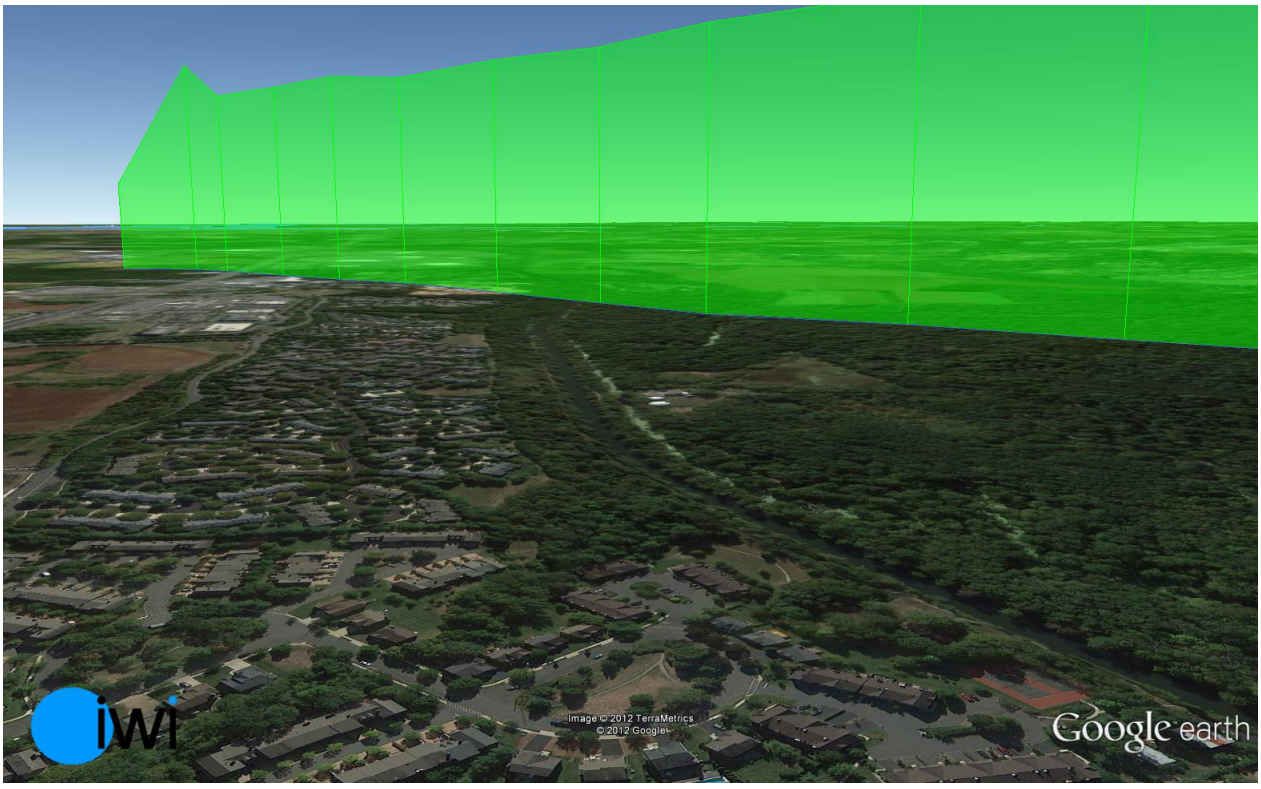
# *Immersive Witness Interview (IWI ®)*

***Accident: AS355 F1, S/N: 5227; N58020; Analar Corporation; West Windsor, NJ; Sept-15-2012; NTSB Ref: ERA12FA563***




Immersive Witness Interview (IWI) - Reconstruction



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## Background about IWI

The Immersive Witness Interview (IWI ®) technique was developed by Dr. Bauer since 2007 to provide a qualitative and simple to understand analysis of accident flight path investigations. To support witness interview on site, the iPad app tool used in this report was developed to collect the required information for the IWI methodology. It principally reconstructs a flight path based on eyewitness observation information where there is no flight data recorder or radar data available. The IWI® methodology and the MSimulation software use basic physiological and psychological information from the interviewing of multiple eyewitnesses of an event to reconstruct and defined a vehicles flight path into a 3D environment.

During the interview of individual eyewitnesses, each witness is asked to provide a 2D account of their statement based observed flight path, established from their lines of sight and the distance to a known fixed reference objects. The individual accounts are then recorded and transferred into a 3D environment to interact with other witness accounts for a consolidated path profile that allows a visualization of the circumstances in a 3D environment.

A verification of the dependencies in the witness statements is calculated with the *Immersive Witness Interview Analyzer* software to identify the level of witness error or accuracy (showing the witnesses who articulate good / poor observations).

IWI® can approximate based on a flight path or moving path with a minimum of two different positioned eyewitness statements. The result with the expected errors using the developed IWI® application is calculated with the *Immersive Witness Interview Analyzer* software and the result can be exported to be visualized with the software Google Earth.

In this report you will see the points referenced on the path created by the witness with the nomenclature: IC = initial contact, FC = final contact and all other special observations that the witness noted as; O1 = first special observation and O2 = the second special observation and so on.

## Case Overview

On September 15, 2012, about 1200 eastern daylight time, an Aerospatiale AS 355F1, N58020, operated by Analar Corporation, was substantially damaged when it impacted terrain following an in-flight separation near West Windsor, New Jersey. The commercial pilot was fatally injured. The positioning flight was conducted under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and no flight plan was filed for the planned flight to Atlantic City International Airport (ACY), Atlantic City, New Jersey. The flight originated from Princeton Airport (39N), Princeton, New Jersey, about 1155.

According to the president of the company that operated the aircraft, the helicopter had flown during the summer with a loaner transmission, after its transmission was removed for repair on June 4, 2012. After the repair was complete, the helicopter's original transmission was received and then reinstalled on September 13, 2012. After the installation, the president, who was also an airframe and power plant mechanic, conducted a maintenance ground run, followed by a 30-minute maintenance test flight, with no anomalies noted. Earlier during the day of the accident, the accident pilot flew the helicopter from 39N to the West 30th Street Heliport (JRA), New York, New York, where he picked up a passenger and returned to N39 uneventfully. The helicopter was completely fueled and then departed on the next flight segment (accident flight) with the intent to pick up another passenger at ACY. The president estimated that the helicopter had flown approximately 1 hour 10 minutes since the installation of the transmission.

According to preliminary information from the Federal Aviation Administration, the helicopter was in radio and radar contact with McGuire Approach Control. Radio and radar contact was lost about 1200 and no distress calls were received. Witnesses near the area of the accident site reported hearing a grinding, pop, or engine rev noise. Witnesses also reported seeing something separating from the helicopter and the helicopter spiraling nose down toward the ground. One witness reported observing a flock of small birds strike the right side of the helicopter, just prior to the upset.

## Case Map

The figure below shows the top view of the case map with provided radar data (green line), main wreckage position (yellow marker) and the positions of the three witnesses (red markers). North is faced to the top.


**Figure 1 : Map with approximate locations of witness #1, #2, #3, main wreckage and radar plot (green line). Map data©2012 Google**

## Witness Overview

In the frame of this subject accident investigation (NTSB Ref: ERA12FA563), three witnesses were interviewed on 09-16-2012 and 09-17-2012 with the *Immersive Witness Interview (IWI®)* method, using the *IWI* iPad app (V 1.08) and photographs. Three of the witnesses, identified by the NTSB, with a visual reference perspective to the final moments of flight were interviewed. These interviews were conducted by the American Eurocopter Investigator Mr. Buttner 1 and 2 days after the accident. The main objective of applying the *IWI* interview method was to catch additional information about the flight path and attitude of the helicopter shortly before the impact. Each witness was located approximately 0.3 to 1.7 Nautical Miles (NM) from the accident site.

