Hawker Beechcraft Corporation
P.O. Box 85
Wichita, Kansas
67201-0085 USA

In Reply, Refer to: 940200905498 / D-4807

June 8, 2009

National Transportation Safety Board
Mr. Tim Monville
Southeast Regional Office
8240 NW 52nd Terrace, Suite 418
Doral, Florida 33166-7765

Subject: Hawker Beechcraft Corporation Model G35 Bonanza, Serial Number D-4807, Registration Number N4615D, accident in Easton, Massachusetts on August 12, 2008 at 1017 EDT (1417 UTC).

Reference: NTSB Preliminary Report MIA08FA163

Dear Mr. Monville:

You provided Hawker Beechcraft Corporation (HBC) with the Federal Aviation Admindistration (FAA) Air Trafic Control (ATC) recorded radar and requested HBC conduct a performance evalvation on the airplane's maneuvers from time 14:14:44 forward. Principal Engineer, Stability and Control Dana Herring produce the following HBC Performance Review:

Based on the ground speed information in the radar data file, and assuming approximately 1g coordinated flight, an estimated bank angle was calculated using the radar information from each source:

$$\text{Bank} = \text{atan} [V \sin(\text{yaw rate}) / g]$$

where V is estimated airspeed (ft/sec), yaw rate is rate of change of radar-based ground track (rad/sec) [labeled HDG in original data file], and g is the acceleration of gravity (ft/sec). The bank angle corresponding to a standard rate turn (360° in 2 minutes, or 3 deg/sec) was also calculated using this formula, and superimposed on the estimated bank angle plot. Estimated airspeed was calculated using a nominal average wind of 20 kts from 090°. Stall speed was estimated based on an assumed weight of 2555 lbs, and adjusted for the calculated bank angle shown above. Estimated stall speed was not adjusted for maneuvering typically associated with the pitch axis (e.g. pull-up to climb), because the low sampling rate of the radar data does not provide sufficient altitude fidelity, when combined with transponder altitudes with only 100 ft resolution. Estimated stall speeds are included on the airspeed plot, showing possible stall departures.

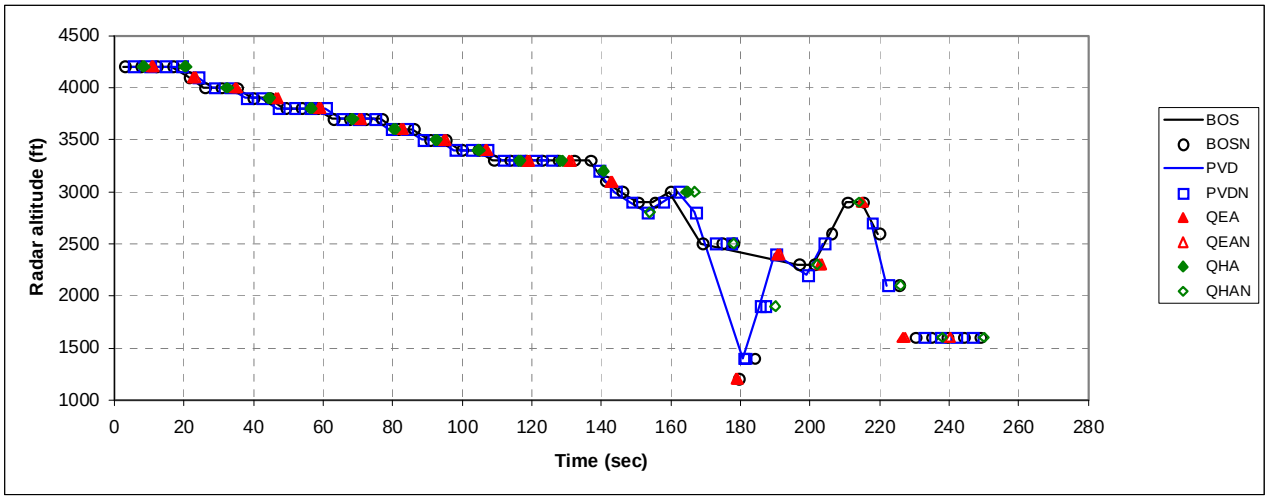
At 14:16:46, the radar controller stated “radar contact lost”, and subsequently the radar data from Boston (BOS) and Providence (PVD) becomes inconsistent. Prior to that time, the (X,Y) radar positions from those two radar installations were within approximately 0.05 nm of each other. However, after that time, the X distance differed by approximately 0.2 nm, and the Y distance differed by as much as approximately 0.7 nm. At the same time, the ground track provided in the radar data file for BOS and PVD differed by up to approximately 90°. Ground track data provided in the original radar data file was presumably calculated using an unknown processing algorithm at the tower or TRACON, which probably included some data filtering. Setting that original ground track data aside, ground track was also recalculated from scratch using the radar (X,Y) data. The resulting values showed rates and trends similar to the ground track provided in the radar data, however there was more noise, and the calculated ground track immediately following “radar contact lost” was even more erratic than in the original radar data. Bank angles calculated from rate of change of the derived ground tracks would not serve to reduce the uncertainty that existed with the original data.

