2017-02-26 DMP.Rev.F Master Variable List - DRAFT

The present document is a preliminary list of the deliverables for the Flight Data Management Plan (DMP) Rev.F. This is a comprehensive list that contains the variables names and type of data that will be requested and collected by NASA from the Test Site Operators as part of TCL3. The final version of this variable list as well as detailed explanations, definitions, formatting of the data and instructions for submission will be released as part of the DMP.Rev.F at a later date. This list is subject to be modified and expanded as the development of the DMP Rev.F and associated software progresses.

Subsequent versions of this Variable Master List might be provided to the Test Site Points of Contact (POCs) as early as practical with the goal of maintaining the POCs informed of updates to Rev.F and of helping with the design of experiments and data collection. Each new version supersedes the previous one.

TCL3 will focus in the following Test Areas:

1- CNS (): Communication, Navigation and Surveillance
2- SAA (): Sense and Avoid
3- DAT (): Data and Information Exchange
4- CON (): Concept of Operations

The present draft includes the following Test Areas: CNS, SAA and DAT.

(a) General DMP variables:
AircraftFlightPlan
UASSpecifications
UASState
AuxiliaryUASOperation

(b) CNS (): Communication, Navigation and Surveillance
CNS.1 Effectiveness of Redundant C2 in Maintaining Operational Control of UA
CNS.2 Impact of GNSS Navigation System Error on UA's Ability to Stay within Flight Geography
CNS.3 Characterize RF environment in which UA operate

(c) SAA (): Sense and Avoid variable list
SAA.1 Description of Conflict Scenario
SAA.2 Description of Mission
SAA.3 Description of Aircraft Performance and State Data
SAA.4 Expected and Measured Sensor Performance
SAA.5 Expected Conflict Resolution Performance
SAA.6 Measured Conflict Avoidance Performance

(d) DAT (): Data and Information Exchange variable list
DAT4.1 UAS ID Identification Rate
DAT4.2 UAS ID Lookup Latency
DAT4.3 UAS ID Detection Range
DAT99.1 Round trip latency on USS Instance submission

- The following tests / deliverables are not specified in the current draft, and will be provided at a later date:

(e) CON (): Concept of Operations

CON.1: BVLOS Landing
CON.2: Contingency Initiation
CON.3: Public Portal
CON.4: Multiple TCL-2/3 operations for a sustained period
CON.5: FIMS/USS interaction when vehicle heads towards controlled or unauthorized airspace

Each table presents the variables REQUIRED by a specific Test Area (identified by test number). DAT tests are all considered part of the same test and not identified individually. Test Site Operators / USSs must collect the data pertinent to their specific tests in preparation for future submission to NASA. Operators are welcome to submit more data than the minimum required, but if an operator is doing a specific test(s) for TCL3, the operator MUST submit the variables listed as part of such test.

6.1 AircraftFlightPlan

Table 2. Variable names for flight plan data (time independent variables)

Variable Name (columns)	Type	Description	Required by
uvin	STRING	Version 4 UUID obtained from prototype NASA USS	ALL TESTS
gufi	STRING	GUFI from the USS for this flight	ALL TESTS
wpSequenceNum_nonDim	INTEGER	Waypoint sequence number (i.e., sequence of waypoint for the aircraft to fly to). Start with “0”. If no waypoints are available, use a single “-1”.	ALL TESTS
wpType_nonDim	INTEGER	Enter 1 for fly-over type, and 0 for fly-by type	ALL TESTS
wpLat_deg	FLOAT	Waypoint latitude (dec. degree), specify at least seven decimal degrees	ALL TESTS
wpLon_deg	FLOAT	Waypoint longitude (dec. degree), specify at least seven decimal degrees	ALL TESTS
wpAlt_ft	FLOAT	Waypoint altitude, WGS-84 (ft)	ALL TESTS
wpTargetGroundSpeed_ftPerSec	FLOAT	Target ground speed at waypoint (ft/s)	ALL TESTS
wpTargetAirSpeed_ftPerSec	FLOAT	Target airspeed at waypoint (ft/s)	ALL TESTS
hoverTime_sec	FLOAT	Time hovering at waypoint (if applicable) (sec). Include 3 decimal places of precision.	ALL TESTS
wpTime	STRING	Arrival time at intended waypoint. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	ALL TESTS

6.2 UASSpecifications

Table 4a. UAS specifications data – REGISTRATION INFORMATION - VEHICLE INSTANCE (time independent variables)

Variable Name	Type	Description	Required by
Vehicle Instance			
Operator	STRING	Operator name	ALL TESTS
Vehicle Name	STRING	Individual name given to vehicle. Max 100 characters	ALL TESTS
N-Number	STRING	Aircraft’s identification number provided by the FAA. Letter N followed by 1-5 alphanumeric characters (capitalized), as in either:	
		· One to five numbers (N12345)	
		· One to four numbers followed by one letter (N1234Z)	

		· One to three numbers followed by two letters (N123AZ)	
FAA-Number	STRING	FAA Registry number. Max 100 alphanumeric characters (capitalized)	
Event		Select one: · UTM TCL2: Vehicles which participated in TCL2 only. · UTM TCL3: Vehicles which participated in both TCL2 **and** TCL3, or TCL3 only.	ALL TESTS
UVIN	STRING	Version 4 UUID obtained from prototype NASA USS (Auto-Generated)	
Last Modified By	STRING	User Name	
Last Modified On		Auto-Generated	
Custom			
Aircraft Receiver Sensitivity	FLOAT	Sensitivity of aircraft C2 receiver (dBm)	ALL TESTS
GCS Receiver Sensitivity	FLOAT	GCS Receiver Sensitivity (dBm)	ALL TESTS
Frequency	FLOAT	The center frequency (Hz)	ALL TESTS
Bandwidth	FLOAT	Bandwidth (Hz)	ALL TESTS
Protocol	chars [a-zA-Z]	Only lower/upper case letters. No numbers or special characters (#, $, %, &, * etc.). E.g.: MavLink, TCPIP, etc.	
Vehicle Type			
Manufacturer	STRING	Select: Manufacturer name	ALL TESTS ALL TESTS
Vehicle Types		Select: Your vehicle type	ALL TESTS

Table 4b. UAS specifications data – VEHICLE INFORMATION: VEHICLE TYPE (time independent variables)

Variable Name	Type	Description	Required by
General			
Manufacturer	STRING	Select: Name of vehicle manufacturer	ALL TESTS ALL TESTS
Model Name	STRING	Specific model of vehicle	
Base Type ID		Leave blank	ALL TESTS
Access Type	STRING	Select: Public / Private	ALL TESTS
Web Link	STRING	Manufacturer's website	
Dimensions			
Length	FLOAT	Vehicle length (inches)	ALL TESTS

Width	FLOAT	Vehicle width (inches)	ALL TESTS
Height	FLOAT	Vehicle height (inches)	ALL TESTS
Engine			
Type	STRING	Select:	ALL TESTS
		Electric Engine	
		Internal Combustion Engine	
Battery	STRING	Select:	ALL TESTS
		Lithium Polymer	
		Lithium Ion	
		Nickel Cadmium	
		Nickel-Metal Hydride	
		Lithium Iron Phosphate	
		Nickel-Zinc	
		Unknown	
Battery Capacity	FLOAT	Battery: rated capacity (mAh)	
Battery Voltage	FLOAT	Battery: rated voltage (V)	
Fuel Capacity	FLOAT	Fuel tank capacity (gal)	
Fuel Type	STRING	Type of engine fuel	
Num.Strokes	INTEGER	Number of strokes of the engine	
Performance Data			
Maximum Velocity	FLOAT	(kts)	ALL TESTS
Cruise Velocity	FLOAT	(kts)	
Max-Wind Velocity	FLOAT	Headwind: applies to takeoff and landing only (i.e., not cruise flight) (kts)	
Max Endurance	FLOAT	This value corresponds to the endurance at maximum payload for the given battery/power source(s) used by this vehicle (min)	ALL TESTS
Max Take-Off Weight	FLOAT	This is the empty weight of the vehicle plus energy source (batteries or fuel) and the maximum payload the vehicle can carry (lbs)	ALL TESTS
Empty Weight	FLOAT	(lbs)	
Payload Capacity	FLOAT	(lbs)	ALL TESTS
Maximum Thrust	FLOAT	Maximum thrust at cruise speed (lbf)	
Maximum Range	FLOAT	This value corresponds to the range at maximum payload for the given battery/power source(s) used by this vehicle (miles)	ALL TESTS
Maximum Ceiling	INTEGER	Maximum altitude (MSL) that aircraft can nominally operate (ft)	

Vehicle Class Data			
Vehicle Class	STRING	Select: Multi-Rotor Fixed Wing Hybrid Helicopter	ALL TESTS
Num Rotors	INTEGER	If vehicle is a multirotor or propeller driven aircraft, indicate the number of rotors	ALL TESTS
Rotor Diameter	FLOAT	(in)	
Max Roll Rate	FLOAT	Maximum Roll Rate (deg/s)	
Max Pitch Rate	FLOAT	Maximum Pitch Rate (deg/s)	
Max Yaw Rate	FLOAT	Maximum Yaw Rate (deg/s)	
Wing Span	FLOAT	Distance from one wingtip to the other wingtip (in)	ALL TESTS
Glide Ratio	FLOAT	The ratio of the distance forwards to downwards while gliding at a constant speed	
Max Bank Angle	FLOAT	(deg)	
Max Turn Rate	FLOAT	(deg/s)	
Required Navigation Performance			
Lateral Navigation Position Error 95%	FLOAT	95% navigation system lateral error (ft)	ALL TESTS
Vertical Navigation Position Error 95%	FLOAT	95% navigation system vertical error (ft)	ALL TESTS
Lateral Navigation Velocity Error 95%	FLOAT	95% navigation system lateral velocity error (ft/s)	ALL TESTS
Vertical Navigation Velocity Error 95%	FLOAT	95% navigation system vertical velocity error (ft/s)	ALL TESTS

Legacy TCL2 Vehicle Specification variables (not mandatory for TCL3, provide only if available):

