National Transportation Safety Board
Aviation Accident Final Report

Location:	LARANDIA, Colombia	**Accident Number:**	MIA00GA083
Date & Time:	02/06/2000, 0905 EST	**Registration:**	N474AW
Aircraft:	Rockwell OV-10D	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Serious
Flight Conducted Under:	Public Aircraft		

Analysis

On the first mission, the pilot was forced to return to base, because the right engine chip detector light came on during the spray run. Maintenance personnel checked the airplane, and after the maintenance was performed it was revealed that the chip detector was found to have some fuzz on the probe. The engine was run, all checks of the engine were normal, and the aircraft was placed back into service. Just after takeoff, on the second mission, the pilot of N474AW reported to the pilot of the lead aircraft, that he was having problems, that he had lost power on No. 2 engine (right), that he could not maintain altitude and said, "it's going in with me." The lead pilot saw him eject from the aircraft, witnessed the fireball as the aircraft impacted in rising terrain, and saw the parachute open, but no seat separation. The pilot of N474AW said, "...the first indication that [he] got was that I felt the airplane start to yaw a little bit...[the] right engine was starting to spool down...[he] reached up and hit the hydraulic dump, to dump the [internal] load." He did not dump the external wing tanks, as is called for in the emergency engine failure checklist. He said "...[he] could [not] get the prop to feather...it was still slowly dying and it wasn't just a catastrophic failure...it was just like it was a slow dying process...and the airplane wouldn't climb...and the prop still wasn't in the feather...I was still flying into what I believed to be rising terrain I couldn't gain any altitude...I determined that I wasn't going to make it, that the airplane was going to wind up in [a] ditch. The pilot described checks he performed on the right engine, but did not mention anything about adding power to the left engine, as called for in item number one of the emergency engine failure check list. The pilot then elected to eject from the airplane. The maximum gross weight for the accident aircraft was 15,000 pounds. On the accident flight the calculated gross weight was 15,500 pounds. After dumping the internal load the calculated weight at impact was 13,056 pounds. According to item # 3, of the engine failure checklist, "External stores and Hooper load...JETTISON, AS REQUIRED." The external load was not jettisoned. Teardown and examinations of both engines and both propellers did not reveal any discrepancies. The calculated density altitude (DA) at the time of the accident was 2,540 feet. A simulated flight in an OV-10D was conducted, in an attempt to duplicate the accident flight. In the opinion of the two pilots that performed the tests, "...It is very possible...an OV-10 configured similarly as [the test airplane]...could perform safely and accomplish a climb if appropriate emergency procedures [as] outlined in [the] OV-10...Pilot's Pocket Checklist are employed...if the same

procedures are followed in the checklist...regarding jettison of 'external stores and hopper load, drag index would be reduced to 50. With reduced drag index, performance would exponentially increase."

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A loss of power in the right engine due to undetermined reasons and the pilot's failure to maintain control of the airplane. Factors in this accident were; the pilot did not perform a weight and balance calculation, (airplane overweight at takeoff); the pilot's failure to follow the emergency checklist, and not jettisoning the external load.

Findings

Occurrence #1: LOSS OF ENGINE POWER
Phase of Operation: CLIMB

Findings
1. (F) AIRCRAFT WEIGHT AND BALANCE - NOT PERFORMED - PILOT IN COMMAND
2. 1 ENGINE - UNDETERMINED
3. (F) EMERGENCY PROCEDURE - NOT FOLLOWED - PILOT IN COMMAND
4. (F) CHECKLIST - NOT COMPLIED WITH - PILOT IN COMMAND
5. (F) AIRSPEED(VXSE) - NOT MAINTAINED - PILOT IN COMMAND
6. (F) AIRSPEED(VYSE) - NOT MAINTAINED - PILOT IN COMMAND
7. (F) LOAD JETTISON - NOT COMPLIED WITH - PILOT IN COMMAND
8. ANXIETY/APPREHENSION - PILOT IN COMMAND
9. (C) AIRCRAFT CONTROL - NOT MAINTAINED - PILOT IN COMMAND

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
10. TERRAIN CONDITION - MOUNTAINOUS/HILLY

Factual Information

HISTORY OF FLIGHT

On February 6, 2000, about 0905 eastern standard time, a Rockwell OV-10D, N474AW, call sign Bronco Two, owned by the United States Department of State (DOS), reportedly lost power during climb and impacted with the ground about 3 miles southwest of the departure runway near Larandia, Colombia. Visual meteorological conditions prevailed at the time, and a company VFR flight plan was filed for the DOS public-use eradication flight. The airplane was destroyed. The commercial-rated pilot was seriously injured, after he ejected from the airplane. The flight had originated from the same airport about 3 minutes earlier.

