

# Development of A Fully Compliant IRIG Digital Recording System for Telemetry

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# I. Compliance

- IRIG
- ADARIO
- Recorder

# IRIG

# IRIG Standard Digital Recording

## Major Parameters:

### ● Data Format Compliance

- ADARIO Mutiplex/Demultiplex Standard for Multiple Data Channel Recording
- IRIG 106-93 ADARIO paragraph 6.14
- **IRIG 106-96 ADARIO paragraph 6.15 modified**
- Appendix G modified

### ● Tape Format Compliance

- Half Inch Digital Cassette (S-VHS) Helical Scan Recording Standards
- **IRIG 106-96 paragraph 6.16 added**
- 19mm Digital Cassette Helical Scan Recording Standards
- IRIG 106-93 paragraph 6.13

# IRIG ADARIO Data Format Capabilities

- The Format, Realized In IRIG-106-96, Extrapolated to Its Maximum, Poses No Limitations to Data Acquisition, Only Challenges:
  - Maximum Aggregate Rate: **3.144 Gbps**
  - Maximum Channel Bit Rate: **3.144 Gbps**
  - Maximum Channel Bandwidth: **52.4 MHz**
  - Maximum Sample Size: **24 Bits**
  - Phase Coherency: **8 Nanoseconds**
  - Maximum Channel Count: **256**

# ADARIO

# ADARIO Family Chronology

1990

1996



## Basic ADARIO 400

- 8 Basic Channels
- 400 MHz Bandwidth
- 100 Msps



## Mini ADARIO 400

- Ruggedized Man-Portable
- Reduced Channel Count



## ADARIO 256

- Autoranging Channel & Aggregate
- 19 Channels/Card
- GUI Control

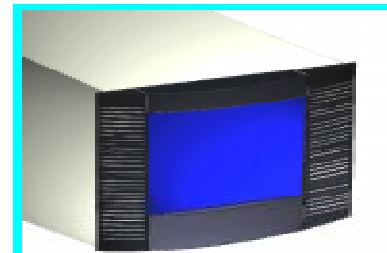
1997

Future



## Fully Modular ADARIO 512

- Expanded to 76 Channels
- Fully Modular Card Set
- MSI/MSO (User-Defined Interface)
- GUI Control



artist rendering

## ADARIO 1000

- > 1 Gbps
- Recorder & ATM Connectivity
- Touch Screen



# ADARIO Performance Leader (Max Spec)

- 512 Mbps
- 76 Channel Capability\*
- Multiple Recorder Outputs
- High Efficiency Data Formatting 2.34%
- Adaptable Clock Rate\*
- Fully IRIG Compliant
- Flexible System Control
- Dynamic Channel Allocation\*
- 10 Nanoseconds Channel to Channel Phase Coherency

