

7th TAI Aviation & Avionics Systems Seminar

ANKARA, TURKEY / November 25-26, 2014



TIME : 9:00 - 17:30
LOCATION : ODTU KKM, ANKARA
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Dear Participants,

We, as Electronics Valley Team, are so much glad to greet you with our deepest respect in our 2014 event : “7th TAI Aviation and Avionics Systems Seminar”. First of all, we would like to send our thanks to Undersecretariat for Defense Industries (SSM), Defense and Aerospace Industry Manufacturers Association (SaSaD), AFCEA Türkiye, the main sponsor TAI and all other organizations, companies and sponsors for their continuous support to make this event possible. We also acknowledge the immeasurable contribution from you, our dear attendees, to maintain, develop and flourish this event over the past seven years, and we send our special thanks to you.

Both in scope and content, Electronics Valley seminars have grown to become evermore valuable simply by creating a synergy among the domestic and international companies and institutions. It is in that respect that we believe these seminars provide a quality venue in which all attendees will be sure to benefit greatly.

The main goal of our seminars is to create a unique environment to share knowledge and experience in the fields of aviation/aerospace and defense technologies by bringing together key players from the public and private sectors, the academia, and various think tanks. In Electronics Valley seminars, we also promote the R&D activities, with an intention to motivate researchers in their pursuit of technological innovations. We also tend to be helpful for small and medium-sized enterprises to expand their business opportunities through our activities. We deeply share the enthusiasm of young engineers and try to be an indispensable source of knowledge and guide for them.

We are so much pleased to see the increased level of interest in our seminars every passing year. In addition, the comments and the feedback we receive from managers, engineers and researchers working in the aerospace and defense industry shed light on our path and boost our efforts by giving us an incredible motivation to work relentlessly.

All Electronics Valley Team is washed over with the feelings of pride and happiness while presenting to you the “7th TAI Aviation and Avionics Systems Seminar” which is a result of dedicated efforts and creative ideas. In addition to short seminar talks where the latest developments in the realms of aviation and avionics are discussed, the seminar program also comprises of industry-certified, visual and application-oriented workshop sessions. The covered topics in this 2-day long program include but not limited to “Avionics Software Testing, Avionics Standards and Certification, Flight Data Recording, Communications Systems, RF and Microwave Technologies, Aerostat Systems, Unmanned Systems, Aircraft Cabling, Air Data Systems, Tactical Data Links, Flight Test Monitoring, High Speed Cameras, Avionics Modernization,...”

In this very book, we are so much glad to present to you the abstracts of all the talks given in this seminar event. We hope everybody will benefit greatly from this activity. We, as Electronics Valley Team, are now planning the future with a brand new vision; organizing events to be known worldwide and introducing Turkish technologies to the globe are our future projects. As always, we value your comments and suggestions. Please feel free to contact us. We thank you once more for your participation and wish you a wonderful seminar.

We look forward to seeing you in the Electronics Valley activities in the near future.

Respectfully,

Dr. Arif Emre Erkoca

Director, Business Development and Marketing (Electronics Valley)

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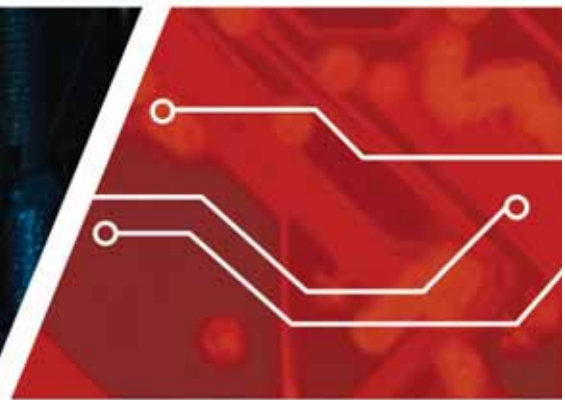


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OPENING CEREMONY

9:00 - 9:10

Serdar ERKOCA
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VALLEY



9:10 - 9:20

Vance Hilderman
VECTOR SOFTWARE

VECTOR
software



9:20 - 9:25

Nezir ERTÜRK
OTONOM TEKNOLOJİ



9:25 - 9:30

Kıvılcım OZANER
UZAYTEM

UZAYTEM

9:30 - 9:35

İTÜ ARISAT UYDU TAKIMI

ARISAT

9:35 - 10:00

Prof. Dr. İsmail DEMİR
Undersecretariat for Defence
Industries



10:00 - 11:00

Break

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PRESENTATIONS

November 25, 2014 - HALL A

- Session Chair : Özgür KOÇ -

TAI

11:00 - 11:30

Integrated Vehicle Management System (IVMS)
Ülgen Cezayirliođlu, Nilgün Altın

TAI

AIM

11:30 - 12:00

Avionics Databus Solutions
ANET - Ethernet based Interface Solutions and their added values
Joachim Schuler



WIND RIVER

12:00 - 12:30

Update on Multicore Implementation of Commercial ARINC
653 Based Operating Environment Alex Wilson

WIND RIVER

- Session Chair : Ahmet TOKTAŞ -

TAI

13:45 - 14:15

A Full Scale Ironbird Application: Footsteps Of An Autopilot
Tolga İnal, Harun Buđra Sađlam

TAI

LDRA

14:15 - 14:45

8 Key Aspects of ED-12C/DO-178C Compliance Mark Richardson

LDRA

AYESAŞ

14:45 - 15:15

Tactical Data Links At Avionics Systems Demet Demir

ayesas

TAI (HALL D)

15:45 - 16:15

Intelligence, Surveillance and Recognition (ISR) Platform - Line
of Sight (LOS) & Beyond Line of Sight Data Link Technologies
Sadık Hotman

TAI



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TAI



Ülgen Cezayirliođlu, Avionics Systems Senior Technical Specialist
Nilgün Altın, Avionics Systems Technical Specialist

Integrated Vehicle Management System (IVMS)

Military aircraft have traditionally been designed as separate systems operating independently within one airframe. Modern aircraft, however, are designed to use a vehicle management system (VMS) that integrates many flight critical functions into one system. This evolution in air vehicle design suggests a need for a corresponding evolution in the VMS design. A new VMS specification is needed which encompasses the requirements for the wide range of functions and components now incorporated into this type of modern system. A unified VMS specification also would simplify the design process by consolidating the requirements into one document, and increase the consistency of VMS designs throughout the military aircraft industry.

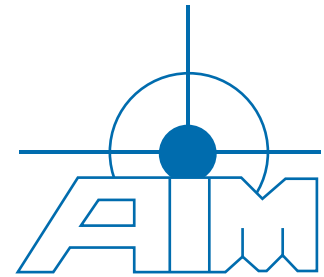
A unified new vehicle management system is most needed to develop a modern fly-by-light new generation fighter aircraft for multi-role missions. In the traditional aircraft design approach, flight control systems (FCS) were tailored to the requirements set forth in FCS specification standards, while the subsystem controllers were designed in accordance with other specifications. Because of the large range of separate functions that old VMSs were designed to perform, requirements for flight controls, propulsion system controls, environmental control, hydraulic power, electrical power, secondary power, landing gear steering and braking, sensors, and actuation all had to be considered separately. To design a unified/integrated vehicle management system (IVMS) for a modern aircraft, a unified set of coherent standards and common guidelines are also required.

The flight critical Vehicle Management System consists of all aircraft components which perform functions required for safe aircraft startup, taxi, takeoff, flight throughout the flight envelope, landing, monitoring, diagnostics and aircraft shutdown. Grouped under the primary functions of Flight Path Management, Aircraft Management and Safety Management, a larger number of functional components on the air vehicle are now considered an integral part of the IVMS. In this paper we shall attempt to describe a modern IVMS to provide highly coherent and centralized management functions with reliable and comprehensive health monitoring.

HALL-A

November 25

11:30- 12:00

**Joachim SCHULER**, Managing and Engineering Director

Avionics Databus Solutions

ANET – Ethernet based Interface Solutions and their added values

In order to deal with the ever changing backplane standards in the PC world such as the ISA, PCI, PCIe , AIM has developed a new set of Ethernet based interface modules, known as the ANET family, for interfacing and testing avionics buses, ARINC429, MIL-STD-1553 and STANAG3910/EFEX. Ethernet has proved time and time again, to be a stable peripheral interface, for several t decades, and available on almost every computing platform today!

One of the design goals of the ANET units was the full software compatibility to the existing range of AIM interface modules (e.g. PCI/PCI-X, PCIe, USB, cPCI, PMC, XMC...) providing a smooth and efficient migration of existing customer and AIM applications. The open design of the ANET units are based on a LINUX embedded SOC (System on Chip) offering much more capabilities, than simply just “another” avionics data bus interface with an Ethernet interface.

This paper outlines these added values and capabilities more in detail, including the execution of applications right on the interface level as well as concepts for portable and scalable analysers for simulation, integration and maintenance based on the ANET family.

WIND RIVER

HALL-A
November 25
12:00- 12:30

Alex WILSON, Director of Aerospace and Defence

Update on Multicore Implementation of Commercial ARINC 653 Based Operating Environment

Historically many safety-related and security-critical systems have been developed and qualified using single-core processors. These platforms could easily meet their increases in system performance requirements through higher processor clock speeds. However, the industry is now approaching the limit of relatively simple upgrade path, and there is an increasing trend towards the adoption of multicore processor architectures in critical systems to address higher performance demands.

In this presentation, we will review the challenges involved in migration to multicore processor architectures and the specific challenges related to their use in safetycritical and security-sensitive systems.

HALL-A

November 25

13:45 - 14:15

TAI**Tolga İNAL**, Avionics System Design Technical Specialist**Harun Bugra SAGLAM**, System Engineering Specialist

A FULL SCALE IRONBIRD APPLICATION : FOOTSTEPS OF AN AUTOPILOT

Iron birds are being widely used throughout the industry for a long time for different purposes. An iron bird is developed and constructed in TAI facilities, which includes, original mechanical flight controls; ailerons, rudder and elevator surfaces of Hürkuş aircraft. A simulation environment is embedded into this infrastructure. Through the project, this infrastructure, born as a SIL (System Integration Laboratory), is modified to become an engineering test station in ironbird.

Constructing a SIL (System Integration Laboratory) parallel to design activities is a very common verification method of the defense industry since 1960s. Such a verification mean can be used for many purposes. The most significant advantage of having such a laboratory is to test the developed system in a simulation environment which simulates peripheral real systems having an input/output relation. It also gives design engineers the ability to verify their designs before integrate it to the real platform. Developed autopilot system was first tested in SIL environment. Verification tests of the autopilot system will be executed in iron bird environment.

In this presentation; gained expeinces, encountered design challenges and design constraints from this project will be shared.

LDRA

HALL-A
November 25
14:15 - 14:45

Mark Richardson, Field Application Engineer

8 Key Aspects of ED-12C/DO-178C Compliance

After seven years of hard work (and unarmed conflict), SC-205/WG-71 added very few new Objectives to the core document, the load bearing beam of the DO-178/ED-12 standard.

Notwithstanding the numerous new Objectives, Activities and Lifecycle Data in associated technology supplements and an exhaustive effort to close the gaps and loop holes on many of the existing objectives and activities in the core DO-178C/ED-12C core document, the guidance remained very similar in its progression from version B to version C. Added however was a restatement of various verification activities and the need for demonstrable evidence of compliance. The presentation will discuss the eight key aspects of ED-12C /DO-178C compliance, including some salient technology supplement Objectives, Activities and Lifecycle Data:

1. Lifecycle Traceability and the Related Trace Data Artifacts Specifically Required
2. Data and Control Coupling Verification During Requirements-Based Testing
3. Consistency of Source Code and the need for static analysis Tools
4. Masking Modified Condition Decision Coverage (MC/DC)
5. Parameter Data Requirements Definition and Verification: A New Reality
6. Source to Object Code Traceability and Verification Objective Uncovered
7. Sub Class Substitutability of OOT Code
8. Independent Verification of Executable Object Code (EOC) from Model Code

We will summarise the guidance behind each of these aspects and present specific techniques that facilitate industry's responsibility for compliance. Using the expertise of FAA Designated Engineering Representatives (DER's), we will also present current guidance related to the regulatory community's responsibility compliance. The net result of these techniques and guidance is a reduced cost of FAA/EASA compliance and a higher degree of certification certainty.

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Demet DEMİR, Technical Leader, Software Group

Tactical Data Links At Avionics Systems

Tactical Data Links (TDLs) have high importance in the digital battle space, by providing situational awareness, and exchange of critical data and ammunition. Data exchanged through TDLs should be processed and transferred fast and safely to constitute the tactical picture at real time. Benefit from the exchange of data depends on the successful time sharing made according to needs/demands of units and their capability of processing and sharing of data within the time reserved for them. Avionics tactical data link processor software is subject to safety critical processes just like any other software at avionic systems. In this presentation, tactical data link processors especially at avionics systems and standards followed during development will be discussed.





Sadık Hotman,

Intelligence, Surveillance and Recognition (ISR) Platform - Line of Sight (LOS) & Beyond Line of Sight Data Link Technologies

Data Link System includes real time data which are radar data, comprising wide-area search/moving target indicators, synthetic aperture radar/fixed target indicators, low-reflectivity indicators and sector search information, electro optic infra red video camera data, vessel tracking data Communications Intelligence (COMINT) data and Signals Intelligence (SIGINT) data transfer between Air Vehicle and Ground Control Station (Mobile/Fixed). Data Link System transfer data, which are producing by ISR system on air vehicle to ground control station and transfer control data from ground control station to related systems on air vehicle. Data Link System includes two main parts: Air Data Terminal and Ground Data Terminal

The Air Data Terminal generally comprises three line replaceable units: an Input/Output Processor; a transceiver and an RF amplifier. The Input/Output Processor provides the primary interface with the aircraft through a MIL-STD-1553B databus or ethernet. It prioritises, encrypts and forwards ISR data for transmission over the datalink, accepts uplink messages, and provides overall control of the datalink, including BIT.

The transceiver contains the downlink transmitter and uplink receiver, which operate with the antenna mounted on the bottom of the airborne fuselage. All of the datalink functions of modulation, coding, frequency spreading and power amplification are contained in this unit.

The RF amplifier is slaved to the transceiver and provides the capability to transmit and receive data from the top-mounted antenna of airborne fuselage. The dual antenna installation provides full and continuous ground coverage at all aircraft attitudes, including turns.



The Ground Data Terminal generally comprises four units: the antenna unit; the Lower Control Unit, which performs data coding, decoding, and datalink timing; the Interface Unit, which provides the interface with the Ground Control Station using a MIL-STD-1553B databus or ethernet and provides for encryption and decryption of all data, datalink and BIT control; the AC-AC converter use by the datalink.

The main feature of Line of Sight Data Link System are broadcast ISR data to all Ground Control Station within line of sight; Ground Control Station access to the aircraft in a time-ordered manner; relay of messages from one Ground Control Station to another; automatic acknowledgement of error-free receipt of messages; multiple networks operating simultaneously and within the same geographical area; all data encrypted.

In order to perform High Speed Data Link which are including; High speed and secure transmission/reception of data for multiple applications, including Remote Video Terminal, High rate imagery downlink capability for Near Real-Time Exploitation and Dissemination of Tactical Reconnaissance Imagery, Ku Band Data Link System is used. The range is reach to 135NM. The downlink Bit Rate is up to 40 Mbps and uplink bit rate is up to 200Kbps.

In order to perform High Integrity Data Link which are including; Lower speed data link for robust and secure transmission / reception of data and control of Unmanned Aircraft System, TDMA architecture allowing one ground segment to communicate with several airborne platforms simultaneously without interference, L/S band 1710 to 1850 MHz (L-band) and 2200 to 2500 MHz (S-band) C-band: 4400 to 4950 MHz (lower C-band) and 5250 to 5850 MHz (upper C-band) Data Link System is used. Either band can be used for uplink or downlink. The range is reach to 80NM. The downlink Bit Rate is up to 10 Mbps and uplink bit rate is up to 200Kbps.

The beyond line of sight data link technologies has been designed for continue to ISR operation due to signal blockages by terrain and on-the-move impairments. In addition, high-quality video is increasingly needed to deliver real-time information from aircraft to ground in intelligence, surveillance, and reconnaissance (ISR) missions. This requires data rates of 10 Mbps or more, and high-definition is also starting to become common for some applications, such as video sensors, aircraft radar, and other types of sensors. Therefore, X, Ku and Ka band Satellite Data Link is used for BLOS data link.

