GNSS Degraded and Denied Test Plan

Rev: 1

Date: 06/08/2026

Change Log

Rev	Notes	POC	Date
1	Initial Release	X. Romo	06/08/2026

Background

The IonStrike Unmanned Aerial System is a Group 3 Counter-UAS solution developed in-house by DZYNE. This test campaign is designed to validate IonStrike's Navigation System performance in GPS/GNSS-degraded and denied environments, ensuring the system can maintain a valid navigation solution and complete its mission.

The test campaign will consist of seven to nine flights, each employing a primary navigation system and a developmental ride-along navigation system. The first six flights will be performance flights (no seeker installed) to validate the system changes. Flights seven through nine will be closed loop flights (seeker installed) against a target. Flights eight and nine will include system integration with a radar and fire control system (C2).

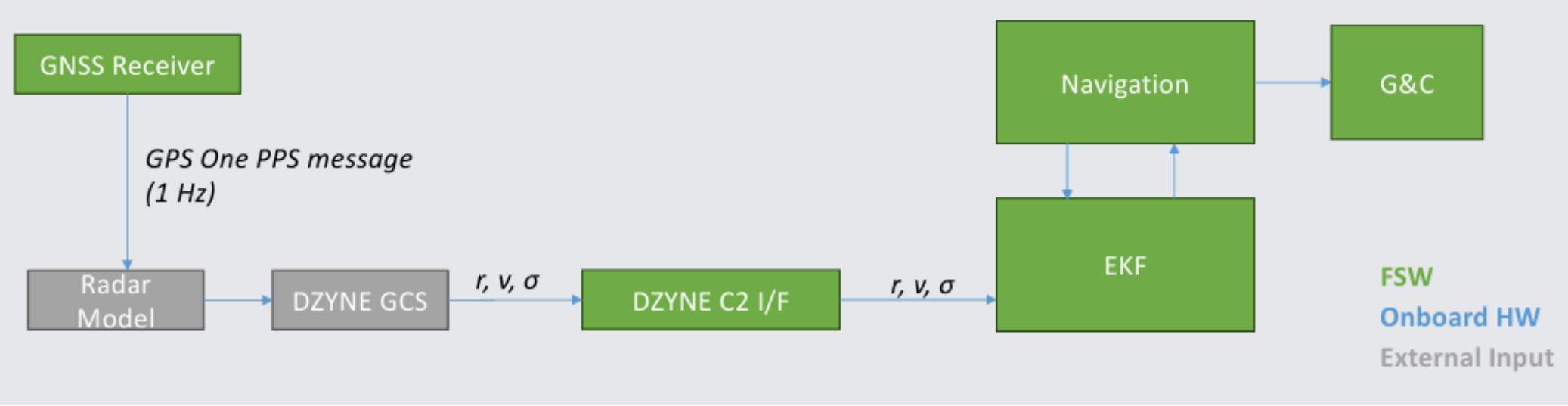
These tests are a critical prerequisite for the upcoming Combat Evaluation, which will take place in contested, GPS-denied environments. The results of this campaign will inform further system development.

Test Item Description

- The item under test is IonStrike Navigation system including sensors and flight software.
  - The intent of the test campaign is not to degrade GPS, but to configure software not to use it.
- Config for flights 1-6
  - No seeker, install mass surrogate
  - No C2, no Radar
- Config for flight 7
  - Seeker installed
  - Mavlink for C2, no radar
- Config for flights 8 and 9
  - Seeker installed
  - C2 and Radar are TBD

Test Item Description

- The GNSS-denied condition will be induced by disabling GPS updates in the navigation filter.
- Flights 1-5, 8: Loosely-coupled GNSS will serve as the Primary Nav Configuration, with Developmental Nav Configurations operating as ride-along software for data collection.
- Flights 6, 7, 9: Ownship position and velocity data provided by the DZYNE GCS will serve as the Primary Nav Configuration.
  - Simulated Ownship: AV data is passed through DZYNE software, which formats it to appear as if it originates from a CUEing system (radar + C2)
  - Radar Ownship: AV data is fed directly to the AV via the CUEing system (radar + C2)



Simulated Ownship Data Flow

Test Item Description: NAV Configurations

- Loosely-coupled GNSS
  - Implements the GNSS-receiver's calculated position, velocity, and time as a measurement to the Extended Kalman Filter (EKF). This is subject to any processing errors that may be present and the filter trusts its reported uncertainty.
- Tightly-coupled GNSS
  - Implements the GPS pseudorange and pseudorange rate as measurements to the EKF. Uncertainties are modeled based on signal strength and industry-accepted error budgets.
- Loosely-coupled GNSS + Airdata
  - Uses GNSS PVT solution
  - Implements pressure sensor measurement of airspeed as an update to the EKF to aid velocity error growth and some attitude observability.
- Airdata – GNSS denied
  - Just pressure sensor measurements as described above. GNSS / GPS updates are disabled.
- Ownship (GNSS denied)
  - Radar (or simulated radar) measurements provide an absolute position and velocity to the EKF as a PVT update. GNSS/GPS are disabled.
- Ownship + Airdata (GNSS denied)
  - Radar + Pressure sensor measurements as described above

Previous Testing

- No previous GNSS-denied flight tests conducted
- Running FSW in simulation in each intended flight configuration by GuideTech GNC engineering.
- FSW regression testing will be conducted for every software release by DZYNE Engineering.
- Relevant successful CUEing system integrations
    - Mavlink
    - TRAX C2
    - FAAD C2
    - RPS-82 + Krechet
    - RPS-82 + Lattice
    - Sawtooth + Defense OS
    - RPS-42 + Krechet

T&E Management

DZYNE-run test with GuideTech providing support. C2 and Radar subcontractor (TBD) will operate their system and provide support for flights 8 and 9.

Schedule & Milestones

Flight Number	Notional Date	Test Platform	Flight Test Method	Ownship Source	Primary Nav Configuration	Developmental Nav Configuration
1	Week of 6/8/26	Config A	Performance Flight	N/A	Loosely-coupled GNSS	Tightly-coupled GPS
2	Week of 6/8/26	Config A	Performance Flight	N/A	Loosely-coupled GNSS	Loosely-coupled GNSS + Airdata
3	Week of 6/8/26	Config A	Performance Flight	N/A	Loosely-coupled GNSS + Airdata	Airdata – GNSS denied
4	Week of 6/15/26	Config A	Performance Flight	DZYNE GCS	Loosely-coupled GNSS + Airdata	Simulated Ownship (GNSS denied)
5	Week of 6/15/26	Config A	Performance Flight	DZYNE GCS	Loosely-coupled GNSS + Airdata	Simulated Ownship + Airdata (GNSS denied)
6	Week of 6/22/26	Config A	Performance Flight	DZYNE GCS	Simulated Ownship + Airdata (GNSS denied)	Loosely-coupled GNSS
7	Week of 6/22/26	Config B	Seeker Closed Loop	DZYNE GCS	Simulated Ownship + Airdata (GNSS denied)	Loosely-coupled GNSS
8	Week of 6/29/26	Config B	Seeker Closed Loop	Radar	Loosely-coupled GNSS	Radar Ownship + Airdata (GNSS denied)
9	Week of 6/29/26	Config B	Seeker Closed Loop	Radar	Radar Ownship + Airdata (GNSS denied)	Loosely-coupled GNSS

