



# Architectural Assessment Tool (AAT) Phase II Final Briefing

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Task Order PSI-04908-002

**BAE SYSTEMS**

In support of Task 02:

“IDHS and DoDIIS Engineering and System Support”

SEESAW 3 (FA8750-04-D-0009/0002)

John H. Fikus, Ph.D.  
Prediction Systems, Inc.

*Use Approved by  
AFRL Leadership*





# Briefing Agenda

- AAT Phase II Overview
- Overview of SINCGARS and Link-16
- Operational Network Requirements Database
- Scenario Design
- AAT Simulation Software Design
- AAT Simulation Software System Capabilities
- Architectural Assessment Example
- User Familiarization Training Overview
- Final Conclusions



# AAT Phase II Overview

- AAT is aimed at assessing impacts of passing IP through Link-16 Tactical Data Links (TDLs).
- Phase II Goals:
  - Design the Operations Network Requirements (ONR) Database for IP through Link-16. (Task 2.1)
  - Design combined SINGARS/Link-16 Scenario. (Task 2.2)
  - Design, Build, Test and Deliver the AAT. (Task 2.4)
  - Provide Final Briefing.
  - Provide User Familiarization Training.



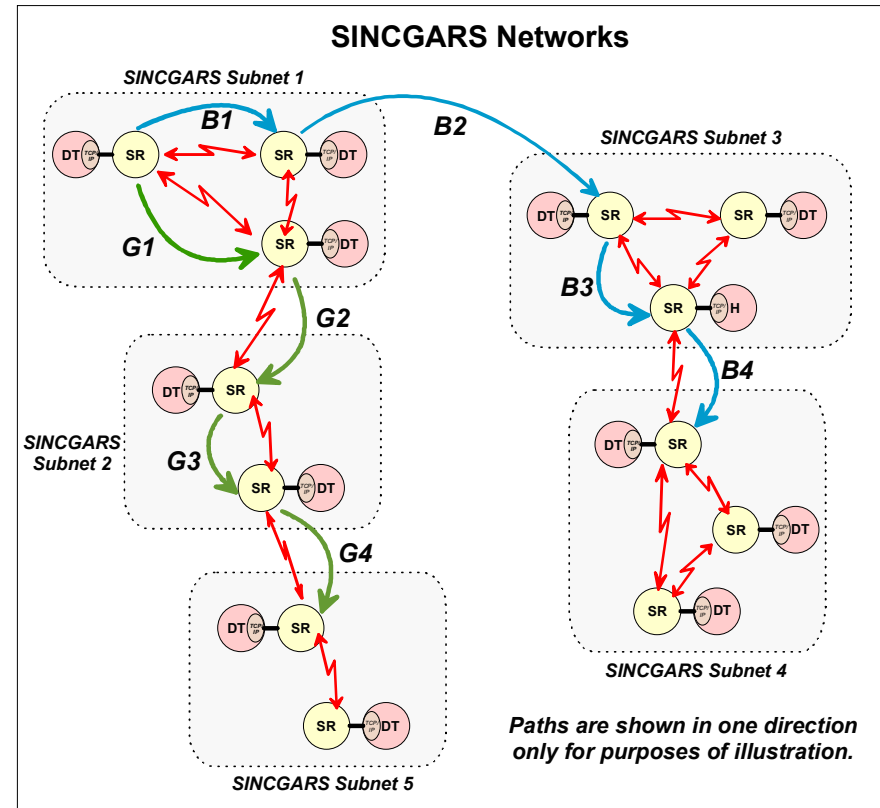
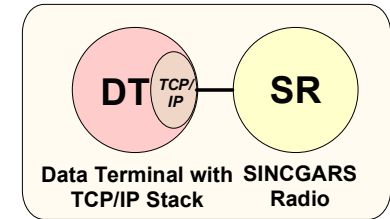
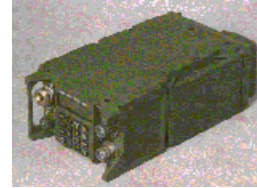
# Background Material

- SINGARS Radio & Simulation
- Link-16 Terminals, Link-16 NMS & Simulation

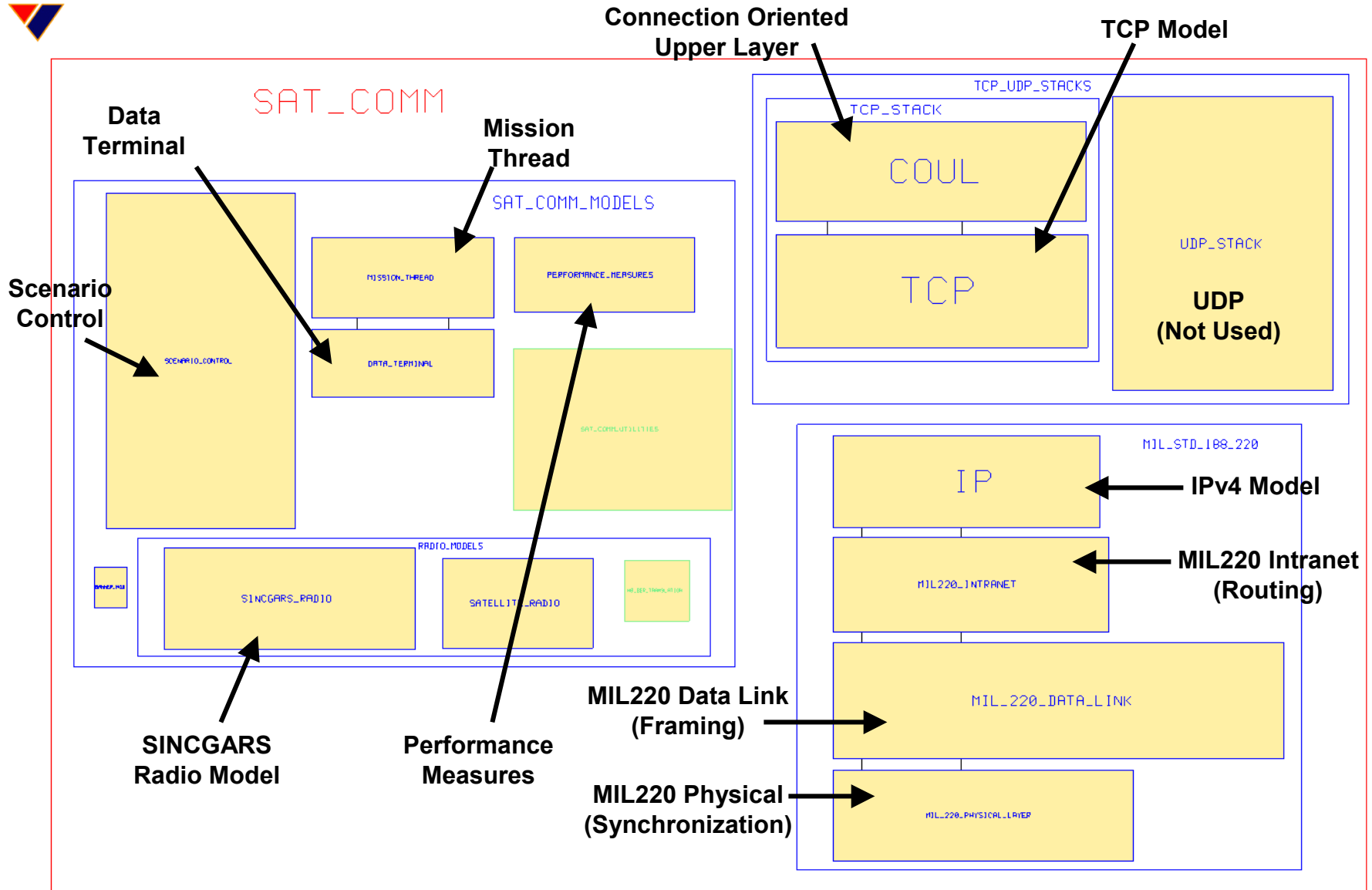


# SINGGARS Overview

- VHF Radios widely deployed in the Army for tactical communications, e.g., fire control.
- Range from 300 m to 35 Km.
- Data terminals use **TCP/IP**.
- Radio sub-nets based on Frequency assignments.
- Internet Routing between sub-nets is via gateways.
- Data rates vary from 1.2 to 16 Kbps.
- Simulation uses:
  - TCP and IPv4 Models.
    - Source of TCP/IP traffic for AAT
  - Scenario file for deployments.
  - Unit colors for sub-net identification.
  - Organization file for network connectivity.
  - “Mission Thread” traffic models.
  - Event file drives Threads.

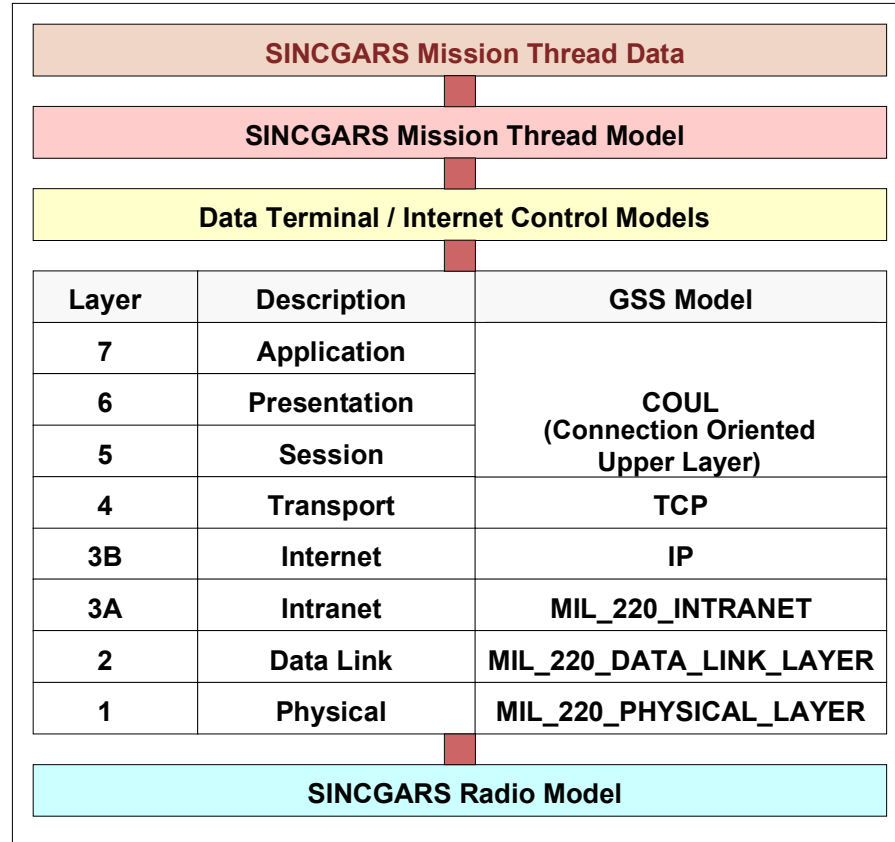


# SINGGARS Related Models





# SINGGARS Comm's Models



Organization Model

Deployment Model

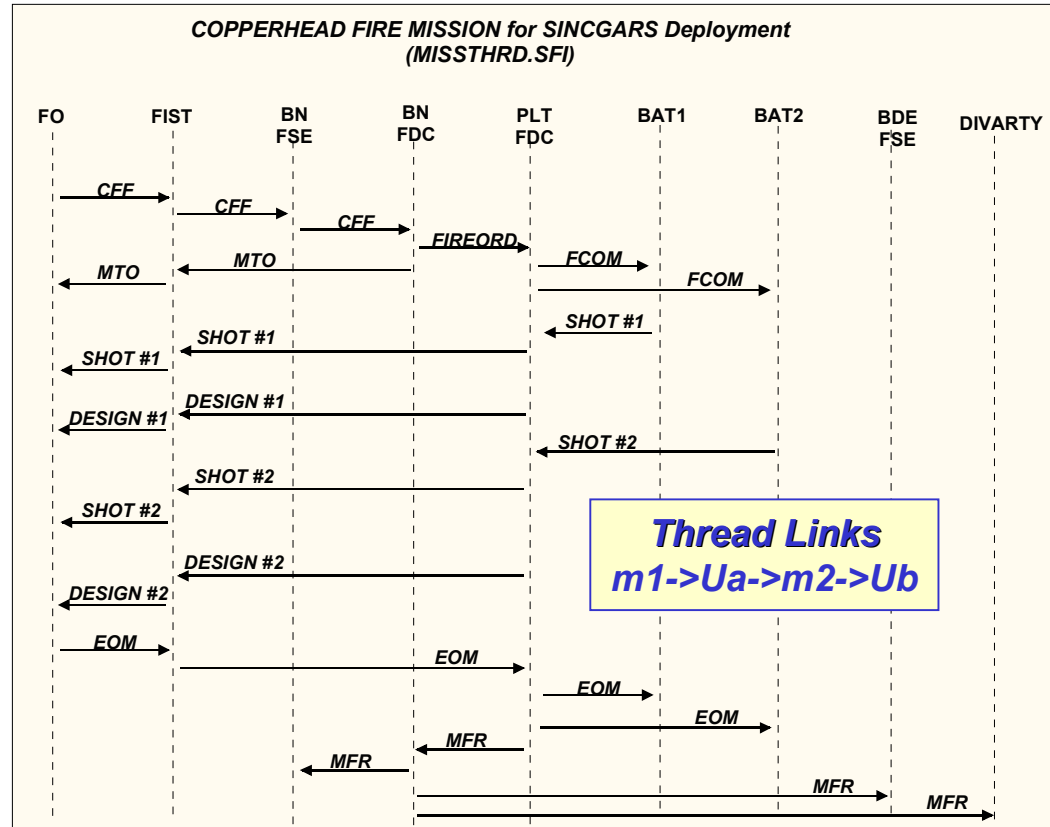
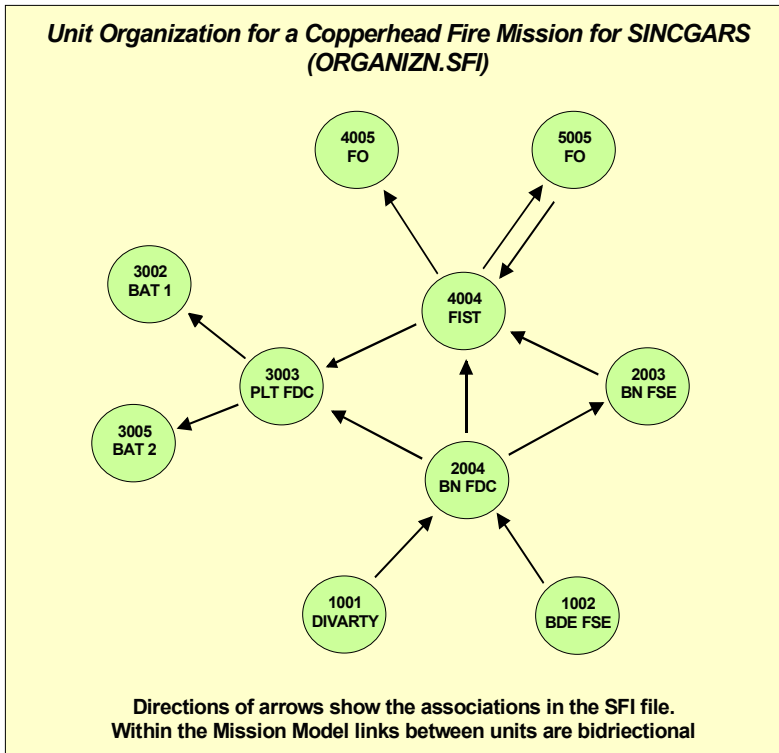


# SINGGARS Concepts

## (Unit Organization & Mission Threads)

### Unit Organization for Networking

### Mission Thread Definition



Uses Unit Instances & Addresses (Unit= Soldier + Radio)

