

Unclassified

Overview of 3rd Party Targeting Demonstration Using the APL Precision Target Locator Demonstrator

Distribution Statement A
Approved for public release: distribution is unlimited

Ben Huguenin Joe Schissler

October 18, 2005

APL
The Johns Hopkins University
APPLIED PHYSICS LABORATORY

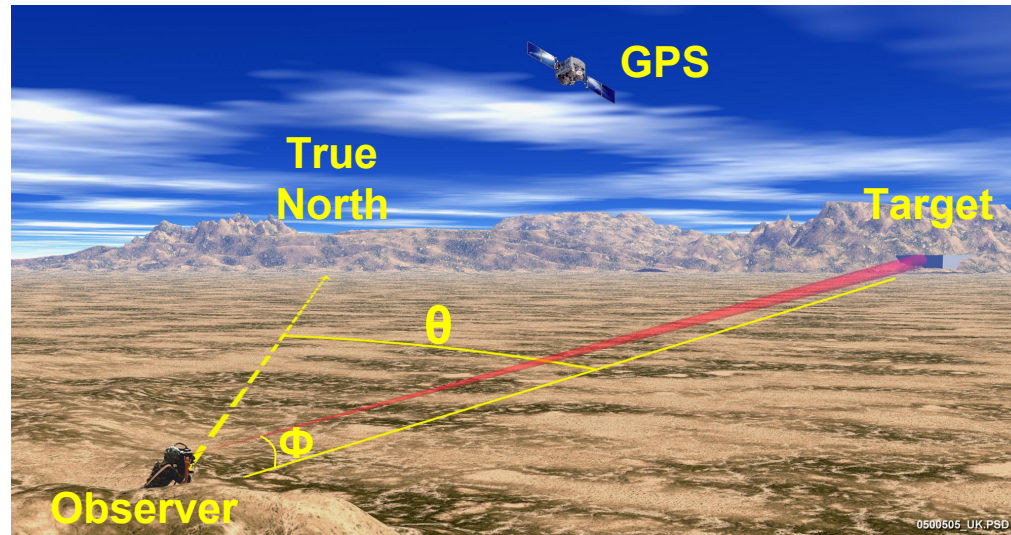
Unclassified

Agenda

- **Introduction**
- **Precision Target Locator (PTL) Demonstrator**
- **Tomahawk Weapon System (TWS)**
- **Demonstration details and results**
- **Summary**

Introduction

- The PTL Demonstrator is a self-contained, man-portable, tripod-mounted, target location device with accuracies an order of magnitude better than current systems



- Question: Can we demonstrate the full utility of this device by quickly and accurately getting the target location to a precision weapon?

PTL Demonstrator

- GPS determines own location
- Laser range finder determines distance to target
- Inertial Navigation System (INS) determines angles to target
- Windows CE-based system computes target location very accurately; APL's goal was $< 7\text{m}$ error at 7 km
- Integrated off-the-shelf components weigh 19.7 lbs, including battery

