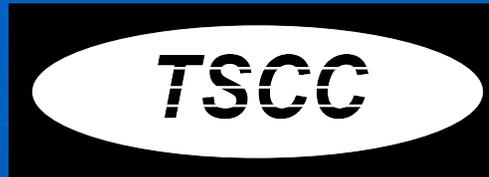


TELEMETERING STANDARDS COORDINATION COMMITTEE



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TSCC FALL 2019

Chair Report

October 21, 2019
Bally's
Las Vegas, NV
ITC 2019

TSCC Membership

- Academia (1)
 - Dr. Michael Marcellin
- Government (5)
 - Mark Bender
 - Albert Gabaldon
 - Richard Graham
 - Myron Moodie
 - Richard Graham
 - Tab Wilcox
- Industry (9)
 - Scott Brierley
 - Brad Fleury
 - Philip Ellerbrock
 - Wayne Klein
 - Steve Nicolo
 - Sergio Penna
 - Joe Sulewski
 - Gilles Freud
 - Malcolm Weir
- Ex-Officios
 - Clifford Aggen (IFT Rep)
- Members Emeritus
 - Lee Eccles
 - Merv MacMedan
 - Erwin (Terry) Straehley

Agenda

13:00 Call to Order S. Nicolo

13:00 Attendance and determination of Quorum W. Klein

13:05 Review and Approve Agenda S. Nicolo
Approval and review of last Minutes **S. Nicolo**

13:10 Officer Reports
Chair Report **S. Nicolo**
Action Item Review **S. Nicolo**
Secretary-Treasurer **W. Klein**
Financial Status

Agenda (Continued)

13:30 Committee Reports

Nominating Committee

S. Nicolo

New nominations/follow-up on members & Votes

Radio Frequency

S. Brierley

Telemetry Data Processing

B. Fleury

Networking and Protocols

S. Nicolo

IRIG 218-19 Update

S. Perry

Recorder / Reproducer

M. Buckley

EITTS (former ETSC) Report

G. Freud

EITTS (European Initiative for Test & Telemetry Standardization)

Cyber Security

M. Weir

Agenda (Continued)

14:30 Website

14:40 Old Business

Lawrence Rauch Award

S. Nicolo

15:00 New Business

Spring Meeting

All

15:30 Adjourn

All

Subcommittee Changes

- None

Subcommittee's & Reports

■ CURRENT SUBCOMMITTEE REPORTS

- Nominating Committee S. Nicolo (Acting Chair)
- Radio Frequency S. Brierley
- Networking and Protocols S. Nicolo (Acting Chair)
- Recorder / Reproducer M. Buckley
- Telemetry Data Processing B. Fleury
- Cyber Security (New SC No Report) M. Weir (NEW)
- EITTS (former ETSC Report) G. Freaud
 - EITTS (European Initiative for Test & Telemetry Standardization)

Member Summary

	Last	First	Association	Member/alternate	Expires	Office	Committee	Last	First	Committee
1	Bender	Mark	Government	Aerospace Corp	2019	member	radio Freq			
2	Brierley	Scott	Industry	ULA	2021	Chair	radio Freq/transd	McNatt	William	radiofreq
3	Ellerbrock	Philip	Industry	Boeing	2023	member				
4	Fleury	Brad	Industry	Edge Consulting	2020	Chair	Data multiplex / RF	Rob Tropa	Edge	rec/rep;data multi
5	Gabaldon	Albert	government	China Lake	2021	member	R & R			
6	Gilles	Freud	Industry	Airbus	2021	member		Mayer	Gerhard	
7	Graham	Richard	Government	China Lake	2023	member	R & R			
8	Klein	Wayne	Industry	Apogee Labs	2022	Treasurer	Network&Protocol	Weaver	Bob	data multi, Net
9	Marcellin	Dr. Michael	academic	Univ of AZ	2019	member		Creusere	Charles	
10	Moodie	Myron	Government	SwRI	2019	member	Network&Protocol	Abbott	Ben	N&P
11	Nicolo	Steve	Industry	GDP Space/Ampex	2020	Chair TSCC Chair	Chair TSCC Network&Protocol Nominating Committee	Weir	Malcolm	radiofreq
12	Penna	Sergio	Industry	Embraer	2019	member	Network&Protocol	Correa	Leonardo de Queiroz	
13	Sulewski	Joe	Industry	L-3	2018??	member	Data Multiplex	Dehmelt	Chris	rec/rep, datamult,Net
14	Weir	Malcolm	Industry	Ampex		Chair	Cyber			
15	Wilcox	Tab	government	YPG	2021	member	R & R			
	Aggen	Cliff	IFT							
	Eccles	Lee	Emeritus	Boeing		member				
	MacMedan	Merv	Emeritus			member	data comp			
	Straehley	Erwin	Emeritus			member	data multiplex			

TSCC Activities

- Officer Vote was taken at Spring 2019 Meeting (because we did not have a Quorem in Fall 2018) for another 2 year term.
 - TSCC Chair: Steve Nicolo
 - TSCC Vice Chair: Philip Ellerbrock
 - Secretary/Treasurer: Wayne Klein
- Pink Sheet Reviews:
 - IRIG 106-19 Chapters 6/9/10/11 (Released June 2019)
- IRIG 106-19 Released this year (June)
 - Public: <https://www.wsmr.army.mil/RCCsite/Pages/Publications.aspx>
 - Private: <https://wsmext.wsmr.army.mil/site/rccpri/default.aspx>
- Submitted TSCC Yearly Status Report to IFT
- Presented status of TSCC to EITTS (European Initiative for Test & Telemetry Standardization) group formally ETSC at the ETTC European Telemetry Conference
- Selected winner for Lawrence Rauch Telemetry Standards Award
 - Winner 'Validation Protocol-The Missing Puzzle Piece