The photographs of the witness's perspective and witness's flight path description have been inserted into the Immersive Witness Interview Analyzer software for analyses.

| Witness Name | Latitude (deg) | Longitude (deg) | Elevation (feet) | Face Direction (deg) | IC Initial contact | FC Final contact | OI Spc Observation | Attitude |
|---|---|---|---|---|---|---|---|---|
| #1 [M. Borek] | 40.302837 | -74.636977 | 99 | 271° | ✓ | ✓ | | ✓ |
| #2 [M. Cox] | 40.3067 | -074.6682 | 59 | 210° | ✓ | ✓ | ✓ | ✓ |
| #3 [M. Tellez] | 40.3164 | -074.6843 | 62 | 140° | ✓ | ✓ | | ✓ |

**Table 1: Position in Latitude, Longitude and Elevation of the interviewed witnesses.**

## Witness #1: (M. Borek)

The following depiction illustrates the photographed perspective of witness M. Borek where he saw the aircraft. The photo has been inserted into the *Immersive Witness Interview Analyzer* software. The red line on the digital photo was illustrated by the witness to describe the flight path that he remembers observing.


**Figure 2: Witness #1 viewpoint with described flight path (red line) and available radar data (green line)**

The witness looked up as soon as he heard an unusual noise come from the helicopters location (unlike what a normally operating helicopter flying would sound like). He described it like the helicopter made an immediate power-up "Roar". At that time the witness said he saw the aircraft falling straight down in a tight spiral with a nose down attitude of approximately 40 degrees. The witness did not see any parts, components, lights or smoke, other than the plume of smoke from the impact fire rising.

The green line shows the available radar data. The position where the radar data shows the fall of the HC fits well with the described final flight path by the witness (red line).

## Witness #2: (M. Cox)

The following depiction illustrates the photographed perspective of witness M. Cox where he saw the aircraft. The photo has been inserted into the *Immersive Witness Interview Analyzer* software. The red line on the digital photo was illustrated by the witness to describe the flight path that he remembers observing.

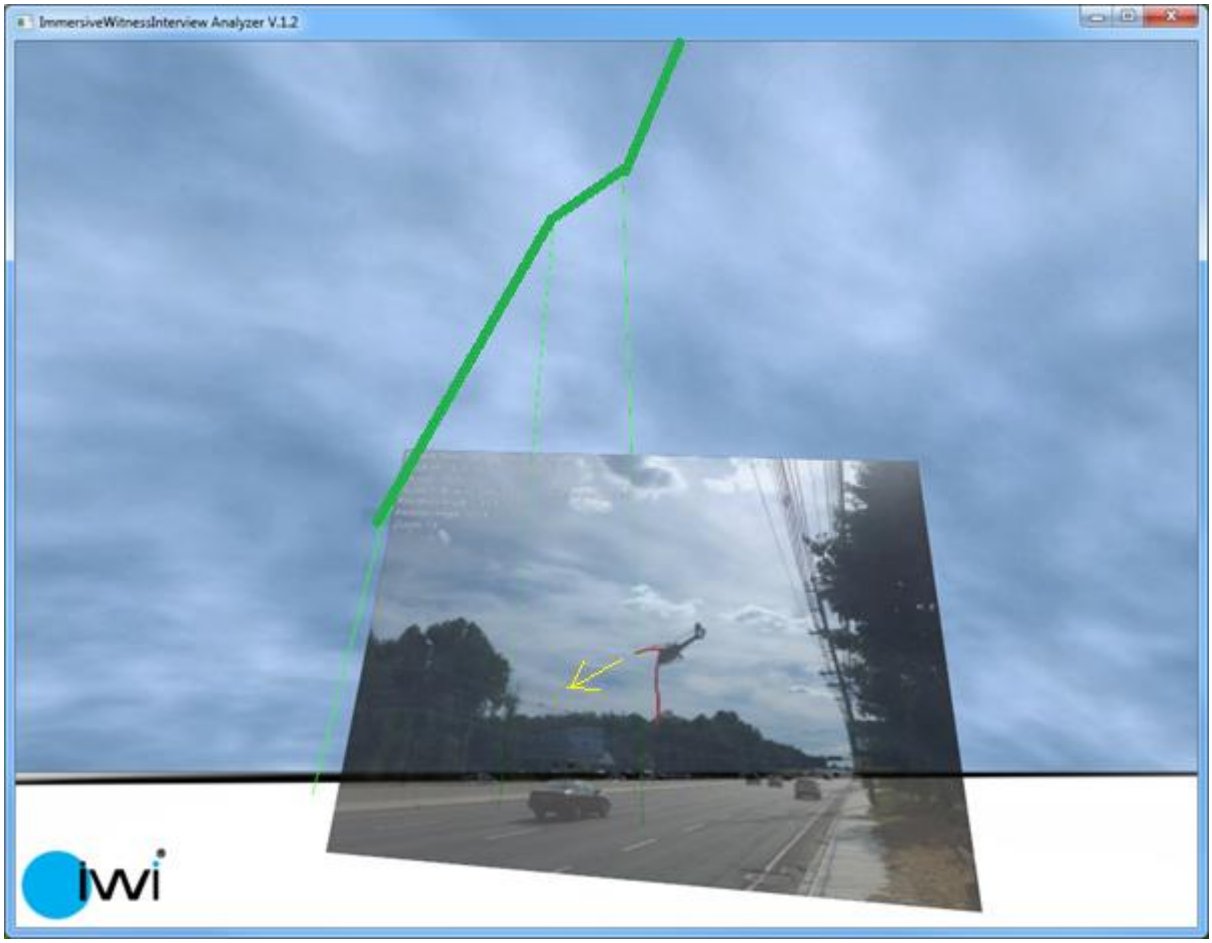


**Figure 3: Witness #2 viewpoint with described flight path (red line), available radar data (green line) and special observation (yellow arrow)**

The witness saw the helicopter from inside his car while driving southwest. He said the Helicopter was flying approximately at him, in his direction, for a brief second, before he saw something depart out to the east of the helicopter and fall to the ground (which he thought was a blade). At the same time the Helicopter fell, straight down in a tight spiral with a nose down attitude of approximately 40 degrees. He saw a rotor blade falling off in the direction as marked with the yellow arrow in figure above. He did not see smoke, other than the plume of smoke from the impact fire rising.

The described position of the helicopter by the witness does not fit well to the radar data (green data). The radar data shows that the helicopter would have flown on the identified observation position almost over the witness. The reason for this mismatch can be found in the inaccurate witness position as the witness was driving with his car during the observation. The later identification of a precise position where the observation took place during driving situation can be very difficult due to the amount of reference objects as the witness focused on the helicopter and traffic. But the witness described like the other two witnesses an almost vertical fall down of the helicopter at the end of the flight path.

## Witness #3 (M. Tellez)

The following depiction illustrates the photographed perspective of witness M. Tellez where he saw the aircraft. The photo has been inserted into the *Immersive Witness Interview Analyzer* software. The red line on the digital photo was illustrated by the witness to describe the flight path that he remembers observing.

