

NATIONAL
TRANSPORTATION
SAFETY
BOARD

NOT FOR RELEASE PRIOR TO
OCTOBER 1991

AIRCRAFT ACCIDENT REPORT

JETCO AVIATION, INCORPORATED
SHORT BROTHERS & HARLAND, LTD.
SKYVAN SERIES 3 (SC-7), N21CK
WASHINGTON NATIONAL AIRPORT
WASHINGTON, D.C.
JULY 2, 1970



NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591

REPORT NUMBER : NTSB-AAR-71-6

SA- None

File No. 3-0594

AIRCRAFT ACCIDENT REPORT

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SHORT BROTHERS & HARLAND, LTD.
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JULY 2, 1970

Adopted: January 13, 1971

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D. C. 20591

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WASHINGTON, D. C. 20591
AIRCRAFT ACCIDENT REPORT

JETCO AVIATION, INCORPORATED
SHORT BROTHERS & HARLAND, LTD.
SKYVAN SERIES 3 (SC-7), N21CK
WASHINGTON NATIONAL AIRPORT,
WASHINGTON, D. C.
JULY 2, 1970

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20591
AIRCRAFT ACCIDENT REPORT

Adopted: January 13, 1971

Jetco Aviation, Incorporated
Short Brothers & Harland, Ltd.
Skyvan Series 3 (SC-7), N21CK
Washington National Airport,
Washington, D. C.
July 2, 1970

SYNOPSIS

At approximately 10:48 a.m. eastern daylight time on July 2, 1970, Short Brothers & Harland, Ltd., Skyvan Series 3, N21CK, operated by Jetco Aviation, Inc., Washington, D. C., as air taxi cargo flight, Flight 106, crashed during a VOR approach to Washington National Airport. The aircraft was demolished but did not burn. Both crewmembers received fatal injuries. There were no passengers.

According to witnesses, the aircraft was first visible to them, through fog and haze, when it was 700 to 800 feet above and about one-half mile out from the threshold of Runway 15.

Shortly after the aircraft came into view of the witnesses, it nosed down and rolled left until the wings were nearly vertical. The nosedown angle steepened progressively until it reached 45° or more. The aircraft struck the water of Roaches Run in this attitude, cartwheeled onto the right wingtip and sank in water 12 to 15 feet deep about 1,800 feet north of the threshold of Runway 15.

The Board determines that the probable cause of this accident was the loss of effective elevator control due to the forward shift of improperly secured cargo when the aircraft was placed in a steep nosedown attitude during a landing approach in reduced visibility conditions.

As a result of this investigation the Board recommends that:

The Federal Aviation Administration (FAA) take the necessary action to instruct all air taxi cargo operators to stow and secure their cargo in accordance with the provisions of Part 135.117 of the Federal Aviation Regulations and the manufacturer's specifications for the aircraft involved.

As a result of information obtained during this investigation, Short Brothers & Harland, Limited, Belfast, Northern Ireland, issued two Service Bulletins:

Service Bulletin No. 27-53 - Flying Controls:

To introduce a re-designed fork end fitting on the Anti-Up Float Spring Pot in Elevator Control Circuit.

Service Bulletin No. 25-56 - Equipment & Furnishings:

To fit guards at rear of 1st and 2nd Pilot's Seats.

INVESTIGATION

Jetco Aviation, Inc., Skyvan, Flight 106, N21CK, was completing the last leg of a point-to-point cargo flight that originated at Washington, D. C., at approximately 1730 ^{1/} the previous day. Jetco Flight 106 was scheduled to depart John F. Kennedy International Airport (JFK), New York, at 0600, July 2, 1970; however, because of en route delays, departure from JFK was not until 0856. The flight was made in accordance with a visual flight rules (VFR) flight plan until it arrived in the vicinity of Atlantic City, New Jersey. The crew then air-filed an abbreviated instrument flight rules (IFR) flight plan and the flight was cleared to the Washington National Airport.

As Flight 106 approached Washington, D. C., the crew received clearance for a VOR ^{2/} approach to Runway 15 and at 1047:25, the tower controller at Washington National Airport (DCA) cleared the flight to land. He advised the crew that the surface wind was from 200° at 5 knots, and asked them if they had the airport in sight. At 1047:35, the crew replied, "Tower, not yet, we've got the Pentagon here." At 1047:55, the crew reported, "106 has the runway." This was the last communication from the aircraft and, 5 to 10 seconds later, the local controller and his assistant saw the aircraft at an estimated altitude of 500 feet. It was in a steep, diving bank to the left when it disappeared from their view.

The crewmembers were properly certificated and medically qualified for the performance of their duties. The copilot, a part-time pilot, was making his first trip with Jetco. The duty time for both pilots the preceding 24 hours was 18:18 hours. (For details, see Attachment 2.)

The aircraft was properly certificated for the flight. N21CK, serial No. SH1858, was a cargo configuration of the Skyvan Series 3, Model SC-7, Variant 200. (For details, see Attachment 3.)

The maintenance records for the aircraft show that it had met the airworthiness standards in all maintenance categories except one; at the time of the accident, the aircraft had accumulated 111:86 hours since the last 100-hour inspection.

The aircraft fuel tanks were filled with jet fuel prior to the departure from John F. Kennedy International Airport.

The cargo floor in this type of aircraft contains 70 cargo-restraint fittings. Each fitting is designed for a load of 4,000 pounds. The cargo hold is 18 feet

^{1/} All times used herein are eastern daylight, based on the 24-hour clock.

^{2/} Very high frequency omnidirectional range. The landing minima for a VOR approach to Runway 15 are 700 feet ceiling and 1 mile visibility for propeller-driven aircraft.

7 inches long, 6 feet 6 inches wide, and 6 feet 6 inches high. There are seven seat-retaining rings on each side of the cargo compartment, which are not designed to restrain cargo. The front and rear rings are single and all the rest are double rings. Following the accident, tensile strength tests of these ring assemblies were made by the National Bureau of Standards. The tests revealed that failure occurs along the longitudinal axis of the bracket when a load of 1,330 pounds is applied. Failure occurs 45° to the longitudinal axis when a load of 400 pounds is applied.

The driver who delivered the New York cargo consignment to the aircraft later assisted the crew in loading some of the heavier boxes. The New York cargo weighed 2,766 pounds and was contained in 67 cartons and boxes. The driver noticed that some cargo had been previously loaded in the forward section of the cargo compartment. This cargo weighed 611 pounds and was contained in 29 boxes and cartons that were loaded on board at Boston. The driver said that most of the cargo he delivered was loaded on a "plywood" sheet, directly over cargo rollers, in the forward section of the cargo area, and the remainder was wedged along the sides. He saw the crewmembers tie down the cargo. He said they used one web-type nylon strap. One end of this strap was secured at a forward point on the left sidewall of the cabin. The other end was placed around the rear of the cargo and secured to a point on the right rear sidewall of the cabin. A crewmember then used a ratchet to tighten the strap at the right side point.

The 1029 surface weather observations, taken at Washington National Airport prior to the accident, were:

Estimated ceiling 8,000 feet overcast, visibility 2½ miles, fog, haze; wind from 200°, 5 knots, altimeter setting 29.94.

The 1057 reported Washington National Airport weather observation was as follows:

Estimated ceiling 8,000 feet overcast, visibility 2½ miles, fog, haze; temperature 77° F., dew point 73° F., wind from 180°, 5 knots, altimeter setting 29.94.

Runway 15 at Washington National Airport is 5,212 feet long and 200 feet wide. Runway 15 has high-intensity runway lights, runway end identifier lights, and a Visual Approach Slope Indicator (VASI). All field lights were on at full brightness.

The airport elevation is 15 feet m.s.l.^{3/} The distance from the end of Runway 15 to the Pentagon is 0.8 nautical miles. (See Attachment 4.)