The pilot of the lead airplane (call sign Bronco One), had taken off, and stated that after takeoff, "...I reported in the air...[the pilot of N474AW] reported he was initiating his take-off roll, I did not hear him call he was in the air, I asked him if he was in the air, he called out that he was having problems and that he had lost power on No. 2 engine (right). I immediately initiated a 180 degree turn to form up with him, it was at that time that I saw [N474AW] dumping his internal load, I caught up with him...on his right side about 150 to 200 feet above him and about one aircraft length behind him, I asked him if the aircraft was gaining any altitude and his reply was 'it's going in with me.' I replied get rid of the external tanks, it was at that time I saw him eject from the aircraft and simultaneously witnessed the fire ball as the aircraft impacted in rising terrain...I had seen the parachute open, but no seat separation...as I executed a left 360 degree turn I saw he was down and was moving."

A satellite imagery (SATLOCK Tracking) showing the flight path and speed of N474AW before impact revealed that at the departure end of the runway the altitude N474AW had reached was 864 feet [above airport elevation of 873 feet], or 9 feet agl (above ground level), and a speed of 120 mph. The highest altitude that N474AW reached was 1,171 feet (298 above airport elevation) and highest speed was 155 mph. The last altitude depicted was 149 feet above airport elevation and the speed was 118 mph. Just before impact the satellite data showed that the airplane turned to the left. (See the satellite imagery (SATLOCK Tracking), an attachment to this report).

The pilot's statement of events was taken at his residence on February 24, 2000. The statement was recorded with his permission, and his attorney was present. The recording was transcribed and the pilot declined to sign the transcribed statement.

According to the pilot on the first mission, the right engine chip detector light came on during the spray run. He called the lead aircraft and told him, "...that [he] had a master caution and...had a right chip light...we immediately broke off flying altitude and returned to base." At the time they were located about 40-50 nautical miles south of base.

The pilot said, "...we came in and I shut the airplane down...and went in to pull the power levers back to put the props on the locks, it did not lock on the locks, and that had been the third instance of that airplane not locking that particular engine...on the locks...a mechanic there he noticed that the prop was not on the locks. He looked up into the aircraft and confirmed that I had the power lever all the way back and asked me...had I moved them prior to the rotation and I said no sir and so he actually took up what I thought to be a can of W-D 40 or whatever while the one mechanic was checking...the chip detector and draining the oil of the crankcase he actually greased the prop locks on both props."

According to the statement of the maintenance supervisor, "...during the time the aircraft was in the parking spot to the best of my knowledge, we did not removed [sic] the prop spinners off either engine and lube the pitch locks."

The pilot said he never deplaned the airplane. According to the pilot, "...the mechanic had checked the airplane, and told me it was ready to restart, I was still in the airplane, still strapped in. I restarted the engine, the number two engine, the right engine and everything was normal, everything ran normal, I didn't get any bad indications from any instrument. I set the chronometer when the engine started. The [engine] ran for about eight and a half minutes...they had checked with me, I hadn't had any indications on engine instruments chip light...I proceeded to start my number one engine, and started it, got everything booted up, my SATLOCK, the whole nine yards. By the time we got all that running it was probably...about 7 and a half minutes into the second engine run. So on a lapse time of about fifteen minutes...everything was normal on my engine instruments and he [lead, Bronco One] proceeded to take off...once he took off, I pulled into position did a full power run up, everything was fine, and no fault indications. Everything was in the green everything was normal. I don't exactly remember the exact torque readings that I got on...takeoff, but they were within the tolerances...for the...temperature...so I released brakes and started takeoff."