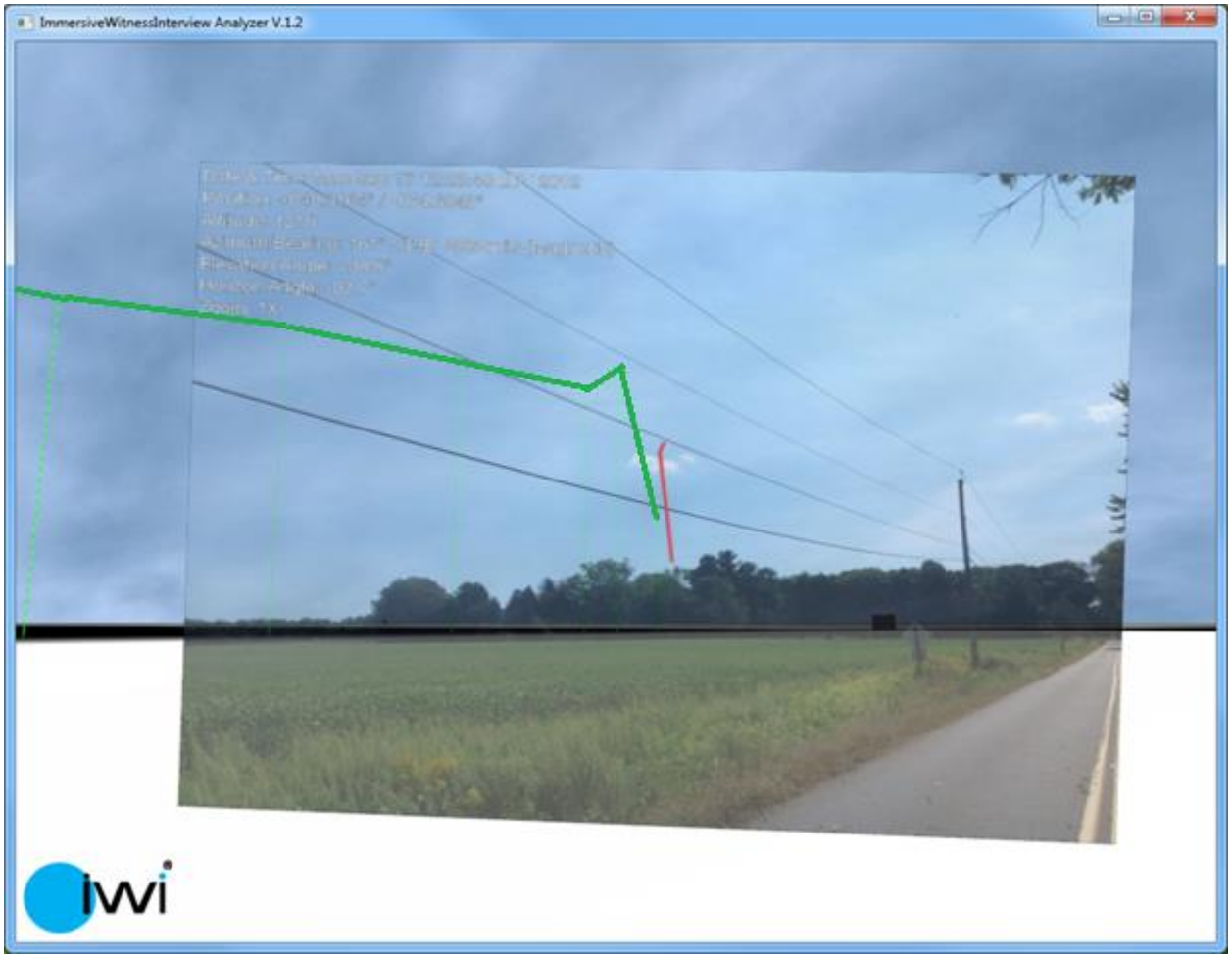


**Figure 4: Witness #3, viewpoint with described flight path (red line) and available radar data (green line)**

The witness was walking next to a road and he looked up as soon as he heard an unusual noise come from the helicopters location (unlike what a normally operating helicopter flying would sound like). He described it like the helicopter made an immediate power-up “Roar”. At that time the witness said he saw the aircraft falling straight down in a tight spiral with a nose down attitude of approximately 40 degrees. The witness did not see any parts, components, lights or smoke, other than the plume of smoke from the impact fire rising.

The radar data (green line) fits very well with the described final flight path (red line) by the witness.

## Meteorological Information

According to the nearest METAR reporting station, Trenton Mercer Airport, Trenton, NJ (KTTN), visual meteorological conditions prevailed at the time of the accident; Wind: 350 degrees, at 9 kts, Sky: clear, Temperature: 21 C, Due Point: 09 C, Altimeter Setting: 30.14 inHg. This information was the constituent with the general condition described by the aforementioned IWI witnesses."

## Terrain Background

The terrain around the accident site is quite flat and the terrain surface level goes from 50 feet up to 300 feet sea level.

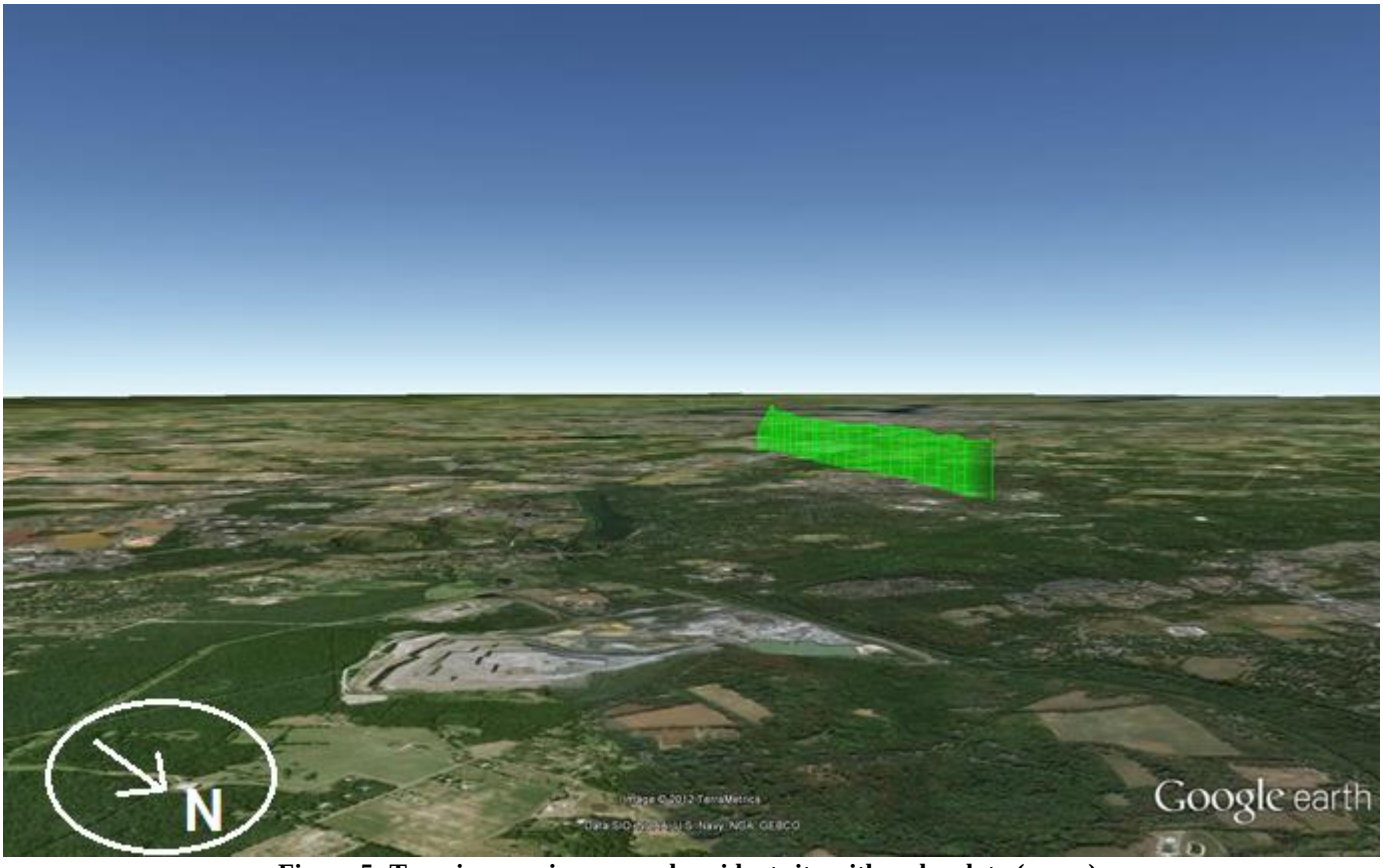


**Figure 5: Terrain overview around accident site with radar data (green).**

## IWI Reconstruction - Witness 1

The following images are from the perspective of the witness M. Borek:

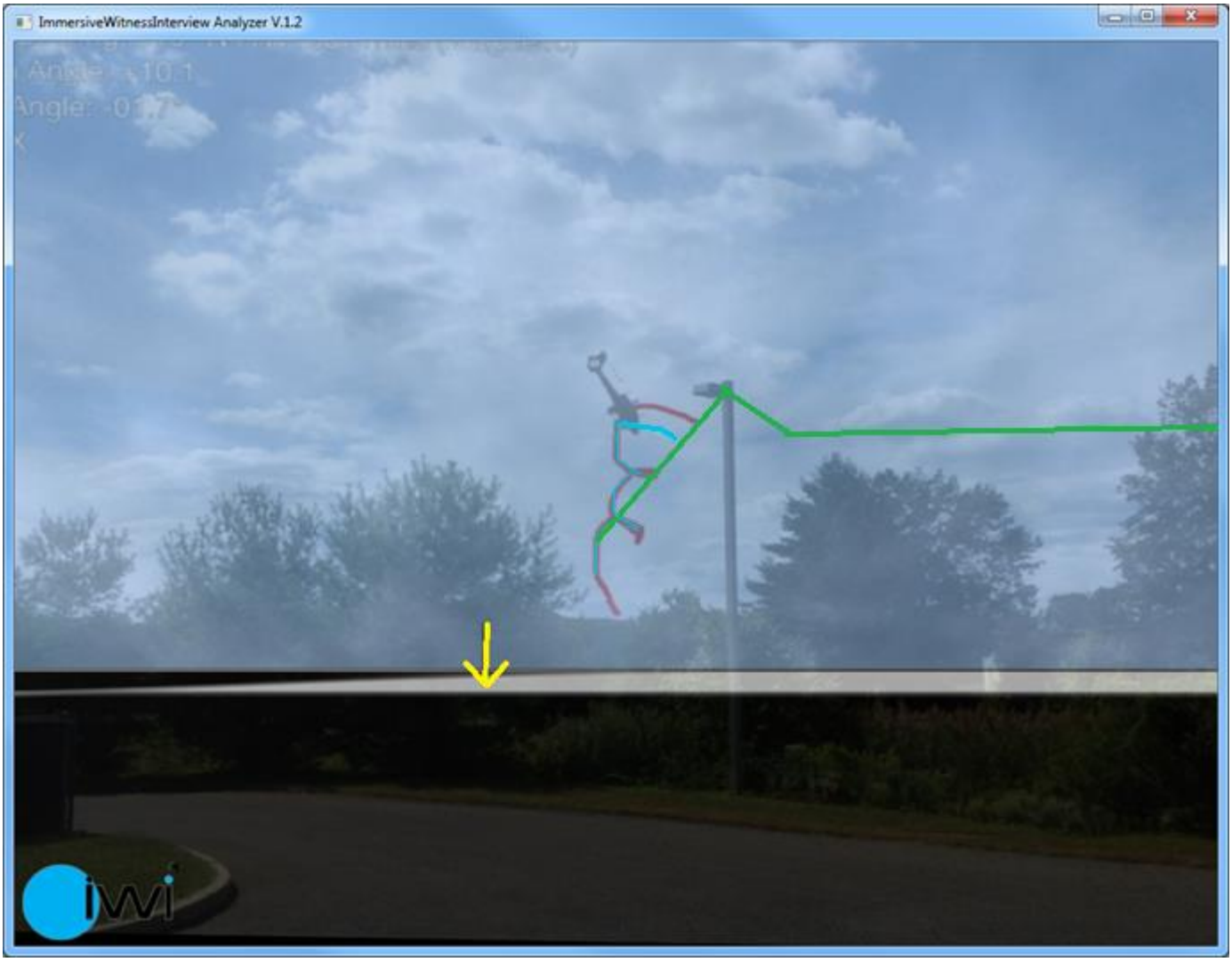


**Figure 6: M. Borek's 2D description (red) combined with the iwi reconstructed flight path (blue), radar data (green) and main wreckage position (yellow arrow)**

The reconstruction fits very well with the description of this witness and the final trajectory of the helicopter is in line within the last two radar positions. The position of the main wreckage (yellow arrow) is 4° in azimuth to the left of the position (end of red line) where the witness described the helicopter went down. A study (by Dr. Bauer in 2009) and results of other previous accident investigations have shown that for this observed field of view the witness accuracy in azimuth can be up to 5°.

The witness #1 (M. Borek) was able to explain to the interviewer the positions and attitude of helicopter on his observed flight path. The attitudes were illustrated on the *IWI* iPad app.
With the Heading, Pitch and Roll information of this position as illustrated in Google Earth (Figure 7), the helicopters attitude was inserted into the IWI analyzer at the position identified.

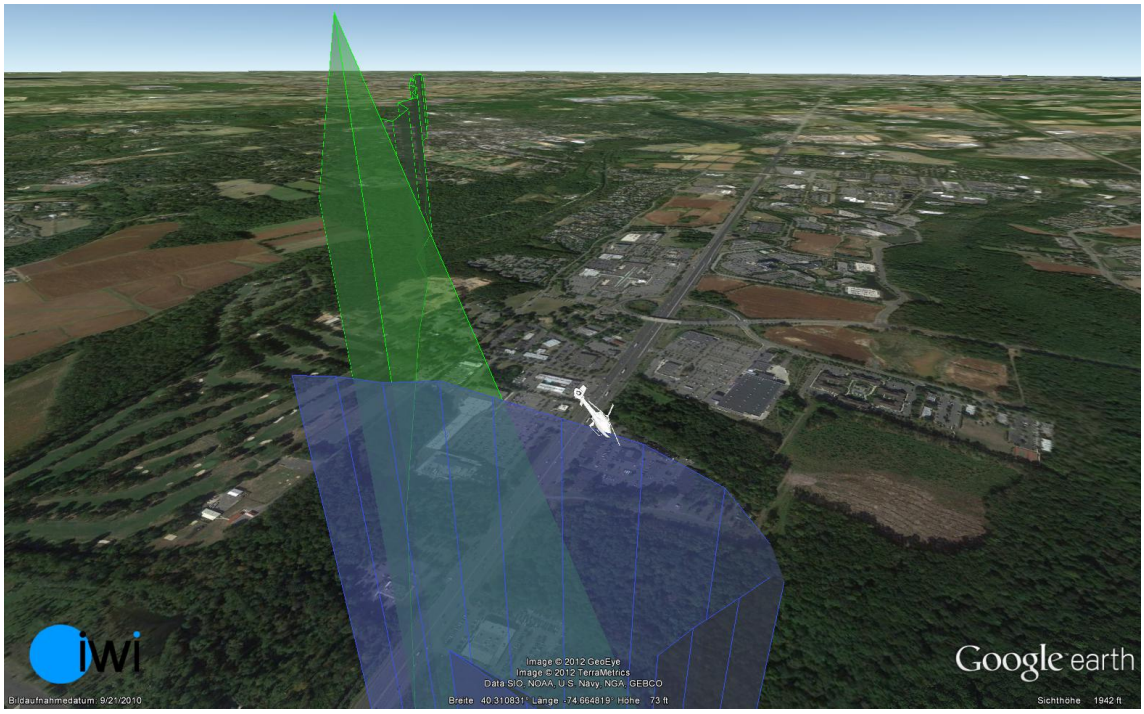


**Figure 7: Helicopter model with attitude described by witness at reconstructed position, radar data (green) and reconstructed flight path (blue)**

