

ITC 2008 Technical Program

Tuesday, Oct. 28th, 1:30 - 4:30 p.m.

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**Session 1: Joint Range Commanders Council – Telemetry Group (RCC-TG)
and Telemetry Standards Coordinating Committee (TSCC)
Special Session**

**Chair: James Yates, L3 Communications - Telemetry & RF Products and
Ronald Pozmantier, AFFTC - Edwards AFB**

This session has been created to allow the dissemination of the results of work accomplished in the telemetry field by two of the industries leading organizations for both standards development and review. The first half will be briefings/presentations on on-going task efforts being undertaken by the RCC-TG, including progress to date, expected results, interesting findings and expected completions. The second half will be briefings/presentations on on-going reviews task efforts being undertaken by the TSCC over the last 12 months, including findings across both flight test and spacecraft telemetry standards developments.

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Session 2: Time-Space Positioning / GPS

Chair: Kevin Crawford, NASA/Marshall Space Flight Center

1:30 p.m.
08-02-01 **"Dual Antenna use on a GPS Receiver"**
Hal Altan, Honeywell International

Combining signals from multiple antennas have always created challenges for dynamic GPS receiving system designers during acquisition and tracking. This paper tries to open the topic for further discussion and study.

2:00 p.m.
08-02-02 **"High-Precision Geolocation Algorithms for UAV and UUV Applications in Navigation and Collision Avoidance"**
Hua Lee, University of California, Santa Barbara

This paper presents the theoretical analysis, signal processing, and the field experiments of two algorithms in UAV and UUV applications in homing and docking as well as collision avoidance.

2:30 p.m.
08-02-03 **"The Development of a Flight Test Real Time GPS Navigation Tool (GNAV)"**
Nelson Paiva Oliveira Leite et al., Grupo Especial de Ensaios em Vôo, Centro de Computação da Aeronáutica de Brasília and Instituto Tecnológico de Aeronáutica - Divisão de Eng. Eletrônica

The development and the preliminary tests results of a real-time data processing tool to compute Time Space Position Information using differential GPS techniques is presented where Rover observables are embedded into the FTI PCM stream.

3:00 p.m.
08-02-04 **"Current Status of Adding GPS Tracking Capability to a Missile Telemetry Section"**
Scott Kujiraoka, NAVAIR-Pt. Mugu, Russ Fielder & Alvia Sandberg, NAVAIR-China Lake

This paper chronicles the latest effort in adding GPS Tracking Capability (developed by JAMI) to a Five Inch Diameter Missile Telemetry Section as well as upgrading the Test Ranges to support these new Missile Firings.

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Session 3: System Management

Chair: Ray Faulstich, CSC Range and Engineering Services

1:30 p.m.
08-03-01 **"System Management in Network-Based Telemetry Systems"**
Allison Bertrand, Michael Moore, and Ben Abbott, Southwest Research Institute

Network-based flight test systems benefit from being managed in a coordinated fashion. Standards-based System Management interfaces support variable styles of user interaction and quick integration of new types of devices. Implementation trade-offs will be discussed.

2:00 p.m.
08-03-02 **"Technology Trades for Management of Telemetry Network Systems"**
Allison Bertrand, Thomas Grace, Ben Abbott, Kase Saylor, Southwest Research Institute and NAVAIR

The Integrated Network Enhanced Telemetry (iNET) Project System Management Standards Working Group has been studying foundation technologies for interfaces supporting the integrated management of telemetry network systems to ensure interoperability among varied equipment.

2:30 p.m.
08-03-03 **"iNET Based Automatic Hardware Selection"**
Benjamin Kupferschmidt, Teletronics Technology Corp.

The paper discusses the design of an automatic hardware selection system that can automatically transform the requirements for a flight test program into a list of hardware that can accomplish the desired task.

3:00 p.m.
08-03-04 **"Managing Instrumentation Networks"**
Eric Pesciotta, Teletronics Technology Corporation

This paper explores the technologies required to satisfy traditional system configuration as well as the less understood aspects of network management and analysis. Examples of software that meet or exceed these requirements are provided.

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Session 3: System Management (*continued*)

3:30 p.m.
08-03-05

"The Optimization of Node Configuration in a Mixed network for Quality of Service"

Laurie St. Ange and Richard Dean, Morgan State University

This paper shows that optimum node configurations can be achieved in a mixed network for Quality of Service and Signal-to-Interference requirements. This is achieved by implementing developed distance measures in a modified k-means clustering scheme.

