SA-396 File 2-0160

AIRCRAFT ACCIDENT REPORT

Adopted: July 17, 1968

HONEYWELL, INC.

GRUMMAN G-159, N861H

NEAR LE CENTER, MINNESOTA

JULY 11, 1967

NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
WASHINGTON D.C. 20591

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SYNOPSIS

At 1034 c.d.t., July 11, 1967, a Grumman G-159, (Gulfstream I) N861H, owned and operated by the Honeywell Corporation, departed from the Minneapolis-St. Paul International Airport, Minneapolis, Minnesota, The purpose of the flight was training on the aircraft for a company pilot. The weather was clear.

At 1100, the flight while in communication with the Minneapolis Air Route Traffic Control Center to receive VFR radar advisory service, made an emergency request for a radar vector to the nearest airport. The pilot indicated fire in one, possibly both engines. Just before 1104 he advised, "We're crash landing." The radar target of N861H was lost at 1104.

Between 1100 and 1104, ground witnesses located about 5 miles south-southeast of Le Center, Minnesota, saw the aircraft approach on e north-easterly heading and begin a wide, right circle. As the circle progressed, white smoke or vapor was seen coming from the right engine nacelle Wing area and the left propeller was stopped. Shortly thereafter, the right propeller stopped, fire appeared in the right engine nacelle wing area, and about the same time there was an explosion and pieces of wing separated from the aircraft.

The aircraft immediately went out of control, crashed and burned. Both pilots, the only occupants of the aircraft, were fatally injured. The aircraft was destroyed.

The Safety Board determines that the probable cause of this accident was overtemperaturing of both engines, inflight fire and explosion caused by the failure of the "Z" relay in the propeller automatic cruise pitch lock retraction system.

1. INVESTIGATION

1.1 History of the Flight

On the morning of July 11, 1967, a Grumman G-159, (Gulfstream I), N861H, owned and operated as a corporate aircraft by Honeywell, Inc., was scheduled for an approximate 2-hour local VFR, no-flight-plan flight from the Minneapolis-St. Paul International Airport at Minneapolis, Minnesota. The purpose of the flight was training to prepare one of the company pilots for a G-159 rating. The instructor pilot was the company's Manager of Flight Operations. The weather was clear throughout the area. Departure was at 1034 1/ with the instructor in the right pilot seat and the trainee in the left.

After takeoff, the flight advised Minneapolis Tower it would be operating 30 to 40 miles west of the airport between 9,000 and 11,000 feet, and requested VFR radar advisory service. At 1058, radar contact was established and the flight was in communication with the Minneapolis Air Route Traffic Control Center on frequency 125.9 MHz.

At 1100, the Center received an emergency call from the flight requesting a radar vector to the nearest airport. The aircraft, observed on radar to be on a northeast heading, was advised to turn to 240° for the Mankato, Minnesota Airport; however, no turn was observed. The pilot of N861H then asked for the distance to Mankato and was advised it was 14 miles and to reverse course. At this time the pilot stated, "We got a dual fire - single fire now." Asked his situation shortly thereafter, he answered, ". . . we had a fire in the left engine - got it out now, we think." He again asked

1/ All times are central daylight based on the 24-hour clock.

for the heading to Mankato and was told 240°. Asked again about his situation the pilot answered, "Probably going to land short - you better get somebody out here." At 1103:35, he radioed in a hurried voice ". . .we're crash landing." This was the last transmission from the flight, and at 1104 the radar target of the aircraft was lost.

During the above sequence of events, ground witnesses near Le Center, Minnesota, which is about 40 miles southwest of the Minneapolis-St. Paul International Airport, saw the aircraft approach on a northeasterly heading and being a wide, right turn. When the aircraft reached a southerly heading, some witnesses saw a stream of white smoke or vapor trailing from the right engine and others noted that the left propeller was stopped. As the turn progressed to a westerly heading, the aircraft descended to between 300 and 500 feet above the surface. The trailing smoke or vapor turned gray or black and the right propeller was observed to slow and stop. While the aircraft was turning to the northwest, fire appeared in the right engine nacelle and wing area. Almost simultaneously there was an explosion in the wing, and pieces separated from the wing area. The aircraft immediately went out of control and crashed. Ground fire consumed major portions of the aircraft wreckage.

