Industry News & Events | TDL Integration | Useful Resources

TDL Technology

Published by SyntheSys for the Tactical Data Links Community

Issue 7
Autumn 2018

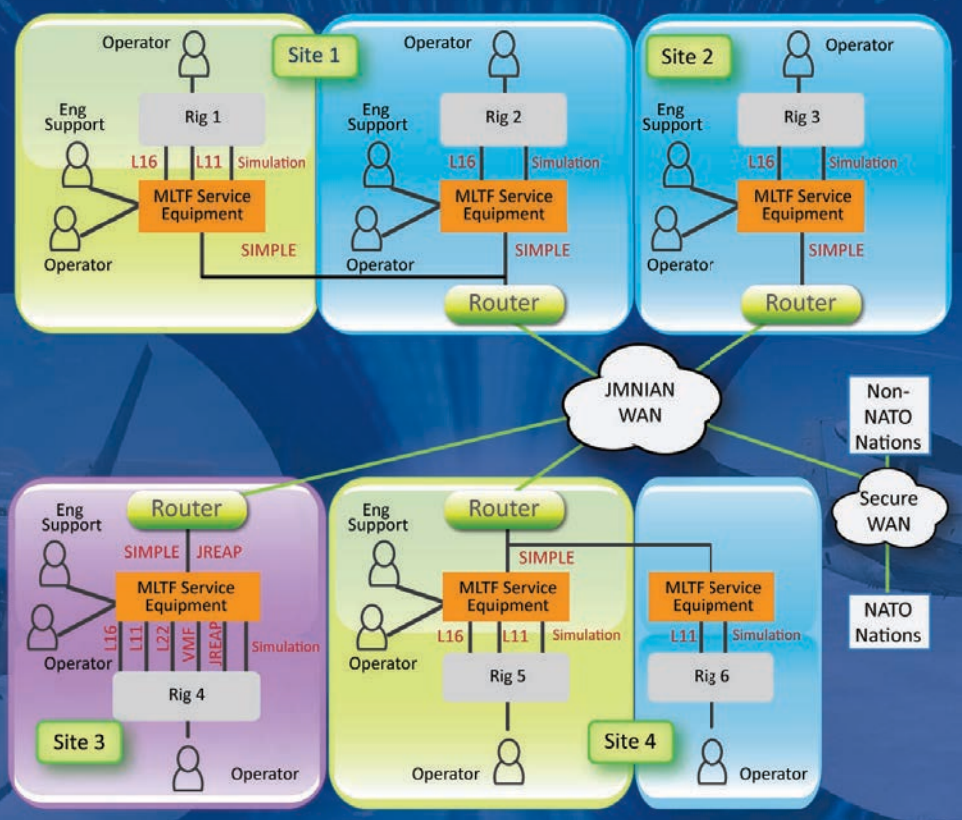
www.synthesys-defence.co.uk

SyntheSys

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.

SyntheSys DEFENCE

Letter from the MD

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SyntheSys

Seasons Greetings

Dr J S Hartas Managing Director

As Christmas 2018 approaches, and we look forward to spending time with loved ones, I'd like to build on the sentiment and remind readers what TDL Technology aims to achieve.

We commissioned the magazine in 2015 after recognising the global need for a platform to share best practices within the Tactical Data Link (TDL) arena. It's fair to say that the response to the magazine has been far greater than we could have ever foreseen, and we have thoroughly enjoyed working with the community over the past three years to circulate the publication.

For Issue 7, we felt a 'back to basics' issue would be of use, and our experts offer insight for those new to the TDL space, or those looking to expand their knowledge of wider supporting TDL systems (Page 7). We also offer a free Glossary of TDL Terms which we hope will prove to be a useful resource. See Page 15 for details.

"As we bring 2018 to a close, we reflect on a productive year here at SyntheSys. Our work within the TDL market continues to develop, and we have successfully served our global customer base with TDL Testing, Training and Interoperability management services."

As a wider business, our Systems Engineering business group has seen notable success during 2018, having secured contracts with major transportation players such as working on the UK's High Speed 2 (HS2) rail project and Transport for London (TfL). Moving on to SyntheSys Direct, the group continues to develop new and existing customer accounts and we have been involved in some interesting projects, where we have used IBM Watson Internet of Things (IBM Watson IoT ™) tools to create efficiencies within manufacturing and engineering organisations. Finally, SyntheSys Software continues to develop bespoke software solutions for customers. Of significance is a contract with EUROCONTROL and we continue our involvement with The Met Office.

We thank all our Customers for their loyalty during 2018, and we look forward to a successful 2019.

Very best wishes for the festive season.

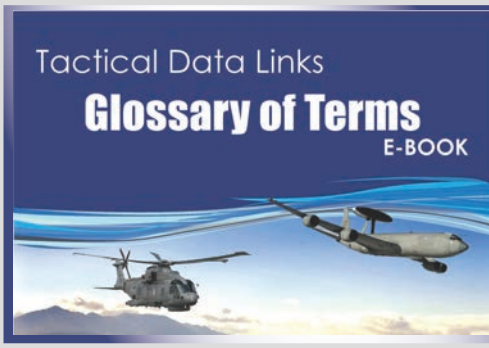
John S Hartas

Contents

News & Industry Events

Technical Knowledge Bank

Best Practices



SyntheSys News

SyntheSys' Flying the 'STEM' Flag by Sponsoring the 'S Prize'

Science, Technology, Engineering and Mathematics (STEM) subjects provide the foundations of future innovation. Engaging young people to become inspired by these subjects and developing the talents that are needed, are key to ensuring a thriving knowledge-based economy as part of our country's place in future, global markets.

