



BirdRad:

A Mobile Avian Radar For Near-Range Sampling Of Bird Populations

24 August 2004 Savannah, GA

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Report Documentation Page

Form Approved
OMB No. 0704-0188

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1. REPORT DATE 01 AUG 2004		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE BirdRad: : A Mobile Avian Radar For Near-Range Sampling Of Bird Populations				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Computer Sciences Corporation				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES See also ADM002111. Department of Defense Conservation Conference. Held in Savannah, Georgia on August 22-27, 2004, The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Overview

- Background to BirdRad Project
- Status of BirdRad Avian Radar
- Planned Enhancements
 - Current
 - Future



Background

■ History

- Weather Radars (WRS-88 or NEXRAD) Used to Study Migratory Birds
 - Coverage Gaps
- 1999: DOD Legacy Contract To Sid Gauthreaux at Clemson University

■ Design Requirements

- Primary User Community: Natural Resources Managers
 - Application to BASH Came Later
- Portability - Within & Between Sites
- 360° Azimuth
- Range 0-6 NMI
- Measure Horizontal & Vertical(!) Location of Birds
- Affordable



Status

- First BirdRad Unit Delivered in 2001
- Units Currently Operational At:
 - MCAS Cherry Point
 - NAS Patuxent River
 - NAS Point Mugu
 - NAS Whidbey Island
 - USAFB Elmendorf
 - SSC San Diego (R&D)



Current Configuration

BirdRad System Configuration

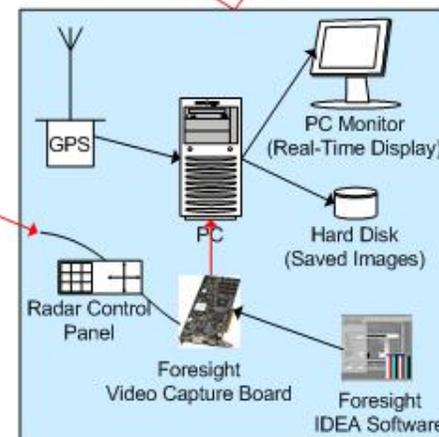
Furuno 2155BB Radar & Parabolic Antennal



