



Innovation ... Delivered.

Multi-Stage Supersonic Target (MSST)

Mike Stuart
ATK Defense Electronics Systems
Director, Missiles Business Development

NAVAIR Public Release 10-1294
Approved for public release; distribution is unlimited.

MSST Overview



A premier aerospace and defense company

- Requirement
- Preliminary Design Review (PDR)
- Engineering Evaluation (EEU) #2
- Critical Design Review (CDR)
- Flight Test Program
- MSST Profile
- Growth Opportunities



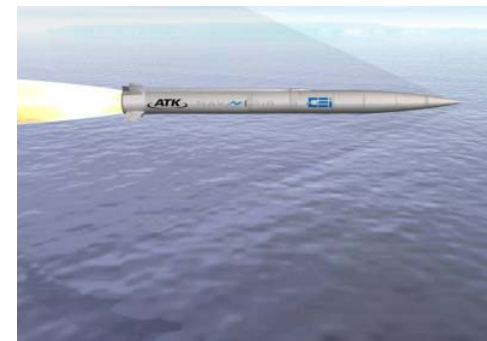
- MSST is system designed to represent a family of threat systems with an extremely wide variety of flight parameters and representations
 - A two-stage unmanned aerial target, launcher and associated support equipment
 - Subsonic bus stage followed by a supersonic sprint stage
 - Maximum range in excess of 100 NM
 - Minimum cruise altitude approximately 50 feet
 - Separation event at altitudes below 3000 feet
- MSST will provide unparalleled threat representation for developmental and operational testing of major DoD and international weapon systems

Multi-Stage Supersonic Target Requirement



A premier aerospace and defense company

- MSST is designed to emulate advanced two-stage Anti-Ship Cruise Missiles in support of Air Defense Weapons/Combat Systems T&E events for major acquisition programs
- Prime Contractor: Alliant Techsystems Inc. (ATK)
- Development effort will lead to follow-on contract for Low-Rate Initial Production and Full- Rate Production
- Initial Operational Capability planned for 2014
- ACAT IVM Program that directly impacts ACAT I Programs



Preliminary Design Review



A premier aerospace and defense company

- Completed 2nd Quarter 2010
- Due to impending Pre-CDR flight test in November 2010, the maturity of both the hardware and software designs were well ahead of most programs at the PDR stage
- Rocket motor technology was adapted from a well proven VLA design
- The bus system was adapted from the well proven BQM-167x design used by Composite Engineering Inc (CEi)
- Successful passing of the PDR was accomplished by closing some RFAs required for CDR and within 90 days of PDR conclusion



Prototype
MSST
Vehicle for
PDR

Engineering Evaluation Unit #2



A premier aerospace and defense company

- A risk-reduction Engineering Evaluation Unit (EEU) #2 flight is scheduled prior to the Critical Design Review (CDR)
- This flight test requires a significant amount of the required CDR design be completed prior to this flight.
- Fidelity of both hardware and software is well ahead of most programs due to this flight test (HW 95%, SW 85%)
- Flight test scheduled for 17 Nov 2010
- EEU#2 will significantly reduce the engineering development cycle following CDR

Critical Design Review



A premier aerospace and defense company

- Currently planned for 1st Quarter 2011
- 80% of critical Design will be completed by EEU#2 Flight Test
- Subsystem CDRs scheduled to be completed by the end of 2010
- With successful completion of EEU#2 risk-reduction flight, CDR is anticipated to go extremely well
- Scheduled closure of CDR is April 2011

Flight Test Program (FTP)



A premier aerospace and defense company

- FTP is scheduled to be initiated during the 1st quarter of 2012
- FTP consists of 6 flight tests scheduled to complete the design requirements matrix
- 7 EDM vehicles are scheduled to be deployed during FTP
- One flight test includes 2 units fired in close proximity of each other and at the same ship
- FTP scheduled to conclude in early 2013

