



Date: February 7, 2024

To: Leah Read, Office of Aviation Safety

From: John O'Callaghan, Office of Research and Engineering

Subject: Airplane performance plots during approach for ERA23FA235

Leah:

This memorandum transmits plots of several airplane performance parameters for HondaJet HA-420 N255HJ during its landing approach to Summerville Airport (KDYB) runway 24 on May 18, 2023 (NTSB accident #ERA23FA235). The airplane overran the runway after landing and was destroyed, though the commercial pilot and five passengers were not injured. As noted in the *Preliminary Report* of the accident, the pilot stated that he delayed departure from Wilkes County Airport, North Wilkesboro, North Carolina (KUKF) to let rainstorms pass through the Summerville area, and that he knew he would be landing on a wet runway at KDYB. The KDYB weather at 00:18 EDT included calm winds, visibility 6 miles, mist, few clouds at 200 ft, broken clouds 3,200 ft, overcast clouds 10,000 ft, temperature 21 degrees C, dewpoint 21 degrees C, and a barometric pressure setting of 29.87 in Hg.

The performance plots presented here are based on Automatic Dependent Surveillance - Broadcast (ADS-B) data for the accident flight and winds aloft data (there is no Flight Data Recorder or other on-board recorded data available for N255HJ).

The ADS-B data ends when the airplane is still about 200 ft. above the runway on final approach (likely because it descended below the line-of-sight to the nearest ADS-B ground station). Consequently, only the performance parameters of the airplane during the approach are available; no recorded data captures the airplane's touchdown on runway 24 or its subsequent landing roll. The touchdown conditions (speed and location), and braking performance achieved on the runway, are therefore also unknown.

The ADS-B data for N255HJ were provided by the Federal Aviation Administration (FAA) and consist of:

- Time of the ADS-B messages in Universal Coordinated Time (UTC), at a frequency of approximately 1 report every second (1 Hz).

- Latitude, as determined by the airplane's Global Navigation Satellite System (GNSS) receiver, recorded to the nearest hundredth of an arc-second.
- GNSS longitude, recorded to the nearest hundredth of an arc-second.
- GNSS altitude, recorded to the nearest 25 feet (i.e., within an uncertainty of ± 12.5 ft.). The GNSS altitude is the height above the WGS84 ellipsoid. Altitude above mean sea level (MSL) is obtained by subtracting the height of the geoid above the ellipsoid from the GNSS height. In this case, MSL altitude = GNSS altitude + 110 ft. (at KDYB, the geoid is 110 ft. below the ellipsoid).
- Pressure altitude to the nearest 25 feet.
- Avionics-reported¹ GPS-based north and east velocities recorded to the nearest knot.
- Avionics-reported barometric-based rate of climb recorded to the nearest foot per second.

The recorded ADS-B positions defining the airplane's flight path during the last six minutes of the accident flight (starting as N255HJ was descending through about 3,600 ft. MSL) are plotted as north and east coordinates relative to the KDYB runway 24 threshold in Figure 1. The labeled points indicate the ADS-B time in HH:MM:SS EDT, the GNSS altitude in feet MSL, and the computed calibrated airspeed in knots. The approach fixes for the KDYB RNAV (GPS) RWY 24 approach (PROSO, UTUYO, and JERAK) are also shown (the approach plate is depicted in Figure 2). The north and east coordinates of the airplane are plotted vs. time in Figure 3.

Figure 4 plots the ADS-B GNSS and pressure altitudes vs. ADS-B time (the GNSS altitude is corrected for the geoid height). The pressure altitude corrected for the altimeter setting of 29.87" Hg and the non-standard lapse rate of temperature² is depicted in Figure 3 as the red line labeled "temperature-corrected barometric altitude."

Figure 5 depicts a profile view of the approach to runway 24, with the approach fixes also shown (JERAK is depicted at the Minimum Descent Altitude (MDA) of 540 ft. MSL). The 3.04° glide path angle between UTUYO (the Final Approach Fix (FAF)) and the runway is also depicted.