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Session 4: Payload and System Software Development

Chair: Rodger Charroux, The Aerospace Corporation

1:30 p.m.
08-04-01 **"A Data-Oriented Software Architecture for Telemetry"**
Rajive Joshi, Real-Time Innovations Inc.

Historically telemetry architectures have tightly coupled remote articles, links, and ground resulting in brittle/expensive designs. "Data-Oriented Architecture" is a framework for loosely-coupled real-time information-driven systems, relying on tunable standards-based middleware to realize modular scalable designs.

2:00 p.m.
08-04-02 **"Using LabVIEW to Design a Payload Control System"**
Stephen Horan, New Mexico State University

In this paper, we will look at LabVIEW-based state machines for controlling a payload and its groundstation, the challenges for the PC/104 flight computer development, and show how the final product was deployed.

2:30 p.m.
08-04-03 **"IP-Based Networking as Part of the Design of a Payload Control System"**
Stephen Horan, Ryan Aaronscooke, and Daniel Jaramillo, New Mexico State University

We have developed a ground station and flight computer employing IP-based networking for command and telemetry communications. We have also demonstrated the ability to operate the payload remotely over the Internet through the remote groundstations.

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Session 5: Network & Transport Protocols

Chair: Lance Self, Air Force Research Lab

1:30 p.m.
08-05-01
"Analysis and Application Scenarios for Telemetry Data Transmission and Synchronization over Wireless LAN"
Nikki Cranley and Diarmuid Corry, ACRA Control Inc.

This paper provides an overview and experimental analysis of WLAN technology focusing on its application in networked telemetry data acquisition systems and its limitations for real-time telemetry data transmission.

2:00 p.m.
08-05-02
"Real-time Transport Protocols for Telemetry Data and Signaling"
Nikki Cranley and Diarmuid Corry, ACRA Control Inc.

This paper presents the open standard Real-time Transport Protocol (RTP) for networked telemetry systems and proposes a preliminary Telemetry payload profile definition as a subset of the RTP protocol specialized for telemetry data transmission.

2:30 p.m.
08-05-03
"Networked Data Acquisition Systems for the Army FCS Program"
Eric Pesciotta, John Roach, Nathan Sadia and Hsueh-szu Yang, Teletronics Technology Corp.

This paper describes the High-Speed Digital Recording system, a network-based data acquisition system designed to allow for the recording of high-resolution (1600x1280) RGB video, user-selected Ethernet packets, along with audio and GPS time information.

3:00 p.m.
08-05-04
"A Cross-Layered Protocol Architecture for Highly-Dynamic Multihop Airborne Telemetry Networks"
Abdul Jabbar, James P.G. Sterbenz and Erik Perrins, University of Kansas

Networks of high-velocity airborne nodes present unique challenges to the current Internet protocols. This paper presents the architecture and design of a network layer and a cross-layered routing protocol optimized for airborne telemetry networks.

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Session 5: Network & Transport Protocols (*continued*)

3:30 p.m.
08-05-05

"NonTraditional Uses of the CCSDS Space Link Extension (SLE) Protocol"

Brian Safigan, Kirill Lokshin and Amit Puri, CVG/Avtec Systems, Inc.

This paper discusses non-traditional uses of the CCSDS SLE protocols outside the constrained discrete packet telecommand/telemetry model envisioned by CCSDS.

4:00 p.m.
08-05-06

"Key Components in a Networked Data Acquisition System"

Diarmuid Corry, ACRA Control Inc.

This paper assumes little previous experience with networks, and looks at how a networked based approach affects the elements of an FTI network and the things the engineer must look for when designing an Ethernet based FTI network.

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Session 6: Emerging iNET Standards Special Session

Chair: Daniel Skelley, NAVAIR - Pax River

Sponsored by the Central Test and Evaluation Investment Program (CTEIP), the integrated Network Enhanced Telemetry (iNET) Project has developed an architecture for network enhancing telemetry. This architecture will be implemented via a set of standards; allowing multiple vendors hardware to interoperate within a single system. Throughout 2008, iNET has engaged the community through a collaborative working group process to develop the standards. This session will present an overview of these emerging standards, and describe the work performed to date.

- 8:30 a.m. **"Overview of iNET Acquisition Strategy"**
William Cookson, Edwards Air Force Base
- 9:00 a.m. **"System Management Standards"**
Ben Abbott, Southwest Research Institute
- 9:30 a.m. **"Communication Link Standards"**
Kip Temple, Edwards Air Force Base
- 10:00 a.m. **"Test Article Standards"**
Gary Ragsdale, Southwest Research Institute
- 10:30 a.m. **"Ground Station Applications"**
Bruce Lipe, Edwards Air Force Base
- 11:00 a.m. **"Metadata Standards"**
Michael Moore, Southwest Research Institute

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Session 7: Telemetry in Extreme Environments

Chair: Jaime Reyes, White Sands Missile Range

8:30 a.m.
08-07-01 **"In-Bore Acceleration Measurements of an Electromagnetic Gun Launcher"**

Edward F. Bukowski, T Gordon Brown and Tim Brosseau, US Army Research Laboratory

This paper discusses a system to measure in-bore structural loads of projectiles launched from an electromagnetic gun.

