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# Tactical Decision Making Under Stress (TADMUS)

<http://www-tadmus.spawar.navy.mil>

**Space and Naval Warfare Systems Center - San Diego  
(SPAWARSYSCENSD)**

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# Presentation Overview

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## ◆ TADMUS Project History

- Decision Support System 1
- DEFTT Laboratory
- DSS1 (Video)
- Structured Interview / Fleet Perspective (Video)
- DSS2 Description (Demonstration)

## ◆ Future Directions

- TADMUS 2
- Response Planner and Manager (RPM)
- TADMUS to SEA (formerly Combat Enhancement through Integrated Decision Support)
- Decision Centered Design

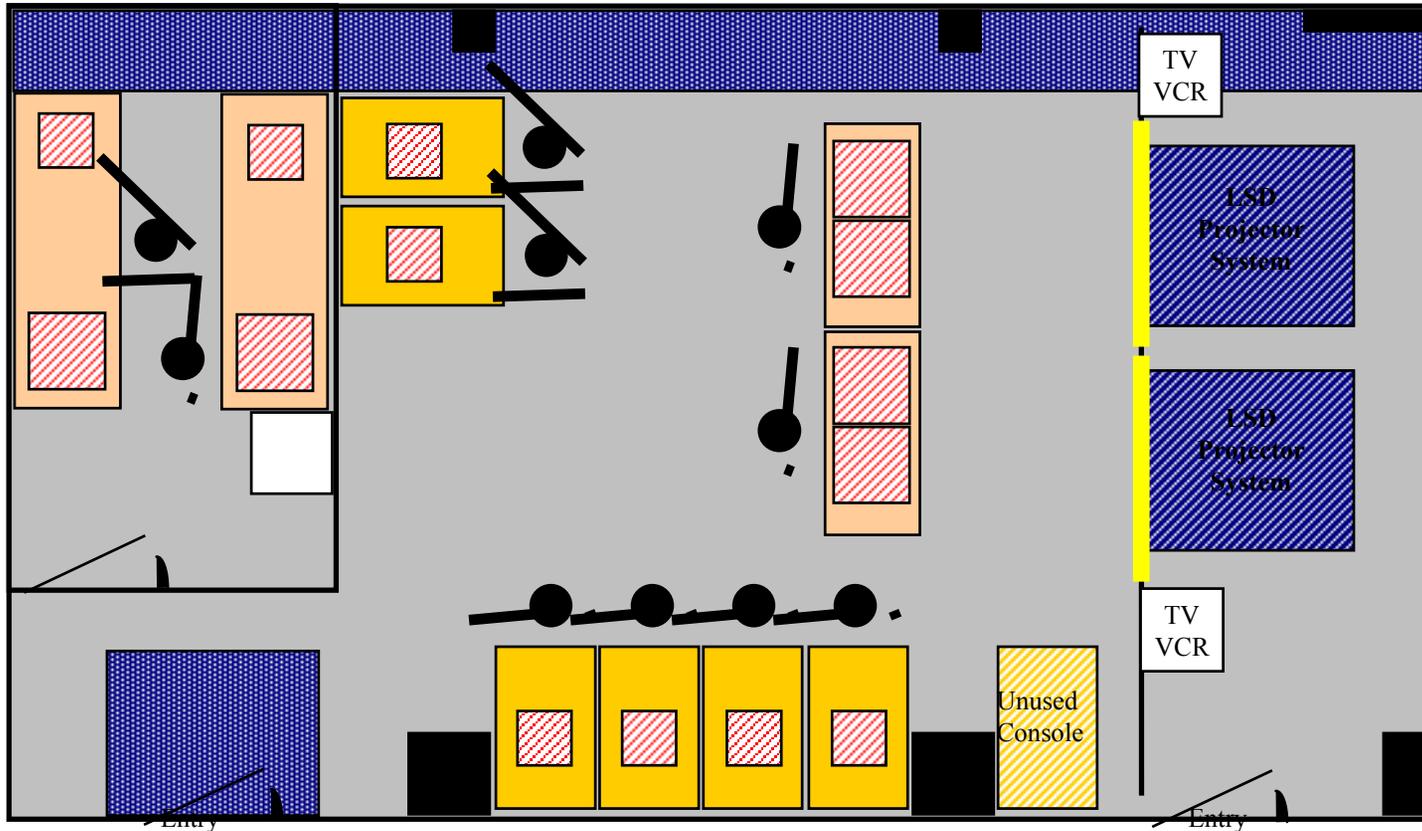
**UNCLASSIFIED**

# DEFTT TADMUS Laboratory Layout

Control/Observation Room

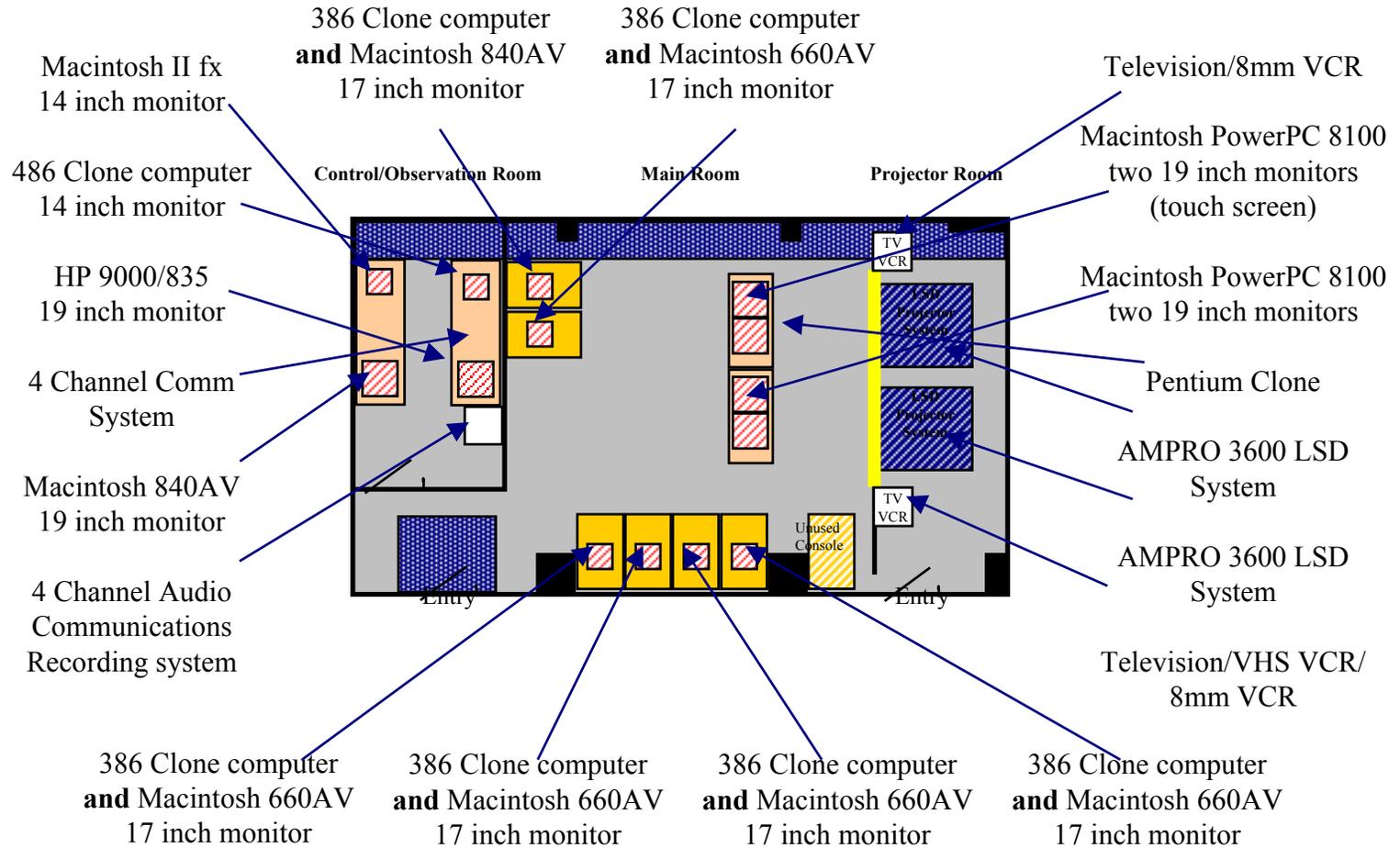
Main Room

Projector Room



Building A33, Room 0418 Scale: 1" = ~4'

