U. S. ARMY
TARGETS MANAGEMENT OFFICE

GPS-Based Target Control Software Innovations

BRIEFER:

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Background

The Army Targets Management Office, a division of PM for Instrumentation Targets and Threat Simulators, provides target presentations worldwide & provides lifecycle support of aerial and ground targets.

- **Targets**
  - MQM-107D, E, IAP
  - QUH-1 Helicopter.
  - BQM-34
  - MQM-171 (Broadsword)
  - QH-50 Helicopter
  - QAH-1 Helicopter
  - MQM-170 (Outlaw)
  - Mobile Ground Targets

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TTCS Introduction

Background

Original TTCS –Vega Corp.
1976-2004

Next Generation TTCSR –
Micro Systems, Inc.
1989-Present

Current Generation TTCSU –
Micro Systems, Inc.
1998-Present

TTCS

Army's Primary Target Control System for Rotary Wing and Subscale Targets!

Variations

QTY

1- **FIXED SITE**

8- **TRANSPORTABLE SHELTERS**

2- **PORTABLE UNITS**

Configuration

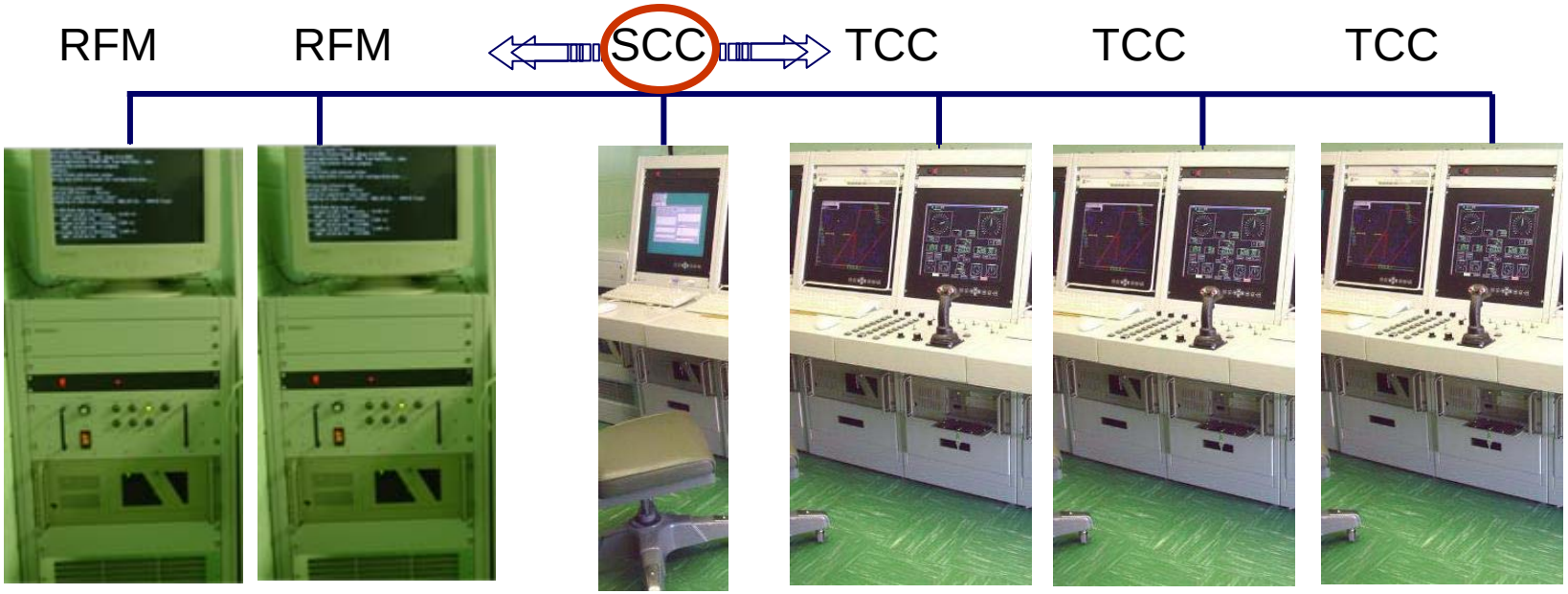
- **System Control Console**
- **Target Control Console**
  - Position Display Subsystem (PDS)
  - Telemetry Display Subsystem (TDS)
  - Trainer/Simulator (Stealth)
- **Radio Frequency Unit**
  - 2 transceiver sections (RFM)