The flightpath of the aircraft at impact was approximately 50° magnetic. The center point of the wreckage area was located about 240 feet from the nearest shore under 12 to 15 feet of water. Approximately 95 percent of the aircraft was

^{3/} Mean sea level.

salvaged from a circular area in the water about 170 feet in diameter. Missing items included the copilot's seat, some instruments, both flight control columns, and some small pieces of fuselage skin.

All of the recovered trim control cables sustained tension failures. All of the turnbuckles were intact and safety wired. The elevator trim actuator was 1° down (1° noseup trim). The total trim available was 5° noseup and 4° nosedown.

The right wing was recovered practically intact but without the engine and nacelle. The aileron and two sections of flap were attached to the wing. The flap was partially extended. Measurements of the flap actuator in the aircraft were compared with measurements of a similar aircraft with the flaps in various positions. These comparisons indicated that the flaps on Flight 106 were extended 50° (full down) at impact. The right flap impact mark on the fuselage measured 50°. Both wing flaps are operated by one actuator, and the position of one flap corresponds mechanically to the position of the other flap.

The left wing was recovered in two pieces. One piece, the inboard quarter behind the main spar, had a section of flap attached. The other piece comprised the remainder of the wing, less the aileron and the engine. The left engine had separated from the wing at the main mounts.

The right side of the empennage was essentially intact. The left vertical stabilizer, left rudder, and left side of the elevator had separated from the empennage, but were recovered.

The nose section, the pilot's half of the cockpit, and the entire left side of the fuselage were fragmented. The right side of the fuselage, including the top of the copilot's entrance door, showed four slashmarks. The pilot's entrance door, the ditching hatch, and the rear cargo doors were recovered. The cargo floor was examined, and all cargo restraint rings were found to be intact except for two on the left side where the floor was broken. None of the cargo restraint rings had cargo strap hooks attached, nor was there any evidence that any had been attached. Four cargo rollers and a ½-inch thick pressed-wood pallet were recovered. Two of the rollers were each 10 feet long and two were 5 feet long.

Seven nylon cargo straps were aboard the aircraft at impact. These were recovered and none of the straps was broken. Cargo nets were not used on this flight.

One cargo strap hook had a single fuselage seat-storage ring attached and another strap hook had double fuselage seat-storage rings attached. These two straps were wrapped about each other when salvaged.

Of the five remaining straps, one that was compactly rolled was found lodged under the pilot's seat. The other four were loose with all locking and ratchet mechanisms and hooks intact.

The engines and propellers were examined under NISB cognizance at the Airsearch plant at Phoenix, Arizona. This examination showed that both engines were rotating at impact and that both propellers were set for landing approach power.

No evidence was found that would indicate any preimpact malfunction or failure of the aircraft systems that could be related to the cause of the accident.

The entire flight control system was recovered, including all the push-pull rods and rod end fittings in the empennage. All breaks were typical of breaks resulting from gross bending and tension overloads. The elevator anti-up float spring pot assembly was still attached to the fuselage attaching structure. However, the clevis end of this assembly was separated in the threaded section with the clevis end attached to its respective bell crank. The fractured ends showed preimpact fatigue cracks on the top and bottomsides through approximately 20 percent of the cross-sectional area. The cracks were typical of fairly low cycle, high-stress type fatigue propagation. This assembly supplies artificial "feel" of elevator control force to the pilot in the last 30 percent of up-elevator travel, and its eventual failure would not affect the controllability of the aircraft.

The accident was nonsurvivable. Autopsies showed that both pilots sustained fatal injuries as the result of impact.

The maximum certificated takeoff and landing weight for the aircraft is 12,499 pounds. The following computations relate to the weight and balance of N21CK on departure from JFK, using actual weights:

Aircraft basic weight	7,778 pounds
Crew	375 "
Flight bags	40 "
Fuel	2,260 "
Cargo	3,412 "
Miscellaneous equipment	259 "
Total weight at takeoff	14,124 "
Estimated fuel burnoff	- 934 " (@ 500 lbs./hr.)
Estimated aircraft gross weight at time of crash	13,190 pounds

The aircraft was about 1,600 pounds overweight for takeoff; however, the manufacturer states that "experience has shown that this in itself would not be dangerous although performances after an engine failure would be marginal."

The maximum trimmable center of gravity limit forward is 10 percent of the mean aerodynamic chord (MAC) ahead of the forward center of gravity limit. Beyond this point, the aircraft is uncontrollable. The computed center of gravity for the aircraft at takeoff was 2.30% forward of the forward limit. The manufacturer states, "Although wrongly loaded this is still well within the trimmable range."

ANALYSIS AND SUMMARY

Investigation of the aircraft, engines, systems, and aircraft records indicated that there were no mechanical malfunctions or failures of the aircraft that could be related to the probable cause of the accident.

Air Traffic Control functions were properly executed as they related to Flight 106, and there was no evidence of any equipment or navigational facility malfunctions.

The reported visibility was $2\frac{1}{2}$ miles with fog and haze; however, there is evidence that the crew did not see Runway 15 until the aircraft had approached to within about one-half mile, or less, from the end of the runway. They did not have the runway in sight in the vicinity of the Pentagon, which is 0.8 nautical mile from the end of the runway.

The landing minima on this approach to Runway 15 is ceiling 700 feet and one mile visibility, requiring that the pilot maintain a minimum m.s.l. altitude of 715 feet until the runway is in sight. This would account for the high approach altitude which ground witnesses observed and estimated to be between 700 and 800 feet.

The cargo floor of the aircraft was adequate for cargo tiedown; however, the cargo was not secured in accordance with approved procedure. There were no cargo nets aboard. None of the cargo straps was anchored to the floor tiedown rings either fore and aft or from side to side over the load. (See Attachment 8.) The cargo tiedown straps used were attached to a forward sidewall seat-retaining ring, placed around the rear of the load, and attached to an aft sidewall seat-retaining ring.

Assuming that the pilot was flying at about 700 feet altitude at one-half a mile out, it would be necessary for him to descend at a rate of at least 2,100 feet per minute (f.p.m.), on a glide slope of about 13° to be in proper landing position over the runway. A normal rate of descent for a standard landing glide slope of 3° is about 400 f.p.m.

A STOL aircraft, such as the Skyvan, is capable of making a steep glide slope final approach to a runway due to its high lift features. However, in order to make good a 13° glide slope, the deck angle of the aircraft must be changed drastically. Initially, the power is reduced to idle and the pilot then lowers the flaps to full down. This maneuver, which combines a steep nosedown attitude, full flaps, and the drag from the propellers would have caused forward longitudinal forces to be exerted on the 96 boxes and cartons in the cargo hold. If this cargo were not properly restrained from these forward forces, it would progress forward, moving the aircraft center of gravity accordingly. As the center of gravity moved beyond its forward controllable limit, effective elevator control would be lost. (See Attachment 5.) Witness descriptions of the aircraft's nose dropping down through a 45° angle indicate that a progressive control loss of this type occurred.

Probable Cause

The Board determines that the probable cause of this accident was the loss of effective elevator control due to the forward shift of improperly secured cargo when the aircraft was placed in a steep nosedown attitude during a landing approach in reduced visibility conditions.

Recommendations

As a result of this investigation the Board recommends that:

The Federal Aviation Administration (FAA) take the necessary action to instruct all air taxi cargo operators to stow and secure their cargo in accordance with the provisions of Part 135.117 of the Federal Aviation Regulations and the manufacturer's specifications for the aircraft involved.

Corrective Actions

As a result of information obtained during this investigation, Short Brothers & Harland, Limited, Belfast, Northern Ireland, issued two Service Bulletins.