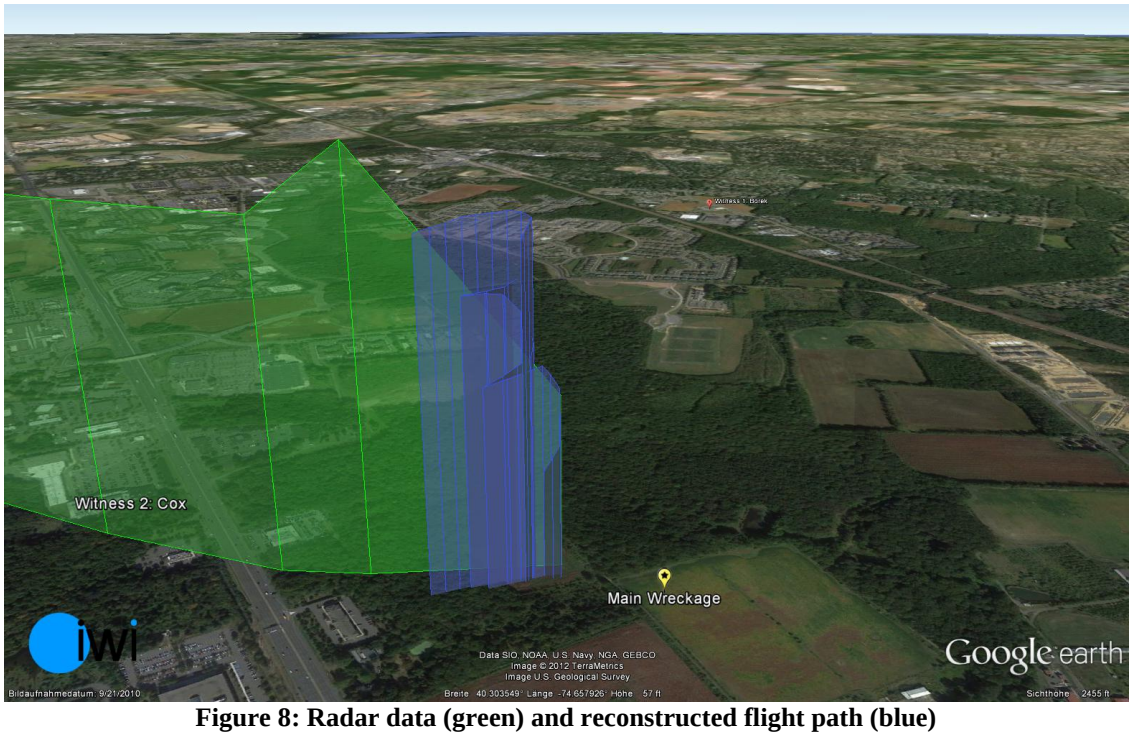


**Figure 8: Radar data (green) and reconstructed flight path (blue)**

## IWI Reconstruction - Witness 2

The following images are from the perspective of the witness M. Cox:

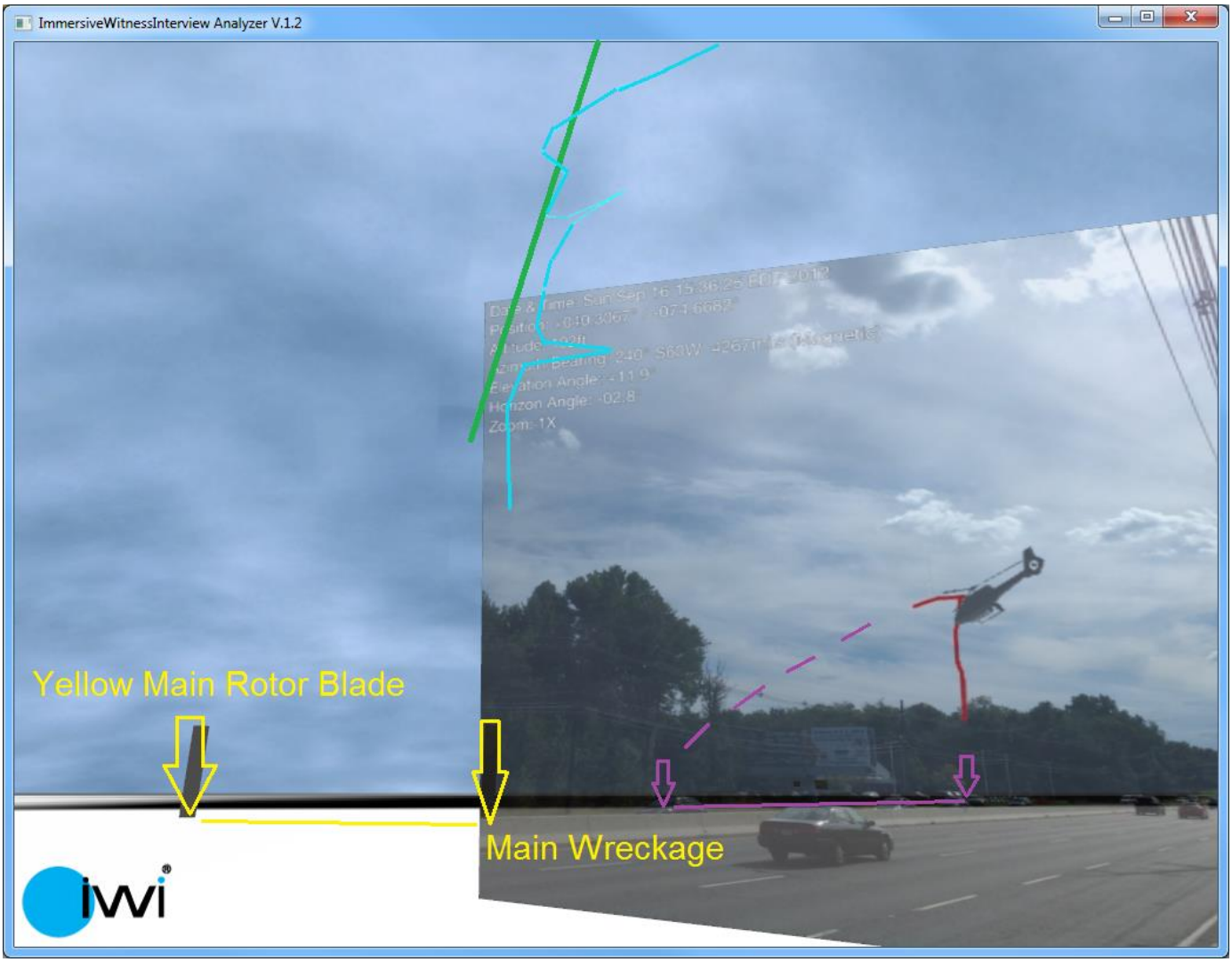


**Figure 9: M. Cox's 2D description (red) combined with the iwi reconstructed flight path (blue) and radar data (green)**

The flight path explained by the witness (red) is far to the right of the provided radar data. The reason of this mismatch may be linked to the inaccurate position of the witness, as he was driving within a car during observation. Therefore only the described trajectory explaining that the HC felt down spinning can be considered for reconstruction. The position of trajectory (red) is not in line with the other witness observations.
The yellow arrows in the image below show the position of the main wreckage and the position of the yellow main rotor blade. The witness described that a rotor blade fall off to the left at the described position as shown in the figure above (red line pointing to the left at HC model). It should be noted, that it is difficult to identify the exact position of the witness when he observed the helicopter during driving the car on the road. The described loss of a rotor blade and the fact that the yellow main rotor blade was found to the left of the main wreckage, should be considered. It can be assumed that the observation by the witness took place at a position earlier at the road.
If it is considered that the witness might have observed the helicopter at a position on the road 0.2 miles to the east, the witness would have seen the helicopter coming from the right and going down on the left side of the road close to another building located on the left side of the road. The following figures show the top view of the map with the moved position of the witness and the new virtual witness view at the changed position with the radar

data. Considering the radar data, it can be assumed, that the witness observed the helicopter for a duration of 5 seconds.

