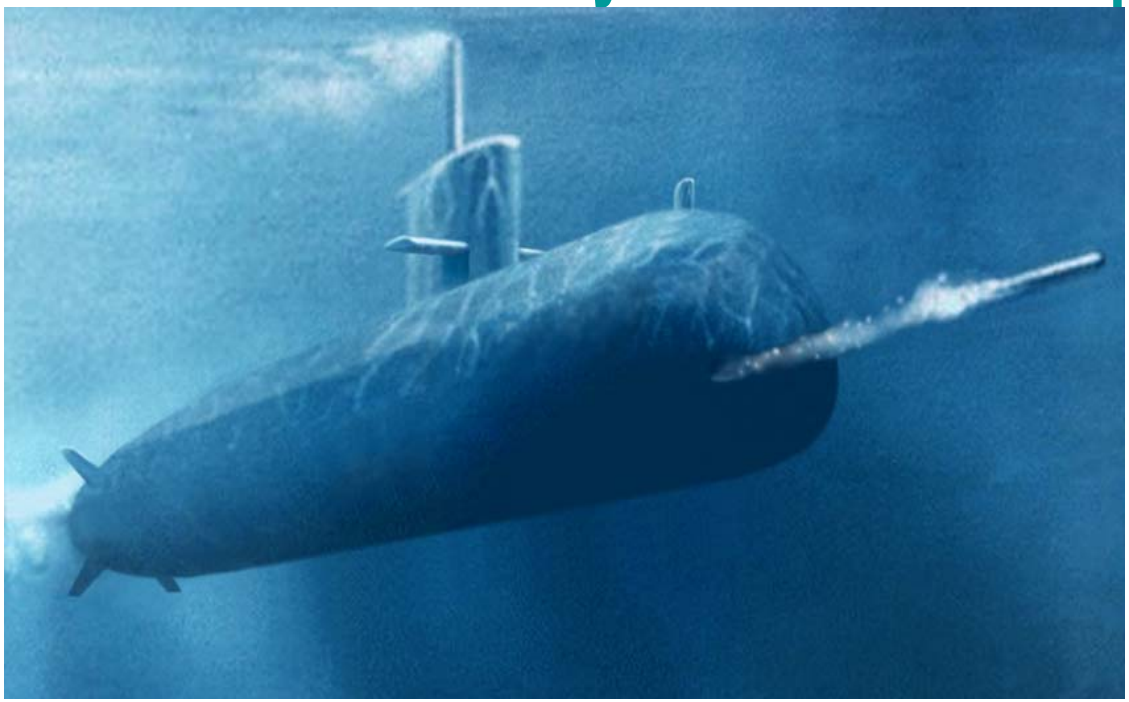
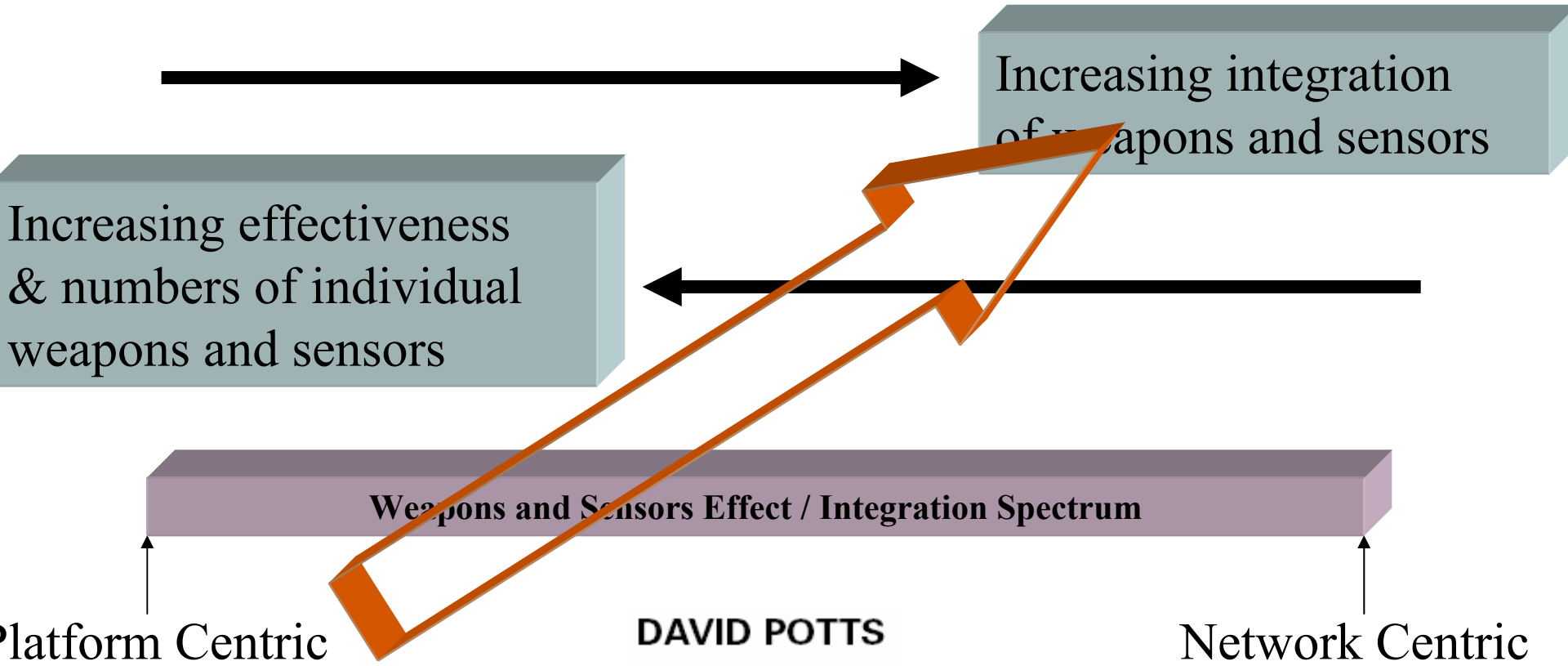
Investigating the network enabled conventional submarine II: A summary of Australian Experimentation



Sam Huf, Andrew Tynan, Sanjeev Arulampalam, Todd Mansell, Garry Brown, Rodger Manning (QINETIQ), CMDR Mel Jones (RANR).

Investment in NCW?

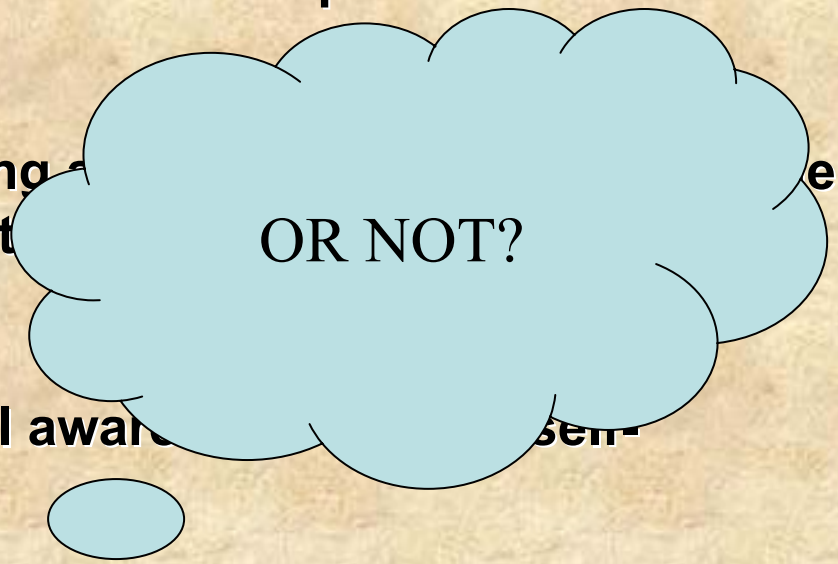


DAVID POTTS

MARCH 2002

The tenets of NCW are:

1. A robustly networked force improves information sharing.
2. Information sharing [illegible] quality of informat[illegible] awareness.
3. Shared situational awar[illegible] synchronization.
4. These, in turn, d[illegible]atically increase mission effectiveness.



Ref: http://www.dodccrp.org/research/ncw/ncw.htm

NCW: Our BOSS (CDF)

"…Let me tell you what it means to the ADF.

In c…s
of t…y
off…a
bro…

But…
all…o
tha…ir
adv…

1. **"… opportunities to detect, identify and engage targets using a broader range of sensors and weapons …"**
2. **"… allows our people to collaborate …"**

CDF Speech to ADO Network-Centric Warfare Conference: Tuesday 20 May 03
http://www.defence.gov.au/media/2003/200503.doc

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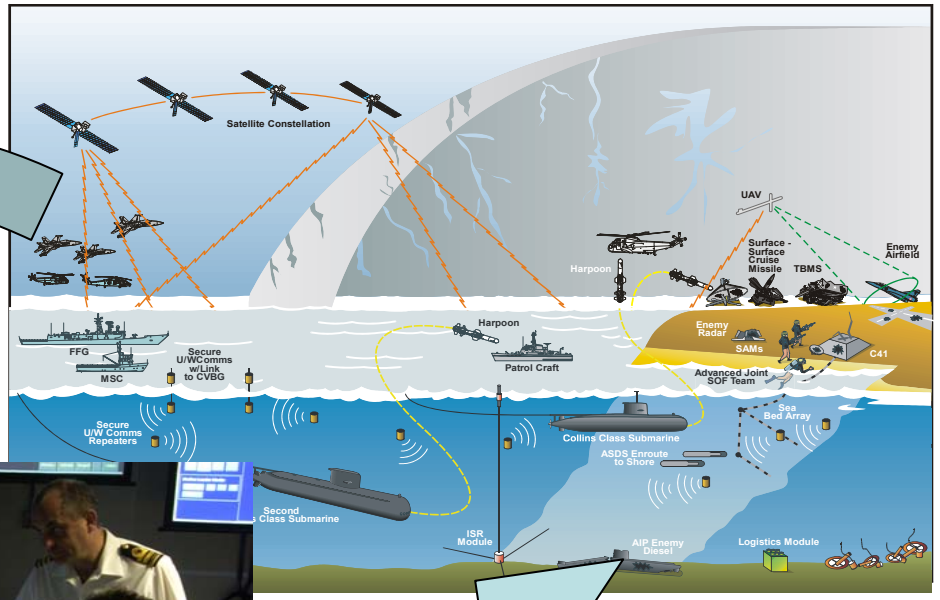
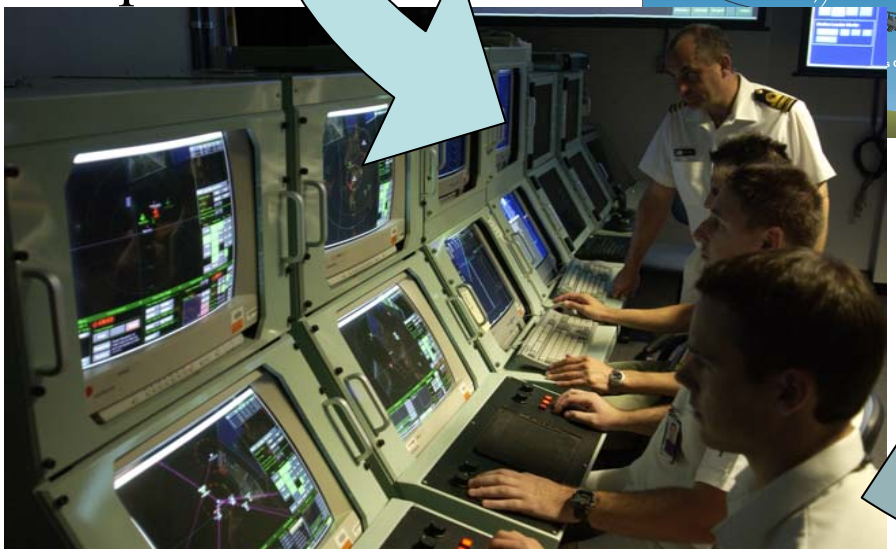
Human-in-the-loop simulation experiments