Service Bulletin No. 27-53 - Flying Controls:

To introduce a redesigned fork end fitting on the Anti-Up Float Spring Pot in Elevator Control Circuit. (See Attachment 6.)

Service Bulletin No. 25-56 - Equipment & Furnishings:

To fit guards at rear of 1st and 2nd Pilot's Seats. (See Attachment 7.)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/	<u>JOHN H. REED</u> Chairman
/s/	<u>OSCAR M. LAUREL</u> Member
/s/	<u>FRANCIS H. McADAMS</u> Member
/s/	<u>LOUIS M. THAYER</u> Member
/s/	<u>ISABEL A. BURGESS</u> Member

January 13, 1971

ATTACHMENT 1

INVESTIGATION AND HEARING

1. Investigation

The Board received notification of the accident at 1102 e.d.t. on July 2, 1970. The Investigator-in-Charge was dispatched immediately to the scene from the Washington Field Office at Dulles International Airport, with technical assistance from Washington, D. C. Working groups were established for operations, witnesses, air traffic control, structures, powerplants, aircraft and maintenance records, systems, and human factors. Parties to the investigation were Jetco Aviation, Inc., the Federal Aviation Administration, Short Brothers & Harland, Ltd., the Garrett Corporation, and Airesearch Manufacturing Company. The on-scene phase of the investigation was completed in about 9 days due to the need for underwater salvage operations. Tests and failure analysis of specific aircraft parts were conducted at the Safety Board headquarters and at the National Bureau of Standards. The engines were examined at the Airesearch Mfg. Co. plant at Phoenix, Arizona.

2. Hearing

There was no public hearing.

3. Preliminary Reports

An interim report of investigation summarizing the facts disclosed by the first phase of the investigation was published on September 14, 1970.

Attachment 2

20. PILOT HISTORY												
A. Pilot-in-Command												
NAME AND ADDRESS Louis John Weihs, Jr. 2215 West Ialoma Dr. Rancho Cordova, Calif. 95670					DATE OF BIRTH 3/31/24		NATIONALITY USA		SEAT OCCUPIED IF		REG. AND D.O. NO. OF RESIDENCE	
FAA PILOT CERTIFICATE HELD						FAA MEDICAL CERTIFICATE						
CERTIFICATE NO. 753714		DATE OF ISSUE 6/2/67		INSTRUMENT TRAINING PRIOR TO SOLO		YES NO		BLUE SEAL		YES NO		
DATE OF ISSUE 6/10/70												
<input checked="" type="checkbox"/> AIRLINE TRANSPORT		RATINGS AND LIMITATIONS										
<input checked="" type="checkbox"/> COMMERCIAL		<input checked="" type="checkbox"/> AIRPLANE		<input checked="" type="checkbox"/> MULTIENGINE LAND		CLASS <input checked="" type="checkbox"/> FIRST <input type="checkbox"/> SECOND <input type="checkbox"/> THIRD						
<input checked="" type="checkbox"/> FLIGHT INSTRUCTOR		<input type="checkbox"/> ROTORCRAFT		<input type="checkbox"/> MULTIENGINE SEA		LIMITATIONS						
<input type="checkbox"/> PRIVATE		<input type="checkbox"/> GLIDER		<input checked="" type="checkbox"/> SINGLE ENGINE LAND		None						
<input type="checkbox"/> STUDENT		<input type="checkbox"/> INSTRUMENT		<input checked="" type="checkbox"/> SINGLE ENGINE SEA		PATHOLOGICAL AND/OR TOXICOLOGICAL EXAMINATION PERFORMED						
OTHER (Specify)		OTHER (Specify)		TYPE RATINGS DC-3, CV 240/3401 4401, C-46 Lbxv 33124		<input type="checkbox"/> NO <input checked="" type="checkbox"/> YES (Extent) P & T						
PILOT FLIGHT TIME (To nearest hour)			SOURCE OF INFO.		<input checked="" type="checkbox"/>		PILOT'S FLT. LOG		FAA RECORDS		OPERATOR'S ESTIMATE	
TYPE			LAST 24 HOURS		LAST 90 DAYS			TO DATE				
			DUAL SOLO		DUAL SOLO TOTAL			DUAL SOLO TOTAL				
(1) THIS MAKE AND MODEL			7:30		44:00 51:30			20:18 84:40 107:58				
(2) NIGHT					27:12 27:12			1626:42				
(3) DAY					26:30 26:30			8654:18				
(4) INSTRUMENT			ACTUAL SIMULATED		9:00 9:00			1000:00				
(5) SINGLE ENGINE					2:12 2:12			500:00				
(6) MULTI ENGINE					51:30			9772:00				
(7) ROTORCRAFT												
(8) GLIDER												
TOTAL (5, 6, 7, 8)					53:42			10272:00				
B. Second Pilot												
NAME AND ADDRESS Robert Gilmour Williams 8700 Colwyn Road Oxen Hill, Maryland					DATE OF BIRTH 4/25/35		NATIONALITY USA		SEAT OCCUPIED RF		REG. AND D.O. NO. OF RESIDENCE	
FAA PILOT CERTIFICATE HELD						FAA MEDICAL CERTIFICATE						
CERTIFICATE NO. 7718403		DATE OF ISSUE 5/3/68		INSTRUMENT TRAINING PRIOR TO SOLO		YES NO		BLUE SEAL		YES NO		
DATE OF ISSUE 12/2/69												
<input checked="" type="checkbox"/> AIRLINE TRANSPORT		RATINGS AND LIMITATIONS										
<input checked="" type="checkbox"/> COMMERCIAL		<input checked="" type="checkbox"/> AIRPLANE		<input checked="" type="checkbox"/> MULTIENGINE LAND		CLASS <input checked="" type="checkbox"/> FIRST <input type="checkbox"/> SECOND <input type="checkbox"/> THIRD						
<input checked="" type="checkbox"/> FLIGHT INSTRUCTOR		<input type="checkbox"/> ROTORCRAFT		<input type="checkbox"/> MULTIENGINE SEA		LIMITATIONS						
<input type="checkbox"/> PRIVATE		<input type="checkbox"/> GLIDER		<input checked="" type="checkbox"/> SINGLE ENGINE LAND		None						
<input type="checkbox"/> STUDENT		<input checked="" type="checkbox"/> INSTRUMENT		<input type="checkbox"/> SINGLE-ENGINE SEA		PATHOLOGICAL AND/OR TOXICOLOGICAL EXAMINATION PERFORMED						
OTHER (Specify)		OTHER (Specify)		TYPE RATINGS		<input type="checkbox"/> NO <input checked="" type="checkbox"/> YES (Extent) P & T						
PILOT FLIGHT TIME (To nearest hour)			SOURCE OF INFO.		<input checked="" type="checkbox"/>		PILOT'S FLT. LOG		FAA RECORDS		OPERATOR'S ESTIMATE	
TYPE			LAST 24 HOURS		LAST 90 DAYS			TO DATE				
			DUAL SOLO		DUAL SOLO TOTAL			DUAL SOLO TOTAL				
(1) THIS MAKE AND MODEL			7:30 0		0 0 0			7:30 7:30				
(2) NIGHT			4:06 0		10:42 0 10:42			150:54				
(3) DAY			3:44 0		22:54 0 22:54			709:12				
(4) INSTRUMENT			ACTUAL SIMULATED		0 0 0			16:42				
(5) SINGLE ENGINE			0 0		26:16 1 27:06			816:54				
(6) MULTI ENGINE			7:30 0		7:30 0 7:30			43:12				
(7) ROTORCRAFT			0 0		0 0 0			0				
(8) GLIDER			0 0		0 0 0			0				
TOTAL (5, 6, 7, 8)			7:30 0		28:06			860:06				

