

**N87-16034****COFS I GUEST INVESTIGATOR PROGRAM**

Anthony Fontana and Robert L. Wright  
NASA Langley Research Center  
Hampton, Virginia

First NASA/DOD CSI Technology Conference  
Norfolk, Virginia  
November 18-21, 1986

**PRECEDING PAGE BLANK NOT FILMED**

## **SUMMARY**

The process for selecting guest investigators for participation in the COFS-I program is in place. Contracts and grants will be awarded in late CY87. A straw-man list of types of experiments and a distribution of the experiments has been defined to initiate definition of an experiments package which supports development and validation of CSI technology. A schedule of guest investigator participation has been developed.

## COFS-I GUEST INVESTIGATOR PROPOSAL REVIEW PROCESS

Potential guest investigators have submitted approximately 60 proposals in response to the Dear Colleague Letter of February 7, 1986 which announced the opportunity to participate in the COFS-I Guest Investigator Program. The proposal review process is presented in figure 1. The Technical Merit Panel is made up of ten members from five NASA centers -- MSFC, GSFC, JSC, JPL, LaRC. The Technical Reviewers are given 1 month for individual evaluation of the proposals prior to the formal meeting of the Technical Merit Panel at LaRC in October. Proposals considered responsive by the Technical Merit Panel are reviewed by the Accommodations Panel and Business Panel for implementation feasibility and cost aspects. The Technical Merit Panel reviews and approves any changes made by the Accommodation Panel or Business Panel to insure that the integrity of the experiment package is preserved. The Experiment Evaluation Board is made up of five senior members from five NASA centers. This board reviews and approves the experiment package recommended by the Technical Merit Panel. The review process is completed at NASA Headquarters by the Controls/Structures Interaction (CSI) Steering Committee with final selection for negotiations being made by the OAST Associate Administrator in early 1987. Contracts will be awarded in late CY87.

