APPENDIX F

Evaluation of Jet Altitude Profiles

APPENDIX F
EVALUATION OF JET ALTITUDE PROFILES

Technical Subcommittee members questioned whether Air Traffic Control (ATC) procedures for operations to and from the east of the Airport were resulting in consistently lower than normal altitude profiles at the Airport. In response, the consultant team examined the actual altitude profiles of jet aircraft departures from, and jet aircraft approaches to, the Airport to evaluate whether the INM default profiles are representative of actual operations the Airport.

Because noise from jet aircraft is the dominant contributor to noise exposure at the Airport, the focus of the profile analysis was jet departures and jet arrivals. Because jets climb faster than piston and turbo-prop aircraft, jets will reach any presumed "hold down" altitudes sooner and closer to the airport than other aircraft types, and thus jet aircraft "hold downs" have the potential to contribute more significantly to the total annual average aircraft noise exposure than piston and turbo-prop aircraft. For both of these reasons, jet aircraft represent the "worst case" scenario for any potential deviations from the INM default profiles.

Because altitude restrictive air traffic control procedures, such as "hold downs" are more likely to occur to the east of the Airport towards the Port Columbus Terminal Control Area (TCA), this analysis focused on jet departures to the east on Runway 9R and jet arrivals from the east on Runway 27L. Lower average altitudes related to other non-ATC causes would also be apparent in these operations.

The data collected were for the Cessna 560 (C560) and Beechjet 400 (BE40) aircraft because these aircraft account for 42 percent of the jet operations at OSU. A primary focus of the analysis was the influence of air traffic control "hold downs" on the actual profiles compared to the profiles for the MU3001 in the FAA's Integrated Noise Model (INM). The MU3001 is the FAA-approved INM substitute for both the Cessna 560 and the Beechjet 400.

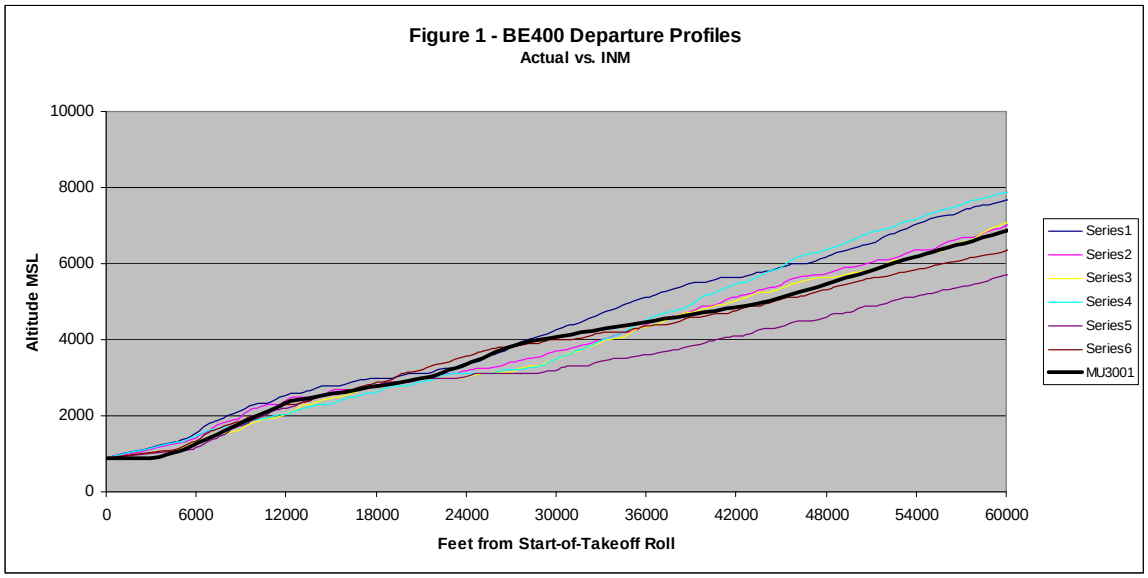
The Cessna 560 and Beechjet 400 data were collected from the Airport's Era AirScene flight track system. At the time of the analysis, data were available for three quarters of 2007. Several hundred altitude profiles comprised of over 100,000 data points were reviewed. We note that through April 23, 2007, the altimeter readings from the aircraft in AirScene were not adjusted for actual barometric pressure. Data from before April 23, 2007 reflects some variability associated with that fact. After April 23, 2007, the altitudes were calibrated using the actual barometric pressure and were more consistent. The pre-April 23, 2007 data were still useful in the analysis, however, because "hold downs" and other trends (if present) can still be observed regardless of whether the barometric pressure calibration was made.