According to the pilot, he rotated the airplane, pulled the gear up, but said, "...I don't remember...whether it was after I got the flaps up, but the airplanes are heavy, you lose a lot of lift and we had to climb a little hill and I tried to get the flaps, or bleed the flaps up as quickly as possible so it is possible that I had the flaps up I don't know l00 percent myself. The first indication that I got was that I felt the airplane start to yaw a little bit. When I felt the yaw I looked down at my engine instruments and my right engine was starting to spool down. When I saw that my right engine was starting to spool down, I reached up and I hit the hydraulic dump, to dump the load. I got a little mirror right here in the vein and I could see where the boom you can't actually see the dump occurring but you can see the refection of the dump and the boom of the airplane, so I knew I was dumping. I verified that it was the right engine that was spooling down to the right condition lever went all the way back into condition fuel instead of shutoff, and put in some left rudder trim to start taking up for some of the rudder pressures that I was having...or might have been right rudders, I don't remember, or I just retrimmed the airplane so it wouldn't have to holding so much rudder pressure. I checked the right engine and the prop wasn't set. I brought the condition lever back out of feather and the fuel shut off back up...I went all the way into normal flight altitude [attitude], but I cycled it part of the way out and then pulled it back, back into feather and the fuel shutoff to see if I could get the prop to feather, and it was still slowly dying and I mean it wasn't just a catastrophic failure or whatever it was just like it was a slow dying process. I was still at low altitude...one or two hundred-foot estimation above ground level at the spot after takeoff the ground does rise a little and I was turning...trying to turn five degrees or so into the good engine like I was taught to keep leveling low to starting turning into the good engine like I was taught to keep the left wing low and turning into the good engine. I was coming around to the left, and the airplane wouldn't climb. I looked back over my shoulder and the prop still wasn't in the feather and I brought it back out and tried cycling it one more time by this time the airplane was, I was still flying into what I believed to be rising terrain I couldn't gain any altitude, I saw a pasture...two hills, and my first reaction...was to ride the airplane in and try to belly it in on the second ridge. I realized part of the way into...the second ridge I was going to have to stretch...to the second ridge and I knew that the airplane was going to want to start torque rolling...with me and at

that particular time I couldn't remember whether the...ejection seat, the front one went out to the left or went to the right but I didn't want to get into a roll of any kind of magnitude because I knew if I was rolling into the side of the seat...that I would just be punching myself into the ground rather than up in the air. It got to the point where...I said...I was going to make it to that second hill to be stretching the glide. I determined that I wasn't going to make it, that the airplane was going to wind up in that ditch. I looked down at the handle put my hand on the handle my left hand on the handle and put my right hand in my lap and put my head back against the chin-rest raised my chin a little bit and pulled the handle."

The NTSB investigator-in-charge (IIC) asked the pilot if while going down the runway did it seem that the airplane had rotated at a normal spot. The pilot answered "yes."

The pilot was asked what gave him the indication that the engine was spooling down. He said, "I got the yaw, I could feel the airplane, was yawing around and the engines stalled and the gauges on the right engine were just coming down. The fuel pressure was coming down, oil pressure...fuel flow...all the ones across the board were going down." In addition, he said no warning lights had come on.

When the pilot first explained the actions he performed after he became aware that "...my right engine was starting to spool down," he never mentioned anything about the emergency checklist or the action he took reference the good engine (left). When prompted by the NTSB IIC, he said that while he was trying to feather the right engine, that he applied "maximum power" to the left engine.

He remembered that the landing gear "was up," and he verified that the chemicals were dumping. In addition, he said the aircraft did not take on any different characteristics as the load was dumping. He said, "...it takes a good while for that load to dump out, it takes a little better than twenty seconds." He was not sure how many gallons of chemicals were loaded the second time. He said, "...[he] was... not positive. We had sprayed a partial load and then...came back...as to whether or not they actually took it back up to three hundred gallons or not...[he was] not sure."

