



TMO

Targets Management Office

U.S. Army TMO's Towed Targets Program

47th Annual Targets, UAVs and
Range Operations Symposium
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Briefer:
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PM-ITTS

A collage of military-related images is located in the top left corner. It includes an American flag, a tank, a red fighter jet, and a soldier in camouflage gear holding a rifle. The background of the slide is a light-colored map of the United States.

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

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- 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 $\leq 1/25^{\text{th}}$ 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

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MQM-107 on launch with tows under wing stations



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



Internal tow reel assy

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



TRX-4A Deployment

MQM-107 parachute recovery



Manned Aircraft Towing Platforms

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



RM-30B Reeling Machine



Lear 36 during development of TAPS



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



**T-38 during development of JCHAAT
(simulates MQM-107 type launch)**

TMO Towed Targets

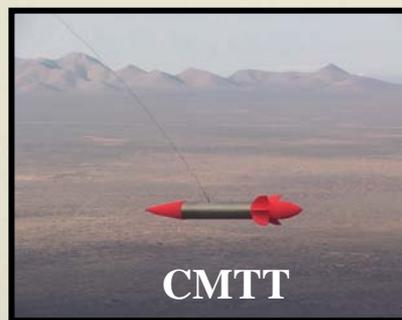
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Snatch Banner



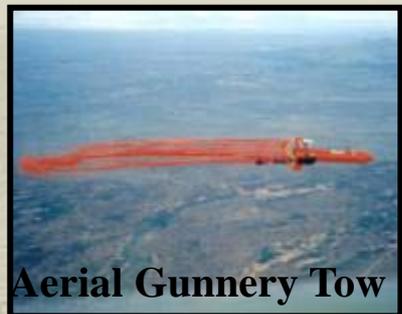
TRX-4A



CMTT



JCHAAT



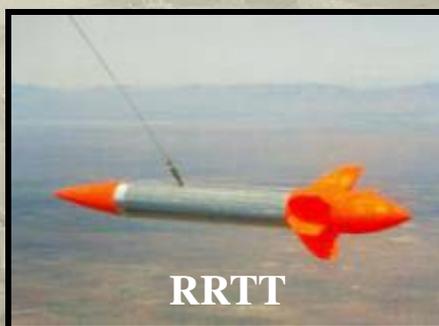
Aerial Gunnery Tow



Sphere Tow



POTA-Tow



RRTT



TIX-4 (3 versions)



TIX-MARS-888



MISSILE DATCOM

Aerodynamic prediction code. Input the Geometry of the flight vehicle, body configuration, surface roughness Control surfaces, etc.....out put 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.

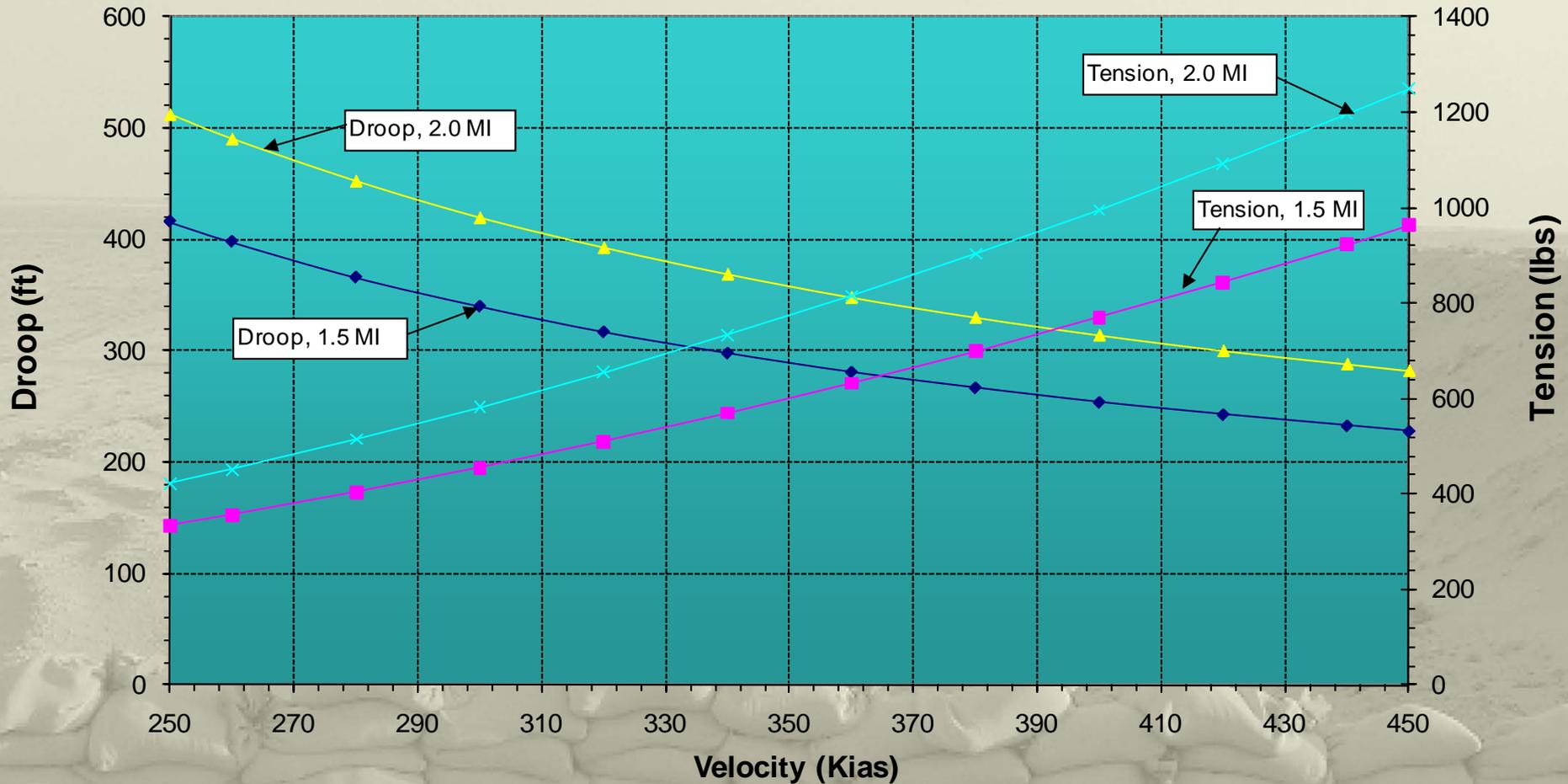
XPATCH

Enter tow target geometry and materials, predicts RCS signature as a function of frequency, polarization & and aspect angle.