# DEFTT Laboratory Resources



# What TADMUS is ...

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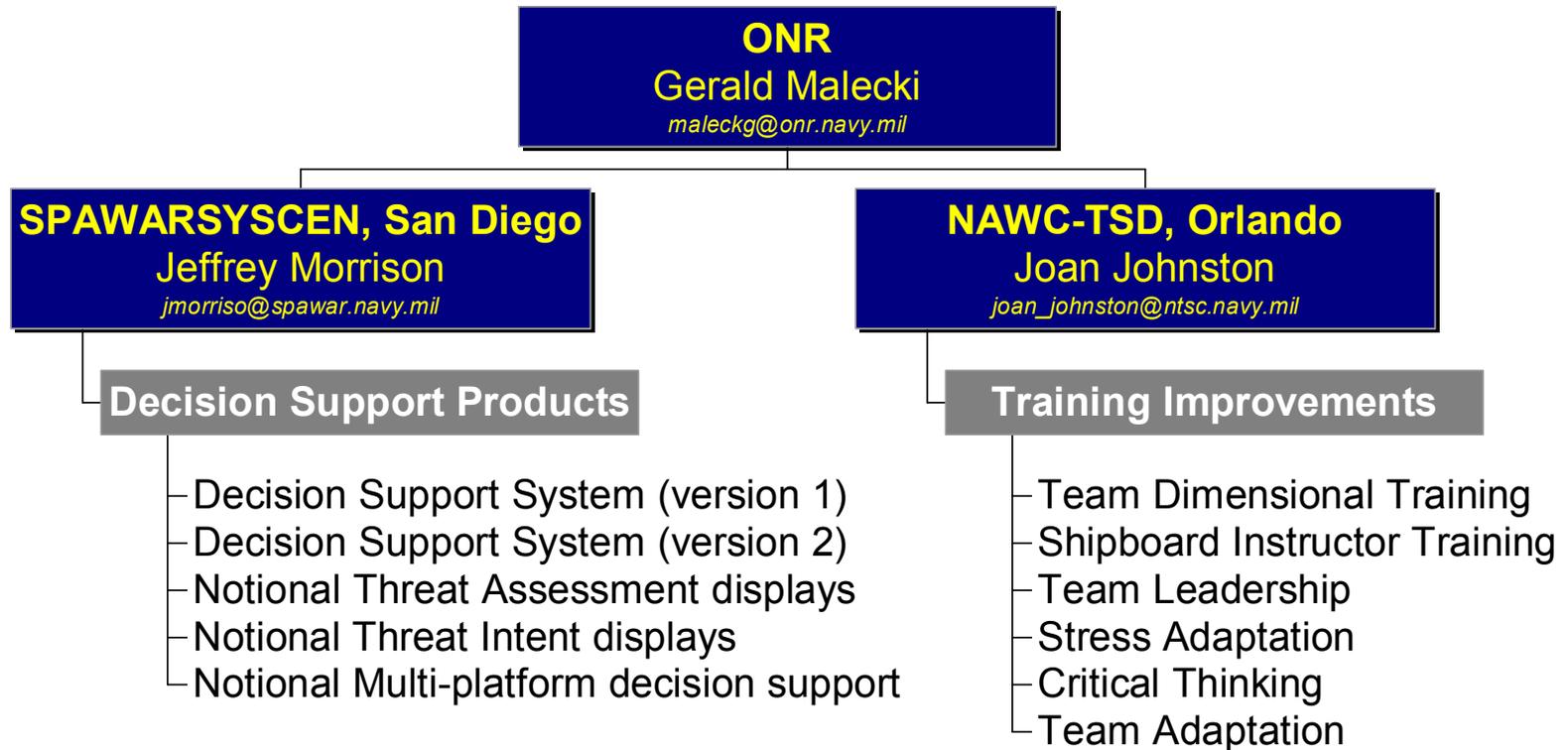
- ◆ **An Office of Naval Research (ONR) 6.2 funded research program.**
- ◆ **A bridge between emerging cognitive theories / models and Navy C<sup>4</sup>I requirements.**
- ◆ **Development of Decision Support (SPAWARSYSCEN) and Training (NAWC-TSD) interventions to supplement & improve command decision making.**
- ◆ **Owned by the Navy - concepts available to transition at any time & at minimal cost.**
- ◆ **Transitioning to advanced development (6.3) and to hardware projects, e.g. Aegis Combat System.**

# What TADMUS is NOT ...

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- ◆ **A program to reduce combat stress.**
- ◆ **Criticism of Aegis (or any other system).**
- ◆ **Decision making by computer.**

# Current Project Organization



# TADMUS Objectives

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- ◆ **Study command decision making & effects of environmental stressors: time compression & ambiguity.**
- ◆ **Apply “Naturalistic” Decision Making Theory to CO & TAO team in CIC.**
- ◆ **Develop interface & decision support concepts.**
- ◆ **Develop a prototype interface & decision support system.**
  - “Decision Support System” (DSS)
- ◆ **Test/validate principles experimentally in a tactical environment.**

# Project Team Expertise

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## ◆ Operational Expertise

- CO, NTU Cruiser; CO, Tactical Training Group Pacific; Commander & Chief of Staff, Carrier Group ONE
- CO, Aegis Cruiser; CO, Tactical Training Group Pacific; Project Officer CINCPACFLT Littoral Study
- CO, Fleet Combat Systems Training Unit Pacific; Officer In Charge, COMNAVSURFPAC Combat Systems Assessment Team; Combat Systems Officer, Afloat Training Group Pacific
- Senior Electronic Warfare Operator/Technician; Master Training Specialist

## ◆ Research Expertise

- Engineering Psychologist, 10+ Yrs experience: aviation, advanced automation, decision aiding, cognition, system engineering.
- Engineering Psychologist, 20+ Yrs. experience: C4I, RDT&E, personnel selection & training, display design, cognition.

## ◆ Fleet Participation

# Naturalistic Decision Making

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- ◆ **Experts make decisions differently from novices.**
  - Experts use heuristics as decision making shortcuts.
    - » Recognition-Primed Decision Making
    - » Explanation-Based Reasoning
  - Heuristics lead to *biases* & can cause *error*.
    - » Framing
    - » Anchoring
    - » Confirmation
  
- ◆ **Stress Affects Performance.**
  - Hypervigilance (Impulsive action)
  - Intolerance of ambiguity
  - Fixation on primary task / Tunnel vision
  - Less communicative
  - Short-term memory degradation

# Decision Support System 1

## *Requirements & Features*

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- ◆ **Designed as a flexible research tool.**
  - Based on Cognitive Strategies used in tactical decision making.
  - Simple to learn & use.
  - Flexible Interface - Easy to modify.
  - Code readily transitionable.
  - Not intended for direct transition to shipboard applications.
- ◆ **Designed to map identified decision making needs and cognitive theories to specific display modules.**
- ◆ **CO/TAO experimental support coordinated through CNSP staff (N812).**

# DSS 1 Used as Supplement to Traditional Geo-Plot Display

**Character Read Out (CRO) Display**

Provides text track data on a single track

Numerous multi-function display controls

**UNCLASSIFIED**

Platform Type: Super Puma Helo  
 Bearing: 162 deg  
 Range: 29 nm  
 Course: 000 deg  
 Speed: 110 kn  
 Altitude: 3000 ft

**7037**  
 Priority: 3  
 DSS Assessment: **THREAT**  
 Last Alert: Inside enemy weapon's range 07:48

Exocet

SM-2MR Guns

Verify airspace  
 1st warning  
 CIWS to auto/ready self defense systems  
 2nd warning/Cover  
 Execute EW packages  
 3rd warning/Illum  
 Report to senior  
 Engage / Do not Engage decision

**Basis for Assessment**

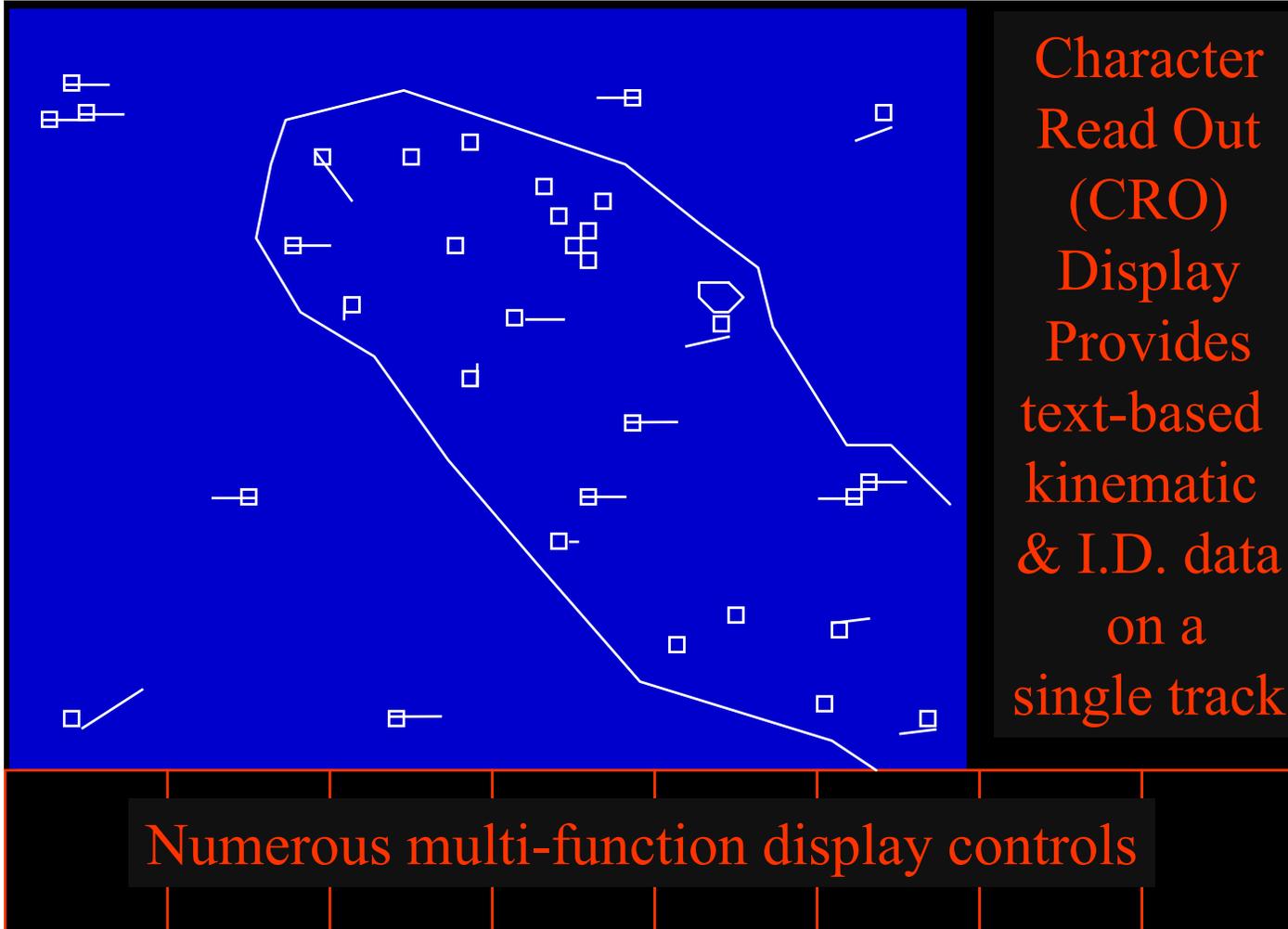
SUPPORTING EVIDENCE:	COUNTER-EVIDENCE:	ASSUMPTIONS:
<ul style="list-style-type: none"> <li>THREAT: ES-Platform ID (Threat)</li> <li>Origin near island</li> <li>Unfavorable track history</li> <li>No IFF response</li> <li>Closing in range</li> </ul>		<ul style="list-style-type: none"> <li>Carrying weapon</li> <li>IFF inoperative/off</li> </ul>

Threat	Non-Threat	Fit
Speed	Altitude History: 400-3000 feet	Fit
Altitude	Current Altitude: 3000 feet	Unk
Alt Change		
EW Emitter		
IFF	Tactical aircraft operating within tactical norms	Misfit
Origin		
Time in Air		
Intel		

