

**NATIONAL TRANSPORTATION SAFETY BOARD  
Office of Research and Engineering  
Vehicle Recorder Division  
Washington, D.C. 20594**



**GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION**

**ERA16FA311**

**By  
James Cash**

**WARNING**

The reader of this report is cautioned that the transcript of a cockpit voice recorder audio recording is not a precise science but is the best product possible from a Safety Board group investigative effort. The transcript or parts thereof, if taken out of context, could be misleading. The transcript should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the transcript as the sole source of information.

**NATIONAL TRANSPORTATION SAFETY BOARD**  
Vehicle Recorder Division

November 8, 2018

## **Cockpit Voice Recorder**

### **Group Chairman's Factual Report By James Cash**

#### **1. EVENT SUMMARY**

Location: Palm Bay Florida  
Date: September 06, 2016  
Aircraft: S-61N, Registration N805AR  
Operator: AAR Airlift Group  
NTSB Number: ERA16FA311

On September 6, 2016, about 1340 eastern daylight time, a Sikorsky S-61N, N805AR, was destroyed when it impacted a field under unknown circumstances near Palm Bay, Florida. The airline transport pilot, commercial copilot, and maintenance crewmember were fatally injured. The helicopter was registered to EP Aviation LLC and operated by AAR Airlift Group as a post-maintenance flight conducted under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and a company flight plan was filed for the local flight that departed Melbourne International Airport (MLB), Melbourne, Florida, at 1324.

A solid-state cockpit voice recorder (CVR) was sent to the National Transportation Safety Board (NTSB) Vehicle Recorder Division for evaluation. The CVR group meeting convened on October 11, 2016 and a partial transcript was prepared of the 2-hour, digital recording (see attached).

#### **2. GROUP**

Chairman: James Cash  
Electronics Engineer  
National Transportation Safety Board

Member: Chihoon Shin  
Aerospace Engineer  
National Transportation Safety Board

Member: Richard Wallace  
Pilot  
AAR Airlift Group

Member: Patrick Hempen  
Air Safety Investigator  
Federal Aviation Administration

Member:                   Stuart Drost  
                                  Lead Engineer  
                                  Sikorsky Helicopters

### **3. DETAILS OF INVESTIGATION**

The NTSB Vehicle Recorder Division received the following CVR:

Recorder Manufacturer/Model:   **Universal CVR-120**  
Recorder Serial Number:         **unk**

#### **3.1 CVR Carriage Requirements**

Per federal regulation, multiengine turbine powered aircraft with more than six passenger seats and requiring two pilots manufactured prior to April 7, 2010, and operated under 14 CFR 91/135, must be equipped with a CVR that records a minimum of the last 30 of aircraft operation; this is accomplished by recording over the oldest audio data. When the CVR is deactivated or removed from the airplane, it retains the most recent 30 minutes or 2 hours of CVR operation depending on the CVR model.

#### **3.2 Recorder Description**

This model CVR, the Universal CVR-120, is a solid state CVR that records 120 minutes of digital audio. Specifically, it contains a 2-channel recording of the last 120 minutes of operation and separately contains a 4-channel recording of the last 30 minutes of operation. The 120-minute portion of the recording is comprised of one channel that combines the three cockpit audio panel sources and a second channel that contains the cockpit area microphone (CAM) source. The 30-minute portion of the recording contains 4 channels of audio information: one channel for each of the flight crew, one channel for a cockpit observer, and one channel for the CAM.

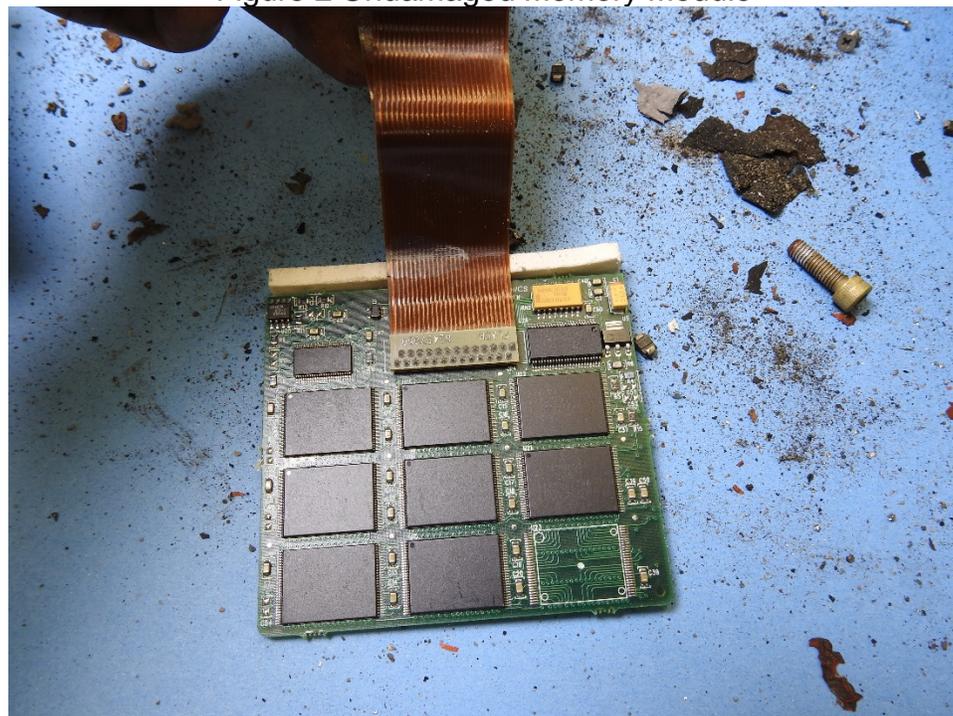
#### **3.3 Recorder Damage**

Upon arrival at the laboratory, it was evident that the exterior of the CVR had sustained significant heat and fire damage. The burned outer case was removed and the interior crash-protected case did not sustain any heat or fire damage (see Figures 1 and 2). The memory board within the crash-protected case was checked for heat or structural damage and none was found. The ribbon cable that connects the memory module to the main CVR circuit board had sustained fire and heat damage and was replaced. The ribbon cable and several support electronic components were replaced in order to get the memory to playback successfully. The digital audio was successfully downloaded from the crash-survivable memory unit using the manufacturer's supplied software and hardware.

