

National Transportation Safety Board

Office of Research and Engineering

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ONBOARD IMAGE, AUDIO AND DATA RECORDER

Group Chair's Factual Report

September 4, 2025

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. ONBOARD IMAGE, AUDIO AND DATA RECORDER GROUP.....	3
C. DETAILS OF THE INVESTIGATION	4
1.0 Appareo Vision 1000 Device Description	4
1.1 Data Recovery	4
2.0 APPAREO VISION 1000 RECORDING DESCRIPTION	5
3.0 OBSERVED DATA DESCRIPTION	6
4.0 TIMING AND CORRELATION	7
5.0 FIGURES AND TABULAR DATA.....	7
5.1 Recorded Parameters.....	7
5.2 Parameters Observed from Video.....	7
6.0 APPAREO VISION 1000 VIDEO SUMMARY	8

A. ACCIDENT

Location: Raft River, Idaho
Date: August 2, 2024
Time: 21:07 mountain daylight time (MDT) on August 2, 2024
03:07 coordinated universal time (UTC) on August 3, 2024
Helicopter: Bell 407, US Forest Service, N20BH

B. ONBOARD IMAGE, AUDIO AND DATA RECORDER GROUP

A group was convened on December 4, 2024, and a summary was prepared. The group consisted of the following members:

Group Chair:	Olivia Fowler Mechanical Engineer - Vehicle Recorders National Transportation Safety Board (NTSB)
IIC:	Elliott Simpson Senior Aviation Accident Investigator National Transportation Safety Board (NTSB)
Specialist:	Pierre Scarfo Aerospace Engineer - Powerplants National Transportation Safety Board (NTSB)
Group Member:	John E. Mills Air Safety Investigator Department of the Interior - Office of Aviation Services
Group Member:	Jack Johnson Senior Air Safety Investigator Rolls-Royce Corporation
Group Member:	Tom Ronan ECU Design and Software Engineer Rolls-Royce Corporation
Group Member:	Tony Peltier Chief Pilot Brainerd Helicopter Service Inc.
Group Member:	Matthew McLuckie Air Safety Investigator Bell Flight

C. DETAILS OF THE INVESTIGATION

The NTSB Vehicle Recorder Division received the following onboard recorder:

Device Manufacturer/Model:	Appareo Vision 1000
Part Number:	150575-000014
Device Serial Number:	VIS-FK6R

1.0 Appareo Vision 1000 Device Description

The Appareo Vision 1000 device is a small self-contained image, audio, and data recorder. The unit is typically mounted in the overhead panel of the aircraft's cockpit and records an image at a rate of four times per second with its internal camera. A GPS receiver is included that receives GPS satellite-based aircraft time, position, altitude, and speed. The Appareo unit also has a self-contained real-time inertial measuring unit that can record 3-axis acceleration, and derived pitch, roll and yaw data.

Two independent audio tracks can be recorded, depending on installation and configuration. One audio track records ambient sounds in the helicopter cabin using a microphone mounted in the device. The second audio track can optionally be wired to another audio source, such as the helicopter's intercom. In this case, the second audio track was not used.

The Appareo unit records the image, audio and parametric data on a removable SD memory card that is inserted into the unit.¹ Depending on card size, this removable memory retains approximately the last two hours of image and audio data and about the last 100 hours of parametric data. In addition to the removable memory, the Vision 1000 is also equipped with a memory module that is mounted internally to the unit. The internal memory records the same information as the removable SD card.

In a typical installation, the Appareo unit is connected to the aircraft electrical bus. Any time the battery switch is turned on, the Appareo unit will start to record audio, images, and data. The Vision 1000 unit creates a new file for every electrical power application and can create multiple files for the same power cycle if the recording time exceeds a certain time limit.

1.1 Data Recovery

The device was in good condition, as shown in figure 1, and the unit contained a removable Appareo branded SD card. The SD card was removed and downloaded

¹ SD - Secure Digital - A type of nonvolatile memory card used extensively in portable devices.

using the manufacturer's software. The file system contained parametric, image and audio data. The audio data consisted of one track, consistent with a cockpit area mic (CAM) channel. No further data was recovered, and previous flights were not reviewed.



Figure 1. The Appareo Vision 1000 as received.

2.0 Appareo Vision 1000 Recording Description

The recovered recording of the accident flight on August 2, 2024, consisted of parametric data and a video file with audio.² The recording of the accident flight was approximately 1 hour, 26 minutes and 44 seconds in duration. No other previous flight data is discussed in this report.

The parametric data were recorded at a sampling rate of 4 hertz (Hz).