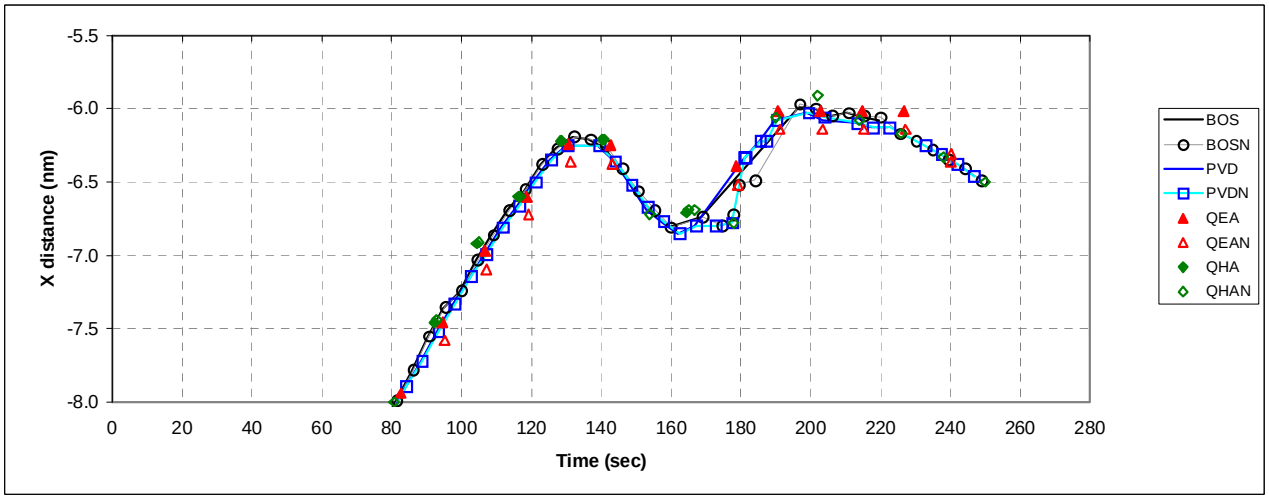
It is evident that following the radar controller's request to "turn left heading zero six zero" at 14:14:44, the pilot entered a left turn at rates at or below standard rate. The aircraft did stabilize on approximately the requested heading. The controller subsequently requested "turn left heading zero one zero". The aircraft entered a left turn, which quickly exceeded standard rate. The bank angle for a standard rate turn at that speed was approximately 21°, however estimated bank angles reached 35° to 45°. Subsequently the aircraft entered a right turn at estimated bank angles up to 35°, where standard rate at that speed corresponded to 23°. In the following seconds, the aircraft lost several hundred feet of altitude, and estimated bank angles became unreliable, commensurate with the discrepant reported radar locations when radar contact was lost. The following plots illustrate the final minutes of the flight.