SyntheSys has been playing its part in contributing to STEM initiatives with the Whitby-based firm's Managing Director, John Hartas, recently getting involved in a dynamic initiative at a local school.

John, who is a STEM Ambassador (www.stem.org.uk), was thrilled to initiate Caedmon College's 'S Prize'. Youngsters from the college battled for the prize, amazing everyone with their extensive knowledge of subjects ranging from how plastic in the ocean affects marine life, to mysterious Dark Matter.

John said: "The submissions we received were as documents, PowerPoint presentations, a model of a volcano (that actually erupted), and a computer game. All the submissions were of a really high standard and the judges were greatly impressed."

The winner of the Key Stage 3 prize was a joint team formed by Joshua Harland and Connor Betts. Their submission was on the Life Cycle of a Star and included a computer game they invented.

The Key Stage 4 prize went to Rebecca Morgan for her submission in the style of a scientific paper on Dark Matter. Rebecca said her project overall was based on the questions and confusion about Dark Matter which, in her opinion, is one of the biggest mysteries in any modern day scientific field. She said: "I was inspired to write about this topic as no one truly knows what Dark Matter is yet, so I decided that since it is going to be one of the most talked about topics in science for many decades to come, I would want to be informed of potentially one of the biggest scientific breakthroughs of the century."

The prize for Key Stage 5 was won by Emma Sharpe for her submission on the effects of plastic pollution on our oceans. Emma said that taking part in this project had inspired her to be more conscientious about recycling, and in future, she hopes to take part in activities such as beach cleans in order to help keep our oceans free of plastic.

G-Cloud 10 Success

SyntheSys is thrilled to have been accepted onto the Government's Digital Marketplace updated 'G-Cloud 10' Supplier List

Crown Commercial Service Supplier

We are delighted to announce that we have been accepted for inclusion onto the G-Cloud supplier list in all three categories: Cloud Hosting; Cloud Software and Cloud Support. G-Cloud 10 replaces the G-Cloud 9 services.

The United Kingdom (UK) Government G-Cloud is an initiative targeted at easing procurement by departments of UK public-sector bodies.

Only suppliers who meet a set minimum standard are considered for a place on the G-Cloud 10 framework agreement.

G-Cloud provides a mechanism for clients to access our leading software and systems engineering solutions through our cloudbaSE product, with associated technical support and training from our team.

For some years it has been impossible to ignore the increasing presence of 'The Cloud'. Our 'Engineering Development and The Cloud' article considers the merits of using Cloud Computing as a means to execute software and systems engineering projects in a global 24/7 environment. To read the article visit https://bit.ly/2DBJzX5

To find out more about our Government G-Cloud involvement, or to speak to us about your cloud hosting, software or support requirements, contact: info@synthesys.co.uk.

Commemorate, Celebrate, Inspire…

*April 1 1918 witnessed the formation of the Royal Air Force (RAF), the world's first independent Air Force. The enduring theme for the RAF100 celebrations has been to **Commemorate** the service and sacrifices of the past century, **Celebrate** the highly capable Force of today and **Inspire** the next generation of RAF personnel.*

SyntheSys supports the Armed Forces in many ways and following 25 years of regular service, SyntheSys expert Kate Chandler has been honoured, as a Royal Air Force Reservist, to play a part in a range of events marking the RAF Centenary in Wales as part of the RAF100 Wales contingent.

In February the RAF100 Wales team supported the launch of the RAF Youth and STEM (Science, Technology, Engineering and Mathematics) programme at the National Museum, Cardiff. This aims to engage children from eight to fifteen in the subjects and address a skills shortage. The day saw over 300 schoolchildren building rocket cars, computer coding, riveting aircraft and making balloons to safely deliver eggs from a balcony 15 metres above the museum's marble floor (without breaking!).

In early April a National Service of Celebration to mark the Centenary of the RAF was held in St Mary's Church, Swansea. Following the service, attended by Alun Cairns, Secretary of State for Wales, senior RAF Officers, local dignitaries and veterans, more than 450 RAF personnel, paraded through Swansea. The parade was comprised of the Band of the RAF College Cranwell, the Queen's Colour Squadron from RAF Northolt, Number 4 School of Technical Training from Ministry of Defence (MOD) St Athan and RAF Air Cadets from across South Wales.

During May, Cardiff City Hall hosted the first leg of the RAF100 Aircraft Tour, which saw aircraft spanning the hundred years of the RAF on public display, including a First World War Sopwith Snipe, a Spitfire and a Typhoon fighter. There were performances by the RAF Central Band and Queen's Colour Squadron and a flypast by the World War II Lancaster bomber from the Battle of Britain Memorial Flight prior to a Gala Dinner in Cardiff City Hall to raise funds for the RAF100 appeal.

In June Mrs Chandler organised the visit of Air Chief Marshal Sir Stephen Hillier, the Chief of the Air Staff, to the National Assembly for Wales.

Carwyn Jones, the First Minister of Wales, Welsh Government Assembly Members and guests enjoyed an RAF100 Wales themed presentation by Air Cadets from No. 948 (Haverfordwest and City of St David's) Squadron. RAF personnel manned stands representing various activities.

The Royal Welsh Show in Llanelwedd in July was attended by more than 250,000 visitors. The RAF again had a large presence with parachute displays, flypasts, static replica aircraft and an RAF 'village'. During the event Mrs Chandler met up with SyntheSys colleagues who were providing IT support at the event.