IRIG 106-19 Released in June 2019

- CHAPTER 1: Introduction
- **CHAPTER 2: * Transmitter and Receiver Systems**
- CHAPTER 3: Frequency Division Multiplexing Telemetry Standards
- CHAPTER 4: Pulse Code Modulation Standards
- CHAPTER 5: Digitized Audio Telemetry Standard
- CHAPTER 6: Recorder & Reproducer Command and Control
- **CHAPTER 7: * Packet Telemetry Downlink**
- CHAPTER 8: Digital Data Bus Acquisition Formatting Standard
- **CHAPTER 9: * Telemetry Attributes Transfer Standard**
- **CHAPTER 10: * Digital On-board Recorder Standard**
- **CHAPTER 11: * Recorder Data Packet Format Standard**
- CHAPTER 21: Telemetry Network Standard Introduction
- CHAPTER 22: Network-Based Protocol Suite
- CHAPTER 23: Metadata Configuration
- **CHAPTER 24: * Message Formats**
- **CHAPTER 25: * Management Resources**
- CHAPTER 26: TmNSDataMessage Transfer Protocol
- **CHAPTER 27: * Radio Frequency Network Access Layer**
- **CHAPTER 28: * Radio Frequency Network Management**

- *** Changed**

Actions (NEW)

- S. Nicolo to update member list on web site (Done)
- W. Klein to look into new plaque vender with more reasonable cost. (DONE)
- Resolve/Update Attendance History Document (Treasurer will then take ownership)..... OPEN
- *One year Plaques still need to go out.... OPEN*

TELEMETERING STANDARDS COORDINATION COMMITTEE



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TSCC Fall 2019

'Treasurer' REPORT

October 21, 2019 Fall TSCC
Bally's Hotel Las Vegas, NV in conjunction with
ITC Show
Palace 1 Room (13:00)

Treasurer Report

for the Period 3/5/19 thru 10/18/19

■ INCOME (Total)	\$ 1000.00
• IFT Funding (May 2019)	\$ 1000.00
■ EXPENDITURES (Total)	\$ (488.77)
• 2019 (3) Best Paper Award plaques	\$ (488.77)
■ Net Increase (Decrease) in Cash	\$ 511.23
■ Beginning Cash Balance	\$ 1965.77
■ Ending Cash Balance	\$ 2477.00
• Note(s): TSCC account #: xxxxxx2632	

TELEMETERING STANDARDS COORDINATION COMMITTEE



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TSCC FALL 2019
*Nominating
Subcommittee Report*

October 21, 2019

Bally's

Las Vegas, NV

ITC 2019

Nominating Sub-Committee Membership

- Current Nominating Subcommittee Membership
 - CHAIR ...S. Nicolo Acting Chair (Diarmuid Retired)
 - Scott Brierley - United Launch Alliance
 - Wayne Klein - Apogee Labs
 - Stephen Nicolo - GDP Space Systems

Sub-Committee Focus

- The nominating sub-committee shall **propose TSCC members and officers** for approval by the membership.
- **Prospective TSCC members and officers can be nominated by the TSCC membership or by a nominating subcommittee.**
- All nominations must be approved by a membership **vote.**

TSCC Membership Rules

- The TSCC shall have **16 members**.
- **Adequate representation** shall always exist from the **diverse groups constituting the telemetry community**
- Representatives of **government and commercial entities** shall **each** constitute a **minimum of one-third (1/3)** of the regular TSCC Membership
- The **remaining one-third (1/3)** may include, **but is not limited to those in commercial, government, and academic organizations**
- Membership by representatives of non-US entities shall not exceed 25% of the total regular membership

Member Summary

	Last	First	Association	Member/alternate	Expires	Office	Committee	Last	First	Committee
1	Bender	Mark	Government	Aerospace Corp	2019	member	radio Freq			
2	Brierley	Scott	Industry	ULA	2021	Chair	radio Freq/transd	McNatt	William	radiofreq
3	Ellerbrock	Philip	Industry	Boeing	2023	member				
4	Fleury	Brad	Industry	Edge Consulting	2020	Chair	Data multiplex / RF	Rob Trep	Edge	rec/rep;data multi
5	Gabalton	Albert	government	China Lake	2021	member	R & R			
6	Gilles	Freud	Industry	Airbus	2021	member		Mayer	Gerhard	
7	Graham	Richard	Government	China Lake	2023	member	R & R			
8	Klein	Wayne	Industry	Apogee Labs	2022	Treasurer	Network&Protocol	Weaver	Bob	data multi, Net
9	Marcellin	Dr. Michael	academic	Univ of AZ	2019	member		Creusere	Charles	
10	Moodie	Myron	Government	SwRI	2019	member	Network&Protocol	Abbott	Ben	N&P
11	Nicolo	Steve	Industry	GDP Space/Ampex	2020	Chair TSCC Chair	Chair TSCC Network&Protocol Nominating Committee	Weir	Malcolm	radiofreq
12	Penna	Sergio	Industry	Embraer	2019	member	Network&Protocol	Correa	Leonardo de Queiroz	
13	Sulewski	Joe	Industry	L-3	2018??	member	Data Multiplex	Dehmelt	Chris	rec/rep, datamult,Net
14	Weir	Malcolm	Industry	Ampex		Chair	Cyber			
15	Wilcox	Tab	government	YPG	2021	member	R & R			
	Aggen	Cliff	IFT							
	Eccles	Lee	Emeritus	Boeing		member				
	MacMedan	Merv	Emeritus			member	data comp			
	Straehley	Erwin	Emeritus			member	data multiplex			