The pilot was asked if he ever consider dumping the wing tanks. He said, "...I considered it and I started to reach for the button, but...if I couldn't get that prop better, I was just fighting an inevitable battle, and...I would have dumped the tanks I might have given myself a few more seconds for the prop to feather out, I don't [know] if the prop ever feathered or whether it didn't, I can't testify to that. Both times that I looked out it had not feathered and like I say, by the time I had done it like a third time I was so low I was dodging trees to try to make the pasture."

The pilot was asked to explain what he saw reference the maintenance performed to correct the chip detector light. He said, "...I can't remember that guy's actual name...[a mechanic] greased the props and basically oversaw the chip but the actual hands on wrenching was...I guess what you call the crew chief of the airplane that day and I really don't know the guy's name...he is the one that was actually draining the oil. He drained the oil while [a mechanic] sprayed the pump." Instructions were given as far as the engine run after the maintenance was performed. He said that he and the maintenance personnel had a conversation about it, and "...a thirty minute ground line [was needed], [and] there was conversation about that wasn't necessary...[one of the mechanics] made a wisecrack and when I made the comment that I did not want to be responsible for saying when that engine was

ready to go, that I wanted them to give me a signal when enough ground time had been run on the engine so that I could leave."

The accident occurred during the hours of daylight about 01 degrees, 29 minutes north, and 075 degrees, 32 minutes west.

PERSONNEL INFORMATION

Based on company records the pilot's flight hours at the time of the accident were 10,000 hours of total flight time in all aircraft, and 106 hours in this make and model airplane. In addition, he recorded 48 hours in the last 90 days, 21 hours in the last 30 days, and 1 hour in the last 24 hours.

AIRCRAFT INFORMATION

According to statements taken from maintenance personnel that worked on the airplane after it returned from the first mission. A mechanic (TZ) stated, "...[N474AW] taxied into the parking spot with both engines running and I advised the pilot to shut down both engines. We started to open the engine cowlings when I asked the pilot if he still had a chip light and [he] advised me that he only had a flicker once or twice, but that it never stayed on or did it flicker again...we continued to check out the engine chip detector to see if it had any metal chips on it. Upon removing the chip detector we noted there was a small amount of fuzz on the chip detector, no chips, we then decided to drain the oil from the gear case and inspect it for any metal, there was none noted. We then serviced the engine with about one-to-one half quarts of engine oil to bring the level back to normal...the chip detector housing and plug was reinstalled and saftied [sic]. We decided to run the aircraft for about 20 minutes to see if the light would come back on, it did not. The Quality Control [representative]...Lead [mechanic], myself [supervisor]...the pilot, and the mechanics agreed to this corrective action...everything looked good to us. We ran it [engine] for 20 minutes. The pilot gave us a thumbs up and we taxied him out of the parking spot to prepare for takeoff."

The quality control (QC) representative working on N474AW was asked to check on how many hours the No. 2 engine had and what past work had been performed. According to the QC representative's statement, "...[he] pulled up the engine historical as well as the...engine oil samples, remembering samples where pulled just 2 days earlier, for routine 50 hour samples left and right [engines]. [The oil sample] information showed that the engine was installed 121 hours prior...on September 99. There has been no history prior with engine having chip lights...maintenance pulled the detector out and we all, as well as maintenance lead observed that there was what would be called fuzz, on the detector contact, we pulled the housing to drain oil inside the gear box, noted nothing additional. The decision was made since there were no actual chips on the detector and no history as well, to release the aircraft...with no problems noted the aircraft was released...it should be noted the aircraft was bore scoped for gearbox pinions...15 hours prior to the incident with no problems noted."

METEOROLOGICAL INFORMATION

The reported weather at the Larandia base camp at the time of the accident was; clear skies, visibility 10 sm, winds calm, temperature 82 degrees F, and the altimeter was 29.99 inches Hg. The calculated density altitude (DA) at the time of the accident was 2,540 feet.

MEDICAL AND PATHOLOGICAL INFORMATION

The pilot injured his back due to the ejection seat was operated outside of its envelope

precipitating subsequent lack of seat separation causing the pilot and the seat to impact with the ground at the same time.

Toxicological tests were conducted at Foundation Santa Fe of Bogota, Columbia, and revealed, "No ethanol or drugs detected."