A computation based on the regular sequence of training maneuvers for the flight and the norma times for their execution indicated that when the accident sequence started, the pilots were probably engaged in approaches to stalls in one of the various aircraft configurations, or the canyon approach. A slow airspeed and a rapid application of appreciable power would be common to these maneuvers.

1.2 Injuries to Persons

Both pilots, the only occupants of the aircraft, received fatal injuries. There were no injuries involving other persons.

Post-mortem pathological and toxicological examinations of the pilots revealed no evidence of a human factor involvement in the accident.

1.3 Damage to the Aircraft

Destroyed by impact and fire.

1.4 Other Damage

The aircraft crashed on a cultivated bean field causing property damage to the crop.

1.5 Crew Information

The instructor and trainee pilots were both qualified and properly certificated for the flight. See Appendix A for detailed crew information.

1.6 Aircraft Information

N861H was a Grumman G-159, Gulfstream I. Aircraft records indicated that the aircraft had been maintained in accordance with applicable Federal Aviation Administration (FAA) requirements. See Appendix A.

There were no writeups of any repetitive discrepancies in the aircraft flight logbook. The last writeup was on July 6, 1967. This indicated that during takeoff climb at 175 knots the pilots had experienced a momentary decrease in r.p.m. and increase in turbine temperature for the right engine.

The writeup indicated that at the time the propeller cruise pitch lock out lights were out and the lock was in place. The writeup indicated there was no apparent reason for the problem. No corrective action was taken. There had been no other prior or subsequent writeups of the problem.

1.7 Meteorological Information

Weather was clear.

1.8 Aids to Navigation

Not involved.

1.9 Communications

There were no communications difficulties.

1.10 Aerodrome and Ground Facilities

Not involved.

1.11 Flight Recorders

None was installed or required on the aircraft.

1.12 Wreckage

The aircraft crashed in an open cultivated field approximately 5 miles southeast of Le Center, Minnesota. 2/ It struck the ground right wing down and disintegrated along a northwest ground path, 1,220 feet long and 264 feet wide. At impact, the landing gear and flaps were up and the propellers of both engines were feathered.

A section of the right wing lower skin from between wing stations 164 and 293, which includes portions of the right wing fuel tank, wheelwell, and engine nacelle areas, was found 930 feet from the initial impact point back

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2/ Geographical location: Latitude N40°-20' Longitude W93°-44' along the final flightpath. This structure and other pieces of the wing and pieces of engine nacelle found at or near this location showed evidence of intense inflight fire and the force of an explosion.

Along the ground from the major wing pieces to the initial impact point there were numerous burned and molten pieces from the right wing engine nacelle area. Smaller bits and pieces of burned and molten metal were also located as far back as 3,200 feet along the final flightpath. The right main landing gear Was recovered outside the ground fire zone. The tires and other components showed evidence of exposure to intense inflight fire.

in the main wreckage area, structure from locations adjacent to the separated wing and nacelle pieces showed evidence of inflight fire. The fire patterns indicated that the fire was concentrated in the right engine nacelle area. The structure also showed evidence indicating that explosion forces were generated in the wing tank area. The balance of the airframe wreckage located in the main wreckage area revealed no additional evidence significant to the accident.

Examination of the powerplants of the aircraft disclosed that during the ground impact sequence, the left propeller remained with its engine while the right one was broken away. Both propellers were feathered when initial impact occurred.

Both engines had been subjected to extreme and destructive pre-impact operating overtemperature which was concentrated in the turbine sections and near the tops of the engines in the combustion chamber areas. In the right engine, there were indications of inflight fire in the top section of the aircraft firewall in the engine mount area. Among numerous other indications of engine overtemperature, the major portions of most intermediate and high-pressure turbine blades were melted away. These blades are made of Nimonic (nickel alloy) material, capable of withstanding approximately 2,400°F., compared to the normal maximum operating engine turbine temperature of about 1,500°F.