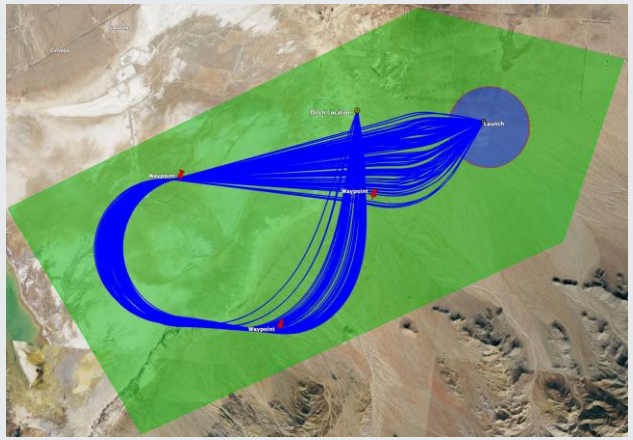
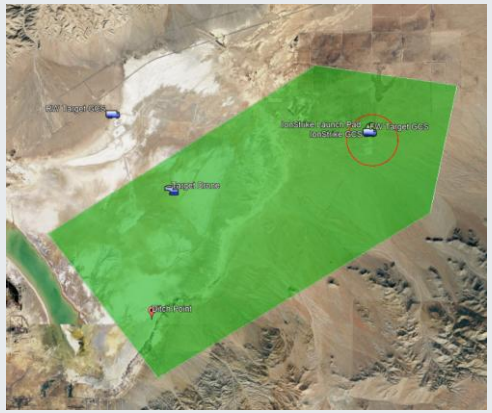
Approvals

- Frequency Authorizations
  - Flights 1-7 will be at RRS or FAR; no Frequency Authorization required
  - Flights 8-9: TBD
- Airworthiness
  - IonStrike Interceptor – N/A (non-recoverable UAS)
  - Flights 7-9: Target UAS – Part 107
- Test Approvals
  - DZYNE Flight Readiness Review (FRR)

Test Objectives

General Test Objective	Specific Test Objective	Measure of Performance
Validate that the IonStrike UAS can provide a valid navigation solution in GPS/GNSS degraded and denied environments	1. Evaluate a valid navigation solution is maintained in a GPS/GNSS degraded environment (AIR-AVCS-35)	1.1 Error between loosely-coupled GNSS solution and actual GPS position
		1.2 Mission completion
		1.3 Flight controller CUEing system induced error correction
	2. Evaluate a valid navigation solution is maintained in a GPS/GNSS denied environment (AIR-AVCS-36)	2.1 Error between Ownship solution and true GPS position
		2.2 Mission completion
		2.3 Flight controller CUEing system induced error correction
	3. Evaluate the GCS's ability to persistently display the Interceptor's position in-flight in GPS/GNSS degraded and denied environments (GND-GCS-34)	3.1 Indicator Position Accuracy
		3.2 Navigation State Indicators

MOP 1.1

Error between loosely-coupled GNSS (+ airdata) navigation solution and the true GPS position data.		
Test Method	Performance Flight Test Interceptor flight without the seeker installed. The AV will use waypoint navigation using Loosely-Coupled GNSS and airdata for the navigation solution. A developmental ride-along software navigation solution will be used for data collection only.  Flights 1-5	Seeker Closed Loop Flight Test This test method is representative of the IonStrike mission in a GNSS denied environment. Full data flow from CUEing system to the interceptor through the Navigation software to the autopilot. Flight profile will be against a target UAS. Image shows profile for flights at RRS/FAR.  Flight 8
Data Required	IonStrike datalogs (GuideTech GCS, DZYNE GCS, C2 datalogs, Radar datalogs), primarily parameters for Interceptor position and velocity	
Additional Data	Weather; Test team notes	
Data Reduction and Analysis	Analysis tools such as MATLAB, Python, or specialized analysis software will be used to process and synchronize raw datalogs from each data source to compare true GPS interceptor data to planned flight path	
Final Data Product	Graphical comparison of each source's interceptor position	
Completion Criteria	Flights 1-5 & 8 are flown until the terminal point of the profile (Ditch Point or intercept)	
Evaluation Criteria	Data collection and navigation solution behavior deemed acceptable per GuideTech GNC engineer	

MOP 1.2

Mission Completion: The health, status, and flight behaviors are expected to be good, and if they are not, this indicates a possible navigation system issue	
Test Method	Same as MOP 1.1
Data Required	IonStrike Datalogs (GuideTech GCS, DZYNE GCS), primarily parameters for system status, aircraft attitude, and control behaviors; Test team notes
Additional Data	Seeker datalogs; Target UAS logs; Radar logs; C2 logs; weather data
Data Reduction and Analysis	Analysis tools such as MATLAB, Python, or specialized analysis software will be used to process raw datalogs from each data source to verify AV completed planned mission with expected system behavior. Notes will be compiled and compared to the datalogs.
Final Data Product	Plot of expected system behavior against system responses; Summary of events
Completion Criteria	Flights 1-5 & 8 are flown until the terminal point of the profile (Ditch Point or intercept)
Evaluation Criteria	Data collection and navigation solution behavior deemed acceptable per GuideTech GNC engineer

MOP 1.3

Flight controller CUEing system induced error correction	
Test Method	Same as MOP 1.1
Data Required	IonStrike datalogs (GuideTech GCS, DZYNE GCS, C2 datalogs, Radar datalogs)
Additional Data	Weather; Test team notes
Data Reduction and Analysis	Analysis tools such as MATLAB, Python, or specialized analysis software will be used to process the error between the Nav solution from the loosely-coupled GNSS (and airdata) and the true GPS position data of the interceptor.
Final Data Product	Graphical comparison of each source's interceptor position
Completion Criteria	Flight 8 is flown until the intercept point is reached by the Interceptor
Evaluation Criteria	Data collection and navigation solution behavior deemed acceptable per GuideTech GNC engineer

MOP 2.1

Error between Ownship (+ airdata) navigation solution and the true GPS position data.	
Test Method	Same as MOP 1.1 but using the simulated and radar Ownship data flow (shown on slide 5) for the simulated GPS denied conditions. Flights 6 (performance) and 7 & 9 (closed loop).
Data Required	IonStrike datalogs (GuideTech GCS, DZYNE GCS, C2 datalogs, Radar datalogs), primarily Interceptor position and velocity parameters
Additional Data	Weather; Test team notes
Data Reduction and Analysis	Analysis tools such as MATLAB, Python, or specialized analysis software will be used to process and synchronize raw datalogs from each data source to compare true GPS interceptor data to planned flight path
Final Data Product	Graphical comparison of each source's interceptor position
Completion Criteria	Flights 6, 7, & 9 are flown until the terminal point of the profile (Ditch Point or intercept)
Evaluation Criteria	Data collection and navigation solution behavior deemed acceptable per GuideTech GNC engineer

