



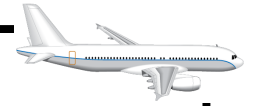
Detailed Example Using of the Integrated Noise Model

CEE 4674 – Airport Planning and Design

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Associate Professor of Civil Engineering
Virginia Polytechnic Institute and State University

Blacksburg, Virginia

2008



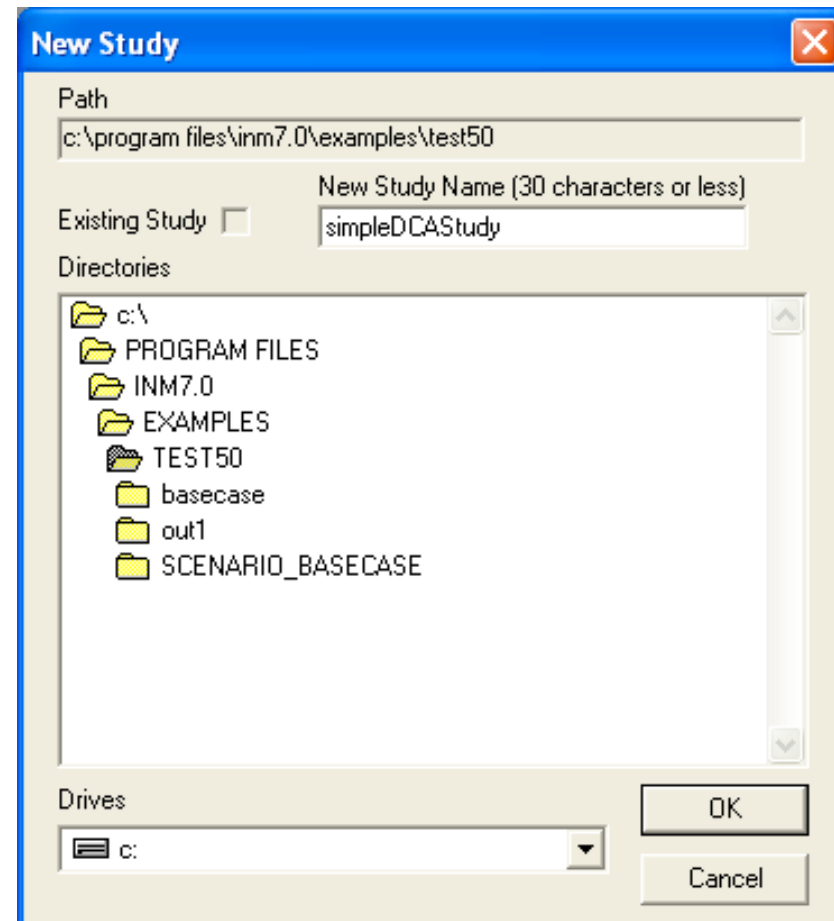
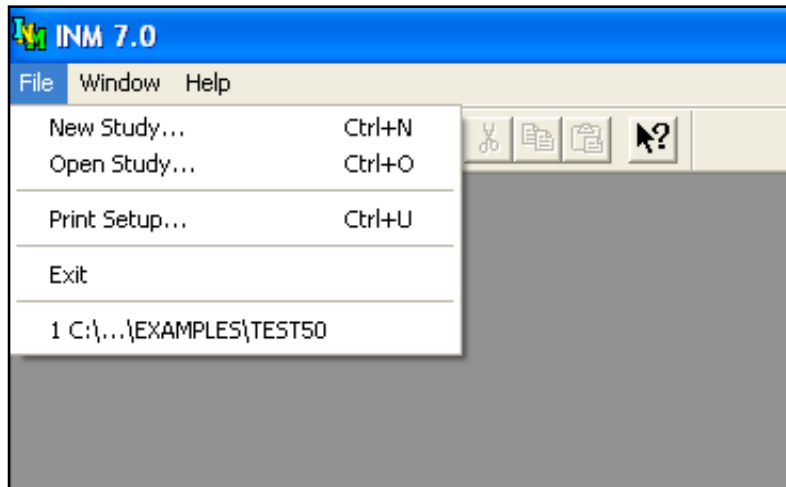
Purpose of the Analysis

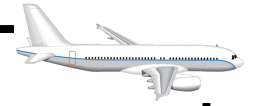
- Predict noise contours for two distinct aircraft and compare their noise signatures
- Determine departure noise contours for:
 - Boeing MD-80
 - Cessna Citation 500
- Use Ronald Reagan National Airport runway 01 in our case study



Starting a New Case in INM

- Start a new case in the INM menu





DCA Airport (source: Google Earth)

- Use a satellite picture to help you guide the process of creating tracks
- The red track simulates a departure track from DCA runway 01





Selecting the Airport for Our Case Study

- View the airports available and select the one to be used in the study

Study Setup [simpleDCASStudy]

Units Created

Description

Origin of Coordinates

Latitude (deg) Airport

Longitude (deg)

Elevation (ft)

View Airports

Airports

CT	IGOR I SIKORSKY MEMORIAL	BDR
CT	TWEED-NEW HAVEN	HVN
CT	WATERBURY-OXFORD	OXC
CT	WINDHAM	JD
DC	RONALD REAGAN WASHINGTON	DCA
DC	WASHINGTON DULLES INTERNA	IAD
DE	DELAWARE AIRPARK	33N
DE	DOVER AFB	DOV
DE	NEW CASTLE COUNTY	ILG
DE	SUMMIT	EVY
FL	ALBERT WHITTED	SPG
FL	ARTHUR DUNN AIR PARK	X21
FL	BARTOW MUNI	BOW
FL	ROR SIKES	CFW