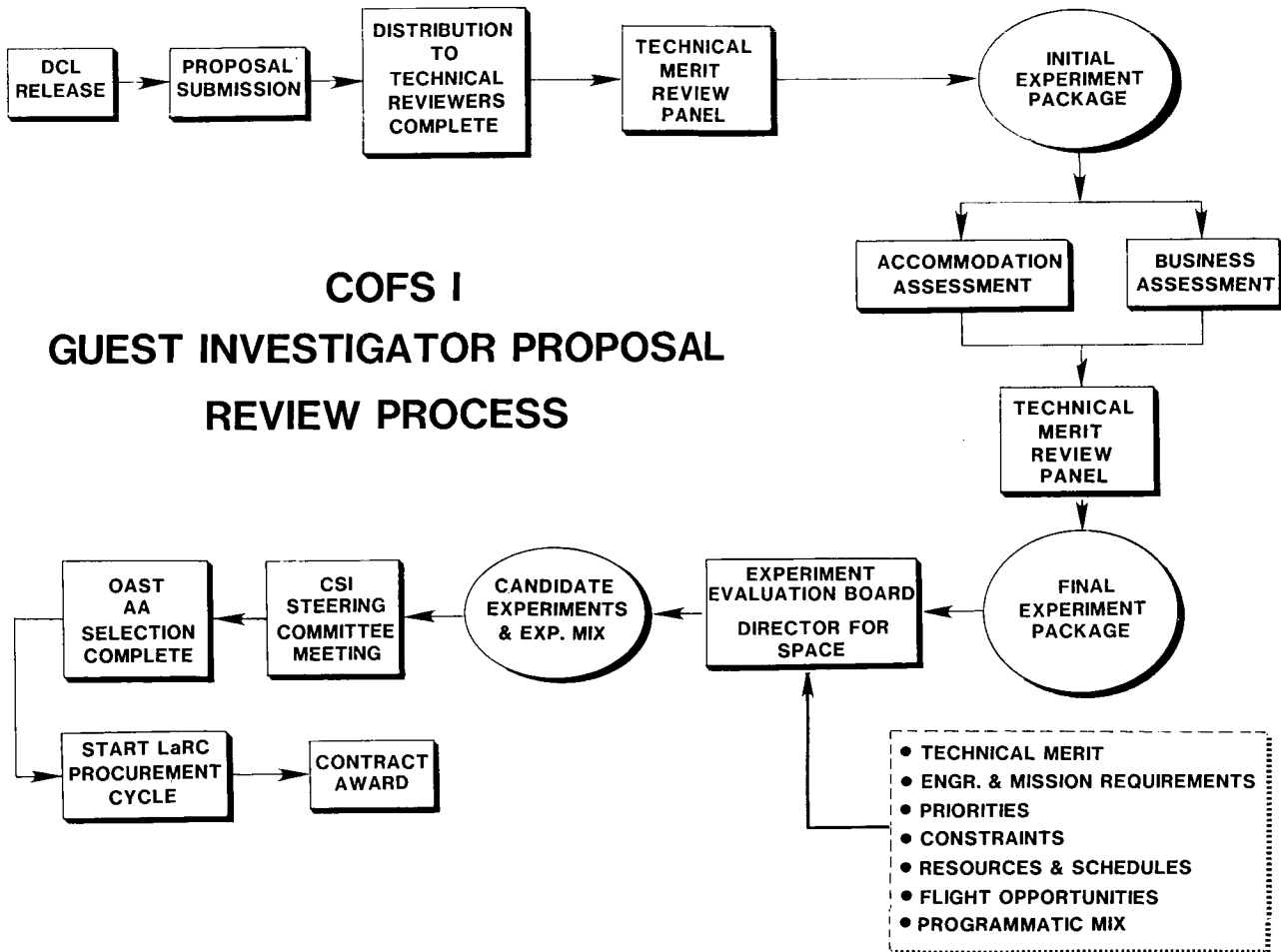


Figure 1

## PANEL CHARTERS

The Charter of each panel is shown in figure 2. The Technical Merit Panel makes a technical evaluation of each proposal and assembles the best of the proposals into an integrated on-ground and on-orbit experiments package which best supports development and validation of Control/Structures Interaction (CSI) technology. The Technical Merit Panel reviews the output of the Accommodation Panel and Business Panel to insure the preservation of the integrity of the experiments package. The Accommodations Panel defines the hardware and software modifications that must be made to the Mast Flight Article in order to accommodate the proposed experiment. This Panel also establishes the feasibility of implementing these modifications and assesses the safety of each proposed experiment. The Business Panel establishes the validity of the experiment cost as presented by the proposer and the cost to NASA for implementing the experiment on the Mast Flight Article. This panel also evaluates the overall management plan presented by the proposer. The Experiments Evaluation Board reviews and approves the final experiments package recommended by the Technical Merit Panel and makes a recommendation for selection to NASA Headquarters.

- TECHNICAL MERIT PANEL

- EVALUATE PROPOSALS AND ESTABLISH THE TECHNICAL MERITS OF EACH
- RECOMMEND A PACKAGE OF PROPOSALS WHICH BEST SUPPORTS CSI TECHNOLOGY ADVANCEMENT
- REVIEW AND APPROVE CHANGES MADE TO THE RECOMMENDED PACKAGE BY THE ACCOMMODATIONS OR BUSINESS PANELS

- ACCOMMODATIONS PANEL

- DEFINE FLIGHT ARTICLE H/W AND S/W MODIFICATIONS OR DEVELOPMENTS REQUIRED FOR IMPLEMENTATION
- DECIDE ON FEASIBILITY OF THESE H/W AND S/W MODIFICATIONS OR DEVELOPMENTS
- ASSESS SAFETY OF THE PROPOSED EXPERIMENT

- BUSINESS PANEL

- INDEPENDENTLY ESTIMATE EXPERIMENT COST AS PROPOSED BY THE GI
- ESTIMATE COST OF FLIGHT ARTICLE H/W AND S/W MODIFICATIONS OR DEVELOPMENTS REQUIRED FOR NASA IMPLEMENTATION
- ASSESS MANAGEMENT PLAN AND INSTITUTIONAL SUPPORT

- EXPERIMENT EVALUATION BOARD

- REVIEW AND APPROVE THE EXPERIMENTS PACKAGE RECOMMENDED BY THE TECHNICAL MERIT PANEL
- MAKE RECOMMENDATIONS FOR SELECTION TO NASA HEADQUARTERS

Figure 2

## STRAW-MAN LIST OF TYPES OF EXPERIMENTS

A list of potential experiment categories is presented in figure 3. Each category is defined below.

1. Deployment Kinematics and Dynamics - Prediction of beam kinematics, loads, strains, and deflections that occur during on-orbit deployment and retraction.
2. Static Linearity of Deployed Beam - Development of a sensor system for measurement of straightness of deployed beam on-orbit. Prediction of precision of straightness of deployed beam and variation of precision after disturbance.
3. Structural Characterization
  - a) Design of excitation algorithms for use on-orbit for purposes of exciting the structure to produce dynamic response data containing the desired characterization information.
  - b) Design of identification algorithms for use on-ground, post-flight for purposes of extracting the structural characteristics from dynamic response data taken on-orbit.
  - c) Design of identification algorithms which reside in the flight article computer and are used open-loop, on-orbit to extract structural characteristics from dynamic response data.
4. Control Law Evaluation
  - a) Design of non-distributed control algorithms using collocated sensors and actuators for purposes of on-orbit, real-time, disturbance suppression.
  - b) Design of distributed control algorithms using non-collocated sensors and actuators for purposes of on-orbit, real-time, disturbance suppression.
  - c) Design of adaptive control algorithms for use on-orbit which automatically adjust for such things as sensor/actuator failures, and changes in structural characteristics.
5. Hardware Development - Development of sensors, active actuators, passive dampers, structural members, etc. for on-orbit evaluation.
6. Other - Review of the proposals may define additional categories.

