Accelerating the development and deployment of autonomous aviation technologies

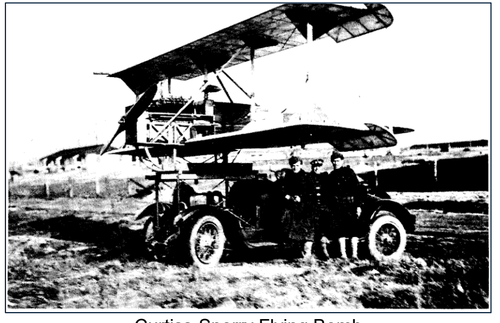
Tom Pieronek
Northrop Grumman Aeronautic Systems

April 13, 2026

First naval uncrewed combat air vehicle

- 1916: Peter Hewitt and Elmer Sperry developed a radio controlled, gyro-stabilized “automatic airplane”
- 1917: Navy procured seven Curtiss N-9H seaplanes equipped with Sperry gyro-stabilized autopilots; wanted to use against U-Boats
- 1917-1918: Curtiss-Sperry Flying Bomb
  - Marmon automobile provided open-air wind tunnel at 80 mph on Long Island Expressway
  - March 6, 1918 – first uncrewed, heavier than air, powered controlled flight
- World War I Armistice ended need for the program

Curtiss N-9H Seaplane (Wikipedia)

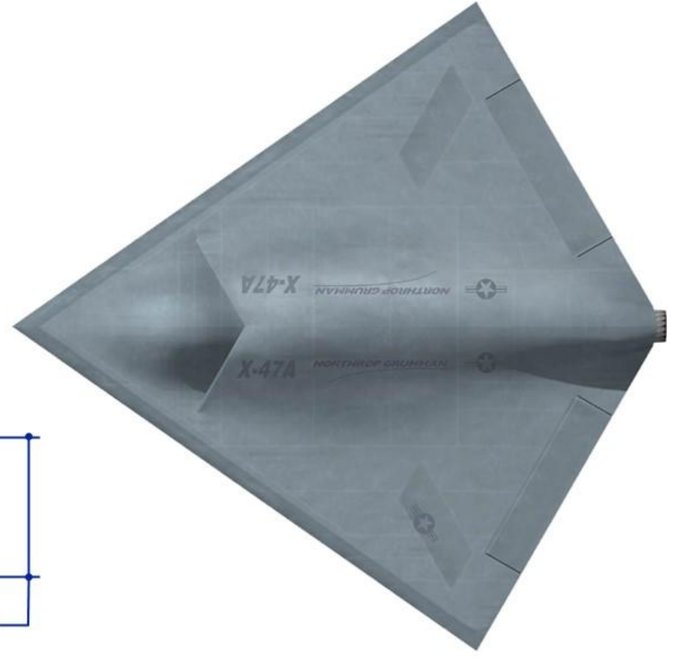


Curtiss-Sperry Flying Bomb
(From Pearson, *Developing the Flying Bomb*,
Naval Air Systems Command, 1968)

Project Pegasus (X-47A)

X-47A objectives and specifications

Demonstrate aerodynamic qualities suitable for **autonomous flight operations from an aircraft carrier**



Powerplant:	P&W JT15D-5C
Thrust:	3,190 lb
Weight Empty:	3,835 lb
Takeoff Gross Weight:	5,500 lb

First flight: February 23, 2003 (NAWS China Lake)