Verify Information about the Airport

- Always check the runway and setup information in INM

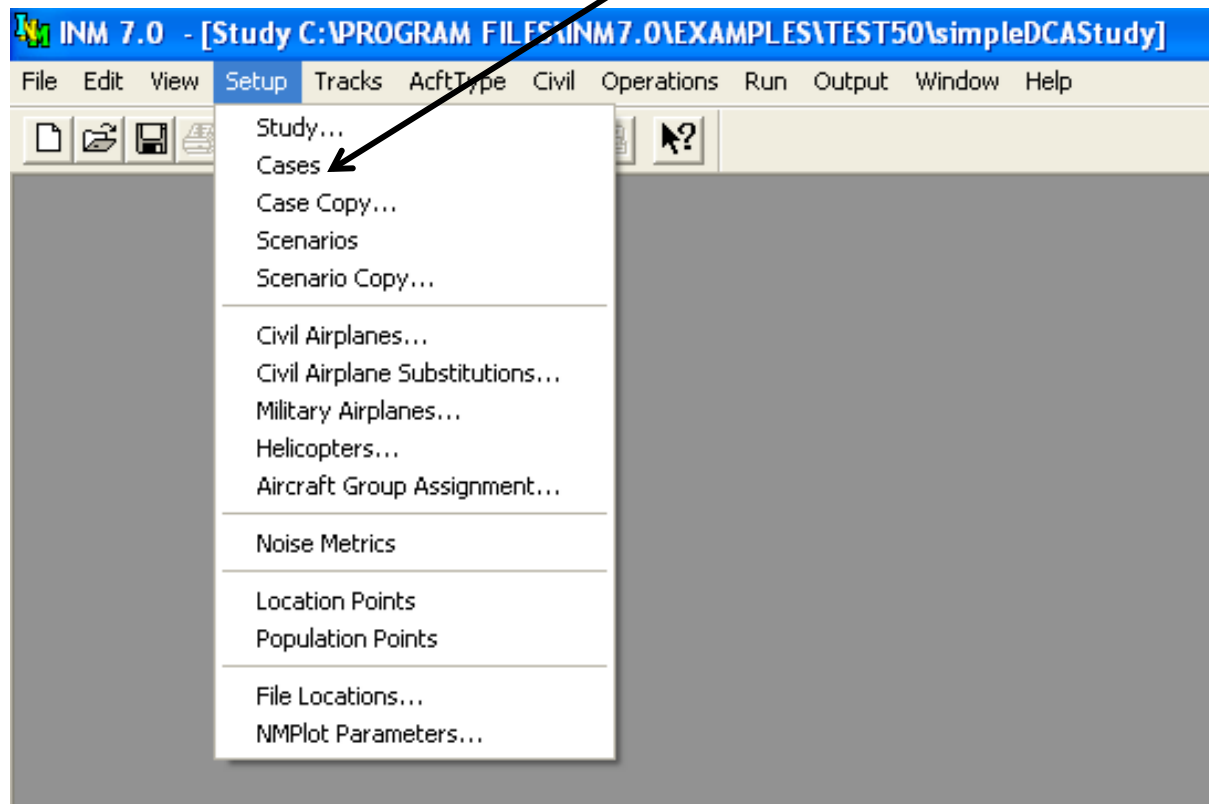
The screenshot shows the INM 7.0 software interface. The main window title is "INM 7.0 - [Study C:\PROGRAM FILES\INM7.0\EXAMPLES\TEST50\simpleDCASStudy]". The menu bar includes File, Edit, View, Setup, Tracks, AcftType, Civil, Operations, Run, Output, Window, and Help. The toolbar contains icons for file operations and navigation. Two dialog boxes are open:

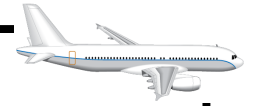
- Runway Ends and Helipads:** This dialog shows a list of runways on the left, with "01" selected. The right pane displays the configuration for runway 01:
 - Runway: 01
 - Coordinates: X/Y Lat/Long
 - X (nmi): 0.0421, Y (nmi): -0.5810
 - Elevation MSL (ft): 11.6
 - Displaced Thresholds:
 - Approach (ft): 0
 - Takeoff (ft): 0
 - Glide Slope (deg): 3.0
 - Thresh. Crossing Height (ft): 50.0
 - Change in Headwind (%): 0.0
- Study Setup [simpleDCASStudy]:** This dialog shows the study configuration:
 - Units: English, Created: 23-Apr-08 22:31
 - Description: A simple study of noise generated by two aircraft using DCA runwau 01
 - Origin of Coordinates:
 - Latitude (deg): 38.852083, Longitude (deg): -77.037722, Elevation (ft): 15.0
 - Airport: DCA
 - Buttons: View Airports, OK



