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TDL Technology

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Issue 3
Autumn 2016

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SyntheSys

Photo courtesy of Lt Cdr Richard Lewis QVRM MCGI RNR

SyntheSys

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Working Together to Provide Systems Engineering Excellence

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- CSEP Training
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Interoperability Assurance & Management

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We provide high quality, cost effective information systems engineering products and services to government and industry around the world.

Letter from the MD

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SyntheSys

Letter

Dr J S Hartas Managing Director

Greetings colleagues and customers and a warm welcome to the third Issue of TDL Technology.

Many of you have read and enjoyed the first two editions of our magazine, which was last published in the Spring. Thanks to your subscriptions and support, it seems to be going from strength to strength.

I hope the success continues with this issue, in which we have introduced our TDL Technology Community Forum on Pages 7-10. This is a section of the magazine where we invite contributions from other organisations. I am delighted that we have been able to include articles from Engility, DIGINEXT, and from the Royal Naval Air Station at Culdrose. If your organisation would like to contribute an article to the next issue, please contact the editor.

You will all be aware that we specialise in military tactical communications systems. Indeed, one of our own highlights since the last issue has been the winning of a contract from the UK Ministry of Defence for Multi-Link Test Facility (MLTF) services. We feel that this contract confirms our position as one of the leading Tactical Data Link (TDL) test organisations. You can read more about this on Page 5.

We also feature our regular *Ask the TDL Expert* article (Page 6), further articles on modelling to support interoperability (Page 11) and a guide to choosing a TDL capability (Page 12).

This magazine will be available at the forthcoming International Data Links Symposium from 1-4 November 2016 in Maastricht. You can also download a copy from www.tdl-technology.com, or contact tdltech@synthesys.co.uk for a hard copy.

I will be very interested in hearing any comments you might have about our magazine and the articles in it. Please do not hesitate to contact me at john_hartas@synthesys.co.uk.

Very best regards,

John S. Hartas

Contents

News & Industry Events

Features

Technical Knowledge Bank

Best Practices


Photo: Lt Cdr Richard Lewis QVRM MCGI RNR

SyntheSys News

SyntheSys Awarded £5.7m Contract by UK Ministry of Defence to Provide Interoperability Test Support using Multi-Link Test Facility

SyntheSys is delighted to announce that we have recently been awarded a contract to provide continued Multi-Link Test Facility (MLTF) services and associated Tactical Data Link (TDL) platform support to the UK Ministry of Defence. This contract is following on from similar MLTF contracts which SyntheSys has delivered over the last 6 years. SyntheSys aims to undertake a technology refresh of the currently installed equipment, whilst continuing to provide MLTF services to meet the need of the UK test and trials programme, thereby ensuring no loss of capability. This will allow the MLTF integrated, geographically distributed, platform rigs to verify and validate that they conform to United Kingdom (UK) Interoperability (IO) policies.

The work involves providing an integrated end-to-end testing service which aims to collaborate both national and international platforms with five UK-based main end users.

SyntheSys will make equipment and support services available to enable UK Platform TDL testing, including local host conformance, focused platform IO and UK TDL IO testing. We will also provide meeting support to include the coordination of test planning and participation from a variety of different nations.

MLTF is a service provision contract which tests the integration of various data links within a platform.

We offer scenario capability which allows simulation-based testing prior to real-world platform testing to maximise the potential of actual platform test exercises. Users can benefit from multi-link capability including Link 11, Link 16 and the Joint Range Extension Application Protocol (JREAP). The multi-link nature of our services offers unique, unlimited potential and gives the capability to test platforms and the collaboration of platforms at a whole new level. MLTF also provides an unrivalled simulation-based training solution, built on real-world scenarios, to enhance engineers' performance.

"It's no secret that Tactical Data Link test initiatives are highly complex. At a very basic level, the task ahead for SyntheSys is all about simplifying complexity for the tester, training operators and engineers to be able to maximise the potential of real-world platform testing. We have unrivalled experience in this area and we look forward to working with the UK MOD to validate conformance to standards in accordance with UK Interoperability policies".

- Mark Hudspeth, technical lead on the MLTF project

For more information about the MLTF
contact: info@synthesys.co.uk

IT Governance Congratulates SyntheSys on Achieving Cyber Essentials Certification

Here at SyntheSys we are proud to announce that we have achieved Cyber Essentials, a Government-backed cyber security certification that sets out a minimum standard for cyber security.

The Cyber Essentials scheme outlines five security controls to help organisations mitigate cyber risks and improve their cyber security posture.

To achieve certification, organisations are required to address their boundary firewalls and internet gateways, implement secure configuration, adequately manage access control and administrative privilege management, implement patch management, and ensure malware protection.

Nikki Haynes, Operations Manager of SyntheSys, said:

"Achieving Cyber Essentials was seen as a way to demonstrate a level of assurance to our customers, by showing that security controls are in place to protect the business, its IT systems and information, and that these controls have been assessed against an independent, formal framework. "

To see what IT Governance, the cyber security consultancy firm and CREST-accredited certification body, have to say about our achievement visit:
http://bit.ly/2dgEAxD

Ask the TDL Expert

Q: How many surveillance Time Slots (TS) should I request for a C2 JTIDS/MIDS Unit (JU) on a Link 16 network?

A: ***As an instructor, you always try and prepare yourself for every possible question that could be asked by a student.***

But let us be fair, the students we attract to our Data Link Manager/Interface Control Officer (DLM/ICO) course all have different roles, experience and ultimately interest, in one subject over another, and this can open up any questioning possibility.

Thankfully, the questions posed remain focused on understanding the why. All students have a desire to recognise why something works in the way it does. Why does one concept work better than another? But more importantly, a student's aspiration is to consider each theory so they can define new ways to improve their product and proactively share this with their colleagues.

Within our DLM/ICO Course we focus students on understanding the why. For example, a DLM/ICO has to understand the effective throughput of every Tactical Data Link (TDL) in order to maximise efficiency. Considering how many potential users there might be in an operational TDL architecture only reinforces the need to know how best to exploit one's resources.

Link 16 networks can be and usually are, all different. However, the calculation that a network designer applies to the question posed above can be a simple one based on the rules defined within the standards. Nonetheless, one must appreciate that the standards are not always followed!

Usually when a DLM/ICO assesses a request for surveillance capacity, a Command & Control Joint Tactical Information Distribution System / Multifunctional Information Distribution System (JTIDS/MIDS) Unit (C2 JU) will state the number of tracks they need to be able to transmit. Anyone who has monitored surveillance within a Link 16 network will tell you that at least 80-90% of all surveillance data being transmitted is that of a J3.2 Air Track Message. Accordingly, if you understand the rules of the J3.2 Message then one can calculate approximate throughput per TS allocated for surveillance.