F.1 Jet Aircraft Departure Profiles

The altitude profiles for an aircraft departing an airport are affected by many different factors including, but not limited to: takeoff weight; aircraft performance; thrust settings; pilot technique; air traffic control instructions; density altitude; wind speed; and weather conditions. Despite these various influences on the departure profile flown, a given aircraft type will generally have very similar profiles over a series of many flights. While some of the actual profiles may be higher and some may be lower, a nominal altitude profile can be used to represent a given aircraft type for noise modeling purposes.

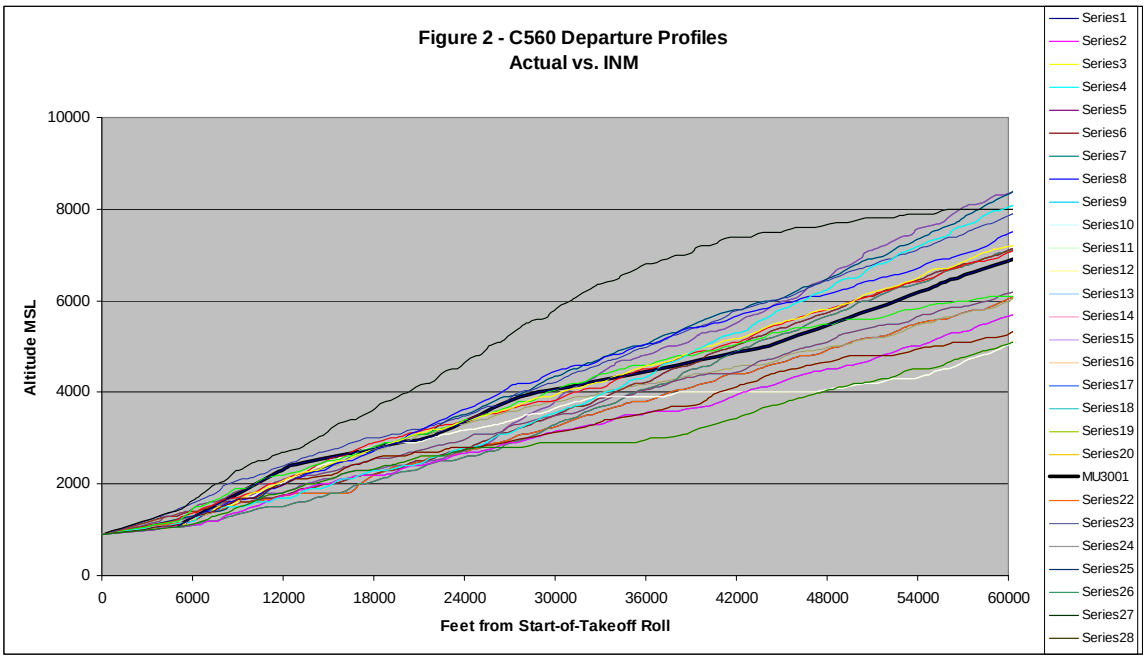
The actual altitude profiles for jet departures to the east on Runway 9R were reviewed on a point-by-point basis from the aircraft's initial detection by the AirScene system to a point when the aircraft reached 10,000 feet above ground level or 20 nautical miles, whichever came first. Based on a review of previous Day-Night Average Sound Level (DNL) contours for the Airport, it is likely that the 65 DNL contours will fall within two nautical miles from the start-of-takeoff roll on Runway 9R. Therefore, the altitude profiles within the first two to three nautical miles from start-of-takeoff roll are most important with respect to their influence on the potential areas of incompatibility and identify the area of most concern from a noise modeling standpoint. Differences in actual altitude profiles versus the INM profiles beyond three nautical miles from the start-of-takeoff roll on Runway 9R are likely to have no effect on the size and shape of the 65 DNL contour to the east of the Airport.

As shown in **Figure 1**, the actual and INM departure profiles for the Beechjet 400 align very well. The actual profiles have the same general shape as the INM departure profile for the MU3001, and they surround the INM MU3001 departure profile. That is, some of the actual BE40 departure profiles are above the INM MU3001 departure profile, while some of the actual BE40 departure profiles are below the INM MU3001 departure profile. In addition, there were relatively few "hold downs" in the data. A "hold down" would be identified by a cessation of an aircraft's climb prior to reaching a cruise altitude, which would be represented by a flat horizontal line in the figures below. Therefore, with respect to the BE40, the MU3001 departure profile is a good representation of the actual BE40 departure profiles at the Airport. This is especially true in the first two to three nautical miles that are critical to the development of the 65 DNL contour.



As shown in **Figure 2**, the INM MU3001 departure profile also falls within the range of the actual C560 departure profiles. Some of the actual C560 departure profiles are higher than the INM MU3001 departure profile, while some are lower. In general, the actual C560 departure profiles show a trend toward a less steep climb than the INM MU3001 departure profile, but few "hold downs". The steepness of the INM MU3001 departure profile implies a higher power setting and/or lower airspeed than the C560 appear to be flying at the Airport. From a noise exposure standpoint, we expect that the higher power setting and slower speed apparent in the

INM MU3001 departure profile would offset the slightly lower altitude and increased airspeed of some of the actual C560 departure profiles. Therefore, with respect to the actual C560 departure profiles, the INM MU3001 departure profile is a good representation of the actual C560 departure profiles at the Airport for noise modeling purposes.



