

TDL Technology

7 In the News:
Read all about it

12 JRE vs SIMPLE:
What's the Verdict?

15 Free Resource for all readers:
TDL Testing Help Sheet

*Published by SyntheSys
for the Tactical Data
Links Community*

Issue 5
Autumn 2017

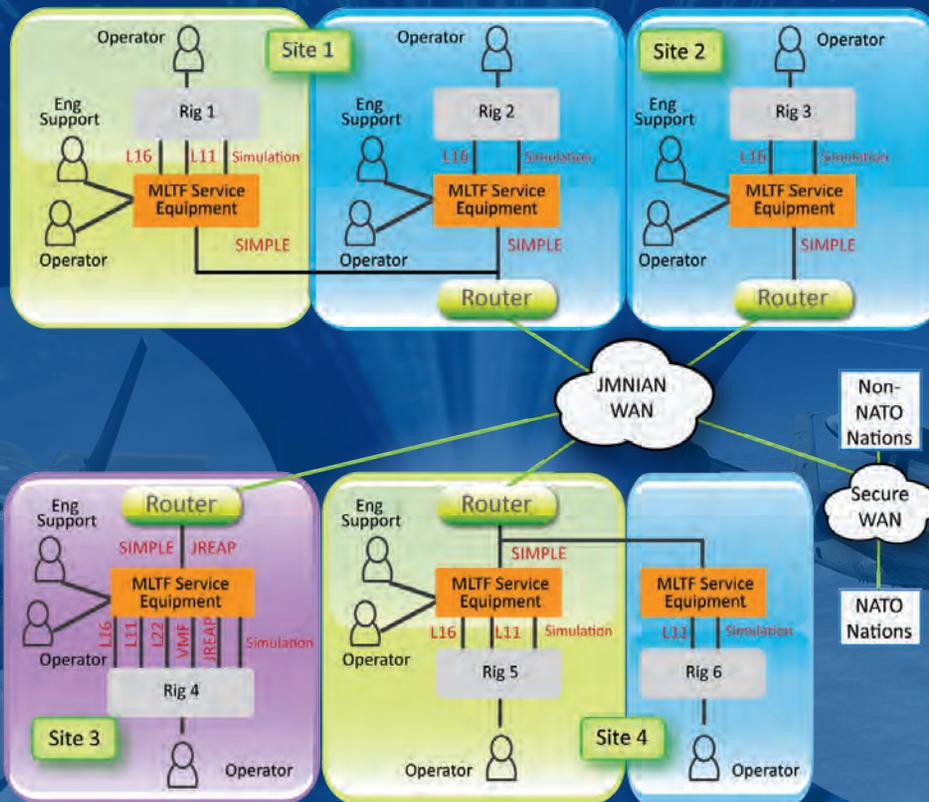


The SyntheSys Multi-Link Test Facility (MLTF) Service Seamlessly Manages TDL Interoperability Test & Assurance

✔ Supports & Aids Operator Training

✔ Controlled and Repeatable Test Environment

✔ Through-Life Support



Representative example of a common platform including possible platform configurations and Wide Area Network connections

It's no secret that testing TDL systems using live trials is expensive.

SyntheSys' MLTF service enables TDL interoperability testing of geographically dispersed equipment over a secure Wide Area Network, thus providing a highly cost-effective solution to standards compliance and interoperability assurance testing.



Letter from the MD

Editorial

Editor: Sarah Thomas
Email: sarah_thomas@synthesys.co.uk

Copy Editor: Penny Morgan
Email: penny_morgan@synthesys.co.uk

Contributors:
John S Hartas, John Miller
Su Ross, Paul Czajkowski
Michael Morgan

With Special Thanks to:
Lt. Col. Volker Schaaf (Bundeswehr),
IT Insider

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Autumn 2017: Issue 5

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TDL Technology Makes its Mark

Greetings colleagues and customers and a warm welcome to the fifth issue of TDL Technology. We hope that it contains topical and interesting articles that entertain and inform.

Alongside our regular 'Technical Knowledge Bank' article and Paul 'Ski' Czajkowski's well-read 'Ask the Trainer' article, we have introduced a new 'In the News' feature, which gives a digest of recent news from the TDL community.

We also include free resources for our readers, such as our Defence Community Portal, which gives access to more information. In this issue a 'TDL Interoperability Test Help Sheet' is available to help you release the full potential of your test initiatives.

Naturally, we include achievements and customer success stories from our own company, but we want TDL Technology to be a resource for the whole industry and not just about SyntheSys. In this issue, look out for an article on 'Exercise Timber Express' from Lt. Col. Volker Schaaf and an interesting read first published in the 'IT Insider' blog by Su Ross from our sister company, SyntheSys Direct.

As we go forward we would like other companies and colleagues to contribute more articles and information to make TDL Technology more of a community magazine. To contribute an article, or to put a free insert in the 'In the News' section, please contact the editor.

You can download a copy of TDL Technology from www.tdl-technology.com or contact: tdltech@synthesys.co.uk for a hard copy.

Finally, may I thank all our contributors and readers for their enthusiastic support for previous issues.