Processes

People





Technology

Processes

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Virtual Maritime System Architecture

JSAF

Gateways to Other Simulation Systems

DIS

Virtual SEA4000

Virtual Tactical Data Link

Virtual ANZAC

HLA Run Time Infrastructure

Virtual Collins

Virtual FFG

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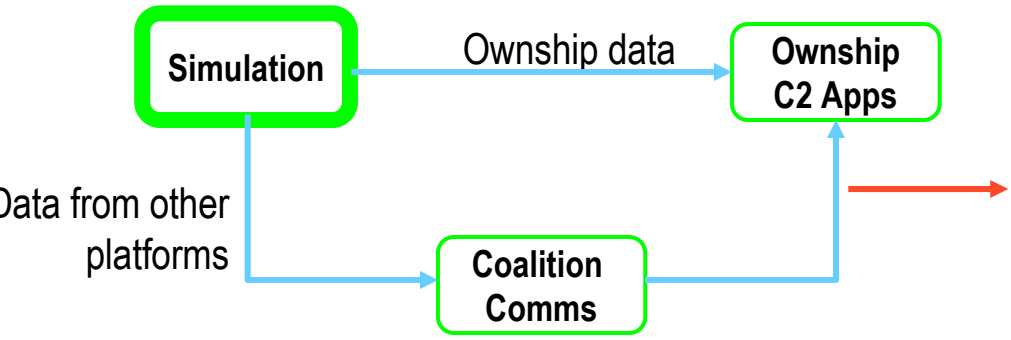
Simulating a Collins Control Room



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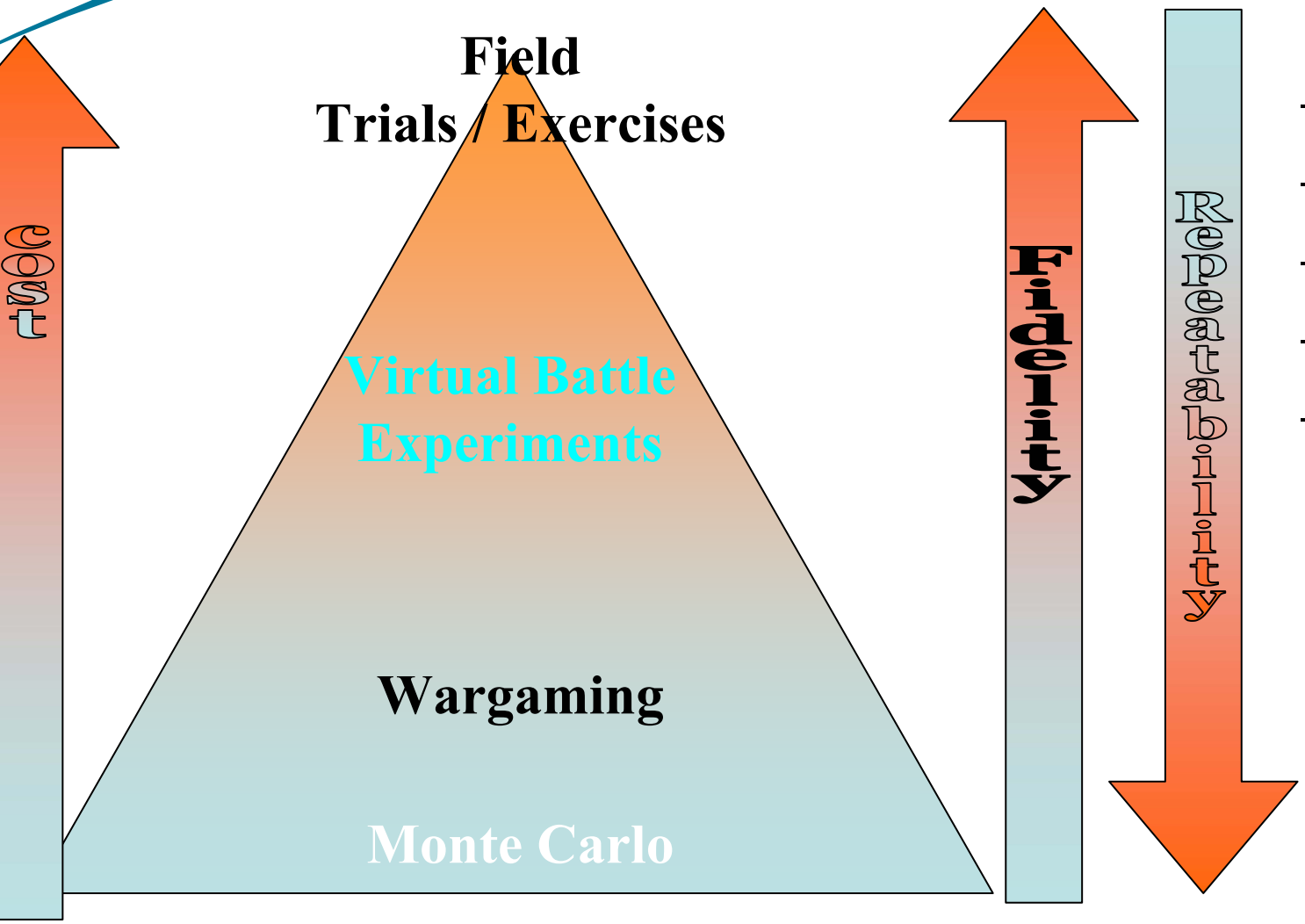
"Spectrum" of Experimentation



- Cheap
- Flexible
- Shorter timescales
- Controlled
- Instrumented for
  - Analysis
  - Evaluation
  - Application
  - Evolution

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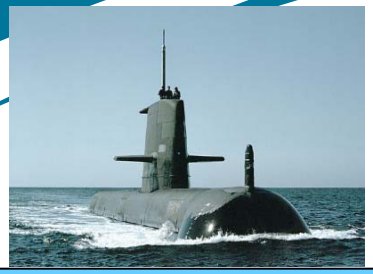
MAR TP-1 Conceptual Model





NCW Distribution Layer

AS | CA | NZ | UK | US

Scenario/Simulation Layer

Virtual Battle Experiment
- Experimental Methodology
- Analysis / Metrics

Common Simulation Environment
- Above water sensors
- Underwater sensors
- Motion
- NCW Comms

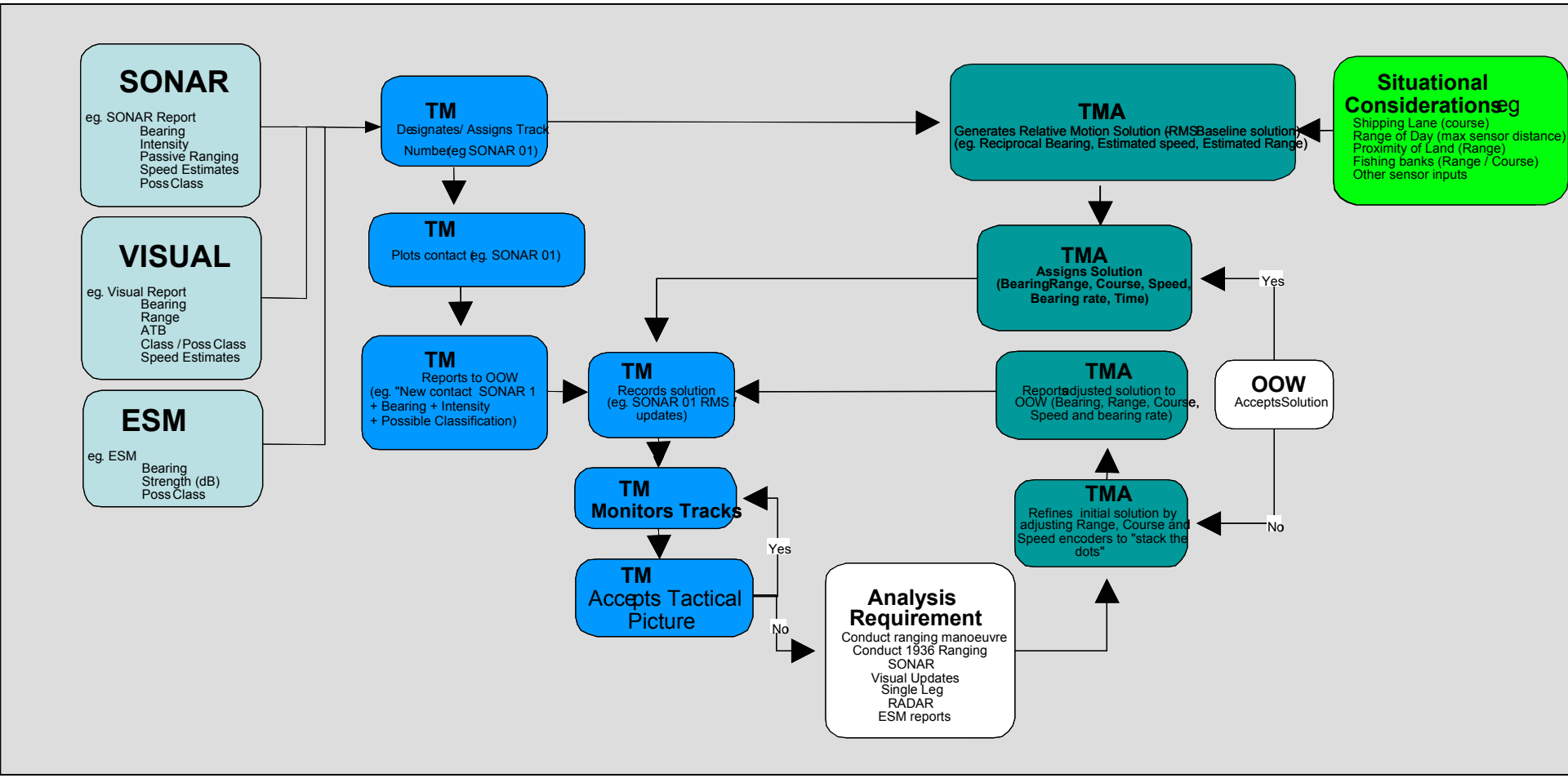
Virtual Combat Systems
- Submarine
- Surface Ship
- Generic Airborne Platform

