1025-A

Y 4
Sci 2
96/ccc

GOVERNMENT
Storage

[COMMITTEE PRINT]

SPIN RECOVERY TRAINING

DOCUMENTS

OCT 7 1980

FARRELL LIBRARY
KANSAS STATE UNIVERSITY

REPORT

PREPARED BY

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

SECOND SESSION

Serial CCC

A11100 772115

JULY 1980

Printed for the use of the Committee on Science and Technology

U.S. GOVERNMENT PRINTING OFFICE

66-020 O WASHINGTON : 1980

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

DOCUMENTS

COMMITTEE ON SCIENCE AND TECHNOLOGY

DON FUQUA, Florida, *Chairman*

ROBERT A. ROE, New Jersey
MIKE McCORMACK, Washington
GEORGE E. BROWN, JR., California
JAMES H. SCHEUER, New York
RICHARD L. OTTINGER, New York
TOM HARKIN, Iowa
JIM LLOYD, California
JEROME A. AMBRO, New York
MARILYN LLOYD BOUQUARD, Tennessee
JAMES J. BLANCHARD, Michigan
DOUG WALGREN, Pennsylvania
RONNIE G. FLIPPO, Alabama
DAN GLICKMAN, Kansas
ALBERT GORE, JR., Tennessee
WES WATKINS, Oklahoma
ROBERT A. YOUNG, Missouri
RICHARD C. WHITE, Texas
HAROLD L. VOLKMER, Missouri
DONALD J. PEASE, Ohio
HOWARD WOLPE, Michigan
NICHOLAS MAVROULES, Massachusetts
BILL NELSON, Florida
BERYL ANTHONY, JR., Arkansas
STANLEY N. LUNDINE, New York
ALLEN E. ERTEL, Pennsylvania
KENT HANCE, Texas

JOHN W. WYDLER, New York
LARRY WINN, JR., Kansas
BARRY M. GOLDWATER, JR., California
HAMILTON FISH, JR., New York
MANUEL LUJAN, JR., New Mexico
HAROLD C. HOLLENBECK, New Jersey
ROBERT K. DORNAN, California
ROBERT S. WALKER, Pennsylvania
EDWIN B. FORSYTHE, New Jersey
KEN KRAMER, Colorado
WILLIAM CARNEY, New York
ROBERT W. DAVIS, Michigan
TOBY ROTH, Wisconsin
DONALD LAWRENCE RITTER, Pennsylvania
BILL ROYER, California

HAROLD P. HANSON, *Executive Director*
PHILIP B. YEAGER, *General Counsel*
REGINA A. DAVIS, *Administrator*
PAUL A. VANDER MYDE, *Minority Staff Director*

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

JIM LLOYD, California, *Chairman*

JEROME A. AMBRO, New York
RONNIE G. FLIPPO, Alabama
ALBERT GORE, JR., Tennessee
BILL NELSON, Florida

MANUEL LUJAN, JR., New Mexico
WILLIAM CARNEY, New York
TOBY ROTH, Wisconsin

CONTENTS

	Page
Letter of transmittal	1
The hearings	3
Summary, conclusions, and recommendations	4
Highlights of witness testimony	5
Mr. Bernard A. Geier, FAA	5
Mr. James Patton, NASA	6
Mr. J. Lynn Helms, GAMA	6
Mr. Elwood Driver, NTSB	7
Capt. Verne Jobst, EAA, IAC, UAL	7
Mr. William Stanberry, AOPA	8
Mr. Roger Boggs, FAA (ret)	8
Mr. C. O. Miller, System Safety, Inc	9
Mr. Anthony A. LeVier, Lockheed (ret)	9
Col. Charles S. Wingate, USA	10
Col. Donald F. Bracket, USAF	10
Capt. Milton M. Scott, USN	10
Mr. A. Scott Crossfield	11
Summary of witness' positions	12

LETTER OF TRANSMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, D.C., August 1980.

Hon. DON FUQUA,
Chairman, Committee on Science and Technology, Washington, D.C.

DEAR MR. CHAIRMAN: The General Aviation accident rate in the United States declined over the last several years due to a strong cooperative effort on the part of the government, manufacturers, and operators. They are to be commended.

However, there is still much room for improvement. One question of safety that refuses to be put to rest is the FAA policy of not requiring spin recovery training as a prerequisite for a Private Pilot License—or any license for that matter.