Very Best Regards

John S. Hartas



Dr J S Hartas Managing Director

Contents

News & Industry Events

- 5 **SyntheSys News**
The latest news from us
- 15 **Meet Us At**
Dates for your diary
- 16 **Training Schedule**
The outlook for 2017/18

Community Forum

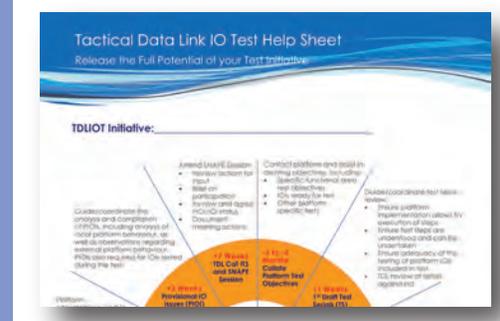
- 7 **In the News**
Consolidation of Defence and TDL news pieces from around the globe
- 8 **Bundeswehr**
Lt. Col. Volker Schaaf talks TIMBER EXPRESS
- 10 **IT Insider Article**
Some of the challenges involved in complex & collaborative development lifecycles

Technical Knowledge Bank

- 12 **JREAP vs SIMPLE**
Understand the difference
- 14 **Ask the Trainer**
The exchange of MODE S and MODE 5 over MIDS Link 16 and its impact

Best Practices

- 15 **FREE Resource: TDLIOT Test Initiative Help Sheet**
One to print out!



SyntheSys News

General Dynamics UK Hosts Multi-Tactical Data Link Operational Demonstration Event in Collaboration with SyntheSys, Diginext and UK Ministry of Defence

During the first week of April 2017, SyntheSys presented a Multi-TDL Operational Demonstration event hosted at the General Dynamics (GD) EDGE Facility in Newport, South Wales.

The event welcomed both national and international attendees and aimed to establish the importance of rigorous interoperability (IO) testing when implementing and managing Tactical Data Link (TDL) equipment and programmes. Delegates attended a variety of different IO related educational briefs supported by hands-on demonstrations of SyntheSys' Multi-Link Test Facility (MLTF) service, which provides a cost-effective solution for TDL implementation and IO testing.

In collaboration with General Dynamics, Diginext and the UK Ministry of Defence's (MOD's) Tactical Data

Link Support Unit, the team was able to simulate a full test programme using a mix of different tools. These included: Diginext products - Tactical Environment Simulator (TactX), Direct Computer Generated Forces (CGF), Link 22 Network Cycle Structure (NCS) and Link 22 Network Management and Monitoring (NMM); the Daronmont Data Link Training Suite (DLTS); and GD UK NetLink 22. The test architecture allowed for testing of Link 16 and Link 22 as well as Joint Range Extension Application Protocol (JREAP).

GD provided administrative and technical support, which resulted in a highly successful event. If you would like to learn more about the MLTF service and the projects the service has successfully supported, contact info@synthesys.co.uk

Expert Consultant Kevin Farquhar has recently joined SyntheSys

Kevin currently works within the SyntheSys Defence Business Group, primarily responsible for the delivery of IO Assurance, support and assistance to customers utilising the Multi-Link Test Facility.

He has both an operational and technical background developed over 30 years' exemplary service in the Royal Air Force (RAF) undertaking numerous Radar, Electronic Warfare (EW) and TDL related roles. His final 10 years working within the RAF were spent as a crew member on Sentry E-3D Airborne Early Warning (AEW) and an Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) Instructor specialising in Air Command & Control (C2), EW and TDL. He was deployed worldwide in support of Operations and

Exercises. On leaving the RAF, he went into industry as a Link 16 Advisor with BAE Systems, Saudi Arabia, joining SyntheSys in April 2017.

Kevin brings his expertise to the Company in the following areas: Multi-TDL Instructor, Training and Development, TDL Network Management, TDL Operations and Analysis, Air/Ground/Maritime Integration, C2 Systems, Extensive Operational experience, Track Management and Sensor Fusion.

We are thrilled to welcome Kevin to the team.

New Defence Community Portal - Now Available!



Technical Articles
Reference Guides
Training Material
TDL Technology
Capabilities and Limitations Database

visit <http://www.tdl-technology.com/community-portal> to register



SyntheSys Training Services

The Route to Knowledge



Tactical Data Links & Related Training

- Data Link Manager/Interface Control Officer (DLM/ICO)
- Link 11, Link 16 & Link 22
- Variable Message Format (VMF) & Combat Net Radio (CNR)
- Joint Range Extension Application Protocol (JREAP)
- Standard Interface for Multiple Platform Link Evaluation (SIMPLE) (STANAG 5602 (now ATDLP-6.02))

In today's TDL Environment, knowledge is everything.

Much of our success hinges on how well we can empower our customers via TDL & Related Training - and we achieve that on a daily basis.

Whether you are new to TDLs, or an established user, SyntheSys Training Services will cover what you need to know to effectively understand, manage and maximise TDL usage and implementation in your organisation.

Why Choose Us?