Variable (DMP Rev.E.2)	UAS Specs Type	Type	Description	Required by
maxRateOfAscent_ftPerSec	Performance Data	FLOAT	(ft/s)	
maxRateOfDescent_ftPerSec	Performance Data	FLOAT	(ft/s)	
minTurnRadius_ft	Performance Data	FLOAT	(ft)	
maxPitchAngle_deg	Performance Data	FLOAT	(deg)	
maxRollAngle_deg	Performance Data	FLOAT	(deg)	
maxYawAngle_deg	Performance Data	FLOAT	(deg)	

maxCrossWind_ftPerSec	Performance Data	FLOAT	Crosswind: applies to takeoff and landing only (i.e., not cruise flight) (ft/s)	
maxGust_ftPerSec	Performance Data	FLOAT	(ft/s)	
maxRpm_rotPerMin	Performance Data	FLOAT	For a single rotor (rpm)	
maxAccel_ftPerSec2	Performance Data	FLOAT	Maximum Acceleration (ft/s^2)	
posUpdateRate_hz	Custom	FLOAT	Position update rate (Hz)	
attUpdateRate_hz	Custom	FLOAT	Vehicle orientation (attitude) update rate (Hz)	
timeDist2Command_sec	General	FLOAT	Time from disturbance detection to command calculation (human versus autopilot) (sec). Include 3 decimal places of precision.	
timeCommand2Act_sec	General	FLOAT	Time from command calculation to actuation (sec). Include 3 decimal places of precision.	
jxx_lbFt2	General	FLOAT	Moment of inertia for xx (lb ft^2)	
jyy_lbFt2	General	FLOAT	Moment of inertia for yy (lb ft^2)	
jzz_lbFt2	General	FLOAT	Moment of inertia for zz (lb ft^2)	
jxy_lbFt2	General	FLOAT	Moment of inertia for xy (lb ft^2)	
jxz_lbFt2	General	FLOAT	Moment of inertia for xz (lb ft^2)	
jyz_lbFt2	General	FLOAT	Moment of inertia for yz (lb ft^2)	
rotorInertia_lbFt2	General	FLOAT	For a single rotor (lb ft^2)	
cl0_nonDim	General	FLOAT	Lift coefficient for a fixed wing vehicle at steady-level flight trim condition	
cd0_nonDim	General	FLOAT	Drag coefficient for fixed wing or representative value for a multi rotor at steady-level flight trim condition	
thrustCoefficient_nonDim	Engine	FLOAT	Thrust coefficient for motor/rotor propelled vehicles	
kv_rpmPerVolt	Engine	FLOAT	Motor Velocity Constant: increase of motor RPM when voltage goes up by 1 volt (kv_rpmPerVolt x Voltage = RPM) (rpm/V)	
c2BerAircraft_hz	General	FLOAT	Bit Error Rate at aircraft (bit errors per sec, in Hz)	
c2BerGcs_hz	General	FLOAT	Bit Error Rate at GCS (bit errors per sec, in Hz)	

6.3 UASState

Table 6a. Variable names for UAS state data (basic identifiers)

Variable Name (columns)	Type	Description	Required by
uvin	STRING	Version 4 UUID obtained from prototype NASA USS	ALL TESTS
gufi	STRING	GUFI from the USS for this flight	ALL TESTS

timestamp	STRING	Coordinated Universal Time stamp (UTC). Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The 'Z' implies UTC time and is the only timezone accepted.	ALL TESTS

Table 6b. Variable names for UAS state data (time dependent variables)

Variable Name (into rows)	Type	Description	Required by
vehiclePositionLat_deg	FLOAT	GPS Latitude (dec. deg). Report at least seven decimal degrees	ALL TESTS
vehiclePositionLon_deg	FLOAT	GPS Longitude (dec. deg). Report at least seven decimal degrees	ALL TESTS
vehiclePositionAlt_ft	FLOAT	Vehicle reported GPS altitude (ft)	ALL TESTS
barometricAltitude_ft	FLOAT	Pressure based altitude (ft)	
barometricPressure_psi	FLOAT	Pressure sensor value used for barometric altitude (psi)	
altitudeUsedByAutopilot_ft	FLOAT	Best estimate of altitude (filtered/processed) used by the autopilot at any given time (ft)	
aboveTerrainAltitude_ft	FLOAT	Best estimate of altitude above terrain (e.g. filtered/processed) (ft)	ALL TESTS
laserSensorAltitude_ft	FLOAT	Laser/LiDAR-sensor reported altitude above terrain (ft)	
opticalSensorAltitude_ft	FLOAT	Optical/LED/infrared-sensor reported altitude above terrain (ft)	
imageSensorAltitude_ft	FLOAT	Camera/Image-processing-sensor reported altitude above terrain (ft)	
radarSensorAltitude_ft	FLOAT	Radar-sensor reported altitude above terrain (ft)	
acousticSensorAltitude_ft	FLOAT	Sonar/ultrasonic-sensor reported altitude above terrain (ft)	
indicatedAirspeed_ftPerSec	FLOAT	Indicated airspeed (ft/s)	ALL TESTS
trueAirspeed_ftPerSec	FLOAT	True airspeed in (ft/s)	ALL TESTS
groundSpeed_ftPerSec	FLOAT	Ground Speed (ft/s)	ALL TESTS
groundCourse_deg	FLOAT	Ground Course (deg, True North)	ALL TESTS
hdop_nonDim	FLOAT	HDOP: Horizontal dilution of precision of GPS constellation	ALL TESTS
vdop_nonDim	FLOAT	VDOP: Vertical dilution of precision of GPS constellation	ALL TESTS
numGpsSatellitesInView_nonDim	INTEGER	Number of GPS satellites to which the aircraft has line-of-sight to (whether acquired or not by the GPS receiver)	ALL TESTS
numGpsSat_nonDim	INTEGER	Number of GPS satellites being tracked by GPS receiver	ALL TESTS
roll_deg	FLOAT	Roll (deg). Negative roll indicates left	ALL TESTS
pitch_deg	FLOAT	Pitch (deg). Negative pitch indicates nose down	ALL TESTS
yaw_deg	FLOAT	Yaw (deg). Zero-degree yaw is North.	ALL TESTS
velNorth_ftPerSec	FLOAT	Velocity-North (ft/s)	ALL TESTS
velEast_ftPerSec	FLOAT	Velocity-East (ft/s)	ALL TESTS
velDown_ftPerSec	FLOAT	Velocity-Down (ft/s)	ALL TESTS

rollRate_degPerSec	FLOAT	Roll Rate (deg/s)	
pitchRate_degPerSec	FLOAT	Pitch Rate (deg/s)	
yawRate_degPerSec	FLOAT	Yaw Rate (deg/s)	
accBodyX_ftPerSec2	FLOAT	Acceleration-Body-x (ft/s^2)	
accBodyY_ftPerSec2	FLOAT	Acceleration-Body-y (ft/s^2)	
accBodyZ_ftPerSec2	FLOAT	Acceleration-Body-z (ft/s^2)	
motor1ControlThrottleCommand_nonDim	FLOAT	Motor 1-16 control throttle command, between 0% and 100%. If vehicle has a single engine, use motor1 variable. For PWM, 0%=zero width duty cycle, 100%=full width duty cycle, where DutyCycle = (PulseWidth / Period) x 100%. For other motor control, use 0%=min.throttle setting, 100%=max.throttle setting	
motor2ControlThrottleCommand_nonDim	FLOAT		
motor3ControlThrottleCommand_nonDim	FLOAT		
motor4ControlThrottleCommand_nonDim	FLOAT		
motor5ControlThrottleCommand_nonDim	FLOAT		
motor6ControlThrottleCommand_nonDim	FLOAT		
motor7ControlThrottleCommand_nonDim	FLOAT		
motor8ControlThrottleCommand_nonDim	FLOAT		
motor9ControlThrottleCommand_nonDim	FLOAT		
motor10ControlThrottleCommand_nonDim	FLOAT		
motor11ControlThrottleCommand_nonDim	FLOAT		
motor12ControlThrottleCommand_nonDim	FLOAT		
motor13ControlThrottleCommand_nonDim	FLOAT		
motor14ControlThrottleCommand_nonDim	FLOAT		
motor15ControlThrottleCommand_nonDim	FLOAT		
motor16ControlThrottleCommand_nonDim	FLOAT		
aileronActuatorCommand_nonDim	FLOAT	-100% to 100%; where -100%= min. neg. deflection, 100%=max. positive deflection	
elevatorActuatorCommand_nonDim	FLOAT	-100% to 100%; where -100%= min. neg. deflection, 100%=max. positive deflection	
rudderActuatorCommand_nonDim	FLOAT	-100% to 100%; where -100%= min. neg. deflection, 100%=max. positive deflection	
flapActuatorCommand_nonDim	FLOAT	0 to 100%; where 0%= fully retracted, 100%=fully extended	
landingGearActuatorCommand_nonDim	FLOAT	Either 0 = Retracted or 1 = Deployed	