FIGURE 1 Fire Damaged CVR Exterior Case



Figure 2 Undamaged Memory Module



### 3.4 Audio Recording Description

Each channel's audio quality is indicated in Table 1.<sup>1</sup> In this particular installation, channel numbers three and four of the 30-minute portion of the recording did not contain any audio information.

**Table 1: Audio Quality.**

| Channel Number | Content/Source       | Quality | Duration |
|----------------|----------------------|---------|----------|
| 1              | Mixed intercom/radio | Good    | 120 min  |
| 2              | Area Microphone      | Good    | 120 Min  |
| 1              | Mixed intercom/radio | Good    | 30 Min   |
| 2              | Area Microphone      | Good    | 30 Min   |
| 3              | N/A                  | N/A     | 30 Min   |
| 4              | N/A                  | N/A     | 30 Min   |

### 3.5 Timing and Correlation

Timing on the transcript was established by correlating the local time of the accident to the corresponding CVR event. The CVR events were offset to reflect the local eastern daylight time of the accident.

### 3.6 Description of Audio Events

A summary of events from the CVR are as follows: The 2hr and 4-minute recording began as the aircraft taxied and waited for takeoff for the 1<sup>st</sup> of 3 functional control maintenance flights. The recording continued uninterrupted during the approximately 26-minute flight. During the flight, the co-pilot conducted the takeoff and did most of the flying during the short flight. The aircraft landed and taxied back to its parking spot at 10:30 EDT. The recorder was off for approximately 40 minutes. The recorder started again at 11:18 EDT as the same crew was preparing for engine start for the 2<sup>nd</sup> maintenance flight. Engine start and takeoff were normal, again with the co-pilot doing most of the flying. The aircraft landed at 12:01 EDT after the approximately 30-minute flight. After main engines were shut down, the CVR continued to run as the Captain audibly calculated the aircraft's weight and center of gravity (CG) for the 3<sup>rd</sup> maintenance flight. This 9-minute ground portion of the CVR was transcribed. Electrical power was again removed from the CVR. The electrical power was restored to the CVR at 13:12 EDT as the same crew prepared for the 3<sup>rd</sup> maintenance flight. The engine and rotor system start was normal. The verbatim transcript starts at 13:22:11 EDT. The flight was cleared for takeoff at 13:23:13 EDT for the 3<sup>rd</sup> maintenance flight. The recording continues uninterrupted until it ends at 13:39:55 EDT.

<sup>1</sup> See attached CVR Quality Rating Scale.

## Attachment I

### CVR Quality Rating Scale

The levels of recording quality are characterized by the following traits of the cockpit voice recorder information:

|                          |   |
|--------------------------|---|
| <b>Excellent Quality</b> | Virtually all of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate only one or two words that were not intelligible. Any loss in the transcript is usually attributed to simultaneous cockpit/radio transmissions that obscure each other.   |
| <b>Good Quality</b>      | Most of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate several words or phrases that were not intelligible. Any loss in the transcript can be attributed to minor technical deficiencies or momentary dropouts in the recording system or to a large number of simultaneous cockpit/radio transmissions that obscure each other.  |
| <b>Fair Quality</b>      | The majority of the crew conversations were intelligible. The transcript that was developed may indicate passages where conversations were unintelligible or fragmented. This type of recording is usually caused by cockpit noise that obscures portions of the voice signals or by a minor electrical or mechanical failure of the CVR system that distorts or obscures the audio information.  |
| <b>Poor Quality</b>      | Extraordinary means had to be used to make some of the crew conversations intelligible. The transcript that was developed may indicate fragmented phrases and conversations and may indicate extensive passages where conversations were missing or unintelligible. This type of recording is usually caused by a combination of a high cockpit noise level with a low voice signal (poor signal-to-noise ratio) or by a mechanical or electrical failure of the CVR system that severely distorts or obscures the audio information. |
| <b>Unusable</b>          | Crew conversations may be discerned, but neither ordinary nor extraordinary means made it possible to develop a meaningful transcript of the conversations. This type of recording is usually caused by an almost total mechanical or electrical failure of the CVR system.   |

**Transcript of a Universal CVR-120 solid-state cockpit voice recorder, serial number unknown, installed on an AAR Airlift Group S-61N (N805AR), which crashed during a functional control maintenance flight in a field near Palm Bay Florida.**

## **LEGEND**

|             |   |
|-------------|---|
| <b>CAM</b>  | Cockpit area microphone voice or sound source                     |
| <b>INT</b>  | Flight crew intercom voice or sound source                        |
| <b>RDO</b>  | Radio transmissions from accident aircraft                        |
| <b>TWR</b>  | Radio transmission from the ATC location airport tower controller |
| <b>TCAS</b> | Traffic Collision Avoidance System sound source                   |
| <b>-1</b>   | Voice identified as the captain/PIC/pilot                         |
| <b>-2</b>   | Voice identified as the first officer/SIC/co-pilot                |
| <b>-3</b>   | Voice identified as the flight mechanic                           |
| <b>-?</b>   | Voice unidentified  |
| <b>*</b>    | Unintelligible word   |
| <b>#</b>    | Expletive   |
| <b>@</b>    | Non-pertinent word  |
| <b>( )</b>  | Questionable insertion  |
| <b>[ ]</b>  | Editorial insertion   |

Note 1: Times are expressed in eastern daylight time (EDT).