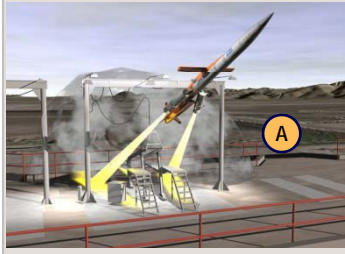
MSST Profile



A premier aerospace and defense company

ATK MSST Mission Sequence

Launch (Boost)
Phase



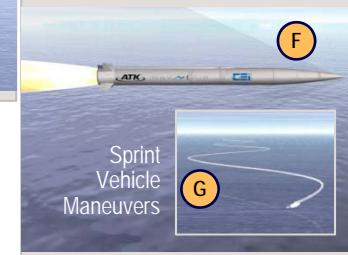
Integral Vehicle Subsonic
Cruise Phase



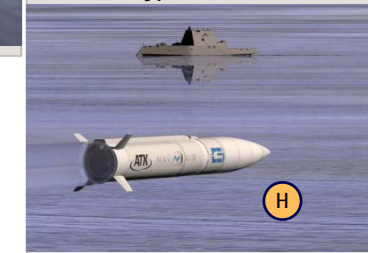
Separation Event
Phase



Terminal Supersonic
Phase



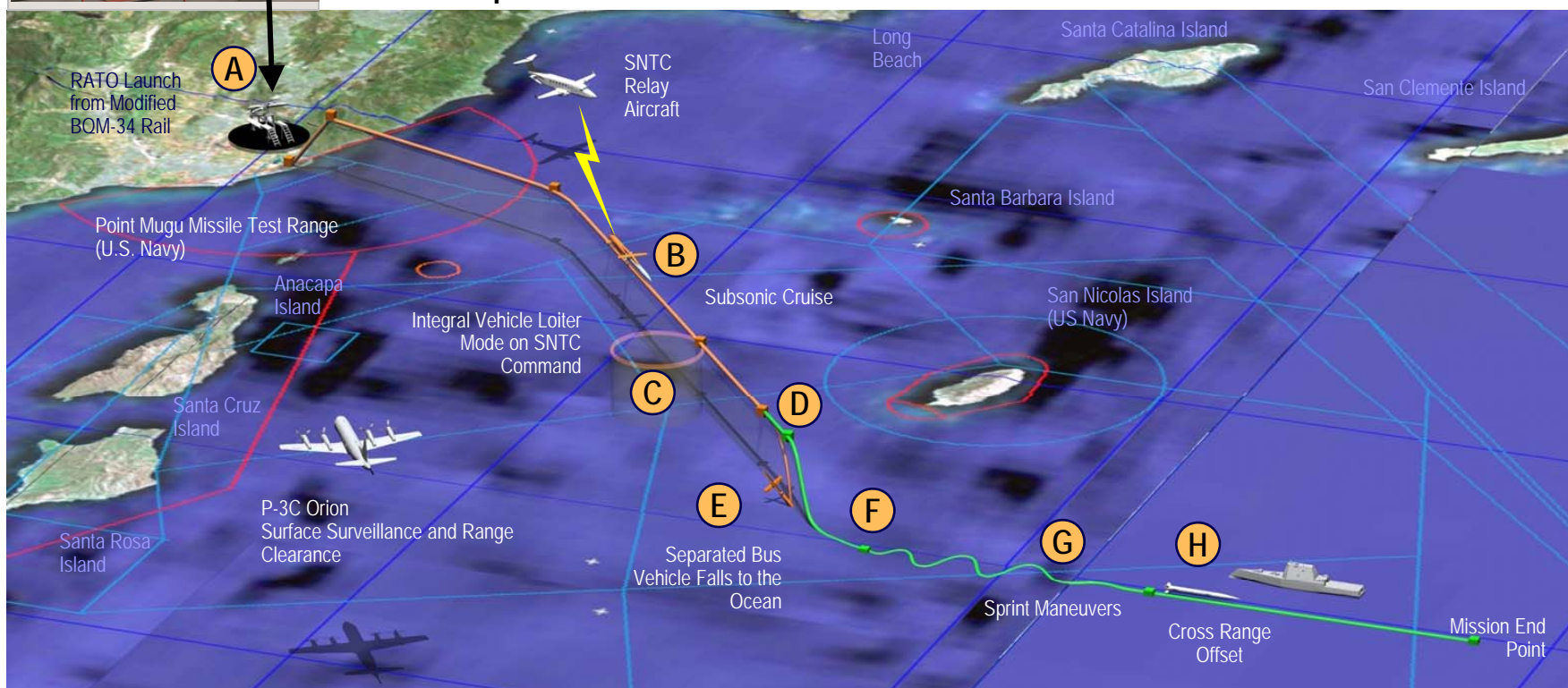
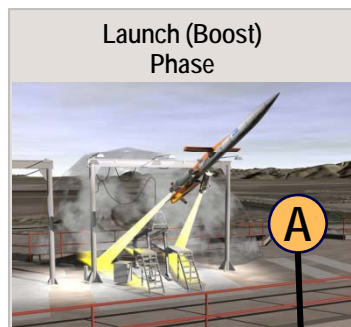
Fly-By to Final
Waypoint Phase



Designed with Low Cost and
Efficient Target Representation
as the Priority

Launch Boost Phase

- Ground launched by dual Rocket Assisted Take Off (RATO) bottles providing ~ 26,000 lbs of total thrust
- RATOs separate from Integral Vehicle ~2.5 seconds after launch
- Autopilot stabilizes vehicle