BirdRad Trailer

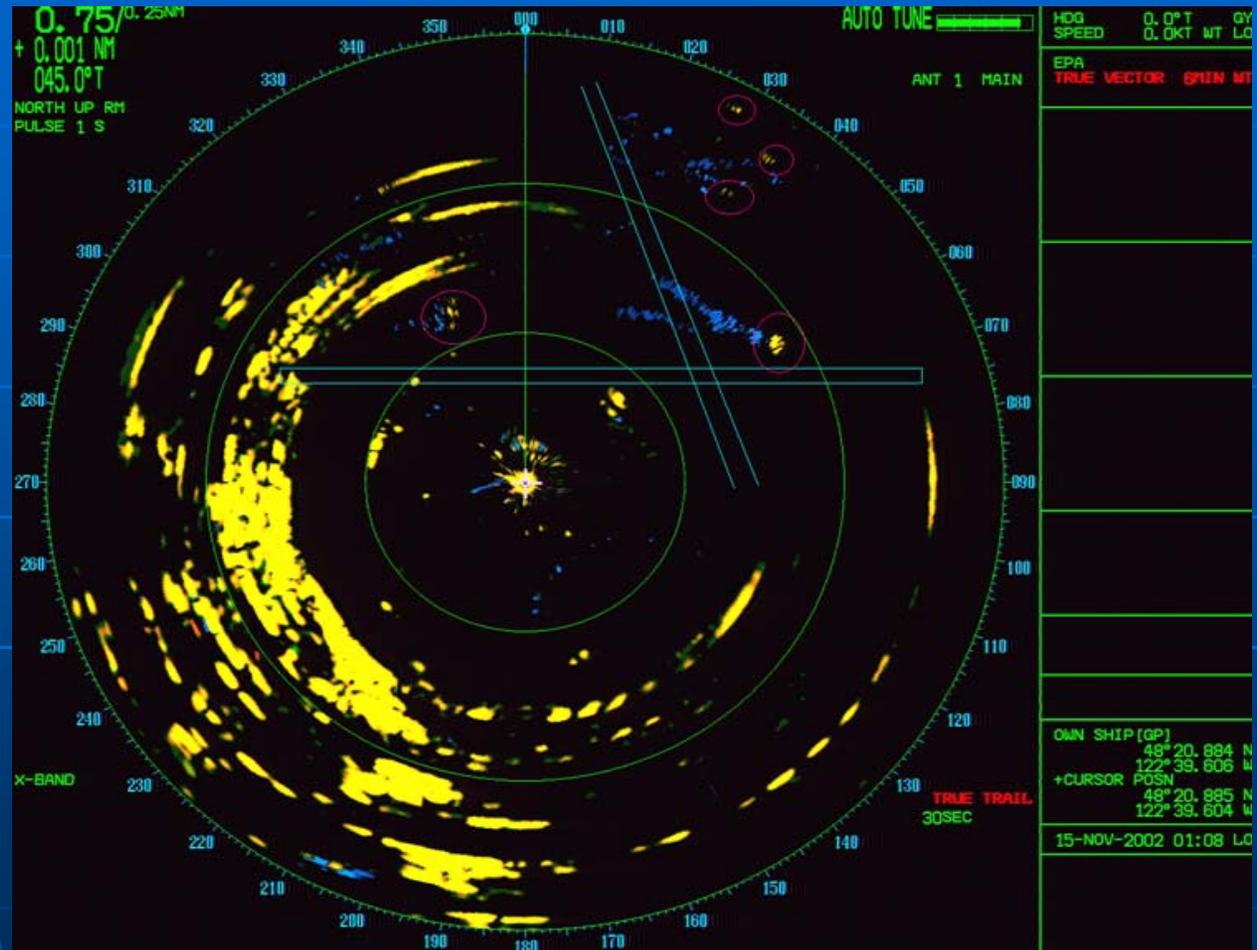


50 Ft. Umbilical Cord
(Power, Control, Video Out)





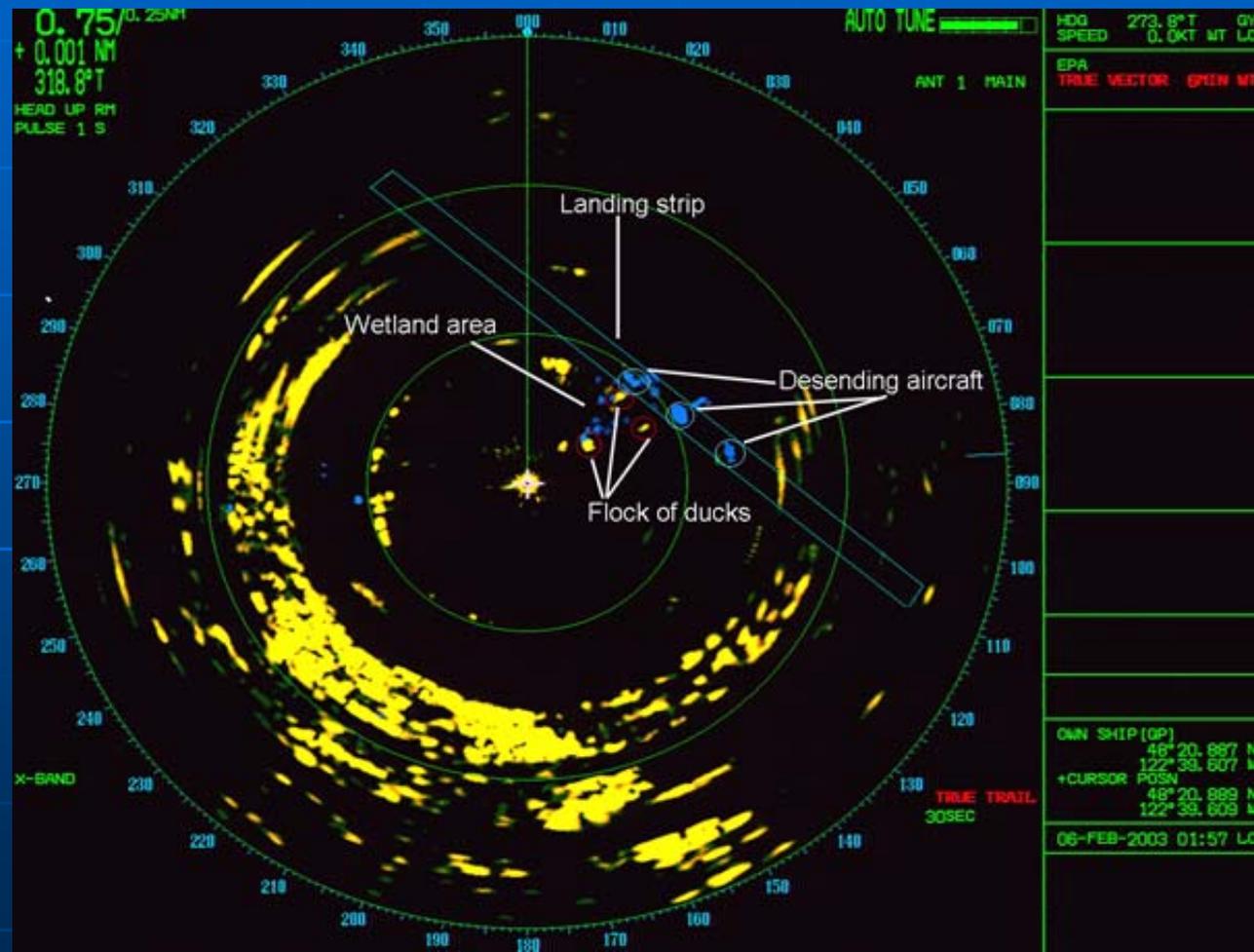
Visual Display



Sample BirdRad Display
NAS Whidbey Island 12 Nov 2002 17:09 PST