Access to Unrivalled
Training Tools

Expert
Trainers

Custom Training
Available

5% Discount for
Military ID Card
Holders

Read more about our training tools

e.g. the Data Link Training Suite & Qwizdom here: <http://www.synthesys-defence.co.uk/training.html>

TDL Technology Community Forum

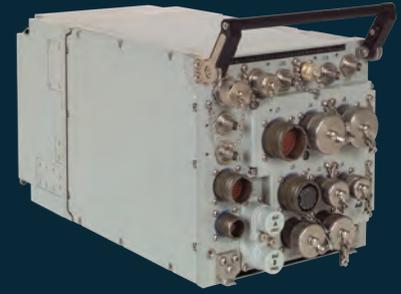
Have you got a burning question to ask? Or perhaps a topic you feel doesn't get enough scrutiny? Our Community forum is for you! We are asking members of the TDL and related communities to come forward with different ideas and topics for inclusion in this Community Forum which is dedicated to you. If you are interested in contributing please contact Sarah Thomas: sarah_thomas@synthesys.co.uk

In the News - from the TDL & Related Defence Industry

ViaSat's Canadian Army's first Link 16 Radio to successfully pass Live RF Testing

September 2017 - <http://bit.ly/2xlpAla>

ViaSat announces that its KOR-24A Small Tactical Terminal (STT) is the first small form factor, software-defined Link 16 radio to pass live Radio Frequency (RF) range testing for the Canadian Army's Air Space Coordination Centre Modernization (ASCCM) project.



F-35 pilots from UK and Europe start inaugural coalition interoperability trials

September 2017 - <http://bit.ly/2xAGh00>

Royal Navy and Royal Air Force pilots have completed a first by joining F-35 pilots from Italy and the Netherlands to take part in the latest in a series of F-35 interoperability trials.



Northrop Grumman, RAF Lightning and Typhoon trial success

February 2017 <http://bit.ly/2k1SR1X>

A successful communications interoperability trial involving the F-35B Lightning II and Typhoon FGR4 aircraft has been completed by Northrop Grumman Corporation (NYSE: NOC) and the Royal Air Force (RAF), via an Airborne Gateway developed by Northrop Grumman.

U.S. Navy and Coalition Forces radio boost

July 2017 - <http://bit.ly/2wjIR9u>

Data Link Solutions (DLS) has been awarded a \$47.5 million contract by the U.S. Navy's Space and Naval Warfare Systems Command to provide Multifunctional Information Distribution System Joint Tactical Radio Systems (MIDS JTRS) to U.S. and coalition forces.



10th European Defence Agency (EDA) Helicopter Training Exercise puts the Spotlight on Interoperability and Joint Training

2017 - <http://bit.ly/2vIRvoh>

Exercise Black Blade marked a significant milestone for the EDA at the 10th edition of its Helicopter Exercise Programme (HEP). Hosted by Belgium at its Florennes airbase, approximately 400 personnel and 14 air assets undertook an intensive and successful three week programme. As a Special Operations Forces (SOF) orientated helicopter exercise, Black Blade focused on enhancing European interoperability and developing cooperation with SOF. See Page 26 of the linked publication.



DEUTORNADO 4-ship

Bundeswehr



Exercise TIMBER EXPRESS 2017 - An Environment for Mission Specific Data Links

What is TE?

Earlier this year the exercise TIMBER EXPRESS 2017 (TE) was conducted. TE was a "Link 16 Live Training Exercise" sponsored by the German Air Force Headquarters and conducted by the TDLMC (Tactical Data Link Management Cell) of the national Air Operation Command (AOC). TE itself was a bi-national exercise with the involvement of the US Air Force Life Cycle Management Center (AFLCMC) at Hanscom AFB.

Although Link 16 was the core of the exercise, there were Improved Data Modem (IDM)-based data links like Variable Message Format (VMF) and Cooperative ESM Electronic Support Measures Operation (CESMO) during the experimental phase involved. The goal of TE was to promote the use of Link 16 in established as well as new and challenging ways.

One of the challenges was to advance Link 16 interoperability:

- Within Link 16 among the platforms and Command and Control (C2) systems.
- In concert with other data links.
- Through data link analysis.

What should have happened during TE?

First of all the exercise was a live one! TE was set during a large scale live flying exercise in addition to routine operations. The challenge for the TDLMC was to maintain a "huge" complex Link 16 exercise network as well as several networks for test purposes. In addition, the Link 16 support of Quick Reaction Alert (Interceptor) (QRA(I)) and routine missions (incl. training) within the German Flight Information Region (FIR) was mandatory.

Training was one of the objectives; true to the motto "Train as you fight – fight as you train". Primarily, TE aimed to be a learning experience for Link 16 subject matter experts. It also provided an opportunity for advanced operators to complete their training as a TDL-Manager. This was realised by the practical phase of a

Link 16 focused TDL Manager Course (in accordance with NATO ATDLP-5.55). In addition TE sought to educate senior leadership about the possibilities of (tactical) data links.

The experimental part covered the integration of VMF and CESMO. The fusion of different domains (like Link 16) automatically to establish a "common picture" was the focus. One of the primary goals was to forward (translate and retransmit) automatically a VMF and/or CESMO message over Link 16. The next step was to incorporate this message into the Air Operation Centre's combined Link 16 air picture. Finally, the augmentation of the situational awareness for non-CESMO participants should be achieved.