In order to determine the best interests of safety in this matter the Subcommittee on Investigations and Oversight held hearings to address the question: "Would spin training as a requirement for a Private Pilot License result in a net saving of lives?"

While not unanimous, the testimony overwhelmingly concurred that some form of spin training was desirable and essential. Only considerations not purely involving safety provided a basis for disagreement.

The subcommittee considers that the hearings contributed to an equitable and objective basis for direction from the committee.

This report summarizes the issues and viewpoints and offers the findings and recommendations of the subcommittee.

Sincerely,

JIM LLOYD,
Chairman, Subcommittee on Investigations and Oversight.

The Hearings

On June 17, 18 and 19, 1980, the Subcommittee on Investigations and Oversight held hearings on the subject of spin recovery training requirements for aspiring pilots. The manufacturers' and owners' trade associations, the government, the military services, and a variety of expert individuals gave oral testimony and/or submitted written testimony for the record. The question addressed at these hearings reduces to one that asks: "Would spin training as a requirement for a Private Pilot License result in a net saving of lives?"

The chairman set the thesis of the hearings in his opening remarks by observing that after 30 years we are raising the question of whether or not we should do what we did 30 years ago without question. He asked, if we returned to an equivalent practice of 30 years ago: "Simply stated, is this beneficial to the aviation community? Would there be a saving of lives? Would we instill greater confidence (in pilots)? Would we come up with a better product, namely the private pilot as an aviator in today's aviation world?"

Summary, Conclusions, and Recommendations

Only FAA remained adamant in their defense of the no-spin training policy. All other witnesses, to varying degrees, expressed the need for spin and spin recovery training as a common sense safety requirement, even occasionally, in contradiction to their assessment of the statistical picture. The same statistics were used to support opposing arguments across the spectrum. Table I summarizes the witness' positions.

It can be concluded without equivocation that the experienced aviators overwhelmingly demand that aspiring pilots be trained to protect themselves and be able to recover from post stall gyrations, incipient spins, and spins. There was no evidence of compromise in this consensus.

The only disagreement appears to stem from other than safety considerations from the trade groups and the FAA. It can be further concluded that a capricious or arbitrary reinstating of the rescinded 1949 policy would be an untenable disruption of the entire General Aviation structure and industry.

The subcommittee recommends that some form of spin recovery training become a requirement for a Private Pilot License. To accomplish this the subcommittee recommends that:

1. An unbiased phase I study and analysis be conducted to determine a proper and realistic syllabus for such training. The study is to be carried to an end product of a proposed flight training manual. A knowledgeable university with a broad, hands-on expertise could well accomplish this end.

2. An additional phase II study be conducted designed to develop an implementation plan to accomplish restoration of spin training to flight training. Such a plan must have the basic protection for the grandfather rights of current aircraft certification, current instructor and private pilot's certification, and the entire logistic and economic structure of the flight training industry. The same organization could well accomplish or coordinate phase I and II.

3. Firm dates and milestones acceptable to the committee be established and considered mandatory. The program plan to accomplish phase I and phase II should be submitted to the committee no later than December 1, 1980.

Highlights of Witness Testimony

Several witnesses used a variety of statistics to initiate their several arguments. However, fundamental concern was the survival from accidental stall and post stall gyrations.

Of fatal accidents: Uncontrolled collision with ground/water (14.46 percent in 1978) and stall, stall/spin, and stall/mush (112 and 14.12 percent in 1978 and 155 and 22.08 percent in 1977) are of concern here. Any attempt to dilute attention to the basic problem by belaboring the exact details of those numbers evades the intention of these hearings.

One general conclusion is that the overwhelming evidence from testimony reveals a whole flight regime of fatal accident source that is kept a mystery to the licensed aviator by the FAA by practice and regulation unless pursued by the individual aviator on his own initiative.

No witness expressed the opinion that training in post stall gyrations was not good. Two witnesses maintained that it was not necessary, was inconvenient to require, was against regulations, and would be difficult to implement. All other witnesses favored some required training in post stall recovery and/or spin recovery training for instructors and students to various degrees.

The polarization was clear between the unfettered aviators and the bureaucracy and institutions with their conflicting concerns for convenience and economics. Here one could not help but recognize the lack of recognition that it has always proven cheaper to be safe.

To the credit of all witnesses considerable attention was given to how, and how much deep stall and spin recovery training should be given. How to reverse the practice of thirty years without unacceptable burden on manufacturers, FAA, and grandfather rights of pilots and instructors was the underlying thesis of those reluctant to endorse full deep stall and spin recovery training.

