746 Test Squadron

Innovate, Execute, Excel

A NEW TEST CAPABILITY

SAASM - Integrated System Evaluator and Reporter (SAASM-ISER)

19 Oct 05

Jim Killian
746 Test Squadron

Integrity - Service - Excellence - Agility

Overview

- **Background**
  - **What is SAASM (for those unfamiliar)**
- **Motivation for the New Test Capability**
  - **Problem; Testing shortfall**
  - **Proposed Solution**
  - **SAASM-ISER Concept**
- **HIMARS Checkout, proof of concept**
- **Schedule**
- **Conduct Activity**
- **Future Plans**
- **Summary**

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Background

- **GPS is critical to precision employment**
- **What is SAASM GPS**
  - **SA = Selective Availability,**
  - **ASM = Anti-Spoofing Module**
  - **New generation GPS Security Architecture**
  - **Same Accuracy Performance**
  - **More Capability**
  - **Securer Military Operations**

Background

- **What does the user get out of it?**

  – **Unclassified keys:**
    - **This allows the receiver to remain unclassified even after keying.**

  – **Over-The-Air Re-keying (OTAR) capability:**
    - **This simplifies key distribution, storage, expiration and disposal issues and helps to maintain Precise Positioning Service (PPS) for isolated terminals.**

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Background

- **What's the user get? (continued)**

  - **Hardware:**
    - **Can be designed and fielded to be unclassified, eliminating a host of logistic complexities.**

  - **Added capability:**
    - **Allows the receiver to more easily acquire the P(Y)-code "direct", without the usual C/A to P(Y)-code sequence.**

Background

- **CJCS Master PNT Plan; CJCSI 6130.01C-E3a**

  – *"SAASM is the 'next generation' of GPS cryptography and UE developed to decrease GPS vulnerabilities and implement new capabilities. "*

  – *"All newly fielded DOD systems will use SAASM compliant PPS devices no later than 1 Oct 06 for the Army, Navy, Air Force, and Marines."* (without an ASD/C3I waiver).

Background

- **CJCS Master PNT Plan; CJCSI 6130.01C – E3b:**
  - *"SAASM implements the Joint Staff and NSA requirement to transition the US (and its allies) from classified red keys to unclassified black keys as soon as possible"*
  - *"SAASM delivers black keys, improved anti-tamper, and new "Over the Air" capabilities."*

Two Example GPS Receivers

- ## PLGRS
  - ### Non SAASM

- ## DAGR
  - ### SAASM

  - **Unclassified Keys**

  - **OTAR**

  - **Direct Y code enabler**

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GPS = TWO Signals

- **Note: Each SV broadcasts TWO signals:**
  - **Military Precise Code, P(Y)**
  - **Civilian Coarse Acq Code, C/A**

GPS SV

P(Y) Code
PPS

C/A Code
SPS

MILITARY

CIVILIAN

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Why a New Test Capability

- **Shortfall in Testing Integrated Systems**

  - **No SAASM Signal in Space (SIS) yet**

  - **No standard method in place to verify integrated system level functional integrity**

  - **SAASM GPS testing done at GPS receiver Host Application Equipment (HAE) level**

Why a New Test Capability?

- **Possible Consequences of Shortfall**
  - **Find 'glitches' during real-world operations**
  - **Disruption of ops., limfacts, friction of war**

- **Innovated Solution – SAASM-ISER**
  - **Simulated SIS to test Over-the-Air functions**
  - **Test anywhere, anytime, on FMC platforms**
  - **Virtually no 'down-time' on aircraft/platform**

Proposed Solution

- **SAASM Integrated System Evaluator and Reporter (SAASM-ISER)**

  – **Cost effective solution for verifying SAASM end-to-end Performance**

  – **Mobile Test Capability;**
    - **Palletized Simulator**
    - **Provides signals not yet available from satellites**

Proposed Solution (cont)

- **SAASM Integrated System Evaluator and Reporter (SAASM-ISER)**

  - **Ability to broadcast GPS and SAASM scenarios directly into platform antenna**
    - **Especially useful for systems passing information from a GPS receiver to another piece of equipment**

  - **Real-time assessment via cockpit displays & data collected from receiver instrumentation port or bus**
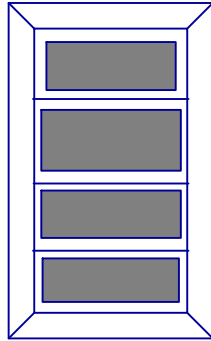   - **Verifies integrated navigation system functionality**