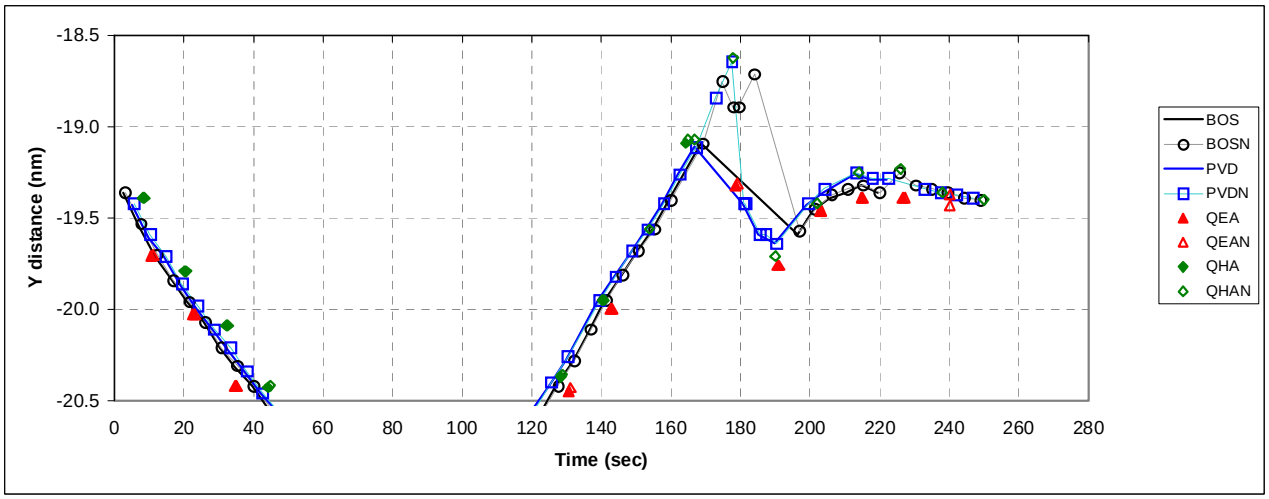
In the attached Excel data file, data and formulas in blue were added by HBC. Two sources of radar data are available for each radar installation, where the first (e.g. BOS) presumably consists of primary returns, and the second (e.g. BOSN) is presumably enhanced with aircraft transponder return data.

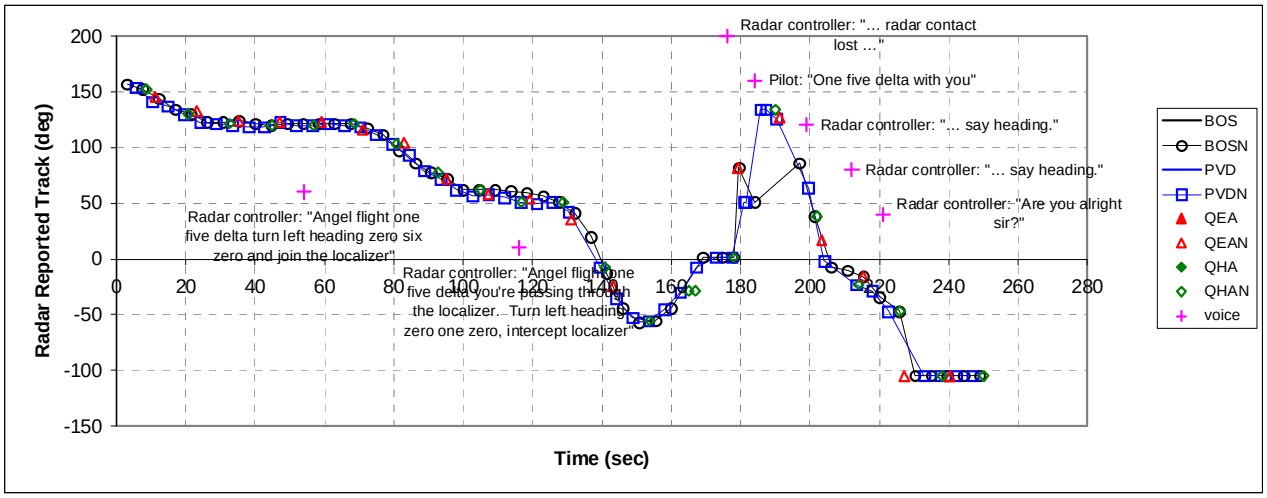
NTSB Identification: **MIA08FA163**
Accident occurred Tuesday, August 12, 2008 in South Easton, MA
Aircraft: Beech G35, registration: N4615D
Injuries: 3 Fatal.
Summary of radar data