Warfare Domains
- ASuW ✓
- ASW ✓
- Amphibious Operations
- Maritime Strike
- AAW

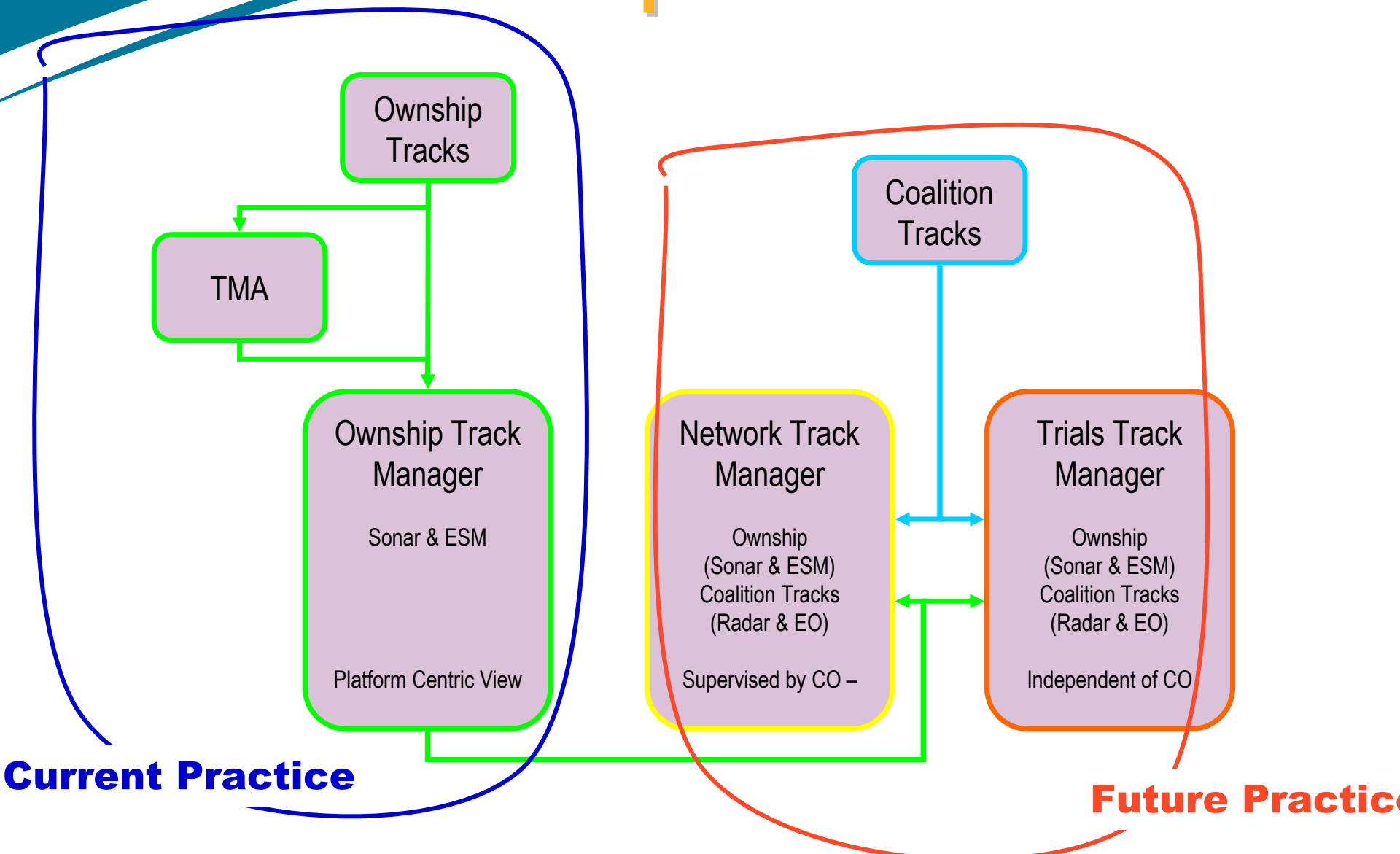
A series of VBE Experiments

Title	Date	Location	Scenario	Principle Objectives
VBE-A	May 2002	UK	2 platform coalition	VMSA Connectivity verification
VBE-AS1	Sep 2002	AS	2 platform coalition	Develop baseline for experimentation (Conduct and infrastructure)
VBE-AS2	Oct 2002	AS	2 platform coalition	Introduction of non-scripted ownship Development and use of metrics for detailed analysis
VBE-AS3	Apr 2003	AS	4 platform coalition	Define baseline for VBE-B
VBE-B	May 2003	NZ	4 platform coalition	First five nation VBE Internet Connectivity Trial (NZ–CA)
VBE-AS4	August 2003	AS	4 platform coalition	Verify modified conduct & data fusion algorithms

Task Analyses: Picture Compilation



Method: Concurrent Comparison



Metrics

Picture Quality (SIAPS Attributes)

- **Accuracy** — A reflection of the measurement errors.
- **Completeness** — Degree to which information includes every RWO of interest
- **Continuity** — A picture is continuous when the track number as signed to a RWO does not change and its attributes are maintained over time.

Human Performance (Human Performance)

- **Task Performance** — (Association / Fusion / Application Usage)
- **Situation Awareness** — (SART Ratings – recent move to objective measures)
- **Workload** — ('moment-to-moment' measure developed at SPAWAR)