SAASM-ISER Concept

SAASM-ISER

Test Signals

Cockpit Displays

GPS Antenna

FMC Platform

Weapon
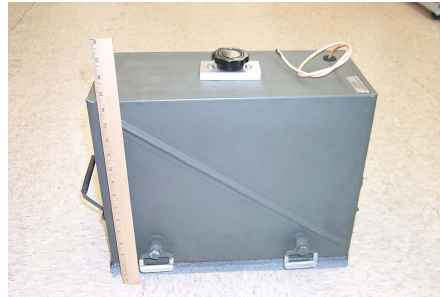
REPORT

ANALYSIS
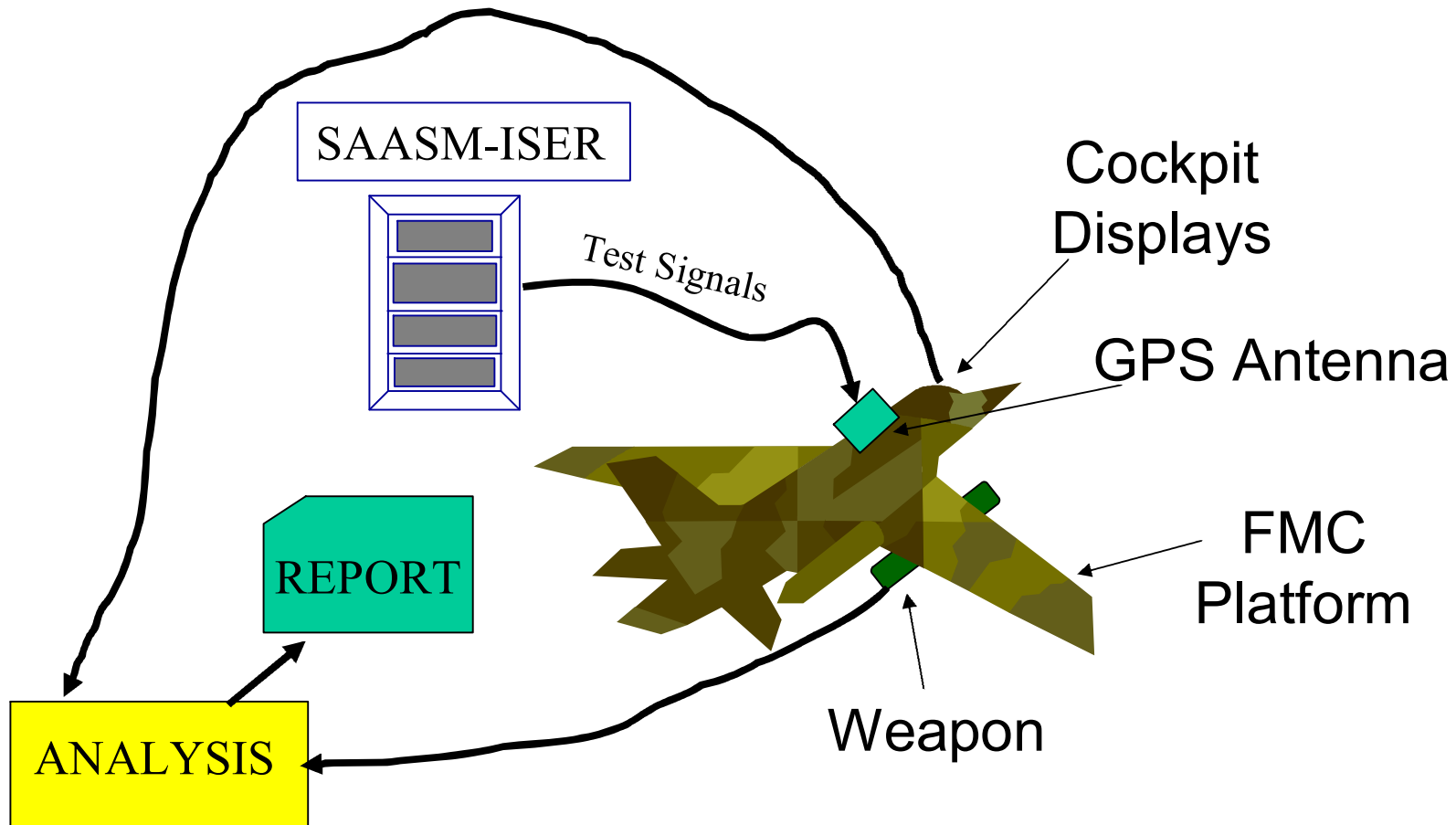
Location = anywhere

Flow of Test Signal

Palletized
SAASM-ISER
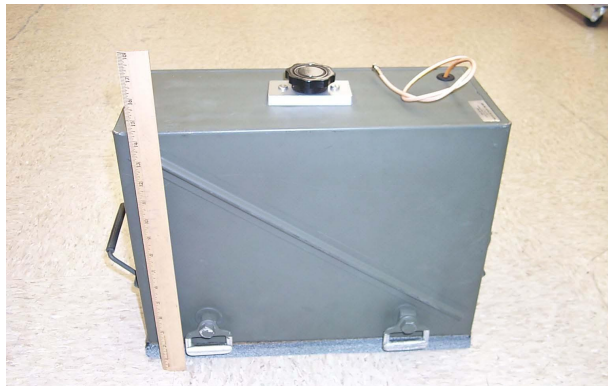
Antenna Hood, RF Link

Defense Adv
GPS Receiver
(DAGR)

Typical Integrated Navigation /
Weapon System Under Test

Baseline Reference
Simultaneously Run for