Static Droop/Tension Plot From CBAS

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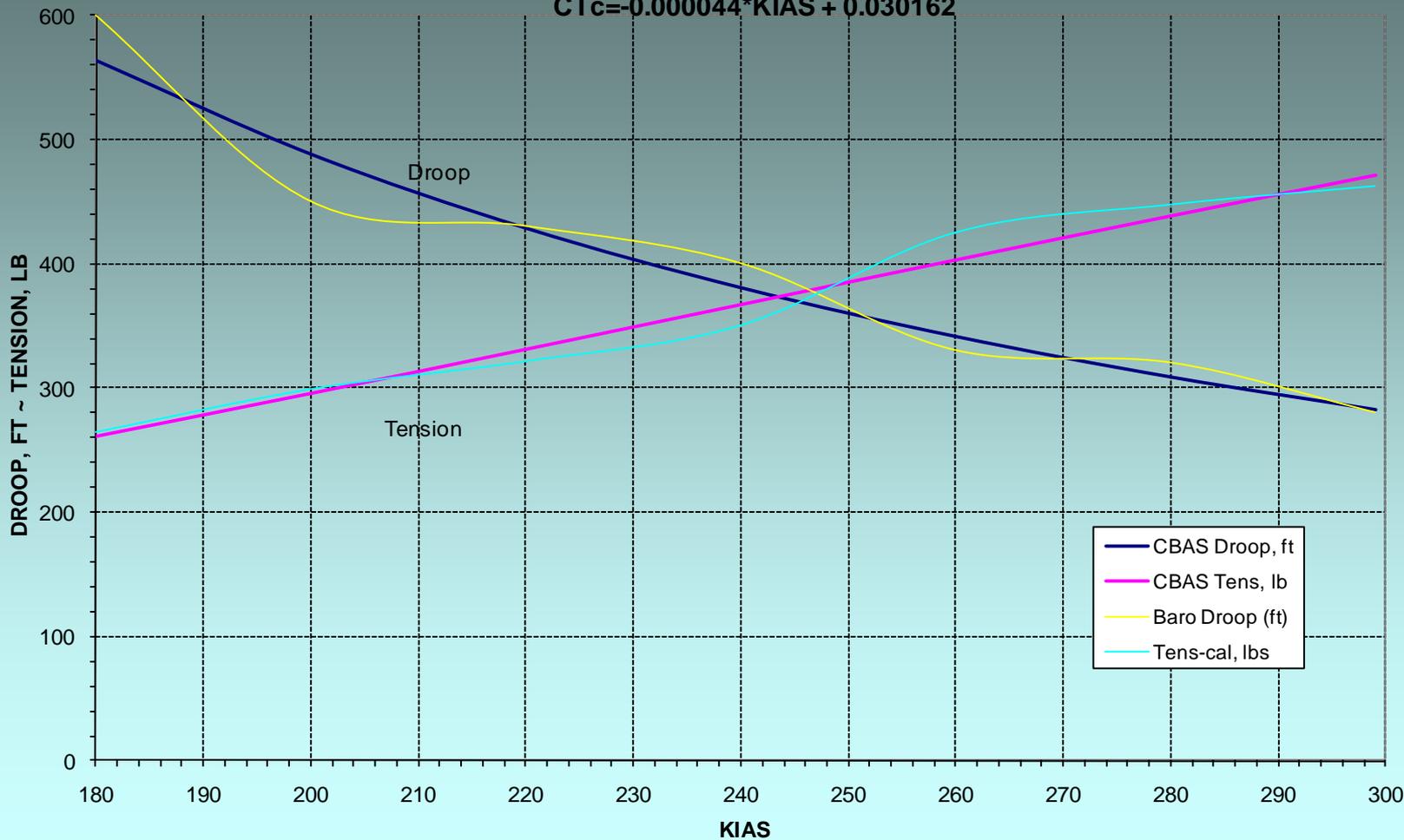
**GENERIC TOW TARGET (80 lbs),
1.5 & 2.0 Miles of 0.085" Zylon Cable**