Winds aloft are based on a High Resolution - Rapid Refresh (HRRR) model sounding for 00:00 EDT over KDYB, obtained from a National Oceanographic and Atmospheric Administration (NOAA) website (<https://www.ready.noaa.gov/READYamet.php>). The

¹ Here "avionics-reported" indicates that the recorded speed values were computed by the airplane's avionics and broadcast over the ADS-B system, as opposed to being computed on the ground using the GNSS latitude and longitude coordinates broadcast by the airplane.

² The altimeter setting used is that reported at KDYB at 00:15 EDT, and the temperature aloft was obtained from the winds-aloft data described below.

wind speed, wind direction, and air temperature as a function of altitude from this model are plotted in Figure 6.

The north-south and east-west components of ground speed computed by on-board avionics are included in the ADS-B messages broadcast from the airplane. These speed components can be combined to produce total ground speed and ground track angle. This total ADS-B ground speed is plotted in the top plot of Figure 7. The true and calibrated airspeeds computed by combining the ADS-B ground speed with the winds and temperatures aloft data are also plotted. The ADS-B messages also include the vertical speed component (rate of climb), which is presented in the bottom plot of Figure 7. The “computed rate of climb” depicted by the red line in the bottom plot of Figure 7 is the time derivative of the “temperature-corrected barometric altitude” plotted in Figure 4.

The north and east ADS-B ground speeds can also be integrated as a function of time to yield north and east positions. These positions are depicted as the blue “integrated ADS-B speeds” lines in Figures 1 and 3, and compare very well with the ADS-B position data.

Figures 1-7 indicate that at 00:02:00 EDT, N255HJ was about 10 nm northwest of PROSO (the Initial Approach Fix (IAF)), flying towards PROSO while descending through 3,500 ft. MSL at a rate of 1,500 ft./min., and at a ground speed of 258 knots, corresponding to a calibrated airspeed of about 250 KCAS (the maximum allowed airspeed below 10,000 ft. MSL). Between 00:02:30 and 00:03:15, N255HJ decelerated from about 250 KCAS to about 190 KCAS, and leveled off at about 2,100 ft. MSL while maintaining its course towards PROSO.

At 00:04:10, about 3 nm from PROSO, N255HJ started a right turn from a track of 130° (true) to a track of 230° (true) to align with the final approach course for KDYB runway 24, while maintaining an altitude of about 2,100 ft. and an airspeed between 192 and 198 KCAS.

At about 00:06:00, about 1 nm northeast of UTUYO, N255HJ intercepted the 3.04° glide path to the runway, and started descending along that glide path. Shortly after, the airplane started to decelerate, slowing continuously from 190 KCAS at 00:06:15 to 119 KCAS at 00:08:00. The airplane then maintained about 119 KCAS until the end of the ADS-B data at 00:08:14, when it was about 200 ft. above the runway elevation.

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

Regards,

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ERA23FA235: HondaJet HA-420, N255HJ, Summerville, SC, 05/18/2023