Example

We have a C2 JU requesting the ability to transmit n number of tracks. Subsequently, the DLM/ICO needs to understand how many TS to request within a Network Design Request (NDR). After all, the earlier they know this, the shorter the planning cycle becomes which results in increased efficiency. A network designer will normally allocate a packing structure of Pack 4 single pulse to each TS allocated for surveillance. This supports a maximum throughput per TS of 12 J-words. The J3.2 Message transmit rule dictates that for the first transmission an Initial (I), Extension (E) and Continuation (C) word 1 has to be transmitted, i.e. I, E0 and C1.

However, on 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.

Exception

The exception to the rule is that the pattern may change if:
a) the Identification Friend or Foe / Selective Identification Feature (IFF/SIF) modes and codes of the track change; or
b) if there is a J7.1 Data Update Request Message received by the transmitting unit pertaining to the J3.2 in question.
Thus, the number of words required for each J3.2 Message is 2 or 3. So, for every surveillance TS at Pack 4 single pulse, we could fit between 4 and 6 J3.2 Messages, but on average we shall say 5.

This leads us back to our request and drive for efficiency. For example, we shall say n is 50 tracks. The transmit rule plus the track request allows us to calculate our requirements when submitting our NDR. So based upon our average of 5 tracks per TS, 50 tracks would require 10 TS. Ultimately, there are other J-Series messages being transmitted and it is based on an average, but now the DLM/ICO knows why and they can now aspire to be as efficient as possible.

Furthermore, our training courses use the Daronmont Data Link Training Suite (DLTS), which simulates the exchange of messages in accordance with the standard. This reinforces the student understanding through interaction, thereby proving or challenging their own derived answers. Rules exist throughout all TDLs for all messages no matter whether they are M, J, K or F-Series.

To benefit from a balanced view, we at SyntheSys instruct throughput and associated calculations for Links 1, 11 and 22 applying the same methodology.

Our desire is for students to understand why and not be satisfied with - 'That's the way it's always been done!'

SyntheSys Expert for this article

Consultant Paul Czajkowski has had a 22 year exemplary career within HM Royal Air Force and four year's 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-Tactical Data Link Network Design, Management, Testing and Instruction. An excellent, enthusiastic communicator offering extensive operational and technical experience.

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.

Do you have a question you would like to ask?

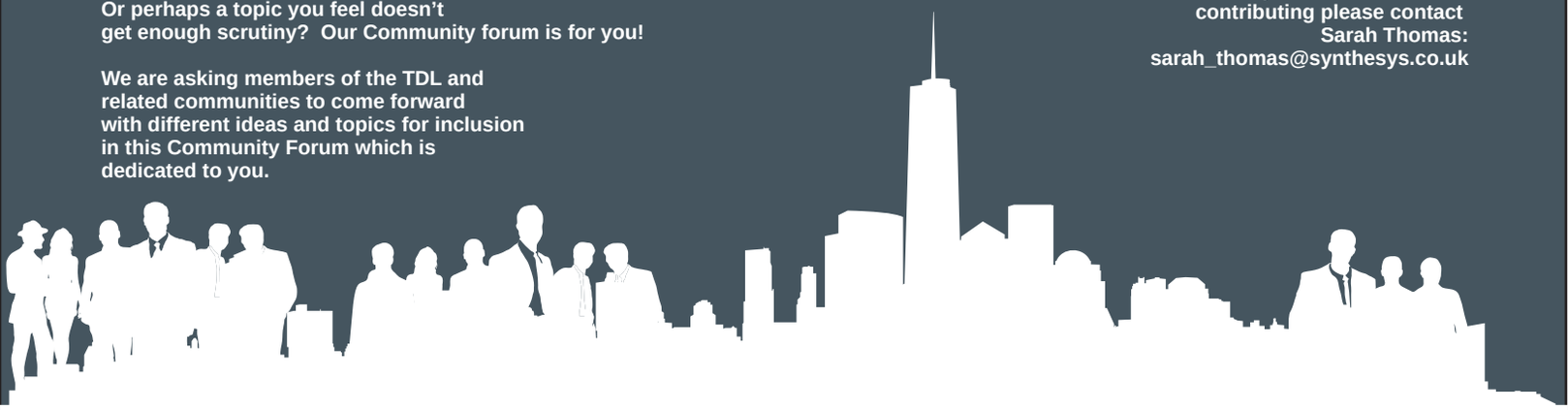
contact: tdltech@synthesys.co.uk

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



Engility Joint Range Extension & HF Radios

Introduction and Use Case

Joint Range Extension Application Protocol Appendix – A (JREAP-A) has been certified and fielded in JREs for over 13 years.

Traditionally JREAP-A is intended for use with satellite communication.

Satellite access typically poses a barrier for wide use of JREAP-A because the costs can be astronomical (pun intended) if parties can even **get** satellite time.

This poses an issue particularly when participating in Joint Operations as priorities for satellite time tend to shift to the controlling nation.

The Engility Joint Range Extension team has recently demonstrated JREAP-A data over High Frequency (HF) radios.

Setup

Two-way communications were tested with two different JRE form factors using JRE software on Linux OS and Win 7 OS (with JRE USB to Synchronous Serial Cable) environments on the JRE 3G™ and JRE installed on a Panasonic Toughpad®, respectively, with the following settings.

JREAP-A settings:

- Com Port: 2400
- Radio Type: Other
- Timeout: Custom

The systems were able to pass PPLIs (J2.x), tracks (J3.x), text messages (J28.2) and imagery (J16.0) after changing the JRE Imagery Processing Tx/Rx timeouts.

Benefits and Savings

This capability can be leveraged to repurpose existing HF voice radios or to push Link 16 quality data over HF radios currently being used to support Link 11.

War fighters may add another arrow to their TDL architecture arsenal without the added cost of expensive satellite time.

For more information about JRE solutions and products visit us at www.JRE-GW.com.