batteryVoltage_v	FLOAT	Vehicle Battery Voltage (V)	ALL TESTS
batteryCurrent_a	FLOAT	Vehicle Battery Current (A)	
angleOfAttack_deg	FLOAT	Angle of Attack (deg)	
sideSlip_deg	FLOAT	Angle of Side Slip (deg)	
targetWaypointLat_deg	FLOAT	Target waypoint latitude (dec. deg). Report at least seven decimal degrees	ALL TESTS
targetWaypointLon_deg	FLOAT	Target waypoint longitude (dec. deg). Report at least seven decimal degrees	ALL TESTS
targetWaypointAlt_ft	FLOAT	Target waypoint WGS-84 altitude (ft)	ALL TESTS
aircraftControlMode	INTEGER	Aircraft control mode, specify an integer value for either mode: Manual = 0, Automatic = 1, Mixed Mode = 2	
targetGroundSpeed_ftPerSec	FLOAT	Target vehicle ground speed (ft/s)	ALL TESTS
targetAirSpeed_ftPerSec	FLOAT	Target vehicle air speed (ft/s)	ALL TESTS
aircraftAirborneState_nonDim	INTEGER	Real time report based on aircraft sensor. Specify an integer value for current state: either Ground = 0, or Airborne = 1	ALL TESTS
minDistToDefinedAreaLateralBoundary_ft	FLOAT	Orthogonal minimum lateral distance between UAS and the boundary of the flight geography (defined area: allocated airspace) (ft)	ALL TESTS
minDistToDefinedAreaVerticalBoundary_ft	FLOAT	Orthogonal minimum vertical distance between UAS and the boundary of the flight geography (defined area: allocated airspace) (ft)	ALL TESTS
c2Rssi Aircraft_dBm	FLOAT	C2 link RSSI measured in dBm at aircraft	
c2RssiGcs_dBm	FLOAT	C2 link RSSI measured in dBm at GCS	
c2NoiseAircraft_dBm	FLOAT	Sum of Thermal noise power and RF interference power, measured in dBm at aircraft	
c2NoiseGcs_dBm	FLOAT	Sum of Thermal noise power and RF interference power, measured in dBm at GCS	
c2PacketLossRateAircraftPrct_nonDim	FLOAT	Packet loss rate at aircraft (0 to 100% of packets lost)	
c2PacketLossRateGcsPrct_nonDim	FLOAT	Packet loss rate at GCS (0 to 100% of packets lost)	
lateralNavPositionError_ft	FLOAT	Current navigation system lateral error (ft)	ALL TESTS
verticalNavPositionError_ft	FLOAT	Current navigation system vertical error (ft)	ALL TESTS
lateralNavVelocityError_ftPerSec	FLOAT	Current navigation system lateral velocity error in (ft/s)	ALL TESTS
verticalNavVelocityError_ftPerSec	FLOAT	Current navigation system vertical velocity error in (ft/s)	ALL TESTS

6.4 AuxiliaryUASOperation

Table 8a. Variable names for auxiliary UAS operation data (columns) (time independent variables)

Variable Name (columns)	Type	Description	Required by
uvin	STRING	Version 4 UUID obtained from prototype NASA USS	ALL TESTS

gufi	STRING	GUFI from the USS for this flight	ALL TESTS

Table 8b. Variable names for auxiliary UAS operation data (into rows) (time independent variables)

Variable Name (into rows)	Type	Description	Required by
typeOfOperation	STRING	Use either “Live” or “Simulated”	ALL TESTS
flightTestCardName	STRING	Name of the flight test card. 280 characters maximum, between quote marks " ", all characters in between are valid except for quote marks as they signal the beginning and end of the string.	ALL TESTS
testIdentifiers		List of the identifier(s) of the test(s) being performed during the current flight. Enclose between quote marks " ", the only valid values for this variable are the identifiers listed below. Do not use quote marks other than at the beginning/end of the string. Separate the test identifiers with commas, with no spaces in between. List as many identifiers as tests are done during an individual flight. Test Identifier / Description CNS.1 Effectiveness of Redundant C2 in Maintaining Operational Control of UA CNS.2 Impact of GNSS Navigation System Error on UA's Ability to Stay within Flight Geography CNS.3 Characterize RF environment in which UA operate SAA.1 Description of Conflict Scenario SAA.2 Description of Mission SAA.3 Description of Aircraft Performance and State Data SAA.4 Expected and Measured Sensor Performance SAA.5 Expected Conflict Resolution Performance SAA.6 Measured Conflict Avoidance Performance DAT.4 UAS ID Identification Rate DAT.4 UAS ID Lookup Latency DAT.4 UAS ID Detection Range DAT.99 Round trip latency on USS Instance submission CON.1 BVLOS Landing CON.2 Contingency Initiation CON.3 Public Portal CON.4 Multiple TCL-2/3 operations for a sustained period CON.5 FIMS/USS interaction when vehicle heads towards controlled or unauthorized airspace e.g. Valid values for testIdentifiers are: “CNS.2” (single test during one flight) “SAA.3,DAT.4,DAT.99” (for 3 different tests during the same flight) “” (empty, just quotes) for no specific test being performed in the current flight	ALL TESTS
takeoffWeight_lb	FLOAT	Vehicle weight at takeoff (lb)	ALL TESTS
takeOffTime	STRING	Time at takeoff (UTC), defined as the moment the vehicle leaves the ground/launching device. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	ALL TESTS
takeoffPosLat_deg	FLOAT	Takeoff position latitude (dec. degree). Report at least seven decimal degrees	ALL TESTS

takeoffPosLon_deg	FLOAT	Takeoff position longitude (dec. degree). Report at least seven decimal degrees	ALL TESTS
takeoffPosAlt_ft	FLOAT	Takeoff position WGS-84 altitude (ft)	ALL TESTS
landingTime	STRING	Time at landing (UTC), defined as the moment returns to ground/recovery device. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The 'Z' implies UTC time and is the only timezone accepted.	ALL TESTS
landingPosLat_deg	FLOAT	Landing/recovery position latitude (dec. degree). Report at least seven decimal degrees	ALL TESTS
landingPosLon_deg	FLOAT	Landing/recovery position longitude (dec. degree). Report at least seven decimal degrees	ALL TESTS
landingPosAlt_ft	FLOAT	Landing/recovery position WGS-84 altitude (ft)	ALL TESTS
gcsPosLat_deg	FLOAT	Ground Control Station (GCS) position latitude (dec. degree). Report at least seven decimal degrees	ALL TESTS
gcsPosLon_deg	FLOAT	GCS position longitude (dec. degree). Report at least seven decimal degrees	ALL TESTS
gcsPosAlt_ft	FLOAT	GCS position WGS-84 altitude (ft)	ALL TESTS

1-CNS (): Communication, Navigation and Surveillance

CNS.1-Effectiveness of Redundant C2 in Maintaining Operational Control of UA & CNS.2-Impact of GNSS Navigation System Error on UA's Ability to Stay within Flight Geography

Variable Name (columns)	Type	Description	Time Dependent (TD) / Independent (TI)	Required by
Communication Systems Description This is a section of a single CNS PDF file	PDF	Section name: CNS.1-Communication Systems Description Description of type of communication systems UAS is using for C2. Vehicle used in this test must have more than one communication system, featuring redundant C2 link. For point-to-point radio system, must include system specification document from manufacturer of the communication system or the vehicle maker as a part of this description. For mesh-network based system, must include description of mesh-network setup and coverage area, and also expected performance of the mesh-network, such as expected	TI	CNS.1

		data transfer rate, expected latency, etc. For cellular network based system (e.g., LTE), must include description of the network including provider, cell tower locations, frequencies used, expected data transfer rate, expected latency, etc. For satellite based system (e.g., iridium), must include description of satellite service, including provider, coverage area, expected data transfer rate, expected latency, etc.		
Process To Switch Between Redundant C2 Link This is a section of a single CNS PDF file	PDF	Section name: CNS.1-Process To Switch Between Redundant C2 Link Description of process to switch from one C2 link to another. Must indicate whether switching is automatically or manually performed, and describe steps involved including actions to be taken by person(s) in the manual case. Flowchart, sequence diagram, or other visualization methods can be used to describe this process.	TI	CNS.1
Method To Detect Loss Of C2 Link This is a section of a single CNS PDF file	PDF	Section name: CNS.1-Method To Detect Loss Of C2 Link Description of loss of C2 detection method. If this method is different per each communication system, it should be described separately. Flowchart, sequence diagram, or other visualization methods can be used in this description.	TI	CNS.1
Loss Of C2 Contingency Steps This is a section of a single CNS PDF file	PDF	Section name: CNS.1-Loss Of C2 Contingency Steps Description of ALL contingency steps when C2 link is lost. Must include contingency steps to be taken when ALL C2 links are lost. Must include description of contingency plan implemented during TCL3 testing. Flowchart, sequence diagram, or other visualization methods can be used to describe this process.	TI	CNS.1
contingencyCause_nonDim	STRING	Defined as a cause that necessitates a contingency response. Specify list of contingency causes in the following format: "[0],[1],....[n]" (include quotation marks); e.g. At a given moment, for simultaneous contingencies LOST_NAV, LOW_FUEL and SECURITY (3, 5 and 10, as defined below), the value of contingencyCause_nonDim would be: "[3],[5],[10]". For no contingency, the value of contingencyCause_nonDim would be: "[0]" This is a time dependent variable, specify "contingencyCause_nonDim " as many times as the contingency(ies) occur simultaneously or separately during the flight. Specify an integer value for either cause: 0. NO_CONTINGENCY_CAUSE 1. LOST_C2_UPLINK The operation has lost command or control uplink to the vehicle. 2. LOST_C2_DOWNLINK The operation has lost downlinks from the vehicle. 3. LOST_NAV The vehicle no longer has sufficient navigation sources. 4. LOST_SAA The vehicle's sense and avoid solution is no longer reliable. 5. LOW_FUEL The vehicle does not have enough power to complete its mission. Still enough fuel to safely land or potentially return to base. 6. NO_FUEL The vehicle is either completely without fuel or has only enough fuel to land immediately. 7. MECHANICAL_PROBLEM	TD	CNS.1, CNS.2

