Immersive Witness Interview (IWI ®)

Accident: AS350, LQ-FJQ and LQ-CGK;
Rioja, Argentina; 09 March-2015

Report Outline

SECTION:	PAGE:
Background about IWI®	3
Case Overview	4
Case Map	4
Witness Overview	5
Witness 1	7
Witness 2	8
Meteorological Information	9
Terrain Background	9
Reconstruction	
Witness 1	10
Witness 2	13
TimeSync	15
Attitude	16
Conclusion	17
Appendix	20
References	22

Background about IWI®

The Immersive Witness Interview (IWI ®) techniques and the iPad app tool used in this report were developed by Dr. Bauer since 2007 to provide a qualitative and simple to understand analysis of accident flight path investigations. The IWI methodology 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 world.

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 visual verification of the dependencies in the witness statements can quickly be identified in the *Immersive Witness Interview Analyzer* software to qualify the level of witness error or accuracy (showing the witnesses who articulate good / poor observations).

IWI® can approximate a flight path or moving path with a minimum of two different positioned eyewitness statements. The result can be visualized with the expected errors using the developed IWI® application called: *Immersive Witness Interview Analyzer* software for 3D visualization.

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 9th March 2015, in the province of Rioja in Argentina, two Airbus Helicopters AS 350 collided in flight.

Case Map

The figure below shows the top view of the case map with radar data (green line), accident site (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, and #2,location of main wreckages of AS350 B3e and AS350 B3+ Map data©2012 GoogleMaps

Witness Overview

In the frame of this subject accident investigation, both witnesses recorded the accident situation with a video camera. The video data has been used as witness observation information and applied with the *Immersive Witness Interview (IWI®)* method and inserted into the 3D environment of the Immersive Witness Interview Analyzer software for analyses.

Witness	Position Latitude (deg)	Position Longitude (deg)	Position Elevation (feet)	Face Direction	IC Initial contact	FC Final contact	◊1 Spc Observation	Attitude
#1 Witness1	-29.011483	-68.213969	4284	308°- 328°	X	X		X
#2 Witness2	-29.007728	-68.223183	4244	62° - 95°	X	X		X

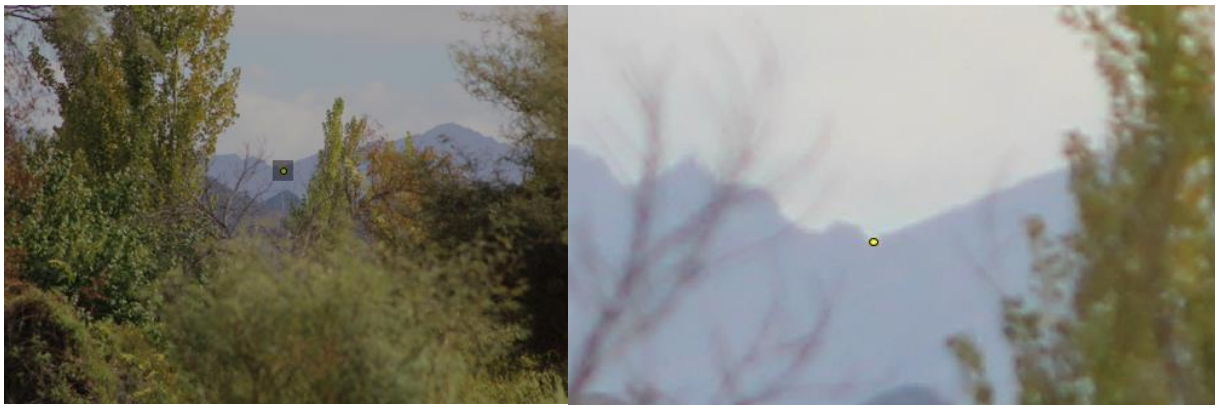
Table 1: Position in Latitude and Longitude of the available witnesses.

For the correct placement of the images in the 3D environment, the following reference objects have been used:

Reference Points	Position Latitude (deg)	Position Longitude (deg)	Position Elevation (feet)	Witness View Azimuth to Ref Object	Witness View Elevation to Ref Object	Ref Position Distance to witness position
Ref1 : Witness1, V11	-28.97759700	-68.26356000	4800	309,5°	1,8°	6.150 m
Ref2 : Witness1, V22	-28.84651800	-68.36202400	6400	324,0°	1,4°	23.800 m
Ref3 : Witness2, V33	-28.98298500	-68.17243300	5300	60,8°	3,2°	5.750 m
Ref4 : Witness2, V44	-28.99015300	-68.17093500	5100	68,8°	2,6°	5.450 m

The reference points Ref1 (V11), Ref2, V22, Ref3, V33 and Ref4 (V44) had been measured on site, provided by local authority. The reference points had been identified in the images of witness 1 and witness 2 and placed in the IWA application.

Reference Point 1, V11 (left zoom out, right zoom in), yellow dot shows marker [1]



Reference Point 2, V22 (left zoom out, right zoom in), yellow dot shows marker [1]

Reference Point 3, V33 (left zoom out, right zoom in), yellow dot shows marker [1]

Reference Point 4, V44 (left zoom out, right zoom in), yellow dot shows marker [1]

Witness #1:

The following depiction illustrates the filmed perspective of witness #1 where both helicopters had been observed. The photo has been inserted into the *Immersive Witness Interview Analyzer* software. The red marks show the AS350B3+ and the green marks show the AS350 B3e with the time stamp (minutes::seconds) of the taken screenshot from the video.

Figure 2: Witness #1 viewpoint with observed positions (screenshot export from video)

The video shows both helicopters coming from the right, flying behind the trees (center) and then colliding together in the left side of the image.

Witness #2:

The following depiction illustrates the filmed perspective of witness #1 where both helicopters had been observed. The photo has been inserted into the *Immersive Witness Interview Analyzer* software. The red marks show the AS350B3+ and the green marks show the AS350 B3e with the time stamp (minutes::seconds) of the taken screenshot from the video.

Figure 3: Witness #2 viewpoint with described flight path (red line).

The video shows both helicopters coming from the left and then colliding together in the right side of the image.

Meteorological Information

At accident time (9th March 2015, approx. 17:15 local time) the meteorological conditions were good, as shown on the screenshots of the videos of the witnesses with good visibility.

Terrain Background

The terrain around the accident site is quite flat and the terrain surface level goes from 4240 feet up to 4280 feet sea level.