**Track Priority List**

Track	Type	Assessment	Brg/Rng	Status	Next action	Alerts	Last Alert	Time
7013	La Combattante	THREAT	079 / 15.7	IMMED	CIWS to Auto	Inside enemy weapon's range	00:06	08:48
7023	P-3	THREAT	051 / 17	IMMED	CIWS to Auto	Inside 35 nm ROE limit	05:18	
7037	Super Puma Helo	THREAT	162 / 29	IMMED	Execute EW	Inside enemy weapon's range	07:48	
7001	Unknown	THREAT	187 / 9.1	low priority	3rd Warning	Change in DSS assessment	01:18	
7020	Helicopter/Lt Air	THREAT	045 / 34	low priority	2nd Warning	Inside 35 nm ROE limit	05:54	

# Traditional Geo-Plot Display



Platform Type: Super Puma Helo

Bearing: 162 deg  
 Range: 29 nm  
 Course: 000 deg  
 Speed: 110 kn  
 Altitude: 3000 ft

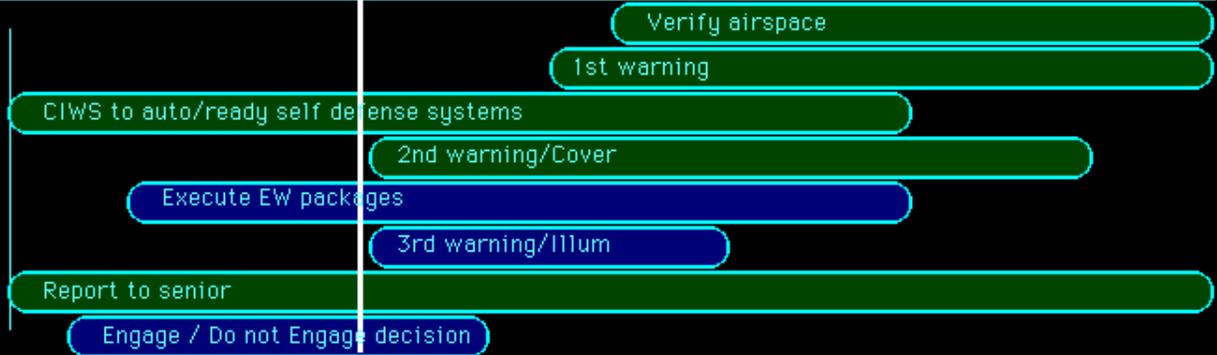
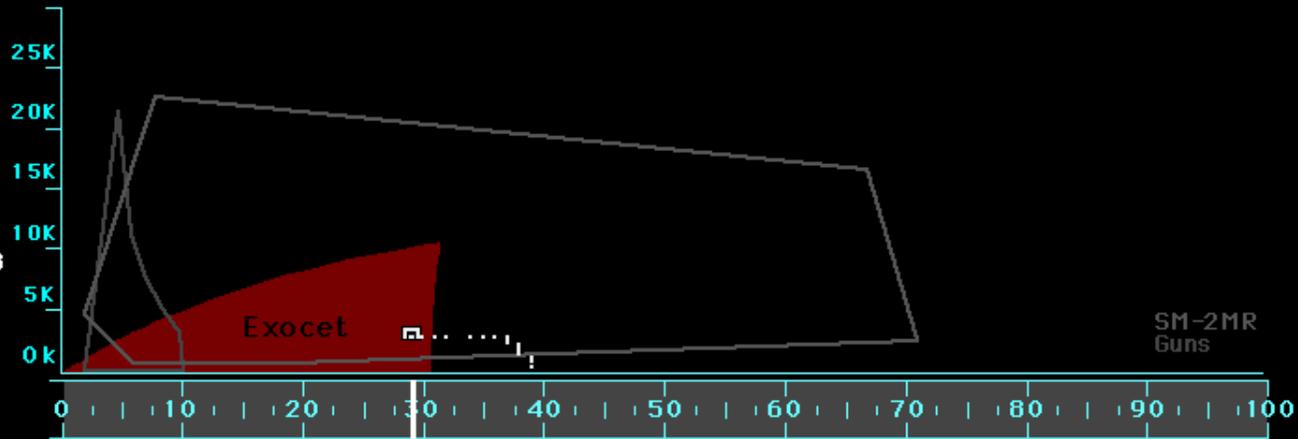
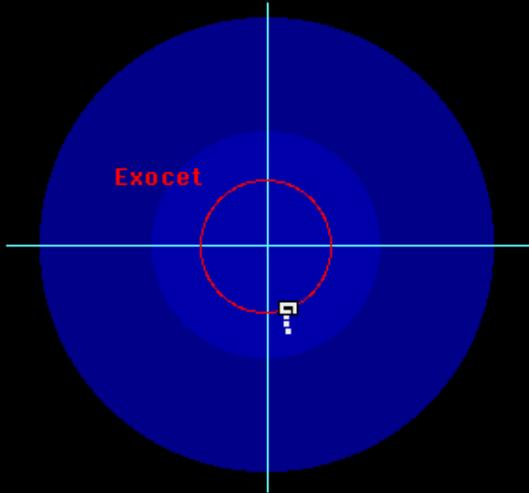
7037

Priority: 3

DSS Assessment:

**THREAT**

Last Alert: Inside enemy weapon's range 07:48



Basis for Assessment

SUPPORTING EVIDENCE:	COUNTER-EVIDENCE:	ASSUMPTIONS:
<p><b>THREAT</b></p> <p>ES-Platform ID (Threat)</p> <p>Origin near island</p> <p>Unfavorable track history</p> <p>No IFF response</p> <p>Closing in range</p>		<p>Carrying weapon</p> <p>IFF inoperative/off</p>

	Threat	Non-Threat	
Speed	█	█	Altitude History: 400-3000 feet
Altitude	█	█	
Alt Change	█	█	
EW Emitter	█	█	Current Altitude: 3000 feet
IFF	█	█	Tactical aircraft operating within tactical norms
Origin	█	█	
Time in Air	█	█	
Intel	█	█	

- Fit ●
- Unk ●
- Misfit ●

Track Priority List

Alerts

Track	Type	Assessment	Brg/Rng	Status	Next action	Last Alert	Time
7013	La Combattante	THREAT	079 / 15.7	IMMED	CIWS to Auto	Inside enemy weapon's range	00:06
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# DSS1 Study

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*Are we on the right track with DSS?*

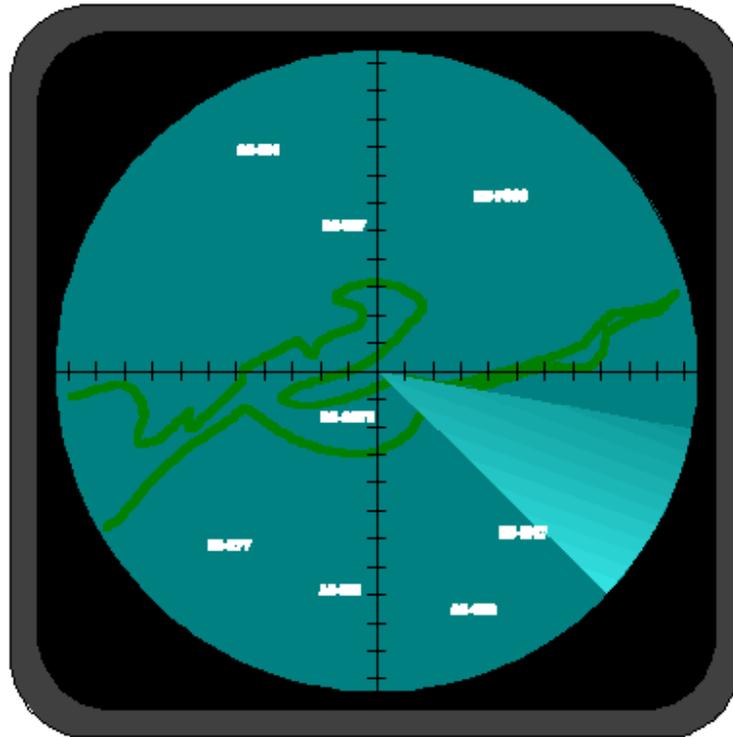
◆ **Objectives**

- **Determine overall effects of DSS**
- **Examine the use of DSS modules**

◆ **Research Questions**

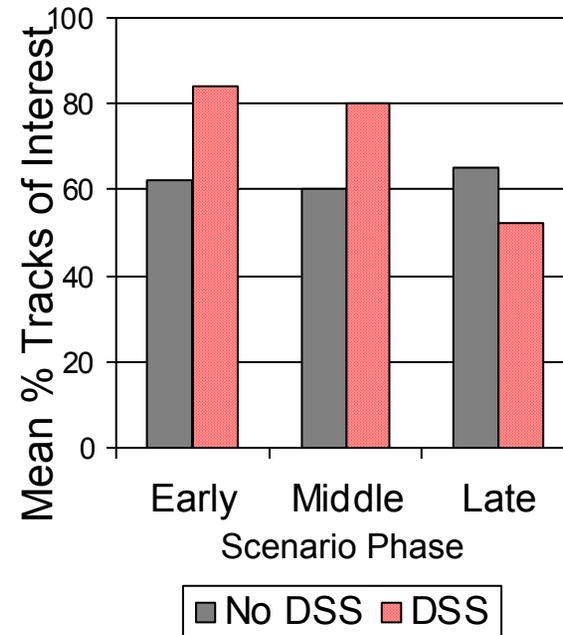
- **Situation Awareness**
- **Communications**
- **DSS Utility**
- **DSS Usability**

# Situation Awareness



# *Do teams recognize more critical contacts when using DSS?*

- ◆ **More tracks of interest were reported at early and at middle probes.**
- ◆ **No difference at late.**  
End-game more obvious.
- ◆ **Most felt a positive effect of DSS. (5.78 of 7-points)**  
*“more confident of my grasp of the overall tactical picture and priority threats”*