		The vehicle is experiencing a mechanical problem necessitating initiation of a contingency response. 8. SOFTWARE_PROBLEM The vehicle or some component of the required platform ground equipment is experiencing a software problem. 9. ENVIRONMENTAL There are conditions in the environment necessitating initiation of a contingency response. Generally these will be weather-related phenomena. 10. SECURITY There is a security incident interrupting this operation. 11. TRAFFIC The density or type of air traffic near the vehicle necessitated a contingency response. 12. LOST_USS The operation has lost at least some portion of expected USS services. 13. OTHER Some cause not captured in any other category.		
contingencyResponse_nonDim	INTEGER	Specify an integer value for either contingency response (only one state valid at any given time): 0. NO_CONTINGENCY_RESPONSE 1. LANDING The operation will be landing by targeting the contingency_point. 2. LOITERING The operation will loiter at the contingency_point at the specified altitude with the noted loiter_radius_ft. 3. RETURN_TO_BASE The operation will return to base as specified by the contingency_point. The USS may issue an update to the operation plan to support this maneuver.	TD	CNS.1, CNS.2
plannedContingencyLandingPoint_deg	STRING	Specify list of predetermined contingency landing point(s) in the following format: "[Lat_1,Lon_1],[Lat_2,Lon_2],....[Lat_n,Lon_n]" (include quotation marks). e.g. for 3 different landing points, a valid value of plannedContingencyLandingPoint_deg could be "[37.4119851,-122.0623431],[37.4119853,-122.0623429],[37.4119857,-122.0623423]" Report at least seven decimal degrees. (deg)	TI	CNS.1, CNS.2
plannedContingencyLandingPointAlt_ft	STRING	Specify list of predetermined contingency landing point altitude(s) in the following format: "[LandAlt_1],[LandAlt_2],....[LandAlt_n]" (include quotation marks). e.g. for 3 different landing altitudes a valid value of plannedContingencyLandingPointAlt_ft could be "[300],[250],[350]" Expressed in WGS84 standard (ft)	TI	CNS.1, CNS.2
contingencyLandingPoint_deg	STRING	Specify list of contingency landing point(s) in the following format: "[Lat_1,Lon_1],[Lat_2,Lon_2],....[Lat_n,Lon_n]" (Include quotation marks). e.g. At a given moment, for 3 different landing points, a valid value of contingencyLandingPoint_deg could be "[37.4119851,-122.0623431],[37.4119853,-122.0623429],[37.4119857,-122.0623423]" This is a time dependent variable (UTC time stamped), specify "contingencyLandingPoint_deg" as many times as the contingency landing point settings change during the flight (e.g. for a fixed point, it'll have the same values of [Lat_n, Lon_n] all along the flight).	TD	CNS.1, CNS.2

		Report at least seven decimal degrees. (deg)		
contingencyLandingPointAlt_ft	STRING	Specify list of contingency landing point altitude(s) in the following format: "[LandAlt_1],[LandAlt_2],....[LandAlt_n]" (include quotation marks). e.g. for 3 different landing altitudes a valid value of plannedContingencyLandingPointAlt_ft could be "[300],[250],[350]". (UTC time stamped). Expressed in WGS84 standard (ft)	TD	CNS.1, CNS.2
plannedContingencyLoiterAlt_ft	STRING	Specify list of predetermined contingency loiter altitude(s) in the following format: "[LoiterAlt_1],[LoiterAlt_2],....[LoiterAlt_n]" (include quotation marks). e.g. for 3 different loiter altitudes a valid value of plannedContingencyLoiterAlt_ft could be "[300],[250],[350]" Expressed in WGS84 standard (ft)	TI	CNS.1, CNS.2
plannedContingencyLoiterRadius_ft	STRING	Specify list of contingency loiter radius(es) in the following format: "[LoiterRadius_1],[LoiterRadius_2],....[LoiterRadius_n]" (include quotation marks). e.g. for 3 different loiter radiuses a valid value of plannedContingencyLoiterRadius_ft could be "[100],[30],[55]"	TI	CNS1, CNS.2
contingencyLoiterType_nonDim	INTEGER	Specify an integer value for either loiter type (UTC time stamped): 0=No contingency 1=Hover at location 2=Loiter around the point in a circular flight pattern 3=Any other type (must include description of such in "CNS1-Loss Of C2 Contingency Steps" section of PDF file)	TD	CNS.1, CNS.2
contingencyLoiterAlt_ft	STRING	Specify list of contingency loiter altitude(s) in the following format: "[LoiterAlt_1],[LoiterAlt_2],....[LoiterAlt_n]" (include quotation marks). e.g. At a given moment, for 3 different loiter altitudes a valid value of contingencyLoiterAlt_ft could be "[300],[250],[350]" This is a time dependent variable (UTC time stamped), specify "contingencyLoiterAlt_ft" as many times as the loiter altitude settings change during the flight (e.g. for a fixed loiter altitude it'll have the same value of [LoiterAlt_n] all along the flight) Expressed in WGS84 standard (ft)	TD	CNS.1, CNS.2
contingencyLoiterRadius_ft	STRING	Specify list of contingency loiter radius(es) in the following format: "[LoiterRadius_1],[LoiterRadius_2],....[LoiterRadius_n]" (include quotation marks). e.g. At a given moment, for 3 different loiter radiuses a valid value of contingencyLoiterRadius_ft could be "[100],[30],[55]" This is a time dependent variable (UTC time stamped), specify "contingencyLoiterRadius_ft" as many times as the contingency loiter radius settings change during the flight (e.g. for a fixed loiter radius it'll have the same value of [LoiterRadius_n] all along the flight)	TD	CNS.1, CNS.2

maneuverCommand	STRING	Description of maneuver command sent to the vehicle for later verification of its execution. Report every time a maneuver command is submitted (UTC time stamped). 280 characters max, between quote marks " ", all characters in between are valid except for quote marks as they signal the beginning and end of the string. For cross-checking, must include this in "CNS1-Maneuver Command Execution Verification Steps" section of PDF file.	TD	CNS.1
Maneuver Command Execution Verification Steps This is a section of a single CNS PDF file	PDF	Section name: CNS.1-Maneuver Command Execution Verification Steps Description of steps taken to verify execution of maneuver command. Flowchart, sequence diagram, or other visualization methods can be used to describe this process.	TI	CNS.1
estimatedTimeToVerifyManeuver_sec	FLOAT	Estimated time in seconds to go through steps described in "CNS1-Maneuver Command Execution Verification Steps" section of PDF file (UTC time stamped). Include 3 decimal places of precision (sec)	TD	CNS.1
cns1TestType_nonDim	INTEGER	Specify an integer value for either CNS1 test type (UTC time stamped): 0 = No maneuver Command sent 1= maneuver command sent with primary link 2= maneuver command sent with redundant link	TD	CNS.1
timeManeuverCommandSent	STRING	UTC time that a maneuver command is sent to vehicle. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	TD	CNS.1
primaryLinkDescription	STRING	Description of the primary link that maneuver command is sent with. Report every time the maneuver command utilizes this link (UTC time stamped). 280 characters max, between quote marks " ", all characters in between are valid except for quote marks as they signal the beginning and end of the string. For cross-checking, must include this in "CNS1-Communication Systems Description" section of PDF file	TD	CNS.1
timeManeuverVerification	STRING	UTC time that execution of the sent maneuver command is verified. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	TD	CNS.1
timePrimaryLinkDisconnect	STRING	UTC time that the primary link is disconnected (only for the test with secondary link). Note: this must be earlier than "timeManeuverVerification".Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	TD	CNS.1
redundantLinkDescription	STRING	Description of the redundant link that maneuver command is sent with (only for the test with secondary link). Report every time the maneuver command utilizes this link (UTC time stamped). 280 characters max, between quote marks " ", all characters in between are valid except for quote marks as they signal the beginning and end of the string.	TD	CNS.1

		For cross-checking, must include this in "CNS1-Communication Systems Description" section of PDF file.		
timeRedundantLinkSwitch	STRING	UTC time that C2 link is switched to the redundant link, which is then used to send maneuver command (only for the test with secondary link). Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	TD	CNS.1

CNS.2-Impact of GNSS Navigation System Error on UA's Ability to Stay within Flight Geography & CNS.3 Characterize RF environment in which UA operate

Variable Name (columns)	Type	Description	Time Dependent (TD) / Independent (TI)	Required by
Vehicle Navigation Systems Description This is a section of a single CNS PDF file	PDF	Section name: CNS.2-Vehicle Navigation Systems Description Description of vehicle's navigation system. For this test, GPS/GNSS must be used as a primary means of navigation. Must include the following information. GNSS and type of service used: (e.g., GPS L1 C/A only, GPS L1, L2 C/A and carrier phase, GPS L1 C/A and GLONASS L1OF, etc.) Augmentation service used: (e.g., GPS WAAS, Carrier-phase Differential GPS error correction via UFH link, etc.) RAIM capability Inertial device that is used for integration (e.g. Kalman filtering)	TI	CNS.2
Method To Detect Loss Of Vehicle Navigation This is a section of a single CNS PDF file	PDF	Section name: CNS.2-Method To Detect Loss Of Vehicle Navigation Description of loss of Vehicle Navigation detection method. Flowchart, sequence diagram, or other visualization methods can be used in this description.	TI	CNS.2
Loss Of Vehicle Navigation Contingency Steps This is a section of a single CNS PDF file	PDF	Section name: CNS.2-Loss Of Vehicle Navigation Contingency Steps DMP: Description of ALL contingency steps when vehicle navigation is lost. When more than one navigation systems are on-board the vehicle, must include contingency steps to be taken when ALL navigation capabilities are lost. Must include description of contingency plan implemented during TCL3 testing. Flowchart, sequence diagram, or other visualization methods can be used to describe this process.	TI	CNS.2

