

# **Flight Sciences Methods and Data Corrective Action Team**

## **Recommendations**

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**SFO Number 910005, Flight Technologies Common Data Format**

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## **Executive Summary**

### **Methods and Data (MAD) Corrective Action Team Problem Statement**

*Currently, our tools do not allow efficient use of data and our methods do not provide consistent, credible results.*

#### **Problem Scope**

- ☛ Initial SFO 910005, Flight Technologies Common Data Format, identified a problem in A-12 methods and data use.
- ☛ Scope of MAD CAT investigation limited to Flight Sciences, but the suspect problem may be engineering wide.
- ☛ Surveyed Flight Sciences and identified potential annual savings of \$1.7 million by eliminating non-value-added data handling and \$650 thousand in duplicate data development. Data handling is activities, methods, and software concerned with storage, retrieval, basic manipulation, and presentation of engineering data.

#### **Recommendation**

- ☛ Establish a Flight Sciences Methods Project for coordinated development and maintenance of significant Flight Sciences analysis software. This approach would be similar to an IPT process, although it would be applied to several technical products. Section or project engineers would be co-located for proper coordination of common software elements.
- ☛ Specify, make/buy, and support common computer software and data formats for engineering data handling.
- ☛ Provide information on software and software development to engineers so software is developed and used efficiently. Convene appropriate user groups.
- ☛ Measure efficiency improvements in software development and engineering data handling.

#### **Solution Cost/Benefit**

- ☛ Initial costs of setting up facilities for the Flight Sciences Methods Project
- ☛ Recurring costs of a Flight Sciences Software Development Manager, plus support for generic software development and maintenance. Most actual software development could be supported by Engineering Modernization funds. Funds for participating engineers and programmers will be from existing funding lines (CRAD, EnMod, IRAD, and project).
- ☛ Flight Sciences will benefit through elimination of cause of SFO problem.
- ☛ Up to \$2.3 million of benefit will be realized through elimination of redundant effort and inefficient software.
- ☛ Coordinated, standard data handling software and data formats can be marketed outside General Dynamics, providing a potential source of revenue.

## **Introduction**

The Methods and Data Corrective Action Team (MAD CAT) was initiated in response to a Search for Opportunity (SFO) form submitted by Mike Yokell. The SFO is attached to this Recommendation in the Appendix. In brief, Mike's SFO outlined a then-significant effort resolving aircraft performance prediction discrepancies on an existing aircraft program. While different functional groups (such as Aeroanalysis and Aerodynamic Stability and Control) used the same source test data to derive aircraft characteristics, they produced different electronic datasets in incompatible formats. Although it was understood that different methods were used to obtain a result, it was very difficult to verify whether the discrepancies came from the datasets or the methods, since a complete dataset comparison required enormous effort. The MAD CAT has used the SFO as a starting point to identify the basic problem.

The Methods and Data Corrective Action Team (MAD CAT) has endeavored to obtain sensible, practical solutions to a historical problem: Currently, our tools do not allow efficient use of data and our methods do not provide consistent, credible results. This basic problem has expensive and critical ramifications. Since data is not communicated properly, it is redeveloped. Since it may be redeveloped using different methods, different results may be presented that confuse internal customers or our final customers. Inefficient data development increases our costs for required analysis and decreases the capability to do thorough engineering within a fixed budget. The MAD CAT has also tried to identify the cost of this pervasive problem.

The cost of inefficient data development was estimated by a wide-range survey of Flight Sciences engineers and management. The survey results indicated \$1.7 million of waste each year in non-value-added data handling. This is mainly in the areas of restructuring input data, dealing with hostile computer programs, data translation, and difficulty in generating presentation-quality graphics. The survey dealt directly with data duplication, and the estimate of waste due to duplication was \$648 thousand each year. This is a very significant estimate considering that most engineers are reluctant to identify themselves with poor performance, even on an anonymous survey.

The MAD CAT has concluded that organizational change is required to best implement improvements in the department's analysis tools. We recommend that the development and maintenance of Flight Sciences' analysis tools be combined to create a Flight Sciences Methods Project. The project would be responsible for providing tools to our engineers and held accountable to those same engineers for proper features and maintenance in a timely manner.

The MAD CAT recognizes that many factors will determine the kind of organizational changes that will provide positive change. We have determined a rather broad mission and charter and have suggested an organization structure that can assure an enduring cure for problems in engineering software and its use. Our emphasis is on the tasks that need to be accomplished to help General Dynamics engineers efficiently produce a high-quality, high technology product.

We feel that engineers will be more motivated and productive when they have superior software tools and consistent methods.

The MAD CAT has thoroughly explored the origins of the original SFO problem statement. We feel that our recommended solution is a practical solution to the underlying problem cause that we have identified. A Flight Sciences Methods Project will promote communication on methods and data handling in the engineering staff with its IPT approach. The IPT approach will also provide the multidisciplinary requirements for effectively developing a common data handling approach.

This Recommendation has four parts: Mission and Charter, Project Organization, Recommended Activity, and Draft Requirements. A copy of the initiating SFO, and our estimate of inefficiencies in the current engineering process, as related to our problem statement, is provided in the Appendix. A glossary is included, since many of the terms in this document are highly specialized.

## **Mission and Charter**

### **Mission Statement**

To provide Flight Sciences with efficient analysis tools that produce consistent, credible results.

### **Charter**

- ★ Plan Flight Sciences software development in a coordinated fashion, enhancing data interchange and eliminating redundant and over-specialized software.
- ★ Provide a focal point for maintenance and configuration management of Flight Science software tools.
- ★ Establish common data formats and data handling software in Flight Sciences.
- ★ Provide an effective conduit for exchanging essential information on engineering methods, software tools, and data handling.
- ★ Enable engineers to produce high-quality work with computer assets.
- ★ Measure improvements in data handling and engineering software efficiency.
- ★ Coordinate engineering software development with division-wide planning.