# US Naval Safety Center

## Flight Recorder Program

# Mishap Investigation Technologies

## Safety Editor's Conference

September 2003

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NAVY
0278

# US Naval Safety Center
## Flight Recorder Program

What are the emerging electronic technologies used in mishap investigation ?

# US Naval Safety Center
## Flight Recorder Program

## Topics

- FIR Program Overview
- FIR Processing
- FIR Deliverables
- Use FIR Data Before The Mishap

# Flight Recorder Factoids

- FIR: Flight Information Recorder
  - FDR: Flight Data Recorder
  - CVR: Cockpit Voice Recorder
  - FVR: Flight Video Recorder
- Flight Recorder memory is protected from crash environment
- FFIR (Fixed) vs DFIR (Deployable)

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## Flight Recorder Program

### USN/USMC Flight Recorder Eqpd Acft:

| | |
|---|---|
| VADR (SI): | C-2, C-130, VH-3, VH-60, VP-3, F-18 B/C(*), AV-8(**) |
| CSMU (SI): | MV-22 |
| DFIR (DRS): | F-18C/D, F18E/F(*) |
| F1000 (L3): | C-9, C-20, C-12, ,C-35 T-44(*) |
| OTHER: | E-6, T-45 |

* under contract
** prototype

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# Flight Recorder Program

## Issues

Lack of Unified USN FDR Program

Platform Adherence to Parameter Lists

Platform Resistance to Periodic Maintenance

Platform Failure to Acquire Support Equipment

Expanding Commitments

Data Centric Integration

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# FIR Processing

- Data
- Audio
- Video

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## Processing
## Flight Recorder Information

1. Extraction: FIR Memory to Media (Disk)

2. Bridging: Decode Data to Readable Format

3. Presentation: Reproduce for Analysis

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## Bridging FIR Data
### Software Conversion To:

- Data: paper / ASCII / xls
- Audio: audio tape / wav / mp3
- Video: VHS tape / mpeg / avi

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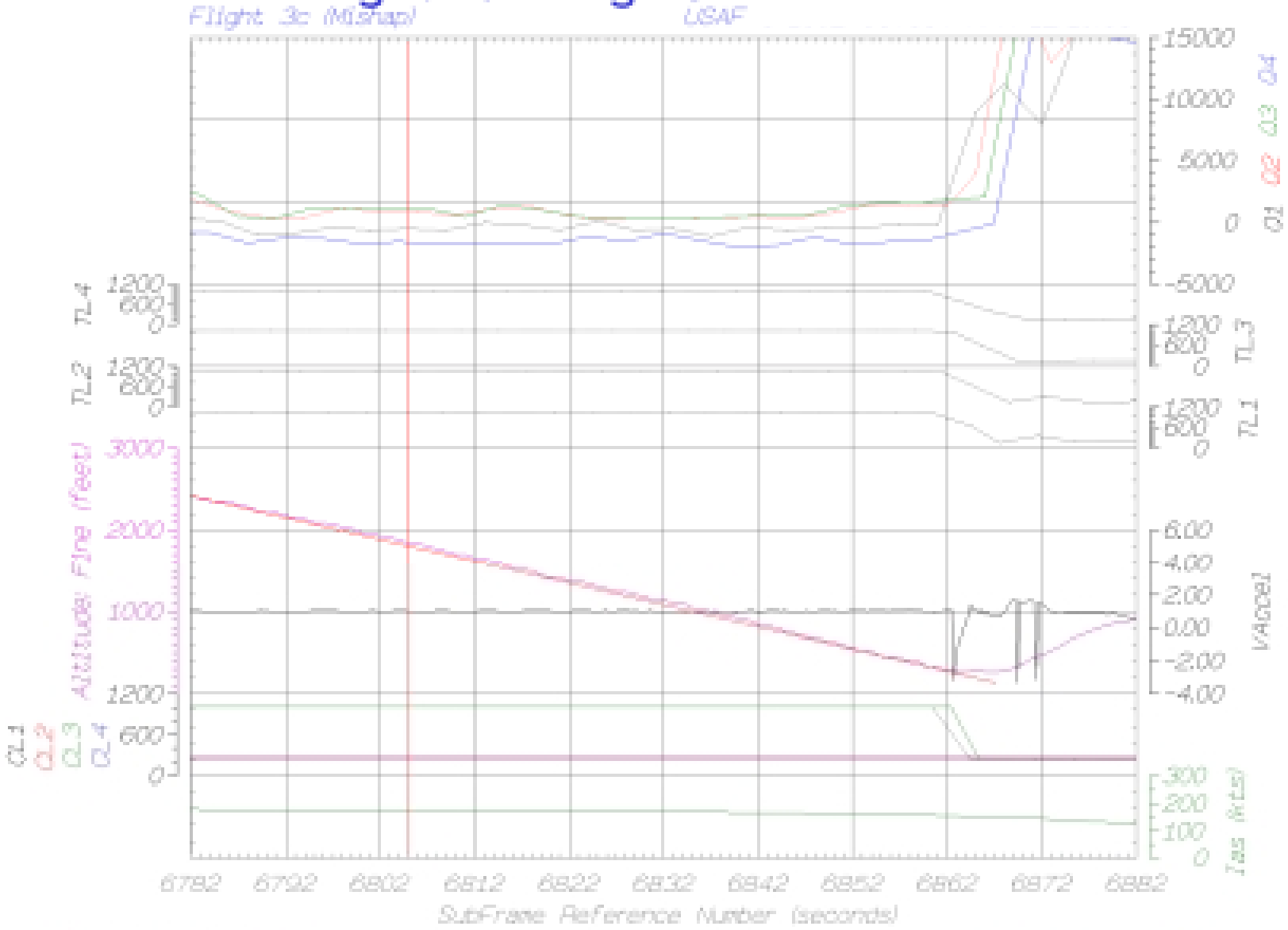
## FIR Presentation