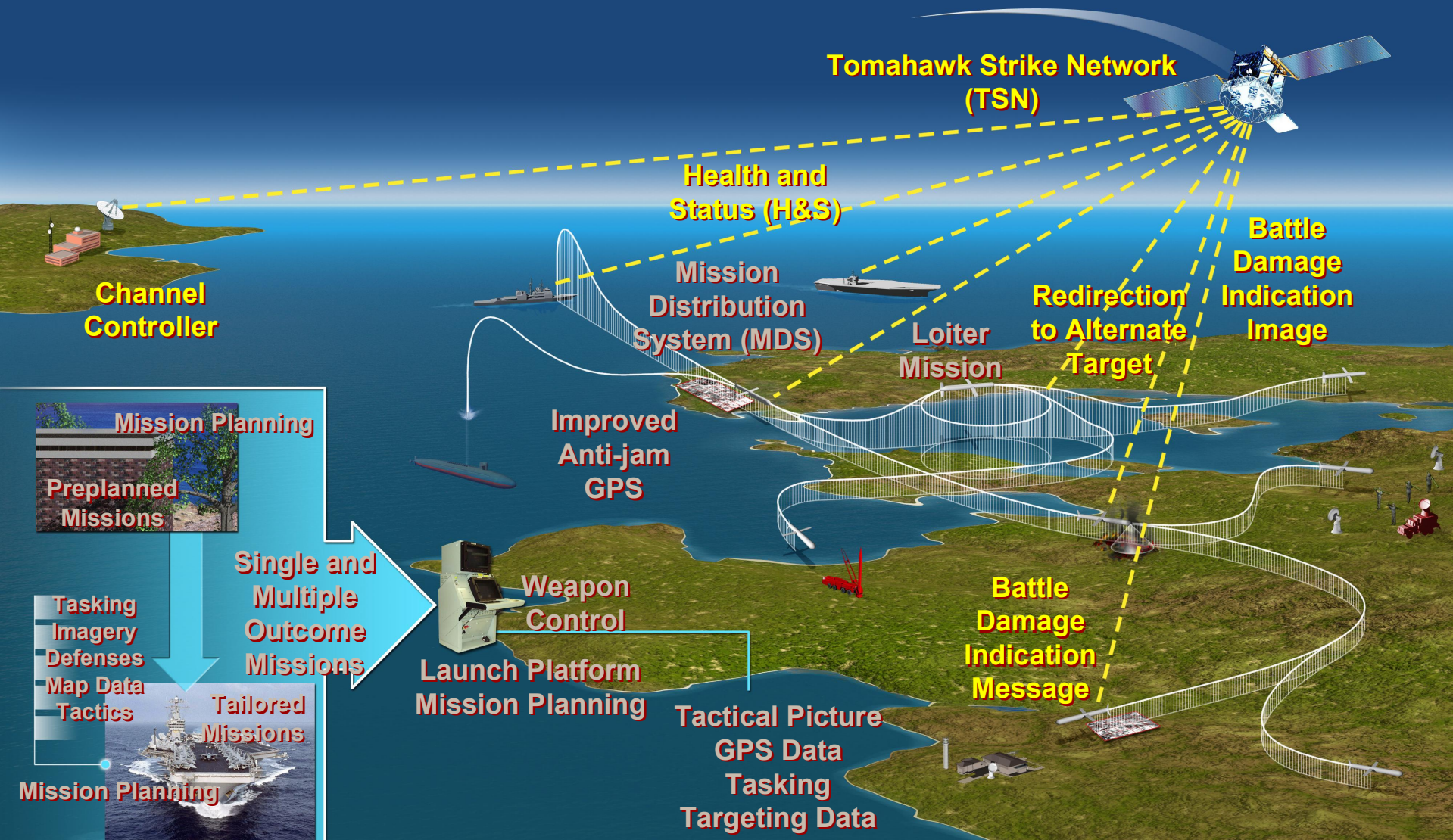


Accuracy Testing Results

Root-Mean-Square (RMS) Errors (m)				
Target Range	Target Distance	Cross Range	Vertical	Downrange
Aberdeen	5 km	3.2	3.1	2.6
Aberdeen	7 km	4.3	2.7	3.6
Fallon*	5 km	4.7	1.4	3.4
Fallon	7 km	6	1.8	3