IDM Ground Station

Goal number two of this part of the exercise was to forward automatically the other way round; a J-message over VMF and/or CESMO. The challenge to the planners was that the experimental part of TE may not jeopardize the stability of the link environment for the live participants. The biggest challenge was to establish and maintain a Joint Range Extension Application Protocol (JREAP)-C connection from the AOC in Germany to Hanscom AFB in the USA. It was a challenge because the idea was to use the open "dirty" internet to securely transfer the classified data using a High Assurance Internet Protocol Encryptor (HAIPE) device.

Besides this primary goal, secondarily the establishment and maintenance of direct terminal connections from Germany to the USA should be achieved. The idea was that the German Liaison Officer (as part of the exercise) was able to conduct remote control of the Link 16 terminals in Germany. The established JREAP-C connection was also foreseen to forward VMF and/or CESMO messages to Hanscom AFB.

What is CESMO?

Cooperative ESM Operations (CESMO) exploit the benefits of using intercept data collected simultaneously on a target from different location and orientations to rapidly and accurately geo-locate threats in a number of seconds.

Link 16 during TIMBER EXPRESS

- o Day-to-Day network across Germany in support of routine and air defense operations.
- o FRISIAN FLAG network over the North Sea exercise area.
- o Experimental networks for VMF/CESMO integration testing in the Uedem area using STT/LVT1/LVT11s.
- o Dedicated data link analysis position across all networks.

60 Jahre Luftwaffe

UNCLASSIFIED

Link 16 During TE17



The Author:

Lieutenant Colonel Schaaf is the Head of the Branch at the German Air Force Headquarters dealing with the operational aspects of the weapons systems and platforms focused on the aspects of Tactical Data Links, Identification, and Simulation. He acts as the "Operational Requirements Holder TDL" of the German Air Force.



Why CESMO?

Hostile emitters will only radiate briefly to search the airspace for targets or track an already detected target. As a consequence, ESM systems on board platforms (airborne, sea-based, ground-based units) might detect these short emissions, without ample time to geo-locate the emitter. As a rule of thumb, these platforms need to receive multiple emissions in a timespan of several minutes before a meaningful position can be calculated. Tactical Data Links (e.g. Link 11, Link 16, Link 22, IDM-based communication) connect aircraft, ships and ground-based units. Through these data links, information generated on board a single platform can be made available at every other participating platform in near real-time. As such, the individual platform hunting for a specific hostile emitter can be fed instantaneously with measurements from other platforms which happen to detect the same target during their mission.

What happened in reality?

Training: The German Air Force took advantage of the exercise FRISIAN FLAG taking place during the same period, to create a demanding data link environment for the training of the already trained network manager of the DEU Air Force Tactical Data Link Management Cell (AF TDLMC). In addition to the support of the training flights across the North Sea, the QRA and routine flying operations in the German FIR were further supported, as well as an additional experimental network for the integration of the TORNADO equipped with a VMF/CESMO demonstrator kit. Including the preparation and follow-up of TE 17, more than 2,000 Link 16 requests were evaluated, edited and implemented.

Experimental part: During the IDLS 2016, within the framework of the German Air Force's exhibition, the theoretical feasibility of an automated translation of VMF to CESMO could be demonstrated. Based on this experience, TE17 was used to demonstrate this possibility by using live systems and data. A DEU Tactical Air Wing supported the exercise with a fighter aircraft "TORNADO" including a deployable IDM ground station. The exercise scenario was the measurement (geo-location) of a radar site within the exercise area and the transfer of the obtained data, via an IDM, as CESMO data to the ground station. By providing a Link 16 terminal and processing the integration into the ground station, it was possible to use the gateway – but now developed further – for the automatic transmission of the "electronic battle" information to a Link 16 network.



TE17 Tornado "low profile"

So far as we know this can be achieved for the first time. The German Army participated with 2 Joint Terminal Attack Controller (JTAC) in the exercise, demonstrating the use and operation of a VMF capable ground kit for the Joint Fire Support (JFS).



DEU JTAC

Hanscom connection:

At the instigation of USA partners, DEU AF TDLMC from USAFE Ramstein was provided with a NATO and NSA certified crypto device for the duration of the exercise, which is certified for the transfer of NATO classified data via an open and/or public line. Using an internet access in the Air Operations Centre, an IP connection was established to the United States, encrypted and then successfully used for the transmission of the "tactical picture".

Benefits/Assessment?

Training: Through the creation of a consistently demanding data link environment, the training goals were achieved very well. The recordings collected by the data link analyzer tool ADIVS already indicated the conspicuous behavior of individual link platforms in the so-called "quick look report". The more detailed analysis, which has already been done, proved to be an effective way of obtaining further detailed insights.

Experimental part: Through the automated connection of the information domains Link 16 and CESMO under live conditions, a first step could be taken to a new kind of "common situation picture". The enormous information density of the EW-specific CESMO networks cannot be depicted in Link 16 without a meaningful reduction or a summary of the findings. The automated steps required for this are, in principle, obvious, but a considerable amount of "fine tuning" will be necessary in future operations using this technique.

