

Representative Measures of a Single Integrated Air Picture (SIAP)

Background:

Interoperability shortfalls have existed for some time and are recognized as an area of increasing concern. Results from Desert Storm, the All Service Combat Identification Evaluation Team (ASCIET) test series and other real world operations and interoperability test initiatives have clearly documented the deficiency in interoperability. A SIAP, and therefore success in the Air Defense mission area, is unachievable without fixing this important shortfall. As a result, CNO designated NAVSEA (CNO 021648Z May 1998) as having the central responsibility to address BMC4I/ Combat Systems interoperability problems within the SYSCOMs/PEOs and to coordinate resolution with the fleet. Subsequently, NAVSEA 05 was identified as the focal point for the coordination and resolution of Battle Force interoperability issues.

NAVSEA 05 has embarked on an effort to identify and fix current interoperability shortfalls. NAVSEA proposed (NAVSEA 070515Z October 1998) a process to develop Fleet CINC specified metrics and mechanisms that would assess warfighting capabilities. Because of demanding latency requirements, the Air Defense mission area was chosen as the initial focus. Since the SIAP is key to mission success in air defense, performance measures were developed to measure the ability of the Joint Integrated Air Defense System (JIADS) to maintain the SIAP. This document represents the results of a coordinated NAVSEA 05 and Fleet lead effort to identify warfighting and interoperability performance measures of the ability of the JIADS to build and maintain a SIAP.

Process:

The first step in the process of identifying performance measures for the systems and procedures used in developing and maintaining the required tactical picture was to draw on fleet operator experience in recognizing the critical components and indicators of the SIAP. On 13 November 1998, CINCLANTFLT and NAVSEA 05 hosted a panel of experienced fleet operators and tasked the panel to define the characteristics and functional components of the SIAP which are required for successful completion of joint theater, air, and missile defense missions. The panel used the Universal Navy Task List (UNTL), the Joint Task List (JTL), and air defense operational requirements documents as baseline references. The **critical components** identified by the panel are:

1. Detect
2. Track
3. Identify
4. Report
5. Manage

The second step in the process was a collaborative Fleet and NAVSEA effort to research existing bodies of work and to collect representative measures that have been used to assess system and operator performance of SIAP tasks. The research effort focused on performance measures found in Operational Requirements Documents (ORD), Analysis of Alternatives (AOA) studies, and Test and Evaluation Master Plans (TEMP). The performance measures were then matched to critical components. During this matching it was found that the measures could be further categorized by specific attributes. Those attributes are :

1. Completeness. The percentage of real tracks that are included in the SIAP.
2. Correctness. Data accurately reflects true track attributes (position, kinematics, and identity).
3. Commonality. Track attributes of shared data are the same for each SIAP user.
4. Continuity. Proper maintenance of track attributes over time.
5. Timeliness. Data is where it is needed, when it is needed.

Note: Additional definitions are included in the Appendix at the end of this document.

From the components and attributes that were identified, an initial set of **Critical Operational Issues (COIs)** and **Measures of Effectiveness (MOEs)** were developed. **Measures of Performance (MOPs)** were then developed and mapped to the SIAP attributes. The results of this effort were compared with those of other organizations working on similar efforts. The goal was to leverage existing methodologies to ensure the best performance measures were captured.

The final step in the process was to get the concurrence of CINCLANTFLT, CINCPACFLT, and CINCUSNAVEUR staff that the performance measures developed are valid indicators of required capabilities. The draft COI, MOE, and MOP were forwarded to Fleet CINC staff and operational commands for review and comment. Representatives from Fleet CINC staff, Type Commanders, OPNAV, and Program Offices then met 17-18 February 1999 to refine the draft COI/ MOE/MOP and to gain a broader consensus for the SIAP performance measures. The 17-18 February meeting was held at the Combined Atlantic Command Groupware Facility in Norfolk, VA. The comments and recommendations from the 17-18 February meeting were reviewed by CINCLANTFLT, CINCPACFLT, and CINCUSNAVEUR N8 staff and appropriate changes were made to the COI/MOE/MOP.

Results:

The MOEs/MOPs presented in the following sections are the result of the coordinated efforts of fleet operators and NAVSEA 05 staff to define performance measures as a roadmap that can be used for engineering analysis and performance assessment of systems that support developing, maintaining, and disseminating the SIAP. The work is not complete and continued cooperation between fleet operators and the acquisition community is necessary to ensure systems are designed and perform to the standards needed for successful completion of naval missions.

I. Critical Operational Issue (COI) #1:

Does the Naval Force operating independently or as part of a joint/combined force have the necessary tactical situational awareness (SIAP) to conduct passive defense, active defense, and attack operations to protect operational forces and defended assets from enemy air and missile attack?

A. Measure of Effectiveness (MOE) #1

Determine the Naval Force's ability to recognize and react to theater air and missile threats.

1. Measures of Performance (MOP)

- a. Number of threat aircraft and missiles that successfully penetrate friendly theater defenses compared to the total number of threat presentations (Percentage of successful threat penetrations).
- b. Number of engagements ordered against each air and missile threat presentation.
- c. Number of engagements ordered against non-threat vehicles.
- d. Number of threat presentations engaged by more than one firing unit.
- e. Number of air and missile threats engaged as percentage of total threat presentations.
- f. Average range from defended asset/area, or own unit for self-defense, for initial engagement by threat type.
- g. Average range from defended asset/area, or own unit for self-defense, for subsequent engagements by threat type.
- h. Average time to engage enemy aircraft and missiles measured from time the threat enters the defined battle space to time of first engagement ordered by a firing unit.

B. Measure of Effectiveness (MOE) #2

Determine the Naval Force's ability to prevent fratricide (engagement of friendly and neutral aircraft by own air defense forces).

1. Measures of Performance (MOP)

- a. Number of friendly aircraft lost as a result of not being identified as friend.
- b. Number of neutral aircraft lost as a result of not being identified as neutral.
- c. Number of friendly aircraft lost as a result of being mis-identified as hostile.
- d. Number of neutral aircraft lost as a result of being mis-identified as hostile.

C. Measure of Effectiveness (MOE) #3

Determine if Naval Forces have sufficient situational awareness to conduct attack operations against re-locatable, time critical (RTC) Theater Missile Defense (TMD) targets; e.g. , TELs.

1. Measures of Performance (MOP)

- a. Number of RTC TMD targets destroyed.
- b. Number of missed RTC target attack opportunities as a percentage of missiles launched from RTC targets.
- c. Calculate/measure average time from first indication of TEL activity to launch of threat missiles.
- d. Calculate TEL target location errors.
- e. Calculate the area centered on orbit points in which RTC are subject to attack from CAP aircraft. Area covered is a function of expected time delay in receipt of TEL locating data, TEL location error, time required for TELs to set-up and launch missiles, and aircraft flight, sensor, and weapon performance characteristics.