* Three ranges between 4.5 and 4.8 km

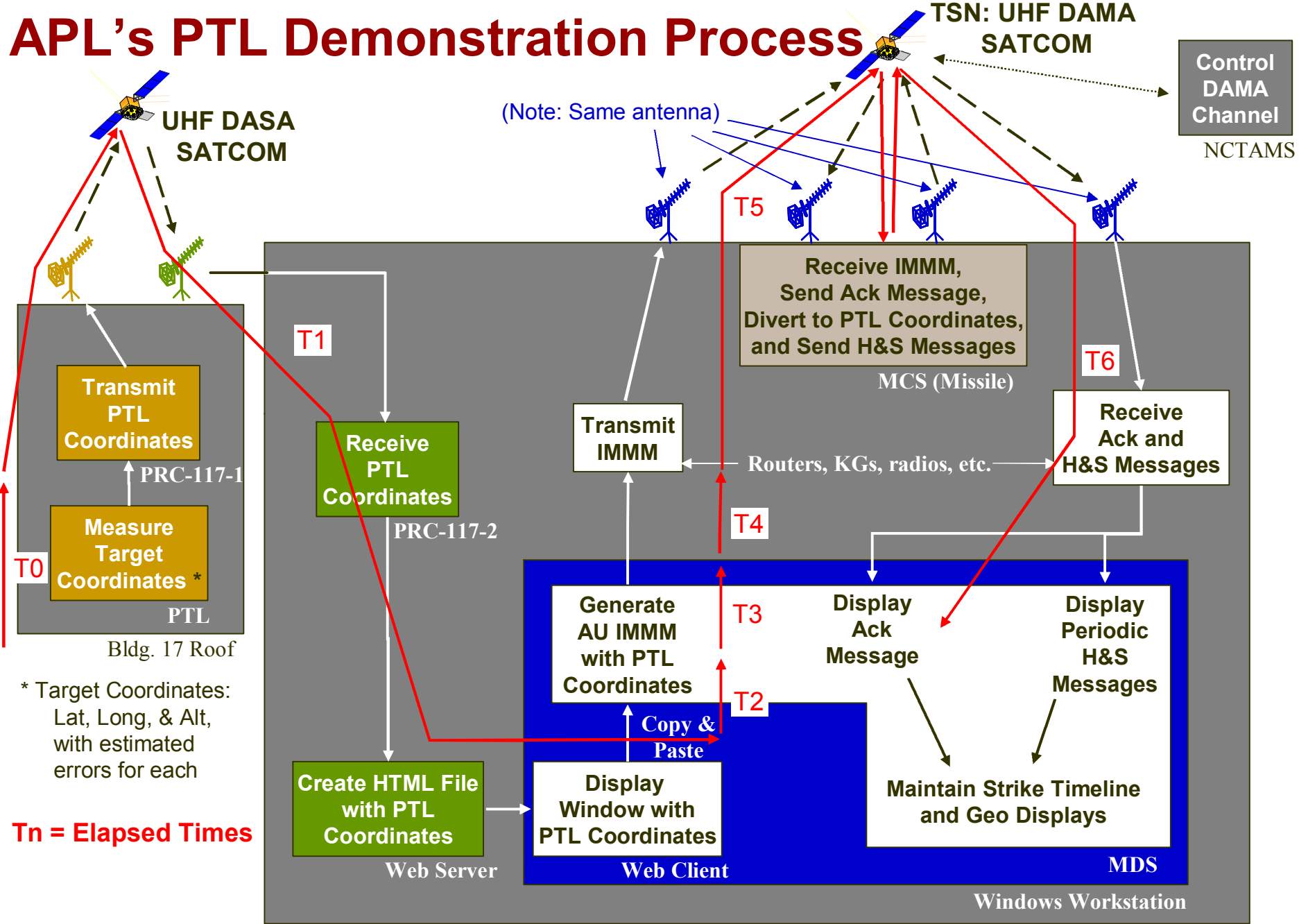
Tomahawk Weapon System Baseline IV Capability



Demonstration Scenario

- **SOF observes target and submits CAS request**
- **On-going Tomahawk strike with a missile that can be redirected**
- **TACAIR unavailable; CAS request paired to Tomahawk**
- **SOF measures target location with PTL and electronically sends to TWS**
- **TWS sends In-flight Mission Modification Message (IMMM) to redirect missile**
- **Missile diverts to PTL-measured target coordinates**
- **Scenario consistent with 2nd Fleet's draft Tactical Bulletin on Third Party Targeting**

APL's PTL Demonstration Process



* Target Coordinates: Lat, Long, & Alt, with estimated errors for each

Tn = Elapsed Times

Target Identification



Measuring, Transmitting, and Receiving Target Coordinates



PTL Web Client and Tomahawk MDS

Web Client

Target Latitude	39-11-17.411N
Target Longitude	076-49-1.268W
Target Altitude (MSL feet)	544
Inertial Altitude	4000
Clearance Command	600
Impact Angle	84