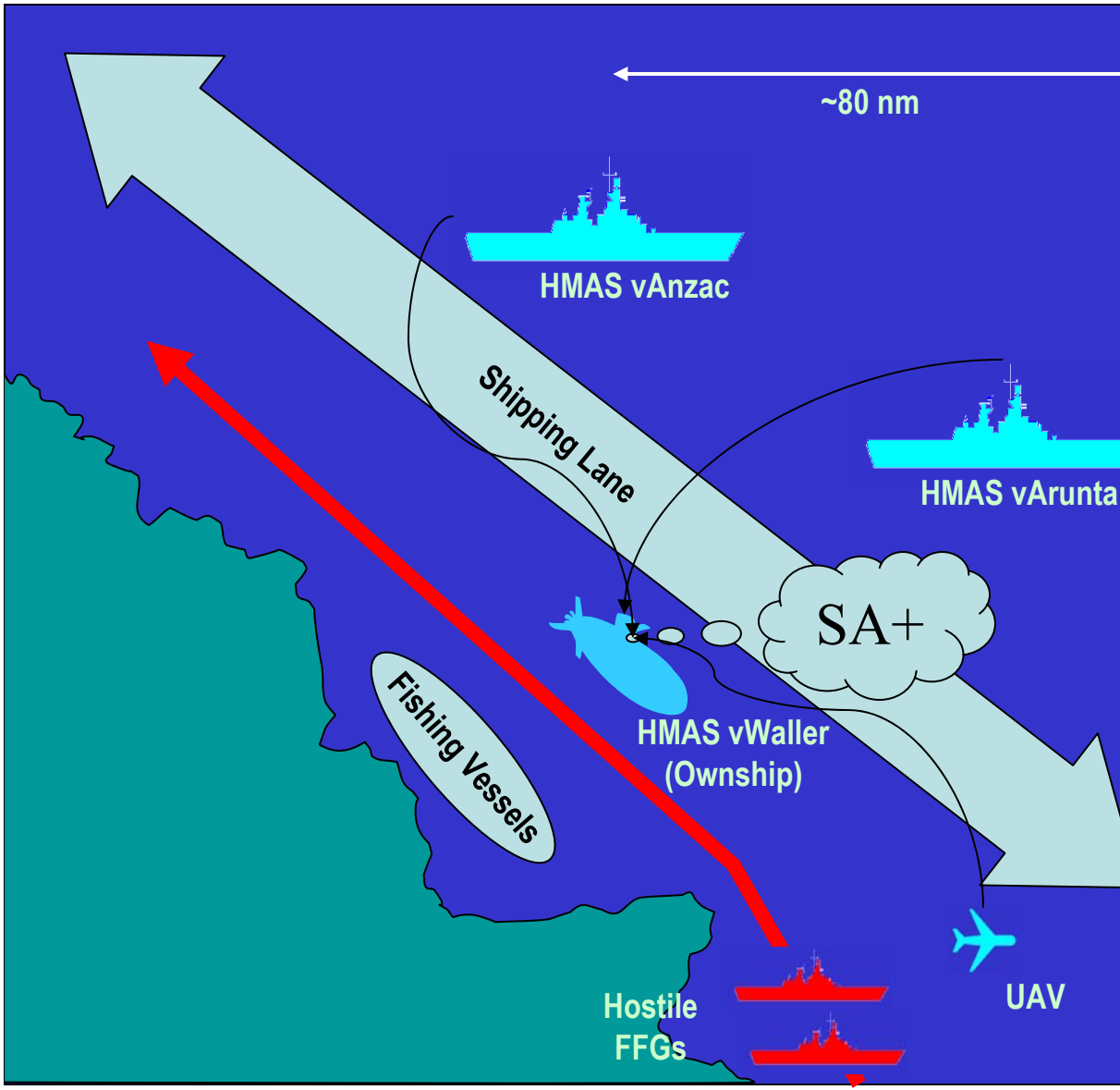
VBE AS-4 Hypotheses

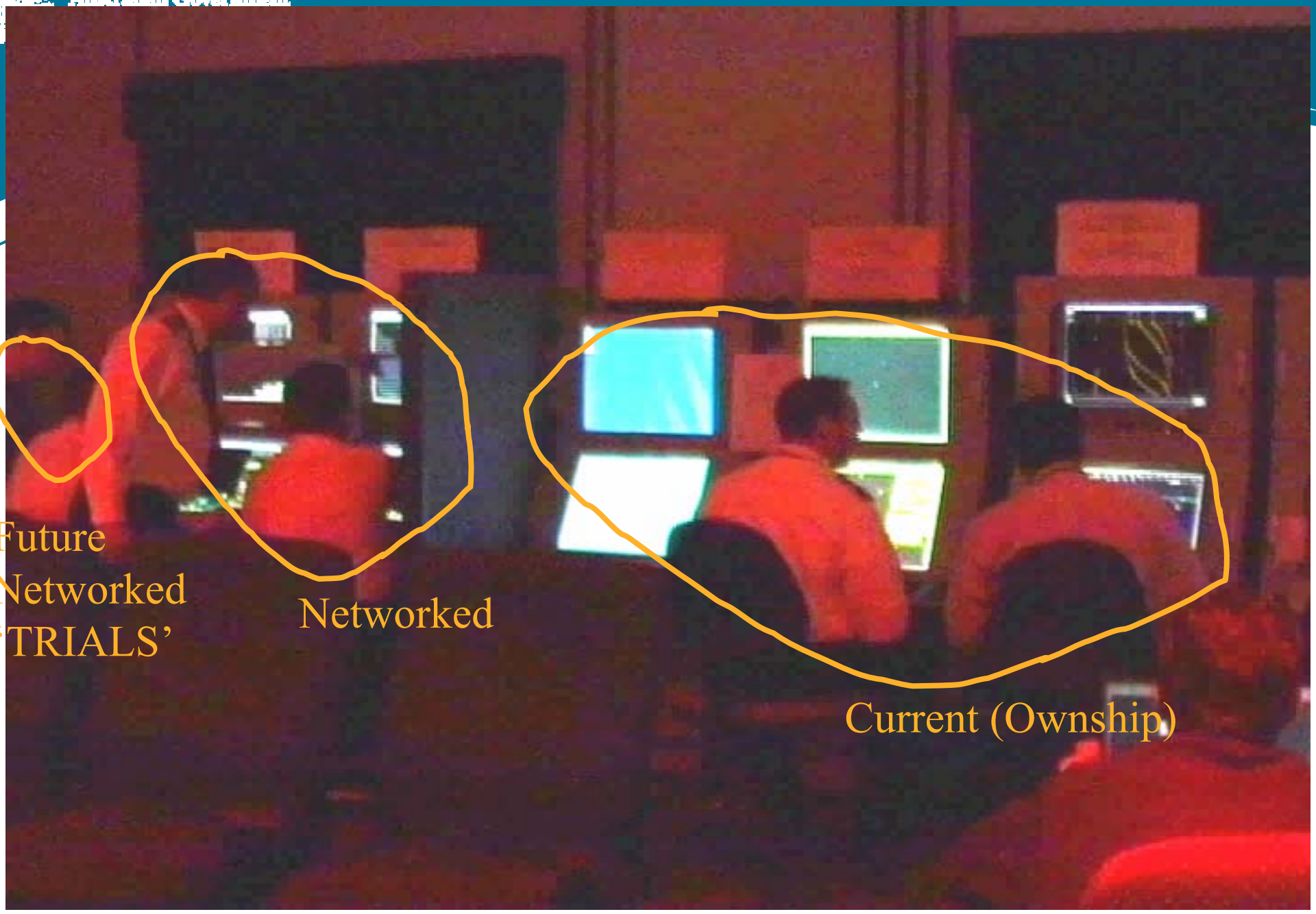
1. IF track sharing occurs THEN a more complete and accurate representation of the operating environment can be maintained by each platform

2. IF track-sharing of high priority targets occurs THEN they can be more continuously monitored with a greater accuracy

3. IF background association algorithms are provided to the operator THEN a less cluttered picture can be maintained

Simple but Representative Network Scenarios




Future
Networked
'TRIALS'
Networked
Current (Ownship)

Recording Plan (VBE-AS4)

- Track data (every 30s)
- Truth data (every 30s)
- Mapping files to link truth and track data
- Alerts & recommendations to the operators
- Perceived operator workload / Situation Awareness
- Dictaphone for CO
- Plugin activation
- Photographic & video record
- Formal observer records
- Screen snapshots

Summary Findings

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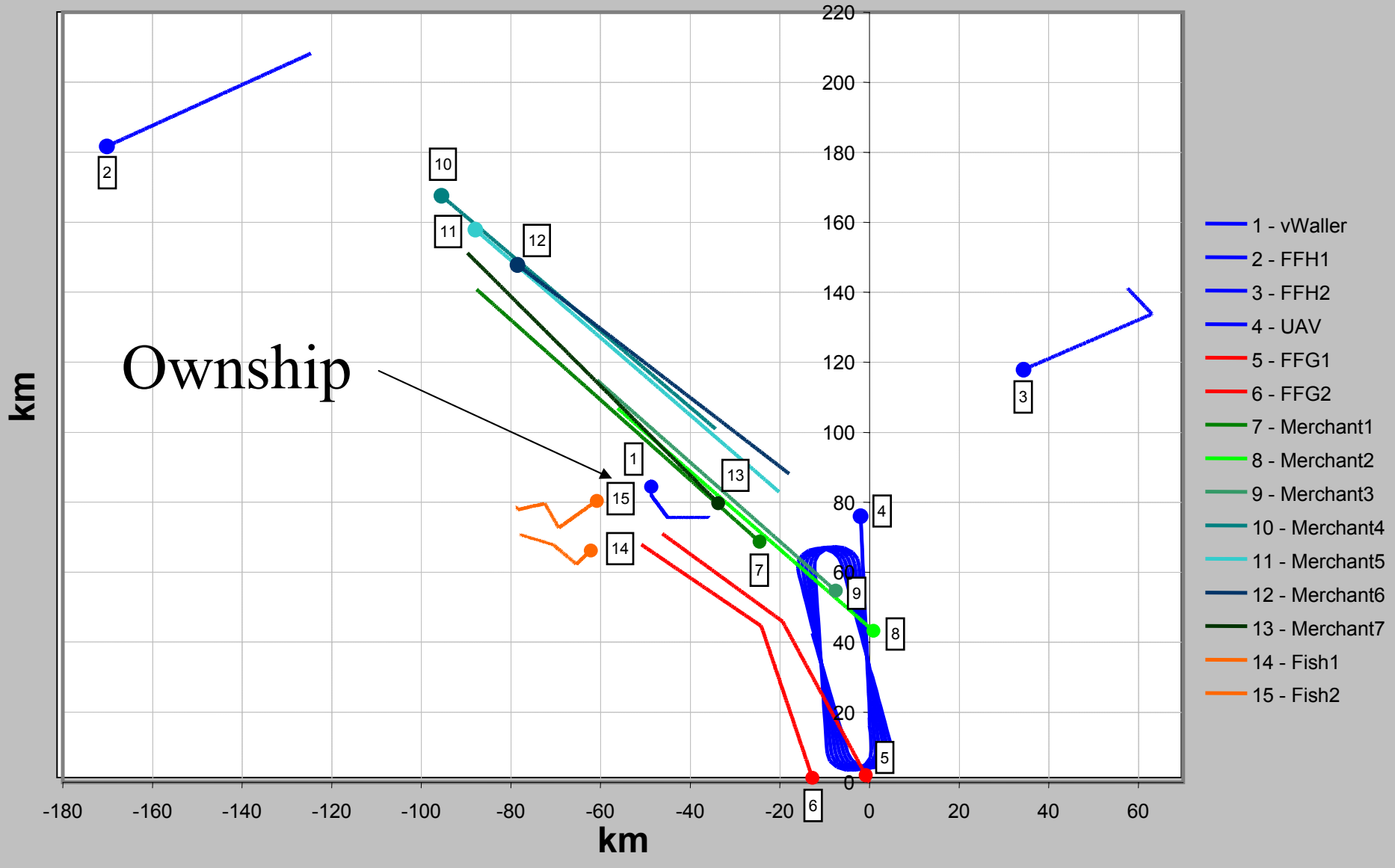
VBE-AS4 Ground Truth



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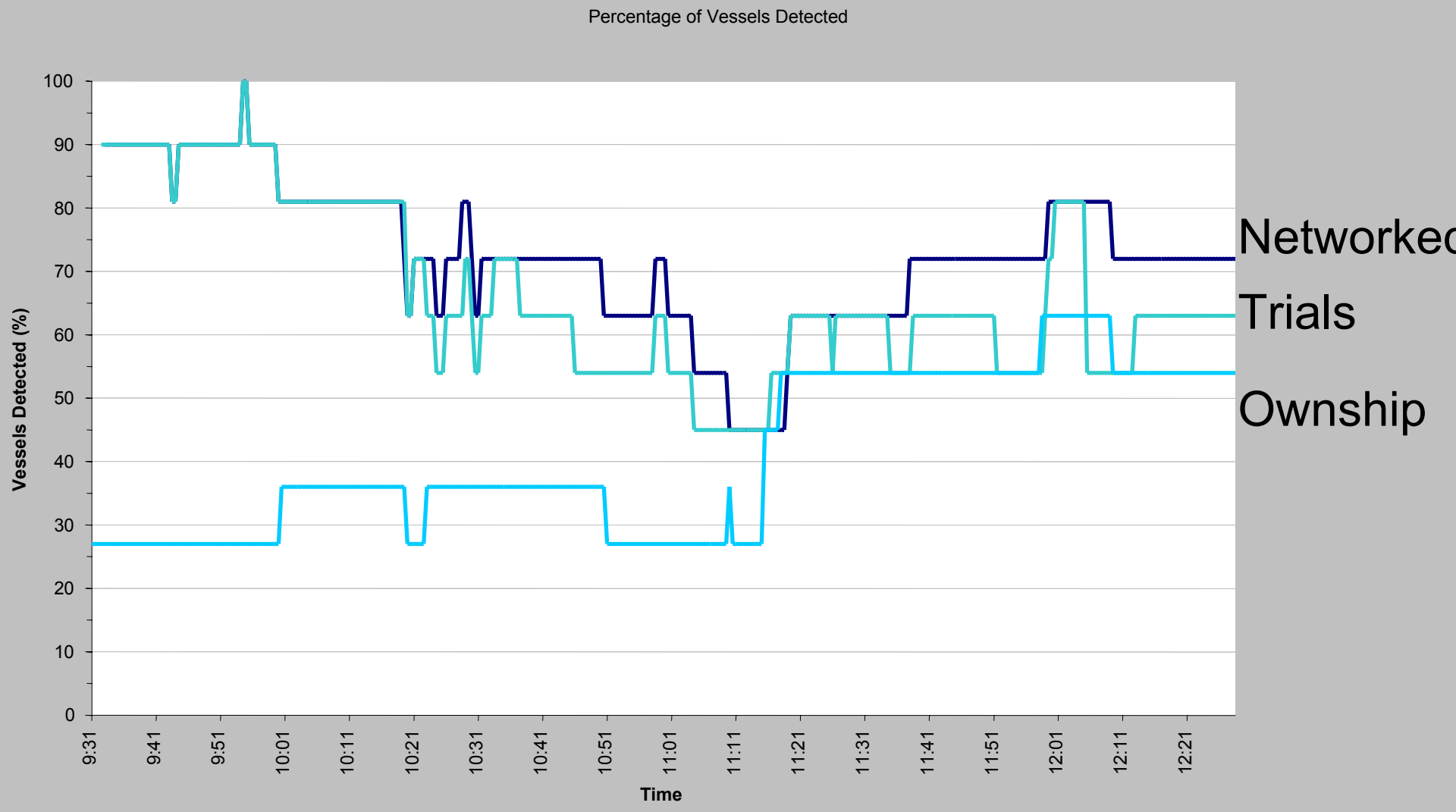
Detection Completeness