RAF Locking Reunion: A pleasant surprise and a BIG success!

Hundreds of people gathered at Weston-Super-Mare to celebrate the 100th anniversary of the RAF over the Easter weekend.

One of those who attended was SyntheSys Programme Director, Mark Hudspeth.

The event was organised by ex-RAF Locking student, Dale Egleton, who served at RAF Locking.

What started out as a "beer call" with the expectation of less than one hundred people attending, swiftly, by the power of Facebook, became a huge event with 700 attendees. It may have been bigger but the venue couldn't take any more!

Personnel who trained at RAF Locking, the home of No.1 Radio School, held a packed celebration party at Weston Football Club to catch up with old friends and reminisce.

Mark said: "It was a great event, and it was fantastic to meet up with people I trained and served with over 20 years ago. People flew in from all over the world, including some who hadn't seen each other for nearly 40 years. I hear moves are afoot to make it an annual event, although I am not convinced my body could tolerate that every year!"

A parade and church service were also held in Weston on the Saturday of the event, followed by a barbecue at the Royal Air Forces Association (RAFA) Club.

Demystifying Tactical Data Links (TDLs)

Why do we need digital tactical communications systems?

Digital tactical communications, their associated technologies and their applications are as deep and complex as they are diverse. There are very few, if any of us, that understand them in their entirety. This is the first in a series of articles that aims to cast a light over the entire range of technologies and applications, providing an insight into some of those areas that we often 'gloss over'. This, our first article, introduces digital tactical communications systems. Perhaps the question most obvious to ask first is why do we need digital tactical communications systems?

Why?

We have all seen those World War II films where fighters communicate with each other with cut-glass accents over a clear radio circuit. In reality, communications across the HF and VHF bands (see figure below) were often unintelligible.

International Telecommunications Union Frequency Bands

Band Name	Abbreviation	Frequency
Extremely Low Frequency	ELF	3-30 Hz
Super Low Frequency	SLF	30-300 Hz
Ultra Low Frequency	ULF	300-3,000 Hz
Very Low Frequency	VLF	3-30 kHz
Low Frequency	LF	30-300 kHz
Medium Frequency	MF	300-3,000 kHz
High Frequency	HF	3-30 MHz
Very High Frequency	VHF	30-300 MHz
Ultra High Frequency	UHF	300-3,000 MHz
Super High Frequency	SHF	3-30 GHz
Extremely High Frequency	EHF	30-300 GHz
Tremendously High Frequency	THF	300-3,000 GHz

This could be due to radio propagation effects, or simply down to differences in pronunciation. That is why code words were developed for clarity and why the phonetic alphabet was invented.

The need for code and phonetic pronunciation meant that the speed of exchange of information was very slow – even a good operator struggled to pass more than ten tracks per minute!

As if this wasn't enough, adversaries could tune-in to each other's messages and then jam them by transmitting noises over them or even pass false messages.

All these factors contributed to the information being received by the end user being of variable quality, timeliness and accuracy, leading to a very confused picture. Digital tactical communications systems overcome most of these deficiencies with high data rate, high security, resistance to jamming and timeliness.

WHAT IS MEANT BY DIGITAL?

In the context of the communications systems described in this article, the term digital means that data are expressed as a series of binary digits (0 or 1).

WHAT IS A TRACK?

Search radars are designed to scan systematically a volume of space on a periodic basis. The measured position of a detected object is referred to as a plot. A track is the sequence of plots made during successive scans that are relevant to the same moving target.

WHAT IS A MODEM?

A modem (a contraction of modulator-demodulator) is a hardware device that converts data so that it can be transmitted from computer to computer over some medium.

Components

All digital tactical communications systems have similar components, consisting of:

a. A data source. This could be a sensor system such as a radar, but it could also be a human operator entering command and control directions or manual observations.

b. A Data Processing and Display System. When transmitting, this collects coordinate information from the data source(s) and makes sure that it meets criteria for release to the tactical communications network. When receiving, this stores the received information in local databases for use by other integrated systems. It is likely that it will have a user interface from which the parameters of the tactical communications system can be controlled.

c. Cryptographic system (optional). The cryptographic system encodes the data that is being transmitted and, in some cases, also introduces pseudo-random transmission characteristics (such as frequency hopping) to improve resistance to jamming.

d. Communications system. For radio frequency systems, this typically consists of a modem, a radio transceiver, and an antenna. Land line systems obviously don't need the radio transceiver and the antenna.

e. Message set. Current digital tactical communications systems that exchange parametric data utilise a set of messages that have a pre-defined format.

Connectivity

Digital tactical communication systems might support:

- Single direction data transfer (simplex)
- Two-way data transfer, but transfer in only one direction at any time (semi-duplex)
- Simultaneous two-way data exchange (duplex)

Three basic types of connectivity are used:

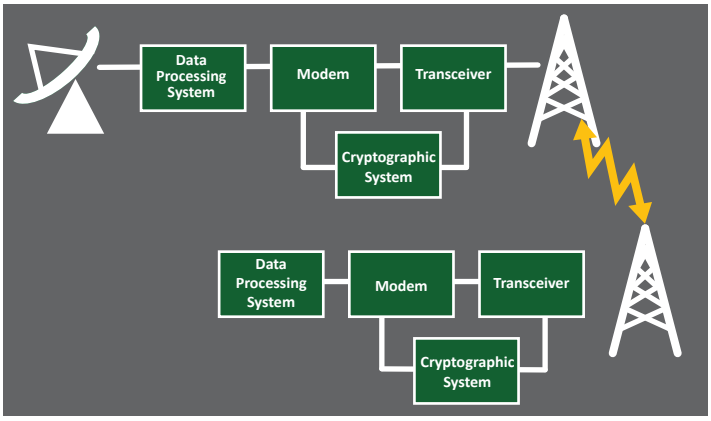
- **Point-to-point.** A dedicated link between a pair of units, normally only issued between fixed Command and Control (C2) posts, or from C2 posts to a missile command post.