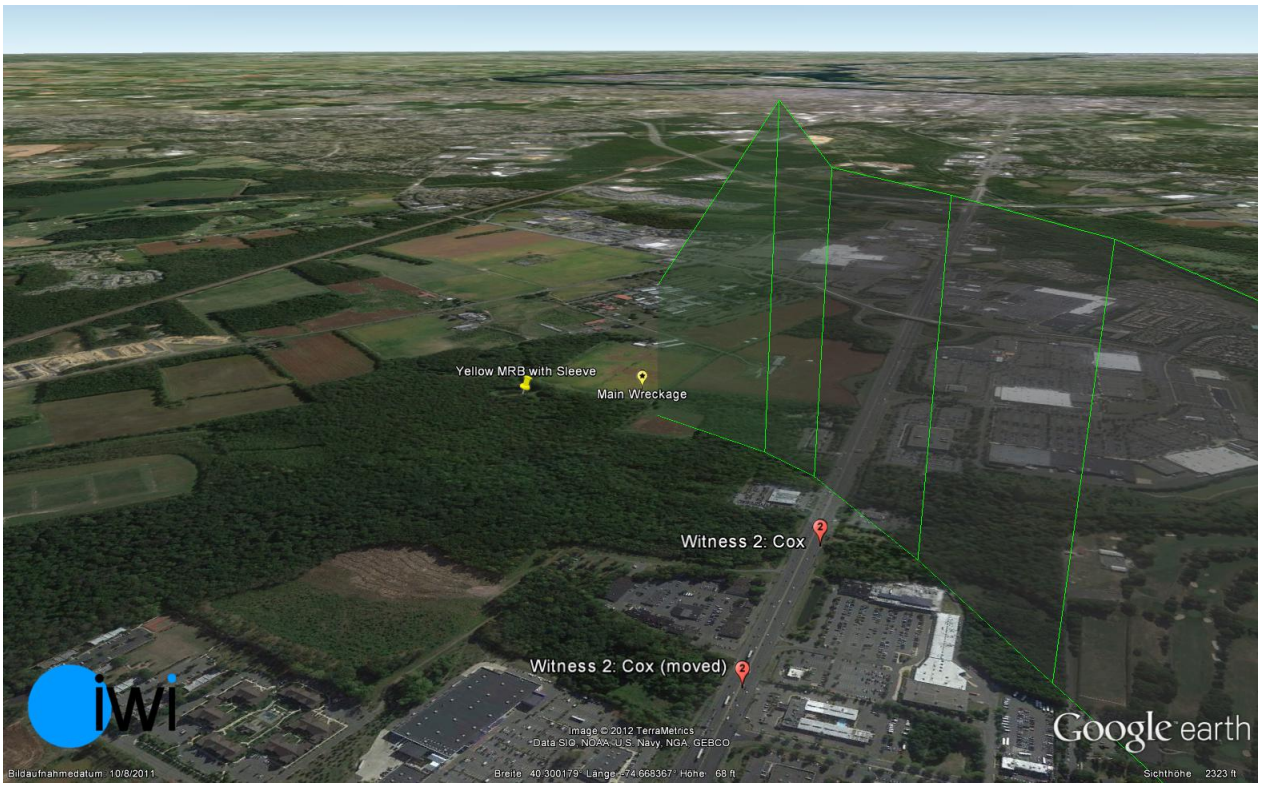


**Figure 10: Top view showing provided and moved position (red) of M. Cox's and provided radar data (green)**


**Figure 11: M. Cox's virtual view at moved position with radar data (green), described flight path (red) and yellow main rotor blade and main wreckage position (yellow arrows)**

## IWI Reconstruction - Witness 3

The following images are from the perspective of the witness M. Tellez:


**Figure 12: M. Tellez's 2D description (red) combined with the iwi reconstructed flight path (blue) and radar data (green)**

The reconstruction (blue) fits well with the description of this witness (red) and the final trajectory of the helicopter is in line within the last two radar positions (green).
The last radar plot is located 1.5° in azimuth to the left of the described and reconstructed flight path. A study (by Dr. Bauer in 2009) and results of previous other accident investigations have shown that for this observed field of view the witness accuracy in azimuth can be up to 5°.

## Conclusion

The iwi reconstruction shows, that the witness observations of witness 1 (M. Borek) and 3 (M. Tellez) are in line with the available radar data.
The observed trajectory of witness 2 (M. Cox) fits with the radar data showing that the helicopter fell down at the end of the trajectory, but the position where witness 2 (M. Cox) saw the helicopter falling down is not in line with provided radar flight path data.
On page 13 a corrected witness position has been introduced that would allow that observed trajectory to correspond with the provided radar data. The witness also explained that the helicopter lost a rotor blade what consists to the fact a main rotor blade was found approximately 780 feet from the main wreckage.


**Figure 13: Top view showing ground track of reconstructed path (blue) and radar data (green).**

All witnesses explained that the helicopter went down at the end almost vertical. All witnesses also explained that the helicopter was rotating in circles as it was falling. Witness 1 (M. Borek) drew the circles as shown on page 7.
The reconstructed flight path (blue) shows the circles influenced by witness 1 (M. Borek). The position of the reconstructed flight path is due to the possible error of the witnessed in azimuth about 250 feet north of the position of the main wreckage.
The reconstruction (blue) shows that between the last two radar points the helicopter went down in circles with the vector as given by the radar data towards the position where the main wreckage was found.
Based on the radar data the flying speed over ground has been calculated and is shown in the appendix on page 20.
Also, in addition to the witness statements, special attention was given to the radar return data that was made available, which shows the aircraft in a level cruse flight at approximately 1,700 feet, and at an average ground speed of approximately 134 kts for several miles before it abruptly made a climb to 2,000 feet and slowing to approximately 63 kts. All of the accounts of the witness were of the moments at which it was falling, or within seconds before it was seen falling, as in witness Mr. Cox's observation who described an object (Main Rotor Blade) depart the aircraft just before he described it falling. The speeds, the time and distance interval between the radar

hits at the end of the flight path, in conjunction with the witness statements of a near vertical and circling fall path, suggest an event occurred over a local area in the last moments of flight.