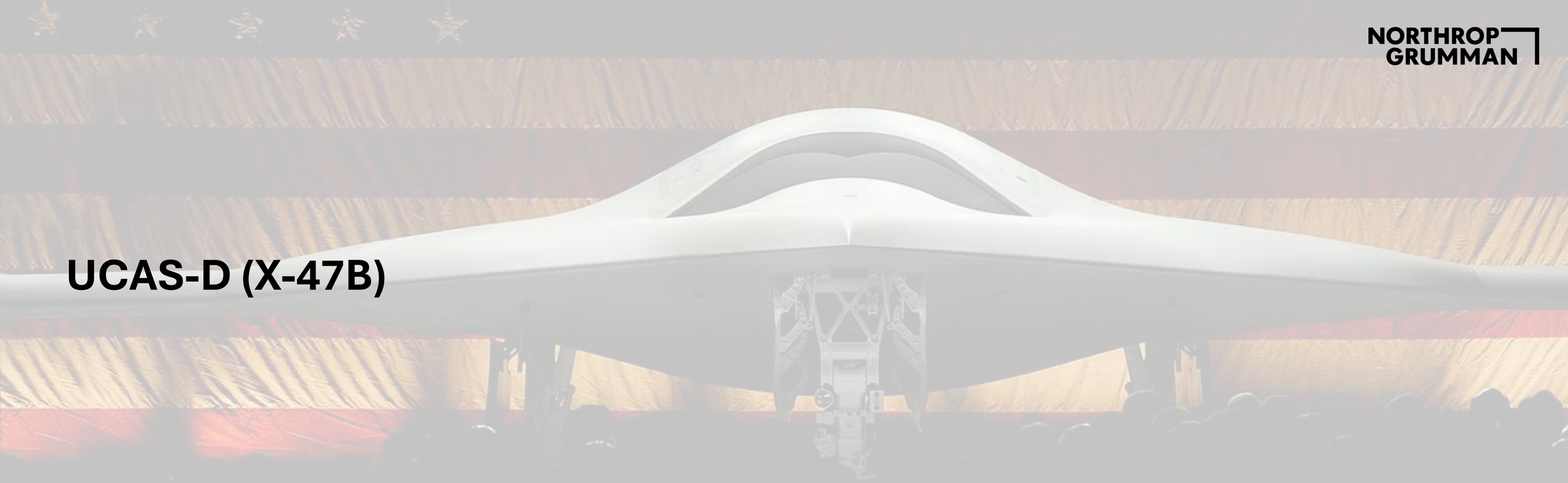
Excerpt from previously released video: X-47A Pegasus First Flight China Lake 1 - YouTube

Accomplishments

- X-47A made just one flight but satisfied demonstration objectives and provided credibility for a naval uncrewed combat air vehicle
- Used 1990s digital technology to control a tailless aircraft
- Proved autonomous flight control, commanded by mouse/ keyboard
- X-47A later used to help develop a Deck Handling System

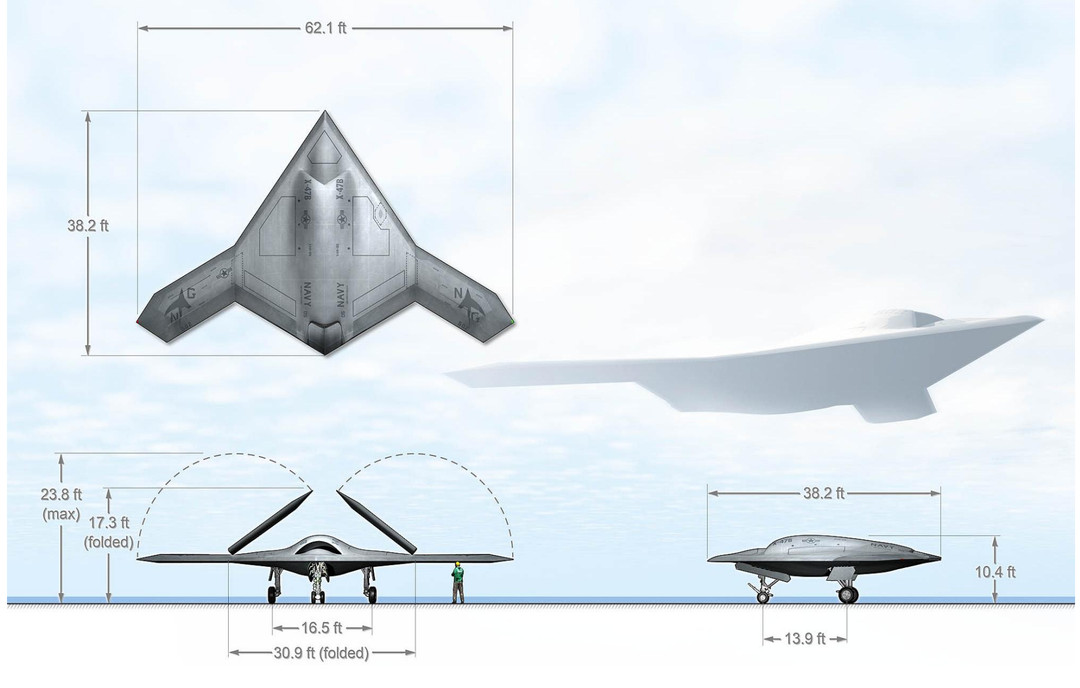
NORTHROP GRUMMAN

UCAS-D (X-47B)