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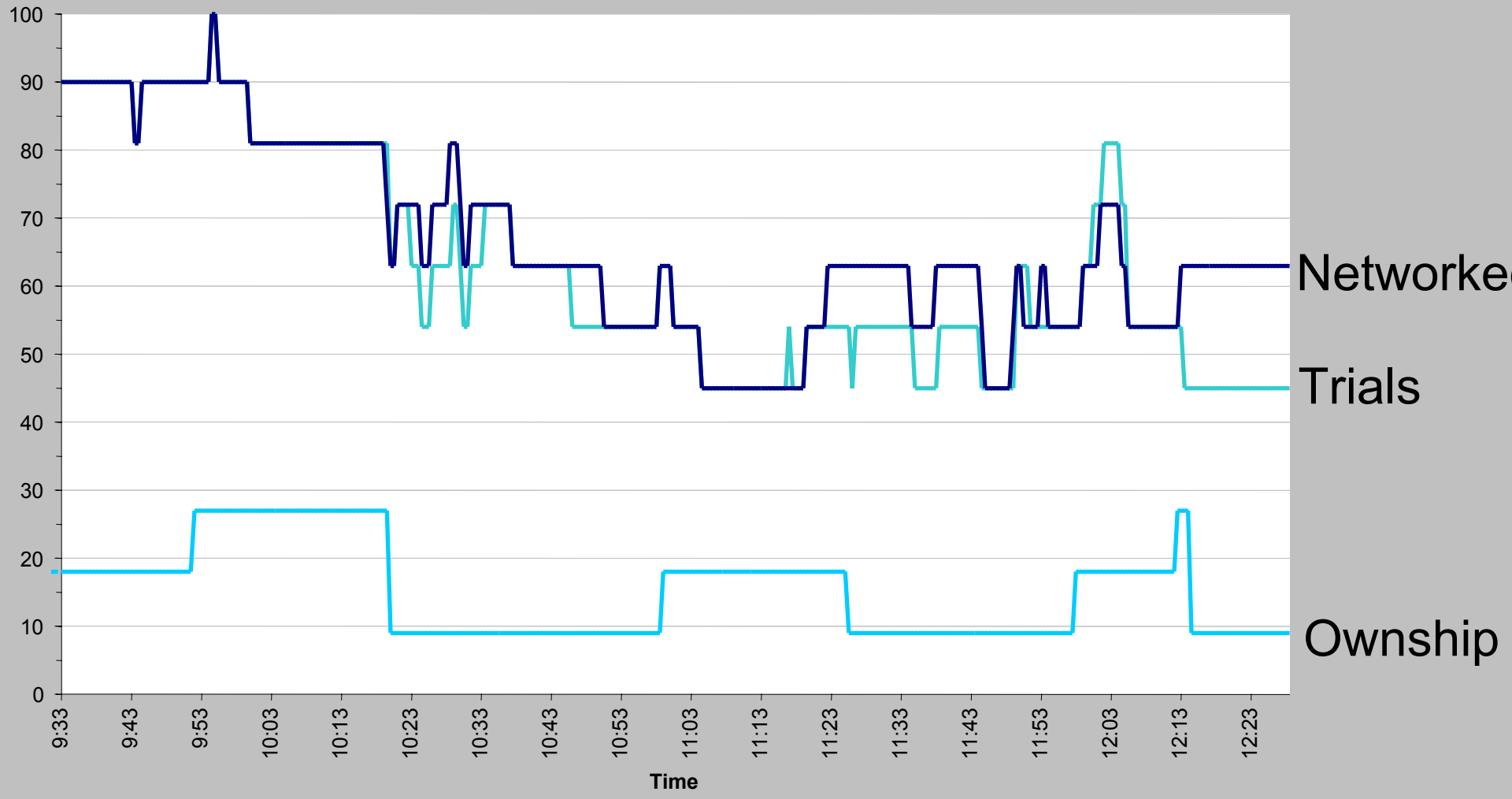
Solution Completeness



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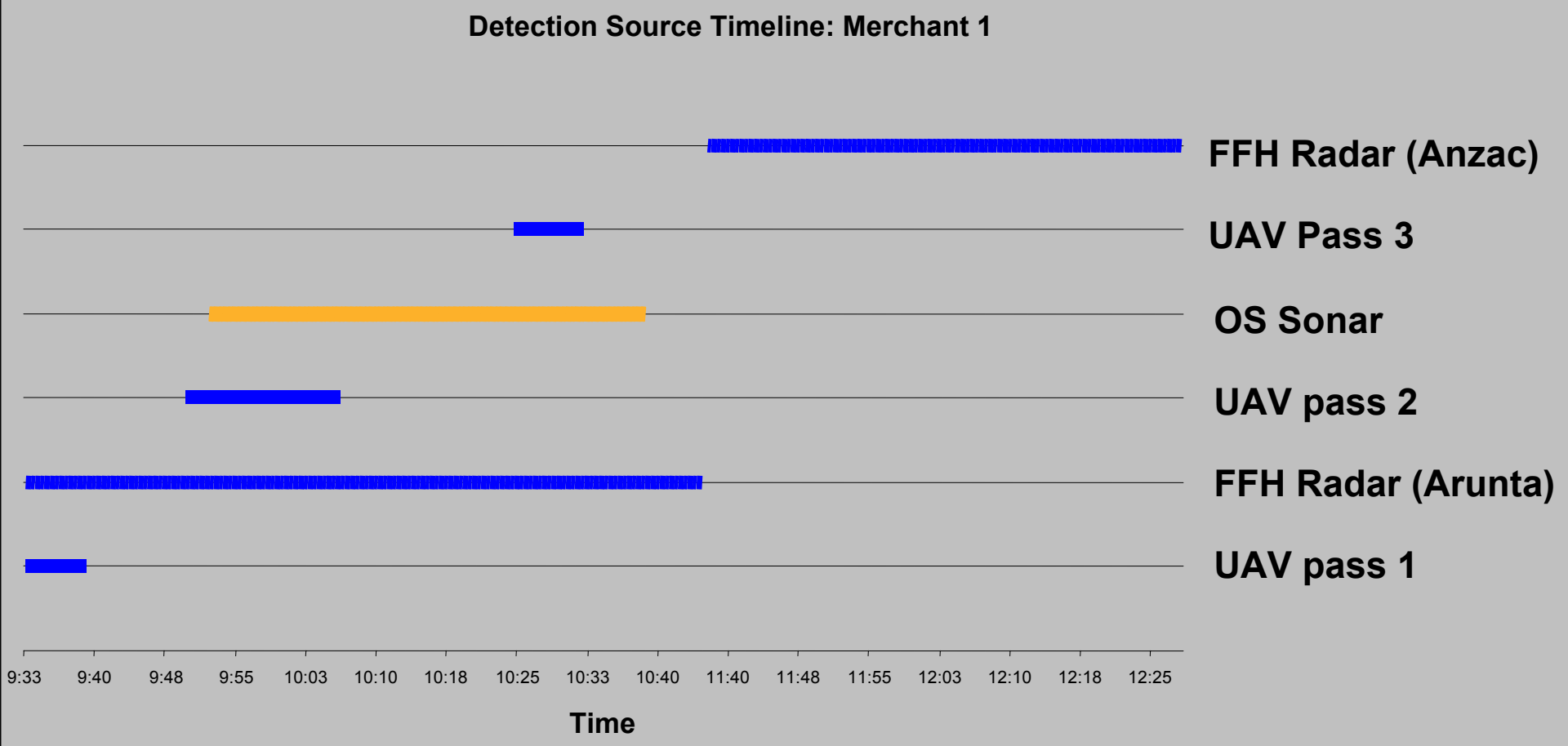
Multiple Sensor Sources