MSST EEU2 on Launch Rail - 01 October 2010



A premier aerospace and defense company



MSST EEU2 on Launch Rail - 01 October 2010

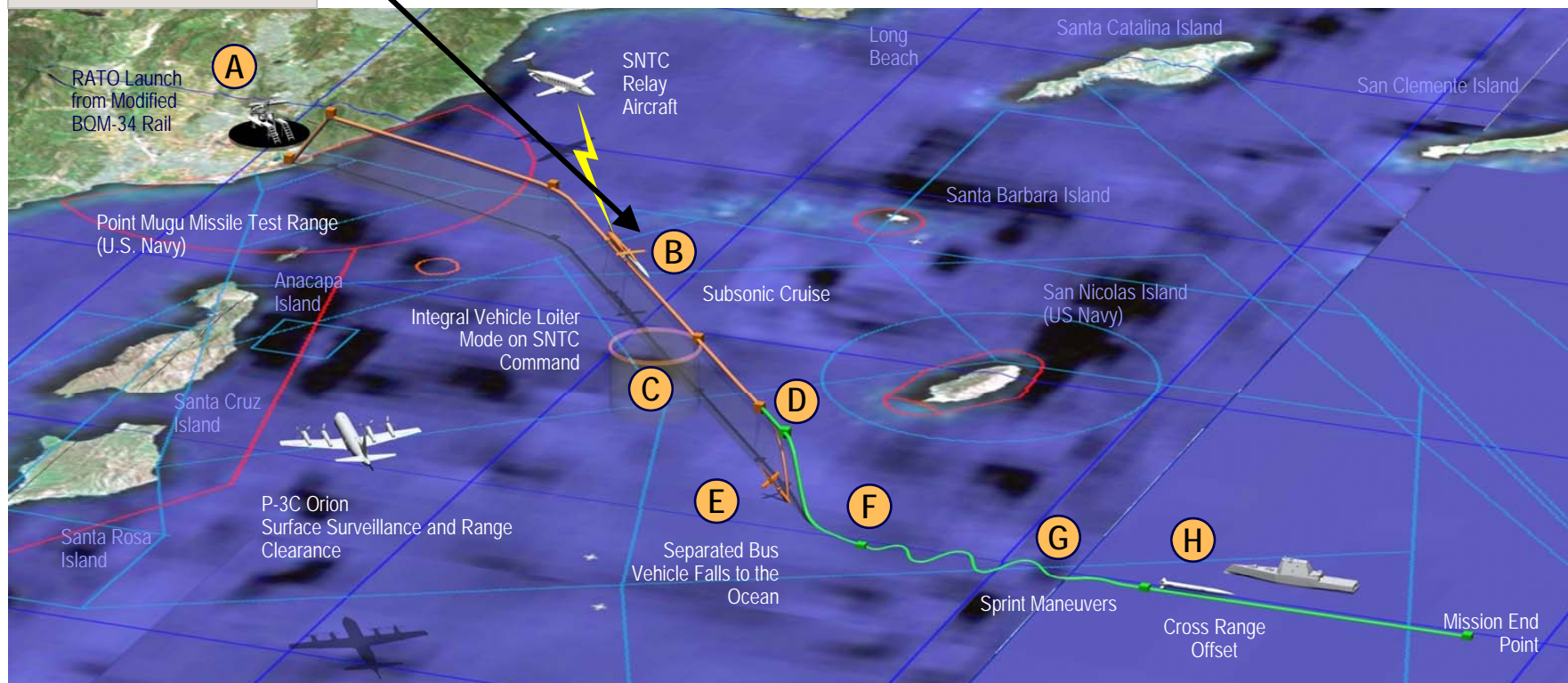
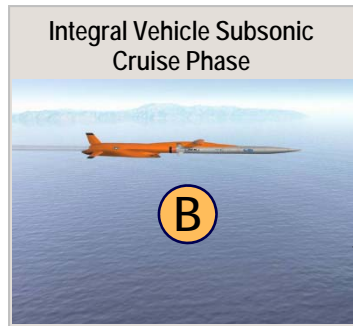


