rudder deflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)						
		rudderTabDeflection_d[number of rudder tab control surfaces]	Vector of rudder tab control positions, one for each surface deflected. Order is outboard port (left) to outboard starboard.	TEL					
		avgRudderTabDeflection_d	Average rudder tab deflection	TEL					
		differentialRudderTabDeflection_d	Measure of yaw control due to rudder tab tdeflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)						
		elevatorDeflection_d[number of elevator control surfaces]	Vector of elevator (or stabilizer/stabilator) control positions, one for each surface deflected. Order is outboard port (left) to outboard starboard.	TEU					
		avgElevatorDeflection_d	Average elevator (or stabilizer/stabilator) deflection	TEU					
		differentialElevatorDeflection_d	Measure of roll control due	Right					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			to elevator (or stabilizer/stabilator) deflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)	control TEU					
		elevatorTabDeflection_d[number of elevator tab control surfaces]	Vector of elevator (or stabilizer/stabilator) tab control positions, one for each surface deflected. Order is outboard port (left) to outboard starboard.	TEU					
		avgElevatorTabDeflection_d	Average elevator (or stabilizer/stabilator) tab deflection	TEU					
		differentialElevatorTabDeflection_d	Measure of roll control due to elevator (or stabilizer/stabilator) tab deflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)	Right control TEU					
		canardDeflection_d[number of canard control surfaces]	Vector of canard control positions, one for each surface. Order is outboard port (left) to outboard starboard.	TED					
		avgCanardDeflection_d	Average canard deflection	TED					
		differentialCanardDeflection_d	Measure of roll control due to canard deflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)	Right control TED					
		canardTabDeflection_d[number of canard tab control surfaces]	Vector of canard tab control positions, one for each surface. Order is outboard port (left) to outboard starboard.	TED					
		avgCanardTabDeflection_d	Average canard tab deflection	TED					
		differentialCanardTabDeflection_d	Measure of roll control due to canard tab deflection differences in vehicles with multiple control surfaces, usually (right deflections-	Right control TED					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			left deflections)						
		speedbrakeDeflection_d	Speedbrake deflection	Extended					
		landingGearPosition[number of landing gear struts]	Vector of landing gear positions, one for each strut. Order is outboard port (left) to outboard starboard.	0= up and locked 1= full extension with no weight on wheels					
		landingGearWeightOnWheels_lbf[number of landing gear struts] landingGearWeightOnWheels_kg[number of landing gear struts]	Vector of landing gear weight on wheels, one for each strut. Order is outboard port (left) to outboard starboard.						
		landingGearWheelSpeed_rs_1[number of landing gear struts, number of trucks, number of wheels per truck]	Array of landing gear wheel speeds by strut, one for each strut. Order of struts is outboard port (left) strut, to outboard starboard. Order of trucks is front to rear. Order of wheels on each truck is port to starboard.						
Vehicle Aerodynamic Characteristics									
C_L	CL	totalCoefficientOfLift	Coefficient Of Lift, Total, includes effects of stores	UP				3	
C_D	CD	totalCoefficientOfDrag	Coefficient Of Drag, Total, includes effects of stores	AFT				3	
		aeroBodyForceCoefficient[3]	Vector of total aerodynamic force coefficients in the body axis system, comprised of the three components as defined below.						
C_X	CX	aeroXBodyForceCoefficient	X-body Force Coefficient due to aerodynamic loads, includes stores (Body axis)	FWD				3	
C_Y	CY	aeroYBodyForceCoefficient	Y-body Force Coefficient due to aerodynamic loads, includes stores (Body axis)	RT				3	
C_Z	CZ	aeroZBodyForceCoefficient	Z-body Force Coefficient due to aerodynamic loads, includes stores (Body axis)	DOWN				3	
		aeroBodyForce_lbf[3] aeroBodyForce_N[3]	Vector of total aerodynamic forces in the body axis system, including stores. Comprised of the three components as defined below.						
F_{AX}	FAX	aeroXBodyForce_lbf aeroXBodyForce_N	Total X-body Force due to aerodynamic loads, includes stores (Body axis)	FWD				3	
F_{AY}	FAY	aeroYBodyForce_lbf aeroYBodyForce_N	Total Y-body Force due to aerodynamic loads, includes stores (Body axis)	RT				3	

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
F_{AZ}	FAZ	aeroZBodyForce_lbf aeroZBodyForce_N	Total Z-body Force due to aerodynamic loads, includes stores (Body axis)	DOWN				3	
		thrustBodyForce_lbf[3] thrustBodyForce_N[3]	Vector of total net propulsion system forces in the body axis system (includes installion losses, inlet efficieny and propeller efficiency). Comprised of the three components as defined below.						
F_{EX}	FEX	thrustXBodyForce_lbf thrustXBodyForce_N	Total net engine thrust Force, X-body axis	FWD				3	
F_{EY}	FEY	thrustYBodyForce_lbf thrustYBodyForce_N	Total net engine thrust Force , Y-body axis	RT				3	
F_{EZ}	FEZ	thrustZBodyForce_lbf thrustZBodyForce_N	Total net engine thrust Force, Z-body axis	DOWN				3	
		gearBodyForce_lbf[3] gearBodyForce_N[3]	Vector of total landing gear ground reaction forces in the body axis system. Does NOT include aerodynamic forces on the landing gear which are included in aeroBodyForce defined above. Comprised of the three components as defined below.						