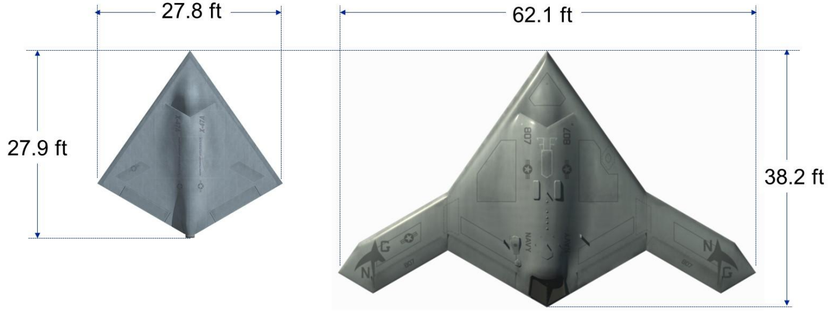


X-47B objectives and specifications

Seamless integration of an uncrewed platform into an **aircraft carrier environment**



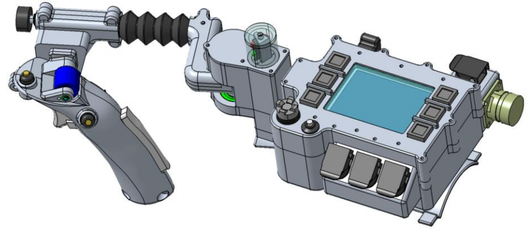
Weight Empty (AV-1)	**28,287 lb**
CV Landing Weight	**35,000 lb**
Takeoff Gross Weight	**44,000 lb**
Flt Envelope Max Altitude	**29,000 ft**
Flt Envelope Max Airspeed	**223.5 KEAS**
CV Launch OPWOD (44 klb)	**+2.2 knots**
CV Recovery Headwind (35 klb)	**+7.2 knots**
Spot Factor (Relative to F/A-18C)	**0.87**



Comparison: X-47A to X-47B

Seamless carrier integration

- “Digitized” aircraft carrier procedures
- Flight deck training and procedures unchanged
- Predictable performance monitored by Carrier Air Traffic Control Center
- Landing Signal Officer retains safety control
- Deck operator is charged with moving the aircraft on the deck



Carrier demonstration highlights (2013)

NOTE: Video previously approved for Public Release NAVAIR 2014-192, NGAS 14-0536

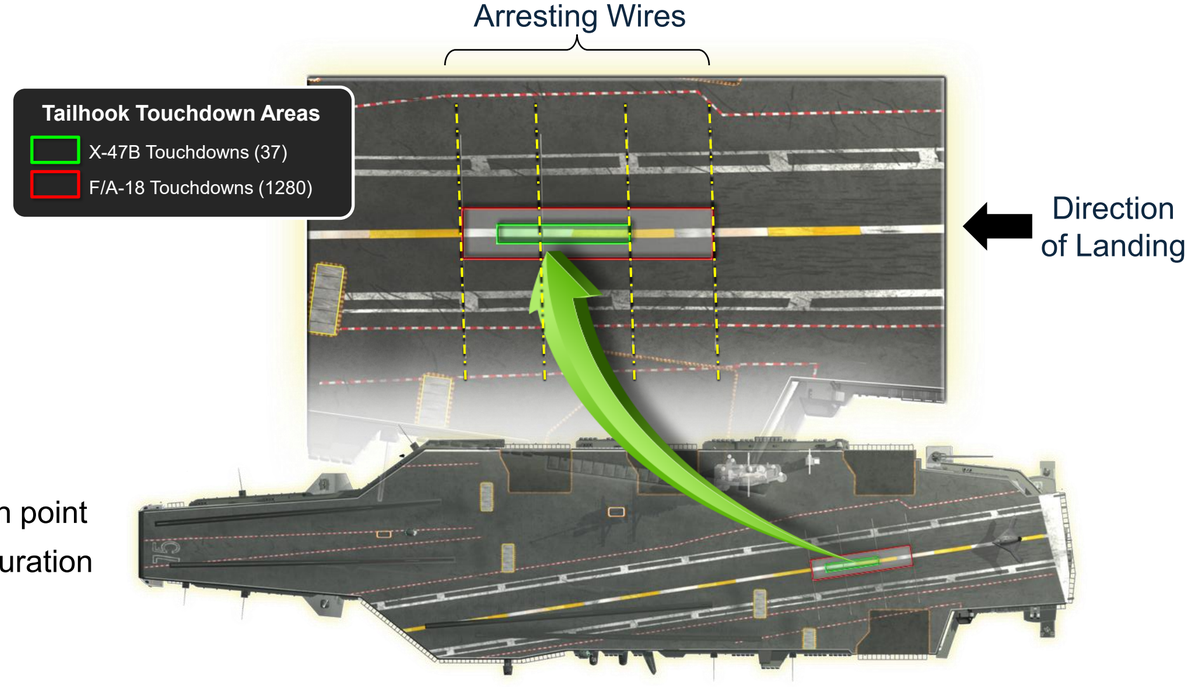
Carrier landing touchdown dispersion

X-47B (Green box)