- **Broadcast.** This is where one unit will transmit data to be received simultaneously by several participants. This is also, by definition, a simplex transmission since the data flow is in one direction only from the broadcasting unit to the recovery unit.

- **Networked.** This allows all units in the network to pass data to all other units. Each transmitting unit may transmit information to all other units on the network (that have the correct cryptographic keys), similar to a broadcast, or it might address information to a specific unit, similar to a point-to-point link.

Media

Land lines are used to support data transmissions between fixed ground sites. These can be dedicated copper cables, but more frequently are fibre optic. Most often though, they are part of a multi-route pocket switching network.



Satellite Communications (SATCOM) are being used increasingly to support tactical communications, especially with the introduction of man-portable systems that can find, connect and remain locked in to non-stationary satellites.

Radio is probably the most common medium used for tactical communications. Modern radios are reliable, portable, powerful and easily encrypted. Of the frequency bands defined by the International Telecommunications Union (ITU), military use tactical communications radios tend to operate in the range from HF to SHF, though some very low frequencies are used for submarine communications.

VHF, UHF, and SHF are limited to Line-of-Sight (LOS) and some of the higher frequencies have shorter ranges due to atmospheric water absorption. HF has a Beyond LOS (BLOS) capability, so it is usable over very long ranges or in mountainous terrain but is also susceptible to ionospheric effects.

Some Existing Tactical Communications Systems

NATO Link 1	**North Atlantic Treat Organisation (NATO) Link 1**. NATO Link 1 is possibly the oldest Tactical Data Link (TDL) in NATO use. It exchanges air tracks and basic TDL management messages and is used for wide area picture compilation between static sites in Europe. It can also be used to send the air picture to land based units such as Surface to Air Missile (SAM) sites and army C2 units. NATO Link 1 is included in the NATO Air Command and Control System (ACCS). Finally, NATO Link 1 connections now exist with many Partnership for Peace (PfP) nations such as Sweden and Finland for example.
Link 11	Link 11 passes air, surface and subsurface pictures between ground, airborne and maritime units. It was initially intended to provide picture compilation for naval units but has become the most widespread picture compilation TDL, being also found in missile systems such as Phased Array Tracking Radar to Intercept on Target (PATRIOT).
Link 16	The fully developed Joint Tactical Information Distribution System (JTIDS) based TDL, Link 16, passes air, space, surface, subsurface, ground picture, weapons control, C2 messages, Electronic Warfare (EW) information, imagery and TDL management messages between most tactical land, air and naval units. Having a very high degree of security and Electronic Counter Measures (ECM) resistance, it also offers embedded free text and secure voice capabilities. Multifunctional Information Distribution System (MIDS) is a more recent version of the JTIDS bearer system and is compatible with it.
S-Link 16	**Satellite Link 16**. S-Link 16 messages have been exchanged over SATCOM bearers for many years in order to overcome the LOS limitations of Link 16 Radio Frequency (RF) network. SATCOM allows Link 16 message to be exchanged over thousands of miles.
VMF	**Variable Message Format.** VMF has been created to provide for the United States (US) Army and Marine Corps requirement for a flexible system providing for Fire Control (FC) and Close Air Support (CAS) operations. VMF systems, unlike most other TDLs, are not bearer dependent. Information may be transferred over various mediums such as UHF, VHF or HF radio, SATCOM or over physical bearers such as copper wire or fibre optics.

