Standard Simulation Variable Names

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.

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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, NxxVelocity_fs_1 may represent;

NEIVelocity_fs_1 for the EI axis sytem- Earth centered Inertial (also know as geocentric inertial) axis sytem

NEFVelocity_fs_1 for the EF axis system- Earth centered earth Fixed (also known as Geocentric Earth [GE] axis system)

NVOVelocity_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) frame.			
Φ	PHI	rollEulerAngle_d	Roll Euler Angle, LL frame.	RWD	-180,-π	180, π

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Min Value	Max Value
		rollEulerAngle_r				
θ	THET	pitchEulerAngle_d	Pitch Euler Angle, LL frame	ANU	-90, $-\pi/2$	90, $\pi/2$
		pitchEulerAngle_r				
ψ	PSI	yawEulerAngle_d	Yaw Euler Angle, LL frame	ANR	-180,$-\pi$	180, π
		yawEulerAngle_r				

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

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) frame.						
ϕ	PHI	rollEulerAngle_d rollEulerAngle_r	Roll Euler Angle, LL frame.	RWD	From vehicle trim	-180	180	2	
θ	THET	pitchEulerAngle_d pitchEulerAngle_r	Pitch Euler Angle, LL frame	ANU	From vehicle trim	-90	90	2	
ψ	PSI	yawEulerAngle_d yawEulerAngle_r	Yaw Euler Angle, LL frame	ANR	From vehicle trim	-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		
$\underline{T}_{FE/B}$	T (FEBT?)	FEToBodyT(3,3)	The FE to Body transformation matrix composed of the elements defined below						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
$T_{FE/B}(1,1)$	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						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value		Note	Date Changed
			element							
$T_{FE/B}(3,3)$	T33	FEToBodyT33	CPHI*CTHT (FE to B) axis transformation element							
γ_V	GAMV	flightPathAngle_r flightPathAngle_d	Flight Path Angle Above Horizon	ANU		-π/2 -90	π/2 90	10) 1.3.5.2	3	
γ_H	GAMH	flightPathAzimuth_r flightPathAzimuth_d	Flight Path Angle In Horizon Plane, from North	CWFN		-π -180	π 180	10) 1.3.5.1	3	
h	ALT	altitudeMSL_f altitudeMSL_m	Altitude Of Aircraft Above Sea Lvl FE (flat earth or local) frame	UP						
	XLON	xxLongitude_r xxLongitude_d	Longitude Of Aircraft in xx frame.	WEST						
	XLAT	xxLatitude_r xxLatitude_d	Latitude Of Aircraft in xx frame.	NORTH						
	SLAT	xxSineLatitude	Sine Of Aircraft Latitude in xx frame.	NORTH						
	CLAT	xxCosineLatitude	Cosine Of Aircraft	NORTH						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			Latitude in xx frame.						
	HGT_RWY	runwayHeightAboveSL_ft runwayHeightAboveSL_m	Height Of Runway W/r/t mean Sea Level	Above					
		xxCGPosition_ft (3) xxCGPosition_m (3)	Vector of positions of the CG with respect to a user defined reference point in the specificed axis system. Comprised of the three components as defined below.						
	XCG	XxxCGPosition_ft XxxCGPosition_m	X Position of the CG W/r/t the user defined reference point in the xx axis system	CG Northward of the reference point					
	YCG	YxxCGPosition_ft YxxCGPosition_m	Y Position of the CG W/r/t the user defined reference point in the xx axis system	CG East of the reference point					
	ZCG	ZxxCGPosition_ft ZxxCGPosition_m	Z Position of the CG W/r/t the user defined reference point in the xx axis system	CG below the reference point					
		xxReferencePosition_ft (3) xxReferencePosition_m (3)	Vector of positions of the moment reference center with respect to a user defined reference point in the specificed axis system. This is sometimes more convenient to locate a vehicle						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			since the moment reference center is fixed in the vehicle, but the CG moves. Comprised of the three components as defined below.						
	XREF	XxxReferencePosition_ft XxxReferencePosition_m	X Position of the moment reference center W/r/t the user defined reference point in the xx axis system	moment reference center Northward of the reference point					