Ground Truth System Description This is a section of a single CNS PDF file	PDF	Section name: CNS.2-Ground Truth System Description Description of ground truth system. When this system is on-board the vehicle, it can not use GPS/GNSS for navigation source. Must include the followings. Truth system accuracy (percentile, feet) Truth system position integrity Description and specification of truth system Location of the truth system, if not on-board UA (ECEF, feet)	TI	CNS.2
GPS LOS Block Multipath Arrangement Description This is a section of a single CNS PDF file	PDF	Section name: CNS.2-GPS LOS Block Multipath Arrangement Description Description of man-made structures or terrain feature that blocks line-of-sight from Unmanned Aircraft (UA) to some or all RF communication targets during flight Description of man-made structures that will affect UA with GPS/GNSS signal multipath effect during flight Location of man-made structures and their dimensions Picture of man-made structures with scale LOS: Line Of Sight	TI	CNS.2
Flight Test Card This is a section of a single CNS PDF file	PDF	Section name: CNS.2-Flight Test Card Flight test card must includes known areas of blocked line-of-sight to GPS/GNSS satellites and areas that can generate multipath effect, accompanied with a layout of flight plan and man-made structures (e.g., in KML) and assessment of blocked line-of-sight and multipath impact (e.g., LOS to PRN12, PRN13 from UA expected to be blocked at waypoint X, multipath from PRN14 expected at waypoint Y). If a RF inhibiting device on aircraft (e.g., aluminum foil covering parts of GPS antenna, activated by servo motor) is used to obstruct LOS to GPS satellites or cause multipath effect, reasonably accurate description of the environment that this device is emulating must be included (e.g., when fully deployed it blocks LOS to GPS satellite as if a large metal-skinned aircraft hangar is within 100ft of the vehicle in span-wise direction with vehicle flying at 50ft from the ground).	TI	CNS.2
uasTruthEcefXCoordinate_ft	FLOAT	X-Coordinate truth position of UA (ECEF: Earth Center Earth Fixed, inch-level resolution); as reported by the Ground Truth System (Truth Reference System, e.g. optical, radar, LiDAR, nav. beacon, etc). Can be reported by the UAS but has to be GNSS independent (UTC time stamped). Report at least least 3 decimal places of precision (ft)	TD	CNS.2
uasTruthEcefYCoordinate_ft	FLOAT	Y-Coordinate truth position of UA (ECEF: Earth Center Earth Fixed, inch-level resolution); as reported by the Ground Truth System (Truth Reference System, e.g. optical, radar, LiDAR, nav. beacon, etc). Can be reported by the UAS but has to be GNSS independent (UTC time stamped). Report at least least 3 decimal places of precision (ft)	TD	CNS.2
uasTruthEcefZCoordinate_ft	FLOAT	Z-Coordinate truth position of UA (ECEF: Earth Center Earth Fixed, inch-level resolution); as reported by the Ground Truth System (Truth Reference System, e.g. optical, radar, LiDAR, nav. beacon, etc). Can be reported by the UAS but has to be GNSS independent (UTC time stamped). Report at least least 3 decimal places of precision (ft)	TD	CNS.2
estimatedTruthPositionError95Prct_in	FLOAT	Estimated truth system position error at time of measurement (95percentile, inches). UTC time stamped (in)	TD	CNS.2
prnGpsSat_nonDim	STRING	List of PRNs that the GPS receiver is tracking. PRN Number refers to the satellite's unique pseudorandom noise code, used to identify ranging codes a satellite uses along with ID of the actual satellite (UTC time stamped).	TD	CNS.2, CNS.3

		Specify PRN number of satellites that the GPS receiver is tracking in the following format: ”[1],[2],....[32]" (include quotation marks). This is a time dependent variable (UTC time stamped), specify “prnGpsSat_nonDim” as many times as the number of GPS satellites being tracked changes during the flight. e.g. At a given moment, if the receiver is tracking GPS satellites with PRN 3, 12 and 23, then prnGpsSat_nonDim would be "[3],[12],[23]"; if the satellites tracked are the same during the full duration of the UAS flight, then the reported value [n] of prnGpsSat_nonDim will fixed.		
uere_in	FLOAT	User Equivalent Range Error (UERE) for tracked GPS satellites. Time dependent (per satellite). This error is captured in +/- values (UTC time stamped), with unit in inches (in)	TD	CNS.2

CNS.3 Characterize RF environment in which UA operate

Variable Name (columns)	Type	Description	Time Dependent (TD) / Independent (TI)	Required by
RFData File name format: UTM-{yourOrganizationName}-{dateOfFlight}-{takeoffTime}-rfData.bin (or other binary file type) e.g. UTM-UASORG-20180231-1459-rfData.bin	Binary	Separate binary file (e.g. *.bin, *.dat, *txt file): sample received signal at rate greater than or equal to the Nyquist Rate of the measurement band. Each data point must be UTC time stamped. Specify sampling rate/timestamp of initial datapoint in the "CNS.3-RF Payload Description" pdf file. UTC Time stamp of each datapoint must follow ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must be expressed in the resolution necessary to accurately reflect the sampling frequency (add positions as needed after decimal point). The ‘Z’ implies UTC time and is the only timezone accepted.	TD	CNS.3
RF Payload Description This is a section of a single CNS PDF file	PDF	Section name: CNS.3-RF Payload Description Description of RF channel sensing payload. Must include how NASA provided requirements and specifications are met. It must include the follwing information regarding the submitted RF Data binary file: (1) Sampling Rate (Hz) (2) UTC Time stamp of initial datapoint. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must be expressed in the resolution necessary to accurately reflect the sampling frequency (add positions as needed after decimal point). The ‘Z’ implies UTC time and is the only timezone accepted.	TI	CNS.3

2-SAA (): Sense and Avoid

	Variable Name (columns	Type	Description	Time Dependent (TD) / Independent (TI)	Required by
SAA.1: Description of Conflict Scenario	timeAtEncounterInit	STRING	Time at Encounter Initiation: Time at which a conflict is defined, used to determine conflict duration. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	TI	SAA.1
	timeAtConflictAlert	STRING	Time at Conflict Alert: Time at which a conflict alert is issued to a UAS Operator/UAS. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	TI	SAA.1

	timeAtConflictResManeuverInit	STRING	Time at Conflict Resolution Maneuver Initiation: Time at which the aircraft begins to maneuver to resolve a conflict. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The 'Z' implies UTC time and is the only timezone accepted.	TI	SAA.1
	timeAtConflictResManeuverComplt	STRING	Time at Conflict Resolution Maneuver Completion: Time at which the aircraft completes maneuver to resolve a conflict. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The 'Z' implies UTC time and is the only timezone accepted.	TI	SAA.1
	timeAtClearOfConflict	STRING	Time at Clear of Conflict: Time at which the aircraft/UAS Operator declares the aircraft is clear of the conflict. Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The 'Z' implies UTC time and is the only timezone accepted.	TI	SAA.1
SAA.2: Description of Mission	See DMP Section 6.4 (AuxiliaryUASOperation), Section 6.1 (FlightPlan)				SAA.2
SAA.3: Description of Aircraft Performance and State Data	Same as SAA.1, See DMP Section 6.3 (UASState)				SAA.3
SAA.4: Expected and Measured Sensor Performance	intruderPositionLat_deg	FLOAT	Horizontal Range at first detection: Latitude position of intruder vehicle as detected by a sensor in the north east down reference frame of the ownship aircraft. Report at least seven decimal degrees (UTC time stamped) (deg)	TD	SAA.4
	intruderPositionLon_deg	FLOAT	Horizontal Range at first detection: Longitude position of intruder vehicle as detected by a sensor in the north east down reference frame of the ownship aircraft. Report at least seven decimal degrees (UTC time stamped) (deg)	TD	SAA.4
	intruderPositionAlt_ft	FLOAT	Vertical Range at first detection: Altitude position of intruder vehicle as detected by a sensor in the north east down reference frame of the ownship aircraft (UTC time stamped) (ft)	TD	SAA.4
	intruderGroundSpeed_ftPerSec	FLOAT	Relative closure rate at first detection between two aircraft in conflict: Intruder aircraft ground speed in the north east down reference frame of the intruder aircraft (UTC time stamped) (ft/s)	TD	SAA.4

	intruderVelNorth_ftPerSec	FLOAT	Relative closure rate at first detection between two aircraft in conflict: Intruder aircraft North-velocity in the north east down reference frame of the intruder aircraft (UTC time stamped) (ft/s)	TD	SAA.4
	intruderVelEast_ftPerSec	FLOAT	Relative closure rate at first detection between two aircraft in conflict: Intruder aircraft East-velocity in the north east down reference frame of the intruder aircraft (UTC time stamped) (ft/s)	TD	SAA.4
	intruderVelDown_ftPerSec	FLOAT	Relative closure rate at first detection between two aircraft in conflict: Intruder aircraft Down-velocity in the north east down reference frame of the intruder aircraft (UTC time stamped) (ft/s)	TD	SAA.4
	intruderGroundCourse_deg	FLOAT	Relative closure rate at first detection between two aircraft in conflict: Intruder aircraft heading in the true North reference frame (UTC time stamped) (deg)	TD	SAA.4
	relativeHeadingAtFirstDetection_deg	FLOAT	Relative heading or course at first detection: relative angle between the divergent trajectories of the two aircraft in conflict (refer to diagram) (deg)	TI	SAA.4
	azimuthSensorMin_deg	FLOAT	Field of Regard - Minimum Azimuth coverage of the sensor (deg)	TI	SAA.4
	azimuthSensorMax_deg	FLOAT	Field of Regard - Maximum Azimuth coverage of the sensor (deg)	TI	SAA.4
	elevationSensorMin_deg	FLOAT	Field of Regard - Minimum Elevation coverage of the sensor (deg)	TI	SAA.4
	elevationSensorMax_deg	FLOAT	Field of Regard - Maximum Elevation coverage of the sensor (deg)	TI	SAA.4
	typeOfSaaSensor	STRING	Type of SAA sensor: e.g. LiDAR, Radar, etc	TI	SAA.4
	saaSensorMinSlantRange_ft	FLOAT	Minimum slant detection Range of SAA sensor (per manufacturer specification) (ft)	TI	SAA.4
	saaSensorMaxSlantRange_ft	FLOAT	Maximum slant detection Range of SAA sensor (per manufacturer specification) (ft)	TI	SAA.4
	minRcsOfSensor_ft2	FLOAT	Minimum detectable Radar Cross Section (RCS) of SAA sensor per manufacturer specification (ft^2)	TI	SAA.4
	maxRcsOfSensor_ft2	FLOAT	Maximum detectable Radar Cross Section (RCS) of SAA sensor per manufacturer specification (ft^2)	TI	SAA.4
	updateRateSensor_hz	FLOAT	Configured Update Rate / Refresh Rate of SAA sensor (Hz)	TI	SAA.4
	saaSensorAzimuthAccuracy_deg	FLOAT	Azimuth Accuracy of SAA sensor: uncertainty of the azimuth measurement for the sensor. Accuracy=how close a measured value is to the actual (true) value (e.g. for accuracy +/- 5, write "5") (deg)	TI	SAA.4
	saaSensorAltitudeAccuracy_ft	FLOAT	Elevation / Altitude Accuracy of SAA sensor: uncertainty of the elevation / altitude measurement for the sensor. Accuracy=how close a measured value is to the actual (true) value (e.g. for accuracy +/- 5, write "5") (ft)	TI	SAA.4
	horRangeAccuracy_ft	FLOAT	Horizontal Range Accuracy of SAA sensor. This is the accuracy or uncertainy of the horizontal range	TI	SAA.4

