


Flight Data Monitoring for General Aviation

Report from FDM Workshop
Daytona Beach
January 7-9, 2007

Background

On January 7-9, 2007, CAPACG and Embry-Riddle convened a workshop on Flight Data Monitoring (FDM)

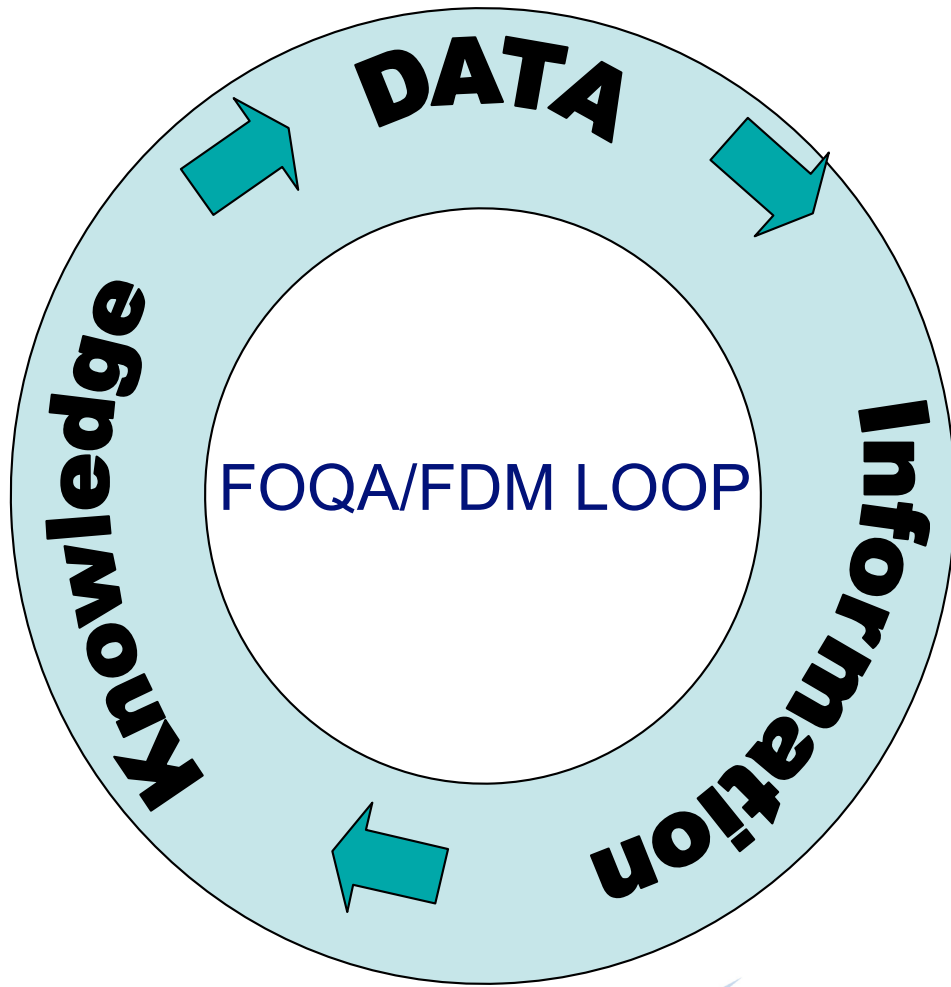
- Approximately 55 persons attended the workshop
- Represented directly or by proxy:
 - General aviation airplane operations:
 - Collegiate fleet operators, commercial training organizations, FBOs
 - Fractional ownership operators, with many different shared ownership models
 - Air Taxi operators, both propeller and VLJ
 - Individual airplane owners
 - Original equipment manufacturers, propeller, VLJ, and engine manufacturers
 - FAA
 - Voluntary Safety Programs
 - Air Safety Investigation
 - Small Airplane Directorate
 - Manufacturers of FDM Equipment and Software
 - Other stakeholders:
 - AOPA ASF, UPS IPA, Austin Digital, Battelle, Air Logistics, R3 Consulting, Global Aerospace (insurance)
- Cessna and Cirrus airplanes demonstrated FDM recording and playback
- The term “Plug and Play” (PnP) was coined to describe the intended deliverable
 - Establish FDM-relevant categories of general aviation operations
 - Create PnP FDM capability with necessary hardware, software, & processes to suit each category
- Proceedings from the workshop are available on <http://www.capacg.com/>
- **Two slides from the workshop are included as an overview of the FDM concept** 

FDM – Data, Information, and Knowledge - *A Hierarchy of Values*

- Flight Data Monitoring converts recorded flight data into information.
- Proper analysis converts this information into knowledge.
- Knowledge can then be used to enhance safety, training, or flight operations based on meaningful findings and recommendations.
- Findings and recommendations can be monitored by flight data. (FOQA loop)