CBAS Predicted vs Actual Flight Data

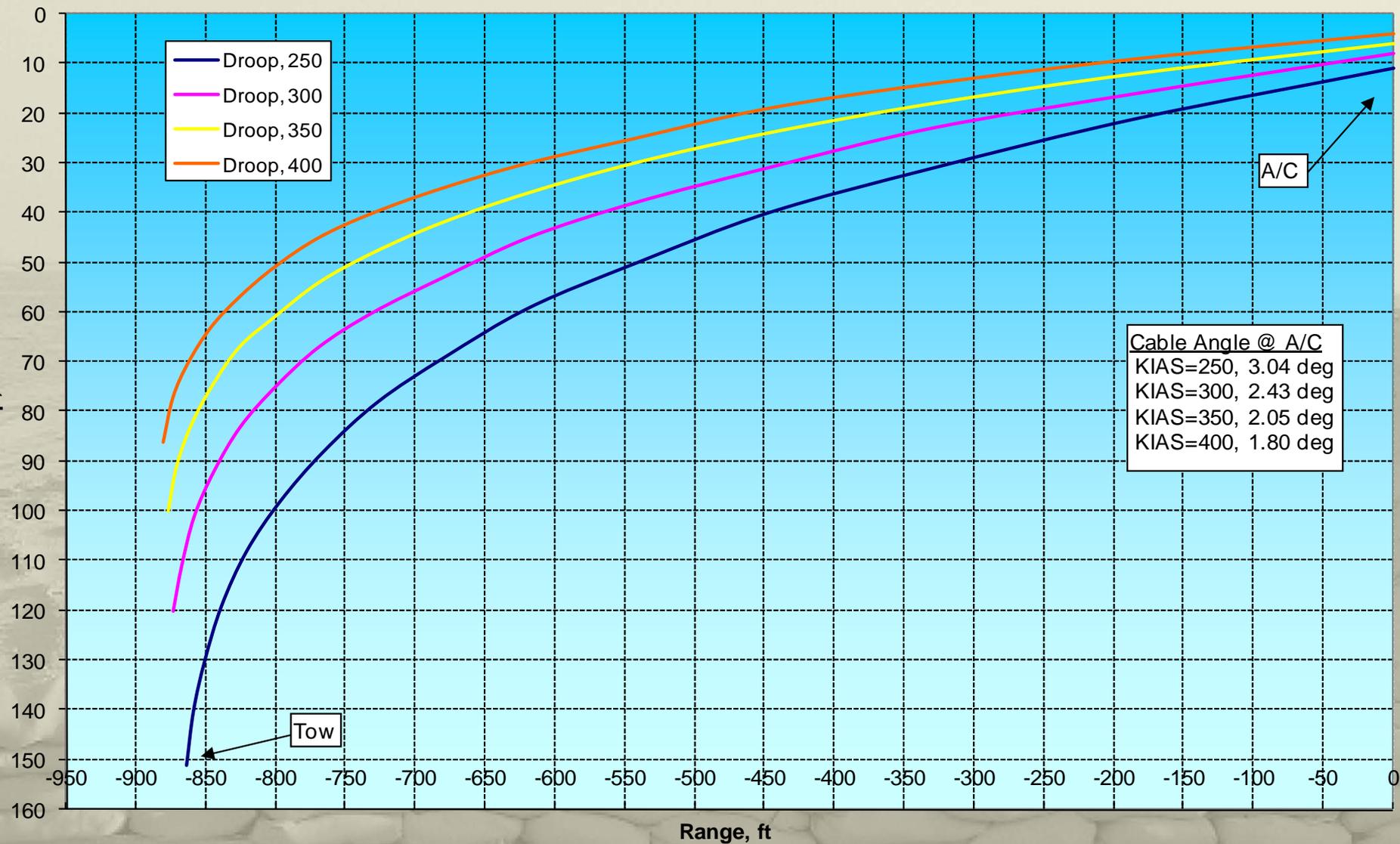


6 FIN CMTT Rad Alt (CBAS updated w/flt data): DROOP AND TENSION
2 Miles (10,560') of 0.085" Zylon Line, 76.2 lb Tow
CNC= 0.003232*KIAS + 1.503794
CTc=-0.000044*KIAS + 0.030162



CBAS Predicted vs Actual Flight Data

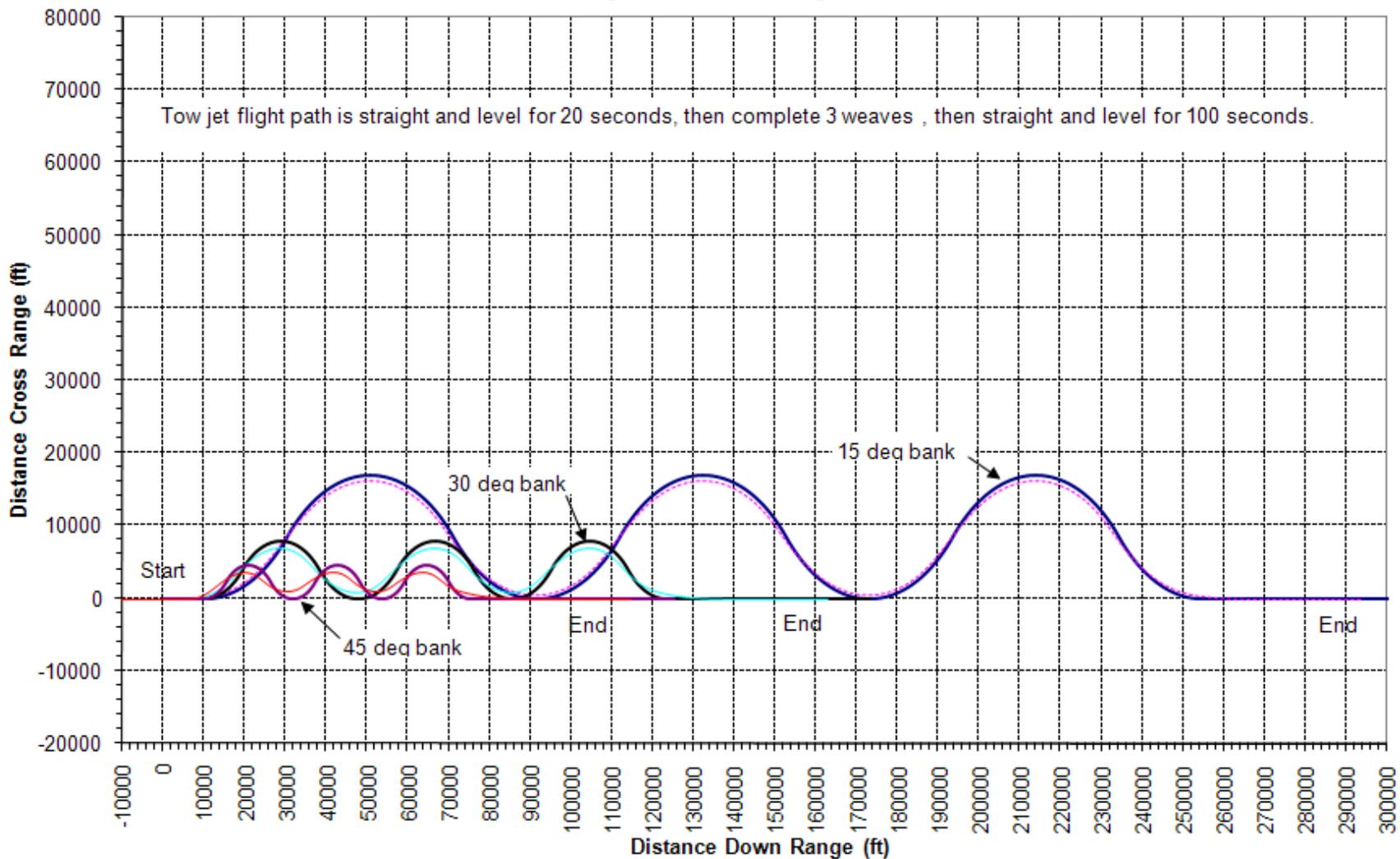
JCHAAT Cable Shape With KIAS;
320 m 0.085 Zylon Cable



CBAS Sr. Dynamic Prediction Code

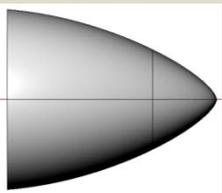
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CMTT Rad Alt, Weaves at 15, 30, and 45 deg Bank Angle
10560' of 0.085" Zylon Line, 5,000' MSL, 275 KIAS
Cross Range vs. Down Range Distance



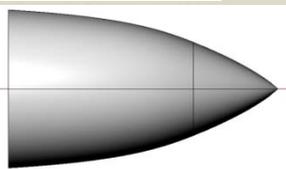
X-Patch RCS Signature Prediction Code

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Which nose-cone provides the best signature for my application?

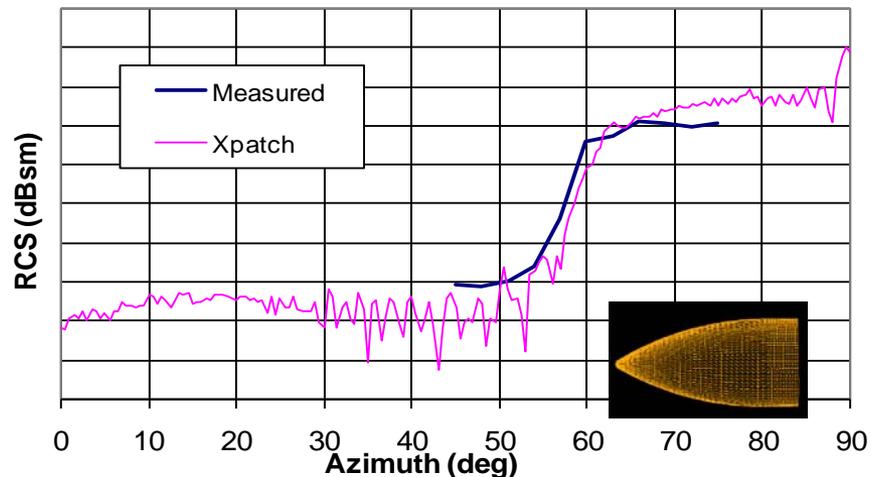
What is the RCS of each nose-cone?