9:00 a.m.
08-07-02 **"Low-Cost Semi-Active Laser Seekers for US Army Applications"**
K. Hubbard et al., Army Research Laboratory and Dr. T. G. Horwath Consulting, LLC

This paper presents the design and basic characteristics of a low-cost semi-active laser seeker for gun launched projectiles.

9:30 a.m.
08-07-03 **"An Economic Method to Increase Equipment Rack Shielding"**
Robert Ridgeway, Digi International Inc. and Henry Newton, National Radio Astronomy Observatory

The ALMA Project is developing a based radio astronomy array for northern Chile. The array utilizes high level shielded racks. Carbon filled foam installed in the racks is being used to enhance shielding.

10:00 a.m.
08-07-04 **"Approaches to Mitigate Disruption of Telemetry During Directed Energy Testing"**

Michael Keidar et al., The George Washington University, University of Michigan and Edwards Air Force Base

Telemetry in the case of directed-energy beam interaction with a target might be disrupted due to plasma formation causing communication blackout. In this paper several mitigation approaches, namely electrostatic and electromagnetic, are considered.

10:30 a.m.
08-07-05 **"Soft Recovery Recording System for Interior and Exterior Ballistics Characterization"**

Mauricio Guevara and Boris Flyash, US Army ARDEC, Precision Munitions Instrumentation Division

This paper describes the design and acceleration data collected of a data acquisition system built to fit in a M831 modified tank round.

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Session 8: Reliability, Maintenance & Risk Management

Chair: Brian Keating, NAVAIR - Pax River

8:30 a.m.
08-08-01 **"Analytic Redundancy of Navigation Systems for Flight Test Data Validation"**

Walton Williamson, Jason Speyer, Greg Glenn, Vu Dang and Terri Xiao, SySense Inc.

Theory and flight test example of using analytic redundancy methods to automate the process of looking for sensor anomalies. The example demonstrates detection of air data system anomalies using GPS.

9:00 a.m.
08-08-02 **"A Constraint-Based Approach to Predictive Maintenance Model Development"**

Joe Gorman, Glenn Takata, Subhash Patel and Dan Grecu, Charles River Analytics

Predictive maintenance can provide significant cost savings while preserving system performance and readiness. This paper describes a novel application of constraint-based data mining applied to predictive maintenance

9:30 a.m.
08-08-03 **"Spectral Analysis for Spacecraft Analog Telemetry Behavior"**

Len Losik, Failure Analysis

Spectral analysis analyzes complex electronic signals breaking them in amplitude, time, frequency and phase components and provides another tool to resolve suspect space vehicle telemetry measurement behavior reducing risk to critical space assets.

10:00 a.m.
08-08-04 **"Launch Vehicle and Satellite Independent Failure Analysis Using Telemetry Prognostic Algorithms"**

Len Losik, Failure Analysis

Telemetry prognostics is the use of generic, data-driven algorithms usable across all satellites and launch vehicles allowing identification of equipment failures that will occur for up to one year in the future or has already occurred allowing for an independent failure analysis.

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Session 8: Reliability, Maintenance & Risk Management (*continued*)

10:30 a.m.
08-08-05 **"Predicting Long-Term Telemetry Behavior for Lunar Orbiting,
Deep Space, Planetary and Earth Orbiting Satellites"**
Len Losik, Failure Analysis

Oracol is a Windows-based telemetry behavior prediction service providing accurate, long-term information engineers need to develop tailored in-orbit analysis tools prior to launch and for comparison with actual spacecraft telemetry behavior for decades into the future.

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Session 9: Modulation & Synchronization

Chair: Robert Selbrede, JT3 - Edwards AFB

8:30 a.m.
08-09-01 **"Space-Time Shaped Offset QPSK"**
Xiaoyu Dang and Michael Rice, Brigham Young University

This paper describes the use of orthogonal space-time block codes to overcome the performance and complexity difficulties associated with Shaped Offset QPSK modulation in multiple-input, single-output telemetry systems.