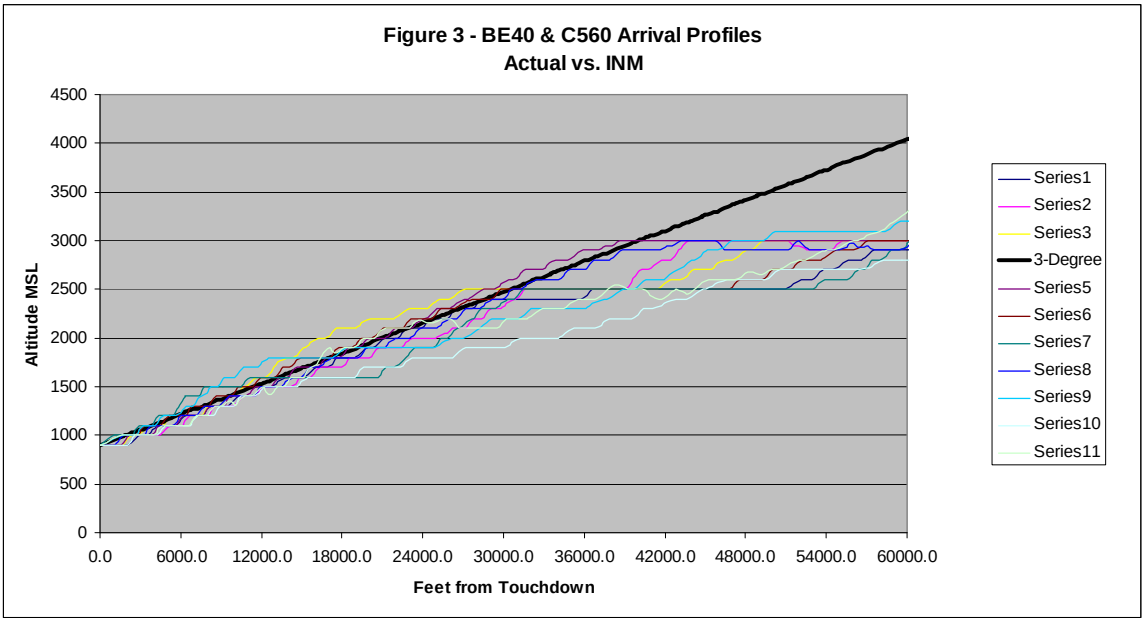
There are a few "hold downs" in the actual C560 departure profiles. When they do occur, they tend to be beyond three nautical miles. There are also a few aircraft that transit from the Airport to Port Columbus International Airport that have the appearance of a "hold down", because they maintain level flight between the two airports. There are relatively few of these operations.

F.2 Jet Aircraft Arrival Profiles

Unlike departure altitude profiles, which can exhibit a great deal of variability, arrival profiles for jet aircraft typically exhibit much less fluctuation, especially within the last two to three nautical miles from the runway end. In fact, most jet aircraft fly a 3-degree approach even under visual flight conditions.

Actual jet aircraft approach profiles to Runway 27L were analyzed for data points up to 6,000 feet above ground level or out to 20 nautical miles, whichever came first. The arrival profiles in the INM begin at 6,000 feet above ground level and descend at a 3-degree approach to the runway touchdown point, which is about 954 feet down the runway from the landing threshold. Nearly all of the jet aircraft arriving from the east to Runway 27L experience a "hold down". The "hold down" appears to occur between 5 to 7 nautical miles from the Runway 27L touch down point. After that point, as shown in **Figure 3**, most aircraft are flying a standard 3-degree approach from about 5 nautical miles to the runway touchdown point. As with the departures, some of the actual profiles are above the INM 3-degree approach, while some are below it. Because the "hold down" occurs more than three miles from the touchdown point, the INM 3-degree approach profile does

a good job replicating the actual BE40 and C560 approach profiles in the critical noise exposure areas on approach to the Airport.



F.3 Conclusion

Based on the examination of both the departure and arrival profiles for the BE40 and C560, the consultant team concludes that there is not a need to alter the standard INM departure and arrival profiles for the noise modeling effort at the Airport. Any "hold downs" that may occur are beyond two to three nautical miles from the end of the runway and, therefore, will have no impact on the determination of the 65 DNL contour. In addition, any deviation from the INM default profiles would require FAA approval. This approval has been sought previously for the Airport and was denied by the FAA. In the present analysis, no new information has been found that would suggest the FAA would reconsider that previous denial, and we have found no reason to suggest that pursuing such a request again would be productive or useful.