Adding a Case Inside Our Study

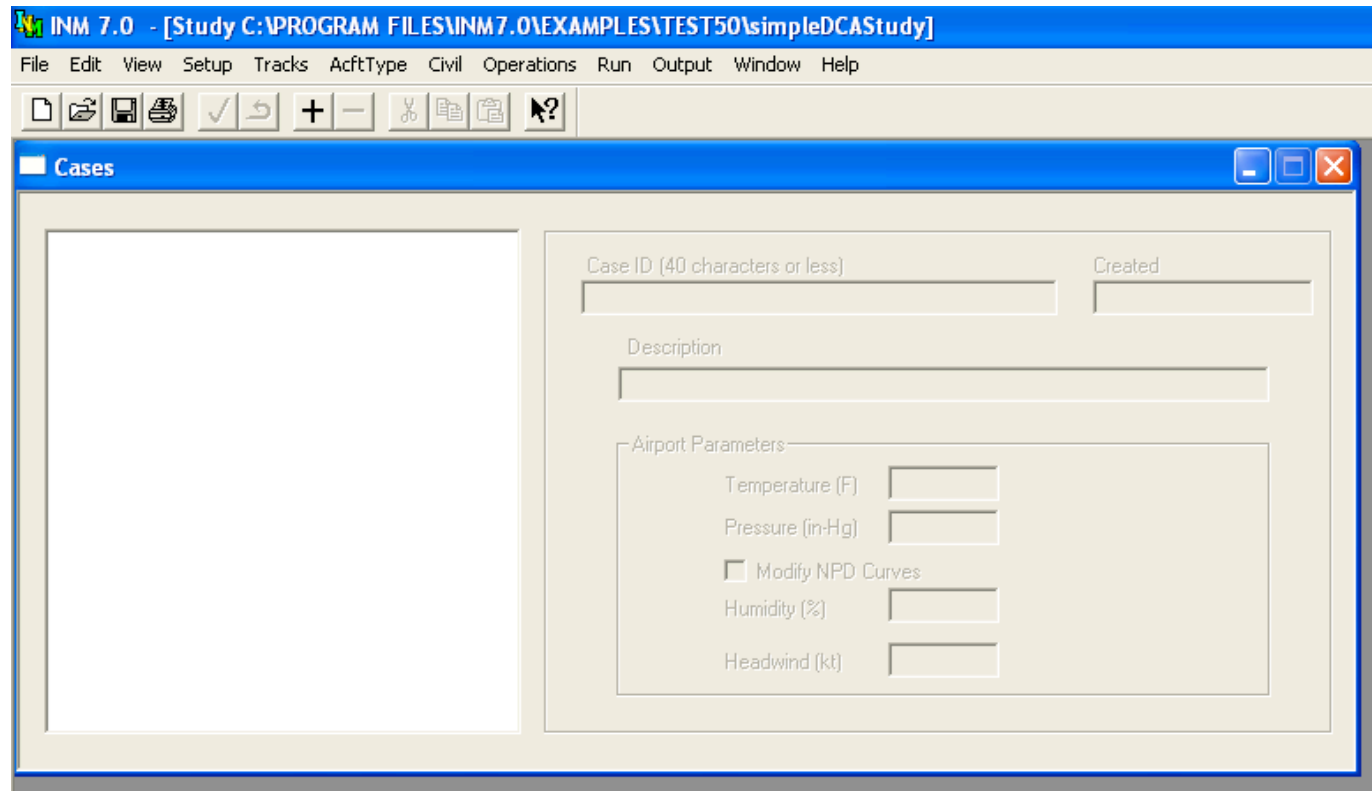
- Click here to go start the process to add a new case





Empty Case Window

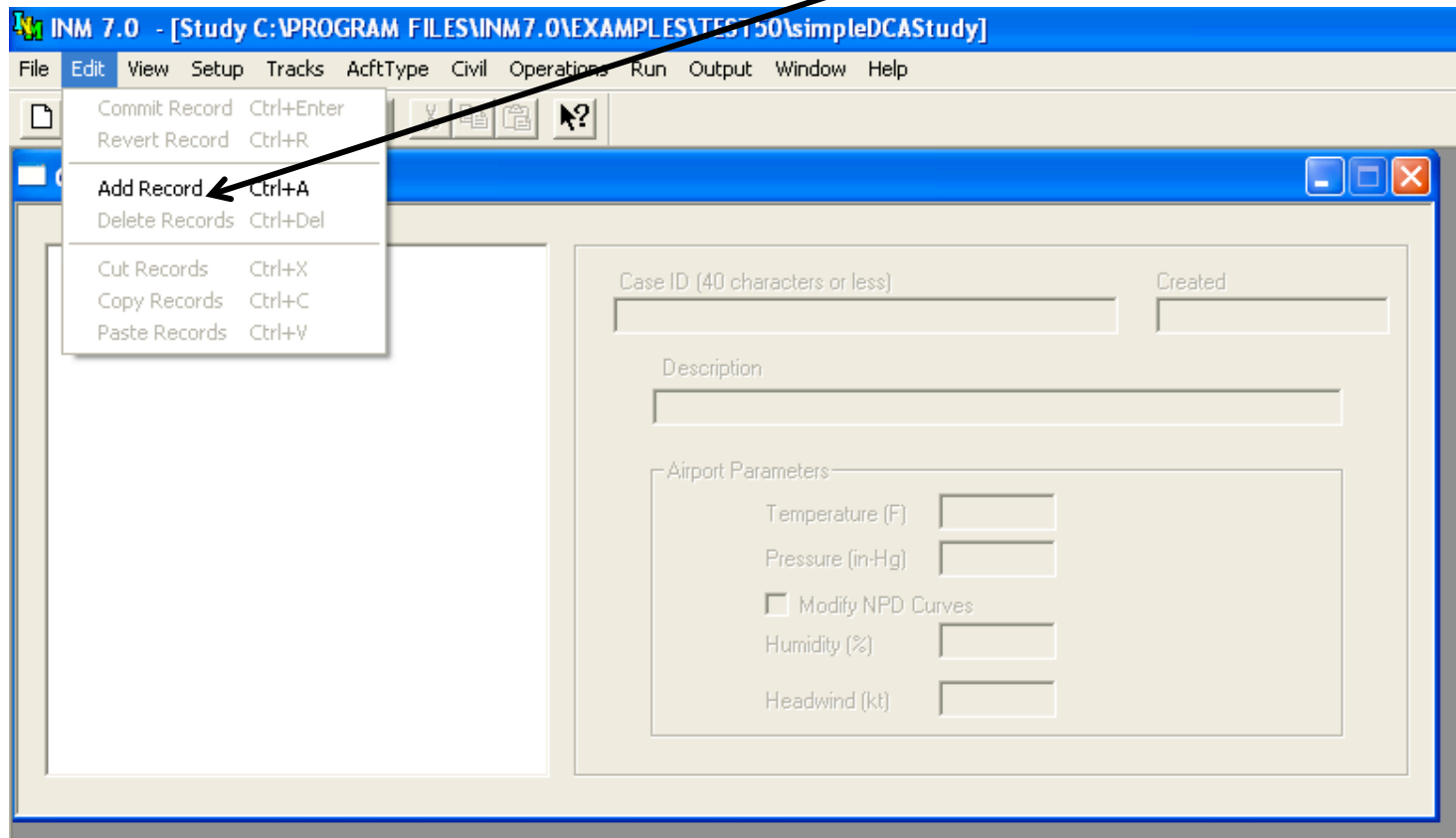
- Each new case is presented in the case window pane