A premier aerospace and defense company



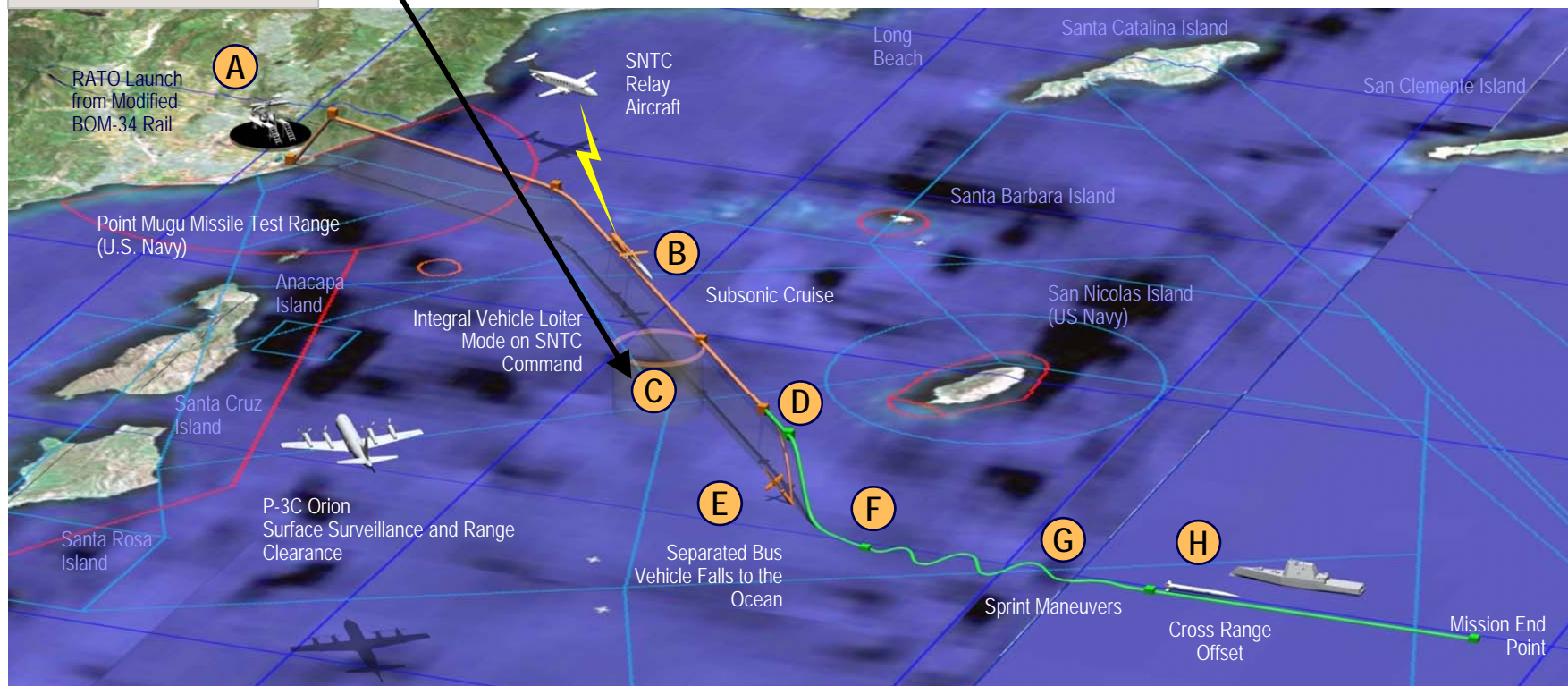
Integral Vehicle Subsonic Cruise Phase

- After the Integral Vehicle is stabilized, waypoint guidance is initiated based on pre-programmed mission events
- A turbojet engine provides thrust for subsonic cruise up to Mach .8



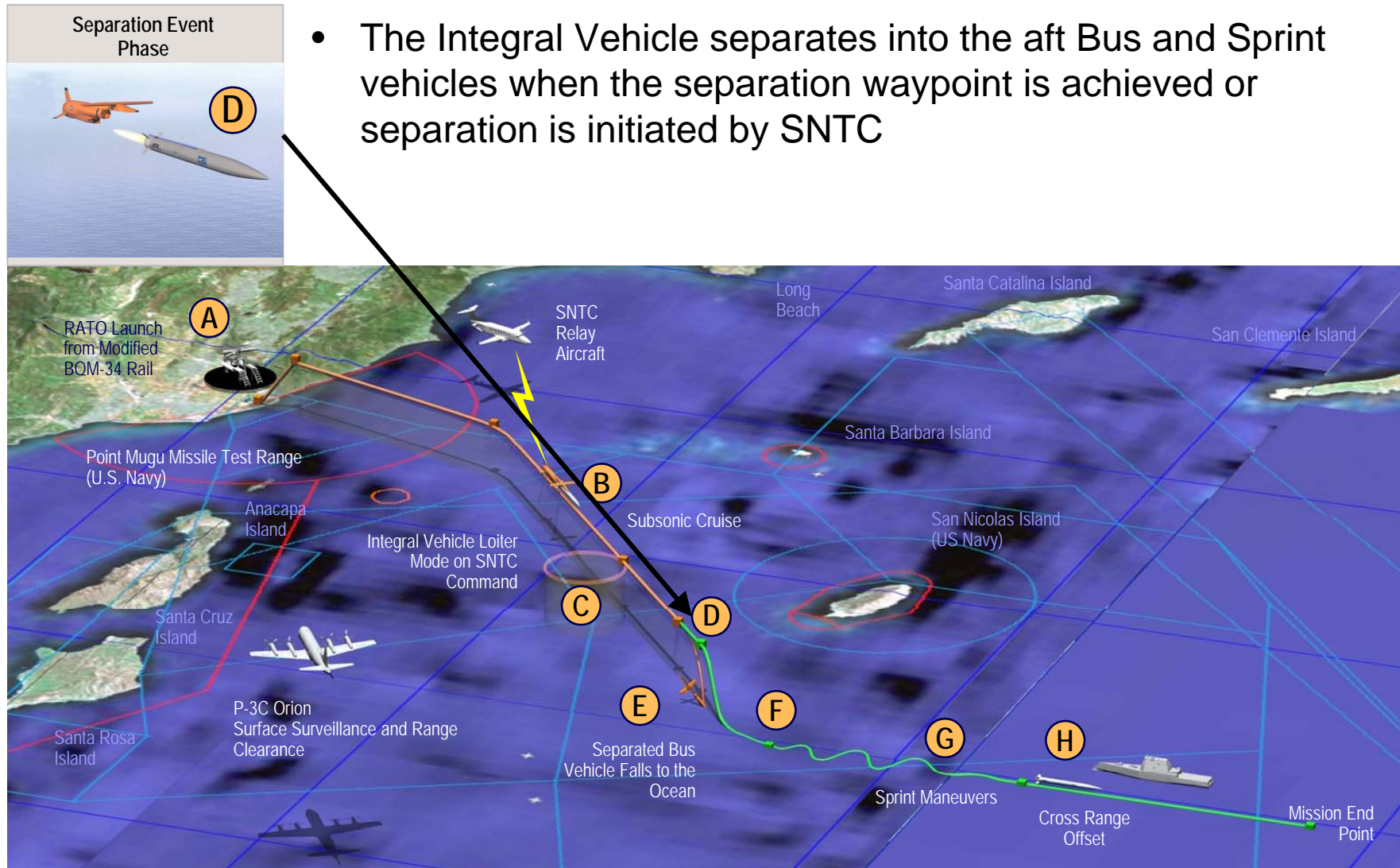
Integral Vehicle Subsonic Cruise Phase Loiter Mode

- The System for Naval Target Control (SNTC) can be used to modify pre-programmed missions or takeover vehicle control
- The SNTC operator can control the vehicle to avoid unforeseen obstacles and initiate the separation sequence