TSCC Membership Terms

- TSCC Membership Terms are for five years
 - Terms are staggered so that the terms of 20% (rounded to the nearest integer) of the regular membership end each year
 - Members may be re-nominated for additional terms by the nominating sub-committee.
- 5 Year Term Expirations – Fall 2019: (Must Vote)
 - Mark Bender (Government)
 - Dr Michael Marcellin (Academic).. Will not serve next year
 - Myron Moodie (Government)
 - Sergio Penna (Industry).. Will not searve next year
 - Joe Suleski: Joe's term expired 2018. He would like to continue for another 5 year term but must get approval from his new company. We must then vote.

Membership Changes

- MEMBERS:
 - Short one member (Government)
 - Joe Sulewski (term is up 2018 but must get approval from his new company to serve another term)
 - Four Members terms expire at the end of 2019
- Voting on Alternates:
 - None
- Alternates still needed for:
 - Mark Bender
 - Albert Gabaldon
 - Tab Wilcox
 - Malcolm Weir (Just became Full Member)
 - Richard A. Graham Jr (Just became full member)
 - Steve Nicolo (Malcolm was SN's Alternate)
- Retiring members:
 - Dr Michael Marcellin (at the end of 2019)
 - Sergio Penna (at the end of 2019)
 - Myron Moodie (at the end of 2019) ...Has proposed replacement would²⁰ like to be Alternate

TSCC Membership

- Academia (1)
 - * Dr. Michael Marcellin
 - Government (5)
 - * Mark Bender
 - Albert Gabaldon
 - Richard Graham (New)
 - * Myron Moodie
 - Tab Wilcox
 - Industry (9)
 - Scott Brierley
 - Brad Fleury
 - Philip Ellerbrock
 - Wayne Klein
 - Steve Nicolo
 - * Sergio Penna
 - ** Joe Sulewski (TBD)
 - Gilles Freud
 - Malcolm Weir (New)
 - Ex-Officios
 - Clifford Aggen (IFT Rep)
 - Members Emeritus
 - Lee Eccles
 - Merv MacMedan
 - Erwin (Terry) Straehley
- **SHORT 1 GOV or ACADEMIA MEMBER**
 - *** 5 Year Term is up 12/31/19**
 - **** Changed Companies**

Open Membership Slots

- We currently have 15 full members as of Fall 2019.
- **Need 1 Government member** to maintain our approx 33% split between industry, academic and government.
- In 2020 we will need 1 additional member from academia or government.
- Will need at least 2 more in January 2021 due to retiring terms

TSCC Officers

- **Officers shall serve for a two year term of office**
 - The **term** of office shall begin at the **start of the TSCC Year** in even calendar years
 - The **TSCC Vice-Chair** succeeds to the Chair's position to fulfill a two year term as Chair
 - The Secretary-Treasurer may be re-elected
 - **Officer Terms up December 31, 2020**

- Officers below were voted in at the Spring meeting because there was not a Quorum at the Fall 2018 Meeting
 - Chair – Steve Nicolo (2nd Consecutive Term)
 - Vice-Chair - Philip Ellerbrock
 - Secretary-Treasurer – Wayne Klein

- Subcommittee Chairs
 - All filled at this time

Open Actions

- TSCC has 1 open position. Should be Government or Academic. **Note that we will have at least 3 additional openings (4 total) by Spring of 2020**
- Alternates still needed for:
 - Mark Bender
 - Albert Gabaldon
 - Tab Wilcox
 - Malcolm Weir (Just became Full Member)
 - Richard A. Graham Jr (Just became full member)
 - Steve Nicolo (Malcolm was SN's Alternate)

TELEMETERING STANDARDS COORDINATION COMMITTEE



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RF Sub-Committee Report – Fall 2019

October 21, 2019

Bally's

Las Vegas, NV

ITC 2019

Sub Committee Membership

- Scott Brierley, Chairman
- Members:
 - Johnny Pappas
 - Mark Bender
 - Mark Dapore
 - Brad Fleury
 - Lloyd Lautzenhiser
 - Bill McNatt
 - Rich Siegal
 - Brad Oney
 - James Carwell

Sub-Committee Focus

- RF Subcommittee reviews standards dealing with the Radio Frequency (RF) telemetry link
- Current standards
 - RCC IRIG-106
 - RCC IRIG-118
 - RCC RF Handbook
 - CCSDS-401
 - CCSDS-411
 - SGLS
 - STDN
 - 1451.5

Open Actions

- RF Vendors Working Group
 - RCC/IFT doesn't recognize this as an activity of the TSCC RF Subcommittee
 - RFVWG not an LLC or incorporated group, just a bunch of people on an E-mail list
 - No restrictions on membership