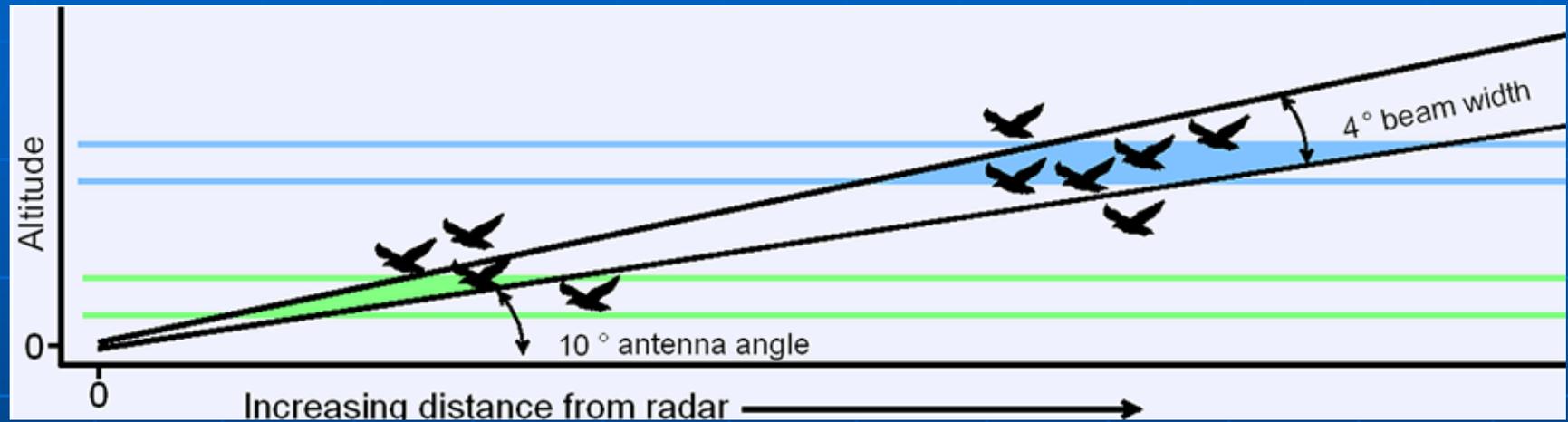


Capturing A Near-Miss





Narrow Radar Beam



- Radar Beam Width: 4°
 - More Accurate Target Altitude
 - Larger "Cone of Silence" - Unsampld Volume Above & Below Beam
- Antenna Angle: $5-10^\circ$