D. Measure of Effectiveness (MOE) #4

Determine if Naval Forces have sufficient situational awareness to warn friendly forces and civilian populace of imminent threats from weapons of mass destruction.

1. Measures of Performance (MOP)

- a. Calculate the predicted WMD impact point area of uncertainty for each combination of sensor and threat type.
- b. Calculate average time prior to TBMD/WMD impact that warning is given.

II. Critical Operational Issue (COI) #2:

Evaluate the Naval Force's capability (operating independently or as part of a Joint/Combined Force) to detect and maintain a single and continuous track on each air and space vehicle within the assigned battlespace.

A. Measure of Effectiveness (MOE) #1:

Determine the capability of the Naval Force to detect and create a firm track for each air and space vehicle within the assigned battlespace.

1. Measures of Performance (MOP):

a. Attribute: Completeness:

(1) % of air and space vehicles detected in the assigned battlespace

$$\frac{\text{Number of Air \& Space Vehicles detected}}{\text{Number of Ground Truth Air \& Space Vehicles}}$$

(2) Mean % of time an air or space vehicle was detected and tracked in the assigned battlespace

$$\frac{\begin{array}{l} \Sigma \text{ Time air or space vehicle/formation was detected and} \\ \text{tracked} \end{array}}{\text{divided by}} \frac{\Sigma \text{ Time air or space vehicle/formation was in the assigned} \\ \text{Battlespace}}$$

b. Attribute: Timeliness

(1) Mean time from air or space vehicle entry into the assigned battlespace to initial detection by each unit

$$\frac{\Sigma_{\text{Max}} [(\text{Time initial detection was made } \textit{minus} \text{ time air or space vehicle/formations entered the assigned battlespace}),0]}{\text{divided by}} \text{Total number of vehicles/formations}$$

(2) Mean time to firm track

$$\frac{[\Sigma [\text{Time (Track transitioned to firm track)}] \text{ minus } [\text{Time (Initial Detection was made)}]]}{\text{Total number of vehicles}}$$

(3) The mean range at which initial detection (by sensor type: Search radar, Fire control radar, ESM, IFF, Visual, etc) was made compared to the predicted range (considering RCS, environmental, radar Horizon, etc). (This is a chart)

$$\frac{\Sigma [\text{range at which detection of the vehicle/formation was made (by sensor) in a given environment} \text{ divided by the predicted sensor detection range of the vehicle/formation (in a given environment)}]}{\text{divided by } \# \text{ of vehicles/formations}}$$

Note: Multiple objects that are part of a formation not discriminated by the force sensors will be counted as only one ground truth vehicle (until the formation breaks)

c. Attribute: Correctness

(1) Percentage of time tracking false tracks (for each individual unit and for all links)

$$\frac{\Sigma \text{ the duration of all false tracks}}{\Sigma \text{ the duration of all tracks}}$$

(2) Mean track positional accuracy/errors of sensors

$$\frac{\Sigma \text{ of the difference between sensor positional and kinematics data of air and space vehicles and the 3D positional and kinematics truth data for air and space vehicles}}{\text{divided by } \# \text{ of track updates}}$$

(3) For false tracks, mean time from Track Start to Drop Track tracks (for each individual unit and for all links)

$$\frac{\Sigma [\text{Time (Drop track)} \textit{ minus } \text{Time (Track Start)}]}{\text{Number of false tracks}}$$

B. Measure of Effectiveness (MOE) #2:

Determine the capability of the Naval Force to maintain a single continuous track on air and space vehicles within the assigned battlespace.

1. Measures of Performance (MOP):

a. Attribute: Correctness

(1) % of time dual designations were associated with an air and space vehicle

$$\frac{\Sigma \text{ Amount of time the vehicle/formation was dualed}}{\textit{divided by} \Sigma \text{ Total time the vehicle/formation was in the assigned battlespace and tracked by one or more units}}$$

(2) Mean duration of dual designations

$$\frac{\Sigma [\text{Time (dual designation ended)} \textit{ minus } \text{time dual designation started}]}{\textit{divided by} \text{Number of dual designations}}$$

(3) Mean time to resolve dual designations

$$\frac{\Sigma [\text{Time the dual was eliminated} \textit{ minus } \text{time the dual began}]}{\textit{divided by} \text{The number of dualing instances}}$$

(4) Mean and max 3-D positional distance between dualed tracks (This is a chart arranged by sensor type)

Note: Conducted as a pair-wise treatment for each dual track

(5) Mean and max kinematics deltas between dualed tracks (This is a chart arranged by sensor type).

Note: Conducted as a pair-wise treatment for each dual track

(6) Average amount of time there were multiple duals (three or more TNs per aircraft) associated with flights/formations

Σ Amount of time the vehicle/formation had three or more TNs assigned

divided by

Σ Total time the vehicle/formation was in the assigned battlespace

b. Attribute: Continuity

(1) Mean % of time an air and space vehicle is reported on the link

Σ Time air or space vehicle/formation was reported on the link

divided by

Σ Time air or space vehicle/formation was in the assigned Battlespace

Note: When air vehicles are flying in tight formation (and it is not clear which vehicle(s) is (are) being tracked), formations will be looked at vice separate air vehicles.

(2) Mean number of Track Number (TN) changes per track

Total number of TN changes

Total number of ground truth tracks

(3) Average duration of intervals between TN changes

Σ of the duration of intervals between TN changes

divided by

Number of intervals

(4) Probability that a track will change TN

of tracks that changed TN

of tracks

III. Critical Operational Issue (COI) #3:

Evaluate the Naval Force's capability (operating independently or as part of a Joint/Combined Force) to correctly identify and maintain the correct ID on each air (and space) vehicle within the assigned battlespace.

A. Measures of Effectiveness (MOE) #1:

Determine the capability of the Naval Force to correctly identify air (and space) vehicles within the assigned battlespace.

