National Transportation Safety Board

Memorandum

Date: September 5, 2019

To: Stephen Stein
Air Safety Investigator, Western Pacific Region
WPR18MA087 Investigator in Charge (IIC)

From: John O'Callaghan
National Resource Specialist – Aircraft Performance
WPR18MA087 Aircraft Performance Specialist

Subject: Plots of radar data for Papillon helicopter flights preceding N155GC from KBVU / KLAS to QMB

References:
1. National Transportation Safety Board, Office of Research and Engineering, *Memorandum from John O'Callaghan to Stephen Stein re: Plots of Appareo Vision 1000 data for May 4, exemplar Papillon flight from KBVU to QMB; testimonies of Papillon pilots re: winds on approach to QMB; Airbus Helicopters yaw control simulations,* (November 28, 2018).
2. National Transportation Safety Board, Office of Aviation Safety, *Operations Factual Report, WPR18MA087, Papillon Airways, Inc., Airbus Helicopters EC130 B4, N155GC, Peach Springs, AZ, February 10, 2018* (July 1, 2019).

Stephen:

This memorandum transmits flight path, speed, and altitude information for several Papillon helicopters that preceded N155GC (Papillon ship #34) into the Grand Canyon from both Boulder City Municipal Airport (KBVU) and Las Vegas McCarran International Airport (KLAS) on the day of the accident involving N155GC (on February 10, 2018). Data from the May 4, 2018 "exemplar" flight from KBVU to Quartermaster Base (QMB), described in my earlier memo (Reference 1), are also presented for comparison. The data for the flights on February 10 come from FAA radar coverage of the airspace between KBVU/KLAS and QMB, and generally ends near the "Canyon" radio reporting point used by Papillon, shortly before the helicopters descend below the canyon walls and below radar coverage. The data for the May 4 exemplar flight are GPS positions recorded by an Appareo 1000 device covering the complete flight from KBVU to QMB (see Reference 1). The helicopters are identified by both their registration ("N") numbers, and their Papillon ship numbers.

Radar data for the February 10 flights was provided by the NTSB Air Traffic Control Group Chairman for this accident. All tour helicopters flying between the Las Vegas area and the Grand

Canyon operate under VFR flight plans and a corresponding 1200 transponder code, and so it is not possible to distinguish individual helicopters in the radar data using the transponder code alone (unlike the case for aircraft on IFR flight plans or using VFR flight following, which are assigned unique transponder codes). However, for some (but not all) of the February 10 helicopters, data was available from the Harris "OpsVue" database, in which each radar return is associated with a uniquely identified aircraft (likely as the result of Mode S transponders broadcasting a unique identifier for each aircraft, that can then be associated with its registration number). Tracks for the helicopters for which OpsVue data is unavailable have to be culled from the "cloud" of 1200 code radar returns from all aircraft in the area, which can be difficult given the traffic density along the similar routes used by the tour operators.

A track for one helicopter (N153GC, Papillon ship #30) was identified as follows. The approximate coordinates of the "Canyon" reporting point used by Papillon was located by noting the coordinates, at the "Canyon" reporting times, of helicopters with known OpsVue tracks. The track for ship #30 was then identified by finding radar returns that approximately matched the "Canyon" coordinates at the "Canyon" reporting time of ship #30.

A similar technique was used to try to find tracks for ships #39, #10, and #50. Many returns that could possibly be ships #39 and #10 were found near the estimated "Canyon" reporting point at the reporting times for these helicopters, but the points were so closely spaced in time that it was not possible to distinguish the individual returns associated with each helicopter with any certainty; consequently, no tracks were identified for these two helicopters (nonetheless, the radar returns that likely contain the tracks for these helicopters are presented in the plots that follow). For ship #50, no radar returns were found near the estimated "Canyon" reporting point at the reporting time for that helicopter, and so no track was identified for ship #50, either. The reasons for the absence of radar returns near the estimated reporting point at the reporting time for ship #50 are unknown.

The *Operations Factual Report* for this accident (Reference 2) contains a table listing the departure times and "Canyon" radio reporting times for Papillon's February 10 flights. This information is reproduced here in Table 1, which also presents the helicopter registration number and the availability / disposition of radar data for each helicopter.