WRECKAGE INFORMATION

The airplane impacted in rolling hilly terrain, about 3 miles from the departure airport. The flight path of the airplane just before impact was about 175 degrees. The airplane caught fire upon impact and shed parts. The debris field was on a heading of 240 degrees. The first ground scars observed along the wreckage path appeared to be oriented in the direction of flight. The first parts observed on the wreckage path were from the aft under belly spray apparatus. The right engine separated from the airframe, and the main wreckage came to rest about 3,000 feet from the first parts observed along the wreckage path. Both engines and propellers were shipped to Patrick Air Force Base, for a more detailed examination.

A photograph taken by the Department of State about 7 hours after the accident showing the power quadrant, revealed that the left engine power lever was in the full rearward position, and the right power lever was almost full forward. The condition levers as shown in the photo revealed that the left lever was full forward and the right lever was at a mid-range position. There were no reports that these levers had been moved or touched after the accident, and prior to the photo being taken. (See photo No. 12, an attachment to this report).

TEST AND RESEARCH

The engine teardowns were conducted under the supervision of the National Transportation Safety Board at Patrick Air Force Base, Florida, on May 2nd and 3rd, 2000.

Left Engine: T76-G420X0, S/N GA-E00999A.

The left engine displayed some minor impact damage. Portions of the engine were coated with fire soot. The engine inlet area was lightly coated with a "blackish", "oily" feeling substance. Examination of the inlet and exit areas of the power section disclosed no discrepancies, other than the blackish coating on the inlet.

Turbine:

The turbine section was disassembled to the point of removing the stator vane case assembly. The turbine bearing area displayed an absence of oil. There was evidence of exposure to fire of the external surfaces. There were metal spray deposits on the suction side of several third stage turbine wheel blades. There were metal spray deposits on the suction side of all of the second stage turbine wheel blades. There were metal spray deposits on the suction side of all of the second stage stator vanes. Light blade tip rubs were found on the blade tip shrouds with corresponding rubs on the second stage turbine blade tips. Metal spray deposits were observed on the suction side of all of the first stage turbine wheel blades. Metal spray deposits were found on the suction side of the first stage stator vanes. There were light rub marks on the blade tip shrouds with corresponding rub marks on the first stage blade tips.

At least one of the two thrust bearings in the first direct drive fuel control (DDFC) idler assembly was found to be in the initial stages of spalling. The gears that these bearings support and their mating gears appeared to be undamaged. Therefore, this unit was considered to be capable of operation at the time of impact.

The left engine was not completely torn down, because it was determined that the metal spray deposits observed on the three turbine stators and turbine wheel were an indication that the engine was operating at the time of impact. Nothing was found in the components removed or accessed on this engine to indicate any discrepancies.

Right Engine: T76-G-421, S/N GE-00589.

The gearbox was found separated from the power section. The diaphragm and nose cone assemblies were fractured into multiple pieces. The beta valve was not present. Portions of the engine were coated with fire soot. The engine inlet area was coated with a "blackish", "oily" feeling substance. The coating or amount of this substance was more pronounced than on the left engine.

Nose Cone:

The housing was found broken into multiple pieces. The forward section of the nose cone housing was separated from the main nose cone housing and still retained the forward propeller shaft ball bearing and seal assembly. The forward propeller shaft ball bearing was not damaged.

Gearbox/Diaphragm:

The gearbox was broken into multiple pieces. The portion of the diaphragm section housing, which contained the scavenge pump assembly was separated from the main diaphragm section. The upper portion of the gearbox housing, which contained the oil pressure pump, accessory drive gear and starter/generator drive was separated from the main gearbox section. The starter/generator was still attached to the gearbox section. The starter/generator drive shaft was removed, and observed to have no discrepancies.

The following observations were made of the two bearings in the first DDFC gear assembly. The forward bearing when removed was rough when rotated. The inner race of the aft bearing, attached to the gear shaft showed signs of spalling. The two DDFC gears on the back of the diaphragm assembly appeared to be intact with no obvious signs of bearing or gear distress. The gear with part number 896803-1 is the forward gear on the number 2 DDFC idler assembly. Rotation of this gear assembly by hand revealed a "roughness" in the rotation. Visual examination of the aft bearing, as installed, did not disclose any abnormalities.