1. Measure of Performance (MOP):

a. Attribute: Completeness

(1) % of air (and space) vehicles that have been identified as either Friendly, Hostile, or Neutral (F, H, N) (independent of correctness)

$$\frac{\text{The \# of air (and space) vehicles ID'd}}{\text{The \# of Ground Truth air (and space) vehicles}}$$

(2) % of time air (and space) vehicles were depicted as unknown (including unknown pending, unknown evaluated, unknown unknown for LINK 11) tracks

$$\frac{\Sigma \text{ The amount of time air (and space) vehicles had an ID of unknown (including unknown pending, unknown evaluated, unknown unknown for LINK 11)}}{\text{divided by}} \frac{\Sigma \text{ The amount of time ground truth air (and space) vehicles were tracked}}$$

(3) % of time air (and space) vehicles were depicted as suspect tracks

$$\frac{\Sigma \text{ The amount of time air (and space) vehicles had an ID of suspect}}{\text{divided by}} \frac{\Sigma \text{ The amount of time ground truth air (and space) vehicles were tracked}}$$

(4) % of time air (and space) vehicles were depicted as pending tracks

Σ The amount of time air (and space) vehicles had an ID of pending

divided by

Σ The amount of time ground truth air (and space) vehicles were tracked

(5) % of air vehicles requiring VID that are friendly air vehicles

$\frac{\text{\# of friendly air vehicles requiring VIDs}}{\text{\# of ground truth air vehicles}}$

(6) % of air vehicles requiring VID that are hostile air vehicles

$\frac{\text{\# of hostile air vehicles requiring VIDs}}{\text{\# of ground truth air vehicles}}$

(7) % of air vehicles requiring VID that are neutral air vehicles

$\frac{\text{\# of neutral air vehicles requiring VIDs}}{\text{\# of ground truth air vehicles}}$

(8) % of friendly aircraft responding to IFF interrogations

$\frac{\text{\# of aircraft that responded to an IFF interrogations}}{\text{\# of interrogated friendly aircraft}}$

(9) % of air vehicles with the ID of unknown or pending reaching Inner Defense Zones (IDZ) (or appropriate “keep out” areas)

$\frac{\text{\# of unknown or pending tracks reaching the IDZ}}{\text{\# of ground truth air vehicles}}$

(10) % of air vehicles with the ID of suspect reaching Inner Defense Zones (IDZ) (or appropriate “keep out” areas)

$\frac{\text{\# of suspect tracks reaching the IDZ}}{\text{\# of ground truth air vehicles}}$

(11) % of air (and space) tracks, which were ID'd as friend, that were ID'd by cooperative means

of air (and space) tracks ID'd as friend which were ID'd using cooperative means
divided by
of air (and space) tracks ID'd as friends

(12) % of air (and space) tracks, which were ID'd as neutral, that were ID'd by cooperative means

of air (and space) tracks ID'd as neutral which were ID'd using cooperative means
divided by
of air (and space) tracks ID's as neutral

(13) % of air (and space) tracks, which were ID'd as friend, that were ID'd by non-cooperative means

of air (and space) tracks ID'd as friend which were ID'd using non-cooperative means
divided by
of air (and space) tracks ID'd as friends

(14) % of air (and space) tracks, which were ID'd as neutral, that were ID'd by non-cooperative means

of air (and space) tracks ID'd as neutral which were ID'd using non-cooperative means
divided by
of air (and space) tracks ID'd as neutral

(15) % of air (and space) tracks, which were ID'd as hostile, that were ID'd by non-cooperative means

of air (and space) tracks ID'd as hostile which were ID'd using non-cooperative means
divided by
of air (and space) tracks ID'd as hostile

(16) % of air (and space) tracks, which were ID'd as friend, that were ID'd by procedural means

of air (and space) tracks ID'd as friend which were ID'd using procedural means
divided by
of air (and space) tracks ID'd as friends

(17) % of air (and space) tracks, which were ID'd as neutral, that were ID'd by procedural means

of air (and space) tracks ID'd as neutrals which were ID'd using procedural means
divided by
of air (and space) tracks ID'd as neutrals

(18) % of air tracks, which were ID'd as friend, that were VID

of air tracks ID'd as friend which were VID'd
of air tracks ID'd as friends

(19) % of air tracks, which were ID'd as neutral, that were VID

of air tracks ID'd as neutral which were VID'd
of air tracks ID'd as neutrals

(20) % of air tracks, which were ID'd as hostile, that were VID

of air tracks ID'd as hostile which were VID'd
of air tracks ID'd as hostile

(21) Mean % of time Mode I/II/III/IV/DI is associated with a track

Σ Time track has Mode I/II/III/IV/DI
divided by

Σ Total time (friendly or neutral) ground truth tracks were held

Note: Modes should be calculated separately

(22) % of IDs declared by non-cooperative systems (ID regardless of correctness)

$$\frac{\text{\# of declared (by non-cooperative systems) IDs}}{\text{Total \# on ID attempts (by non-cooperative systems)}}$$

(23) % of time IFF means were used to ID air (and space) vehicles

Σ Number of times an air (and space) track was ID'd using IFF means

divided by

Σ Total number of times air (and space) tracks were ID'd

(24) Average range (e.g., penetration) at which the ID (independent of correctness) was made

$$\frac{\Sigma \text{ ID range}}{\text{\# of tracks}}$$

Note: Ranges are determined from TBD

b. Attribute: Timeliness

(1) Mean time it took each air (and space) vehicle that was identified as F, H, or N to be identified (independent of correctness)

Σ [Time air (and space) tracks were ID'd as F, H, N *minus* the time ground truth air (and space) track was detected]

divided by

The number of tracks that were ID'd as F, H, or N (regardless of correctness)

(2) Average Time between initial detection and correct identification

$$\frac{\Sigma (\text{time to correctly ID } \textit{minus} \text{ time to detect})}{\text{number of correctly ID tracks}}$$

(3) Average Time it takes to resolve an ID conflict

$$\frac{\Sigma (\text{time to resolve ID conflict correctly})}{\text{number of conflicts resolved correctly}}$$

c. Attribute: Correctness

(1) % of time Mode I/II/III/IV/DI is correctly assigned to an air (and space) track

$$\frac{\Sigma \text{ Time track had correct Mode I/II/III/IV/DI}}{\Sigma \text{ Time track held Mode I/II/III/IV/DI assignment}}$$

Note: Modes should be calculated separately

(2) % of hostile air (and space) vehicles correctly ID'd in the assigned battlespace

Number of air (and space) vehicles detected and ID'd as hostile

divided by

Number of hostile ground truth air (and space) vehicles

(3) % of friendly air (and space) vehicles correctly ID'd in the assigned battlespace

Number of air (and space) vehicles detected and ID'd as friends

divided by

Number of friendly ground truth air (and space) vehicles

(4) % of neutral air (and space) vehicles correctly ID'd in the assigned battlespace