The Appareo Vision 1000 was mounted to the frame of the aircraft and was oriented to show a forward-facing field of view that included a portion of the instrument panel. The field of view of the accident recording is shown in figure 2. The video recording was made at a resolution of 1600x1200 pixels at a frame rate of 4 frames per second (fps). The associated audio track was recorded from the device's internal microphone.

² In UTC, the accident occurred on August 3, 2024.



Figure 2. Image showing camera field of view.

3.0 Observed Data Description

The group assessed and documented the gauge indications visible in the video. During the first 85 minutes of flight, the gauge indications were documented approximately every 5 minutes, or when indications changed substantially. Data was recorded once per second from when the measured gas temperature (MGT) gauge started to increase rapidly through impact (approximately for 1 minute). At 3:06:16 UTC, the MGT digital readout ceased to display numbers, however the top of trend arc began to rise into the yellow portion of the gauge, indicating an increase in temperature. The group estimated the percentage of the yellow arc and calculated the approximate temperature for readings between 3:06:16 UTC and 3:06:31 UTC. At 3:06:31 UTC, all segments in the MGT display illuminated, consistent with the gauge performing a built in test (also known as a BIT check). Some parameters were not recorded at every timestep, either because they were obstructed from view or because the group determined them to be insignificant.

4.0 Timing and Correlation

The parametric data from the Appareo Vision 1000 records time in UTC by referencing the GPS data. The video image exported in video elapsed time, starting at 00:00:00, and was converted to UTC by offsetting the starting point of the video to the UTC time from the first recorded data point. All times given in this report are in UTC. The aircraft departed from Elko, Nevada, in Pacific daylight time (UTC -7 hours). The accident was in Raft River, Idaho, in mountain daylight time (UTC -6 hours).

5.0 Figures and Tabular Data

5.1 Recorded Parameters

Table 1 lists select recorded parameters from the Vision 1000 that were verified and provided in this report.

Table 1. Recorded parameters.

Parameter Name	Parameter Description	Units
Elevation	GPS Altitude	feet
GroundSpeed	Average Derived Groundspeed	knots
Pitch	Pitch	degrees
Roll	Roll	degrees
VSpd	Vertical Speed	feet per minute (ft/min)

Figures 7 and 8 contain the parameters listed in table 1. Figure 7 shows the entire flight and figure 8 shows the accident sequence. The corresponding tabular data used to create figures 7 and 8 are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

5.2 Parameters Observed from Video

Table 2 lists the parameters that were observed from the helicopter instruments and used in this report. Parameters with a blank unit description are parameters that were either on or off.

Table 2. Observed parameters.

Parameter Name	Parameter Description	Units
AGL Altitude	Altitude Above Ground Level from radar altimeter	feet (ft)
Airspeed	Indicated Airspeed	knots (kt)
Check Instr Light	Check Instrument Light	
Cyclic Centering Light	Cyclic Centering Light	
Fuel Quantity	Fuel Quantity	pounds (lbs)
HDG	Heading	degrees (deg)
Hydraulic Sys Light	Hydraulic System Light	
MGT	Measured Gas Temperature	degrees Celsius (deg C / °C)
MSL Altitude	Altitude above Mean Sea Level from barometric altimeter	feet (ft)

Parameter Name	Parameter Description	Units
NG	Gas Generator Speed	percent (%)
NP	Power Turbine Speed	percent (%)
NR	Main Rotor Speed	percent (%)
OAT	Outside Air Temperature	degrees Fahrenheit (deg F / °F)
RPM Light	Revolutions Per Minute Light	
Torque	Torque	percent (%)
Vertical Speed	Vertical Speed	feet per minute (fpm)

Figures 9 and 10 contain the observed data from the event flight. All the observed parameters listed in table 2 are plotted except Heading and Cyclic Centering Light.

Figure 9 shows the observed data for the entire accident flight. The AGL altitude varies substantially as the helicopter flies over mountainous terrain.

Figure 10 shows the observed data for the final 1 minute and 10 seconds of flight. During this time, the MGT gauge indicates a rapid rise and then enters a BIT check and doesn't display any value. The time the MGT gauge entered a BIT check is annotated on figures 8 and 10.

The corresponding tabular data used to create figures 9 and 10 are provided in electronic comma-separated value (CSV) format as attachment 2 to this report.

6.0 Appareo Vision 1000 Video Summary

The pilot was seated on the right side. A passenger was seated on the left side wearing a white helmet, which partially obscures the panel sometimes. There are no controls on the left side.

The recording began at 1:40:45 UTC, 6:56 minutes before takeoff, with the aircraft on the ground at Elko Regional Airport in Elko, NV (KEKO). The pilot and front seat passenger can be seen preparing the cockpit and going through the engine start process.

