

Airborne Recording from a Ground Station Perspective

Dr. Lou York
The MITRE Corp.
202 Burlington Road
Bedford, MA 01730-1420

Phone: 781-271-2897; FAX: 781-271-2721
e-mail: lyork@mitre.org

Presented at the THIC meeting at the Nassau Bay
Hilton Marina, Houston, Texas
March 29 - 30, 1999

Organization: G034
Project: 03990521-0D

MITRE

Background

- Image data “centric” view
- Imagery Groundstations rely heavily on high density digital tape recording
 - Data input and long-term archival storage
 - Data bandwidths: 80 Mb/s - 2,000 Mb/s
- Input Data is recorded on-board the aircraft
 - Delivered to user upon return
 - Critical data provided via high bandwidth datalink
 - Real-time or near real-time off of tape
- The “Grail”: Seamless interchange of data
 - Common data formats
 - Interchange standards

Interchange and Interoperability

- **Goals**

- Reproduce any recorded airborne imagery data at any imagery ground station at any time

- **Interchange and data format standards**

- Minimize ground station size and cost

- **Mobility is a key requirement**

- Improve ground station reliability

- Accommodate improvements in state-of-the-art off-the-shelf technology

- **Success rate: nominal**

- High reliability is expensive; requires custom equipment and packaging

Imagery Trends

- **Increases in number of imagery collection platforms**
 - **Single and dual mode manned recce aircraft**
 - **Unmanned Aerial Vehicles**
 - **High Altitude Endurance, Tactical, Miniature and Micro**
- **Significant improvements in sensors**
 - **Electro-Optical, Infrared, Synthetic Aperture Radar, Multi- and Hyperspectral, Moving Target Indicators, etc.**
 - **Very high data bandwidths (> 1 Gb/s)**
 - **Both digital and analog data**
- **New imaging environments**
 - **Tactical fighter aircraft environment**
- **Very short timelines: “sensor to shooter”**
 - **15 minute or less “detect to kill” timelines**

Airborne Recording Technology

- **How are recorders used today?**
 - Record and return tape to groundstation (no datalink)
 - Record and playback selected sections for datalink
 - Backseat editing from tape and transmission
 - Automatic target locating and transmission
- **Why magnetic tape in airborne applications?**
 - Very low cost/byte
 - Very high data bandwidths
 - Very high capacity
 - Reusable
- **Standard formats in use today**
 - DCRsi, ANSI ID-1, SVHS, 8 mm

Airborne Recording Issues

- **Recorder reliability: Power, weight, cooling, shock, and vibration requirements are becoming severe**
 - Pull tape during 4 g (or greater) maneuvers
 - Operate over very wide temperature extremes
 - Withstand carrier take-off and landings
 - Operate off of minimal aircraft power
 - Weigh next to nothing
- **Media stability and crossplay**
 - Among same model recorders
 - Across differing models
 - Largely isolated to ANSI ID-1 recorders and media
- **Rapid access to recorded data**
- **Access data while recording**

Groundstation Recording Technology

- **How are recorders used today?**
 - Record data received over datalink
 - Reproduce data recorded on aircraft
 - Archival storage of processed imagery
- **Why magnetic tape in airborne applications?**
 - Same reasons as for airborne usage
- **Standard formats in use today**
 - DCRsi, ANSI ID-1, SVHS, 8mm for returned aircraft tapes
 - Many other formats used for archive
 - Interchange standards applied locally
 - Magnetic Hard Disk Drive based systems required for globally accessible archival storage

Groundstation Recording Issues

- **Reliability: significantly less severe environment**
 - Transportability requirements result in shock and vibration requirements
 - No mobile operations
 - Minimal spares when deployed
- **Crossplay has been a constant “issue”**
 - Differences in aircraft recording environment and groundstation reproduce environment
 - Environmental factors required
 - Thermal and Hygroscopic coefficients (free & bulk)
 - Thermal and Hygroscopic time constants (free & bulk)
 - Standards compliance, calibration and alignment
- **Rapid Access to data**

Airborne Recording Trends

- **Serious consideration is being given to replacing magnetic tape recording in airborne applications**
 - **Solid state recorders, magnetic hard disk drives, Other?**
 - **“Reliability and Interoperability” are key reasons**
- **NATO is collaborating on an interoperability standard for future airborne data recording and storage**
 - **Advanced Data Storage Technology Advisory Group to NATO working group is led by the US**
 - **Industry participation is and has been encouraged**
 - **The resulting standard is expected to define the interface**
 - **Removable element and unit**
 - **Accompanying documents will define and advise on typical applications**

Summary

- **Tape recording will continue to be used in both airborne and groundstation imagery applications**
 - **Cost per Byte and data bandwidth are still key drivers**
 - **Media and crossplay issues need to be resolved**
 - **Availability of environmental data for media is key**
 - **Resolution of conflicting experiences required**
 - **Establishment of “good enough”**
 - **Standard calibration data and process**
- **Groundstations will continue to use tape for datalink data capture and archival storage**
- **Airborne recording environments may force new recording media and technologies**