Number of air (and space) vehicles detected and ID'd as neutrals

divided by

Number of neutral ground truth air (and space) vehicles

(5) % of air (and space) tracks, which were correctly ID'd as friend, that were ID'd by cooperative means

of air (and space) tracks ID'd as friend which were correctly ID'd using cooperative means

divided by

of air (and space) tracks ID'd as friends

(6) % of air (and space) tracks, which were correctly ID'd as neutral, that were ID'd by cooperative means

of air (and space) tracks correctly ID'd as neutral which were ID'd using cooperative means

divided by

of air (and space) tracks ID's as neutral

(7) % of air (and space) tracks, which were correctly ID'd as friend, that were ID'd by non-cooperative means

of air (and space) tracks correctly ID'd as friend which were ID'd using non-cooperative means

divided by

of air (and space) tracks ID'd as friends

(8) % of air (and space) tracks, which were correctly ID'd as neutral, that were ID'd by non-cooperative means

of air (and space) tracks correctly ID'd as neutral which were ID'd using non-cooperative means

divided by

of air (and space) tracks ID'd as neutral

(9) % of air (and space) tracks, which were correctly ID'd as hostile, that were ID'd by non-cooperative means

of air (and space) tracks correctly ID'd as hostile which were ID'd using non-cooperative means

divided by

of air (and space) tracks ID'd as hostile

(10) % of air (and space) tracks, which were correctly ID'd as friend, that were ID'd by procedural means

of air (and space) tracks correctly ID'd as friend which were ID'd using procedural means

divided by

of air (and space) tracks ID'd as friends

(11) % of air (and space) tracks, which were correctly ID'd as neutral, that were ID'd by procedural means

of air (and space) tracks correctly ID'd as neutrals which were ID'd using procedural means

divided by

of air (and space) tracks ID'd as neutrals

(12) % of air (and space) tracks, which were correctly ID'd as friend, that were VID

of air (and space) tracks correctly ID'd as friend which were VID'd

divided by

of air (and space) tracks ID'd as friends

(13) % of air (and space) tracks, which were correctly ID'd as neutral, that were VID

of air (and space) tracks correctly ID'd as neutral which were VID'd

divided by

of air (and space) tracks ID'd as neutrals

(14) % of air (and space) tracks, which were correctly ID'd as hostile, that were VID

of air (and space) tracks correctly ID'd as hostile which were VID'd

divided by

of air (and space) tracks ID'd as hostile

(15) % of correct IDs declared by non-cooperative systems

Number of correctly declared IDs (by non-cooperative systems)

divided by

Total # on ID declarations (made by non-cooperative systems)

(16) % of air vehicles initially identified correctly (on initial ID there was at least one associated track that was correctly identified, and there were no associated incorrectly-identified tracks, unknowns excepted)

$$\frac{\text{Number of vehicles so identified}}{\text{Number of vehicles identified}}$$

(17) % of air vehicles initially identified correctly (on initial ID there was at least one associated track that was correctly identified, and there were no associated incorrectly-identified tracks, unknowns excepted) and were subsequently re-identified with an incorrect ID

$$\frac{\text{Number of vehicles identified correctly and were subsequently re-identified with an incorrect ID}}{\text{Number of vehicles identified}}$$

(18) % of air vehicles initially identified incorrectly (on initial ID there was at least one associated track that was incorrectly identified)

$$\frac{\text{Number of vehicles so identified}}{\text{Number of vehicles identified}}$$

(19) % of air vehicles initially identified incorrectly (on initial ID there was at least one associated track that was incorrectly identified) and were subsequently re-identified with a correct ID

$$\frac{\text{Number of vehicles identified correctly and were subsequently re-identified with a correct ID}}{\text{Number of vehicles identified}}$$

(20) % of IFF interrogations responding with a valid response

$$\frac{\text{\# of interrogations resulted in a valid response}}{\text{\# of interrogations made}}$$

d. Attribute: Continuity

(1) % of time tracked air (and space) vehicles were depicted by only correctly-identified tracks

Σ amount of time air (and space) vehicle was depicted with correct ID

divided by

Σ amount of time ground truth air (and space) vehicle was tracked

B. Measures of Effectiveness (MOE) #2:

Determine the capability of the Naval Force to correctly maintain the correct ID of air (and space) vehicles within the assigned battlespace.

1. Measure of Performance (MOP):

a. Attribute: Continuity

(1) % of air (and space) vehicles that were initially ID'd correctly but didn't remain correctly identified while in the battlespace

of air (and space) vehicles/formations that did not remain correctly ID'd throughout the battlespace

divided by

of air (and space) vehicles/formations that were correctly ID'd

(2) Average number of ID changes (using the results of MOP 1A(1))

TBD

(3) Mean time that the ID was correct

Σ Time air (and space) vehicle remained correctly ID'd

divided by

Σ Time air (and space) vehicle remained in the battlespace with its initially correct ID

(4) % of air (and space) vehicles that were initially ID'd incorrectly but were subsequently ID'd

of air (and space) vehicles/formations that initially were ID'd incorrectly but subsequently ID'd correctly
divided by
of air (and space) vehicles/formations that were in correctly ID'd

(5) Average number of ID changes (using the results of MOP 1A(4))

TBD

(6) Mean time that the ID was correct

Σ Time air (and space) vehicle remained correctly ID'd
divided by
 Σ Time air (and space) vehicle remained in the battlespace with its initially correct ID

(7) % of unresolved ID conflicts over a period of time with a designated track load

of unresolved ID conflicts (over a specified period of time)
divided by
Total # of ID conflicts (over same period of time)

b. Attribute: Commonality:

(1) % of time aircraft formation were depicted by at least one correctly-identified track (and no incorrectly ID'd tracks) and zero or more unknown (pending/unknown evaluated) tracks

Σ Time formation depicted with at least one correctly-ID'd track (and no incorrectly ID'd tracks) and zero or more unknown (pending/unknown evaluated) tracks
divided by
 Σ Time formation was in the battlespace

(2) % of time aircraft formation were depicted by at least one incorrectly-identified track (and no correctly ID'd tracks) and zero or more unknown (pending/unknown evaluated) tracks

Σ Time formation depicted with at least one incorrectly-ID'd track (and no correctly ID'd tracks) and zero or more unknown (pending/unknown evaluated) tracks

divided by

Σ Time formation was in the battlespace

(3) % of time aircraft formation were depicted by at least one correctly-identified track and one or more incorrectly-identified tracks

Σ Time formation depicted with at least one correctly-ID'd track and one or more incorrectly ID'd tracks)

divided by

Σ Time formation was in the battlespace

IV. Critical Operational Issue (COI) #4:

Evaluate the Naval Force's capability (operating independently or as part of a Joint/Combined Force) to manage, and execute a C4I architecture that allows assured, accurate, and timely exchange of sensor, track, identification, force order, and management reports.

A. Measure of Effectiveness #1

Determine the capability of the Naval Force to exchange sensor, track, identification, force order and management reports.