Note 2: Generally, only radio transmissions to and from the accident aircraft were transcribed.

Note 3: Words shown with excess vowels, letters, or drawn out syllables are a phonetic representation of the words as spoken.

Note 4: A non-pertinent word, where noted, refers to a word not directly related to the operation, control or condition of the aircraft.

| <u>TIME and SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS CONTENT</u>               | <u>TIME and SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS CONTENT</u> |
|------------------------|---|------------------------|--|
| 09:58:05               | [start of recording]                                      |                        |  |
| 10:00:39               | [takeoff of 1 <sup>st</sup> flight]                       |                        |  |
| 10:26:51               | [touchdown of 1 <sup>st</sup> flight]                     |                        |  |
| 10:31:00               | [rotor stops after 1 <sup>st</sup> flight]                |                        |  |
| 11:21:00               | [rotor starts at the beginning of 2 <sup>nd</sup> flight] |                        |  |
| 11:30:36               | [takeoff of 2 <sup>nd</sup> flight ]                      |                        |  |
| 12:01:53               | [landing of 2 <sup>nd</sup> flight]                       |                        |  |
| 12:05:02               |   |                        |  |
| <b>INT-1</b>           | [start of transcript] let's see                           |                        |  |
| 12:05:04               |   |                        |  |
| <b>INT-2</b>           | forty eight oh one point seven                            |                        |  |
| 12:05:13               |   |                        |  |
| <b>INT-1</b>           | it's half way we'll call it eight                         |                        |  |
| 12:05:17               |   |                        |  |
| <b>INT-1</b>           | sixteen and six thirty twenty two hundred pounds          |                        |  |
| 12:05:25               |   |                        |  |
| <b>INT-1</b>           | six fifty again okay                                      |                        |  |
| 12:05:26               |   |                        |  |
| <b>INT-1</b>           | ECL's coming off  |                        |  |
| 12:05:27               |   |                        |  |
| <b>INT-2</b>           | boost pumps - rotor brake                                 |                        |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>  | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|--|----------------------------------|--|
| 12:05:45                         |  |                                  |  |
| <b>INT-2</b>                     | rotor brake  |                                  |  |
| 12:05:57                         |  |                                  |  |
| <b>CAM</b>                       | [rotor stops at the end of 2 <sup>nd</sup> flight]   |                                  |  |
| 12:06:40                         |  |                                  |  |
| <b>CAM-1</b>                     | all right switches   |                                  |  |
| 12:06:46                         |  |                                  |  |
| <b>CAM-1</b>                     | we'll hold on that let those things cook a little bit now let's see what we gotta do for this next one   |                                  |  |
| 12:06:55                         |  |                                  |  |
| <b>CAM-2</b>                     | there's two ten - clear one  |                                  |  |
| 12:06:57                         |  |                                  |  |
| <b>CAM-1</b>                     | clear one  |                                  |  |
| 12:07:16                         |  |                                  |  |
| <b>CAM-2</b>                     | clear on two   |                                  |  |
| 12:07:17                         |  |                                  |  |
| <b>CAM-?</b>                     | roger  |                                  |  |
| 12:07:44                         |  |                                  |  |
| <b>CAM-1</b>                     | five fifty in the center-  |                                  |  |
| 12:07:53                         |  |                                  |  |
| <b>CAM-1</b>                     | eight hundred in the aft   |                                  |  |
| 12:08:00                         |  |                                  |  |
| <b>CAM-1</b>                     | alright we need ah - forward actually forward center of gravity of two fifty eight - let's come back here to ah  |                                  |  |
| 12:08:16                         |  |                                  |  |
| <b>CAM-1</b>                     | we'll delete that just to see what that does to it two fifty seven point five - problem is that we gotta have two- seventeen hundred pounds on board we're down to fifteen |                                  |  |
| 12:08:42                         |  |                                  |  |
| <b>CAM-1</b>                     | okay let's see   |                                  |  |