Papillon Ship #	Registration	Departure time, MST	"Canyon" time, MST	Radar data status
45	N893PA	16:05	16:40	OpsVue track available
41	N130GC	16:10	16:46	OpsVue track available
39	N135PH	16:30	16:03	Returns too dense to clearly identify track
10	N8935PA	16:35	17:02	Returns too dense to clearly identify track
30	N153GC	16:32	17:04	Track identified from Canyon reporting point
50	N836GC	16:35	17:08	No returns matching Canyon reporting point
23	N156GC	16:36	17:09	OpsVue track available
53	N8959S	16:38	17:10	OpsVue track available
34	**N155GC**	**16:42**	**17:12**	OpsVue track available
40	N137PH	16:39	17:13	Not evaluated

Table 1. Papillon flights to QMB on February 10, 2019. N155GC (#34) is the accident helicopter.

The radar data for the February 10 flights, and the Appareo data for the May 4 exemplar flight, are presented in Figures 1-4. Figure 1 presents a plan view of the flights overlaid on a *Google Earth* satellite image background. Note that Papillon ships #45, #41, and #39 departed from KLAS and approach the Hoover dam area from the west; all the other flights originated from KBVU.

Figure 2 plots the altitude and groundspeed of each flight as a function of time. The OpsVue data contained groundspeed computed by the radar tracking algorithms; the ground speed for ship #30 was computed based on the track extracted from the 1200 returns. The times for the May 4 exemplar flight have been shifted so that the data for this flight could be plotted on a similar time scale to the February 10 flights.

Figure 3 plots the east and north coordinates of the flights (cross-plotted in Figure 1) as a function of time. Figure 4 is similar to Figure 3, but uses an expanded scale to show detail near the "Canyon" reporting point coordinates and times for the flights covered by the radar data (other than the OpsVue tracks for ships #41 and #45, no radar data was provided for times prior to 16:40 MST). Figure 3 shows that there are no likely candidate code 1200 returns for ship #50 near the east coordinate of the reporting point for the 17:08 MST reporting time of that helicopter. Figure 3 also shows that for the 17:02 – 17:03 MST "Canyon" reporting times of ships #10 and #39, there are multiple candidate 1200 returns that could correspond to the tracks for these helicopters, and that distinguishing the returns associated with each helicopter would be difficult. Nonetheless, the code 1200 radar returns plotted in Figure 1 indicates that the flight paths associated with Papillon helicopters are all very similar, and the similar slope of the radar points in the east vs. time plots in Figure 3 indicates that the speeds of these aircraft are also similar.

Please let me know if you would like to discuss the contents of this memorandum further.