1. Measure of Performance (MOP):

a. Attribute: Completeness

(1) The % of air and space vehicles detected but not reported on the link/network

of air and space vehicles detected but not reported on the link/network

divided by

Total # of ground truth air and space vehicles

(2) % of messages received by each individual remote IU (within the TADIL network) compared to messages transmitted

TADIL A messages received at IU from O/U

TADIL A messages transmitted by O/U

TADIL J messages received at IU from O/U

TADIL J messages transmitted by O/U

plus

O/U PPLI received at remote IU

of expected PPLIs during the time of the run

(3) % of tracks reported by O/U CDS (for all local tracks in the O/U CDS track database which qualify to be reported over the TADILs)

tracks reported by O/U CDS

tracks held by O/U CDS which qualify for transmission

(4) % of tracks reported by O/U CDS that are transmitted in TADIL messages (for all tracks that passed MOP 1A(3))

tracks reported by O/U over TADIL

tracks reported by O/U CDS

(5) % of tracks reported by O/U CDS that must be forwarded to another TADIL and received by the forwarding JU (for all tracks that passed MOP 1A(4))

tracks received by the forwarding JU over TADIL

tracks reported by O/U over TADIL

(6) % of tracks received by the forwarding JU on one TADIL that are forwarded to the other TADIL (for all tracks that passed MOP 1A(5))

tracks forwarded by forwarding JU over TADIL

tracks received by the forwarding JU over TADIL

(7) % of tracks forwarded by the forwarding JU that are received by a remote IU (for all tracks that passed MOP 1A(6))

tracks received by the remote IU over TADIL

tracks forwarded by forwarding JU over TADIL

(8) % of tracks that are received in TADIL messages by each individual remote IU (for all tracks that passed MOP 1A(4) which are transmitted to another unit on the same TADIL)

tracks received by the remote IU over TADIL

tracks reported by O/U over TADIL

(9) % of tracks that are received at a remote IU over the TADIL from O/U that are transferred to that remote IU's CDS (for all tracks that passed MOP 1A(7) or MOP 1A(8))

tracks transferred to remote IU CDS
tracks received by the remote IU over TADIL

(10) % of tracks that are updated in the remote IU's track database (for all tracks that passed MOP 1A(9))

tracks entered into the remote IU database
tracks received by the remote IU CDS

(11) % of tracks that are updated in each individual remote IU's track database (for all local tracks in the O/U CDS track database which qualify to be reported over the TADIL)

For J to J and A to A:

Results of MOP 1A(3) x 1A(4) x 1A(8) x 1A(9) x 1A(10)

For J to A and A to J:

Results of MOP 1A(3) x 1A(4) x 1A(5) x 1A(6) x 1A(7) x
1A(9) x 1A(10)

(12) % of time each unit was able to develop and maintain positional adjustments (i.e. pads)

Time (Surface pads available)
Time (Run)

Time (Surface pads not available for reason (n))
Time (Run)

Time (Air pads available)
Time (Run)

Time (Air pads not available for reason (n))
Time (Run)

(13) % of time each unit was able to develop and maintain IU positional adjustments (i.e. pads)

$$\frac{\text{Time (Surface IU pads available)}}{\text{Time (Run)}}$$

$$\frac{\text{Time (Surface IU pads not avail for reason (n))}}{\text{Time (Run)}}$$

$$\frac{\text{Time (Air IU pads available)}}{\text{Time (Run)}}$$

$$\frac{\text{Time (Air IU pads not available for reason (n))}}{\text{Time (Run)}}$$

(14) % of time an air or space vehicle was detected but not reported on the link/network

$$\frac{\text{Time air or space vehicle was not reported}}{\text{Time air or space vehicle was detected}}$$

(15) (as applicable) % of tracks that are reported to Shipboard Gridlock System (SGS) (for all tracks in the O/U CDS track database which qualify to be reported to SGS in other than a TADIL message)

For inline SGS configurations:

$$\frac{\begin{aligned} &\# \text{ of local tracks reported by O/U CDS to SGS} \\ &\textit{divided by} \\ &\# \text{ local/mutual tracks held by O/U CDS (that qualify for} \\ &\text{transmission)} \end{aligned}}{\text{-----}}$$

For adjunct SGS configurations:

$$\frac{\begin{aligned} &\# \text{ of local tracks reported by O/U CDS to SGS} \\ &\textit{divided by} \\ &\# \text{ local tracks held by O/U CDS (that qualify for} \\ &\text{transmission)} \\ &\textit{plus} \\ &\# \text{ of remote/mutual tracks reported by O/U CDS to SGS} \\ &\textit{divided by} \\ &\# \text{ remote entered into the O/U CDS (that qualify for} \\ &\text{transmission)} \end{aligned}}$$

b. Attribute: Correctness

(1) % of messages received correctly (i.e. with matching data) (within the TADIL network) (for all TADIL messages generated by O/U which passed MOP 1a(2) and received by each individual remote I/U)

TADIL A messages received correctly at remote_IU from O/U

divided by

TADIL A messages received at IU from O/U

TADIL J messages received correctly at remote_IU from O/U

divided by

TADIL J messages received at IU from O/U

(2) % of reporting periods that have matching (correct) message content (for all local tracks of interest in the O/U CDS track database that are being reported)

of reporting periods with matching data content

of reporting periods with track data

(3) % of tracks reported by O/U CDS that is transmitted in TADIL messages with matching (correct) data content (for all tracks of interest)

of messages reported by O/U over TADIL with matching track data

divided by

of messages reported by O/U over TADILs

(4) % of tracks reported by O/U that are received by the forwarding JU with matching (correct) data content (for all tracks of interest which must be forwarded to another TADIL)

of messages received by the forwarding JU with matching track data

divided by

of messages received by the forwarding JU

(5) % of tracks reported by O/U that are forwarded by the forwarding JU from one TADIL to another with matching

(correct) data content (for all tracks of interest which must be forwarded to another TADIL)

of messages forwarded by the forwarding JU with
matching track data
divided by
of messages forwarded by the forwarding JU

(6) % of tracks reported by O/U that are forwarded to a remote IU with matching (correct) data content (for all tracks of interest which must be forwarded to another TADIL)

of messages forwarded to a remote IU with matching
track data
divided by
of messages forwarded to a remote IU

(7) % of tracks reported by O/U that are received by each individual remote IU with matching (correct) data content (for all tracks of interest which must be forwarded to another TADIL)

of messages received by a remote IU with matching track
data
divided by
of messages received by a remote IU

(8) % of tracks received at a remote IU over the TADIL from O/U that are transferred to that remote IU's CDS with matching (correct) data content (for all tracks of interest)

of messages transferred to a remote IU CDS with
matching track data
divided by
of messages transferred to a remote IU CDS

(9) % of tracks that originated at O/U and were transferred to a remote IU's CDS that are updated in the remote IU's track database with matching (correct) data content (for all tracks of interest)

of messages received by a remote IU CDS and entered into the IU's track database with matching track data
divided by
of messages received by the remote IU CDS