WORKSHOPS

November 25, 2014

- HALL KEMAL KURDAŞ -

VECTOR SOFTWARE

11:00 - 12:30



Airborne Software Testing and Code Coverage : Processes,
Techniques and Best Practices for Certification
Vance HILDERMAN

- HALL B -

METEKSAN

11:00 - 12:30



Part 1 - Millimeter Wave Radar Applications for Air Platforms
Fahri AKÇOMAK, Sezgin ÖZYILDIRIM
Part 2 - Miniature Military Radar Altimeter Solutions for Air Platforms
Emre SERDAROĞLU, Dr. Faruk KURAL

TEKTRONİK

13:45 - 17:15



Get Certification-ready with Simulation
Yavuz KORUCU, Dođukan TOPTAŞ

- HALL C -

GORE

11:00 - 12:30



Part 1 - Proving Installed Performance of Airframe Microwave Assemblies
Jim FOREMAN
Part 2 - Improving Cable Performance in Harsh Environments
Craig HISLOP

- HALL D -

OTONOM

11:00 - 12:30



Aerostat Systems & Areas of Use Nezir ERTÜRK

CURTISS WRIGHT

15:45 - 17:15



Latest Technology Air Data Systems Paul HART



Vance Hilderman, Director of Global Services, Vector Software

Airborne Software Testing and Code Coverage : Processes, Techniques and Best Practices for Certification

Synopsis: This workshop covers technical aspects of testing airborne software and firmware logic. Modern testing techniques and tools are addressed, along with tips for optimizing efficiency, productivity, and utilizing today's best practices associated with DO-178C, DO-278A, and DO-254.

Content : Airborne software requires specialized testing to achieve both mission and certification compliance. Related standards such as DO-178C, DO-254, DO-278A, and ARP-4754A address testing but do not provide real "guidance" or details. Attendees to this session will learn:

- * What is the true intent of testing airborne software?
- * What do DO-178C, DO-254, DO-278A, and ARP-4754A really require for Testing?
- * What is functional, robustness, performance, and structural coverage for testing?
- * What is bottom to top traceability and why is it important for testing?
- * What are decision-condition and MCDC testing and do they really work?
- * What is the role of Unit, Integration, and System testing, and what different testing techniques should be applied?
- * What is Continuous Based Testing and can it reduce costs/schedule?
- * What is Regression testing and can it be automated?
- * How can Vector Software's tools such as VectorCAST/Cover, VectorCAST/C++, Vector Manage, and VectorCAST/RSP improve testing quality/efficiency?

Attendees will also learn common mistakes and best practices for testing modern aviation software. A prediction for future trends in software testing will also be provided.

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Fahri AKÇOMAK, RF Chief System Engineer, Sensor Systems
Sezgin ÖZYILDIRIM, RF System Engineering Technical Leader, Sensor Systems

Millimeter Wave Radar Applications for Air Platforms

In today's military applications, especially in the tactical field, weight, size and power consumption are important design parameters of the developed systems. Since the use of millimeter wave radars is very advantageous in size and weight due to small wavelengths, they have wide application fields. In this session, the millimeter wave radar techniques and the possible application fields will be discussed. The discussion will be detailed with research and application results from METEKSAN DEFENCE's millimeter wave projects.

The discussion will be followed by three different application examples of millimeter wave radar technologies on air platforms. First example will be a Fire Control Radar, a millimeter wave radar system that will be used on helicopters, with "Track While Scan" and "Terrain Profiling" capabilities. The second example will be a SAR/GMTI radar, a millimeter wave radar imaging system that will be used on UAVs with Synthetic Aperture Radar (SAR) techniques. The final example will be a Automated Take-Off and Landing Radar , a 3-dimensional high resolution tracking radar that will be used as Automatic Take-Off and Landing System.

Emre SERDAROĞLU, Program Engineer, Sensor Systems
Dr. Faruk KURAL, RF System Engineering Technical Leader, Sensor Systems

Miniature Military Radar Altimeter Solutions for Air Platforms

Limited payload capacities and problems due to excessive power consumption have led airborne sensor developers to aim lighter, smaller sensors with minimal power consumption (SWaP). Initialized with its own personnel and monetary resources in 2012, Meteksan Defence aimed to design and produce qualified Miniature Radar Altimeters that are compatible for manned and unmanned aerial platforms. This product development project succeeded with two different Radar Altimeter products, C-Band Miniature Radar Altimeter 'CRA-101' and K-Band Miniature Radar Altimeter 'KRA-101', that are tested and qualified to meet the military standards MIL-STD-810F and MIL-STD-461D.

CRA-101 and KRA-101, are designed to produce accurate altitude values up to 2500 ft even in high platform ground speeds (300 m/s) and platforms with high maneuverability. Very low RF output power and power management capabilities, lead to significant low probability of intercept advantages. Detailed Built-in-Test ability and carefully designed algorithms result in reliable, precise products for manned and unmanned aerial vehicles.

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Jim Foreman, Aerospace Product Specialist

Proving Installed Performance of Airframe Microwave Assemblies

A recent study showed that 64 percent of respondents expected microwave cable assemblies to fail before the end of the aircraft's service life. The survey also showed that more than 29 percent of assemblies are replaced due to installation damage and 41 percent fail during their service life due to damage caused by the environmental conditions or maintenance activities on the aircraft. Not only does your overall purchasing cost go up, but you can experience an even greater increase in costs from delayed production schedules, compromised system performance, maintenance downtime, and additional re-testing to verify system performance. Ultimately, your end customer needs the assurance that the cable installation is serviceable at all times to ensure mission success.

Therefore, Gore designed an installation simulator that allowed us to engineer the new GORE-FLIGHT™ Microwave Assemblies, 6 Series. They are lightweight and deliver the lowest insertion loss before and after installation. Their robust construction withstands the challenges of installation, maintenance activities, and flight conditions. In this part of the workshop, Gore will demonstrate the installation simulator, the test process and the results from testing of Gore's and its closest competitor's products. We hope to show that the reality of a true fit and forget microwave cable assembly for aircraft use has arrived.

Craig Hislop, Aerospace Product Specialist

Improving Cable Performance in Harsh Environments

Cables are often the last component considered during system designs. In many situations, cables are really the systems lifeline, if a cable goes down the entire system can stop which can lead to the loss of the aircraft systems and missions. Cable systems are being used today in more demanding harsh environments where cable reliability, signal integrity and life is being challenged by the harsh environment they are used in. The most important issues to consider for aircraft applications are electrical performance, for example cable shielding, cross talk, attenuation, conductor materials and mechanical attributes such as vibration, flexure, acceleration loads and potential damage during installation and maintenance.

Operating costs and capability are directly related to the weight of the aircraft therefore wire and cable materials should be electrically and mechanically robust and should not add significant mass to the aircraft.

Gore recommends attendance by engineers who specify technical requirements for aircraft cabling and personnel who are involved in the procurement, application and maintenance of cable installations. You will learn about the comprehensive testing and products that Gore can offer to guarantee reliable performance, mission assurance and reduced life-cycle costs.

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- Border Patrol
- Tactical Systems

- Common Data Links
- Control Link
- Ground Control Centre



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Nezir Ertürk , General Manager

Aerostat Systems & Areas of Use

Aerostats are moored balloons that fly with lighter than air technology. The roots of the lighter than air technology reach to famous Montgolfier Brothers, who invented the hot air balloon in 1783. The technology found an extensive use during and after the First World War. In 1940s aerostats and airships were used to detect submarines and to protect harbours and critical facilities.

In 1980s the aerostats appeared again in skies mostly for ISR missions at critical borders. One of the famous successes of aerostats is the early detection of Saddam Hussein's units that invaded Kuwait in 1990.

Improvements in electronics, sensor technologies, energy storage, materials and other components of aerostat systems brought us to 2000s. Today aerostats can carry heavier payloads and can reach to altitudes of thousands of feet. They can operate at strong winds and provide unmatched endurance. Last but not the least; they have superior advantage for cost effectiveness for persistent surveillance and communications missions.

Common usages of today's aerostats are border surveillance, communications relay, port, facility and pipe-line security. On the other hand smaller environmental footprint and advances in sensor technologies created new opportunities including early detection of forest fires, communications and surveillance for disaster conditions, aerial imaging, public safety and more.

During the workshop recent advances in aerostat technologies, conventional and modern use of aerostats and latest trends will be presented in an interactive way. Potential benefits, concerns and other parameters of aerostat usage will be discussed together with Otonom Teknoloji's experience gained from Doruk Aerostat System.

Everybody is welcome to attend the workshop, with particular attention to potential end users, sensor and communication technology developers, platform integrators, and rule makers.

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Simulation is used by most engineering disciplines in today's world. Simulation allows engineers to test designs faster, cheaper, and more reliably than using the physical world alone. In the software disciplines simulating the functional behavior of target hardware, allows engineering, integration, and test teams to work simultaneously, reducing the development time and improving the quality of safety-critical systems.

Using Simics, developers preparing for certification can reduce costs, time and risk of failure. In this presentation, you will learn how:

- * Simics properties that have proven useful for safety-critical system developers
- * Total certification costs can be reduced without actually making any attempt to test for credit with Simics
- * Hardware needs are reduced during development while simultaneously increasing the availability of test systems

**CURTISS -
WRIGHT**



Paul Hart, Director of Avionics Engineering and Chief Technology Officer

Latest Technology Air Data Systems

To meet new navigation requirements for the SESAR and NextGEN initiatives on fixed-wing aircraft and also to provide accurate situational awareness for helicopter pilots across the operating envelope, Curtiss-Wright has developed innovative solutions which enhance the accuracy of airspeed and altitude calculations .

In this presentation, Mr Paul Hart will describe many of the challenges, approaches and solutions to Air Data Measurement needs and requirements.

Some of the topics discussed shall include:

Helicopter Pilot Situational Awareness

- * Analysing the challenges and solutions for accurate Low Air Speed measurement (< 30 knots) and compensating for downwash effects on Air data probes.
- * How safety is compromised in low visibility conditions and during night flying.
- * Automatic Flight Control (AFCS) and Stability Augmentation (SAS) Systems functionality.
- * Impacts on future developments of Helicopter auto land systems at low airspeed

These problems are addressed by a new, innovative Curtiss-Wright development called LASP – Low Air Speed Probe - that uses ultrasonic time-of-flight measurement to determine airspeed and direction.

In addition to providing significantly improved situational awareness to pilots and low airspeed data to flight control systems such as AFCS and SAS, the LASP output can be routed to a Fire Control Computer for Attack Helicopters to enable ballistic offset corrections to be calculated based on local air conditions.

The presentation will detail the algorithms used in the LASP design and implementation as well as providing details on the supported data interfaces and Air Data parameters output to the aircraft.



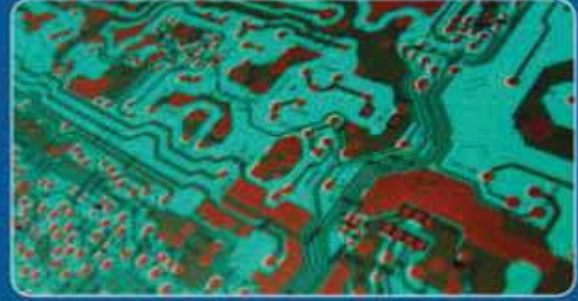
Otomatik Tren Kontrol
Interlocking, HMI
Elektronik Motor Kontrol
Trafik Yönetim Sistemi
Yolcu Bilgi Sistemi



3G/4G, LTE, WIMAX
Media Gateway, Soft Switch
Session Border Controller
IMS, IPTV, Data Center
Media Streaming, Blade Server
Ağ Hızlandırıcı Platform
Android Geliştirme Ortamı



C4ISR, Radar, Sonar, SIGINT
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PRESENTATIONS

November 26, 2014 - HALL A

- Session Chair : Mehmet YILMAZ

TAI

9:00 - 9:30

Computation and Simulation Applications for Atmospheric Conditions' Effects in Fire Control Systems
Yasin Kaygusuz, Berna Akıncı



ESTEREL

9:30 - 10:00

Ansys System® Solutions for the Challenges and New Trends in Avionics
System and Software Engineering Amar Bouali



AOS

10:00 - 10:30

HIGH SPEED CAMERAS FOR AIRBORNE and MILITARY APPLICATIONS Reto Huber



TAI

11:00 - 11:30

Integration Aspects and Approaches to Test and Evaluation (T&E) of the
Electronic Mission Systems on Fighter Platforms S.Özgür Koç



GORE

11:30 - 12:00

Part 1 - Reducing Life Cycle Costs of Airframe Microwave Assemblies
Part 2 - Improving Cable Performance in Harsh Environments
Jim Foreman, Craig Hislop



TAI

12:00 - 12:30

REAL TIME FLIGHT TEST MONITORING Hakan Eser



- Session Chair : Erol OĞUZ -

TAI

13:45 - 14:15

Next Generation UAV Mission Scenarios and Avionics Systems Architectures
Emre Erdiñç



TAI

14:15 - 14:45

System Level Test Approach in ANKA Project Erdem Dağdelenler



OTONOM

14:45 - 15:15

ADVANCES in LIGHTER-THAN-AIR TECHNOLOGIES Cankal ALTUN



TAI

15:45 - 16:15

ERCIYES C-130 AVIONIC MODERNIZATION FLIGHT TEST CAMPAIGN
Serdar ÇORA



TAI

Yasin Kaygusuz, Weapon Systems Design Leader
Berna Akıncı, Weapon Systems Design Specialist

Computation and Simulation Applications for Atmospheric Conditions' Effects in Fire Control Systems

A Fire Control System (FCS) integrated in an air vehicle is responsible for performing the pre- and post-launch computations for accurate delivery of air launched weapons. For ballistic ejection and also even for guided munitions, the atmospheric conditions such as wind vector, temperature or air density will have possibly negative effects on the pre-launch computations. For a missile which does not transfer its current position to aircraft via a dedicated data link after launch, the post-launch weapon position and direction estimations are also subjects to the effects of the atmospheric conditions.

Obviously, before or after the launch or ejection of a munition, the FCS shall be able to add the atmospheric conditions effect to the trajectory or position computations of the weapon. The issue is that the munition will follow most of the time a trajectory which is not yet discovered by the air vehicle before the launch. So the FCS shall include means to estimate the atmospheric conditions belonging to points in a 3D space, the atmospheric properties of which are in fact not measured yet.

The methods used to estimate the wind vector for the weapon trajectory computations, databases to be used in these models, and additional tools such as filters or statistical methods are unified under the name "atmospheric estimation models" (AEM) in the computational weapons systems engineering terminology. To perform the above given functions, an AEM may use any one or any set formed of the followings; standard atmosphere tables, measurement based linear or non-linear estimation techniques, deployable decoys, external measurement data belonging to other platforms.

In this presentation, some introductory information on atmospheric models will be presented using simulations and comparisons with previous flight test data. Additionally potential effects of atmospheric conditions on ballistic weapon trajectory and accuracy will be provided



Amar BOUALI,

Ansys System® Solutions for the Challenges and New Trends in Avionics System and Software Engineering !

Abstract !!Electronic systems are being used increasingly across transportation sectors. Whether it is the hybrid-electrical vehicles, the railway systems, or the more electric aircraft, rising fuel costs, tightening environmental regulation, and global competition are driving companies to increase the number and complexity of electronic systems in their next generation products. !

Engineers are challenged to incorporate these new technologies without compromising safety or reliability, and without reaching prohibitive costs when applying for certification products. !

In this seminar we will introduce comprehensive simulation based engineering solutions and model-based solutions to support the design and development of safety critical electronic systems with reduced costs, risk, and time-to-certification compared to traditional development flows. We will detail the benefits of the introduced approach in the management of the design complexity, in the reduction of costs in the development of critical software, and in the optimization of system performances with multi-physics realtime simulation.



AOS
Technologies AG



AOS Q-EM G2: high resolution airborne camera



The Q-EM G2 digital high-speed camera is specifically made for airborne and defense applications. Some of the outstanding features are: high image resolution of 3 megapixels, frame rates up to 100,000 fps, built-in image memory (up to 10.4 GB), models with connectors on the back or on the side.

The latest generation also features a Wifi connection to parameterize the camera, a HDMI video output and a very fast non-volatile CFast memory card.

Q-EM G2

- ... meets and exceeds standards as MIL-STD-810 and MIL-STD-461 for most airborne applications.
- ... meets criteria for integration in onboard networking systems and supports IRIG-106 data format.
- ... is functional ready to go into UCAV/UAV, supporting functions such as manageable data bandwidth to telemetry system.

AOS Technologies AG
Taefernstrasse 20
CH-5405 Baden-Daettwil

Tel. +41 (0)56 483 34 88
Fax +41 (0)56 483 34 89
info@aostechnologies.com
www.aostechnologies.com





Reto Huber: Engineering Manager

AOS Technologies AG - high speed cameras for airborne and military applications

AOS Technologies AG is a worldwide leading manufacturer of high speed cameras and high speed streaming systems offering turnkey installations for its broad customer base. AOS products serve as THE high speed measurement device in demanding defence applications such as airborne store separation tests.