# *Do teams take more of the required actions against threat tracks with DSS?*

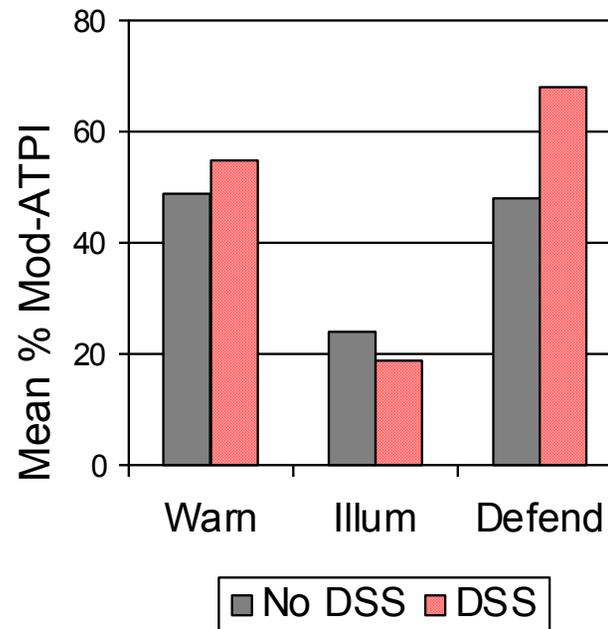
- ◆ **Significantly more likely to take timely defensive measures.**

Track Profile

Response Manager

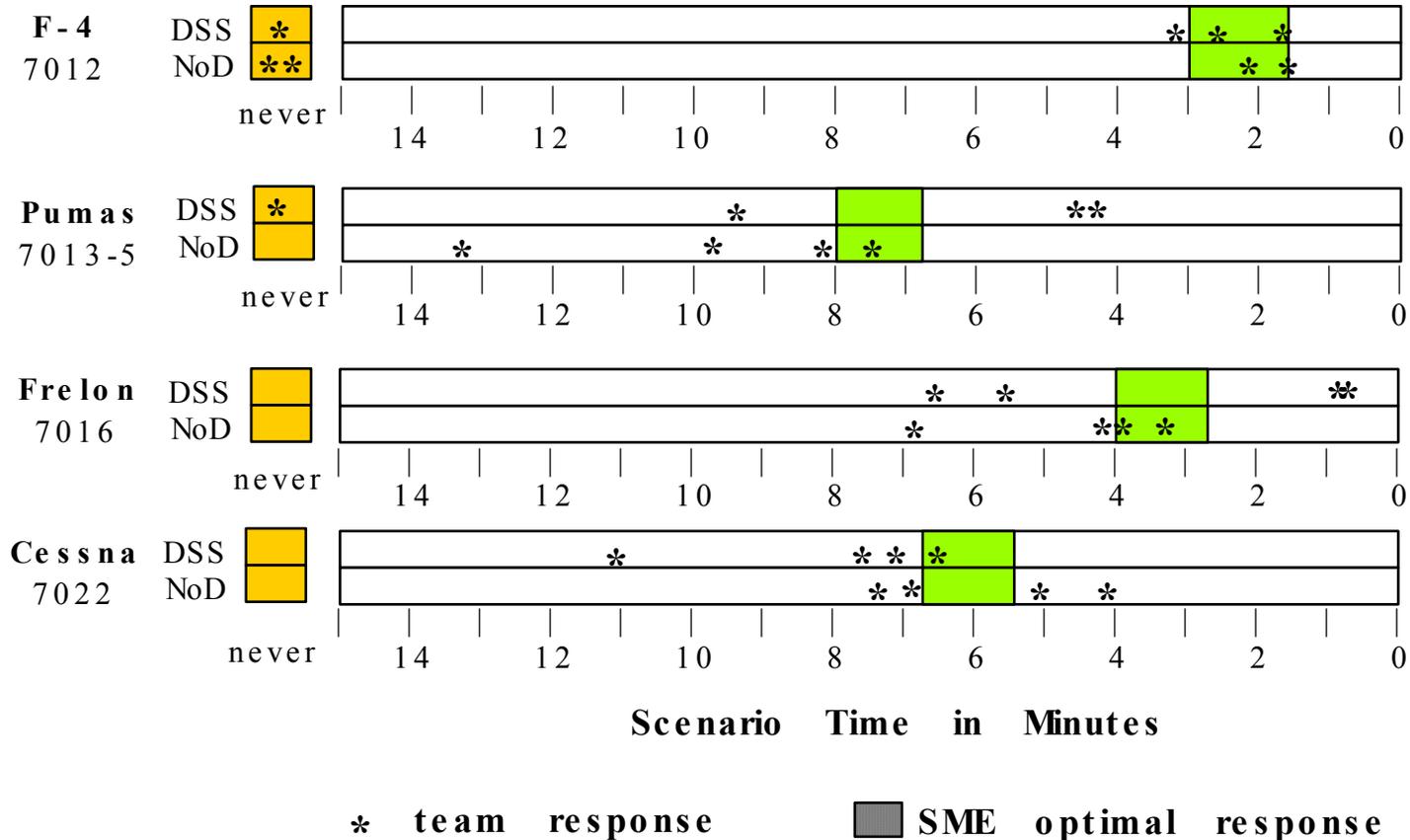
- ◆ **No difference in warnings and illuminations (provocative actions).**

**Note: Improved SA is reflected by taking less provocative actions earlier and more provocative actions later for a track.**



# When do teams take required actions against threat tracks?

## First Warnings – Scenario D



# *Would the DSS help prevent engagements with friendly and neutral tracks?*

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***“More information would certainly help.”***

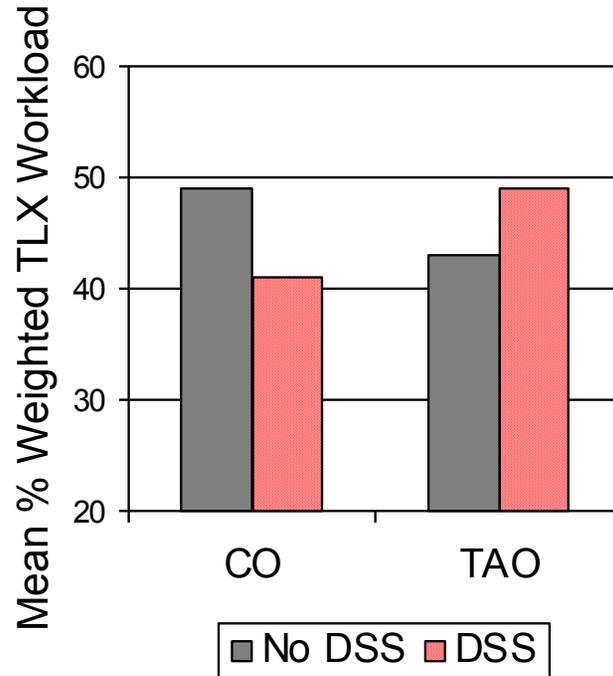
***“You can at least think about assumptions to check confidence in your assessment.”***

***“I’m reluctant to trust computers with these kinds of judgments.”***

***“You could ‘play with’ the evidence and assumptions to help reach a decision.”***

# Does DSS reduce workload?

- ◆ Significant reduction in workload for CO when using the DSS.
- ◆ Non-significant increase in workload for TAO with DSS.
- ◆ Large differences between teams.





# Team Communications

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# Communications Coding

Analysis of transcribed voice communications required re-coding in terms of type and source.

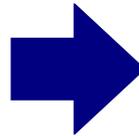
Message Type

Message Content

Time of Comm.

Comm. Links (To-From)

Subject Tracks



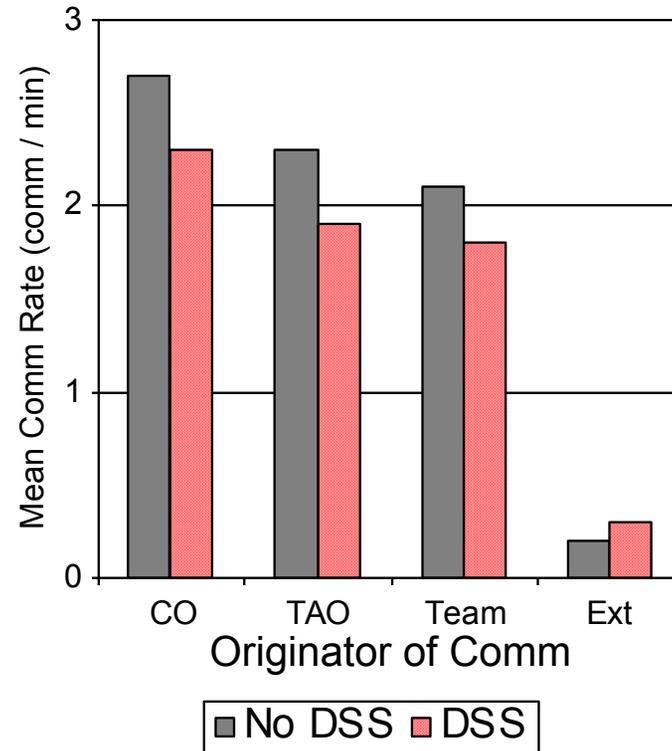
	Request	Reply	Provide	Acknowledge
Information				
Status				
Clarification				
Correlation				
Decision				
Order				

Did not code acknowledgments, problem control, reverberating orders, incomplete comms, and comms not involving CO / TAO.

Coded communications (52% of total comms) entered into MacSHAPA to support sequential communication analyses.

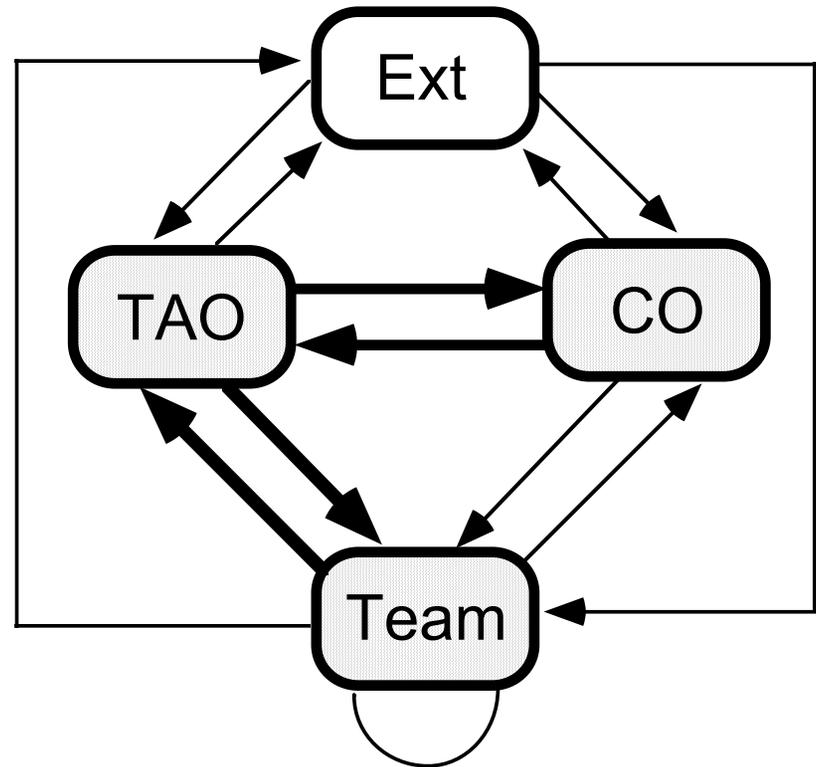
# Does the rate of communications change when using DSS?