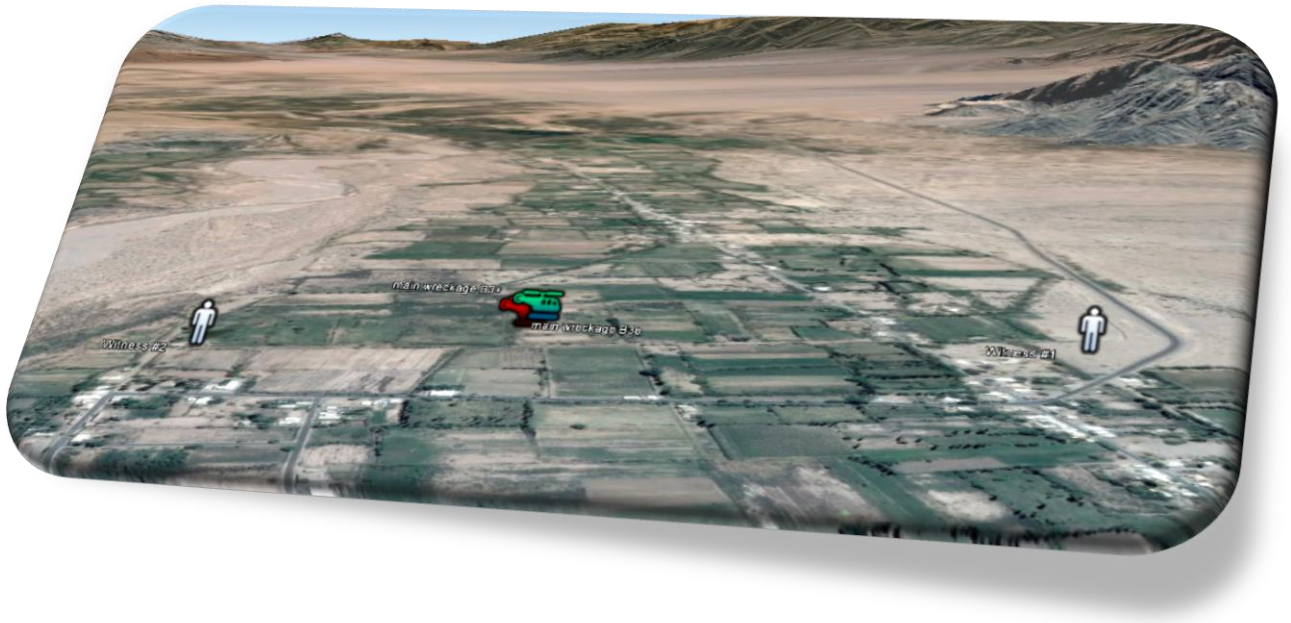


Figure 4: Terrain overview around accident site with witness positions and position of wreckages.
Map data©2012 Google

IWI Reconstruction - Witness #1

The following images are from the perspective of the video recorded by witness #1.

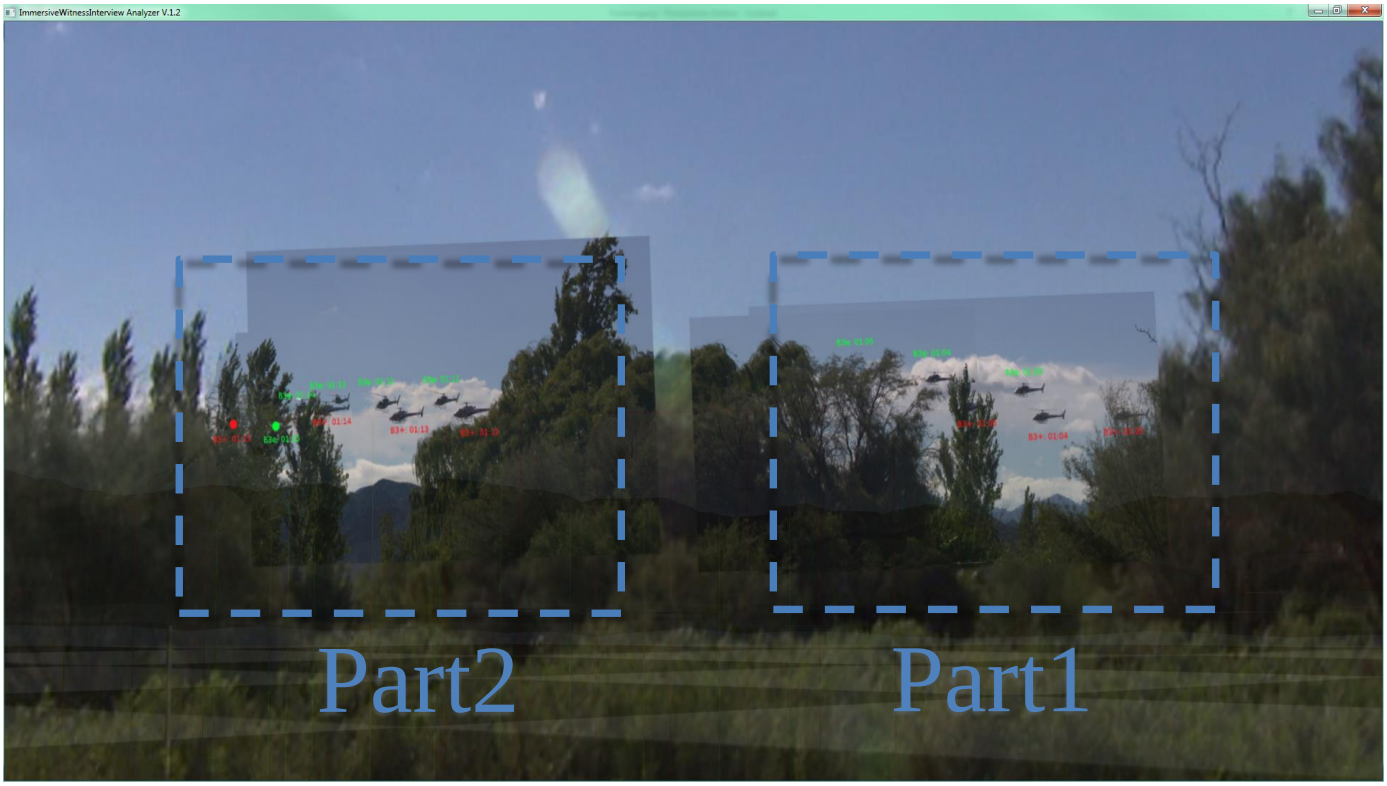


Figure 5: Witness #1 recorded video with time stamps (minutes::seconds)for the AS350 B3+ (red) and AS350 B3e (green)