Regards,

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John O'Callaghan

WPR18MA087: Airbus Helicopters EC-130 B4, N155GC, Peach Springs, AZ, 02/10/2018

Plan view of route of Papillon flights from KBVU / KLAS to Quartermaster Base

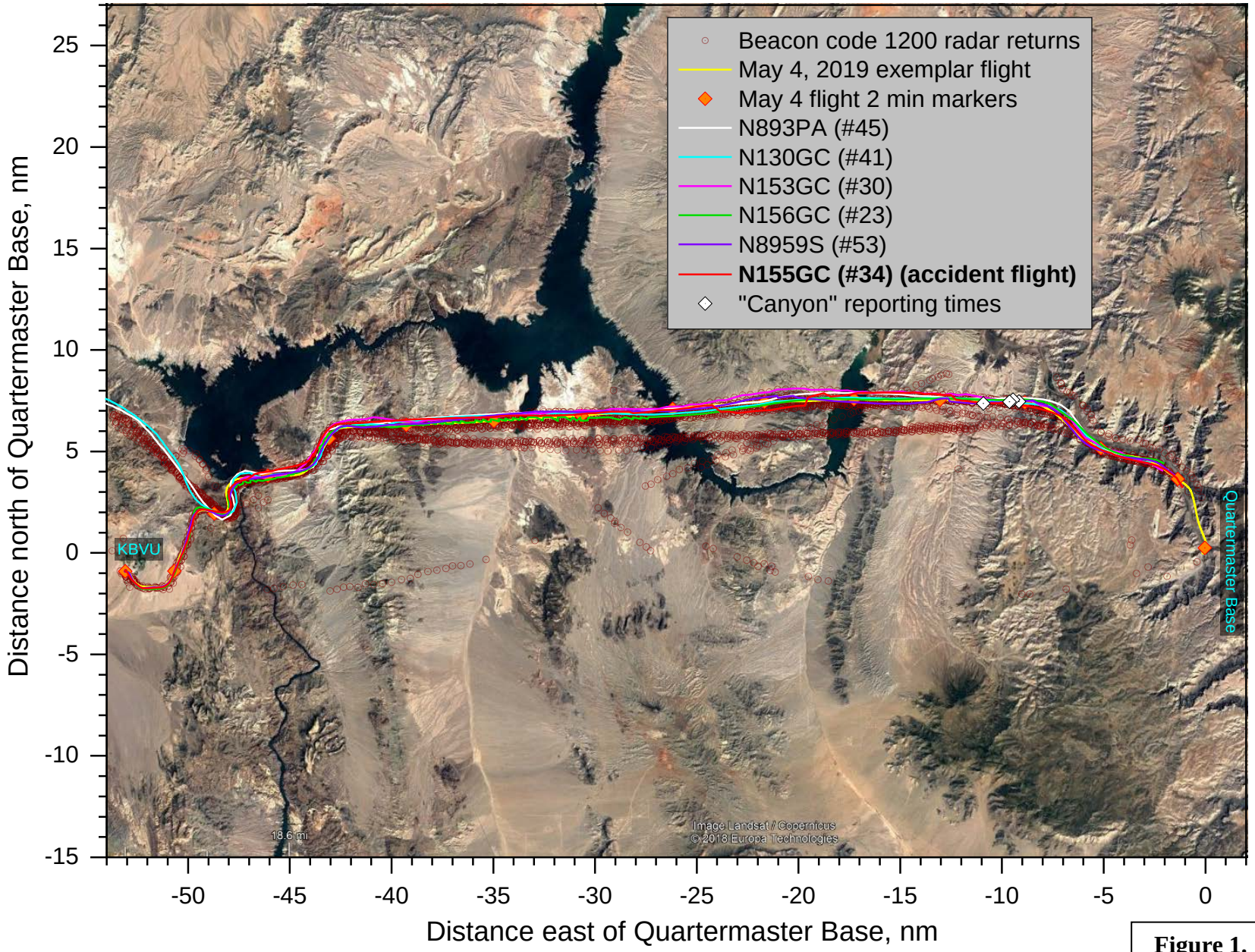

Figure 1.