| <u>TIME and SOURCE</u>   | <u>INTRA-COCKPIT COMMUNICATIONS CONTENT</u>   | <u>TIME and SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS CONTENT</u> |
|--------------------------|---|------------------------|--|
| 12:09:13<br><b>CAM-1</b> | let's see what it says here about we need to be at seventeen hundred pounds I need two thousand pounds somewhere on this aircraft |                        |  |
| 12:09:29<br><b>CAM-1</b> | *   |                        |  |
| 12:09:38<br><b>CAM-1</b> | one two three - four - five not six let's seat six *  |                        |  |
| 12:10:00<br><b>CAM-1</b> | didn't take it  |                        |  |
| 12:10:12<br><b>CAM-1</b> | puts me way out of CG forward that's not gunna work got to have it further aft  |                        |  |
| 12:10:34<br><b>CAM-?</b> | hay @ you got one more flight this morning don't ya?  |                        |  |
| 12:10:36<br><b>CAM-1</b> | yeah  |                        |  |
| 12:10:37<br><b>CAM-?</b> | okay  |                        |  |
| 12:10:41<br><b>CAM-?</b> | are you guys going to lunch first   |                        |  |
| 12:10:43<br><b>CAM-1</b> | no lunch who does lunch   |                        |  |
| 12:10:51<br><b>CAM-1</b> | actually I need four hundred pounds more to get my forward  |                        |  |
| 12:10:55<br><b>CAM-?</b> | have a couple of cheese burgers and you'll have that  |                        |  |
| 12:10:59<br><b>CAM-1</b> | ah you're dreaming we actually need to move it forward of the door  |                        |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>  | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|--|----------------------------------|--|
| 12:11:06                         |  |                                  |  |
| <b>CAM-1</b>                     | about where seat ten is  |                                  |  |
| 12:11:09                         |  |                                  |  |
| <b>CAM-?</b>                     | seat ten?  |                                  |  |
| 12:11:08                         |  |                                  |  |
| <b>CAM-1</b>                     | yup I need to move the weight up to there you can  |                                  |  |
| 12:11:14                         |  |                                  |  |
| <b>CAM-?</b>                     | understand seat ten you want it centered on seat ten or further aft than seat ten                  |                                  |  |
| 12:11:15                         |  |                                  |  |
| <b>CAM-1</b>                     | yup  |                                  |  |
| 12:11:17                         |  |                                  |  |
| <b>CAM-1</b>                     | right in that general area   |                                  |  |
| 12:11:23                         |  |                                  |  |
| <b>CAM-1</b>                     | if we had sixteen hundred there let's see what that does for us                                    |                                  |  |
| 12:11:30                         |  |                                  |  |
| <b>CAM-1</b>                     | gets me to sixteen four  |                                  |  |
| 12:11:25                         |  |                                  |  |
| <b>CAM-1</b>                     | you just count back one two three four five about ten is where it's at yup                         |                                  |  |
| 12:12:04                         |  |                                  |  |
| <b>CAM-1</b>                     | but I need about four hundred pounds more in that canister   |                                  |  |
| 12:12:08                         |  |                                  |  |
| <b>CAM-?</b>                     | yes sir *  |                                  |  |
| 12:12:20                         |  |                                  |  |
| <b>CAM-1</b>                     | all right  |                                  |  |
| 12:12:53                         |  |                                  |  |
| <b>CAM-1</b>                     | yup that's what I need that will give me a takeoff weight of seventeen thousand - zero twenty nine |                                  |  |

| <u>TIME and SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS CONTENT</u>  | <u>TIME and SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS CONTENT</u>  |
|------------------------|--|------------------------|---|
| 12:13:08               |  |                        |   |
| <b>CAM-1</b>           | two fifty five three * fifty eight point nine - two seven  |                        |   |
| 12:13:28               |  |                        |   |
| <b>CAM-1</b>           | two seventy eight six  |                        |   |
| 12:14:01               | [power interruption to CVR]  |                        |   |
| 13:17:00               |  |                        |   |
| <b>CAM</b>             | [rotor starts turning at the beginning of 3 <sup>rd</sup> flight]  |                        |   |
| 13:22:11               |  |                        |   |
| <b>INT-1</b>           | before takeoff checks tail wheel parking brake anti-ice systems are all off - boost pumps are coming on fuel panel is noted engine transmission and hydraulics are all within nominal ranges warning panel lights are all extinguished cabin passengers transponder set chocks time noted AFCS ECL to one oh six |                        |   |
| 13:22:44               |  |                        |   |
| <b>INT-1</b>           | there's one oh six note our time here  |                        |   |
| 13:22:55               |  |                        |   |
| <b>INT-1</b>           | ready?   |                        |   |
| 13:22:56               |  |                        |   |
| <b>INT-2</b>           | ready  |                        |   |
|                        |  | 13:23:03               |   |
|                        |  | <b>RDO-1</b>           | Melbourne tower November eight zero five alpha romeo helicopter holding short of kilo kilo two information papa VFR departure southwest |
|                        |  | 13:23:13               |   |
|                        |  | <b>TWR</b>             | November five alpha romeo Melbourne can you depart to the east I'll get you turned south bound as soon as I can                         |

TIME and  
SOURCE

INTRA-COCKPIT COMMUNICATIONS  
CONTENT

13:23:28  
**INT-2** power's comin' in coming up  
13:23:31  
**INT-2** ten feet again?  
13:23:36  
**INT-1** ten foot power checked  
13:23:40  
**INT-1** and you're looking good  
13:23:42  
**INT-1** \* start your turn  
13:23:53  
**INT-1** level acceleration at forty five  
13:23:59  
**INT-1** start your climb  
13:24:03  
**INT-1** gently  
13:24:04  
**INT-2** yeah  
13:24:08  
**INT-1** heading zero nine zero

TIME and  
SOURCE

AIR-GROUND COMMUNICATIONS  
CONTENT

13:23:18  
**RDO-1** eight zero five alpha romeo wilco  
13:23:20  
**TWR** eight zero five alpha romeo taxiway kilo  
kilo two you are cleared for takeoff east  
bound I'll get you turned as soon as I  
can  
13:23:26  
**RDO-1** roger cleared for takeoff east bound