- Robert Shafer, JRE International Programs Manager, Engility Corporation

Robert.Shafer@engilitycorp.com

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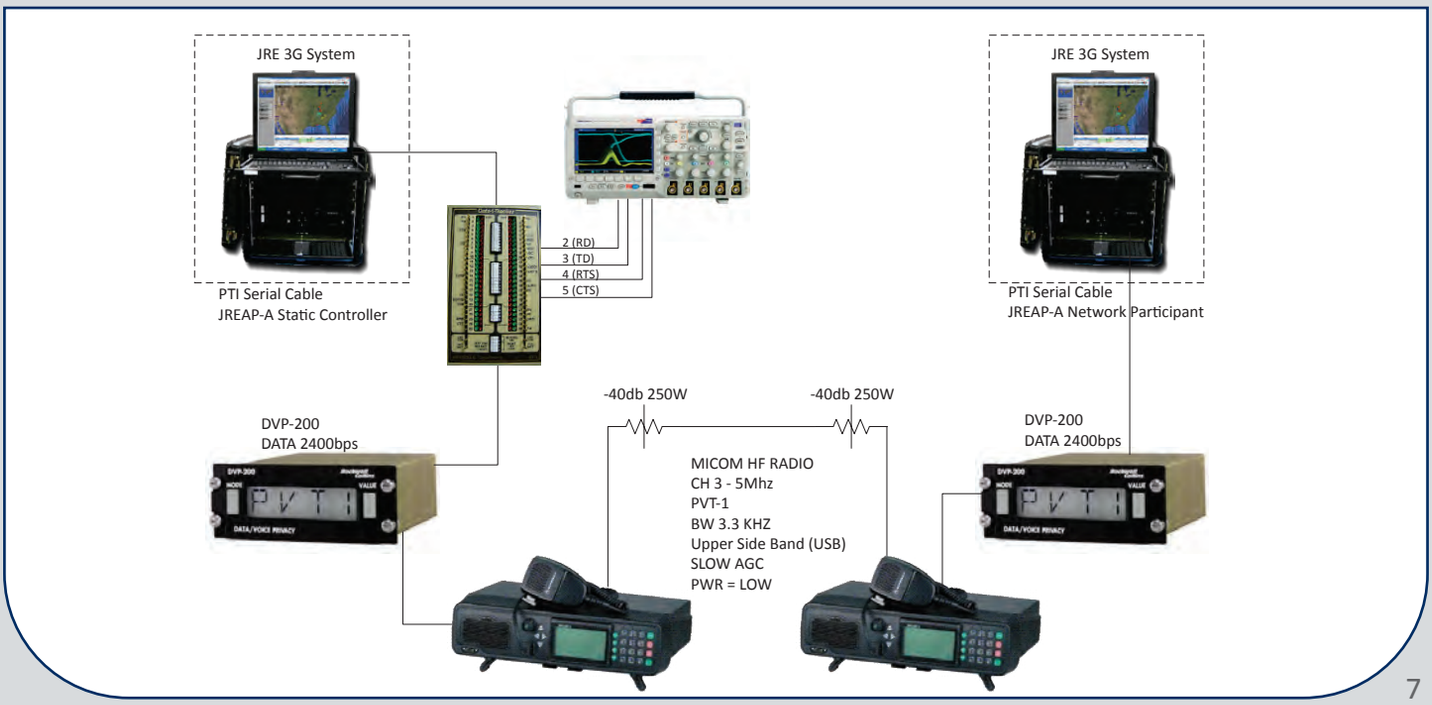


DIGINEXT
be visionary

From Live to Live Virtual Constructive Training

Introduction

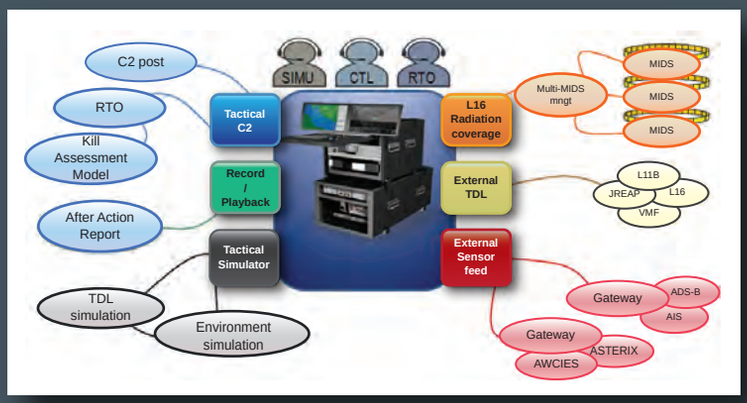
French DGA (Direction Générale de l'Armement) has launched a specific contract in order to equip the three armed forces with a Link 16 training tool. The goal is to use Link 16 and Simulation to train operators in a live environment.

French forces have defined the main objectives of this kind of system:

- Take into account the constant growth of TADIL J* fitted weapons systems and the fact that Link 16 is mandatory for modern warfare operations:
  - Enhance the Link 16 knowledge for operators (pilots and controllers)
  - Enhance the Standard Operating Procedures within forces and in Joint Operations
- Train daily using a dedicated training system designed for all forces:
  - Budget cuts should not have any impact on the training level
  - Train pilots and fighter controllers in A/A and S/A scenarios
  - 5 systems to be delivered - (3 Air Force, 1 Army, 1 Navy)
  - Single Force or Joint Force training or exercise support
  - Scalable scenarios to reach according to educational purposes
- Flexibility and scalability:
  - 3 different combat areas and ranges in France
  - Up to 3 communities during the exercise:
    Blue
    Red
    White (ExDir)

French forces have also defined their 8 major requirements for the system:

1. Real and simulated tactical situation elaboration in 1, 2 or 3 combat areas
2. Link 16 radiation covering large training ranges based on multiple MIDS systems
3. Mission's Command & Control for red, blue and white forces
4. Real-time Kill Assessment
5. Exercise record and replay
6. Distant site situation display and debriefing
7. External simulators, systems and TDL training systems
8. MIDS digital voice



This system has 3 levels of capabilities, Live, Virtual and Constructive (LVC), to answer the 8 major requirements of French forces.

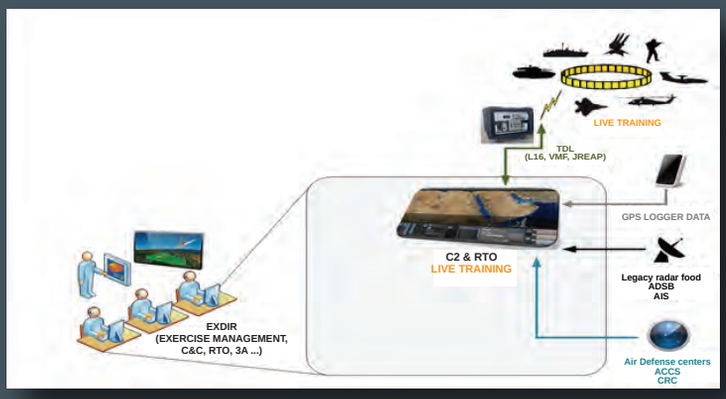
*For non-US users Tactical Digital Information Link TADIL J is Link 16

The "Live" Level

The Link 16 Training System is connected to different "Live" equipment:

- Multi-MIDS management to radiate Link 16 over a large training area
- Legacy radar feed, ADSB and AIS receiver
- Connection to CRC and ACCS systems (when in place for the second one)
- GPS Logger data for Non-Link 16 equipment. The position of this equipment will be added in the debrief system

The goal of this level is to have live training with real systems. The EXDIR is composed of an Exercise Manager, a Command & Control Operator and a Range Training Officer.



The "Constructive" Level

The Constructive level is based upon our realistic forces simulator, Direct CGF, enhanced by our TDL simulator, TactX, to produce Data Link Messages to complete the Live Data Link picture.