Resultant PnP solution converts data into useful information and the end user gains knowledge



FDM Workshop Findings - Benefits

- Transport category history applies:
 - FDM will benefit general aviation in ways similar to effect on 30 years of transport category experience
 - Lessons learned implementing transport programs will allow accelerated general aviation acceptance
 - FOQA, LOSA, ASAP, and other programs either apply directly or can be adapted to general aviation
 - FDM can be utilized as an integral part and safety incentive of a SMS (Safety Management System) as offered by AC 120.92
- Benefits primarily exist in four areas: safety, operational, training, and maintenance
 - Safety benefit arises primarily by identifying and intercepting accident precursors
 - Operational benefit arises primarily by producing aggregate data to support anecdotal flight operations feedback and using it to change operating environments or procedures
 - Training benefit arises primarily through graphic playback of training flights and enhancing student understanding
 - Maintenance benefit arises primarily through application of aggregated and individual airplane data to engine and airframe maintenance costs
- Potential liability and insurance benefits may also exist as experience with FDM accumulates
- FDM data may be helpful in accident investigation, but FDM in general aviation is not and should not be seen primarily as accident investigation FDR's
- Individual airplane owners will receive most benefit from FDM by allowing themselves to be grouped into "virtual" fleets, such as on the basis of airplane type

FDM Workshop Findings - Benefits (Continued)

- FDM would confer safety, operational, training, maintenance, and training benefits to all categories of general aviation operations
- General aviation operations exist in two categories: Organizations with a training mission who “Fly to Train” and those with a transportation mission who “Train to Fly”

- Hypothetical benefits allocation*

General Aviation Operation	FDM Benefit Emphasis			
	Safety	Operational	Training	Maintenance
Collegiate, FBO, Commercial Training	XXX	X	XXX	X
Air Taxi	XXX	XXX	X	XXX
Fractional	XXX	XXX	X	XXX
Owner Operated & Joint Ownership	XXX	X	X	XX
Special Mission	To Be Determined			

* Needs to be demonstrated through appropriate research

FDM Workshop Findings - Equipment, Software, and Implementation Process

- General aviation FDM equipment and software are ready for implementation
 - Transport category equipment and software are being proposed, scaled to general aviation application
 - New equipment and software developed by new companies is available and being proposed
- Implementation can take place by airplane operators or contracting to third parties
- Although portability of FDM equipment is possible, permanent installation is preferred for all but demonstration purposes
- Classes of FDM equipment installation similar to EFB were defined at the workshop:
 - Class 1 Portable and self contained sensor except for plug-in power
 - Class 2 Retrofit installation with airplane systems data source/input and/or self contained sensor input
 - Class 3 OEM installed with airplane systems data source/input and/or self contained sensor input
- Processes for application of FDM data into flight operations, maintenance, and training operations need careful design

FDM Workshop Findings -

Regulatory Factors, Communications, & Pilot Acceptance

- Regulatory:
 - Transport Category advisory circulars can and should be used to implement general aviation FDM
 - The AC de-identification practices, FOIA protection, and regulatory procedures are applicable to general aviation
 - Pilot and labor group interests, as well as good practice, suggest general aviation *not* “reinvent this wheel”
- Significant data are required to demonstrate FDM benefits to a new community of practitioners
 - A trial demonstration with representation from all fleet categories is necessary to prove the benefits of FDM in general aviation
 - A significant communications program is necessary to carry that message to all members of the general aviation community

FDM Workshop Findings -

Fleet Readiness

- Both traditional type designs and TAAs are able to benefit from FDM
- The cost of implementing FDM on TAAs with digital busses may be lower
- The data gathered to realize FDM benefits may be enhanced by a few additional discrete and analog airplane information sources
 - Desirability depends on airplane characteristics (e.g., retractable gear) and desired monitoring
 - Maintenance benefits of FDM may be weighed against parameter measurement
- Future equipment such as engine FADEC will be useful in FDM, and may help open doors to cost savings such as increased engine overhaul periods
- The operators of general aviation fleets are strongly biased toward OEM inclusion of FDM capability
- New airplane production could offer OEM installation as either basic or an option