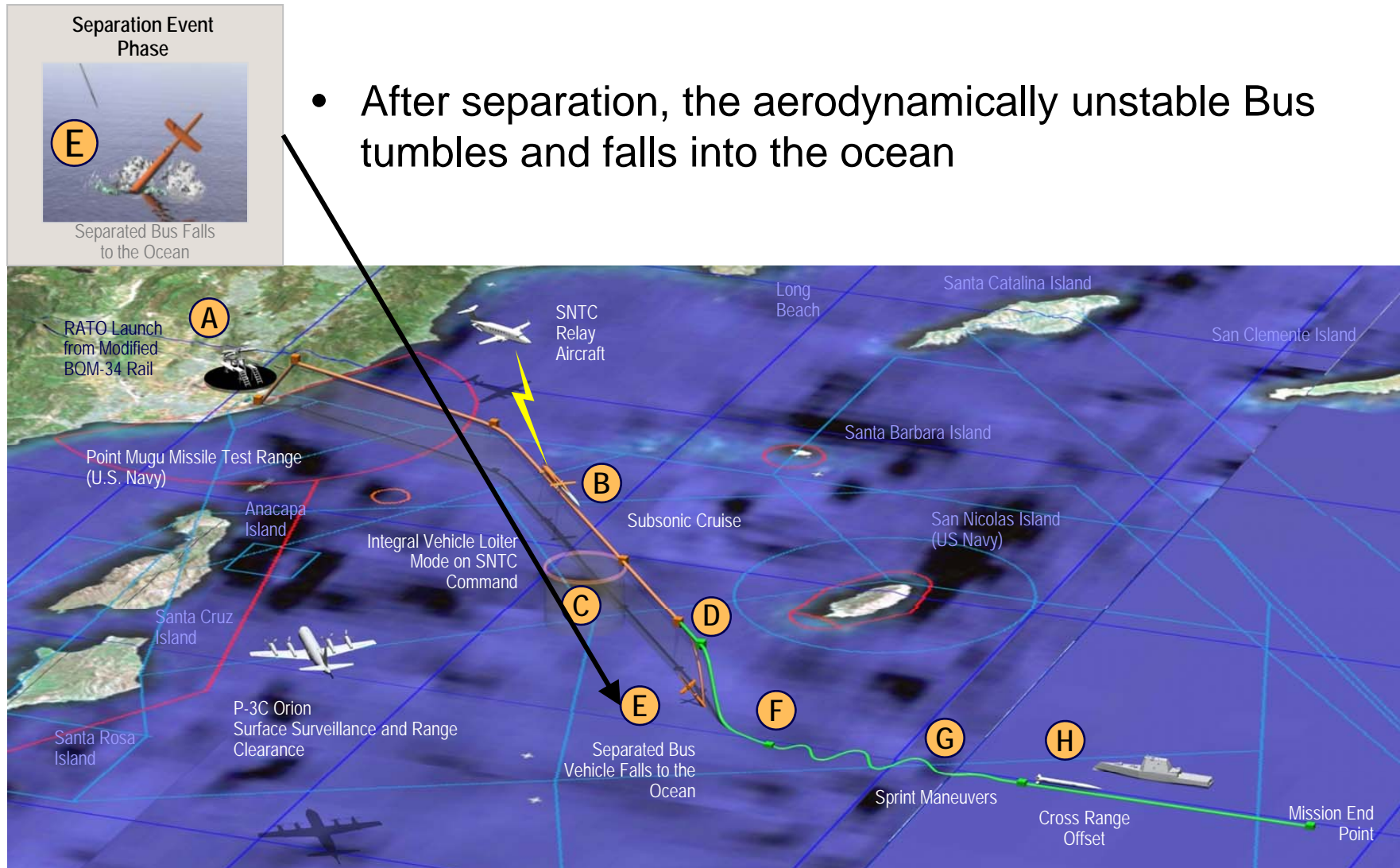
Separation Event Phase

- The Integral Vehicle separates into the aft Bus and Sprint vehicles when the separation waypoint is achieved or separation is initiated by SNTC