- Tabulation
- Graphics
- 2D Reconstruction
- 3D Reconstruction

FIR DATA CODE 29  FILENAME:  C:\dte\mufiles\164737.299
PASS 1 OF 4

| ZULU TIME DD MM HR:MN:SEC | HUD AOA (DEG) | NORML ACCEL (G's) | RAD ALT (FT) | BARO ALT (FT) | PITCH (DEG) | OUTER ROLL (DEG) | AILERON POS. LT (DEG) | AILERON POS. RT (DEG) | STAB POS. LT (DEG) | STAB POS. RT (DEG) | TEF POS LT (DEG) | TEF POS RT (DEG) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 OCT 19 16 44.80 | -1.40 | 0.62 | | | | | | | | | | |
| 21 OCT 19 16 45.00 | 0.00 | 0.75 | 224 | 216 | -1.4 | 1.4 | 16.4 | 22.4 | 1.8 | 2.1 | 18.2 | 18.5 |
| 21 OCT 19 16 45.20 | 0.00 | 0.62 | | | | | | | | | | |
| 21 OCT 19 16 45.40 | 0.00 | 0.50 | | | | | | | | | | |
| 21 OCT 19 16 45.50 | | | 224 | | -4.2 | 1.4 | 17.1 | 17.5 | -1.8 | -1.8 | 16.4 | 16.8 |
| 21 OCT 19 16 45.60 | 0.00 | 0.50 | | | | | | | | | | |
| 21 OCT 19 16 45.80 | 0.00 | 0.38 | | | | | | | | | | |
| 21 OCT 19 16 46.00 | 0.00 | 0.25 | 224 | 192 | -5.6 | 4.2 | 14.7 | 16.8 | 0.0 | 0.7 | 14.0 | 14.3 |
| 21 OCT 19 16 46.20 | -1.40 | 0.25 | | | | | | | | | | |
| 21 OCT 19 16 46.40 | -1.40 | 0.12 | | | | | | | | | | |
| 21 OCT 19 16 46.50 | | | 192 | | -8.4 | 4.2 | 13.3 | 15.1 | -0.3 | 0.0 | 11.9 | 12.2 |
| 21 OCT 19 16 46.60 | -1.40 | 0.00 | | | | | | | | | | |
| 21 OCT 19 16 46.80 | -1.40 | -0.12 | | | | | | | | | | |
| 21 OCT 19 16 47.00 | -1.40 | -0.12 | 160 | 132 | -11.2 | 2.8 | 12.6 | 12.9 | 0.0 | 0.0 | 10.1 | 10.1 |
| 21 OCT 19 16 47.20 | -2.80 | -0.12 | | | | | | | | | | |
| 21 OCT 19 16 47.40 | -2.80 | -0.25 | | | | | | | | | | |
| 21 OCT 19 16 47.50 | | | 128 | | -14.0 | 1.4 | 11.2 | 11.6 | 0.3 | 0.0 | 8.1 | 8.1 |
| 21 OCT 19 16 47.60 | -2.80 | -0.25 | | | | | | | | | | |
| 21 OCT 19 16 47.80 | -2.80 | -0.38 | | | | | | | | | | |
| 21 OCT 19 16 48.00 | -2.80 | -0.38 | 96 | 44 | -16.8 | 0.0 | 9.8 | 10.1 | -2.5 | -2.5 | 5.9 | 5.9 |
| 21 OCT 1 20 9.05 | 2.80 | 1.12 | | | | | | | | | | |
| 21 OCT 1 20 9.25 | 2.80 | 1.12 | | | | | | | | | | |
| 21 OCT 1 20 9.35 | | | 8160 | | -2.8 | -1.4 | -1.8 | 7.0 | -7.0 | -7.0 | 34.0 | 39.9 |
| 21 OCT 1 20 9.45 | 2.80 | 1.12 | | | | | | | | | | |
| 21 OCT 1 20 9.65 | 2.80 | 1.12 | | | | | | | | | | |
| 21 OCT 1 20 9.85 | 2.80 | 1.12 | 8160 | 68 | -2.8 | -1.4 | -1.8 | 7.0 | -7.0 | -7.0 | 34.0 | 39.9 |
| 21 OCT 1 20 10.05 | 2.80 | 1.12 | | | | | | | | | | |
| 21 OCT 1 20 10.25 | 2.80 | 1.00 | | | | | | | | | | |