- 30 touch and go landings
- 7 arrested landings
- Includes off-nominal wind conditions
- 2 different aircraft
- 2 different carriers
- Tight control of touchdown point

F/A-18 (Red box) – 1280 landings

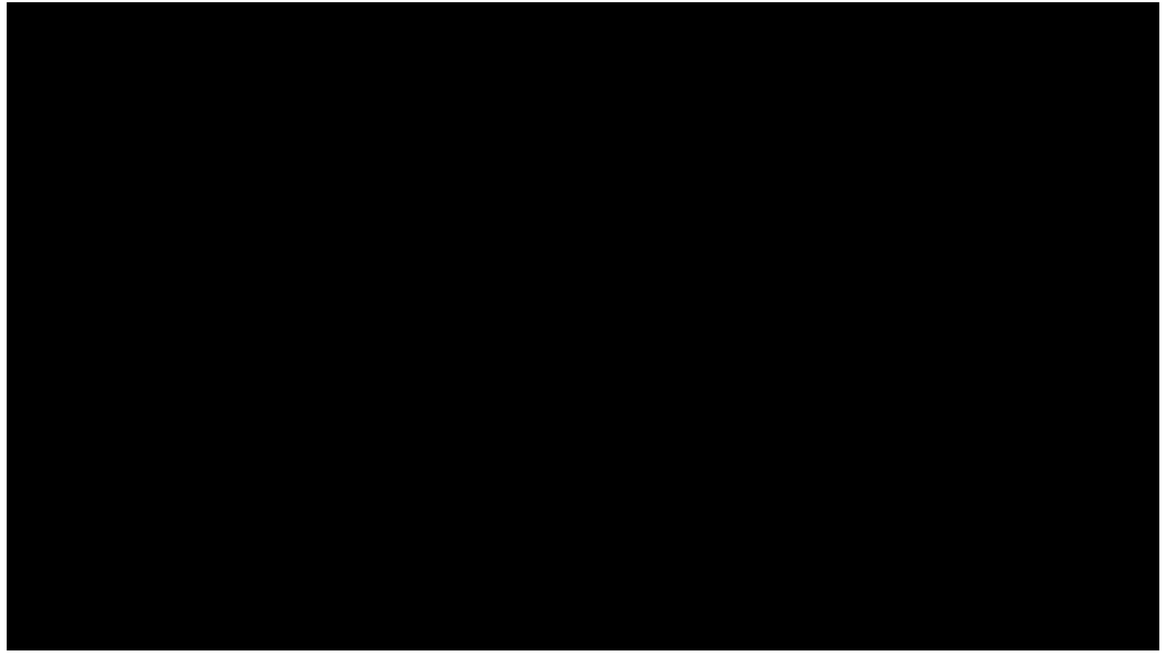
- X-47B demonstrated predictable and repeatable touchdown point
- X-47B proved carrier suitability of tailless flying wing configuration



NOTE: Slide content previously approved for Public Release NAVAIR 2014-192, NGAS 14-0536

Automated aerial refueling demonstration highlights (2015)

NORTHROP GRUMMAN



NOTE: Video previously approved for Public Release NAVAIR 2015-451 NG 15-0726

Accomplishments

- First autonomous, tailless, uncrewed air system to launch, recover, and operate seamlessly aboard an aircraft carrier
- First autonomous, air refueling (AAR) of an uncrewed air system – and using the most challenging method (Navy probe and drogue)
- Demonstrated precision GPS (PGPS) that enabled autonomous navigation around the aircraft carrier & during AAR

Paradigm shifts

- Single purpose demonstration **to** multi-purpose operation
- Performance / Cost / Schedule **to** Schedule / Cost / Performance
- Commoditization of autonomy
- Embracing standards unlocks innovation from multiple parties

NORTHROP GRUMMAN

Talon IQ

Talon IQ objectives

- Establish a crewed and **optionally autonomous** flight test capability to quickly mature **Mission Autonomy**
- Develop an ecosystem to **rapidly integrate Mission Autonomy with NG's Proven Flight Autonomy**
- Team with **strategic partners** to bridge non-traditional defense innovators and Northrop Grumman pedigree

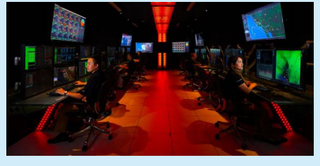
ACCELINT · Applied Intuition · AUTONODYNE · MERLIN 6 · SHIELD AI