Plan view of approach to KDYB runway 24

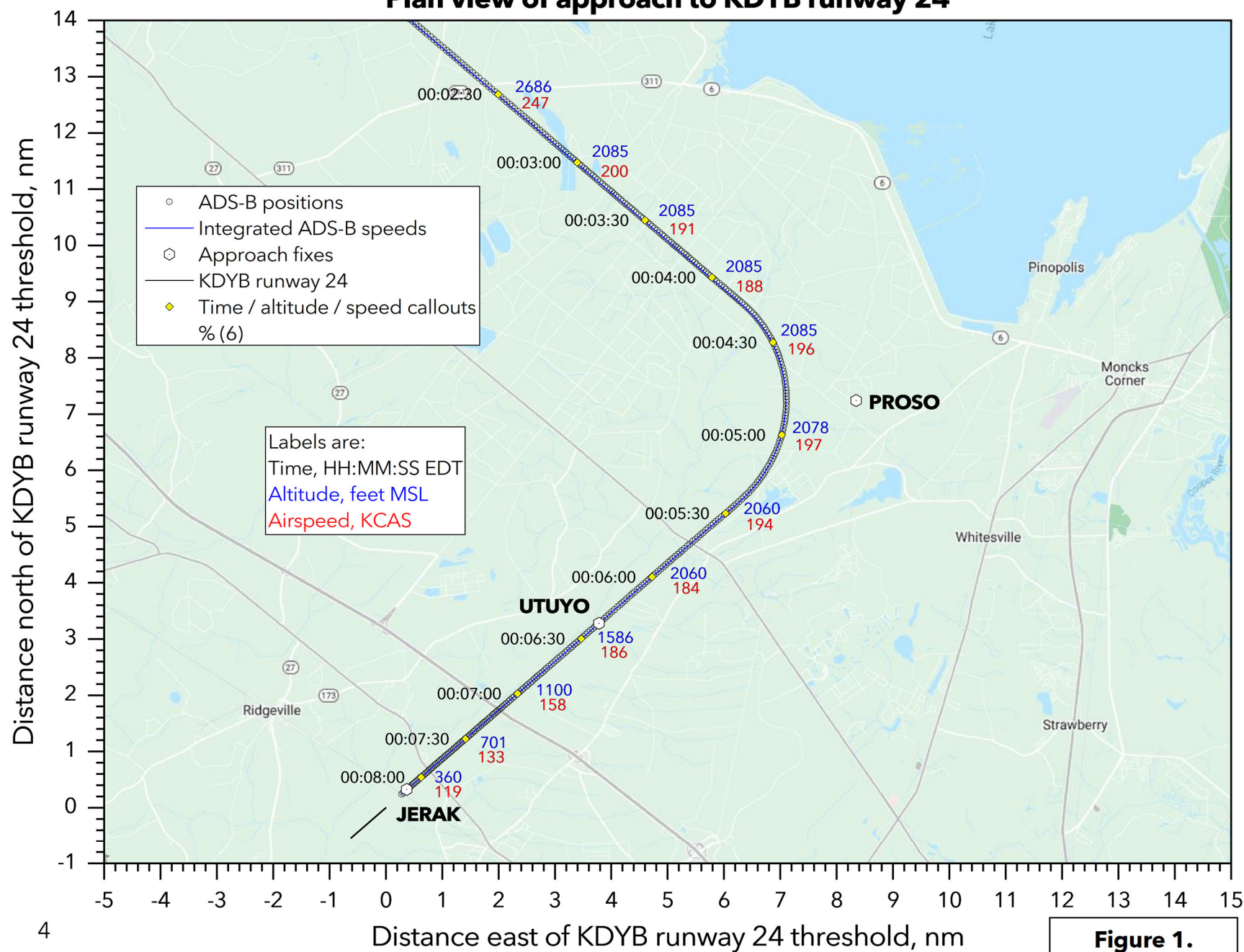


Figure 1.

