National Transportation Safety Board

Office of Aviation Safety

Washington, D.C. 20594-2000

December 24, 2015

Summary of Key Events

CEN15FA034

A. Accident

Location: Wichita, KS Mid-Continent Airport
Date: October 30, 2014
Time: 0948 CDT
Vehicle: Raytheon Super King Air 200, BB1686, N52SZ,
Engine: Pratt Whitney PT-6A-42, 850 SHP
Propeller: Hartzell Propeller, Inc.

B. Investigators

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C. Summary

On October 30, 2014, about 0948 central daylight time, a Raytheon Aircraft Company King Air B200, N52SZ, operated by a private individual, was destroyed shortly after takeoff when it impacted a building at the Wichita Mid-Continent Airport (KICT). The private pilot sustained fatal injuries. Visual meteorological conditions prevailed for the personal flight conducted under Title 14 Code of Federal Regulations Part 91. The flight originated from KICT and was destined for Mena Intermountain Municipal Airport (KMEZ), Mena, AR.

The airplane was taking off from Runway 1R. Shortly after takeoff, the pilot reported that power was lost in the left engine. Witnesses reported that the airplane started turning left, levelled wings briefly, and then began a descending left bank. The airplane descended rapidly and hit the east wall and roof of the Cessna Citation Learning Center, operated by Flight Safety International, Inc. The impact and post-crash fire resulted in three additional fatalities inside a flight simulator in the building. Four flight simulators in the north end of the building were substantially damaged.

The airplane was powered by two Pratt Whitney PT-6A turboprop engines.

D. Discussion

Three data sets were used to create the summary data below. The first data set used spectrum data from the cockpit voice recorder (CVR) to establish the initial takeoff time history. The CVR data provided an overview of the entire flight. The second data set was created by using a simple simulation routine. The simulation started at the point of liftoff and continued to impact. The simulation input data was modified so that the calculated motion matched the key event times and positions after liftoff. The third data set used surveillance video (see Video Study) to define ground speeds and airplane positions at key events near the end of the flight.

1.0 CVR Spectrum Data

CVR sound spectrum data provided several signatures useful in reconstructing the flight (see Image 1). The various lines are created by frequencies recorded on the CVR area microphone. The varying colors represent increasing energy in the data. Less energy is represented by the blue colors, increasing energy progresses through the red colors to the yellow colors.

The bright yellow line across the graph is consistent with the propeller blade tip sounds and propeller rpm. At 120 seconds, the split in the yellow line is consistent with one propeller slowing down. The yellow line disappears when the energy drops below a detectable level.

The bright vertical yellow line to the right is consistent with the high energy sound attributed to impact with the building.

The series of diagonal lines are consistent with increasing ground speed. Several of the lines are harmonic signatures created by a primary signature. The primary signature was not identified. Typically, the signature is created by a nose wheel rolling across a grooved runway. The signature stops when the nose wheel is lifted off the runway. The lowest signature observed is consistent with the other signatures. However, the signature not stop at 110 seconds but started decreasing. The rolling signatures do not appear until 95 seconds and/or 55 Hz. The lines are extrapolated and converge at 85 seconds and 0 Hz.

The propeller signatures are observed starting at 77 seconds and 85 Hz. One propeller signature line is extrapolated to 72 seconds and 0 Hz.