9:00 a.m.
08-09-02 **"PAM-Based Timing Synchronization for ARTM Modulations"**
Erik Perrins and Sayak Bose, University of Kansas, Marilyn P. Wylie-Green, Nokia Siemens Networks

We develop a simple decision-directed timing recovery method for continuous phase modulation (CPM), and apply this method to PCM/FM, SOQPSK-TG, and ARTM CPM. The proposed approach performs close to the theoretical limits in simulations.

9:30 a.m.
08-09-03 **"A Novel Multi-h CPM-SC-FDMA Transmission Scheme for Aeronautical Telemetry"**
Marilynn Wylie-Green, Nokia Siemens Networks and Erik Perrins, University of Kansas

We describe a novel scheme that combines key characteristics from continuous phase modulation and Single-Carrier Frequency Division Multiple Access in order to produce a robust, power efficient scheme for high-rate multiple-access aeronautical telemetry applications.

10:00 a.m.
08-09-04 **"Re-Engineering PCM/FM as a Phase Modulation Scheme"**
Ratish J. Punnoose, Sandia National Laboratories

With modern receivers, PCM/FM can have better error performance (but worse spectral efficiency) than SOQPSK or multi-h CPM. We present the limits of its error performance and explore additional modifications that can improve it further.

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Session 9: Modulation & Synchronization (*continued*)

10:30 a.m.
08-09-05

"Considerations for Deploying IEEE 1588 v2 in Network-Centric Data Acquisition and Telemetry Systems"

Todd Newton, Evan Grim and Myron Moodie, Southwest Research Institute

This paper discusses the recently updated IEEE 1588 standard for precise time synchronization. New features introduced in this version of the standard as well as interoperability issues with version 1 are discussed.

11:00 a.m.
08-09-06

"Utilization of an IEEE 1588 Timing Reference Source in the iNET RF Transceiver"

Cheng Lu, John Roach and George Sasvari, Teletronics Technology Corp.

Synchronization is essential for iNET due to its TDMA access control and coherency of signal modulation waveforms. TTC proposes a cross-layer (MAC, PHY) synchronization architecture that utilizes the 1588 timing reference to improve transceiver performance.

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Session 10: Multipath Environments

Chair: Terry Hill, Quasonix

8:30 a.m.
08-10-01 **"New Results In Unitary Space-Time Code Construction and Comparison to Upper Bounds"**
Adam Panagos, Dynetics, Inc., Chris Potter and Kurt Kosbar, Missouri S&T

A survey of unitary space-time code construction techniques, some newly found codes, and a comparison of best known codes to diversity product and diversity sum upper bounds are presented

9:00 a.m.
08-10-02 **"MIMO Channel Prediction Using Recurrent Neural Networks"**
Chris Potter and Kurt Kosbar, Missouri S&T, Adam Panagos, Dynetics, Inc.

This paper describes the use of a recurrent neural network to predict the state of multiple-input multiple-output channels.

9:30 a.m.
08-10-03 **"Hardware Discussion of a MIMO Wireless Communication System Using Orthogonal Space Time Block Codes"**
Chris Potter and Kurt Kosbar, Missouri S&T, Adam Panagos, Dynetics, Inc.

This paper describes a hardware test-bed which will be used to evaluate multiple-input multiple-output systems for missile and other aerospace telemetry applications.

10:00 a.m.
08-10-04 **"Iterative Equalization for SOQPSK in Multipath Fading"**
Qiang Lei and Michael Rice, Brigham Young University

This paper investigates the application of iterative equalization techniques to overcome multipath fading for shaped offset QPSK in aeronautical telemetry. An iterative decision feedback equalizer suitable for use with SOQPSK-TG is proposed and this equalizer offers good complexity/performance trade-offs and exhibits impressive performance for SOQPSK-TG.

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Wednesday, Oct. 29th, 2:30 - 5:30 p.m.

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Session 11: Joint Advanced Missile Instrumentation (JAMI) User Group Special Session

Chair: Rick Marvin, NAVAIR - China Lake

JAMI is a Central Test and Evaluation Investment Program (CTEIP) sponsored project that has developed a Global Positioning System (GPS) Time Space Position Information (TSPI) solution for telemetry applications. The purpose of the users group is to provide a forum for users to share their experience and application of the technology, discuss issues with the current system, and develop recommendations for future enhancements.

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Session 12: iNET Technologies

Chair: Daniel Skelley, NAVAIR - Pax River

2:30 p.m.
08-12-01 **"The Design of a High-Performance: Network Transceiver for iNET"**

Cheng Lu, Paul Cook, John Hildin, and John Roach, Teletronics Technology Corp.

iNET transceiver enables two-way communication capability between nodes on both the ground and in the air. We describe TTC development path in its implementation of nXCVR-2000G, an OFDM 802-11a-based iNET-ready IP transceiver.