AOS operates in two main business fields. The original business unit is conventional high speed imaging. AOS high speed cameras are small, fanless and fully self-contained with on-board memory and battery. Typical recording speeds are 500 frames per second at 3 Megapixels or 1000 frames per second at 1.3 Megapixels. Cameras with HD-format are available as well.

The latest generation of AOS high speed cameras features an integrated wireless interface which makes setup even easier than before. There is no need for any cables. The camera is just mounted to the device under test, turned on, a wireless connection is set up and it is ready to be parameterized.

The core of AOS high speed cameras is a powerful image processor allowing in camera image compression or post processing.

The second business unit is high speed image streaming. AOS high speed streaming cameras are very small and deliver crisp images of 2 Megapixels at 85 frames per second or VGA resolution at 500 frames per second. These cameras are attached to a central fanless controller via one single cable.

The latest high speed streaming camera model features a very high resolution sensor delivering 12 Megapixels at a speed of 160 frames per second to a central controller. These high resolution images are able to capture movements of the smallest details.

All military versions of the AOS product range are certified by an external laboratory according to environmental MIL-STD-810 and EMI MIL-STD-461 for airborne use. AOS cameras allow tests where other cameras do not fit or fail.

For these two business units AOS provides custom engineering to fulfill customers' individual needs and not just provide them with a standard off the shelf product. Together with the customer AOS is working as a team to find the best solution.



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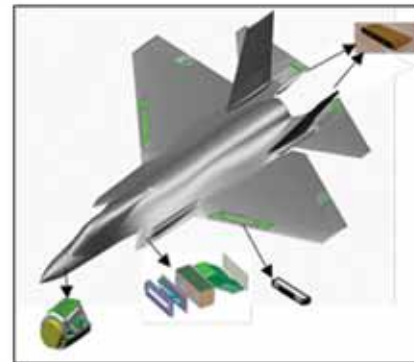
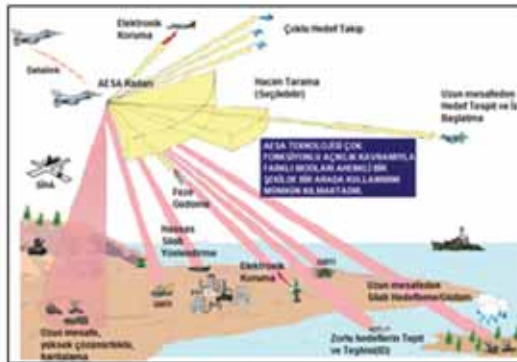
HALL-A
November 26
11:00 - 11:30

S. Özgür Koç, Chef Technical Expert

Integration Aspects and Approaches to Test and Evaluation (T&E) of the Electronic Mission Systems on Fighter Platforms

The 4+ and 5th generation fighters possess the electronic mission systems which are basically AESA Multi-functional Radar, Electronic Warfare Systems and EO/IR Sensing and Targeting Systems. In the presentation; the integration aspects, specific problem areas and domains of work for the mission systems' integration onto fighter platforms are discussed. These areas include the integration with the environmental control system, electrical power generation system, the aircraft structure, RF Interoperability, effects on low-observability, radome and integration with the mission computer. The fusion process of the outcomes of mission sensors in order to reduce the ambiguity is fulfilled on the mission computer depending on a sensor fusion architecture.

The relationship of the mode & functions of mission systems and tactical missions are discussed. The driving input for the initial sizing of the mission systems in the conceptual design phase is considered. For assuring the installed performance of the mission systems, the need to the RF installed performance Test facilities (ISTFs) and a flying testbed are discussed. The electronic warfare test ranges to measure the effectiveness of sensors for the survivability capability of a fighter are also considered.



HALL-ANovember 26
11:30 - 12:00**Jim Foreman**, Aerospace Product Specialist

Reducing Life Cycle Costs of Airframe Microwave Assemblies

Have you ever considered what happens after you select microwave cable assemblies for an aircraft installation? A recent study showed that 64 percent of respondents expected assemblies to fail before the end of the aircraft's service life. The survey also showed that more than 29 percent of assemblies are replaced due to installation damage and 41 percent fail during their service life due to damage caused by the environmental conditions or maintenance activities on the aircraft.

Therefore, we designed an installation simulator that allowed us to engineer the new GORE-FLIGHT™ Microwave Assemblies, 6 Series. They are lightweight and deliver the lowest insertion loss before and after installation. Their robust construction withstands the challenges of installation, maintenance activities, and flight conditions. You should no longer have to accept the practice of replacing assemblies that fail during installation or can't survive the harsh conditions within the aircraft. GORE-FLIGHT™ Microwave Assemblies, 6 Series provide the most cost-effective solution throughout the life of the aircraft and ensures mission-critical system performance.

I would like to discuss how Gore can provide a lightweight cable solution with reliable performance after installation and during the life of the aircraft to eliminate the painful and costly burden of replacing assemblies.

Craig Hislop, Aerospace Product Specialist

Improving Cable Performance in Harsh Environments

Cables are often the last component considered during system designs. In many situations, cables are really the systems lifeline, if a cable goes down the entire system can stop which can lead to the loss of the aircraft systems and missions. Cable systems are being used today in more demanding harsh environments where cable reliability, signal integrity and life is being challenged by the harsh environment they are used in. The most important issues to consider for aircraft applications are electrical performance, for example cable shielding, cross talk, attenuation, conductor materials and mechanical attributes such as vibration, flexure, acceleration loads and potential damage during installation and maintenance.

Operating costs and capability are directly related to the weight of the aircraft therefore wire and cable materials should be electrically and mechanically robust and should not add significant mass to the aircraft.

I would like to discuss how Gore can provide a lightweight, small size reliable solution for the demanding challenges of the aerospace industry.

TAI

Hakan ESER,
Telemetry and Database Engineer

HALL-A

November 26
12:00 - 12:30

REAL TIME FLIGHT TEST MONITORING

Development and certification of flight test of an experimental aircraft may require huge amount of flight hours spread over a period of years. Telemetry is one of the most efficient ways of optimising this long period. Also during this period it provides assistance to the flight crew and considerably improves the safety of flights. This safety aspects of telemetry is prime importance.

Human factor plays fundamental and vital role in safety of flight testing. Well designed real time monitoring displays and screens in telemetry control room should reduce human factor errors in a flight test.

HALL-A

November 26
13:45 - 14:15

Emre Erdinç, Chief of Avionics

Next Generation UAV Mission Scenarios and Avionics Systems Architectures

With increasing needs of operational theatre, payloads and communication architecture need to be changed in serial production of Anka UAS. High Definition surveillance, communication relay and personnel locating for search and rescue missions are new upgrades and add-ons. Operation range is extended with thanks to line of sight data link handover and satellite communication. Control flexibility is achieved with command and control handover between fixed and mobile ground control stations.

All these new missions and operational scenarios are integrated to existing Anka UAS design thanks to modular and expandable avionics architecture. This presentation will touch on all new payload capabilities, new operational scenarios, technical solutions and supporting avionics architecture.

TAI

Erdem Dağdelenler, Test and Integration Chief

System Level Test Approach in ANKA Project

The main goal of this presentation is to present the system level test approach performed to verify ANKA Avionics Systems Design and Integration. Unit and Integration tests which are performed in System Integration Laboratory will be detailed. This presentation also mentions system testing strategies commonly used in system design world and gives an overview of the verification and validation (V&V) process.



Cankal Altun, Electrical and Electronics Engineer

Advances in Lighter-than-Air Technologies

For many centuries, humans tried different ways to fly. One of the oldest techniques is lighter-than-air flight and it was pretty popular in the first half of the 20th century. Airships were used in both defensive and offensive missions during the First World War and mostly defensive missions during the Second World War. Moored and free balloons were also used for military purposes during these periods. The technology was also successfully utilized for air transportation until the passenger airship Hindenburg disaster of 1937. During the post war period, airships were only used for advertising, sightseeing and research purposes.

Advances in science and technology in the modern world made lighter-than-air technologies attractive for different purposes again. These include ISR missions, communications, security, mapping, research and even cargo transportation. Recent advances in material technology enable lighter and more durable envelopes, which in turn provide the means for very long missions in terms of weeks, even months. Research projects on unmanned airships have been underway. Stratospheric lighter-than-air platforms draw quite a bit attention for which the term satelloon was suggested to indicate the platform's being both a balloon and almost a satellite.

In the presentation, recent improvements about lighter-than-air technologies, including airships, aerostats and free balloons will be covered. The ongoing studies and challenging targets for the near future of this technology will also be discussed.

TAI**HALL-A**

November 26

15:45 - 16:15

Serdar CORA

Flight Test, Telemetry and Data Evaluation Engineering Chief

ERCIYES C-130 AVIONIC MODERNIZATION FLIGHT TEST CAMPAIGN

ERCIYES Modernization project is an avionics upgrade program of the C-130 B/E aircraft. It covers the integration of 23 systems in total, ranging from flight management system to NVIS lighting system. These modern systems that are approximately worth the aircraft itself, must comply with all the design criteria that the agreement imposes.

A considerable number of flight tests were carried out to provide feedback in the iterative design process as well as ensuring that the design and certification criteria are met. Operational flight tests were also carried out to validate that the final platform complies with the operational requirements of the customer. This presentation aims to illustrate in brief, the flight test campaign of the ERCIYES project.

WORKSHOPS

November 26, 2014

- HALL B -

MILSOFT

Modern Avionics Architecture: FACE™ Berrin BALCI

9:00 - 10:30



ESTEREL

Scade Jair GONZALEZ

11:00 - 12:30



STARTEKNİK

SHAKERS - CONTROLLERS - ACCELEROMETERS

13:45 - 15:15



- HALL C -

INNALABS

Inertial Sensors for Tactical and Navigation Grade Applications
Dr. Alberto Torasso

9:00 - 10:30



COBHAM MICROWAVE

Microwave Components and Test Benches for SPACE and DEFENSE
Applications Julien Mouliade

11:00 - 12:30



SAMTEC

Part 1 - Out of the box, into the box, get easy connector solutions
Part 2 - SIGNAL INTEGRITY FUSION

13:45 - 17:15



- HALL D -

CURTISS WRIGHT

Flight Data Recording and Data Streaming Paul Hart

9:00 - 10:30



TAI

AN INTRODUCTION TO AUTOPILOT SYSTEMS
Tolga İnal, Harun Buğra Sağlam, Koray Özel, İpek Barış

11:00 - 12:30



- HALL H -

RTI

Safety Certifiable Middleware for Unmanned Aircraft Tim OWEN

13:45 - 15:15





MilSOFT Yazılım Teknolojileri A.Ş., established in 1998, is 100% Turkish & private CMM-I Level 5 company. MilSOFT, specialized in Software System Integration and Software Development has business presence and interest in both defense industry and public sector. MilSOFT aims to develop indigenous and internationally competitive solutions based on the latest technologies.

Mil-CMS

Combat Management System

Mil-CMS is a scalable and modern command control system which integrates sensors and weapons, establishes recognized maritime tactical picture as well as operator support functions to enable effective decision making onboard ships.

JETS-JETSIM

Joint Electronic Warfare Training & Simulation Center

JETS & JETSIM is a Joint Electronic Warfare Training & Simulation Center which provides EW training both in theory and practice for planners and decision makers.

JETS & JETSIM is mainly composed of two applications:

- EW e-learning Application (Joint Electronic Warfare Training System / JETS)
- Interactive EW Application (Joint Electronic Warfare Training Simulation / JETSIM)

Mil-EMIS

Emergency Management Information System

Mil-EMIS is a disaster / emergency and management information system that manages any kind of disaster, emergency and incident by providing coordination and communication among responsible organizations in all phases of Emergency Management including Mitigation, Preparedness, Response, and Recovery.

Mil-DDS

Data Distribution Services Middleware

Mil-DDS is a middleware software providing data centric publish-subscribe mechanism for distributed applications.

Mil-DLP

Multi Data Link Processor

Mil-DLP is a system that provides multi-link processing capability to share tactical information among surface, subsurface, air, and land platforms / units.



Network Centric Geographical Information System

PiriMap is a high performance and easy-to-use cross-platform GIS software development kit (SDK) that can be used by customers to develop map-centric applications targeting various defense, e-government, and civilian domains which can run on desktop consoles, web browsers, and mobile devices.

Mil-IES

Image Exploitation Solutions

- Transportable Image Exploitation System (TIES) receives EO/IR, SAR, GMTI, Telemetry sensor data from UAV via Ground Control Station, performs screening and exploitation functions and reports the exploitation products to intelligence requesters.
- Remote Video Terminal (RVT) receives and displays sensor data that are transferred directly from the UAV. The equipment is suitable to be used for forward observing posts in the battlefield.
- Ground Control Station Mission Systems (GCSMS) is a complete mission system solution for Ground Control Station of UAVs which consists of Mission Planning Software, Payload Control Software, Communication System and Integrated Test and Monitoring Software.

Mil-TRAC

Logistics Lifecycle Support & Fleet Management System

Mil-TRAC is a maintenance information and decision support system developed for the purpose of managing various maintenance activities of complex systems in different platforms. Mil-Trac is compatible with Modern International Logistic Standards such as 51000D, 52000M and PLCS

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Berrin BALCI, Software Engineer

Modern Avionics Architecture: FACE™

The current procurement system in avionics world does not support the process of hardware and software reuse across different programs. Another problem is the inability to use current commercial standards because they do not adhere to the stringent safety requirements developed to reduce risk and likelihood of loss of aircraft, reduced mission capability, and ultimately loss of life.

In order to standardize avionics architecture IMA and ARINC 653 are defined.

An IMA standardized platform software provides;

- * API between OS and application
- * Resource Management
- * Health Monitoring and Fault Management

The key characteristics of an IMA infrastructure;

- * Platform resources are shared by multiple applications
- * An IMA Platform provides robust partitioning of shared resources
- * An IMA Platform only allows hosted applications to interact with the platform and other hosted applications through well-defined interfaces

From application perspective;

- * An application may be designed independent of other applications and obtain incremental acceptance on the IMA platform independently of other applications
- * Applications can be integrated onto a platform without unintended interactions with hosted applications
- * Applications may be reusable
- * Applications are independently modifiable

ARINC 653 is a software standard interface for avionics applications to provide a platform for safety-critical systems. ARINC 653 defines an Application/Executive (APEX) software interface between applications software and the Operating System in IMA Architecture. The *Application Programming Interface (API)* provides support for partition management, process management, time management, inter-partition communication, intra-partition communication, and health monitoring.

In order to establish a Common Operating Environment to support portability of software across airborne electronics platforms FACE is defined by "The Open Group" with sponsorship of leading avionics companies.

- * The FACE approach allows software-based "capabilities" to be developed as components that are exposed to other software components through defined interfaces. It also provides for the reuse of software across different hardware computing environments that contain platform devices.
- * FACE will support airworthiness qualification of airborne systems from DO-178B Levels A through E or equivalent qualification requirements.
- * Ultimately, the goal of FACE is to reduce development and integration costs and reduce time to field new avionics capabilities to platforms.

In this workshop, MiISOFT will present FACE compliant Data Link Processor architecture to initiate a discussion to share participants' experiences on FACE standards on ARINC 653 operating systems.

Innovative inertial sensors for the harshest environments



Built on decades of experience and innovation, InnaLabs industry leading inertial sensors offer high quality robust solutions for the aerospace, subsea, marine, space, energy, industrial, civil engineering and transportation markets.

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- Off the shelf and custom solutions to meet your project needs
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For more information on the InnaLabs range of inertial sensors visit:

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DR. ALBERTO TORASSO, Applications Engineer

Inertial Sensors for Tactical and Navigation Grade Applications

Inertial sensors, accelerometers and gyroscope, play a vital role in many applications ranging from navigation and control to stabilization of platforms, gyro compassing, precision drilling and other scientific and industrial uses. Depending on the application, gyroscopes and accelerometer are either the only way to measure speed, position, attitude, vibration, and shocks or key sources of information when their signal is fused with other sensors. More in detail, when integrated with other measurement (e.g. GPS, radar, laser ranging, encoders, etc.) inertial sensors are able to provide continuous information when other information is not available (due to data lag, failures, or a hostile environment) and to calibrate other sensors errors by means of data fusion.

Inertial sensors find enormous diffusion in the commercial market as well, nevertheless the workshop is focused on high end applications which require industrial, tactical, as well as navigation grade performance such as commercial and military aircrafts, UAVs, rockets and missiles, ships, UGV, land vehicles, satellites, stabilized platforms (weapons station, electro-optical, radars, etc.) either on ground or airborne, precision drilling, high end scientific and industrial application, such as railway and structural monitoring.