Link 22	Link 22 was originally conceived as an upgraded Link 11, its primary aim being to resolve the deficiencies in ECM resistance suffered by Link 11. This new TDL was to be called NATO Improved Link Eleven (NILE). However, the advent of Link 16 demonstrated that Link 11's shortcomings were not restricted to ECM resistance. Link 11 is not, by modern standards, a fast TDL and the more units in a Link 11 net, the slower is the net cycle time. So, to resolve these problems, a new TDL was to be developed which would be called Link 22.
JTIDS/ MIDS	**Joint Tactical Information Distribution Systems (JTIDS) / Multifunctional Information Distribution Systems (MIDS), Interim JTIDS Message Specification (IJMS) & Link 16.** The JTIDS is a bearer structure which supports two message sets, IJMS and Link 16 J-Series. The two message sets are so closely integrated with the bearer that it is common to consider them as the same thing, so you will normally see them described as JTIDS/IJMS and as JTIDS/Link 16.
ATDL-1	**Army Tactical Data Link-1.** ATDL-1 is a secure, point-to-point, full duplex data link, utilising serial transmission frame characteristics and standard message formats. The link operates at the basic rate of 1200 bps, with an alternate rate of 600 bps, and also has optional rates of 2400 or 4800 bps.
EPLRS	**Enhanced Position Location Reporting System.** EPLRS is a secure, jam resistant, computer controlled communications network that distributes near real-time tactical information, generally integrated into radio sets. It is primarily used for data distribution and position location and reporting. It enhances command and control of tactical units by providing commanders with the location of friendly units.
SADL	**Situation Awareness Data Link.** SADL is installed on US Air Force F-16 and A-10 fighters and coordinates with EPLRS for ground support missions. Additionally, certain other units are able to operate as a gateway between Link 16 and SADL enabling specific exchange of Situational Awareness (SA).
MADL	**Multifunction Advanced Data Link.** MADL is a future data waveform to provide secure data-linking technology between 5th generation fighter aircraft. It is used by the F-35 to exchange data in close proximity with other F-35 aircraft. Unfortunately, the waveform that MADL utilises is incompatible with that used by the other 5th generation fighters such as the F-22 Raptors Intra Flight Data Link (IFDL).
IFDL	**Intra Flight Data Link.** Similar to MADL in that it supports the exchange of data and voice for 5th generation fighters but is limited to the F-22 Raptor. IFDL allows a group of F-22 aircraft to exchange information without the fear of detection.
CDL/TC-DL/HIDL	**Common Data Link (CDL) / Tactical Common Data Link (TCDL) / High Integrity Data Link (HIDL).** In 1991, the US Department of Defense (DoD) designated CDL as its data link standard for imagery and signal intelligence. CDL consists of a secure, jam resistant uplink operating at 200 kbps, and a downlink that can operate at 10.71 Mbps, 45 Mbps, 137 Mbps or 274 Mbps. Currently only the first of these downlink rates is secure.
AIS	**Automatic Identification System (AIS).** Not technically a TDL, AIS is an automatic tracking system used on ships and by Vessel Traffic Services (VTS) for identifying and locating vessels by electronically exchanging data with other nearby ships, AIS base stations, and satellites.
IBS	**Integrated Broadcast System.** IBS will replace the current family of UHF satellite intelligence broadcast systems, comprising Theatre Information Broadcast Service (TIBS), Tactical Reconnaissance Intelligence Exchange Service (TRIXS), Near Real-Time Tactical Dissemination System (NRTD) and Tactical Related Applications Broadcast System (TRAP) (which uses the TRAP Data Dissemination System (TDDS) and TADIXS-B broadcast systems). It will receive tactical intelligence information from national and theatre producers, and from tactical Intelligence, Surveillance, and Reconnaissance (ISR) systems, and disseminate tactical intelligence throughout the world via various communications paths (either directly or through a gateway).
ADS-B	**Automatic Dependent Survelliance - Broadcast.** This is a cooperative surveillance technology in which an aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked. The information can be received by air traffic control ground stations as a replacement for secondary radar.
TACFIRE	**Tactical Fire Control.** TACFIRE was developed as a computer system to conduct fire support operations. The system included central computer systems to analyse and process fire requests, as well as smaller hand-held devices to input messages and transmit over Combat Network Radios (CNRs) to higher echelons.
IDM	**Improved Data Modem.** Not a data link, the IDM is employed within many platforms to provide the digital/analogue interface between the platform host system and the radios. The IDM essentially implements the chosen waveform protocols and modulation schemes (typically MIL-STD-188-220 and some parts of MIL-STD-2045-47001) and may also host the TDL application i.e. VMF, Air Force Applications Program Development (AFAPD) etc. Albeit dependent on implementation, this may be resident within the platform host system.
SSSB	**Ship-Shore-Ship-Buffer.** SSSB is a NATO initiative to allow for the seamless exchange of data between fixed ground sites such as Control & Reporting Centres (CRC), with TDL equipped ships at sea. In particular, SSSB sites transmit this exchange of SA through Link 11 with surface units.

Today's Complex & Interwoven Multi-Link Environment

Tactical Data Links (TDLs) have been developed, purchased and brought into service in a piecemeal way and so there has, until recently, been no overall implementation plan to ensure interoperability of TDLs fitted to various platforms.

Consequently, many platforms have been fitted with more than one TDL so that they are able to operate with a range of other platforms.

The result is that it is very rare to operate only one TDL in one theatre of operations. Usually there are wide ranges of TDLs operating simultaneously and this can be a problem if it is not planned for very carefully.

Four-Dimensional Environment

In planning TDL operations it is essential to remember that the operation occurs in a four-dimensional environment. Rather than defining our space in terms of length, height and width, we should define a TDL operating volume in terms of range, area, altitude and time. Each of these dimensions must be considered in initial planning and during on-line management if successful connections are to be obtained.

Range

The range at which TDL operations are going to be carried out is one of the main factors in determining the type of TDLs which will be used and the media which must support them. For example, Line-of-Sight (LOS) ranges between surface units are very short, of the order of 30 nautical miles (NMI), so the use of an Ultra High Frequency (UHF) TDL such as a Link 16 Radio Frequency (RF) network is likely to cause connectivity problems between surface units which are unable to maintain LOS with each other. So, if we wish to establish and maintain TDL connectivity beyond LOS ranges, the use of a High Frequency (HF) or Satellite Communications (SATCOM) capable TDL or UHF relay will be essential.

Some TDLs have range limitations built-into their architecture. For example, the Multifunctional Information Distribution System (MIDS) is limited by its Time Division Multiple Access (TDMA) architecture to a maximum range of 500 NMI between communicating units.

Area

Whilst the range at which we wish to maintain connectivity may determine the type of TDLs we use, the area within which we want to maintain TDL coverage will often determine the TDL configuration. Ground-to-air information exchanges centred on a single fixed ground site might allow a TDL configuration with direct LOS UHF communications. However, if we wish to combine local connectivity with long range early warning of hostile targets we would be likely to use a combination of UHF and Joint Range Extension Application Protocol (JREAP) / SATCOM / HF TDLs, possibly with data being forwarded from one TDL into another.