It can be unconditionally concluded that all witnesses except FAA felt strongly that spin and spin recovery training in some form was good, desirable, or even a necessary essential to being a safe aviator. The only reservations arose from qualms about the bureaucratic burden that would come from an arbitrary requirement.

Some salient elements of testimony of the several witnesses can be excerpted or paraphrased: (full testimony and other inputs submitted for the record are published in the hearing record).

BERNARD A. GEIER

Mr. Bernard A. Geier of FAA expounded the FAA policy: "Interests of aviation would not be served—(with a spin training requirement.)" It was maintained that the FAA Stall Awareness and Avoidance Program was quite adequate. A strong point was made that this training included deliberate distraction of the trainee while in slow speed flight.

The FAA holds instructor and student clinics on stall/spin avoidance and have been encouraged to hold more in the future. This testimony gave clear evidence of the vital concern and interest the FAA gives the stall/spin problem in the G.A. arena.

Mr. Geier stated "Training in the use of flight instruments, which is required by pilot certification regulations, has developed pilot awareness of flight attitudes regardless of outside visual references."

That startling approach may, in itself, explain the source of some stall/spin accidents. The weight of opinion is strongly opposite to that of Mr. Geier's. For example, Captain Jobst of the Experimental Aircraft Association insists that his students look out of the cockpit for space and attitude positioning.

Some very reputable instructors have in the past, and still do, give a significant fraction of basic air work with all of the instruments covered to preclude a student's escape from learning basic airmanship.

Mr. Geier did not expand on his remark that instrument reference was preferable to contact clues for spatial reference for the neophyte pilot. Mr. Geier further underscored the questionable FAA attitude by defining a stall as occurring when the clacker sounded.

JAMES PATTON

Mr. James Patton of NASA after thousands of turns in hundreds of programmed and instrumented spins clearly revealed that there is really no mystery about spins with single engine G.A. configurations and that spin and recovery characteristics are very responsive to small aerodynamic and control changes.

Mr. Patton was constrained to express only a personal expert opinion on the hearing question. He favored some form of post stall, spin recovery training and certainly instructor proficiency demonstration requirements.

Mr. J. Lynn Helms representing the General Aviation Manufacturers Association (GAMA) concluded from recent statistics his "belief" that spins should not be a requirement of flight training. However the bulk of his testimony did not argue in that vein.

J. LYNN HELMS

Mr. Helms stated: " * * * I know of no single engine airplane in production today that cannot be placed in a spin and recovered easily by a test pilot." He had more problems with the FAA spin certification maneuver than with spins per se.

While professing a negative view of spin training, Mr. Helms revealed his position as one of degree. He observed that:

> The minimum training that I see would include spins in both directions for at least two or three training flights to include power off and power on entry, and with flaps up and with flaps down. Psychologically I doubt that the average student could take more than three or four spins per flight. Therefore we automatically say that it would take two to four flights for him to get completely exposed. * * * this would enhance his probability of recovery from a (inadvertent) spin.

So it appears that, in fact, Mr. Helms is not far away from the opinion of most aviators. He further expressed the opinion that 60 percent of the pilots voluntarily take spin training away so it should not be a requirement imposed upon the other 40 percent. Mr. Helms

expressed deep concern over the possibility of spin-trained pilots being tempted to do spins at various passenger loadings. Mr. Helms emphasized spin resistant design and the difficulty in selecting the amount of control power to balance spin susceptability with recovery capability.

ELWOOD DRIVER

Mr. Elwood Driver of the National Transportation Safety Board (NTSB), using the same statistics as Mr. Helms drew a different conclusion and voiced deep concern over stall/spin accidents.

A 1972 NTSB study concluded with nine recommendations, three addressed to training. Mr. Driver expressed disappointment in the response to their recommendations and the results on stall/spin statistics.

He did say that FAA actions were good as far as they went but were insufficient.

> We can keep on pulling out that link which says keep the guy from getting into trouble but what are you going to do when he (does) get into trouble? He has got to know what to do * * *. It does not occur very often but it is awfully catastrophic to the one guy that it does occur to.

With that statement, Mr. Driver drew the base line argument of the aviators who want to eliminate the mystery beyond the stall.