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>       | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|---|----------------------------------|--|
| 13:24:28                         |   |                                  |  |
| <b>INT-1</b>                     | start your turn   |                                  |  |
| 13:24:29                         |   |                                  |  |
| <b>INT-2</b>                     | clear right   |                                  |  |
| 13:24:31                         |   |                                  |  |
| <b>INT-1</b>                     | make your climb to fifteen hundred feet                     |                                  |  |
| 13:24:33                         |   |                                  |  |
| <b>INT-2</b>                     | roger   |                                  |  |
| 13:24:33                         |   |                                  |  |
| <b>INT-1</b>                     | we're gunna turn to a heading of one eight zero             |                                  |  |
| 13:24:35                         |   |                                  |  |
| <b>INT-2</b>                     | roger   |                                  |  |
| 13:24:46                         |   |                                  |  |
| <b>INT-2</b>                     | fifteen hundred   |                                  |  |
| 13:24:50                         |   |                                  |  |
| <b>INT-1</b>                     | continue your climb   |                                  |  |
| 13:24:52                         |   |                                  |  |
| <b>INT-2</b>                     | continuing  |                                  |  |
| 13:24:58                         |   |                                  |  |
| <b>INT-1</b>                     | ten degrees to go   |                                  |  |
| 13:25:04                         |   |                                  |  |
| <b>INT-2</b>                     | one eight zero  |                                  |  |
| 13:25:06                         |   |                                  |  |
| <b>INT-1</b>                     | roger - ninety knots climbing to fifteen                    |                                  |  |
| 13:25:13                         |   |                                  |  |
| <b>INT-2</b>                     | still got a lot of forward cyclic on this thing             |                                  |  |
| 13:25:16                         |   |                                  |  |
| <b>INT-1</b>                     | yup   |                                  |  |
| 13:25:18                         |   |                                  |  |
| <b>INT-1</b>                     | that's cause we got it trimmed forward - we can trim it aft |                                  |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>                       | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|---|----------------------------------|--|
| 13:25:24<br><b>INT-1</b>         | how does that feel?   |                                  |  |
| 13:25:25<br><b>INT-2</b>         | it's better   |                                  |  |
| 13:25:33<br><b>INT-1</b>         | just follow this road south this is Babcock                                 |                                  |  |
| 13:25:36<br><b>INT-2</b>         | okay  |                                  |  |
| 13:25:47<br><b>INT-1</b>         | five hundred feet to go   |                                  |  |
| 13:26:29<br><b>INT-1</b>         | two- two hundred feet to go   |                                  |  |
| 13:26:31<br><b>INT-2</b>         | roger   |                                  |  |
| 13:26:33<br><b>TCAS</b>          | (sound of two beeps) traffic  |                                  |  |
| 13:27:34<br><b>INT-1</b>         | as soon as we clear his airspace we'll turn to our heading                  |                                  |  |
| 13:27:37<br><b>INT-2</b>         | okay  |                                  |  |
| 13:27:38<br><b>INT-1</b>         | we'll turn to our needles   |                                  |  |
| 13:27:45<br><b>INT-1</b>         | okay level off checks   |                                  |  |
| 13:27:49<br><b>INT-1</b>         | after takeoff ECL's set one oh three we'll get those back here a little bit |                                  |  |
| 13:28:09<br><b>INT-1</b>         | okay set one oh three   |                                  |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>  | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|--|----------------------------------|--|
| 13:28:12                         |  |                                  |  |
| <b>INT-1</b>                     | ground inverter is identified coming off   |                                  |  |
| 13:28:15                         |  |                                  |  |
| <b>INT-1</b>                     | external lights are as required  |                                  |  |
| 13:28:17                         |  |                                  |  |
| <b>INT-1</b>                     | engine transmission instruments checked all within nominal ranges  |                                  |  |
| 13:28:21                         |  |                                  |  |
| <b>INT-1</b>                     | AFCS pitch normal your discretion blue sky tracker's on don't know if it's functioning or not because I can't read the silly screen anyway |                                  |  |
| 13:28:38                         |  |                                  |  |
| <b>INT-1</b>                     | alright on your needles turn to your needles   |                                  |  |
| 13:28:41                         |  |                                  |  |
| <b>INT-2</b>                     | roger cleared right or coming right  |                                  |  |
| 13:28:44                         |  |                                  |  |
| <b>INT-1</b>                     | it's   |                                  |  |
| 13:29:21                         |  |                                  |  |
| <b>INT-1</b>                     | course * center up   |                                  |  |
| 13:29:28                         |  |                                  |  |
| <b>INT-1</b>                     | can you see the compound out there that light green area   |                                  |  |
| 13:29:30                         |  |                                  |  |
| <b>INT-2</b>                     | yup  |                                  |  |
| 13:29:31                         |  |                                  |  |
| <b>INT-1</b>                     | that's where we're headed  |                                  |  |
| 13:29:32                         |  |                                  |  |
| <b>INT-2</b>                     | okay   |                                  |  |
| 13:29:36                         |  |                                  |  |
| <b>INT-1</b>                     | for the first part of this check   |                                  |  |