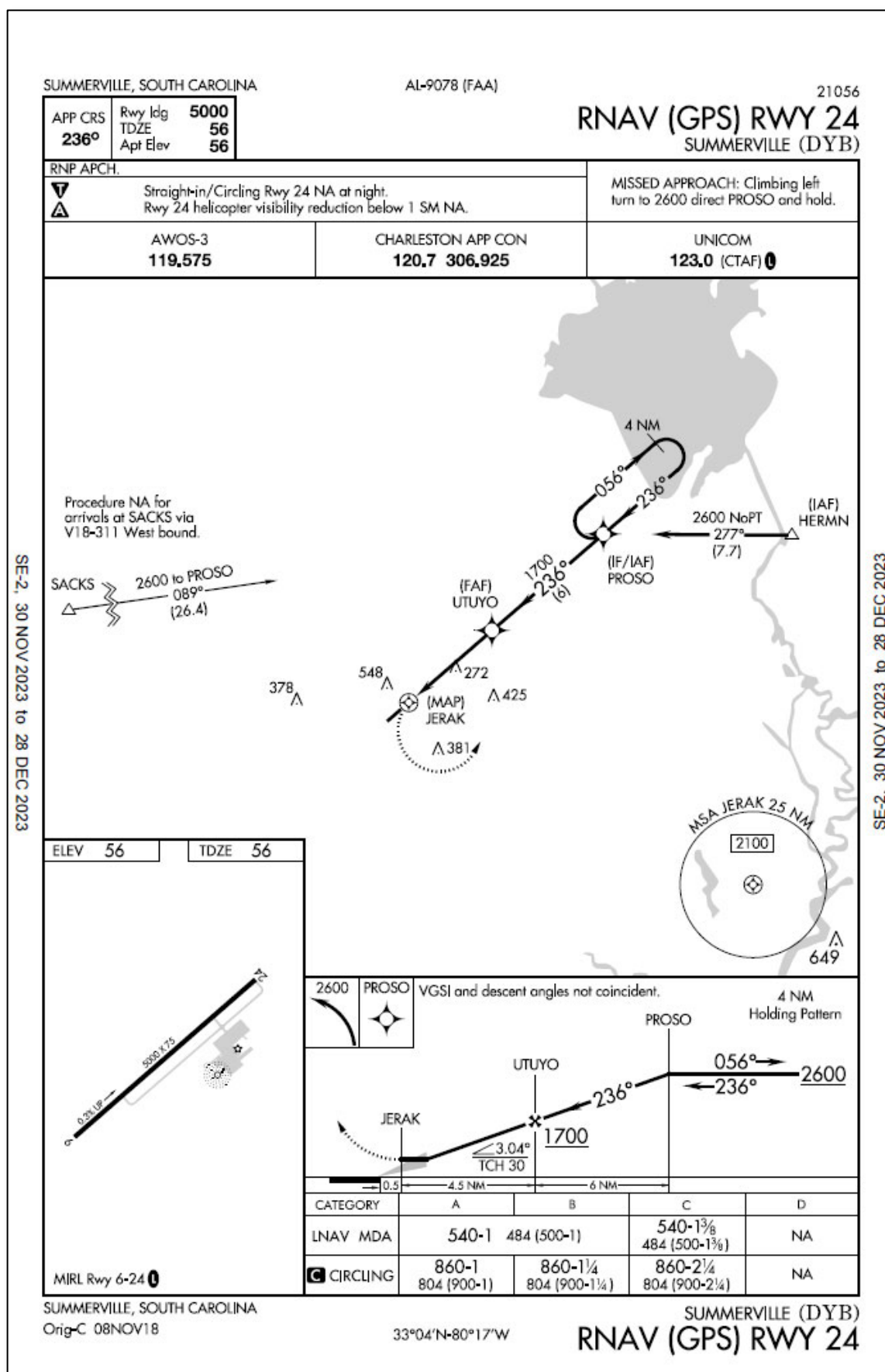


Figure 2. KDYB RNAV (GPS) RWY 24 approach plate.