MOP 2.2

Mission completion: The health and status and flight behaviors are expected to be good, and if they are not, this indicates a possible navigation system issue	
Test Method	Same as MOP 2.1
Data Required	IonStrike Datalogs (GuideTech GCS, DZYNE GCS), primarily parameters for system status, aircraft attitude, and control behaviors; Test team notes
Additional Data	Seeker datalogs; Target UAS logs; Radar logs; C2 logs; weather
Data Reduction and Analysis	Analysis tools such as MATLAB, Python, or specialized analysis software will be used to process raw datalogs from each data source to verify AV completed planned mission with expected system behavior. Notes will be compiled and compared to the datalogs.
Final Data Product	Plot of expected system behavior against system responses; Summary of events
Completion Criteria	Flights 6, 7, & 9 are flown until the terminal point of the profile (Ditch Point or intercept)
Evaluation Criteria	Data collection and navigation solution behavior deemed acceptable per GuideTech GNC engineer

MOP 2.3

Flight controller CUEing system induced error correction	
Test Method	Same as MOP 2.1
Data Required	IonStrike datalogs (GuideTech GCS, DZYNE GCS, C2 datalogs, Radar datalogs)
Additional Data	Weather; Test team notes
Data Reduction and Analysis	Analysis tools such as MATLAB, Python, or specialized analysis software will be used to process the error between the Nav solution from the Ownshoip (and airdata) and the true GPS position data of the interceptor.
Final Data Product	Graphical comparison of each source's interceptor position
Completion Criteria	Flights 7 & 9 are flown until the intercept point is reached by the Interceptor
Evaluation Criteria	Data collection and navigation solution behavior deemed acceptable per GuideTech GNC engineer

MOP 3.1

GCS GUI Indicator position accuracy	
Test Method	Ground Test Software Regression Testing will be conducted by DZYNE engineering for each FSW release before flight test IAW ION-EATP-001-LRIP SW Regression & Integration Test Procedure Flight Test Same as MOP 1.1
Data Required	IonStrike datalogs (GuideTech GCS, DZYNE GCS, C2 datalogs, Radar datalogs); GCS screen recordings; SITREPS; Test team notes
Additional Data	None
Data Reduction and Analysis	Analysis tools such as MATLAB, Python, or specialized analysis software will be used to process raw datalogs from each data source to verify GCS GUI Indicators display the interceptor's accurate position; Screen recordings will be reviewed and compared to the datalogs
Final Data Product	Graphical comparison of each source's interceptor position
Completion Criteria	Ground testing will be done before each flight. For flight test, data will be collected for the duration of the test campaign
Evaluation Criteria	Data collection and navigation solution behavior deemed acceptable per GuideTech GNC engineer

MOP 3.2

GCS GUI Navigation State Indicators	
Test Method	Same as MOP 3.1
Data Required	IonStrike datalogs (GuideTech GCS, DZYNE GCS, C2 datalogs, Radar datalogs); GCS screen recordings; SITREPS; Test team notes
Additional Data	None
Data Reduction and Analysis	Analysis tools such as MATLAB, Python, or specialized analysis software will be used to process raw datalogs from each data source to verify GCS GUI Indicators display correct Navigation state indicators; Screen recordings will be reviewed and compared to the datalogs
Final Data Product	Graphical comparison of Navigation State indicators from datalogs versus expected system behavior
Completion Criteria	Ground testing will be done before each flight. For flight test, data will be collected for the duration of the test campaign
Evaluation Criteria	Data collection and navigation solution behavior deemed acceptable per GuideTech GNC engineer

Test Range

- The following ranges may be used for IonStrike flights
  - Reaction Research Society (RRS)
  - Friends of Amateur Rocketry (FAR)
  - More ranges TBD

Instrumentation

- IonStrike
  - Developmental Navigation Configuration ride along software
  - TM datalogs
  - Wireshark
  - DoodeLabs python logging script
  - GCS screen recordings
  - Seeker UDP logger (saved on GCS) - Seeker Closed Loop Only
  - Videos of launch (optional)
- Target – Seeker Closed Loop Only
  - Datalogs
  - UAS-mounted camera video (optional)
- C2 - TBD
- Radar - TBD
- Other
  - Weather station

Support Equipment and Aircraft

- Transport vehicles for equipment
- IonStrike Packout kit
- C2 - TBD
- Radar - TBD
- Targets
  - Flight 7: RedShift/BlueShift
  - Flights 8-9: TBD

Test Team and Responsibilities (required)

Role	General Responsibilities
Test Director (TD)	• Responsible for the overall conduct and safety of the test • Ensures test data is collected, stored, processed, and analyzed IAW the DMAP • Responsible for compiling inputs and writing the SITREP • Ensures proper pre-mission coordination has been done with appropriate agencies (range or airfield management, frequency management, ATC, etc) • **Depending on the team's needs for a specific test day, the TD may cover the TC or MC roles**
Interceptor Remote Pilot in Command (RPIC)	• Responsible for, and is the final authority as to the safe operation of the IonStrike Interceptor • Verify test item health before employment • Initialize test item mission routine • Monitor test item health during flight
Interceptor Crew Chief (CC)	• Responsible for the transportation and setup of equipment • Performs AV maintenance and pre-flight checks • Designated rocketry shooter
Target RPIC	• Responsible for, and is the final authority as to the safe operation of the target UAS • Verify test asset health before employment • Initialize test asset mission routine in Mission Planner • Monitor test asset health during flight
Target Safety Pilot (Sticks)	• Pilot in control during Target takeoffs and landings • Will take control of Target while in-flight if safety concerns arise or the UAS fails to perform the desired Mission Planner mission
Target Crew Chief	• Assist with target preflight ops • Hand launch UAS (when applicable) • **May be performed in conjunction with other test team roles such as TD, MC, or Interceptor CC**

Test Team and Responsibilities (optional)

Role	General Responsibilities
Test Conductor (TC)	• **Optional role dependent on the team's needs for a test day; May be combined with TD role** • Paces the crew through the test cards • Makes notes during a flight test relevant to the quality of the data and SUT performance • Leads pre-briefing and debrief
Target Visual Observer	• **Optional role to be used in circumstances when the test setup will not allow the Target RPIC and/or Safety Pilot to maintain visual line of sight (VLOS) with the target as required by FAA Part 107, or during complex missions** • Acts as a second set of eyes for the Target RPIC • Responsible for maintaining VLOS with the Target and scanning the airspace for hazards like other aircraft, people, or obstacles
Target Mission Commander	• **Optional role dependent on the team's needs for a test day; May be combined with TD role** • Communicate with Interceptor GCS • Helps pace the crew through the test cards • Monitor Flight Operations and airspace to help ensure safety of operations

Comms Plan

- The Interceptor team will communicate via Bluetooth Sonetics
- Communication with the Range Representative will follow standard range procedures.
- In addition, engineers from DZYNE and GuideTech will be on call to aid in troubleshooting.