Hanscom connection: By connecting the US command center via the Internet, an important step has been taken in the area of further development of "networked enabled operations"; hereby using open or public "data links". The use of existing (civil) data infrastructure for military operations contains significant advantages as well as potentially serious disadvantages, which, however, due to the brevity of the embedding period could not be fully assessed (4 days).

What's next in 2018?

First, carry out another TIMBER EXPRESS in March/April 2018. Second, to achieve the remaining goals from 2017. In addition, the idea is to have Link 22 involved in the exercise.

Author: Lt. Col. Volker Schaaf
German Air Force Headquarters
All photographs: German Airforce



Accountable, auditable, compliant – across the collaborative development lifecycle



CLOUD August 2017



Su Ross of SyntheSys Direct Limited explains some of the challenges involved in managing today's more complex and collaborative development lifecycles.

While the engineering lifecycle, as applied to both software and systems projects, has remained fairly stable for many years, recent trends show a clear shift towards a collaborative lifecycle. The promise is that by making development and process data available to all relevant parties and adding workflow control, projects are accelerated and product quality improved.

However, managing large distributed teams, internally and on the customer's side, all inputting to the project, raises its own challenges. Imagine trying to manage a product development project that has dozens, even hundreds, of stakeholders. What's more, these professionals are scattered across different time zones on different continents. And they're working on multiple projects, too.

At the same time, research reinforces the importance of retaining control of evolving requirements:

- Error detection in the maintenance phase can **cost up to 200 times more** than detection early in requirement analysis phase
- **More than 40% of development budget** can be consumed by poor requirements
- Being late to market by 6 months or more will **cost organisations 33% of the 5-year ROI**

Let's explore some must-haves...

Can stakeholders believe what they see?

Even the simplest project will have many stakeholders: the core developers, the QA team, testing, the customer's team...

Those working on collaborative projects must have a centralised, trusted source of the truth, with all stakeholders accessing the same information with a single, up-to-the-minute view of the project, wherever they are located: within the same office or on opposite sides of the planet.

Does control lie in the right hands?

'Super users', such as project leads, need to be able to spot anomalies instantly before they can damage quality, compliance, timescales or cost. They need a precise, detailed record, with changes logged with name and time, so that they can verify changes, query anything that doesn't make sense, and, if necessary, turn the clock back to before the change.

Project leads must be empowered to view and edit change. In contrast, while you may be happy for the customer to view progress, you probably wouldn't want them interfering directly in the development process!

Uncontrolled change soon sends costs escalating and blows the product development budget. The potential extra costs incurred in making a change need to be visible and negotiated with the customer, rather than accepted without debate.

Can you reproduce success?

Developing products is an expensive business. If you can build on best practice by transferring the details of a component developed on one project to another project, this saves significant time, money and energy.

It's virtually impossible to capture, trace, analyse and manage requirements in this way using generic Office applications, such as Microsoft Word or Excel. Complex scenarios will soon push these tools beyond their limits. Why not visit the SyntheSys stand at the Advanced Engineering show at the NEC on 1st - 2nd November to discuss the alternatives?

In the meantime, an IBM white paper 'Ditch the Documents and Spreadsheets' makes interesting reading in outlining ways to cut development costs while accelerating time to market.

OUR research indicates that over

80%
DEVELOPMENT FAILURES

result directly from poor requirements gathering, management, and analysis.

-IDC

WANT TO FIND OUT MORE OR VOICE YOUR OWN OPINIONS?

Contact: <https://www.theinsider.co.uk/get-involved/>



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We equip you to release the full value from your software investment by teaching you how to quickly and effectively adopt the software, mentor you on best practices and identify where tools can enhance your current development programmes.



Verification & Validation Tools



System Design & Development Tools



Requirements Management Tools



Project Management Tools



JREAP vs SIMPLE

Within the capability streams for distributing Tactical Data Link (TDL) information beyond normal communication limits there exists two military standards: Joint Range Extension Application Protocol (JREAP) and Standard Interface for Multiple Platform Link Evaluation (SIMPLE).

Military staff have therefore asked the question “Which should I implement that can support operations?”.