CAPT. VERNE JOBST

Captain Verne Jobst was the first witness to speak as a free agent aviator as well as a primary and advanced flight instructor, an internationally known aerobatic competitor, and a trunk airline Captain. Captain Jobst also represented the Experimental Aircraft Association (EAA) position strongly in favor of restoring spin training to the Private Pilot test program.

Captain Jobst, who carries "two to three primary students most all the time" in addition to various advanced rating students, feels that a lot of "solid basics" have been lost to flight instruction in the last few years. He personally demands competency in recognition and recovery from spins before he will authorize solo flight for a student.

Captain Jobst argues that allowing or teaching a student to refer to instruments for basic flight reference in VFR conditions is an error and thwarts teaching of basic airmanship.

Captain Jobst makes a case that avoidance of the word spin and spin experience causes many pilots to not really know what is being discussed and further, they probably could not tell a spin from a graveyard spiral if confronted with either. Captain Jobst emphasized that his teaching of several maneuvers including spins was a very powerful confidence builder for students and served to supplant their fears with skill and confidence to recovery from inadvertent maneuvers. It is imperative that we go beyond academic discussion of spin and spiral and demonstrate and experience them in the opinion of Mr. Jobst.

Captain Jobst reported that members of his Quiet Birdmen Hanger, to a man, recommended spin training. Further, at the Chicago Flight Instructor Clinic held in early July, 102 out of 104 instructors in attendance felt that "spin training should be reintroduced." Captain Jobst's one on one association with FAA personnel revealed that all want those close to them (friends and loved ones) to have spin training as part of their early pilot training for their own safety.

A panel of Mr. William Stanberry, AOPA Flight Safety Foundation; Mr. Roger Boggs, FAA (ret.); and Mr. C. O. Miller, President of System Safety, Inc., reviewed the subject of spin training from their viewpoint.

WILLIAM STANBERRY

Mr. William Stanberry of AOPA Flight Safety Foundation reported that he could not justify a recommendation for spin training after reviewing accident statistics. Because "stalls, spins, spiral, and mush" accidents and accident rates diminished from 1965 to 1977, and spins per se (1,243 or about 100 per year) were only 2 percent of G.A. accidents he felt the status quo quite acceptable. NTSB (above) using the same data came to a different conclusion while Mr. Helms, based upon these data, struck a middle ground.

Mr. Stanberry drew a conclusion that we should avoid spin training because of the many spin accidents that occur during dual instruction. Another witness, Mr. Crossfield, later concluded that this was a distortion and should be viewed as an indictment of our training system and in itself justified the requirement for spin training.

Mr. Stanberry concluded that spin training would "not reduce the incidence of spin accidents and could very well increase the occurrence." He did, though, make valid points of the burden that arbitrary return to spin requirements could impose across the industry.

Mr. Stanberry would also add an angle of attack instrument to preclude approaching stall. Mr. Stanberry did concede that "FAA should tighten up on certification of Flight Instructors * * *" and that "* * * a halfway decent flight instructor will learn how to spin airplanes and he will make it his business, if he is worth his salt, to pass on this area of training to his student." So it seems, that like Mr. Helms, Mr. Stanberry is not against spin training but has qualms about the consequence of regulatory requirements.

ROGER BOGGS

Mr. Roger Boggs, after a long flight and governmental service career, spent the last 16 years on the FAA Headquarters Accident Investigation Staff intimately associated with the actual accidents in addition to their statistics. Mr. Boggs observes that the accident investigator can become "cynical only when action fails to follow repeatedly revealed facts. The facts in the stall/spin accidents sound like a broken record."

Acknowledging that human error is dominant in accidents and a large part of that is categorized as pilot error, Mr. Boggs observed that "Ignorance is prominent in pilot error. Most ignorance is voluntary. I know of only one area of ignorance which was decreed by regulation and which government has sponsored ever since—spin training."

He goes on to say that in a stall/spin accident the facts from investigation are ignored. "The CAB unmindful of or unimpressed by the dramatic reduction in stall spin accidents creditable to the CPT disciplines and apparently believing that ignorance is acceptable if decreed by government rescinded the spin training rule." He surmises that the FAA has stringent rules and enforcement against violators for all types of emergency and safety situations except the most deadly of them all: the spin, which isn't even on the list.

Mr. Boggs believes that the Administrator, presented with the testimony here, would assign a high priority regulatory effort to reconcile the circumstance in the interest of safety.