Figure 6: Witness#1 recorded videoWitness Part1

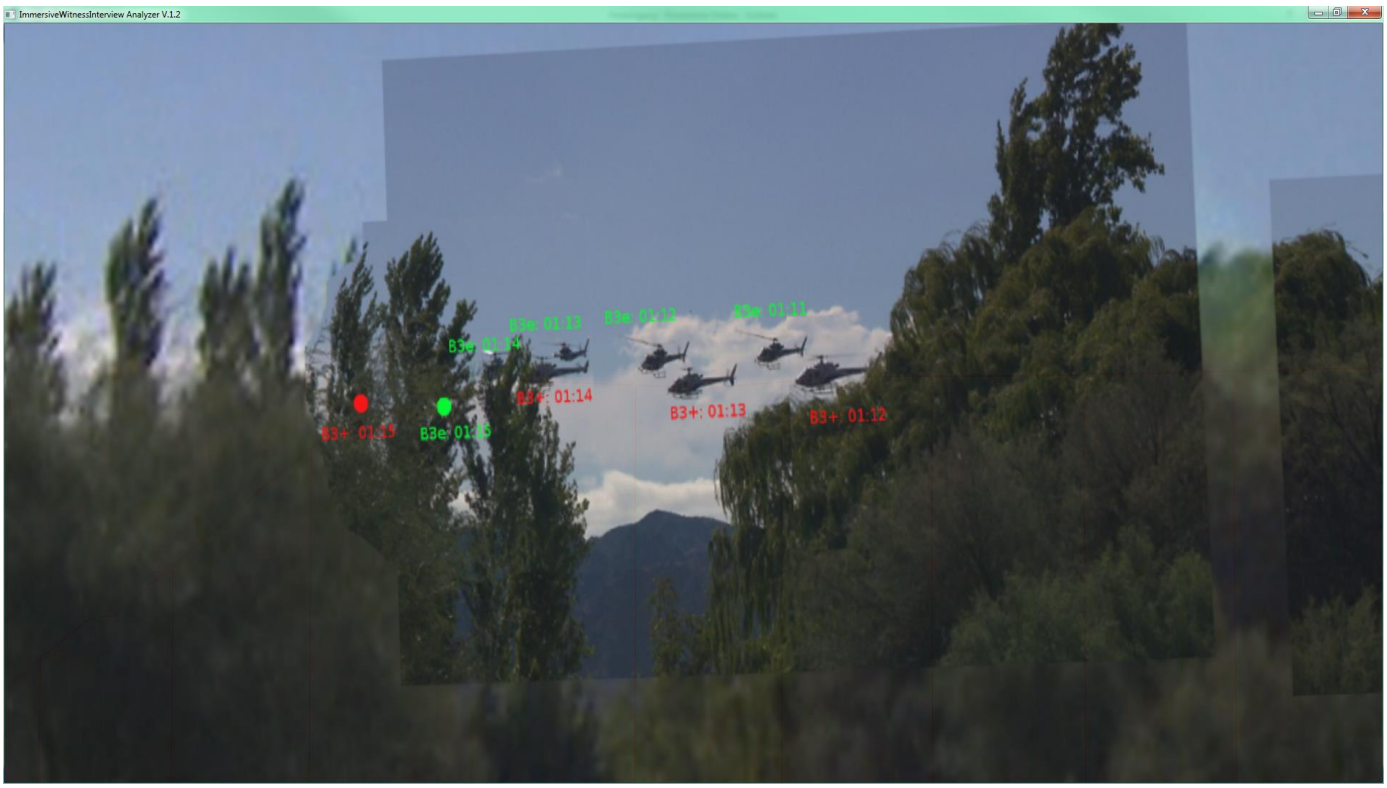


Figure 7 : Witness#1 recorded videoWitness Part2

For both helicopters, the lines of sight have been created based on the recorded video images.

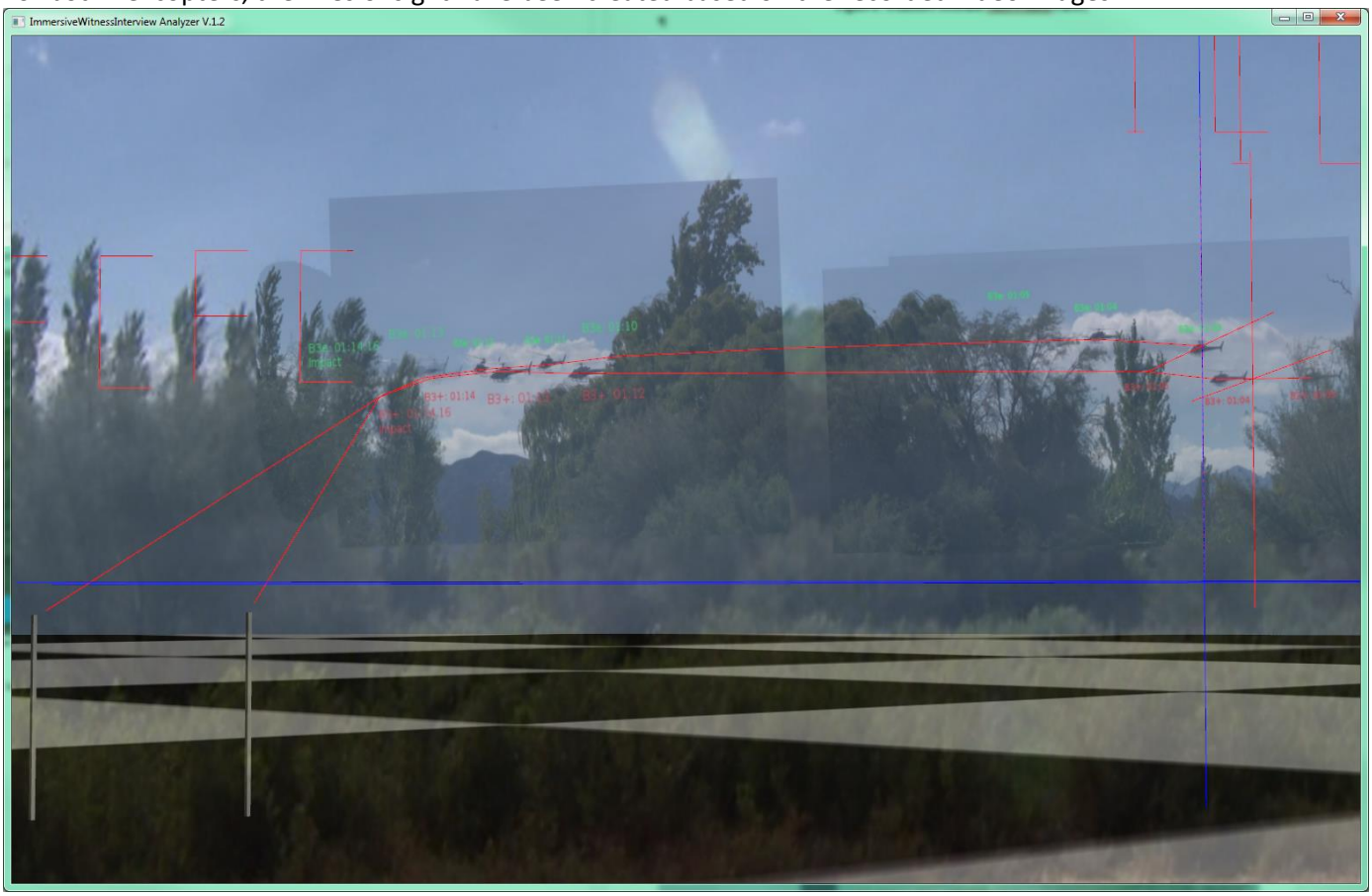


Figure 8 : Witness #1 view with observed flight path lines for both helicopters.

Between Part1 and Part2, the helicopters were not visible, as they were hidden behind the trees. The flight path has been assumed to be linear. The position of the wreckages is marked with two grey cylinders on the left.

