U.S. Army TMO’s Towed Targets Program

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Briefer:
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FALSE IMPRESSION CAVEAT

It should be explicitly noted that the U.S. Government makes no official commitment nor obligation to provide any additional detailed information or an agreement of sale on any of the systems/capabilities portrayed during this presentation that have not been authorized for release.
OUTLINE

• Towed Target Platforms (droned/manned)
• Various Towed Targets
• TMO Towed Target Simulation Capabilities
• R&D Efforts
• Future Efforts
• Summary
Towed Targets can inexpensively emulate airborne threats

TMO has a “basket” of various towed targets

Performance envelope very similar to drone or aircraft towed from (except Gs)

Less Costly Acquisition & Tracking Testing

Less Costly Live-Fire Testing/Training (typically ≤ 1/25th cost of towing drone)

TMO has in-house/ and contract capability to design/fab prototype towed targets to meet customer testing requirements.
Typical TMO MQM-107 Tow Target Mission

MQM-107 on launch with tows under wing stations

MQM-107 deploys tow target while en-route to hot leg

AGT tow fully deployed (ready for live-fire).

MQM-107 parachute recovery
Manned Aircraft Towing Platforms

Manned Aircraft used during developmental flight testing
(not used during live-fire)

RM-30B Reeling Machine

Cruise Missile Tow Target deploying from F-16/RM-30

Lear 36 during development of TAPS

T-38 during development of JCHAAT
(simulates MQM-107 type launch)
TMO Towed Targets

- Snatch Banner
- TRX-4A
- CMTT
- JCHAAT
- Aerial Gunnery Tow
- Sphere Tow
- POTA-Tow
- RRTT
- TIX-4 (3 versions)
- TIX-MARS-888
Simulations

MISSILE DATCOM
Aerodynamic prediction code. Input the Geometry of the flight vehicle, body configuration, surface roughness Control surfaces, etc. Output is aero coefficients and derivatives, center of pressure, etc.

CBAS
Cable Body Aero Simulation: Computes the dynamic motions of a tow body and tow cable behind the towing aircraft, given the dynamic movement of the towing aircraft.

CBAS- Jr
Cable Body Aero Simulation: Static version used for “steady state” flight. Easy to use, (XCEL version). Predicts towline tension, angle, droop, etc.

XPATCH
Enter tow target geometry and materials, predicts RCS signature as a function of frequency, polarization & aspect angle.
Static Droop/Tension Plot From CBAS

GENERIC TOW TARGET (80 lbs),
1.5 & 2.0 Miles of 0.085" Zylon Cable

Droop (ft)

Tension (lbs)

Velocity (Kias)
CBAS Predicted vs Actual Flight Data

6 FIN CMTT Rad Alt (CBAS updated w/flt data): DROOP AND TENSION
2 Miles (10,560’) of 0.085” Zylon Line, 76.2 lb Tow
CNc = 0.003232*KIAS + 1.503794
CTc = 0.000044*KIAS + 0.030162

Droop

Tension

DROOP, FT ~ TENSION, LB

KIAS
CBAS Predicted vs Actual Flight Data

JCHAAT Cable Shape With KIAS;
320 m 0.085 Zylon Cable

- Droop, 250
- Droop, 300
- Droop, 350
- Droop, 400

Cable Angle @ A/C
KIAS=250, 3.04 deg
KIAS=300, 2.43 deg
KIAS=350, 2.05 deg
KIAS=400, 1.80 deg
CMTT Rad Alt, Weaves at 15, 30, and 45 deg Bank Angle
10560' of 0.085" Zylon Line, 5,000' MSL, 275 KIAS
Cross Range vs. Down Range Distance

Tow jet flight path is straight and level for 20 seconds, then complete 3 weaves, then straight and level for 100 seconds.
Which nose-cone provides the best signature for my application?

What is the RCS of each nose-cone?

What should the nose look like as part of my signature budget?