C. O. MILLER

Mr. C. O. Miller of distinguished flight, NTSB, and safety investigation background concentrated upon two points:

1. It takes more time to describe what happens, post stall, and into the developing spin than a pilot has available to respond to the situation. Further, post stall gyrations are indescribable in early pilot experience. In short, a pilot cannot determine what is happening to a departing airplane, about three axes, when it first occurs to him. Only training and experience will give him the skills and the tools for timely response with the proper actions to prevent, forestall, or recover from an inadvertent potential spin or spin through the post stall gyrations. Properly done, an inadvertent spin recovery should not exceed $\frac{1}{8}$ to $\frac{1}{2}$ turn. Accompanying this point was a strong criticism of the lack of real world sense in most handbook descriptions and recommendations about spins.

2. The stall and departure or post stall gyrations that constitute the incipient spin phase or the commencement of "out of control" flight should be accorded as high or higher priority as spin recovery per se. The time of pilot response to a departure situation can occupy up to the entire span of time to a developed spin.

Mr. Boggs agreed with Mr. Miller's argument except for the length of time for a trained pilot's response which he felt was shorter.

Mr. Stanberry, acknowledging the length of time, felt it adequate to train in stall awareness and "* * * incipient spin recovery. We should not teach how to do spins but teach spin recovery." He did not expand on how to separate them.

After extensive discussion with the Chairman, the panel concluded that implementation of any plan to reinstate spin training would demand careful and considerate planning to avoid serious disruption of the flight training industry and its economics.

In response to direct questioning by Congressmen Lloyd, all three panelists supported requirements for instructor qualifications in spin and spin recovery techniques. Mr. Miller and Mr. Boggs would mandate extending that requirement to the student level as a prerequisite for a Private Pilot License.

ANTHONY A. LE VIER

Mr. Anthony A. LeVier, a retired test pilot, air race pilot, and private pilot of some 50 years, had polled students and veteran aviators on spin training requirements. The answer in all cases was "Yes, unequivocally, Yes!" Mr. LeVier related a personal opinion that he has expressed vehemently and repeatedly, publically and privately, where ever he found a forum for 30 years, that without the skills of spin recovery, a pilot "will * * * in an emergency * * * be left to the mercy of his own fright and untrained reflexes. Only blind luck or the Grace of God will save him."

He maintains that flying is inherently dangerous and lack of skill and judgement adds substantially to that danger for the pilot, his

passengers, other aircraft, and people on the ground that occupy his potential crash site.

Mr. LeVier was highly critical of the fearful or gentle approach to flight training and the insulation of the student from any knowledge of other than nearly straight and level flight. He envisioned this as a form of entrapment of the innocent. Mr. LeVier would increase the requirement for a Private Pilot License to a minimum of 25 hours of dual, 25 hours of solo, and 10 hours of instructor discretion time for work on weak characteristics. He would significantly upgrade requirements for instructor certification and proficiency verification. "An instructor who has not mastered his own fear of a spin * * * is unqualified to teach any kind of flying." Mr. LeVier cited situation after situation to confirm the value of spin training and recovery skills. He made an admittedly emotional plea that something be done about the blanket denial of aviators' demand to correct training deficiencies.

The U.S. Military establishment gave testimony of the Services' policy regarding spin training.

COL. CHARLES S. WINGATE

Col. Charles S. Wingate, USA, stated that the Army does not train for spins, they have no equipment that is certified to spin, they emphazise stall awareness, and their primary priority addressed helicopter training and its unique requirements.

COL. DONALD F. BRACKETT

Col. Donald F. Brackett, USAF, described that the Air Force has historically made spin training a major element in training and a mandatory proficiency for Air Force tactical pilots.

The necessity for the Air Force to expect their pilots to use the full performance envelope, and even beyond, in the course of their operational and tactical flying makes special attention to all spin characteristics and all spin recovery essential.

CAPT. MILTON M. SCOTT

Capt. Milton M. Scott, USN, described a very extensive and all encompassing spin training program that is standard in the Navy, starting before the student solos. Further, this is carried into the fleet as an ongoing "out of control-spin" training program that trains the fleet pilot in all attainable departure, out of control, post stall gyrations, and spin situations. Captain Scott makes a case that the violence of many maneuvers makes it necessary for the pilot to be familiar with spins through experience or there would be no way for him to regain control of the aircraft. The Navy has established two "out of control" training squadrons.