Gyroscopes use several different technologies to sense angular speed. The workshop covers the most important features of each technology including mechanical gyros, DTG, FOG, RLG, HRG, MEMS as well as Coriolis Vibratory Gyros (CVG). Advantages and limits are presented together with key applications. Tactical and Navigation grade accelerometer are mainly based on quartz-pendulum force rebalance technology. The characteristics of these accelerometers are presented together with description of applications and integration of accelerometers in complex systems such as Inertial Measurement Systems (IMU).

Innalabs Ltd is an Irish company based in Dublin which design and manufacture ITAR-free tactical grade gyroscopes and tactical and navigation grade accelerometers. Innalabs has developed a high-grade Coriolis Vibratory Gyroscope (CVG) for stabilisation control systems and tactical grade systems. Based on a very unique design, the CVG is successful in covering at very low cost a wide spectrum of performances from 1 to 10°/hr with an extremely low output noise better than 0.01 deg/s up to 100 Hz, with a MTBF of 500,000 hours, breaking with the trend driven by expensive and complex Fiber Optical Gyros (FOG) or Hemispherical Resonator Gyros (HRG). In parallel, Innalabs has developed a family of quartz pendulum accelerometers whose performance span the tactical and navigation range.

Two examples are presented: the integration of an Innalabs gyro in an Electro/Optical stabilization platform, and the integration of Innalabs accelerometers in an Inertial Measurement Unit. These test cases are used to describe the most important performance and operational characteristics of the inertial sensors and their impact on the systems in which are integrated.

Everybody is welcome to attend the workshop, with particular attention to engineers which design, test, and manufacture complex systems which requires inertial sensors, controls engineers, experts in navigation, stabilization, airborne, land, and marine systems.

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- ▶ Retrofitting glass-cockpits
- ▶ Consolidating system controls
- ▶ Aggregating sensor output display
- ▶ Utility / vehicle management
- ▶ Crash protected recorders
- ▶ Enabling RVSM and IVSI capabilities
- ▶ Fire and ice detection and protection
- ▶ Onboard electrical systems management
- ▶ Mission computing

**CURTISS -
WRIGHT**



Paul Hart, Director of Avionics Engineering and Chief Technology Officer

Flight Data Recording and Data Streaming

Since their introduction in the early 1960s, nearly all commercial fixed-wing aircraft and helicopters have been mandated to carry flight recorders. Military aircraft have, to a great degree, followed suit.

The Penny & Giles Business Unit within Curtiss-Wright Avionics & Electronics was the birthplace of the flight recorder and flew the first magnetic based crash-protected recorder on an RAF Gloster Meteor aircraft VM917 in 1955. The Munich air disaster in 1957 was the catalyst that mandated flight recorders in the UK in 1960 and today the company provides the latest generation of crash protected solid-state recorders across the whole spectrum of military and commercial aviation.

This presentation will discuss current and evolving needs of the market as well as FAA and EASA mandates in terms of aircraft flight recording. The topics will be discussed, including industry mandates, emerging technologies and aircraft disasters, all of which have forced the Avionics industry to continue to evolve solutions.

Mr. Paul Hart will discuss the driving forces of change and chart the evolution of Flight Recording from its beginnings to the current market needs and will then detail how new needs and emerging technologies and also aircraft tragedies have influenced the design of Next Generation Flight Data Recording Architectures.

The emergence of AFDX Networks, SATCOM and integrated Flight Data Monitoring Systems shall be presented including the approaches taken by Curtiss Wright to meet these challenges into the future.



Airborne high speed cameras



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Jair GONZALEZ, Application Engineer

SCADE has been and is used to develop the software of hundreds of critical systems all around the world. You will find SCADE in the R&D departments of the main players in the Aerospace, Nuclear, and Rail industries because it produces high quality code; it reduces the development time and it highly decreases the certification risks associated to safety critical projects.

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SCADE offers a well-integrated tool-chain that is **qualified** to support the whole **DO-178C LifeCycle process**, including support for the Planning, **Development**, Verification, Configuration Management, Certification Liaison and Quality assurance.

This workshop will focus on the SCADE Support for the **DO-178C Software development process** and the **Verification process**.

We will show how these processes are carried with the support of SCADE, from the **conception** of the system using SCADE Sytem, the **traceability** to requirements using SCADE LifeCycle, the **development** of control applications using SCADE Suite, the **code generation** using KCG, the **verification** using the SCADE Rapid Prototyper and the Qualified Test Environment (QTE).



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COBHAM
MICROWAVE



HALL-C

November 26
11:00 - 12:30

Julien MOULIADE

MICROWAVE COMPONENTS AND TEST BENCHES FOR SPACE - DEFENSE APPLICATIONS

Cobham Microwave is a European leader in the supplies of microwave components and equipments for space. We have a long heritage of more than 35yrs and our state of the art products are orbiting into over 100 satellites.

Cobham Microwave designs and manufactures RF, microwave systems and components: diodes, modules, filters & duplexers, isolators, circulators and waveguides. It supplies Original Equipment Manufacturers in the Space, Defense , Communications, Industrial, Scientific and Medical industries throughout the world.

The isolator business unit of Cobham Microwave design and manufacture isolators, circulators and loads. The factory is equipped with a clean room (class 100 000), a thermal vacuum chamber, an anechoic chamber for EMC measurements and RF power amplifiers for testing. With over 30 years in space activities, the teams are qualified and dedicated to space activities. This expertise has helped to establish a strong space heritage.

The "Systems & Test Benches" business unit of Cobham Microwave designs , manufactures and supports all equipment and systems dedicated to Defense, Space, Industrial, Scientific and Communication areas. It has 30 years of experience in testing, simulation and system integration benches. Cobham provides satellite and launcher OEMs with flight subsystems and test benches specifically designed for their applications. Working closely with Space OEMs since 1974, Cobham has developed custom test benches in order to provide satellite and launcher manufacturers with a dedicated solution for their critical ground testing. Cobham provides a cutting-edge solution for satellite repeater testing. The multicarrier generator systems (MCGS) of "Cobham Microwave" has been used by many satellite OEMs worldwide over the last 20 years. This unique solution combines high accuracy testing and flexibility and has a user friendly configuration.

Cobham Microwave Test Bench system also includes Radar echo simulator, Bench tests for missile seekers, Radar and transponder test bench, IFF switch matrix and Programmable delay line.

We would like to invite you to attend the workshop with particular attention to Space and Satellite Communication Engineers who involves with the design, test, and manufacture of complex microwave communication systems.

TAI**HALL-D**
November 26
11:00 - 12:30

Tolga INAL, Avionics System Design Technical Expert

Harun Bugra SAGLAM, System Engineering Specialist

Koray Özel, Software Engineering Senior Technical Specialist

İpek Barış, Software Engineering Technical Specialist

AN INTRODUCTION TO AUTOPILOT SYSTEMS

In this workshop, gained experiences and learned lessons from an autopilot system design project will be shared. The workshop will cover fundamental design concept by starting from top level requirements development process through final product verification.

Systems engineering activities, applicable standards, advisory circulars, requirement development, requirement management and widely-accepted autopilot design concepts will be summarized from systems engineer point of view. Sub-system design challenges and gained experiences will be shared.

History of autopilot systems, fundamentals of flight control, modern autopilot systems, avionics system architecture approaches, hardware design concepts, modes and functions of autopilot systems will be summarized from avionics design engineer point of view.

Software code development challenges, gained experiences from code integration phase, integration challenges encountered during real time operating systems for both autopilot and enabling systems will be summarized.



Safety Certifiable Middleware for Unmanned Aircraft

As electronics systems complexity has risen, so has the importance of the communications infrastructure. Besides the inherent challenges throughout the design, development, and integration phases, safety-critical systems have the added complexities and costs relating to certification. Fortunately, certifiable middleware offers an extremely cost-effective alternative.

In this white paper, certifiable communications middleware is overviewed within the context of a specific safety-critical application: unmanned aerial vehicles (UAVs). Actual UAV use cases have proven that certifiable communications middleware can deliver cost savings in the range of \$2 million. Equivalent savings are realistic for any project that must meet stringent safety-certification criteria. The certification evidence for middleware solutions is also highly re-usable, which translates into excellent long-term savings and value.

**HALL-C**November 26
13:45 - 15:15

Out of the box, into the box, get easy connector solutions

What is the right connector for my application? This question includes all of the following points, price, availability, size, robustness, speed, quality and processing progresses to the service of designs, documentation, test reports and the website. From the large number of these points Samtec has built its customer service.

How do I find the correct connector? With this challenge, employs the seminar "Out of the box, into the box, get easy connector solutions"

Microsystem and Rugged Systems and Signal Integrity alone considering or combined in one connectors system, offered by Customer Service staff, FAE's, the Interconnect Solutions Catalogue and its home page on the Internet, submitted by professional elaboration groups such as ASP, SIG, HDR, SME, SOG RF, IPG and CES will complement and support.

With the Solutionator and simulator online Picture Search are three tools on the WEB page for the disposal keep the path to the right solution for your application ready. To shorten the R & D times the Evaluation Kit "Final Inch is offered for Signal Integrity connectors and measuring.

With quick steps to correct connection of more than 1,000,000,000 solutions support with sample boxes and a literature packet for you, this is the content of our workshop



HALL-B
November 26
13:45 - 15:15

Mr. Holger Boller, VIBRATION RESEARCH European Office Managing Director

Feature Trends in Mechanical Testing World

Vibration Research Corporation (VR) has been providing its customers with reliable, user-friendly hardware and software for vibration control for nearly 20 years. VR was formed in 1995 and provides vibration testing solutions from a facility of over 8,000 square feet in suburban Grand Rapids, Michigan US. The VR team combines vibration testing expertise with hardware and software development and a strong desire to take vibration testing to a new level. VR has been an innovator from the delivery of its first vibration control system and is continually providing new testing capabilities and software enhancements. As an example - VR was the first to introduce long time field data replication and pioneered kurtosis control of random testing using its Kurtosion® software module.

Vibration Research prides itself on providing superior customer support and unmatched equipment reliability. Controllers come with a standard 3 year hardware warranty and customer support is handled by an experienced, in-house technician. A reputation for quality products and superior performance is very important to us.

Vibration Research control systems are used in the automotive, aerospace, military, packaging, and seismic fields among others. VR is continually innovating to meet the ever changing demands of our customers. The software development team utilizes customer feedback to help make VibrationVIEW the best software on the market.



Mr. Massimo Ravazzini, MEGGITT SA, Regional Sales Manager

Accelerometers For Smart Engineering And Their Check Tools

Founded in 1947 Endevco Corporation is the world's leading designer and manufacturer of dynamic instrumentation for vibration, shock and pressure measurements.

Endevco's product line includes piezoelectric, integral electronics piezoelectric, piezoresistive and variable capacitance accelerometers, piezoresistive pressure transducers and associated signal conditioning equipment.

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- Industry's first high temperature Isotron (IEPE) triaxial accelerometer, up to 175°C

Technology includes:

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- PE / IEPE (Isotron®)
- LVDT sensors
- Conditioning electronic and calibration systems
- Cables

**HALL-B**November 26
13:45 - 15:15**Mr. Michael Mollwitz**, TIRA, Sales Engineer

Environmental Simulation with Vibration Test Systems: TIRA GmbH

Foundation in 1947, as “Thüringer Industriewerk Rauenstein”. As a worldwide supplier of measuring and testing systems for industry and research, TIRA operates from a number of sites and is active in the development and production of advanced equipment (including application-specific software) for simulating environmental conditions, testing the properties of materials, and eliminating undesirable vibrations.

The TIRA group is structured for maximum flexibility and production depth, an effect reinforced by interaction between such product lines as vibration testing and environmental simulation, a company-owned mechanical manufacturing center, and divisions for material testing and balancing equipment. Records have been kept for the last 65 years and include design data, past experience and the latest findings regarding the industry as a whole, all designed to form the best technological standards and reliable performance. Customers can thus expect customized and/or standardized system solutions from one source, and advice from the development, planning and design stages through to assembly, installation, startup and after-sales services.

Product range:

- * Electrodynamic vibration systems, 9N - 300 kN
- * Modal thrusters
- * Long stroke systems, max. stroke 100 mm
- * Analog/digital amplifiers
- * Vibration control systems for sine/random/shock/mixed mode
- * Slip tables, linear/hydrostatic guided
- * Climatic/temperature systems
- * Head expanders/special-purpose units
- * Calibration systems



HALL-C

November 26

15:45 - 17:15

Signal Integrity Fusion

SI Fusion is Samtec's unique ability to provide end-to-end interconnect solutions to make your system faster, thinner, and lighter, and cross longer distances, with lower overall costs. Samtec designs and develops all levels of interconnection, from the bare die where the signal begins, to an interface 100 meters away with an optical cable assembly, and all points in between with high speed connectors and cable assemblies.

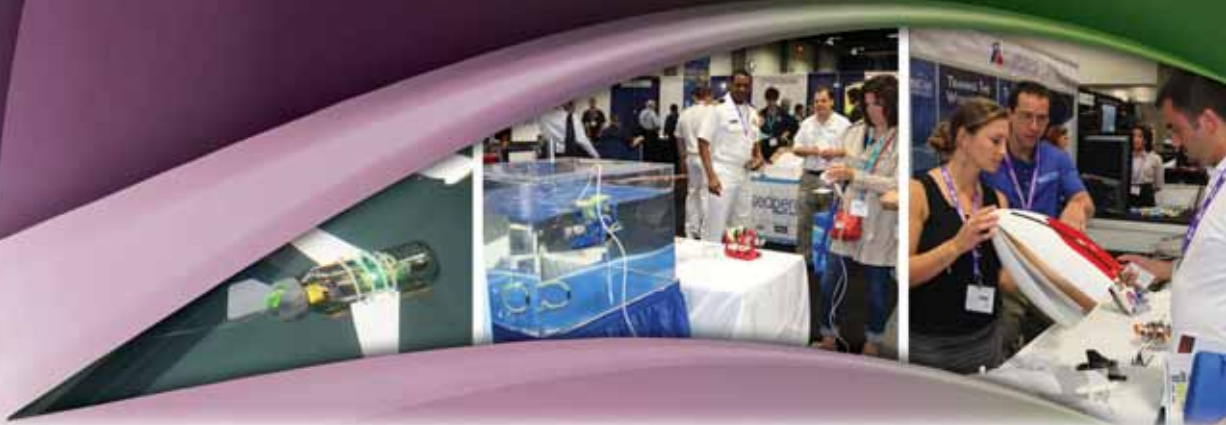
SIGNAL INTEGRITY PRODUCTS

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Challenges in Relaying Video Back To Mission Control

Using a customizable H.264 hardware encoder is essential to delivering the high compression ratio and guaranteed speed needed for mission critical manned and unmanned video streaming applications.

By Christopher Fadeley, Software Engineer, Tech Source

The change in emphasis to a more avionics approach to the military theatre has introduced a new set of challenges in terms of technological feasibility. It is often requested to have an active video feed sent large distances back to ground, with low latency and in high definition. These criteria must be met at all times. The video feed is typically used for monitoring and/or recording of the mission, so if the video feed arrives too late or in poor quality, the resulting images are of no use to control staff and the mission can be compromised.

The real challenge is dealing with the low bandwidth available to stream video. All transmissions must be sent wirelessly and ground control may be a long distance away, especially when it involves remote controlled Unmanned Aerial Vehicle (UAV) or intelligence gathering missions (Figure 1). Wireless transmission is usually performed in an atypical method with limited bandwidth, like a cellular relay or satellite transmission. This often puts a very strict limitation on the data transfer rate of the video.



Figure 1: UAVs need the feed streamed remotely in as timely a fashion as possible, otherwise the mission may be compromised. (Copyright iStock.com-Joelena-credit required)

Raw video by definition is lossless, but is also highly wasteful in the amount of data it takes to display. A 1080p 30fps raw video has a data rate upwards of 200MB/s (megabytes per second). Raw video has its place in the military field in the form of live local viewing and GPGPU processing on the fly. But in applications where the video needs to be streamed remotely, raw video is not feasible.

The solution is to compress the video, but this comes with its own set of challenges. Compressing video can cause a drop in quality. The bigger challenge is that video must be sent in a timely fashion and compression introduces latency. Latency is the time between the camera capturing the video and the time that data is actually displayed or recorded remotely or locally. Compression takes time, especially if high quality and/or resolution are needed.

The best way to ensure low latency with reasonable compression is to use dedicated compression hardware. And given the military field, the hardware must be ruggedized to survive in harsh environments and still consume low power. Keeping that low power while compressing with expected results can be difficult. Hence the hardware must also be computationally efficient.