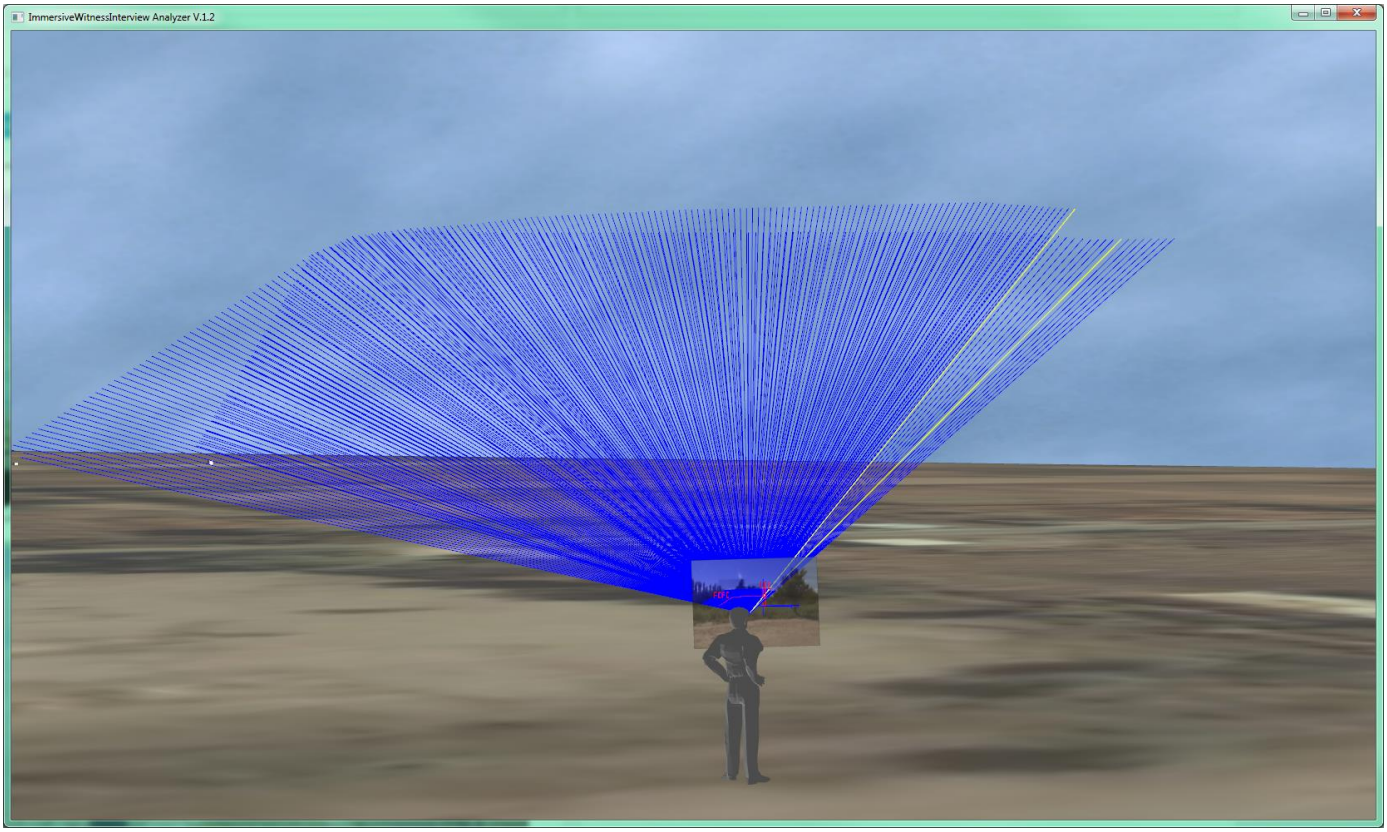


Figure 9: Witness #1 view (*Immersive Witness Interview Analyzer)* software with lines of sight.

IWI Reconstruction - Witness 2

The following images are from the perspective of the video recorded by witness #2.

Figure 10: Witness #2 recorded video with time stamps (min:sec) for the AS350 B3+ (red) and AS350 B3e (green)

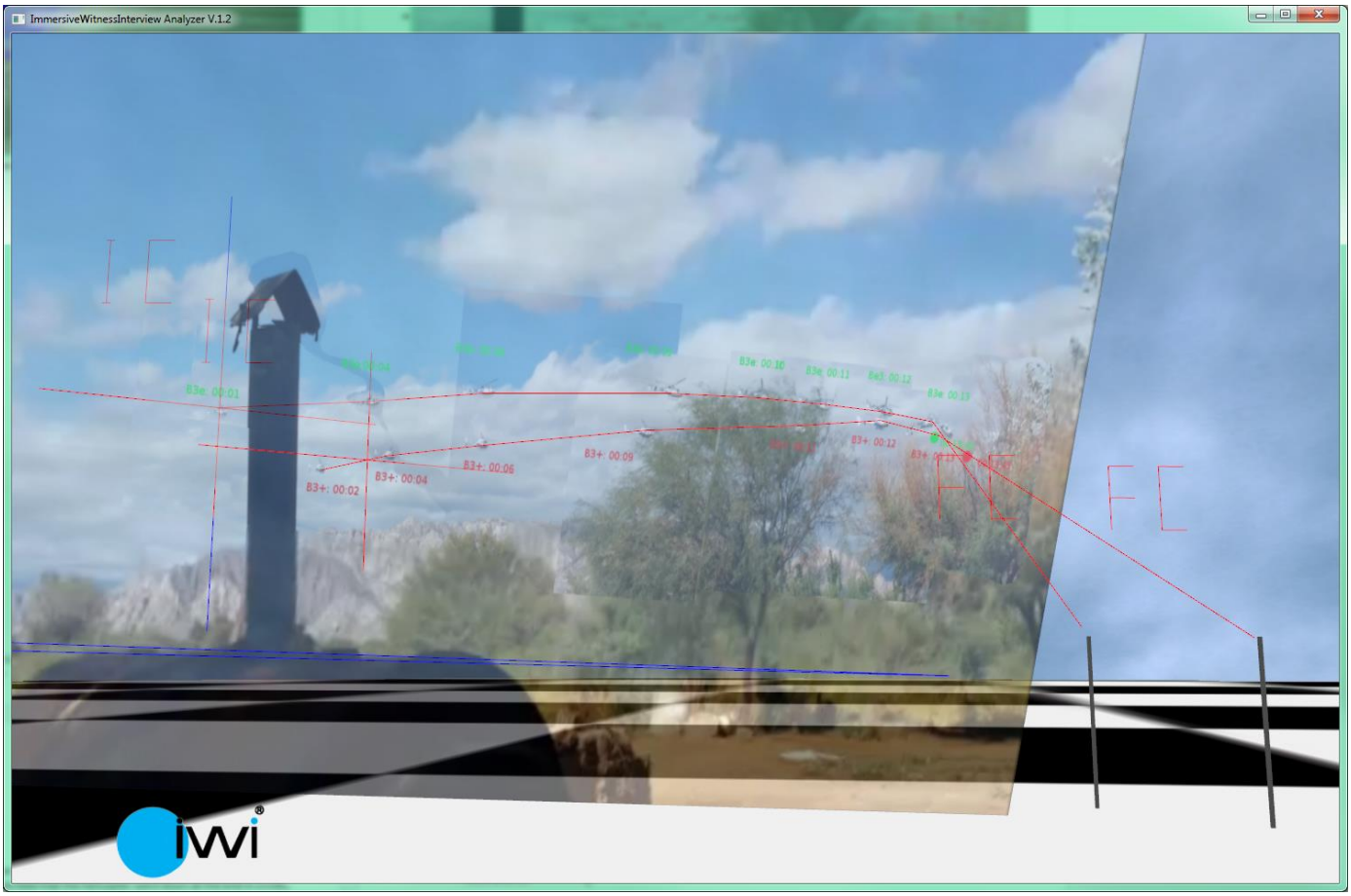


Figure 11 : Witness #2 view with observed flight path lines for both helicopters.

The position of the wreckages is marked with two grey cylinders on the right.