The engine started at 1:42:50 UTC, 4:51 minutes before takeoff. At ground idle, NP and NR are at 58% and NG is 63.2%. The helicopter has 767 lbs of fuel. No MGT exceedance was observed.

At 1:47:41 UTC, the helicopter took off and departed to the northeast. Engine parameters indicated within nominal ranges.

Throughout the flight, the pilot adjusted the heading with the heading bug to navigate around terrain. Fuel pressure stayed steady around 14 pounds per square inch (psi) throughout the flight.

Beginning about 10 minutes after takeoff, the engine was operated around maximum continuous operating range on the MGT.

At 2:05:47 UTC, the CHECK INSTR light came on and the MGT trend arc began to flash.³ The CHECK INSTR light went off at 2:06:02 UTC and came back on at 2:11:15 UTC. It remained on until 3:06:31 UTC, when the MGT gauge appeared to enter a BIT check.

At 2:11:45 UTC, the MGT gauge displayed an "E", which remained illuminated for the remainder of the flight (with the exception of the MGT inconsistency around 3:06 UTC). The aircraft was maneuvering through terrain.

At 2:11:53 UTC, the pilot pointed at the CHECK INSTR light. MGT reduced from 736°C to about 710°C and torque reduced from 74.2% to about 67.1%.

The flight proceeded over mountainous terrain, occasionally getting terrain alerts on the dash-mounted GPS, and making small heading and altitude changes. The reflection of the CHECK INSTR light could be seen in the passenger's helmet.

Around 2:36:45 UTC, the pilot reached up to the GPS. The passenger leaned to the right and the camera's field of view was obscured by his helmet.

Around 2:38:15 UTC, reflections of the check instrument light, attitude indicator, Garmin 796 GPS could be seen in passenger's helmet. Additionally, a light green reflection consistent with the pilot's iPad, and an orange light consistent with the barrier filter light could be seen reflected in the helmet.

At 2:40:22 UTC, the pilot reached his left hand up to the overhead panel.

At 3:02:29 UTC, the pilot turned the panel lights on. The sun had set, and it was dusk. The terrain visible outside the cockpit consisted of agricultural fields. The aircraft was at 5,250 ft MSL.

At 3:06:16 UTC, the MGT gauge digital readout began to display random segments and no longer indicated numbers or "E". The trend arc moved up, illuminating segments at the top of the band and eliminating alternating segments at the bottom of the band. Other engine instrument gauges remained constant and within nominal operating ranges: airspeed was 123 kts, torque was 76.1%, NG was 101.2%, and NP and NR were both 100%. The fuel gauge indicated 351 lbs of fuel.

³ If the MGT remains above 727°C for 4 minutes and 30 seconds, the caution panel CHECK INSTR light comes on and the trend arc flashes, indicating an impending exceedance. If the MGT remains above 727°C for 5 minutes, the device logs an exceedance, indicates "E" on the gauge, and the CHECK INSTR light remains on until acknowledged. The "E" on the gauge can only be reset on the ground by maintenance personnel using specialized equipment.

At 3:06:30 UTC, the HYD SYSTEM light flashed on for less than 1 second.

At 3:06:35 UTC, the top of the MGT trend arc indicated approximately 840°C, several segments near the bottom segments of the trend arc were dark, as shown in figure 3. Altitude was 5,120 ft MSL, AGL altitude was obscured, the vertical speed indicator (VSI) showed a 1,200 fpm descent, airspeed dropped to 115 kts, torque dropped to 43.6%, NG dropped to 91.7%, and NP and NR remained constant at 100%. This is consistent with a commanded reduction in power.

At 3:06:36 UTC, all lighted segments of the MGT gauge illuminated, as shown in figure 4, consistent with the BIT check. The CHECK INSTR light went off.

For reference, figure 5 shows the engine instruments in daylight with the helicopter powered off.