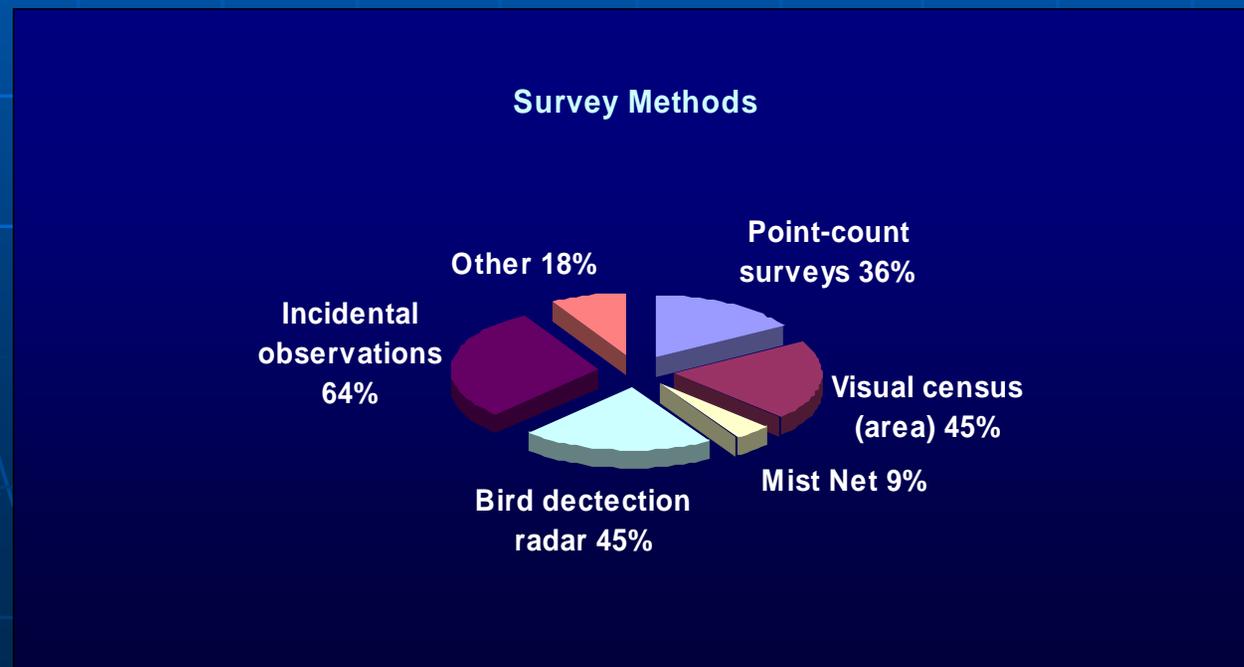
Enhancements

- BirdRad System Met Design Goals
 - Highlighted Additional Requirements
- 2002: NAVFAC Tasks SSC San Diego to Research Additional Requirements of BirdRad Users
- SSC Extends Analysis of Requirements



General Requirements

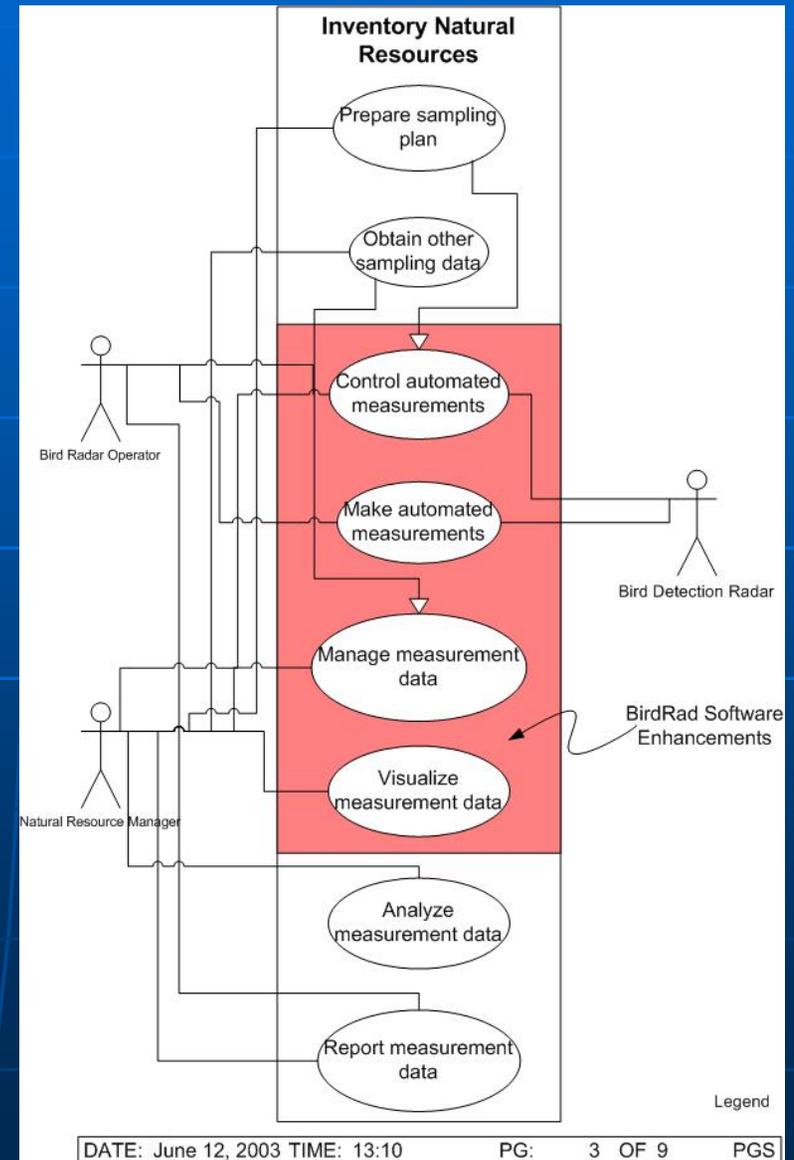
- Analyzed Resource Managers' Requirements for Bird Activity Data in General