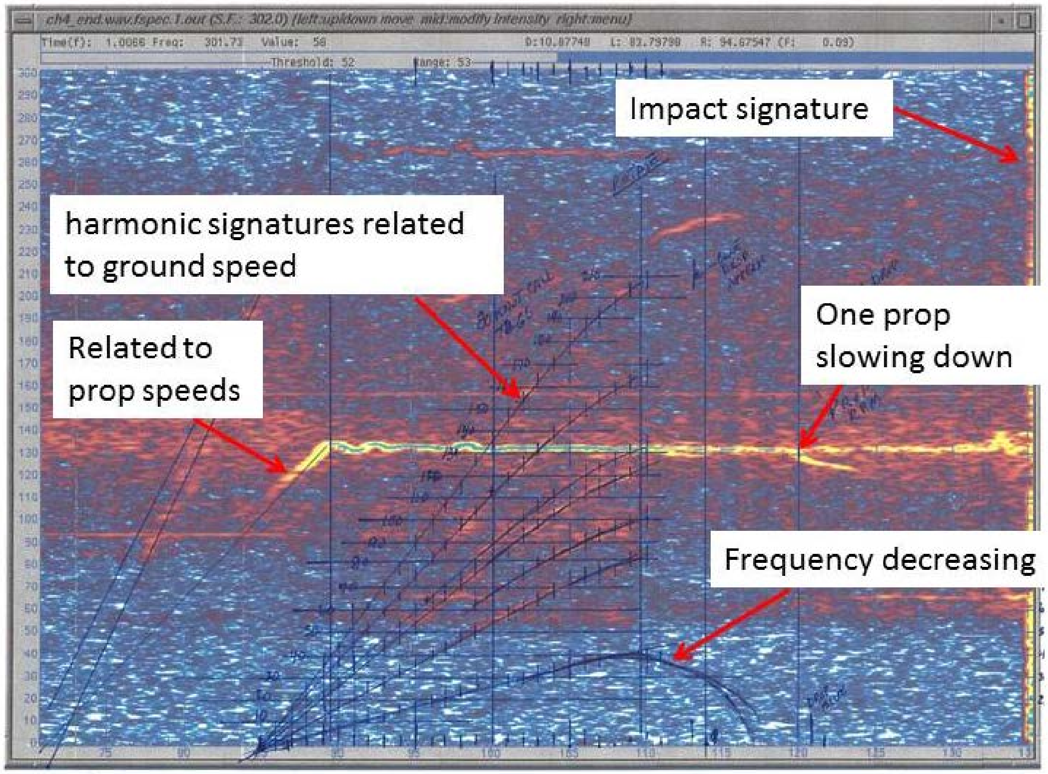


Image 1 – Signatures from the CVR cockpit area microphone.

Image 2 contains data from the CVR. The data was recorded on a microphone channel. However, a microphone was not connected to the microphone jack. The signature is consistent with electrical noise generated by the engines. The area of four signatures is consistent with two engines with increasing rpm, each engine producing two signatures. The fourth signature is very faint but can be seen in the original image. The area of two signatures is consistent with one engine slowing down. Safety Board engineers suspect the noise is generated by one tach generator mounted on each engine.