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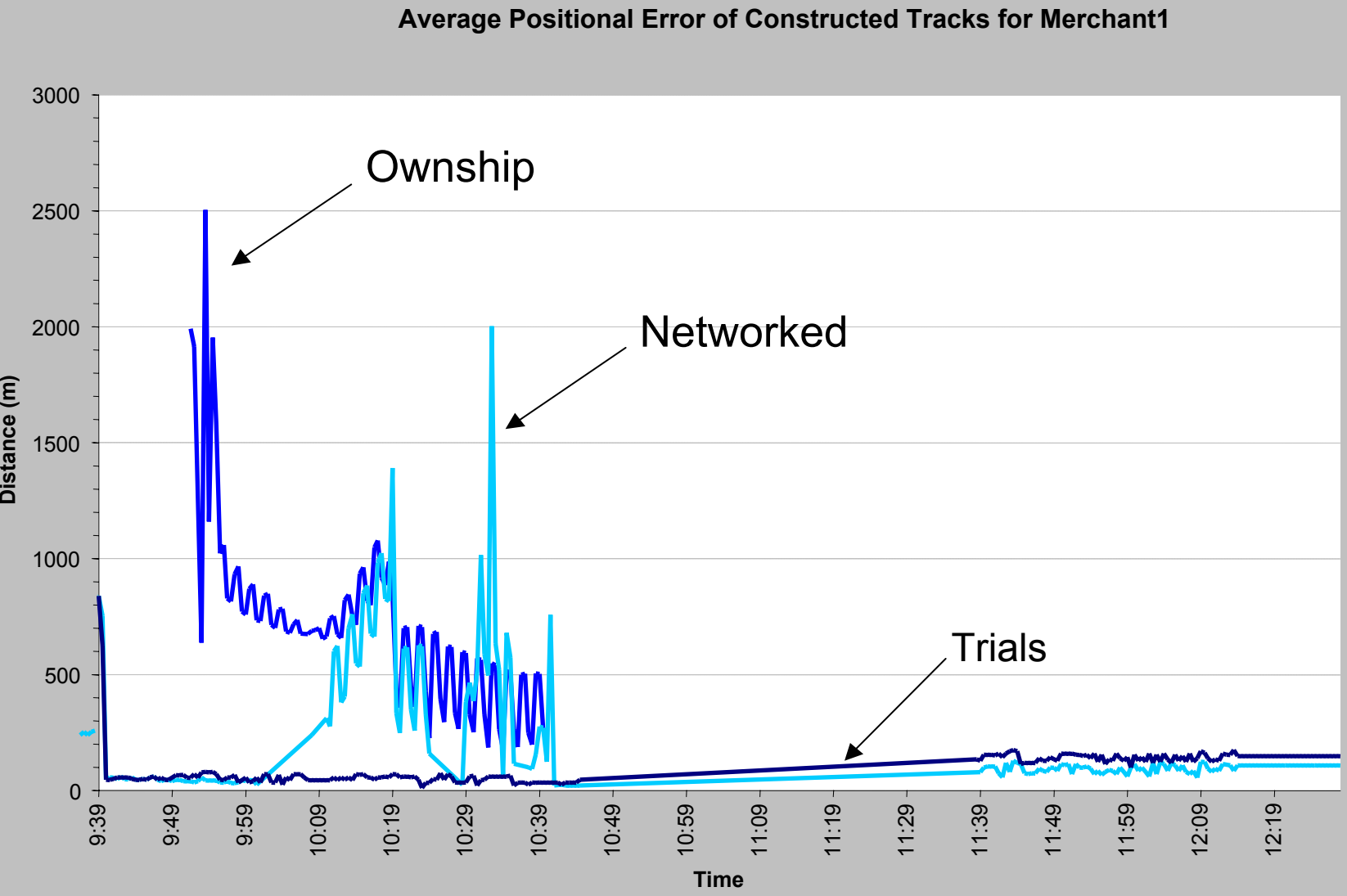
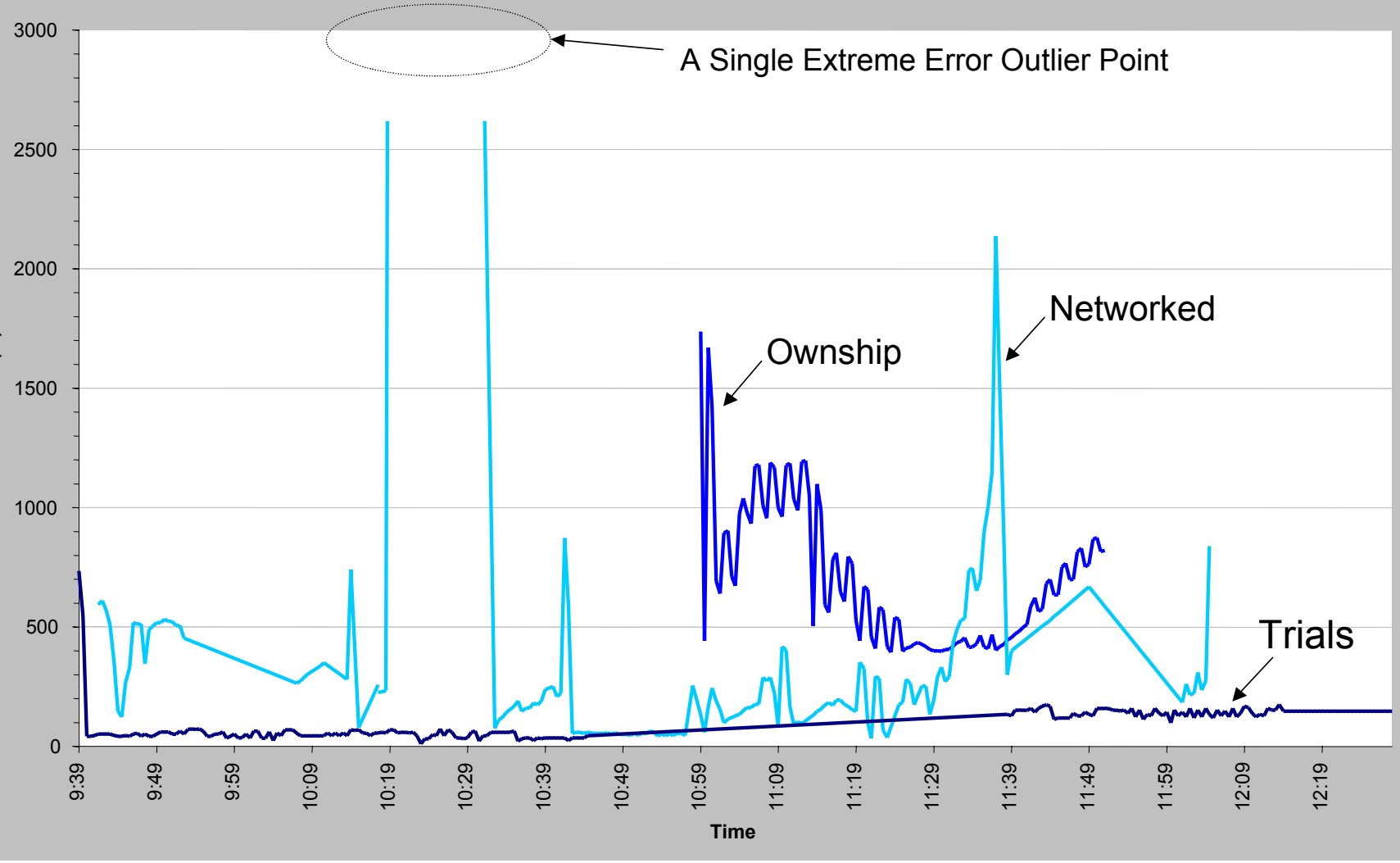
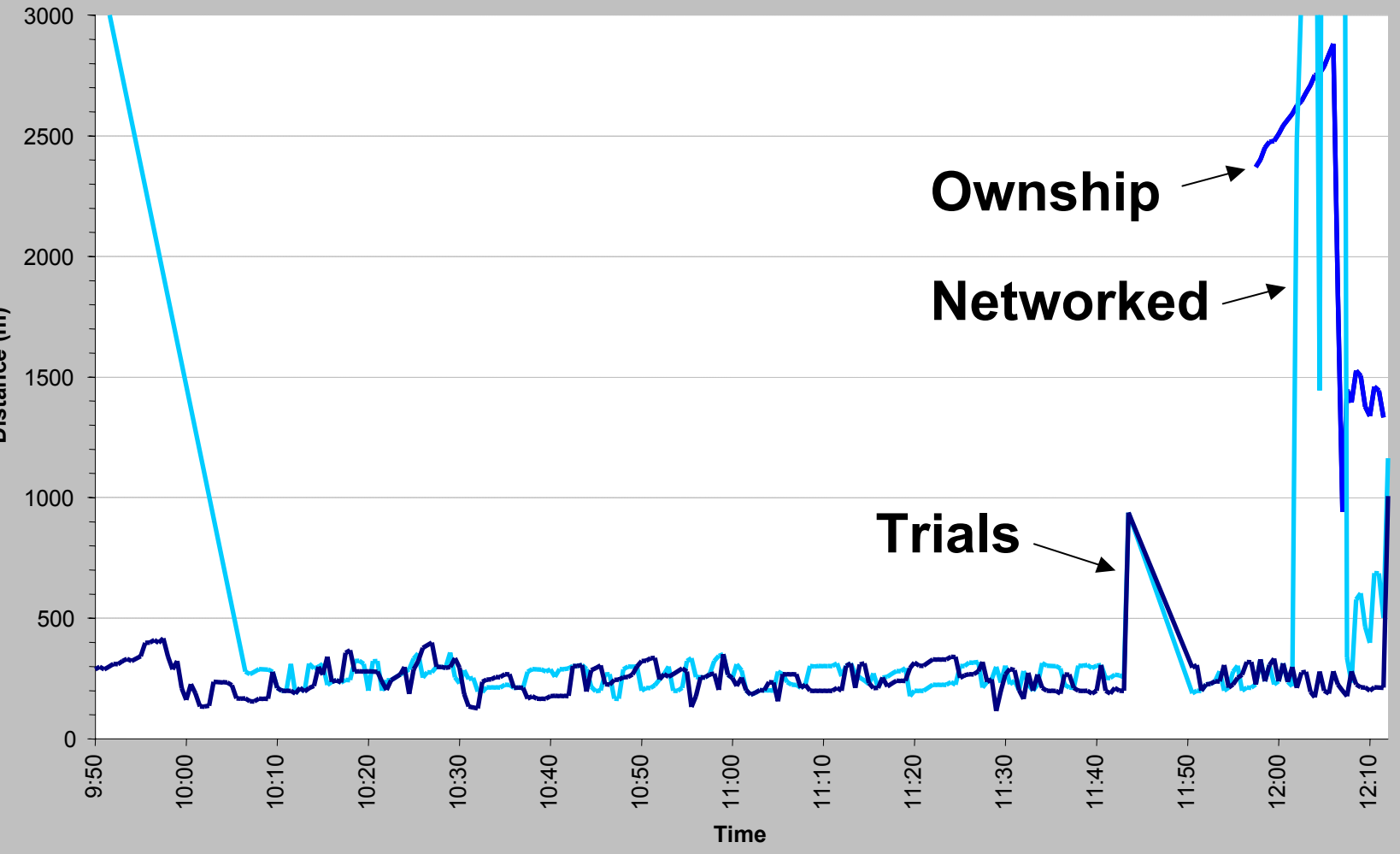
Average Position Error