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

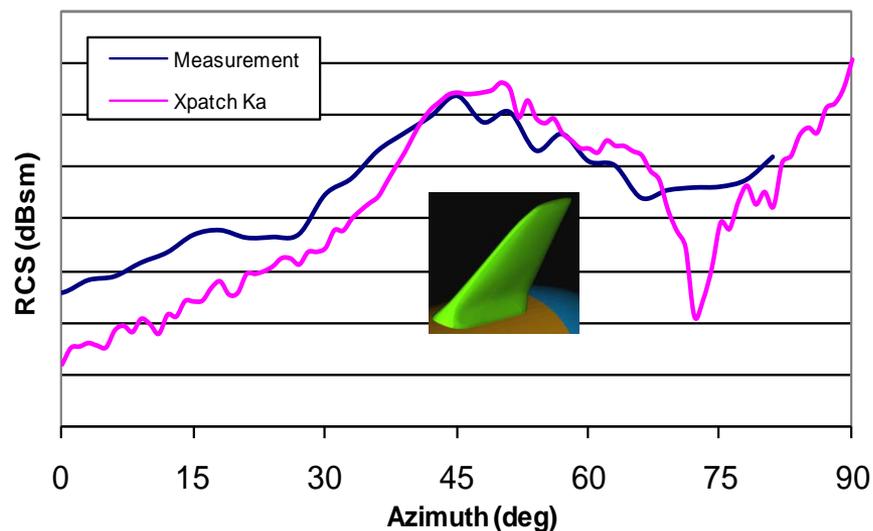
- Use RCS prediction codes to prototype target parts prior to fabrication
- Xpatch
 - DoD state-of-the-art code
 - High frequency
 - Based on Physical Optics and Shoot-and-Bounce Ray Theory
- Generate RCS as a function of look-angle
- Analyze scattering features
- Coordinate RCS requirements with aerodynamic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

Xpatch Nose Design and Analysis



Ka-band Fin Analysis: Xpatch vs. Measurement

0 degree Roll Orientation



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TMO R&D Efforts



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Tow Reel on Manned AC

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AT-38 with MQM-107 Tow Launcher



**RM-30B tow reel integration
40th FLTS, Eglin**



Recent/ Ongoing Developmental Efforts

Reduced Radar Tow Target (RRTT)

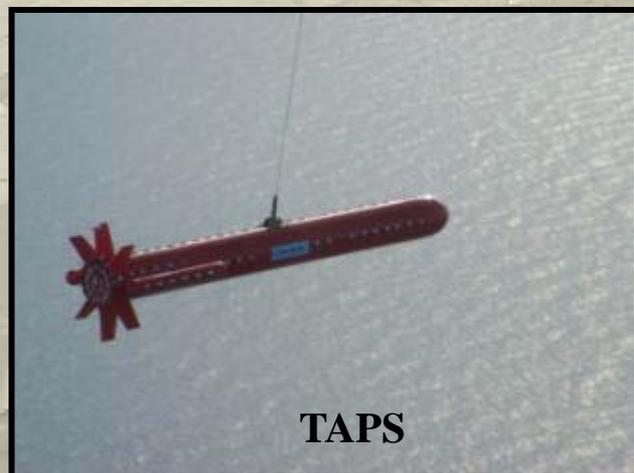
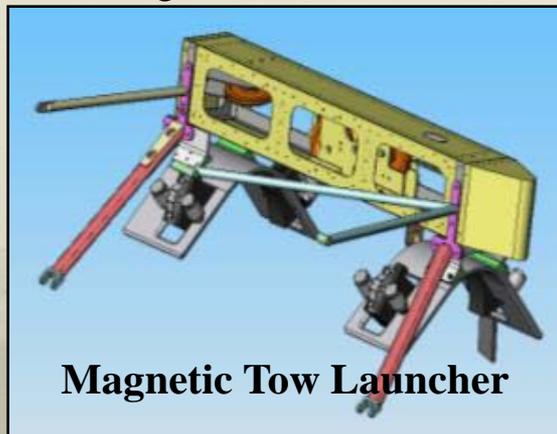
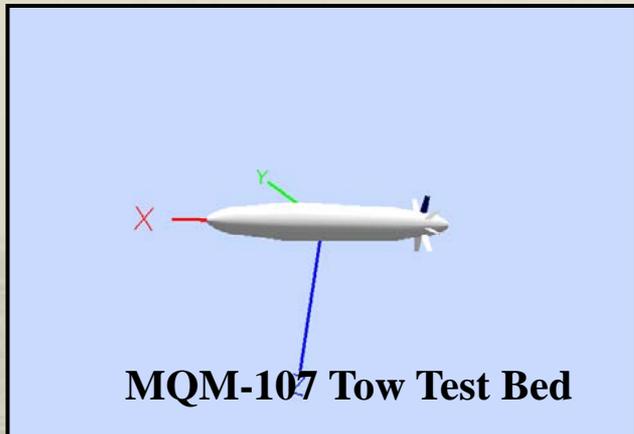
Magnetic Tow Launcher

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



Radar Altimeter Tow Target Flight Test

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Onboard Video Camera for Tow Reel

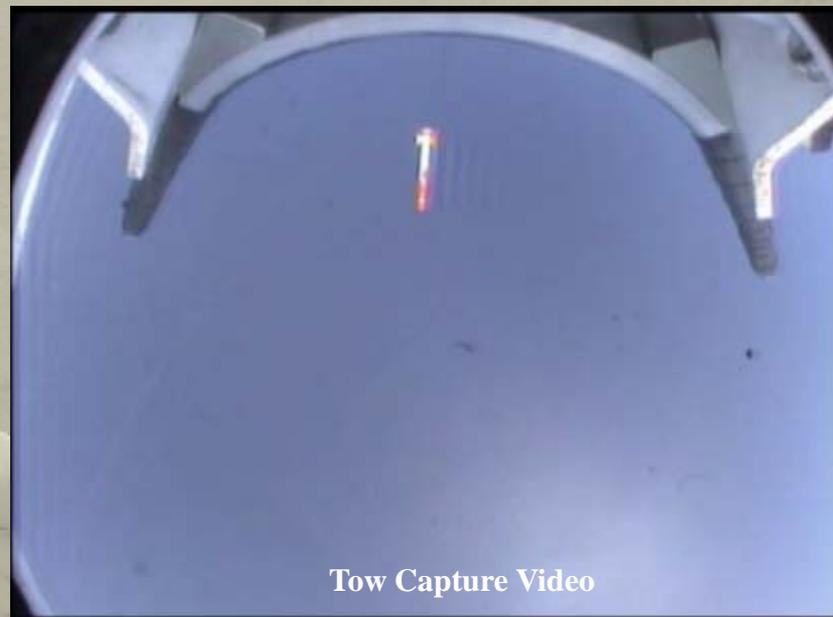
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Video Camera fits on nose of launcher