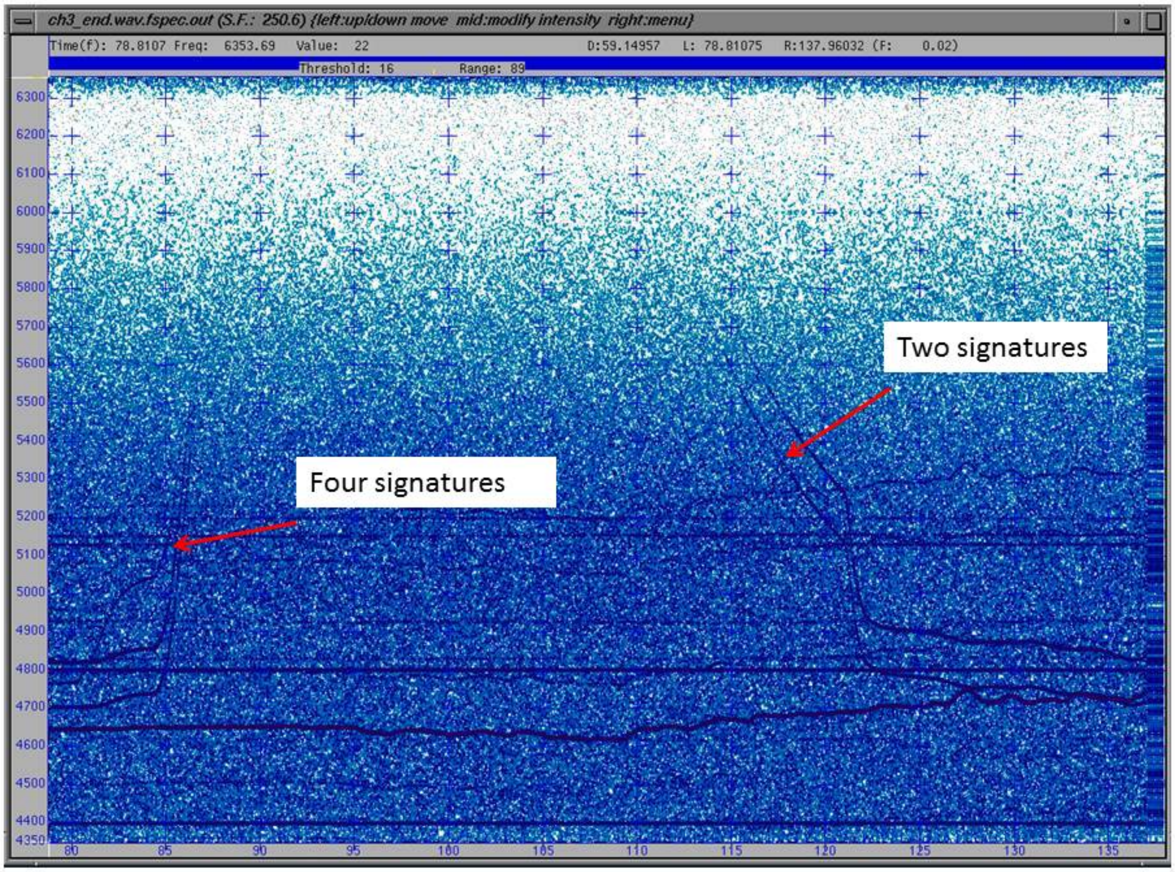
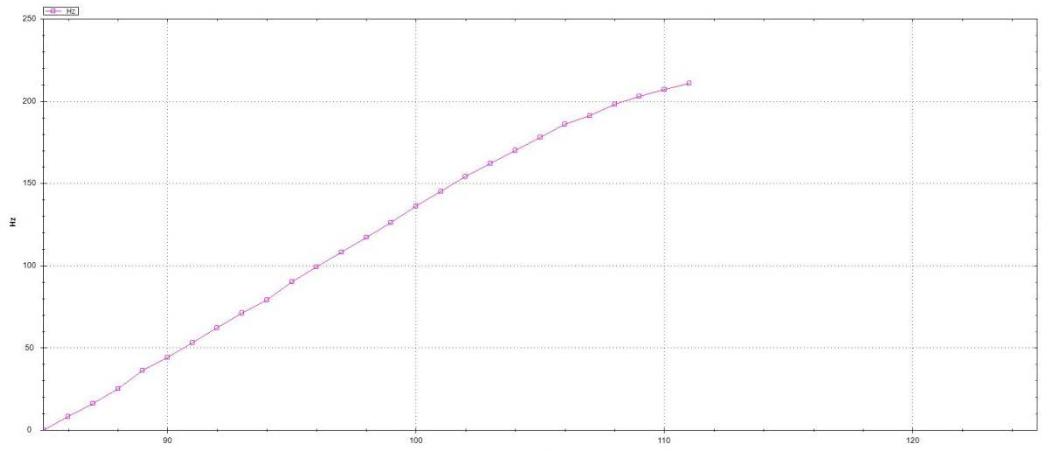


Image 2 – Signatures from a microphone input to the CVR. A microphone was not attached to the microphone jack.

1.1 Frequency/Ground Speed calculations

The frequency time history of the top line harmonic is presented in Image 1 is presented in Graph 1.



Graph 1 – Harmonic frequency from Image 1.

An 80 knot call was made at 100 seconds. The 80 knot call is consistent with the pilot observing 80 KIAS on the airspeed indicator or anticipated reaching 80 KIAS. Correcting for wind and atmospheric conditions, the ground speed would be 71 KGS when the airspeed indicator is registering 80 KIAS. The frequency was 136 Hz. Ground speed was calculated based on the ratio of 136 Hz/71 KGS. The ground speed values are considered valid after 90 seconds.