- Based on "Montage" control system developed by MSI.
- Montage is also the basis for the Navy AFWTF control system (decommissioned) and the SNTC.
- Each TTCS Shelter Contains:
  - Two TCCs
  - Two T/S
  - One SCC
  - One RFU
- Each shelter capable of controlling 2 targets.
- Each RFU capable of controlling 4 targets
- Cost effective life cycle.
  - Procurement
  - Maintenance
  - Sustainment
- Faraday shelter (EMI Insulated) protects ground equipment in high EM field environments.

Capabilities

- **System Control Console**
- **Target Control Console**
- **Radio Frequency Unit**

- System Control Console (SCC) is the "Master Coordinator" of the TCS.
- Up to 8 Target Control Consoles (TCC) can be added to a SCC
- Up to 4 Radio Frequency Modules (RFM) can be added to the SCC
- SCC coordinates RF frequency and TCC assignments.



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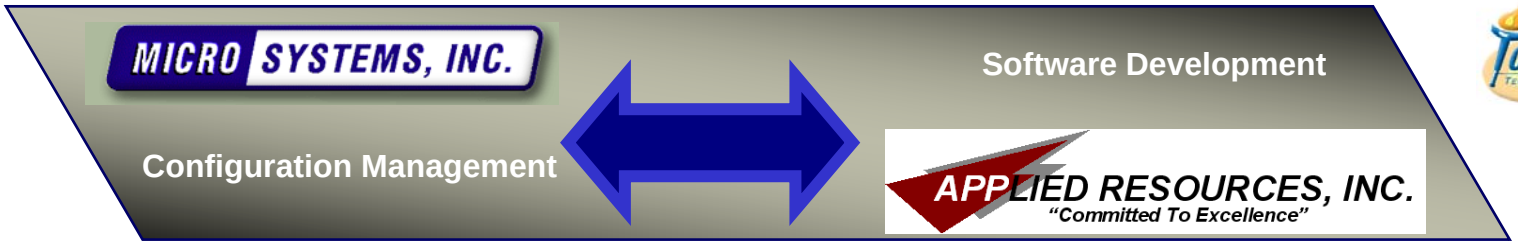
New Target Control Software Tools

Software

- TTCS target control is through joystick, discrete and proportional commands.
  - Very precise value input
  - Ability to follow straight flight track very closely.
  - Flight track in turns is extremely difficult.
- Major capability update to automated control.
  - ***Rabbit Follower (RF).***
  - ***Improved Low Altitude Threat Simulation (ILATS).***
  - ***Autonomous MQM-107IAP.***



Software

- ***Rabbit Follower***
  - Based on DFCS & GRDCS software algorithms and source code.
  - Mission planning upgraded to “point and click” drawing tools.
  - Improvements in tracking errors and throttle handling algorithms.
    - Max cross track error nominally < 100ft.
  - Includes formation offset capability.