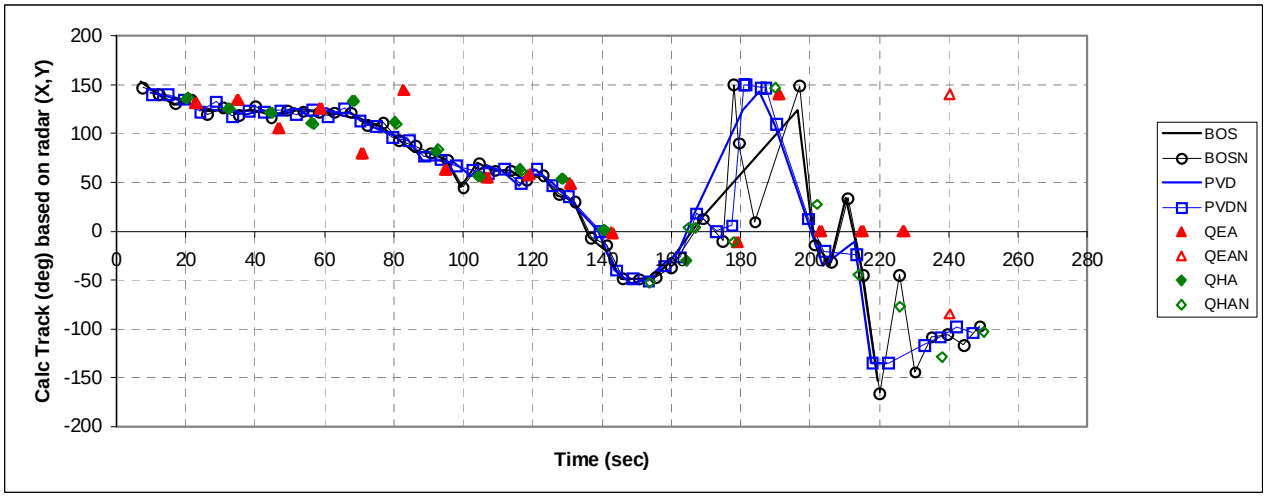
Assumption: all heading/track angles are magnetic
Assumption: distance units are nautical miles
t=0 is Aug 12 2008 14:13:50.000
Standard rate turn corresponds to a complete circuit in 2 minutes (360 deg / 120 sec = 3 deg/sec)