| <u>TIME and SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS CONTENT</u>   | <u>TIME and SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS CONTENT</u> |
|------------------------|---|------------------------|--|
| 13:29:47               |   |                        |  |
| <b>INT-1</b>           | is the hovering turn part   |                        |  |
| 13:29:58               |   |                        |  |
| <b>INT-2</b>           | anything in here on the GPS or anything gives you a wind indication   |                        |  |
| 13:30:03               |   |                        |  |
| <b>INT-1</b>           | give you a what?  |                        |  |
| 13:30:04               |   |                        |  |
| <b>INT-2</b>           | wind indication   |                        |  |
| 13:30:06               |   |                        |  |
| <b>INT-1</b>           | nope  |                        |  |
| 13:30:18               |   |                        |  |
| <b>INT-2</b>           | winds have been from behind us already there so I'll make left traffic and come in land back to the east                        |                        |  |
| 13:30:23               |   |                        |  |
| <b>INT-1</b>           | yeah that'll be fine  |                        |  |
| 13:30:47               |   |                        |  |
| <b>INT-2</b>           | so is this gunna be a subdivision or something out here   |                        |  |
| 13:30:50               |   |                        |  |
| <b>INT-1</b>           | at one point it was but they didn't get their environmental impact study done so they placed like a fifty year moratorium on it |                        |  |
| 13:30:57               |   |                        |  |
| <b>INT-2</b>           | whoa  |                        |  |
| 13:31:03               |   |                        |  |
| <b>INT-2</b>           | okay I'm gunna start a descent I'm gunna set us up in a left traffic here   |                        |  |
| 13:31:07               |   |                        |  |
| <b>INT-1</b>           | okay  |                        |  |
| 13:31:10               |   |                        |  |
| <b>INT-2</b>           | we'll land back over there where we were - earlier  |                        |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>   | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|---|----------------------------------|--|
| 13:31:14                         |   |                                  |  |
| <b>INT-1</b>                     | yeah that'll work - before landing checks   |                                  |  |
| 13:31:21                         |   |                                  |  |
| <b>INT-1</b>                     | ah let's see fuel panel's checked fuel's noted  |                                  |  |
| 13:31:25                         |   |                                  |  |
| <b>INT-1</b>                     | I'll transfer some of this fuel   |                                  |  |
| 13:31:28                         |   |                                  |  |
| <b>INT-1</b>                     | engine transmission hydraulic instruments all within nominal ranges parking brake released tailwheel's locked gear's down and locked ECL's set at one oh three cabin and passengers |                                  |  |
| 13:31:37                         |   |                                  |  |
| <b>INT-3</b>                     | ready   |                                  |  |
| 13:31:38                         |   |                                  |  |
| <b>INT-1</b>                     | all righty  |                                  |  |
| 13:31:50                         |   |                                  |  |
| <b>INT-2</b>                     | be a pretty sweet place right there   |                                  |  |
| 13:31:53                         |   |                                  |  |
| <b>INT-1</b>                     | yup   |                                  |  |
| 13:32:06                         |   |                                  |  |
| <b>INT-2</b>                     | there's some ATV's out there  |                                  |  |
| 13:32:09                         |   |                                  |  |
| <b>INT-1</b>                     | alright - that may impact our ability to use that area  |                                  |  |
| 13:32:19                         |   |                                  |  |
| <b>INT-2</b>                     | coming left   |                                  |  |
| 13:32:20                         |   |                                  |  |
| <b>INT-1</b>                     | clear   |                                  |  |
| 13:32:25                         |   |                                  |  |
| <b>INT-1</b>                     | go down to the south end down there   |                                  |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>                                      | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|--|----------------------------------|--|
| 13:32:28                         |  |                                  |  |
| <b>INT-2</b>                     | okay   |                                  |  |
| 13:32:28                         |  |                                  |  |
| <b>INT-1</b>                     | where we were before the ATV's as long as they stay up here north it shouldn't be a factor |                                  |  |
| 13:32:47                         |  |                                  |  |
| <b>INT-2</b>                     | I do have the wires  |                                  |  |
| 13:32:49                         |  |                                  |  |
| <b>INT-1</b>                     | wires and there's a car on that road out there   |                                  |  |
| 13:32:52                         |  |                                  |  |
| <b>INT-2</b>                     | visual   |                                  |  |
| 13:33:07                         |  |                                  |  |
| <b>INT-1</b>                     | just kind a cut through here the ATV guys are over here now                                |                                  |  |
| 13:33:27                         |  |                                  |  |
| <b>INT-2</b>                     | bet you there's all kinds of nefarious stuff goes on out here                              |                                  |  |
| 13:33:30                         |  |                                  |  |
| <b>INT-1</b>                     | oh yeah this is where the high school kids come to play                                    |                                  |  |
| 13:33:33                         |  |                                  |  |
| <b>INT-2</b>                     | yup  |                                  |  |
| 13:33:35                         |  |                                  |  |
| <b>INT-1</b>                     | see all kinds of burn out marks and skid tires   |                                  |  |
| 13:33:38                         |  |                                  |  |
| <b>INT-2</b>                     | yup  |                                  |  |
| 13:33:39                         |  |                                  |  |
| <b>INT-1</b>                     | camp fire rings  |                                  |  |
| 13:33:43                         |  |                                  |  |
| <b>INT-1</b>                     | come out here under goggles at night it's all exciting                                     |                                  |  |
| 13:33:48                         |  |                                  |  |
| <b>INT-2</b>                     | ha yeah  |                                  |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>                  | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|--|----------------------------------|--|
| 13:33:54                         |  |                                  |  |
| <b>INT-1</b>                     | alright - you got the flag right there                                 |                                  |  |
| 13:33:58                         |  |                                  |  |
| <b>INT-2</b>                     | yeah   |                                  |  |
| 13:34:18                         |  |                                  |  |
| <b>INT-1</b>                     | alright back up to that thirty foot hover more or less                 |                                  |  |
| 13:34:36                         |  |                                  |  |
| <b>INT-1</b>                     | alright got some good reference points                                 |                                  |  |
| 13:34:39                         |  |                                  |  |
| <b>INT-1</b>                     | why don't you go ahead and turn the AFCS off                           |                                  |  |
| 13:34:42                         |  |                                  |  |
| <b>INT-2</b>                     | okay   |                                  |  |
| 13:34:44                         |  |                                  |  |
| <b>INT-1</b>                     | and we'll then go to the left  |                                  |  |
| 13:34:49                         |  |                                  |  |
| <b>INT-2</b>                     | I'll expect to see --  |                                  |  |
| 13:34:49                         |  |                                  |  |
| <b>INT-1</b>                     | let's start here it says hovering turn three hundred and sixty degrees |                                  |  |
| 13:34:53                         |  |                                  |  |
| <b>INT-2</b>                     | man again  |                                  |  |
| 13:34:54                         |  |                                  |  |
| <b>INT-1</b>                     | yup  |                                  |  |
| 13:34:55                         |  |                                  |  |
| <b>INT-2</b>                     | alright  |                                  |  |
| 13:34:57                         |  |                                  |  |
| <b>INT-2</b>                     | tail clear right   |                                  |  |
| 13:34:59                         |  |                                  |  |
| <b>INT-1</b>                     | clear  |                                  |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>           | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|---|----------------------------------|--|
| 13:34:59                         |   |                                  |  |
| <b>INT-3</b>                     | tail clear right  |                                  |  |
| 13:35:11                         |   |                                  |  |
| <b>INT-2</b>                     | she does not want to do it                                      |                                  |  |
| 13:35:13                         |   |                                  |  |
| <b>INT-1</b>                     | ah she'll get around there                                      |                                  |  |
| 13:35:16                         |   |                                  |  |
| <b>INT-1</b>                     | there she goes  |                                  |  |
| 13:35:18                         |   |                                  |  |
| <b>INT-1</b>                     | pressure - counter pressure keep it from getting out of control |                                  |  |
| 13:35:38                         |   |                                  |  |
| <b>INT-1</b>                     | alright let's try one the other direction                       |                                  |  |
| 13:35:39                         |   |                                  |  |
| <b>INT-2</b>                     | okay  |                                  |  |
| 13:35:40                         |   |                                  |  |
| <b>INT-1</b>                     | back up to thirty feet  |                                  |  |
| 13:35:43                         |   |                                  |  |
| <b>INT-2</b>                     | tail's clear left   |                                  |  |
| 13:35:44                         |   |                                  |  |
| <b>INT-3</b>                     | clear left  |                                  |  |
| 13:36:04                         |   |                                  |  |
| <b>INT-1</b>                     | catch it  |                                  |  |
| 13:36:12                         |   |                                  |  |
| <b>INT-1</b>                     | alrighty - any problems with that?                              |                                  |  |
| 13:36:14                         |   |                                  |  |
| <b>INT-2</b>                     | nope  |                                  |  |
| 13:36:16                         |   |                                  |  |
| <b>INT-1</b>                     | alright   |                                  |  |