	YREF	YxxReferencePosition_ft YxxReferencePosition_m	Y Position of the moment reference center W/r/t the user defined reference point in the xx axis system	moment reference center East of the reference point					
	ZREF	ZxxReferencePosition_ft ZxxReferencePosition_m	Z Position of the moment reference center W/r/t the user defined reference point in the xx axis system	moment reference center below the reference point					
		pilotEyePosition_ft (3)	Vector of positions of the pilots eye with respect to the CG in						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		pilotEyePosition_m (3)	the body axis system. Comprised of the three components as defined below.						
	XPLT2CG	pilotEyeXPosition_ft pilotEyeXPosition_m	X Position Of Pilot eye point W/r/t C.g., in the body axis system	Eye FWD of CG					
	YPLT2CG	pilotEyeYPosition_ft pilotEyeYPosition_m	Y Position Of Pilot eye point W/r/t C.g. , in the body axis system	Eye Right of the CG					
	ZPLT2CG	pilotEyeZPosition_ft pilotEyeZPosition_m	Z Position Of Pilot eye point W/r/t C.g. , in the body axis system	Eye below CG					
	Example	Runway22Position _ft (3) Runway22Position _m (3)	Vector of positions of the aircraft CG relative to the Runway 22 (a user defined) touchdown reference point. Comprised of the three components as defined below.						
	XCGTD	XRunway22Position _ft XRunway22Position t_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	YRunway22Position _ft YRunway22Position t_m	C.g. Y-position W/r/t Runway touchdown point in the specified	CG to the right of the					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			(Runway22) axis system.	reference point					
	ZCGTD	ZRunway22Position _ft ZRunway22Position _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 aircraft.						
	RALT	altitudeAboveTerrain_f altitudeAboveTerrain_m	height of the aircraft cg above the terrain	NSG					
	HTERRAIN	heightOfTerrain_f heightOfTerrain_m	Height of the terrain under the a/c 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.						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value		Note	Date Changed
		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.							
p_B	PB	rollBodyRate_rs_1 rollBodyRate_ds_1	Aircraft Roll Velocity, Body Frame	RWD				10) 1.4.6	3	
q_B	QB	pitchBodyRate_rs_1 pitchBodyRate_ds_1	Aircraft Pitch Velocity, Body frame	ANU				10) 1.4.6	3	
r_B	RB	yawBodyRate_rs_1 yawBodyRate_ds_1	Aircraft Yaw Velocity, Body frame	ANR				10) 1.4.6	3	
		bodyAngularRateNoTurb_rs_1(3) bodyAngularRateNoTurb_ds_1(3)	Vector of aircraft angular rates with respect to the angular turbulence velocities. Comprised of the three components as defined below. Body frame.							
	PBWN	rollBodyRateNoTurb_rs_1 rollBodyRateNoTurb_ds_1	Roll rate wrt roll turbulence	RT wing down						
	QBWN	pitchBodyRateNoTurb_rs_1	Pitch rate wrt pitch	Nose UP						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		pitchBodyRateNoTurb_ds_1	turbulence						
	RBWN	yawBodyRateNoTurb_rs_1	Yaw rate wrt yaw	Nose RT					
		yawBodyRateNoTurb_ds_1	turbulence						
$\underline{\dot{\varepsilon}}$	EULD	eulerAngleRate_ds_1(3)	Vector of the roll, pitch, and yaw Euler angle rates defined						
		eulerAngleRate_rs_1(3)	below. LL (locally level) frame						
$\dot{\phi}$	PHID	rollEulerAngleRate_rs_1	Euler roll rate, LL frame	RWD	From vehicle trim				
$\dot{\theta}$	THETD	pitchEulerAngleRate_rs_1	Euler pitch rate, LL frame	ANU	From vehicle trim				
$\dot{\psi}$	PSID	yawEulerAngleRate_rs_1	Euler yaw rate, LL frame	ANR	From vehicle trim				
$\underline{V}_B$	VELB	bodyVelocity_fs_1(3)	Vector of body axis translational velocities comprised of the						
		bodyVelocity_ms_1(3)	three components as defined below.						
u_B	UB	UbodyVelocity_fs_1	X-velocity Body frame.	FWD			10) 1.4.4	3	
		UbodyVelocity_ms_1							
v_B	VB	VbodyVelocity_fs_1	Y-velocity Body frame	RT			10) 1.4.4	3	
		VbodyVelocity_ms_1							

