INM Version 6.0c Software Update

September 21, 2001

Version Information

INM Version 6.0c is a software update to Version 6.0b. You must already have INM 6.0, 6.0a, or 6.0b to use this software update. If you do not have one of these three previous versions, you can order a CD-ROM containing INM 6.0 by downloading the INM Order Form from the FAA AEE-100 web site (http:/www.aee.faa.gov/aee-100/inm). After installing INM 6.0, you can download the INM 6.0c software update.

The Version 6.0 User's Guide (9/99) is the current manual for INM Version 6.0c software. Release notes *inm60a.pdf* (5/00), *inm60b.pdf* (1/01), and *inm60c.pdf* (9/01) document changes to INM after the User's Guide was published. A Version 6.0 Technical Manual is being prepared and will be mailed to INM 6.0x users.

Installation Instructions

1. Use MS Windows to make a copy of your existing *INM6.0b* directory. Select your *INM6.0b* directory, and using the Windows File Manager under the "Edit" menu, select "copy" and then select "paste". This will create a new directory called "*Copy of INM6.0b*".
2. Use the right button of your mouse to select the *Copy of INM6.0b* directory created in step 1. Select "Rename" and rename the directory *INM6.0c*.
3. Download the *INM60C.EXE* file from the FAA Web site. Put it in the new *INM6.0c* directory.
4. Double click on the *INM60C.EXE* file name to automatically extract the updated files into the new *INM6.0c* directory. Select the "Unzip" button. This process will overwrite the old INM 6.0b files and replace them with those required for INM 6.0c. The distributed files are:

File	**Date**
inm.exe	09/07/2001
compute.dll	09/07/2001
graph.dll	09/07/2001
compu50.dll	09/07/2001
winutil.dll	09/07/2001
inm60a.pdf	05/19/2000
inm60b.pdf	01/16/2001
sys_data\acdb60.bin	09/06/2001
sys_data.dbf (12 files)*	09/06/2001
sys_data\spectra.bin	07/10/2001
Helo\HeloExample (study directory)	
Helo\Helicopter.doc	09/04/2001
Helo\HnmGrd.exe	05/22/2001

Helo\hnmgrd.cfg	03/10/2000
process\census\Census2000.doc	09/04/2001
process\census\Census2000.exe	07/17/2001
process\census\census2000.cfg	07/25/2001
process\census\fipstate.dat	07/18/2001
process\census\fipscode.dat	07/18/2001

Helicopter Noise Modeling

The FAA model for helicopter noise is the Heliport Noise Model (HNM) Version 2.2, which was developed by the Department of Transportation Volpe National Transportation Systems Center, and was last updated and released in 1994. This model is distributed by FAA AEE-100. Since that time the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD) produced the Rotorcraft Noise Model (RNM), which is distributed by NASA.

There have also been many cases where users have attempted to approximate helicopter operations in INM by creating aircraft similar to the S-76 provided in the INM software distribution example *Test411* study, and by using noise-power-distance (NPD) curves extracted from HNM.

The INM 6.0c release provides information about options available to users wishing to model helicopters. Two basic options are (1) approximate helicopter NPD data and profiles inside INM or (2) merge noise calculations from HNM or RNM with those from INM. The *Helo* subdirectory of this INM 6.0c update contains instructions and examples for both of these options; documentation is in the *Helicopter.doc* file. In the future, the FAA intends to fully integrate the HNM model into INM.

Census 2000 Support

The INM 6.0c release contains new software that can read U. S. Census 2000 Public Law 94-171 data files and write INM input files. Instructions for creating population points are in *Census2000.doc*, which is located in the *process\census* subdirectory. The existing INM software for extracting TIGER data will process the new 2000 TIGER redistricting files, which are currently released by the Commerce Department.

Database Modifications

1. Data for the Airbus A319-131 with V2522-A5 engines were added to the INM database. The aircraft identifier is A319 and the noise identifier is V2522A. The single fixed-point approach profile is a standard 3-degree descent with a 3000-foot level segment. There are three sets of procedural departure profiles: ICAO_A, ICAO_B, and STANDARD, all of which have stage lengths 1 through 4. The STANDARD departure profiles are identical to the ICAO_B profiles.

2. The A319 substitution was removed from the *acft_sub.dbf* file. INM 6.0c automatically converts the A319 substitution, if used in a study, into the new A319 aircraft.