1.12A <u>Pertinent Propeller Information</u>

The Dowty-Rotol propeller system as installed on the aircraft includes a set of propeller cruise pitch locks on each propeller. These are designed to prevent the propeller blades from fining off (decreasing) below 34.5" in the event of a malfunction or failure at a high airspeed which could otherwise result in a dangerous propeller overspeed.

In normal operation of the system there is an automatic electrical cruise pitch lock withdrawal feature to retract the locks when the propeller blades fine off aerodynamically during a decrease in airspeed. In an airspeed range of 160 to 175 knots, propeller blade angles reach 36.5°, at which point a propeller hub switch in each propeller closes, permitting electrical current to flow to the "X" relay (left engine) and to the "Z" relay (right engine). When both relays receive electrical power and their electrical contacts close, current flows to the flight safety lock switch and then to the left and right propeller cruise pitch lock removal solenoids. When the solenoids are energized, they operate to cause engine oil pressure to extract the cruise locks, allowing the propeller blades to fine off so that appropriately high r.p.m. may be attainable at the lower airspeeds.

A pair of lights, the cruise pitch lights on the pilot's instrument panel, are also operated by the propeller hub switches and are illuminated in unison when either propeller is at 36.5" or below. A second pair of lights, the cruise lock out lights, located below the cruise pitch lights, are illuminated separately by the application of engine oil pressure to remove the cruise pitch locks. Both the "X" relay and the "Z" relay must function for these lights to come on and for the circuit to be completed through the flight safety lock switch.

The propeller system design incorporates a provision for circumventing the automatic cruise pitch lock withdrawal system in case of a malfunction or failure which might remove the locks prematurely or remove them when they need to remain in place, such as during a propeller overspeed. Placing the flight safety lock switch to emergency position breaks the electrical circuit at the switch and prevents automatic cruise pitch lock extraction and the propeller blade angles cannot decrease below 34.5°. The system also incorporates a provision to extract the locks manually. Positioning of the high pressure fuel cocks, fuel and propeller control levers on the power quadrant, to the cruise lockout position will, regardless of the condition of the automatic removal system and position of its switches or the availability of electrical power, open separate valves mechanically and port engine oil pressure to the extraction side of the cruise pitch locks to extract them. In the event the cruise pitch locks do not extract properly, the warning to the pilot would be failure of the cruise pitch lockout lights to come on.

If the cruise pitch locks were not extracted at low airspeed, and an attempt were made to apply power, the turbine sections of the engines would be subjected to overtemperature. This is because the Rolls Royce Dart engine control system is correlated with the propeller control system in such a way that the engine control system depends on the propeller control system for governing airflow at given flight and power lever conditions. Thus, under normal conditions, acceleration fuel under a power application would be matched with a large increase in airflow through rapid engine spool-up. If, however, the engine were in an overloaded condition because of propeller blade hang-up at the cruise pitch lock angle and could not accelerate fast enough to alleviate very high fuel-air ratios, it would be subjected to a rapid and extreme over-temperature.

1.12B Examination of Pertinent Engine and Propeller Controls and Systems

Examination of cockpit engine and propeller controls revealed that both power levers were at or near idle. The high-pressure cocks were full rearward, the propeller feather position. The ground fine lever was in the flight position.

The left engine fire extinguisher T-handle was pulled out and the fire extinguisher bottle switch was positioned to the No. 2 bottle. The right engine fire extinguisher T-handle was broken off but the mechanism showed it had been in the stowed position when it was broken off. Both engine fire extinguisher bottles were empty. The left engine fuel shutoff valve was closed; the right was open.

The flight safety lock switch, a rocker type, was found. in the emergency position. The unit and surrounding structure, however, had received considerable impact damage. The top mounting screw was intact, but the lower mounting screw was torn out and the lower end of the switch was pulled out of the panel about one-quarter inch. The plastic cover of the rocker element of the switch was knocked off and the panel molding around the switch was twisted and broken.