Mobile Control Center

Experienced pedigree to quickly mature autonomy

NORTHROP GRUMMAN

Autonomy Capability Development



NGAS Prism Mission Autonomy Software

+ Partner Autonomy Skills

Autonomy Software Integration

Prism Dev Kit

Proven Mission Systems Hardware + SW

System Integration Lab Testing

Safety Critical Infrastructure

Autonomy Flight Testing

Experimental Operations at Scaled Composites

Creates a proven pipeline to advance autonomy development through affordable, rapid, and thorough airworthiness

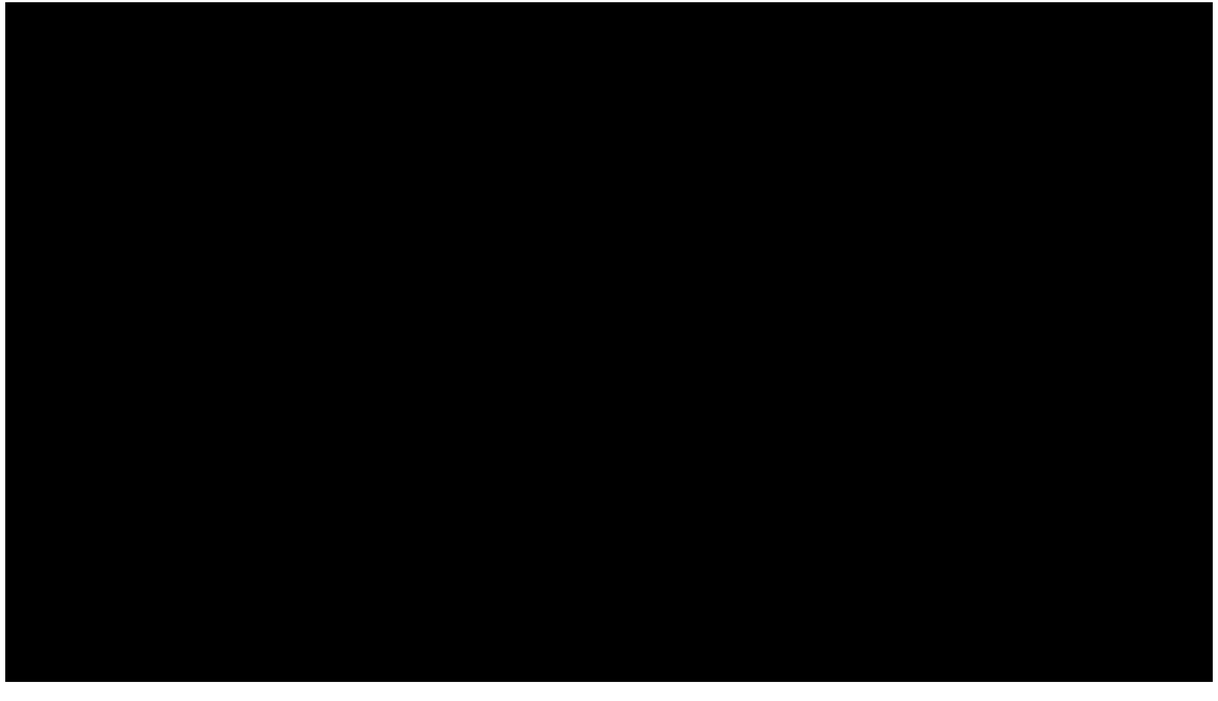
Talon IQ flight testing

2025 Flights	
☑ M437 Return-to-Flight Flight 002	Sep 20, 2025
☑ Envelope Expansion Flight 003	Nov 3, 2025
☑ Envelope Expansion Flight 004	Nov 11, 2025

2026 Flights	
☑ Flight Autonomy Flight 005	Mar 4, 2026
☑ Flight Autonomy Tuning Flight 006	Mar 2, 2026
☐ Prism Autonomy Flight 007	Mar 18, 2026
☐ Partner Mission Autonomy Flight 008	Mar 26, 2026
☐ Partner Mission Autonomy Flight 009	May 2026
☐ Partner Mission Autonomy Flight 010	May 2026
☐ Partner Mission Autonomy Flight 011	Jun 2026
☐ Partner Mission Autonomy Flight 012	Jun 2026

Talon IQ Autonomy Flight Test - Feb 2026

NORTHROP GRUMMAN



What does it take to Accelerate?

- Decades of experience enables us to know which “knobs” matter
- Acceleration comes from modulating risk due to knowledge
- Model-based digital engineering and test allow more rapid expansion of flight envelope

Questions

NORTHROP GRUMMAN