3. Data for the Airbus A320-232 with V2527-A5 engines were added to the INM database. The aircraft identifier is A32023 and the noise identifier is V2527A. The single fixed-point approach profile is a standard 3-degree descent with a 3000-foot level segment. There are three sets of procedural departure profiles: ICAO_A, ICAO_B, and STANDARD, all of which have stage lengths 1 through 5. The STANDARD departure profiles are identical to the ICAO_B profiles.

4. Data for the Gulfstream II aircraft were added to the INM database. The identifier is GII and the noise identifier is SPEYHK. There are three procedural departure profiles, QF_FLEX, QF_FULL and STANDARD. QF_FLEX and QF_FULL correspond to Gulfstream "Quiet Flying" published procedures for reduced and full power takeoff. They include approved power reductions designed to reduce noise. These power cutbacks may be modified as part of airport specific noise reduction strategies and to reflect the actual profiles flown at the airport. The STANDARD profile is identical to the QF_FLEX.

5. The GULF2 substitution is still in the *acft_sub.dbf* file, and it is now equated to the new GII. The new GII aircraft should be used in all INM studies, and users should take steps to change references to the GULF2 substitution to the new GII standard identifier. A future version of INM will remove the GULF2 record from the *acft_sub.dbf* file, and a study using GULF2 will have to be manually converted by the user.

6. The Gulfstream IIB/III aircraft was added to the INM database, replacing the previous GIIB data. The GIIB and the GIII share identical noise certification and all GIII aircraft should be modeled using the INM GIIB aircraft. There are three procedural departure profiles, QF_FLEX, QF_FULL and STANDARD. QF_FLEX and QF_FULL correspond to Gulfstream "Quiet Flying" published procedures for reduced and full power takeoff. They include approved power reductions designed to reduce noise. These power cutbacks may be modified as part of airport specific noise reduction strategies and to reflect the actual profiles flown at the airport. The STANDARD profile is identical to the QF_FLEX.

7. The GULF3 substitution is still in the *acft_sub.dbf* file, and it is equated to the new GIIB. The standard GIIB identifier should be used in place of the GULF3 substitution, and users should take steps to change the substitution to the GIIB standard identifier. A future version of INM will remove the GULF3 record from the *acft_sub.dbf* file, and a study using GULF3 will have to be manually converted by the user.

8. The aircraft Noise identifier for the GII and GIIB is SPEYHK. For the GIIB, this is a change from SP5118, which has been deleted. All user defined aircraft derived from the previous GIIB or any user-define aircraft that referenced the SP5118 identifier, must now reference the new SPEYHK noise identifier. **INM 6.0c will not do this automatically**. A user must load the study aircraft.dbf file into an outside application such as EXCEL, and manually change SP5118 to SPEYHK. This is only required for user-defined aircraft, that reference the SP5118 identifier.

9. The Gulfstream GIVSP with the TAY 611-8 was added to the INM database, replacing the previous GIV data. The previous GIV used the noise curves for the current INM F10062 as an approximation; with this submission, the INM GIV now has its own set of NPD curves.

10. Data for the Gulfstream V aircraft were added to the INM database. The aircraft identifier is GV and the noise identifier is BR710. The dataset contains standard procedural profiles for one 3-degree approach, one departure, one touch and go, and one circuit profile.

11. Data for the Boeing 767-400ER aircraft with CF6-80C2B(F) engines were added to the INM database. The aircraft identifier is 767400 and the noise identifier is CF680C. The single fixed-point approach profile is a standard 3-degree descent with a 3000-foot level segment. There are three sets of procedural departure profiles: ICAO_A, ICAO_B, and STANDARD, all of which have stage lengths 1 through 7. The STANDARD departure profiles initiate cutback and acceleration to zero flaps at 1000 feet as compared to the ICAO B, which cutbacks after flap retraction. Other INM 767 aircraft cutback in-between, but are considered to be closer to the ICAO B definition.

12. The 767400 substitution was removed from the *acft_sub.dbf* file. INM 6.0c automatically converts the 767400 substitution, if used in a study, into the new 767400 aircraft.

13. Data for the Boeing 777-300 aircraft with Trent 892 engines were added to the INM database. The aircraft identifier is 777300 and the noise identifier is TRENT8. The single fixed-point approach profile is a standard 3-degree descent with a 3000-foot level segment. There are three sets of procedural departure profiles: ICAO_A, ICAO_B, and STANDARD, all of which have stage lengths 1 through 7. The INM STANDARD departure profiles initiate cutback and acceleration to zero flaps at 1000 feet as compared to the ICAO B, which cutbacks after flap retraction. The 777300 STANDARD profiles are similar to the 777200 profiles.