| <u>TIME and SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS CONTENT</u>  | <u>TIME and SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS CONTENT</u> |
|------------------------|--|------------------------|--|
| 13:36:39               |  |                        |  |
| <b>INT-1</b>           | alright my controls  |                        |  |
| 13:36:40               |  |                        |  |
| <b>INT-2</b>           | you have the controls  |                        |  |
| 13:36:41               |  |                        |  |
| <b>INT-1</b>           | I have the aircraft  |                        |  |
| 13:36:43               |  |                        |  |
| <b>INT-1</b>           | alright - now the fun begins   |                        |  |
| 13:36:53               |  |                        |  |
| <b>INT-1</b>           | clear us back there bill because we're gunna be coming back                          |                        |  |
| 13:36:59               |  |                        |  |
| <b>INT-1</b>           | gunna come up in altitude a little bit   |                        |  |
| 13:37:13               |  |                        |  |
| <b>INT-1</b>           | alright - about there two hundred feet ought to do it somewhere in that neighborhood |                        |  |
| 13:37:20               |  |                        |  |
| <b>INT-1</b>           | alright we're comin backwards Bill   |                        |  |
| 13:37:22               |  |                        |  |
| <b>INT-3</b>           | okay you're cleared back   |                        |  |
| 13:37:33               |  |                        |  |
| <b>INT-1</b>           | airspeed going from there looking for twenty knots                                   |                        |  |
| 13:37:35               |  |                        |  |
| <b>INT-2</b>           | fifteen  |                        |  |
| 13:37:39               |  |                        |  |
| <b>INT-1</b>           | the groundspeed  |                        |  |
| 13:37:40               |  |                        |  |
| <b>INT-2</b>           | there's twenty right there   |                        |  |

| <u>TIME and SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS CONTENT</u> |
|------------------------|---|
| 13:37:41               |   |
| <b>INT-1</b>           | alright                                     |
| 13:37:42               |   |
| <b>INT-C</b>           | [Sound of two thumps]                       |
| 13:37:42               |   |
| <b>INT-2</b>           | how much *                                  |
| 13:37:43               |   |
| <b>INT-1</b>           | groundspeed                                 |
| 13:37:44               |   |
| <b>INT-C</b>           | [sound of two thumps]                       |
| 13:37:44               |   |
| <b>INT-2</b>           | thirty one                                  |
| 13:37:44               |   |
| <b>INT-1</b>           | *   |
| 13:37:45               |   |
| <b>INT-1</b>           | that's not good                             |
| 13:37:48               |   |
| <b>INT-2</b>           | do you want the AFCS back on?               |
| 13:37:50               |   |
| <b>INT-1</b>           | yup bring the AFCS back on                  |
| 13:37:51               |   |
| <b>INT-2</b>           | the AFCS's on                               |
| 13:37:54               |   |
| <b>INT-2</b>           | oh compressor stall in there                |
| 13:37:56               |   |
| <b>INT-1</b>           | yup   |
| 13:38:00               |   |
| <b>INT-1</b>           | alright Bill we're headed home              |
| 13:38:02               |   |
| <b>INT-2</b>           | I didn't notice the T-five                  |

| <u>TIME and SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS CONTENT</u> |
|------------------------|--|
|------------------------|--|