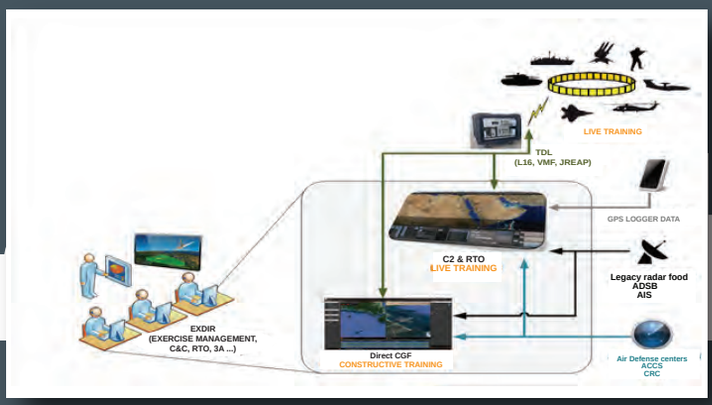
The information that we can produce with the "Constructive" Level is:

- Hostile Target generation
- Specific platform simulation
- Generic Units' simulation
- SAM site

With our tools, TactX and Direct CGF, we are able to generate a realistic kinematic for a specific track in function of the capabilities of the simulated platform. On this kinematic, we are able to attach a Data Link Processor (DLP) to generate Link 16 messages to the Live Network. On receipt of a specific message from the Live Network, we generate an equivalent message on the Simulation side for Direct CGF which interprets the message and automatically does the action of the message.

For example, on receipt of the J12.0 MAD Engage, the simulated NC2 unit takes into account the message, goes to the Target (contained in the Mission Assignment Discrete message) and performs the order. Once the mission is terminated, the simulated unit goes back to the previous pattern.

The Constructive Level is also another way to train operators on real systems. Inside Direct CGF, we take into account the position of real systems and we add onto it a simulated sensor that detects simulated tracks. At the end, TactX sends the entire simulated picture to the Live Network to train operators together. The idea behind that is to train the operator when it's not possible to switch on radars and detectors.



The "Virtual" Level

The Virtual Level is done by coupling Tactical Part Task Trainers (PTT), for virtual training, to the live training.

Our tool provides Data Link messages to PTTs to stimulate their DLP and we also generate simulation data from Live Data Link messages to stimulate radar feeds. So, operators in the PTT operate as if they were in the real world and they can train themselves with real systems. The Virtual Level also reduces the cost of the training. For example, in this case, we can train a real frigate on shore connected to simulated Anti-Submarine Warfare helicopter and simulated fighters. These three platforms can not be co-localized physically but can be co-localized by simulation. Of course virtual training doesn't replace live training. Pilots and operators need live training, but when forecast weather conditions or technical maintenance means that aircrafts or helicopters are grounded, pilots and operators can use Virtual Level to continue the training for specific missions.

Another part of the Virtual Level is the Proof of Concept. It is possible to design what a system needs for a mission easily in term of functions, messages, detectors, reflectors, armaments, etc. In other terms, we can develop a prototype for a new operational system and test it with real systems and check the reaction of all systems. The goal, of course, is to reduce the cost of the development of a new system. When everything is fine between the simulated system and the real system, then we can ask industry to develop the real one.

But what about the Data Link for this case? We can imagine simulated Data Link messages or protocol, not based on STANAGs or MIL-STDs, but based on Data Link functions and not attached to a specific protocol like L16 or L11. These messages must be as generic as possible. The idea is not to include in this protocol the complexity of the STANAG in terms of recurrence rate, acknowledgment, message structure, Lower Significant Bit, etc. If we realize this kind of protocol and if we are able to normalize it, it will be possible for anybody to connect their own PTT together for test purposes. And what about connection to a live network in that case? We only need a gateway that contains the specification of the Data Link to manage and generate what is needed to have a connection to a L16 MIDS terminal, a L11 DTS or a L22 SNC.

Conclusion

Live training is a necessary and inescapable step for the preparation of units - and simulation will never replace the real world situations. Besides, the development of the data link integrated in the weapon systems requires the players to be also trained to act and respond through these new real-time exchanges.

The Constructive part gives the capabilities to extend red and blue situations, also to create events difficult to produce in live activities (for instance massive air raid, non-available assets or weapons) and to add threats directed by artificial intelligence.

The Virtual part permits not only to train real people operating Part Task Trainers of any kind (JTAC, AOC, GBAD, MBT etc.), but also to have a human in the loop in order to offer a more realistic opposition to cope with the lack of inventiveness of Artificial Intelligence. This is particularly interesting to train people on symmetrical conflicts.

The diversity of the technical environment required by an LVC system allows us to consider a simultaneous training of different user levels, not only pilots, but also airborne and ground controllers. It will give them the capability to enhance the efficiency of their exchanges for command and coordination activities, as today operations cannot be conducted without real-time data links.

- Laurent Mounet
TDL Engineer
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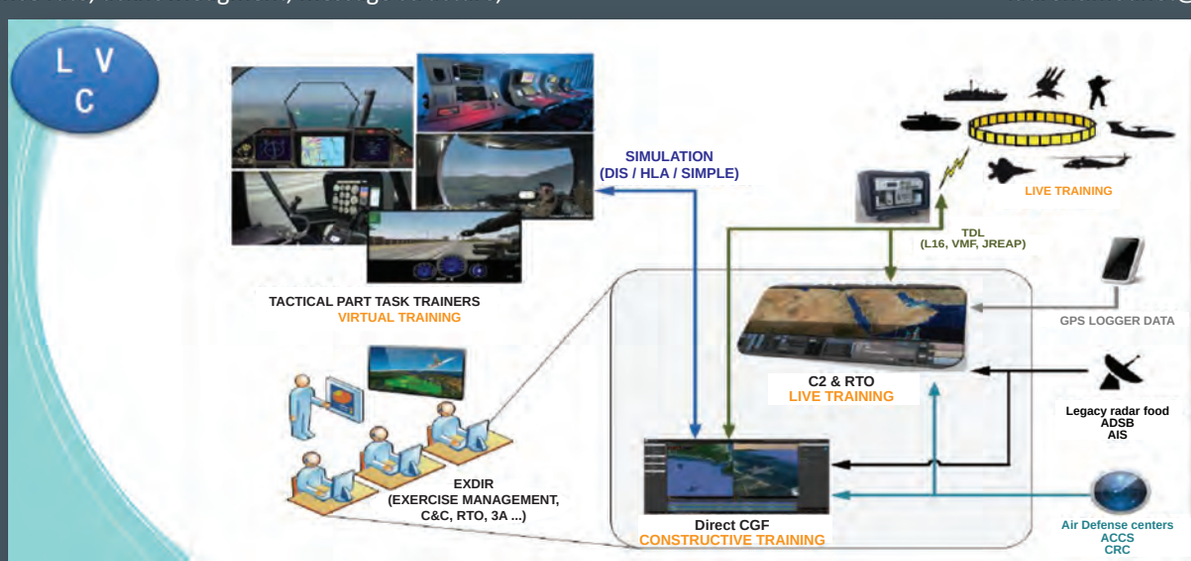


Synthetic Training for Sea King


Photo courtesy of Lt Cdr Richard Lewis QVRM MCGI RNR

Synthetic training for the Sea King Airborne Surveillance and Control (SKASaC) of 849 Naval Air Squadron (NAS) took a quantum leap during May this year as the squadron participated in a ground-breaking training event.