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North & east coordinates during approach to KDYB runway 24

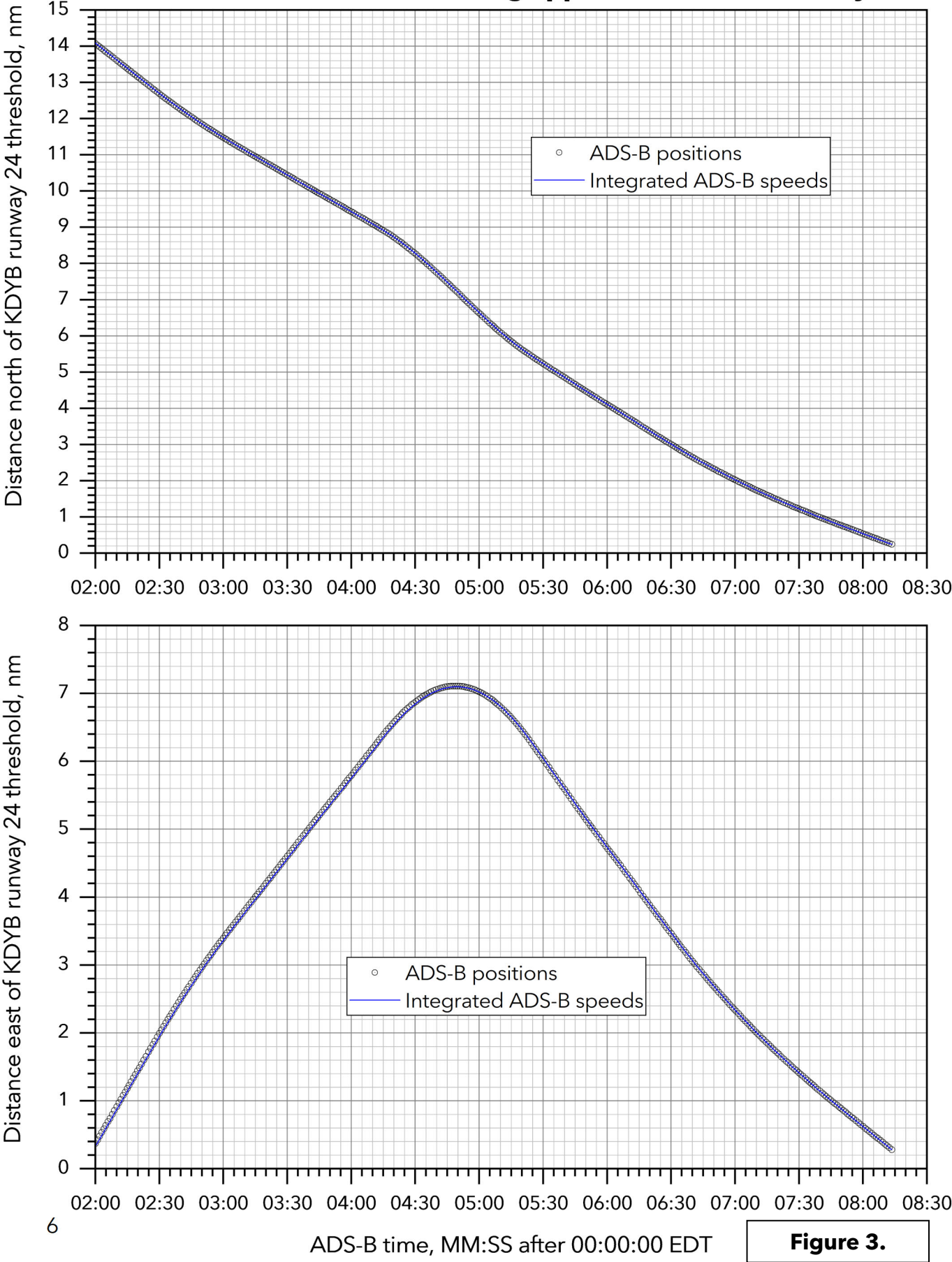
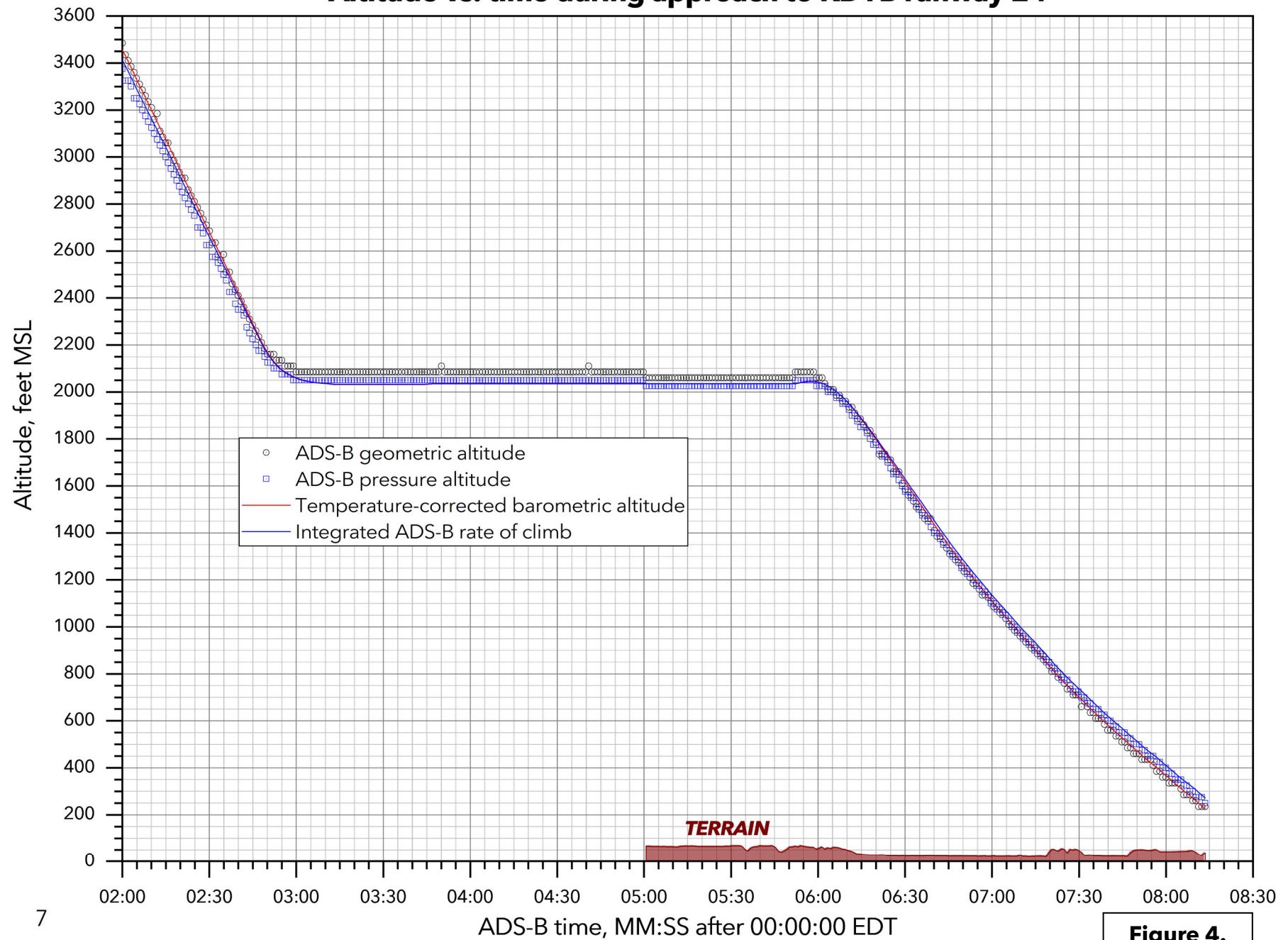