3:00 p.m.
08-12-02 **"An Airborne Network Telemetry Link for the iNET Technical Demonstration System"**

Kip Temple and Dan Laird, Air Force Flight Test Center

This paper will discuss a COTS wireless network link for use in aeronautical telemetry. A system description, system configuration and monitoring tools, and flight test results over various flight paths are presented.

3:30 p.m.
08-12-03 **"Implementing iNET and the Operational Issues Involved"**

David Hodack, Naval Air Systems Command

This paper will discuss an iNET operational demonstration that will involve instrumenting an H-60 helicopter with a network based telemetry system and the expected operational issues involve with such an installation.

4:00 p.m.
08-12-04 **"Technology Trades in IP-based Telemetry Networks"**

Joshua Kenney, Myron Moodie and Gary Ragsdale, Southwest Research Institute, Thomas Grace, NAVAIR

The iNET test article standards working group is defining open standards for telemetry network interoperability. This paper describes the current technology trades of an IP-based network paradigm used in producing standards for test article networks.

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Session 12: iNET Technologies (*continued*)

4:30 p.m.
08-12-05

"Distance Measures for QOS Performance Management in Mixed Networks"

Yacob Astatke and Richard Dean, Morgan State University

This paper provides the analytical foundation to prove that the "power" distance measure is an excellent tool for optimizing the clustering of a Mixed Network for Quality of Service applications for the iNET project.

5:00 p.m.
08-12-06

"TENA in a Telemetry Network System"

Kase Saylor, William Malatesta and Ben A. Abbott, Southwest Research Institute and NAVAIR

This paper discusses a demonstration prototype that is being used to investigate the use of the Test and Training Enabling Architecture (TENA) across a constrained integrated Network Enhanced Telemetry (iNET) environment.

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Session 13: Aeronautical Telemetry

Chair: James Yates, L3 Communications - Telemetry & RF Products

2:30 p.m.
08-13-01 **"Migrating Airborne Instrumentation Systems from PCM to Network"**

Albert Berdugo, Teletronics Technology Corporation

This paper describes hardware components that enable instrumentation engineers to migrate their existing PCM-based instrumentation system to a network-based system.

3:00 p.m.
08-13-02 **"Design and Implementation of an Avionics Full Duplex Ethernet (A664) Data Acquisition System"**

Alberto Perez, John Hildin and John Roach, Teletronics Technology Corp.

This paper provides the hardware and software implementation choices made by Teletronics in the design of an ARINC 664 bus monitor used as part of a network-based data acquisition system.

3:30 p.m.
08-13-03 **"Flight Test Instrumentation Manager Software"**

Christian Herbepin, Eurocopter Flight Test Department

This paper presents a fully integrated and user friendly tool, internally developed in JAVA at Eurocopter covering all the activities relative to the Flight Test Instrumentation.

4:00 p.m.
08-13-04 **"End-to-End Disruption-Tolerant Transport Protocol Issues and Design for Airborne Telemetry Networks"**

Justin P. Rohrer, Erik Perrins, and James P.G. Sterbenz, University of Kansas

This paper explores the unique challenges to end-to-end communication due to the highly dynamic topology and time-varying connectivity found in airborne telemetry networks. We present a design for a domain-specific transport protocol to address these issues.

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Session 14: Remote Site Telemetry Systems

Chair: Darryl Burkes, NASA - Dryden Flight Research Center

2:30 p.m.
08-14-01 **"Telemetry System for a Remote Ecological Field Station"**
Erik Perrins, Balachandra Kumaraswamy and Sayak Bose, University
of Kansas

This paper presents a system-level design of a data transfer link for a remote ecological field station, including requirements, candidate solutions, and basic measurements from the fielded system.

3:00 p.m.
08-14-02 **"Using the Ground Equipment Monitoring Service (GEMS) for
Satellite Telemetry & Command Systems"**
Rob Andzik, Real Time Logic Inc.

Communication with space vehicles requires a sophisticated suite of ground equipment. Integration of these devices can be a costly and problematic endeavor. This paper describes how the GEMS specification simplifies integration efforts and reduces costs.

3:30 p.m.
08-14-03 **"Cost-Effective, Focused Instrumentation for TT&C/COMMS
Engineering"**
Steve Williams, Real Time Logic Inc.

This paper describes economical and focused toolsets for TT&C and COMMS system simulation, development, verification, analysis, maintenance, debugging and education.