Briefings

- T-1 Briefing
  - Held the day before the test
  - Will cover the test profile, critical points, limitations, team test members' duties, and contingencies and emergency protocols
  - This briefing also provides stakeholders with situational awareness of the mission
- T-0 Briefing
  - Conducted with the test team members on test day
  - Will cover mission details, airspace, weather, approvals, safety plans, and limitations
- Debrief
  - Conducted immediately post-test with the team
    - If crew duty limitations apply, a shortened debrief will focus on critical items, with a full debrief scheduled later
  - Will cover mission results, squawks, watch items (WIT), test effectiveness, and next steps

Test Limits

- No additional system limits
- In cases where there are differing limits between systems, the most restrictive limit will be followed
- Interceptor
  - Weather
    - Flight through clouds & light precipitation allowed
    - Icing: Avoid known atmospheric conditions conducive to icing
    - Takeoff winds
      - Max Headwind: 30 kts
      - Max Crosswind: 15 kts
      - Max Tailwind: 10 kts
    - Turbulence: No greater than medium per METAR
    - Ambient Temp: -20°C to 60°C
    - AV Temp for Launch: 1.6°C to 60°C
      - If ambient temp <1.6°C, keep vehicle/battery warm (as warm as possible but below 60°C) for as long as feasible before installing in launcher
      - The interceptor can sit outside in a wind-blocked area (i.e. closed launcher) for up to 1 hour with AV power on.
    - GCS: 0°F to 100°F
  - System
    - Max Autopilot Temp: 80°C (monitor for any TM drops)
    - Battery Takeoff Voltage: >48.5V
- Target UAS
  - Limits will be IAW Part 107 and flight manual limits
  - If UAS has no flight manual, then the following limits will be used:
    - Weather
      - 3sm visibility
      - Remain 500ft below and 2,000ft horizontally from clouds
      - Takeoff winds
        - Max Wind: 10 kts
        - Max Gusts: 15 kts
        - Max Gust Delta: 10 kts
        - Winds aloft: < 15 kts
      - Turbulence: No greater than medium per METAR
      - Icing: Avoid known atmospheric conditions conducive to icing
      - Ambient Temp
        - AV and GCS: -18°C to 38°C
- Support Equipment
  - C2 (TBD)
  - Radar (TBD)

Go/No-Go Criteria

- The following Go/No-Go Criteria must be met prior to Interceptor launch
  - Weather is within limits for Interceptor, Target UAS, and test support equipment (if applicable)
    - multiple weather sources including local METARs, local AWOS, online weather sites (such as Windy and Weather Underground), and weather station data must agree the weather is within limits
  - Instrumentation is on and recording
  - Engagement cue is received from C2 (if Seeker Closed Loop Flight)
  - RSO and TD confirm range is clear
  - PVT solution (orange dot) is accurate and updating
- TD has the final authority on calling a Go/No-Go at all stages of test; other personnel will provide a Go/No-Go recommendation on their respective responsibilities or expertise

Knock-it-Off Criteria

- "Knock-it-Off" directs all aircraft to cease maneuvering when flight safety is at risk
- The flight crew will call "Knock-it-Off" and halt maneuvers in the following situations:
  - Weather degrading below limits
  - Unstable Interceptor launch behavior
  - Unsafe situation developing, including but not limited to:
    - Air or ground traffic enter area
    - Target UAS has system error or is off condition (if Seeker Closed Loop)
    - Unexpected Interceptor flight behavior
    - IonStrike UAS system failure
- Any member of the test team can call “Knock-it-Off” (KIO) at any time if they witness an unsafe situation.

Mishaps & Security

- Mishap Convening Authority
  - IAW DZYNE company policies and procedures
- Communications Security
  - IAW DZYNE company policies and procedures
- Operations Security
  - IAW DZYNE company policies and procedures

SITREP

- Will be released by the TD by the end of a test day
- Content:
  - Daily test objectives
  - Summary of daily activities
  - Summary of the test results
  - List of new squawks

Final Report

- No final report is required, and tech debrief is sufficient
  - The Tech Debrief is a meeting held weekly by DZYNE engineering where flight data and relevant results are shared and discussed with the larger team and senior leadership.

General Mitigating Procedures

- Battery Safety: Inspection of batteries, charging using standard charger, fire equipment
- RSO will be on-site to verify range closed, clear, and ready for our flight
- During the launch, all personnel will be distanced at least 70m from the launchpad or under cover if they are within 70m of the launchpad
- In the event of an IMU Failure, the "In-flight Safety Issues" EP will be followed and the flight aborted
- The Ditch Point will be distanced >600m from GCS
- For performance flights 1-6:
  - A stopwatch will be used to verify when the max flight time has elapsed
- For closed loop flights 7-9:
  - Expected impact between interceptor and target will be mitigated by having all personnel outside the geofence or under cover
  - Radar standoff distance shall be maintained when radiating IAW operator manual

Test Hazard Analyses

		Mishap Severity Category			
		Level 1 Catastrophic	Level 2 Critical	Level 3 Marginal	Level 4 Minor
Probability of Mishap Occurrence	Level A Frequent				
	Level B Probable	HIGH			
	Level C Occasional		~~MEDIUM~~		
	Level D Remote			LOW	
	Level E Improbable				NEGLIGIBLE

THA1: Interceptor flight outside geofence

Risk Level: 2/C (MEDIUM)

CAUSE

1. Incorrect Nav solution or PVT position
2. Software algorithm issue
3. Stale GPS indicator data
4. Undesired interceptor flight heading

EFFECT

1. Damage to the environment or structures
2. Injury to people

MITIGATIONS

1. (C1, C4, E2) Buffer area between civilization and geofence boundary
2. (C1, C3, E1) Guidance logic is unchanged, if the Nav solution or PVT report outside the geofence, the autopilot guidance will automatically Abort the Interceptor
3. (C2, C3, C4, E1) RPIC monitor GCS orange indicator (true GPS) for stale or undesired position/heading

CORRECTIVE ACTIONS

1. RPIC command abort on GCS if undesired position/heading
2. Contact Range Rep/emergency services if needed

Test Hazard Analyses

THA2: Seeker Acquires on False Positive

Risk Level: 2/D (Medium)

CAUSE

1. Interceptor inadvertently aims toward persons or objects on the ground or in the airspace

EFFECT

1. Damage to the false target

		Mishap Severity Category			
		Level 1 Catastrophic	Level 2 Critical	Level 3 Marginal	Level 4 Minor
Probability of Mishap Occurrence	Level A Frequent				
	Level B Probable	HIGH			
	Level C Occasional		MEDIUM		
	Level D Remote			LOW	
	Level E Improbable				NEGLIGIBLE