- ◆ **Significantly fewer communications / min. overall with DSS (7.3 vs. 6.3).**
  - less need to exchange or verify data verbally
- ◆ **Consistent effect for all originators of messages.**



# Does the team's communication pattern change when using DSS?

- ◆ **No significant change in team communication pattern with DSS.**
  - 40% between CO & TAO
  - 35% between TAO & Team
  - less than 5% on other links
- ◆ **Note well defined and highly practiced roles of team members.**



# Content Coding Categories

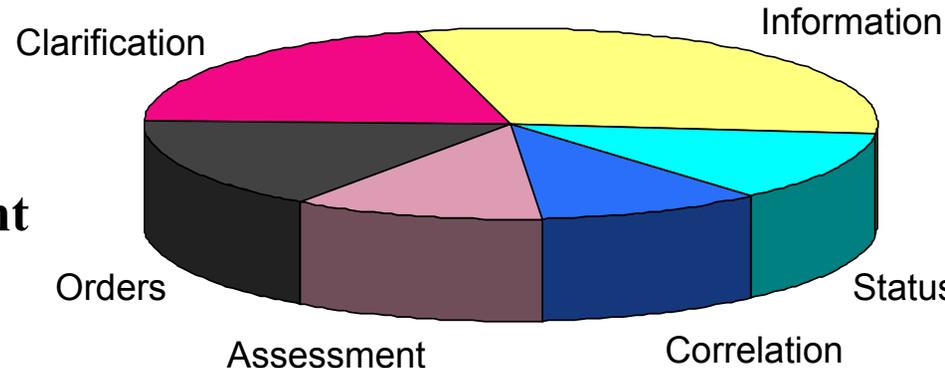
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- ◆ ***Information*** – exchange of sensor-based data
- ◆ ***Status*** – exchange of procedure-based data
- ◆ ***Correlation*** – association of two or more data
- ◆ ***Assessment*** – discussion of expected track behavior, likely intent, or future actions
- ◆ ***Orders*** – commands to perform an action
- ◆ ***Clarification*** – efforts to elucidate, interpret, or correct other communications

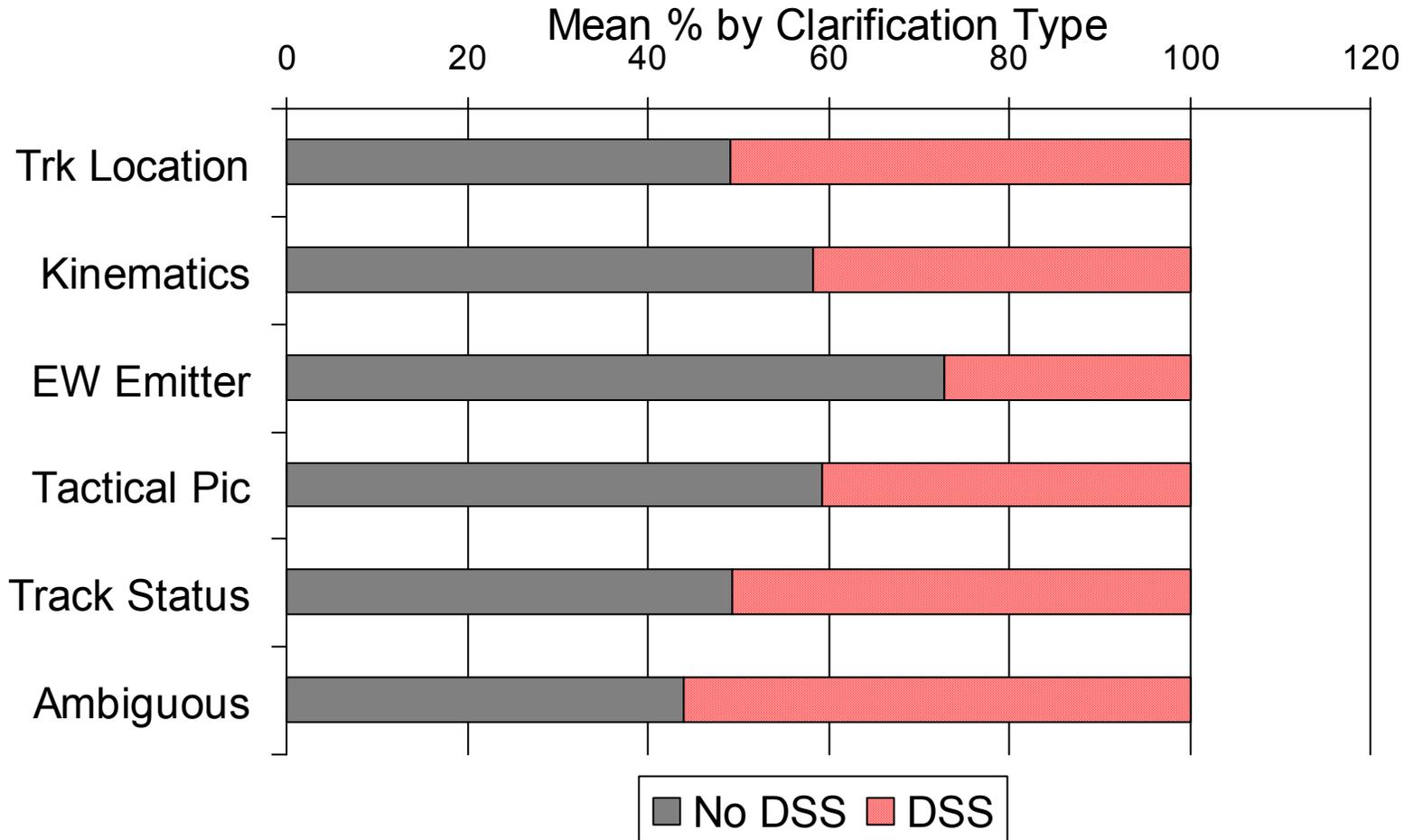
**Inter-rater reliability (3 raters): kappa = .92**

# A Glimpse Into DEFTT Lab Team Communications

- ◆ **Most comms (30%) involve exchange of sensor data.**
- ◆ **About 20% of comms involve Clarifications.**
- ◆ **Remaining comms involve other issues related to track management.**
- ◆ **Results are relatively consistent across teams and scenarios.**



# How does DSS affect clarifying communications?



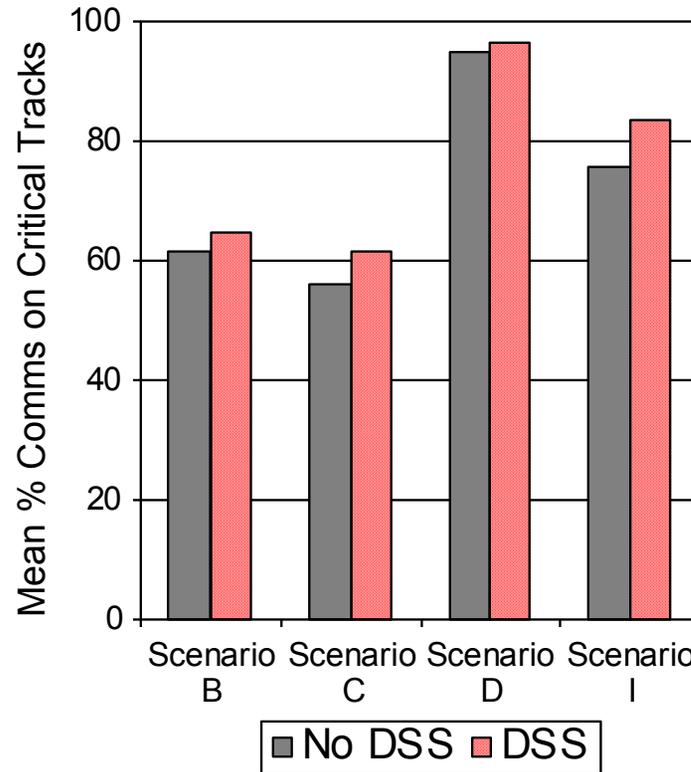
# *Do more of the communications concern critical tracks when using DSS?*

- ◆ **Non-significant increase in comms about critical tracks with DSS.**

*However...*

- expert tactical decision makers
- limited DSS practice
- highly structured roles of team members

- ◆ **Notable differences across scenarios.**



# Other Analyses

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- ◆ **Timelines showing communication density.**
- ◆ **Duration / dwell sequences for tracks.**
- ◆ **Transition matrices of communication content and type for particular tracks and events.**
- ◆ **Sequential analysis of event-based communications.**

# DSS1 Study - Conclusions

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- ◆ **CO and TAO use the DSS frequently.**
- ◆ **DSS is considered useful and adds value.**
- ◆ **Fewer communications and fewer of certain types of clarifications with DSS.**
- ◆ **More of the critical contacts recognized earlier.**
- ◆ **More likely to take defensive measures.**
- ◆ **DSS is easy to understand and use.**
- ◆ **Many valuable suggestions for revising DSS.**