Both O-rings on the Negative Torque Sensing System (NTS) transfer tube, adjacent to the feather valve, on the aft side of the diaphragm showed no discrepancies. (Note: Negative torque is a condition wherein propeller torque drives the engine. The NTS system automatically modulates the propeller blade angle during this condition so that the propeller produces minimum drag.)

The oil screen normally located on the NTS solenoid was not present. All three O-rings on the solenoid valve were present and appeared to have no discrepancies. Power was applied to the solenoid connector and the solenoid was found to actuate.

The high-speed pinion (HSP) aft retainer bolts were in place. The breakaway torque on the four aft high-speed retainer plate bolts exceeded 60 in-lbs (50 plus or 3 in-lbs is specified). The fourth was torqued, but broke loose with the torque wrench set at 50 in-lbs before reaching the wrench set point. The HSP and associated gearing rotated freely.

An O-ring located on the oil jet assembly, which was located in the gearbox just above

the torque sensor housing, was missing a small section (approximately lo degree arc).

The tube portion of the oil transfer tube that sets into the torque sensor housing was found fractured upon removal.

The torsion shaft was bent and retained in the compressor bearing. The torsion shaft was cut using a pneumatic cutting tool to facilitate the removal of the torque sensor housing and compressor bearing assemblies from the gearbox.

Compressor Section:

The first stage compressor impeller was found to have five blades, which at the exit of the shroud line edge had metal shavings adhering to them. These shavings were consistent with rub indications on the first stage impeller shroud as having come from those rub areas. These rub indications were heavy, however, the length of the rub marks was less than the distance between individual impeller blades. The type and degree of these rub marks was an indication that there was little to no rotation in the engine at the time of impact.

Several second stage compressor impeller blade line edges near the exit displayed areas of light "polishing". These polished areas corresponded to static impact marks on the second stage compressor shroud.

Turbine Section:

The third turbine wheel was observed to have light blade edge tip rubs on several blades corresponded with light tip shroud rubs on the third stage tip shroud.

The second turbine wheel was observed to have light turbine blade tip rubs with corresponding light tip shroud rubs on the second stage turbine stator.

The inner transition liner assembly, first stage stator and second stage stator were not removed from the vane case. Therefore, the first stage turbine wheel could not be accessed.

The turbine plenum, fuel manifolds (including nozzles) and combustor were removed as a single assembly. No further disassembly was performed. When this assembly was removed, several metallic "shavings" were observed in the exit area of the compressor housing, underneath the outer transition liner. These shavings were bright silver in color. There was also a small quantity of dirt observed in this same area.

Externals (Right feather valve assembly):

The pilot had stated that when he shut the engine down before the maintenance was performed, that the right propeller would not go on the locks, and that the condition had happen before. It was decided to remove the right feather valve assembly from the accident airplane, and test it on a similar airplane. Observations revealed that counting back from the front to the rear of the feather valve assembly, the third O-ring back was found to have two cuts/gouges in the material.

This feather valve, from the right side of the accident airplane, was installed in an "on wing" engine. A test was then conducted where the propeller was moved from the feather position to a position where the start locks engaged. This was done using the aircraft's unfeathering pump. The start locks were then disengaged using a flat plat tool to unseat the locks one at a time. The propeller essentially remained at a low blade angle, moving to the feather position at an almost indiscernible rate. The aircraft's condition lever was then moved

to the emergency stop position and the propeller began to move toward feather at a much greater rate. No specifications were used to judge the movement from the feather position to the start lock position and back again to the feather position, however, on a qualitative basis, the performance of the feather valve was judged to be acceptable by the investigative team.

The finger filter in the propeller governor line contained a couple of pieces of what appear to be dirt but was otherwise uncontaminated. This line, however, was not connected to anything at the time of teardown and was observed to have sustained impact damage.

The propeller governor input shaft rotated freely and the splines were intact.

Only one small portion of the fuel pump housing was available. This piece of the fuel pump housing contained a portion of the fuel filter housing, however, the filter was missing.