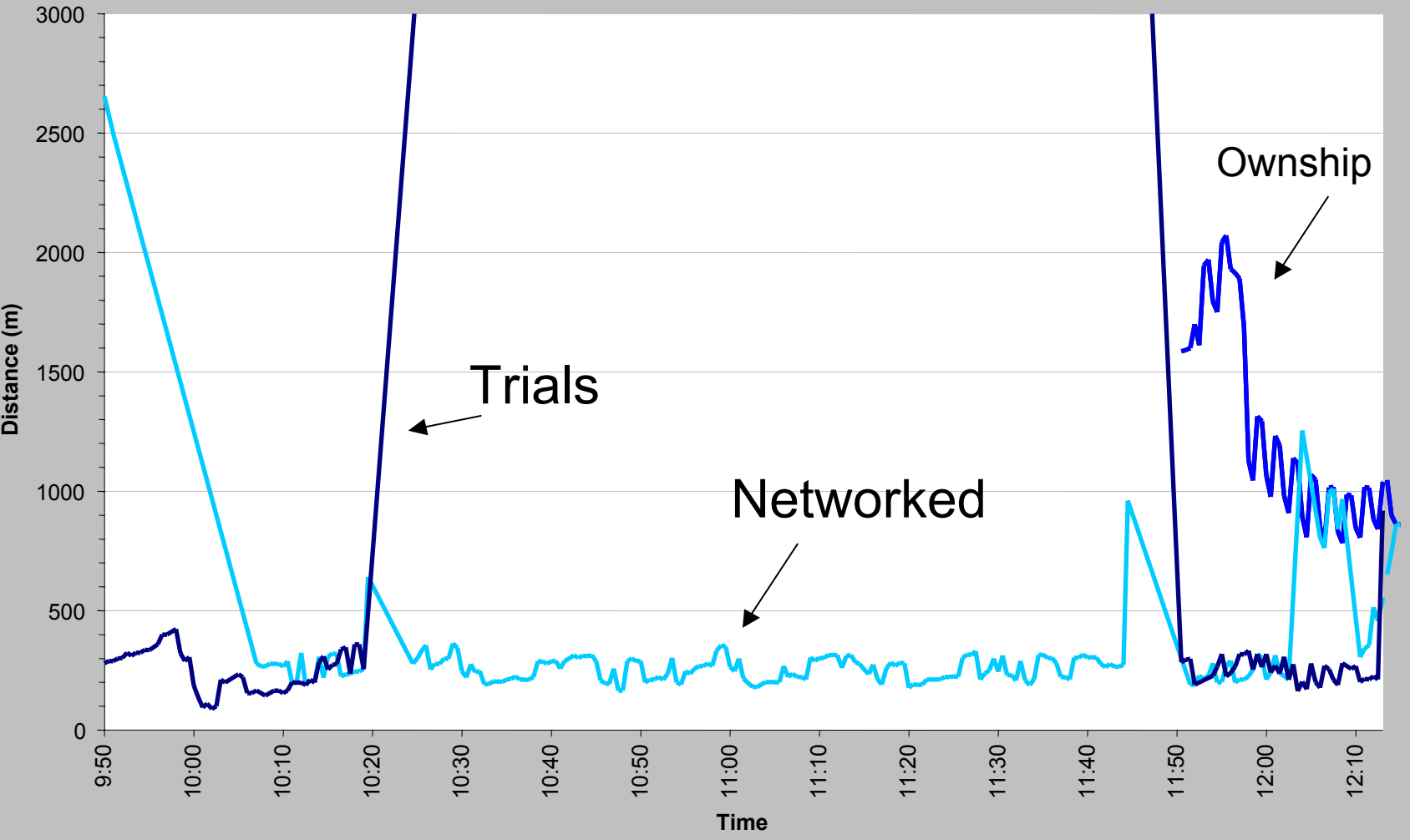
Position Error Merchant 2



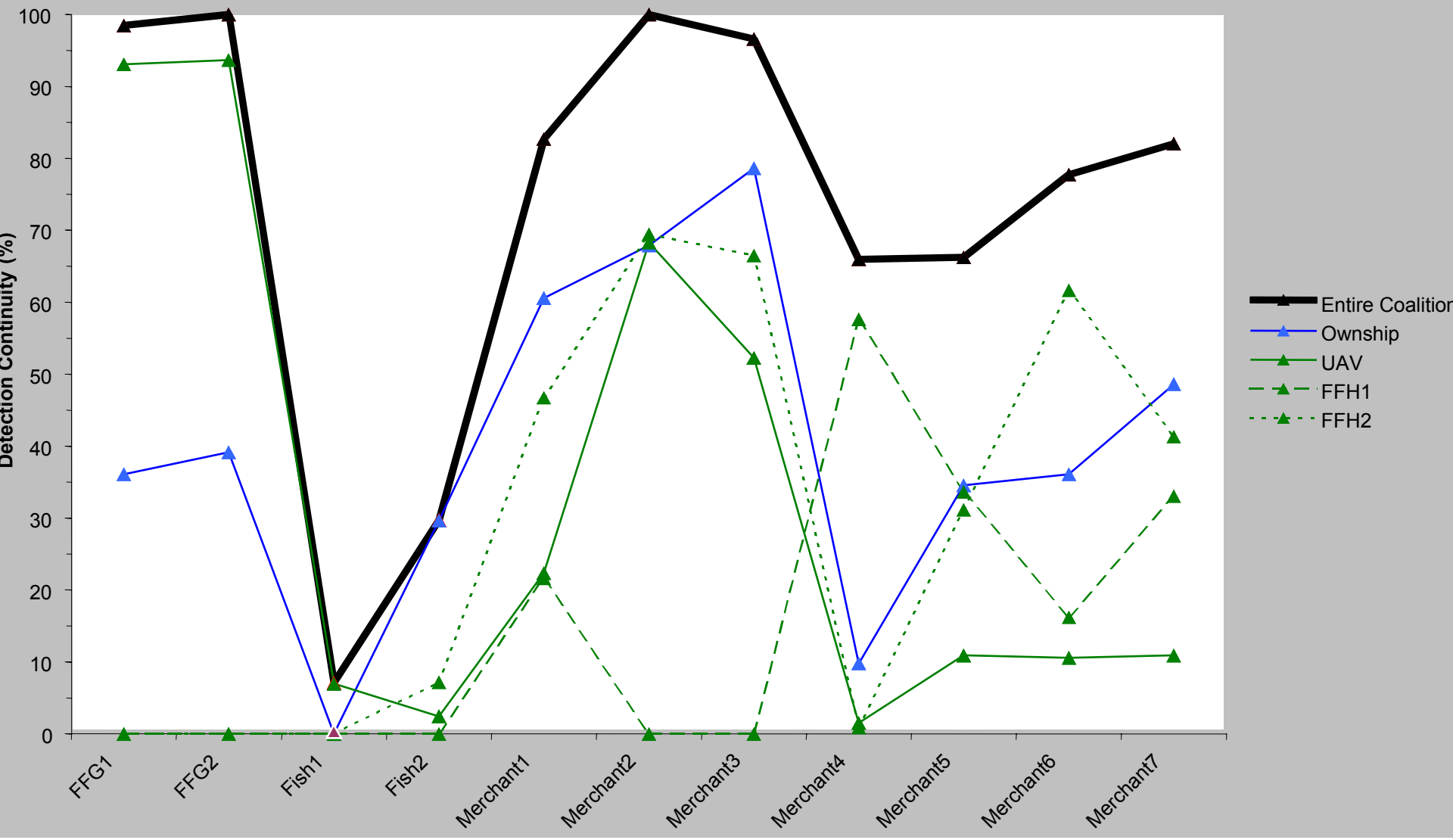
Priority Contacts 1



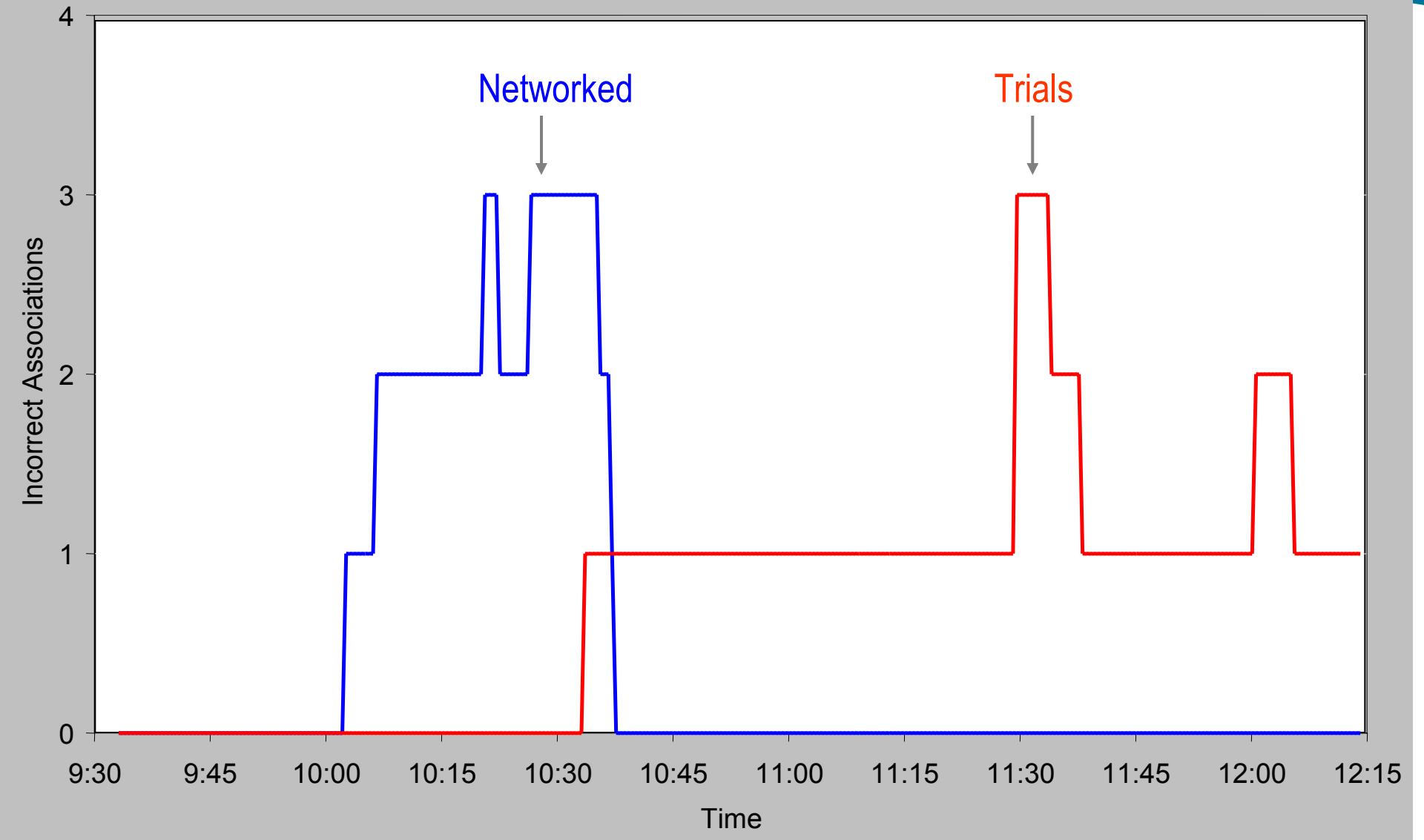
Priority Contacts 2



Track Continuity: Shared v Unique



Operator Performance Comparisons – eg. Incorrect Associations (Error)