Thread Definition Uses Generic Unit Types

Events on Specific Units Create Instances of Threads



# Link-16 Overview



Computer-to-Computer and Voice Tactical Communication System

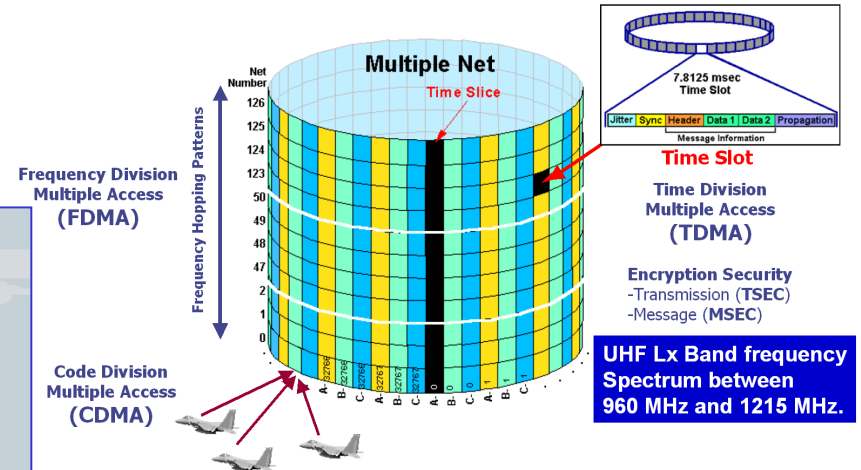
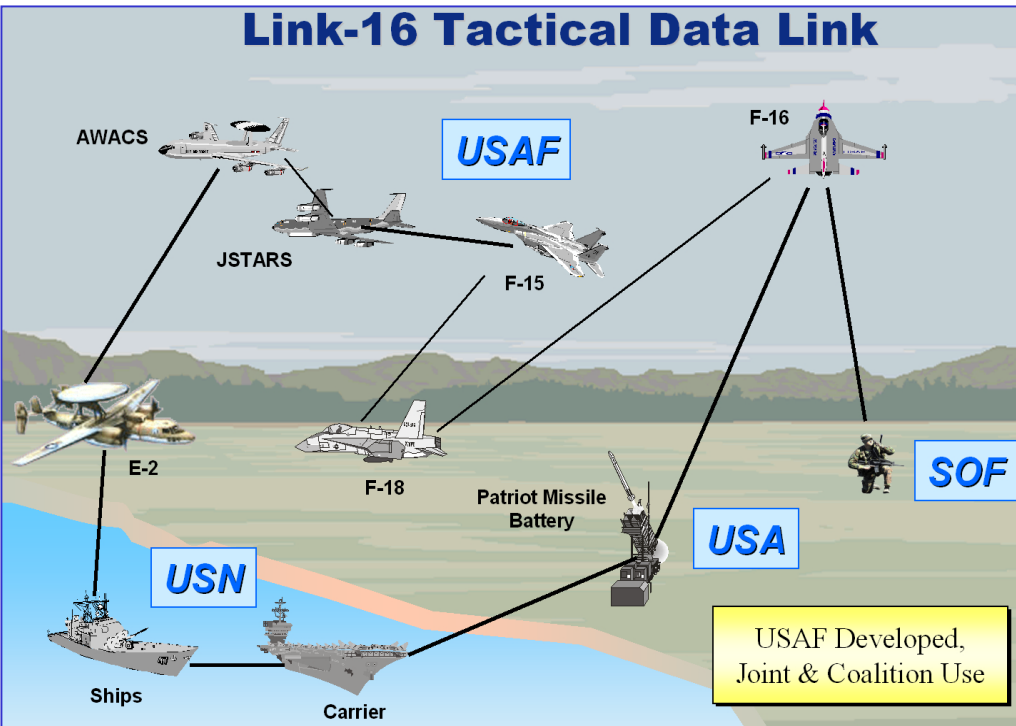
- Supports time-critical, robust radio communications.
- Integrated into many platforms including fast movers.
- Complex Waveform (TDMA/CDMA/FDMA)

MIDS  
LVT



*Link-16 Networks must be pre-planned*

## Link-16 Tactical Data Link



### Features & Applications:

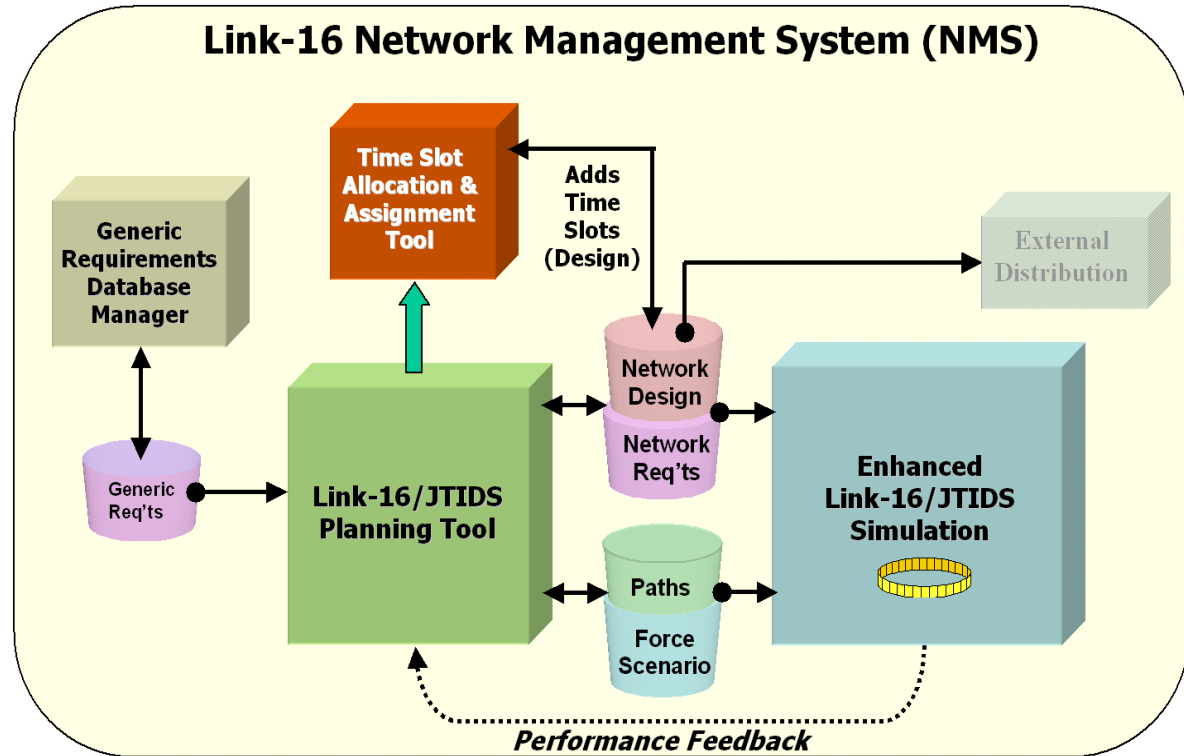
- Highest Bandwidth Tactical Data Link
- Jam Resistant Radio
- Very Secure
- Relative Navigation
- Precise Participant Location and ID
- Platform Status (Fuel, Weapons...)
- Surveillance (Track data)
- Mission Management
- Weapons Control
- High Quality Digital Voice



# Link-16 Network Management System

## Integrated Tool Suite

- Captures Generic Requirements
- Supports Interactive Planning:
  - Dynamic Scenario Creation
  - Requirements Definition
  - Connectivity Analysis
- Time Slot Automation:
  - Optimizes Allocations
  - Runs Fast!
- Simulation:
  - High Fidelity Validation
  - Performance Analysis



**Key Foundation for Architectural Assessment Tool**





# Link-16 Threads

**Event File:**  
 "Fires" messages  
 at Platform Instances  
 at specified times.

$12s, I_j, m_1$   
 $22s, I_k, m_9$   
 $23s, I_a, m_5$   
 ...  
 $65s, I_b, m_2$   
 ...

Event File



External  
 Timed Events

Send  $M_x$   
 to Instance  $N$

**Thread Reaction Table:**  
 Specific Message  
 On a Platform Instance  
 Generates a Message to  
 A Platform Instance

$m_1 \rightarrow I_j \rightarrow m_z [ON_k]$   
 ...  
 $m_z \rightarrow I_k \rightarrow m_w [ON_x]$   
 $m_z \rightarrow I_m \rightarrow m_u [ON_y]$   
 ...  
 $m_u \rightarrow I_n \rightarrow m_a [ON_k]$

Mission  
 Thread  
 Table



Mission Thread Model

**Message Map:**  
 Maps each message to  
 a TDL-J Message  
 & Size of Message

$m_1, J2.2, Size$   
 $m_2, FTXT, Size$   
 ...  
 $m_{99}, J10.2, Size$

Message  
 TDL-J Map



Message Translation  
 J-Series Message

Host Segmentation/Reassembly Model

Host-Terminal Interface



**Threads in Link-16 are more basic  
 than those in SINGARS.**

**Link-16 "threads" are more like  
 links in a SINGARS thread**

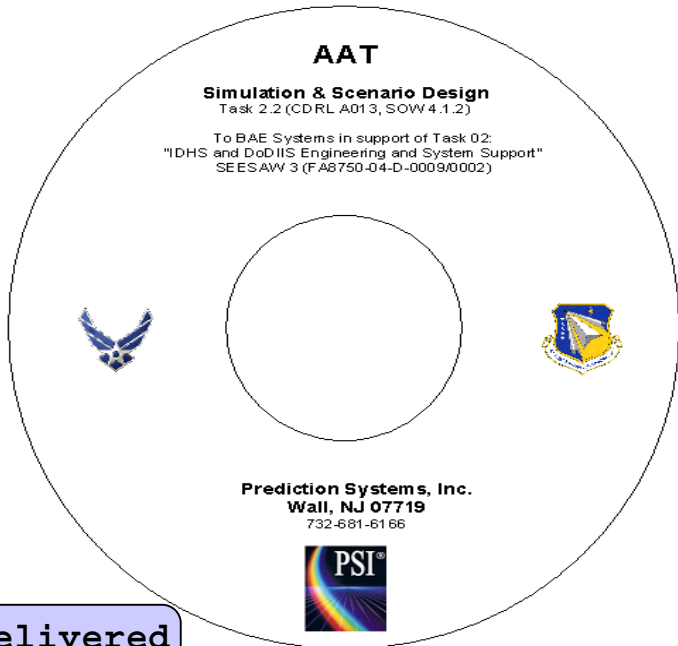




# AAT Software Composition

- We recognized that AAT really needed to be a combination of component tools:
  - Planning, Network Design, and Simulation
- Link-16 NMS architecture served as the basis for these tools with SINGARS components and capabilities integrated into it.

# Simulation & Scenario Design (Task 2.2)



Delivered  
June 05

**Read Me – Task 2.2**  
**AAT Task 2.2 Report**  
**S-KORONA.SCN**  
**DEPLOYIN.SFI**  
**AAT\_v0.1 – Prelim Software**

**AAT Phase 2 – Task 2.2: Simulation and Scenario Design**

[This is the Read Me file for the AAT Phase 2 Task 2.2 delivery CD. The contents of this CD are as follows:

- **Read Me – Task 2.2.doc** – this file.
- **AAT Task 2.2 report.doc** – the documentation for this task that includes the AAT Simulation design and the AAT Scenario design.
- **S-KORONA\_DEMO.SCN**: Version of the Korona scenario designed for AAT.
- **DEPLOYIN.SFI**: The SINGARS deployment in Korea for AAT.
- **AAT\_v0.1**: Early prototype of the AAT Planning Tool that reads the Link-16 scenario (S-KORONA\_DEMO.SCN) and the SINGARS deployment (DEPLOYIN.SFI) for the integrated AAT scenario. This directory has the structure shown in Figure 1. The prototype planning tool can be launched by executing AAT.EXE in the NMS/PLAN\_SIM directory. Load the S-KORONA\_DEMO.SCN file when prompted. The SINGARS units will load automatically from the DEPLOYIN.SFI file.

**Figure 1 - Prototype AAT Planning Tool**

# AAT Simulation Software Design

## •AAT Planning:

- Combined Link-16 and SINCGARS planning capabilities into one tool.

## •AAT Simulation:

- Combined Link-16 and SINCGARS simulation capabilities into one tool.

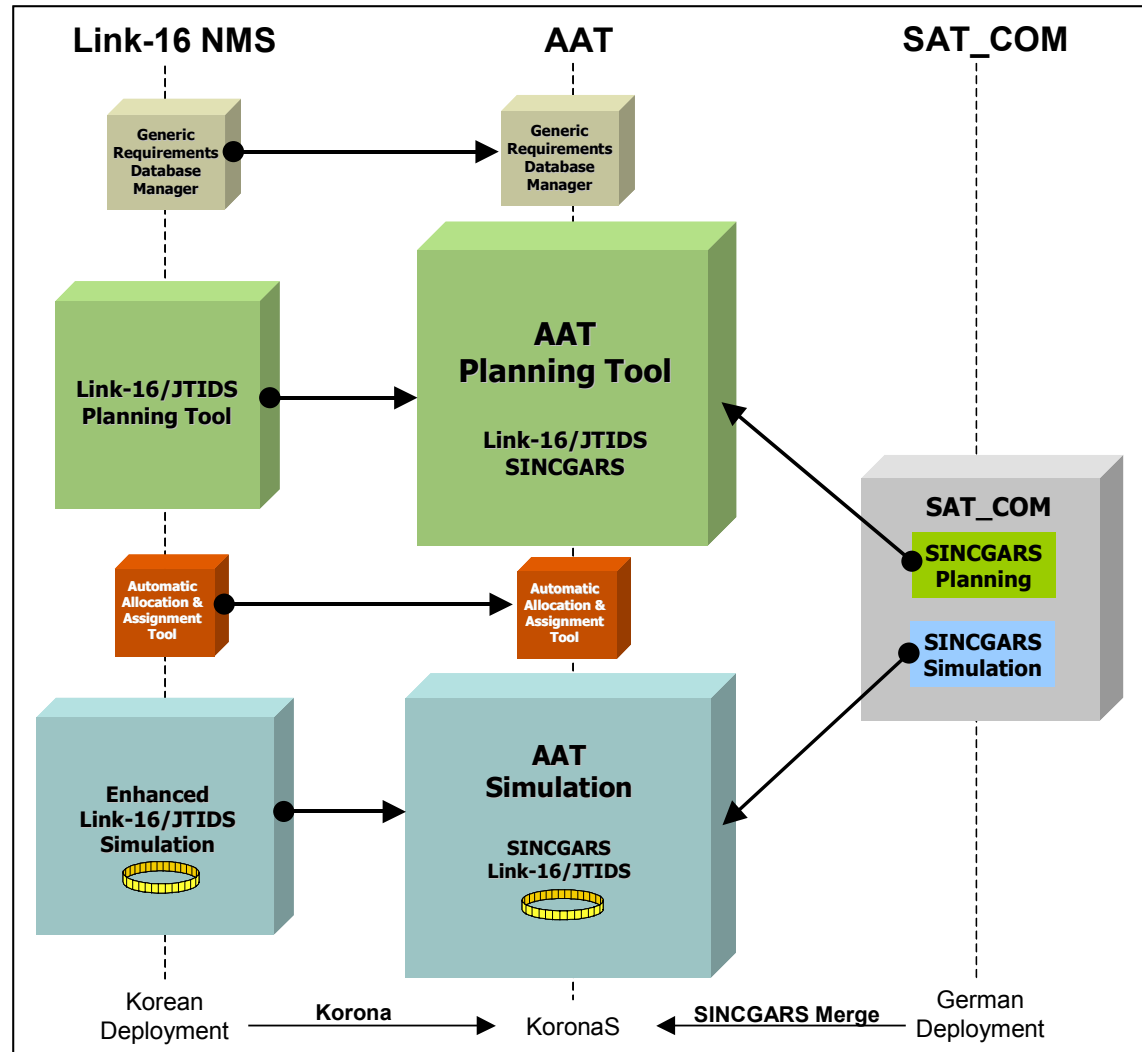
## •Retained Link-16:

- Generic Req'ts Manager.
- Time Slot Allocation Tool.