Onboard Monitor



Tow Capture Video

Tow GPS Efforts

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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

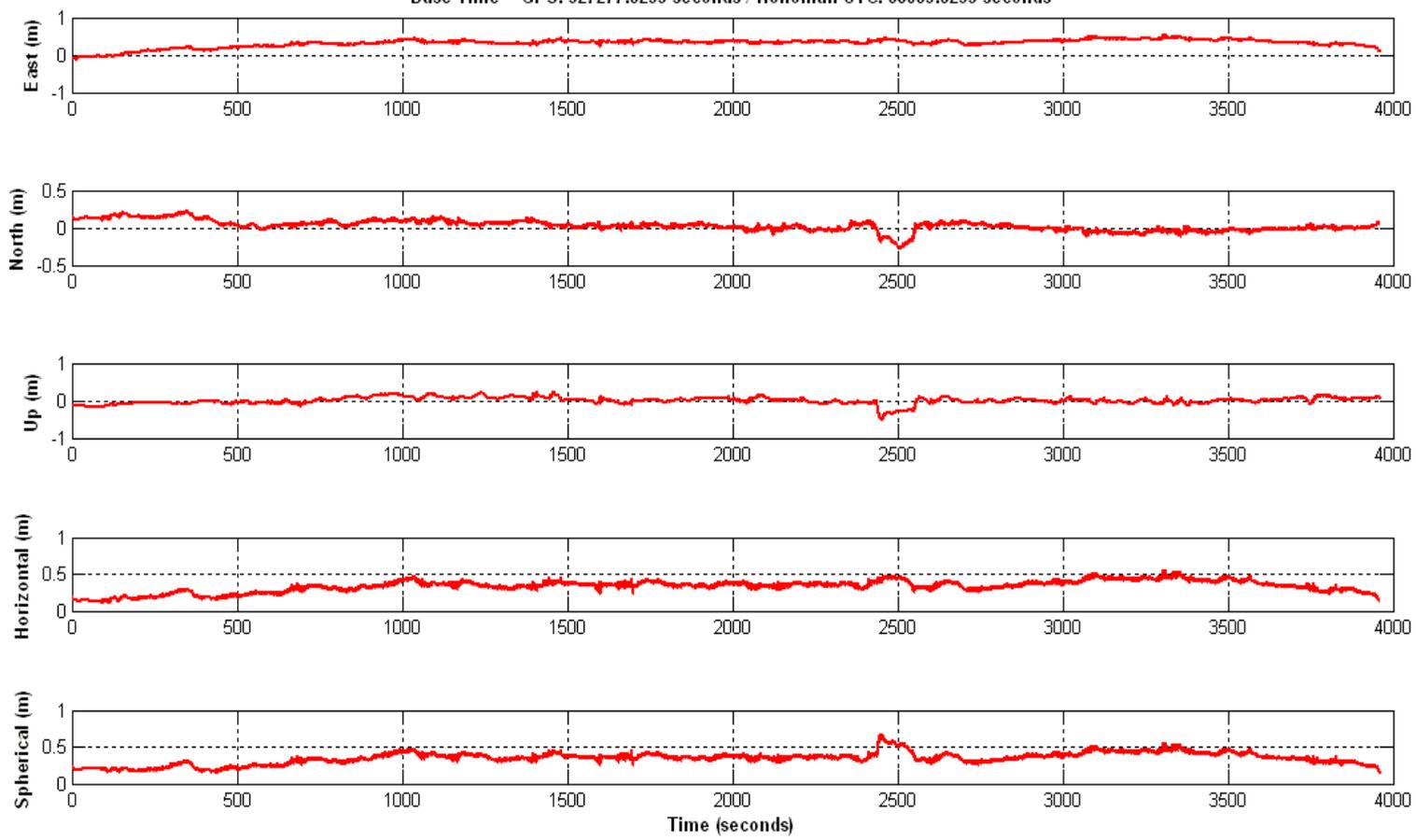
Holloman Test December 2008 Comparison Results

Mission 2 (Sortie 1 - December 17)

Position Errors for Reprocessed Data

Relative to Holloman Reference Data

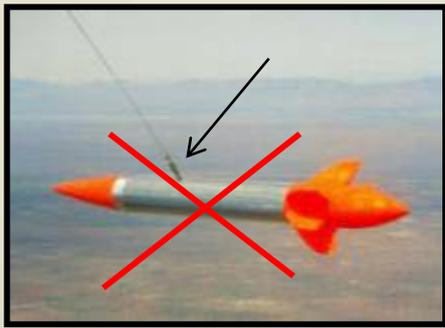
Base Time = GPS: 327277.6235 seconds / Holloman UTC: 68063.6235 seconds



