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Multi-Stage Supersonic Target (MSST)

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

• 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

• 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
• 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
• 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
• 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)

• 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

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
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
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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 50 PSI Separation Test.avi
MSST Growth Opportunities

• 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