(10) % of tracks that are updated in each individual remote IU's track database with matching (correct) data content (for all tracks in the O/U CDS track database which qualify to be reported over the TADIL)

of messages received by a remote IU CDS and entered into the IU's track database with matching track data
divided by
of reporting periods with track data

(11) % of time each track is correlated accurately based on system design and implementation of the correlation rules (for each locally held object of interest)

Time (Object is correlated accurately based on systems correlation rules)
divided by
Time (Object should be correlated)

Time (Object is not correlated accurately based on systems correlation rules for reason (n))
divided by
Time (Object should be correlated)

of correlations per object accurately performed based on systems correlation rules
divided by
of correlations per object inaccurately performed based on systems correlation rules for reason (n)

(12) % of time each track is correlated accurately based on that object's true attributes (for each locally held object of interest)

Time (Object is correlated accurately based on true attributes)

divided by

Time (Object correlated)

Time (Object is not correlated accurately based on true attributes for reason (n))

divided by

Time (Object correlated)

of correlations per object accurately performed based on true attributes)

divided by

of correlations per object inaccurately performed based on true attributes for reason (n)

(13) Time each track is de-correlated accurately based on system de-correlation rules (for each mutually held object of interest)

Time (Object should have de-correlated based on systems de-correlation rules, but didn't)

of de-correlations per object accurately performed based on systems de-correlation rules

of de-correlations per object inaccurately performed based on systems de-correlation rules for reason (n)

(14) Time each track is de-correlated accurately based on that object's true attributes (for each mutually held object of interest)

Time (Object should have de-correlated based on the object's true attributes, but didn't)

of de-correlations per object accurately performed based on the object's true attributes

of de-correlations per object inaccurately performed based on the object's true attributes for reason (n)

(15) Number and % of tracks not correlated that should have been (as defined by the Corr/De-Corr ICP)

TBD

(16) % of time Reporting Responsibility was accurately determined (for all local tracks of interest)

$$\frac{\text{Time (R2 was accurately determined)}}{\text{Time (Track held)}}$$

Time (R2 should not have been held and was for reason (n))

divided by

Time (Track held)

Time (R2 should have been held and was not for reason (n))

divided by

Time (Track held)

$$\frac{\# \text{ Accurate R2 shifts per track for reason (n)}}{\# \text{ of R2 decisions made per track}}$$

$$\frac{\# \text{ Inaccurate R2 shifts per track for reason (n)}}{\# \text{ of R2 decisions made per track}}$$

Ideal Object R2 (Highest TQ) vice Actual R2

(17) For each air track, determine if the actual TQ is greater than or equal to reported TQ (This is a chart)

(18) For each locally held air track, calculate the number and percentage of time TQ is reported correctly and consistently

Time (TADIL A calculated TQ is correct)

Time (TADIL J calculated TQ is correct)

Time (TADIL A calculated TQ is incorrect and consistent)

Time (TADIL J calculated TQ is incorrect and consistent)

(19) % of time each unit correctly applied computed pads on both transmission and reception (for times which pads were available)

$\frac{\text{Time (Surface pads applied correctly)}}{\text{Time (Surface pads available)}}$

$\frac{\text{Time (Surface pads not applied correctly for reason (n))}}{\text{Time (Surface pads available)}}$

$\frac{\text{Time (Air pads applied correctly)}}{\text{Time (Air pads available)}}$

$\frac{\text{Time (Air pads not applied correctly for reason (n))}}{\text{Time (Air pads available)}}$

(20) % of time each unit applies positional adjustments (i.e. pads) that accurately align remote tracks to the local frame of reference (for times which pads were applied)

$\frac{\text{Least Square Sum [(Surface(Remote Position) minus Surface (Local Position))^2]}{\text{divided by}}}{\# \text{ Surface Track Pairs}}$

$\frac{\text{Least Square Sum [(Air(Remote Position) minus Air (Local Position))^2]}{\text{divided by}}}{\# \text{ Air Track Pairs}}$

(21) % of time each unit was able to apply manual pads correctly

$\frac{\text{Time (manual pads applied correctly)}}{\text{Time (manual pads active)}}$

(22) % of time each unit correctly applied computed IU pads on reception (for times which IU pads were available)

$\frac{\text{Time (Surface IU pads applied correctly)}}{\text{Time (Surface IU pads available)}}$

 $\frac{\text{Time (Air IU pads applied correctly)}}{\text{Time (Air IU pads available)}}$

(23) % of time each unit applies IU positional adjustments (i.e. pads) that accurately align remote tracks to the local frame of reference (for times which IU pads were applied)

Least Square Sum [(Surface(Remote Position) *minus*
Surface (Local Position)]²
divided by
Surface Track Pairs

Least Square Sum [(Air(Remote Position) *minus* Air (Local
Position)]²
divided by
Air Track Pairs

(24) % of time each unit is in geodetic sensor alignment

Least Square Sum [(Surface(Track Ground Truth) *minus*
Surface (Track TADIL position reported by O/U)]²
divided by
Ground Truth Surface Tracks

Least Square Sum [(Air (Track Ground Truth) *minus* Air
(Track TADIL position reported by O/U)]²
divided by
Ground Truth Air Tracks

(25) Time each unit is in geodetic navigation alignment

Least Square Sum [(O/U (Ground Truth) *minus* O/U (IU
Report)]²

(26) % of tracks upon which the proper transmission filter actions are performed (for all tracks of interest in the O/U CDS track database that are eligible to be reported over the TADILs)

of tracks properly transmitted or transmit filtered over a
specific TADIL
divided by
of tracks

(27) % of tracks upon which the proper reception filter actions are performed (for all remote tracks of interest received over the TADILs that are eligible for filtering)

of tracks properly received or receive filtered from a specific TADIL
divided by
of tracks

(28) (as applicable) % of tracks that are reported by CDS to the Shipboard Gridlock System (SGS) with matching/correct message content (for all tracks in the O/U CDS track database which are reported to SGS in other than a TADIL message)

For inline and adjunct SGS configurations:

of track messages received by SGS for CDS with matching data content
divided by
of track messages transferred to SGS from CDS

c. Attribute: Timeliness

(1) Latency between the time of any database update event and the time of the corresponding report of the event by CDS (for all tracks in the O/U CDS track database that are being reported)

Σ [Time (CDS message transmit) *minus* Time (O/U Update)]
divided by
of updates

Max [Time (CDS message transmit) *minus* Time(O/U Update)]