X,Y,Z Accuracy vs Truth Position Data

Magnetic Tow Launcher Testing

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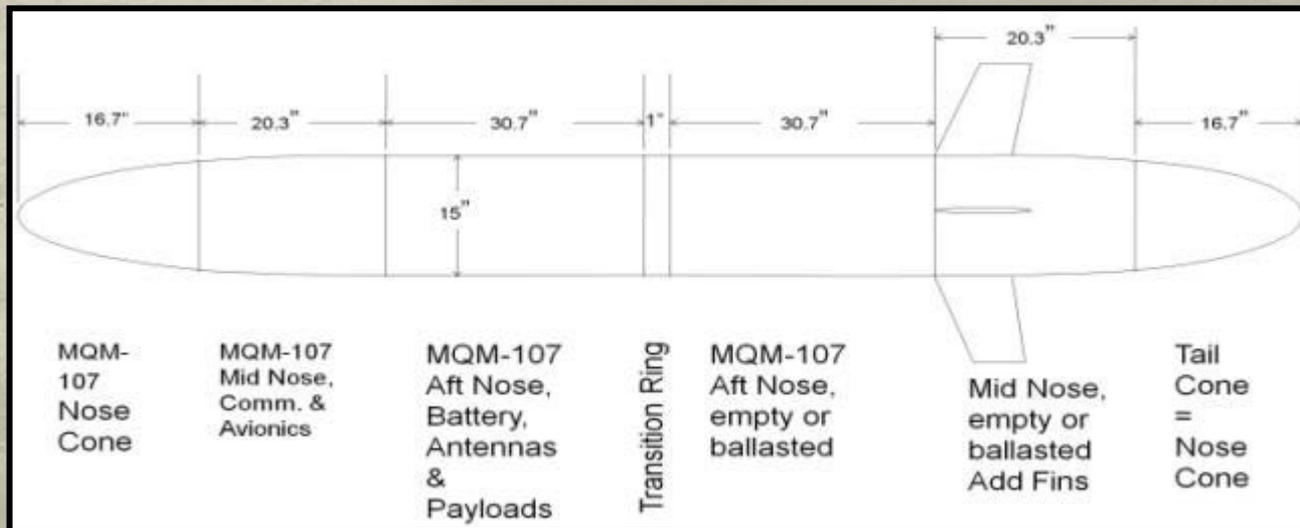
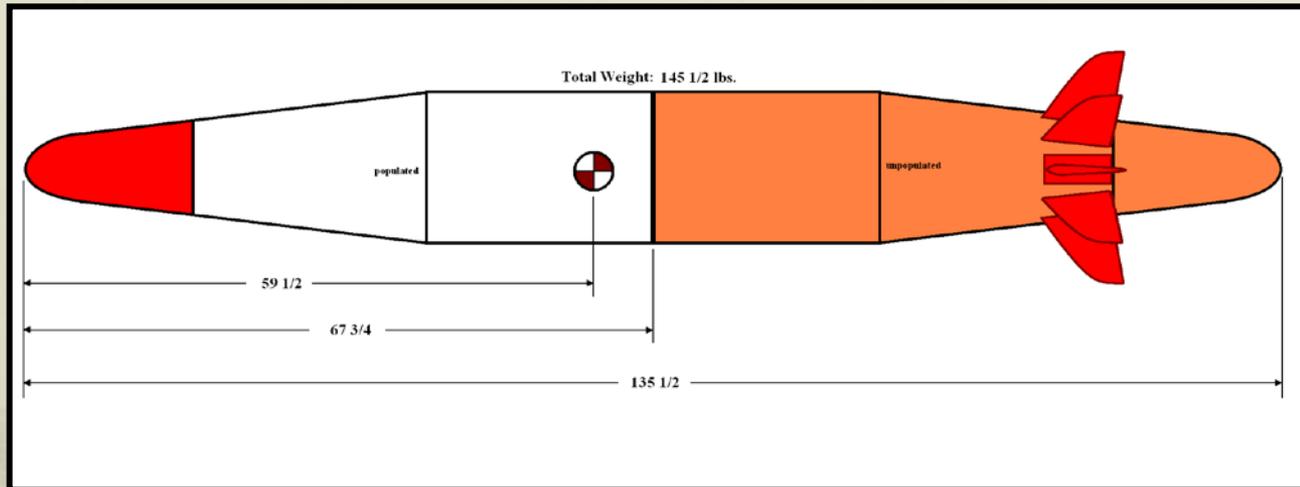




1st Deploy

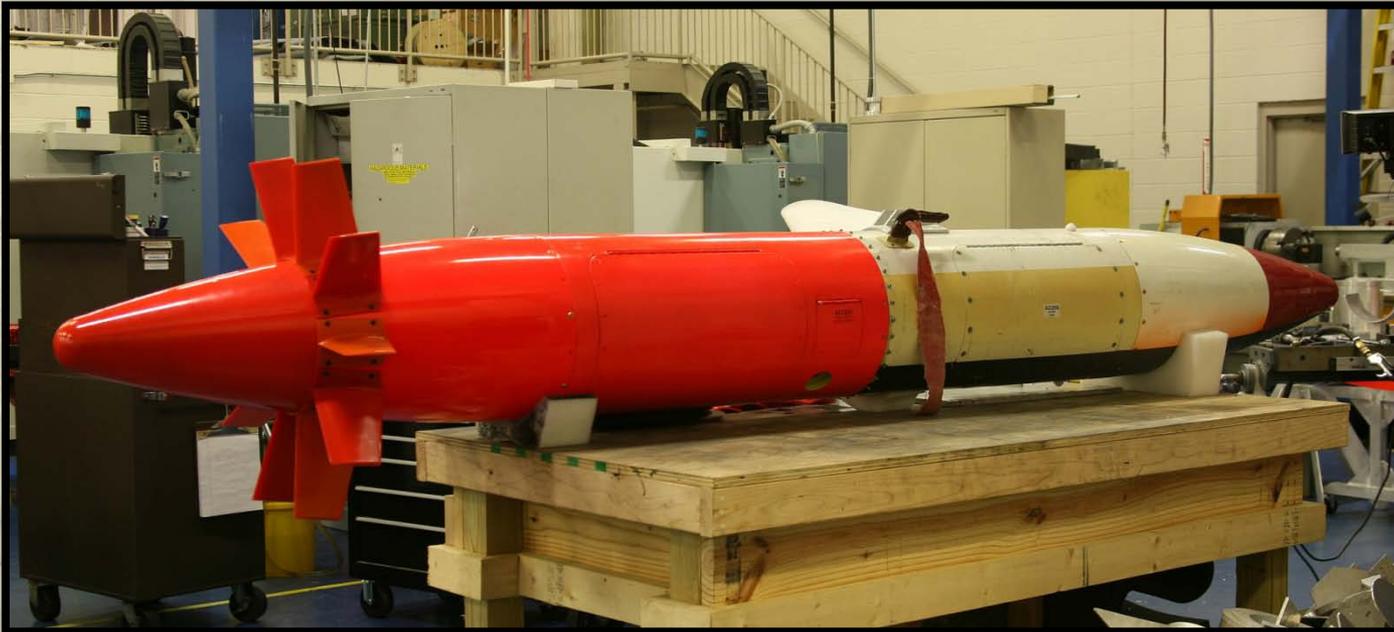
MQM-107 Tow Test Bed

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MQM-107 Tow Test Bed

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Towed Airborne Plume Simulator (TAPS)

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Support to Center for Countermeasures (CCM)



Tandem Towed Targets

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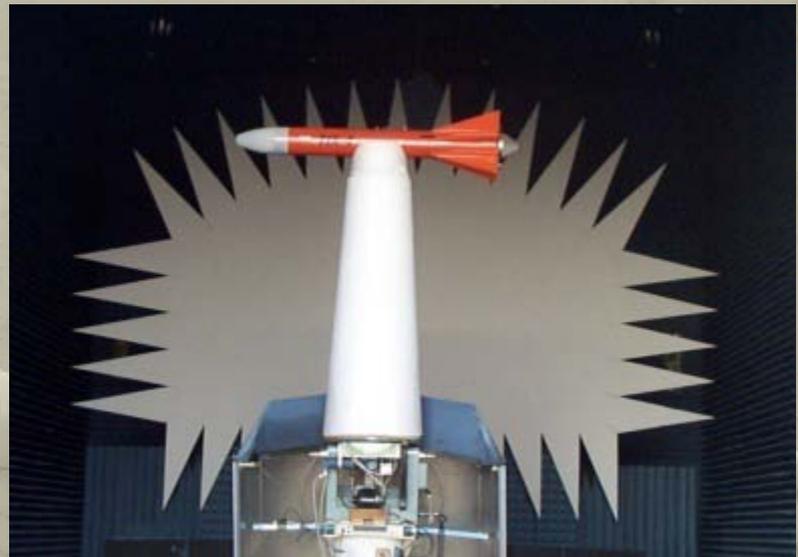
Tandem Towed Targets