			measurement for the sensor. Accuracy=how close a measured value is to the actual (true) value (e.g. for accuracy +/- 5, write "5") (ft)		
	verRangeAccuracy_ft	FLOAT	Vertical Range Accuracy of SAA sensor: uncertainty of the vertical range measurement for the sensor. Accuracy=how close a measured value is to the actual (true) value (e.g. for accuracy +/- 5, write "5") (ft)	TI	SAA.4
	slantRangeAccuracy_ft	FLOAT	Slant Range Accuracy of SAA sensor: uncertainty of the slant range measurement for the sensor. Accuracy=how close a measured value is to the actual (true) value (e.g. for accuracy +/- 5, write "5") (ft)	TI	SAA.4
	timeToTrack_sec	FLOAT	Time to Track of SAA sensor: time required to establish a track for the sensor since first detection. Include 3 decimal places of precision (sec)	TI	SAA.4
	probabilityFalseAlarmPrct_nonDim	FLOAT	Probability of False Alarm: the likelihood of an alert being issued that would result in no loss of separation (if action was not taken). Express in percentage, between 0 and 100.	TI	SAA.4
	probabilityIntruderDetectionPrct_nonDim	FLOAT	Probability of Intruder Detection: the likelihood of detection of a intruder aircraft within the surveillance coverage of the sensor. Express in percentage, between 0 and 100.	TI	SAA.4
	targetTrackCapacity_nonDim	INTEGER	Target Track Capacity: number of targets that can be tracked simultaneously	TI	SAA.4
	dataPacketRatio_nonDim	FLOAT	Packet Delivery/Reception Ratio: ratio of data-packets-sent to data-packets-received between UA and UA (V2V)	TI	SAA.4
	transmissionDelay_sec	FLOAT	Transmission time delay associated with transmitting data packet information from a source to a destination (V2V). Include 3 decimal places of precision (sec)	TI	SAA.4
	numberOfLostTracks_nonDim	INTEGER	Number of Lost Tracks: tracks that are dropped per flight	TI	SAA.4
	intruderRadarCrossSection_ft2	FLOAT	The estimate of the detectablility of an aircraft by a radar (ft^2)	TI	SAA.4
	txRadioFrequencyPower_w	FLOAT	Transmit Power Output: amount of power of radio frequency that a transmitter/surveillance sensor produces as its output (Watts)	TI	SAA.4
SAA.5: Expected Conflict Resolution Performance	lookAheadTime_sec	FLOAT	Temporal parameter used to predict the anticipated actions of aircraft in the near future. Include 3 decimal places of precision (sec)	TI	SAA.5

	Separation Criteria This is a section of a single SAA PDF file	PDF	Section name: Separation Criteria The logic used to establish a loss of separation between two aircraft (flowchart). PDF file, format to be provided in DMP Rev.F.	TI	SAA.5
	Alerting Criteria This is a section of a single SAA PDF file	PDF	Section name: Alerting Criteria The logic used to establish that action is needed to avoid a potential collision (flowchart). PDF file, format to be provided in DMP Rev.F.	TI	SAA.5
	typeOfConflictResolution_nonDim	INTEGER	Type of resolution: The level of control a UAS Operator has in resolving a given conflict. Specify either digit: 0: Pilot IN the Loop, 1: Pilot ON the Loop, 2: Manage by exception, 3: Automated resolution	TI	SAA.5
	Clear of Conflict Criteria	PDF	Section name: Clear of Conflict Criteria The logic used to establish that an aircraft no longer poses a threat (flowchart). PDF file, format to be provided in DMP Rev.F.	TI	SAA.5
	expectedOperatorResponseTime_sec	FLOAT	Expected UAS Operator response time: temporal parameter used in the conflict resolution algorithm to estimate the UAS Operators time needed to initiate a resolution maneuver. Include 3 decimal places of precision (sec)	TI	SAA.5
	expectedUASResponseTime_sec	FLOAT	Expected Time for aircraft maneuver: temporal parameter used in the conflict resolution algorithm to predict the time needed for the aircraft to perform a resolution maneuver. Include 3 decimal places of precision (sec)	TI	SAA.5
	expectedCommLatency_sec	FLOAT	Expected Transmission Latency: total communication latency expected in the conflict resolution (e.g. round-trip time). Include 3 decimal places of precision (sec)	TI	SAA.5
	expectedClimbRateOwnship_ftPerSec	FLOAT	Expected Vehicle Climb Rates of the ownship used in the conflict resolution algorithm (ft/s)	TI	SAA.5
	expectedDescendRateOwnship_ftPerSec	FLOAT	Expected Vehicle Descend Rate of the ownship used in the conflict resolution algorithm (ft/s)	TI	SAA.5
	expectedTurnRateOwnship_degPerSec	FLOAT	Expected Vehicle Turn Rate of the ownship used in the conflict resolution algorithm (deg/s)	TI	SAA.5
SAA.6: Measured Conflict Avoidance Performance	numberOfLossesOfSeparation_nonDim	INTEGER	Number of Losses of Separation: Number of times aircraft violated a separation criteria as defined by SAA.5.2 ("Separation Criteria pdf") per flight	TI	SAA.6

	numberOfNmac_nonDim	INTEGER	Number of Near Mid-air Collisions (NMAC) Violations: Number of times aircraft came within 500 ft horizontal AND 100 ft vertically per flight	TI	SAA.6
	numberOfPrimaryConflicts_nonDim	INTEGER	Number of primary conflicts in a given scenario per flight. Primary Conflicts: those that have been prioritized to be resolved first (as opposed to a secondary conflict which are lower priority with respect to resolutions)	TI	SAA.6
	numberOfInducedConflicts_nonDim	INTEGER	Number of induced conflicts in a given scenario per flight. Induced Conflicts: those caused by SAA that did not exist nominally per flight (e.g. secondary conflict: a conflict which is generated by the avoidance maneuver for the first/primary conflict)	TI	SAA.6
	numberOfResolvedConflicts_nonDim	INTEGER	Conflict resolved by a sense and avoid system (SAA) per flight	TI	SAA.6
	numberOfUnresolvedConflicts_nonDim	INTEGER	SAA attempts to resolve but unsuccessful, per flight	TI	SAA.6
	slantRangeAtPtOfApproach_ft	FLOAT	Weighted Slant Range at Closest Point of Approach: sqrt[(dx^2+ dy^2) / 25+ dz^2] (ft)	TI	SAA.6
	horMissDistAtClosestPtApproach_ft	FLOAT	Horizontal Miss Distance between aircraft at the closest point of approach (closest point along the flown path) (ft)	TI	SAA.6
	verMissDistAtClosestPtApproach_ft	FLOAT	Vertical Miss Distance between aircraft at Closest Point of Approach (closest point along the flown path) (ft)	TI	SAA.6
	numberOfAlertsPerPrimaryConflict_nonDim	INTEGER	Number of alerts issued for a Primary Conflict	TI	SAA.6
	numberOfAlertsPerInducedConflict_nonDim	INTEGER	Number of alerts issued for an Induced Conflict	TI	SAA.6
	numberOfStrengtheningAlertsPerConflict_nonDim	INTEGER	Number of Strengthening Alerts (per conflict): Alert commanding increased maneuver magnitude-per conflict	TI	SAA.6
	numberOfStrengtheningAlertsTotal_nonDim	INTEGER	Number of Strengthening Alerts (Aggregate): Alert commanding increased maneuver magnitude-Aggregate	TI	SAA.6
	numberOfWeakeningAlertsPerConflict_nonDim	INTEGER	Number of Weakening Alerts (per conflict): Alert commanding decreased maneuver magnitude-per conflict	TI	SAA.6
	numberOfWeakeningAlertsTotal_nonDim	INTEGER	Number of Weakening Alerts (Aggregate): Alert commanding decreased maneuver magnitude-Aggregate	TI	SAA.6
	numberOfReversalAlertsPerConflict_nonDim	INTEGER	Number of Reversal Alerts (per conflict): Alert commanding reversal of maneuver direction-per conflict	TI	SAA.6
	numberOfReversalAlertsTotal_nonDim	INTEGER	Number of Reversal Alerts (Aggregate): Alert commanding reversal of maneuver direction-Aggregate	TI	SAA.6
	numberOfYoYoAlertsPerConflict_nonDim	INTEGER	Number of Yo-Yo Alerts (per conflict): Multiple subsequent reversal alerts for a given conflict-per conflict	TI	SAA.6
	numberOfYoYoAlertsTotal_nonDim	INTEGER	Number of Yo-Yo Alerts (Aggregate): Multiple subsequent reversal alerts for a given conflict-Aggregate	TI	SAA.6
	horFlightPathDeviation_ft	FLOAT	Horizontal Flight Path Deviation: Horizontal distance from nominal trajectory when following commanded maneuver. (ft) Nominal flight path is the flight path as defined by the flight	TI	SAA.6