Significant Activity

- My notes from the Spring 2019 Vendors Working Group
 - May be redundant with report from Johnny Pappas

Significant Activity

- Items reviewed by RF Vendor Working Group:
 - Test Methods for DQM/DQE
 - Test Methods for adaptive equalizers
 - Library of AMT waveforms for system level testing
 - Interoperability testing of receivers and xmtrs
 - 70 MHz IF recording

Significant Activity

- Test Methods for DQM/DQE
 - Generate synthesized RF signal
 - Recover “corrupted” data with clock
 - Extract frame sync word, including DQM
 - Measure BER of payload data
 - Compare DQM (converted to BEP) to measure BER

Significant Activity

- Test Methods for adaptive equalizers
 - Four multipath scenarios
 - Static
 - Taxiing
 - Take off
 - Far flight
 - Simplify
 - Stick to 2 ray model
 - Stick to one SNR, propose 20 dB.
 - Limited set of amplitude and delays
 - Many phase angles

Significant Activity

- Test Methods for adaptive equalizers
 - Tier 0, 1, and II
 - Tier 0: 1,5,20,20 MBPS
 - Tier 1 and tier II double that of Tier 0
 - Areas for further research
 - STC – different multipath on each signal
 - LDPC – six codes?
 - Proposed static channels
 - Channel response depends on
 - Carrier frequency
 - Delay
 - Reflection amplitude
 - Reflection phase
 - Delay (In bits) fo.5, 1,5,10,20,50

Significant Activity

- Test Methods for adaptive equalizers
 - Amplitudes of .5 to .9 in steps of .1
 - Include .95 and .98 for bonus phase
 - Phase in 10 deg steps

Significant Activity

- Library of AMT waveforms for system level testing
 - Arbitrary waveforms emulated waveforms in MATLAB for STC and LDPC combinations
 - Record the 70 MHz waveforms

Significant Activity

- Library of AMT waveforms for system level testing
 - Library of Waveforms – SOQPSK, CPM
 - Simulated Signals
 - 6 samples per symbol
 - Randomized and not randomized
 - Make sure we have an even number of bits so that it can repeat
 - PN sequence 11
 - Multipath can be produced with a delay line and a digital phase shifter to change phase
 - Repeat with actual transmitter(s)

Significant Activity

- Interoperability testing of receivers and xmtrs
 - S&C Band
 - Dual output transmitter
 - SOQPSK-STC, LDPC
 - CPM
 - Transmitters from multiple suppliers, such as
 - L3, Herley, Microwave Innovations, Quasonix, Emhizer, Curtiss Wright

Significant Activity

- 70 MHz IF recording
 - Interoperable file format for IF recording
 - Chapter 10 files that cannot be read by another suppliers recorders
 - Three methods:
 - Downcovert to baseband, record I and Q
 - Downcovert to 20 MHz and record that signal
 - Sample at 70 MHz
 - VITA 49.1 for record and transmit (VME bus international transmit association)

TELEMETERING STANDARDS COORDINATION COMMITTEE



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TSCC Fall 2019 Telemetry Data Processing Committee Report

Brad Fleury
Edge Consulting and Sales

Committee Members

- Brad Fleury – Director Edge consulting and sales
- Alternate – looking for a new person

Sub-Committee Standards

- Current standards
 - IRIG-106 -17 (-19)
 - Telemetry App's Handbook.
 - TMATS use cases, complete but updates are made as needed
 - RCC XML handbook for IHAL and DDML XML

Sub Committee Membership

Jon Morgan – RCC lead EAFB

Joe Sulewski – L-3 Communications

Joe Merritt – RT Logic

Jack Sheldon

Erwin Straehley

Duane Wheaton

Looking for new members

Sub-Committee Focus

- Jon Morgan presentation at ITC Wed session 10
- Discussion about release of 218-19
- Lots of discussion about TMATS S-groups
- S-group data structure
- Also discussing chapter 9 and 11, MDT, TMNS
- Activity level low during last period

Open Actions

- Support RCC ongoing efforts:
 - TMATS Handbook releases
 - IRIG standards
- Support RCC –TG Telemetry Data Processing telecons and RCC meetings.

TELEMETERING STANDARDS COORDINATION COMMITTEE



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TSCC FALL 2019

Networks Subcommittee

Report

October 21, 2019

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Las Vegas, NV

ITC 2019

Sub Committee Membership

- Steve Nicolo, (Acting Chair) – GDP Space Systems, Ground Telemetry
 - Ben Abbot, Southwest Research Institute
 - Rich Hoffman, GDP Space Systems
 - Gary Thom, Delta Information systems
 - Myron Moodie, Southwest Research Institute
 - Wayne Klein, Apogee Labs
 - William Malatesta, NAVAIR
 - Hyong Yi, Curtiss-Wright Controls, Avionics and Electronics
 - Robert Weaver, Apogee Labs
 - Chris Dehmelt, L3 Telemetry – East
 - Joe Sulewski
 - Malcolm Weir, Ampex
 - Sergio Penna, Embraer
 - Dave Buckley, Curtiss-Wright Controls