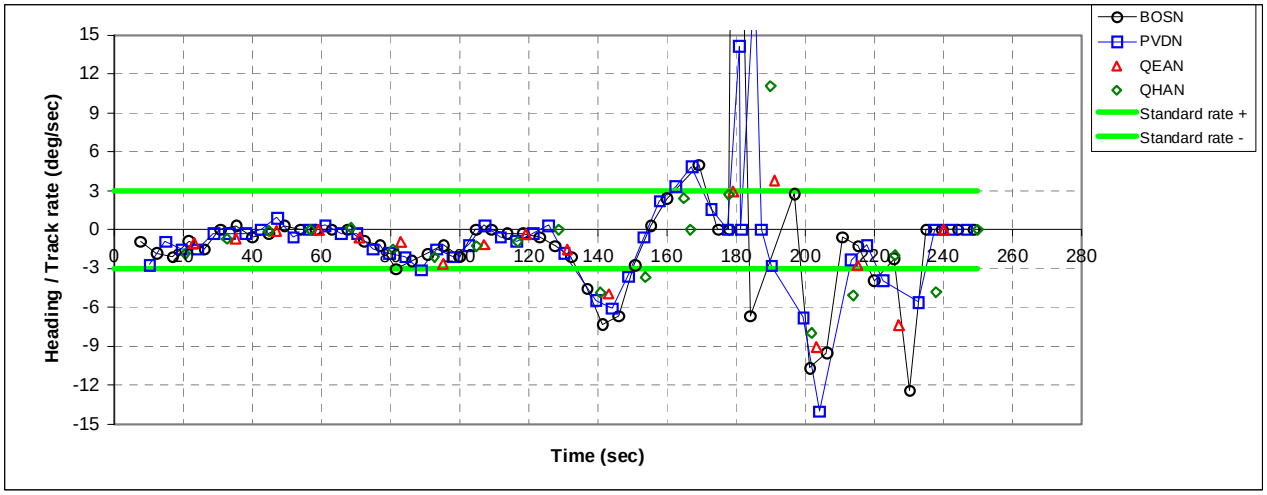


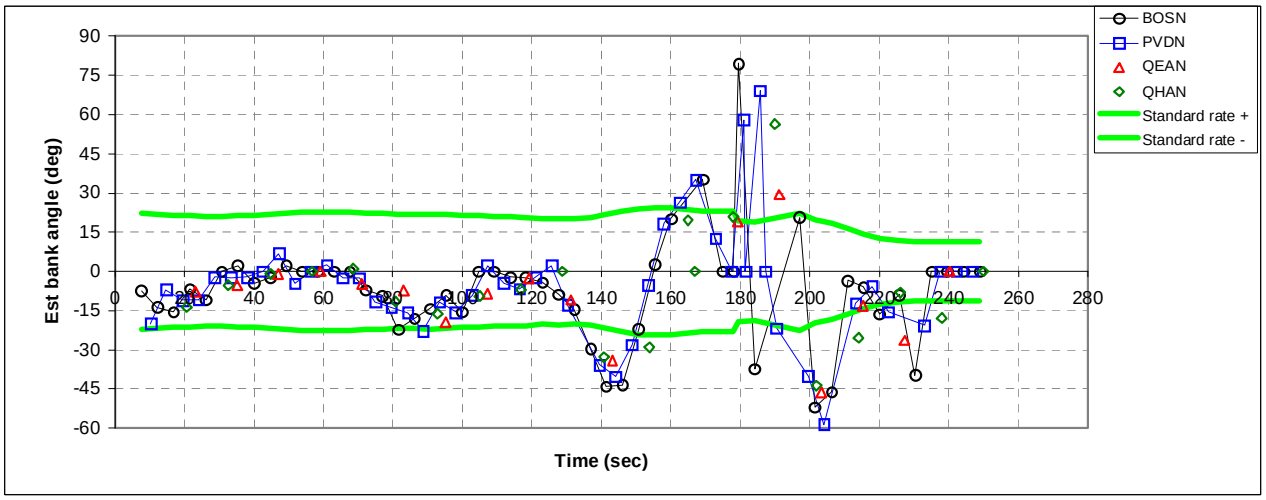


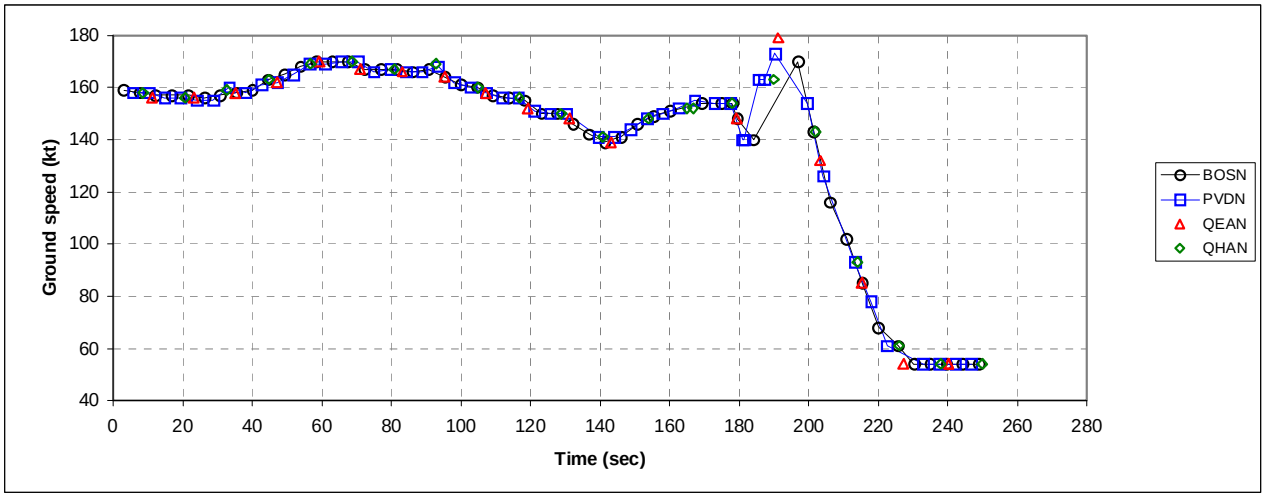


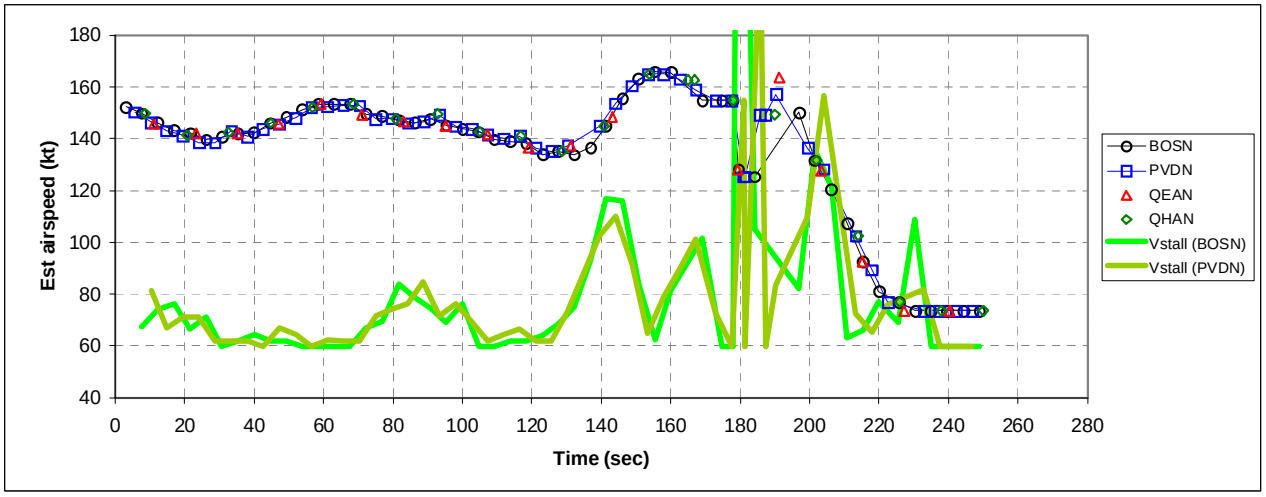

Radar Reported Track (deg)
Time (sec)
Radar controller: "... radar contact lost ..."
Pilot: "One five delta with you"
Radar controller: "... say heading."
Radar controller: "... say heading."
Radar controller: "Are you alright sir?"