MITIGATIONS

1. (C1, E1) TD and RPIC to monitor OKSI UDP stream to verify seeker isn't acquiring incorrect target
2. (E1) Use appropriate (~1km) geofence to protect nearby civilian areas
3. (E1) System design limits closed-loop control to a maximum 1200m distance from target cue location
4. (C1, E1) RSO will visually check flight area prior to employing interceptor

CORRECTIVE ACTIONS

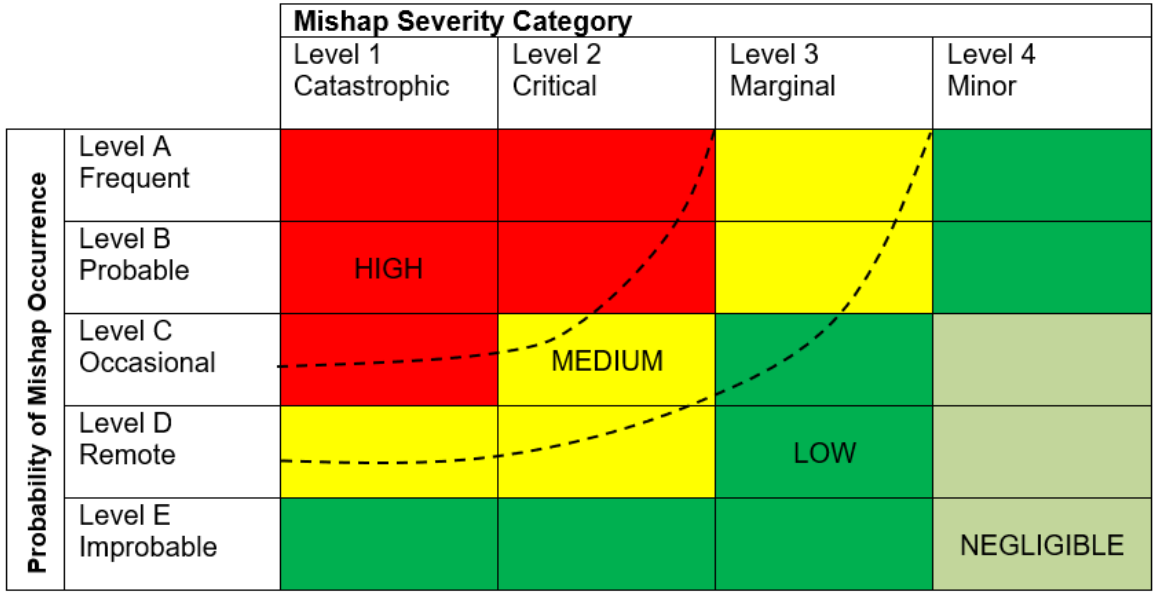
1. If seeker acquires incorrect target, RPIC ditch/abort mission
2. Contact Range Rep/emergency services if needed

Backup/Support Slides

Mishap and Probability Definitions

Level	Mishap Severity	Description
1	Catastrophic	Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or monetary loss equal to or exceeding $2M.
2	Critical	Could result in one or more of the following: permanent partial disability, injuries or occupational illness that may result in hospitalization of at least three personnel, reversible significant environmental impact, or monetary loss equal to or exceeding $100K but less than $2M.
3	Marginal	Could result in one or more of the following: injury or occupational illness resulting in one or most lost work day(s), reversible moderate environmental impact, or monetary loss equal to or exceeding $10K but less than $100K.
4	Negligible	Could result in one or more of the following: injury or occupational illness not resulting in lost work day, minimal environmental impact, or monetary loss less than $10K.

Level	Mishap Probability	Description
A	Frequent	Likely to occur often in the lifespan of the item (e.g. test exceeds design limits or mishap occurred during similar testing)
B	Probable	Will occur several times in the lifespan of the item (e.g. test at design limits or mishap almost occurred during similar testing)
C	Occasional	Likely to occur sometime in the lifespan of the item
D	Remote	Unlikely to occur, but possible to occur in the lifespan of the item (e.g. test activity within design limits and accomplished previously w/ no problems encountered)
E	Improbable	So unlikely, it can be assumed that occurrence may not be experienced in the lifespan of the item