Software

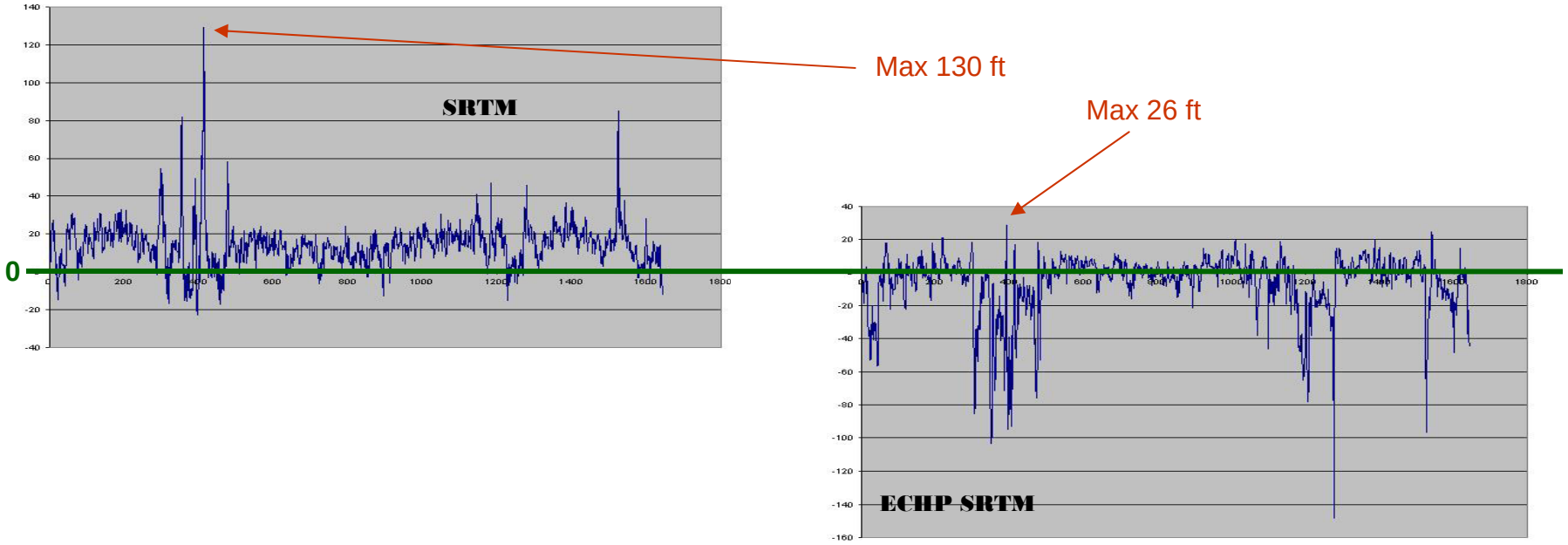
- ***Improved Low Altitude Threat Simulation (ILATS)***
  - Perform low altitude terrain following with or without radar altimeter augmentation.
  - Terrain look-ahead distance settable.
  - Allows use of any of several digital terrain databases.
  - Database information augmented by Ellipsoid and High Point processing.
  - Best performance (simulation) with SRTM data over DTED I / II.
    - DTED Level 1 data are too widely spaced, leaving room for peaks well above the posts.
    - DTED Level 2 data is available but bulky. *(24 Geocells take over 600 MB in RAM.)*
    - SRTM ECHP data is suitably detailed for subscale aircraft missions.
      - Combines Level 2 Information with Level 1 Storage Size
  - Multiple test flights down to 100 feet AGL

Software

- ***Ellipsoid***
  - SRTM & DTED Data are provided as EGM96 referenced data
    - EGM96 is a Standard Geoid
  - The MQM-107 GPS provides position relative to the WGS84 Standard Ellipsoid
    - A table provides EGM96 to WGS84 differences
  - Pre-flight converted files eliminate need for real-time conversion, many times per second