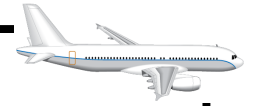




New Case in the Analysis

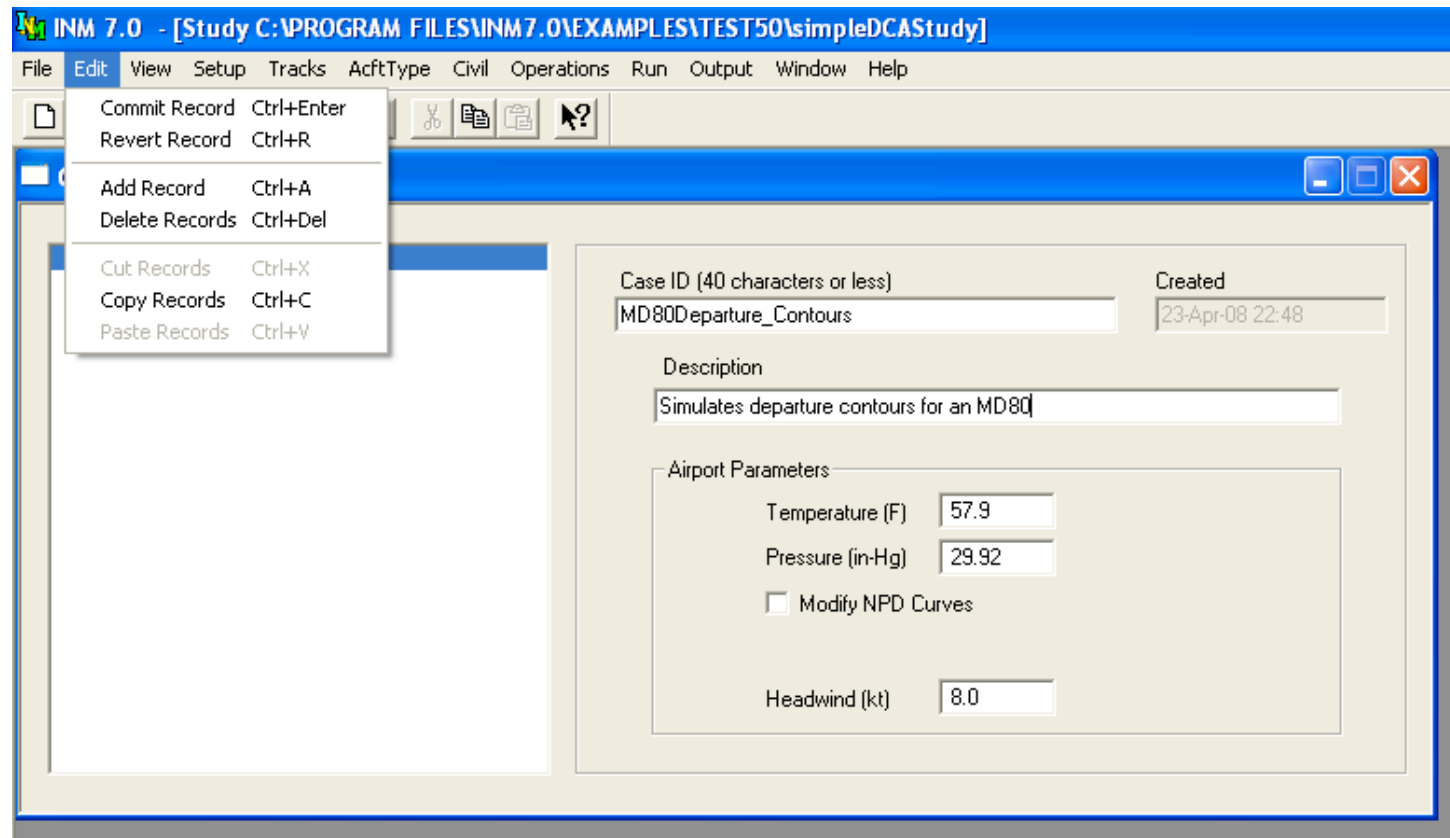
- Adding a record to start a new case in the INM menu