Radar controller: "Angel flight one five delta turn left heading zero six zero and join the localizer"
Radar controller: "Angel flight one five delta you're passing through the localizer. Turn left heading zero one zero, intercept localizer"
BOS
BOSN
PVD
PVDN
QEA
QEAN
QHA
QHAN
voice

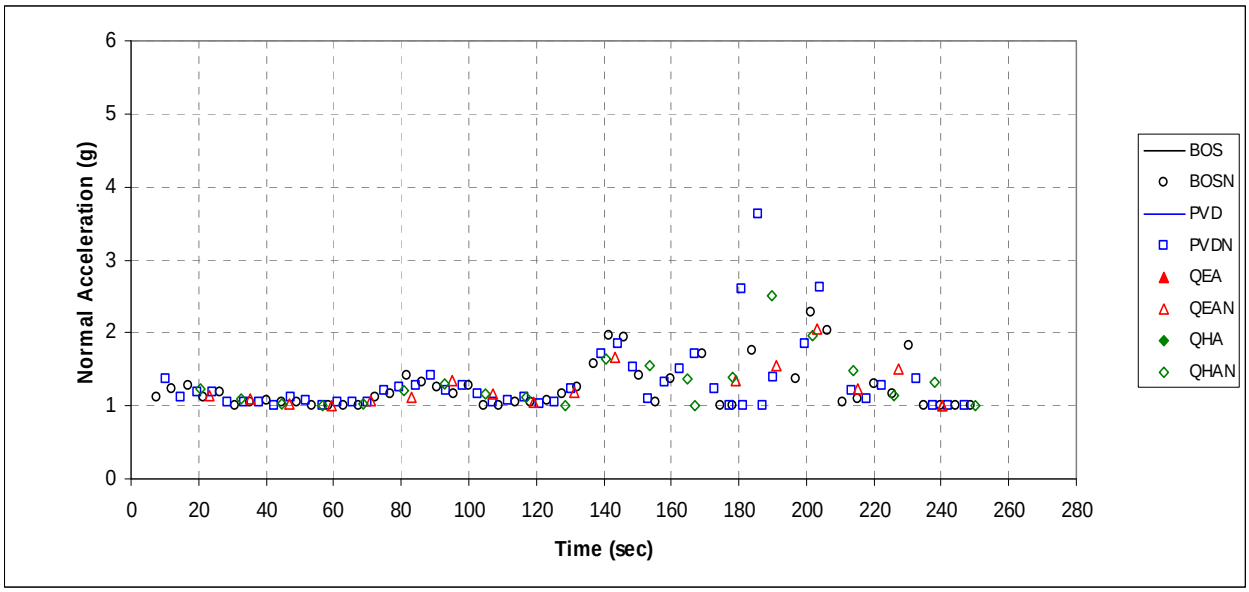

Calc Track (deg) based on radar (X,Y)
Time (sec)
BOS
BOSN
PVD
PVDN
QEA
QEAN
QHA
QHAN