The "X" and "Z" relays and other pertinent components of the propeller operating system hereinbefore described were recovered. These, as well as fuel system components and key accessories, were checked functionally and/or internally examined.

Fuel, oil and water-methanol samples were tested, and an indentification analysis was made of samples of metal spatter found in the left engine exhaust unit. 3/

1.13 Fire

This accident involved a fire and explosion in the right wing engine nacelle areas prior to impact.

1.14 Survival Aspects

The accident was nonsurvivable.

1.15 Tests and Research

Fuel, oil and water-methanol samples given laboratory examination were found to be within specifications and without contamination.

A sample of metal spatter found in the left engine exhaust unit was analyzed and found to be composed of the same material as the turbine blades.

3/ See Section 1.15, Tests and Research.

The fuel pumps, fuel control units, propeller control units and low torque switches from both engines were checked. All were capable of normal operation except the right engine fuel pump and fuel control unit which were too badly damaged for functional checking. Teardown inspection of these components, however, showed no evidence of pre-impact malfunction or failure.

The flight safety lock switch, the propeller pitch lock units and hub contact switches were checked and found to operate normally.

The propeller junction box containing the "X" and "Z" relays was recovered, and the relay units were given laboratory examination and functional checks. The "X" relay showed evidence of considerable arcing and material transfer on its contact points, but it operated normally. When the "Z" relay was tested, the normally closed contacts remained open in the power-off condition. When the unit covers were then sawed off, it was found that three of the four contact leaves were broken and the contacts showed minimal arcing and material transfer. The failures of the leaves were in fatigue. A voltage check revealed that the voltage necessary to make the relay operate varied from a minimum of 24 to 40 volts, with most checks requiring well above 24 volts. The aircraft electrical system is a 24-volt system.

From the results of the examination and testing, it was considered that the "X" relay possibly would have been intermittent in operation, and, at best, the operation of the "Z" relay would have been unreliable.

1.16 Other Pertinent Information

A review of the Grumman approved training manual and the Honeywell training data revealed that they explained the operation of the automatic cruise pitch lock system and related panel indicator lights. They further explained the use of the flight safety lock switch, its effect on the automatic cruise pitch lock withdrawal system, and the manual cruise pitch lock extraction procedure using the high-pressure fuel cocks.

The Grumman and Honeywell flight manual procedures require positioning the high pressure fuel cocks in the cruise pitch lockout position before and during takeoff and before, during and after landing. They do not, however, call for such positioning for low airspeed flight or for maneuvers involving a combination of low airspeed and high power recovery.

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

The physical condition of the engines of N861H showed that both had been subjected to severe overtemperature during operation. While the damage to the left was more severe than to the right, it was the same kind, and in both instances required inflight engine shut down.

The severe overtemperature damage to the turbine sections of the engines could only have resulted from an excessive amount of fuel being introduced for the engine operating conditions. Such an over-rich mixture could have resulted from one of two causes: either from a grossly malfunctioning fuel control unit of each engine occurring at the same time, or from an engine r.p.m. and resultant mass airflow too low for normally scheduled fuel.

Examination and tests of the fuel control unit of each engine eliminated the first of these possible causes for over-richness. This leaves only the inordinately low r.p.m. which would have been the result of propeller blade hang-up of both propellers on the cruise pitch locks upon power lever advancement at low airspeed. As previously explained, an attempt to increase power under these condtions would result in an especially rapid and high rise in engine gas-turbine temperature. Normally, acceleration fuel would be matched by a large increase in airflow through fast engine spool-up. However, with the engines overloaded due to the combination of high propeller blade angle and low airspeed, acceleration could not occur fast enough to alleviate the extremely high fuel-air ratios and consequent overtemperaturing of the engines. A rapid high power application which would be used in recovering from a practice approach to a stall, or during the latter phase of a canyon approach, would complete the conditions for very high engine temperatures. In this instance, as evidenced by the melted turbine blades, the temperature in the engine turbine areas was at least 2,400°F.