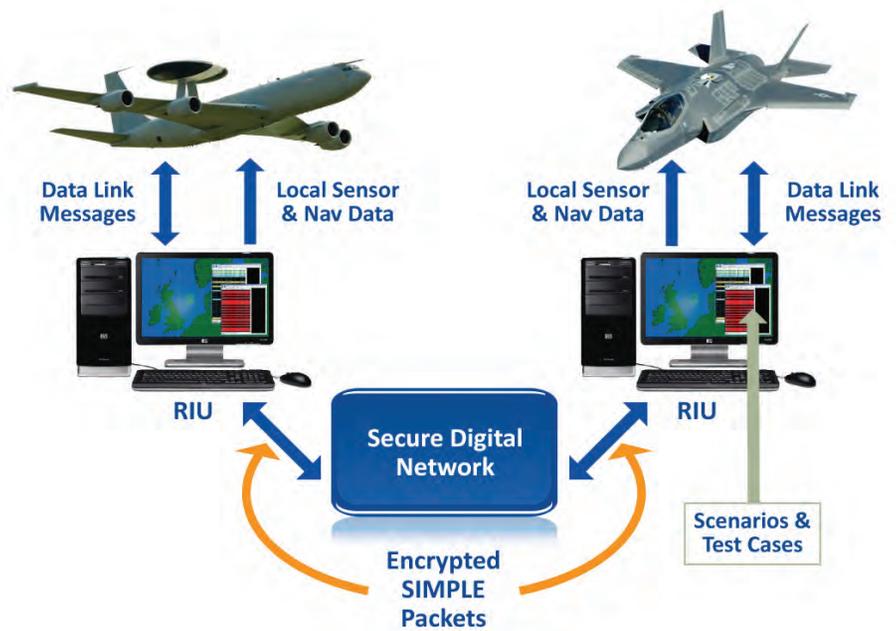
Both are NATO standards born out of the need to distribute information beyond the typical communication limits and provide a mechanism for linking into TDL systems. JREAP was originally implemented through MIL-STD-3011 but has now been adopted under NATO cover ATDLP-5.18 (STANAG 5518) and SIMPLE through ATDLP-6.02 (STANAG 5602).

In short, JREAP is a deployable tactical capability whereas SIMPLE is used in a test environment. However, this article scrutinises the capabilities and implementation of each and provides a comparison of abilities to support front-line operations.

JREAP was developed due to the need to communicate data over long distances, i.e. Beyond Line of Sight (BLOS), without degradation to the message format or content. JREAP takes the message from the format it was originally in and encapsulates it within a JREAP wrapper so that the message can be transmitted over BLOS media and to those platforms not equipped with traditional Link 16 equipment such as MIDS terminals. If one was to examine the history of JREAP publications the first MIL-STD-3011 issue is a cut down version of STANAG 5602 Edition 1 with additions to operate over a number of specified communication bearers.

SIMPLE was developed by the Tactical Data Link Capability Team Interoperability Testing Syndicate (TDL CaT ITS) to support a test setting within which geographically dispersed test laboratories can be linked together operating in the same virtual

harmonised environment. STANAG 5602 was born out of a Space and Naval Warfare Systems Command (SPAWAR) equipment Interface Specification and adopted for military testing and designed to support multiple TDLs and is easily extensible through its message catalogue. Currently SIMPLE supports Link 11A/B, Link 16, Link 22 and Variable Message Format (VMF). Whereas JREAP provides for transport of: Link 16 Messages to include all message words; X-Series Management Messages, and planned future implementation of VMF; Common Message Format (CMF); Integrated Broadcast Service (IBS) and Link 22. However, it must be stressed that currently this is limited to Link 16 messages only.



JREAP architecture in its simplest and commonly used form, consists of two JREAP nodes connected over an Internet Protocol (IP) path using either Transmission Control Protocol (TCP), or User Datagram Protocol (UDP).

Nonetheless, in many operational scenarios multiple Server/Client connections exist, and all are joined together in a complex network potentially operating over multiple media paths. SIMPLE user nodes are commonly referred to as Rig Interface Units (RIU) which provide a physical connection to the platform under test to the rest of the test network.

What's the Verdict?

However, it must be stressed that the protocols deployed by SIMPLE are not designed to operate in operational warfare as they allow messages to be broadcast with no priority consideration and no concept of network capacity or transmission rules.

SIMPLE networks include architectures that allow either TDL terminals to be emulated or positioned as in-line equipment. Thus to cater for both architectures there is no concept of network initialisation within SIMPLE and therefore no knowledge of other network users, such as their JTIDS Units (JU) Source Track Number (STN), prior to joining the network. If deployed in an operational environment this could allow erroneous transmission of messages across the real network and cause undesirable impacts on message processing.

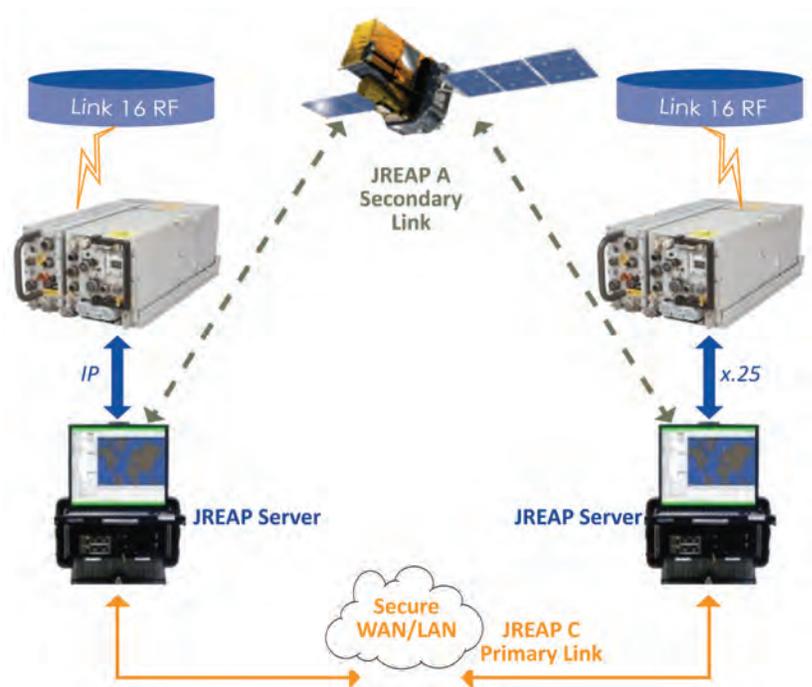
JREAP is able to manage disparate Link 16 networks by monitoring JUs and transmission of J2.0 Indirect Precise Participant Location Identification (PPLI) messages, which automatically indicate to a JU on one network that the other unit is not directly contactable without accessing an Interface Unit (IU).