If a rolling takeoff was executed, the airplane acceleration would be increasing as the thrust was increasing from 72 seconds until the propeller rpm becomes stabilized, at 89 seconds. The blue shaded area before 90 seconds accounts for an increasing acceleration from zero to the area of more constant acceleration starting at 90 seconds. The results are presented in Table 1.

If the pilot had released the brakes at 90 seconds as full power was attained, the total take off distance would be 210 feet less than the rolling takeoff distance presented in Table 1.

Table 1 – Ground speed and distance derived from CVR data.

INPUT	9.0	WIND			
	80.0	KIAS at	136.0	Hz	80 KNOT CALL AT 100 SECONDS
	71.0	KGS			
		SCALE =	0.5221	KGS/HZ	

	accel factor	sec	Hz	KGS HZ*SCALE	KIAS KGS+WIND	FPS GS	DIST FT
estimated	0.00	73.0	0.0	0.0	9.0	0.0	0.0
	0.53	74.0	0.3	0.1	9.1	0.2	0.1
	1.06	75.0	0.8	0.4	9.4	0.7	0.6
	1.59	76.0	1.6	0.8	9.8	1.4	1.6
	2.12	77.0	2.6	1.4	10.4	2.3	3.5
	2.65	78.0	4.0	2.1	11.1	3.5	6.4
	3.18	79.0	5.6	2.9	11.9	4.9	10.6
	3.71	80.0	7.4	3.9	12.9	6.5	16.3
	4.24	81.0	9.5	5.0	14.0	8.4	23.8
	4.76	82.0	11.9	6.2	15.2	10.5	33.3
	5.29	83.0	14.6	7.6	16.6	12.8	45.0
	5.82	84.0	17.5	9.1	18.1	15.4	59.1
	6.35	85.0	20.6	10.8	19.8	18.2	75.9
	6.88	86.0	24.1	12.6	21.6	21.3	95.6
	7.41	87.0	27.8	14.5	23.5	24.5	118.5
	7.94	88.0	31.8	16.6	25.6	28.0	144.8
	8.47	89.0	36.0	18.8	27.8	31.8	174.7
	9.00	90.0	44.0	23.0	32.0	38.8	210.0
		91.0	53.0	27.7	36.7	46.8	252.8
		92.0	62.0	32.4	41.4	54.7	303.5
		93.0	71.0	37.1	46.1	62.6	362.2
		94.0	79.0	41.2	50.2	69.7	428.3
		95.0	90.0	47.0	56.0	79.4	502.9
		96.0	99.0	51.7	60.7	87.3	586.3
		97.0	108.0	56.4	65.4	95.3	677.6
		98.0	117.0	61.1	70.1	103.2	776.8
		99.0	126.0	65.8	74.8	111.2	884.0
PINNED	80.00	100.0	136.0	71.0	80.0	120.0	999.6
HERE		101.0	146.0	76.2	85.2	128.8	1124.0
		102.0	155.0	80.9	89.9	136.8	1256.8
		103.0	163.0	85.1	94.1	143.8	1397.1
		104.0	172.0	89.8	98.8	151.8	1544.9
		105.0	181.0	94.5	103.5	159.7	1700.6
		106.0	188.0	98.1	107.1	165.9	1863.4
		107.0	195.0	101.8	110.8	172.0	2032.3
		108.0	201.0	104.9	113.9	177.3	2207.0
SOUND	ROTATE	109.0	203.0	106.0	115.0	179.1	2385.2
CHANGED		110.0	200.0	104.4	113.4	176.5	2563.0

NOTE: acceleration factor corrects for increasing acceleration as power is added.