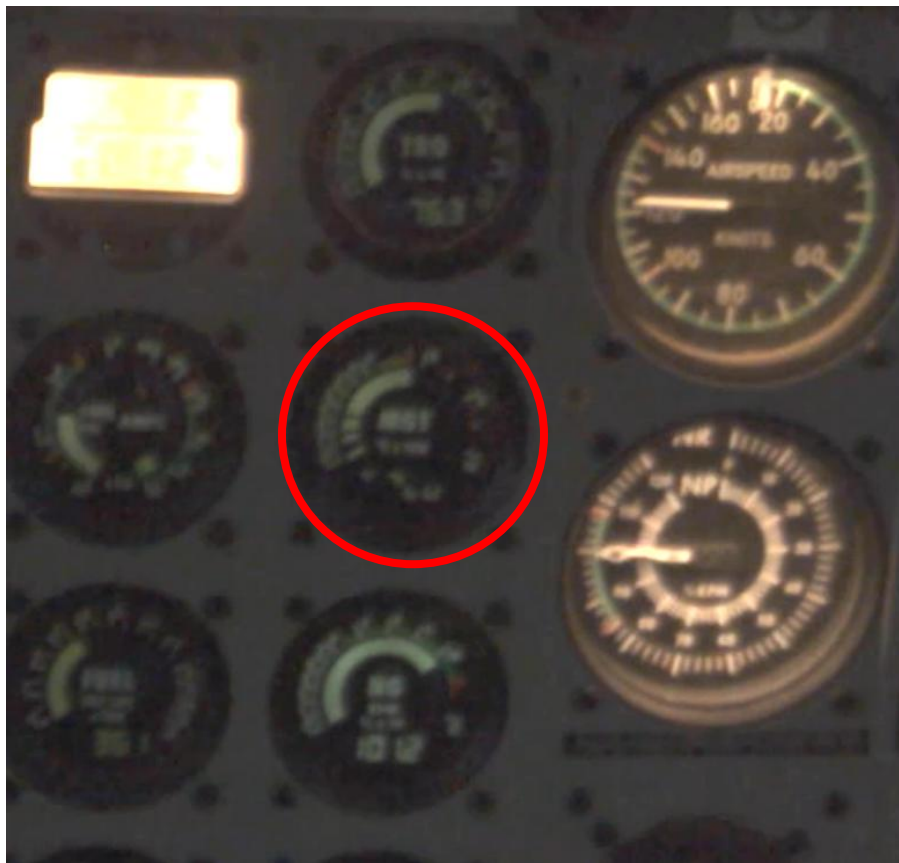


Figure 3. Engine instruments at 3:06:35 UTC. Image has been brightened to show gauges. The MGT gauge is circled in red.

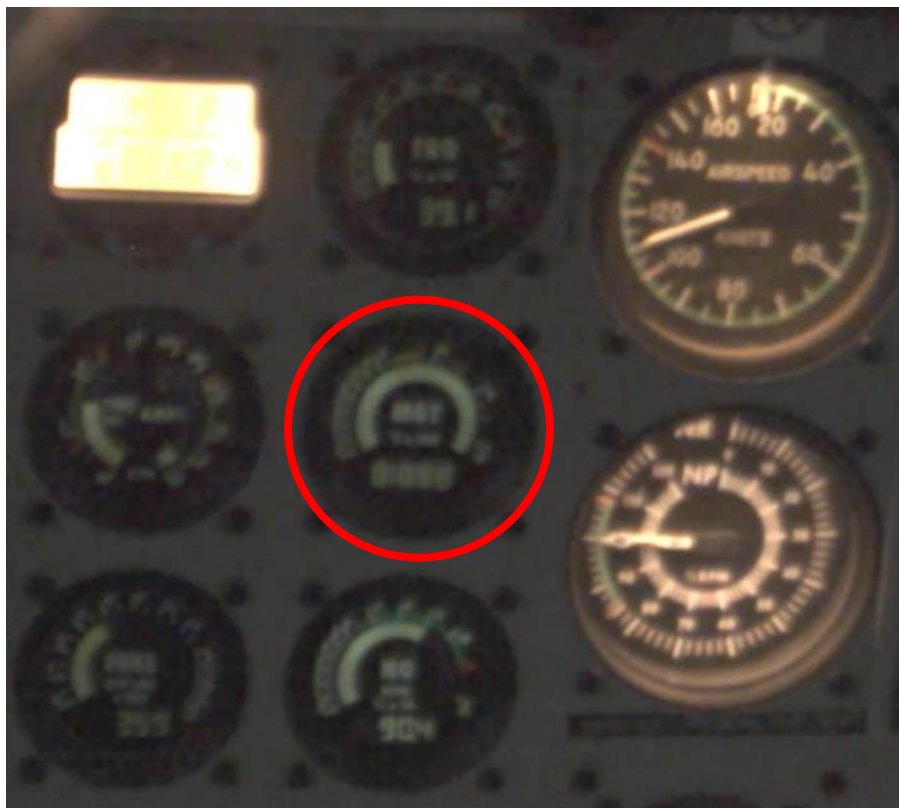


Figure 4. Engine instruments at 3:06:36 UTC. Image has been brightened to show gauges. The MGT gauge is circled in red.



Figure 5. Engine instruments in daylight with helicopter powered off.