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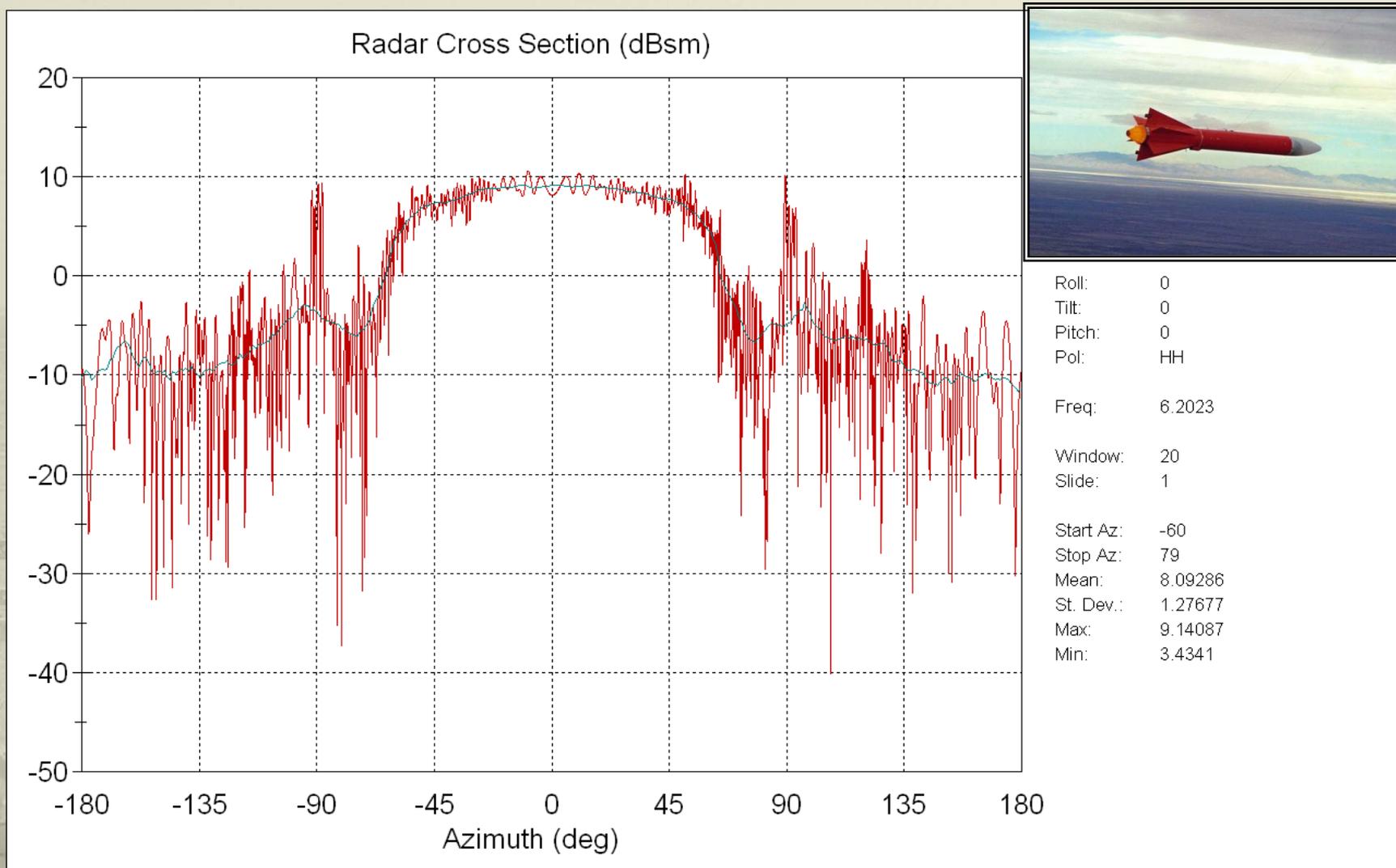
Radar Cross Section (RCS) Measurement at Pt. Mugu

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Radar Cross Section (RCS) Sample

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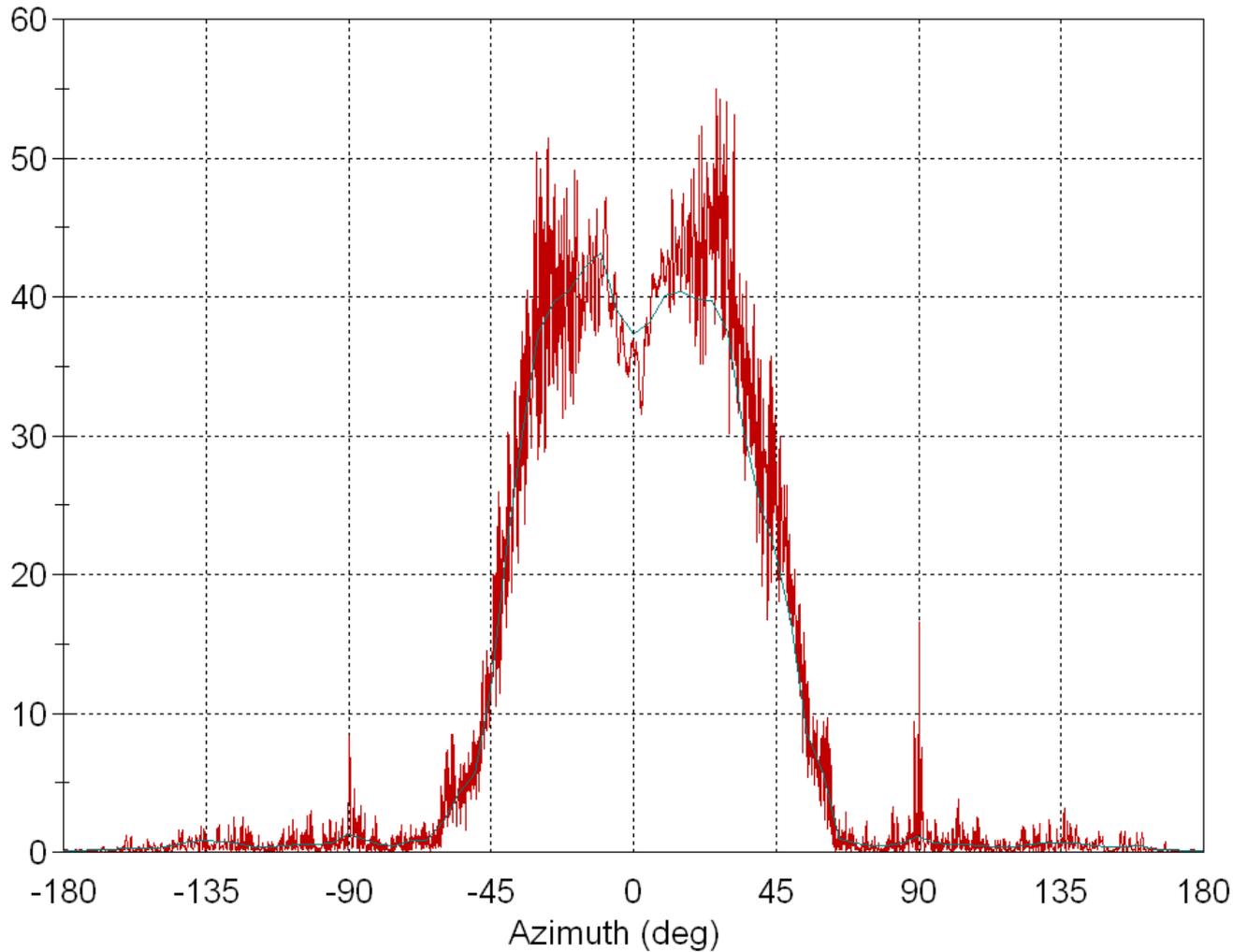