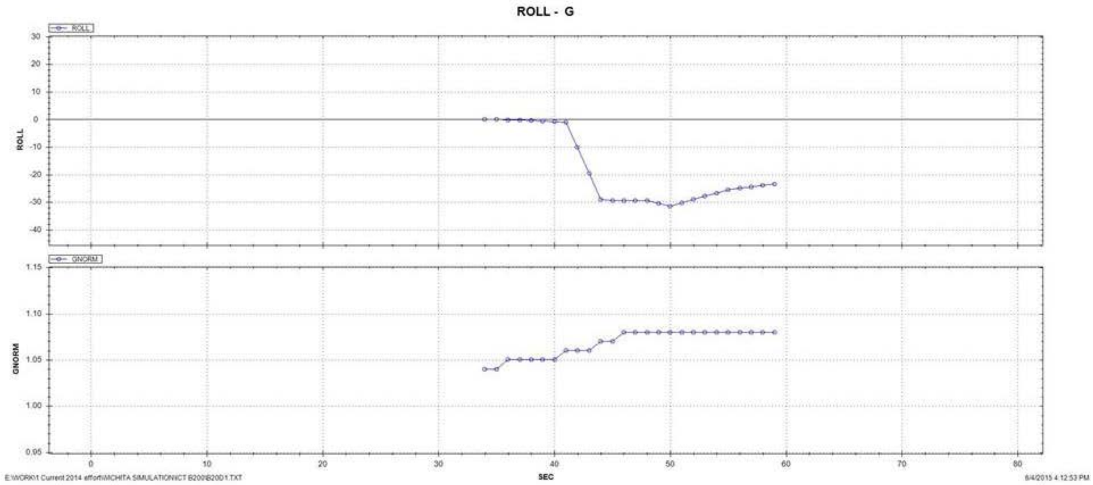
2.0 Simulation

A simple simulator program was created to capture the motion of the airplane. The intent was to generally define the time histories of various input parameters so that the model motion would match the time and/or positon data available from various sources. The simulation started once the airplane was airborne and ended at the impact with the building. The starting point of the simulation is defined in Section 1.1.

The CVR also provided timing for some of the events, but not position. The surveillance video provided both time and position data. On-scene documentation provided the impact point and flight path direction at impact.

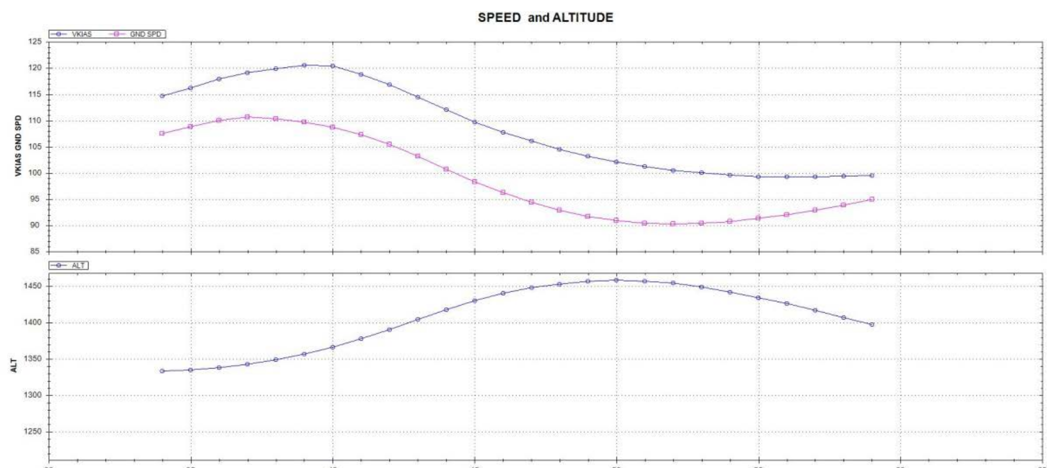
Graph 2 presents the roll angle and G_{norm} time histories. The roll angle provides for the turn and maneuver to the left. However, the roll angle includes the net effect of both roll angle and sideslip angle.

The G_{norm}[1] time history produces the altitude profile consistent with the roll angle history[2] and the altitude history noted in the Video Study.



Graph 2 – Roll angle and G_{norm} time histories.

The resultant ground speed/airspeed and altitude time histories are presented in Graph 3. The airspeed time history would result in the airplane motion that matches the positon and timing of key events. The altitude time history matches the altitude data presented in the Video Study.



Graph 3 – Resultant Indicated Airspeed, Groundspeed, and Altitude time histories.

[1] G_{norm} = lift/weight.

[2] If roll angle and sideslip angle were used separately, the G_{norm} profile would be very slightly less.