(2) Latency between the time a track is reported by O/U CDS and the time the corresponding transmission occurs on the TADIL (for all tracks of interest)

$$\frac{\Sigma [\text{Time (TADIL message transmit)} \textit{ minus } \text{Time (CDS message transmit)}] \textit{ minus } \text{Clock Delta}}{\textit{divided by}} \\ \# \text{ of CDS messages}$$

$$\text{Max} [\text{Time (TADIL message transmit)} \textit{ minus } \text{Time (CDS message transmit)}]$$

(3) Latency between the time an O/U generated message is transmitted over the TADIL and the time the forwarding JU receives the corresponding message (for all tracks of interest which must be forwarded to another TADIL)

$$\frac{\Sigma [\text{Time (TADIL message received at the forwarding JU)} \textit{ minus } \text{Time (TADIL message transmit)}] \textit{ minus } \text{Clock Delta}}{\textit{divided by}} \\ \# \text{ of TADIL messages}$$

$$\text{Max} [\text{Time (TADIL message received at forwarding JU)} \textit{ minus } \text{Time (TADIL message transmit)}]$$

(4) Latency between the time an O/U generated message is received by the forwarding JU on one TADIL and the time the forwarding JU forwards the corresponding message over the other TADIL (for all tracks of interest which must be forwarded to another TADIL)

$$\frac{\Sigma [\text{Time (TADIL message transmitted by the forwarding JU)} \textit{ minus } \text{Time (TADIL message received at the forwarding JU)}]}{\textit{divided by}} \\ \# \text{ of TADIL messages received by forwarding JU}$$

$$\text{Max} [\text{Time (TADIL message transmitted by forwarding JU)} \textit{ minus } \text{Time (TADIL message received at the forwarding JU)}]$$

(5) Latency between the time the forwarding JU forwards an O/U generated message over a TADIL and the time each individual remote IU receives the corresponding message (for all tracks of interest which must be forwarded to another TADIL)

Σ [Time (TADIL message received) *minus* Time (TADIL message transmitted from forwarding JU)] *minus* Clock Delta

divided by

of TADIL messages

Max [Time (TADIL message receive) *minus* Time (TADIL message transmit from forwarding JU)]

(6) Latency between the time an O/U generated message is transmitted and the time each individual remote IU receives the corresponding message (for all tracks of interest which are transmitted to another unit on the same TADIL)

Σ [Time (TADIL message received) *minus* Time (TADIL message transmitted)] *minus* Clock Delta

divided by

of TADIL messages

Max [Time (TADIL message receive) *minus* Time (TADIL message transmit)]

(7) Latency between the time an O/U generated TADIL message is received at a remote IU and the remote CDS receives the corresponding message (for all tracks of interest)

Σ [Time (Transfer to CDS) *minus* Time (TADIL message received)] *minus* Clock Data

divided by

of TADIL messages

Max [Time (Transfer to CDS) *minus* Time (TADIL message received)]

(8) Latency between the time a remote CDS receives a message generated from an O/U TADIL report and the time the remote IU's corresponding update to it's CDS database is made (for all tracks of interest)

$$\frac{\Sigma [\text{Time (Remote IU Updated)} \textit{ minus } \text{Time (CDS message received)}] \textit{ minus } \text{Clock Data}}{\text{# of CDS messages}}$$

$$\text{Max } [\text{Time (Remote IU Update)} \textit{ minus } \text{Time (CDS message received)}]$$

(9) Latency between the time of any O/U CDS database update event and the time of the corresponding remote IU CDS database update (for all tracks of interest)

$$\frac{\Sigma [\text{Time (Remote IU updated)} \textit{ minus } \text{Time (O/U updated)}] \textit{ minus } \text{Clock Data}}{\text{# of Updates}}$$

(10) Latency between the time of any database update event at CDS and the time of the corresponding update event at SGS (for all tracks of interest in the O/U CDS track database which are being reported to SGS in other than a TADIL message)

$$\frac{\Sigma [\text{Time (CDS to SGS message event recorded in SGS)} \textit{ minus } \text{Time (CDS to SGS message event occurs in CDS)}]}{\text{# of message events}}$$

$$\text{Max } [\text{Time (CDS to SGS message event recorded in SGS)} \textit{ minus } \text{Time (CDS to SGS message event occurs in CDS)}]$$

(11) Rate at which message occurrences are generated (for a subset of tracks that O/U holds R2 on TADIL A for a majority of the time)

$$\frac{\Sigma [\text{Time (Occurrence n)} \textit{ minus } \text{Time (Occurrence n-1)}]}{\text{# of Occurrences}}$$

Standard deviation from average

(12) Rate at which message occurrences are generated (for a subset of tracks that O/U holds R2 on TADIL J for a majority of the time)

$$\frac{\sum [\text{Time (Occurrence } n) \textit{ minus Time (Occurrence } n-1)]}{\# \text{ of Occurrences}}$$

Standard deviation from average

d. Attribute: Commonality

(1) % of track numbers held in common compared to the total number of tracks

$$\frac{\# \text{ of tracks numbers held in common}}{\text{total } \# \text{ of tracks}}$$

(2) % of common tracks with a common position compared to the number of tracks held in common

$$\frac{\# \text{ of tracks numbers held in common with a common position}}{\text{total } \# \text{ of tracks held in common}}$$

(3) % of common tracks with a common position and a common ID compared to the number of common tracks with common position

$$\frac{\# \text{ of tracks which have a common position and a common ID}}{\# \text{ of common tracks which have a common position}}$$

Note: Common ID is defined as having an identical identity. Per OPSPEC 516, assignments of Friend, Assumed Friend, Neutral, Unknown, Pending, Suspect, or Hostile (F, AF, N, U, P, S, H). Per OPSPEC 411, assignments of Friend, Hostile, and Unknown (F, H, U).

APPENDIX

Definitions:

Battlespace: Designated area of operations and/ or area of responsibility for a specific unit or force.

Area of Operations: An operational area defined by the joint force commander for land and naval forces. Areas of operations do not typically encompass the entire operational area of the joint force commander, but should be large enough for component commanders to accomplish their missions and protect their forces. For joint theater air missile defense, the area of operations defined in terms of ranges, altitudes and geometric configuration is specified by the AADC based on mission objectives, threat OOB and capability, own force resources, national boundaries, geography, topography, and weather.

Coherent Tactical Picture: A clear, consistent, and intuitively obvious display of all objects of interest (vehicular and non-vehicular tracks, geographic and political regions, operating areas) to users across the force, within an operator-selectable region of interest

Combat Identification (CID): The process of attaining an accurate characterization of detected objects in the joint battlespace to the extent that high confidence, timely application of tactical options and weapons resources can occur. (Note: Depending on the situation and the tactical decisions that must be made, this characterization will be at least, but may not be limited to, “friend”, “enemy”, or “neutral.”)