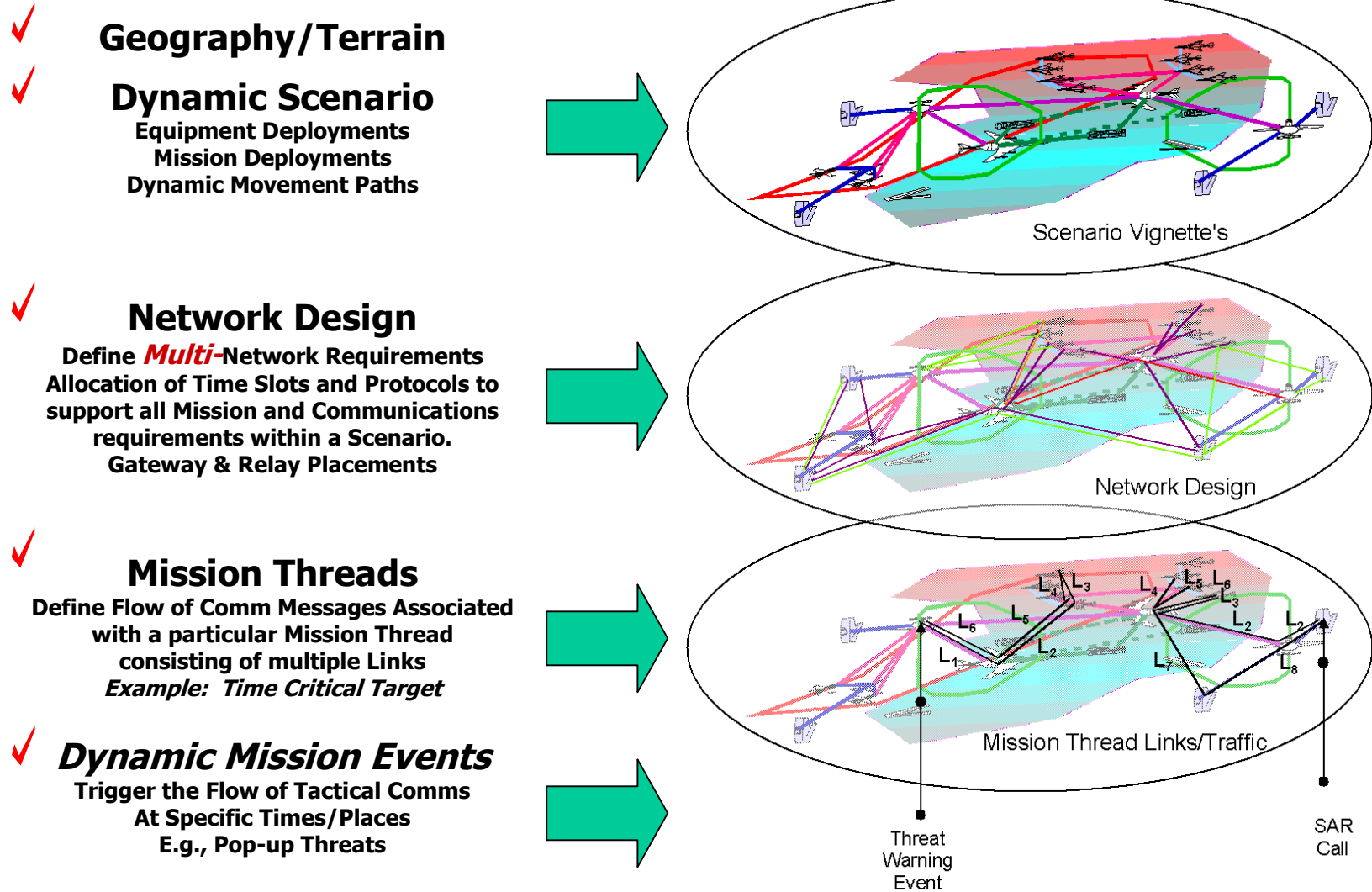


**Separated SINCGARS pieces.  
New Gateway Model & Files.  
Merged Together:**

- Models
- Scenarios
- Simulation Controls
- Graphics & GUIs
- Network Designs
- Event Handling



# Scenario Design Considerations





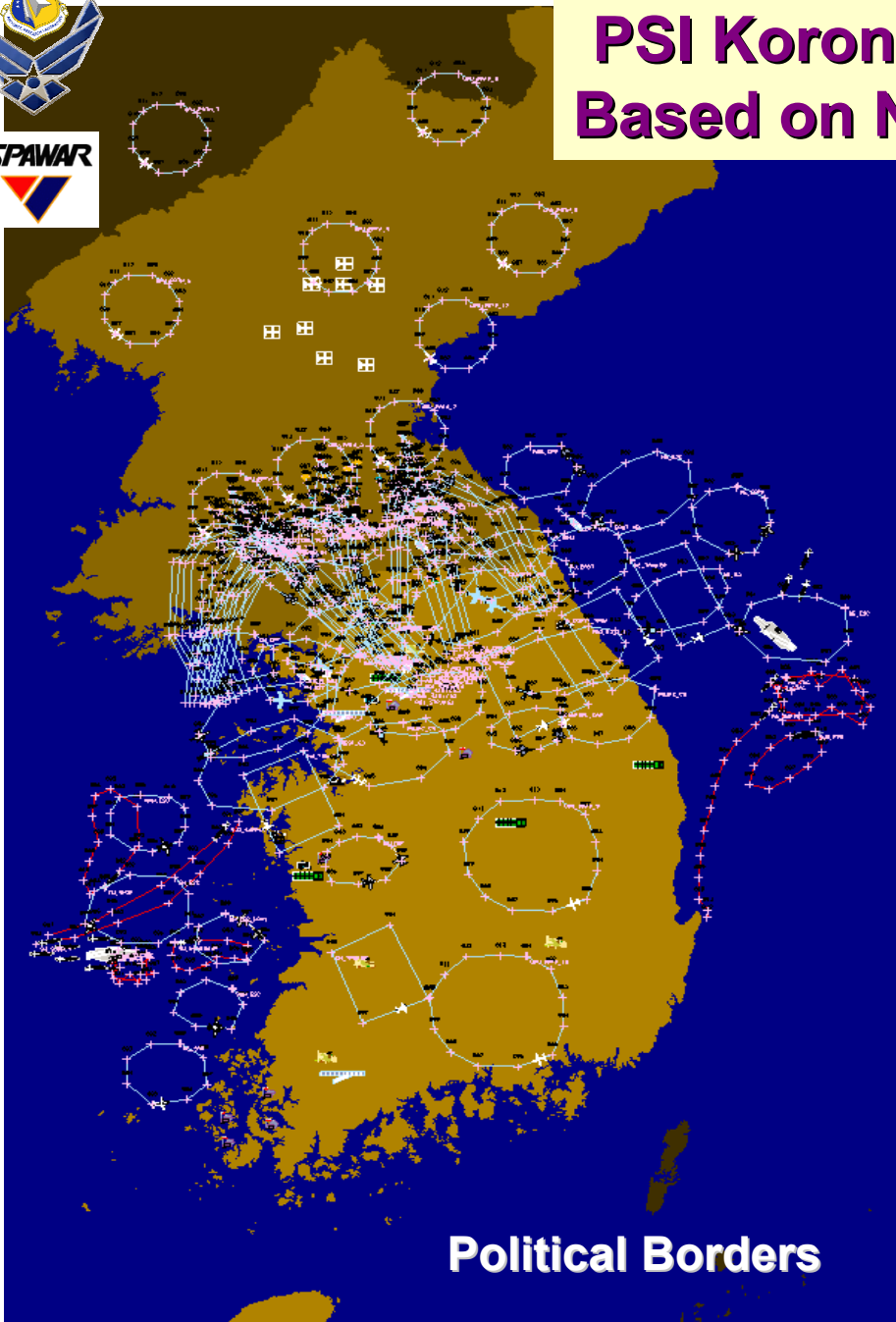
# AAT Scenario Design (Task 2.2)

- Merged SINCGARS deployment into the PSI Link-16 Korona scenario: Five groups of 5 SINCGARS Units.
- Korona Link-16 scenario force deployment:

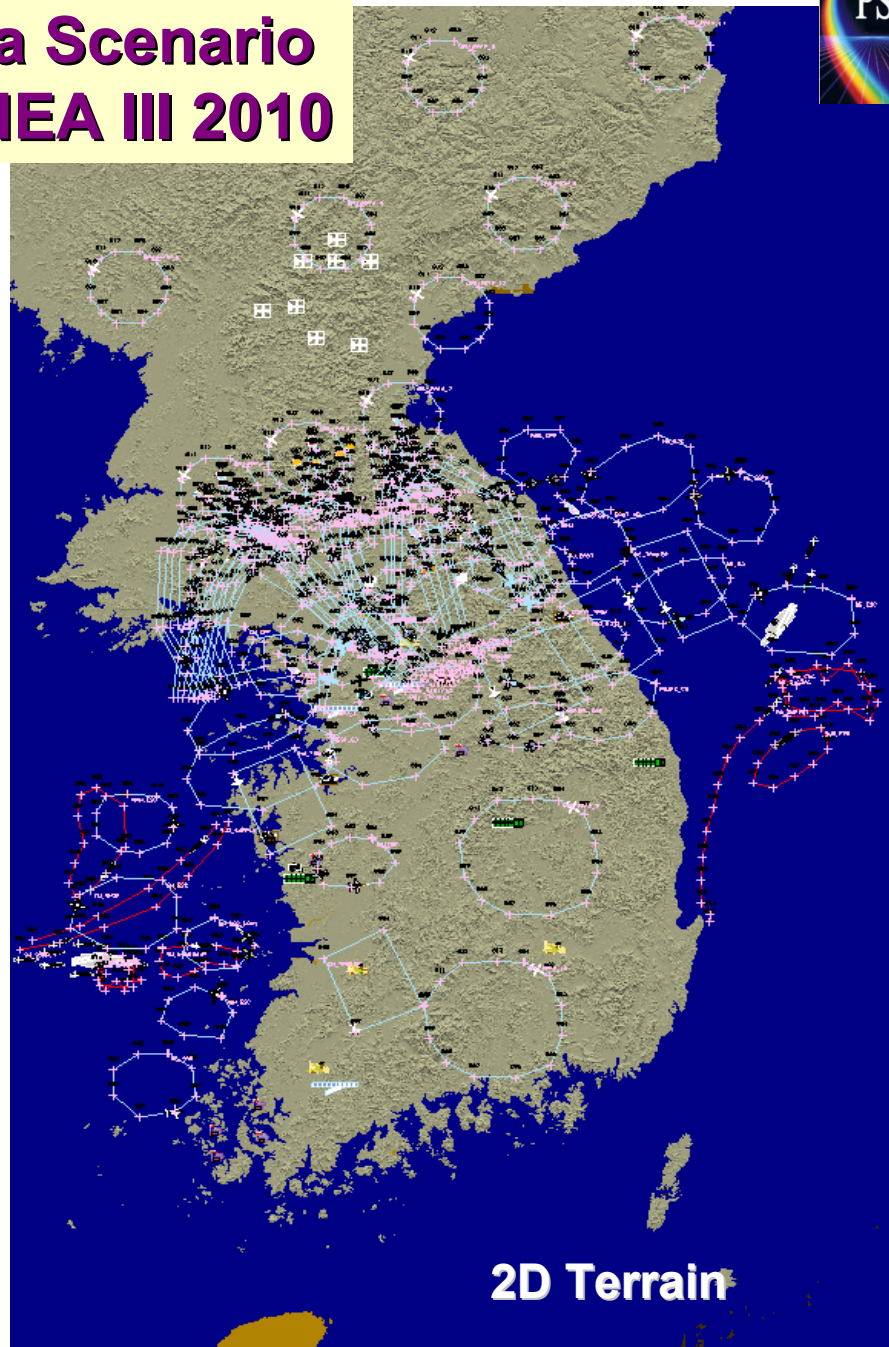
Air Platforms	AB IFC Sensor	2
	ABL	4
	KC 135	5
	Air Cav Helo	2
	E2C	6
	E3	1
	F15F	24
	F18	24
	JLENS	3
	JSTARS	2
	Rivet Joint	2
	Global Hawk UAV	12
	<b>Total Air</b>	<b>87</b>
Sea	Carriers	2
	Cruisers	15
	Submarine	1
	<b>Total Sea</b>	<b>18</b>
<b>Total Moving 105</b>		
Ground	CAC2S	6
	CRC	2
	JTAGS	4
	Patriot ICC	4
	SHORAD	2
	TOAM	2
	THAAD TOC	4
	UAV Grnd Station	1
	<b>Total Ground</b>	<b>25</b>
	<b>Total Stationary 25</b>	
<b>Total Link-16 Platforms 130</b>		
Movement Paths	87	
Reference Icons	18	
Navy Carrier Groups	2	

- Deployed SINCGARS/Link-16 Gateways

# PSI Korona Scenario Based on NEA III 2010



**Political Borders**

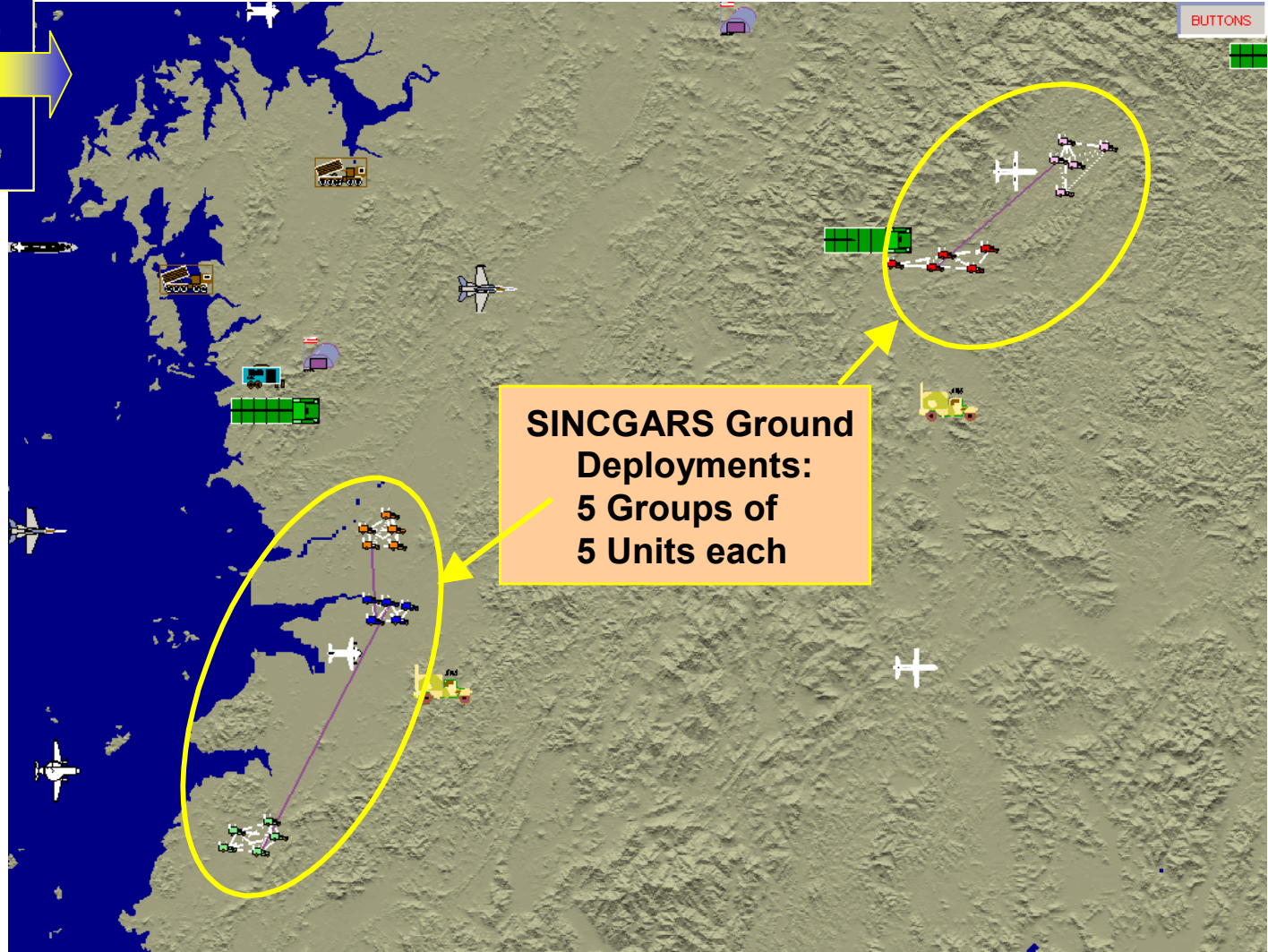
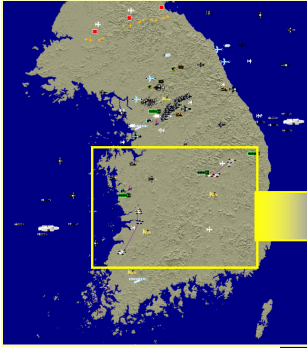


**2D Terrain**





# SINGGARS Deployments in Korona



Low power SINGGARS radios plus rugged Terrain required tight clusters of radios.