MDS

Aimpoint Update IMM

MS# 1 Transmission Time 17171154Z MAY 05

Subscriber Id 20000

Target Latitude Target Longitude

Target Altitude Ft Impact Angle Degrees

Inertial Altitude Ft Mach Cmd

Clearance Cmd Ft Segment Logic Choice HEX

Dive Rate Cmd Ft/Second Warhead Control HEX

Immediate H/S rep

- Immediate Ack Enroute BDII
- Scheduled H/S
- Event H/S
- BDI
- Enroute BDII

Route Validation Data

Launch To Departure Point NM

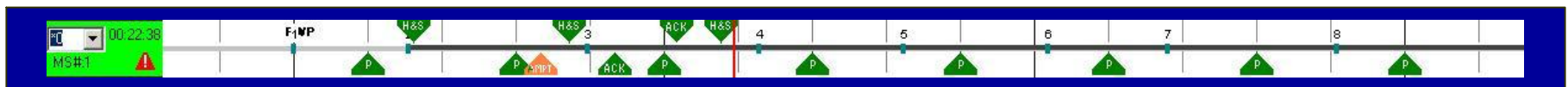
Remaining Msl Range NM

Departure Point To Target NM

Departure Point To Target

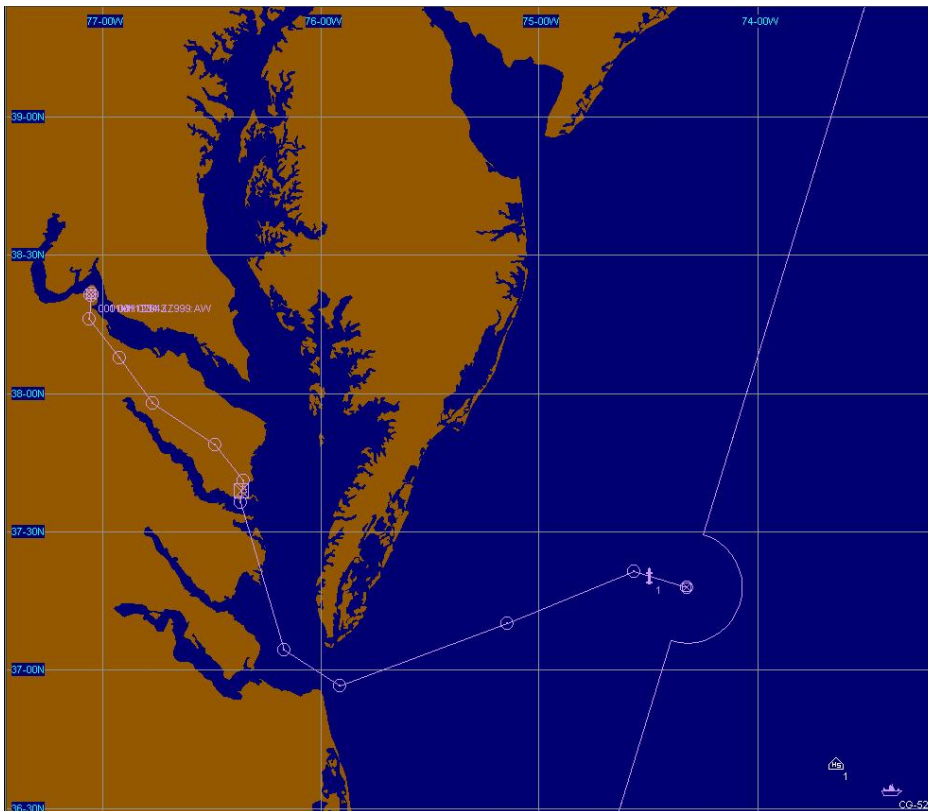
Est TOT

MDS Timeline

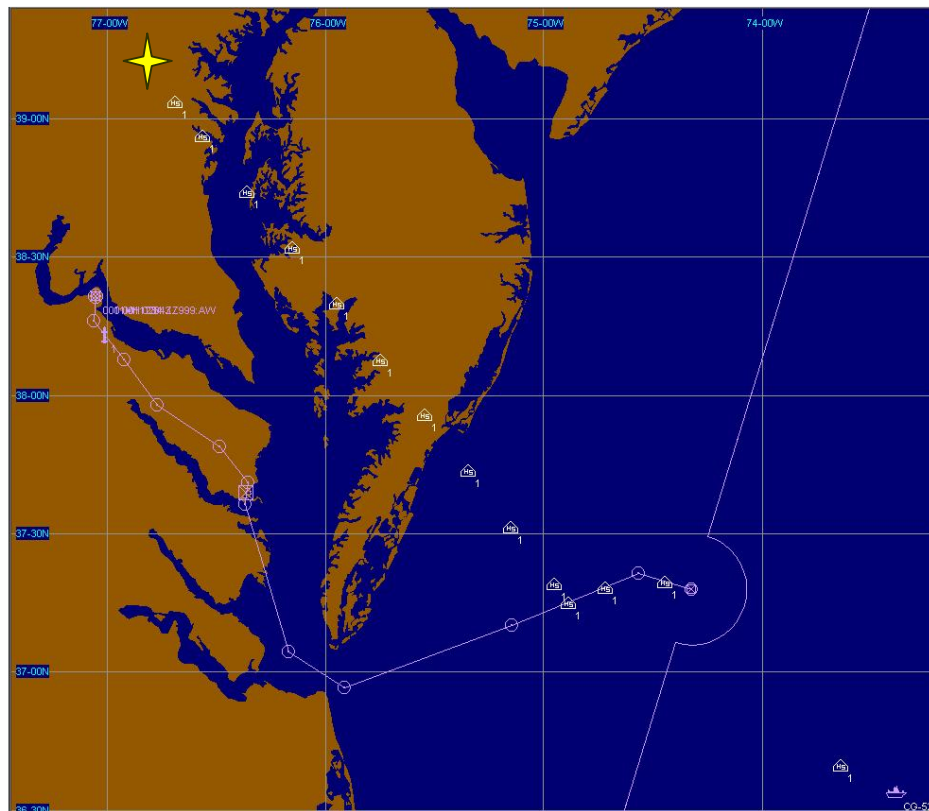


Pre-planned Tomahawk Mission and Result after Redirection

As Planned



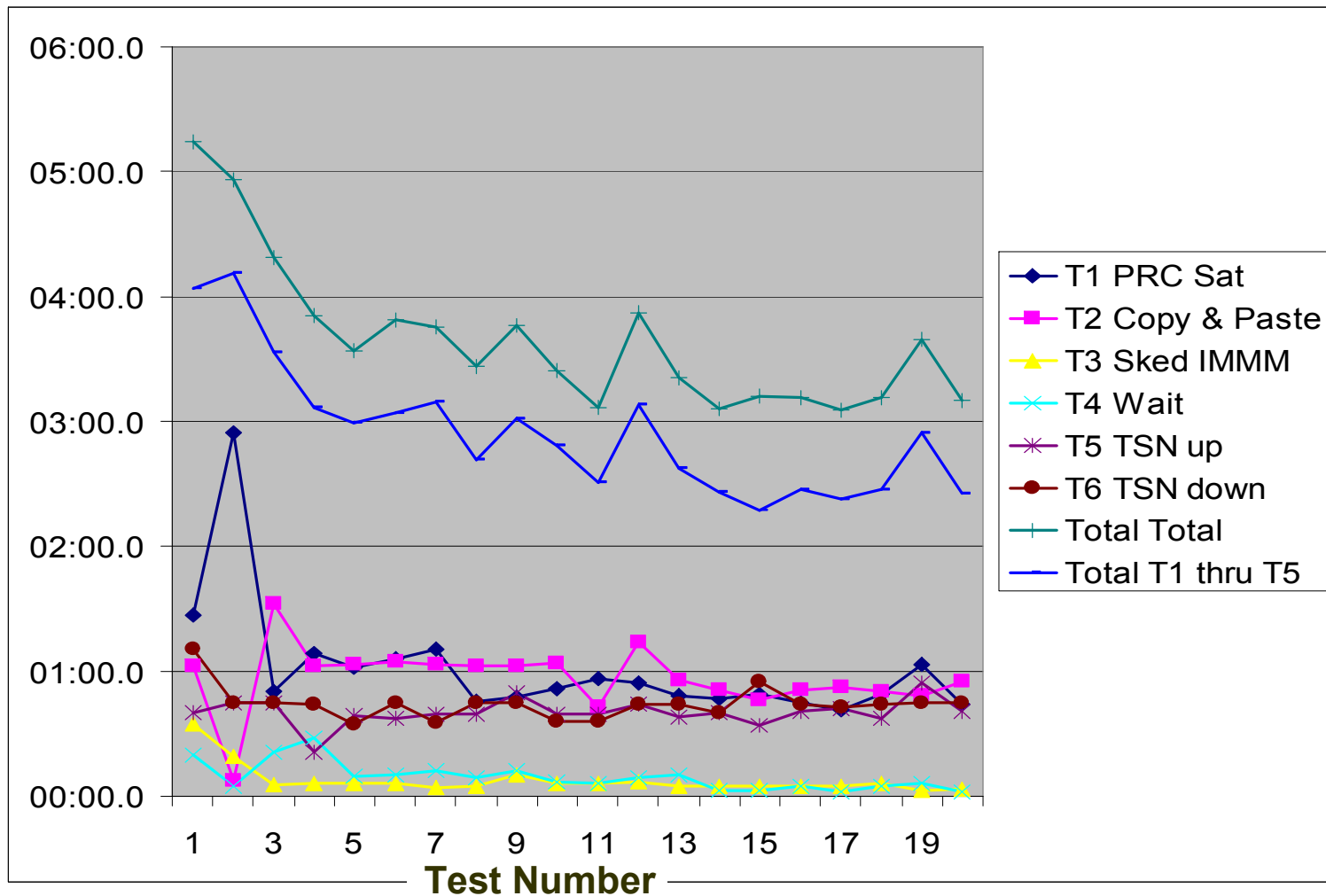