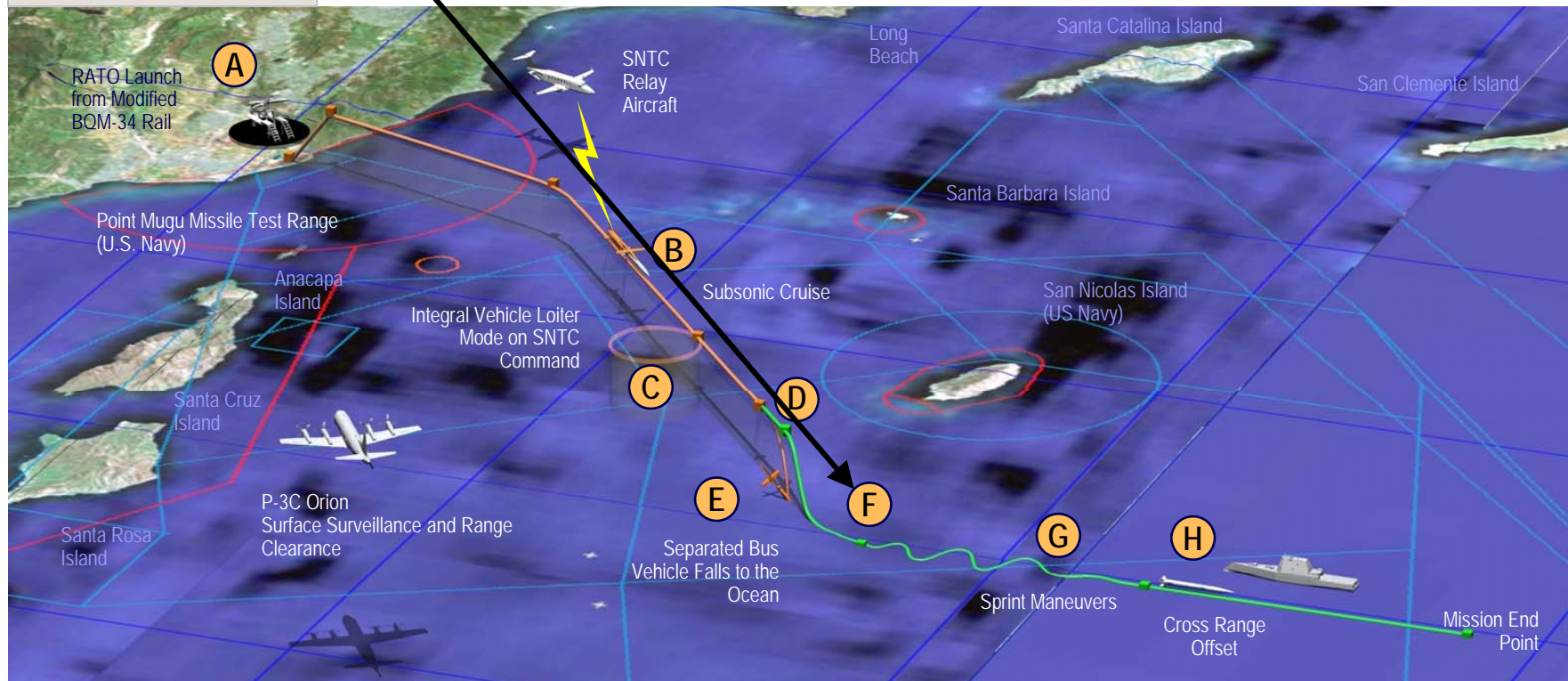
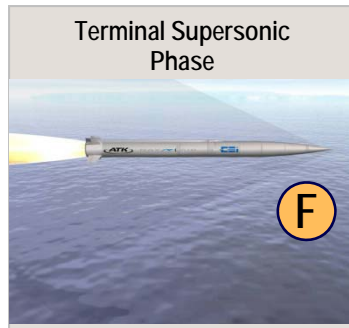
Separation Event Phase Bus Falls Into Ocean

- After separation, the aerodynamically unstable Bus tumbles and falls into the ocean