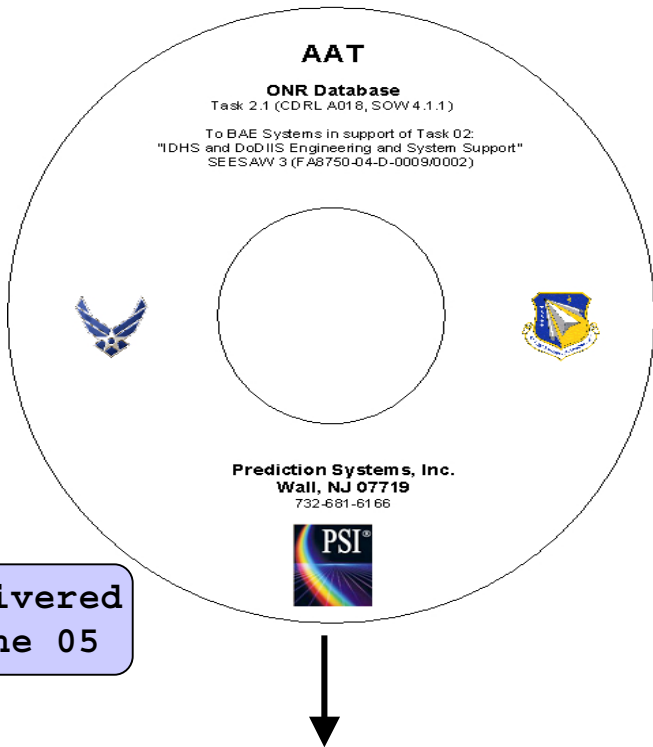
Color coding shows communications sub-groups.

Sub-groups are connected by SINGGARS gateways.

SINGGARS Ground Deployments:  
5 Groups of 5 Units each

# Operational Network Requirements Database (Task 2.1)

Delivered  
June 05



Read Me – Task 2.1  
AAT Task 2.1 Report  
KORONA\_AAT.NET  
PSI\_L16\_NMS - Viewer

## AAT Phase 2 – Task 2.1: Operations Network Requirements (ONR) Database

[This is the Read Me file for the AAT Phase 2 Task 2.1 delivery CD. The contents of this CD are as follows:

- **Read Me – Task 2.1.doc** – this file.
- **AAT Task 2.1 report.doc** – the documentation for this task that includes the AAT Operations Network Requirements (ONR) Database.
- **KORONA\_AAT.NET**: The Link-16 ONR Network Design file. This is a binary file that requires a Link-16 Planning Tool to view.
- **PSI\_L16\_NMS**: The PSI Link-16 Network Management System (NMS) Planning Tool (PLANTOOL2D.EXE) and associated support files. The Planning Tool can be used to view the AAT Phase 2 ONR Database (KORONA\_AAT.NET). When the tool starts, load the version of the Korona scenario for AAT (S-KORONA\_DEMO.SCN). Next load the ONR database by following the sequence in Figure 2.

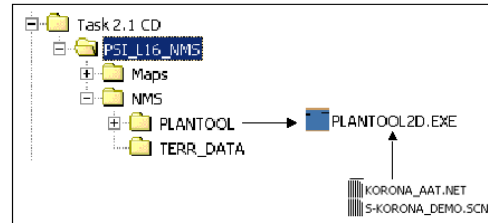


Figure 1 - Prototype AAT Planning Tool

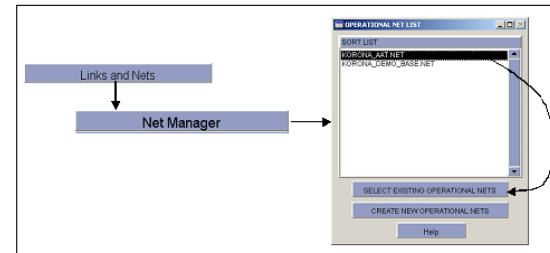


Figure 2 – Load sequence for KORONA\_AAT.NET ONR Database.





# Operational Network Requirements (ONR) Database (Task 2.1)

- Designed Link-16 Networks to handle transport of TCP/IP messages through Link-16 and to/from Link-16 Platforms (Terminal Host)
  - Added four new Operational Nets to basic Korona Network.
- Assumptions:
  - Existence of a new SINCGARS IP/Link-16 Gateway.
  - SINCGARS Data Terminal “terminates” the TCP/IP message and passes whole message:
    - Link-16 Platforms do not have to terminate TCP/IP.
    - IP header overhead is avoided.
    - Retained information: Data size, Addresses, Message ID.
  - Nominal bandwidth of 4.8 Kbps needed for IP through Link-16.
  - Nominal bandwidth for IP to/from Link-16 is ~1 Kbps

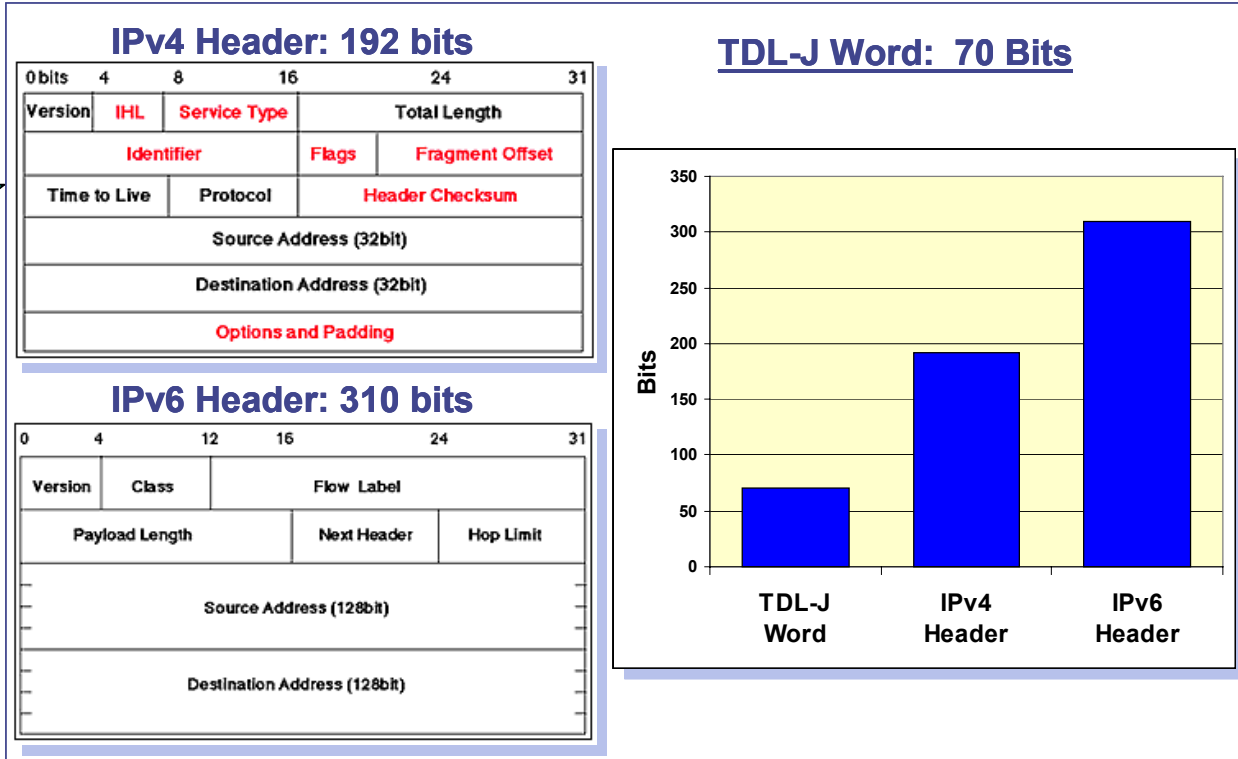


# Link-16 Uses TDL-J (J-Series) Messages

- TDL-J Words (J-Words) are:
  - 70 bits long, most use Fixed Word Format (FWF)
  - Fields are bit-oriented for minimal overhead
- Each Message typically consists of 1-8 J-Words
  - Exception: J28.2 (0) Text Message can support up to 240 J-Words for a maximum of 13,680 characters.
- Each Message has a specified set of transmit and receive rules, which can specify:
  - Response times
  - Repetition rates
  - Receipt Compliance
  - Predefined values for different fields

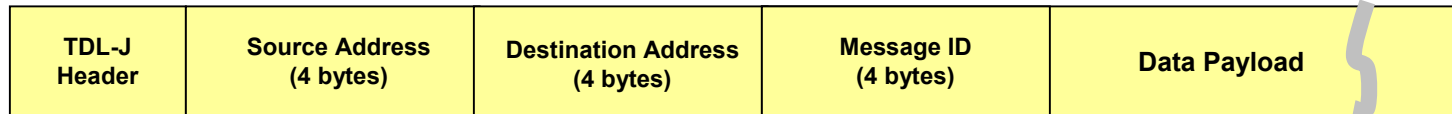


# IP / Link-16 Challenge



**Link-16 Messages Typically Consist of 1-8 J-Words**

**SINGARS/Link-16 Gateway Message Approach**



**Message Type**



# TDL-J (J-Series) Messages

Message Category	Message Sets
Network Management	J0.x, J1.x
Precise Participant Location & Identification	J2.x
<b>Surveillance</b>	J3.x
Antisubmarine Warfare (ASW)	J5.4
Intelligence	J6.0
Information Management	J7.x, J8.x
Weapons Coordination & Management	J9.x, J10.x
Control	J12.x, J14.x, J17.x, J16.x (reserved)
Platform & System Status	J13.x
Threat Warning	J15.0
Text Messaging	J28.2(0)
National Use	J28.x, J29.x, J30.x
Miscellaneous	J31.x
Round Trip Time (RTT)	RTT-A, RTT-B, RTT-REP