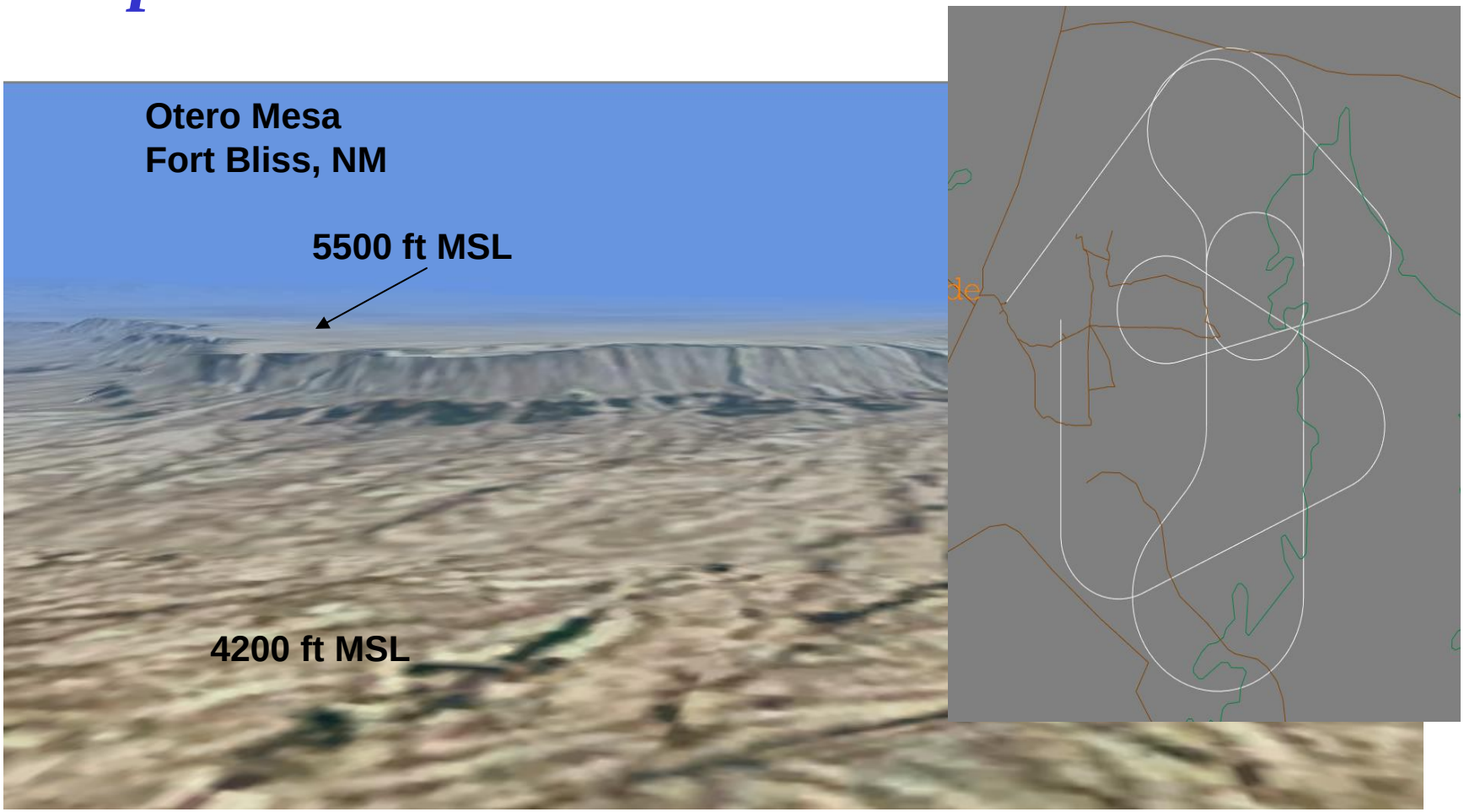
Software

- ## High Point Processing
  - Un-processed DTED1, DTED2, SRTM1 or SRTM2 would drive altitudes up to stay safe.
    - Graphical data shows the differences between terrain clearances computed from GPS altitude and the databases and mission data based on an on-board radar altimeter.
    - Data = Computed – Measured
    - ***Positive Values are dangerous*** (computed values expected greater clearance than reality provided).
    - ***Negative values show we would fly higher than desired.***