Always Commit Records in INM

- Specify the new case



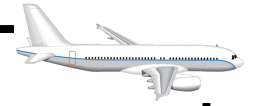


New Case Added to the INM Study

- Write a comment so that you know what the case is about

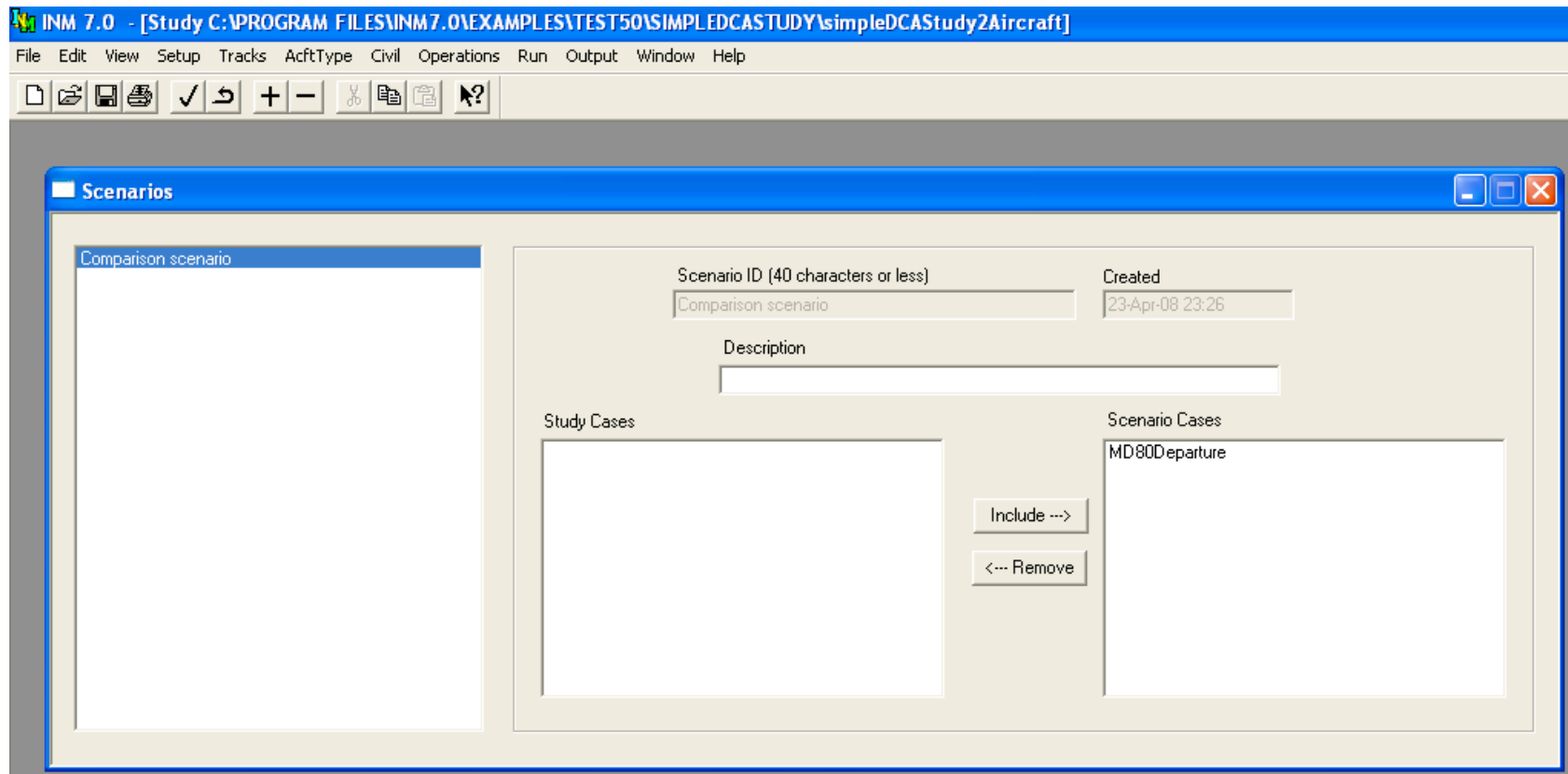
The screenshot shows the INM 7.0 software interface. The title bar reads "INM 7.0 - [Study C:\PROGRAM FILES\INM7.0\EXAMPLES\TEST50\simpleDCASudy]". The menu bar includes "File", "Edit", "View", "Setup", "Tracks", "AcftType", "Civil", "Operations", "Run", "Output", "Window", and "Help". The toolbar contains icons for file operations and navigation. The main window is titled "Cases" and contains a list of cases on the left and a form for editing a case on the right. The case "MD80departure_Contours" is selected. The form fields are as follows:

Case ID (40 characters or less)	Created
MD80departure_Contours	23-Apr-08 22:48
Description	
Simulates departure contours for an MD80	
Airport Parameters	
Temperature (F)	57.9
Pressure (in-Hg)	29.92
<input type="checkbox"/> Modify NPD Curves	
Headwind (kt)	8.0



