

# **Use of Calibrated Airborne Targets for Validation of Radar Modeling and Simulation Results**

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# Aeromation Corporation

- **Provides Manned Aircraft for Electronic System Testing**
- **Patrick Harris, President / Owner**
  - **Formerly, System Integration Engineer**
    - LockheedMartin, Raytheon, Learjet
    - Radar Systems, Avionics
  - **Aircraft available include:**
    - Pitts S2 (9g, 180 kts, 200lb useful load, ceiling 21k)
    - Cessna T310R (3.5g, 220 kts, 1000lb useful load, ceiling 27k)
    - Eclipse 500 (3.5g, 370 kts, 1000lb useful load, ceiling 41k)
    - Fairchild SA-226T (3.5g, 265 kts, 3500lb useful load, ceiling 31k)
      - Civil variant of C-26

**Aeromation is a Small, Veteran-Owned, Systems Engineering Business**



# A Perspective of Airborne Radar T&E Based on Experience with ARPDD

- **Lab, Factory, and Depot Module Testing**
  - Noise figure
  - Third order intercept
  - Intermodulation
  - Phase linearity, Missing Codes
  - Power, Compression Points
  - Near field testing of arrays
    - Test coverage is very good
- **Airborne Radar I&T**
  - Distance to detect, known RCS ground mounted targets
  - Imaging (ISAR) resolution
  - Time to detect pop ups
  - System test coverage can be very effective with modest capital outlay for range operations

**Effective Methods are in Place to Test and Evaluate Airborne Radar Systems**

# A Perspective of Surface Radar Testing Based on Experience with DD(X) / Aegis

- **Lab, Factory, and Depot Module Testing**
  - As in the airborne case, test coverage is very good
- **Ground based radar I&T**
  - Track known RCS balloons
  - Target towers, with delay lines, mixers
  - Track N targets
  - Engage and destroy a single target
  - Detection performance in large part by analysis
- **Gap in test coverage for ground based radar systems.**
  - Can module test, systems analysis and system performance be correlated?
  - Special designed airborne equipment may close the gap at a reasonable cost

**Air Defense Radar Testing may Benefit from the Use of Towed Airborne Targets**

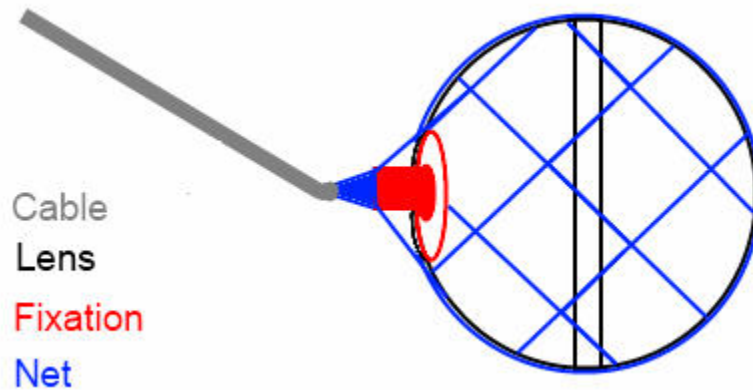
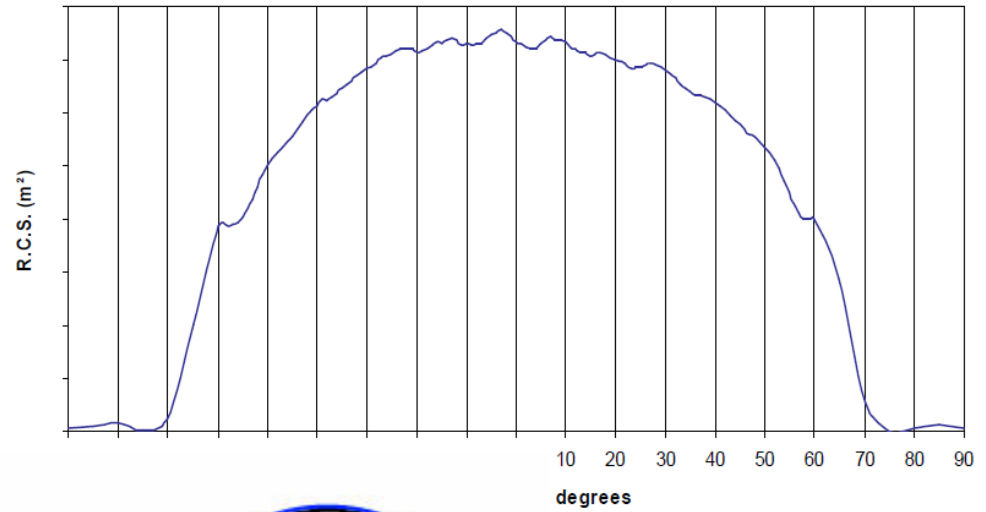
# COTS Airborne Target System

- **Missionized COTS target tow aircraft**
  - Three  $<4\text{m}^2$  RCS targets in tow
  - 80-220 Knots
  - 1k to 27k feet, LOS 30-190 miles + Refraction
  - Targets 500m behind, 75m below with 5m to 100m separation
  - 4 hours on station
  - ECM Support: Radom, 2Kw, 2' x 3' shelf, 100lb
  - Low RCS composite propellers available

**Multi-Engine Turbocharged Piston Powered Aircraft Meets Mission Requirements**

# System Components (1 of 3)

- Retro reflector, Luneburg lens



**COTS Reflectors with Traceable Calibration Data**

# System Components (2 of 3)

- **Powered Target Extension Retraction Mechanism**
- **COTS Game Fishing Tackle**
- **2500 Yards of 80lb line**
  - 1m<sup>2</sup> target = 6lb of drag
- **Mounted in the cabin**
- **Line run thru tubing to tail and wing tips**



**US-Made, COTS 28v DC Reel Compatible with Aircraft Power System**

# System Components (3 of 3)

- **COTS Airframe: Cessna T310R**
  - 200 knots @ 25k feet towing three 0.5m<sup>2</sup> targets
  - 200 amps DC @ 28V
  - 1000lb Useful Load
  - Panel space for UHF/FM radios
  - Radom with ECM equipment space just aft

**Cessna T310R Meets Mission Profile with Reasonable Acquisition Cost**



# Summary

- An airborne system towing multiple small RCS targets creates a 'radar range' in the sky
- Supports direct comparison of tracking performance between competitive systems
- Fills possible void between lab test and system analysis of air defense radar systems
- Assembled from off the shelf components
- Low direct operating cost
- Usable across multiple programs

**Realistic Testing at a Reasonable Cost**

Cross-range [m]

# Questions

# Thank you

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