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value		Note	Date Changed
w_B	WB	WbodyVelocity_fs_1 WbodyVelocity_ms_1	Z-velocity Body frame	DWN				10) 1.4.4	3	
$\underline{V}_{FE}$	VELFE	FEVelocity_fs_1(3) FEVelocity_ms_1(3)	Vector of Flat Earth (FE) axis translational velocities comprised of the three components as defined below.							
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						
$\underline{V}_{GE}$	VELxx	xxVelocity_fs_1(3) xxVelocity_ms_1(3)	Vector of aircraft cg translational velocities wrt the specified (xx) axis system comprised of the three components as defined below.							
V_N	VNxx	NxxVelocity_fs_1 NxxVelocity_ms_1	Northward Velocity Over specified (xx)Earth Fixed Axis System	NORTH						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
V_E	VExx	ExxVelocity_fs_1 ExxVelocity_ms_1	Eastward Velocity Over specified (xx)Earth Fixed Axis System	EAST					
V_D	VDxx	DxxVelocity_fs_1 DxxVelocity_ms_1	Downward Velocity Over specified (xx)Earth Fixed Axis System	DOWN					
	Examples	EGEVelocity_fs_1	Eastward (Y axis) velocity over the earth in the geocentric earth (GE) axis system in ft/sec	East					
		NEFVelocity_kms_1	Northward (X axis) velocity over the earth in the earth centered earth fixed (EF) axis system in kilometers/sec	North					
		UBodyVelocity_fs_1	X axis velocity in the Body axis system in ft/sec	Forward					
		ZRunway22Velocity_fs_1	Z axis velocity in the user defined “runway22” coordinate system in f/s	Down					
$V_{T_{xx}}$	VTxx	xxTotalVelocity_fs_1 xxTotalVelocity_ms_1	Total Velocity where xx is the reference frame as	forward					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			defined in the body of this standard.						
$V_{G_{XX}}$	VGxx	xxGroundSpeed_fs_1 xxGroundSpeed_ms_1	Vehicle velocity relative to the ground, where xx is the reference frame as defined in the body of this standard.	forward					
M_N	XMACH	mach	Mach Number of the aircraft	forward					
$V_{RW_{XX}}$	VELRWxx	xxVelocityRelativeToWind_fs_1(3) xxVelocityRelativeToWind_ms_1(3)	Vector of fixed xx axis translational velocities wrt the specified (xx) axis system comprised of the three components as defined below.						
V_{NRW}	VNRWxx	xxVelocityXRelativeToWind_fs_1 xxVelocityXRelativeToWind_ms_1	North Relative Velocity Vn-vnw in the xx frame.	NORTH					
V_{ERW}	VERWxx	xxVelocitxxRelativeToWind_fs_1 xxVelocitxxRelativeToWind_ms_1	East Relative Velocity Ve-vew in the xx frame.	EAST					
V_{DRW}	VDRWxx	xxVelocityZRelativeToWind_fs_1 xxVelocityZRelativeToWind_ms_1	Down Relative Velocity Vd-vdw in the xx frame.	DOWN					
$\dot{h}_{XX}$	ALTDxx	xxAltitudeRate_fs_1 xxAltitudeRate_ms_1	Altitude time rate of change in xx frame.	DOWN					
	XLOND	xxLongitudeRate_rs_1 xxLongitudeRate_ds_1	Longitude Rate Of Change in xxfrane.	WEST					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
	XLATD	xxlatitudeRate_rs_1 xxlatitudeRate_ds_1	Latitude Rate Of Change in xx frame.	NORTH					
p_s	PS	rollVFRate_rs_1 rollVFRate_ds_1	Roll about the X axis in the VF reference frame, also know as stability axis roll rate.	RWD					
r_s	RS	yawVFRate _rs_1 yawVFRate_ds_1	Yaw about the Z axis in the VF reference frame, also known as the Stability Axis yaw rate	ANR					
		Vehicle Linear and Angular Accelerations							