Use Case Analysis

- Uniform Modeling Language (UML)
- Aid Both Programmers & End-Users to Understand System Capabilities
 - “What’s In, What’s Out”





Proposed Enhancements

Constraint	Enhancements
Digital Signal Processing	<ul style="list-style-type: none">■ Clutter Removal■ Data Acquisition System■ Data Visualization
Furuno Controls	<ul style="list-style-type: none">■ Remote Operations
Operations, Not R&D	<ul style="list-style-type: none">■ Environmental Controls
Technical Feasibility & Cost	<ul style="list-style-type: none">■ Birds vs. Insects■ "Cone of Silence"



In Progress

Parallel



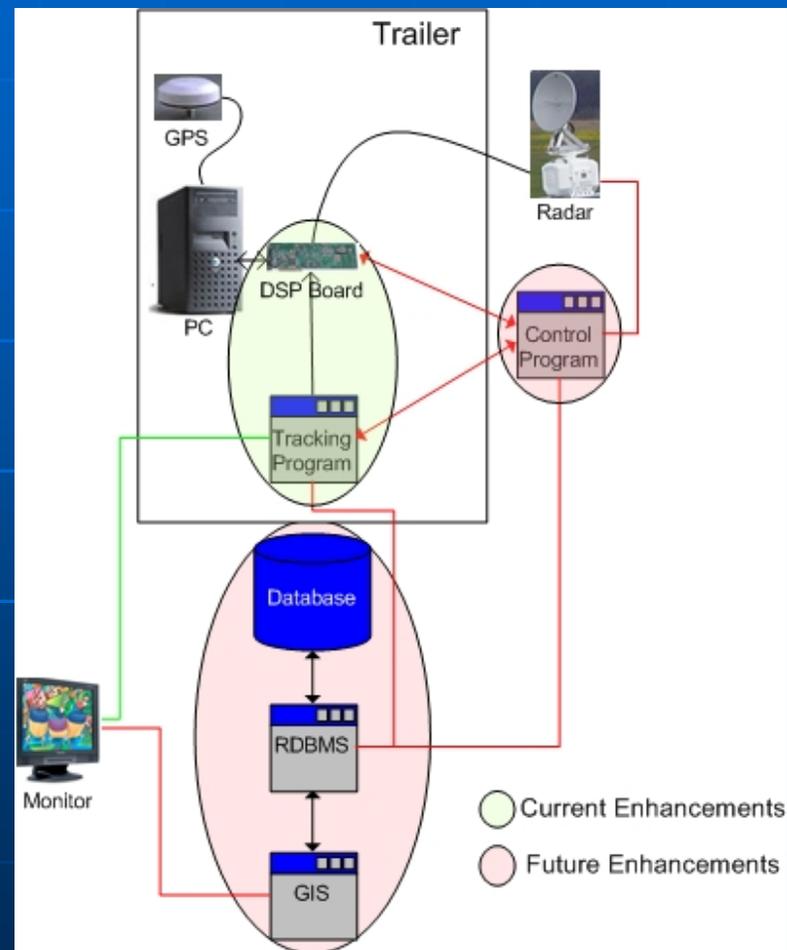
Planned

On Hold



Proposed Enhancements

- **Current Enhancements (Sicom Systems Ltd.)**
 - Digital Signal Processing
 - Rutter Graphics Rsi4000RT
 - Target Tracking Program
 - MT-Tracker™
- **Future Enhancements**
 - Remote Scheduling and Control Program
 - Output to RDBMS With Feed to GIS