The fuel control (data plate missing) sustained impact damage. The P3 diaphragm housing was missing. The input shaft splines were intact. Input shaft would not rotate (by hand). The Power Lever shaft was missing. The specific gravity setting was set at .83. The top portion of the fuel enrich solenoid valve assembly (near the specific gravity adjustment) was separated exposing a small metal transfer tube.

Neither the Phase Shift Controller nor the LVDT controllers were present for examination.

It was concluded that the right engine displayed a lack of rotational damage in the compressor section coupled with un-melted compressor shroud material "shavings" in the outer transition liner area, and that these are indicative of an engine that was not operating at the time of impact.

The two Hamilton Standard, model 33LF-355 and -356 propellers were torn down at the facilities of Aviation Propeller Inc., Opa Locka, Florida, under the supervision of the NTSB IIC, on April 27, 2000.

The left propeller, serial number N240470, revealed that the grove in the cylinder was found in the reverse position. Impact marks to the propeller butts were not overly visible, precluding the determination of the exact blade angles at impact. Based on the impact signatures that were available it was determined that the left propeller blades were close to low pitch, high rpm at the time of impact. No discrepancies were found with the left propeller.

The right propeller, serial number N236285, examination revealed that three blades displayed fire damage. The blades displayed little impact damage or chord wise damage. The piston was found in the feather position. Lubrication was present on the piston. Based on impact damage and the position of the piston, it was determined that the right propeller was found to be in the feather position, at impact. No discrepancies were found with the right propeller.

The disassembly of both engines and both propellers did not reveal any discrepancies.

On May 17, 2000, the Department of State, Standardization/Security Manager, and DYNCORP, OV-10, Standardization Instructor Pilot, performed maneuvers in an OV-10, similar to the accident aircraft, at Melbourne, Florida.

In an unclassified memorandum to the Director the following was observed, "...the purpose of this flight was an attempt to replicate some of the flight characteristics experienced by [the pilot] just prior to his accident in OV-10, V-7 on February 6, 2000...since we could not

duplicate all conditions present at the time of [the] accident increased approximations were made...[they] included flying at higher pressure and density altitude, similar ambient temperatures, and higher gross weights...the following is a comparison of flight and aircraft conditions encountered...at the time of the accident...and on this date...field ambient temperature [for the accident airplane], estimated 27C, [for the test airplane] reported 26C. Field elevation, 860 feet [for the accident airplane] 10 feet [for the test airplane]. Gross weight [for the accident airplane] prior to the chemical dump 15,500 pounds, [for the test airplane] prior to water dump 14,300 pounds. The gross weight [for the accident airplane], after [the] chemical dump [was] 13,056 pounds, [for the test airplane] after [the] water dump [was] 13, 700 pounds. Estimated pressure altitude [for the accident airplane] during suspected engine failure 1,091 through 996, [for the test airplane] simulated engine failure 5,500 through 4,500. Drag index 100 on both [aircraft]..."

The memorandum further stated, "...SUMMARY: 5,500 msl; [for the test airplane] was configured with engine number 2 at high RPM and minimum power, number one engine was at high power, weight 14,300 pounds. In this configuration [the test airplane] was able to maintain altitude with significant yaw. With simulated feather on number two engine and number one engine at reduced power the aircraft entered into a decent of up to 500 FPM [feet per minute]. In this configuration yaw was significantly reduced. Turn performance of the aircraft was acceptable...we dumped the water load; operating weight was reduced to 13,700 pounds...approximately 600 pounds heavier than [the accident airplane] after dumping of chemicals. With engine number two completely feathered and number one engine at high power, a climb of up to 500 FPM could be attained, but not maintained at all times. Turn performance to the left increased our climb performance...this profile was accomplished at Vsse [stall single engine], (117 kts)...adjusted airspeed to 125-130 knots performance improved. At this weight we also lowered flaps to 20 degrees, climb performance improved. At this weight and an operating msl of 5,500 to 4,400 msl yaw was normal with number one engine at high power, but reduced when we reduced power on number one engine...during feathering of [the] number two engine [DoS Accident Board President] looked out to the right observing the engine. [He] tried to replicate [the pilot's] actions enumerated in his statement...the condition lever [was moved] to 'fuel shut-off.' [He] could feel a distinct detent. This could be miss-identified as feather. The NTS responded immediately and reduced yaw. [I] then moved the number two condition lever past the 'fuel shutoff' detent into 'feather and fuel shutoff' position. The prop immediately feathered and performance improved. This action was practiced to determine if a pilot could [have mis-identified "fuel shutoff' detent from the 'feather and fuel shutoff' detent."