FDM Workshop Findings - Market Factors

- Economic benefits; general aviation operators want:
 - FDM hardware and associated software at a price point not to exceed \$5000 per airplane
 - FDM data analysis services not to exceed \$2 per flight hour DOC
 - Savings in airframe and engine maintenance; looking for 10 - 15%
 - Savings in insurance costs; not happy with likely delay in realization
 - Affordable data management and training playback
- Economic benefits; OEM's want:
 - Potential FDM data use in liability mitigation
 - Ownership or custody of data to monitor fleets, sub-fleets, and individual operations
- Training organizations want:
 - Simple procedures to acquire the data for immediate playback following flight
 - Playback capability in post flight de-briefings
 - Intuitive operation of the software
 - Fast forward and event location capability
 - Non-intrusive operation in the context of existing de-briefing practice
- Pilots and pilot organizations want:
 - Data de-identification as in transport operations with a Gatekeeper function per AC 180-82
 - Opportunity to report systemic operational problems with confidence they will be addressed
- Airplane owners want:
 - Opportunity to participate in FDM with “virtual” fleet benefits
 - Advice on incipient failures and issues emerging from the larger data base

FDM Workshop Findings - Summary

- FDM for general aviation is ready for a major “test drive”
 - A “White Paper” briefing tool is needed soon as a communication tool
 - A major trial of FDM hardware, software, and processes involving all categories of general aviation operations should be started
 - Every category of general aviation operation and manufacturers present at the workshop wants to participate in a trial
 - Some cost incentive will be needed to convince operator management until the benefits are demonstrated
- A General Aviation FDM Steering Committee with diverse representation will be named to provide guidance to these efforts
- Another meeting will be appropriate to share progress in about six months
- CAPACG offered to continue to lead the process
- ERAU offered to act as the research principal investigator function in a trial program, collaborating with other institutions
- The FAA offered to assist in seeking funding for a trial program
- CGAR’s officer presenting at the workshop offered to advise in framing a research grant application
- R3 consulting offered to assist in framing and seeking funding

Outline of FDM Trial Project

Grant Application to FAA through CGAR (Center for General Aviation Research)

- Participation by:
 - 3 to 5 collegiate fleets with total of about 45 airplanes
 - 1 air taxi fleet with total of 20 airplanes
 - 1 to 2 fractional operators with total of 10 airplanes
 - 3 to 4 private owners with total of 4 airplanes
- Duration and research for the trial project:
 - Trial has one year duration
 - CGAR member and other participating collegiate institutions provide research services
 - Report back periodically to the General Aviation FDM Steering Committee
- Costs for each participating operator are fixed at half the target market price
 - \$2500 from operator airplane equipment and associated software, \$2500 underwriting from grant
 - FDM analysis services \$1 per flight hour from operator, 1\$ underwriting per flight hour from grant
- Equipment suite and monitoring service selection is by private contract between operator and participating hardware manufacturer and monitoring service provider
- OEM participation is voluntary and will be sought after identification of all the fleet participant airplane types
- Grant financing ground rules:
 - Grant application will request up to 50% coverage of all costs, including hardware, software, data management, overhead, and expenses
 - Other 50% or more will come from operators as a matching contribution
 - Matching will include credit for operator payment for hardware, software, and data management.
 - Matching may include credit for portion of the DOC of the participating airplanes

Outline of FDM Trial Project

Candidate Airplane, OEM, and Equipment Manufacturer Participation

- Candidate airplane participation by:
 - 3 to 5 collegiate fleets with total of about 45 airplanes
 - CMU XX airplanes
 - Embry-Riddle XX airplanes
 - LeTourneau XX airplanes
 - MTSU XX airplanes
 - 1 air taxi fleet with total of 20 airplanes
 - SATSAir XX airplanes
 - 1 to 2 fractional operators with total of 10 airplanes
 - AirShares Elite XX airplanes
 - OurPlane XX airplanes
 - 3 private owners with total of 4 airplanes
 - AOPA FSF 2 airplanes
 - CAPACG 1 airplane
 - Delta Papa Ltd 1 airplane
- OEMs interested in project include Cessna, Cirrus, Diamond, Adam
- Universities interested in research participation: ERAU, MTSU, WMU, SLU, LeTourneau, Purdue
- Equipment suite and monitoring service selection is by private contract between operator and participating hardware manufacturer and monitoring service provider
 - FDM Airborne Equipment and analysis software candidate providers
 - Alaka'i Technologies
 - Appareo
 - Sagem Avionics
 - Teledyne
 - UHL Research Associates
 - FDM Analysis and Consulting candidate providers
 - Austin Digital
 - CAPACG

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FDM Workshop -

Next Steps

- Immediate action
 - CAPACG will create a summary of the workshop results in the form of this PowerPoint presentation
 - Steve Hampton will bring the proposed trial to the attention of the CGAR steering committee during the week of January 15
 - Participants in the workshop are sending CAPACG confirmation of their interest to participate in a trial
 - CAPACG is preparing a white paper, to be ready in 30 days
 - CAPACG will propose the creation of a General Aviation FDM Steering Committee and composition within 30 days to the persons who attended the workshop
- CAPACG will draft a grant application and review it with the Steering Team within 60 days
- A proposal for future meeting(s) will be tendered to the Steering Team within 90 days