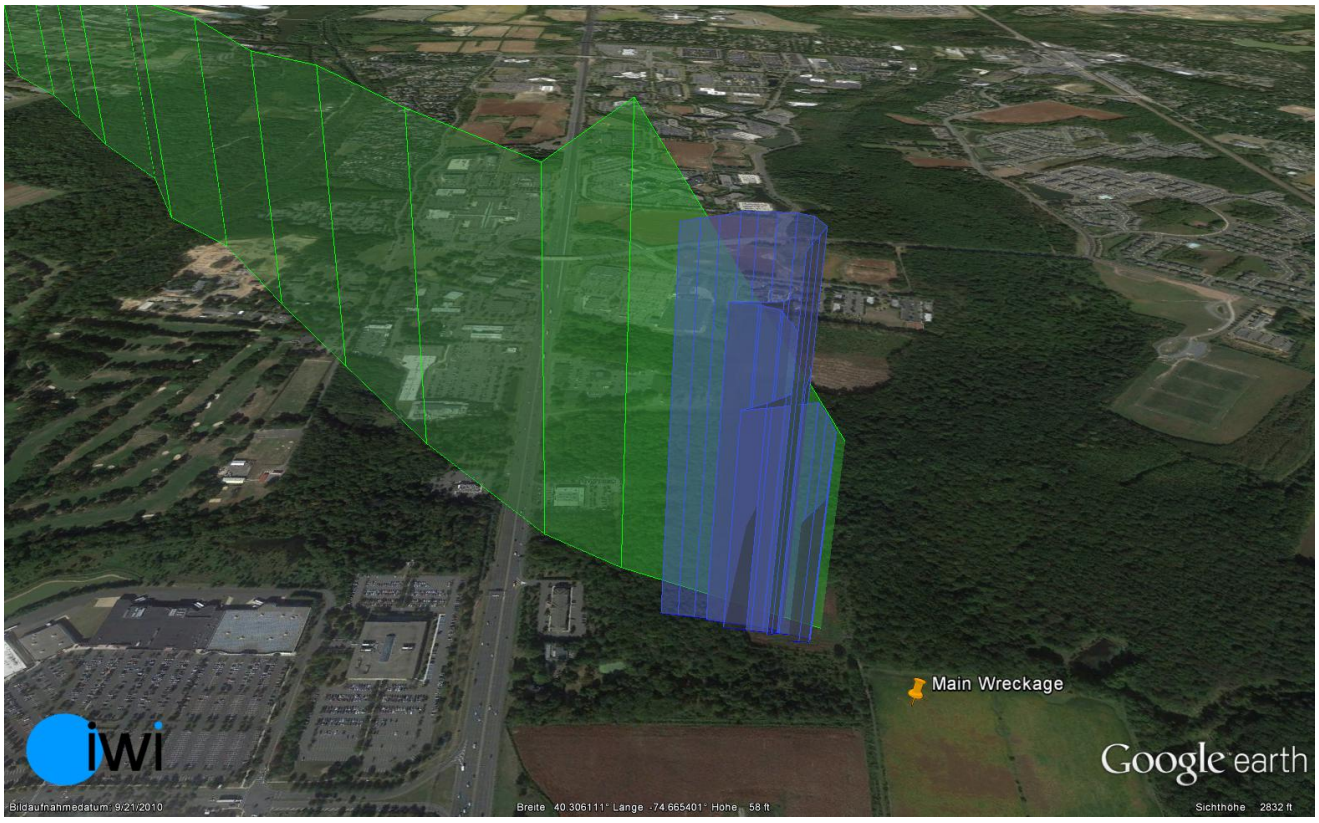


**Figure 14: 3D view showing reconstructed flight path (blue) and radar data (green).**


**Figure 15: 3D view showing reconstructed flight path (blue) and radar data (green).**

# Appendix

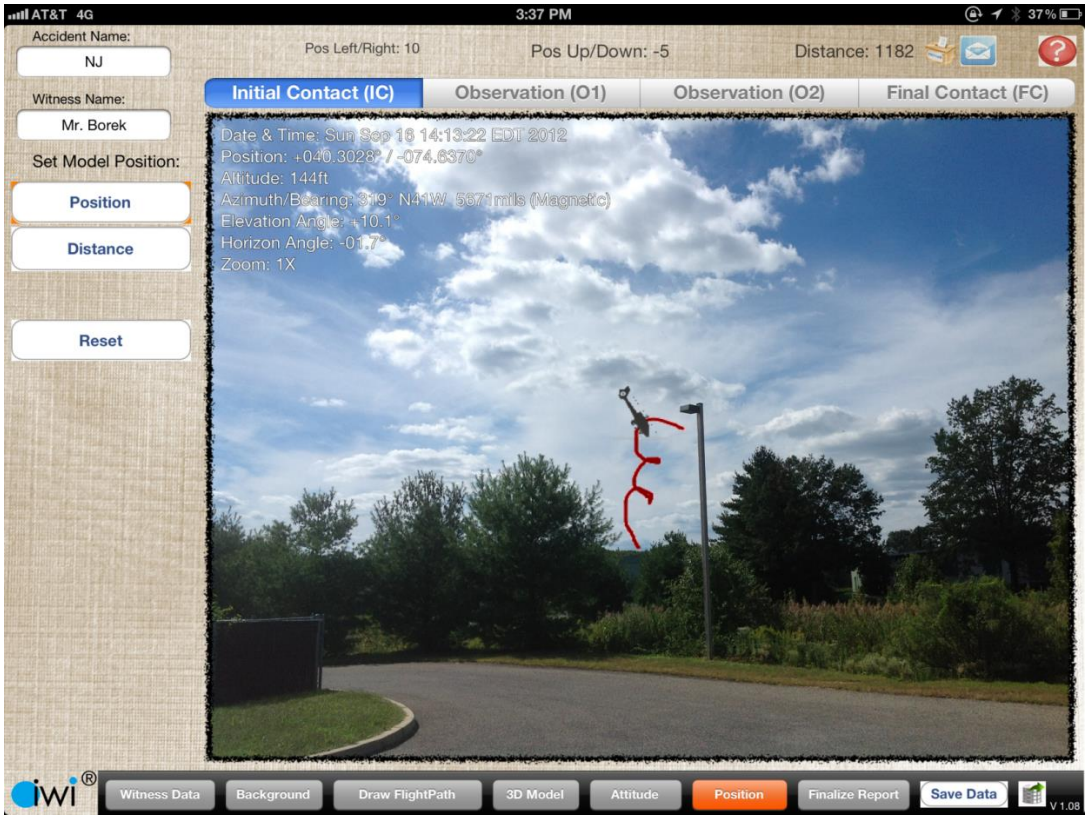


**Figure 16: Screenshot of iwi iPad app with information collected for witness M. Borek**

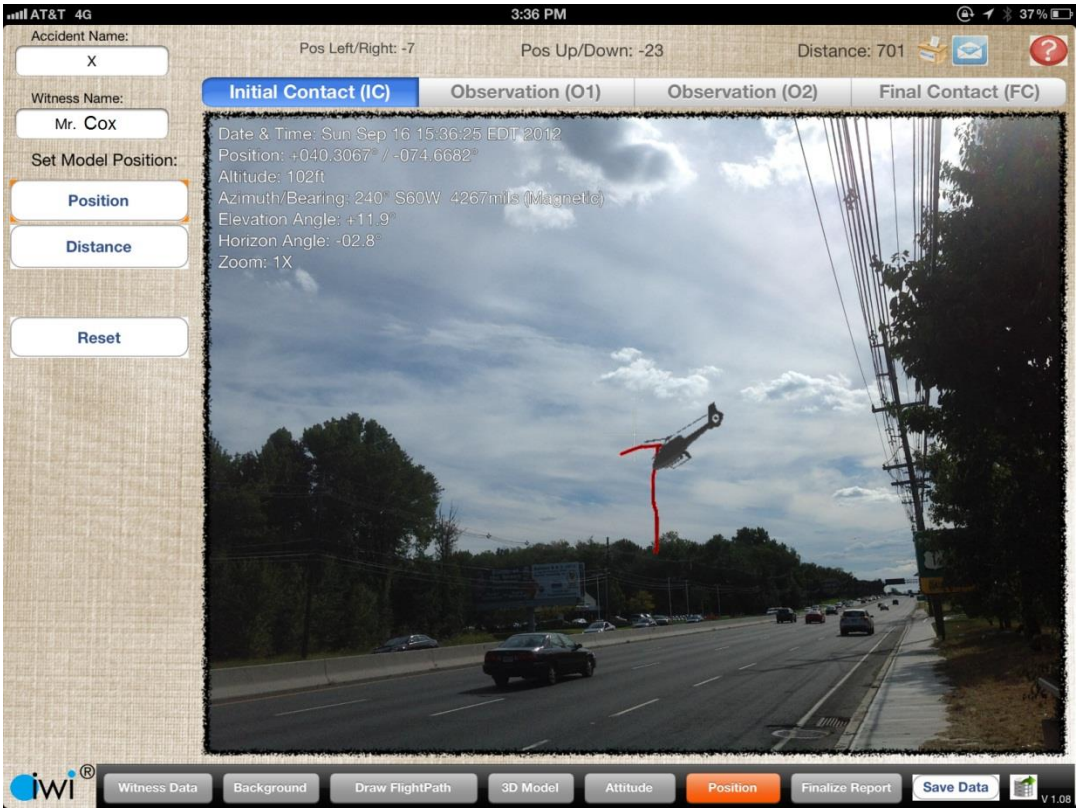


**Figure 17: Screenshot of iwi iPad app with information collected for witness M. Cox**

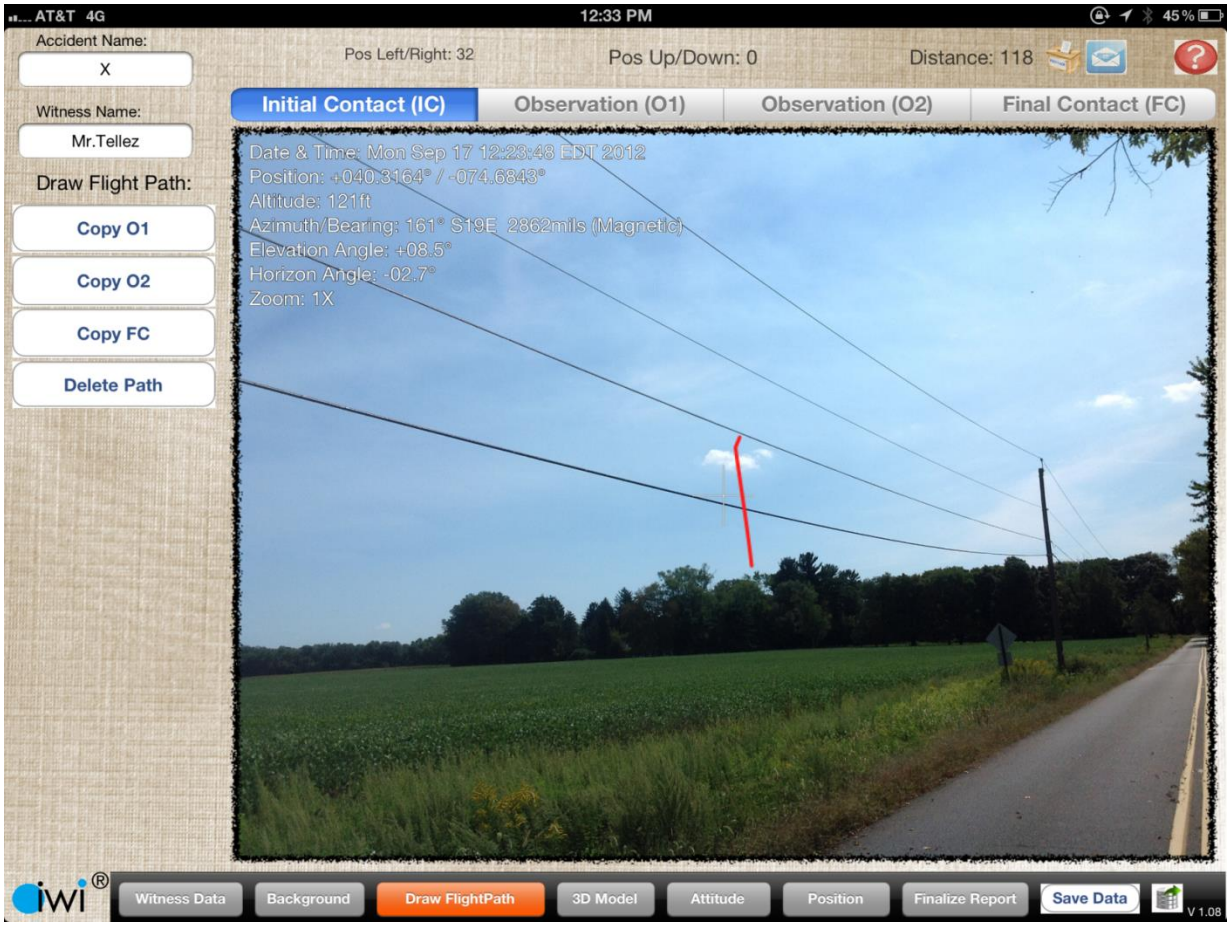


**Figure 18: Screenshot of iwi iPad app with information collected for witness M. Tellez**

The figure and table below shows the provided available radar data and the calculated ground speed values of the helicopter:

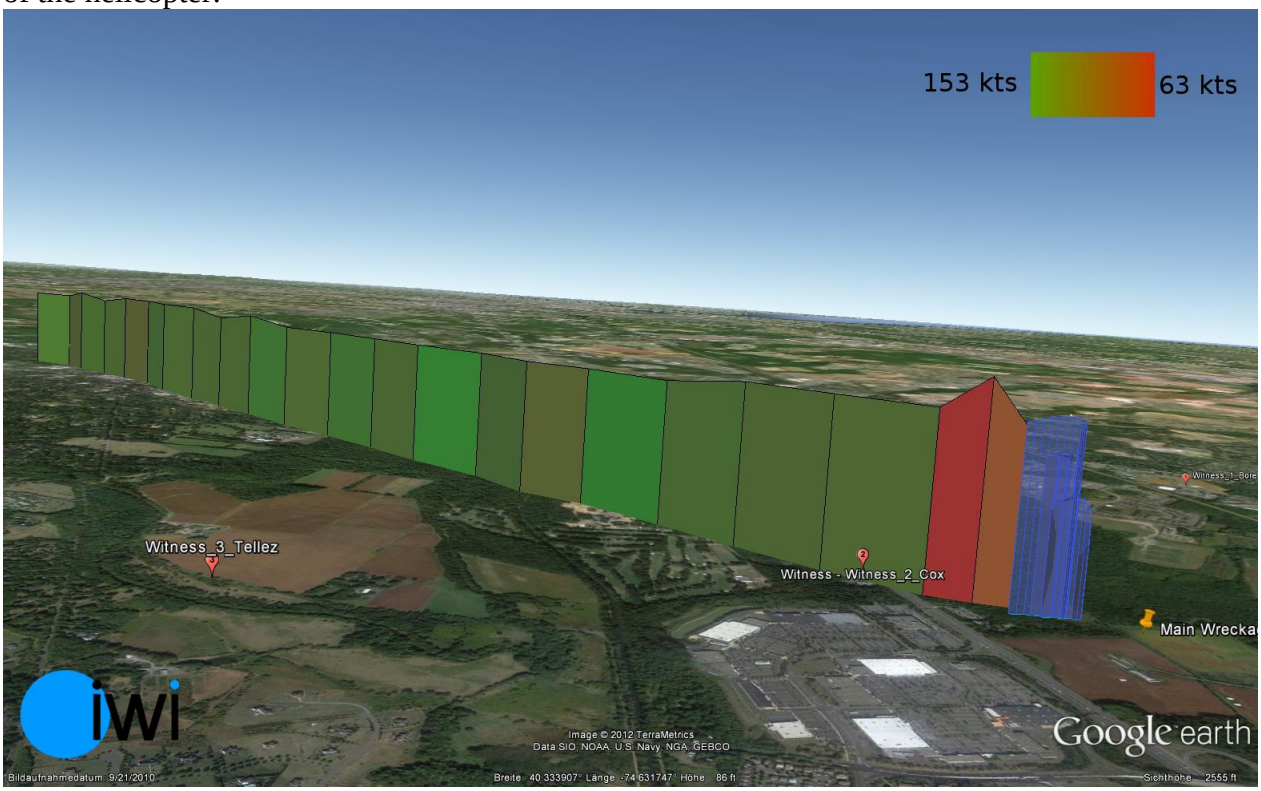


**Figure 19: Radar Data (airspeed color, green/red) and reconstructed flight path (blue)**

| Time (sec) | Latitude (deg) | Longitude (deg) | Altitude (feet) | Calculated AirSpeed (kts) |
|---|---|---|---|---|
| 0,00 | 40,361111 | -74,660556 | 1600 | |