Altitude

Clearly, the altitude of a transmitter or receiver has a significant influence on its LOS range - the higher it is (and the corresponding receiver / transmitter), the further is its LOS. For example, a TDL-equipped fighter, if sufficiently low, may suffer from terrain masking, which can interfere with air-to-air connectivity.

Time

The last of the four dimensions is time. TDLs often operate 24 hours a day and for some units, such as ground sites, or ships at sea, this is not a problem. However, aircraft fly sorties of limited duration and, where an airborne platform is an essential part of the TDL plan, that aircraft must be replaced or its duties passed to another unit.

Aspects to be Addressed

The Plan

The TDL plan is designed to meet the Commander's intentions. It must be flexible and adaptable, but its sole purpose is to enable the data and information flow required by the battle plan. Nevertheless, it is almost inevitable that the plan is a compromise between many priorities. The following are just a few of the aspects to be addressed:

TDL Assets Available

The first element of a plan is to assess the TDL capabilities of the platforms taking part in the operation. This will be done at the highest level – Link 11, Link 16, etc., but must also consider how the implementation of each TDL limits the capabilities of the platforms in question.

Geographical and Time Constraints

The location of platforms, operating areas, height/range relationships, LOS considerations and endurance of airborne platforms are all matters of importance which must be taken into account.

Task Allocation

TDL related tasks must be allocated to participating units, Data Network Control Station (DNCS) for Link 11, Network Time Reference (NTR) and Initial Entry JTIDS Unit (IEJU) for Link 16 networks and relay assignments. In addition, TDL functions such as management, surveillance areas and Weapons Control responsibilities must all be allocated to appropriate units.

Details

Detailed planning includes items such as allocation of Participating Unit (PU) / Joint Tactical Information Distribution System (JTIDS) Unit (PU / JU) Numbers, Track Number Assignments, Frequencies, crypto and the network design to be used.

Data Forwarding - Data Looping

Most current TDL scenarios involve the use of numerous data forwarders operating on a variety of TDLs. This can be a major problem for planners because of the high risk of data looping and this occurs when data from an originating unit goes out and then comes back to the same unit on another TDL after being forwarded. The result is a huge number of duplicate tracks and trying to sort out the real tracks from the 'looped' tracks ranges from being difficult to impossible! Careful planning can stop this from occurring, or at least minimise the instances of it.

Procedures

Having planned the operation, all participating units must be notified accurately and in good time of the details of the multi-link plan. This will normally be carried out via the Operational Tasking (OPTASK) Link. However, dissemination of Link 16 network design files is generally via email, while some nations may have a server / website where designs are stored and are available for download by the user.

In operation, single TDL system procedures will normally be in accordance with the relevant Allied Tactical Data Link Publication (ATDLP) if it is a NATO context, possibly modified by local or system specific procedures. Multi-TDL operations are described in ATDLP-7.33 and controlled by the Data Link Manager / Interface Control Officer (DLM / ICO). This function is known as the Joint Interface Control Officer (JICO) in the United States (US); with TDLs designed to operate in the Land environment almost exclusively there is often a Ground ICO (GICO) reporting to the JICO. This single point of control is essential if things are to progress smoothly and with minimal trouble.

In the last analysis, the ability of TDLs to meet the needs of operational commanders rests at least as much on the ability of the personnel charged with operating the systems as it does on the capability of the systems themselves.

'The first element of a plan is to assess the TDL capabilities of the platforms taking part in the operation. This will be done at the highest level – Link 11, Link 16, etc., but must also consider how the implementation of each TDL limits the capabilities of the platforms in question.'

Flying High – Shaping the Future of Drones in UK Cities

SyntheSys is delighted to have been involved in the high-profile development of the latest Industrial Strategy United Kingdom (UK) Research and Innovation Flying High Project and subsequent Nesta report. Urban drone operations from the provision of security and support for emergency services to 'last mile' mail and commercial deliveries are being developed throughout the world.

Thirty-nine cities are currently pioneering key research projects which, in turn, will influence global regulation and technologies for drone evolution from the research phase to real-time operations. The creation and application of new technologies allows shaping and influence of regulatory development and safety testing validation requirements during the crucial initial stages. Through a series of workshops designed to develop, challenge and explore the potential opportunities and ambitions for UK drone activities, the Nesta Flying High Project has been able to identify some of the key challenges that will impact commercial drone operations on a global scale.

Launched in late 2017 the Flying High Project has engaged with national government, cities, local authorities, industry and citizens to gauge public interest and potential acceptance of increased drone operations within UK airspace. To fully achieve the economic viability of drone operations at scale within increasingly congested and highly regulated airspace, subject matter experts were brought together to examine the feasibility of five UK cities and their proposals for incorporating drone operations. The five cities and regions featuring within the report (London, Bradford, Preston, West Midlands and Southampton) all have widely varied expectations for the potential opportunities and benefits that the incorporation of increased drone operations could deliver. Of note is that all five focus upon the potential of the perceived benefits of drone application for the direct benefit of public services, although the individual visions and focus for drone development within each environment differ markedly.

"The Nesta Flying High Project has been able to identify some of the key challenges that will impact commercial drone operations on a global scale"

Varying requirements are dependent upon the specific operating environment. Whether operating Beyond the Visual Line-of-Sight of the ground controller, considering autonomous operations or the introduction of precision flight parameters there are key areas that require extensive validation and testing; you can, after all, be precisely wrong. Extensive scoping of the public to identify the perceived level of acceptance has been an integral element of the initial methodology.