# CO/TAO Feedback

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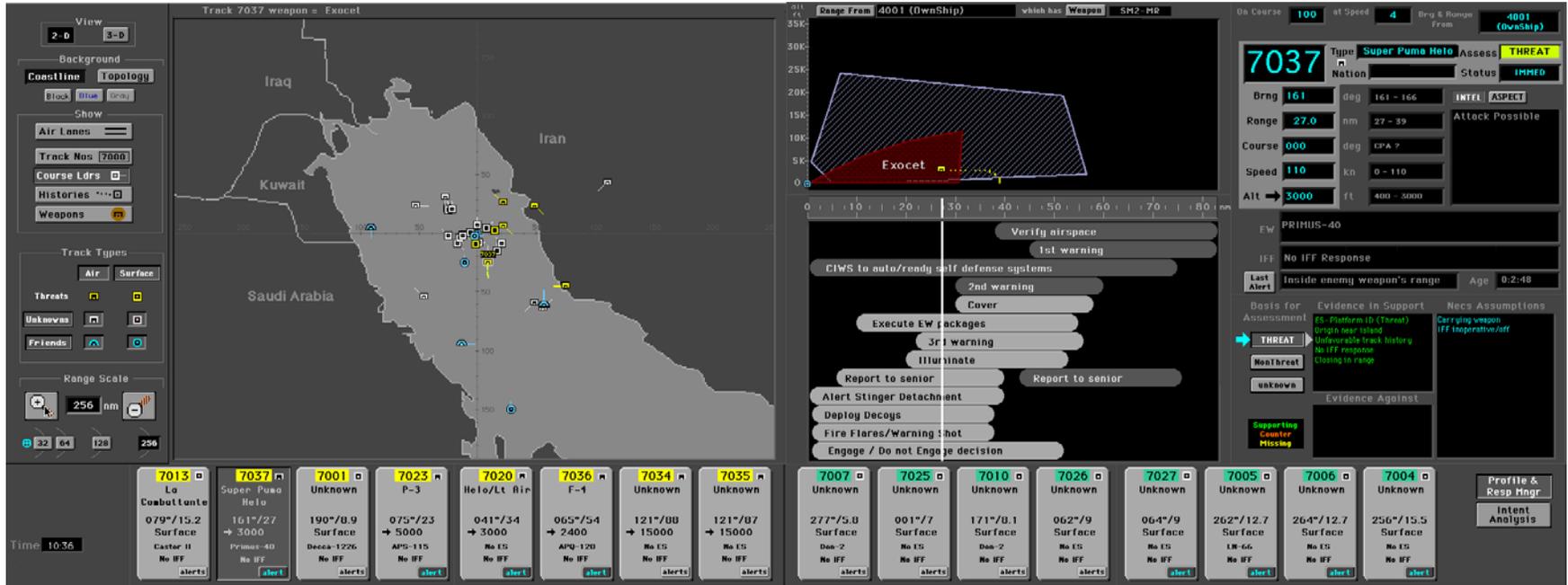
- ◆ **DSS evaluation questionnaire.**
  - Usage, utility, and usability ratings of modules
  - Overall assessment of DSS utility & usability
  
- ◆ **Structured interview.**
  - Comments about pros / cons of DSS overall
  - Suggestions for changes to the display & information
  - Reactions to incorporating DSS into ship CIC

## Decision Support System (DSS-2)

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- ◆ Revised display concepts based on the results from on-going research with DSS-1.
- ◆ Integrates Geo-plot from existing CIC into the DSS.
- ◆ Incorporates new concepts derived from emerging cognitive theories / models and needs expressed by Fleet operators.
- ◆ Currently working software.
- ◆ To be evaluated in simulations with revised scenarios.
- ◆ Potential application to TFCC.

# TADMUS DSS-2: CIC Conceptual Design



*For additional information:*

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San Diego, CA 92122  
(619) 535-1661  
E-Mail: [ramoore@nosc.mil](mailto:ramoore@nosc.mil)

**View**

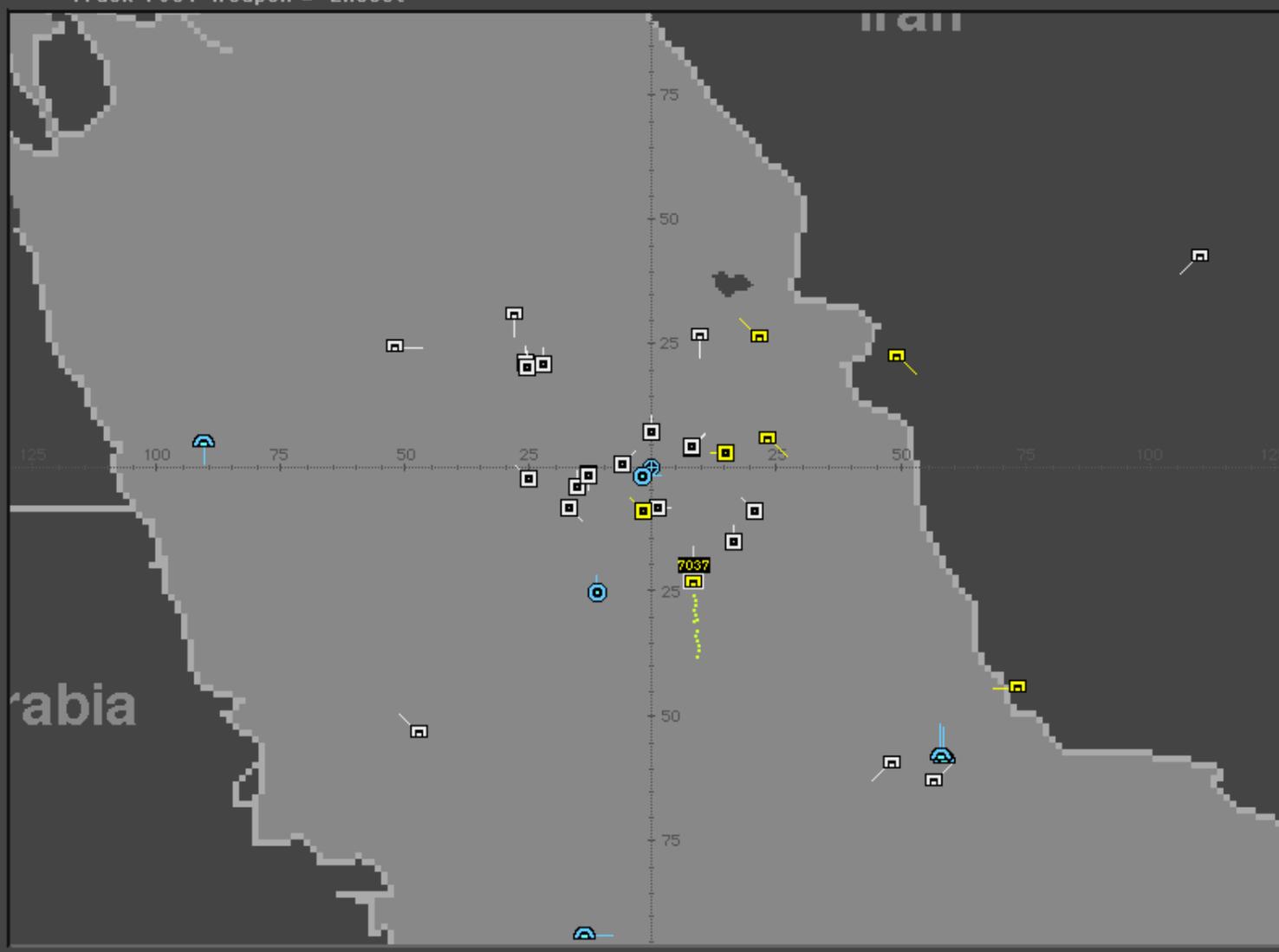
**Background**

**Show**

**Track Types**

**Threats**    
**Unknowns**    
**Friends**

**Range Scale**



Time 10:48

**7013**   
 La Combattante  
 079°/15.2  
 Surface  
 Castor II  
 No IFF

**7037**   
 Super Puma  
 Helo  
 160°/25  
 → 3000  
 Primus-40  
 No IFF

**7001**   
 Unknown  
 190°/8.9  
 Surface  
 Decca-1226  
 No IFF

**7023**   
 P-3  
 077°/24  
 → 5000  
 APS-115  
 No IFF

**7020**   
 Helo/Lt Air  
 040°/34  
 → 3000  
 No ES  
 No IFF

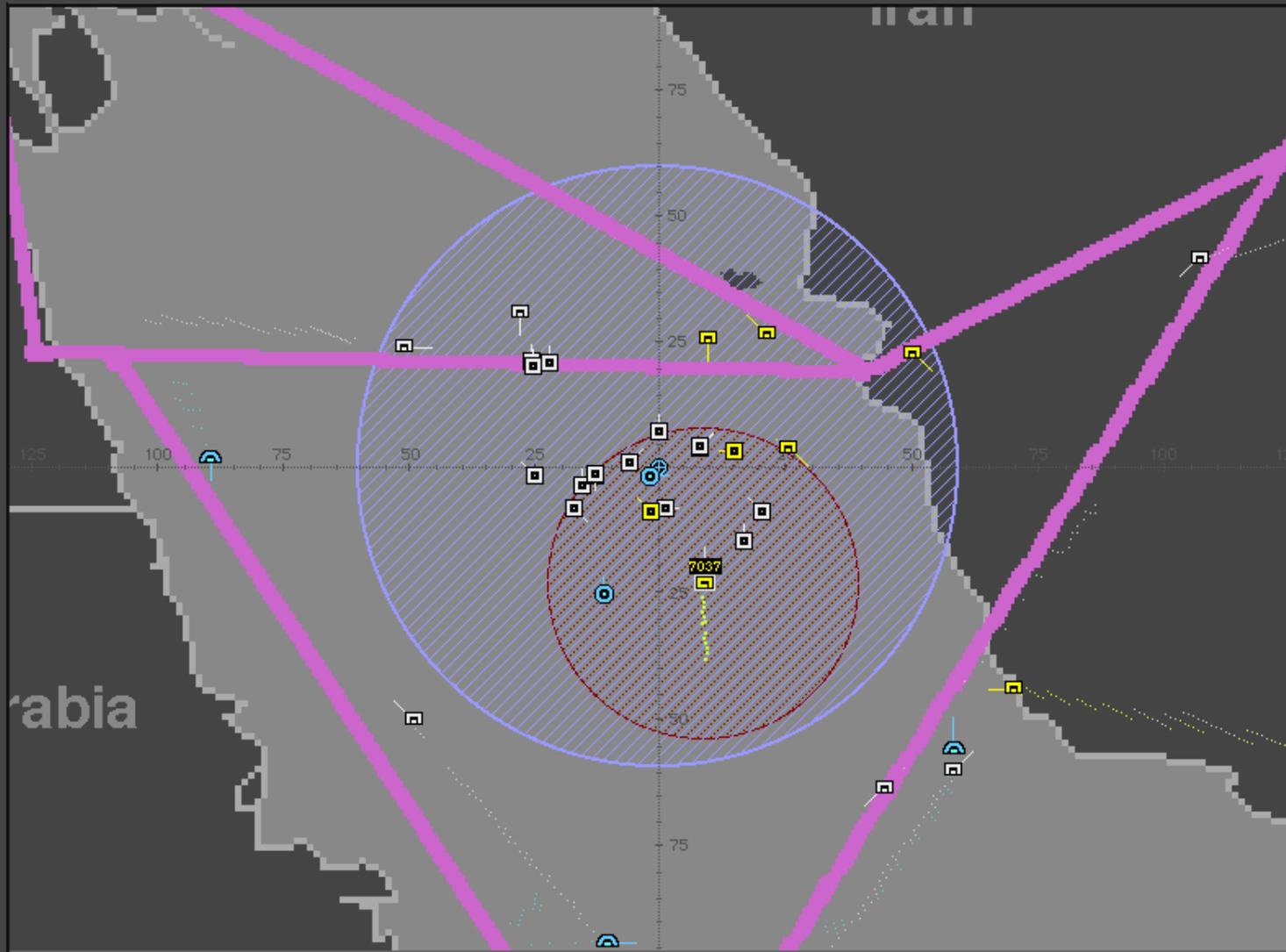
**7036**   
 F-4  
 066°/54  
 → 2400  
 APQ-120  
 No IFF