$\underline{\dot{\omega}}_B$	OMBD	bodyAngularAccel_rs_2(3) bodyAngularAccel_ds_2(3)	Vector of body axis angular accelerations comprised of the three components as defined below.						
$\dot{p}_B$	PBD	rollBodyAccel_rs_2 rollBodyAccel_ds_2	Aircraft Roll Acceleration, Body frame	RWD					
$\dot{q}_B$	QBD	pitchBodyAccel_rs_2 pitchBodyAccel_ds_2	Aircraft Pitch Accel, Body frame	ANU					
$\dot{r}_B$	RBD	yawBodyAccel_rs_2	Aircraft Yaw	ANR					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		yawBodyAccel_ds_2	Acceleration, Body frame						
		bodyAccel_fs_2(3) bodyAccel_ms_2(3)	Vector of accelerations of the cg of the a/c wrt the interital frame in the body axis system. Therefore does not include the gravity vector. Comprised of the three components as defined below.						
u_B	UBD or UBD	UbodyAccel_fs_2 UbodyAccel_ms_2	Lonngitudinal acceleration (along the X-body axis)	FWD					
v_B	VBD or VBD	VBodyaccel_fs_2 VBodyaccel_ms_2	Right Sideward Acceleration, Body axis	RT					
w_B	WBD or WBD	WBodyaccel_fs_2 WBodyaccel_ms_2	Downward Acceleration, Body axis	DOWN					
$\dot{V}_{T_{XX}}$	VTDxx	xxTotalAccel_fs_2 xxTotalAccel_ms_2	Rate of change of inertial velocity, where xx is the reference frame as defined in the body of this standard.	forward					
		xxAccel_fs_2 xxAccel_ms_2	Vector of aircraft cg translational wrt the specified (xx) axis system comprised of the three components as defined below.						
V_N	VND	NxxAccel_fs_2 NxxAccel_ms_2	North Acceleration Over Earth	NORTH					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
V_E	VED	ExxAccel_fs_2 ExxAccel_ms_2	East Acceleration Over Earth	EAST					
V_D	VDD	DxxZAccel_fs_2 DxxAccel_ms_2	Down Acceleration Toward Earth surface or center	DOWN					
		bodyCgAccelSensed_fs_2(3) bodyCgAccelSensed_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.						
	AX	XBodyCgAccelSensed_fs_2 XBodyCgAccelSensed_ms_2	X Acceleration Of A/c C.g. (body axis) Includes the gravity vector.	FWD					
	AY	YBodyCgAccelSensed_fs_2 YBodyCgAccelSensed_ms_2	Y Acceleration Of A/c C.g. (body axis) Includes the gravity vector.	RT					
	AZ	ZBodyCgAccelSensed_fs_2 ZBodyCgAccelSensed_ms_2	Z Acceleration Of A/c C.g. (body axis) Includes the gravity vector.	DOWN					
		bodyPilotAccel_fs_2(3) bodyPilotAccel_ms_2 (3)	Vector of accelerations at the pilot reference point, in the body axis system, comprised of the three components as defined						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			below.						
	AXP	XBodyPilotAccel_fs_2 XBodyPilotAccel_ms_2	X Acceleration Of Pilot reference point (body axis)	FWD					
	AYP	YBodyPilotAccel_fs_2 YBodyPilotAccel_ms_2	Y Acceleration Of Pilot reference point(body axis)	RT					
	AZP	ZBodyPilotAccel_fs_2 ZBodyPilotAccel_ms_2	Z Acceleration Of Pilot reference point(body axis)	DOWN					
	G	localGravity_fs_2 localGravity_fs_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	From aircraft trim	$-\pi$,-180	$+\pi$,+180		
β	BETA	angleOfSideslip_d angleOfSideslip_r	Sideslip Angle, Body axis	ANL	From aircraft trim	$-\pi$,-180	$+\pi$,+180		
$\dot{\alpha}$	ALFD	angleOfAttackRate_rs_1	Angle Of Attack Rate, Body axis	ANU	From aircraft trim				
$\dot{\beta}$	BETD	angleOfSideslipRate_rs_1	Sideslip Angle Rate	ANL	From aircraft trim				