Adding a Scenario in INM

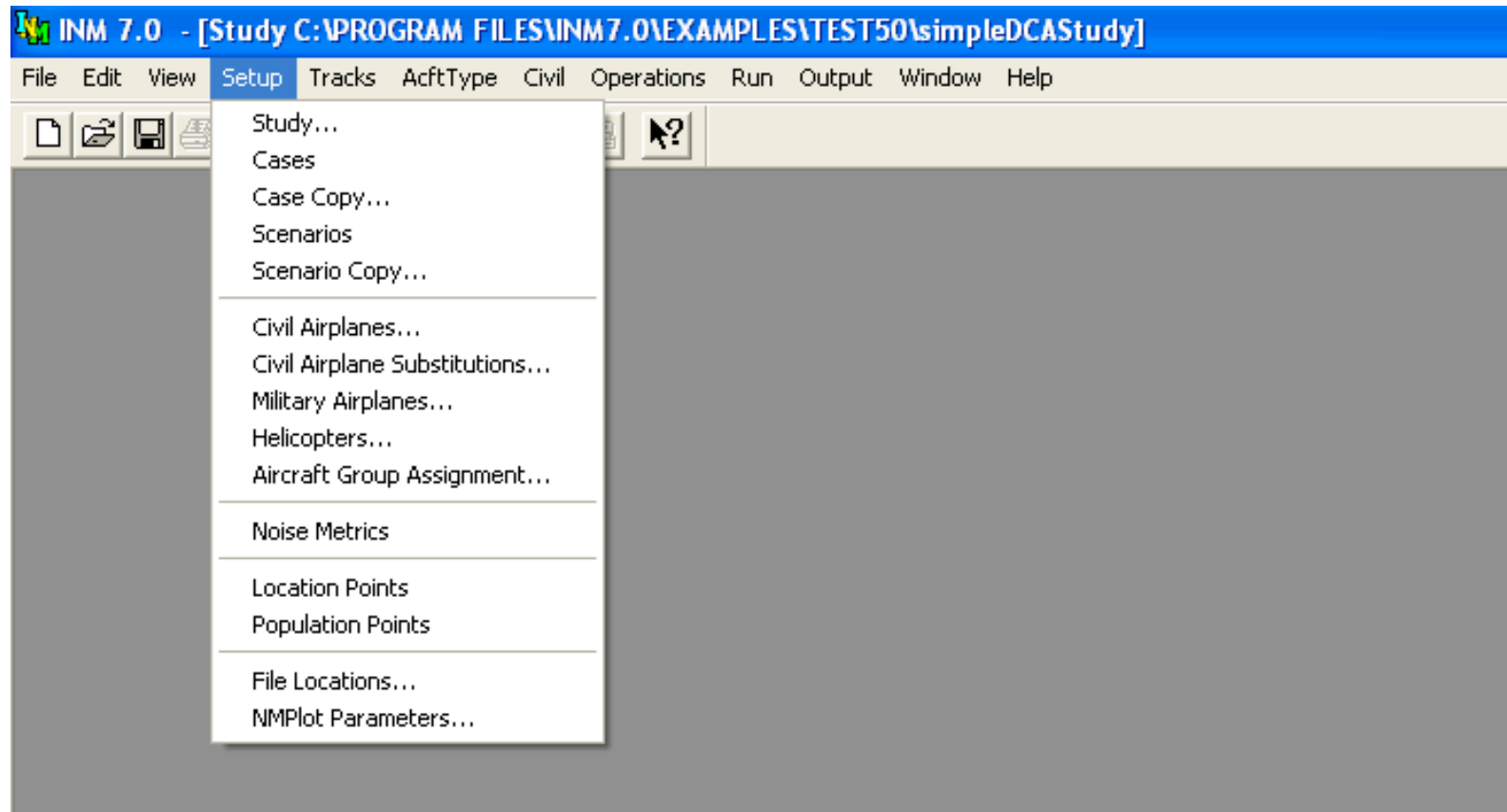
- Add a scenario to your analysis





Adding Aircraft to the Case Study

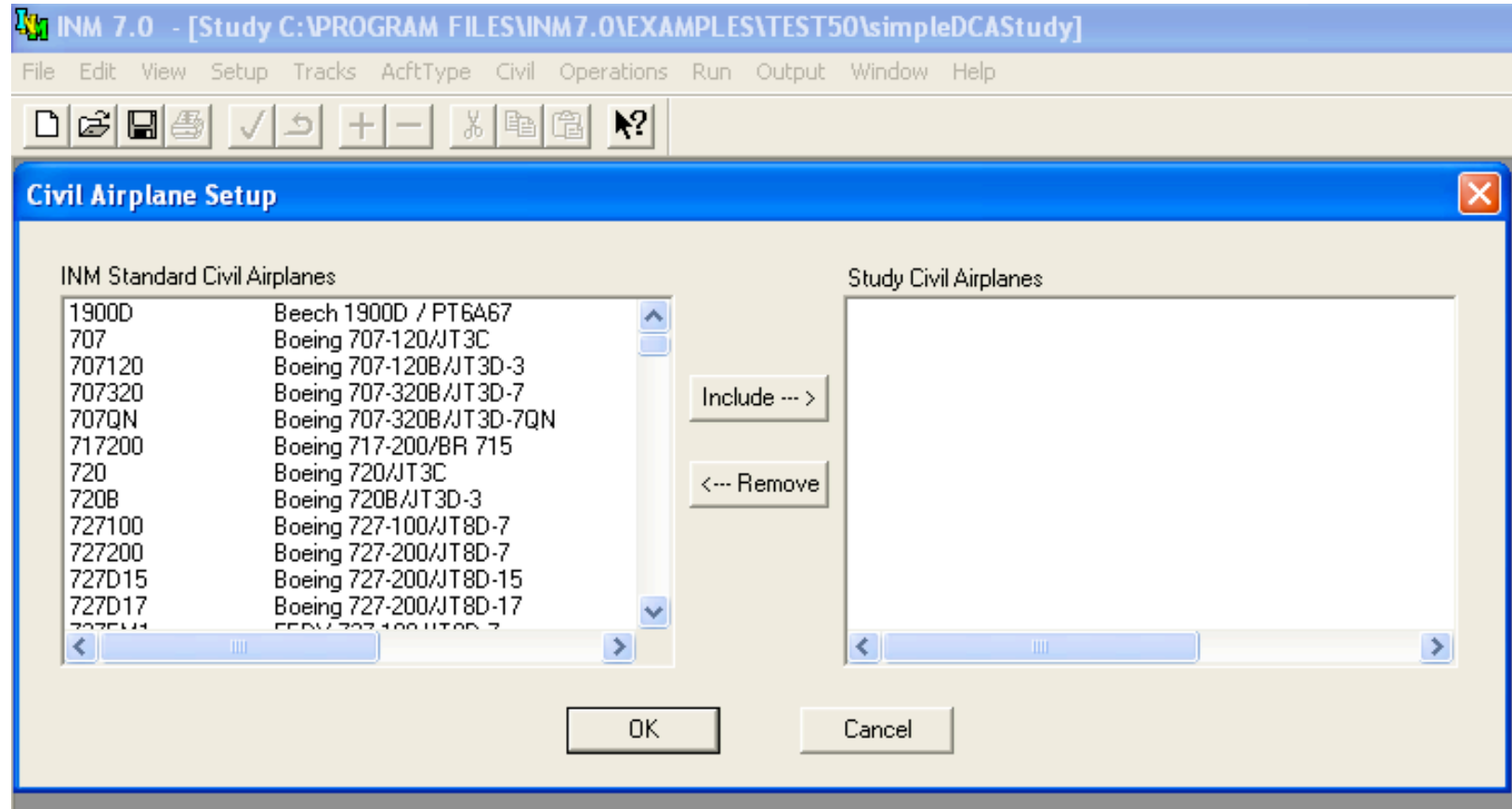
- INM has civilian and military aircraft