Commonality: Track attributes of shared data are the same for each SIAP user; an attribute

Completeness: Amount of real tracks that are included in the SIAP; an attribute

Contact: A detected but unevaluated person or object.

Continuity: Proper maintenance of track attributes over time; an attribute

Correctness: Data accurately reflects true track attributes (position, kinematics, and identity); an attribute

Correlation: The determination that a locally derived track represents the same object or point as another track and/or the process of combining two such tracks/data under one track number

Data Forwarding: The process of receiving data on one TADIL and outputting the data in the proper format and protocol of another TADIL.

Data Mile: A unit of distance measurement equivalent to 6000 ft

Data Registration: The process by which all positional data for a given TADIL is synchronized to the same plane of reference for track reporting.

Decorrelation: The determination that locally held track data for a given track number does not represent the same object or point as track data being received in a remote track report for the same track number

Drop Track: An indication from the unit having reporting responsibility for a particular track that a unit will no longer report it. Other units holding locally derived data on that track may continue to report it.

Dual designations: The same track is being reported by two or more units using two or more different track numbers

Dualed: When a dual designation occurs

Duplicate Track Numbers: The same TN is being used by two or more units to report two or more different tracks.

Filter: The process of inhibiting data from transmission on a TADIL, and or inhibiting data received on a TADIL from entry into a unit data base.

Firm Track: A track that met all criteria to be entered into the combat direction system

Formation: Two or more air vehicles flying with same kinematics attributes in the close (approximately 1 mile) proximity of one another

Forwarding JTIDS Unit (FJU): A JU that translates and forwards data among units using J-series messages (TADIL J) and M-series messages (TADIL A and B).

Forwarding Participating Unit (FPU): A participating unit that is forwarding data between TADIL A and one or more TADIL B units.

Forwarding Reporting Unit (FRU): A unit that is forwarding data between two or more TADIL B units.

Gridlock: The method of data registration employed on TADIL A to synchronize all positional data to the same "grid", or plane of reference, for track reporting.

Identity: Per OPSPEC 516, assignments of Friend, Assumed Friend, Neutral, Unknown, Pending, Suspect, or Hostile (F, AF, N, U, P, S, H). Per OPSPEC 411, assignments of Friend, Hostile, and Unknown (F, H, U).

Identification: The process of determining the friendly, enemy or neutral character of a detected person or object(s). The characterization of a unit which includes for Link 16:

identity, platform, activity, and specific type or for Link 11: identity, primary amplification, and ID amplification.

Friendly: A person, unit, aircraft, vehicle, vessel, etc. of the same military force including military allies and coalition partners.

Enemy: (1) An armed foe. (2) An opposing military force, nation or state.

Hostile: (1) An additional characterization (usually based upon ROE) of a person or object previously identified as enemy. (2) A track that is eligible to be engaged. This designation does not constitute authority or direction to engage.

IFF: An interrogator, which can be either ground based or airborne, that transmits pulses and receives replies containing the responding aircraft's identity, altitude, and other essential information.

Interface Unit (IU): A term used to describe any unit operating on either TADIL A as a Participating Unit, TADIL B as a Reporting Unit, or TADIL J as a JTIDS unit

JTIDS Unit (JU): A unit communicating directly on TADIL J

Link: The tactical data link that is being used (i.e. Link-11, Link-16)

Multiple Dual: Having three or more tracks (and track numbers) assigned to the same air vehicle (or formation)

Neutral: A track whose characteristics, behavior, origin, or nationality indicate that it is neither supporting nor opposing friendly forces.

Object: Any physical thing which occupies real space and time

O/U: Own Unit – the unit which is being treated as the local unit

Participating Unit: A unit communicating directly on TADIL A

Precise Participant Location and Identification (PPLI): The function performed by the JTIDS terminal to periodically transmit own unit's position and identifying information on TADIL J.

Relay: A network role assigned to a JTIDS Unit. Messages received within designated time slots are retransmitted after a specified delay. The retransmission of messages by airborne relay platforms allows information to be propagated to other units that are not within line of sight of the original transmitters.

Reporting Period: Dependent upon the network in question. For LINK 11/TADIL A, it is the Net Cycle Time. For LINK 16/TADIL J, it is a more complicated issue, based in part on time slot allocation

Net Cycle Time: The length of time between reporting opportunities, as measured by each Participating Unit (TADIL A)

Time Slot: The time slot is the basic unit of access to the JTIDS network and is assigned to each JTIDS Unit for either transmission or reception. Recurrence rate number (RRN) is an indication of how many time slots are in a time slot block, and how often they recur. A RRN of 15 has a slot interval of just over 23 msec, and contains 3 slots, while a RRN of 0 has a slot interval of 12.8 minutes and contains 98304 slots.

Reporting Responsibility: The requirement for the interface unit with the best positional data to track to transmit track data on the interface.

Reporting Unit: A unit communicating directly on TADIL B.

Selective Identification Feature (SIF): A capability that, when added to the basic IFF system, provides the means to transmit, receive, and display selected coded replies which uniquely identify a platform

Sensor: Equipment which detects, and may indicate, and/or record objects and activities by means of energy or particles emitted or reflected

Sensor kinematics data: Velocity and acceleration measurement data which is derived from a sensor

Sensor positional data: Three dimensional information (x, y, and z, axis) obtained from a sensor. However, a particular sensor may measure only one, two or three dimensions of position. Also, sensors may only measure bearing.

Single Integrated Air Picture (SIAP): The product of fused, common, continuous, unambiguous tracks of all airborne objects in the surveillance area. Each object within the SIAP has one, and only one, track number and set of associated characteristics. The SIAP is developed from near-real-time and real-time data, and is scaleable and filterable to support situation awareness, battle management, and target engagements.

Timeliness: Data is where it is needed, when it is needed; an attribute

Track: The graphic and/or alphanumeric representation of an object, point, or bearing whose position and or characteristics are collated from sensors and/or other data sources. Symbols used to display tracks on a data display console or other display device

Local Track: A track established within an interface unit based on locally-entered positional information. Amplifying data associated with the track may be derived locally, from supporting units, or from TADILs

Remote Track: A track established within an interface unit based upon positional information derived from a TADIL report or reports. Amplifying data associated with the track may be derived locally, from supporting units, or from TADILs

Track attributes: Characteristics of a track when used in context with correlation criteria (e.g., position, velocity, altitude, latency (real time, non-real time), identity).

Track Number: The unique numeric or alphanumeric octal identifier associated with a specific set of tack data representing a vehicular object, point, line of bearing, fix, or area of probability.

Track Quality: A numerical value assigned to a track computed from data related to the past tracking performance on the track, representing the accuracy of the track position. TQ "0" is assigned only to a non real-time track.

Vehicle: A propelled object (e.g., airplane, TBMs, cruise missiles)