Figure 3.

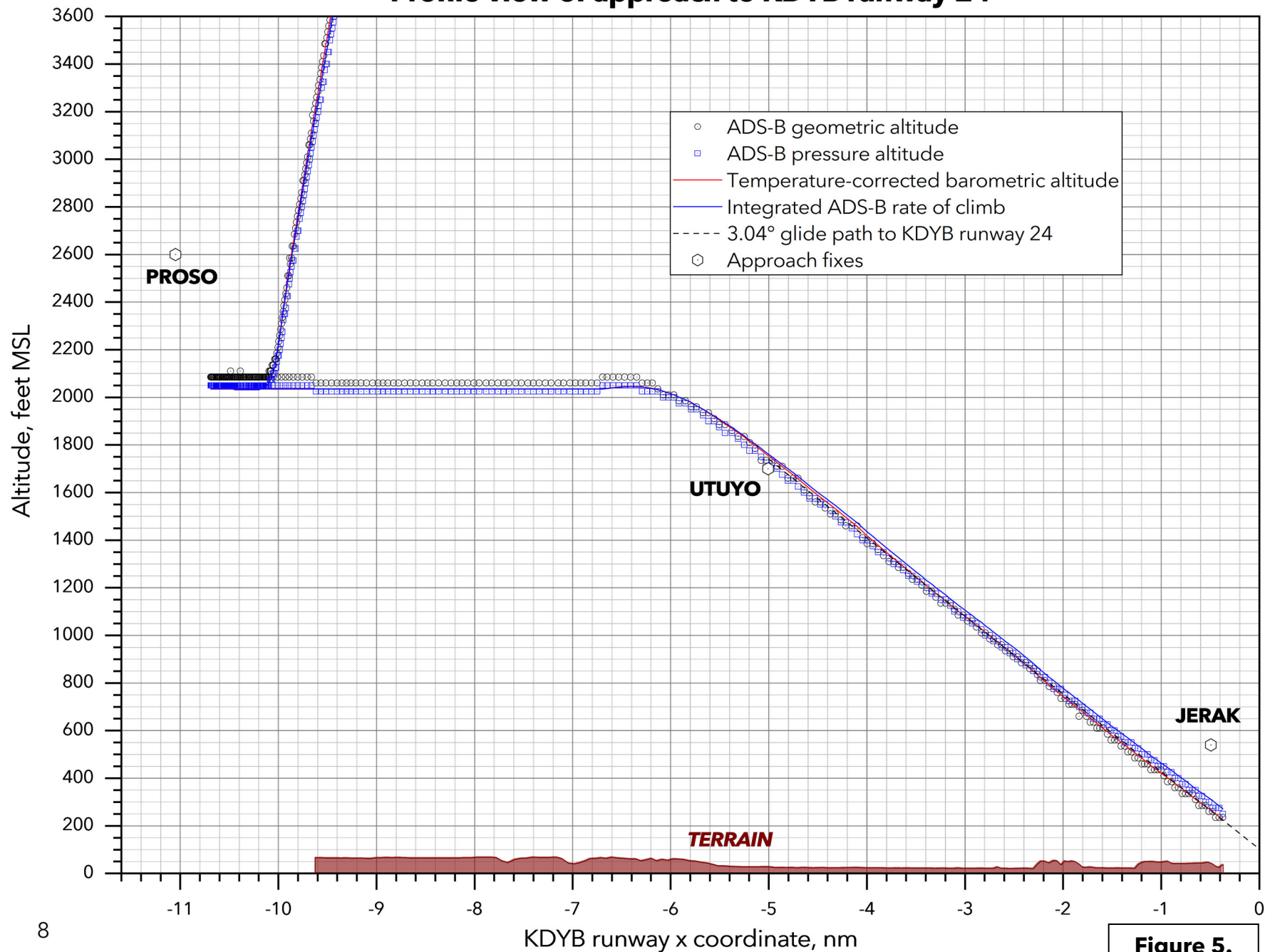
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Altitude vs. time during approach to KDYB runway 24



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Profile view of approach to KDYB runway 24



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Winds aloft from 00:00:00 EDT HRRR model