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Session 15: Data Management & Post Processing

Chair: Richard Hansen, AFFTC - Edwards AFB, retired

2:30 p.m.
08-15-01 **"Quantifying Coding Gain from Telemetry Data Combining"**
Michael A. Forman, Ken Condreva, Gary Kirchner, and Kevin Lam,
Sandia National Laboratories

A method for combining telemetry data for a ballistic missile test flight is presented. Received data is combined from multiple receivers and polarizations, providing estimated coding gains as high as 30 dB.

3:00 p.m.
08-15-02 **"Designing An Object-Oriented Data Processing Network"**
Hsueh-szu Yang, Nathan Sadia, and Benjamin Kupferschmidt,
Teletronics Technology Corp.

This paper discusses a solution to the problem of decoding and displaying many different types of data in the same system, using the concept of a linked network of data processing nodes.

3:30 p.m.
08-15-03 **"Integrating Heterogeneous Systems in an FTI Environment"**
Alan Cooke, ACRA Control

This paper discusses three different ways of integrating hardware from FTI vendors. The first employs ad-hoc methods, the second leverages an FTI meta-data standard and the final method involves using service oriented architecture approach

4:00 p.m.
08-15-04 **"Storage Systems and Security Challenges in Telemetry Post Processing Environments"**
Jeff Kalibjian, Hewlett Packard Corporation

This paper reviews the storage options appropriate for telemetry post-processing environments. In addition, the security services such systems typically offer will be discussed and contrasted.

4:30 p.m.
08-15-05 **"Sanitization of IRIG-106 Chapter 10 Storage Media"**
Alfredo Berard, Catherine Cogan, Lorin Klein, Heath Massey, and Rick Williams, Eglin Air Force Base

This paper examines the challenge of sanitizing and downgrading media that is Commercial off-the-shelf and is utilized by test organization in the operational communities, the Major Range Test Facility Base, and other test ranges.

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Session 16: Imaging & Video

Chair: Jesus M. Benitez, White Sands Missile Range

2:30 p.m.
08-16-01 **"Highly Precise and Fast Digital Image Stabilization Technique Based on the Control Grid Interpolation"**

Jin-Hyung Kim, et al., Korea University and DANAM Systems Inc.

In order to achieve higher stability, the small instability should be removed in as small accuracy with sub-pixel. The proposed methods outperform other techniques in the terms of computational complexity and the performance of stabilizing.

3:00 p.m.
08-16-02 **"Scalable Perceptual Image Coding for Remote Sensing Systems"**

Han Oh, Hariharan G. Lalgudi, Michael W. Marcellin and Ali Bilgin, University of Arizona

This paper describes a scalable perceptual JPEG2000 encoder which exploits the properties of the human visual system, including contrast sensitivity function and visual masking effects, to improve the visual quality of encoded remote sensing images.

3:30 p.m.
08-16-03 **"Joint JPEG2000/LDPC Code System Design for Image Telemetry"**

Kristin Jagiello et al., University of Arizona

The joint selection of the JPEG2000 source code rate and the LDPC channel code rate in an image telemetry system is considered. The goal is to determine the optimum apportioning of bits between the rates.

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Thursday, Oct. 30th, 8:30 - 11:30 a.m.

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Session 17: International Consortium of Telemetry Spectrum (ICTS) Special Session on the Future Direction of International Telemetry

Chair: Gerhard Mayer, University of Salzburg / ICTS

This session address how the telemetry community plays "internationally". Recent successes at WRC2007, and telemetry topics to be presented at WRC2011, will be discussed. This session is sponsored by the International Consortium for Telemetry Spectrum and will serve to keep the attendee aware of international issues and how to engage to address these issues in the international arena. Topics to be covered include: 1. Reports from international regions on telemetry status and issues 2. Report from WRC 2007 - additional telemetry for flight test applications 3. International C-band telemetry band - use it or lose it. 4. Agenda for WRC2011 - requesting spectrum for UAV payload telemetry.

"Welcome of the ICTS Chairman & Introduction"

Gerhard Mayer, University of Salzburg

"The ICTS: 10 Years of Intensive Work Towards the WRC 2007"

Darrell Ernst, The Mitre Corporation

"WRC 2007 Decisions on Aeronautical Mobile Telemetry Spectrum"

Brian Ramsay, The Mitre Corporation

"Regional Impacts and Status of WRC 2007 C-Bands Implementation"

Jean-Claude Ghnassia and Mikel Ryan

"Agenda for the WRC 2011: Requesting Spectrum for UAV-Payload Telemetry"

Tim Chalfant, Edwards Air Force Base

"Body Sensor Network, Testing for Interference to Aeronautical Mobile Telemetry"

Danny Hankins, Cessna Aircraft Co.