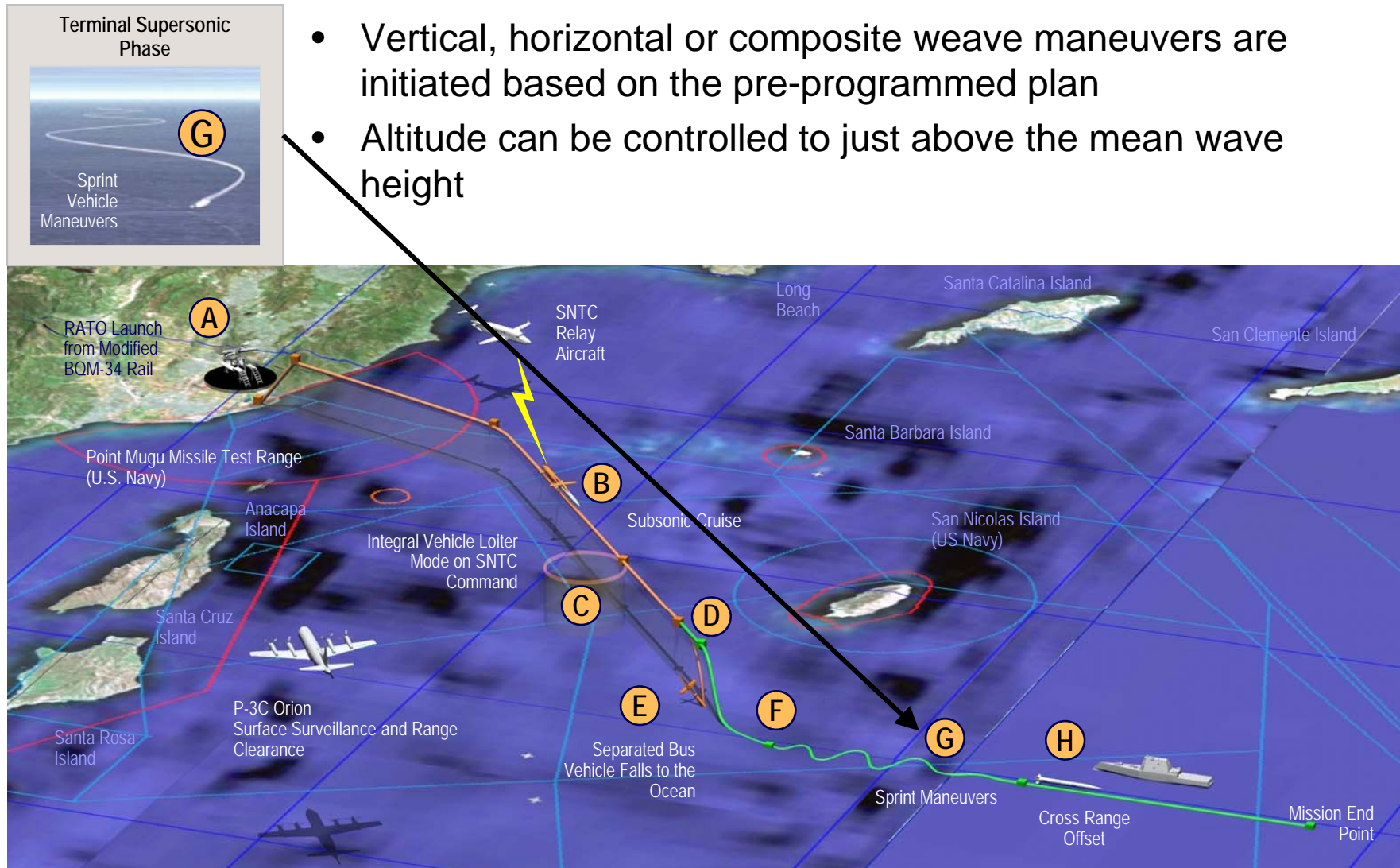
Terminal Supersonic Phase

- The Sprint Vehicle ignites a solid rocket motor after separation and accelerates the vehicle up to Mach 3.5
- Waypoint guidance based on mission events controls the vehicle and initiates climbs, dives or maneuvers



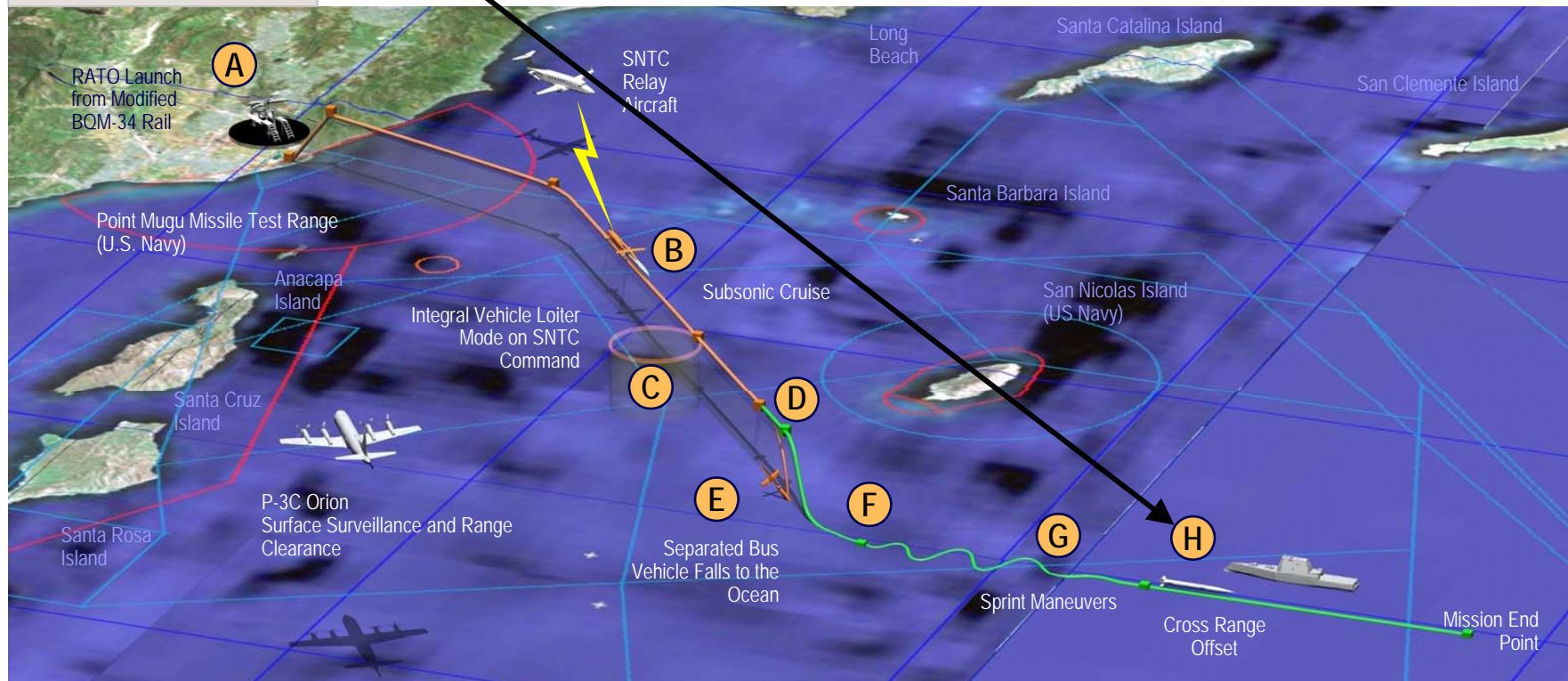
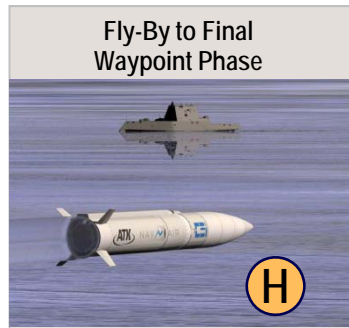
Terminal Supersonic Phase Sprint Vehicle Maneuvers