At 3:06:42 UTC, the CHECK INSTR light illuminated on the caution panel. The MGT gauge displayed "E 281" and the trend arc corresponded to the indicated value of 281 °C. Altitude was 5,000 ft MSL, 780ft AGL, the VSI indicated a 750 fpm descent, airspeed was 97 kts, torque was 6.4%. NP and NR were still 100%. Attitude indicated level flight.

At 3:06:46 UTC, NP remained at 100%, NR increased to 103%. Torque was 0.7%. MGT was 451°C. The ambient noise pitch and volume increased which is consistent with increasing rotor RPM.

At 3:06:53 UTC, the RPM light illuminated, consistent with high rotor RPM. NR was 107% and NP was 100%. MGT was 475°C . The RPM light went off at 3:06:59 UTC.

At 3:07:06 UTC, the RPM light illuminated accompanied by an aural tone, consistent with low rotor RPM. NP was 80%, NR was 94%, torque was 1.2%, MGT was 482°C, NG was 63.2%. Altitude was 4,500 ft MSL, 118 ft AGL. The VSI indicated a 1,000 fpm descent. The attitude indicator showed a 20 deg left bank and 10 deg nose down pitch. The turn slip indicator ball was displaced to the right. The ambient noise decreased, corresponding to the movement of the gauges. The RPM light stayed on for the remainder of the recording.

At 3:07:10 UTC, the attitude indicator showed 10 deg nose up, level flight. Altitude was 48 ft AGL, airspeed was 60 kts, and NR was 92%.

At 3:07:15 UTC the attitude indicator showed 20 deg nose up, level flight. Altitude was 25 ft AGL, airspeed was 38 kts, and NR was 94%. Torque was 1.2% and NG was 63.0%, consistent with idle power.

At 3:07:20 UTC, the Cyclic Centering Light illuminated indicating weight on gear. NR and NP were both 60%, and airspeed was near 0. MGT was 465°C, and torque was 4.9%. A rattling sound could be heard just before impact.

At 3:07:21 UTC, there were sounds of impact and violent movement within the cabin. After impact, the ELT light, transmission oil pressure light, and hydraulic system light illuminated. MGT and NG appeared to be consistent with values immediately prior to impact. Ambient sound consistent with engine noise continued to the end of the recording.

In the final frame of the video, an orange light could be seen in the approximate position of the barrier filter light, as shown in Figure 6.

The recording ends at 3:07:29 UTC.



Figure 6. Portion of instrument panel at 3:07:29 UTC. Barrier filter light circled in red. Crewmembers have been redacted and image has been brightened to show gauges.

Submitted by:

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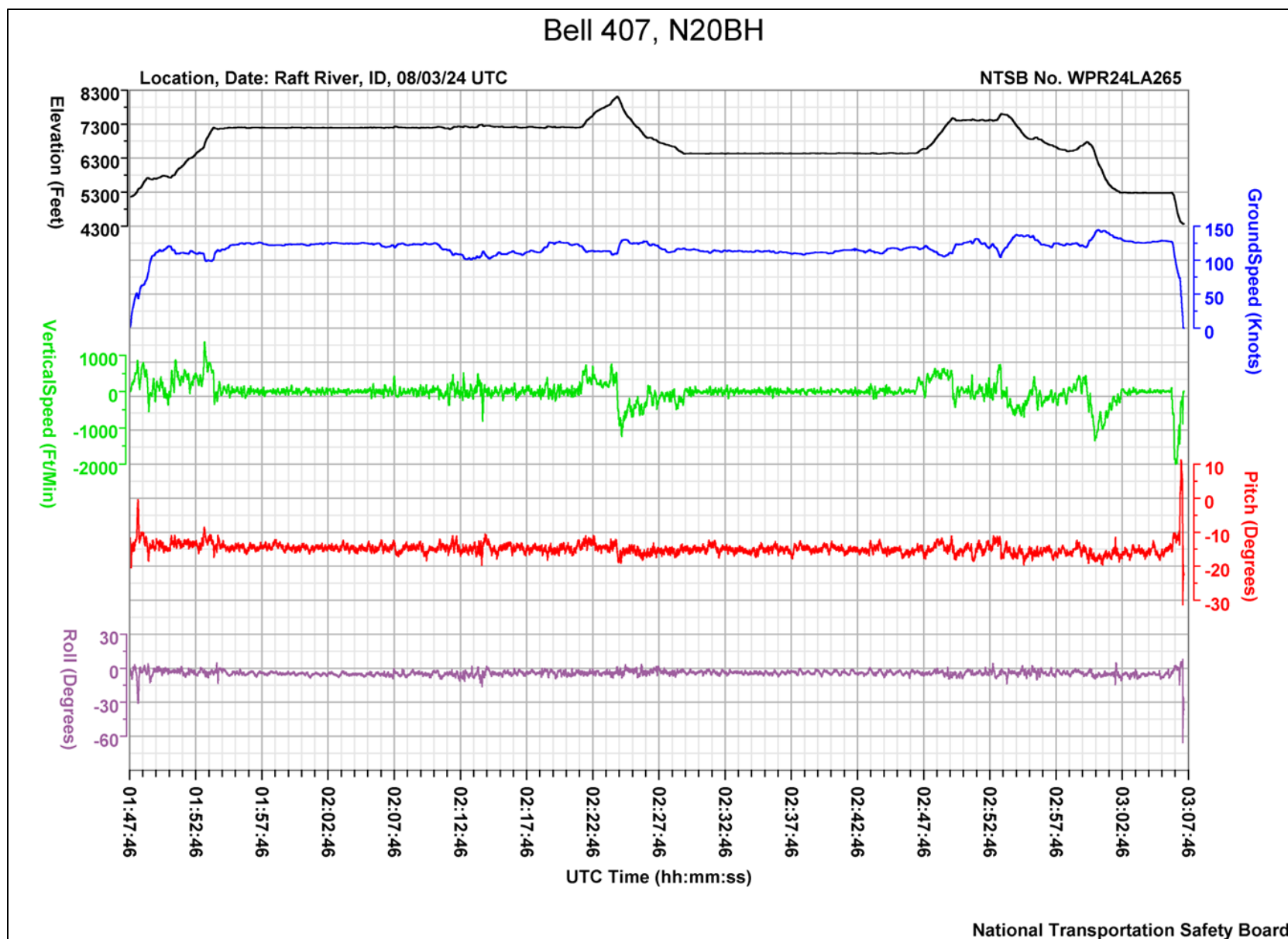