			plan waypoints (what they would have been flying had they not conducted a conflict resolution maneuver). UTC time stamped.		
	verFlightPathDeviation_ft	FLOAT	Vertical Flight Path Deviation: Vertical distance from nominal trajectory when following commanded maneuver. (ft) Nominal flight path is the flight path as defined by the flight plan waypoints (what they would have been flying had they not conducted a conflict resolution maneuver). UTC time stamped.	TI	SAA.6
	maxAbsolutePathDeviation_ft	FLOAT	Maximum absolute deviation from nominal flight path (distance), at a given instant in time. Defined as: max_sqrt [(horFlightPathDeviation_ft)^2 + (verFlightPathDeviation_ft)^2] (ft)	TI	SAA.6
	maxHorPathDeviation_ft	FLOAT	Maximum Horizontal Path Deviation: Furthest horizontal distance from nominal trajectory when following commanded maneuver (ft). Nominal flight path is the flight path as defined by the flight plan waypoints (what they would have been flying had they not conducted a conflict resolution maneuver) NOTE: query of horFlightPathDeviation_ft	TI	SAA.6
	maxVerPathDeviation_ft	FLOAT	Maximum Vertical Path Deviation: Furthest vertical distance from nominal trajectory when following commanded maneuver (ft). Nominal flight path is the flight path as defined by the flight plan waypoints (what they would have been flying had they not conducted a conflict resolution maneuver) NOTE: query of verFlightPathDeviation_ft	TI	SAA.6
	totalHorPathDeviation_ft2	FLOAT	Total Horizontal Path Deviation: Horizontal difference between nominal and commanded trajectory integrated over time (area) from the initial alert to clear of conflict. (ft^2) Nominal flight path is the flight path as defined by the flight plan waypoints (what they would have been flying had they not conducted a conflict resolution maneuver)	TI	SAA.6
	totalVerPathDeviation_ft2	FLOAT	Total Vertical Path Deviation: Vertical altitude difference between nominal and commanded trajectory integrated over time (area) from the initial alert to clear of conflict (ft^2). Nominal flight path is the flight path as defined by the flight plan waypoints (what they would have been flying had they not conducted a conflict resolution maneuver)	TI	SAA.6
SAA.7: Human Factors in Conflict Resolution – Dependent Measures (End-User Interface	This information will be captured through Human Factors Surveys, to be provided by NASA before the flight tests take place (completing those surveys is mandatory)				

and Procedures MOPS)					
	Situation Awareness		DMP Table 9 Measure to address the overall situation awareness of the UAS Operator prior to, during, and after a conflict event. Situation awareness: perception of the elements in the environment within a volume of time & space, the comprehension of their meaning & the projection of their status in the near future (Endsley).		
	Time-to-Detect		DMP Table 9 Length of time between receiving a specified notification and an appropriate operator perceives that the item has been received		
	Time-to-Resolve		DMP Table 9 Length of time between receiving a specified notification and an action that provides a solution is executed to address it.		
	Saliency of information		DMP Table 9 The degree to which the information is relevant at the point in time in which it is accessed		
	Usability of information		DMP Table 9 The degree to which the information was interpretable and understandable and met the purpose for which it was required		
	Usefulness of information		DMP Table 9 The degree to which the information served the purpose that it was desired to fulfill		
	Reliability/Accuracy of information		DMP Table 9 The degree to which information is available when required and is correct at the point in time at which it was reported and is error free		
	Appropriateness/Safety of maneuver		DMP Table 9 Degree to which a maneuver is suitable & fitting to the problem/ situation and has a desired level of safety.		
	Appropriateness/Safety of maneuver Appropriateness/Safety of decision?		DMP Table 9 Degree to which a decision is suitable & fitting to the problem/ situation and has a desired level of safety.		
	Confidence in resolution maneuver		DMP Table 9 Degree to which operator believes that a maneuver will be successful		
SAA.7: Human Factors in Conflict Resolution – Independent Measures (Contextual Descriptors of End-User	This information will be captured through Human Factors Surveys, to be provided by NASA before the flight tests take place (completing those surveys is mandatory)				

Interface and Procedures Data)					
	Operator		DMP Table 10 (pilot-in-control, ground-control-station-operator, USS operator, other)		
	Information access point		DMP Table 10 (co-located with flight-crew, remote location, other)		
	conflict type		DMP Table 10 (UAS-UAS, UAS-manned, UAS-USS, USS-USS, TCL2uas-TCL3uas, loss of C2 for one UAS, loss of nav for one UAS, vehicle failure for one UAS, loss of cooperative comm for one UAS, loss/degraded UAS-USS comm, loss of USS-USS comm, other)		
	resolution type		DMP Table 10 (hover, loiter, RTL, RTB, land-now, pre-planned contingency, other)		
	conformance state throughout maneuver		DMP Table 10 (in conformance, non-conforming, rogue, other)		
	surveillance source		DMP Table 10 (DSRC, ADS-B, airborne radar, ground-based radar, other)		
Geofence parameters	geoFenceAvailable_nonDim	INTEGER	Specify either digit: 0: Non-Available, 1: Available	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5, SAA.6
	geoFenceEnable_nonDim	INTEGER	Specify either digit: 0: Disable, 1: Enable	TD	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5, SAA.6
	geoFenceStartTime	INTEGER	Time at which geofence is enabled in Coordinated Universal Time (UTC). Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5, SAA.6
	geoFenceEndTime	INTEGER	Time at which geofence is disabled in Coordinated Universal Time (UTC). Use ISO 8601 format conforming to pattern: YYYY-MM-DDThh:mm:ss.sssZ. Seconds must have up to millisecond accuracy (three positions after decimal). The ‘Z’ implies UTC time and is the only timezone accepted.	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5, SAA.6

	geoFenceType_nonDim	INTEGER	Specify either digit: 0: Circular-Point and Radius, 1: Polygon	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5
	geoFenceMinAltitude_ft	FLOAT	Minimum defined altitude of geofence (ft)	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5, SAA.6
	geoFenceMaxAltitude_ft	FLOAT	Maximum defined altitude of geofence (ft)	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5
	geoFenceCircularPointLat_deg	FLOAT	Latitude of circular origin point of geofence (deg)	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5, SAA.6
	geoFenceCircularPointLon_deg	FLOAT	Longitude of circular origin point of geofence (deg)	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5
	geoFenceCircularRadius_ft	FLOAT	Radius of circular geofence (ft)	TI	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5, SAA.6
	geoFenceDynamicPolygonPoint_deg	STRING	Specify dynamic location of polygon vertices in the following format: ”[Lat_1,Lon_1],[Lat_2,Lon_2],....[Lat_n,Lon_n]" (include quotation marks). This is a time dependent variable (UTC time stamped), specify “geoFenceDynamicPolygonPoint_deg” as many times as the polygon shape changes during the flight (e.g. for a fixed polygon geofence it’ll have the same values of Lat_n, Lon_n all along the flight). Report at least seven decimal degrees. (deg)	TD	SAA.1, SAA.2, SAA.3, SAA.4, SAA.5, SAA.6

3-DAT (): Data and Information Exchange

REMOTE VEHICLE ID CONCEPT DEMO
UTM TC3
2/23/2018

DAT4.1, DAT4.2, DAT4.3 TESTS

Purpose: The purpose of this section is to describe the Remote Vehicle ID Concept Demo, the associated data elements to record for UTM TCL3, and the mechanism to transmit the data to NASA.

Section 1: Introduction
The primary objective of the Remote Vehicle[1] ID Concept Demo is to test and validate a list of scenarios where identification of a vehicle is required by an authorized entity working near (within visual line of sight) of the operation. An example of this scenario is when a police officer observes a UAS flying overhead and requires

1. identification of the UAS owner and contact
2. vehicle properties including class (fixed-wing, quad, etc.)
3. current flight plan, vehicle speed and heading, and future operations
4. state (if any) of the corresponding flight plan, e.g. ROGUE, NON-CONFORMING, etc.

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[1] UAS, vehicle, and drone are used interchangeably throughout this document.

Given the above information, the officer may choose the appropriate counter-uas measure, if any.

Test-Site Information
Test-sites shall conduct one or more of the test scenarios discussed below. Each test scenario involves (1) a UAS to be remotely identified and zero or more UASs nearby that may also be simultaneously broadcasting drone identification information, (2) a PUB-SAFE USS, (3) a PUB-SAFE *user* who will perform the remote vehicle identification and validate the results of the tests, and (4) a USS that received the original flight plan for the UAS to be identified (note that certain tests which do not include vehicle registration and/or proper flight plan submission to a USS can exclude this component).

A PUB-SAFE user is a person who is registered with a PUB-SAFE USS and has relevant credentials to communicate with the USS using a suitable device (tablet, phone, etc) over the public internet. A PUB-SAFE USS is a USS that has obtained the PUBLIC_SAFETY role. Test-sites shall determine and provide the appropriate hardware and software for both the UAS to be identified and the PUB-SAFE user. The test-site shall supply the PUB-SAFE user with a portable (ideally hand-held), internet connected Vehicle ID Device (VID) that is able to acquire the required information from the UAS to be identified and transmit the information (utilizing the PUB-SAFE user's credentials) to the PUB-SAFE USS.

General Steps
All test scenarios involve the following steps[2] as shown in Figure 1

Step 1: UAS broadcasts UVIN[3]
Step 2: Device acquires broadcasted data and estimates[4] drone location, authenticates with PUB-SAFE USS and sends request (GET).
Step 3: If UVIN has been transmitted, PUB-SAFE USS requests drone information from Vehicle Registration Service.
Step 4: (Skip if no UVIN provided) Response from Vehicle Registration Service is received and data processed
Step 5: Given estimated position information, USS lookup via the discovery service is performed. The owning[5] USS id and other contact information is obtained.
Step 6: PUB-SAFE USS contacts owning USS and requests information.
Step 7: PUB-SAFE USS assembles all relevant pieces of information and performs Drone Observation Resolution (DOR).
Step 8: Results are packaged and transmitted back to VID

Test Scenarios
Test Scenario 1: Valid UVIN; flight plan & observation consistent
UAS provides (transmits) a **valid**[6] UVIN to the VID and its coordinates (WGS-84) are also estimated by the VID. The PUB-SAFE USS receives the UVIN and the vehicle coordinates. Drone Observation Resolution (DOR) determines

- UVIN is valid
- Flight plan submitted is consistent with the observation

Results are packaged and sent back to VID.
Vehicle ID user records results on reporting template.

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[2] Not all steps are applicable, however, depending on the test case.

[3] Some scenarios assume the UVIN is not broadcasted. This could represent a situation where power limitations or malfunction prevent the broadcast.

[4] VID must estimate the drone's position if it is not transmitted. The simplest and least accurate method is to use the GPS location of the VID.

[5] Given position and time, one or more USSs may be retrieve from the discovery service. It is up to PUB-SAFE USS to determine the appropriate USS to contact for drone identification. This USS is said to be the *owning* USS of the drone in question.

[6] A valid drone ID means a v.4 UUID that exists in the registration database .