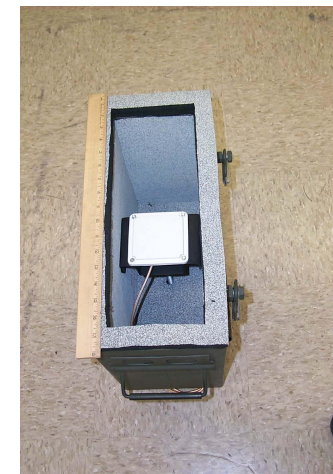Quality Control Monitor
of signal simulation

Active Antenna Hood
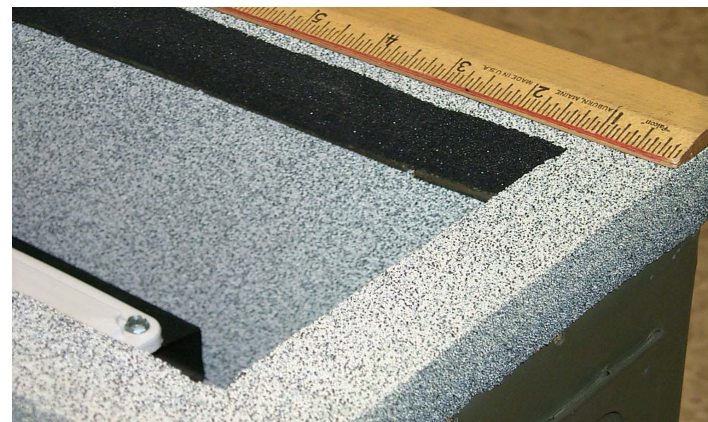

Dimension: 7x17x14 inches

Adjustable FRPA Radiates Internally

Interior RAM

SAASM-ISER Van

- Van Equipped with:
  - Full elec power cap
  - Pallet ties
  - Environment control

-Advertised availability:
Summer 2005

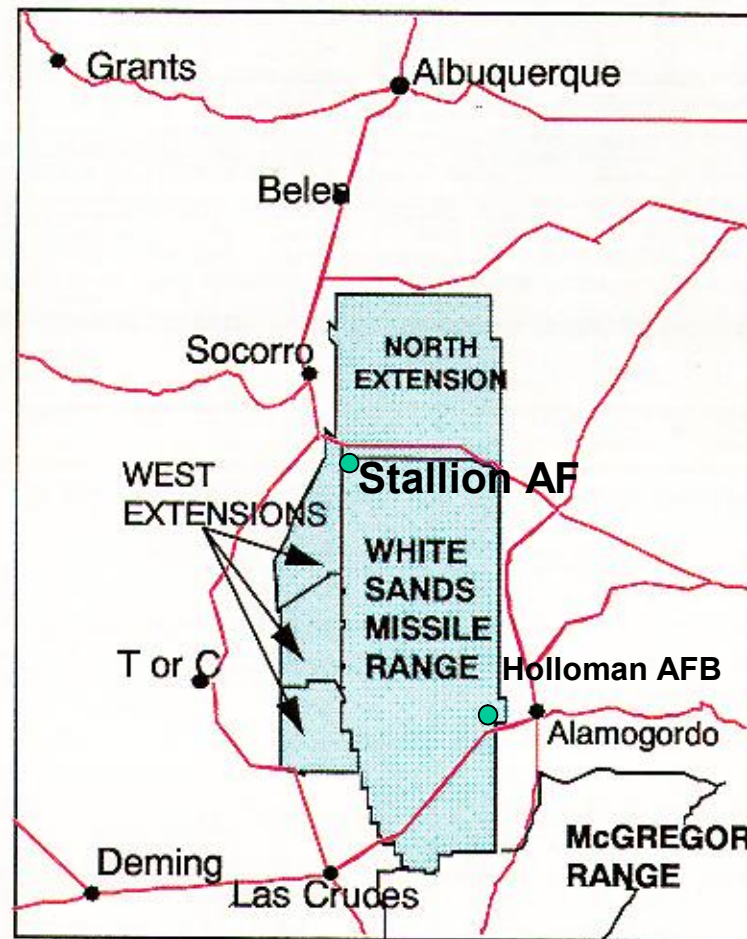-Army HIMARS requested to be
  SAASM-ISEd in May 2005