21. AIRCRAFT HISTORY				SOURCE OF INFORMATION			
MAKE		MODEL		Aircraft Log		SERIAL NO.	
Short Bros. & Harland LTD.		Skyvan SC-7		SH 1858		REGISTRATION MARK	
N		21CK					
AIRWORTHINESS CERTIFICATE							
ISSUANCE DATE	TYPE	NORMAL UTILITY	TRANSPORT	PROVISIONAL	RESTRICTED	LIMITED	EXPERIMENTAL
6/18/69		X					
TOTAL TIME	TIME SINCE OVERHAUL	TYPE OF MAINTENANCE		LAST INSPECTION			
701.0	new	PROGRESSIVE		TYPE	DATE	AIRC. HOURS AT TIME OF INSPECTION	
DATE OF LAST PERIODIC INSPECTION		PERIODIC (Give date of last inspection)		annual		6/13/70	
6/13/70						589.14	
ENGINES							
NO.	MAKE AND MODEL		SERIAL NO.	TOTAL	TIME SINCE OVERHAUL	TIME SINCE LAST INSPECTION	TYPE OF INSPECTION
1	Garrett Airesearch TPE 331-2-271A		P90047	701.0	701.0	111.86	annual
2	TPE 331-2-201A		P90045	1183.4	183.4	111.86	annual
PROPELLERS-ROTORS							
NO.	MAKE AND MODEL		SERIAL NO.	TIME SINCE NEW OR OVERHAUL			
1	Hartzell HC-BE-TN-50/T 10282 HB		BV 469	701.0			
2			BV 465	701.0			
RADIO EQUIPMENT INSTALLED							
RECEIVERS				TRANSMITTERS			
VOR	ILS	ADF/DF	MARKER/BEACON	OTHER (Identify)	VHF	OTHER (Identify)	
VHF	OME	LF/MF	RADAR		LF/MF		
FLIGHT INSTRUMENTS INSTALLED				DEICER EQUIPMENT INSTALLED			
COMPASS		ELECT.	VACUUM	NONE		TYPE	
TURN AND BANK		X		X	PROPELLER DEICERS		
ALTITUDE	2		X	X	WING DEICERS		
AIRSPEED INDICATOR	2			X	EMPENNAGE DEICERS	N/A	L/E
ATTITUDE INDICATOR	2			X	WINDSHIELD DEICERS		
DIRECTIONAL GYRO	2	X		X	WINDSHIELD WIPERS		
RATE OF CLIMB	2		X	X	PITOT HEATER		
CLOCK	1				FUEL TANK VENT HEATER	N/A	
INTEGRATED FLIGHT SYSTEM	N/A			MISCELLANEOUS EQUIPMENT INSTALLED			
AUTOPILOT	N/A			X	NAVIGATION LIGHTS		
APPROACH COUPLER	N/A			X	LANDING LIGHTS		
ALTITUDE CONTROL	N/A			X	ANTI-COLLISION LIGHTS		
FLIGHT RECORDER	N/A			X	INSTRUMENT LIGHTS		
STALL WARNING INDICATOR					FLARES	No	
SAFE FLIGHT INDICATOR	N/A			X	FLASHLIGHT	2 aboard & found	
OTHER (Identify)					LANDING GEAR INDICATOR	N/A	
22. COLLISION ACCIDENTS							
See mid air collisions, a separate NTSB Form 6120 is required for each aircraft involved, and a NTSB Form 6120-11.							
OTHER AIRCRAFT INVOLVED							
MAKE AND MODEL		NAME AND ADDRESS OF OWNER					
REGISTRATION MARK							
N							
23. NARRATIVE STATEMENT OF FACTS, CONDITIONS, AND CIRCUMSTANCES SURROUNDING ACCIDENT (Give a concise, chronological sequence of events and detail the environmental conditions at the time of occurrence)							

7/2/70

NATIONAL TRANSPORTATION SAFETY BOARD



DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C.-20591

Safety Information

For Release:

SB 70-69
(202) 382-7273

Office of the Chairman

ADVANCE For

PM Newspapers
Monday, Sept. 14, 1970

The National Transportation Safety Board released today the attached preliminary report of its investigation of the fatal crash of a Jeteo Aviation, Inc. Short Skyvan on final approach to Washington National Airport last July 2. The cargo flight accident took the lives of both crewmembers aboard.

The Safety Board's preliminary reports of major accidents make public the known accident facts on an interim basis while its investigation continues. Additional or revised information and the formal finding of probable cause will be incorporated in the Board's final accident report.

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AIRCRAFT ACCIDENT PRELIMINARY REPORT

JETCO AVIATION, INCORPORATED
SHORT BROTHERS & HARLAND, LTD.
SKYVAN SERIES 3 (SC-7), N21CK
WASHINGTON NATIONAL AIRPORT,
WASHINGTON, D. C.

JULY 2, 1970

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JULY 2, 1970

NOTE: This report covers the facts, circumstances, and conditions of the accident as they are known to this date. It is released by the Board in order to provide as much information as possible to the aviation industry and the public on an interim basis, pending completion of the investigation and the issuance of a formal Board report. The information herein is preliminary in nature and subject to change in light of additional disclosures that may be made as the result of the Board's continuing investigation of this accident.

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D. C. 20591

NATIONAL TRANSPORTATION SAFETY BOARD
AIRCRAFT ACCIDENT PRELIMINARY REPORT

Adopted: August 26, 1970

Jetco Aviation, Incorporated
Short Brothers & Harland, Ltd.
Skyvan Series 3 (SC-7), N21CK
Washington National Airport,
Washington, D. C.
July 2, 1970

SYNOPSIS

On July 2, 1970, Short Brothers & Harland, Ltd., Skyvan Series 3, N21CK, operated by Jetco Aviation, Inc., Washington, D. C., as air taxi cargo flight Flight 106 from John F. Kennedy International Airport, New York, to Washington National Airport, Washington, D. C., crashed at approximately 1048 eastern daylight time during a VOR approach to Runway 15 at Washington National Airport. The aircraft was demolished but did not burn. Both crewmembers received fatal injuries. There were no passengers.

Witnesses on the ground saw Flight 106 approach the airport for a landing on Runway 15. One witness described the final maneuvers of the aircraft as a left slip for 200 to 300 feet, followed by a steep, nose-down turn to the left, after which, he lost sight of the aircraft as it disappeared below the treetops.

The maneuvers described by the witness began less than one-half of a mile from the approach end of Runway 15, and the aircraft crashed in Roches Run Lagoon, one-quarter of a mile northwest of the airport between the approach paths for Runways 15 and 18.

The aircraft came to rest on a heading of 050°. Fragmentation of the aircraft was extensive but all major aircraft components were confined to a circle approximately 170 feet in diameter, covered by water about 15 feet deep.

There were no injuries to persons other than the crew, and no damage to property other than the aircraft and its cargo.

1. INVESTIGATION

1.1 History of the Flight

Jetco Aviation, Inc., Skyvan, Flight 106, N21CK, was completing

the last leg of a flight that originated at Washington, D. C., at approximately 1730, 1/ July 2, 1970, as Jetco Flight 101. Jetco Flight 106 was scheduled to depart John F. Kennedy International Airport, New York, at 0600, July 2, 1970; however, because of en route delays, it did not depart JFK until 0856. Departure and the initial part of the flight were in accordance with a visual flight rules (VFR) flight plan.

At 0924, the crew contacted Atlantic City, New Jersey, departure control and air-filed an abbreviated IFR 2/flight plan. The flight was cleared to the Washington National Airport from its position via direct to Atlantic City, Victor Airway 44 to Kenton, Victor 16 to North Beach, direct Washington, to climb to and maintain 6,000 feet, and to contact the New York Communication Center. The crew read back the clearance correctly. As Flight 106 approached Washington, D. C., the crew received clearance for a VOR 3/ approach to Runway 15. At 1046, the pilot contacted the Washington (DCA) Tower controller on 119.1 MHz and reported that he was on a VOR approach for Runway 15. This communication was acknowledged by the controller.