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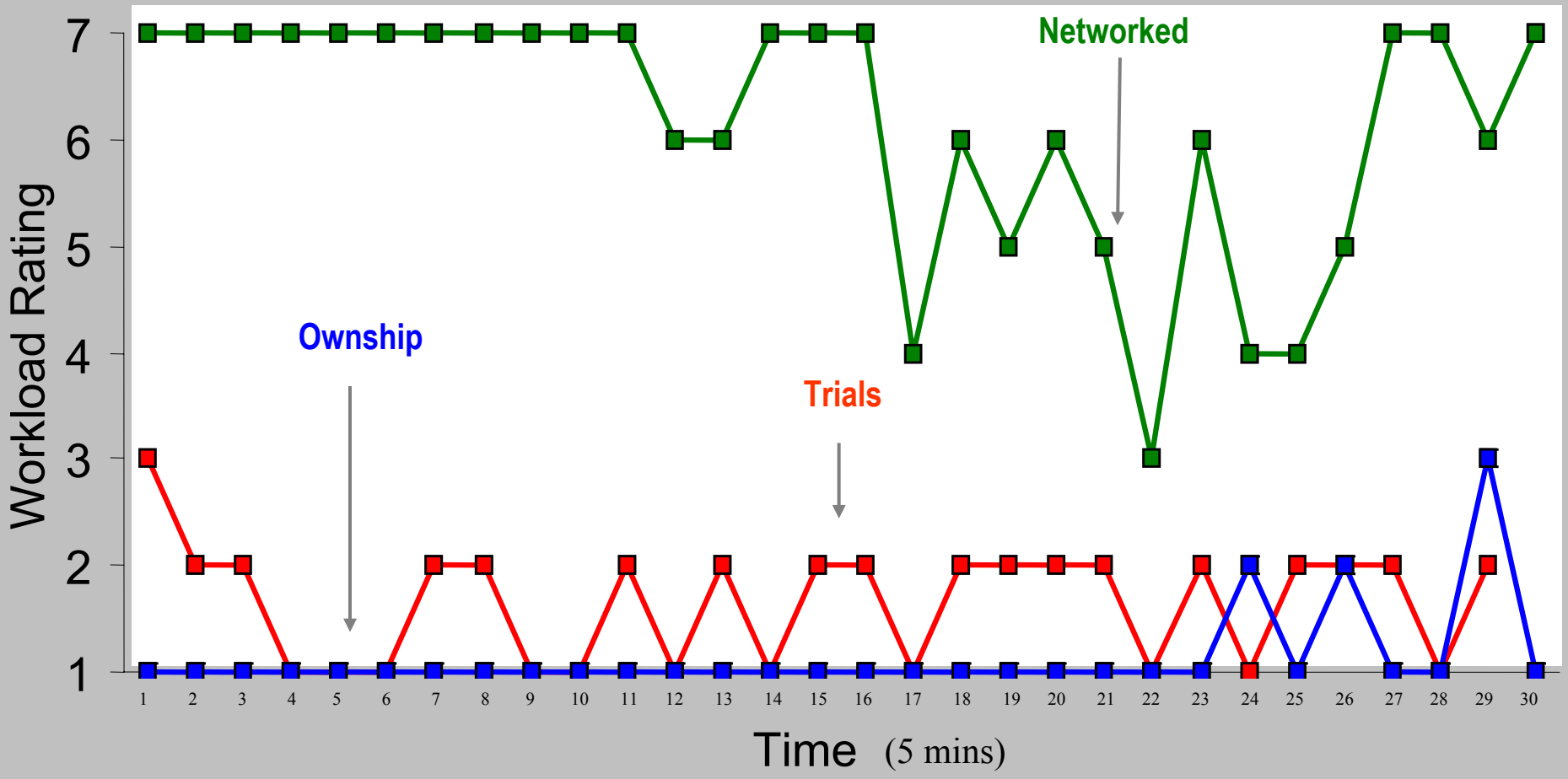
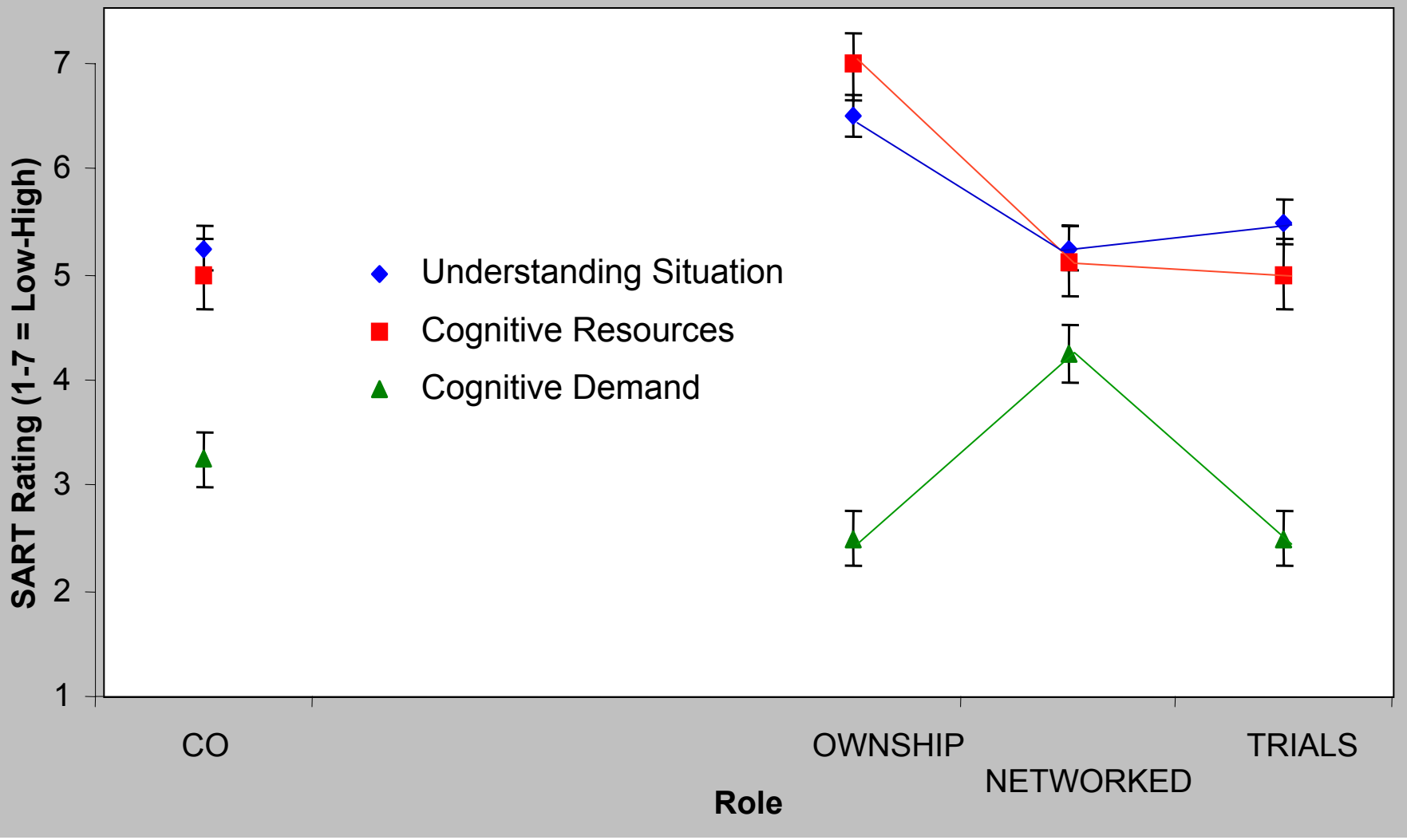
Moment-to-Moment Operator Workload (Developed at SPAWAR)



Subjective Situation Awareness (SART



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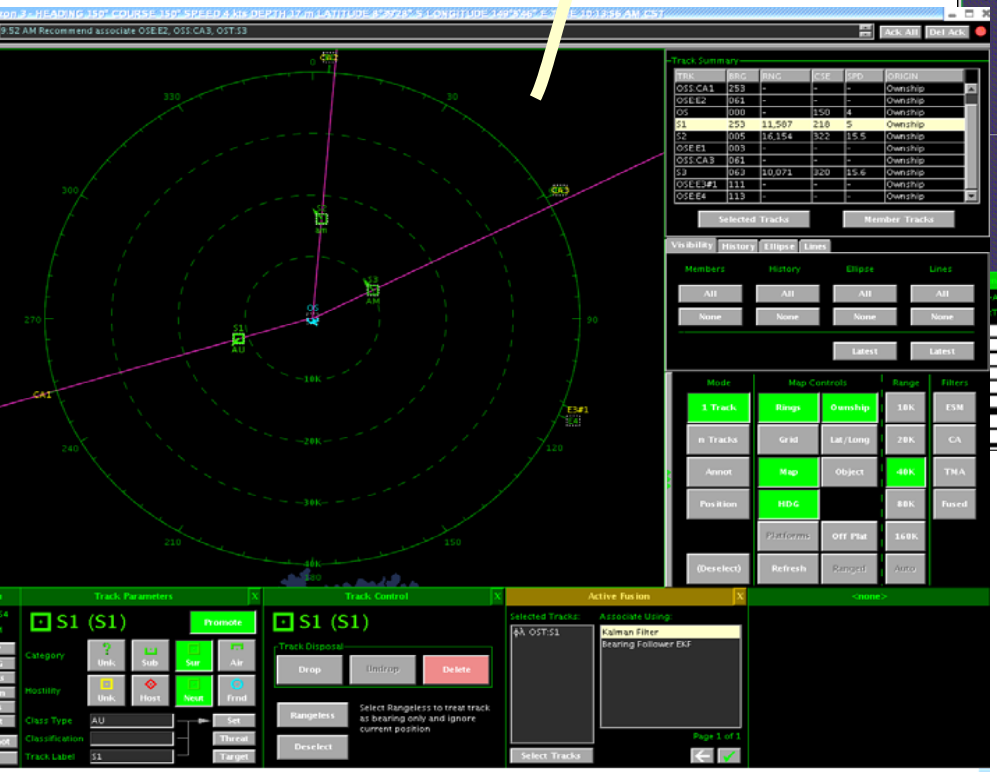
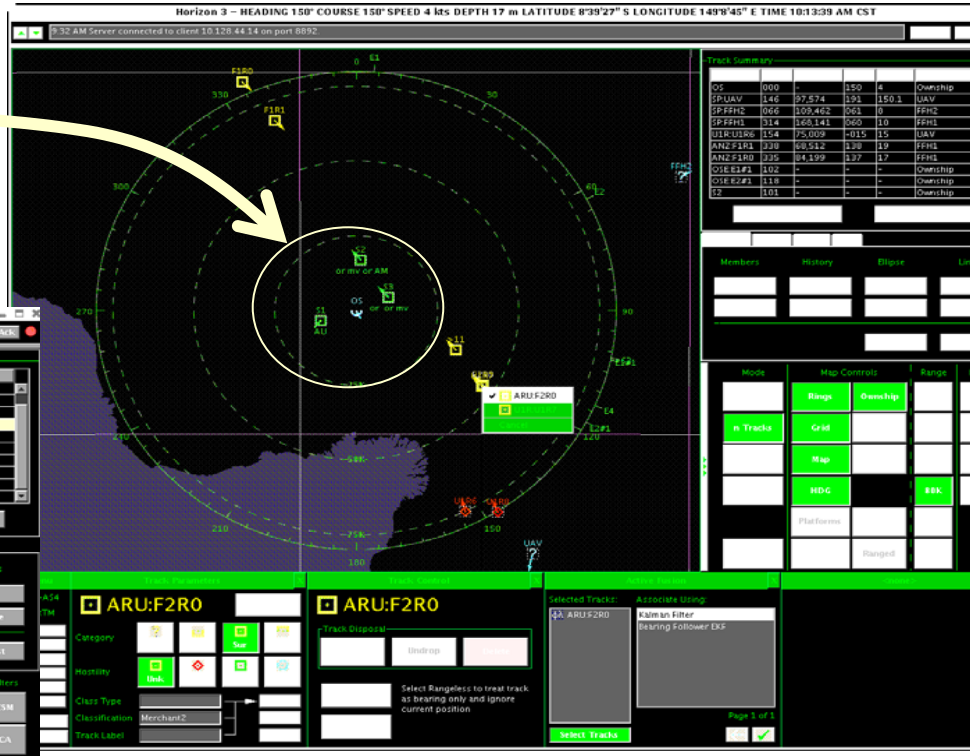
"Field of View" in NCW

Ownship





Networked

Concluding Remarks

- Since our previous ICCRTS (Tynan et al, 2002) we have developed and conducted a number of simple exploratory experiments
- We have developed and proven a useful set of system metrics
- We have introduced and continue to develop a useful set of Human / operator metrics
- The challenge now is to address the actual operational benefits of NCW