Example Follows

46% of TDL-J Messages Support some form of addressing



# J3.2 Air Track Message Example

**J3.2 – Air Track Message consists of 3 TDL-J Words:**

- J3.2I: Initial Word

**J3.2I**

**Track number  
Track Quality  
Altitude**

- J3.2E0: Extension Word

**J3.2E0**

**Latitude  
Longitude  
Course & Speed**

- J3.2C1: Continuation Word

**J3.2C1**

**Air Platform Types and  
Air Platform Activity, or  
Specific Platform References**



# J3.2I – Air Track Message Word\*

```

-----
 24 23 22 21 20 19: 18: 17: 16: 15: 14: 13: 12 11 10: 09 08 07: 06 05 04 03 02: 01 00:
-----
<---      :SIM:      :EMG:FT :PP :EX : MESSAGE : SUBLABEL, : WORD :
          :IND:SPI:IND:IND:T/I:IND: LENGTH : J-SERIES : LABEL, J-SERIES :FORMAT :
          : : : : : : : INDICATOR : : : : :
-----
          : 1 : 1 : 1 : 1 : 1 : 1 : 3 : 3 : 5 : 2 :
-----

 49 48 47 46 45 44: 43 42: 41 40 39 38: 37 36 35 34 33 32 31 30 29 28 27 26 25
-----
<---      : : :
          :ALT SRC: STRENGTH : TRACK NUMBER, REFERENCE
          : : :
-----
          : 2 : 4 : 19
-----

: 69: 68 67 66: 65 64 63 62: 61 60 59 58: 57: 56 55 54 53 52 51 50
-----
: : IDENTITY : IDENTITY : TRACK QUALITY :ID : ALTITUDE, 25 FT
:SI :-----: IDENTITY : TRACK QUALITY :ID : ALTITUDE, 25 FT
:IND: ID AMP: CONFIDENCE : :DIF:
: : DESCR : : :
-----
: 1 : 3 : 4 : 4 : 1 : 13
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```

\*From MIL-STD-6016C



# J3.2C1 Air Track Amplification

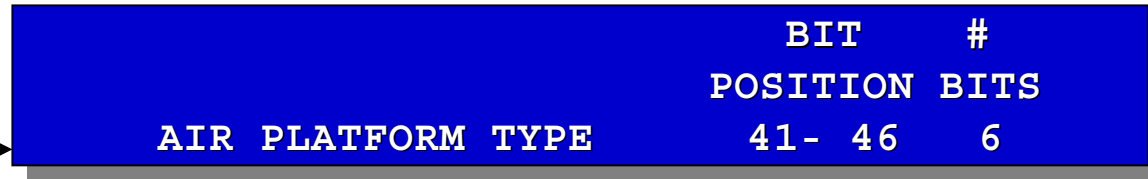
## Continuation Word Air Platform Field\*

J3.2I

J3.2E

J3.2C1

6 bits



NO STATEMENT	0
FIGHTER	1
FIGHTER BOMBER	2
ATTACK	3
BOMBER	4
RECONNAISSANCE	5
TANKER	6
TANKER (BOOM ONLY)	7
TANKER (DROGUE ONLY)	8
INTERCEPTOR	9
TRANSPORT	10
AIRBORNE COMMAND POST (ACP)	11
MISSILE CARRIER	12
MISSILE	13
ELECTRONIC WARFARE (EW)	14
ANTISUBMARINE WARFARE (ASW)	15

AIRBORNE EARLY WARNING AND CONTROL (AEW)	16
MARITIME PATROL AIRCRAFT (MPA)	17
SEARCH AND RESCUE (SAR)	18
DRONE	19
REMOTELY PILOTED VEHICLE (RPV)	20
FIXED WING GUNSHIP	21
CIVIL, AIRLINER	22
CIVIL, GENERAL	23
LIGHTER THAN AIR (LTA)	24
GLIDER	25
DECOY	26
HELICOPTER (HELO)	27
ATTACK HELICOPTER	28
HELICOPTER GUNSHIP	29
ANTISUBMARINE WARFARE HELICOPTER (ASW HELO)	30

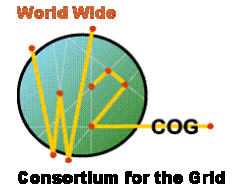
MINE WARFARE HELICOPTER	31
TRANSPORT HELICOPTER	32
TACTICAL SUPPORT PATROL	33
MISCELLANEOUS FIXED WING	34
MISSILE CONTROL UNIT	35
SURFACE-TO-AIR MISSILE (SAM)	36
AIR-TO-SURFACE MISSILE (ASM)	37
SURFACE-TO-SURFACE MISSILE (SSM)	38
LOGISTIC	39
AIR-TO-AIR MISSILE (AAM)	40
SUBSURFACE-TO-SURFACE MISSILE	41
SURFACE-TO-SUBSURFACE MISSILE	42
CRUISE MISSILE	43
BALLISTIC MISSILE	44
AIRBORNE LAND SURVEILLANCE	45
AIRBORNE LASER	46
UNDEFINED	47
RESET TO NO STATEMENT	48 THROUGH 62
	63

Can also use 12-bits for Specific Aircraft Types: > 600 types defined

\*From MIL-STD-6016C



# Why is Link-16 Important to Airborne Networking and NCO/NCW?

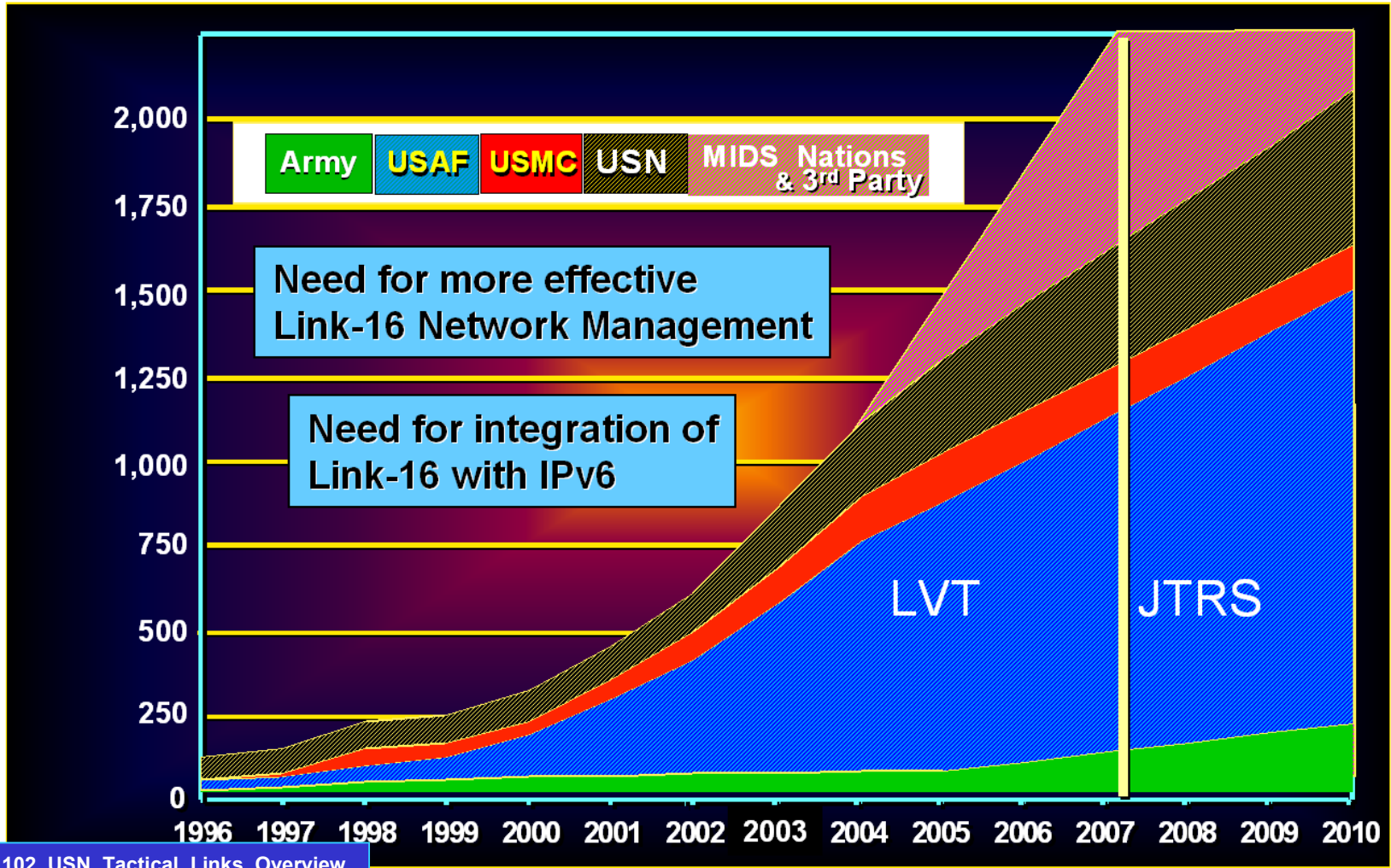


- Link-16 is the tactical RF communications heart of NCO/NCW today and in the near future.
- Link-16 is currently the “last digital mile” to the war fighter.
- Link-16 utilization will increase over the next 5+ years.
- Link-16 platforms will be around for 10-20 more years. There is a HUGE investment in equipment, testing, deployments, etc. Even larger investment in Operational Flight Programs (OFPs), e.g., Host programs.





# Exponential Growth in Link-16 Platforms



From: 102\_USN\_Tactical\_Links\_Overview,  
 Capt S. Des Jardins, USN,  