The exercise, Virtual Fury, was facilitated by the defence training company Inzpire utilising a temporary data connection between the Air Battlespace Training Centre (ABTC), RAF Waddington and the Maritime Composite Training System (MCTS), HMS Collingwood.

The main objective of the exercise was to provide vital pre-deployment training to HMS DEFENDER - a Type 45 Air Defence Destroyer.

Virtual Fury delivered team and collective training simultaneously to crews from Typhoon, Tornado GR-4, Sentry E-3D, HMS Defender and, for the very first time, crews from SKASaC.

The exercise provided exposure to complex, real world Air, Land and Maritime challenges that cannot be achieved in the 'live flying' environment.

Historically, the SKASaC crews maintained their air defence training currency during periods of sea training on the Illustrious class aircraft carriers in which they would embark for exercises with one of the Sea Harrier squadrons. However, since the withdrawal of the Harrier and the retirement of the CVS class carriers, the opportunities for high quality training with modern smart fighter aircraft are rare.

"Whilst the future looks brighter with the Queen Elizabeth carriers and F-35 Lightning II Joint Strike Fighters (JSF) coming into service in the early 2020s, budgetary pressures will no doubt see an increase in the demand for realistic and cost effective synthetic training."

It has long been an aspiration for 849 NAS to participate in federated training such as Virtual Fury. Since being involved in data link trials such as the F-35 UK Interoperability (IO) Trials Programme where the SKASaC Full Mission Trainer (FMT) has been linked via the Joint Multi-National Interoperability Assurance Network (JMNIAN) and the Multi-Link Test Facility (MLTF) to other off-site simulators, the potential for federated training has been identified by the aircrew participating in the trials.

Whilst by definition the MLTF is a test facility and the JSF UK IO Trials Programme is a series of network test exercises, the fact that the SKASaC FMT is the interface means there will inevitably be a degree of training benefit to the aircrew operating the mission system.

Inspired by the training potential that the JSF UK IO Trials Programme had identified, 849 NAS was able to justify inclusion in Virtual Fury which led to the extremely successful training event.

Prior to the event there were concerns that the FMT may have compatibility or other technical issues with either the ABTC or MCTS; indeed there were minor software updates identified and implemented prior to the event.

The squadron also received superb support throughout the exercise from SyntheSys; the company's on-site engineer Mark Hudspeth providing real-time technical trouble-shooting throughout the exercise.

Having proved the FMT's technical capability and demonstrated the value of SKASaC as an asset in a complex multi-platform exercise, 849 NAS is looking forward to participating in the next Virtual Fury in 2017.

For the longer term when the SKASaC goes out of service in 2018 to be replaced by CROWSNEST - a suitably modified Merlin Helicopter; federated training will be a requirement of the associated mission training facility.

- Lt Cdr Richard Lewis
QVRM MCGI RNR

Modelling a Force to Support Interoperability -is it possible?

Military systems are complex things! Not only are individual combat system's equipment (e.g. radar) of varying size and complexity, but each platform system (e.g. Type 26 Frigate) brings much more complex systems equipment together.

Whilst the complexity of a platform is a huge problem to address, Tactical Data Links (TDLs) have increased the complexity problem still further as the resultant combination of platforms forms a joint (cross environment) force. This force is made up of an indeterminate number of individual and independent platform systems communicating and interoperating across a multitude of TDLs in real-time, near real-time and nonreal-time and via other means (e.g. voice, intelligence feeds, civilian data feeds etc.) (i.e. a System of Systems (SoS)).

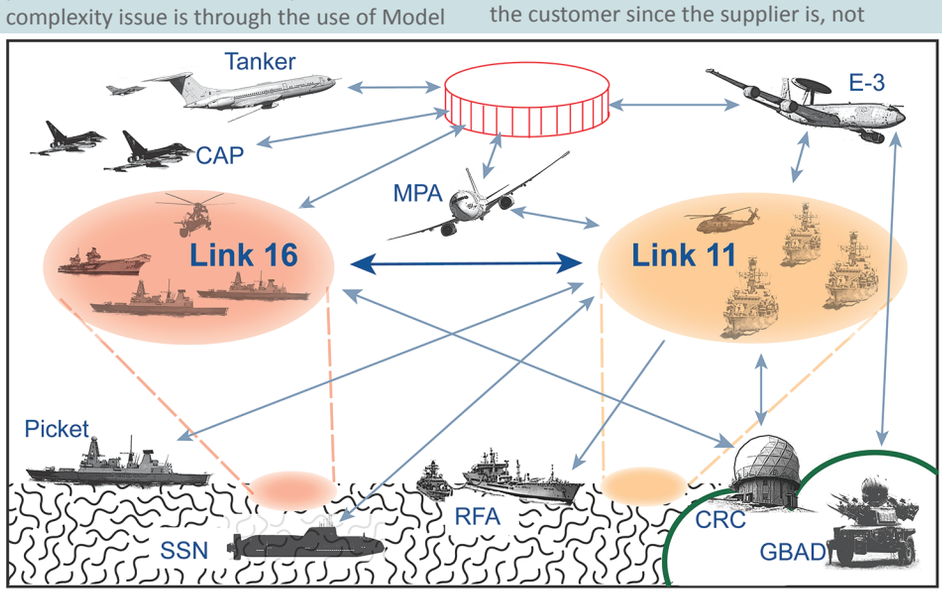
Thus, when considering the requirements for a new platform, you must consider not just the roles that you want the platform itself to perform, but also how you want it to operate with other platforms. For the Queen Elizabeth Class (QEC) aircraft carrier, this included other naval vessels, its own air group and land based aircraft, whilst noting that other naval vessels and fighter controllers also had to interoperate with the QEC's air group. Older in-service legacy platforms such as the Tornado had to be accommodated, whilst new developments such as Typhoon (now in-service) and Lightning II (in development) had also to be considered, or prioritised, as the primary aircraft with which QEC will ultimately operate. The TDL fit for these platforms are thus either out of date, evolving or still in development (not tested in anger) which adds to the Interoperability (IO) problem.

The way in which the supplier of the Combat System (CS) on both the QEC and Type 26 platforms has addressed the platform complexity issue is through the use of Model Based Systems Engineering (MBSE) using an approach and methodology based on the Ministry of Defence Architecture Framework (MODAF). By modelling both the operational aspects of the platform CS and the systems aspects (including system interactions), it was possible to manage the complexity problem. This modelling approach also enabled aspects of platform and system testing to be 'left shifted' (i.e. to occur earlier in the lifecycle). Since problems found earlier in the lifecycle are cheaper to fix, this provided cost saving benefits to the programme. One way of achieving this was through prototyping and simulation of systems and their interactions in advance of their full development.