- Use RCS prediction codes to prototype target parts prior to fabrication
  - Xpatch
    - DoD state-of-the-art code
    - High frequency
    - Based on Physical Optics and Shoot-and-Bounce Ray Theory
  - Generate RCS as a function of look-angle
  - Analyze scattering features
  - Coordinate RCS requirements with aerodynamic design and manufacturing trade-offs
TMO R&D Efforts
Tow Reel on Manned AC

AT-38 with MQM-107 Tow Launcher

RM-30B tow reel integration
40th FLTS, Eglin
Recent/ Ongoing Developmental Efforts

Reduced Radar Tow Target (RRTT)
Magnetic Tow Launcher
Low Observable Instrumented Tow (LOIT) – USAF funded
Towed Airborne Plume Simulator (TAPS) – USAF funded
Camera Kit for Two-way Tow Reel
MQM-107 Tow Test Bed
Onboard Video Camera for Tow Reel

Video Camera fits on nose of launcher

Onboard Monitor

Tow Capture Video
Tow GPS Efforts

High Accuracy GPS Data Logger

Installed in Tow Target

Tow/GPS under wing of launcher

Over water flight testing
GPS Accuracy Testing
Holloman AFB, NM

Holloman Test December 2008 Comparison Results
Mission 2 (Sortie 1 - December 17)
Position Errors for Reprocessed Data
Relative to Holloman Reference Data
Base Time = GPS: 327277.6235 seconds / Holloman UTC: 68063.6235 seconds

X,Y,Z Accuracy vs Truth Position Data
Magnetic Tow Launcher Testing
MQM-107 Tow Test Bed

Total Weight: 145 1/2 lbs.

MQM-107 Nose Cone
MQM-107 Mid Nose, Comm. & Avionics
MQM-107 Aft Nose, Battery, Antennas & Payloads
Transition Ring
MQM-107 Aft Nose, empty or ballasted
Mid Nose, empty or ballasted
Add Fins
Tail Cone
= Nose Cone
Towed Airborne Plume Simulator (TAPS)

Support to Center for Countermeasures (CCM)
Radar Cross Section (RCS) Measurement at Pt. Mugu
ALL TMO TOWED TARGETS HAVE BEEN MEASURED AT MUGU
X-Target RCS (plotted in M^2)

Radar Cross Section (m^2)

Azimuth (deg)

- Roll: 0
- Tilt: 0
- Pitch: 0
- Pol: HH
- Freq: 15.02
- Avg Start: 14
- Avg Stop: 16
- Avg BW: 2
- Window: 10
- Slide: 5
- Start Az: -40
- Stop Az: 45
- Mean: 36.5415
- St. Dev.: 5.68588
- Max: 43.0823
- Min: 21.7052
Cruise Missile Tow Target (CMTT)

**DESCRIPTION**
- TOWED BY F-16 OR T-38 FOR SEARCH/TRACK MISSION. TOWED BY MQM-107 FOR SEARCH/TRACK/LIVE-FIRE.
- TOWED ON 5700 FEET OF RADAR TRANSPARENT .065” DIAMETER “ZYLON” TOWLINE
- LOW RADAR CROSS SECTION
- CAPABLE OF AIRSPEEDS UP TO 450 KNOTS
- CAPABLE OF ALTITUDES AS LOW AS 175 FEET ABOVE THE GROUND
- DEVELOPED BY TMO

**FUNCTIONAL DATA**

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<td><strong>LENGTH</strong></td>
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| **WEIGHT**  | 60 POUNDS FOR MANNED AIRCRAFT VERSION  
76 POUNDS FOR DRONED VERSION |
| **MATERIALS** | ALUMINUM FUSELAGE  
POLYSTYRENE FINS & TAILCONE |
| **TOWLINE** | .065” DIAMETER (15X1000 BRAID) ZYLON |
| **ALTITUDE** | DROOP UNDER TOWING CRAFT VERIFIED AS FUNCTION OF AIRSPEED/MACH NUMBER |
| **RADAR CROSS SECTION** | MEASURED FROM 2-18 GHz |
Future Potential R&D Efforts

Glide Tow

Height Keeping Tow
Summary

- TMO can develop “user specific” tow targets
- Low Radar Cross Sections can be achieved
- Tow Targets save money
Interested in Tow Target Support?

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