\* New Capability

# Set Card Capabilities

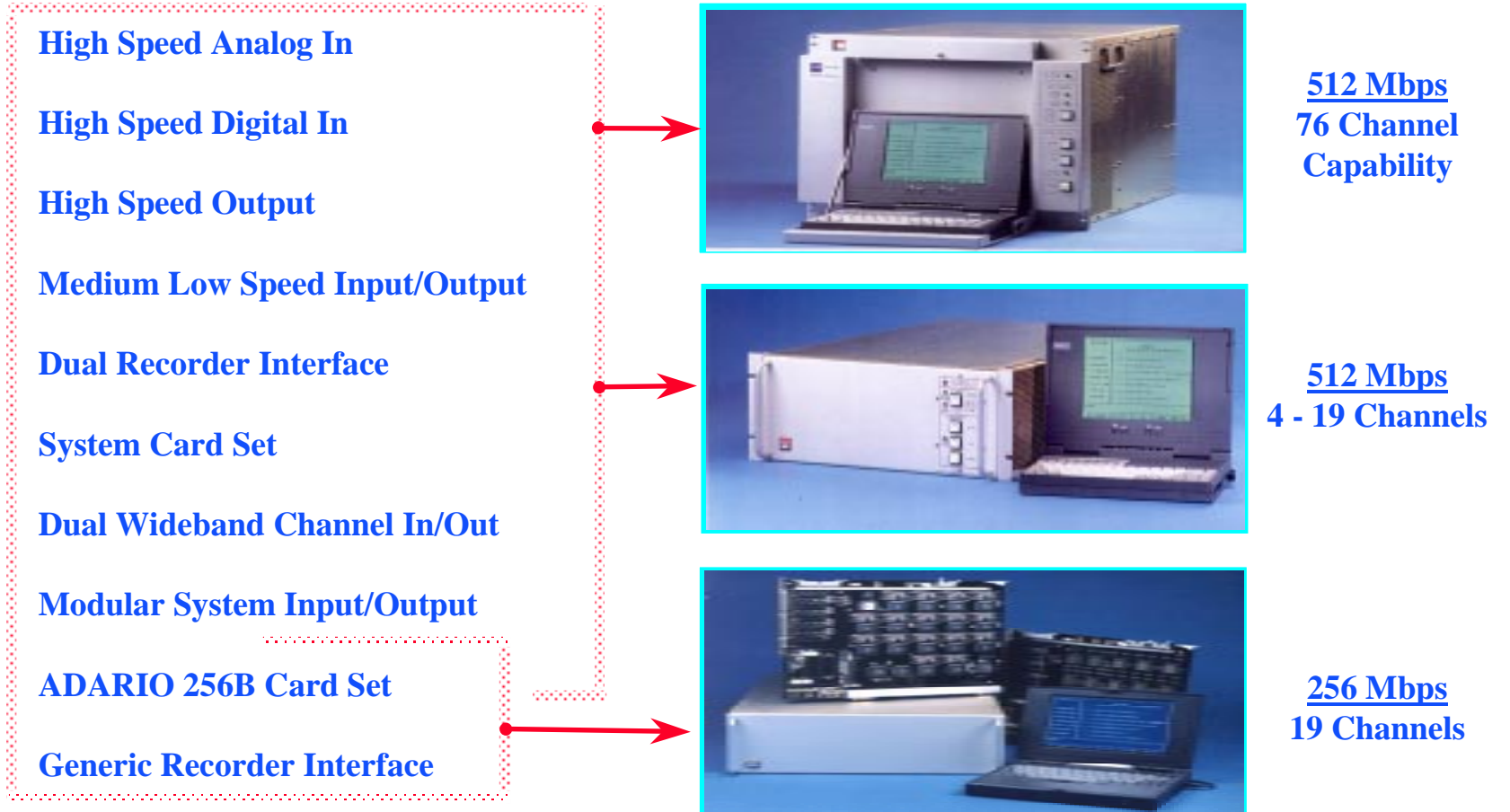
<u>Card Designator</u>	<u>Card Type</u>	<u>Card Capabilities</u>		
<b>HSAI</b>	<b>High Speed Analog In</b>	<b>Analog Only</b>	<b>≤ 40 MHz</b>	<b>4, 6, 8 Bits</b>
<b>HSDI</b>	<b>High Speed Digital In</b>	<b>Digital Only</b>	<b>0 - 100 Msps</b>	<b>1, 2, 3, 4, 6, 8 Bits</b>
<b>HSO</b>	<b>High Speed Output</b>	<b>Analog/Digital</b>	<b>0 - 100 Msps ≤ 40 MHz</b>	<b>1, 2, 3, 4, 6, 8 Bits</b>
<b>MLSI/O</b>	<b>Medium Low Speed Input/Output</b>	<b>Analog/Digital</b>	<b>0 - 50 Msps &lt; 20 MHz</b>	<b>1 - 16 Bits</b>
<b>DWCI/O</b>	<b>Dual Wideband Channel In/Out</b>	<b>Analog/Digital</b>	<b>0 - 25 Msps ≤ 10 MHz</b>	<b>1 - 8 Bits</b>
<b>MSI/O</b>	<b>Modular System Input/Output</b>	<b>User Defined</b>	<b>0 - 50 Msps ≤ 20 MHz</b>	<b>1 - 16 Bits</b>
<b>HSMI/O</b>	<b>ADARIO 256B</b>	<b>Analog/Digital</b>	<b>IRIG ABEG 0 - 26 Mbps</b>	<b>3 Channels 16 Channel</b>
<b>DRIC</b>	<b>Dual Recorder Interface</b>	<b>Two Recorders</b>	<b>8 Bit Differential ECL</b>	
<b>GRIC</b>	<b>Generic Recorder Interface</b>	<b>8, 16, 32 Bit Differential ECL or TTL SCSI-II Fast &amp; Wide; Parallel to PCI</b>		