 March 2005 Multi Link  
 Users Conf Presentation Material

MIDS Third Party Potential: 7625

# Evolution of "MTA" Planning Functions and Scope

## Multi-TDL Architecture

Purely TDL

Automation and more powerful tools/capabilities expands scope of Planning job responsibilities

Net Centric

Additional TDL platforms, new waveforms, information & data centric operations, more dynamic platform relationships, greater introduction of IT-like operations

More sophisticated tools are required for Planning & Analysis.

Time-Slot & Interop Management Oriented

Information Management Oriented

Mix of TDL & IPv6

Near-term Tool Opportunities

----- IPv6 Dominance ----->

Planning Today Fragmented Support

Basic JSS Functions

Enhanced Planning/Assessment Functions

New Planning Functions/Waveforms

Transformational Communications Architecture (TCA)

Future Planner as NetCentric Manager

Increasing Scope of Airborne Networks & GIG

IP Waveforms

MTA Planning, Monitoring, Control

Additional Automation: JU Assignments, TN Block Assignments FU, PU, etc.

JTRS Radio WNW MDL Etc.

Joint Communications Concept

Tactical & IT merge Advanced planning & analysis

Link-16 Filter Analysis/Assignment Relay/JRE Needs Analysis etc., etc.

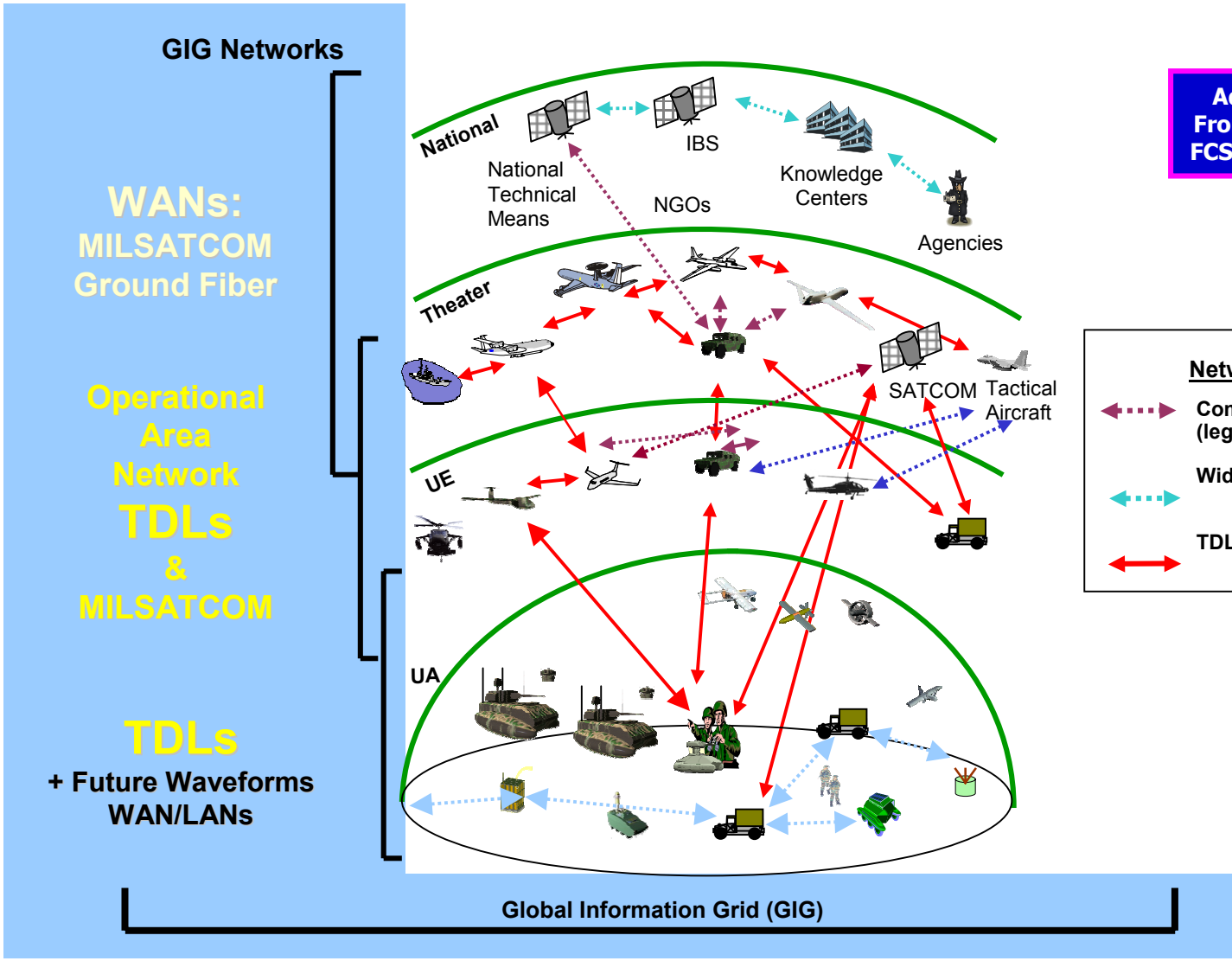
Automated OPTASKLINK Generation Monitoring by Measages

Today

15-20 Years

M&S of Systems of Systems

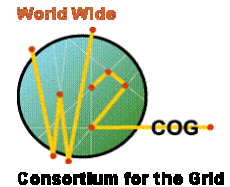
# TDLs in Relation to the GIG





# Challenges in Network Centric Transformation

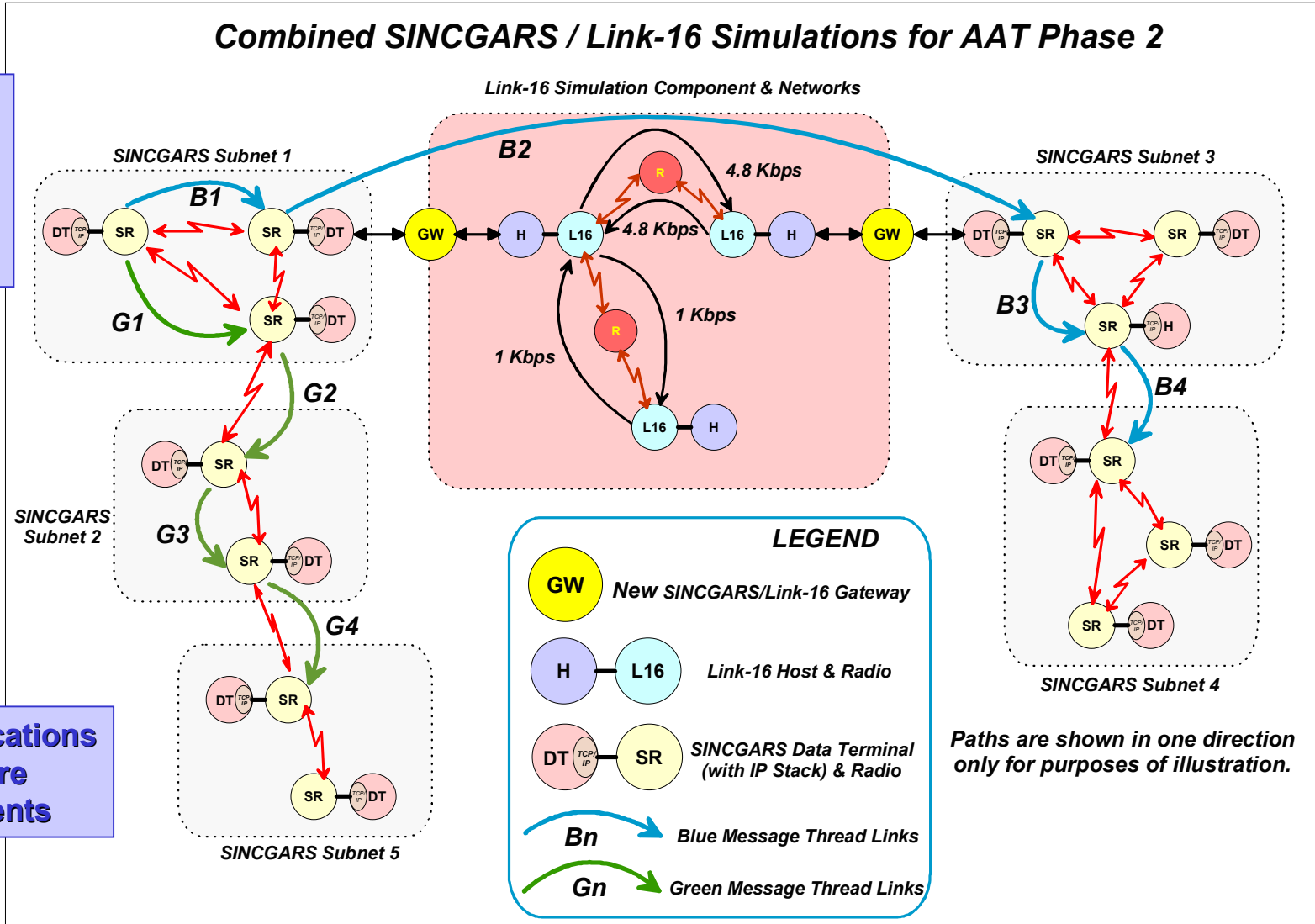
- Exponential Growth & Utilization of Link-16.
- Maximizing use of Link-16
  - Leveraging and extending Link-16 “legacy” terminals
  - WDL-A, JTRS Link-16, etc.
- Link-16 relationship to IPv6 & IP Waveforms, e.g., TTNT
  - Integration of TDLs into IP environment.
- IPv6 Performance:
  - Tactical Message Latency
  - Waveform Susceptibility
- Integration of stove-piped systems:
  - AOC
    - DLARS, TBMCS (T-Bone), GCCS (JC2), etc.
- Large investments - limited answers (or analyses) to date.



# Architecture Assessment Tool (AAT) Network Architecture

## Combined SINGARS / Link-16 Simulations for AAT Phase 2

Integrated  
Link-16 NMS  
& SINGARS  
(TCP/IP)  
Simulation



Communications  
Architecture  
Requirements



# Korona Link-16 Networks

## Original AAT Operational Nets

	J-Words	Message Rate	Unit Time	Response Time	Acknowledgement	Relay Requested	Data Type	Packing Limit
AIRCONTROL_BACKLINK	3	3	24 secs	2	Yes	No	FWF	STD
AIRCONTROL_UPLINK	6	16	12 secs	2	Yes	No	FWF	P2DP
ELECTRONIC WARFARE	6	32	12 secs	12	Yes	No	FWF	P4
ENGAGEMENT_COORD	1	768	12 secs	10	Yes	Yes	FWF	P4
FTR_TO_FTR_CT	6	48	12 secs	10	Yes	No	FWF	P2DP
FTR_TO_FTR_TARGET	6	18	12 secs	10	Yes	No	FWF	P2DP
MISSION_MGT	4	6	12 secs	10	Yes	Yes	FWF	P2DP
NEEDLINE	2	288	12 secs	10	No	No	FWF	P4
PPLI_A	6	128	12 secs	10	No	No	FWF	P2DP
PPLI_B	6	3	12 secs	12	No	Yes	FWF	P2DP
RESIDUAL_MSG	2	288	12 secs	10	No	No	FWF	P4
RTT_B	3	1	12 secs	10	No	No	RTT	STD
SURVEILLANCE	6	192	12 secs	1	No	Yes	FWF	P4
★ VIDEO_DOWNLINK	24	1024	12 secs	10	No	No	FREETEXT- UNENCODED	P4
VOICE_1	24	128	12 secs	10	No	No	FREETEXT- UNENCODED	P4

## New Operational Nets for AAT

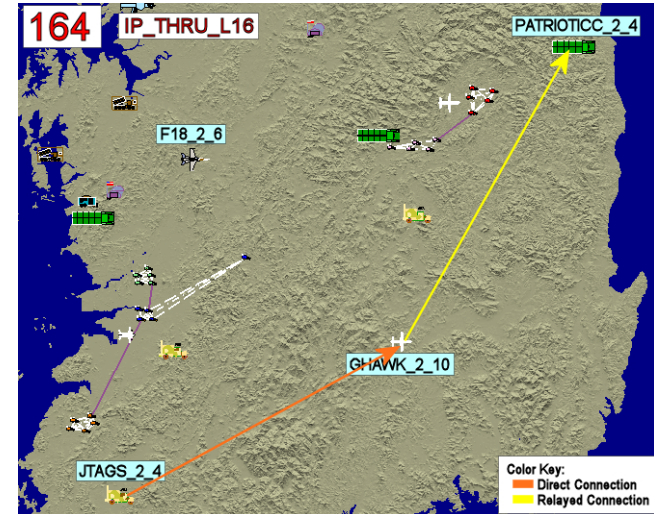
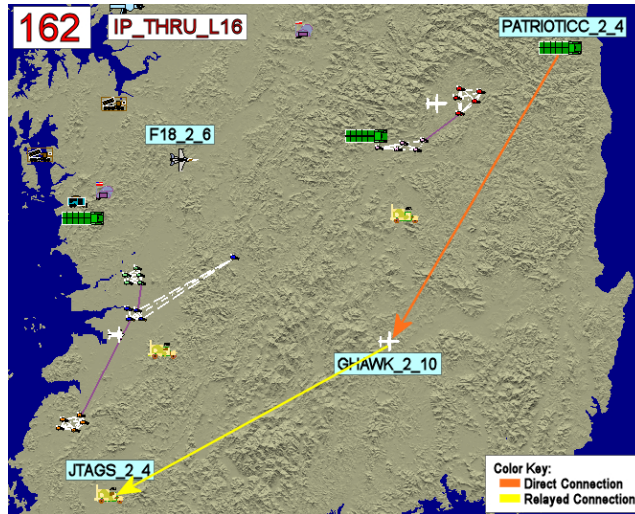
Net ID	Net Type	Source Platform	Destination Platform	J-Words	Messages Per Unit Time	Unit of Time (sec)	Resp Time (sec)	Ack	Data Type	J-Series	Data Encoding	Packing
162	IP_THRU_L16	PATRIOTICC_2_4	JTAGS_2_4	6	120	12	2	No	Free Text	NA	No	P4