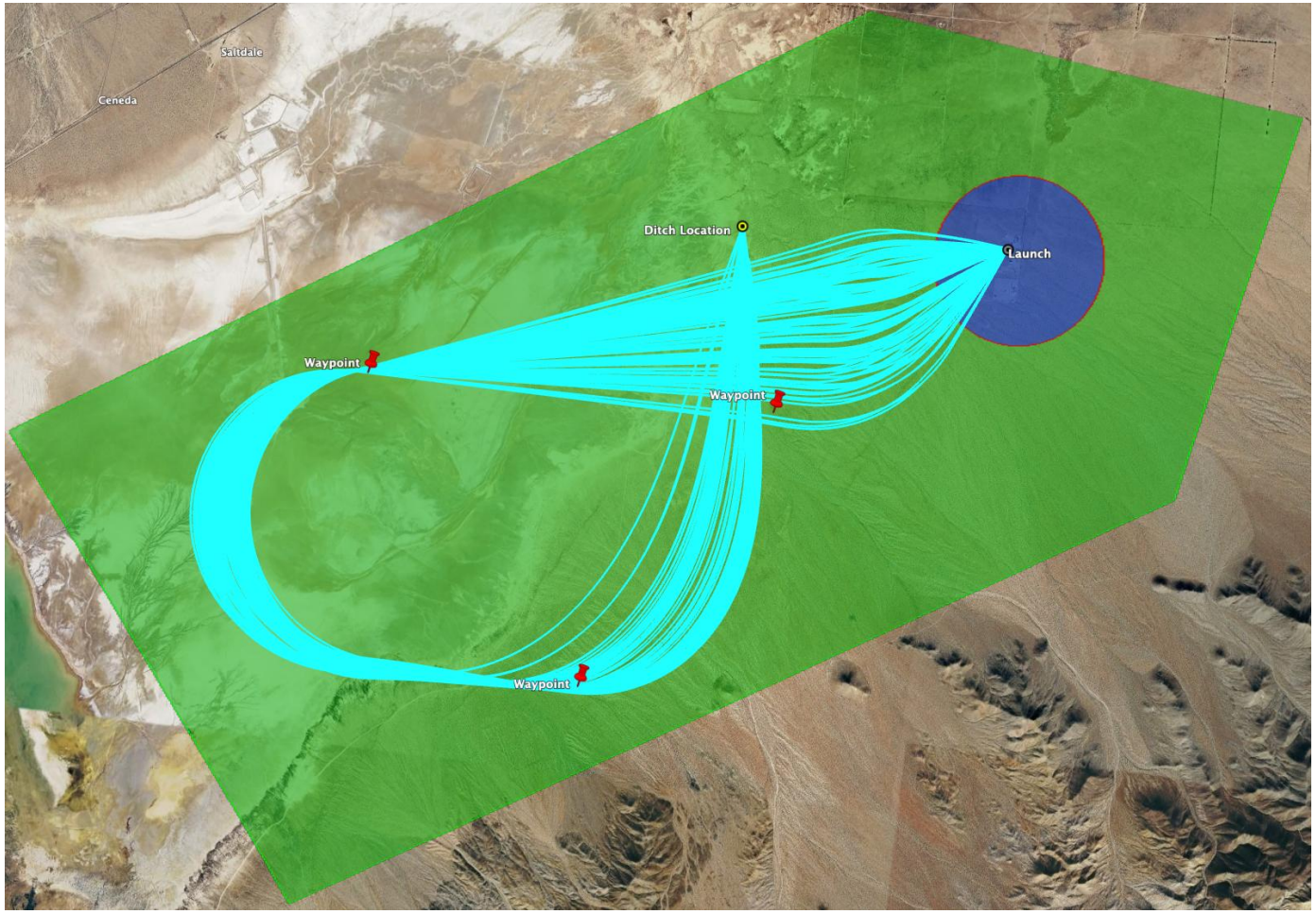


Flight 1 Overview

Primary Nav Configuration:
Loosely-Coupled GNSS

Dev Nav Configuration:
Tightly-Coupled GPS

- 3-waypoint flight
- Launch Location
  - RRS
  - Azimuth: 240° true
- Key Flight Parameters
  - Maneuver time: 120s
  - 300m AGL flight altitude

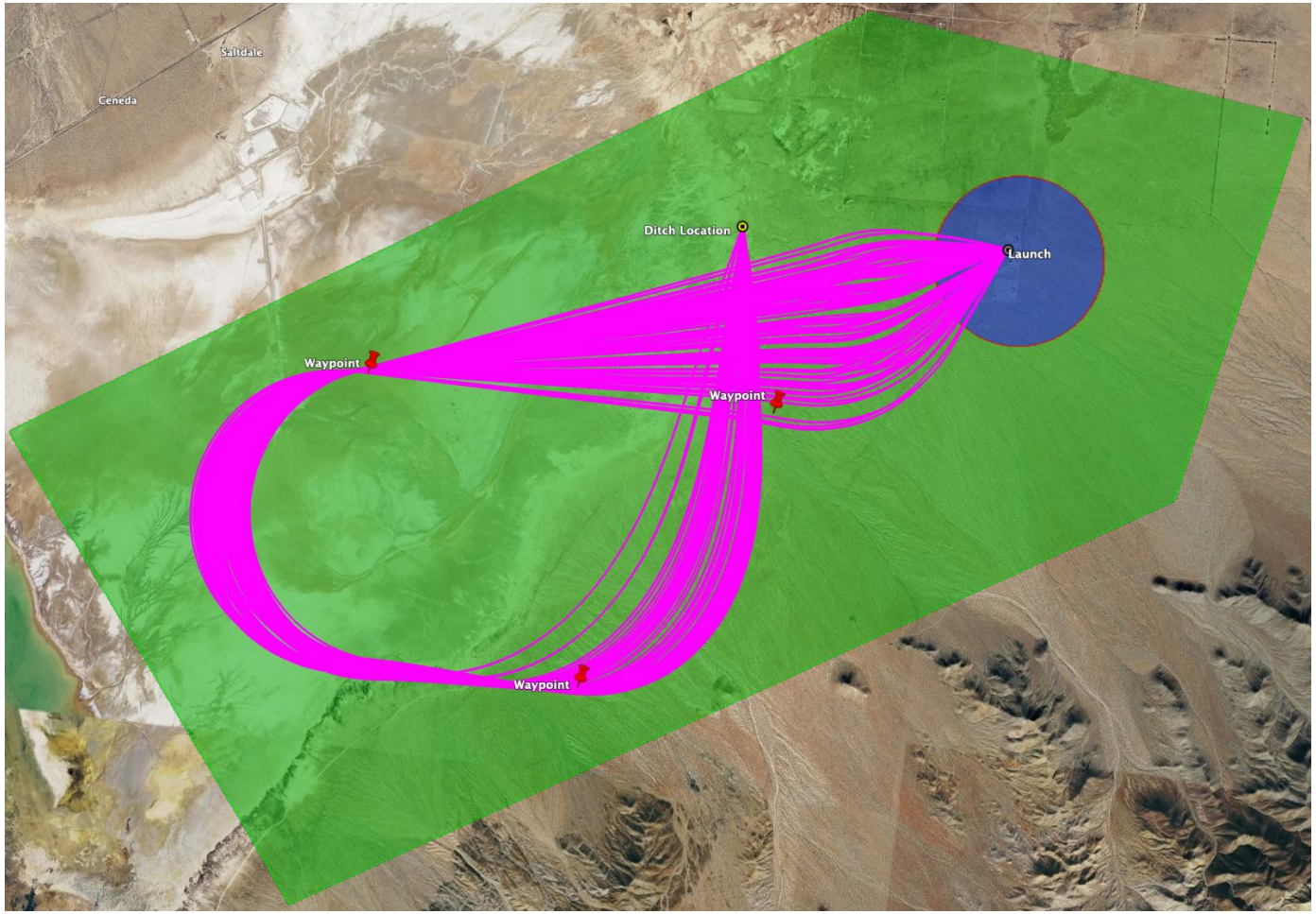


Flight 2 Overview

Primary Nav Configuration:
Loosely-Coupled GNSS

Dev Nav Configuration:
Loosely-Coupled GNSS + Airdata

- 3-waypoint flight
- Launch Location
  - RRS
  - Azimuth: 240° true
- Key Flight Parameters
  - Maneuver time: 120s
  - 300m AGL flight altitude