SAASM-ISER MOBILIZED

- Traveled to the "land of the **ORYX"** for the first remote SAASM-ISER test
- Location: WSMR, Stallion Air Field

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HIMARS Checkout & Proof of Concept

- ## First Customer: HIMARS
  - ### At WSMR for JAMFEST in May 05
  - ### Extended 1 week for SAASM-ISER Testing

High Mobility Artillery Rocket System (HIMARS)

FRPA-3 mounts on the top rear of the right side sponson

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Schedule

- **2 March – Program introduction; HIMARS requests SAASM-ISER test**

- **18 March – Developed requirements**

- **20 April – Finalized development process**

- **16 May – Completed development of SAASM-ISER for HIMARS readiness**

- **18 May – Pre-checkout survey of HIMARS**

- **21 May – JAMFEST completed**

- **23 May – Mobilized to Stallion Air Field and Marshaled equipment with HIMARS**

- **24-25 May – Conducted SAASM-ISER scenarios**

HIMARS Weapon System

HIMARS Integrated Navigation Systems

- CONSISTS OF THREE SYSTEMS INTEGRATED

- Fire control system

- Position / navigation system (GPS / INS)

- Launcher weapon system (GPS / INS)
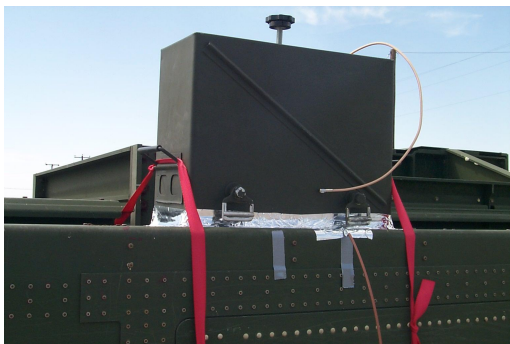
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SAASM-ISER Test Conduct

-**HIMARS FRPA on right launcher sponson**

- Co-located FRPA for DAGR under hood for baseline monitoring and quality control of SAASM-ISER scenarios

- Hood tested for leakage of simulated signals in and out, in lab and on the HIMARS

- Added shielding tape to edged of hood to block all signal

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SAASM-ISER to HIMARS Hookup

HOOD

- **Hood strapped to sponson**

- **Coax leads run from Hood FRPA, DAGR FRPA, and system data-feed**

- **All cables fed through cable access door in van**

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SAASM-ISER Control Station

- **Computer controlled and monitored**

- **Dual AC; Insulated**

- **Temp during Test:**

Outside = 102F

Inside = 65F

Laptop monitors for:

- **Simulator**

- **DAGR Baseline**

- **Test Item**

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Test Result

- **HIMARS TEST:**
  - **Accomplished each of planned tests**
  - **Provided customer with results**
  - **Customer very pleased with success of tests and information obtained**
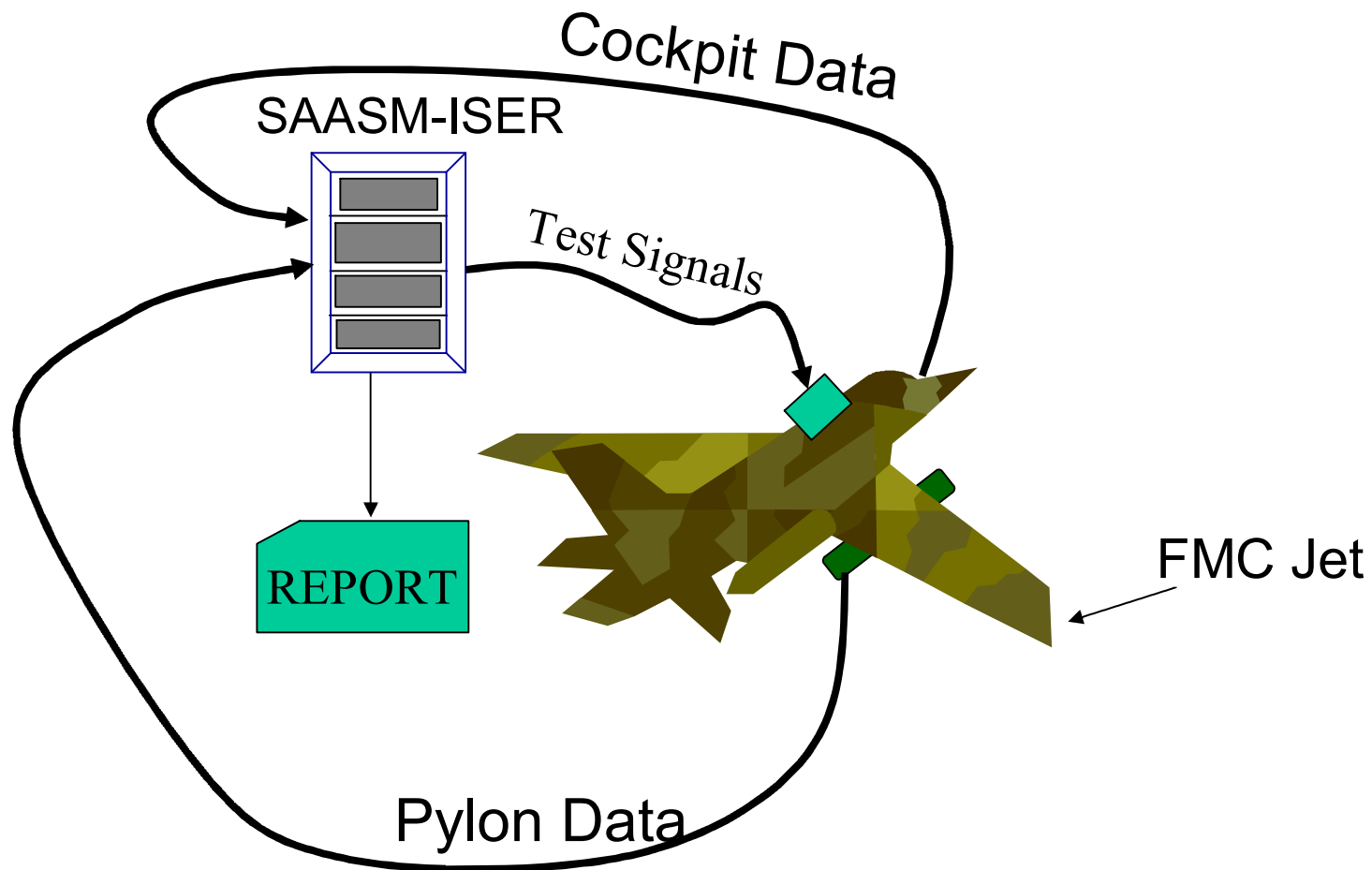
Future Plans

- **Create a larger hood adequate for larger antennas**
  - **Controlled Reception Pattern Antenna (CRPA)**
- **Refine test procedures**
- **Automate sequence of tests desired**
- **Provide automated End-of-Checkout Report from SAASM-ISER**
- **Support anomaly resolution**

Automated SAASM-ISER

Cockpit Data

SAASM-ISER

Test Signals

REPORT

FMC Jet

Pylon Data

Summary

- ## SAASM-ISER

  - ### Provides a government test tool to test end-to-end Integrated SAASM GPS systems

  - ### Verifies the functional integrity of integrated navigation and weapons system on an FMC platform incorporating SAASM GPS

  - ### No re-configuration of FMC platform necessary

  - ### Provides means to investigate anomalies

  - ### Mobile, and can travel where needed

  - ### Demonstrated proof of capability on HIMARS

Questions?

Jim.Killian@46tg.af.mil
DSN: 349-2600
Com: 505-679-2600

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ACRONYMS

- – **SAASM: Selective Availability Anti Spoofing Module**
- – **SIS: Signal in Space**
- – **OTAR: Over The Air Re-key**
- – **P(Y): Precision Code, Encrypted**
- – **C/A: Coarse Acquisition Code**
- – **RF: Radio Frequency**
- – **DAGR: Defense Advanced GPS Receiver**
- – **CRPA: Controlled Reception Pattern Antenna**
- – **FRPA: Fixed Reception Pattern Antenna**