164	IP_THRU_L16	JTAGS_2_4	PATRIOTICC_2_4	6	120	12	2	No	Free Text	NA	No	P4
163	IP_TO.FROM_L16	PATRIOTICC_2_4	F18_2_6	2	100	12	2	No	Free Text	NA	Yes	P4
165	IP_TO.FROM_L16	F18_2_6	PATRIOTICC_2_4	2	100	12	2	No	Free Text	NA	Yes	P4



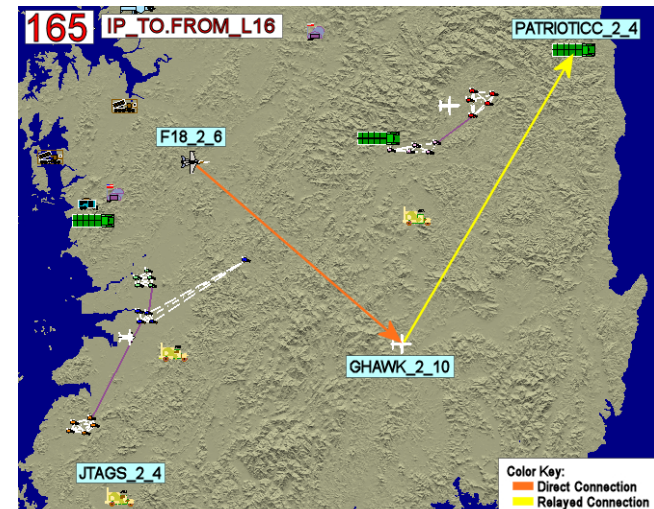
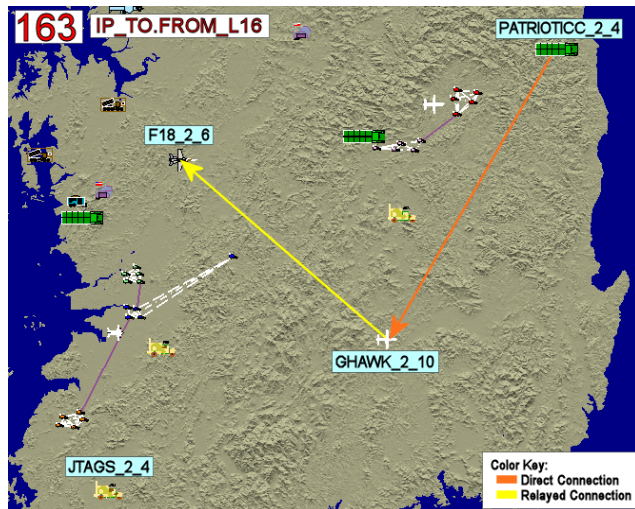


# Link-16 Networks for IP Messages

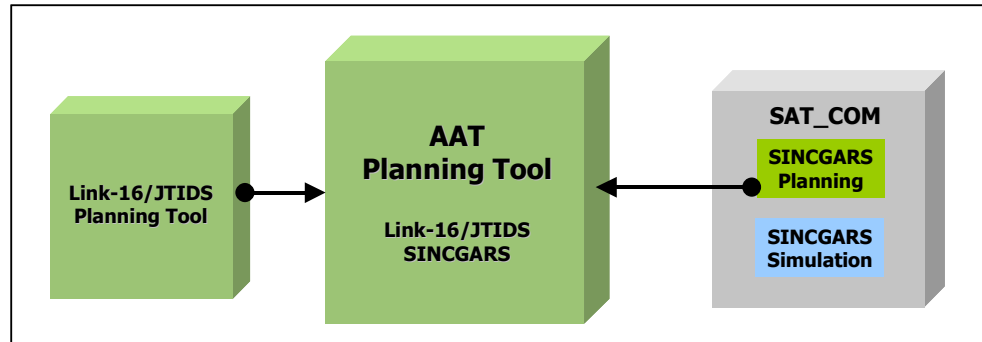
Link-16 Networks  
for transport of  
IP Messages  
through Link-16  
~ 4.8 KBps  
throughput



Link-16 Networks  
for transport of  
IP Messages  
through to/from  
Link-16 Platforms  
~ 1.28 KBps  
throughput



# AAT Planning Tool Functionality

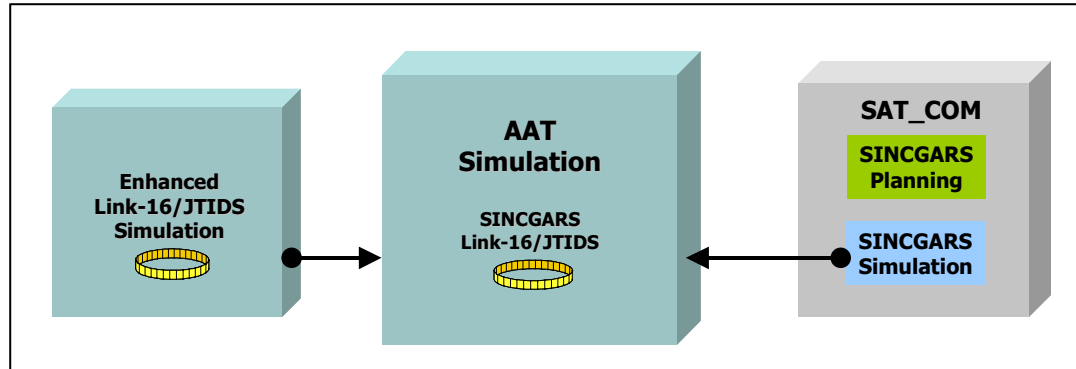


- **Scenario Generation:**
  - SINCGARS Deployments
  - Dynamic Link-16 Deployments (Movement paths)
- **Connectivity Analysis (Interactive and Visual)**
  - SINCGARS sub-networks and Radio Gateways
  - RF and Network connectivity for Link-16
  - SINCGARS/Link-16 Gateway placements
  - Link-16 Relay needs
- **Link-16 Network Requirements and Design (Time Slot Allocations)**
  - Networks for transport of IP through TADIL and to/from Link-16 Platforms
- **Off-Line creation/modification of:**
  - SINCGARS Organization





# AAT Simulation Capabilities



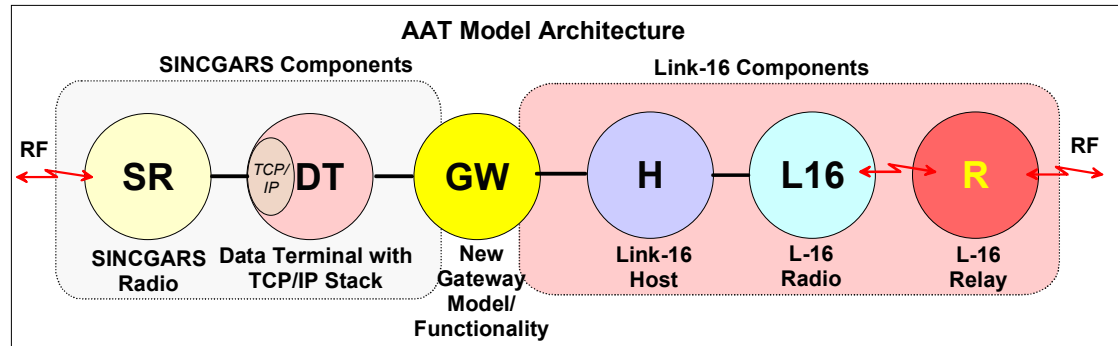
- **Scenario Loading and Execution:**
  - Static SINGGARS and Dynamic Link-16 Deployments.
- **Loading and Operation of Networks:**
  - SINGGARS Form Sub-nets, Link-16 Time Slots Allocated.
- **Connectivity Analysis (Interactive and Visual)**
  - SINGGARS Sub-networks and Radio Gateways.
  - RF and Network Connectivity for Link-16.
- **Thread-based Message Traffic Generation**
  - Loading of SINGGARS and Link-16 Thread Files.
  - Execution of SINGGARS and Link-16 Event files to Stimulate Message Traffic.
  - IP to IP direct, IP to IP through Link-16 Gateways, IP to/from Link-16 Platforms.
- **Network Performance Analysis**
  - Dynamic During Operation.
  - Post Analysis of Thread and Link CSV Output Files, e.g., Import into Excel.



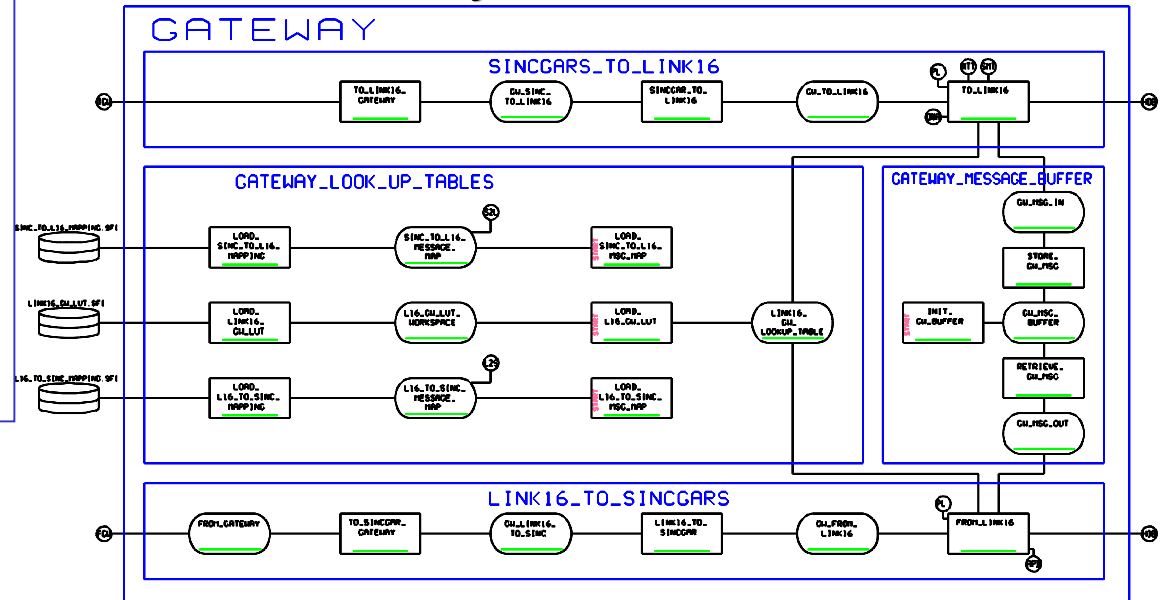
# New Gateway Model

## Gateway Functionality

- Receives transmission request from SINGGARS Data Terminal\*.
- Look-up table maps SINGGARS IDs to Link-16 IDs.
- Look-up table associates Link-16 platforms and Nets with SINGGARS addresses.
- Uses Message Size.
- Retains Source & Destination Addresses.
- Supports:
  - TCP/IP through Link-16 Terminals
  - TCP/IP to/from Link-16 Hosts
- Passes messages received over Link-16 to connected SINGGARS Data Terminal.



## Gateway GSS Model Architecture

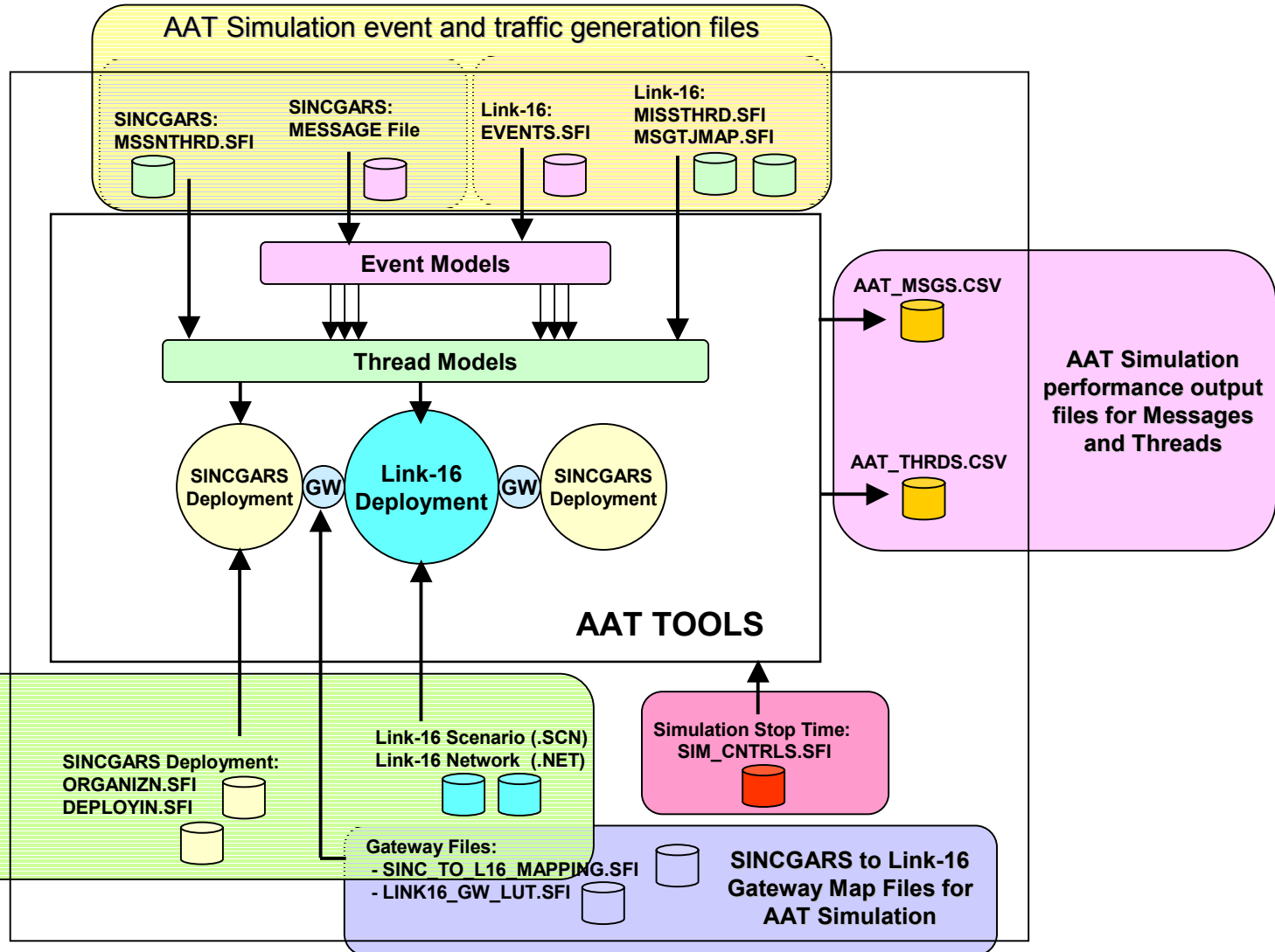


\* Data Terminal terminates TCP message before transmission request to Gateway.

# AAT IO

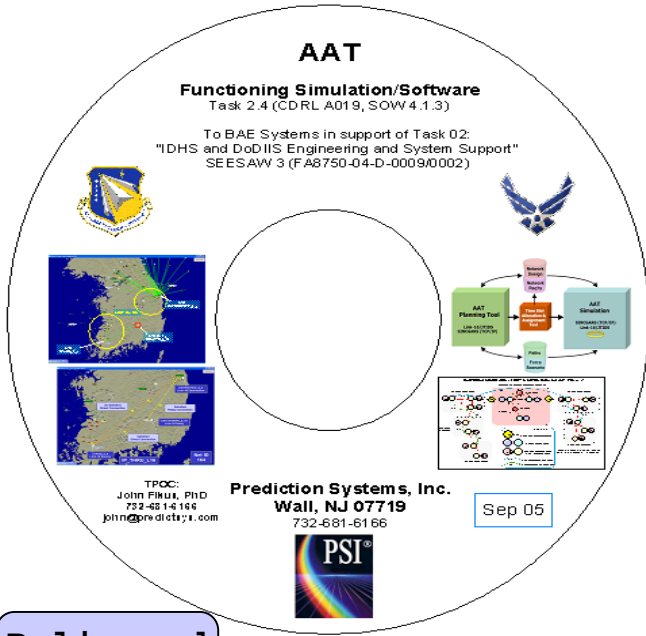
The AAT Simulation Software uses many other fixed-value default initialization files that do not need to be modified

These files are created by AAT Planning Tool & used by AAT Simulation



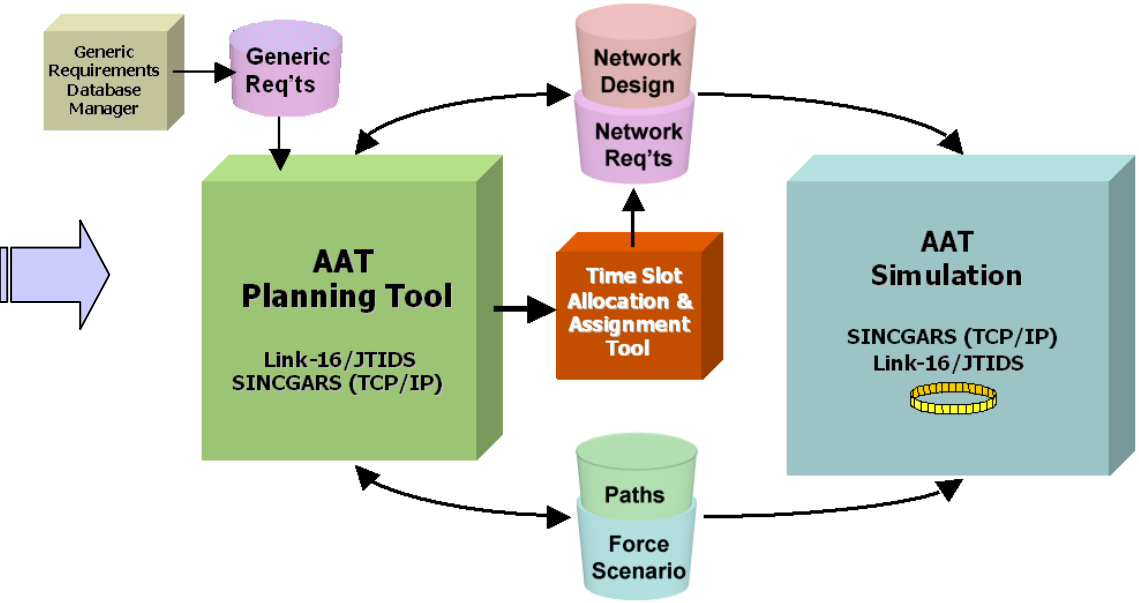


# Complete AAT System Software (Task 2.4)



Delivered  
Sep 05

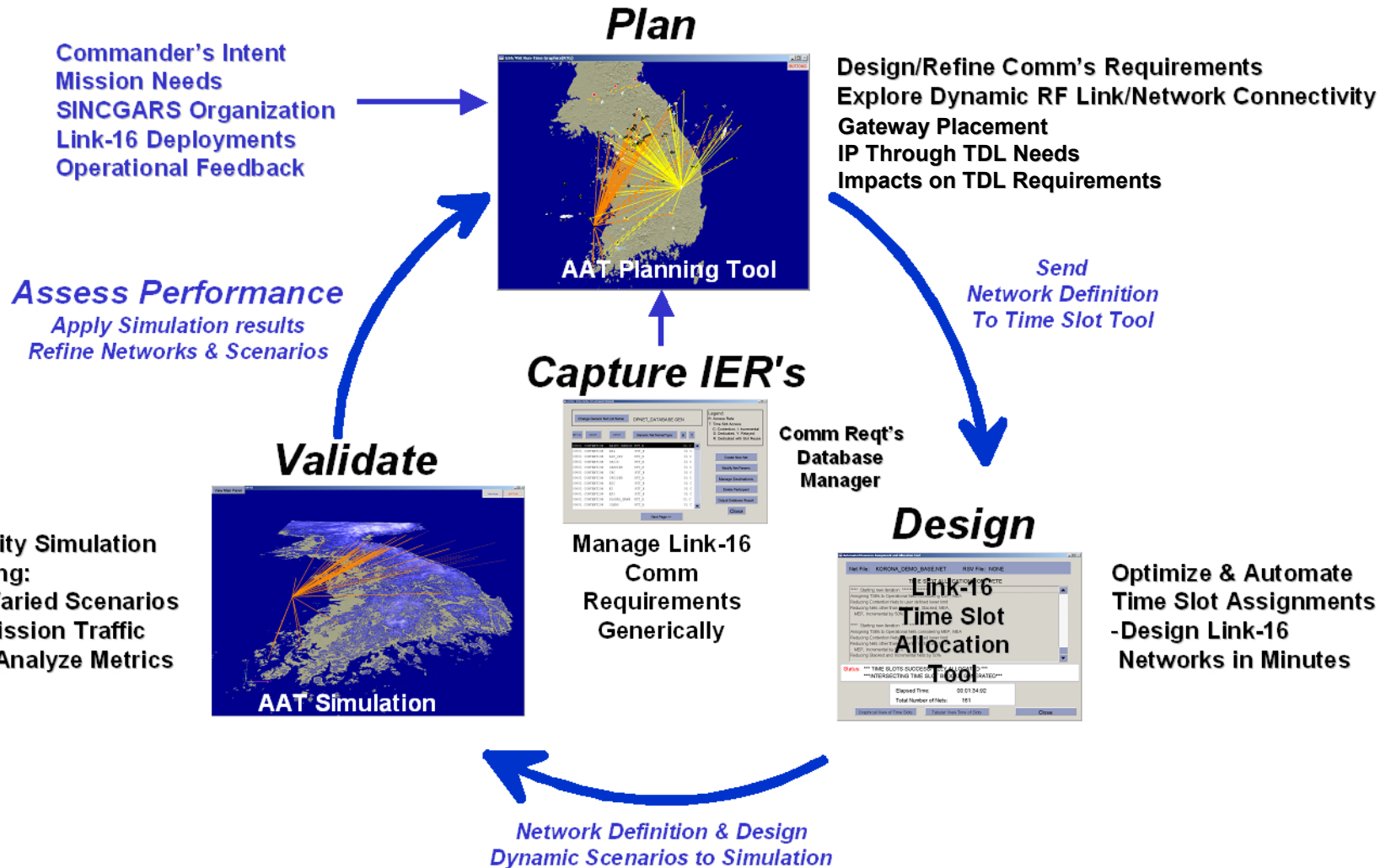
- Install & Uninstall Guide
- Release Notes
- User Guide
- ONR Database Document
- Simulation & Scenario Design



All AAT Software Executables, GSS Source and initialization input files were provided on the distribution CD.



# AAT System Capabilities





# Assessment Outputs

## Link-16 Network Design

### TSA\_OUT

Analysis of design trade-offs  
& requirements impacts