3.0 Summary of Data

Table 2 contains a summary of events, the time and/or position at which each event occurred, and the indicated airspeed. The data sources are:

est – estimated starting time and position – see Section 1.1
red – Image 1
blue – Image 2
cvr – key events heard on CVR
A-G – presented in the Video Study

Table 2 – Summary of Data

source	TIME sec	CVR sec	zero based time put on GE	RED GRAPH DISTANCE ft	end of runway COMMON DISTANCE ft	GND SPEED KGS	KIAS	ALT AGL FT	WIND TRUE	KTS	9E TRACK TRUE	WIND ON NOSE	EVENT
est	73.0	-2.5	-12.0	0.0	435.0	0.0	9.3	0.0	340	12.0	19.0	9.3	starting position using slow power up
red	85.0	9.5	0.0	75.9	510.9	0.0	9.3	0.0	340	12.0	19.0	9.3	
red	86.0	10.5	1.0	95.6	530.6	4.0	13.3	0.0	340	12.0	19.0	9.3	power seen on graph
red	89.0	13.5	4.0	174.7	609.7	19.0	28.3	0.0	340	12.0	19.0	9.3	power peaks
cvr	100.0	24.5	15.0	996.6	1431.6	71.0	80.3	0.0	340	12.0	19.0	9.3	80 knot call
red	109.0	33.5	24.0	2385.2	2820.2	106.0	115.3	0.0	340	12.0	19.0	9.3	rotate
blue	113.0	37.5	28.0					17.0	344	14.0	19.0	11.5	blue graph drop appears
cvr	114.0	38.5	29.0					24.0	348	15.0	19.0	12.9	exclamination
red	120.0	44.5	35.0	**105.0**	**AVE GND SPEED**			87.0	349	15.0	10.0	14.0	prop droop
blue	121.0	45.5	36.0	**115.0**	**AVE IAS**			97.0	349	14.0	5.0	13.5	blue graph sharp drop
red	124.0	48.5	39.0					110.0	349	14.0	346.0	14.0	lose prop signature - 7% loss of rpm
cvr	124.5	49.0	39.5					115.0	349	14.0	342.0	13.9	declare emergency
A	125.9	50.4	40.9	5387.0		84.5	98.2	122.0	349	14.0	337.0	13.7	
B	128.4	52.9	43.4	5783.0		84.9	97.2	118.0	349	14.0	320.0	12.2	
shadow	130.1	54.6	45.1	6026.0		85.0	95.9	104.0	349	14.0	310.0	10.9	
C	131.2	55.7	46.2	6196.0		85.1	94.9	92.0	349	14.0	303.0	9.7	
D	132.5	57.0	47.5	6390.0		87.0	96.0	69.0	350	15.0	297.0	9.0	
E	133.1	57.6	48.1	6487.0		88.3	96.7	58.0	350	15.0	294.0	8.4	
F	133.7	58.2	48.7	6565.0		90.2	98.2	44.0	350	15.0	292.0	7.9	
G	134.2	58.7	49.2	6647.0		92.2	100.0	32.0	350	16.0	289.0	7.8	
red	134.5	59.0	49.5	6668.0		94.0	100.8	25.0	348	14.0	287.0	6.8	impact

The various data were imported into Google Earth. The images are presented below.