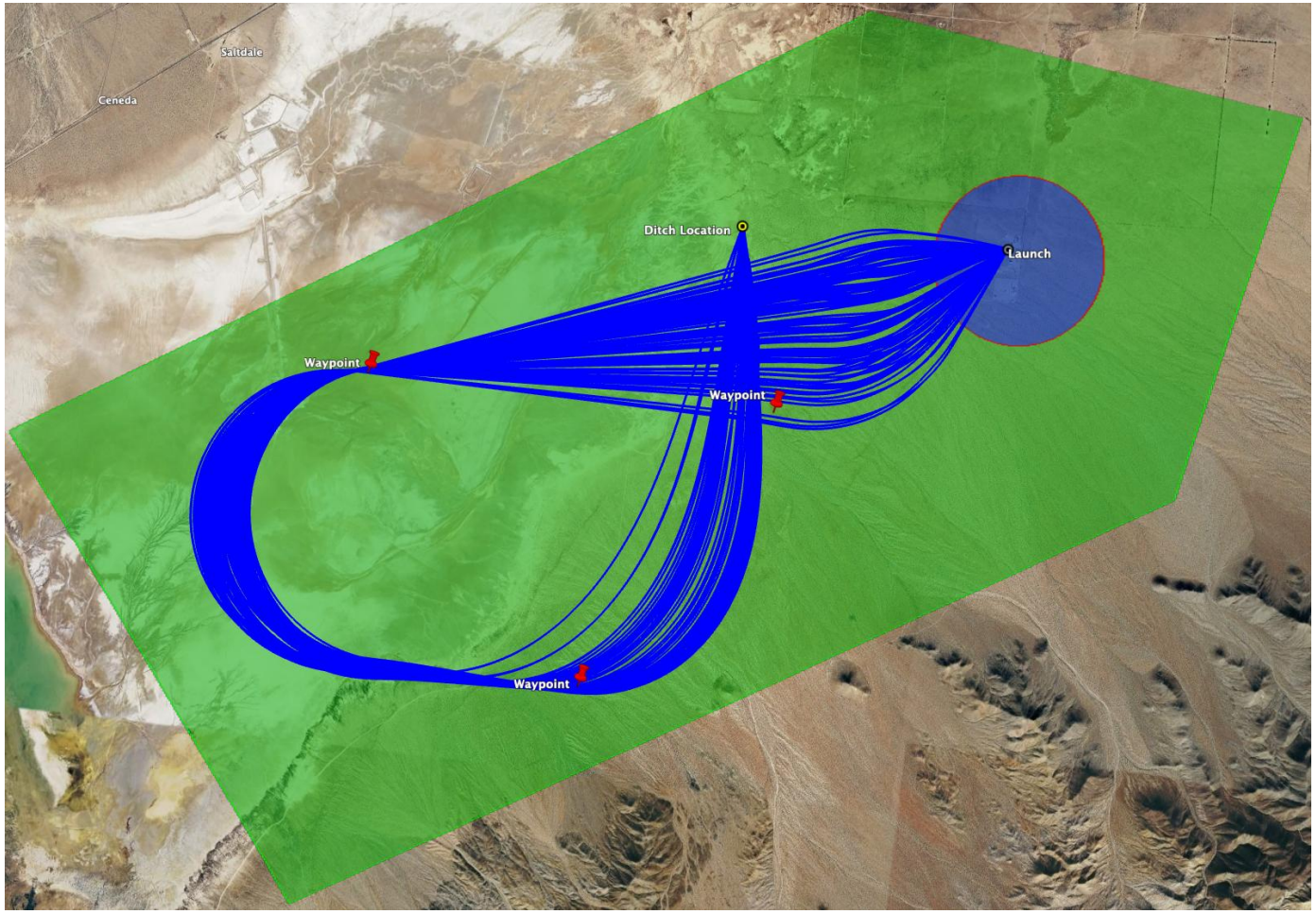


Flight 3 Overview

Primary Nav Configuration: Loosely-Coupled GNSS + Airdata

Dev Nav Configuration: Airdata – GNSS Denied

- 3-waypoint flight
- Launch Location
  - RRS
  - Azimuth: 240° true
- Key Flight Parameters
  - Maneuver time: 120s
  - 300m AGL flight altitude
- Geofence and KOZ breaches
  - IMU failures
  - Actuator failures
  - Engine failures

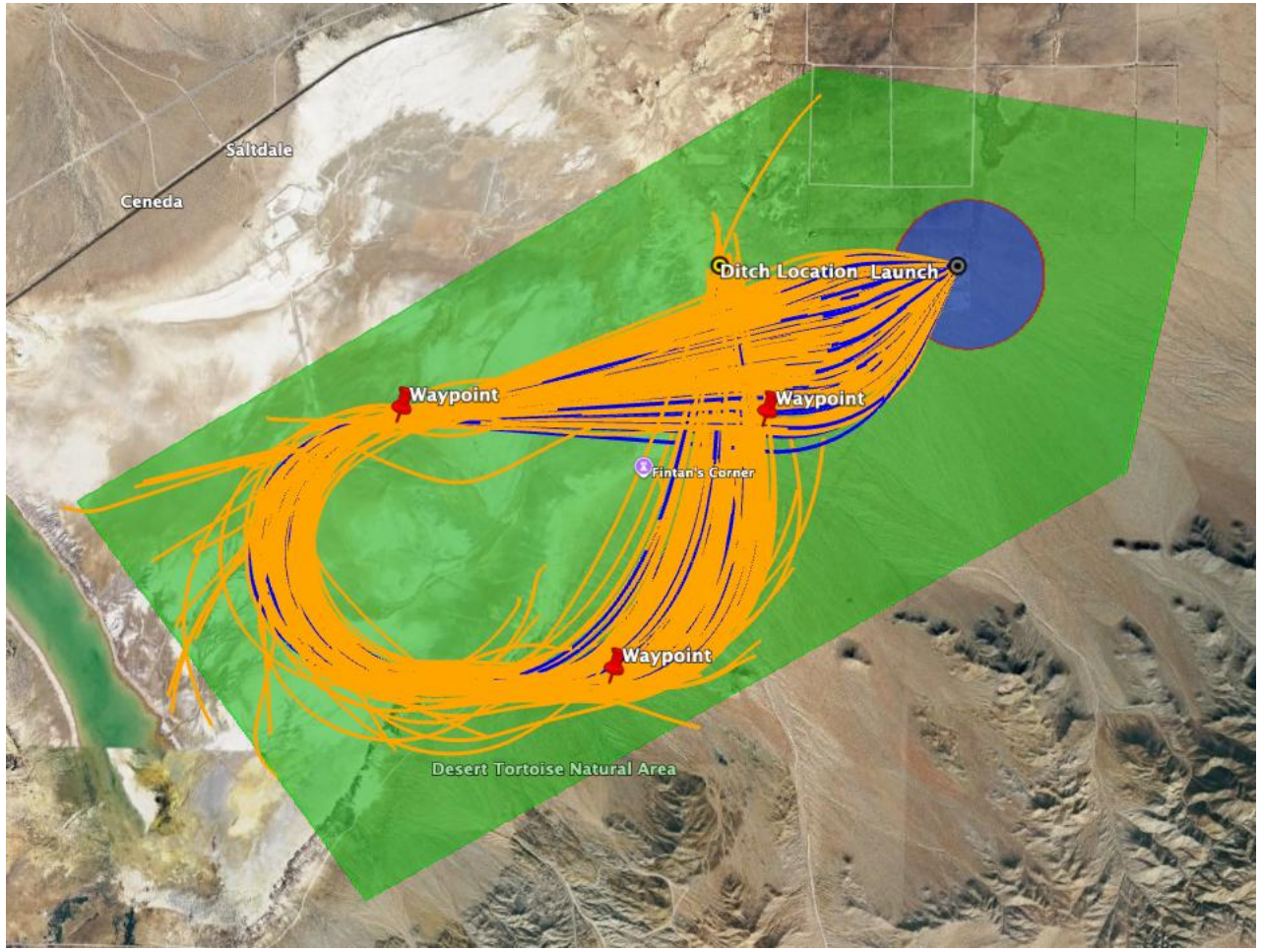


Flight 4 Overview

Primary Nav Configuration: Loosely-Coupled GNSS + Airdata

Dev Nav Configuration: Simulated Ownship (GNSS denied)