Software

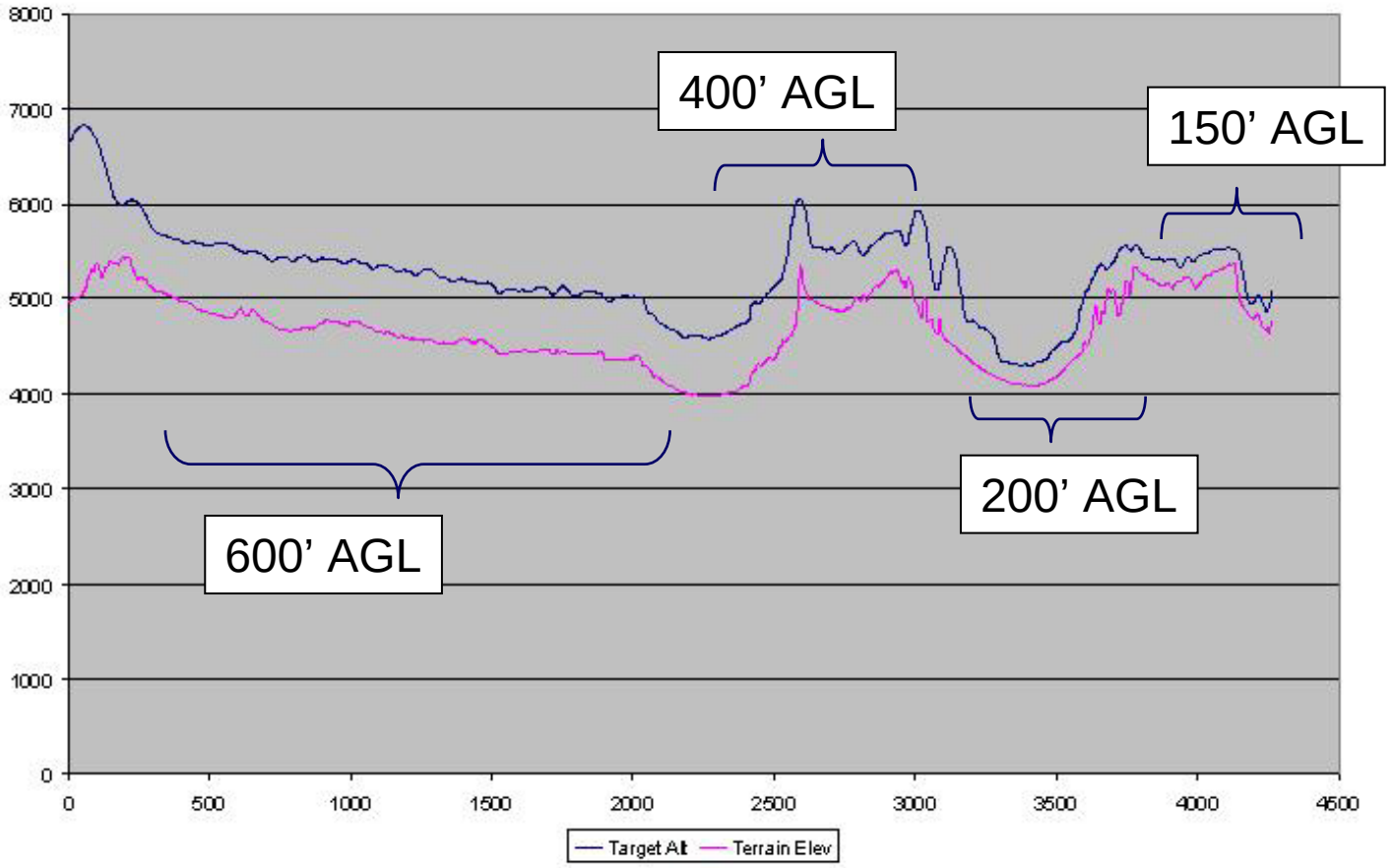
- *Improved Low Altitude Threat Simulation*