**7034**   
 Unknown  
 121°/86  
 → 15000  
 No ES  
 No IFF

**7035**   
 Unknown  
 121°/86  
 → 15000  
 Cyrano-IV  
 No IFF

Track 7037 weapon = Exocet

Italy



View

2-D

3-D

Background

Coastline

Topology

Black

Blue

Gray

Show

Air Lanes

Track Nos 7000

Course Ldrs

Histories

Weapons

Track Types

Air

Surface

Threats

Unknowns

Friends

Range Scale



128 nm



32

64

128

256

7013

La  
Combattante

078°/15.1  
Surface

Caster II  
No IFF

alerts

7037

Super Puma  
Helo

160°/25  
→ 3000

Primus-40  
No IFF

alert

7001

Unknown

190°/8.9  
Surface

Decca-1226  
No IFF

alerts

7023

P-3

081°/25  
→ 5000

APS-115  
No IFF

alert

7020

Helo/Lt Air

039°/34  
→ 3000

No ES  
No IFF

alert

7036

F-4

067°/55  
→ 2400

APQ-120  
No IFF

alert

7034

Unknown

122°/84  
→ 15000

No ES  
No IFF

alerts

7035

Unknown

122°/84  
→ 15000

Cyrano-IV  
No IFF

alerts

Time 11:18

View

2-D

3-D

Background

Coastline

Topology

Black

Blue

Gray

Show

Air Lanes

Track Nos

7000

Course Ldrs

Histories

Weapons

Track Types

Air

Surface

Threats

Unknowns

Friends

Range Scale



128 nm

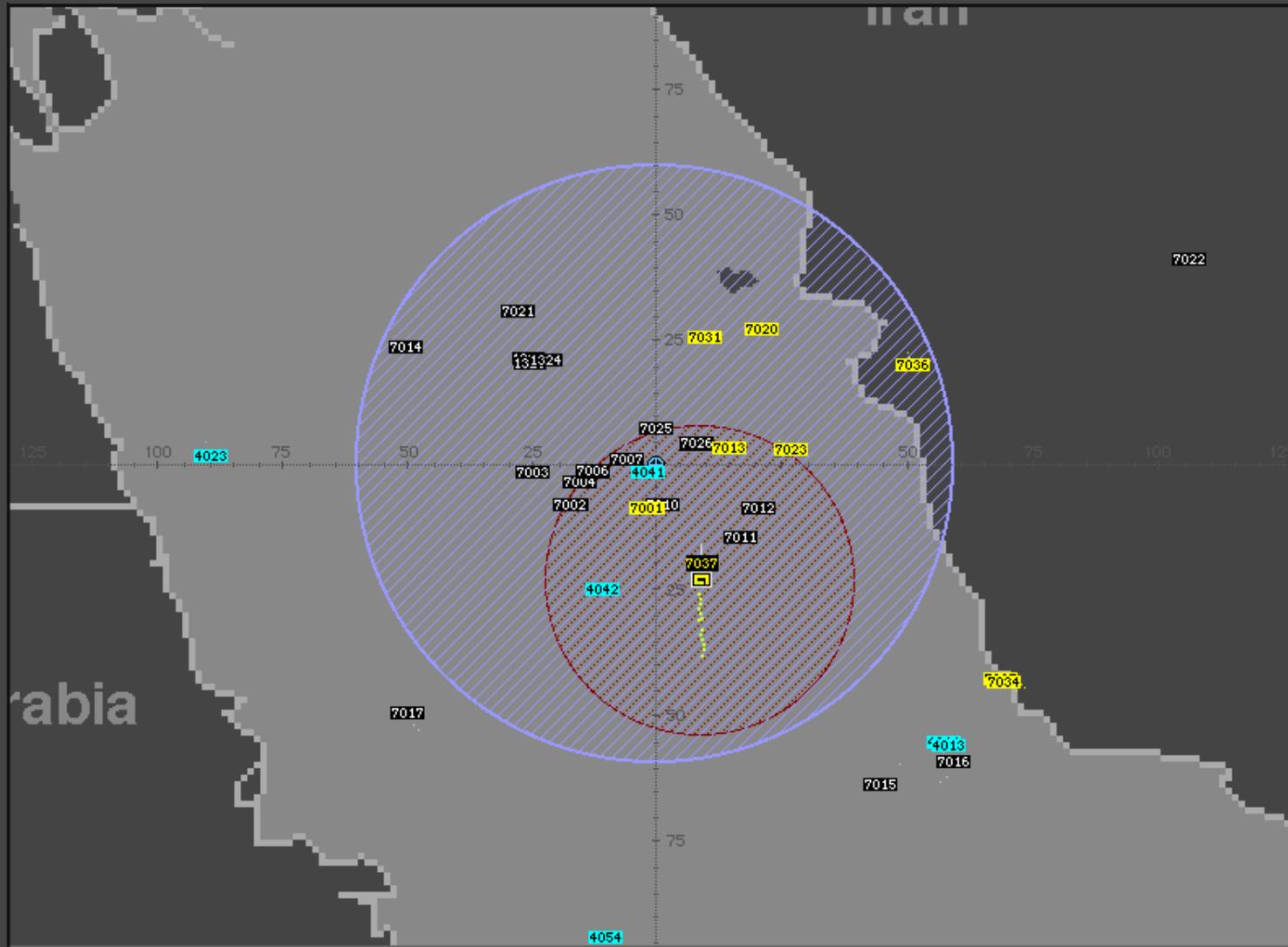


32

64

128

256



Time 11:36

**7013**

La Combattante

078°/15  
Surface

Castor II  
No IFF

**alert**

**7037**

Super Puma  
Helo

159°/25  
→ 3000

Primus-40  
No IFF

**alert**

**7031**

Helo/Lt Air

021°/27  
→ 500

No ES  
No IFF

**alert**

**7001**

Unknown

191°/8.8  
Surface

Decca-1226  
No IFF

**alerts**

**7023**

P-3

083°/27  
→ 5000

APS-115  
No IFF

**alert**

**7020**

Helo/Lt Air

038°/34  
→ 3000

No ES  
No IFF

**alert**

**7036**

F-4

069°/55  
→ 2400

APQ-120  
No IFF

**alert**

**7034**

Unknown

122°/82  
→ 15000

No ES  
No IFF

**alerts**

View

2-D

3-D

Background

Coastline

Topology

Black

Blue

Gray

Show

Air Lanes

Track Nos

7000

Course Ldrs

Histories

Weapons

Track Types

Air

Surface

Threats

Unknowns

Friends

Range Scale



1024 nm



32

64

128

256



<p><b>7013</b> <input type="checkbox"/></p> <p>La</p> <p>Combattante</p> <p>079°/15.2</p> <p>Surface</p> <p>Castor II</p> <p>No IFF</p> <p>alerts</p>	<p><b>7037</b> <input type="checkbox"/></p> <p>Super Puma</p> <p>Helo</p> <p>161°/27</p> <p>→ 3000</p> <p>Primus-40</p> <p>No IFF</p> <p>alert</p>	<p><b>7001</b> <input type="checkbox"/></p> <p>Unknown</p> <p>190°/8.9</p> <p>Surface</p> <p>Decca-1226</p> <p>No IFF</p> <p>alerts</p>	<p><b>7023</b> <input type="checkbox"/></p> <p>P-3</p> <p>071°/21</p> <p>→ 5000</p> <p>APS-115</p> <p>No IFF</p> <p>alert</p>	<p><b>7020</b> <input type="checkbox"/></p> <p>Helo/Lt Air</p> <p>041°/34</p> <p>→ 3000</p> <p>No ES</p> <p>No IFF</p> <p>alert</p>	<p><b>7036</b> <input type="checkbox"/></p> <p>F-4</p> <p>064°/53</p> <p>→ 2400</p> <p>APQ-120</p> <p>No IFF</p> <p>alert</p>	<p><b>7035</b> <input type="checkbox"/></p> <p>Unknown</p> <p>121°/89</p> <p>→ 15000</p> <p>No ES</p> <p>No IFF</p> <p>alerts</p>	<p><b>7034</b> <input type="checkbox"/></p> <p>Unknown</p> <p>120°/89</p> <p>→ 15000</p> <p>No ES</p> <p>No IFF</p> <p>alerts</p>
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Time 10:24