At 1047:25, the controller cleared the flight to land on Runway 15. He also informed the crew that the surface wind was from 200° at 5 knots, and asked them if they had the airport in sight yet. The reply was, "...not yet, we've got the Pentagon here." At 1047:55, the crew advised the controller, "106 has the runway." This was the last communication from the aircraft. Five to ten seconds later, the aircraft was observed by the local controller and his assistant. It was at an altitude of about 500 feet and in a steep, left-wing-down bank from which it nosed down and disappeared behind trees about one-quarter of a mile west of the approach end of Runway 18. These final maneuvers were witnessed by many people on the ground, some of whom were pilots awaiting clearance to take off from Runways 15 and 18 at the Washington National Airport. One of these pilots said that when the Skyvan came into sight, it was at an estimated altitude of 800 feet and slightly left of the extended centerline of Runway 15. He said that immediately thereafter it commenced a nosedown left slip for 200 to 300 feet, and rolled to the left to a wings-vertical attitude. At the same time, he saw the nose drop at an increasing rate, to an angle about 45° before the aircraft was lost from his view due to trees.

1/ All times used herein are eastern daylight, based on the 24-hour clock.

2/ Instrument flight rules.

3/ Very High Frequency omni-directional range. The landing minima for a VOR approach to Runway 15 are 700 feet ceiling and 1 mile visibility for propeller-driven aircraft.

The aircraft crashed into the waters of Roaches Run. Initially, the left wingtip and nose contacted the water while the aircraft was in an estimated 45° to 60° dive, with the wings nearly vertical. Following the initial contact, the aircraft cartwheeled onto the right wingtip and disintegrated, as it sank in 12 to 15 feet of water. The initial impact point was about 1,800 feet north of the threshold of Runway 15. The cargo, which consisted of 96 cardboard and wooden boxes and cartons of varying sizes and weights, was broken up and scattered over a triangular area from the impact point to the shoreline of the lagoon, a distance of about 400 feet.

1.2 Injuries to Persons

The two crewmembers were fatally injured. There were no passengers.

1.3 Damage to Aircraft

The aircraft was demolished by impact.

1.4 Other Damage

There was no other damage.

1.5 Crew Information

The Captain

Captain Louis John Weihs, Jr., aged 46, began flying for Jetco Aviation, Inc., on June 17, 1970. He held Airline Transport Pilot Certificate No. 253714, issued on June 2, 1967, Commercial Pilot Rating, and Flight Instructor Rating and type ratings for the DC-3, Convair 440/340/440, C-46, and Lear 23/24 aircraft. He had flown a total of 10,272 hours, including 107:58 in the Skyvan, and his total multiengine time was 9,772:00 hours. His flight time in the last 90 days was 53:02 hours, of which 7:30 hours were flown during the preceding 24-hour period.

His most recent first-class medical certificate was issued June 10, 1970, with no limitations or waivers.

The Copilot

Robert Gilman Williams, aged 35, was on his first trip with Jetco as a part-time pilot. He held Commercial Pilot Certificate No. 1718403, issued on May 3, 1968, with ratings in airplane, single and multiengine land, instrument, and flight instructor. His total flight time was 850:06 hours, of which 7:30 hours were in the Skyvan. He had flown 7:30 hours in the last 24-hour period. His total multiengine time was 43:12 hours. A first-class medical certificate, issued to him on December 2, 1969, had no limitations.

Duty time for both pilots in the preceding 24 hours was 18:18 hours.

1.6 Aircraft Information

N21CK, serial No. SM858, was a cargo configuration of the Skyvan Series 3, Model SC-7, Variant 200, manufactured by Short Brothers & Harland, Ltd., of Belfast, Ireland. A standard airworthiness certificate was issued on June 18, 1969. The aircraft was owned by the Union Bank of Los Angeles and was operated by Jetco on a lease which started June 16, 1970. The last annual inspection was conducted on June 13, 1970, and the aircraft had been flown a total of 111:86 hours since that time. The total aircraft operating time was 701:0 hours.

The aircraft was equipped with two Garrett Airesearch turbo-prop engines, model TPE331-2-201A. The left engine had accumulated a total of 701:0 hours and the right engine, 1183:4 hours. The propellers were Hartzell HC-H3N-5C/T reversible.

Maintenance records were examined. This examination indicated that the aircraft was properly maintained and airworthy.

The maximum certificated takeoff and landing weight for the aircraft is 12,199 pounds. The following computations relating to the weight and balance of N21CK on departure from JFK were made using the actual weights.

Aircraft basic weight	7,837 pounds
Crew	315 "
Flight bag	20 "
Fuel (full fuel load)	2,320 "
Cargo	3,317 "
Total weight at takeoff	13,929 "
Estimated fuel burnoff	963 " (@ 516/hr.)
Estimated aircraft weight at time of crash	12,966 pounds

The loading of the aircraft for the last flight segment was observed by a driver who delivered the New York cargo consignment to the aircraft and later assisted the crew in loading some of the heavier boxes. The driver noticed that some cargo had been previously loaded in the forward section of the cargo compartment. He said that most of the cargo he delivered was loaded on a "plywood" sheet, directly over cargo rollers, in the forward section of the cargo area, and the remainder was wedged forward and along the sides. He observed the crewmembers tie down the cargo with one web-type nylon strap that was secured at some forward point on the left sidewall of the cabin. The strap was placed around the rear cargo, and its other end was secured to a point on the right rear sidewall of the cabin. A crewmember then tightened the strap at the right side point by using a ratchet-type device.

1.7 Meteorological Information

The 1029 surface weather observations, taken at Washington National Airport prior to the accident, were:

Estimated ceiling 8,000 feet overcast, visibility $2\frac{1}{2}$ miles, fog, haze; wind from 200° , 5 knots, altimeter setting 29.94.

The 1057 reported Washington National Airport weather observation was as follows:

Estimated ceiling 8,000 feet overcast, visibility $2\frac{1}{2}$ miles, fog, haze; temperature 77° F., dew point 73° F., wind from 180° , 5 knots, altimeter setting 29.94.

Ground witnesses described the visibility as "low with haze and smoke."

1.8 Aids to Navigation

There were no reported difficulties with any navigation facilities.

1.9 Communications

There were no reported communications difficulties.

1.10 Airspace and Ground Facilities

Runway 15 at Washington National Airport is 5,212 feet long and 100 feet wide. It is served by high-intensity runway lights, runway end identifier lights, and Visual Approach Slope Indicator (VASI) lights. All field lights were reported to be on at full brightness.

The airport elevation is 15 feet m.s.l. ^{h/}

1.11 Flight Recorders

Flight or voice recorders were not installed aboard the aircraft and none was required by regulation.

1.12 Aircraft Wreckage

The aircraft was intact upon initial contact with the water. The flightpath at impact was approximately 50° magnetic, and the center of the wreckage area was located about 240 feet off shore.

^{h/} Mean sea level.

Most of the wreckage was confined to a circular area about 170 feet in diameter. All major components of the aircraft were salvaged. The copilot's seat, some instruments, both flight control columns, and some small pieces of fuselage skin were not recovered.

Structure

All trim control system turnbuckles were intact and properly adjusted. The elevator trim actuator was 1° down (1° noseup trim). This was confirmed by comparing the measurements of the actuator with that on a similar aircraft. Total trim available was 5° noseup and 4° nosedown.