SIMPLE does not recognise the process of Indirect PPLI and therefore replication of STNs between individual networks may occur, unless very careful planning is conducted.

SIMPLE includes the mechanism of Round Trip Timing (RTT) to calculate the average transmission time from one user on the network to another, thus data can be extrapolated to give more accurate positioning information.

This RTT should not be confused with the Link 16 RTT function which allows terminals to become in Fine Synchronisation with each other. Within JREAP a Common Time Reference (CTR) is negotiated between JREAP nodes to allow for data extrapolation.

Extrapolation of data allows the positional information for messages which contain an element of movement, to be updated to a predicted position, allowing for the time taken to deliver that data between the nodes. The JREAP time function is far more accurate than SIMPLE as the RTT calculation can vary with time and network demands and message latency.



In conclusion, JREAP is the choice for operational networks where Link 16 messages require extended transmission range, as it has been developed for the operational environment to provide a formal standard between operational platforms. Whereas SIMPLE has been designed for easy extensibility to transmit between geographically dispersed test environments, different TDL messages for testing of platform message implementation.

*John Miller
Deputy MD, SyntheSys*



Ask the Trainer

Training Manager Paul Czajkowski has had a 22 year exemplary career within HM Royal Air Force and five years' established civilian instructional expertise. He is accredited to both UK military and civilian education & training standards. Paul has a recognised ability as an innovative and adaptable leader, specialising in Multi-TDL Network Design, Management, Testing and Instruction. He has provided Multi-TDL training, including VMF and JREAP, to a number of NATO Nations, non-NATO nations and international companies. He has also given specialist Network Design support to a variety of nations and organisations including NATO, UK, Austria, Finland, Italy, Denmark, Hungary and international companies.

The Exchange of MODE S and Mode 5 over MIDS Link 16 and its Impact

Earlier this year, in Issue 3, I wrote an article about "How many surveillance Time Slots (TS) should I request for a C2 JTIDS/MIDS Unit (JU) in a Link 16 network?" This is always a common question when we deliver our highly regarded Data Link Manager/Interface Control Officer (DLM/ICO) Course.

Managers and Operators are keen to explore why and subsequently how to create the most detailed MIDS Network Design Request (NDR), to support the most efficient yet practical MIDS Network Design. A DLM/ICO will always aspire to create the most robust Multi-TDL architecture and being efficient with TS is just part of that process.

Accordingly, the article focused on MIDS Network Participation Group (NPG) 7 for Surveillance and in particular the J3.2 Air Track message transmission rules. But no sooner had we gone to press and the rules surrounding the J3.2 Air Track message formally changed. People often say that the wheels can turn slowly within the TDL standards but on this occasion, it had caught me off guard! The result being, that although I was technically correct, the transmission rules for platforms which employ either a Mode S or Mode 5 interrogator and wanted to exchange this data had ultimately changed. The question was what, if any, was the impact?

The introduction and use of both Mode S and Mode 5 interrogators by operational platforms continues to rise. The added benefits of Mode S are not for this article but with the end of Mode 4 approaching, the critical operational importance of being able to exchange Mode 5 data becomes ever more relevant. This leads to the question, how will this operationally sensitive data be exchanged in a fast moving, quick thinking environment?

There are various ways to do this but within the restrictions of this article we will confine ourselves to MIDS Link 16. This takes us back to the J3.2 Air Track message, which we will now refer to simply as the J3.2.

The first point we should clarify is that both Mode S and Mode 5 data can be exchanged through more than just the J3.2; the J7.5

Identification Friend or Foe/Selective Identification Feature (IFF/SIF) Management message is one example. However, to remain focused and to relate to the previous article we will only discuss the J3.2. Furthermore, we will concentrate on Mode S exchange.

You may recall that the J3.2 had 6 J-words defined, those being Initial (I), Extension (E0) and four Continuation (C). A network designer will normally allocate a packing structure of Pack 4 single pulse (P4SP) to each TS allocated for surveillance. This supports a maximum throughput per TS of 12 J-words. The J3.2 transmit rule which dictates that for the first transmission an I, E0 and C word 1 must be transmitted. The next transmission of the same track only the I and E0 words are required to be sent. This continues until 96 seconds have elapsed, when it goes back to I, E0 and C1 with the subsequent transmit being I and E0 and so on. There are exceptions, but let's try to keep this simple for all our examples.