Testing and accepting a system at the platform level alone does not test that the platform will be interoperable, as the supplier will test to the platform's defined external interfaces which do not match those in other platforms that have different message and standards implementations. In addition, the behaviour of bespoke message processing implementations per platform in handling non-deterministic message sequences leads to unexpected events arising from the platform interactions.

Testing of IO between platforms has traditionally occurred during operational use of the platform (i.e. far too late) and whilst there are paper-based IO assessments that are completed earlier, these are platform and standards focused rather than force focused. An extension of these paper-based methods using System Process for Interoperability Requirement and Implementation Testing (SPIRIT), which models the standards against which systems are implemented, is an improvement, but this is still not modelling the force as a whole.

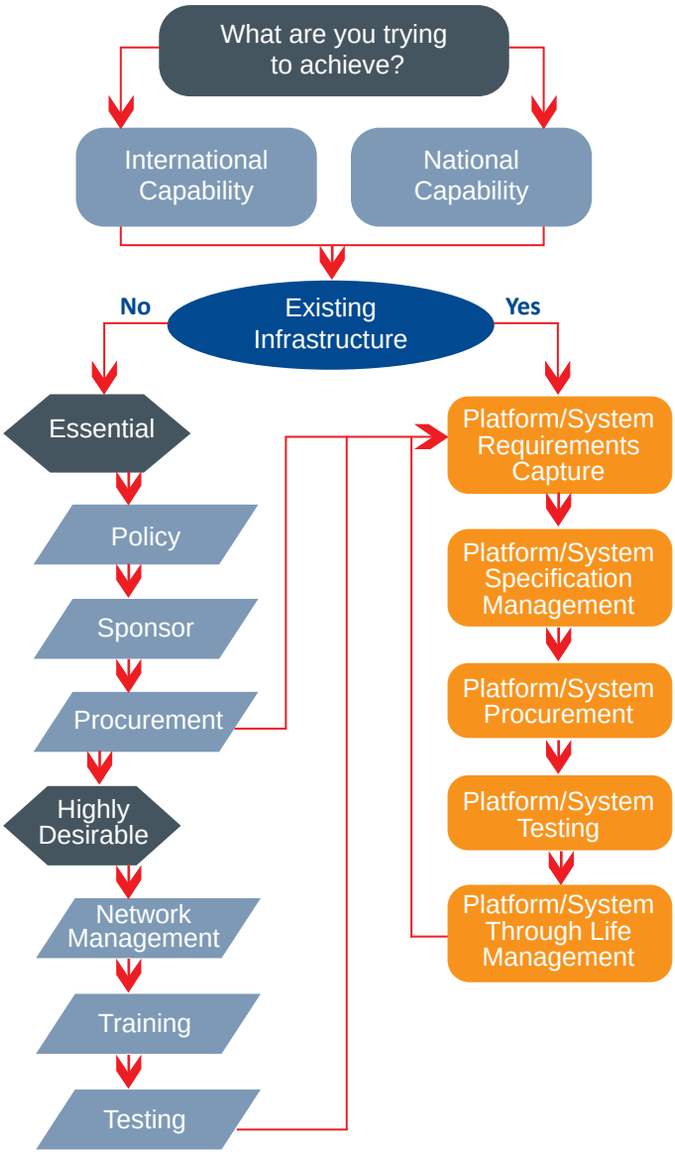
A key issue is the ownership of the IO problem. For a platform, this remains with the customer since the supplier is, not unreasonably, unwilling to take this on. However, no one owns the problem of IO at a force level. How then is IO testing handled today? In the UK, there is the Multi-Link Test Facility (MLTF) which provides a network to interconnect individual platform rigs that interact within a simulated real world scenario. MLTF can also be networked into wider NATO and Coalition simulation and training facilities. However, MLTF testing still occurs at the tail end of a platform's lifecycle, as the rigs are only produced to aid the integration and test of completed subsystems prior to being fitted to the platform. Earlier in the platform lifecycle, some paper based IO testing does occur which can reduce the scope of some of the live/rig testing. There has also been the occasional case where prototypes or early system models have been connected together (cf. QEC and Lightning II) using MLTF and this would be worth extending wider. MLTF is also specified to use a set of fixed platforms and thus doesn't fully address the wider force issue.



A force is not a fixed entity. It can change for every operation and even within an operation. Furthermore, all platforms within the force are subject to change (there is no common reference). The only way to manage this is to model a force as an entity in itself. Realistically, this is impractical/impossible to do for all possible platforms, but may be practical/possible to achieve if restricted to, say, UK platforms (i.e. turning the current UK Interoperability Matrix into a formal model and making it *force* focused rather than *platform* focused). This would be extending MBSE techniques into the force domain and treating the force as a system (rather than an SoS). In normal MBSE practice, consistency checking is used to identify and correct interface 'errors', in this case it could be used to identify potential IO issues between platforms. Note though that there is often no 'right answer' - changing an interface at one platform to enable better interoperation with another may simply create interoperability problems between that platform and one, or many, others. Thus the aim must be to achieve optimal interoperability rather than 100% interoperability.

The concept of modelling a force is highly complex and would take great skill and expertise, but the benefits in terms of IO could be significant. Additionally, if an overarching force model could be developed then a mechanism may be able to be provided whereby existing platform models could be integrated into it and new models be based and built upon it.

- Mike Wilson-Smith
Engineering Director



This simple guide to Implementing a TDL amplifies the flow chart, with BOLD TEXT referring to boxes in the flow chart.

A Guide to Choosing a Tactical Data Link (TDL) Capability

STEP 1: Answer this question: "What are you trying to achieve?"

Generally, the answer falls into one of two areas: you want to be able to interoperate with other nations [**International Capability**], or you have a national data link requirement [**National Capability**]. The difference is that for an **International Capability** you must conform to the rules laid down by the international TDL community; for a **National Capability** you can make up your own rules.

STEP 2: Answer this question: "Do you have an existing national TDL infrastructure capable of supporting your answer at Step 1?"

Some **Essential (E)** or **Highly Desirable (HD)** elements of a TDL infrastructure are: an organisation responsible for producing **Policies [E]** (to answer the question at Step 1 and to help in **Procurement** and **Requirements Capture**); a **Sponsor [E]** (an organisation responsible for equipment, personnel and training); an organisation responsible for **Procurement [E]** (whether international procurement through processes such as Foreign Military Sales {FMS} or national procurement); an organisation responsible for **Network Management [HD]** (network design, planning and management of in-use networks); an organisation capable of providing TDL **Training [HD]** (to users, maintainers, policy makers, procurement personnel, network managers); a **Testing** capability (to prove your implementation works both on paper and in use, both to the specification and with other systems {interoperability}). Without **Policy** there is a danger of **Procurement** purchasing the wrong equipment/capability. Without a **Sponsor** there may be no equipment or personnel to use the capability.