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
$\sin\alpha$	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					
$\overline{q}$	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 aircraft	NSC					
	DENALT	densityAltitude_f	Density altitude					REF 1	

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		densityAltitude_f							
a	SOUND	speedOfSound_fs_2 speedOfSound_ms_2	Velocity Of Sound At Altitude of the aircraft	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	Ambient temperature, at the altitude of the CG						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		ambientTemperatureAtAlt_C							
	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						
	WIND_DIRECTION	steadyStateWindDirection_d	Steady wind heading (blowing FROM true North)	Wind blowing from					
$\underline{V}_{B_{Turb}}$	VELBT	bodyTurbulenceVelocity_fs_1(3)	Vector of body axis translational turbulence velocities						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		bodyTurbulenceVelocity_ms_1(3)	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 fixed xx frame wind velocities velocities wrt the specified (xx) axis system comprised of the three components as defined below.						
W_N	VNWxx	XxxWindVelocity_fs_1 XxxWindVelocity_ms_1	North component of wind velocity in xx frame	To the North					
W_E	VEWxx	YxxWindVelocity_fs_1 YxxWindVelocity_ms_1	East component Of wind velocity in xx frame.	To the East					
W_D	VDWxx	ZxxWindVelocity_fs_1 ZxxWindVelocity_ms_1	Down Component Of Wind Velocity in xx frame.	To Downward					
$W_{T_{XX}}$	VTWxx	xxTotalwindVelocity_fs_1 xxTotalwindVelocity_ms_1	Total Wind Velocity, in xx frame.	NSC					
		netWindVel_fs_1 (3) netWindVel_ms_1 (3)	Vector of the net wind velocities impinging on the aircraft. 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
	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 aircraft. 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 turbulenceFromBelow_ms_1	Vertical component of turbulence	From below					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		bodyAngularTurbulence_ds_1 (3) bodyAngularTurbulence_rs_1 (3)	Vector of angular turbulence velocities comprised of the three components as defined below. Body frame.						
	PTURB	rollBodyTurbulenceRate_ds_1 rollBodyTurbulenceRate_rs_1	Body axis roll turbulence	The turbulence would move the aircraft right wing down					
	QTURB	pitchBodyTurbulenceRate_ds_1 pitchBodyTurbulenceRate_rs_1	Body axis pitch turbulence	The turbulence would move the aircraft nose up					
	RTURB	yawBodyTurbulenceRate_ds_1 yawBodyTurbulenceRate_rs_1	Body axis yaw turbulence	The turbulence would move the aircraft					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
				nose right					
		Vehicle Physical Characteristics							
I		bodyMomentOfInertia_slugf2 (3,3) bodyMomentOfInertia_kgm2 (3,3)	Matrix of the total moments of inertia of the aircraft. This is wrt the CG and includes everything in or attached to the aircraft (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 frame	NSC				10)	1.5.2
I_{xx}	XIYY	bodyYYMomentOfInertia_slugf2 bodyYYMomentOfInertia_kgm2	Vehicle Pitch Moment Of Inertia about Cg, body frame	NSC				10)	1.5.2
I_{zz}	XIZZ	bodyZZMomentOfInertia_slugf2 bodyZZMomentOfInertia_kgm2	Vehicle Yaw Moment Of Inertia about Cg, body frame	NSC				10)	1.5.2
I_{xz}	XIZX	bodyZXProductOfInertia_slugf2 bodyZXProductOfInertia_kgm2	Vehicle ZX Cross Product Of Inertia about Cg, body frame	NSC				10)	1.5.3