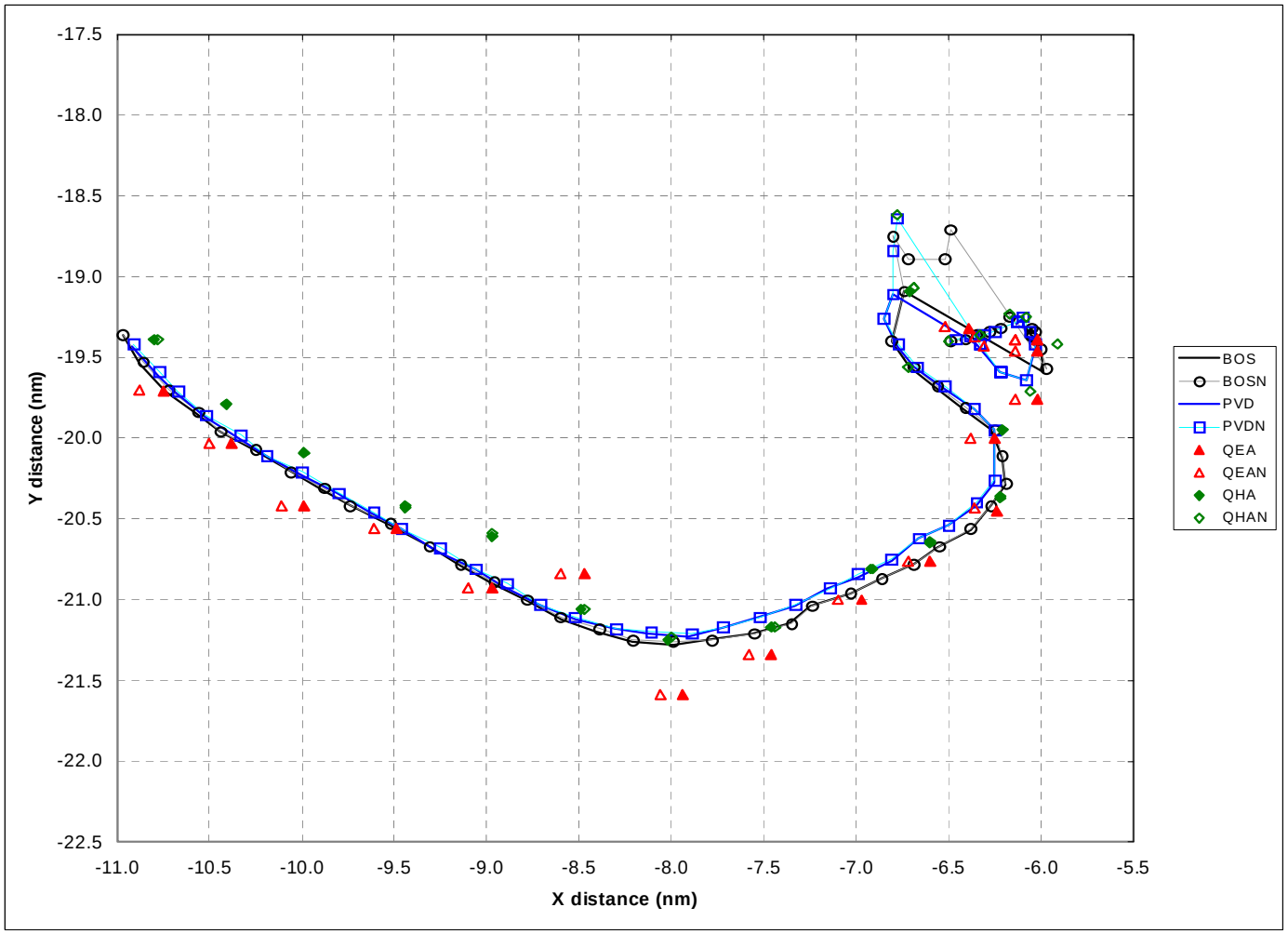

Heading / Track rate (deg/sec)
Time (sec)
BOSN
PVDN
QEAN
QHAN
Standard rate +
Standard rate -