The Civil Aviation Authority was key in the development of some of the associated report methodologies. Appropriately regulated drone traffic management systems, registers, tracking, deconfliction and safety management of these systems are vital if the UK is to have the correct measures in place to protect both the operators, and associated multi domains (e.g. people, property) in addition to all airspace users. Further studies to identify and address safety issues to all environments need to be considered.

In terms of airspace, London is one of the most highly regulated and complex cities in the world. The Flying High challenge focused upon the implementation of a drone delivery network for the transference of urgent medical products between NHS facilities. These activities may include the transfer of pathology samples, blood products and equipment, specifically investigating the feasibility between Guy's and St Thomas' hospitals in South London. One of the key factors within the London case was public perception and associated safety implications on the population. Just one of the many considerations relevant to drone operations was further investigation into the potential risk to the population, not only due to the nature of the products being transported, but also the requirement for stringent packaging requirements to ensure minimal tolerance in the unlikely event of a drone failure.

Furthermore, consideration needed to be given to the safeguard mitigation measures necessary for patients in the event of time critical samples or blood products being lost. These considerations needed investigation even before the discussion could develop onto the potential exemption requirements and regulation amendments necessary to allow drone operations to co-exist within helicopter routes along the Thames, or to operate within built up areas. Critical activities would include the extensive interoperability testing, systems communication requirements and associated audit processes to develop the safe operation of the activity. Southampton also focused upon the benefits that could be achievable in the delivery of medical products, but this time over far greater distance.

The proposed use case investigated securing the connectivity between Southampton and the Isle of Wight, thus reducing financial and time implications for the logistical transfer of medical products. This case study brought into question the current regulatory provision for Beyond Visual Line-of-Sight parameters along with resilience and sustainability of drone operations, again in complex airspace. A robust secure communications and tracking network is vital for the safe implementation of the activity.

Support to Fire and Rescue Services were key to the case study in Bradford. A brief synopsis considered the potential benefits to emergency response crews for the appropriate direction and allocation of resources in the event of a major incident. Over watch from sophisticated cameras could allow a greater level of situational awareness for incident commanders.

Within Preston, which is home to the largest cluster of aerospace activity in the UK, case study focus was on construction and urban regeneration. The Civic Drone Centre is already in situ and local authority buildings and utilities are already inspected by drones. The case specifically focused upon the M55 link road project and the associated inspection and over watch activities required by the contractors, local authorities and environment agency.

Finally, the West Midlands focus was upon the utilisation of drones for traffic incident response operating from, and within, seven miles of Birmingham Airport. Drone endurance, effective communications and appropriate airspace management systems are critical to ensure safe operations within restricted airspace.

Crucially, the case studies examined within the Flying High working groups all required the same underlying principles of effective secure tracking and communication capabilities, audit and accountability, risk management, safety regulation and regulatory development and, most importantly, testing. Validated results can lead global development principles and are critical to ensure that technological breakthroughs can be applied in all spheres of evolutionary operations. Testbed developments can only bring greater unity and cohesion to the UK's drone development aspirations. The key recommendation of the report is for the coordination of major challenge prizes relating to the five use cases to drive innovation and lift technical barriers in drone development.

The Flying High project has been simply superb to be involved within and I look forward to continued SyntheSys engagement and collaboration as the projects develop.

Kate Chandler

In the News

From the Tactical Data Link (TDL) & Related Defence Industry

Visiting the Danish Joint Data Link Operations Centre

November 2018 |https://bit.ly/2QDv9Zb

Robbin Laird visits Karup Airbase and meets with Major Knud Agis Larsen and his staff working the major challenge of shaping and working with a connected force.

PAC-3 Gets Approval for German TLVS Integration

November 2018 |https://bit.ly/2Dmv1tu

Germany will be able to integrate Lockheed's Patriot PAC-3 Missile Segment (MSE) Missile into its next generation TLVS missile defense system.

BAE introduces WEnDL system to improve airspace safety

November 2018 |https://bit.ly/2PnLOU2

BAE Systems has developed a new Web Enabled Data Links (WEnDL) system to increase air traffic situational awareness for military aircraft pilots.

General Dynamics Demos Nano Mobile Encryptor for Tactical Communications

November 2018 |https://bit.ly/2DCSgjQ

General Dynamics' mission systems business has unveiled a small encryption technology built to help military customers secure video, data and voice communications.

Australian Government and Boeing signs E-7A Wedgetail aircraft contract

October 2018 |https://bit.ly/2SwwthY

The Australian Government has signed a head agreement with Boeing Defence Australia (BDA) for the Royal Australian Air Force's (RAAF) E-7A Wedgetail aircraft.

Boeing to build 17 new and rebuilt AH-64E Apache Guardian attack helicopters

October 2018 |https://bit.ly/2qJvEFR

Military helicopter experts at the Boeing Co. will build 17 new and remanufactured AH-64 Apache Guardian attack helicopters for the government of the United Arab Emirates (UAE).

Tactical Communication Forum (TCF) 2019 Dates Confirmed

October 2018 |https://bit.ly/2Fmzejv

TCF 2019 will be held in the beautiful city of Salzburg, Austria at the Arcotel Castellani Hotel between 13th - 15th May 2019.

Kratos Subsidary to Integrate Tactical Waveform in Harris Radios for Air Force

October 2018 |https://bit.ly/2OhMcy2

A Kratos Defence and Security Solitions subsidary has signed a licensing agreement to provide communication waveforms for integration into tactical radio systems.

HMS Queen Elizabeth sets off for F-35B fighter jet trials

August 2018 |https://bit.ly/2MEs7Gn

Royal Navy aircraft carrier, HMS Queen Elizabeth, departed her home town of Portsmouth, UK, bound for the USA to land fast jets on deck for the very first time.