List of Civilian Aircraft

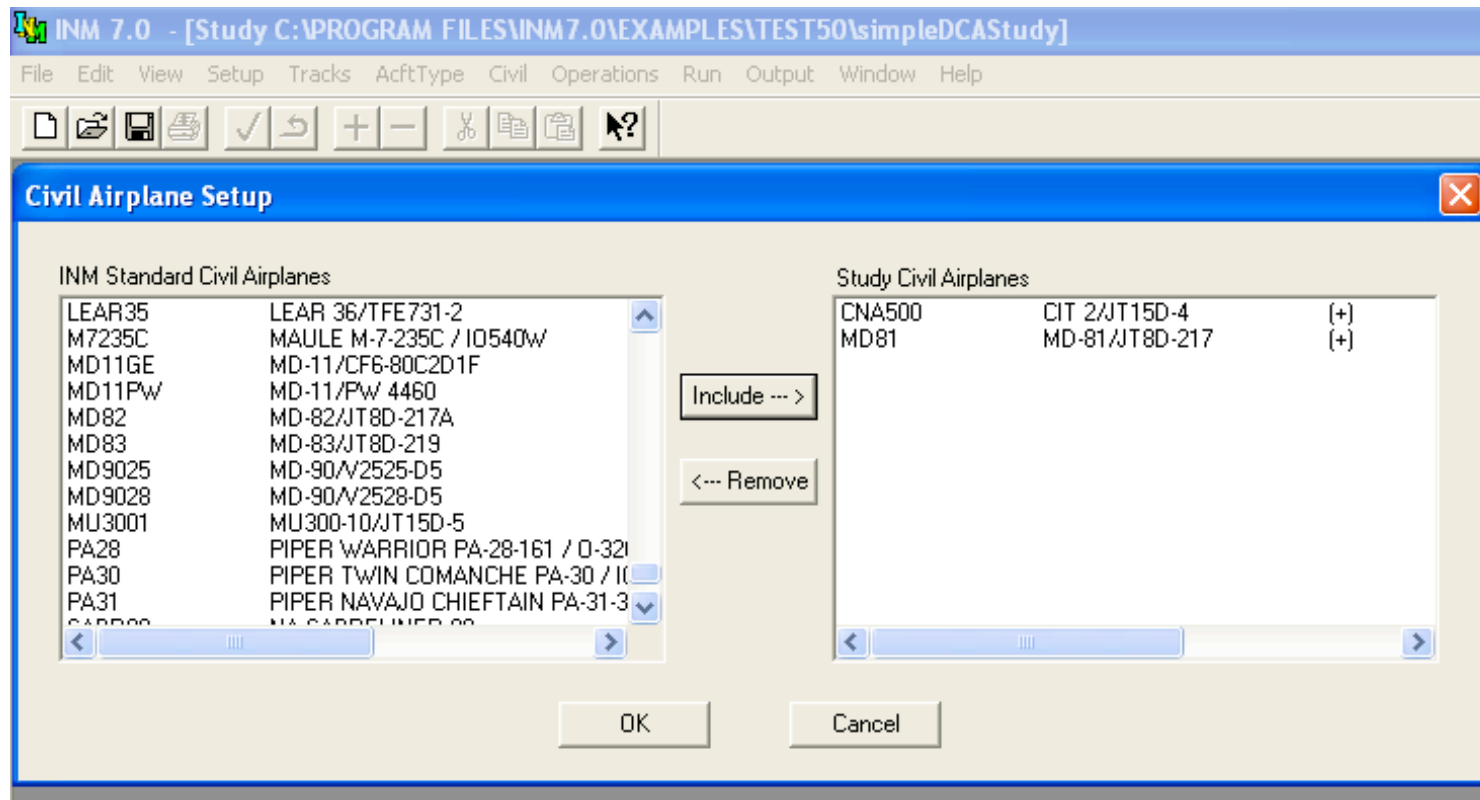
- Civilian aircraft list





Adding Two Aircraft to the Case Study

- Added Cessna 500 and Boeing MD-81 aircraft





Verifying Aircraft Data

- **S**WINM 7.0 - [Study C:\PROGRAM FILES\INM7.0\EXAMPLES\TEST50\simpleDCAS.tudy]

File Edit View Setup Tracks AcftType Civil Operations Run Output Window Help

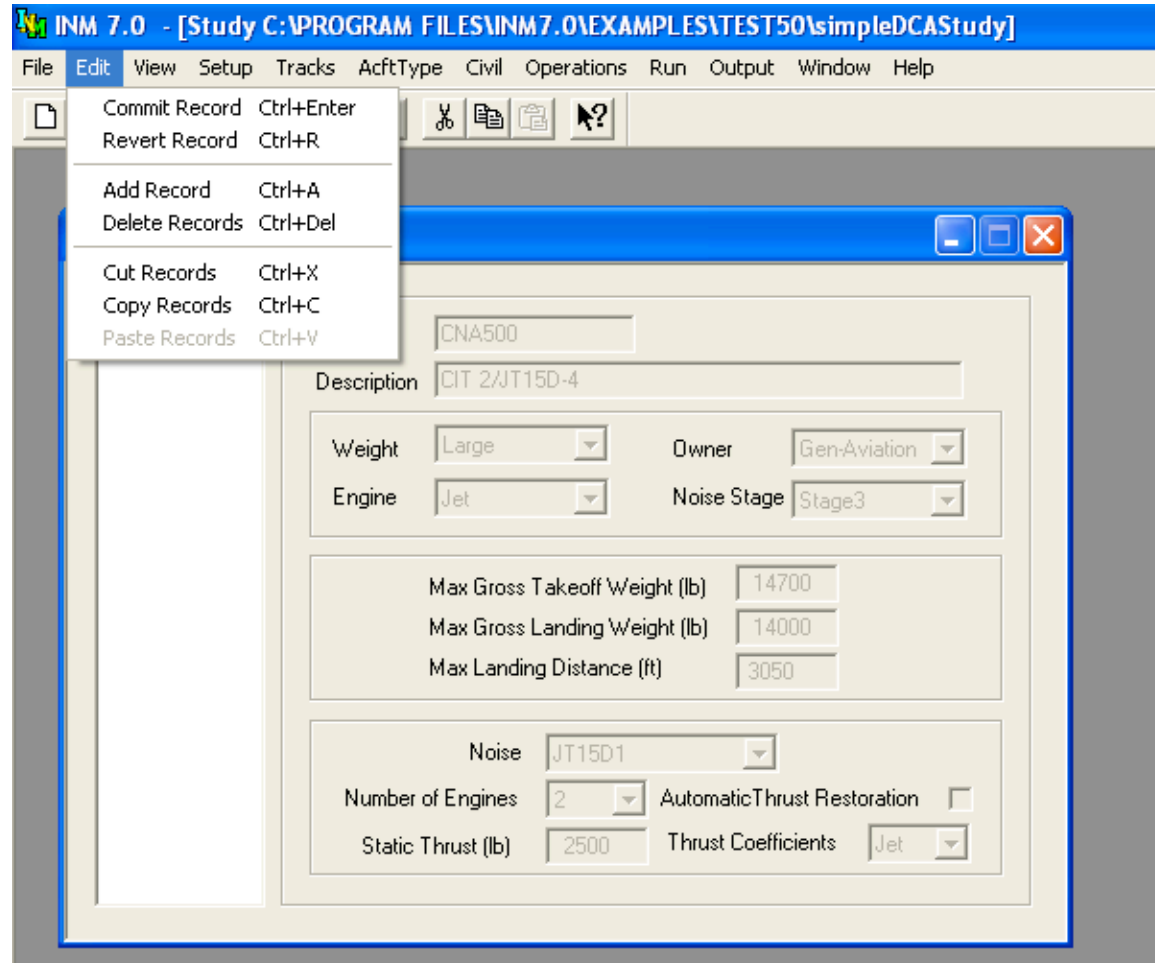
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Civil Airplane Data