- 3-waypoint flight
- Launch Location
  - RRS
  - Azimuth: 240° true
- Key Flight Parameters
  - Maneuver time: 120s
  - 300m AGL flight altitude
- Geofence and KOZ breaches
  - IMU failures
  - Actuator failures
  - Engine failures

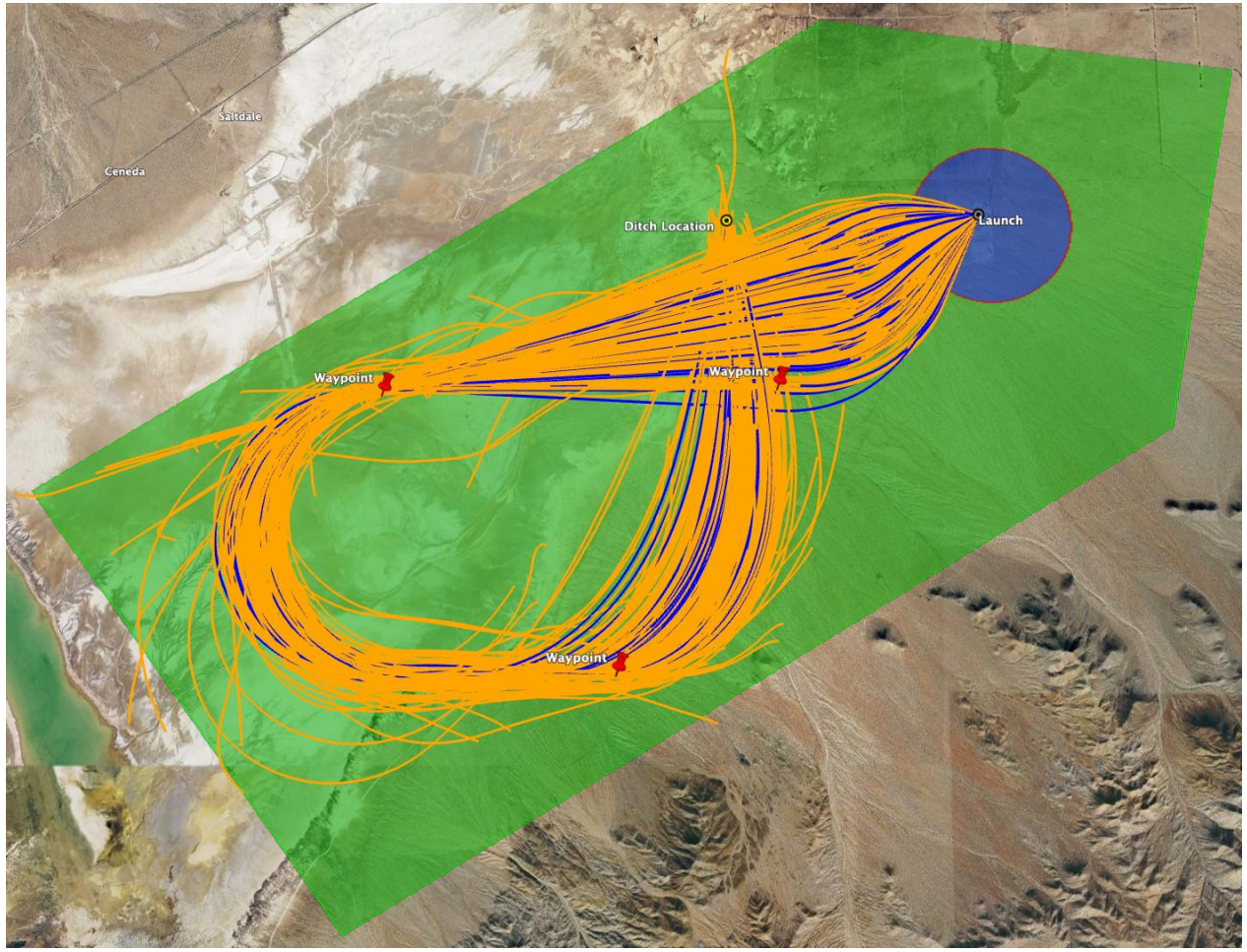


Flight 5 Overview

Primary Nav Configuration: Loosely-Coupled GNSS + Airdata

Dev Nav Configuration: Airdata – GNSS Denied

- 3-waypoint flight
- Launch Location
  - RRS
  - Azimuth: 240° true
- Key Flight Parameters
  - Maneuver time: 120s
  - 300m AGL flight altitude
- Geofence and KOZ breaches
  - IMU failures
  - Actuator failures
  - Engine failures



Test Team and Responsibilities (all)

Role	General Responsibilities
Test Director (TD)	• Responsible for the overall conduct and safety of the test • Ensures test data is collected, stored, processed, and analyzed IAW the DMAP • Responsible for compiling inputs and writing the SITREP • Ensures proper pre-mission coordination has been done with appropriate agencies (range or airfield management, frequency management, ATC, etc) • **Depending on the team's needs for a specific test day, the TD may cover the TC or MC roles**
Test Conductor (TC)	• **Optional role dependent on the team's needs for a test day; May be combined with TD role** • Paces the crew through the test cards • Makes notes during a flight test relevant to the quality of the data and SUT performance • Leads pre-briefing and debrief
Interceptor Remote Pilot in Command (RPIC)	• Responsible for, and is the final authority as to the safe operation of the IonStrike Interceptor • Verify test item health before employment • Initialize test item mission routine • Monitor test item health during flight
Interceptor Crew Chief (CC)	• Responsible for the transportation and setup of equipment • Performs AV maintenance and pre-flight checks • Designated rocketry shooter
Target RPIC	• Responsible for, and is the final authority as to the safe operation of the target UAS • Verify test asset health before employment • Initialize test asset mission routine in Mission Planner • Monitor test asset health during flight
Target Safety Pilot (Sticks)	• Pilot in control during Target takeoffs and landings • Will take control of Target while in-flight if safety concerns arise or the UAS fails to perform the desired Mission Planner mission
Target Crew Chief	• Assist with target preflight ops • Hand launch UAS (when applicable) • **May be performed in conjunction with other test team roles such as TD, MC, or Interceptor CC**
Target Visual Observer	• **Optional role to be used in circumstances when the test setup will not allow the Target RPIC and/or Safety Pilot to maintain visual line of sight (VLOS) with the target as required by FAA Part 107, or during complex missions** • Acts as a second set of eyes for the Target RPIC • Responsible for maintaining VLOS with the Target and scanning the airspace for hazards like other aircraft, people, or obstacles
Target Mission Commander	• **Optional role dependent on the team's needs for a test day; May be combined with TD role** • Communicate with Interceptor GCS