Encoding

The current standard for compressing video is H.264/MPEG4-Part 10 AVC. This process of compression is also called encoding. H.264 is now the most widely adopted advanced video codec in part due to its high compression ratio and highly configurable options. The strict bandwidth limitations make the configuration of H.264 a necessity. H.264 can encode to either a constant or variable bitrate. Constant bitrates are easy to understand. The video being encoded is always encoded at the user defined bitrate with no regard for the video being captured. This allows an end user to strictly define their video stream to their known bandwidth ensuring no transmission overflow since the video is guaranteed to be a certain size.

Variable bitrate is much more complex since it encodes based on what the actual video data is. A video stream with high motion (every frame different from the last) is very difficult to encode. Compression at a basic level relies heavily on the concept of redundant data through time. For example, a zip-file looks at the binary data of a file and sees where data is being repeated. If the file being compressed is a document containing the letter 'A' repeated 1000 times, the encoder can analyze this data and store the file as 'A:1000' instead of the letter being repeated so many times. This saves valuable space.

In the case of video, a repeated black screen is very easy to encode since it is the same pixel data over and over. Variable bitrate encoding can be set to a target bitrate which it tries to meet; however, it is used only as a median. This means when a video is easy to encode, a variable bitrate will reduce the bitrate and in turn optimize the bandwidth available. The same goes for sudden difficult to encode video (fast moving motion video) where the bitrate may increase to ensure a decent quality.

If a video stream is difficult to encode, there is a chance the variable bitrate encoder will surpass the available bandwidth. And this could result in potential loss of video (dropped frames or buffered delayed frames). Therefore, constant bitrate settings are most often used for the military space. Variable bitrate encoders do have the option to enact a strict maximum size in order to limit this potential for overflow, but this can cause more strain on the encoder which is unnecessary for most military applications and ultimately the variability of the bitrate is an unnecessary addition to an already complex system.

H.264 also has various profiles or ways in which the encoding is handled – the 3 primary profiles are Baseline, Main and High. Baseline is computationally simple and fast to encode. Main and High add more features (like B-frames) making the resulting compression ratio better, but at the cost of computation time and hence latency.

Time is of the Essence

Compression ratios keep getting better and better, but this always comes at the cost of simplicity and processing time. And anything that becomes more computationally difficult typically takes longer to process.

The process to receive video from a sensor and send it back to ground is quite complex as figure 2 shows. First, raw video is captured by the sensor and sent to a processing board. Video is then sent through a series of decoders to present the data as actual video data to the system.

This actual video data is then sent to the on-board hardware accelerated encoder. The video is then encoded to H.264.

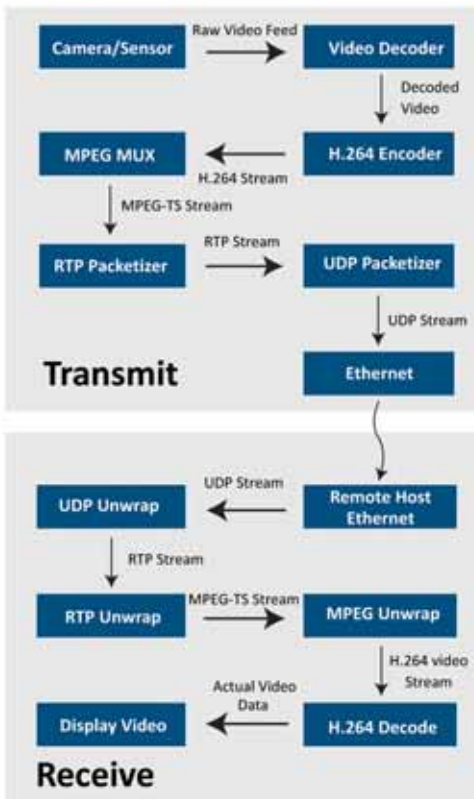


Figure 2: Block diagram shows the full pipeline of sending video remotely and then displaying at control.

The resulting compressed video is then muxed with audio or any other streams into an MPEG-TS2 container. This muxed container then is split into RTP (Real-time Transport Protocol) packets. The RTP packets are then split into UDP packets. The UDP packets are sent out to Ethernet. The UDP packets are then sent back to a remote location in a method solely dependent on the environment.

Back at ground, the UDP packets are captured and the reverse procedure occurs (UDP → RTP → MPEGTS).The MPEGTS stream must then be unwrapped and the H.264 video is decoded into a presentable format. This now presentable pixel format is rendered to the screen to be viewed. All these steps are expected to be performed as fast as possible, preferably (but unrealistically) with no latency.

The main “time” costs in the above system are the time to encode, the time to relay back to ground and the time to decode. As previously mentioned, the time to relay back to ground is solely dependent on the environment of the aircraft and the means to send back the data.

The encoding time is manageable based on hardware and settings. A dedicated H.264 hardware encoder is an absolute requirement to properly meet user expectations. CPUs are too slow due to their fundamentally serial approach. And the GPGPU approach is possible but is ultimately wasteful in power and still not as fast as a dedicated encoder. The only way to have both a high compression ratio with guaranteed speed is to have dedicated hardware to perform the tasks.

With a dedicated encoder, the time to encode and wrap into a streaming format is minimized. As mentioned before, the real user of time is the process of sending the encoded data back to ground. But this may be difficult to improve upon and depends on the communication method between the capture and the display sites.

This encoded video must also be decoded on the receiving side. This means the encoded stream must be extracted from the MPEG-TS mux and decoded back to regular pixel data before being displayed. This is essentially reversing the whole encoding process already performed and in turn takes a similar amount of time to the encoding process. Hence, like the encoding process, this too must be optimized as much as possible to ensure a timely display of remote video. Many of the latest GPUs (graphics processing units) have built-in decoders that display applications can use.

The Reality

Video needs to be sent back to control in a timely fashion. Otherwise, the entire mission could be compromised. The reality of the situation is the video being shown at ground will always be “late” when compared to what is actually happening. The goal is to limit how “late” the video is by as much as possible. If the video is too “late”, it is ultimately useless and decisions made back at ground are being made with a faulty reality. The result of these decisions based on incorrect data can be devastating.

The dedicated encoder on board must then be optimized for the specific environment. As previously mentioned, the strict bandwidth limitations is the real challenge. And with these strict bandwidth limitations, the video will never look perfect. And if it is a high motion video, it may not even be close. Hence if the video isn’t time sensitive (monitoring the video instead of controlling back at ground), certain optimizations can take place at the encoding layer which adds extra time (in the magnitude of ms) but potentially ensuring better quality.

As previously mentioned, implementing a high profile encode may take a few extra milliseconds (5-20ms), but may be the necessary addition to make the video useable. Filters (like temporal motion filters) can also be applied which analyze the video frames for items like motion and sharp contrast and then computationally alleviate these issues.

Again, any addition to the pipeline will always add some degree of extra time.

The Tradeoff

Encoded video will always have the tradeoff between size, quality, power consumption and speed. The smaller the size, the worse the video will look. And the more processing that needs to be performed to improve this quality adds to the final latency and power. Further developments in the encoding field will continue to improve this situation, but this tradeoff will always be an inherent issue.

For now and for some time H.264 is the standard for compressing video and military applications must work within both compression level and the bandwidth limitations to ensure successful implementation.

Alleviations and Implementation

Based on implementation and application need, there is the possibility to implement a system which highly alleviates this tradeoff simply via brute force with multiple streams. If the encoding product has multiple dedicated encoders on board which can be customized individually and bandwidth availability permits, then both encoders can be utilized to meet all needs.

For example, one encoded stream can be set to encode at a the full 30 frames per second at low quality ensuring every frame is sent timely and with no frame loss. And the other encoded stream can be set to encode at a higher quality but at a lower frame rate (5fps for example) and with more leniency for buffering. This way a video feed can be analyzed in real time with no frame loss for live use and the second higher quality stream can be recorded (locally) or referenced live if there is a sudden need for high visual fidelity.

A few card and box level encoders with this dual encoding capability are available in the market today. One such example of a product is the Tech Source Condor VC 100x (figure 3). This rugged XMC card is highly configurable and is an extremely low power hardware encoder that is used in several current programs to achieve the low encoding latency with very high efficiency. With two independent encoders, it achieves the dual mode configuration that is discussed here.

Another configuration is to utilize a combination of raw and encoded video utilizing the same feed. For example in a manned aircraft, the raw video can be captured and analyzed locally for live motion tracking and radar display while the encoded version can be sent back to ground for mission control, recording and analysis.

Priorities and requirements must first be properly evaluated in order to implement a successful and effective system.



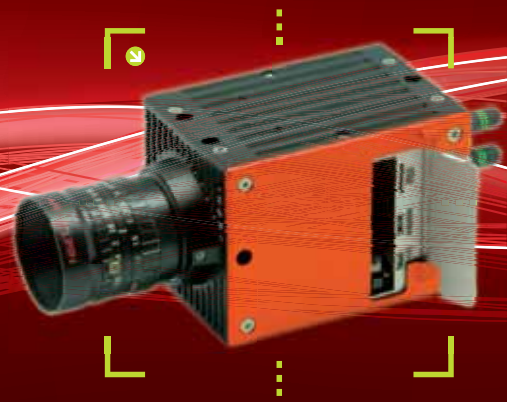
Figure 3

The VC100x XMC H.264 encoder allows video to be sent remotely and in a timely fashion.

Conclusion

There will always be latency in sending video from aircraft back to ground. There is simply no way around this reality. The solution is to alleviate as many bottlenecks as possible in the pipeline prior to implementation. A dedicated hardware encoder is an absolute necessity to limit this delay. Only a dedicated customizable encoder optimized for high efficiency with low power consumption can be used in both manned and unmanned avionics streaming.

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Hybrid Capacitors with High Specific Power

David Evans
 Evans Capacitor Company
 72 Boyd Avenue, East Providence, RI

Electrochemical energy storage devices employ two types of electrodes that differ in the way they store charge. One kind on which electrochemical reactions with the electrolyte occur during charging or discharging has come to be known as faradaic electrode. The other one stores charge without chemical reactions and is non-faradaic. Batteries have a pair of electrodes that store energy by a chemical process. Electric double layer capacitors, electrolytic capacitors, and electrostatic capacitors all store charge physically.

Faradaic charging always involves transfer of electrons between an electrode and an electrolyte. It also requires a mass transfer of ions or atoms at the electrodes. This is the root cause of most disadvantages associated with chemical rather than physical charge storage. Faradaic electrodes have much higher specific energy but suffer in the areas of speed, repeatability, and life. Electrochemical reactions are indeed very slow compared to moving physical charge on a surface, and are subject to limitations imposed by the electrolyte which conductivity decreases with temperature. This explains the generally poor performance of batteries at low temperatures and their low specific power compared to capacitors at any temperature. Repeating charge cycles induce chemical and physical changes to the electrodes that are not quite reversible. So often the life of a battery is measured in hundreds or thousands of cycles. Overall life and shelf life is limited because of parasitic irreversible electrochemistry. The capacitance of faradaic electrodes is often proportional to the electrode volume. Faradaic devices have the highest specific energy, but are limited in operating voltage to the electrolyte breakdown potential.

Non-faradaic charging is a physical charge storage mechanism that suffers none of those problems. Electric current causes no physical change in a conductor. In the ideal case, there are no physical changes and no wear-out mechanisms. The cycle life of electrostatic and electrolytic capacitors is virtually unlimited. Electronic conduction is fast and for the purpose of electrostatic capacitors, independent of temperature. Electrochemical and electrolytic capacitors do have an electrolyte, which has conductivity temperature dependence, a function of the variable speed of ionic charge transfer in a liquid electrolyte, which properties depend on temperature. The capacitance of non-faradaic electrodes is proportional to electrode surface area. The specific capacitance is orders of magnitude lower compared to faradaic electrodes.

A hybrid capacitor (US Pat. 5,369,547) combines a high surface area non-faradaic electrode with a faradaic electrode and a compatible electrolyte to form cells, which tend to maximize the best features of each. Hybrid capacitors are asymmetric and thus correct polarity must be observed. The capacitor described in the patent has a faradaic negative electrode comprised of ruthenium oxide, sulfuric acid electrolyte, and a non-faradaic positive electrode, tantalum pentoxide coated tantalum metal. The negative electrode has a large capacitance and the positive electrode has a high voltage dielectric. The positive electrode has an unlimited cycle life and is responsive to alternating current. The hybrid capacitor has about 4X higher energy density compared to an equivalent electrolytic capacitor. Hybrid capacitors are designed to optimize the voltage at each electrode. The charge is proportional to the capacitance and voltage, and since the two electrodes are in series a charge of equal magnitude exists on both.

$$C_1 V_1 = Q = C_2 V_2$$

Electrodes are sized to avoid the possibility of exceeding the electrolyte breakdown potential at the negative (faradaic) electrode. In a typical tantalum hybrid capacitor, the negative electrode capacitance is at least 100 times greater than the overall capacitance and its voltage 100 times less. Accordingly, the voltage on the non-faradaic positive electrode is much higher and the use of a dielectric prevents electrochemical reactions at that interface.

Because hybrid capacitors can have a high cell voltage, the necessity of series connections is eliminated or greatly reduced. Among obvious advantages, such as greatly facilitated assembly, a single high voltage cell has lower resistance than a stack of symmetric cells. This is important to power performance as power is indirectly related to the resistance. Capacitors with high specific power are needed for a variety of applications with repetitive high current pulse discharges. Using a capacitor, the primary power source can be sized to the average power, saving cost, space, weight, and increasing reliability while improving performance.

Tantalum hybrid capacitors are designed for demanding applications requiring long life, wide temperature range, reliability, high specific energy and power. The hermetic design fits the expectations of customers involved with military or aerospace applications. The design has continued to evolve over the past 10 – 15 years and the latest version has considerably increased specific power. The capacitors have high specific energy compared to electrolytic capacitors and higher specific power.

Figure 1 below is a plot of the impedance of a TDD3125452 capacitor rated for 4500uF at 125 volts. Zreal (z') is the resistance. Zimag (z'') is the reactance. This capacitor has an ESR, taken at 1kHz, of 17mohm.

The capacitance was derived from z'', the reactance, according to

$$C = 1/(2 \pi f z'')$$

where f is the frequency. (see figure 2) The energy stored in a charged capacitor is directly related to the capacitance by,

$$E = \frac{1}{2} C V^2 \quad \text{eq. 1}$$

and the power is proportional to 1/R according to eq. 2,

$$P \propto V^2/R \quad \text{eq. 2}$$

$$P = V^2/4R \quad \text{eq. 2a}$$

Plotting capacitance over 1/R yields Figure 3.

The proportion in eq. 2a, can be understood to lie in the circuit that uses the capacitor. Capacitors can deliver maximum power into a load having equal resistance to the capacitor ESR. So eq. 2 becomes $P = V^2/2R$. However, this is not practically the case. A more conservative estimate of power in a practical device drops this a factor of two, so power is $P = V^2/4R$ is used here. Making $V = 125$ volts from eq. 1, $E = 7812.5$ C. Similarly, at $V = 125$ volts in eq. 2a, $P = 15625/4R$. Doing the arithmetic results in the Ragone diagrams shown below.

TECHNICAL PAPER

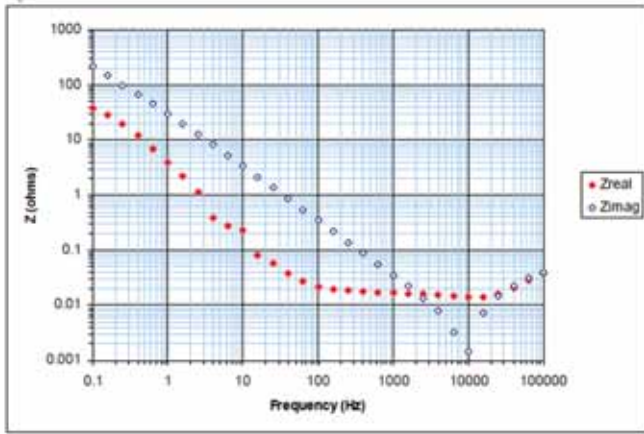


Figure 1

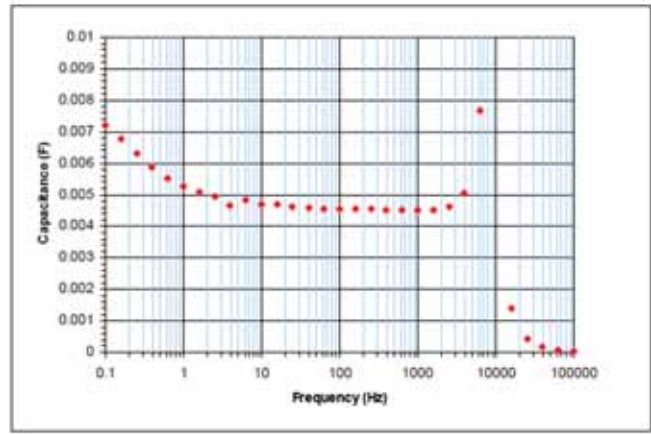


Figure 2. Capacitance of a TDD3125452 capacitor. The steep rise above 3kHz is a value at the resonance frequency and is anomalous. The resonance frequency is about 7kHz.