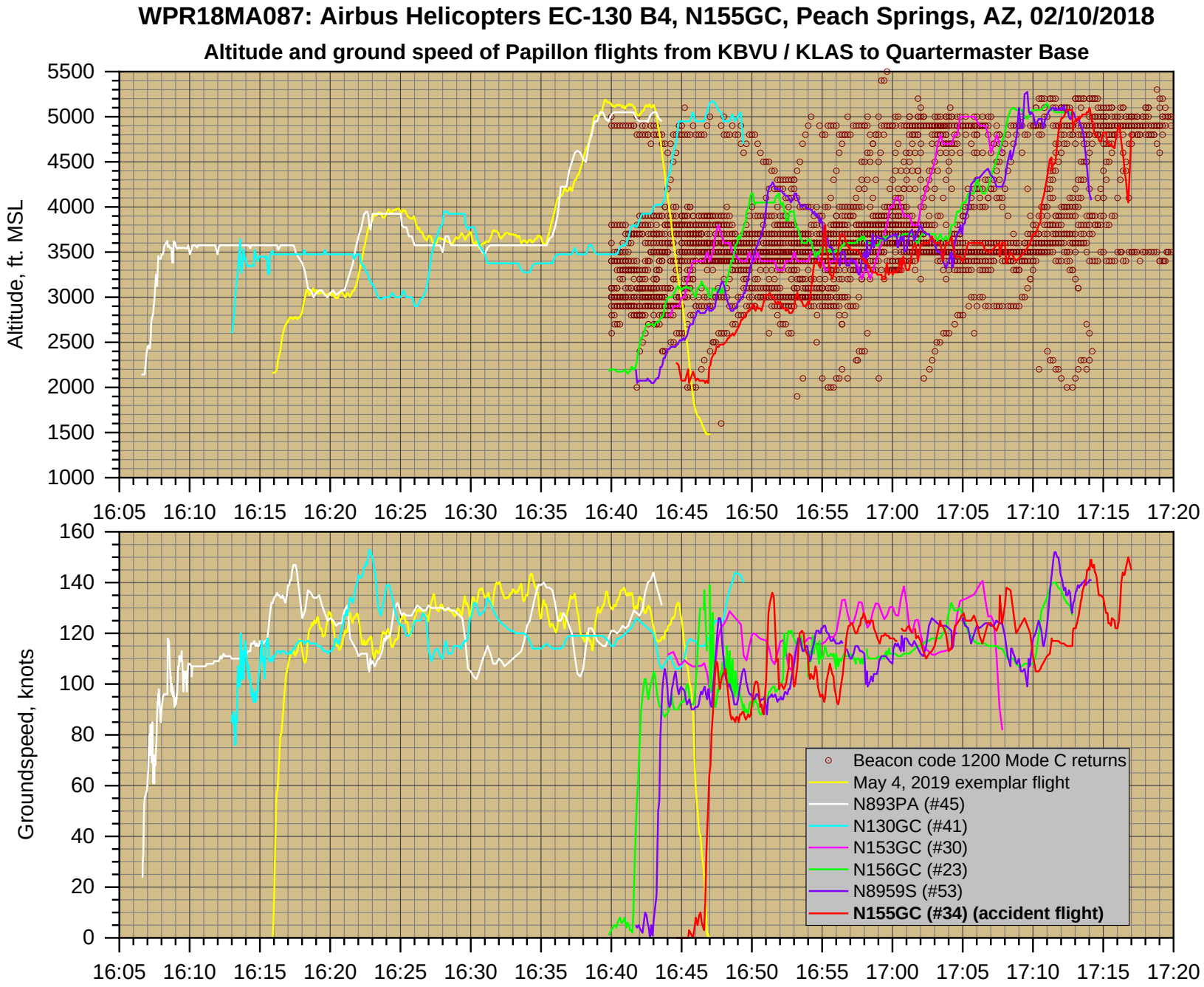
WPR18MA087: Airbus Helicopters EC-130 B4, N155GC, Peach Springs, AZ, 02/10/2018
Altitude and ground speed of Papillon flights from KBVU / KLAS to Quartermaster Base
Altitude, ft. MSL
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
16:05
16:10
16:15
16:20
16:25
16:30
16:35
16:40
16:45
16:50
16:55
17:00
17:05
17:10
17:15
17:20
Groundspeed, knots
160
140
120
100
80
60
40
20
0
Beacon code 1200 Mode C returns
May 4, 2019 exemplar flight
N893PA (#45)
N130GC (#41)
N153GC (#30)
N156GC (#23)
N8959S (#53)
N155GC (#34) (accident flight)

Figure 2.