The right wing was recovered practically intact but without the engine and nacelle. The leading edge near the wingtip was buckled in the direction of the trailing edge. The aileron and two sections of flap were attached to the wing. The flap was partially extended. Measurements of the flap actuator in the aircraft were compared with measurements of a similar aircraft when the flaps were in various positions. These comparisons indicated that the flaps on Flight 106 were extended 50° (full down) at impact. The right flap impact mark on the fuselage measured 50°. Both wing flaps are operated by one actuator, and the position of one flap corresponds mechanically to the position of the other flap.

The left wing was recovered in two pieces. One piece, the inboard quarter behind the main spar, had the flap attached. The other piece comprised the remainder of the wing, less the aileron and the engine. The left engine had separated from the main mounts.

The two main landing gears and the nose gear were recovered. The right gear was still in place on the mount at the side of the fuselage; however, the other two landing gears were broken free of their mounts.

The right side of the empennage was essentially intact. The left vertical stabilizer, left rudder, and left side of the elevator separated from the aircraft, but were recovered.

The nose section, the pilot's half of the cockpit, and the entire left side of the fuselage were fragmented. The right side of the fuselage, including the top of the copilot's entrance door, showed four slash marks. The pilot's entrance door, the ditching hatch, and the four cargo doors were recovered. The cargo floor was examined and all cargo restraint rings were found to be intact except for two on the left side. None of the cargo restraint rings had cargo strap hooks attached, nor was there any evidence that any had been attached.

Four cargo rollers and a 1/2-inch thick pressed wood pallet were recovered. Two of the rollers were each 10-feet long and two were 5-feet long.

The seven nylon cargo straps aboard the aircraft, at impact, were recovered. None of the straps was broken.

One cargo strap hook had a single fuselage seat-storage ring attached. Another strap hook had double fuselage seat-storage rings attached. These two straps were wrapped about each other when salvaged. According to the manufacturer's representatives, seat-storage rings are not designed for use as cargo tie-down rings.

The cargo floor in this type of aircraft contains 70 cargo restraint fittings. Each fitting is designed for a load of 4,000 pounds. There are seven seat-storage rings on each side of the cargo compartment. The cargo hold is 18 feet 7 inches long, 6 feet 6 inches wide, and 6 feet 6 inches high.

Powerplants

Left Engine

The left engine was broken into two pieces. The break occurred approximately 12 inches forward of the parting line between the gear box/compressor casting and the hot section of the engine. One left propeller blade was whole, with leading edge nicks and gouges. The second blade was broken off approximately 14 inches from the hub centerline. The third blade was broken off diagonally 26 inches to 36 inches from the hub centerline. The propeller was separated from the engine at the flange bolts. The dome and pitch change mechanism was separated from the propeller at the threaded area.

Right Engine

The right engine was complete in the nacelle and the propeller was still attached. The propeller blades were bent, twisted, and gouged on the leading edges. One blade tip was broken off. The dome assembly was separated from the hub and the threads were stripped.

An examination of the engines and propellers by personnel at the Aircsearch plant in Phoenix, Arizona, showed that both engines were rotating at impact and that both propellers were set for landing approach power.

Systems

No evidence was found that would indicate any preimpact malfunction or failure of the aircraft systems.

1.13 Fire

There was no fire.

1.14 Survival Aspects

The accident was nonsurvivable. Autopsies showed that both pilots sustained fatal injuries as the result of impact.

1.15 Continuing Investigation

The investigation of this accident is continuing.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ FRANCIS H. McADAMS
Member

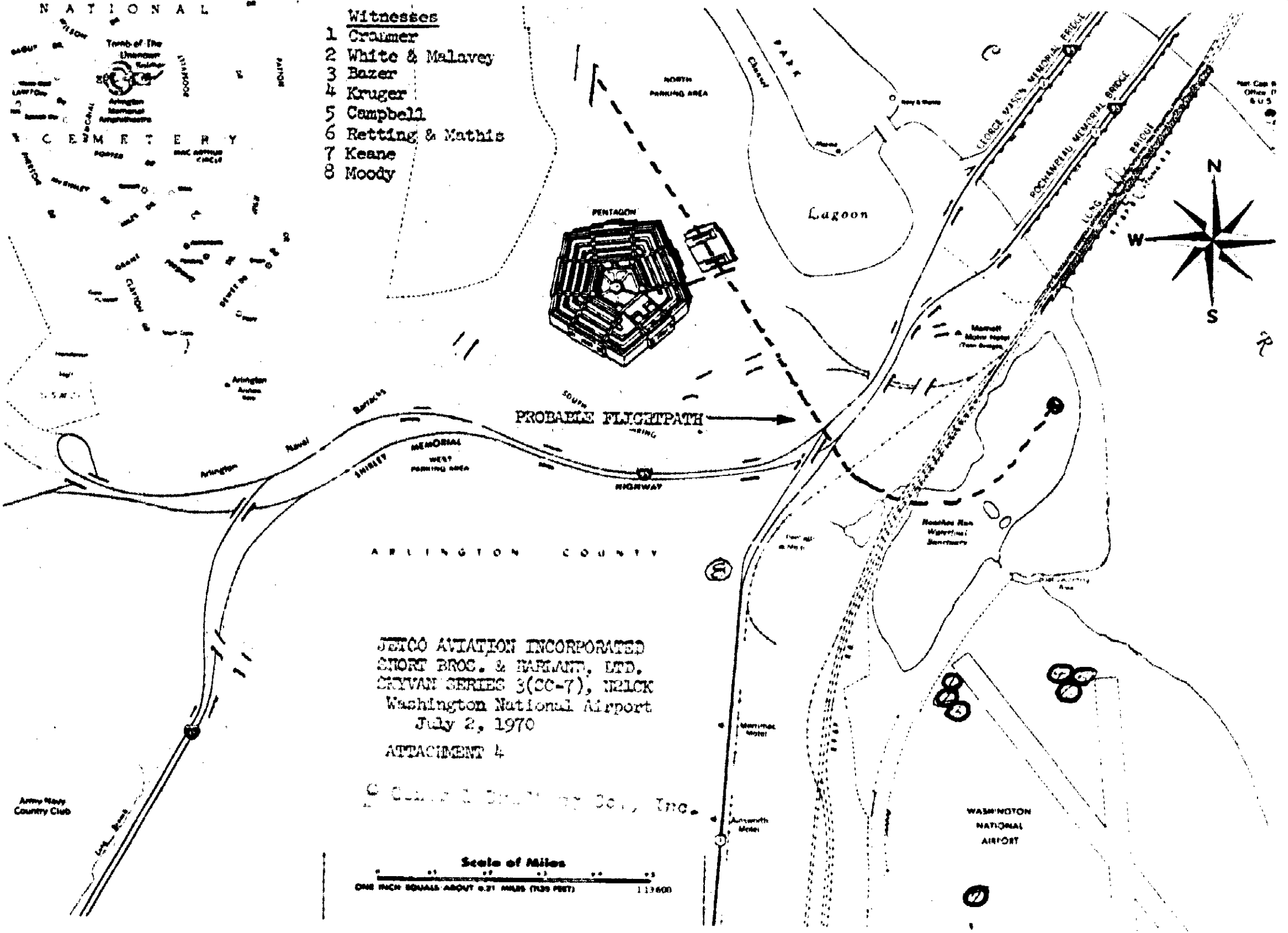
/s/ ISABEL A. BURGESS
Member

Louis M. Thayer, Member, was not present and did not participate in the adoption of this report.

August 26, 1970.