# Modular Architecture Selections

## CARD DESIGNATOR

## SYSTEM CONFIGURATION/CAPABILITY

Higher Levels of Integration ↑



# ADARIO System Control

- **Integrated Control for Both ADARIO and Recorder(s)**
- **Extensive On Line BIT and Fault Isolation**
- **Control Interfaces:**
  - **IEEE-488**
  - **TCP/IP (Ethernet)**
  - **RS-232/RS-422**
- **Graphic User Interface**
- **Easily Extends for Simultaneous Control of Multiple ADARIO/Recorder Systems**

# Recorder

# ADARIO Recorder Supports

## ADARIO CARD DESIGNATOR

### GRIC   DRIC

## RECORDER

## RATE

## IRIG TAPE COMPLIANCE

	*	Schlumberger	480 Mbps	*	(ID-1)
*	*	Datatape LP 200	200 Mbps	*	(ID-1)
	*	Datatape LP 400	400 Mbps	*	(ID-1)
*	*	SONY DIR 1000L	64 Mbps	*	(ID-1)
*	*	SONY DIR 1000M	128 Mbps	*	(ID-1)
*	*	SONY DIR 1000	256 Mbps	*	(ID-1)
	*	SONY DIR 1000H	512 Mbps	*	(ID-1)
*	*	AMPEX DCRSI			
*	*	AMPEX DIS 120	120 Mbps		
*	*	AMPEX DIS 160	160 Mbps		
*	*	METRUM 32 VLDS	32 Mbps	*	(VLDS)
*	*	METRUM 64 VLDS	64 Mbps	*	(VLDS)
*		SONY DTF	120 Mbps		
*		Exabyte			
*		Mammoth			

# Metrum VLDS

- **Field Proven Helical Scan Data Recording Technology**
- **0 - 64 Mbps Sustained Transfer Rates**
- **160 Mbps to Capacity of Internal Buffer (64MB) and Dynamic Speed Matching w/o Bit Stuffing**
- **Uses High Energy S-VHS Cassettes**
  - **Recording Time 57 Minutes Using ST-160 @ 64 Mbps**
  - **43 Minutes Using ST-120 @ 64 Mbps**
- **Total User Capability**
  - **27.5 GB ST-160**
  - **20.8 GB ST-120**
- **Stackable Technology**
- **Error Performance Is Better Than 1 in  $10^{11}$  Between Error Events**



## II. Requirements vs. Performance



# Mux and System Requirements vs. Performance

## Requirements: IRIG Compatible

- 16 Digital PCM Channels
- 2 Time Code Channels
- 1 Analog Channel (up to 200 KHz)
- Autoranging Input (0 - 25 Mbps)
- Autoaggregate Output (0 -64 Mbps)
- Low Overhead
- Timescale 8:1
- PC GUI-Based Control
- Phase-Coherent Multiple Channel Playback
- Tape Dubbing
  
- Unlimited Record Time

## Performance: ADARIO 256B

- 16 PCM Channels
- Dual Analog Channels
- 400 KHz Analog Channel
- Autoranging Input (0 - 26 Mbps)
- Autoaggregate Output (0 - 256 Mbps)
- Overhead < 3%
- Timescale 16:1
- Labview Windows 95/NT
- IRIG Compliant 19 Channel Playback
  
- Tape Dubbing w/Playback  
(simultaneous data processing during dubbing)
- Ping-Pong (dual interface capability)

# Recorder Requirements vs. Performance

## Requirements

- IRIG Compatible
- Continuously Variable Record/Playback
- Low Error Rate
- Quick Change of Tape
- Inexpensive Media
- Search Capabilities
- Remote Control