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Thursday, Oct. 30th, 8:30 - 11:30 a.m.

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Session 18: Telemetry Receivers & Systems

Chair: Archie Moore, Spiral Technology, Inc.

8:30 a.m.
08-18-01 **"Antenna Array Beamforming Technology: Enabling Superior Aeronautical Communication Link Performance"**

Cheng Y. Lu et al., Teletronics Technology Inc. and Villanova University

We propose array beamforming technology in iNET system. By steering of beams and nulls, an array can enhance desired signals and suppress undesired interference. The technology is DSP-based, network-aware, and adaptive, designed for optimizing performance.

9:00 a.m.
08-18-02 **"Application of a High Data Rate Modem (HDRM)"**

Tim Orndorff, Amit Puri, Mike Smiley and John Connell, CVG/Avtec Systems, Inc.

The development of Software Defined Radios (SDRs) with reprogrammable personalities has led to the consolidation of traditional ground station processing elements.

9:30 a.m.
08-18-03 **"Game Theory and Adaptive Modulation for Cognitive Radios"**

Gaurav Sharma

This paper highlights how the concepts of game theory and adaptive modulation can be incorporated in a cognitive radio framework to achieve better communication for telemetry applications.

10:00 a.m.
08-18-04 **"Telemetry Re-Radiation System"**

Paul Cook, Teletronics Technology Corp. and Louis Natale, Lockheed Martin Aeronautics Co.

This paper describes the design considerations for a system which re-radiates the telemetry from missiles held inside a aircraft with the missile bay doors closed.

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Session 18: Telemetry Receivers & Systems (*continued*)

10:30 a.m. **"Using the GNU Radio Platform to implement a Telemetry Receiver"**
08-18-05

Gregory Newcomb and Ratish J. Punnoose, Sandia National Laboratories

GNU Radio is a flexible open-source software radio platform that enables custom radio development. We present this architecture and an example implementation of a PCM/FM receiver using this architecture and the Universal Software Radio Peripheral.

Thursday, Oct. 30th, 8:30 - 11:30 a.m.

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Session 19: Data Acquisition and Instrumentation Systems

Chair: John Welker, AFFTC - Edwards AFB

8:30 a.m. **"Connecting Network-Based Data Acquisition Nodes to the Network"**
08-19-01

John Hildin, Teletronics Technology Corporation

This paper is intended to assist the flight test instrumentation engineer in understanding some of the basics of the Ethernet physical layer. This will help the engineer architect and implement network-based data acquisition systems.

9:00 a.m. **"Design Considerations for a Variable Sample Rate Signal Conditioning Module"**
08-19-02

Jeffrey C. Lee, L-3 Communications - Telemetry-West

This paper focuses on the requirements, design considerations and tradeoffs associated with differing architectural topologies for implementing a variable sample rate signal conditioning module and the resulting implications on the encoder systems data acquisition units.

9:30 a.m. **"XML Data Modeling for Network-Based Telemetry Systems"**
08-19-03

Jeremy Price and Michael Moore, Southwest Research Institute and Bill Malatesta, Naval Air Systems Command

Through our work defining the Measurement Description Language (MDL) we experimented with user roles and presentation aspects. This paper highlights that experimentation.

10:00 a.m. **"Extensions to the Instrument Hardware Abstraction Language (IHAL)"**
08-19-04

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John Hamilton, Ronald Fernandes, Michael Graul and Timothy Darr,
Knowledge Based Systems, Inc

In this paper we describe extensions to the IHAL, including the development of multiple sub-schemas, the separation of the description of instrumentation functions from the description of the hardware, and the addition a function pool.

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Session 19: Data Acquisition and Instrumentation Systems (*continued*)

10:30 a.m.
08-19-05

"Automated Configuration and Validation of Instrumentation Networks"

Timothy Darr, Ronald Fernandes, Michael Graul and John Hamilton,
Knowledge Based Systems, Inc

This paper describes the design and implementation of a test instrumentation network configuration system. This system will select and connect instruments from multi-vendor catalogs that satisfy user requirements (including desired measurement functions) and technical specifications.

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Thursday, Oct. 30th, 8:30 - 11:30 a.m.

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Session 20: Telemetry and Range Systems

Chair: Thomas Grace, NAVAIR - Pax River

8:30 a.m.
08-20-01 **"The Test and Training Enabling Architecture, TENA, Enabling Technology for the Joint Mission Environment Test Capability (JMETC) and Other Emerging Range Systems"**
Gene Hudgins, TENA Software Development Activity (SDA)

The Test and Training Enabling Architecture, TENA, through its enabling of range system interoperability, supports the Joint Mission Environment Test Capability (JMETC), a distributed live, virtual, and constructive (LVC) testing capability, and emerging range systems.