Image 3 - Overview

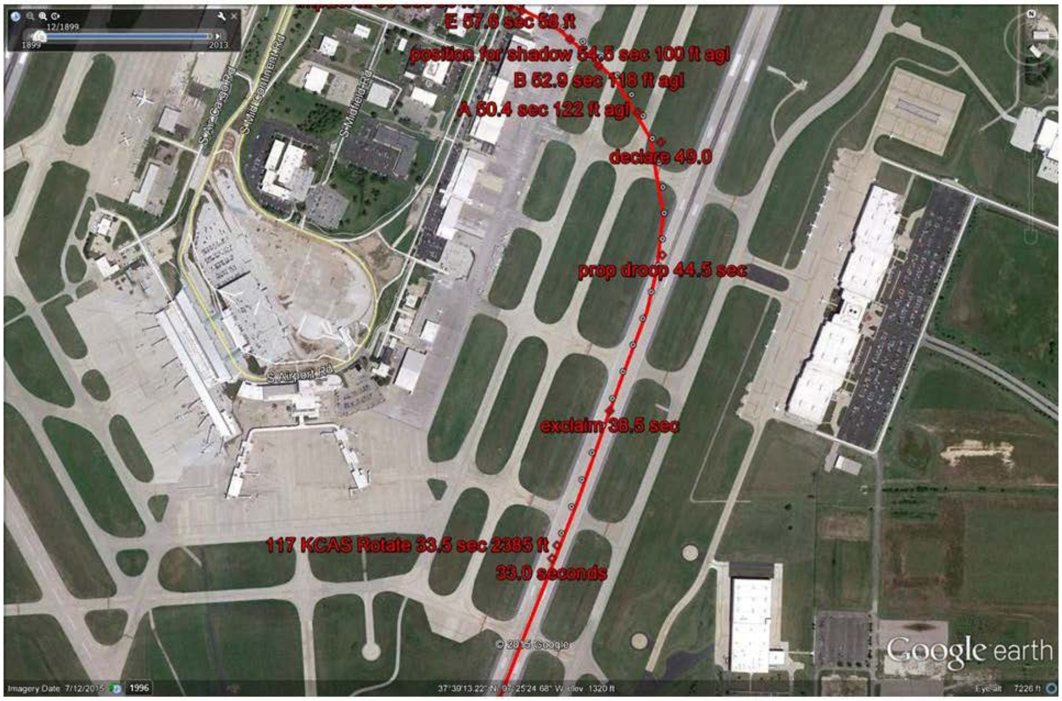


Image 4 – Midflight

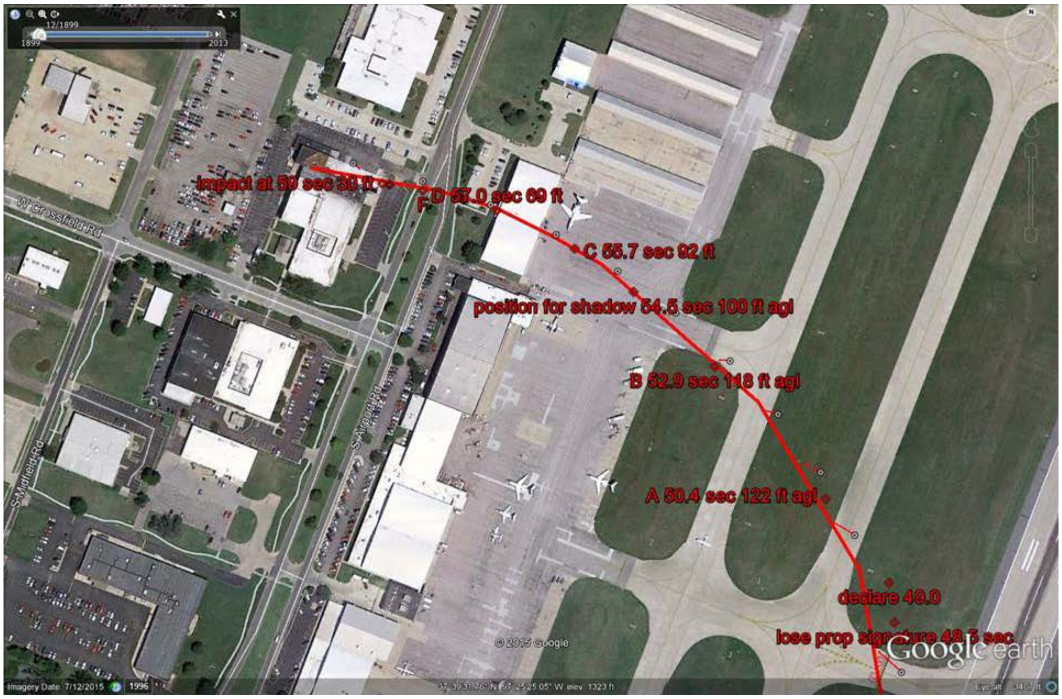


Image 5 – Final maneuver.