Current Enhancements

- Target Trails Display (Optional - Emulates Furuno 2155BB)

- Yellow Heads & Blue Tails

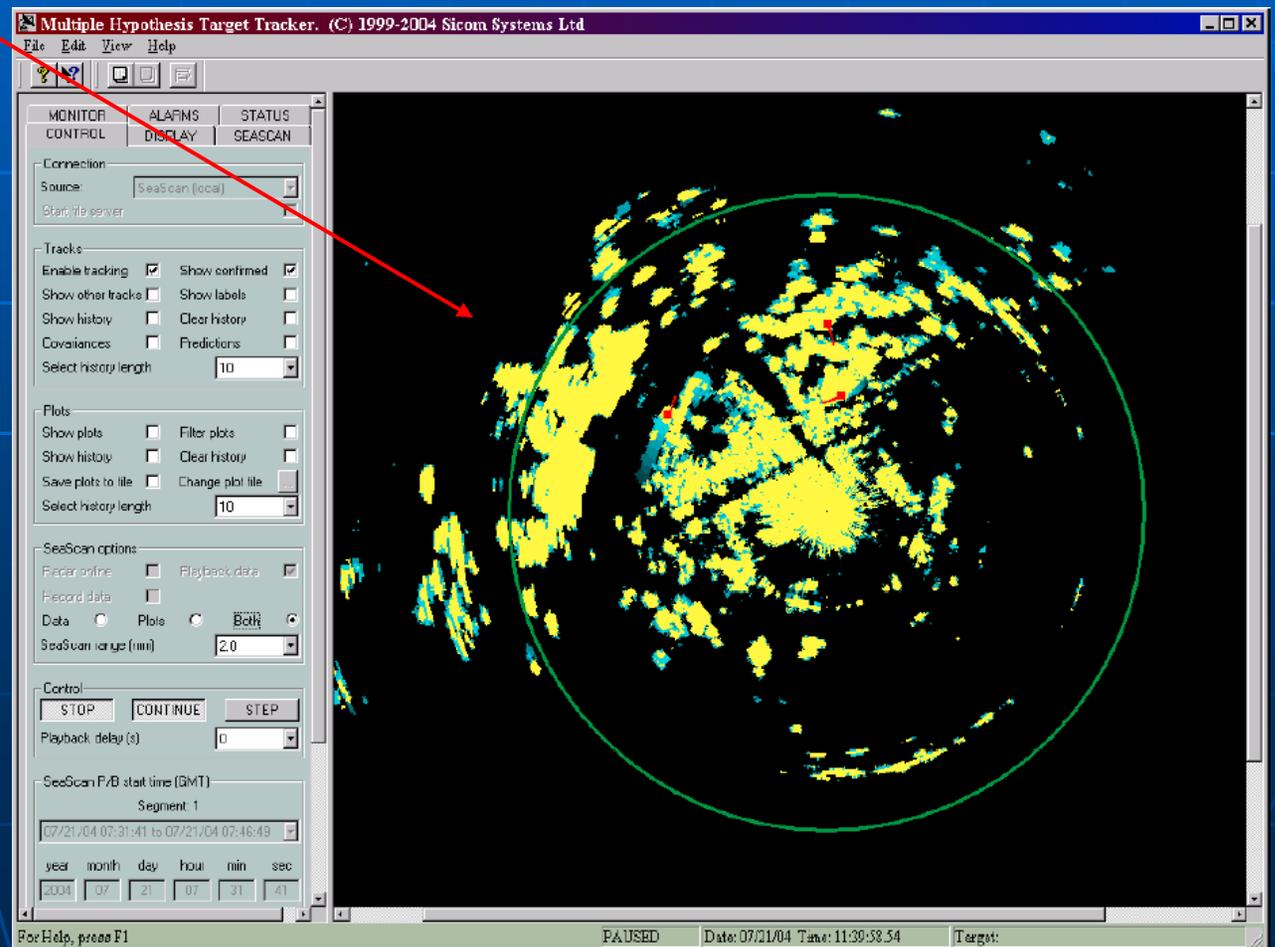
- User Can Select The Background:

- Target Trails (Standard)
- Target Trails (Clutter Removed)
- Map
- Blank

- User Can Select The Overlay:

- Targets
- Tracks
- Both

- Replay Video





Current Enhancements

NAS Patuxent River: 21 Jul 2004 11:39 EDT

- Apply Clutter Map
 - Residual Clutter
 - Heads & Tails

Multiple Hypothesis Target Tracker. (C) 1999-2004 Sicom Systems Ltd

File Edit View Help

MONITOR CONTROL ALARMS DISPLAY STATUS SEASCAN

Connection
Source: SeaScan (local)
Start file server

Tracks
Enable tracking Show confirmed
Show other tracks Show labels
Show history Clear history
Covariances Predictions
Select history length: 10

Plots
Shun plots Filter plots
Show history Clear history
Save plots to file Change plot title
Select history length: 10

Seascan options
Record online Playback data
Record data
Data Plots Both
Seascan range (nm): 2.0

Control
STOP CONTINUE STEP
Playback delay (s): 0

Seascan P/B start time (GMT)
Segment: 1
07/21/04 07:31:41 to 07/21/04 07:48:49
year month day hour min sec
2004 07 21 07 31 41

For Help, press F1 PAUSED Date: 07/21/04 Time: 11:39:42.18 Target:



Current Enhancements

NAS Patuxent River: 21 Jul 2004 11:39 EDT

- Display **Targets** (Circles) & **Tracks** (Squares)

Multiple Hypothesis Target Tracker. (C) 1999-2004 Sicom Systems Ltd

File Edit View Help

MONITOR CONTROL ALARMS DISPLAY STATUS SEASCAN

Connection:
Source: SeaScan [oca]
Start file power

Tracks:
Enable tracking Show confirmed
Show other tracks Show labels
Show history Clear history
Covariances Predictions
Select history length: 10

Plots:
Show plots Filter plots
Show history Clear history
Save plots to file Change plot file
Select history length: 10

SeeScan options:
Pacer online Playback data
Record data
Data Plots Both
SeaScan range (nm): 2.0

Control:
STOP CONTINUE STEP
Playback delay (s): 0

SeeScan P/B start time (GMT)
Segment: 1
07/21/04 07:31:41 to 07/21/04 07:46:49
year month day hour min sec
2004 07 21 07 31 41

For Help, press F1 PAUSED Date: 07/21/04 Time: 11:39:42.18 Target:



Current Enhancements

NAS Patuxent River: 21 Jul 2004

- Image Showing
Targets &
Tracks Only

Multiple Hypothesis Target Tracker. (C) 1999-2004 Sicom Systems Ltd

File Edit View Help

MONITOR CONTROL ALARMS DISPLAY STATUS SEASCAN

Connection:
Source: FileServer
Start file server:

Tracks:
Enable tracking Show confirmed
Show other tracks Show labels
Show history Clear history
Covariances Predictions
Select history length: 10

Plots:
Show plots Filter plots
Show history Clear history
Save plots to file Change plot file:
Select history length: 15

SeaScan options:
Recor online Playback data
Record data
Data Plots Both
SeaScan range (nm): 24.0

Control:
STOP CONTINUE STEP
Playback delay (s): 0.2
SeaScan P/B start time (GMT):
Segment:
year month day hour min sec

For Help, press F1

PAUSED Time: 444.781 Target:



Current Enhancements

NAS Patuxent River: 21 Jul 2004

- Example Of Longer Range
 - Note: Airplane at 8 o'clock, Ships at 5 o'clock

GSK1

Multiple Hypothesis Target Tracker. (C) 1999-2004 Sicom Systems Ltd

File Edit View Help

MONITOR ALARMS STATUS
CONTROL DISPLAY SEASCAN

Connection
Source: FileServer
Start file server

Tracks
Enable tracking Show confirmed
Show other tracks Show labels
Show history Clear history
Covariances Predictions
Select history length: 10

Plots
Show plots Filter plots
Show history Clear history
Save plots to file Change plot file
Select history length: 15

SeaScan options
Radar online Playback data
Record data
Data Plots Both
SeaScan range (nmi): 24.0

Control
STOP CONTINUE STEP
Playback delay (s): 0.2

SeaScan P/B start time (GMT)
Segment:
year month day hour min sec

For Help, press F1 PAUSED Time: 132.781 Target.

Slide 18

GSK1

Is this really 24 nmi?