Subcommittee Focus

Standard	Location	Contact
RCC IRIG-218		New release coming out if 2019
RCC IRIG-106 Chapters 21-28	irig106p2-chpt21-28.zip	Secretariat Range Commanders Council U.S. Army White Sands Missile Range New Mexico 88002-5110
SCPS	http://www.scps.org	http://www.scps.org/html/contact_points.html
CCSDS	http://public.ccsds.org/default.aspx	http://public.ccsds.org/about/contact_us.aspx
TCP (Transmission Control Protocol)	http://www.faqs.org/rfcs/rfc793.html	
UDP (User Datagram Protocol)	http://tools.ietf.org/html/rfc768	
SNMP (Simple Network Management Protocol)	http://tools.ietf.org/html/rfc3411	http://tools.ietf.org/html
EEE-1588 (A Precision Clock Synchronization Protocol for Networked MEasurement and Control Systems)	http://ieee1588.nist.gov	http://www.ieee-ims.org/site/index.php
FTP (File Transfer Protocol) http://www.ietf.org/rfc/rfc959.txt http://tools.ietf.org/html	FTP (File Transfer Protocol) http://www.ietf.org/rfc/rfc959.txt http://tools.ietf.org/html	FTP (File Transfer Protocol) http://www.ietf.org/rfc/rfc959.txt http://tools.ietf.org/html

TSCC Activities

Pink Sheet Reviews

- IRIG 218 : TMoIP Standard: Provided comments
- IRIG 106-19 Chapters 7/9/11 (Released/Updated June 2019)
-

Open Actions

IRIG 218 TMoIP Update Status

ITC 2019

10/21/19

Shawn T. Perry
NAWCAD Pax River
RCC TTG Chairman

Changes In This Edition

- TMoIP Control Word additions
 - 64-bit timestamp with nanosecond resolution
 - Time source reference flag for UTC or TAI
 - Payload shaping for minor frames and DQE
 - Frame sync status for payload shaped frames
 - Fragmentation flag for managing shaped payloads and maximum transmission unit
- TMoIP Control Word subtractions
 - Identify failures in local TM interface
 - Fault signaling capability across the network
 - LEN field
- Reserved a control word version to preserve proprietary variants.
- Bit rates and changes in bit rates shall be calculated using packet timestamps and algorithms. For compliance, no proprietary packets or bits shall be used.
- Removal of real-time protocol from timing as an option for clock recovery.
- Removed many references to range use of ATM.

TMoIP Packet

TABLE E-1. TMoIP PACKET SUMMARY

Field	Description	Length	P/C/F ⁽¹⁾
<u>Ethernet Dest Addr</u>	Identifies station(s) to receive frame	6	P
<u>Ethernet Src Addr</u>	Identifies station that originated frame	6	C
<u>802.1Q Length/Type</u>	Virtual LAN (VLAN) tag length/type	2	F = 0x8100
<u>VLAN Tag Ctrl Info</u>	Bit	Description	
	0 - 2	User Priority Field	P
	3	Canonical Format Indicator (CFI)	F = 0
	4 - 15	VLAN Identifier (VID)	P
<u>Length/Type</u>		2	F = 0x0800
<u>IP Header</u> 20 Bytes Total	Byte	Description	
	0	Version + IP header length	F = 0x45
	1	TOS	P
	2 - 3	Total length of IP packet	C
	4 - 5	16 bit ID	C/F
	6 - 7	Flags + Fragment Offset	F
	8	TTL	F/P
	9	Protocol (UDP)	F = 0x11
	10 - 11	IP Header checksum	C
	12 - 15	Source IP address	P
18 - 19	Destination IP address	P	
<u>UDP Header</u> 8 Bytes Total	Byte	Description	
	0 - 1	Source Port	P
	2 - 3	Destination Port	P
	4 - 5	UDP Length	C
	6 - 7	UDP Checksum	C
<u>Payload</u>	<u>TMoIP Control Word</u>	4 (or 12)	C
	<u>TM Raw Packet Data</u>	<u>Var</u>	C
<u>Ethernet FCS</u>	<u>Ethernet Frame Check Sequence</u>	4	C

⁽¹⁾ P = Programmable by user.
 C = Calculated or placed in packet without user intervention.
 F = Fixed.
Var = Variable.

TMoIP Control Word

TABLE 3-3. TMoIP CONTROL WORD

Field	Bits	Description
VER	4	Version identifier “0000” indicates 218-10 “0001” is reserved for proprietary modified 218 formats “0010” indicates 218-18 “0011” through “1111” reserved for future versions
VDB	12	Version Defined Bits
SEQ NUMBER	16	Sequence Number

Notes

218-10 remains unchanged.

218-P version was added to maintain functionality of several proprietary modified 218-10 variants in use.

218-18 version removes the unused alarm bits, adds the ability to designate that a payload is sized to a PCM or DQE frame, adds bit sync status for PCM frame aligned payloads, and adds a 64-bit timestamp.

218-10

TABLE 3-3.1. TMoIP 218-10 CONTROL WORD

Field	Bits	Description
VER	4	Version identifier “0000” indicates 218-10
L	1	Local Defect Alarm, indicates local circuit fault in the TM stream
R	1	Remote Defect Alarm, indicates remote circuit fault in the TM stream
M	2	Local Defect Alarm Modifier
RES	2	Reserved
LEN	6	If non-zero, LEN indicates <u>TMoIP</u> Payload Length, defined as the <u>TMoIP</u> Control Word + Raw Packet Payload If zero, LEN indicates <u>TMoIP</u> Payload Length greater than 63 bytes. In this case the <u>TMoIP</u> payload length is determined via length fields in lower protocol layers.
SEQ NUMBER	16	Sequence Number

Notes

Req The TMoIP raw packet size shall be user configurable.