In this accident, the propeller blades could have hung up on the cruise pitch locks for one of two basic reasons. The first is that the flight safety lock switch was positioned to emergency. As previously described, with the switch in this position the automatic cruise pitch lock removal system would be inoperative. In such an event, if airspeed were reduced and the cruise pitch locks were not withdrawn manually by positioning the fuel cocks to cruise lockout, the propeller blades would hang up on the locks creating the overloaded engine condition. The second reason is that a malfunction or failure of either or both of the "X" and "Z" propeller electrical system relays occurred, disabling the automatic cruise pitch lock removal system and thereby creating the same overloaded engine condition.

Under the circumstances of either of these reasons, the cruise lockout lights would not have come on indicating withdrawal of the locks. Thus, under either situation it must be presumed that the pilots failed to note that the lights did not come on and did not take the necessary remedial action to remove the locks manually with the high-pressure fuel cocks. Had this action been a matter of flight procedure for reduced-speed maneuvers, as called for during landing and takeoff, it presumably would have been done, and the consequences of the overloaded engine situation resulting from either cause would have been averted. The Safety Board concludes that the absence of this flight procedure was a deficiency in the FAA-Approved Flight Manual for the aircraft. 4/

Several explanations for the flight safety switch to have been in the emergency position were considered but, in doing so, little weight was attached to the fact that the switch was found positioned to emergency. This is because damage to the switch and surrounding panel structure indicated that impact could have accounted for the position.

It was considered that, since the flight was for training, the instructor pilot may have moved the flight safety lock switch to its emergency position to test the trainee's reaction. This possibility is considered

4/ See Recommendations, Section 3.

remote because the training syllabus did not call for such check, and the flight was a training rather than a check flight. Moreover, in view of the consequence of leaving the switch in this position, it is most difficult to imagine the instructor having positioned it to emergency and not taking the necessary corrective action if the trainee failed to do so.

Inadvertent actuation of the flight safety lock switch to emergency was considered as another possibility. The switch on N861H was not guarded and, being a rocker type, only a push on the top portion would be necessary to actuate it. Despite these factors, this possibility is unlikely because the switch was located on the eyebrow panel and it is not next to other switches or controls used in normal flight.

Another possibility was that the switch was positioned to emergency in response to a propeller overspeed condition. This possibility was discounted because there is no evidence of propeller overspeed or of a flight situation conducive to a propeller overspeed.

Probably the most substantive reason for the flight safety lock switch to have been positioned to emergency would be an abnormal operation of the cruise pitch lights indicating a malfunction of the cruise pitch lock system. For this to occur, however, it would require a failure of either the "X" or the "Z" relay in the system and, simultaneously, an intermittent operation of the other relay which did not fail. This coincident manner of operation is not probable because of the apparent operabie condition of the "X" relay, and since only one relay is necessary to the function of the cruise pitch lights, the possibility of erratic operation of the cruise pitch lights is discounted.

There are two additional factors which reduce substantially the likelihood of any of the possibilities which presume an intentional pilot actuation of the flight safety switch to emergency. First, it is most improbable that the pilots would continue a training exercise after experiencing a situation which prompted actuation of the flight safety lock switch to emergency. Secondly, it is equally improbable that they would knowingly move the switch to emergency and not take the companion followup action of positioning the high-pressure fuel cocks to cruise lockout.

In view of the foregoing, the Safety Board concludes that the flight safety lock switch was positioned to emergency by impact and not by intentional or inadvertent crew actuation. Accordingly, it further concludes that the cruise pitch locks remained in place because of a failure within the automatic withdrawal system. In the instant case, the only discrepancy found which could have disabled the system was the deteriorated condition of the "X" and "Z" electrical relays. The physical condition of the relays indicated that either or both could have failed to function; however, testing of the units indicated that it was most probably only the "Z" relay that failed. The failure of one is sufficient to disable the system.