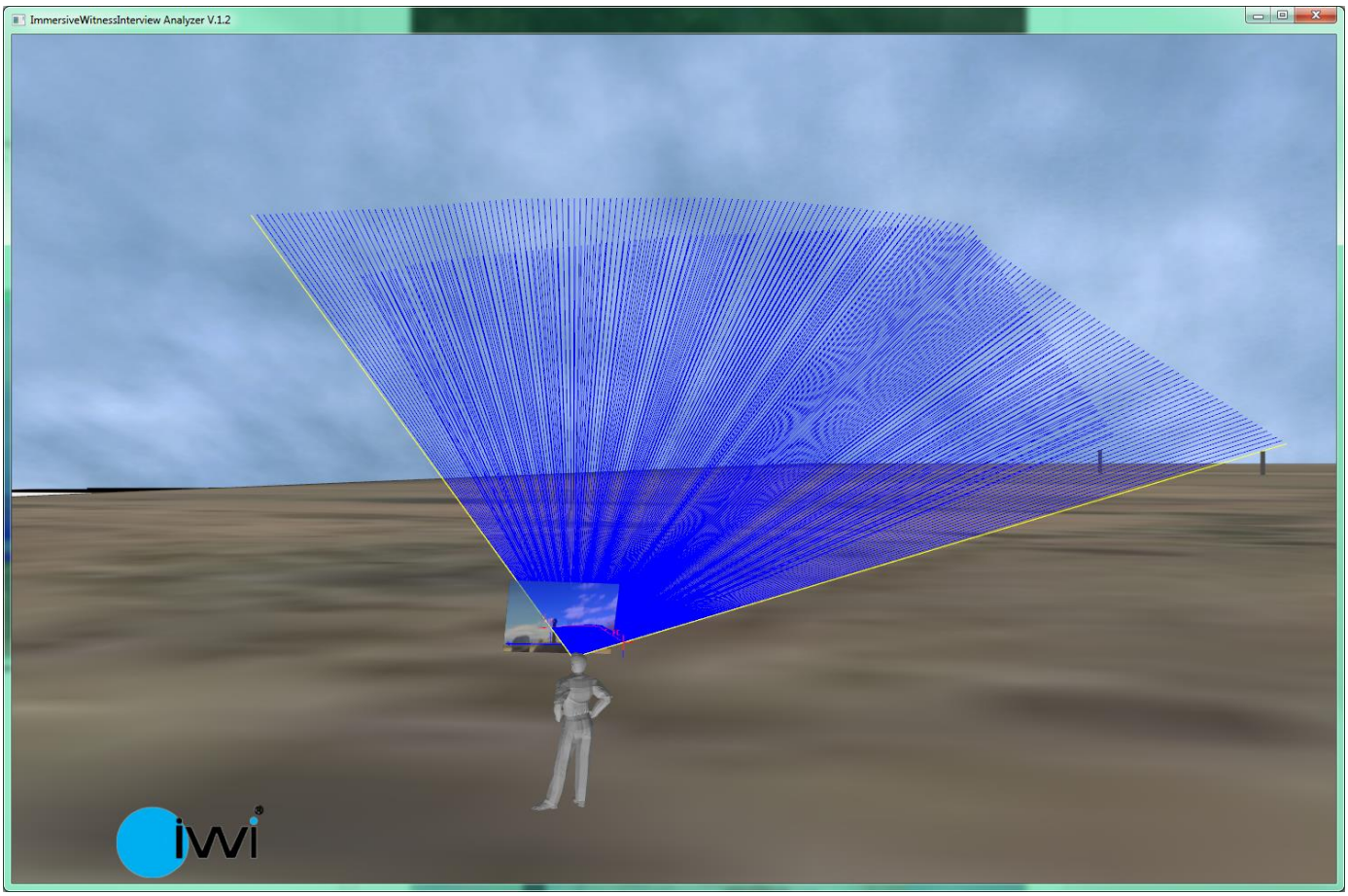


Figure 12: Witness #2 view (*Immersive Witness Interview Analyzer)* software with lines of sight.

IWI Reconstruction - TimeSync

The data was synched to the time of impact, when both helicopters collided.
The loud noise of the impact was clearly hearable. However the noise had a delay due to the distance of the witness to the observed helicopter positions. The delta was calculated based on the reconstructed distance:

Witness #1:

Delta calculation:

v (sound) = 340 m/s
d (distance) = 705 m
h (height above terrain) = 87 m
d_total = d_total$\sqrt{d^2 + h^2}$ = 710 m
delta = d_total / v = 2,1 seconds

Distance of witness #1 to reconstructed collision position

Witness #1, Video Image with Impact Sound
(01min 16,05 seconds)

-2.1s

Witness #1, Video Image minus 2.1s
(01min 13,95 seconds)

Witness #2:

Delta calculation:

v (sound) = 340 m/s
d (distance) = 365 m
h (height above terrain) = 87 m
d_total = d_total$\sqrt{d^2 + h^2}$ = 375 m
delta = d_total / v = 1,1 seconds

Distance of witness #2 to reconstructed collision position

Witness #2, Video Image with Impact Sound
(13,33 seconds)

-1.1s

Witness #2, Video Image minus 1.1s
(12,23 seconds)

The following table shows the timeline of the both videos, mapped with the reconstructed flight path time stamps.

Timeline B3e	T0							Impact
Witness1	01:05			01:10	01:11	01:12		01:14
Witness2		00:04	00:06		00:09	00:10	00:11	00:12
Reconstruction	00:03	00:04	00:06	00:08	00:09	00:10	00:11	00:12

Timeline B3+							Impact
Witness1	01:05				01:12	01:13	01:14
Witness2		00:04	00:06	00:09	-	00:11	00:12
Reconstruction	00:03	00:04	00:06	00:09	00:10	00:11	00:12

Figure 13: Mapping of timetable of both videos and reconstructed flight path

IWI Reconstruction - Attitude

To reconstruct the attitude of the helicopters, a 3D model of an AS350 with the correct dimensions has been loaded into the IWI application. The 3D object has been placed over the photos to verify the size of the 3D model against the helicopter on the image and to set heading, roll and pitch values for each marked position.

Conclusion

Both videos show the last 12 seconds before the impact of the helicopters. In the video of witness #1 the helicopters are hidden for 5 seconds, when flying behind the trees, but the observation on the video of witness#2 shows the continuous flight for this period. Based on that information, the last 12 seconds before the impact could be approximated and due to the performed timesync with the collision sound of the impact, both videos could be synchronized.
The attitude for both helicopters could be reconstructed by overlaying a 3D model in the IWI application.