- Witnesses
- 1 Craumer
 - 2 White & Malavey
 - 3 Bazer
 - 4 Kruger
 - 5 Campbell
 - 6 Retting & Mathis
 - 7 Keane
 - 8 Moody



JETCO AVIATION INCORPORATED
 SHORT BROS. & HARTMAN, LTD.
 CRYVAN SERIES 3(CC-7), NALCK
 Washington National Airport
 July 2, 1970

ATTACHMENT 4

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Scale of Miles
 ONE INCH SQUARES ABOUT 0.21 MILES (7130 FEET) 1:13600

SKYVAN - N21CKACCIDENT AT WASHINGTON, D. C.Note on Weight and Balance

Short Brothers & Harland Ltd., Belfast, Ireland, manufacturers of SKYVAN N21CK, prepared an analysis of the weight and balance conditions involved in the crash of Flight 106. The report of this analysis contains the following computed conditions:

Estimate of effect of cargo shift

Assume main cargo package becomes dismantled due to acceleration caused by deceleration of aircraft and moves as predicted.

Aircraft on approach	13221	/	0.746	/	9865
Take out main payload	2766	/	1.170	/	3236
Take out fwd. payload	611	-	5.17	-	3159
	<u>9844</u>			/	<u>9788</u>
Add displaced main payload	2766	-	2.25	-	6224
Add displaced fwd. payload	611	-	5.58	-	3409
	<u>13221</u>				
Aircraft in final condition	13221	/	0.012 (0.21%)	/	155

After assumed cargo shift

The aircraft was now down to 13221 lb. and the amount of overweight was 721 lb. which would scarcely have been noticeable.

With a CG arm of 0.012 ft. the CG was $0.833 - 0.012 = 0.821$ ft. (9.85 ins.) forward of the normal forward limit or, $\frac{0.821}{5.833} \times 100 = 14.1\%$ SMC forward of forward limit. This is outside the trimmable forward limit which is 10% SMC forward of the normal.

SHORTS SERVICE BULLETIN

NUMBER 27 - 53

Flying Controls: To introduce a re-designed fork end fitting on the Anti-Up Float Spring Pot in Elevator Control Circuit.

Modification No. 1080

1. Planning Information

- | | |
|---|--|
| A <u>Effectivity</u> | Skyvan Series 3 |
| E <u>Reason</u> | Evidence of a premature fatigue has been reported. |
| C <u>Description</u> | The fork end fitting on the spring pot has been re-designed in steel. |
| D <u>Compliance</u> | Recommended. |
| E <u>Approval</u> | This modification and the technical contents of this Bulletin which affect air-worthiness have been approved under the authority of the Air Registration Board Design Approval No. AD/1023/45. |
| F <u>Manpower</u> | 4 Man Hours. |
| G <u>Material Cost and Availability</u> | Modification Kit No. 27-53 is required to accomplish this modification. The price of the kit is £19.00 and may be obtained from: |

Skyvan Co-Ordinator
Product Support Department
Short Brothers & Harland Ltd
Queen's Island
BELFAST BT3 9DZ

This offer is available for three months after receipt of this Bulletin.

Original Issue: Nov. 23/70

27-53-1080

Revision No.

No. of Pages 9

Page 1

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Telegrams: AIRCRAFT BELFAST Telephone: BELFAST 58444 Telex: 74688

SHORTS

SERVICE BULLETIN

NUMBER 27 - 53

Flying Controls: To introduce a re-designed fork end fitting on the Anti-up Float Spring Pot in Elevator Control Circuit.

Modification No. 1080

1. Planning Information (Cont'd.)

H Tooling

No special tooling is required for this modification.

I Weight & Balance

Weight change +0.1 lb.
Moment change +2 lb/ft.

J References

Illustrated Parts Catalogue
Chap. 27-10 Fig.12

27-53-1080

Page 2

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Revision No.

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SHORTS SERVICE BULLETIN

NUMBER 25 - 56

Equipment & Furnishing: To fit guards at rear of 1st and 2nd Pilot's Seats.

Modification No. 1086

1. Planning Information

- | | |
|---|--|
| A <u>Effectivity</u> | Skyvan Series 3 |
| B <u>Reason</u> | To ensure that mechanical controls in pilot's seat pedestal are fully guarded. |
| C <u>Description</u> | Fit guard under seat frame SC7-16-160 at rear of seat and cover 2 flanged holes in seat back. |
| D <u>Compliance</u> | Recommended. |
| E <u>Approval</u> | This mod has been approved by the Air Registration Board and the technical contents of this Bulletin affecting airworthiness has been approved under the authority of the Air Registration Board Design Approval No. AD/1023/45. |
| F <u>Manpower</u> | 5 Man Hours. |
| G <u>Material Cost and Availability</u> | Mod Kit 25-56 is required to accomplish this mod. The price of the kit is £21.34 and is available for three months after receipt of this Bulletin. Orders for kits should be addressed to: |

Skyvan Co-Ordinator
Product Support Department
Short Brothers & Harland Ltd
P.O. Box 241
Queen's Island
BELFAST BT3 9DZ

Original Issue: Nov. 23/70

25-56-1086

Revised No.

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SHORTS SERVICE BULLETIN

NUMBER 25 - 56

Equipment & Furnishing: To fit guards at rear of 1st and
2nd Pilot's Seats..

Modification No. 1086

1. Planning Information (Cont'd.)

H <u>Tooling</u>	No special tooling required.
I <u>Weight & Balance</u>	Weight change + .5 lb. Moment change - 4 lb.ft.
J <u>Reference</u>	Illustrated Parts Catalogue Chapter 25.10 Fig 2 and 3.