Figure 7. Plot of basic parameters recorded by Appareo Vision 1000 during the entire accident flight.

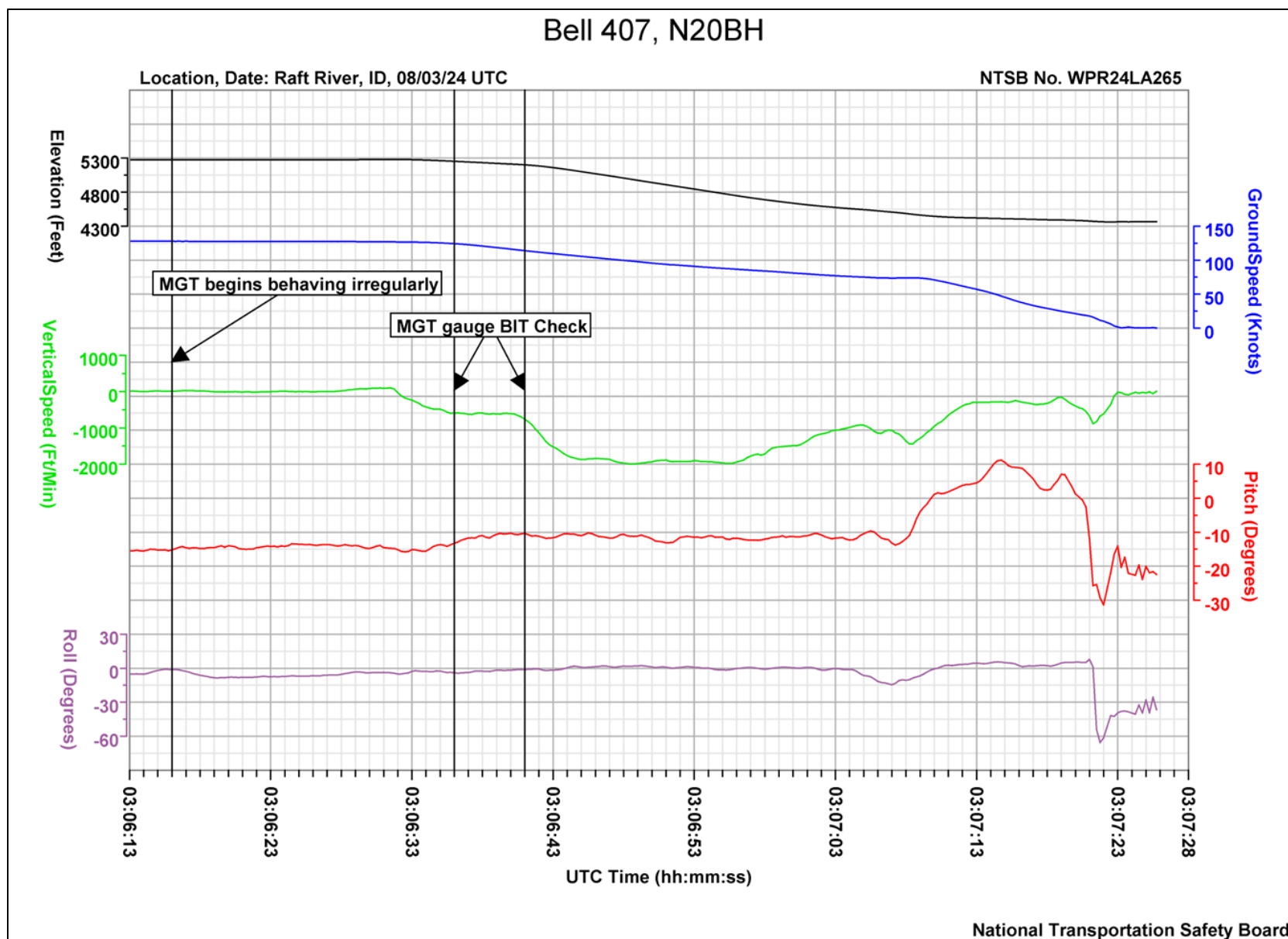


Figure 8. Plot of basic