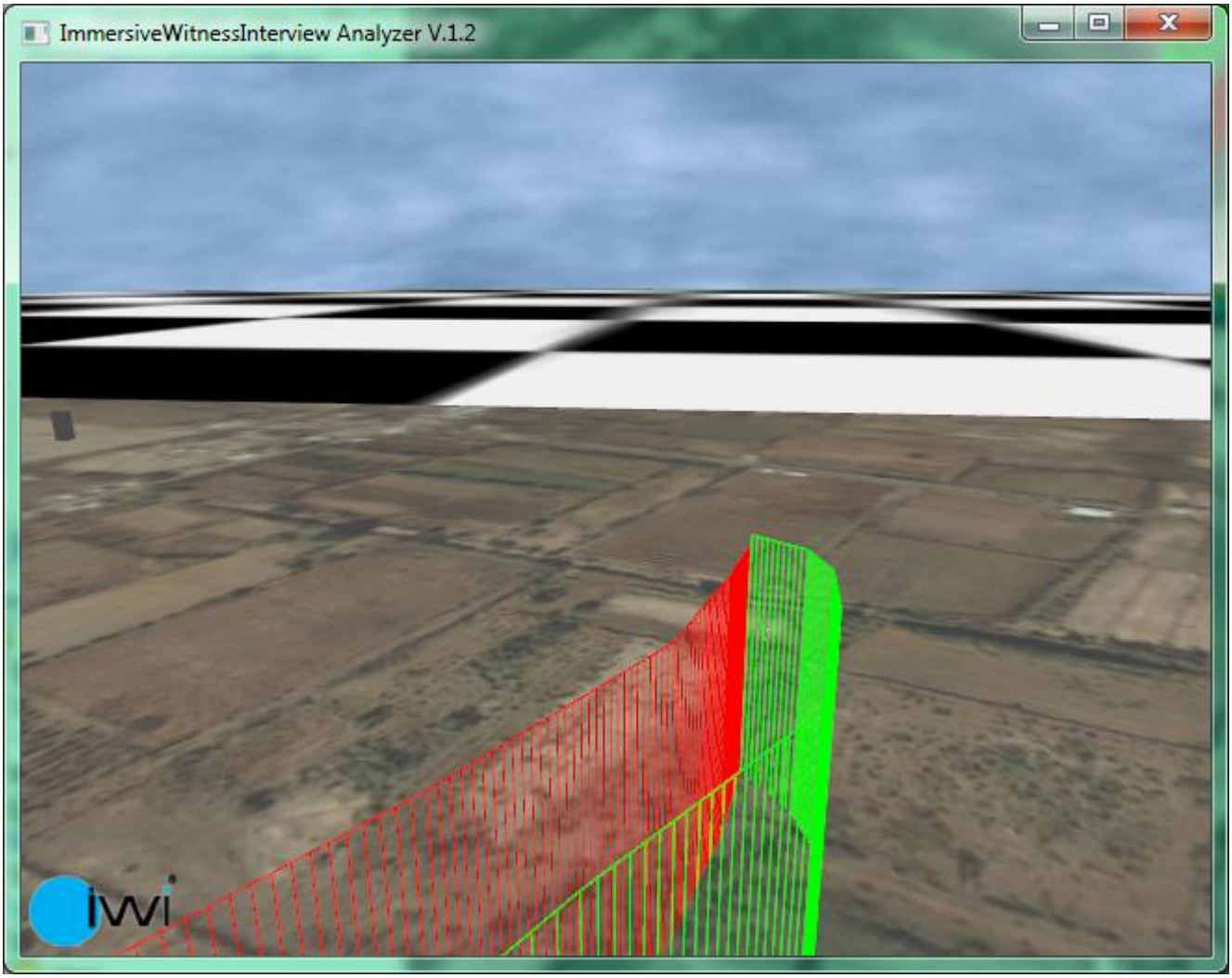
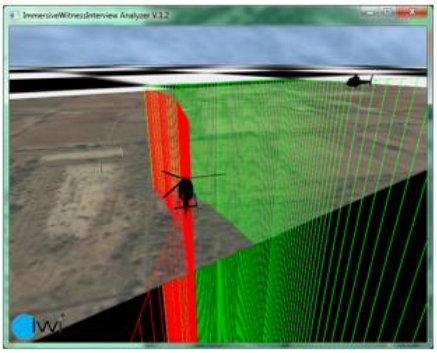
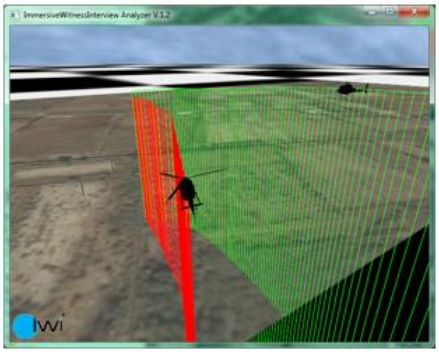


Figure 14: Top view showing ground track of reconstructed path (blue) and radar data (green).

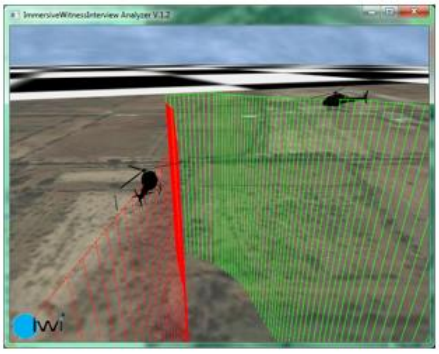
External View:



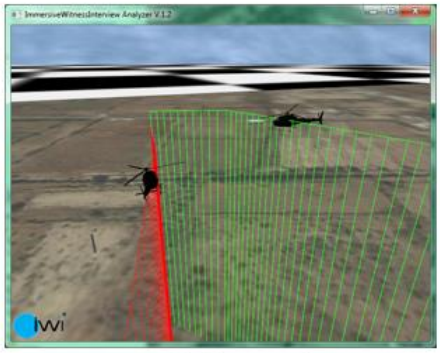
00:04 seconds



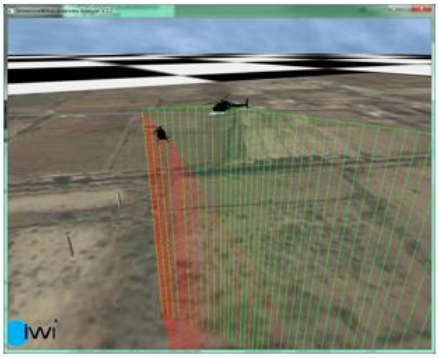
00:06 seconds



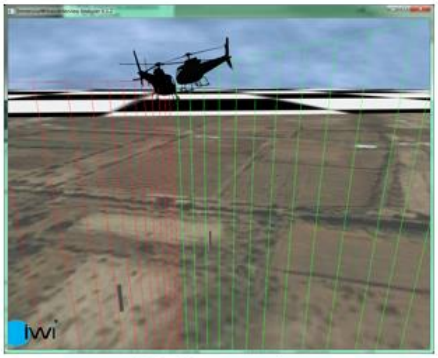
00:08 seconds



00:10 seconds

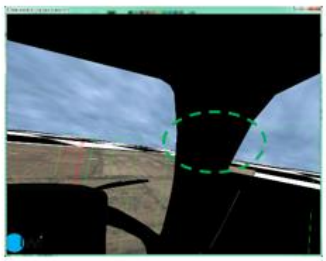


00:11 seconds

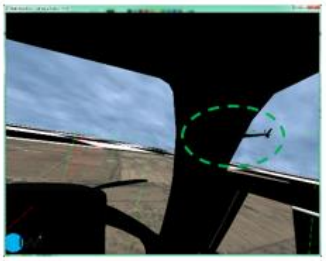


00:12 seconds

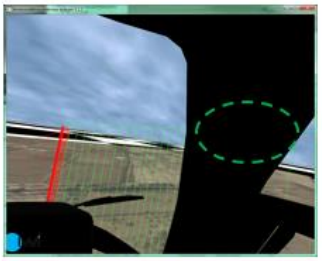
B3+ Cockpit Views



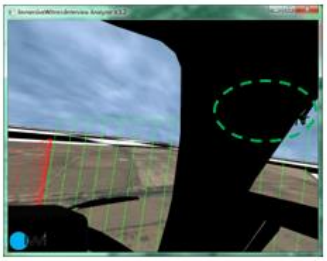
00:06 seconds



00:08 seconds



00:10 seconds

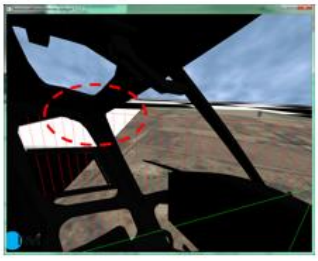


00:11 seconds

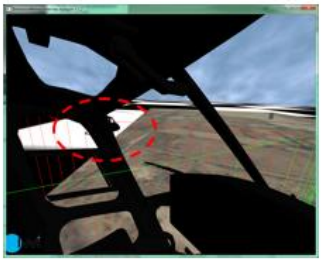
B3e Cockpit Views

00:06 seconds

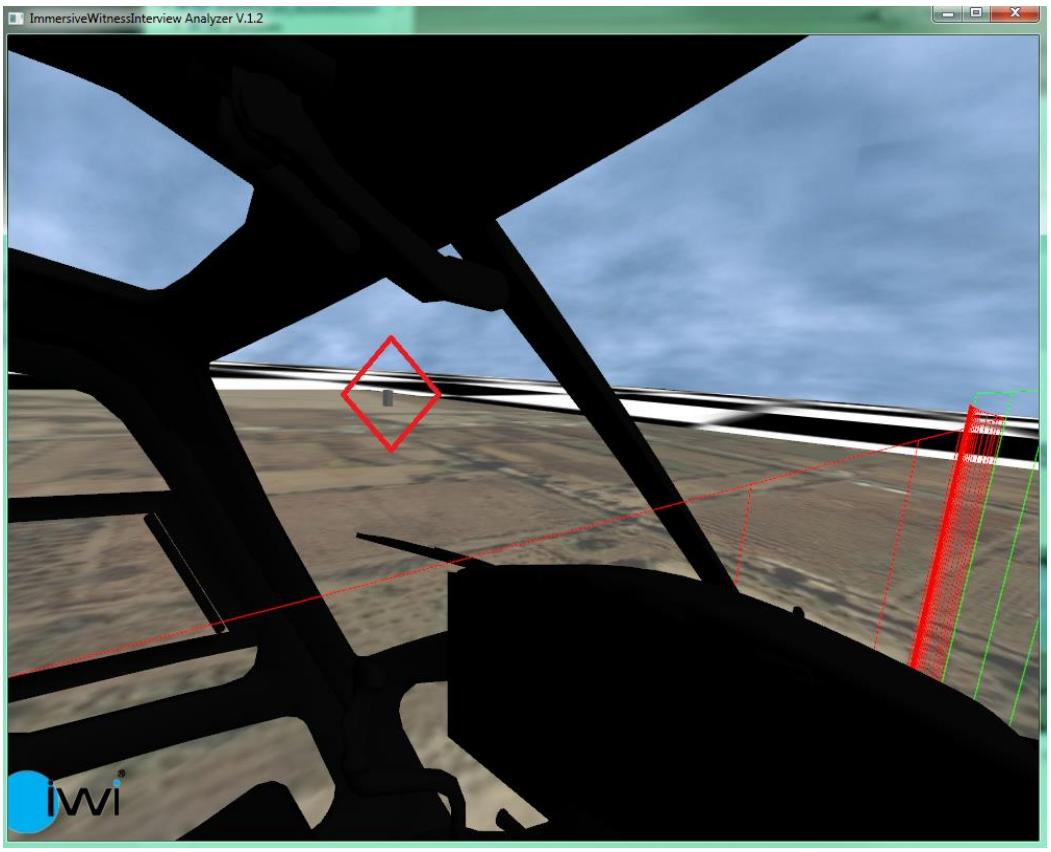
00:08 seconds



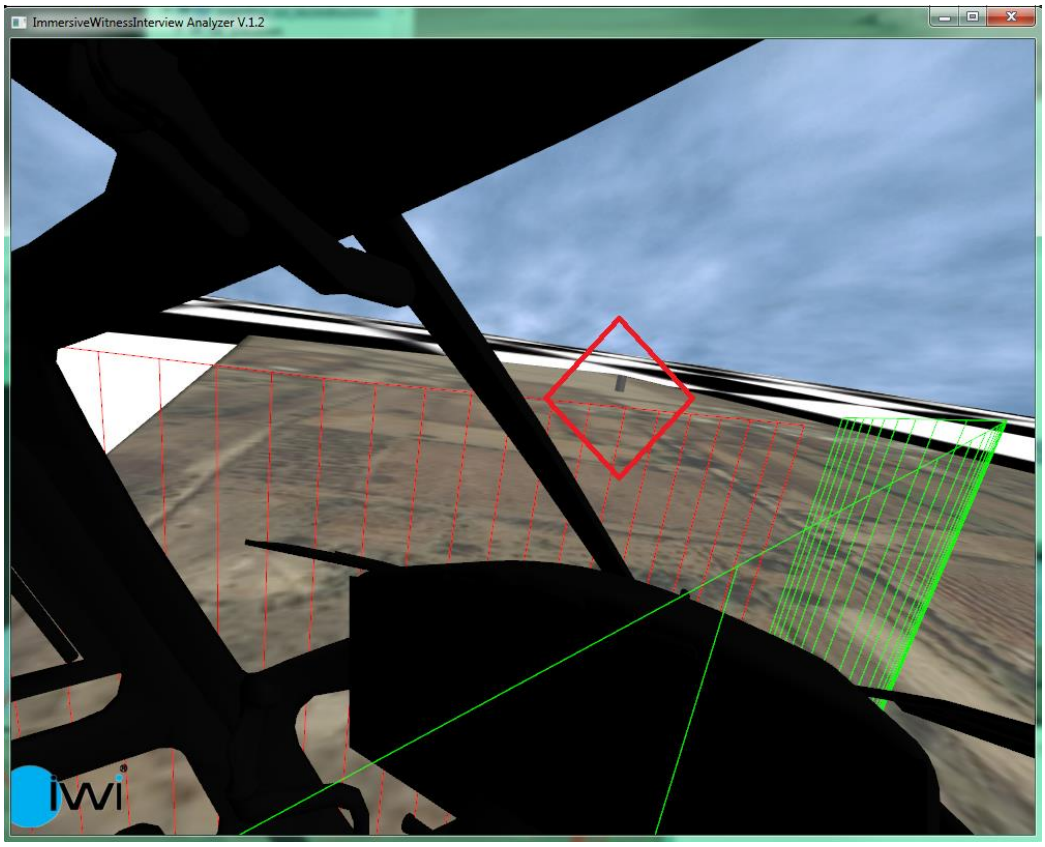
00:10 seconds



00:11 seconds



Cockpit View B3+ (10 seconds), red marker shows departure position (witness #1)



Cockpit View B3e (10 seconds), red marker shows departure position (witness #1)