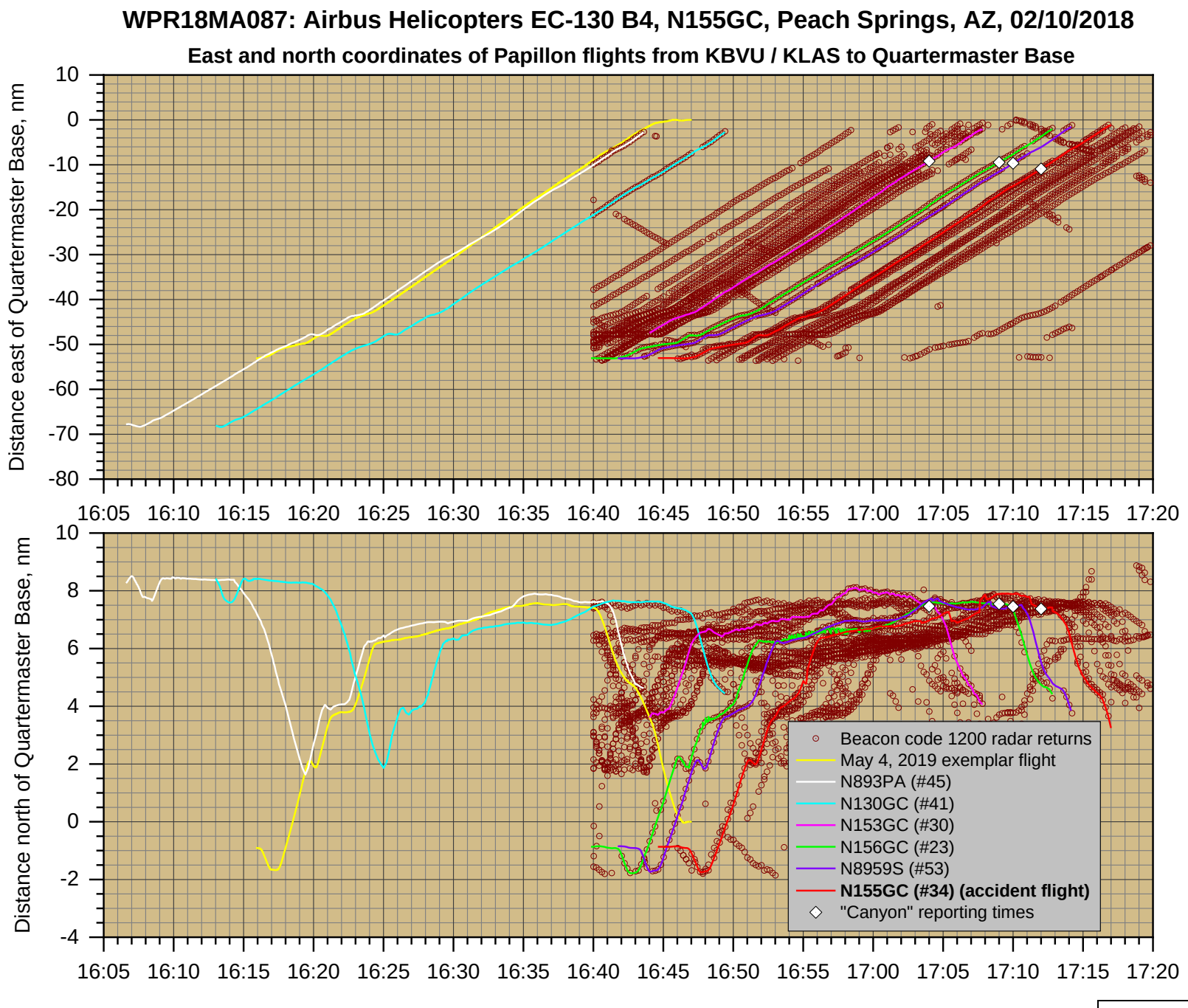
WPR18MA087: Airbus Helicopters EC-130 B4, N155GC, Peach Springs, AZ, 02/10/2018
East and north coordinates of Papillon flights from KBVU / KLAS to Quartermaster Base
Distance east of Quartermaster Base, nm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
16:05
16:10
16:15
16:20
16:25
16:30
16:35
16:40
16:45
16:50
16:55
17:00
17:05
17:10
17:15
17:20
Distance north of Quartermaster Base, nm
10
8
6
4
2
0
-2
-4
Beacon code 1200 radar returns
May 4, 2019 exemplar flight
N893PA (#45)
N130GC (#41)
N153GC (#30)
N156GC (#23)
N8959S (#53)
N155GC (#34) (accident flight)
"Canyon" reporting times

Figure 3.