- Vertical, horizontal or composite weave maneuvers are initiated based on the pre-programmed plan
- Altitude can be controlled to just above the mean wave height



Fly-By to Final Waypoint Phase

- Terminal guidance performs a fly-by of the operating ship to within nominal offset objective location

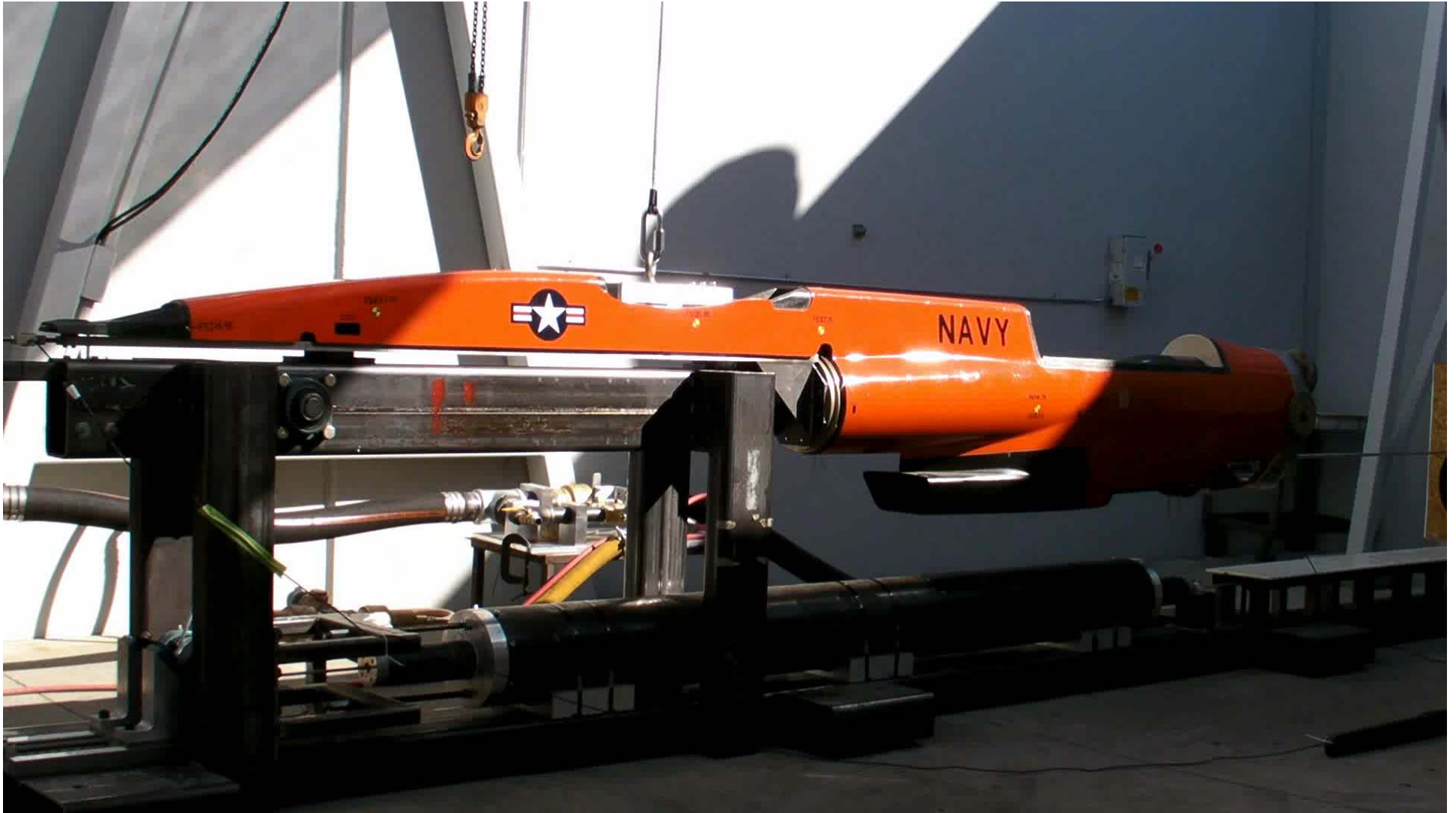


MSST EEU2 on Launch Rail - 01 October 2010



A premier aerospace and defense company





MSST 50 PSI Separation Test.avi



MSST 70 PSI Separation Test.avi

MSST Growth Opportunities



A premier aerospace and defense company

- Introduction of MSST system to additional domestic and international markets
- Replace higher cost supersonic threat simulators with lower cost MSST
- Growth of MSST from the T&E requirement to a more robust operational target
- The MSST program performance is projected to meet or exceed all U.S. Navy objective values
- ATK, working with the US Government, is planning to make MSST available for export on a case by case basis
 - International customer requirements align with the US Navy
 - Specific customer requirements can be incorporated into the MSST flight profile
 - Additional MSST quantities favor follow on customers
 - Reduced Risk
 - In production pricing
- Expansion of launch locations beyond Pt. Mugu
 - Better serves DoD & international customers

Questions



A premier aerospace and defense company