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
I_{xy}	XIXY	bodyXYProductOfInertia_slugf2 bodyXYProductOfInertia_kgm2	Vehicle XYy Cross Product Of Inertia about Cg, body frame	NSC				10) 1.5.3	
I_{yz}	XIYZ	bodyYZProductOfInertia_slugf2 bodyZProductOfInertia_kgm2	Vehicle YZ Cross Product Of Inertia about Cg, body frame	NSC				10) 1.5.3	
		BodyCGPosition_f (3) BodyCGPosition_m (3)	Vector of the CG position of the aircraft in the body axis system. Comprised of the three components as defined below.						
	XCGREF	XBodyCGPosition_f XBodyCGPosition_m	C.g. Position W/r/t L.e. Of the mean aerodynamic chord	CG AFT of LEMAC					
	YCGREF	YBodyCGPosition_f YBodyCGPosition_m	C.g. Position W/r/t the centerline of the aircraft	CG Right of the a/c centerline					
	ZCGREF	ZBodyCGPosition_f ZBodyCGPosition_m	C.g. Position W/r/t the waterline reference of the aircraft (usually WL 0, see ZBodyWaterline_)	CG below the a/c waterline reference					
		BodyAeroMomentArm_ft BodyAeroMomentArm _m	Vector of the distance from the Moment Reference center to the CG position of the aircraft in the body axis system. Comprised of the three components as defined below.						
ΔX_{cg}	DXCG	XBodyAeroMomentArm_ft XBodyAeroMomentArm _m	Cg Displacement From the aerodynamic force and	FWD					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			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 aircraft.						
ΔY_{cg}	DYCG	YBodyAeroMomentArm _ft YBodyAeroMomentArm _m	Cg Displacement From the aerodynamic force and moment reference center, + is CG to the right of the ARC	RT					
ΔZ_{cg}	DZCG	ZBodyAeroMomentArm _ft ZBodyAeroMomentArm _m	Cg Displacement From the aerodynamic force and moment reference center, + is CG below the the ARC	DWN					
		BodyMRCPosition_f (3) BodyMRCPosition_m (3)	Vector of the location of the moment reference center (MRC) of the aircraft in the body axis system. Comprised of the three components as defined below.						
	XMRC	XBodyMRCPosition_f XBodyMRCPosition_m	X MRC Position W/r/t L.e. Of the mean	MRC AFT of					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			aerodynamic chord	LEMAC					
	YMRC	YBodyMRCPosition_f YBodyMRCPosition_m	Y MRC Position W/r/t the centerline of the aircraft	MRC Right of the a/c centerline					
	ZMRC	ZBodyMRCPosition_f ZBodyMRCPosition_m	Z MRC Position W/r/t the waterline reference of the aircraft (usually WL 0, see ZBodyWaterlinePosition_)	MRC below the a/c waterline reference					
	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 aircraft. 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,	NSC					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			etc.)						
W	WEIGHT	grossWeight_lbm grossWeight_kg	Aircraft Gross Weight, 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 and drivetrain. This is wrt the rotational axis of the engine. For multi-engine vehicles is for one engine. It is comprised of the components below. I_{EXX} $-I_{EXY}$ $-I_{EZX}$ $-I_{EXY}$ I_{EYY} $-I_{EYZ}$ $-I_{EZX}$ $-I_{EYZ}$ I_{EZZ}						
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						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			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 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						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			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 aircraft 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						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			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 aircraft 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 should be used.	Tank centroid behind, right, and below the moment reference center.					
		Vehicle Control Positions							
		pilotLongControlPos_d pilotLongControlPos_r	Longitundal control position of the pilot.	AFT					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		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					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		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 port (left) to	FWD					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			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 (	RWD control					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			left deflections-right deflections)						
		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					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		avgSpoilerDeflection_d	Spoiler deflection. Average for all deflected spoilers	TEU					
		differentialSpoilerDeflection_d	Measure of roll control due to spoiler deflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)	RWD 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					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		avgRudderDeflection_d differentialRudderDeflection_d	Average rudder deflection Measure of yaw control due to rudder deflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)	TEL					
		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 differentialRudderTabDeflection_d	Average rudder tab deflection Measure of yaw control due to rudder tab tdeflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)	TEL					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		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 to elevator (or stabilizer/stabilator) deflection differences in vehicles with multiple control surfaces, usually (right deflections-left deflections)	Right 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	TEU					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			(left) to outboard starboard.						
		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	Right control TED					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			surfaces, usually (right deflections-left deflections)						
		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-left deflections)	Right control TED					
		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					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
				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	

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value		Note	Date Changed
		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				10) 1.6.3	3	
C_Y	CY	aeroYBodyForceCoefficient	Y-body Force Coefficient due to aerodynamic loads, includes stores (Body axis)	RT				10) 1.6.3	3	
C_Z	CZ	aeroZBodyForceCoefficient	Z-body Force Coefficient due to aerodynamic loads, includes stores (Body axis)	DOWN				10) 1.6.3	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,	RT					3	

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			includes stores (Body axis)						
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	

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
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 aircraft. 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	

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
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 about the Z-body axis	ANR				3	
		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	ANU					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
			axis						
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)	Vector of total landing gear ground reaction moments in the						

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		landingGearBodyMoment_Nm (3)	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					
		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 aircraft. 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	Total Yawing Moment,	ANR					

Symbol	Short Name	Full Variable Name	Description	Sign Convention	Intial Value	Min Value	Max Value	Note	Date Changed
		totalYawBodyMoment_Nms	about the Z-body axis						
		Simulation Control Parameters							
	TIME	simTime_s	Time Since Start Of	NSC					
		simTime_s	Operate Mode						
		(sim_time_s)							
		deltaTime_s (number of different integration step sizes)	Vector of Integration step sizes						

References:

1. Perkins, Courtland D, Hage, Robert E., Airplane Performance Stability and Control, New York, Jphn Wiley and Sons, 1967, p.478.