Procurement, even in a **National Capability** scenario, provides the required technical, financial and contractual skills to enable the purchasing of equipment and services. **Highly Desirable** elements can be out-sourced from other nations with similar TDL capabilities to those you are aspiring to implement.

Step 3: Deciding what capability you want and how to specify it.

There are two main steps to navigate now – **Platform/ System Requirements Capture** and **Platform/System Specification Management**.

Platform/System Requirements Capture deals with determining exactly what capability you want and why. To get this far you know: (1) what you are trying to achieve – **International** or **National Capability**; (2) what your national **Policy** says {for instance, you might only require a Digital Close Air Support capability or you may want an Air Surveillance and Weapons Management capability}. You are now faced with a number of questions: (1) what TDL and why; (2) what bearer system and why; (3) what information exchange and why – Information Exchange Requirements (IERs) or Services; (4) what interoperability partner systems {with whom do you want to exchange data and why}.

Question (1) should be put on hold until the end {see below for the reasons why) unless **Policy** states otherwise.

Question (2) may also be answered by **Policy** or **Sponsor**; you may want a Beyond Line of Sight (BLOS) capability, or you need the bearer waveform to be implemented into a software definable radio.

Question (3) answers come from **Policy**, **Sponsor** or most usually by user working group backed up by systems documents such as User Requirements, Systems Requirements and **Policy** documents such as Concept of Operations, Concept of Use and Concept of Employment.

Question (4) answers come from **Policy** or **Sponsor**.

The purist approach to **Requirements Capture** is to answer questions (3) and (4) above. At this point you have not specified which TDL. There are existing toolsets which can take your answers and tell that you need TDL A with messages A.1, A.2 and A.3 and TDL B with messages B.1 and B.5.

The more practical approach is to:

(1) Recognise that TDLs are optimised for different environments, functions and systems;

(2) Determine what services you want to receive and donate – choose from Position Reporting, Status Reporting, Surveillance, Weapons Control & Management, Electronic Warfare (EW), Network Management, Text/Voice, Imagery;

(3) Determine what environments you want to operate in – choose from Air, Surface, Subsurface, Land and Space.

Using either the purist or the practical approach great care should be taken to avoid the temptation to start by specifying specific TDL messages unless **Policy** dictates otherwise.

Platform/System Specification Management is the process by which the Requirements Capture results are measured against the TDL Standard to derive the exact message and processing requirements to be implemented.

For an **International Capability** you are constrained to implement the international agreed standards; unfortunately, these standards evolve over time on a regular update cycle and different platforms have implemented different versions of the standards. Hence the reason for determining, if possible, your interoperability partners. Toolsets exist to map the results of the **Requirements Capture** process to sections within the Standard; you just have to decide which version.

An internationally agreed process for maintaining system TDL specifications is iSMART and you couldn't go wrong to follow this process. In the iSMART process, the results of **Requirements Capture** are mapped to the Standard and a document called the Platform Requirements Specification (PRS) is generated as an exact subset of the Standard; in addition, a differences document – Platform Requirements Difference Document (PRDD) – captures the reasons why you have not implemented those parts of the Standard for which the **Requirements Capture** process has resulted in a "not required" result. iSMART also recognises that during the development of an implementation, things change – requirements may alter, cost issues may dictate a lesser capability, testing may result in a test failure which it is agreed not to fix – and therefore the PRS no longer reflect the implementation. An Actual Platform Implementation Specification (APIS) and its counterpart, the Platform Implementation Differences Document (PIDD), tracks the actual implementation throughout the life of the capability. These platform documents – APIS and PIDD – can be exchanged with other nations/systems as a means of informing others of your implementation – for interoperability, testing and operational reasons. Generally the toolsets used in the **Requirements Capture** and **Specification Management** processes support the generation, export and import and comparison of these platform documents.

For an **International Capability**, it is important to follow the spirit of the iSMART process and create exact subsets of the Standard and to avoid the temptation to alter, add to or otherwise change the requirements in the Standard. The chief reason is to ensure interoperability with other systems; if you implement Requirement A but you make changes to the Standard wording, then you have effectively implemented a different Requirement A than another platform. Testing is also impacted as test cases used by other platforms may have to be changed to reflect your different Requirement A; this will add to costs and timescales.

Step 4: Purchasing and testing your capability.

Platform/System Procurement is the process by which your **Procurement** organisation takes the results of the **Requirements Capture** and **Specification Management** process – the PRS and PRDD – and enables through suitable contractual mechanisms (international or national) the delivery of the stated capability. It is in this process that changes to the contractual requirement - PRS - may be made in conjunction with the **Sponsor** and relevant user stakeholders and result in the origination and maintenance of the APIS/PIDD. Both **Sponsor** and user involvement in this process is advisable, hence the need for suitable TDL **Training** of **Sponsor**, **Procurement** and users as Highly Desirable.

Platform/System Testing is the process by which the specified capability is tested for: (1) contractual acceptance; (2) standards compliance; (3) interoperability.

Contractual acceptance testing generally is the remit of **Procurement** and is aimed at proving that the contract has been met. Standards compliance testing and interoperability testing is aimed at proving that the requirements of **Policy** and **Sponsor** have been met, in that the delivered capability meets the users requirements, meets international (or national) standards and is operationally interoperable.

Both these two types of testing can originate as paper-based testing before moving to rig-based and finally "live" testing. Assuming the rigorous generation and maintenance of the PRS/APIS (in that both documents are exact sub-sets of the Standard) rig-based standards compliance testing can use test cases common to other platforms/systems, thus saving both on costs and time but also adding to a degree of interoperability assurance. Interoperability testing is aimed at demonstrating the operational effectiveness of the capability when operating with other nations/systems/ platforms.

Interoperability testing can be conducted as Wide Area Network (WAN)-based rig testing (existing international TDL interoperability testing capabilities are in current use) or as a "live" exercise; the cost of "live" testing and the difficulties in replicating fault conditions are a driving factor behind the need for standards compliance in both specification and manufacture.

Platform/System Testing at the rig and "live" stages can be supported by platform TDL data recording. It is desirable that **Policy** addresses the need for a platform TDL data recording capability.

Step 5: Maintaining your capability.

Platform/System Through Life Management (TLM) is the process by which an implementation is supported from the initial stages of **Requirements Capture** through to its end of operational life.

TLM of a TDL implementation addresses the need to evolve the implementation to meet changes in the Standard, changes to requirements and changes to interoperability partner platform/system implementations. **TLM** is aided by the adoption of the iSMART, or similar, process and especially by the maintenance of the APIS/PIDD. **TLM** in an **International Capability** implementation can also involve attendance and support to a number of international TDL forums and meetings, some TDL specific and some more wide-ranging.

Both **Policy** and **Training** have a role to play in a nation's /system's participation in the wider TDL community.

- David Clarke
Technical Manager

The Defence Community Portal is coming!