After Redirection



MDS Geo Displays

Demonstration Timing Results

Elapsed Time
(min:sec)



Summary

- **Off-the-shelf, operational, and simulated systems were integrated into an end-to-end targeting demonstration**
- **Expected time from good target location to missile redirection is about 1.5 minutes**
- **Total reaction time needs to include other times**
 - **PTL Demonstrator set-up and alignment**
 - **Command decisions**
 - **Missile flight**
- **PTL Demonstrator technology is transitioning to industry**

Demonstrated accurate and timely 3rd Party Targeting using APL's PTL Demonstrator and Tomahawk Redirection

Authors' Contact Info

- Ben Huguenin
 - ben.huguenin@jhuapl.edu
 - 240-228-0205
- Joe Schissler
 - joe.schissler@jhuapl.edu
 - 240-228-5080

Acronyms and Abbreviations

Ack	– Acknowledgement	Long	– Longitude
Alt	– Altitude	MCS	– Missile Communications Simulation
AU	– Aimpoint Update	MDS	– Mission Distribution System
CAS	– Close Air Support	NCTAMS	– Naval Computer & Telecommunications Area Master Station
DAMA	– Demand Assigned Multiple Access	PTL	– Precision Target Locator
DASA	– Demand Assigned Single Access	SATCOM	– Satellite Communications
GPS	– Global Positioning System	SOF	– Special Operations Forces
H&S	– Health & Status	TACAIR	– Tactical Aircraft
HTML	– Hyper-Text Markup Language	TSN	– Tomahawk Strike Network
IMMM	– In-flight Mission Modification Message	TWS	– Tomahawk Weapon System
INS	– Inertial Navigation System	UHF	– Ultra High Frequency
Lat	– Latitude		