Explanations of why the pilots failed to notice that the cruise pitch lockout lights were not on and remove the cruise pitch locks with the high-pressure fuel cock, or to notice the extreme turbine gas temperatures reflected by the turbine temperature instruments when power was applied, remain matters of conjecture. It is evident, however, that while engaged in the power application phase of either a stall or a canyon approach, the attention of the pilots would have been divided and not directed to the lights or power indicators any more or less than to flight instruments. The negative aspect of the light indication would also be easy to overlook. It is also noted that under a rapid and substantial power application that would characterize the use of power in either maneuver, the extreme engine temperature and resultant damage would occur very rapidly.

The sequence in which the engines were overtemperatured is not clear. The use of both fire bottles in the left nacelle and the greater turbine overtemperature damage in the left engine, although not operated as long, suggest that it was the first to overheat. At the same time there was evidence of greater overheat damage external to the basic engine in the instance of the right engine. The fact that the latter was last to be shut down would not seem to have particular significance to the sequence question, because after the left engine was stopped there would be a natural reluctance to shut down the last available power source.

Physical evidence showed, with a high degree of certainty, that an explosion occurred in the right wing fuel tank. It is also evident from the burned right main gear tires there was an inflight fire in the right wheelwell and the' fire was caused by overheat of the right engine. It was not possible, however, to determine the actual fire propagation from the engine to the wheelwell or whether there was a fuel leak in the wheelwell before the explosion. The best explanation seems to be that the jet pipe was ruptured by the "wash" of failed turbine blades permitting extreme heat to enter the wheelwell. This could have been sufficient to have induced the fuel tank explosion. However, in view of the magnitude of the wheelwell fire damage, it is believed there was an actual release of fuel within the wheelwell itself which could have been caused by turbine blade "shrapnel" damage. Then, the combination of superheated jet flow and actual fueled fire would well explain the culminating fuel tank explosion.

2.2 Conclusions

(a) Findings

1. The pilots were properly certificated and qualified for the flight.

2. The flight was initiated as a training flight to prepare the trainee-pilot for a type rating in the aircraft.

3. The flight progressed without incident until the time the performance of stall or canyon approach maneuvers was called for in the training sequence.

4. During the power application phase of a stall or a canyon approach, both engines received destructive overtemperature damage.

5. The left engine was shut down, followed by shutdown of the right engine after emergency fire procedures were executed with respect to the left engine.

6. Inflight fire associated with overtemperature of the right engine caused an explosion of the right wing fuel tank. The explosion damage made the aircraft uncontrollable.

7. Overtemperature of the engines during the power application resulted from an overloaded condition of both engines due to propeller hang-up on the cruise pitch locks.

8. The automatic cruise pitch lock withdrawal system was disabled due to the failure of the "Z" relay and possibly the "X" relay in the electrical circuit of the system.

9. The flight safety switch was in the normal position when the engine overtemperaturing occurred and was moved to emergency position by impact.

10. Before the power application, the pilots did not detect that the cruise pitch lockout lights were not on, indicating the cruise pitch locks were not withdrawn. During the power application they did not note the engine temperature indications in time to prevent the overtemperature damage.

11. Engine overtemperature damage occurred very rapidly at low airspeed under the conditions of high-power fuel lever setting and propeller blade angle too high for low airspeed.

12. The cruise pitch locks are removed manually by positioning the high pressure fuel cocks to cruise pitch lockout. This positioning is a procedure called for in the FAA-Approved Flight Manual for the aircraft for landing and takeoffs but not for slow flight maneuvers.

13. The FAA-Approved Aircraft Flight Manual was deficient in not requiring positioning of' the high-pressure fuel cocks to cruise pitch lockout for low airspeed flight maneuvers.

(b) Probable Cause

The Safety Board determines that the probable cause of this accident was overtemperaturing of both engines, inflight fire and explosion caused by the failure of the "Z" relay in the propeller automatic cruise pitch lock retraction system.