# Flight & Engine Parameters




FDR Track 6

Composed: 02/02/00

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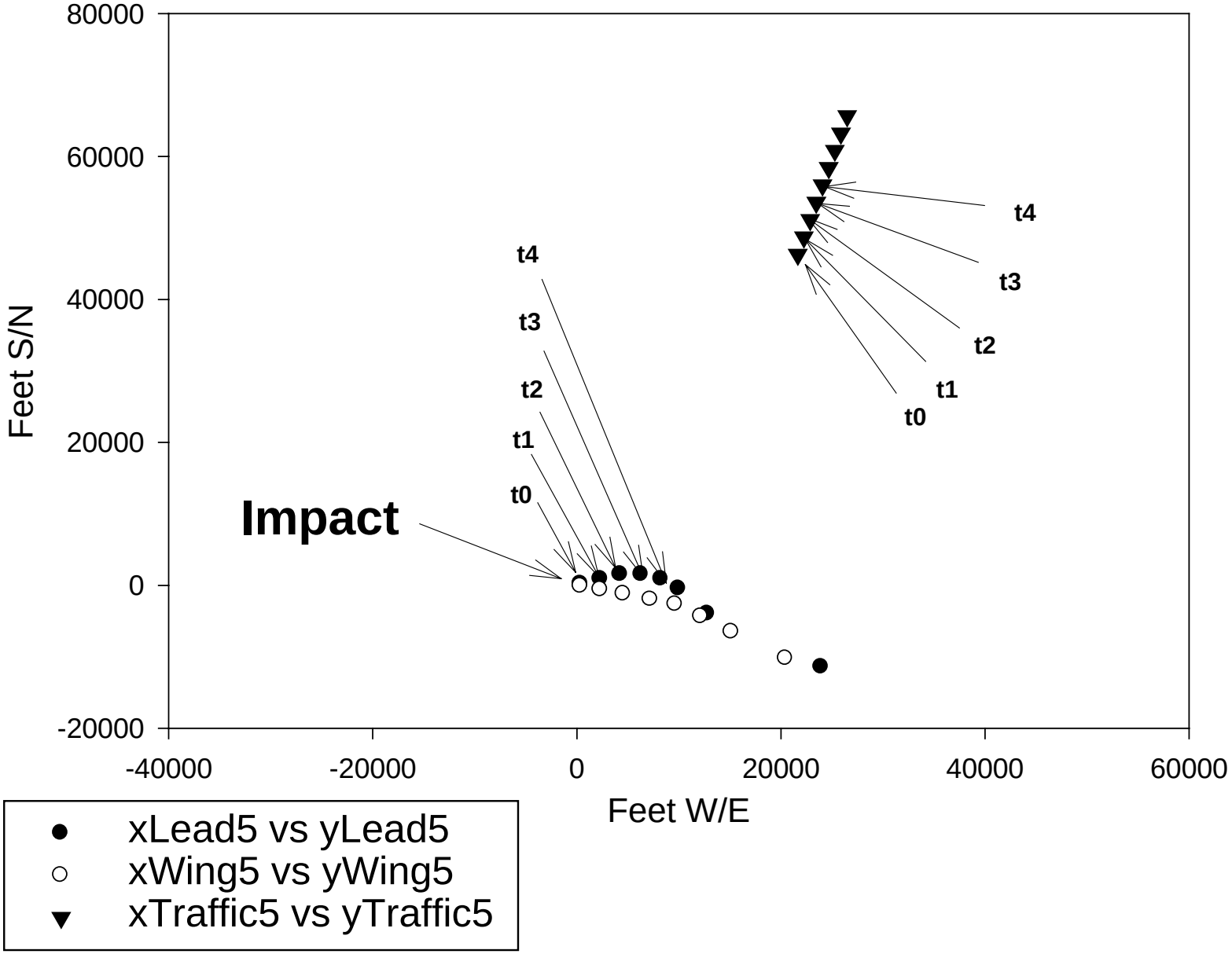
80000
60000
40000
20000
0
-20000
Feet S/N
-40000
-20000
0
20000
40000
60000
Feet W/E
Impact
t0
t1
t2
t3
t4
t0
t1
t2
t3
t4
xLead5 vs yLead5
xWing5 vs yWing5
xTraffic5 vs yTraffic5

Frame: 08548
Time: 02349

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Flight Recorder Program

# Data Centric Concept

Use Flight Data (before the fact) To Reduce Risk

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## Data Centric Functions

1. Mishap Investigation (MI): risk management after the fact
2. Integrated Maintenance Disgnostics/Health & Usage Monitoring (IMD/HUMS)
3. Squadron Playback & Analyis Station (SPAS)
4. Military Flight Operations Quality Assurance (MFOQA)
5. Airborne Activity & Requirements Telemetry (AART)

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## Leverage FIR Data For Mishap Prevention

- Open data architecture
- Convenient download capability
- Sufficient Memory

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# MFOQA

- Automated scanning of flight data to detect pre-defined events
- spots trends & risky behavior
- Distrusted by aviator culture (big brother)

# US Naval Safety Center
## Flight Recorder Program

# Wrap Up

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