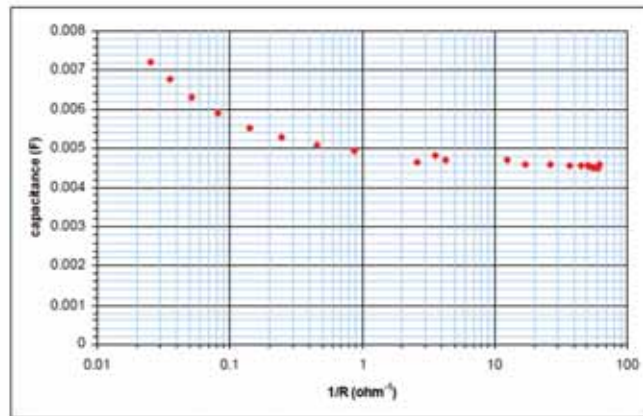


Figure 3. Plot of capacitance vs. 1/R with the values to the right of resonance removed.

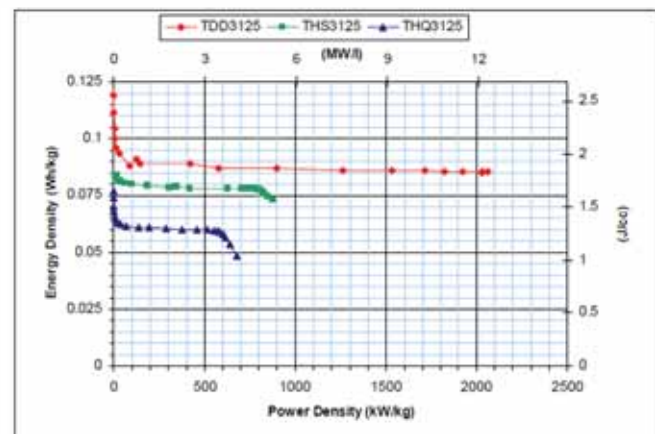
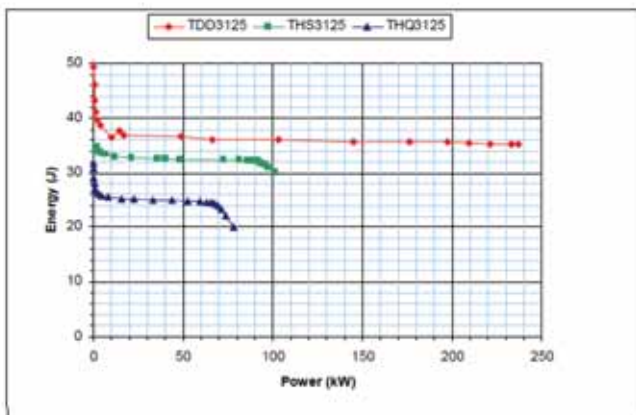


Figure 4.

Figure 4. Energy vs. Power for a single capacitor as noted. The newest TDD3 type has higher energy and power. THS3 and THQ3 are older models.

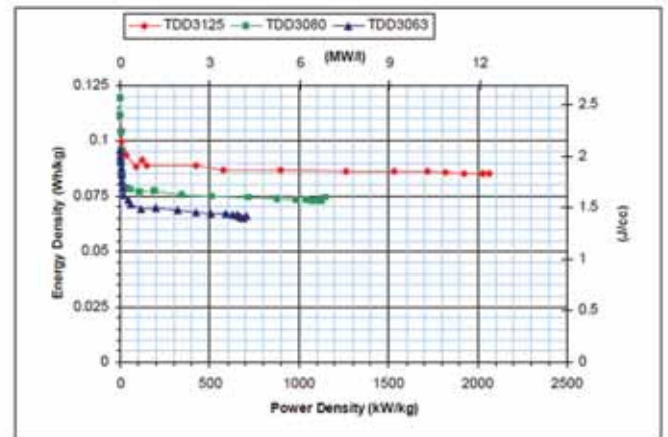
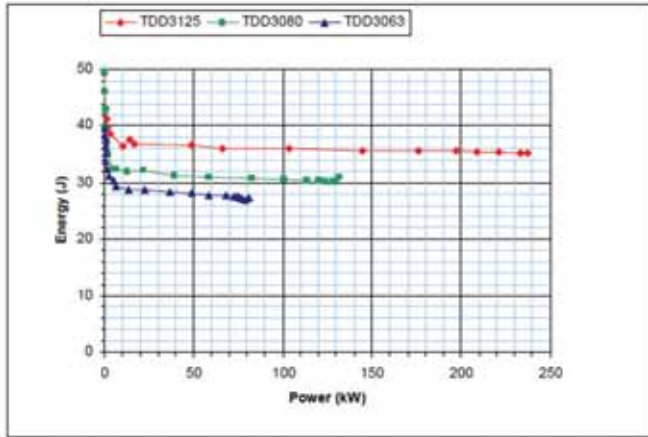
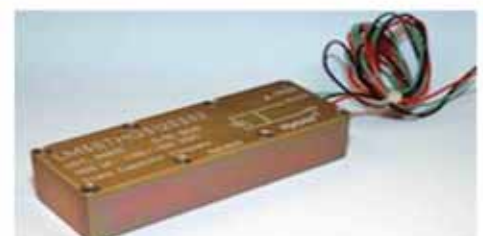
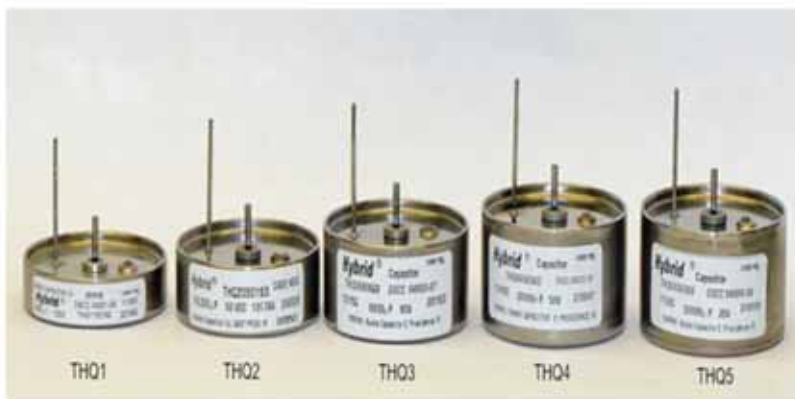


Figure 5. Energy vs. power for TDD3 in three different voltage ratings. The energy of the lower voltage TDD models are similar to the THS or THQ but the power is higher.

Figure 5





**ELECTRONICS
VALLEY**

Platinum Sponsor:



Hittite
MICROWAVE PRODUCTS
FROM ANALOG DEVICES



4th MILITARY ELECTRONICS SEMINAR

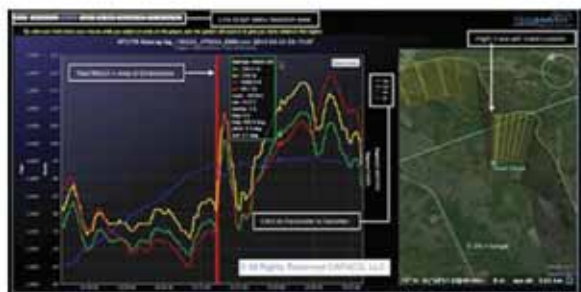
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SkyTrac Systems is dedicated to providing you with the latest technological advances for your fleet's data solutions. Skytrac can connect to any of your aircraft systems and collect data for analysis to provide increased safety, increased revenue and contract compliance. SkyTrac can provide you with the tools you need to analyze your flight and engine data, provide fleet trending, recommendations and reporting all from the same transceiver used to connect air to ground communications. Real time notifications of important exceedances allow immediate steps to be taken on the ground to deal with issues in a proactive manner. Contact info@skytrac.ca for more information about flight data monitoring/management information for your fleet.



One of the important trends in aviation today is the use of flight data to support FDM programs, maintenance programs, back-office operations, and Safety Management Systems (SMS) programs. This trend is fueled by the modernization of fleets, the advent of glass cockpits, Electronic Flight Bags (EFBs) and next generation avionics. Interestingly, the FDM surge on digital aircraft is also reaching backwards to incorporate older analog aircraft. We are seeing more mixed fleets needing access to common data sets as they become dependent on data to drive maintenance operations, billing, flight operations programs, pilot training and safety programs.

SkyTrac leads the aviation industry in FDM services - supporting maintainers, flight operations, office operations, and safety managers with a full range of applications. Our flexible and adaptable services are designed to be applicable to each department in your organization no matter what your requirements or the scale of your operation. From data acquisition through event set determination, EFB back-office integration, real-time exceedance notifications, fleet trending and flight analysis; our services will enhance safety, improve efficiency, and augment maintenance operations. We are equally adept in rotary wing, fixed wing, analog and digital aircraft, ensuring that your data-based programs span the entire fleet.

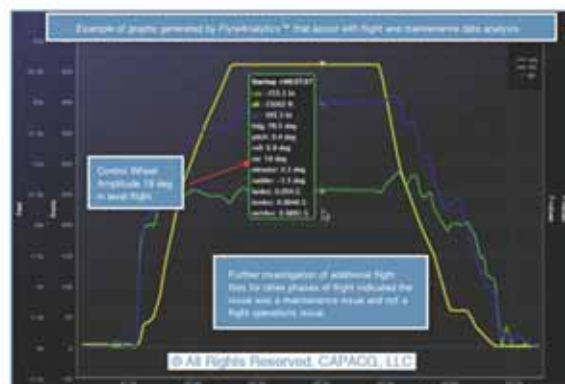
SkyWeb (SkyTrac's cloud-based operator's interface) analyzes your FDM data using FlyteAnalytics™ and provides fleet trending and full analytics. Data parameters, event sets and thresholds are determined in a joint effort between the client and SkyTrac. Data is downloaded manually via a USB stick or wirelessly using our Wi-Fi unit, and loaded into SkyWeb for analysis. As well as post-flight analysis, real-time exceedance notifications can be sent to SkyWeb flight tracking and/or directly to your mobile device. This allows you to be proactive in dealing with any issues that may arise while the aircraft is in flight, minimizing AOG time and enabling accurate diagnostics of flight events.

The following case study illustrates how an FDM program can avert a potentially costly or serious situation.

Overview: An operator utilizes a Flight Data Monitoring (FDM) program as an integral part of their Safety Management System (SMS). Because the monitored aircraft has a limitation on aileron throw during the take-off phase of flight, an algorithm (event set) was developed and deployed to monitor this limitation during the take-off phase. The event set measured aileron throw in excess of 7 degrees left of right of the control wheel center position and was intended to be a low severity event or a routine operational measurement. The FDM program had been operational for less than 30 days.



The above triggered events warranted further investigation. After crew debriefings, it was determined there were no unusual control wheel position or input during flight. Further analysis indicates the aileron throw irregularities were reporting during all phases of flights as depicted in the following example graph generated by FlyteAnalytics™.



Findings: The operator coordinated with maintenance personnel to perform a maintenance inspection during routine scheduled maintenance. It was determined an irregularity with the associated aileron control wheel transducers existed. As indicated, FDM analysis identified this irregularity before there was an issue, potentially preventing an AOG scenario and preventing loss of revenue from canceled flight segments. This is a powerful example of how a properly managed predictive FDM program can improve efficiencies and economies in flight operations.



A dual Telemetry Transmitter with ultra-high Isolation for airborne applications

Emhiser Research Inc is the world leader in the design, development, and production of Telemetry Transmitters and other airborne and ground telemetry and range safety equipment.

With headquarters in Verdi, Nevada, USA, Emhiser has three divisions in North America producing both active and passive devices.

As a Certified ISO 9001:2008 company, Emhiser prides itself on the quality of the products it produces.

Delivery can usually be started in 90 to 120 days ARO (After Receipt of an Order); and, since Emhiser telemetry transmitters are designated as non-ITAR there is no delay in shipments due to licensing. There are no licenses required. Emhiser prices are kept very low due to the efficiencies of operation of the company, which is employee owned.

Engineering at Emhiser has a reputation for solving difficult problems where other companies have failed. The following discussion is with regard to one of these situations, where a customer needed a solution, and the original contractor could not achieve the required results.

The Problem – achieving high isolation between two transmitters feeding a single airborne antenna.

Combining two RF transmitters or power amplifiers into a single antenna requires significant isolation lest intermodulation distortion occurs causing out-of-spec spurious transmissions. These transmissions would be illegal since they would violate the frequency and spectrum controls of the communications authorities, and could cause detrimental interference with other systems. Depending on the power, the isolation required can be in the 50 to 60 dB range. On an airborne platform this degree of isolation is very difficult to attain due to skin effect on the surface of the vehicle.

In order to accomplish this difficult performance, Emhiser has invented a wide-band, high-power combiner which will combine two signals, in the same or different bands, with greater than 60 dB isolation. Insertion loss is less than 2.0 dB above the mathematical loss of 3 dB. Isolation can be increased above this number with the penalty of approximately an additional 0.5 dB of insertion loss per 20 dB of additional isolation.

Once the RF signals are combined in this device, the intermodulation distortion products will not re-appear even if the output of this device is split and sent to two or more antennae in close proximity.

This product is hardened for rugged applications and is tested to 27 G's of vibration and 100 G's of acceleration in addition to the usual temperature, humidity, and other environmental specifications.

The ETTC-27E1D2D2-00 high isolation dual Telemetry Transmitter

The ETTC-27E1D2D2-00 transmitter is the solution to the problem. Incorporating the exclusive Emhiser RF Combiner, this transmitter has now been fully qualified.

A technical bulletin for the ETTC-27E1D2D2-00 telemetry transmitter is shown below. This unit provides two (2) completely isolated telemetry transmitters in a single housing, with a single antenna output feed. Various options regarding temperature extensions are available. The unit may also be ordered with an accompanying heatsink.

This combination of two transmitters in a single housing enables the simultaneous transmission of two data streams without crosstalk or intermodulation between the two signals. The transmitter could be used to transmit the same data stream with redundancy, using frequency diversity; or, it could be utilized for transmitting two entirely different data signals. This could be used where large amounts of data need to be transmitted, and a single transmitter would be insufficient; or, where it is required to transmit a video signal simultaneously with a data stream.

The advantage of utilizing this transmitter is the savings in volume, power consumption, and weight by using this one transmitter instead of two separate transmitters. It should be noted that the ETTC-27E1D2D2-00 does not employ a diplexer so channelization is possible. Further, the two frequencies can be much closer than is possible in a diplexer solution. It also only requires a single airborne antenna, saving space, weight, and cost on the airborne vehicle.

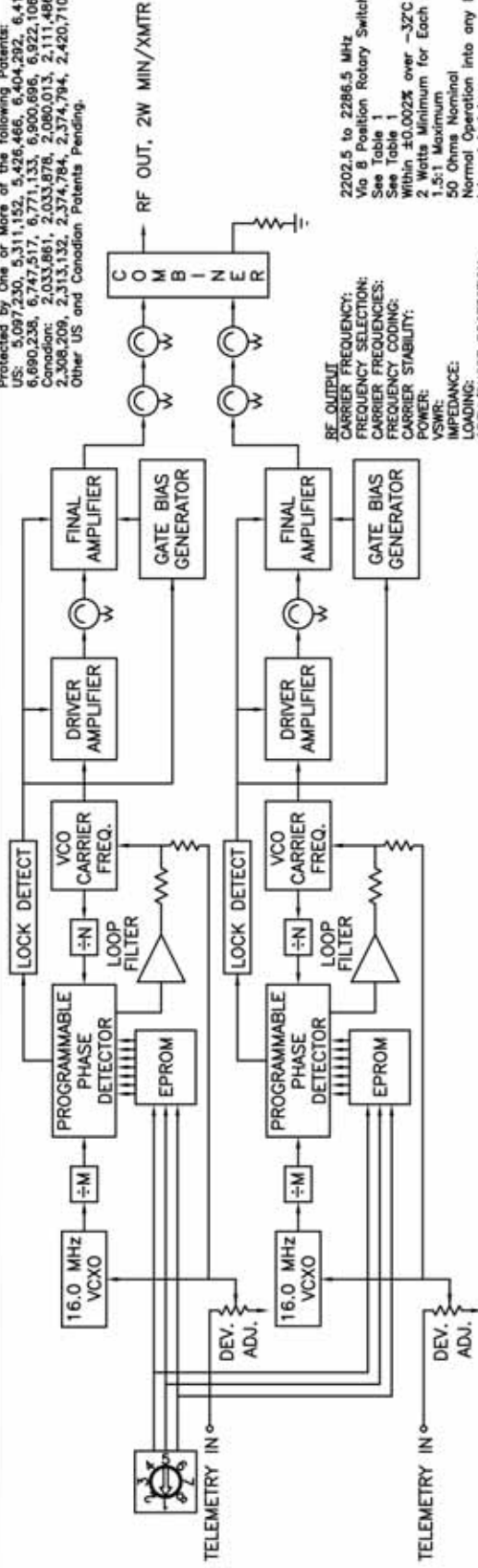
As can be seen from the technical bulletin below this transmitter operates in S-band with 2 watts of transmitted RF power in each of the two transmitters.