14. Data for the 737-700 aircraft with CFM56-7B engines (INM identifiers 737700 and CF567B) has been updated to include ICAO_A, ICAO_B and STANDARD procedures that initiate cutback at 1000 feet. All procedures contain stage weights 1-6 where stage 6 is the maximum takeoff weight. The flap data and jet thrust coefficients were updated to account for the expanded set of procedures.

15. Data for the Boeing 717-200 aircraft were added to the INM database. The identifier is 717200 and the noise identifier is BR715. The single approach profile is a typical INM procedural approach profile, a standard 3-degree descent from 6000 feet. There are two sets of procedural departure profiles: ICAO_B and STANDARD, both of which have stage lengths 1 through 6. The STANDARD departure profiles initiate cutback at 1000 feet and accelerates to zero flaps at 3000 feet, as compared to the ICAO B, which cutbacks after flap retraction.

16. The 717 and 717ER substitutions are still in the *acft_sub.dbf* file. They are now equated to the new 717200 aircraft. However, the new 717200 aircraft should be used

in all INM studies, and users should take steps to change these substitutions to the new 717200 standard identifier. A future version of INM will remove the 717 and 717ER records from the *acft_sub.dbf* file, and a study using these substitutions will have to be manually converted by the user.

17. Data for the Cessna Citation X with Rolls Royce Allison AE3007C engines were added to the INM database. The aircraft identifier is CNA750 and the noise identifier is AE300C. There are three procedural approach profiles: FLAP_5, FLAP_15, and STANDARD. Standard approach is the same as FLAP_15. There are three procedural departure profiles: FLAP_5, FLAP_15, and STANDARD. Standard departure is the same as FLAP_15.

18. The CNA750 substitution was removed from the *acft_sub.dbf* file. INM 6.0c automatically converts the CNA750 substitution, if used in a study, into the new CNA750 aircraft.

Program Modifications

1. The INM program was modified to accept additional sets of jet thrust coefficient data (see User's Guide, page 8-43). These coefficients are referred to as ReduceTakeoff and ReduceClimb. This addition adheres to the SAE-AIR-1845 method of developing power setting data, and provides manufacturers with a means of developing departure procedural profiles for "flex" or "de-rated" power takeoffs. These reduced power settings were used by Gulfstream in developing data for the GII and GIIB aircraft for the INM database, and they may be used by other manufacturers for developing reduced power takeoff procedures.

2. Because the new jet thrust coefficients are called ReduceTakeoff and ReduceClimb, the thrust type previously called "ReduceThrust" (see User's Guide, page 8-25) has been renamed "MinimumThrust". The MinumumThrust option can be used when building Noise Abatement Departure Procedure (NADP) profiles for INM.

3. Acceptable numerical ranges for jet engine coefficients (E, F, Ga, Gb, H) were increased to accommodate new engine performance requirements.

4. Helicopter flyover spectral classes were added to the Acft // Noise Identifier drop-down box that previously held only military afterburner spectral classes. This addition facilitates the use of three operational modes (approach, depart, and flyover) for developing fixed-point profiles for helicopters. Refer to *Helicoper.doc* for more information on how to build helicopter profiles.

5. The Window // Options // Display Noise at Cursor Position function has been modified to display the noise metric name, in addition to the metric value.

6. The display of standard/detailed grid points and population points has been changed. These kinds of points are now displayed and printed as small squares. Previously, grid and population points were displayed as small points.

7. The order in which layers are displayed was changed in the Output Graphics function. Grid points, location points, population points, and streets are now visible on top of color filled contours.

8. The File // Print function was modified so that scaled printing can be activated without having to set the width and length parameters in the Print Scale window. Some printer drivers do not provide the actual print area width and length. Now, printer resolution (e.g., 600 dots per inch) is assumed to provide the correct scale in both x and y directions. You can still override this by inputting width and length in the Print Scale window (see User's Guide, page 3-23).

9. Fixed-point profiles are now used without alteration. Previously, INM changed the first departure speed to 35 knots since the INM noise on takeoff roll algorithm was calibrated with a single user provided takeoff roll segment (which is internally sub-segmented) and a start speed of 35 knots. All INM standard procedural profiles start at 35 knots and the INM standard fixed-point departure profiles have been changed to start at 35 knots. INM will only override the start speed for profile points if the input speed is 0 or 16 knots (16 was the value used by INM 5).