F_{GX}	FGX	gearXBodyForce_lbf gearXBodyForce_N	Total landing gear ground reaction force, X-body axis	FWD				3	
F_{GY}	FGY	gearYBodyForce_lbf gearYBodyForce_N	Total landing gear ground reaction force, Y-body axis	RT				3	
F_{GZ}	FGZ	gearZBodyForce_lbf gearZBodyForce_N	Total landing gear ground reaction force, Z-body axis	DOWN				3	
		totalBodyForce lbf[3] totalBodyForce N[3]	Vector of total forces in the body axis system. Includes all forces exerted upon the vehicle. Comprised of the three components as defined below.						
F_{xTOT}	FX	totalXBodyForce_lbf totalXBodyForce_N	Total Forces On A/c, X-body axis	FWD				3	
F_{yTOT}	FY	totalYBodyForce_lbf totalYBodyForce_N	Total Forces On A/c, Y-body axis	RT				3	
F_{zTOT}	FZ	totalZBodyForce_lbf totalZBodyForce_N	Total Forces On A/c, Z-body axis	DOWN				3	
		aeroBodyMomentCoefficient[3]	Vector of total aerodynamic moment coefficients in the body axis system, including stores. Comprised of the three components as defined below.						
C_l	CLL	aeroRollBodyMomentCoefficient	Total Aerodynamic Rolling Moment Coefficient including stores. Moment about the X-body axis	RWD				3	
C_m	CLM	aeroPitchBodyMomentCoefficient	Total Aerodynamic Pitching Moment Coefficient, including stores. Moment about the Y-body axis	ANU				3	
C_n	CLN	aeroYawBodyMomentCoefficient	Total Aerodynamic yawing Moment Coefficient, including stores. Moment	ANR				3	

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			about the Z-body axis						
		aeroBodyMoment_flbf[3] aeroBodyMoment_Nm[3]	Vector of total aerodynamic moments in the body axis system, including stores. . Referenced to the moment reference center. Comprised of the three components as defined below.						
L_A	TAL	aeroRollBodyMoment_flbf aeroRollBodyMoment_Nm	Total Aerodynamic Rolling moment (including attached stores), about the X-body axis	RWD					
M_A	TAM	aeroPitchBodyMoment_flbf aeroPitchBodyMoment_Nm	Total Aerodynamic pitching moment (including attached stores), about the Y-body axis	ANU					
N_A	TAN	aeroYawBodyMoment_flbf aeroYawBodyMoment_Nm	Total Aerodynamic yawing moment (including attached stores), about the Z-body axis	ANR					
		thrustBodyMoment_flbf[3] thrustBodyMoment_Nm[3]	Vector of total net propulsion system moments in the body axis system (includes installion losses, inlet efficieny and propeller efficiency). . Referenced to the moment reference center. Comprised of the three components as defined below.						
L_E	TEL	thrustRollBodyMoment_flbf thrustRollBodyMoment_Nm	Total Engine Rolling Moment, about the X-body axis	RWD					
M_E	TEM	thrustPitchBodyMoment_flbf thrustPitchBodyMoment_Nm [thrust_body_pitch_moment_flbf]	Total Engine pitching Moment, about the Y-body axis	ANU					
N_E	TEN	thrustYawBodyMoment_flbf thrustYawBodyMoment_Nm	Total Engine yawing Moment, about the X-body axis	ANR					
		landingGearBodyMoment_flbf[3] landingGearBodyMoment_Nm[3]	Vector of total landing gear ground reaction moments in the body axis system. . Referenced to the moment reference center. Does NOT include aerodynamic moments on the landing gear which are included in aeroBodyMoment defined above. Comprised of the three components as defined below.						
L_G	TGL	landingGearRollBodyMoment_flbf landingGearRollBodyMoment_Nm	Total Landing Gear Rolling Moment, about the X-body axis	RWD					
M_G	TGM	landingGearPitchBodyMoment_flbf landingGearPitchBodyMoment_Nm	Total Landing gear Pitch Moment, about the Y-body axis	ANU					
N_G	TGN	landingGearYawBodyMoment_flbf landingGearYawBodyMoment_Nm	Total Landing Gear Yawing Moment, about the Z-body axis	ANR					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		totalBodyMoment_flbf[3] totalBodyMoment_Nm[3]	Vector of total moments in the body axis system. Referenced to the moment reference center. Includes all moments exerted upon the vehicle. Comprised of the three components as defined below.						
L_{TOT}	TTL	totalRollBodyMoment_flbf totalRollBodyMoment_Nm	Total Rolling Moment, about the X-body axis	RWD					
M_{TOT}	TTM	totalPitchBodyMoment_flbf totalPitchBodyMoment_Nm	Total Pitching Moment, about the Y-body axis	ANU					
N_{TOT}	TTN	totalYawBodyMoment_flbf totalYawBodyMoment_Nms	Total Yawing Moment, about the Z-body axis	ANR					
Simulation Control Parameters									
	TIME	simTime_s simTime_s [sim time s]	Time Since Start Of Operate Mode	NSC					
		deltaTime_s[number of different integration step sizes]	Vector of Integration step sizes						