Opt The TMoIP raw payload size may be auto-configurable, based on user priorities (e.g. stream/delay characteristics).

Req The minimum TMoIP raw packet size = 1 byte.

Notes: a. To limit the effects of Ethernet fragmentation, the final Layer 2/3/4/6 packet size should be less than the Ethernet Maximum Transmission Unit (MTU).

b. Padding may be required to meet the minimum Ethernet MTU size.

TMoIP Control Word

TABLE 3-3. TMoIP CONTROL WORD

Field	Bits	Description
VER	4	Version identifier “0000” indicates 218-10 “0001” is reserved for proprietary modified 218 formats “0010” indicates 218-18 “0011” through “1111” reserved for future versions
VDB	12	Version Defined Bits
SEQ NUMBER	16	Sequence Number
Notes 218-10 remains unchanged. 218-P version was added to maintain functionality of several proprietary modified 218-10 variants in use. 218-18 version removes the unused alarm bits, adds the ability to designate that a payload is sized to a PCM or DQE frame, adds bit sync status for PCM frame aligned payloads, and adds a 64-bit timestamp.		

218-P

TABLE 3-3.2. TMoIP 218-P CONTROL WORD

Field	Bits	Description
VER	4	Version identifier “0001” indicates Proprietary variants of 218-10
PDB	12	Proprietary Defined Bits
SEQ NUMBER	16	Sequence Number

Notes

This version allows vendors who created modified versions of 218-10 to maintain functionality. Due to variances in implementation, not recommended in mixed vendor environments.

TMoIP Control Word

TABLE 3-3. TMoIP CONTROL WORD

Field	Bits	Description
VER	4	Version identifier “0000” indicates 218-10 “0001” is reserved for proprietary modified 218 formats “0010” indicates 218-18 “0011” through “1111” reserved for future versions
VDB	12	Version Defined Bits
SEQ NUMBER	16	Sequence Number

Notes

218-10 remains unchanged.

218-P version was added to maintain functionality of several proprietary modified 218-10 variants in use.

218-18 version removes the unused alarm bits, adds the ability to designate that a payload is sized to a PCM or DQE frame, adds bit sync status for PCM frame aligned payloads, and adds a 64-bit timestamp.

218-19

Table 3-5. TMoIP 218-19 Control Word

Field	Bits	Description
VER	4	Version identifier “0010” indicates 218-19
RES	4	Reserved
PLD	2	Payload type “00” indicates no frame alignment “01” indicates PCM frame aligned, first or only packet “10” indicates DQE frame aligned, first or only packet “11” Reserved
<u>mFSS</u>	2	Minor Frame Sync Status (used for PLD = “01” only) “00” indicates Search “01” indicates Check “10” indicates Lock “11” indicates Flywheel
MFSS	2	Major Frame Sync Status (used for PLD = “01” only) “00” indicates Search “01” indicates Check “10” indicates Lock “11” indicates Flywheel
FRG	1	Fragmented Payload (used for PLD = “01” or “10” only) “0” indicates first payload fragment with frame sync or DQE “1” indicates subsequent payload fragments
TSR	1	Timestamp Source Reference “0” indicates UTC “1” indicates TAI
SEQ NUMBER	16	Sequence Number
TIMESTAMP	64	64-bit Timestamp – PTP format. See Figure 3-6 . 32-bit seconds field 2-bit Reserved 30-bit nanoseconds field Prime epoch 00:00 01 Jan 1970

Back Up Slides

TMoIP Origin

- Developed as Ranges transitioned from ATM to IP
- Goal of providing simple transport of SST
- Based on standards such as pseudowire
- 218-10 mentions future growth possibilities (RTP, IPv6)
- Great success so far for Range implementations
 - Distributed flight testing at contractor sites
 - Opens door for Range interconnectivity for LVC
- Ambiguities led to interoperability difficulties
 - Vendors developed proprietary variations

Changing Paradigm

- New requirements emerged
 - Test articles lacking Ch4 time
 - TMoIP not just for muxes anymore
 - Software decoms, best source, receivers, IP decryptors
 - PCM and DQE frame payload shaping
- Vendors and Ranges reached out to RCC TG
- RCC TG reached out to RCC TTG
- RCC TTG posted RFI on 218 growth requests

RFI Results

- Timestamp top priority
 - RTP vs Control Word expansion
 - Format requests varied (UTC vs TAI)
 - Nanosecond resolution
- Unused Control Word bits
- Payload shaping
 - PCM and DQE frames with bit sync status
- Improved interoperability
 - Ability to auto-adjust to bit rate changes and user selected parameters (minimal latency)

TTG 218-19 Goals

- Identify valid requirements
- Maintain 218-10 functionality
- Maintain vendor proprietary variants
- Make update painless to implement on deployed hardware
- Create process for continual improvement
- Account for Range timing transition to 1588