The transmitter consumes only 1.4 amps when operating as a dual unit (0.7 amps each single), is only 27 cubic inches (443 cubic centimeters) and weighs only 18 ounces (510 grams).

For further information :
www.emhiser.com

Protected by One or More of the following Patents:

US: 5,097,230, 5,311,152, 5,426,466, 6,404,292, 6,411,237, 6,417,738, 6,650,180, 6,683,499, 6,690,238, 6,747,517, 6,771,133, 6,900,696, 6,922,106, 7,190,229, 7,936,218, and 8,188,794.
 Canadian: 2,033,861, 2,033,878, 2,090,013, 2,111,486, 2,235,091, 2,299,133, 2,306,977, 2,308,209, 2,313,132, 2,374,784, 2,374,794, 2,420,710, and 2,432,778.
 Other US and Canadian Patents Pending.



RF OUT, 2W MIN/XMTR

C O M B I N E R

RE OUTPUT
 CARRIER FREQUENCY: 2202.5 to 2286.5 MHz
 FREQUENCY SELECTION: Via 8 Position Rotary Switch
 CARRIER FREQUENCIES: See Table 1
 FREQUENCY CODING: Within $\pm 0.002\%$ over -32°C to $+85^{\circ}\text{C}$
 CARRIER STABILITY: 2 Watts Minimum for Each Carrier
 POWER: 1.5:1 Maximum
 VSWR: 50 Ohms Nominal
 IMPEDANCE: Normal Operation into any Load VSWR and Phase Angle
 LOADING: Internal Isolator
 OPEN/SHORT PROTECTION: Harmonic & Spurious Level: -25 dbm Maximum

MODULATION
 TYPE: True FM, Positive Sense, DC Coupled
 FREQUENCY RESPONSE: DC to 500 KHz ± 2 dB Relative to 10 KHz
 PEAK DEVIATION: ± 545 KHz Maximum
 DEVIATION SENSITIVITY: Factory set at 100 KHz/Vpk ± 9.0 KHz
 HARMONIC DISTORTION: 5% Maximum
 INCIDENTAL AM: 2% Maximum
 INCIDENTAL FM: 1.0 KHz RMS Maximum, 3.0 KHz RMS Maximum Under Vibration
 INPUT IMPEDANCE: 10 Kohms ± 1 Kohms, Shunted by 30pF Maximum

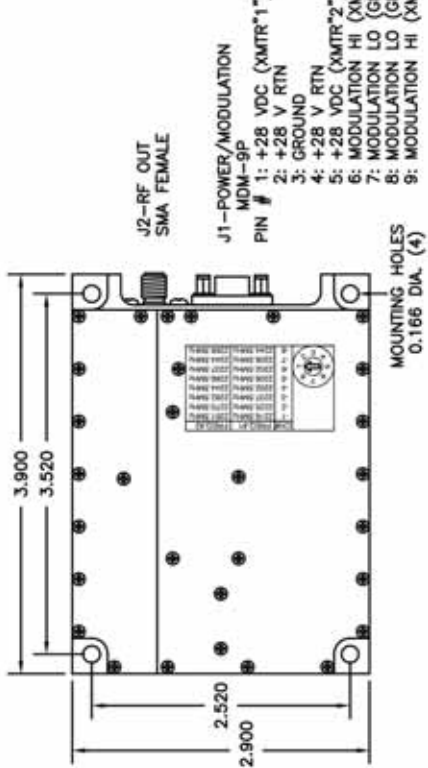
POWER REQUIREMENTS
 INPUT VOLTAGE: $+24$ to $+33$ VDC; Reverse Polarity Protected
 INPUT OVERVOLTAGE: $+50$ VDC for 30 Seconds with No Damage
 INPUT CURRENT: 700 Millamps Maximum when Operated Single
 1.4 Amps Maximum when Operated as a Dual

ENVIRONMENTAL SPECIFICATIONS
 TEMPERATURE: Operating: -32°C to $+85^{\circ}\text{C}$; Storage: -46°C to $+85^{\circ}\text{C}$
 VIBRATION: 27.7 G's RMS, Random, 50 Hz to 3 KHz, 3 Axes
 Profile per Figure 1 of Specification Drawing MIS-50262
 SHOCK: 1/2 Sine, 235 G Pk, 1.1 ms, 3 Axes
 ACCELERATION: Unlimited
 ALTITUDE: Unlimited
 HUMIDITY: To 95% at any Temperature forming Frost or Condensation

PHYSICAL CHARACTERISTICS
 DIMENSIONS: Per Outline Drawing
 WEIGHT: 18 oz. Maximum

TABLE 1

FREQ. PAIR #	FREQ. # 1	FREQ. # 2
1	2215.5MHz	2261.5MHz
2	2225.5MHz	2270.5MHz
3	2237.5MHz	2282.5MHz
4	2202.5MHz	2244.5MHz
5	2208.5MHz	2286.5MHz
6	2202.5MHz	2237.5MHz
7	2208.5MHz	2244.5MHz
8	2244.5MHz	2286.5MHz



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TELEMETRY TRANSMITTER, DUAL
 CHANNELIZED, DC COUPLED
 8 FREQUENCY PAIRS

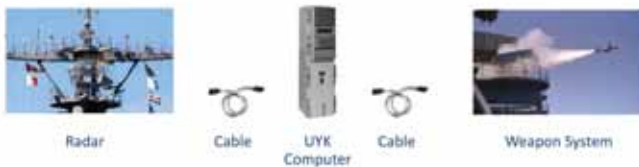
ISSUE DATE: 14 04 20
 DWN: LLL/EM
 APVD DATE: APVD
 CAGE CODE IDENT NO.: 60666
 MODEL NO.: ETT-27E1D2D2-00

NTDS (MIL-STD-1397C)

Signal Conversion to TCP/IP (Ethernet) and Fiber Optic Transmittable Data

To convert existing NTDS (MIL-STD-1397C) communications information into Ethernet and Fiber Optic Transmittable Data

Currently deployed Naval Tactical Data Systems consist of Tactical Data Processors (UYK Computers) interconnected to target and ship's sensor data inputs (Radar, Sonar, GPS, etc.) and weapons systems targeting outputs. The current interconnect is redundant runs of copper cabling to MIL-STD connectors which are comprised of up to 90 individual shielded copper wires within a shielded cable.



higher accuracy requirements which demand faster computing platforms operating in a FORCENet Network Centric TCP/IP or fiber optic 'open architecture' environment. From a budgetary viewpoint, most of the existing fleet-deployed legacy NTDS peripheral sensing and targeting equipment, while receiving signals within required latency specifications, is designed to transmit and receive only in MIL-STD-1397C data formats. As the Navy requirement is to logically upgrade targeting computational efficiencies it is likewise highly desirable to retain the deployed peripheral equipment and existing software applications.

This cannot be accomplished unless MIL-STD-1397C signals can be reliably converted within latency specifications to the new data formats required by modern state of the art Navy Tactical Data Processors.

CURRENT GET HARDWARE SOLUTIONS

GET Engineering Corporation, using company R&D budgets, has developed specific hardware solutions to meet the objective.

NTDS to Fiber Optic Data Converters

GET Engineering has successfully converted MIL-STD-1397C data to a fiber optic data stream enabling transmission of tactical data between tactical peripherals and computing platforms (UYK's) and/or physical layer switching units within the required MIL-STD- 1397C timing requirements. Benefits include:

- * NTDS signals can now be extended fully across installations or between different test facilities. NTDS data can travel up to ten kilometers within NTDS specification instead of the 100 meter capability of copper cables.
- * No software application changes to existing programs. The signals continue to be transmitted in traditional MIL-STD-1397C format.
- * By interconnecting with physical layer switching units (available from 8 ports to 4,096 ports) Naval Ships, as well as Test and Training Commands can configure the exact equipment suite from any deployed active unit with a few clicks on their "mouse".

As the ultimate fiber solution, GET sought to completely eliminate the costly and heavy copper cabling. NTDS to Fiber Optic conversion hardware has been miniaturized by GET to now fit in the actual NTDS MIL-STD-1397C back shell itself, transmitting real time tactical data on a single fiber optic strand (in lieu of a 90 wire copper cable). This advancement enables the removal of an estimated seven tons of copper cabling from the average Navy Combatant ship, allowing for either/both enhanced ship stability and/or additional equipment above the water line.



GET NTDS to Fiber Converter Hardware Configurations :

- * NTDS in the Backshell™
- * One Channel Ruggedized Box
- * Two to Four Channels 19" 3U Rack or Wall Mounted Chassis
- * Sixteen Channel 19" 4U Rack Mount Chassis

GET Engineering has already installed a significant quantity of NTDS to fiber converters in four government facilities and are currently in the process of planning for installation in additional facilities. The facilities include :

- * SPAWASYSSEN, Lab 360, San Diego, CA
- * NSWC Dahlgren, ATRC Lab, Dahlgren, VA
- * NWSA Dam Neck, CDSA Lab, Virginia Beach, VA
- * Langley Air Force Base, VA

**CURRENT GET SOFTWARE SOLUTIONS
(NTDS TO TCP/IP)**

The GET NTDS to Fiber advanced technology still transmits Tactical Data in legacy MILSTD- 1397C format. The NTDS legacy data format is not compliant with the new Net Centric Ethernet environment currently being planned and deployed for ship modernizations. New Naval Tactical Data Processors installed on this Ethernet “Backbone” do not communicate with these legacy devices at all. Accordingly, GET Engineering Corporation R&D has developed, produced and tested a new NTDS to TCP/IP Data Converter that reliably converts MIL-STD-1397C 32 Bit “transmits and receives” into Ethernet Packets that pass to Naval Tactical Data Processors over TCP/IP, effectively reducing all NTDS based Tactical Peripherals to Network Interface Cards (NIC’s).



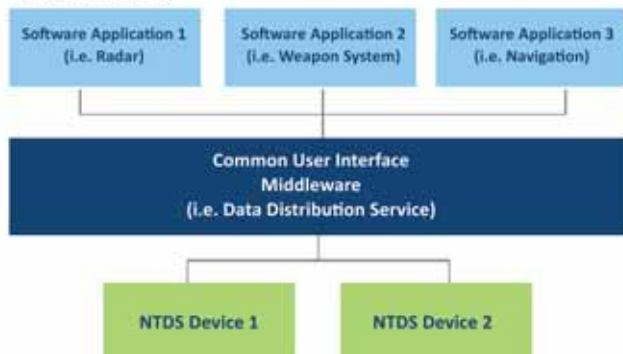
With this new NTDS conversion hardware and software the Navy can now replace the UYK Tactical Data Processors with new high-performance Tactical Processors while reliably continuing to fully utilize the capabilities of currently deployed MIL-STD-1397C peripheral components.

GET NTDS to TCP/IP Converter Hardware Configurations:

- * One Channel Ruggedized Box
- * Two to Four Channels 19” 3U Rack or Wall Mounted Chassis
- * In Development – Sixteen Channel 19” 4U Rack Mount Chassis

GET to TCP/IP Software Configurations:

- * TCP/IP Device Driver
- * TCP/IP “Client Library” Software
- * In Development – Middleware for U.S. Navy Compatibility



CONCLUSION

The operational status of GET Engineering’s products relating to the Navy’s MIL-STD-1397C data conversion are:

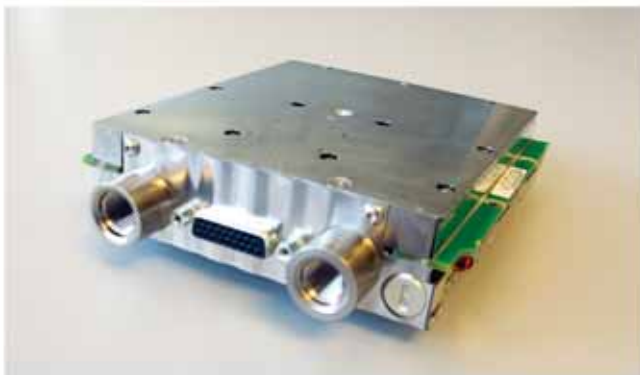
- * Point to Point fiber optic conversion in multiple form factors eliminating the need for heavy costly cabling. This conversion may be used with a layer 1 switching system.
- * MIL-STD-1397C conversion to TCP/IP over fiber or copper in multiple form factors for use in U.S. Navy FORCENet Net CENTRIC environments.

The company’s work on new hardware configurations to suit the U.S. Navy’s future requirements and the completion of the “middleware” component of the software will make these conversion products truly “plug and play”.

Curtiss-Wright Avionics and Electronics Group, part of Defense Solutions Division

ADCM

Curtiss-Wright's Avionics and Electronics division has introduced its latest generation air data computer, the new Air Data Computer Module (ADCM). Designed and manufactured by Defense Solutions' Avionics & Electronics business unit, the commercial off-the-shelf ADCM is Curtiss-Wright's smallest, lightest and most stable vibrating cylinder-based air data computer module, with features unmatched in the market today. The ADCM provides aircraft avionics designers with a compact and lightweight slot-based solution for integrating air data processing directly into their platform's existing host equipment, thereby reducing weight, LRU count and fuel consumption. Curtiss-Wright's first air data computer module to use high-accuracy, high-stability vibrating cylinder sensor technology, the low-maintenance ADCM significantly reduces cost of ownership. Designed for use in both Civil and Defense aircraft platforms, the module speeds and simplifies the integration of air data processing into existing avionics such as SESAR's advanced air traffic management and NextGen. Its ADC functionality and interfaces can be easily tailored to meet the requirements of many aircraft types.



IRIS

(new family of highly rugged flight test instrumentation (FTI) airborne video camera) The IRIS Airborne Cameras will speed-up and simplify the deployment of HD video cameras in FTI systems. IRIS supports in-camera video compression, eliminating the need for the add-on compression modules and dedicated video processing units typically required by flight data acquisition cameras. The cameras also significantly reduce FTI network bandwidth overhead through the use of a unique dual compression stream architecture that supports independent telemetry and recording requirements. Data acquisition is based on the same Precision Time Protocol (PTP) synchronization used by the main instrumentation system. The camera's Ethernet output streams support the open INET-X packet format. To ease camera configuration, the IRIS supports DAS Studio 3 set-up and management software. The HD IRIS airborne camera will be available in both in-cabin and external use variants.



New Multi-Interface Module Features Independently Configurable Analog Channels



Curtiss-Wright Defense Solutions division has introduced a new flexible analog module for its flight test instrumentation (FTI) product range. Designed and manufactured by its Avionics & Electronics Group, the Acra KAM-500 ADC/136 is a commercial off-the-shelf (COTS) module that enables users to interface to different analog sensors on the same module without sacrificing accuracy. The ADC/136 features eight (8) flexible channels that can be used with a wide range of sensor types, including full or half-bridge, potentiometer, single ended, differential ended, Integrated Circuit Piezoelectric (ICP), Resistance Temperature Detector (RTD) or thermocouple sensors. Configuration of each of the individual channels can be performed quickly and easily using Curtiss-Wright's intuitive DAS Studio software. This provides flight test engineers with a simple and highly flexible approach for meeting new or unique sensor requirements. It also helps to reduce the total number of modules necessary in an FTI application where only a small number of parameters need to be acquired. The ADC/136 has programmable primary gain, input range and balance for each channel with a choice of either IIR or FIR filter. It also features programmable current or voltage excitation, high accuracy (up to 0.03%FSR typical), 50KSPs, 12.5KHz bandwidth and high impedance per channel when powered off.