9:00 a.m.
08-20-02 **"Integration Issues in Network-Based Flight Test Systems"**
Rachel Smith, Todd Newton and Myron Moodie, Southwest Research Institute

The future of flight test applications is moving towards a network based approach. This paper discusses some major integration issues encountered while developing a network-centric system and provides guidelines to preventing and overcoming these issues.

9:30 a.m.
08-20-03 **"WSMR Telemetry Capabilities: Today's Technology in Telemetry"**
Zoe Aguirre and Gabriel Beltran, White Sands Missile Range

White Sands Missile Range combines, fixed and mobile telemetry sites with the ability to relay, record, process and display telemetry data in real-time by utilizing modern technology establishing WSMR as a premier test range.

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Thursday, Oct. 30th, 8:30 - 11:30 a.m.

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Session 21: Error Control Coding

Chair: Tim Gatton, Wyle Telemetry and Data Systems

8:30 a.m.
08-21-01 **"Adjacent Channel Interference for Turbo-Coded APSK"**
Christopher Shaw and Michael Rice, Brigham Young University

A study of the effects of interference caused by adjacent channels on the performance of turbo-coded 16- and 32-APSK. We also discuss spectral regrowth in the nonlinear power amplifier when driven by a non-constant envelope modulation.

9:00 a.m.
08-21-02 **"Turbo Product Code with Continuous Phase Modulation"**
Kanagaraj Damodaran and Erik Perrins, University of Kansas

We develop turbo-product coded continuous phase modulation (TPC-CPM) techniques for aeronautical telemetry and study their performances under coherent and non-coherent demodulation. This paper presents a number of simulation results showing impressive coding gain performances.

9:30 a.m.
08-21-03 **"Spectrally Efficient Concatenated Convolutional Codes with Continuous Phase Modulations"**
Kanagaraj Damodaran and Erik Perrins, University of Kansas

This paper describes a bandwidth efficient serially concatenated coded continuous phase modulation techniques for aeronautical telemetry, which has impressive coding gains with only a modest increase in bandwidth for coded SOQPSK and PCM/FM.

10:00 a.m.
08-21-04 **"An Analysis on the Coverage Distance of LDPC-Coded Free-Space Optical Links"**
Ricardo Luna, Hrishikesh Tapse, and Deva K. Borah, New Mexico State University

We design irregular Low-Density Parity-Check (LDPC) codes for free-space optical (FSO) channels for different transmitter-receiver link distances and analyze the error performance for different atmospheric conditions.

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Session 21: Error Control Coding (*continued*)

10:30 a.m.

"On Guaranteed Error Correction Capability of GLDPC Codes"

08-21-05

Shashi Kiran Chilappagari, Dung Viet Nguyen, Bane Vasic and
Michael W. Marcellin, University of Arizona

In this paper, we establish a relation between the error correction capability and expansion of the underlying Tanner graph for GLDPC codes. We also find lower and upper bounds on the guaranteed error correction capability.

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Thursday, Oct. 30th, 8:30 - 11:30 a.m.

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Session 22: Sensor Networks

Chair: Lee Eccles, Boeing Corporation

8:30 a.m.
08-22-01 **"Wireless Sensor Networks: A Grocery Store Application"**
Andrea Chaves et al., University of Arizona

The paper describes the implementation of wireless sensor network system that may be implemented in grocery stores to accelerate the checkout process and reduce waiting times in line at the cashier stations.

9:00 a.m.
08-22-02 **"Wireless Sensor System for Airborne Applications"**
Steve Pellarin and Hy Grossman, Teletronics Technology Corp., Steven Musteric, Eglin Air Force Base

This paper describes the status of the Advanced Subminiature Telemetry System (ASMT) Project. It discusses the progress in fielding a self-contained, wireless sensor system installed on the aircraft skin using an Electro-Cleavable adhesive.

9:30 a.m.
08-22-03 **"A Cost Effective Residential Telemetry Network"**
Sean Byland et al., Missouri S&T

This paper describes the use of a COTS router to implement a low-cost residential automation and telemetry network.

10:00 a.m.
08-22-04 **"Tracking the Human Body via a Wireless Network of Pyroelectric Sensor Arrays"**
James Jolly et al., Missouri S&T

This paper describes the design and construction of a low-cost wireless sensor network intended to track a human body walking upright through its physical topology.

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