Appendix

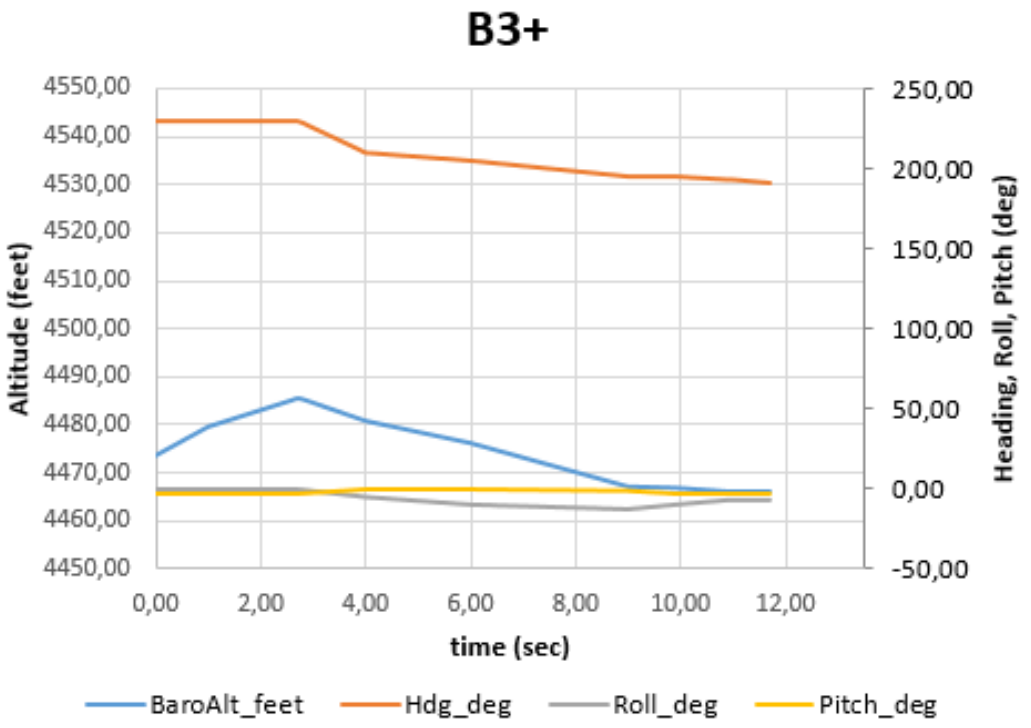


Figure 15: Reconstructed attitude data of the AS350 B3+

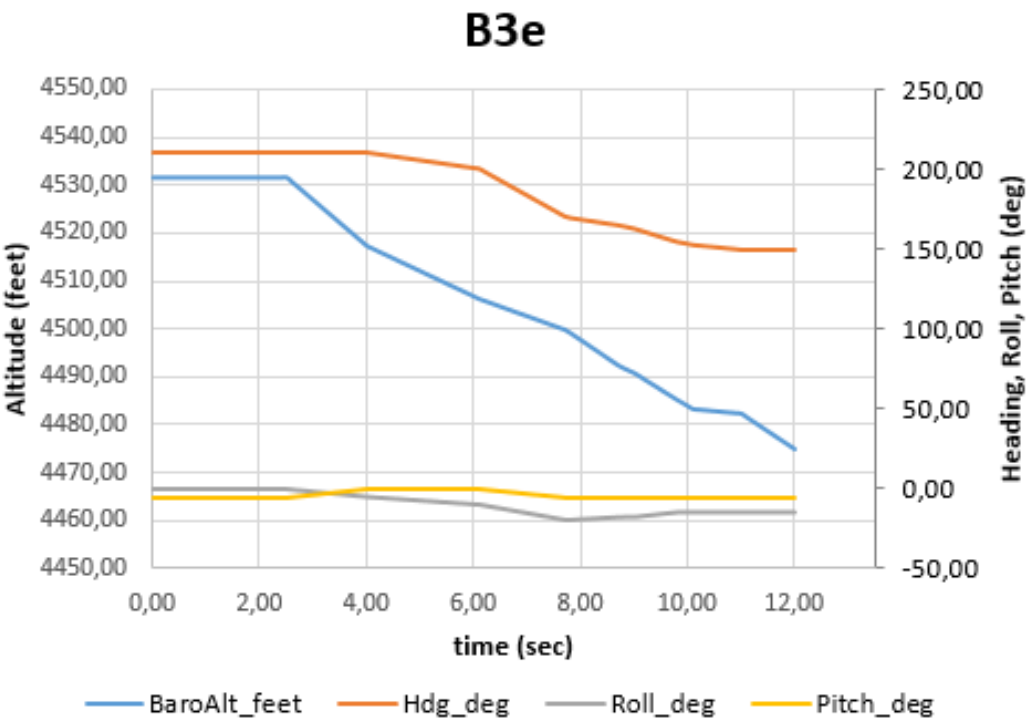


Figure 16: Reconstructed attitude data of the AS350 B3e

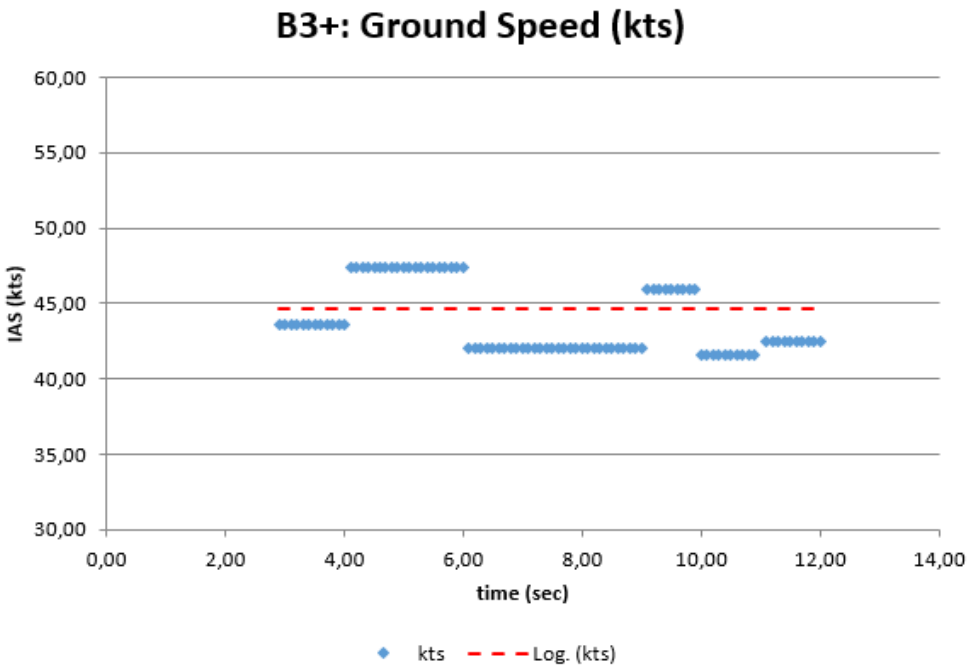


Figure 17: B3+ reconstructed Ground Speed (kts)

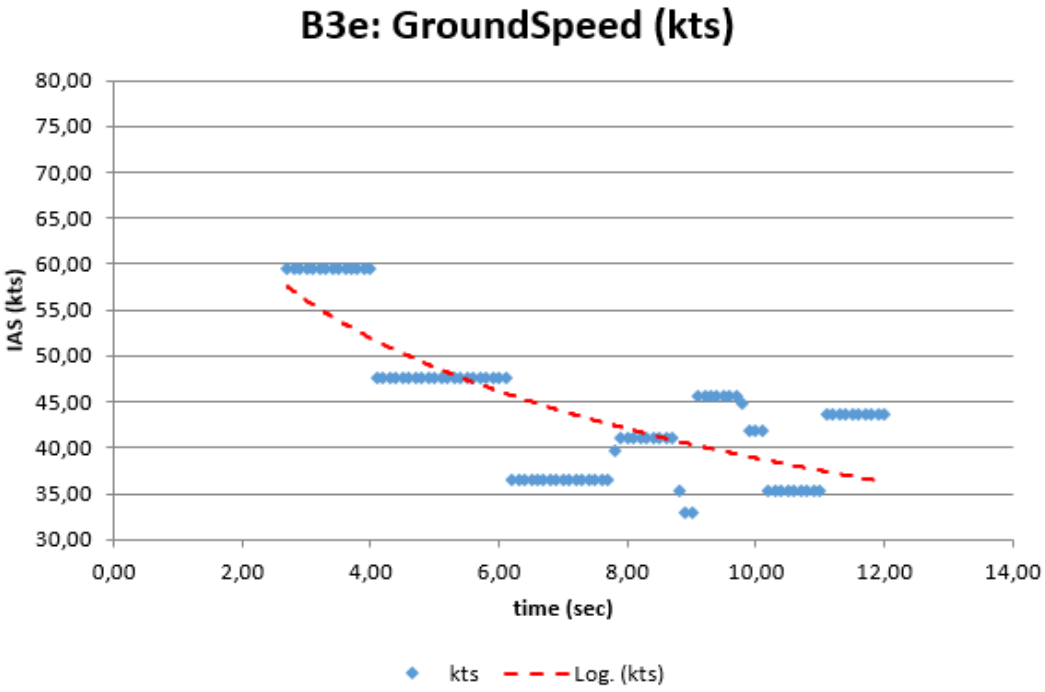


Figure 18: B3e reconstructed Ground Speed (kts)

References

[1] JIAAC –V. CASTELLI, 18-19 May 2015,Argentina