We are inviting members of the Tactical Data Link and wider defence community to register interest for our new Defence Community Portal.

The new online portal gives you secure, easy access to useful tools and information aimed at both the Tactical Data Link and wider defence community.

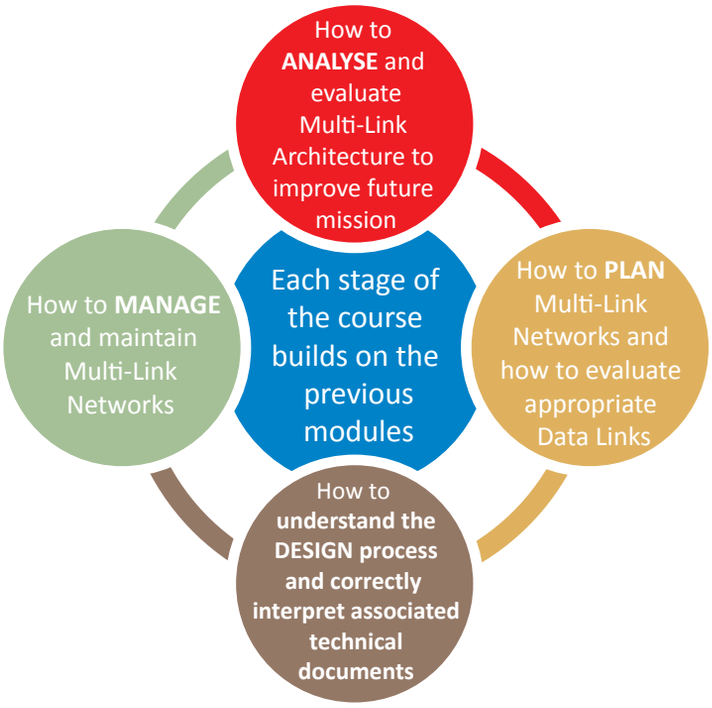
Customers and colleagues will have FREE access to the portal which includes:

- Free access to downloadable technical articles and white papers;
- An open Community Forum where you can share your opinions and ask questions;
- Unlimited subscription to TDL Technology Magazine.

To register for the Community Portal visit:
http://www.tdl-technology.com/community-portal

Meet Us At

Date	Event	Location	Further Information
27 September	IBM Systems & Software Symposium	Old Trafford, UK	Leading speakers
1-4 November	IDLS 2016	Maastricht, The Netherlands	This year's theme is 'enhancing the operational effectiveness of Multi-Link capabilities'
27-30 March	NTDLS 2017	Calpe, SPAIN	Dates for your diary



Data Link Manager / Interface Control Officer (DLM/ICO) Training

Learn how to plan, design, manage & analyse a multi-tactical data link network

Introduction

Designed to provide working knowledge to personnel whose role is to plan, build, manage, interact, develop and engage in multi-tactical data link architecture and operations

Who Benefits?

- Data Link Management Cell (DLMC) personnel, station or squadron TDL personnel
- Multi-TDL Network Designers
- Multi-TDL Planners
- Personnel involved with Multi-TDL evaluation
- Military persons involved in TDL procurements or TDL sustainment

Course Tools

Delivered by our highly knowledgeable instructors, who have recent real-world operational experience, the DLM/ICO course fuses extensive knowledge together with a toolkit of practical simulation platforms, paper based learning and in-use systems to instil this knowledge. These tools include Diginext Multi-Simulation System (TactX), Data Link Training Suite (DLTS) and Joint Range Extension (JRE) software

Learning Outcomes

Learn the fundamentals of a data link environment, details of various data links and how they work in isolation and how to improve future missions with multi-link architecture

To find out more visit - http://bit.ly/2dtz3oW

To attend a course - training@synthesys.co.uk

Training Schedule 2017

January 17-19	JTIDS/MIDS Link 16
January 23-27	Certified Systems Engineering Professional (CSEP)
February 20-March 10	Data Link Manager/Interface Control Officer
March 7-9	Link 22
March 22-31	Certified Systems Engineering Professional (CSEP)
April 3-7	VMF/CNR
July 18-20	JTIDS/MIDS Link 16
September 4-22	Data Link Manager/Interface Control Officer
October 3-5	Link 22
November 13-17	VMF/CNR

All the above courses will be held at Branston Hall Hotel, Lincoln, UK.

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

Customer Successes

Jan
Link 16 & Link 22 Training, QinetiQ.

Feb
15 Day DLM/CO Course, Royal Australian Navy, Canberra.

March
15 Day DLM/CO Course, Danish JDLOC, Karup - (students from Denmark, Netherlands, Czech Republic and Finland).

April
JRE/JREAP Training, DALO, Ballerup, DK. TN16: Training, Hook, UK - (students from UK, Switzerland and Finland).

June
15 Day DLM/CO Course CAOC Uedem, Germany - (students from NATO (CAOCs Uedem & Torrejon plus the DACCC), Czech Republic, Estonia, Latvia, Netherlands, USA, Germany and Norway).

July
JET Technical & Operational Training, Singapore.

JRE/JREAP Training, German Air Force, Berlin –in conjunction with Atheneen.

Introduction to TDL, ISTL, Portsdown, UK.

Hello and Welcome

Welcome to the first of what we intend to become a quarterly update on what's happening within the SyntheSys training group including customer successes, scheduled courses and other interesting news. Within this first edition, we give highlights from the first half of this year, with subsequent editions being published on a quarterly basis. We hope that you will find these newsletters both useful and informative.

UPCOMING COURSES

Data Link Manager/Interface Control Officer (DLM/ICO) Courses for 2016	Our popular Data Link Manager / Interface Control Officer course subscription continues to grow from strength tostrength. We have a further two scheduled courses to round off the year: the annual UK JDLMO event in September (fully subscribed); and at the Institute of Air Force Technology (AFIT) in Warsaw, Poland, in October (places still available).
Advanced Link 16	We are also providing a specialist Advanced Link 16 course in Sweden at the end of September.
Link 22 & VMF	In November, we return to AFIT in Poland for a week of Link 22 and VMF training. Places on these courses are open to non-Polish organisations, so why not join us?

Our Training Customer Satisfaction Results are in!

At SyntheSys, customer satisfaction is our number one priority. As part of our quality guarantee, we offer a no quibble, money back guarantee for all of our training events. Consequently, it is very important that we constantly track and monitor our customers' experience of our training courses. To facilitate this, we ask our customers to rate our training courses through the use of a simple feedback form.

This important information allows us to gain valuable insight into how we are doing; it specifies areas in which we can improve, and highlights how we can continue to build stronger business partnerships with our customers. This process also demonstrates compliance to our ISO9001 certification. We are delighted to share some of the highlights from our 2015 customer feedback.

Attendees from the CAOC Uedem Data Link Manager/Interface Control Officer Course - June 2016

TRAINING E-NEWSLETTER

SyntheSys

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.