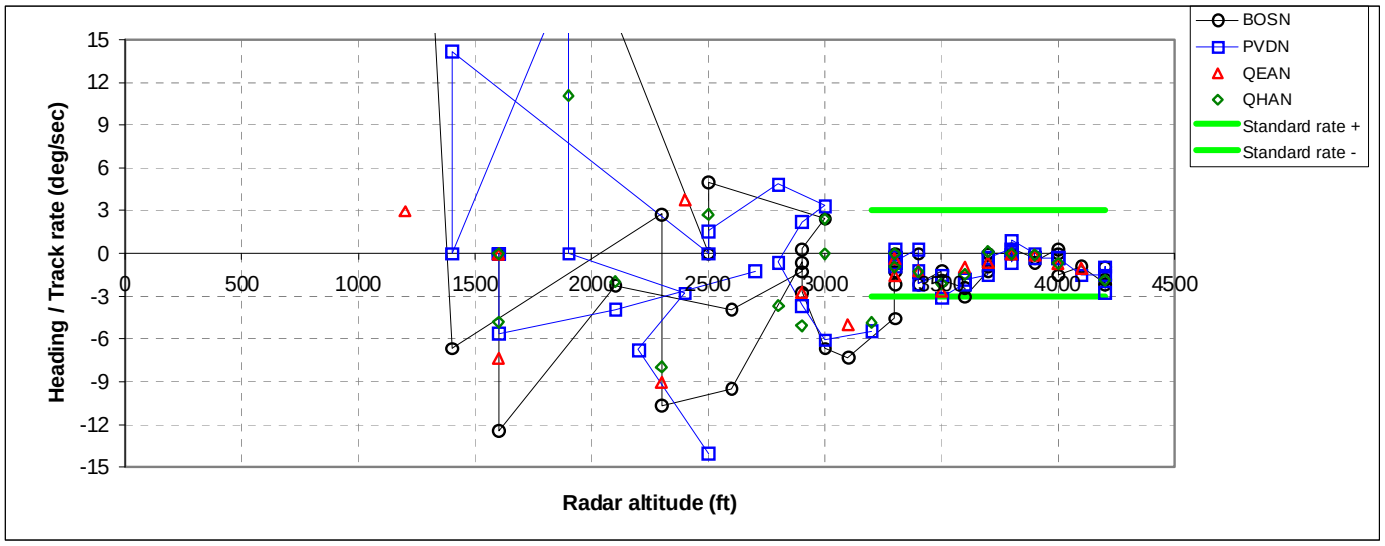

Est bank angle (deg)
Time (sec)
BOSN
PVDN
QEAN
QHAN
Standard rate +
Standard rate -

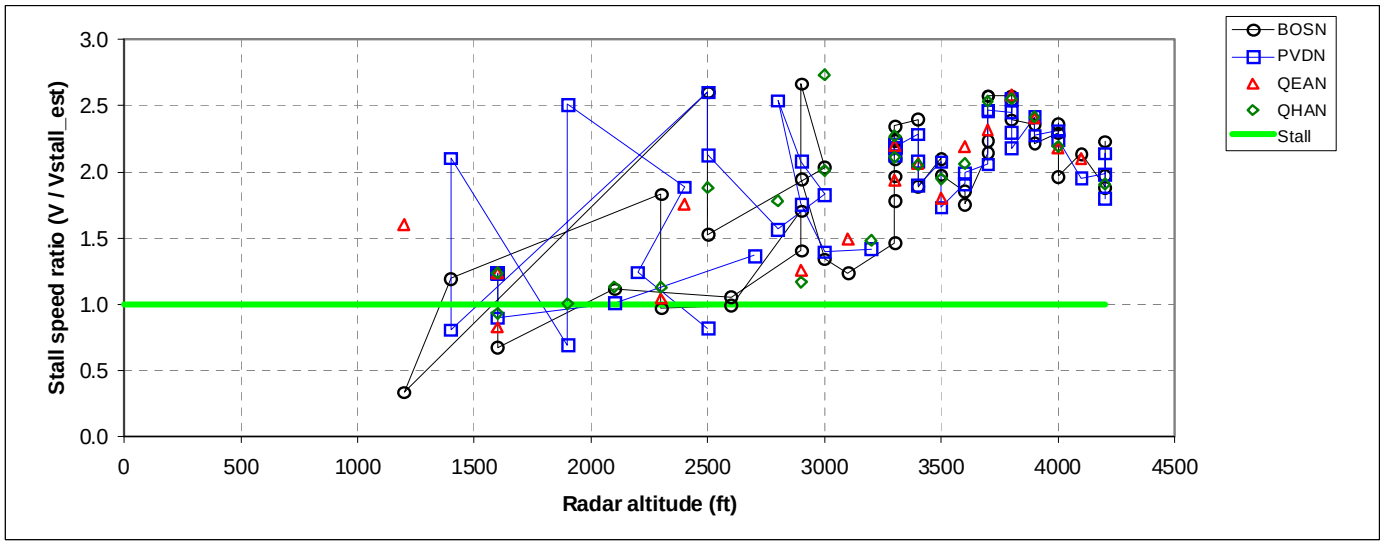

Ground speed (kt)
Time (sec)
BOSN
PVDN
QEAN
QHAN


Est airspeed (kt)
Time (sec)
BOSN
PVDN
QEAN
QHAN
Vstall (BOSN)
Vstall (PVDN)


Normal Acceleration (g)
Time (sec)
BOS
BOSN
PVD
PVDN
QEA
QEAN
QHA
QHAN


Y distance (nm)
X distance (nm)
BOS
BOSN
PVD
PVDN
QEA
QEAN
QHA
QHAN





Should you have any questions, please call me at (316) 676-6434.

Sincerely,

HAWKER BEECHCRAFT CORPORATION

Ernest C. Hall
Air Safety Investigation