parameters recorded by Appareo Vision 1000 during the accident sequence.

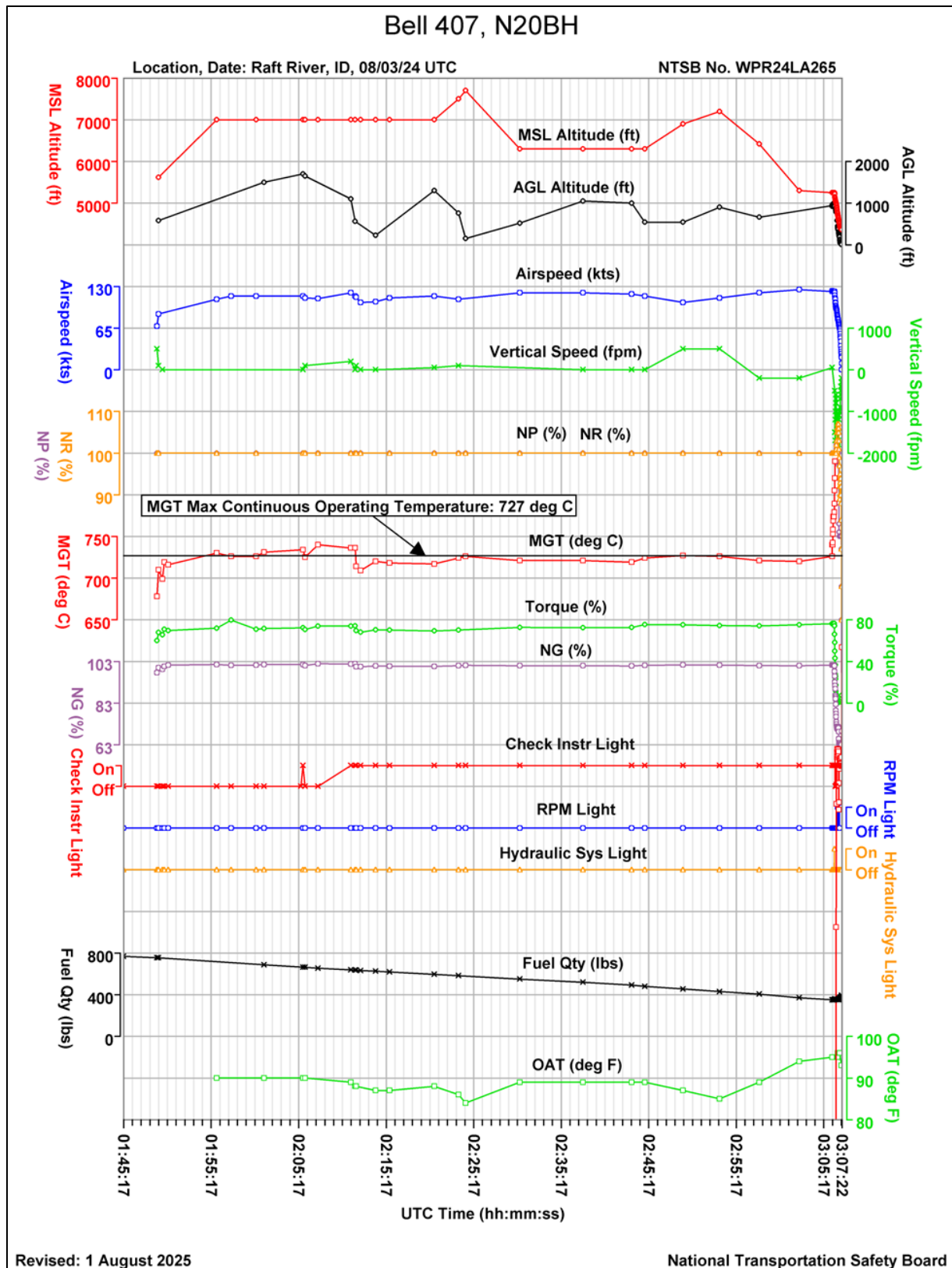


Figure 9. Plot of observed data for entire accident flight.