View

2-D 3-D

Background

Coastline Topology

Black Blue Gray

Show

Air Lanes

Track Nos 7000

Course Ldrs

Histories

Weapons

Track Types

Air Surface

Threats

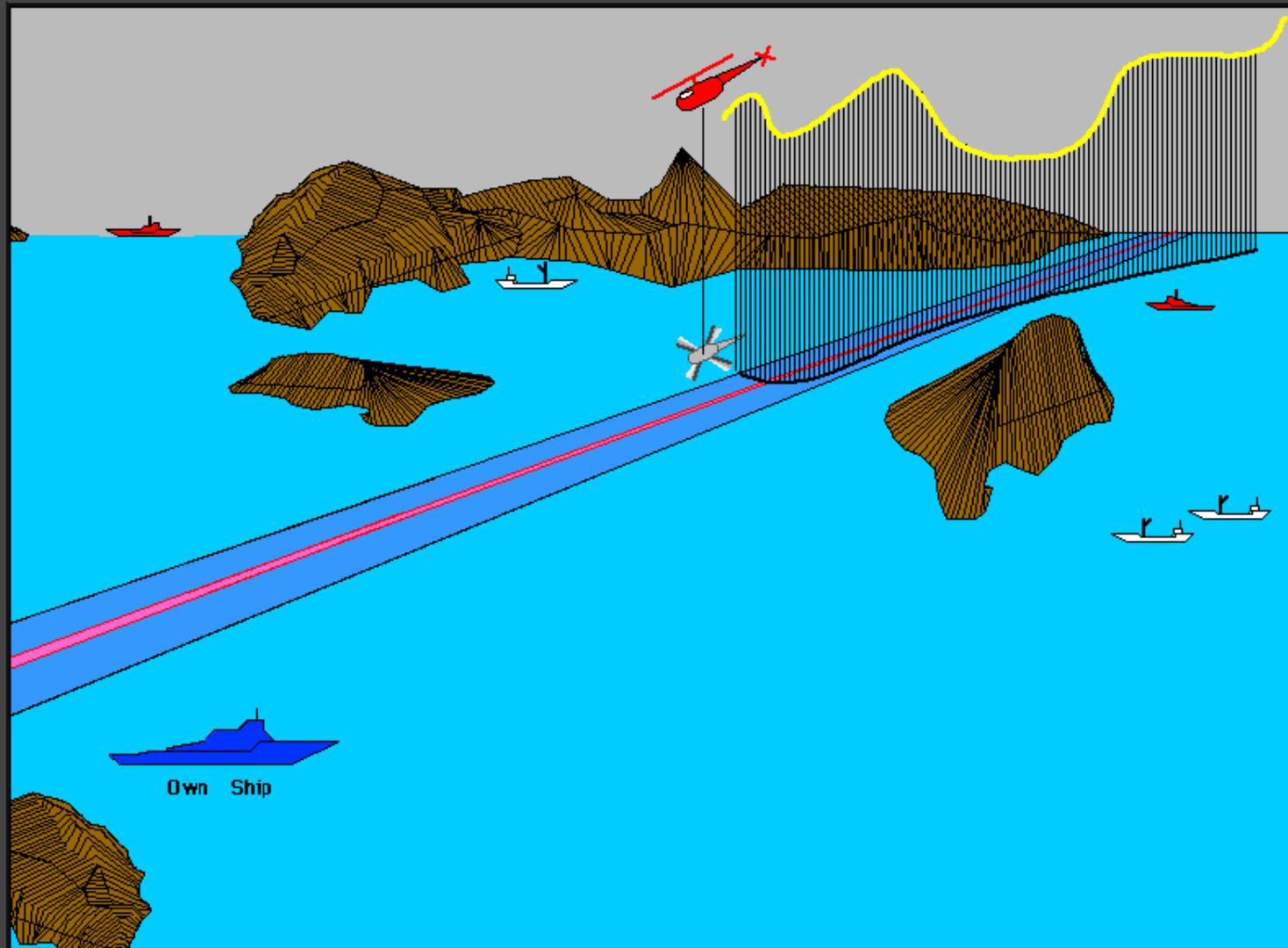
Unknowns

Friends

Range Scale

16 nm

32 64 128 256



**7013**

La Combattante

079°/15.2  
Surface

Castor II  
No IFF

alerts

**7037**

Super Puma Helo

161°/27  
→ 3000

Primus-40  
No IFF

alert

**7001**

Unknown

190°/8.9  
Surface

Decca-1226  
No IFF

alerts

**7023**

P-3

071°/21  
→ 5000

APS-115  
No IFF

alert

**7020**

Helo/Lt Air

041°/34  
→ 3000

No ES  
No IFF

alert

**7036**

F-4

064°/53  
→ 2400

APQ-120  
No IFF

alert

**7035**

Unknown

121°/89  
→ 15000

No ES  
No IFF

alerts

**7034**

Unknown

120°/89  
→ 15000

No ES  
No IFF

alerts



- Verify airspace
- 1st warning
- CIWS to auto/ready self defense systems
- 2nd warning
- Cover
- Execute EW packages
- 3rd warning
- Illuminate
- Report to senior
- Report to senior
- Alert Stinger Detachment
- Deploy Decoys
- Fire Flares/Warning Shot
- Engage / Do not Engage decision

On Course 100 at Speed 4 Brng & Range From 4001 (OwnShip)

**7037** Type **Super Puma Helo** Assess **THREAT**  
 Nation Status **IMMED**

Brng 159 deg 159 - 166 INTEL ASPECT  
 Range 25.0 nm 25 - 39 Attack Possible  
 Course 000 deg CPA ?  
 Speed 110 kn 0 - 110  
 Alt 3000 ft 400 - 3000

EW PRIMUS-40  
 IFF No IFF Response  
 Last Alert Inside enemy weapon's range Age 0:3:48

Basis for Assessment	Evidence in Support	Necs Assumptions
<input checked="" type="radio"/> THREAT <input type="radio"/> NonThreat <input type="radio"/> unknown	ES-Platform ID (Threat) Origin near island Unfavorable track history No IFF response Closing in range	Carrying weapon IFF inoperative/off
Evidence Against		
<input checked="" type="radio"/> Supporting Counter Missing		

- 7035** Unknown 122°/82 → 15000 Cyrano-IV No IFF alerts
- 7007** Unknown 279°/5.8 Surface Don-2 No IFF alerts
- 7025** Unknown 001°/7 Surface No ES No IFF alerts
- 7010** Unknown 171°/8.1 Surface Don-2 No IFF alerts
- 7026** Unknown 063°/9 Surface No ES No IFF alerts
- 7027** Unknown 064°/9 Surface No ES No IFF alert
- 7006** Unknown 264°/12.7 Surface No ES No IFF alert
- 7005** Unknown 262°/12.8 Surface LN-66 No IFF alert

Profile & Resp Mgr  
 Intent Analysis

# Flag Briefings

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- ◆ **VADM Fargo, COMFIFTHFLT**
- ◆ **VADM Hancock, OPNAV(N4)**
- ◆ **VADM Krekich, COMNAVSURFPAC**
- ◆ **VADM Browne, COMTHIRDFLT**
- ◆ **VADM Lautenbacher, COMTHIRDFLT**
- ◆ **ADM Hogg, Director Strategic Studies Group**
- ◆ **RADM Wagner, SPAWAR**
- ◆ **RADM Nutwell, Deputy SPAWAR**
- ◆ **RADM Long, COMCRUDESGRU FIVE**
- ◆ **RADM Marfiak, COMCRUDESGRU FIVE**
- ◆ **RADM McGinn, OPNAV N88**

# TADMUS

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- ◆ **ONR approved a 3-year 6.2 follow-on project starting FY97.**
  - **Develop integrated training & decision support interventions (e.g. Wizards, Tutorials, embedded scenarios)**
  - **Support SWOS PCO/PXO/Department Head tactical decision making requirements**
    - » **Delivering DSS for scenario support and staff/student evaluation**
  - **Extend DSS to other AW positions within CIC (AWC , TIC , EW)**
  - **Extend DSS to other warfare areas in CIC (SUW, USW)**
  - **Apply emerging Decision making theories to CIC problems**
  - **Develop improved metrics / methodologies for measuring tactical decision making (e.g. real-time performance assessment, eye movement, communication analyses, etc.)**

# Response Planner & Manager Project (RPM)

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- ◆ **Customer: U.S. Navy (Battlegroup)**
- ◆ **Objectives:**
  - Analyze and develop cognitive models of military tactical planners & planning process.
  - Develop customized interfaces to:
    - perform pre-deployment planning and real-time re-planning of battle force assets (*author and tailor specific action plans*)
    - perform tactical resource/response management based on established plans (*plan execution and monitoring*)
- ◆ **Status: Funded as FY97, 3-Yr., 6.2 HF Task.**
- ◆ **P.O.C.: George E. Seymour; Code D44210, (619) 553-8008**
- ◆ **Relationship:**
  - Inspired by TADMUS DSS Response Manager & Collaborative planning needs. Marines looking for similar tools.
  - Planning and Execution decision modeling.

# TADMUS to SEA

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- ◆ **Customer: U.S. Navy (COMTHIRDFLT, PMS 400/AEGIS)**
- ◆ **Objectives:**
  - Develop Tactical Fleet Command Center DSS application.
  - Mature underlying DSS algorithms / databases.
  - “DSS@Sea” shipboard evaluation.
  - Integrate decision support concepts into JMCIS
- ◆ **Status: Funded as FY97, 4-Yr., 6.3 Human Factors Task**
- ◆ **P.O.C.: J.Morrison, Ph.D.; SPAWARSYSCEN Code D44210.  
(619) 553-9070**
  - Develop mature components of TADMUS DSS & build into Aegis.
- ◆ **Relationship:**
  - Responding to Fleet requests to implement DSS onboard ship & extend DSS to battle group command level.
  - Leveraged off on-going TADMUS 6.2.



## Command 21 -

# Decision Centered Design (DCD) Initiative

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- ◆ **Sponsor: U.S. Navy (N6M) - 6.4 funded.**
- ◆ **Objectives:**
  - **Develop DCD process for use across Fleet.**
  - **Develop DCD laboratory and expertise.**
  - **Perform Cognitive Task Analyses on AADC, CJTF, CVBF.**
  - **Develop decision support concepts for various Joint / Fleet Applications.**
  - **Integrate decision support concepts with C4I architecture.**
- ◆ **Status: Funded as FY98, 4-Yr., 6.4 Task**
- ◆ **P.O.C.: J.Morrison, Ph.D.; SPAWARSYSCEN Code D44210.  
(619) 553-9070**
- ◆ **Relationship:**
  - **Responding to Fleet reduced manning initiatives.**
  - **Leveraged off on-going TADMUS 6.2 / 6.3.**

# Conclusion

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## TADMUS

**Decision support concepts for  
tactical decision makers which  
are:**

*Theoretically derived,  
Empirically tested,  
Fleet Validated.*