3. RECOMMENDATIONS

As a result of this accident the National Transportation Safety Board made two basic recommendations to the Federal Aviation Administration to prevent the occurrence of another accident for the same or similar reasons. The first recommended that consideration be given to requiring the installation of a flashing red light on the eyebrow panel of G-159 aircraft which would be activated, if for any reason the flight safety switch were in the emergency position. It was recommended that a placard also be installed warning that with the flight safety switch positioned in emergency, the cruise pitch locks must be removed manually when airspeed is reduced below cruise. The red light would deactivate when the locks were removed manually. The second recommendation was that a new instruction be incorporated in the G-159 Airplane Flight Manual which would prescribe that the high-pressure fuel cocks be moved to the cruise lockout position during low airspeed maneuvers, the same as specified for landings and takeoffs.

In response to the first recommendation, the FAA indicated that the installation of the flashing red light would involve a modification of an extensive and complex nature, and therefore it would be necessary to develop an alternate course of action to improve the reliability and operational safety of the propeller system in the problem area. Accordingly, the Administration took action to reduce the replacement time of the "X" and "Z" relays from 2,500 service hours or 5 years to 1,000 service hours or 12 months. It also required and approved a change to the emergency procedures section of the G-159 relating to the flight safety switch. To emphasize the importance of following approved operational procedure, a warning note is incorporated in the revision to indicate that engine turbine overtemperature can occur if the procedures are not followed.

The FAA agreed with the second recommendation, and the G-159 Airplane Flight Manual was revised to incorporate the recommended flight procedure.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOSEPH J. O'CONNELL, Jr.
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ JOHN H. REED
Member

/s/ LOUIS M. THAYER
Member

/s/ FRANCIS H. McADAMS
Member

Crew Information

Instructor pilot, Captain Thomas U. Grove, age 46, held airline transport pilot certificate No. 1469-40 with E-3, CV-340/440 and Grumman G-159 aircraft ratings and commercial privileges SES, SEL, AMEL and AMES. His G-159 rating was acquired March 16, 1965. Captain Grove held a first-class medical certificate issued with no limitations on December 12, 1966.

Captain Grove had accumulated 9,388 total pilot hours, of which 639 were in the G-159. He had flown about 3 hours in the 24-hour period before the accident and his rest time had been 15 hours and 30 minutes.

Captain Grove was employed by Honeywell, Inc., in 1946. During his employment he held positions of Flight Test Engineer, Engineering Pilot and Manager of Flight Operations. The latter position he held for 14 years. He was also a registered Professional Engineer in Minnesota.

Trainee-pilot, Copilot James R. Bradford, age 45, held airline transport pilot certificate No. 478587 with E-3 and CV-340/440 aircraft ratings and commercial privileges AMEL, SEL, and rotorcraft helicopters. He was designated by the FAA as an Engineering Representative (Flight Test) for electronic flight control systems. He held a first-class medical certificate issued with no limitations on March 16, 1967.

Pilot Bradford had accumulated approximately 9,125 pilot hours, of which 67 were as copilot in the G-159. He had flown about 3 hours in the 24-hour period preceding the accident and his rest period had been 15 hours and 30 minutes.

Pilot Bradford was employed by Honeywell, Inc., in 1953. During his employment he had held positions of Aircraft Mgineer, Flight Test Engineer, Engineering Pilot and Project Pilot/Engineer. For the most recent 9 years he was Project Pilot and Engineer on Inertial Guidance, auto-landing, radar altimetry and other company projects. He was a graduate Electrical Engineer.

Aircraft Information

The aircraft was a Grumman model G-159 (Gulfstream I), N861H, manufactured with an Airworthiness. Certificate dated January 5, 1965. Since new the aircraft had accumulated 1937 total hours including 92 since the last major inspection.

The aircraft was equipped with 2 Rolls Royce R-W-7, model 529-8X engines, each of which had accumulated 1,937 hours since new and had not been overhauled. The engines were equipped with Dowty-Rotol R-184/4-30-4/50 propellers, each of which had accumulated 1,937 hours since new and had not been overhauled.