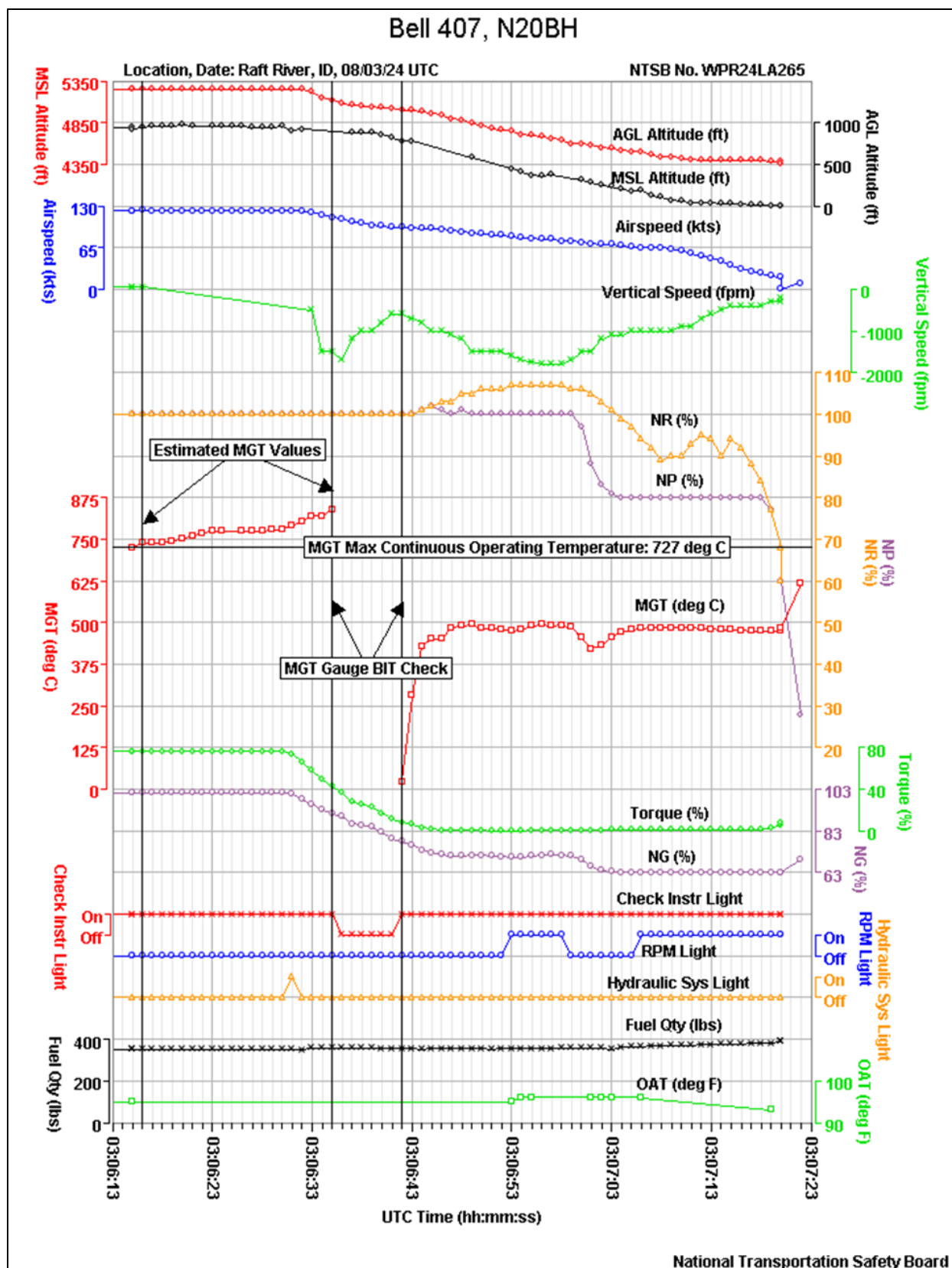


Figure 10. Plot of observed data during the accident sequence.