10. The File // Import Data into Study // Census PL94-171 DBF Files function was modified. It is now called "Census 2000 PL94-171 Files" and a new DOS program is used to process Census 2000 *xxgeo.upl* files. Instructions for obtaining and processing population data are in *Census2000.doc*, which is located in the *process\census* subdirectory.

11. The INM version number (INM 6.0c) was added to the *status.dat* file in the case subdirectory.

12. The Output // Output Graphics // Contour Display Control was modified. The width of overlay contours can now be adjusted.

13. The Setup // Case Copy window was modified to remain active after a case-copy operation. After clicking on the Copy button, a verification window pops up to notify you that the case has been copied. More cases can be copied, and then the Case Copy window can be removed by clicking on the Cancel button.

14. INM can now open and run studies that have Read Only files, as typically happens when a study is copied from a CD-ROM to a hard drive. When INM first opens a study, all files in the study directory and subdirectories are set to Read/Write.

Reported Problems Fixed

1. The maximum number of track points was changed to 999 in the graphical user interface. Previously, the Tracks // Input Graphics function allowed only 99 points per track, even though the DBF data input limit was, and still is, 999 points.

2. The Enable check box in the output graphics Grid Display Control window was fixed. Previously, enabling grids when no grids were highlighted, and when the Grid Display Control window had been accessed through the Output Layers Display Control window, would occasionally lock the INM program.

3. The Import Census TIGER Street Files function was fixed. Previously, the *tiger.cfg* file was not properly called when the *census.exe* program was spawned by INM; instead, the default configuration file was used.

4. The Output // Case Echo Report function was fixed. Previously, an incorrect grid identifier could be written to a report when multiple reports were produced during a single session.

5. The Tracks // Input Graphics, Add Point function was fixed. Previously, a point could not be added between two points that had exactly the same x values or exactly the same y values.

6. A problem with writing overflight tracks to a DXF file was fixed. Previously, OVF tracks were not exported, even though they were visible in the Output Graphics window.

7. Error-trapping code to detect a single NPD curve was fixed. Previously, a single approach or departure SEL, LAMAX, EPNL, or PNLTM curve could be written to the *flight.pth* file and noise computed. Now, an error message informs you that two or more NPD curves must be provided per NPD set. An example of an NPD set is "approach SEL". Two or more curves are needed to interpolate noise levels across thrust setting values (see the User's Guide, page 8-14). If the single-curve error condition is detected, the INM run is terminated before it proceeds to the noise computation phase. **This change only affects user provided data containing single NPD curves**.

8. The File // Import Data into Study // Radar Tracks CSV File function was fixed to correctly import 2-character runway identifiers. Previously, the Input or Output Graphics // Track Display Control function that allows tracks to be turned on or off based on runway end identifier did not work properly.

9. The File // Print function for Output Graphics displaying overlay contours was fixed. Previously, the printed legend showed the overlay contour levels and areas. Now, the legend shows the case contour information.

10. The legend in the graphics printout was modified so that the legend ends at the border, and the landscape legend is the same font size as the portrait legend.

11. The Tracks // Input Graphics // Edit // Disperse Tracks sub-track percents display was fixed. Previously, the default percent values were displayed, even when the values were changed by the user. This was a graphics display problem only; the input percent values were used in the noise calculations.

12. The calculation of lateral distance between source and receiver has been improved for the case in which terrain data are used. This change may result in minor changes to the contour at low source-to-receive angles close to the runway. **The distance used for the regular NPD extrapolation was not affected**.

13. The modeling of aircraft directivity behind takeoff when the terrain option is used was fixed. Previously, aircraft directivity was not applied behind the takeoff roll when terrain data were used. For the terrain case only, this change will make a noticeable difference to the noise behind start of take off roll.

14. The interpolation of NPD curves for a flight segment that uses approach NPD on one end and departure NPD on the other end has been fixed. Previously, some touch-and-go contours were computed with abnormal side spikes for the segment transitioning from roll-out approach to power-on departure. This NPD interpolation problem was especially noticeable for the DHC8 and DHC830 aircraft.

15. A problem in the way the Celsius default temperature was calculated for a new case was fixed. Previously, when a study used metric units, the default ISA temperature was calculated using airport elevation interpreted as feet instead of meters and the default airport temperature was warmer than the ISA value. Now, the ISA value of Celsius temperature is calculated as the default value for a new case when metric units are used.