ALL TMO TOWED TARGETS HAVE BEEN MEASURED AT MUGU

X-Target RCS (plotted in M^2)



Radar Cross Section (m^2)



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.: 5.86588
Max: 43.0823
Min: 21.7052

Cruise Missile Tow Target (CMTT)

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Cruise Missile Tow Target

USERS / CUSTOMERS

deleted

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

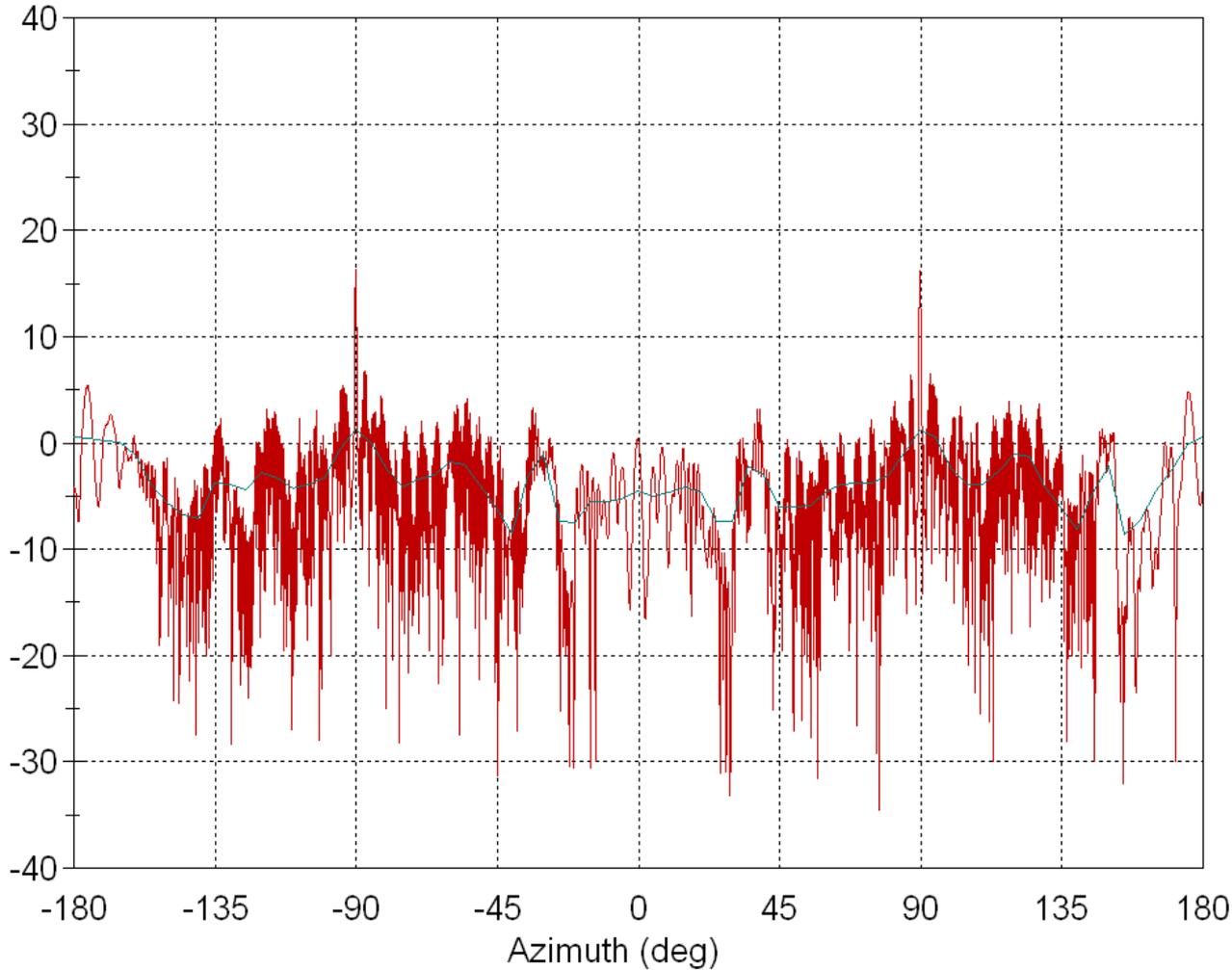
LENGTH	96 INCHES
WEIGHT	60 POUNDS FOR MANNED AIRCRAFT VERSION 76 POUNDS FOR DRONED VERSION
MATERIALS	ALUMINUM FUSELAGE POLYSTYRENE FINS & TAILCONE
TOWLINE	.065" DIAMETER (15X1000 BRAID) ZYLON
ALTITUDE	DROOP UNDER TOWING CRAFT VERIFIED AS FUNCTION OF AIRSPEED/MACH NUMBER
RADAR CROSS SECTION	MEASURED FROM 2-18 GHz

CMTT (7.5 CR) RCS

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Radar Cross Section (dBsm)



File: 02281L11HH.BG801
Date: 08 Oct 2002
Subject: 2000

Configuration:
BL_W_CORNER_REFLECTORS

Roll: 0
Tilt: 0
Pitch: 0
Pol: HH

Freq: 10.0023

Avg Start: 9.0023
Avg Stop: 11.0023
Avg BW: 2

Window: 10
Slide: 5

Start Az: -45
Stop Az: 50
Mean: -4.83128
St. Dev.: 1.91337
Max: -1.1005
Min: -8.54899

Future Potential R&D Efforts

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Glide Tow



Height Keeping Tow

Summary

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- **TMO can develop “user specific” tow targets**
- **Low Radar Cross Sections can be achieved**
- **Tow Targets save money**



Interested in Tow Target Support? **TMO**

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