- DEPLOYMENT KINEMATICS AND DYNAMICS
- STATIC LINEARITY OF DEPLOYED BEAM
- STRUCTURAL CHARACTERIZATION
  - EXCITATION ALGORITHMS
  - GROUND-BASED SYSTEM IDENTIFICATION
  - ON-ORBIT, OPEN-LOOP, SYSTEM IDENTIFICATION
- CONTROL LAW EVALUATION
  - COLLOCATED DISTURBANCE SUPPRESSION
  - DISTRIBUTED CONTROL
  - ADAPTIVE CONTROL
- HARDWARE DEVELOPMENT

Figure 3

## DESIRED CONTENT OF EXPERIMENT PACKAGE

The COFS-I GI experiments package should be an integrated combination of on-ground and on-orbit experiments which best supports the development and validation of Controls/Structures/Interaction (CSI) technology. The package should include experiments from each of the previously discussed categories with emphasis on structural characterization experiments and control law evaluation experiments. Ground-based system identification is technically critical and relatively inexpensive since flight quality software is not required. Therefore, a large number of these ground-based system identification experiments is justified. Other structural characterization experiments and the control law evaluation experiments are technically critical also, but the number of these experiments which can be conducted on-orbit is limited by the on-orbit test time available and the cost of developing the associated flight software. Emphasis of these experiments can be achieved by initially selecting a relatively large number of investigations with subsequent competitive reduction to a relatively small number of investigations for actual on-orbit evaluation. Competitive reduction is achieved by ground-based performance evaluations using a high-fidelity simulation of the MAST flight article.