In the opinion of the two pilots that performed the tests on the above OV10, "...It is very possible...under conditions expressed above an OV-10 configured similarly as [the test airplane] or lighter and at a lower or same altitude could perform safely and accomplish a climb if appropriate emergency procedures [as] outlined in [the] OV-10...Pilot's Pocket Checklist are employed...if the same procedures are followed in the checklist on page 9, item, regarding jettison of 'external stores and hopper load, drag index would be reduced to 50. With reduced drag index, performance would exponentially increase." (See the DoS Memorandum and OV-10 Pilots Pocket Checklist, an attachment to this report).

ADDITIONAL INFORMATION

According to the OV-10 Pilots Pocket Checklist, page 9, item 3, under "Engine

failure/fire after take off," the following procedures are listed:

1. "Power levers...as required; maintain minimum safe single-engine speed." 2. "Landing gear...UP." 3. "External stores & Hopper load...Jettison, as required." 4. "Determine affected engine." 5. "Condition lever...feather and fuel shutoff (affected engine)." 6. "EMER FUEL SHUT OFF switch...SHUT OFF (affected engine)." 7. "Flaps...Up, as required (above 110 KIAS)." 8. "If fire persists...EJECT...If fire goes out...Land as soon as practicable." 9. "Attempt air start (if applicable)."

Due to the mission that was flown, it was common for the aircraft to take off over gross weight. The maximum gross weight for the accident aircraft was 15,000 pounds. On the accident flight the calculated gross weight was 15,500 pounds. After dumping the internal load the calculated weight at impact was 13,056 pounds.

The airplane was released to Mr. Jack Malavic, Standardization/Security Manager for the DOS, on February 10, 2000. The engine and propeller were released to Mr. Jack Malavic on May 3, 2000.

Pilot Information

Certificate:	Flight Instructor; Commercial	**Age:**	32, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane Single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	11/03/1999
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	10000 hours (Total, all aircraft), 106 hours (Total, this make and model), 9000 hours (Pilot In Command, all aircraft), 48 hours (Last 90 days, all aircraft), 21 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Rockwell	**Registration:**	N474AW
Model/Series:	OV-10D OV-10D	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Restricted	**Serial Number:**	155488
Landing Gear Type:	Retractable - Tricycle	**Seats:**	2
Date/Type of Last Inspection:	01/30/2000, Continuous Airworthiness	**Certified Max Gross Wt.:**	15000 lbs
Time Since Last Inspection:	10 Hours	**Engines:**	2 Turbo Prop
Airframe Total Time:	9122 Hours	**Engine Manufacturer:**	Garrett
ELT:	Installed, not activated	**Engine Model/Series:**	T76-420/421
Registered Owner:	US DEPARTMENT OF STATE	**Rated Power:**	1040 hp
Operator:	US DEPARTMENT OF STATE	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	, 0 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	0000	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Clear / 0 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	None / 0 ft agl	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	Calm /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	82°C
Precipitation and Obscuration:			
Departure Point:		**Type of Flight Plan Filed:**	Company VFR
Destination:		**Type of Clearance:**	None
Departure Time:	0900 EST	**Type of Airspace:**	

Airport Information

Airport:	LARANDIA ARMY BASE (NONE)	**Runway Surface Type:**	Gravel
Airport Elevation:	873 ft	**Runway Surface Condition:**	Dry
Runway Used:	35	**IFR Approach:**	None
Runway Length/Width:	5200 ft / 150 ft	**VFR Approach/Landing:**	Forced Landing

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	ALAN J YURMAN	**Report Date:**	09/06/2001
Additional Participating Persons:	JACK A MILAVIC; PATRICK AFB, FL PETER B BAKER; PHOENIX, AZ		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available here.