We concluded that the number of words required for each J3.2 is 2 or 3. So for every surveillance TS at P4SP, we could fit between 4 and 6 J3.2 Messages, but on average we shall say 5.

However, the introduction of Mode S and Mode 5 exchange has created the need for a seventh J-word, this being a fifth C word and, of course, a change in the transmission rules.

Accordingly, the following applies to those platforms who are able and will exchange Mode S and/or Mode 5 via MIDS Link 16.

The J3.2 transmit rule now dictates that for the first transmission when sending Mode S data, an I, E0 and C word 1, C word 4 and C word 5 must be transmitted, i.e. I, E0, C1, C4 & C5. The second and subsequent reports are I, E0. After 96 seconds, the transmitted sequence is I, E0 and C1 followed by repeated I, E0 reports. After 192 seconds, the sequence returns to I, E0, C1, C4 & C5 and the cycle repeats as shown in Figure 1.

These extra words which now must be transmitted when sending a J3.2 with

Mode S data, will now have an impact upon our determination that a single surveillance TS at P4SP will support approximately 5 J3.2 Air Track messages. When a J3.2 Air Track Message has Mode S and/or 5 data, then the maximum number of tracks that could be transmitted per timeslot at P4 for the first transmission, is limited to two.

The result being that a DLM/ICO must now identify if a platform has the capability to exchange Mode S and/or Mode 5 data. If it does, then careful consideration must be given when submitting a NDR.

To compound it further, the rules surrounding the exchange of Mode 5 are slightly different to those of Mode S! Nonetheless, we can certainly conclude that a platform equipped with, and able to exchange Mode S and/or Mode 5 data via MIDS Link 16, will affect our number of TS needed. It further highlights the responsibilities of a DLM/ICO and that of a Link 16 Network Designer to correctly capture Information Exchange Requirements. Undeniably, their duties are ever more extensive and often complex.

If you would like to meet the team, SyntheSys will be attending this year's International Data Links Society (IDLS) in Abu Dhabi, where we will be providing several educational presentations and also holding a MIDS Link 16 & Link 22 Network Design workshop on the training day. A great opportunity to debate and explore some of the areas we have highlighted in TDL Technology.

We would very much welcome your attendance to discuss the wonderful world of TDLs.

Basic Transmission Rule of J3.2 with Mode S Data					
Initial Report	I word	E0 word	C1 word	C4 word	C5 word
Second Report	I word	E0 word			
After 96 seconds	I word	E0 word	C1 word		
After 108 seconds	I word	E0 word			
After 192 seconds	I word	E0 word	C1 word	C4 word	C5 word
After 204 seconds	I word	E0 word			

Figure 1

Do you have a question you would like to ask? contact: tdltech@synthesys.co.uk

TDL Interoperability Test Initiative Help Sheet Now Available

We are pleased to be able to offer access to this and other useful resources via our Defence Community Portal. The sign up process is free and simple, and gives you access to the full inventory of TDL Technology free assets.

To register to use the portal visit:
www.tdl-technology.com/communityportal

We are offering readers a handy TDL Interoperability Test Help Sheet for your office wall or desk. The template is designed to support you through TDLIOT initiatives by guiding you through tasks during the weeks running up to a formal test event taking place. To use the wheel, input the specific dates in the inner wheel and then simply follow the instructions clockwise from 12 o'clock in sequence, reading the time line from the corresponding inner wheel.

A top 10 list of test commandments is attached to ensure you make the maximum use of the resource.

Use the sheet to release the full potential of your test initiative.

To download, register to access the Defence Community Portal.



Meet Us At

Date	Event	Location	Further Information
30 Oct-02 Nov	IDLS 2017	Abu Dhabi, UAE	We look forward to meeting with those attending this year's symposium where we will be delivering our MIDS Link 16 and Link 22 Network Design workshop in addition to various other sessions in the educational stream.
01-02 Nov	Advanced Engineering	Birmingham, UK	We are eagerly anticipating this year's Advanced Engineering event. The event is the UK's biggest annual event for professionals working within an engineering environment and aims to connect suppliers with Original Equipment Manufacturers (OEMs) and top tier industry players.
19-22 March 18	NATO Tactical Data Links Symposium (NTDLS) 2018	Calpe, Spain	Date for your diary.

Training Schedule 2017/18

- Oct 2017
 - MIDS Link 16
 - Data Link Manager/Interface Control Officer & Advanced Link 16
- Nov 2017
 - Data Link Manager/Interface Control Officer
 - MIDS Link 16
- Dec 2017
 - Joint Range Extension Application Protocol (JREAP)
- Jan & Feb 2018
 - Variable Message Format (VMF)
 - MIDS Link 16
 - Link 22
- March 2018
 - Data Link Manager/Interface Control Officer

We take a flexible approach to delivering our training. All of our courses can be held at customer premises globally, as required. We tailor our training according to customers' needs and abilities.



SyntheSys Training E-Newsletter is out now!

Our training newsletter gives a quarterly update on what's happening within the SyntheSys training group including customer successes, scheduled courses and other interesting news.

email: training@synthesys.co.uk if you would like to receive a copy.