Army Aiming for Persistent Communication with Emerging, Commercial Tech

August 2018 |https://bit.ly/2zdQMYK

The U.S Army could soon be acquiring more autonomous vehicle capabilities and commercial communications solutions to bring it closer to a goal of persistent communications, intelligence, survelliance and, reconnaissance (ISR), and faster decision speed.

DRS Building Tactical Networking Terminals for Military Aircraft

August 2018 |https://bit.ly/2PtEnKb

U.S Navy anti-air warfare experts needing an electronics manufacturer to build terminals for the carrier based E-2C and E-2D airborne early warning aircraft have found their solution from DRS Laurel Technologies.

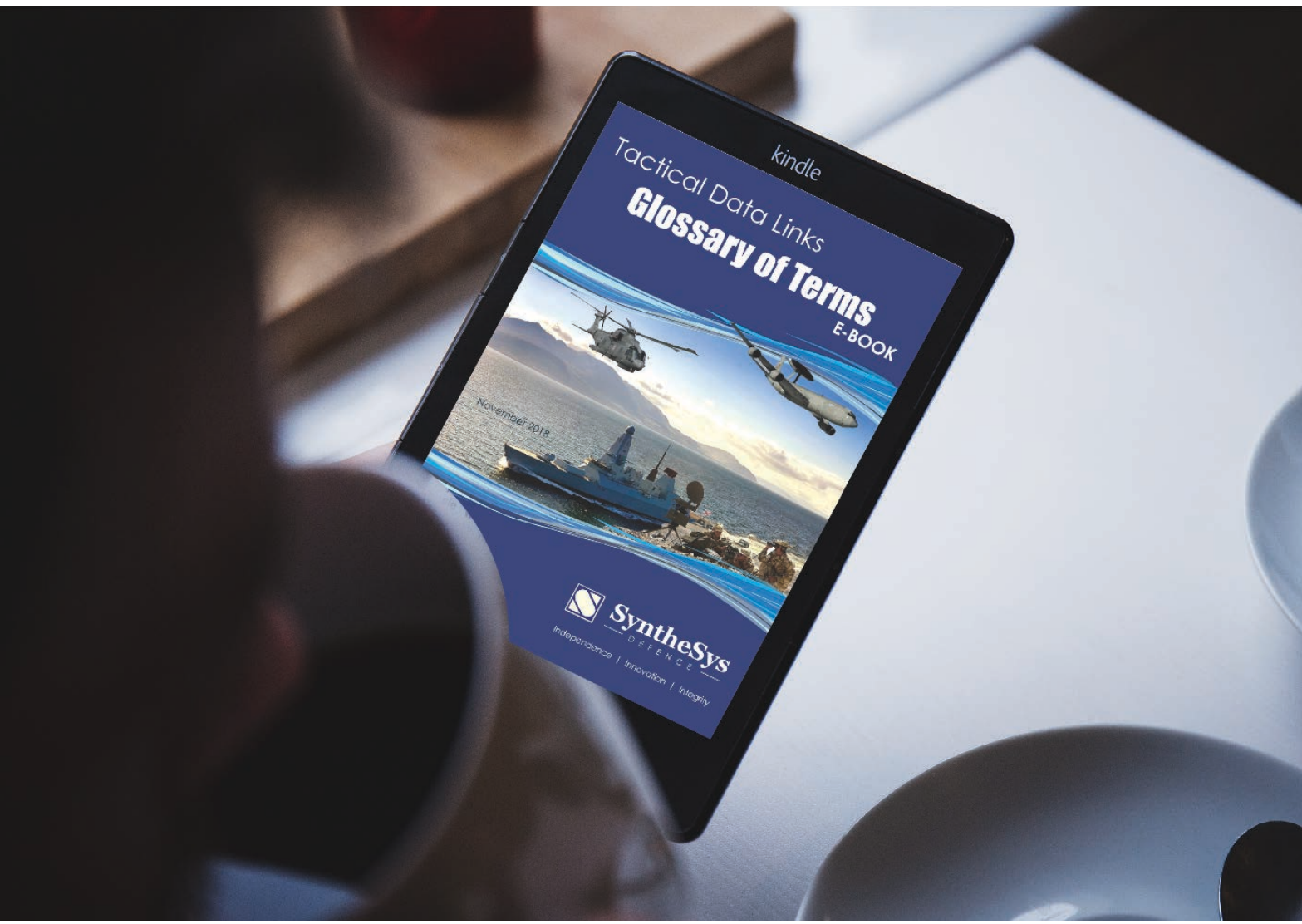
Saab wins FMV order for Tactical Data Link Delivery to Swedish Navy

February 2018 |https://bit.ly/2JrxfIY

The Swedish Defence Materiel Administration, FMV, has contracted Saab for the delivery of multi-tactical data links to the Swedish Navy.

Have you got news to share? Contact: tdltech@synthesys.co.uk

FREE RESOURCE



Tactical Data Link (TDL) Glossary of Terms

This handy E-Book Glossary of TDL terms and acronyms is free resource offered to members of the TDL and wider defence community. It is especially useful to those on the periphery who may be less familiar with shortened terms which are frequently used in literature and everyday communications. Designed to be clear and easy at a glance, it can be kept close by on desktops for instant referral.

To obtain your copy of our Tactical Data Link E-Book Glossary of Terms, register on our Community Portal by visiting: www.tdl-technology.com/community-portal

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