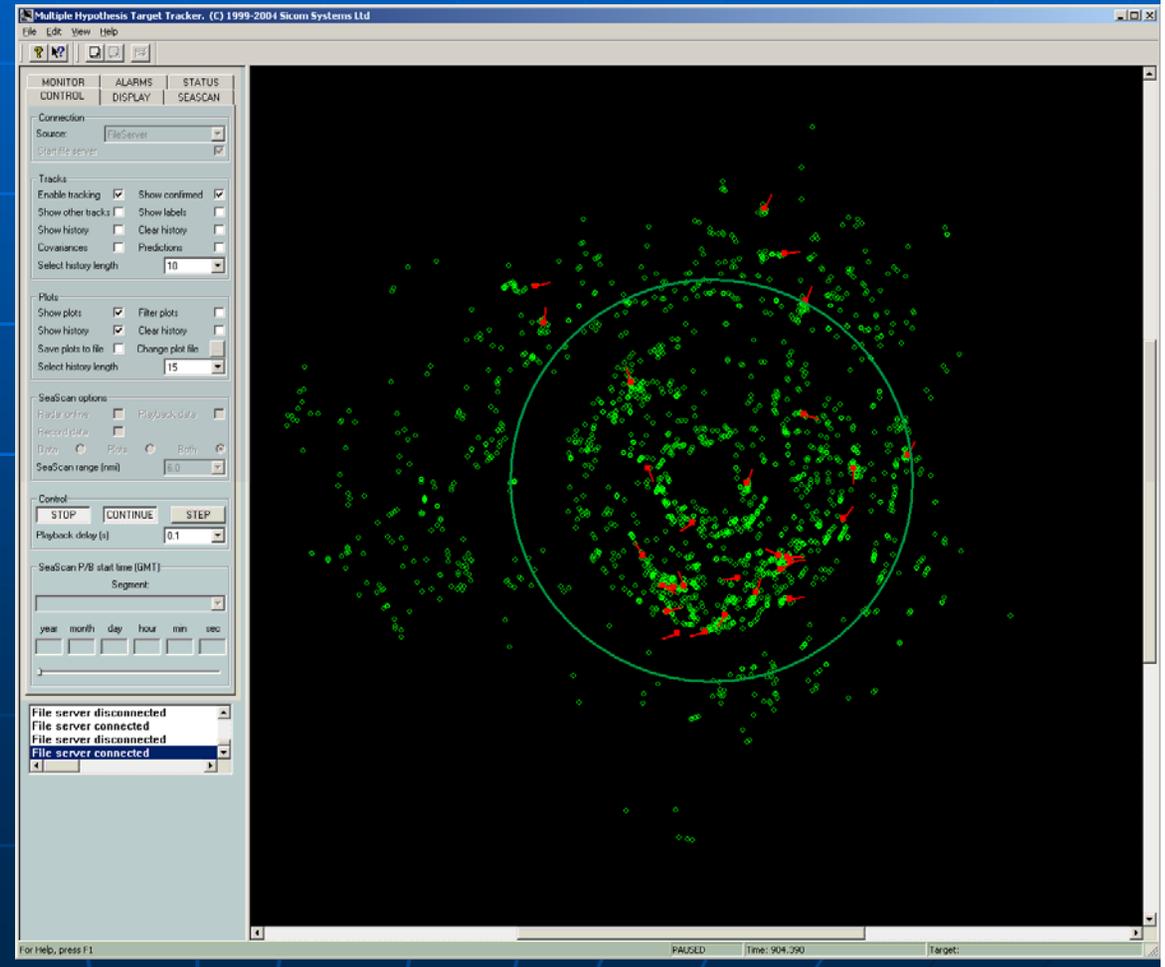
Gerry Key, 8/17/2004



Current Enhancements

NAS Patuxent River: 21 Jul 2004

- Crank Up Sensitivity
 - More Targets
 - Close to Residual Clutter/Noise Level
 - More False Alarms
 - Increases Processing Load on the Target-Tracking Program
 - MT-Tracker™ Has Handled This Load





Trailer

- SSC Charleston → SSC San Diego
 - On Hold – Field Testing of HW/SW Enhancements





Future Enhancements (FY05)

- Remote Control
 - Control Radar On/Off/Standby
 - Preprogram Sampling Times & Configuration
 - Alarms & Notification
- GIS & Database
 - Export XML
 - SensorML
 - Load Into Relational Database
 - Generalized Data Model With Other Measurement Data
 - Configuration As Well As Measurement Data
 - Visualize Using Standalone and Web-Based GIS
- Comparison Study with MARS – October 2004



Future Plans

- Web Services
- Data Streaming
 - Digitized Raw Radar Data on the Net
 - Security Issues
- Other Sensors
 - Thermal Imaging (Insects)
 - Wind Speed Profilers (Insects)
- Taxonomic Identification
- Air Traffic Control? – No Plans



Questions?

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