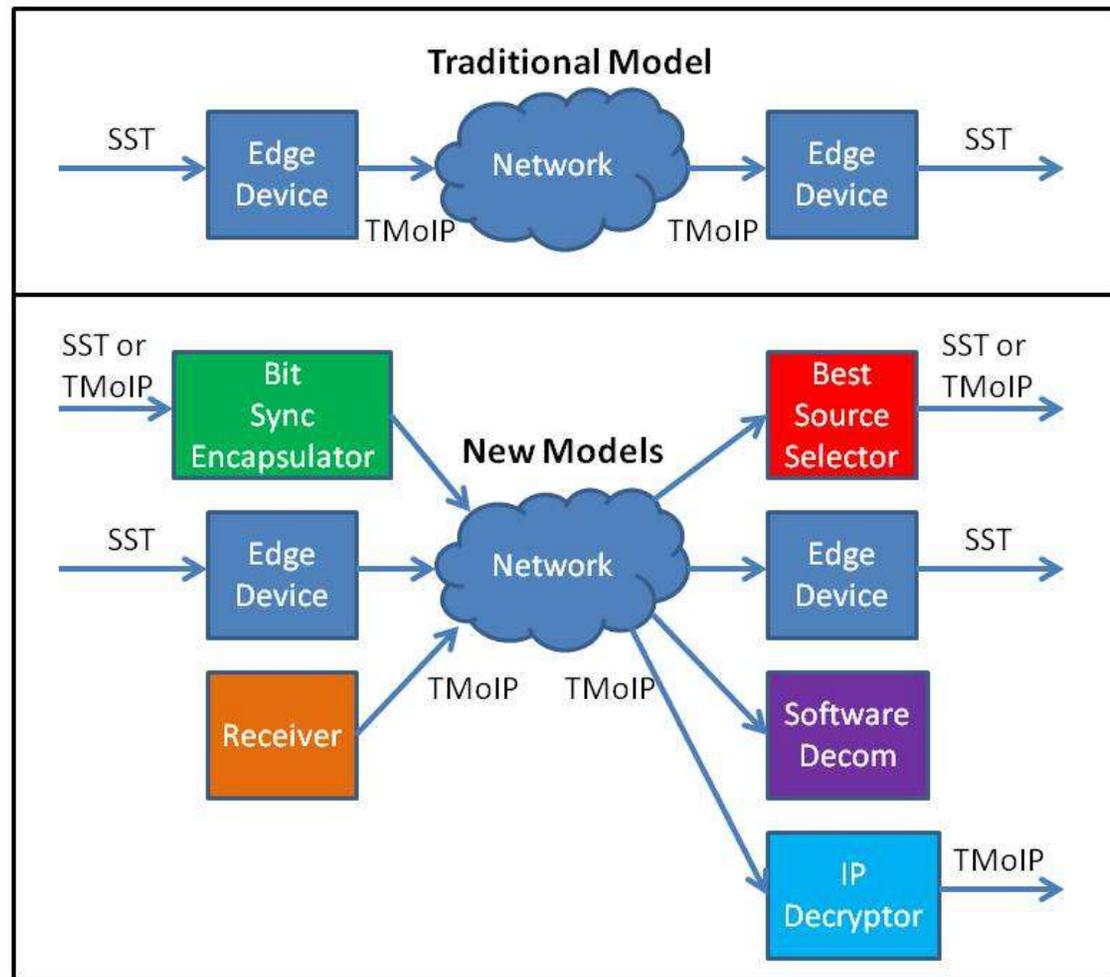
TTG 218-19 Changes

- TMoIP Control Word additions
 - 64-bit Timestamp with nanosecond resolution.
 - Time source reference flag for UTC or TAI.
 - Payload shaping for minor frames and DQE.
 - Frame sync status for payload shaped frames.
 - Fragmentation flag for managing shaped payloads and MTU.
- TMoIP Control Word subtractions
 - Identify failures in local TM interface.
 - Fault signaling capability across the network.
 - LEN field.
- Reserved a Control Word version to preserve proprietary variants.
- Bit rates and changes in bit rates shall be calculated using packet timestamps and algorithms. For compliance, no proprietary packets or bits shall be used.
- Removal of RTP from Timing as an Option for Clock Recovery.
- Removed many references to Range use of ATM.

Conclusions

- Successful vendor interoperability test at ITC
 - Few test cases with interoperability issues
 - Vendors identified “bugs” and work-arounds
- Didn't break 218-10 or proprietary methods
- Should be backward compatible with existing HW
- New features
 - 64-bit 1 ns resolution PTP timestamp format
 - 00:00 01 Jan 1970 prime epoch
 - TAI or UTC source reference flag
 - Payload shaping for minor frames and DQE
 - Bit sync status information metadata
 - Fragmentation flag for payload shaping over smaller MTU network

TMoIP Models



IRIG vs NTP vs PTP

- IRIG

- >64 bits and can't achieve 1 ns resolution

- NTP

- Most likely implemented time source (minimal effort)
- 64 bits with 233 ps resolution

- PTP 1588

- Questions concerning 1588 profiles which affect format
- Greatest implementation impact to vendors
- Greater long-term use potential, but immature now

TELEMETERING STANDARDS COORDINATION COMMITTEE



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Recorders & Reproducers Report – Fall 2019

October 21, 2019

Bally's

Las Vegas, NV

ITC 2019

Sub Committee Membership

- Mark Buckley (Telspan Data), Chairman
- Albert Gabaldon (NAVAIR-CL), Alternate Chairman

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2.	Bob Baggerman	ATAC
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4.	Chris Dehmelt	L3-Harris
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20.	Bela Szabo	RT Logic
21.	Malcolm Weir	Ampex
22.	Craig Wierzbicki	Curtiss Wright
23.	Rick Williams	SDS