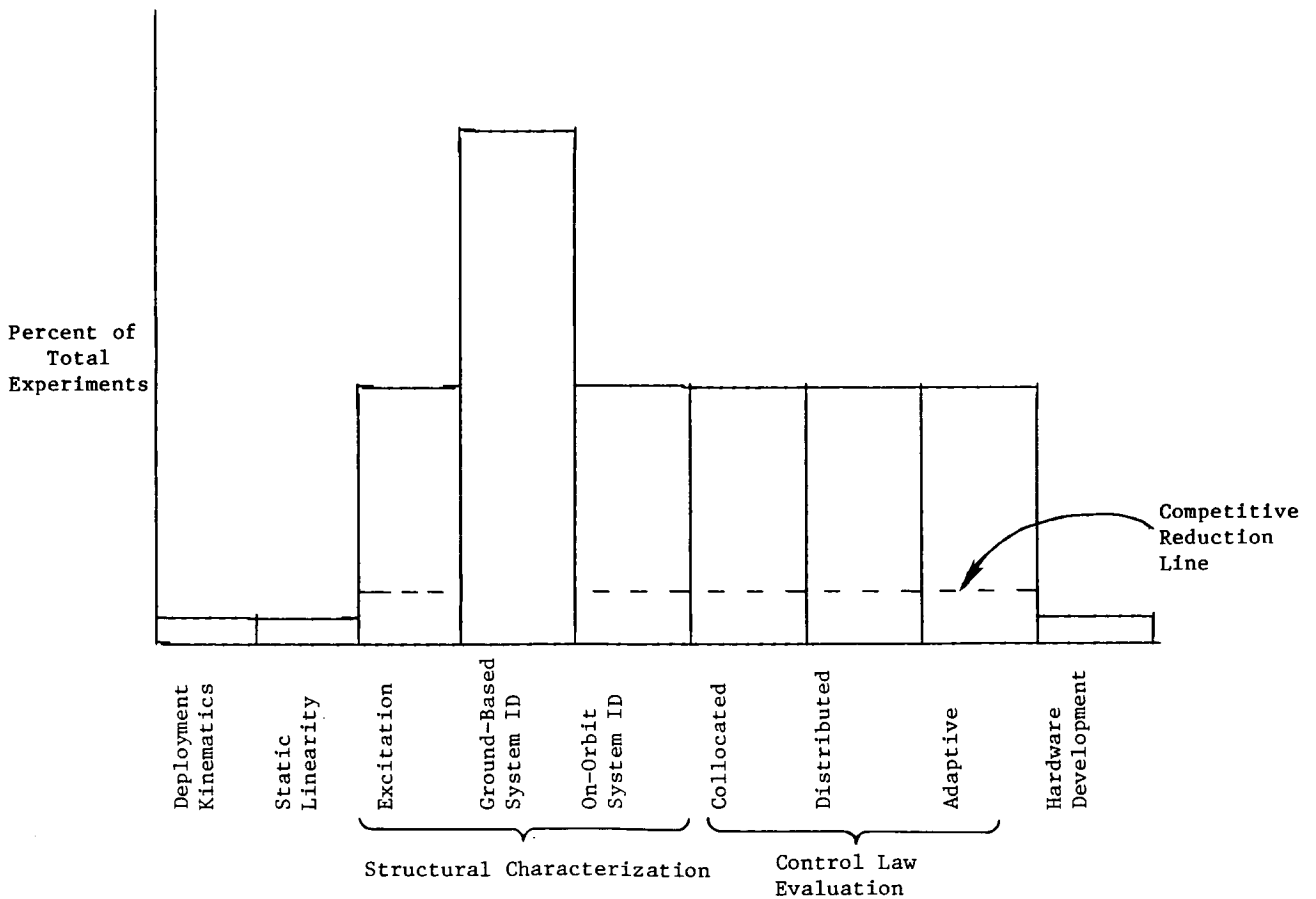


Figure 4

**SCHEDULE OF GUEST INVESTIGATOR PARTICIPATION**

Selection of guest investigators for negotiation will be made in early 1987 with contract and grants awarded by October 1987. Those guest investigators participating in the scaled model ground tests will have to define their test requirements by February 1988 so that timely preparation for their participation can be made by NASA. Likewise, participants in the flight article ground tests will have to submit their requirements by March 1988. Guest investigators developing algorithms for use on-orbit must submit a preliminary design by June 1988, coded in Fortran, for competitive evaluation by NASA. Development of flight software will be initiated by NASA for the best of the on-orbit algorithms. Analysis of flight data will continue for approximately 1 year after the flight tests.

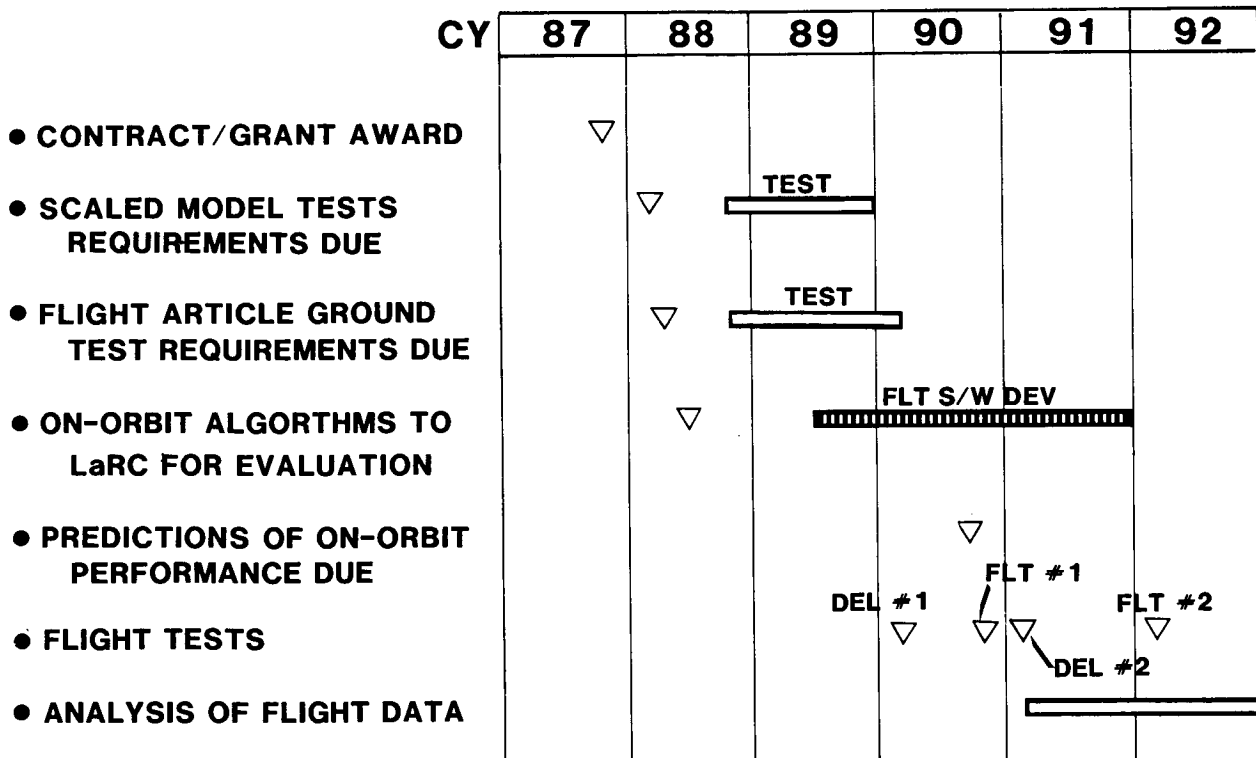


Figure 5