Test Scenario 2: Valid UVIN; flight plan & observation inconsistent
UAS transmits a **valid** UVIN to the VID and its coordinates (WGS-84) are also estimated by the VID. The PUB-SAFE USS receives the UVIN and vehicle coordinates.
Drone Observation Resolution (DOR) determines

- UVIN is valid
- Flight plan submitted is inconsistent with the observation (for example, a rogue operation).

Results are packaged and sent back to VID.
Vehicle ID user records results on reporting template.

Test Scenario 3: Valid UVIN, No flight plan submitted
UAS transmits valid UUID to the VID and its coordinates (WGS-84) are also estimated by the VID. The PUB-SAFE USS receives the UUID and vehicle coordinates and determines that there is no flight plan submitted by the operator of the vehicle with an operating time range[7] that coincides with the observation time.

Test Scenario 4: Unregistered (or expired) UVIN
UAS transmits a UUID to the VID and its coordinates (WGS-84) are also estimated by the VID. The PUB-SAFE USS receives the UUID and vehicle coordinates and determines that there does not exist an entry in the vehicle registration database.

Test Scenario 5: No transmission, Valid flight plan
UAS **does not** transmits a UUID to the VID, however, its coordinates (WGS-84) are estimated by the VID. The PUB-SAFE USS receives the vehicle coordinates and determines that there exists at least one flight plan that is consistent with the transmitted coordinates. . The DOR reports the UUID of the vehicle(s) whose FP is (are) consistent with the observation and notes lack of transmission.

Test Scenario 6: No transmission, No flight plan
UAS **does not** transmit a UUID to the VID, however, its coordinates (WGS-84) are estimated by the VID. The PUB-SAFE USS receives the vehicle coordinates and determines that there does not exist a flight plan that is consistent with the transmitted coordinates. It reports this as an non-UTM participating vehicle/operation and notes the lack of transmission.

Section 2: NASA Roles and Responsibilities

1. Make available over the internet a PUB-SAFE USS for test-sites performing one or more test scenarios.
2. Build required API's to complete the tests as depicted in the figure below. This includes modifications to the vehicle registration databases and USS discovery services
3. Make available a data collection mechanism for the PUB-SAFE USS to upload test data for post-analysis

Data Collection and Upload
For every flight (gufi) the following must be collected by the client (Vehicle ID Device) – also documented here:
https://app.swaggerhub.com/apis/akishiha/DatAPI/v1#/default/post_uas_id_

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[7] Every flight plan submission has associated with it a start and end time.

```
{
  "org-uuid": "00000000-0000-0000-0000-000000000000",
  "data": [
    {
      "uvin": "00000000-0000-0000-0000-000000000000",
      "gufi": "00000000-0000-0000-0000-000000000000",
      "tech": "string",
      "notes": "string",
      "lookup": [
        {
          "startTimeLookup": "2015-08-20T14:11:56.118Z",
          "endTimeLookup": "2015-08-20T14:11:56.118Z",
          "successfulLookupUasId": true,
          "timeOfDetection": "2015-08-20T14:11:56.118Z",
          "vidPosLat": 0,
          "vidPosLon": 0,
          "vifPosAlt": 0,
          "publicSafetyRequestUrl": "string",
          "publicSafetyResponse": "string"
        }
      ]
    }
  ]
}
```

Definitions:

uvin:

unique vehicle identifier

gufi:

unique flight identifier

tech:

a description of the technology used to detect the remote vehicle

notes:

any notes for this flight

lookup:

an array of data associated with the remote ID test

startTimeLookup:

the time (UTC) when a lookup is initiated (GET request to the PUB-SAFE USS)

endTimeLookup:

the time (UTC) when a lookup is completed (GET request to the PUB-SAFE USS).
There must be an endTimeLookup associated with each startTimeLookup. If nothing is received enter null.

successfullLookup:

enter true if the lookup resulted in the expected result, false o/w

timeOfDetection:

the time (UTC) when the remote vehicle is detected

vidPosLat:

the latitude (WGS-84) of the vehicle id device at time timeOfDetection
vidPosLon:
the longitude (WGS-84) of the vehicle id device at time timeOfDetection
vidPosAlt:
the altitude (WGS-84) of the vehicle id device at time timeOfDetection
publicSafetyRequestUrl:
the complete GET request URL for the lookup including all GET parameters
:
the complete HTTP response from the PUB-SAFE USS

Comments:
It's important to note that there can be many lookups during a flight (gufi) where the position of both the public safety user and remote vehicle may be changing. Each lookup must be associated with one and only one detection time and position. The lookup does not need to occur at the same time of detection, however, must occur between the start and end time of the operation.

Data Upload: Each PUB-SAFE USS is responsible for uploading the test data for all gufi's that performed the remote vehicle ID tests. Therefore, a mechanism for data transfer from the VID performing the test to the corresponding PUB-SAFE USS must be determined. The PUB-SAFE USS will upload the data at utmregistry.arc.nasa.gov.
Steps:

1. Access utmregistry.arc.nasa.gov

2. Click on the link USS

3. Click Orgs

4. Underneath the API Key Section there is a section labeled DMP. Toggle link to view drop down menu

5. Upload each file – one per gufi

Once the file has been uploaded, it will be placed in a queue for data sanitizing, validation, and data-basing. You will receive two emails. The first documents the upload including date and time-stamp of upload. The second is generated after it has been processed which could vary depending on server load. If the file fails to be processed, the errors will be reported and the file will remain in a FAILED state until it is fixed and re-uploaded.

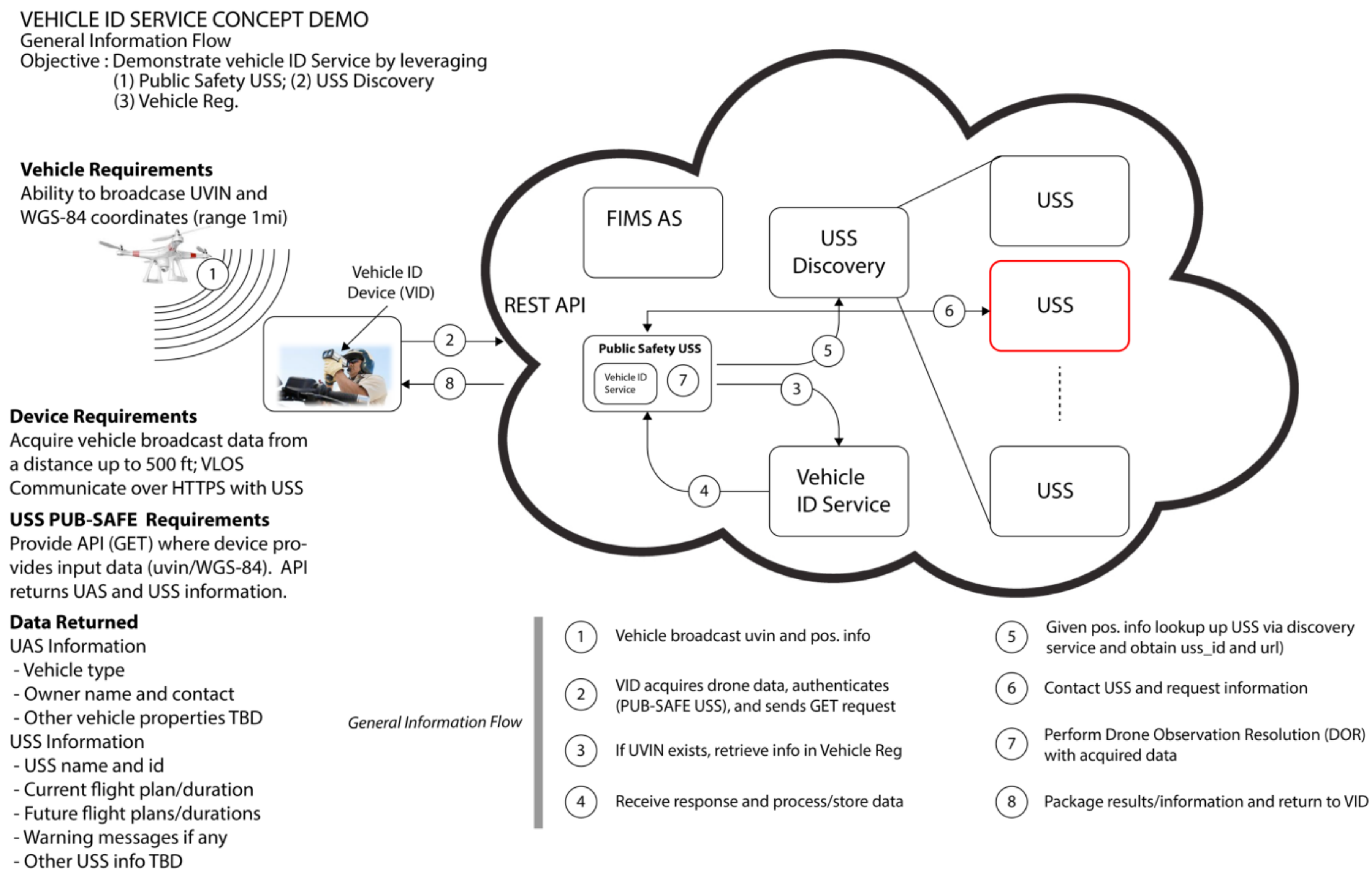

Figure 1: General Steps

DAT99.1 TEST

USS Instance Lookup

The purpose of this test is to analyze the temporal metrics associated with a USS instance registration with the discovery service. For each USS instance under test, the following data must be collected and uploaded (see also: https://app.swaggerhub.com/apis/akishiha/DatAPI/v1#/default/post_instance_lookup_)


```
{
  "org-uuid": "00000000-0000-0000-0000-000000000000",
  "ussInstanceId": "00000000-0000-0000-0000-000000000000",
  "timeInitialSubmission": "2015-08-20T14:11:56.118Z",
  "timeFirstMsgRecieved": 0,
  "timeLastMsgReceived": "2015-08-20T14:11:56.118Z"
}
```


Further details can be found in the USS Spec.
Each USS is responsible for acquiring, formatting, and uploading the data to utmregistry.arc.nasa.gov.