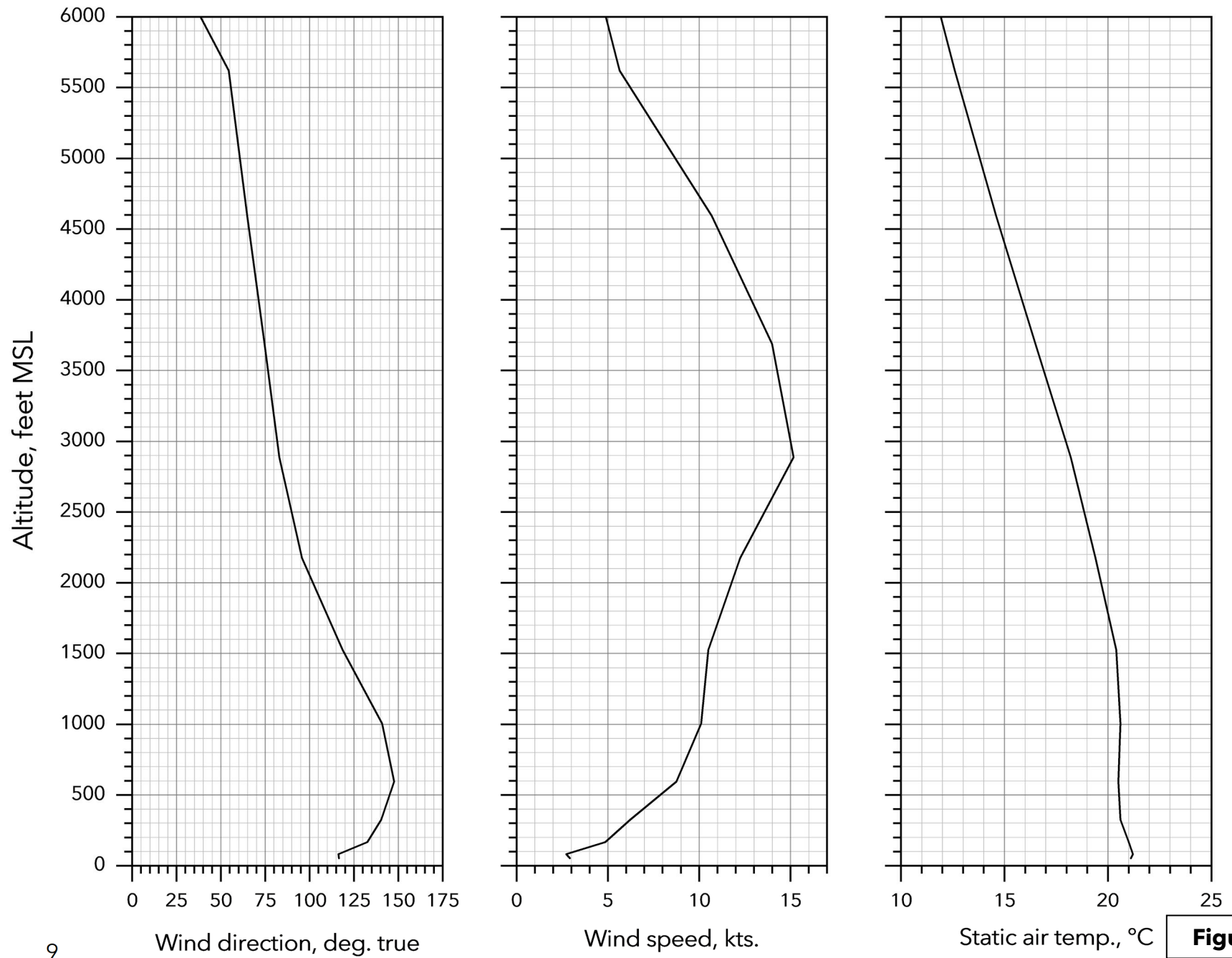


Figure 6.

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Speeds & rate of climb during approach to KDYB runway 24