Sub-Committee Focus

- Data Recorders, Ground and Airborne
- Standards in Place
 - IRIG 106-19 – Range Commanders Council (RCC) Telemetry Standards
<http://www.wsmr.army.mil/RCCsite/Pages/Publications.aspx>
 - STANAG 4575 – North Atlantic Treaty Organization (NATO) Standard Agreement (STANAG) – NATO Advanced Data Storage Interface (NADSI) Allied Engineering Documentation Publication (AEDP)
<http://www.nato.int/STRUCTUR/AC/224/standard/4575/4575.htm>

Significant Activity

- RCC Telemetry Group Recorder & Reproducer Committee
 - IRIG 106-19 Chapters 6/9/10/11
 - Released June 2019
- STANAG 4575, AEDP-6 Ratification

Significant Activity

- TSCC R&R to take an increased roll in CR reviews & recommendations
 - R&R Meeting to discuss V2/MDL header
 - Attempt to ease transition to eventual full TmNS
 - Thr, 24 Oct, 1130 – Bronze 4 Room
- Finally made progress on tdpRR_17_CR-010
 - S-Group Attributes for Description of Messages Structures, Sub-Message Structures & Measurements
 - Submitted to DataMUX Committee
 - Publication is “Ready Soon”
- 2019 approved CR's
 - (Following pages)

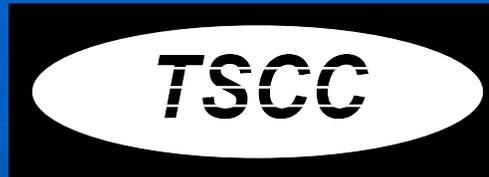
CRs for 2020/2021

CR No	Description	Status
RR_17_CR-001	Ver 2 Packet Header	Working, again
tdpRR_17_CR-002	MDL Header Data Type	On hold
tdpRR_17_CR-003	Fix Video Formats	Working
tdpRR_17_CR-004	Distribution Statement	Working
tdpRR_17_CR-005	Add PN fields	Working
RR_17_CR-006 (CR)	UART, First Packet Flag	Working
RR_17_CR-009	New EtherNet, FC	Proposed
tdpRR_17_CR-010	Update S-Group	99% Complete
RR_18_CR-015 (CR)	PCM, unpacked 16bit	Working
New CRs for RCC-TG-137 (Aug 2019)		
RR_19_CR-001	Data at Rest	Proposed
RR_19_CR-002	Native RMM Media Interface	Proposed
RR_19_CR-003	Message Data Structure Packet	Working
RR_19_CR-004	Network Based Files	Working

Open Actions

- TSCC –
 - CH10/11 in a networked world
 - Recording CH10 Publishers as Native Packets w/ Correlated Time
 - V2 Header w/ 1588 Time
 - V2/MDL Header
 - Standardization of range/test article NAS
 - Metadata hooks into a post/real-time CH10 architecture

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EITTS (former ETSC)

European Initiative for Test & Telemetry Standardization

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Sub Committee Membership

- Gilles FREAUD, Chairman
- Alternate Chairman (TBD)
- A small open international team, a good mix suppliers / users but no strong academic representative

Gerhard Mayer GM Consulting	Steve Lyons Qinetiq	Sergio Penna Embraer	Werner Lange Lange Electronics	Marc Faber ZDS	Renaud Urli Airbus H
Christian Herbepin Airbus H	Marc Seznec Airbus H	Heiko Koertzel Airbus DS	Florent Buttigieg Dassault Aviation	Ghislain Guerrero ZDS	
Bernhard Koderer Airbus DS	Gilles Fréaud Airbus C	Guillaume Duponchel ZDS	Pedro Rubio Airbus DS	Jean Claude Ghnassia ICTS-3AF	
Didier Schott ArianeGroup	David Cumer Airbus C	Franck Rochette Dassault Aviation	Diarmuid Corry Continuity Cons.	Guillermo Martinez Airbus DS	
Luc Falga Airbus C	Stürzer Quiring Airbus DS	Balazs Bago ZDS	Manuel Sanchez Inta	Francisco Jimenez Airbus DS	Diarmuid Collins Curtiss Wright

Significant Activity_1

- 2019 : we continue to Re-energize the working group.
- We use a collaborative tool based on "SLACK"
- Good start in the Video working group
- We are relaunching some working groups this end of year.

Significant Activity_2

* « Data & Video processing & compression » group

VIDEO: We launched a large survey to capture the needs. We have now a solid view.

→we see the needs to standardize some algorithms to perform data and video onboard processing.

Significant Activity_3

- * Wireless / Smart sensors

Large survey to be launched.

- * Telemetry link(including Radio frequency & Spectrum + Usage of low orbital satellite)

No significant activities

- * Data Storage

No significant activities

- * Data protocols & ICD format

No significant activities

Open Actions

- We see a strong need for Handbooks describing the way we test the various functions/equipment.
- Those needs come from users and suppliers
- Next face to face in ETTC2020 Nuremberg

Ettc2020 (23-25 June in Nuremberg) Collaboration and innovation in testing

Partners



Workshop on
"UAV Data Links"

Call for Papers
Abstract deadline: 24 January 2020

www.telemetry-europe.org
(link on the ITC App banner)