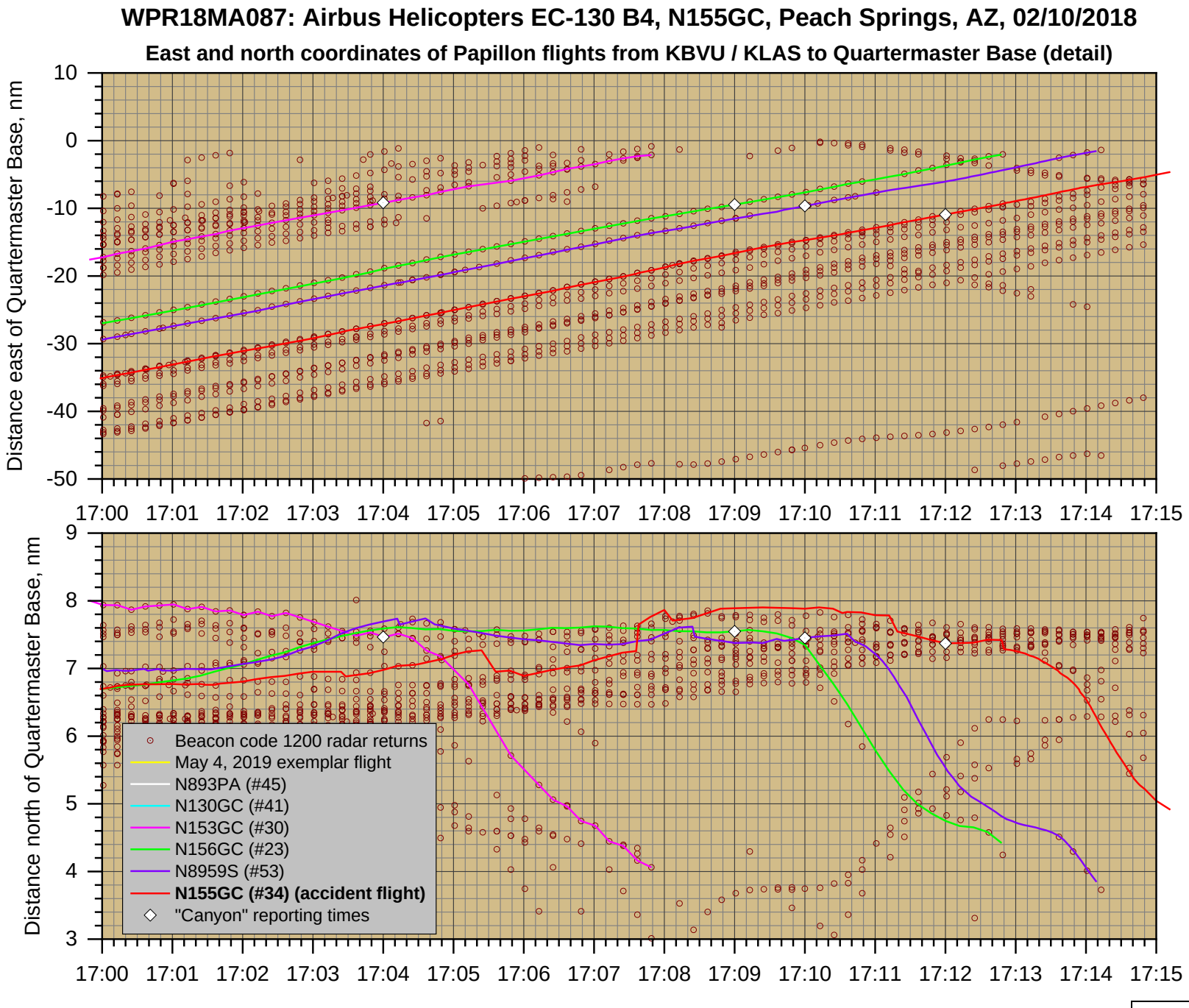
WPR18MA087: Airbus Helicopters EC-130 B4, N155GC, Peach Springs, AZ, 02/10/2018
East and north coordinates of Papillon flights from KBVU / KLAS to Quartermaster Base (detail)
Distance east of Quartermaster Base, nm
10
0
-10
-20
-30
-40
-50
17:00
17:01
17:02
17:03
17:04
17:05
17:06
17:07
17:08
17:09
17:10
17:11
17:12
17:13
17:14
17:15
Distance north of Quartermaster Base, nm
9
8
7
6
5
4
3
Beacon code 1200 radar returns
May 4, 2019 exemplar flight
N893PA (#45)
N130GC (#41)
N153GC (#30)
N156GC (#23)
N8959S (#53)
N155GC (#34) (accident flight)
"Canyon" reporting times

Figure 4.