| 4,74 | 40,358333 | -74,660000 | 1600 | 128 |
| 9,51 | 40,355833 | -74,660833 | 1700 | 118 |
| 14,23 | 40,353056 | -74,661111 | 1600 | 128 |
| 19,14 | 40,350278 | -74,661667 | 1700 | 124 |
| 23,96 | 40,347778 | -74,661944 | 1700 | 112 |
| 28,72 | 40,345000 | -74,663056 | 1700 | 132 |
| 33,55 | 40,342222 | -74,663333 | 1700 | 125 |
| 38,44 | 40,339444 | -74,663889 | 1600 | 125 |
| 43,31 | 40,336667 | -74,664444 | 1700 | 125 |
| 48,10 | 40,333611 | -74,665000 | 1600 | 140 |
| 52,99 | 40,330833 | -74,665000 | 1600 | 123 |
| 57,81 | 40,327778 | -74,665556 | 1600 | 138 |
| 62,63 | 40,325000 | -74,666111 | 1600 | 126 |
| 67,44 | 40,321667 | -74,666389 | 1600 | 150 |
| 72,28 | 40,318889 | -74,667500 | 1600 | 130 |
| 77,05 | 40,316389 | -74,667500 | 1600 | 113 |
| 81,83 | 40,313056 | -74,668333 | 1600 | 153 |
| 86,59 | 40,310278 | -74,668889 | 1700 | 128 |
| 91,50 | 40,307500 | -74,669444 | 1700 | 124 |
| 96,41 | 40,304722 | -74,669722 | 1700 | 123 |
| 101,22 | 40,303611 | -74,669444 | 2000 | 63 |
| 110,84 | 40,301389 | -74,668333 | 900 | 86 |

**Table 1: Radar Date with calculated Airspeed**