```

*****
*NET GenID S INDEX RR NET DESCRIPTION
**** *
1 1 A 48 9 0 Slots required: 8
2 2 A 32 9 127 Slots required: 16, Slots allocated: 8
3 3 A 2 12 127 Slots required: 64
4 4 C 26 10 1 Slots required: 16
5 5 B 6 11 1 Slots required: 159, Slots allocated: 160
5 5 B 14 11 1
5 5 B 1 11 1
5 5 B 9 11 1
5 5 B 5 11 1
6 6 B 15 11 1 Slots required: 96

```

### NETS.OUT

Details on Link-16 Network Design

## Performance Outputs

### AAT\_THRDS.CSV

Overall Thread Performance Data

### AAT\_MSGS.CSV

Detailed Performance Data for Thread Links

### NET\_TRAF.OUT

Performance Data for each Link-16 Net



# Supplied Thread Examples

- **Pure SINGARS IP Thread Case:**

- Single thread triggered once. (One thread instance.)
- Based on Army Copperhead Fire Mission.
- Provided as a SINGARS-only reference.



- **IP Through Link-16 Thread (Default on CD):**

- Single thread triggered once. (One thread instance.)
- Based on Pure SINGARS thread with Links through Link-16:
  - Several links through Link-16.
  - Several links to/from Link-16 platform.

- **Complex IP/Link-16 Threads:**

- Two different thread types: (Three thread instances.)
  - One triggered once.
  - Another triggered twice.



# Architectural Assessment Example

- Assessment of Four Different Link-16 Network Designs
  - Original AAT ONR plus three lower bandwidth variations.
- Impact of AAT Networks on other Link-16 Networks
- Impact on Thread Performance

# AAT Network - Test Variations



Supplied  
On AAT  
Software  
CD

Slower/Smaller  
(Supplied on Documentation CD)

Net ID	Input to Planning Tool										Requested			Allocated			
	J-Words per Msg	Msg's Per Unit Time	Unit of Time (sec)	Resp Time (sec)	Ack	Data Type	J-Series Word	Data Encoding	Packing	JWords/Sec	Bits/Jword	KBps	Slots/Frame	Slots/Sec	Actual Resp Time	Through Put (KBps)	
162	6	120	12	2	No	Free Text	NA	No	P4	60.00	150	9.00	30	2.5	0.40	4.50	
164	6	120	12	2	No	Free Text	NA	No	P4	60.00	150	9.00	30	2.5	0.40	4.50	
163	2	100	12	2	No	Free Text	NA	Yes	P4	16.67	75	1.25	17	1.4	0.71	1.28	
165	2	100	12	2	No	Free Text	NA	Yes	P4	16.67	75	1.25	17	1.4	0.71	1.28	

Net ID	Input to Planning Tool										Requested			Allocated			
	J-Words per Msg	Msg's Per Unit Time	Unit of Time (sec)	Resp Time (sec)	Ack	Data Type	J-Series Word	Data Encoding	Packing	JWords/Sec	Bits/Jword	KBps	Slots/Frame	Slots/Sec	Actual Resp Time	Through Put (KBps)	
162	6	60	12	4	No	Free Text	NA	No	P4	30.00	150	4.50	30	2.5	0.40	4.50	
164	6	60	12	4	No	Free Text	NA	No	P4	30.00	150	4.50	30	2.5	0.40	4.50	
163	2	50	12	4	No	Free Text	NA	Yes	P4	8.33	75	0.63	16	1.3	0.75	1.20	
165	2	50	12	4	No	Free Text	NA	Yes	P4	8.33	75	0.63	16	1.3	0.75	1.20	

Net ID	Input to Planning Tool										Requested			Allocated			
	J-Words per Msg	Msg's Per Unit Time	Unit of Time (sec)	Resp Time (sec)	Ack	Data Type	J-Series Word	Data Encoding	Packing	JWords/Sec	Bits/Jword	KBps	Slots/Frame	Slots/Sec	Actual Resp Time	Through Put (KBps)	
162	6	30	12	8	No	Free Text	NA	No	P4	15.00	150	2.25	15	1.25	0.80	2.25	
164	6	30	12	8	No	Free Text	NA	No	P4	15.00	150	2.25	15	1.25	0.80	2.25	
163	2	50	12	4	No	Free Text	NA	Yes	P4	8.33	75	0.63	16	1.3	0.75	1.20	
165	2	50	12	4	No	Free Text	NA	Yes	P4	8.33	75	0.63	16	1.3	0.75	1.20	

Net ID	Input to Planning Tool										Requested			Allocated			
	J-Words per Msg	Msg's Per Unit Time	Unit of Time (sec)	Resp Time (sec)	Ack	Data Type	J-Series Word	Data Encoding	Packing	JWords/Sec	Bits/Jword	KBps	Slots/Frame	Slots/Sec	Actual Resp Time	Through Put (KBps)	
162	6	12	12	12	No	Free Text	NA	No	P4	6.00	150	0.90	6	0.5	2.00	0.90	
164	6	12	12	12	No	Free Text	NA	No	P4	6.00	150	0.90	6	0.5	2.00	0.90	
163	2	10	12	12	No	Free Text	NA	Yes	P4	1.67	75	0.13	3	0.3	4.00	0.23	
165	2	10	12	12	No	Free Text	NA	Yes	P4	1.67	75	0.13	3	0.3	4.00	0.23	

★ Free Text Bits per J-Word  
150 Bits Unencoded, 75 Bits Encoded

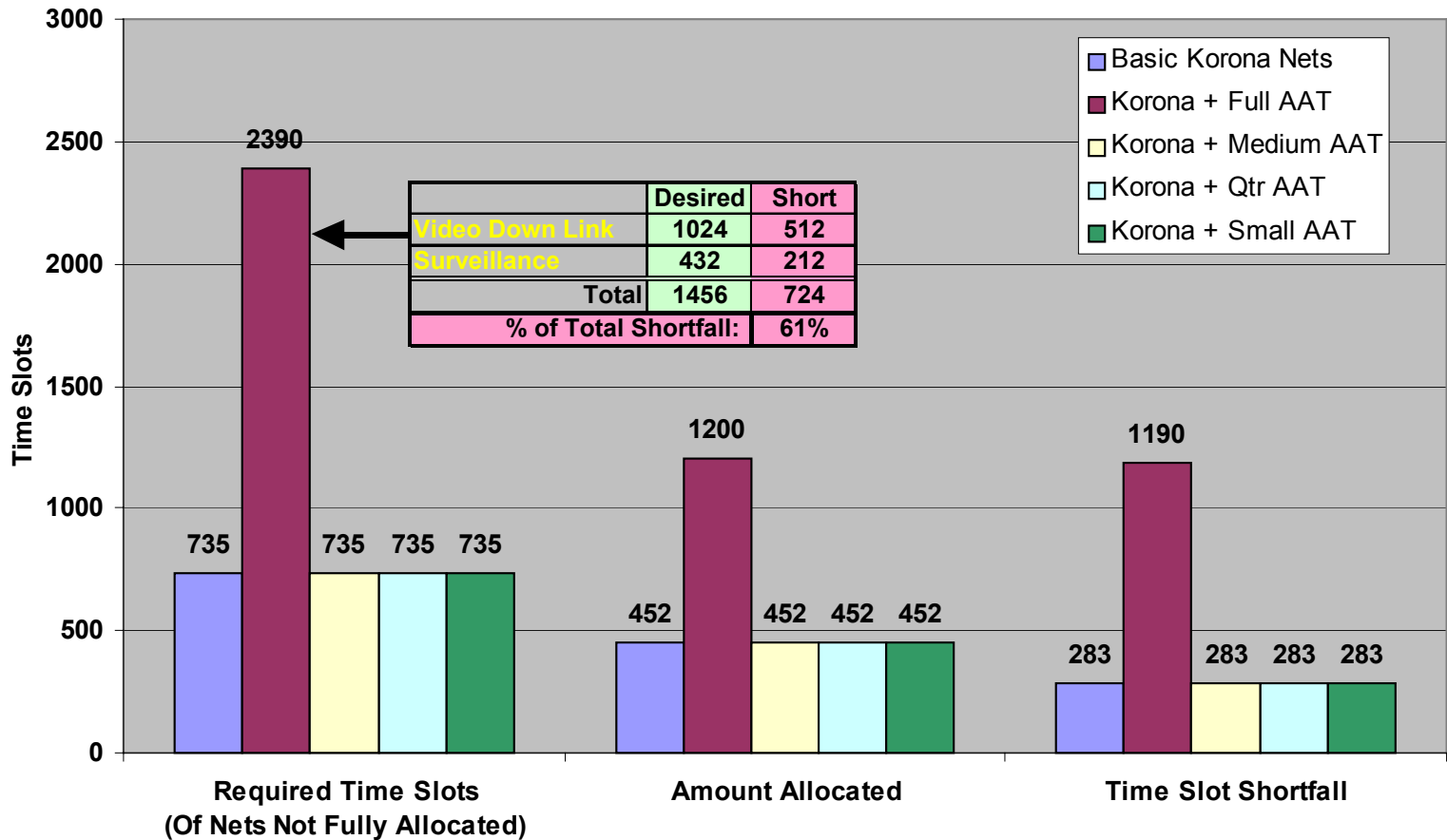


# AAT Nets Impact on Other Networks



Based on TSA\_OUT files

**Impact of AAT Networks for TCP/IP on Basic Korona Network**  
 (Only includes Partially Allocated Operational Nets)



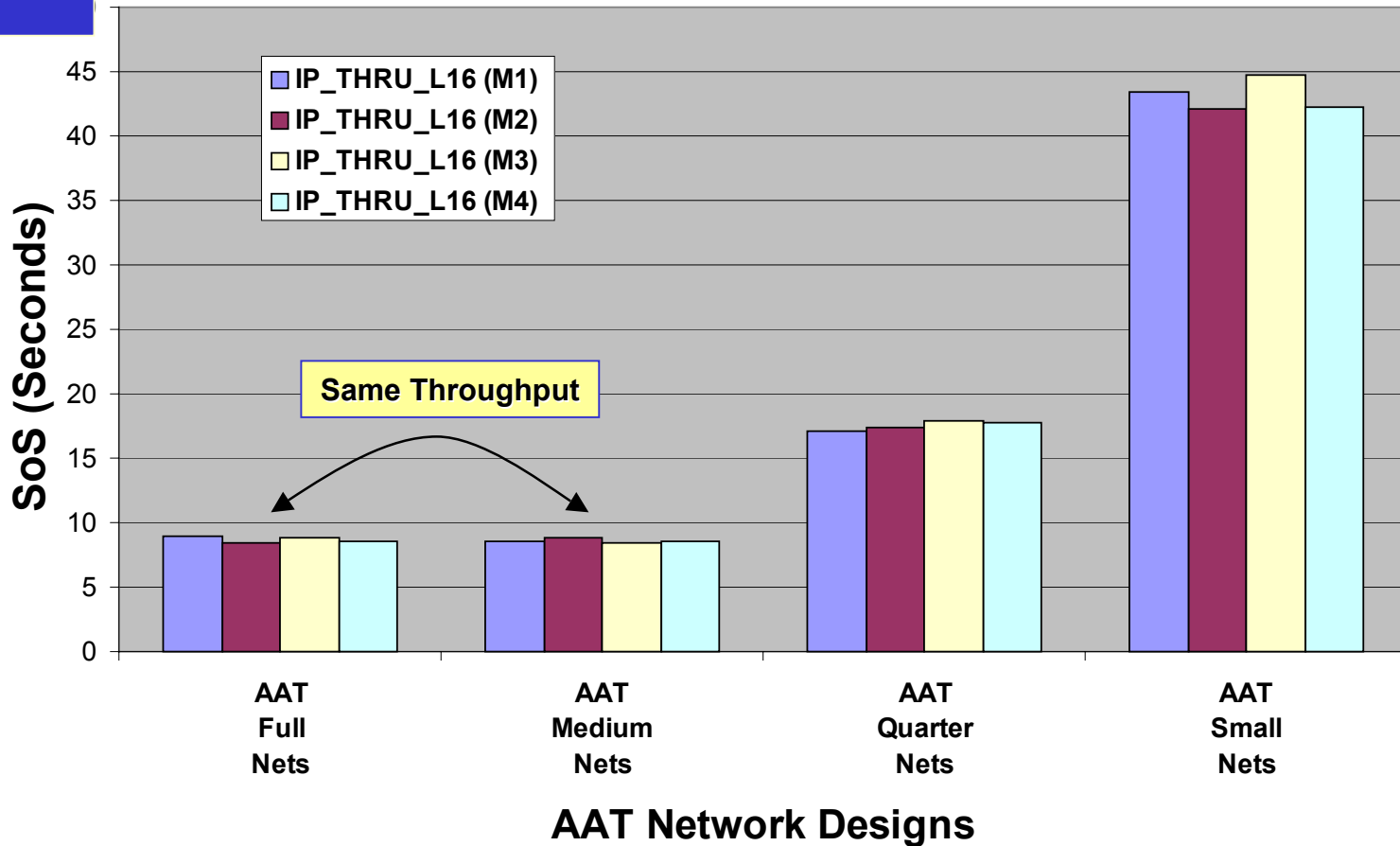




# SoS for Thread Links Thru Link-16

Based on  
AAT\_MSGS.CSV  
files

## Speed of Service (SoS) for Link-16 Messages vs AAT Network Designs

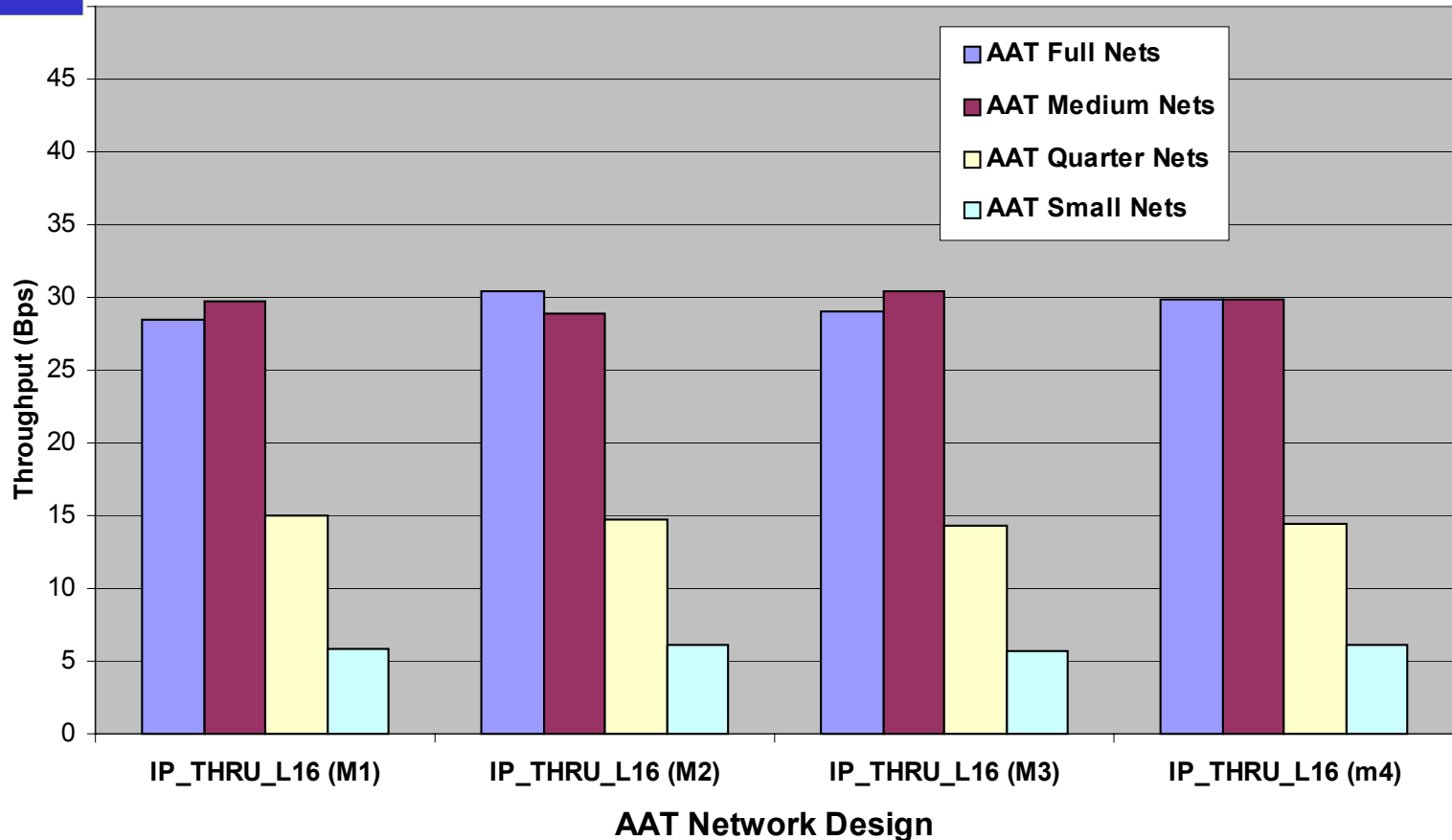




# Throughput of Thread Links Thru Link-16

Based on  
AAT\_MSGS.CSV  
files

### TCP/IP Thread Links Through Link-16

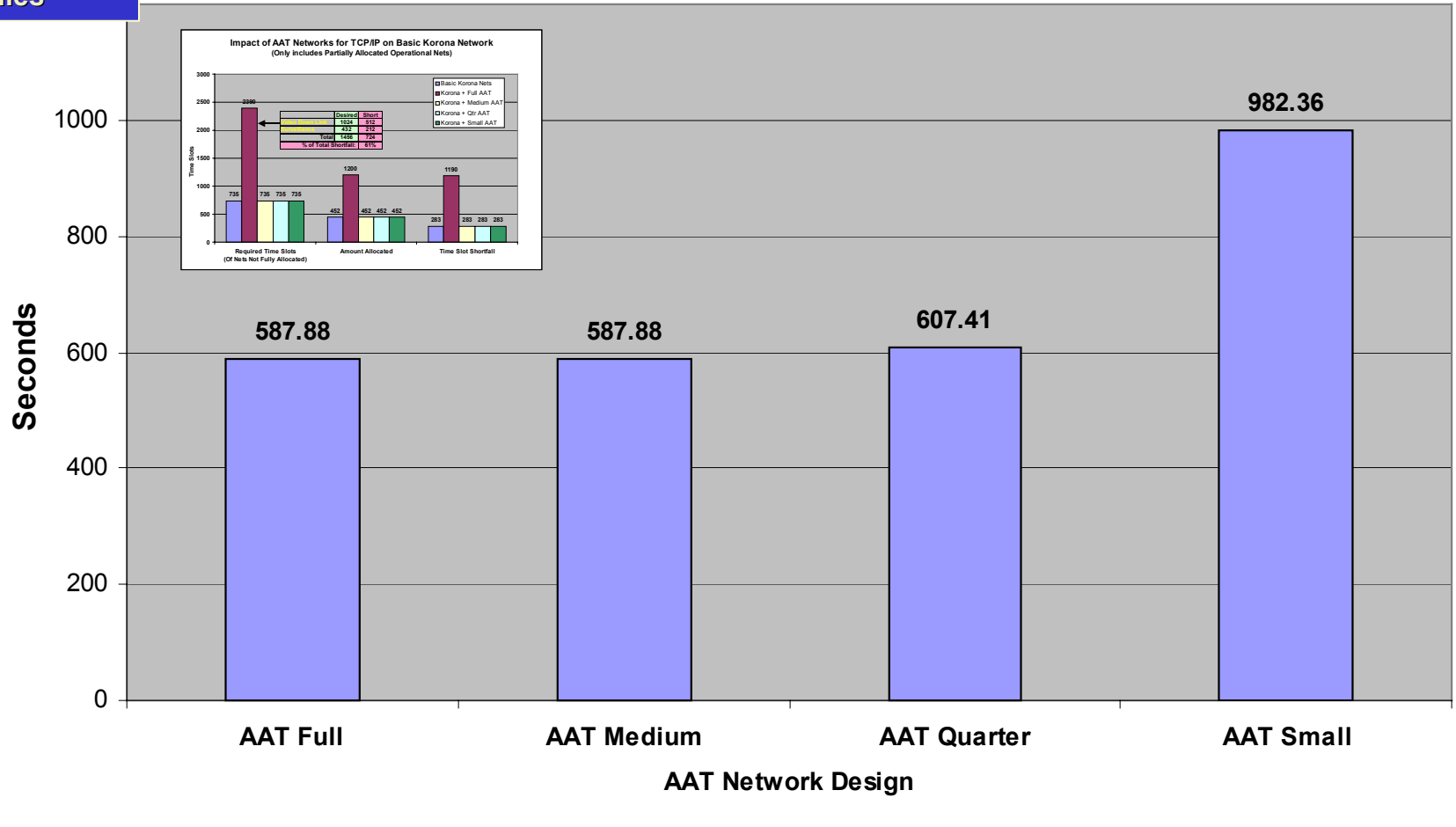




# Thread Completion Performance Comparisons

Based on  
AAT\_THRD.CSV  
files

## Thread Completion Times vs AAT Network Design





# User Familiarization Training Overview

## (Next Session)

- Installation / Uninstall Information
- Support Documentation
- Detail on AAT System Operation:
  - AAT Input/Output files (Planning and Simulation)
  - AAT Planning Capabilities:
    - Scenarios (SINCGARS, Link-16, Gateways)
    - SINCGARS Networks
    - Link-16 Networks and Automated Time Slot Allocation
  - Mission Thread Design and Operation
  - Gateway Set-up Files
  - AAT Simulation and Performance Measures
- Included Operational Files
- AAT Constraints
- Planning for New Tests



# Final Conclusions

- Architectural Assessment Tool (AAT):
  - System was Designed, Developed, Tested, Applied and Delivered
  - Consists of Planning, Network Design & Simulation Components
  - Includes:
    - Merged SINCGARS(TCP/IP) / Link-16 Scenario
    - Operations Network Requirements Database:
      - Designed for TCP/IP through Link-16 and to/from Link-16
      - Tested and Refined
    - New TCP/IP to Link-16 Gateway Model
    - Threads, Events and other files:
      - Developed and tested to generate message traffic.
    - User Documentation
  - Applied to Assessment of Network Design Alternatives
- User Familiarization Training Material is ready.

**The AAT Planning and Simulation System is Ready for Use!**