## Performance

- Metrum VLDS
- Buffered
- $1 \times 10^{11}$  Bit BER
- Cassette
- SVHS Cassettes
- Fast Search By PBN
- RS-232

# Future Enhancements Under Development

- **Seamless Playback**
- **Positive Record Feedback**
- **Time Code Search**
- **Sun Compatibility for Control**

# System Configuration Panel

RETURN

## BARC System Configuration

**Active Systems List**

bmsys.cfg

DEACTIVATE ALL SYSTEMS

**Current Focus System**

bmsys.cfg

SYSTEM ACTIVE
TEST INSTRUMENT COMMUNICATIONS
SAVE SYSTEM SETTINGS

Recorder Configuration

Recorder	(system default)	Type	Port	IEEE-488 Address	IEEE-488 Device	Port	Baud	Parity	Data Stop	TCP/IP Address	TCP/IP Port	
Recorder 1		Metrum 64	RS-232	0	0	2	2400	N	8	1	0.0.0.0	0
Recorder 2		None	IEEE-488	0	0	1	9600	N	8	1	0.0.0.0	0

Bandit Configuration

Bandit Name	Type	Port	IEEE-488 Address	IEEE-488 Device	Port	Baud	Parity	Data Stop	
Bandit 1	HSMI / HSMO	RS-232	0	0	1	19200	N	8	1

Time System Configuration

Time System	Type	Port	IEEE-488 Address	IEEE-488 Device	Port	Baud	Parity	Data Stop	TCP/IP Address	TCP/IP Port	
Time System	None	IEEE-488	0	0	1	9600	N	8	1	0.0.0.0	0

# BANDIT Control Panel

Record						
Channel	State	Max Rate	Edge	Status		
Channel	State	Max Rate	Edge	Trunc	No Samp	
1	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
2	ON	3.30E+6	Falling	<input type="radio"/>	<input type="radio"/>	
3	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
4	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
5	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
6	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
7	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
8	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
9	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
10	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
11	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
12	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
13	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
14	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
15	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
16	ON	3.30E+6	Rising	<input type="radio"/>	<input type="radio"/>	
State	Gain	Format	BW Hz	Range		
17L	ON	0.0	8	12.50E+3	<input type="radio"/>	
17R	ON	0.0	DC coupling	<input type="radio"/>		
18	ON	0.0	8	400.00E+3	<input type="radio"/>	
External Filter		DC coupling				

Play						
Channel	Polarity	Edge	State	Rate	Trunc	No Samp
1	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
2	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
3	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
4	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
5	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
6	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
7	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
8	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
9	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
10	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
11	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
12	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
13	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
14	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
15	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
16	True	Rising	ON	3.30E+6	<input type="radio"/>	<input type="radio"/>
Attenuation	State	Range	BW Hz	Format		
17L	ON	0.0	12.50E+3	8		
17R	ON	0.0	400.00E+3	8		
18	ON	Internal Filter	400.00E+3	8		

**Bandit Control Panel**

Bandit Selection

Channel Configuration

**File** ▾

Timescale

Run Mode  
 Program Mode

Aggregate Sync

Total Digital Rate 52.83E+6

Total Analog Rate 8.44E+6

Bandit Aggregate Rate 61.63E+6

# Main Control Panel

**BANDIT and Recorder Control**

Config Bandit

Dub Record Play Rewind F Fwd Search Format Test Stop

Exit

1->2 2->1

Timescale  
 1.000

Search PBN  
 23702

Interrupt
Eject

**Active Systems Status**

monitor status of next system

0

System Name	Error & Status			
bmsys				
Bandit	Name	Sync Status		
	Bandit 1	<span style="color: green;">●</span> Run		
Recorder Name	State	Mode	PBN	% of Tape Used
Recorder 1	Reproduce	None	4508	<div style="width: 100%; border-bottom: 1px solid black; position: relative;"> <div style="width: 5%; background-color: red; position: absolute; left: 0;"></div> <span style="position: absolute; right: 0; bottom: 0;">0 50 100</span> </div>

System Config

Current Focus System

bmsys

Active Recorder

Recorder 1

BARC Software, Version 1.01 DEV  
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