Software

• *Improved Low Altitude Threat Simulation*

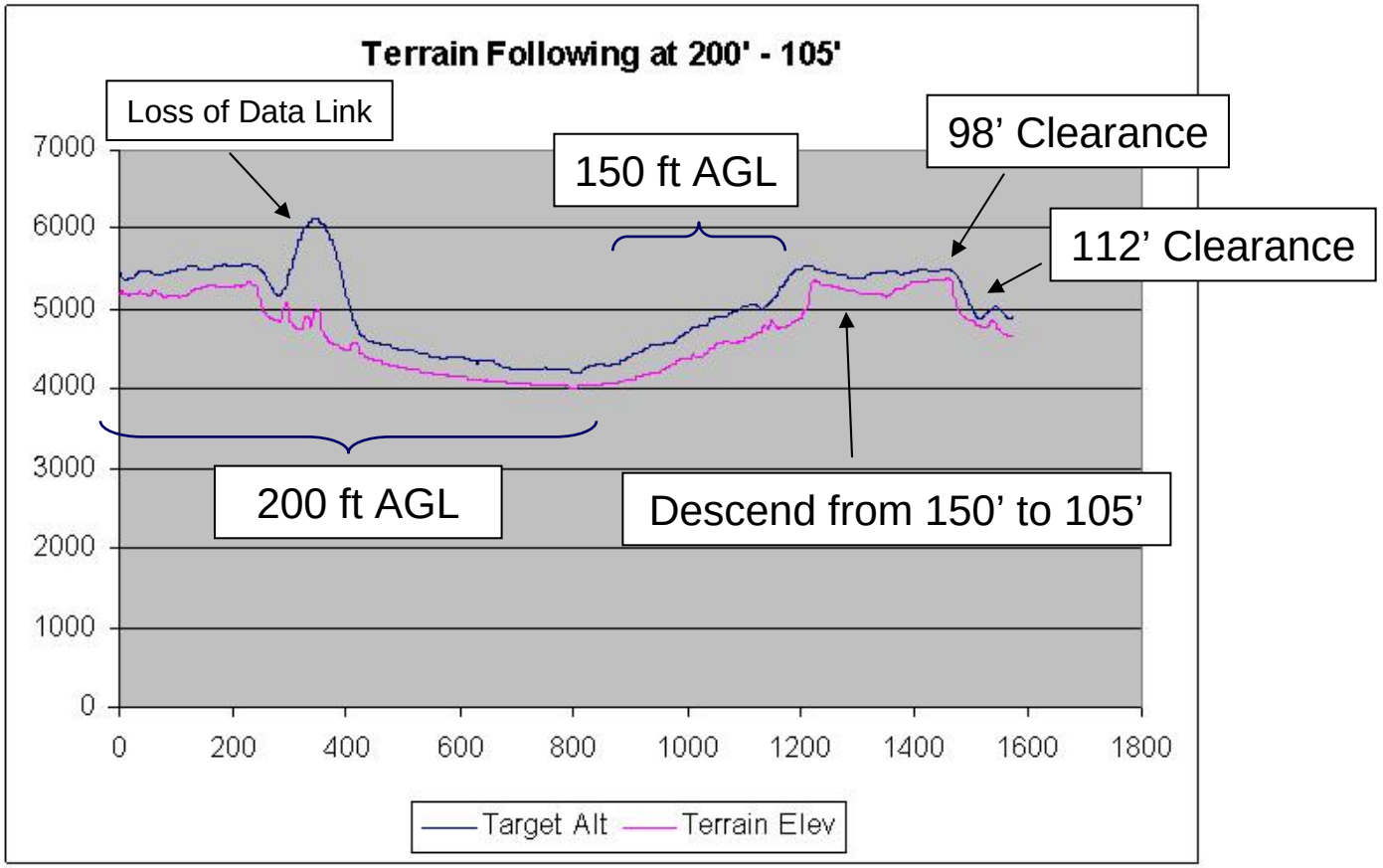
Flight #1 at 350 Kts, Data at 4.5 Hz, 17.5 Minutes Flight Time



Software

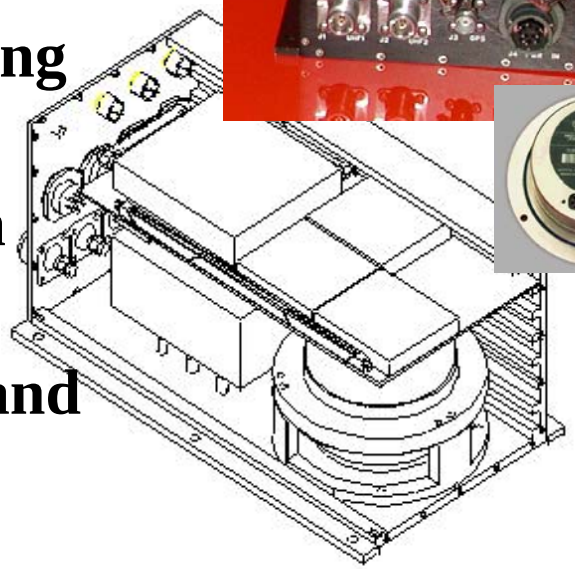
- ***Improved Low Altitude Threat Simulation***

Flight #2 at 350 Kts, Data at 4.5 Hz, 5.8 Minutes Flight Time



Software

- ***Autonomous MQM-107IAP***
  - **Use PDS mission planning tools to create flight profile**
  - **Upload to Common Avionics Package with laptop.**
  - **Maintained UHF data link during test mission.**
  - **Track error slightly larger than RF.**
  - **Discrete commands for smoke and auto recovery did not work.**
    - ***Fix known, not implemented.***



Summary

RF, ILATS, and Autonomous capability provides significant capability improvements to targets and mobile target control assets.