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>                                     | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|---|----------------------------------|--|
| 13:38:05                         |   |                                  |  |
| <b>INT-1</b>                     | I didn't see it either but-   |                                  |  |
| 13:38:07                         |   |                                  |  |
| <b>INT-1</b>                     | I got the compressor stall  |                                  |  |
| 13:38:08                         |   |                                  |  |
| <b>INT-2</b>                     | yup   |                                  |  |
| 13:38:09                         |   |                                  |  |
| <b>INT-2</b>                     | number two is on six hundred number one's reading five<br>twenty five so                  |                                  |  |
| 13:38:15                         |   |                                  |  |
| <b>INT-2</b>                     | correlates with the torque though   |                                  |  |
| 13:38:22                         |   |                                  |  |
| <b>INT-1</b>                     | tell you what   |                                  |  |
| 13:38:26                         |   |                                  |  |
| <b>INT-1</b>                     | we're gunna come back we'll try this once going the other<br>way if that's alright Bill   |                                  |  |
| 13:38:30                         |   |                                  |  |
| <b>INT-3</b>                     | that's fine with me   |                                  |  |
| 13:38:32                         |   |                                  |  |
| <b>INT-1</b>                     | we'll try it going with - with the wind off the nose ta see if<br>that makes a difference |                                  |  |
| 13:38:45                         |   |                                  |  |
| <b>INT-1</b>                     | alright right in here we'll come to a hover   |                                  |  |
| 13:38:48                         |   |                                  |  |
| <b>INT-2</b>                     | okay you want to keep the AFCS on or do you want it off                                   |                                  |  |
| 13:38:51                         |   |                                  |  |
| <b>INT-1</b>                     | ah we'll turn it off here   |                                  |  |
| 13:38:55                         |   |                                  |  |
| <b>INT-2</b>                     | nope  |                                  |  |

| <u>TIME and</u><br><u>SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS</u><br><u>CONTENT</u>  | <u>TIME and</u><br><u>SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS</u><br><u>CONTENT</u> |
|----------------------------------|--|----------------------------------|--|
| 13:38:58                         |  |                                  |  |
| <b>INT-1</b>                     | ah we'll get stabilized in a hover                     |                                  |  |
| 13:39:22                         |  |                                  |  |
| <b>INT-1</b>                     | alright coming back                                    |                                  |  |
| 13:39:24                         |  |                                  |  |
| <b>INT-3</b>                     | clear back   |                                  |  |
| 13:39:31                         |  |                                  |  |
| <b>INT-1</b>                     | all we gotta do is get a little early                  |                                  |  |
| 13:39:33                         |  |                                  |  |
| <b>INT-1</b>                     | watch that groundspeed                                 |                                  |  |
| 13:39:35                         |  |                                  |  |
| <b>INT-1</b>                     | start showing about twenty knots that's what we want   |                                  |  |
| 13:39:37                         |  |                                  |  |
| <b>INT-2</b>                     | it's fifteen right now - seventeen                     |                                  |  |
| 13:39:39                         |  |                                  |  |
| <b>INT-1</b>                     | alright  |                                  |  |
| 13:39:40                         |  |                                  |  |
| <b>INT-2</b>                     | nineteen there's twenty                                |                                  |  |
| 13:39:42                         |  |                                  |  |
| <b>INT-1</b>                     | and from the cyclic tip I got an additional two inches |                                  |  |
| 13:39:45                         |  |                                  |  |
| <b>INT-1</b>                     | that'll work   |                                  |  |
| 13:39:46                         |  |                                  |  |
| <b>CAM</b>                       | [change in background sound]                           |                                  |  |
| 13:39:47                         |  |                                  |  |
| <b>INT-3</b>                     | compressor stall                                       |                                  |  |
| 13:39:48                         |  |                                  |  |
| <b>INT-2</b>                     | AFCS is back on  |                                  |  |

| <u>TIME and SOURCE</u> | <u>INTRA-COCKPIT COMMUNICATIONS CONTENT</u> |
|------------------------|---|
| 13:39:48               |   |
| <b>CAM</b>             | [change in background noise]                |
| 13:39:49               |   |
| <b>INT-1</b>           | #   |
| 13:39:50               |   |
| <b>INT-1</b>           | it's going down                             |
| 13:39:51               |   |
| <b>INT-2</b>           | # #   |
| 13:39:53               |   |
| <b>INT-1</b>           | oh crap                                     |
| 13:39:54               |   |
| <b>INT-2</b>           | #   |
| 13:39:54               |   |
| <b>INT-2</b>           | [sound of grunt]                            |
| 13:39:55               |   |
|                        | end of transcript                           |
|                        | end of recording                            |

| <u>TIME and SOURCE</u> | <u>AIR-GROUND COMMUNICATIONS CONTENT</u> |
|------------------------|--|
|------------------------|--|