Captain Scott described training with a "Lamshovak" maneuver that consists of an accelerated inverted snap roll into an inverted spin initiated from a vertical climb. (A p–51 WW II escape maneuver from a tailing FW–190). Captain Scott reports a significant decrease in the stall/spin accident rate in all operational modes and pilot documented saves of substantial numbers. All of this is accredited to the emphasis on out of control maneuver and spin training.

Captain Scott made the observation that, based upon the hearings, civil aviation seemed to take training and the aerodynamic characteristics of the airplane too lightly.

ANTHONY SCOTT CROSSFIELD

Mr. A. Scott Crossfield, technical consultant for the committee, reviewed and reiterated the views of other aviators with additional arguments and examples to confirm the need for spin training requirements.

He argued that he knew of no unbiased aviator who did not strongly object to the deletion of spin training by the CAB. Citing general statistical experience from the CPT and the Navy in WW II and specific personal experience, the case was made that significant saving of lives resulted from spin training. Not only did spin training preempt surprises in routine flying but spin training proves to be a powerful instructional tool to teach confidence and airmanship, to teach the difference in skills between guiding and flying an airplane.

Mr. Crossfield condemned the interminably repeated boilerplate arguments against spin training:

1. "It is against regulations" is the contrived device used to eliminate spin training in the first place.
2. "Student fear of spins" as a reason not to protect him from them is absurd.
3. "Instructor fear of spins" is just as absurd.
4. "Inadequate training areas" is just a rock to hide behind.
5. "Damage to aircraft and instruments" is a very dubious premise at best.
6. "Discouragement of aspiring pilots" is pure fiction in light of the heavy extracurricular demand for spin training by the neophyte group.

Mr. Crossfield maintains that once empirical tests determine the specific aircraft characteristics there is no mystery about spins of training configurations. Small aerodynamic changes yield large changes in spin susceptibility and recovery characteristics. A bad spinning aircraft is a sign of indolent design engineering this day and age.

Further Crossfield cited a number of reputable sources of aviation legend as all being vehemently in favor of spin training for aspiring pilots. A partial list of aviators who are strongly in favor of mandatory spin training includes: Gen. Ben Kelsey (retired) who fathered safe instrument flying with Jim Doolittle and now has the Lindbergh Chair at the Air and Space Museum, Gen. James H. Doolittle (retired), Capt. Bob Buck, the world ieknown author and safety advocate, Gen. Harold R. Harris (retired) who was the first Army test pilot and handling qualities expert and first to make a free fall emergency parachute jump, Paul Poberezny who is the founder and leader of the Experimental Aircraft Association, Jerome Lederer who is mister "Aerospace safety" emeritus, Capt. Homer Moudin who is Technical Vice President of the Flight Safety Foundation, Harold Hoekstra who is the revered spolesman and author of flight safety common sense and realities.

He concludes that all respectable aviators are convinced that spin training would result in a net savings of lives. Only those who would be inconvenienced continue to voice disagreement.

TABLE I
SUMMARY OF WITNESSES' POSITIONS

	INSTRUCTORS		PRIVATE PILOT STUDENTS	
	Is Spin Training Desirable? / Essential?	Should Spin Training be Required?	Is Spin Training Desirable? / Essential?	Should Spin Training be Required?
FAA (Bernard Geier)	NO / NO	NO	NO / NO	NO
ACPA (William Stanberry)	YES / YES	NO	YES / ?	NO
GAMA (Lynn Helms)	YES / ?	NO	? / ?	NO
NTSB (Elwood Driver	YES / YES	YES	YES / YES	YES
NASA (James Patton)	YES / YES	YES	? / ?	?
EAA, IAC (Capt. Verne Jobst)	YES / YES	YES	YES / YES	YES
FAA - Retired (Roger Boggs)	YES / YES	YES	YES / YES	YES
SYSTEM SAFETY (C.O. Miller)	YES / YES	YES	YES / YES	YES
LOCKHEED (Anthony LeVier)	YES / YES	YES	YES / YES	YES
U.S. ARMY (Col. C.S. Wingate)	PASS / PASS	PASS	PASS / PASS	PASS
U.S. AIR FORCE (Col. D.S. Brackett)	YES / YES	YES	YES / YES	YES
U.S. NAVY (Capt. M.M. Scott)	YES / YES	YES	YES / YES	YES
SCIENCE AND TECHNOLOGY (A. Scott Crossfield)	YES / YES	YES	YES / YES	YES