Your SWaP Optimized Subsystem Partner

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WRIGHT**

CWC-AE.COM

Mission
Computers



Mission
Displays



Data
Storage



Air Data
Computers



Low Air
Speed Probes



Video
Management



Crash Protected
Recorders



Data
Acquisition



Supporting Diverse Applications

- ▶ Avionics upgrades
- ▶ Retrofitting glass-cockpits
- ▶ Consolidating system controls
- ▶ Aggregating sensor output display
- ▶ Utility / vehicle management
- ▶ Crash protected recorders
- ▶ Enabling RVSM and IVSI capabilities
- ▶ Fire and ice detection and protection
- ▶ Onboard electrical systems management
- ▶ Mission computing

L or S BAND FM/SOQPSK/ANALOG ON-BOARD TRANSMITTER

Reference: DMR-L-S-20W-TX

Special Features:

- * **Automatic Data Rate Tracking**
Premod filtering and deviation automatically track the data rate, with no programming or configuration required.
- * **Intuitive Control**
Straightforward configuration and control and platform-independence with serial terminal programming
- * **Clock-Free Input Option Available**
Ideal for replacing analog transmitters or for use with encoders or cryptos that provide a data output, but no clock.
- * **PCM/FM**
PCM/FM (ARTM Tier 0) 20 Mbps.
- * **Variable Power Option Available.**
5 steps and RF power off (30 dBm, 33 dBm, 36 dBm, 39 dBm and 43 dBm) (accuracy ± 1 dB).
- * **IRIG106 Randomizer Option Available**
15 stages LFSR per IRIG106 selectable for bypass or enable.
- * **Analog FM**
Include linear FM modulation for video or PCM/FM all codes.
- * **Automatic Monitoring**
Transmitter can be set-up in Auto or Manual mode. In Auto mode, a frame containing: "Carrier Frequency, Modulation type, Power setting, Temperature at power supply assembly and at RF assembly" is sent every second through RS232 port.

RF SPECIFICATIONS

Carrier frequency range: (factory setting). 1400 to 1600 or 2200 to 2400 MHz (extension bandwidth option available).
RF output power: up to 20 W (43 dBm ± 1 dB) all conditions. VSWR : < 1.8:1 Load mismatch (RF = open or short): no degradation. Carrier frequency tuning step: 250 kHz. Carrier frequency stability: 20ppm over temperature range. Modulation: user selectable digital PCM/FM, SOQPSK-TG (Tier I) and analog video FM. Spectral occupancy: 99% energy with theoretic bandwidth for FM modulated with PCM data. Deviation linearity: 2% max Modulation distortion: 2%

ANALOG FM MODULATION SPECIFICATIONS

Modulation input impedance: 50 or 75 ohms, AC/DC programmable. Analog input Bandwidth: DC to 10 MHz
Analog frequency response: 30Hz to 10MHz. Modulation input level: 0.25,0.5,1,2,5 and 10 V peak to peak programmable. Deviation sensitivity: 0.5, 1, 2 or 5 MHz / Vpp programmable.

DIGITAL PCM/FM and SOQPSK-TG MODULATION SPECIFICATIONS

Modulation: user selectable digital PCM/FM, SOQPSK-TG (Tier I) and analog video FM. Data rate: 100 Kbps to 20 Mbps automatic badaptation of deviation according to Tier0 and Tier I IRIG mask. Signal interfaces: Serial data with separate synchronous clock, TTL 5V or RS422. Modulation input impedance: 50 ohms Control interface: RS-232 serial control.

POWER REQUIREMENT

28 V DC (18 V min to 36 V max) Current: 3A @r 28 V typical. Reverse polarity protection MIL 704D Transient handling compliant

ENVIRONMENTAL CONDITIONS

Operating temperature range: - 30 to +85° C. (baseplate).
Operating Humidity: 0 to 95 % non condensing. Vibration: 20 Hz to 2000 Hz: 19.6 g random 3 axes.
Shock: ½ sinus 5 ms, 60 g 3 axes. Altitude: 100 000 ft maximum. Acceleration: 40 g 3 axes.

PHYSICAL SECTION

Dimensions (L x h x l): 99 x 63.5 x 33 mm without heatsink, need thermal resistance below 0.35°K/W for reliable operating without permanent damage and keep baseplate below 85°C. Weight: <380 g (without heatsink)
RF output connector: SMA(F) Mod Input Connectors: - 1x SMA(M) for analog input Power connector, Signal and Control interfaces : single connector MDM 15 type.

Advanced Missile Launcher

Weighing less than 30kg, the **Advanced Missile Launcher (AML)** is ideally suited for carriage on wing-tip stations or for applications where weight savings are a key requirement, such as Unmanned Aerial Vehicles. AML is also suitable for inclusion on multi-stores carriage systems or individually on inboard stations. The weight reduction allows heavier missiles to be carried, increasing the operational flexibility of the aircraft.



Key Features

- Extremely lightweight modular system
- Sub-66lb/30kg (market leading for fast jet applications)
- Wing-tip or pylon capable with simple role change
- Optional carriage installation (suspension options are 14" and 30")
- Carriage capabilities include internal mounting of missile cooling gas supply from either a bottle or compressor

Specification

Payload capacity	:	1 Short range air to air missile
Weight	:	>66lb/30kg
Dimensions	:	104 x 4.2 x 6.1in
(L x W x H)	:	2650 x 106 x 155mm
Platform integration	:	Easily integrated onto most fast jets, rotary wing or UAV platforms

Weapons Carriage & Release

Wingtip to Wingtip solutions

Cobham provides a comprehensive range of weapons carriage and release equipment for fast jets, rotorcraft and Unmanned Aerial Vehicles. With a capability spanning 'wing-tip to wing-tip' products include Air-to-Air and Air-to-Ground Systems employing both pneumatic and pyrotechnic ejection.

Air-to-Ground Capability

Air-to-Ground products are compatible with a range of smart and dumb munitions including Small Diameter Bomb, Brimstone and Hellfire missiles. Cobham is instrumental in the advancement of proprietary weapons carriage and release. Recent developments:

- Pneumatic store ejection: gas cartridge, compressor or gas bottle
- World class ground firing test facilities approved for both high pressure cold gas and pyrotechnic cartridge development and testing
- Qualification for ejector and cartridge performance
- Environmental testing (thermal) to MIL-STD-810

Products include:

Ejector Release Units

Installed in aircraft bomb bays, wings or fuselage pylons, units provide pneumatic or pyrotechnic ejection for bombs and role equipment.



ERU119



ERU20

The ERU119 (light duty) and ERU120 (heavy duty) products encompass a low weight, high strength design providing consistent and reliable ejection of stores and delivering enduring performance.

Practice Bomb Carriers

Cost effective practice bombing can be achieved with either hot or cold gas ejection



CBL (Carrier Bomb Light Stores)

Cobham's CBL (Carrier Bomb Light Stores) provides the facility for carriage and release of up to four practice stores. Designed for carriage on aircraft wing or fuselage pylons, CBL includes four ERU122 (EX) Ejector Release Units and associated firing control electronics (Autoselector). Traditionally powered by pyrotechnic cartridges, these ejectors can now be fitted with high pressure pneumatic cartridges.

Air-to-Air Capability

Air-to-Air products are compatible with a variety of short, medium and beyond visual range air-to-air missiles: AIM-9L, ASRAAM, IRIS-T, A-Darter, AMRAAM, Meteor, R-Darter. Products include:

Eject Launchers

High velocity long stroke missile ejection.



MEL (Missile Eject Launcher)

Cobham's Missile Eject Launcher (MEL) is a specialized unit designed for the carriage and release of air to air missiles from fast jet aircraft. Units have been developed and specifically tailored for the F-4 Phantom, Tornado GR4 and Eurofighter Typhoon, and offers long-stroke rapid ejection to ensure safe missile/aircraft separation on launch, even in the most extreme flight conditions. Selecting the MEL allows weapon carriage on store stations within bomb bays, conformal stations such as those on the underside of Eurofighter Typhoon which offer stealth through reduced radar signature, or traditional wing pylon stations.

Rail Launchers

Integration of multiple missile types and extremely light weight modular systems are provided for Air-to-Air Rail capability.



AML (Advanced Missile Launcher)

Weighing less than 30kg, Cobham's Advanced Missile Launcher is ideally suited for carriage on wing-tip stations or for applications where weight savings are a key requirement, such as Unmanned Aerial Vehicles.



NMML (NATO Multi Missile Launcher)

The Multi Missile Launcher (MML) is a state of the art rail launcher capable of carrying a range of different missiles without the need for role change; a unique modular construction allows the MML to interface with short, medium and beyond visual range missiles. A variety of power conditioning and missile seeker cooling options are available and a BOL countermeasures dispensing system maybe carried for additional operational flexibility

Multi-Beam Hub Base Station Antenna for Ultra-Fast MIMO

Multi-beam hub Base Station antenna, MBA6-3.5DS45/2045, has been developed by Cobham Antenna Systems, Microwave Antennas to enable MIMO (multiple input multiple output) radio system operators to meet their goal of 1Gbps/km² anywhere within a cell.

Designed for high speed MIMO 4G (and beyond) urban access for backhaul, this was originally a European Union funded project that has become a finished and available multi-beam antenna with additional Military and Security beneficial applications.

For Security and Military applications the technology can be scaled to cover other frequency bands, with applications such as communications to multiple mobile platforms (ground or airborne). This system has the benefit of providing higher gain over a wider angle than a single sector antenna. Communications are more secure and less prone to intercept and jamming than Wide Beam or Omni antennas.

By removing barriers to next-generation network deployment, this multi-narrow-beam antenna allows for a dramatic increase in capacity over existing communication systems. It provides an essential component enabling an improvement to the overall infrastructure capacity density of the current mobile network by an order of magnitude (10x).

Ideal deployment for this antenna is communication with a network of "below-rooftop" Access Base Stations using existing structures. The system strategy with these access base stations will allow self-backhauling.

This multi-beam antenna has 90° coverage (a 90° arc) utilising six individual narrow beam patterns each with a half power beamwidth of 15°. MIMO capability is provided with +/-45° polarisation in each of the six 15° sectors.

The advantage of this format is that a narrow beam can create high density coverage within a specific narrow area allowing for a high level of frequency re-use. This system is also far more efficient than installing 6 separate narrow beam directional antennas.

By positioning four multi-beam antennas in a square formation a complete 360° coverage is achieved. This is provided by 24 dual-polarised beams. The current system benefits from meeting ETSI specification for multi-beam antennas (EN 302 326-3 V.1.1.2) and provides low side-lobe levels for greater system efficiency.

The antenna measures only 586mm (23") high x 456mm (17.95") wide x 76mm (3") deep, making it extremely compact given that it provides 2 x 6 beams each with 17dBi peak gain. For dense urban deployment, this compact Multi-beam antenna will reduce wind-load on towers and the cost of installation compared with conventional alternatives.

Technology

The antenna element comprises a single cross-dipole assembly operating at a centre frequency of 3.5GHz interlocked in a configuration which provides a slant dual polar beam.

Eight sets of these assemblies are fed in phase through a stripline feed to create the single 110° sector antenna which forms the basis for the array. There are eight sector antennas in the complete assembly.

In order for the six dual-polar narrow beams to be formed to cover the 90° arc, two 8x8 Butler matrix beam forming devices are used to feed the separate ports of each antenna element.

By a mechanism of fixed phase shifters and couplers the Butler matrices provide defined sets of phases into each of the eight internal antenna elements which results in two sets of 6 skewed beams. The two outer beams, covering +/-60degree are not currently used.

Within the new unit the Butler matrix devices are fully integrated into the antenna eliminating the need for 16 phased-matched cables. This makes a much more efficient and cost-effective antenna.

In this antenna the down-tilt is a nominal 2° across the band of interest, i.e. 3.4 – 3.6GHz with an elevation beamwidth of 10° to the half-power point.

For more information please contact Cobham Antenna Systems, Microwave Antennas:

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About Cobham Antenna Systems

For more than 60 years Cobham Antenna Systems has been a leader in the design and manufacture of communication systems and antennas. Innovative communication, navigation, jamming, electronic warfare, telemetry and radar antennas serve commercial aviation manufacturers and operators, defence contractors, emergency response organisations and law enforcement agencies. Advanced antenna technology for satellite communications, avionics, radar and surveillance applications connect military and commercial aircraft, naval vessels, vehicles and mobile teams with the world through high-speed data, voice and video. Cobham also has a wide range of standard, composite masts, antenna pointing devices, and vehicle mounting systems and high performance composite structures and products for the aerospace industry, radomes and aircraft components, high temperature aircraft engine products, rotorcraft blade components, unmanned aerial vehicle airframes and sub-components. Cobham Antenna Systems is a leading supplier of flat plate array antennas, standard and custom passive RF components and assemblies, and specialised microwave and electro-mechanical rotating devices. These include RF rotary joints, gear-driven pedestals and RF rotating subsystems used in military and air traffic control radars, and telecommunications systems.

About Cobham Antenna Systems, Microwave Antennas, Newmarket

European Antennas Ltd trading as Cobham Antenna Systems, Microwave Antennas is a British company based near Newmarket, Suffolk. They are specialists in the design and development of high quality antennas used for defence, security, satellite and commercial communication systems. More than 60% of production is exported. Antenna development projects are undertaken.

7th TAI AVIATION and AVIONICS SYSTEMS SEMINAR

November 25-26, 2014

Middle East Technical University, Cultural & Convention Center –Turkey

PROGRAM

<p style="font-size: 1.2em; font-weight: bold;">Opening</p> <p style="font-weight: bold; color: red;">Hall : KEMAL KURDAS</p>	<p>09:00 – 09:10 Opening Ceremony Electronics Valley 09:10 - 09:20 Keynote Speaker Mr. Vance Hilderman 09:20 - 09:30 Universities / Research & Development 09:30 - 10:00 SSM</p>		
November 25, 2014	November 25, 2014	November 25, 2014	November 25, 2014
<p>HALL : H</p> <p>11:00 - 12:30 VECTOR SOFTWARE – Vance HILDERMAN</p> <p>HALL: A</p> <p>15:15 - 17:45 “Love is in the Air!” Can EREL (Middle East Technical University Aerospace Students Society- MASS Event)</p>			
	HALL B	HALL C	HALL D
<p>10:00 - 11:00 Break 11:00 - 11:30 TAI-1 11:30 - 12:00 AIM 12:00 - 12:30 WIND RIVER</p> <p>12:30 - 13:45 Lunch Break</p> <p>13:45 - 14:15 TAI-2 14:15 - 14:45 LDRA 14:45 - 15:15 AYESAS</p> <p>15:15 - 15:45 Break</p> <p>15:15 - 17:15 CAN EREL</p>	<p>10:00 - 11:00 Break 11:00 - 12:30 METEKSAN</p> <p>12:30-13:45 Lunch Break</p> <p>13:45 - 15:15 TEKTRONİK</p> <p>15:15 - 15:45 Break</p> <p>15:45 - 17:15 TEKTRONİK</p>	<p>10:00 - 11:00 Break 11:00 - 12:30 GORE</p> <p>12:30 -13:45 Lunch Break 13:45 - 15:15 Reserved</p> <p>15:15 - 15:45 Break</p> <p>15:45 - 17:15 Reserved</p>	<p>10:00 - 11:00 Break 11:00 - 12:30 OTONOM</p> <p>12:30 -13:45 Lunch Break</p> <p>13:45 - 15:15 CURTISS WRIGHT</p> <p>15:15 - 15:45 Break</p> <p>15:45 - 16:15 TAI-3 16:15 - 17:15 UZAYTEM</p>
November 26, 2014	November 26, 2014	November 26, 2014	November 26, 2014
HALL A	HALL B	HALL C	HALL D
<p>09:00 - 09:30 TAI-4 09:30 - 10:00 ESTEREL 10:00 - 10:30 AOS</p> <p>10:30 - 11:00 Break</p> <p>11:00 - 11:30 TAI 5 11:30 - 12:00 GORE 12:00 - 12:30 TAI 6</p> <p>12:30 - 13:45 Lunch Break</p> <p>13:45 - 14:15 TAI-7 14:15 - 14:45 TAI-8 14:45 - 15:15 OTONOM</p> <p>15:15-15:45 Break</p> <p>15:45 - 16:15 TAI-9 16:15 - 17:15 UNIVERSITIES</p>	<p>09:00 - 10:30 MILSOFT</p> <p>10:30 - 11:00 Break</p> <p>11:00 - 12:30 ESTEREL</p> <p>12:30 -13:45 Lunch Break 13:45 - 15:15 STARTEKNİK</p> <p>15:15 - 15:45 Break</p>	<p>09:00 - 10:30 INNALABS</p> <p>10:30 - 11:00 Break</p> <p>11:00 - 12:30 COBHAM MICROWAVE</p> <p>12:30 -13:45 Lunch Break 13:45 - 15:15 SAMTEC</p> <p>15:15 - 15:45 Break</p> <p>15:45 - 17:15 SAMTEC</p>	<p>09:00 - 10:30 CWC -2</p> <p>10:30 - 11:00 Break</p> <p>11:00 - 12:30 TAI WORKSHOP</p> <p>12:30 13:45 Lunch Break</p> <p style="text-align: center; font-weight: bold; color: red;">HALL H</p> <p>13:45 - 15:15 RTI</p> <p>15:15 - 15:45 Break</p>

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