25-56-1086

Page 2

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30

CARGO RESTRAINT

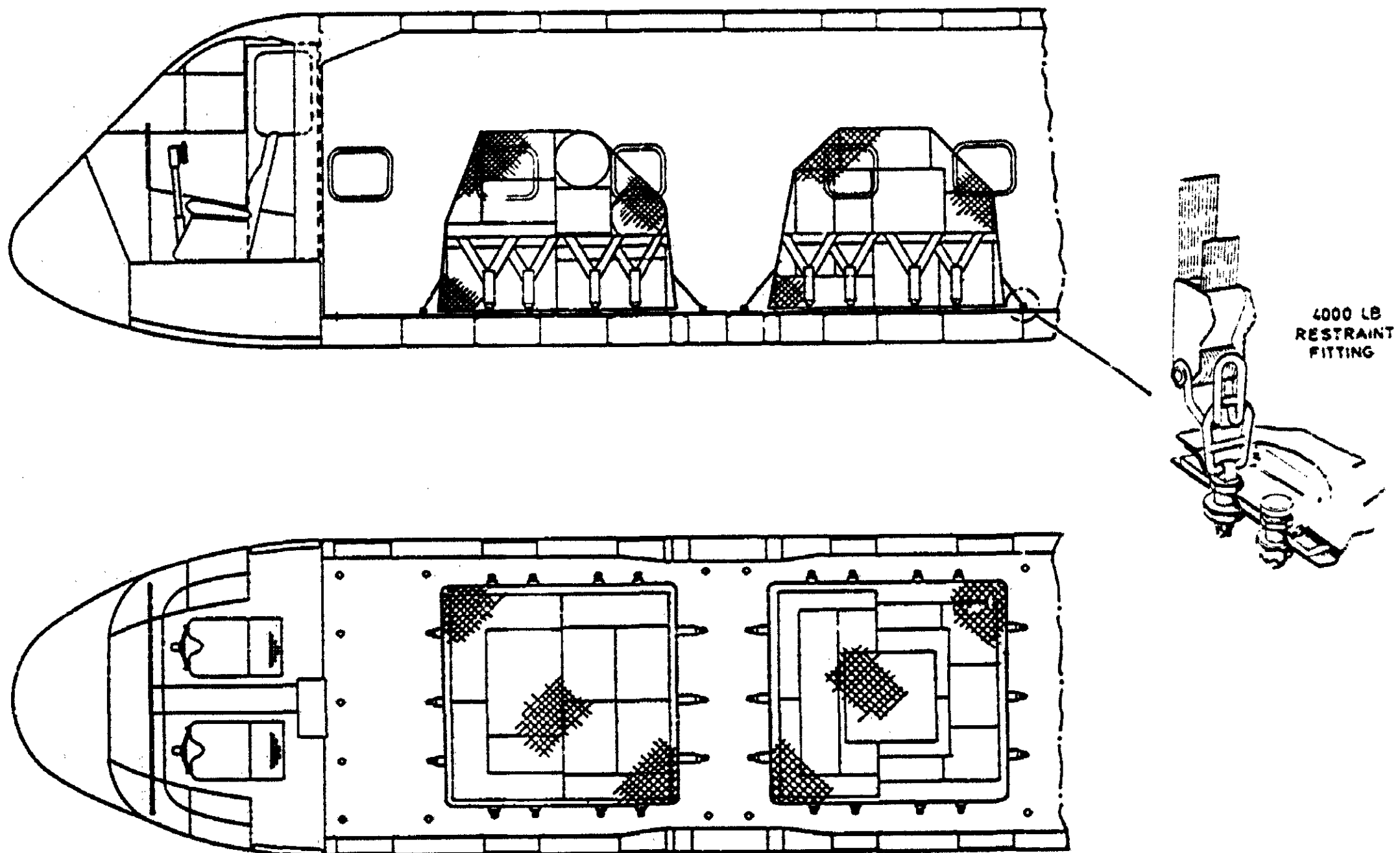
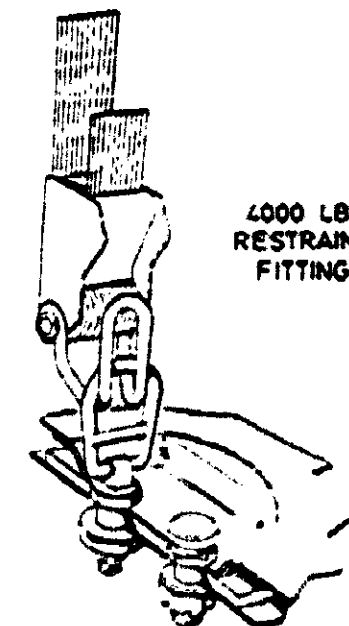
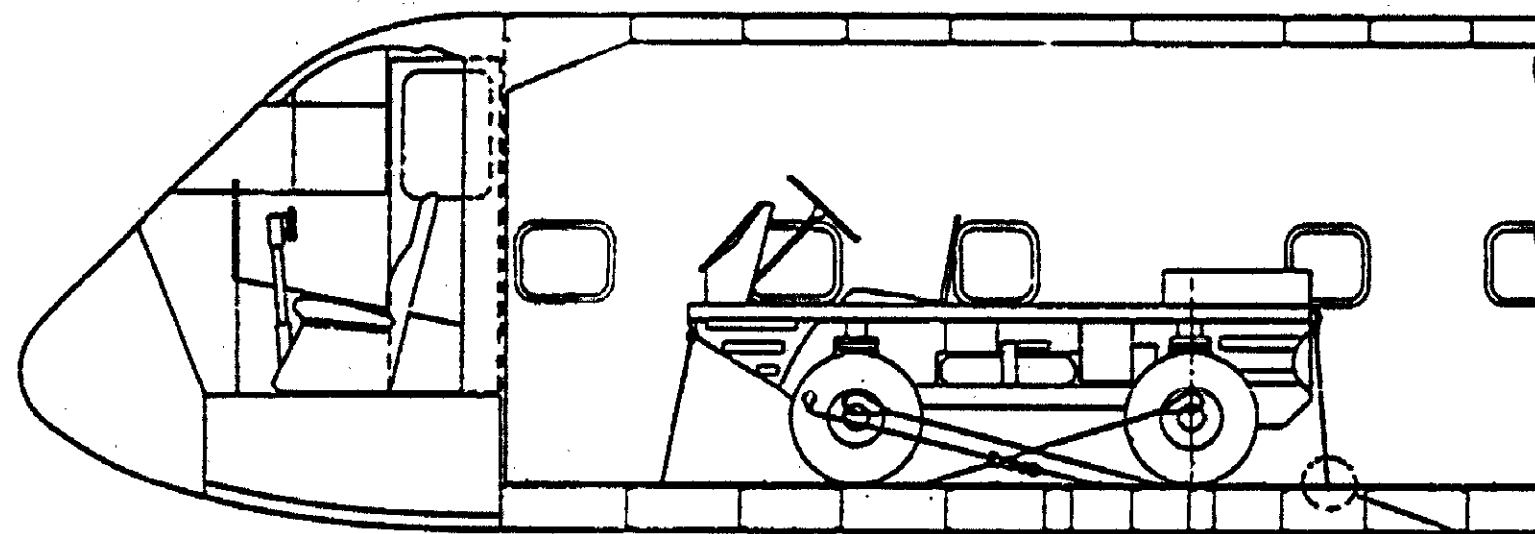


FIG. 18.3.
Sept. 67

SE 0 123A

VEHICLE RESTRAINT



4000 LB.
RESTRAINT
FITTING

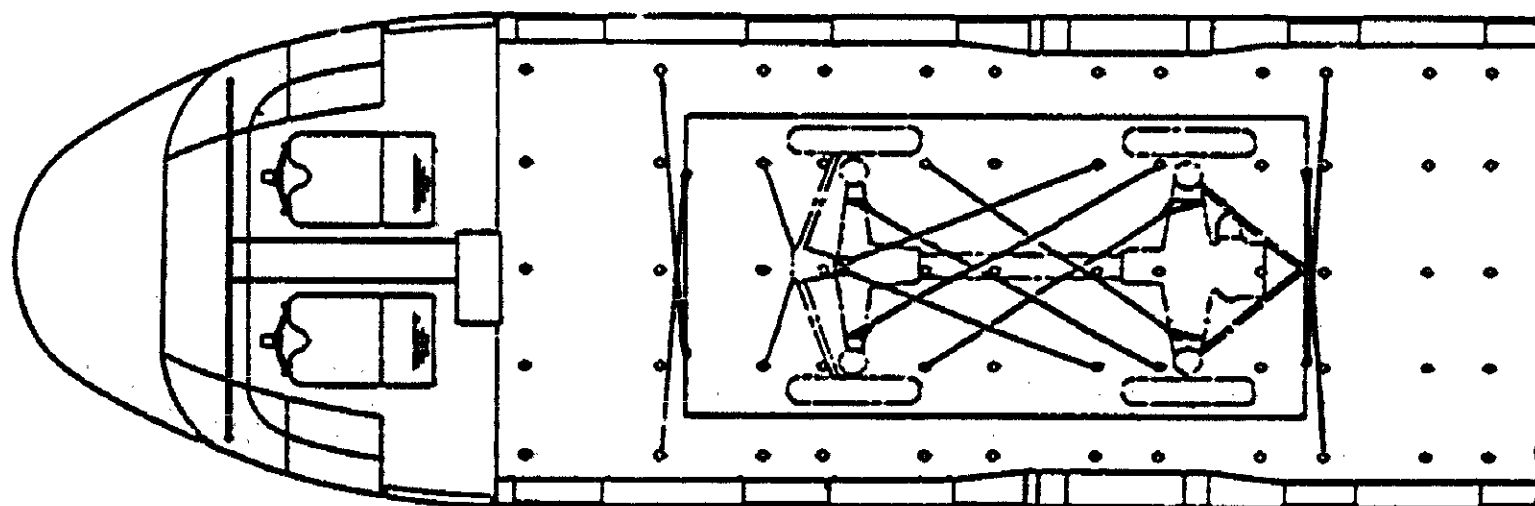


FIG. 18.4.
Sept. '67.

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