CNA500	Aircraft	CNA500
MD81	Description	CIT 2JT15D-4
	Weight	Large
	Owner	Gen-Aviation
	Engine	Jet
	Noise Stage	Stage3
	Max Gross Takeoff Weight (lb)	14700
	Max Gross Landing Weight (lb)	14000
	Max Landing Distance (ft)	3050
	Noise	JT15D1
	Number of Engines	2
	Automatic Thrust Restoration	<input type="checkbox"/>
	Static Thrust (lb)	2500
	Thrust Coefficients	Jet



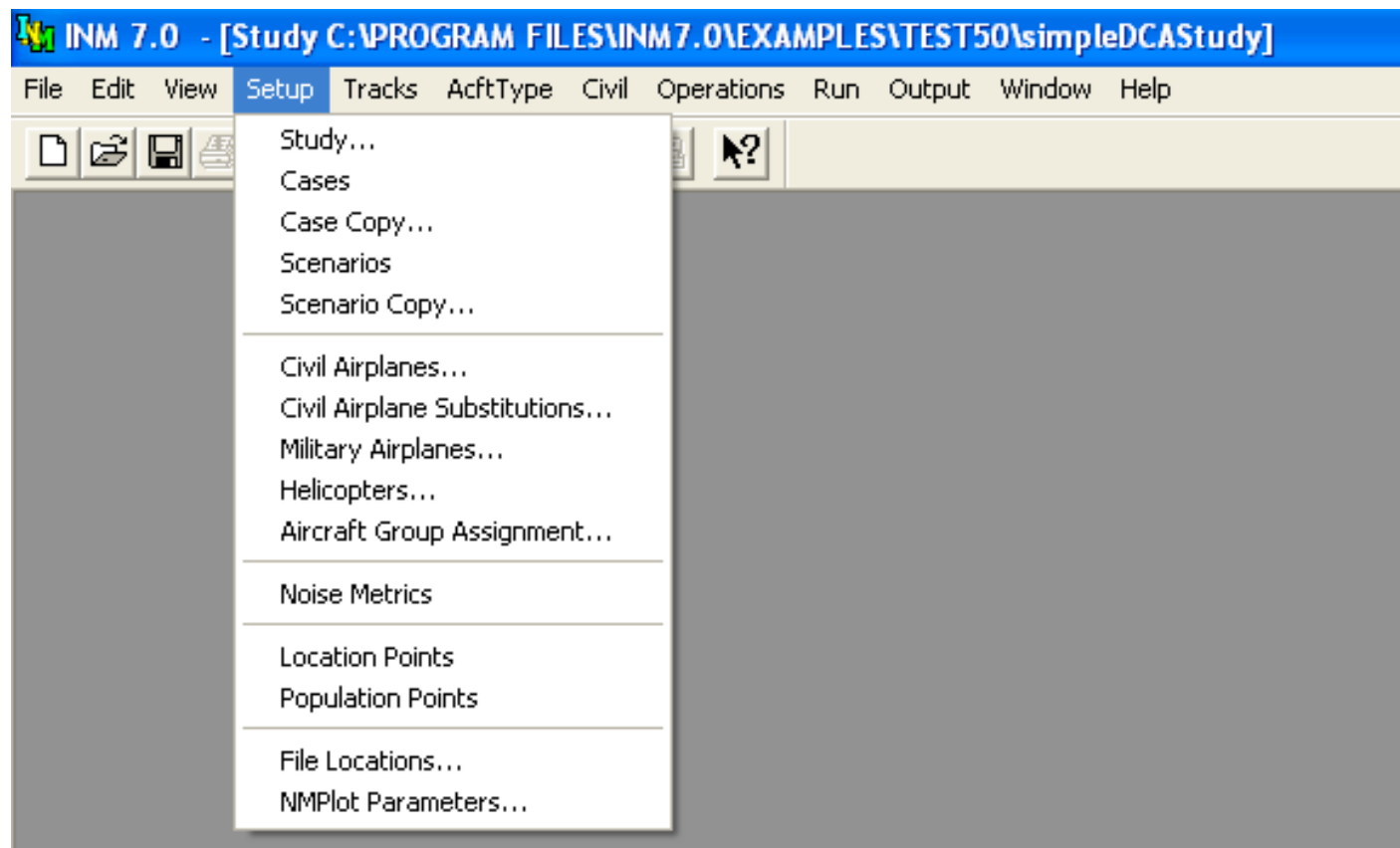
Commit the Records Added





Defining the Noise Metric of the Case Study

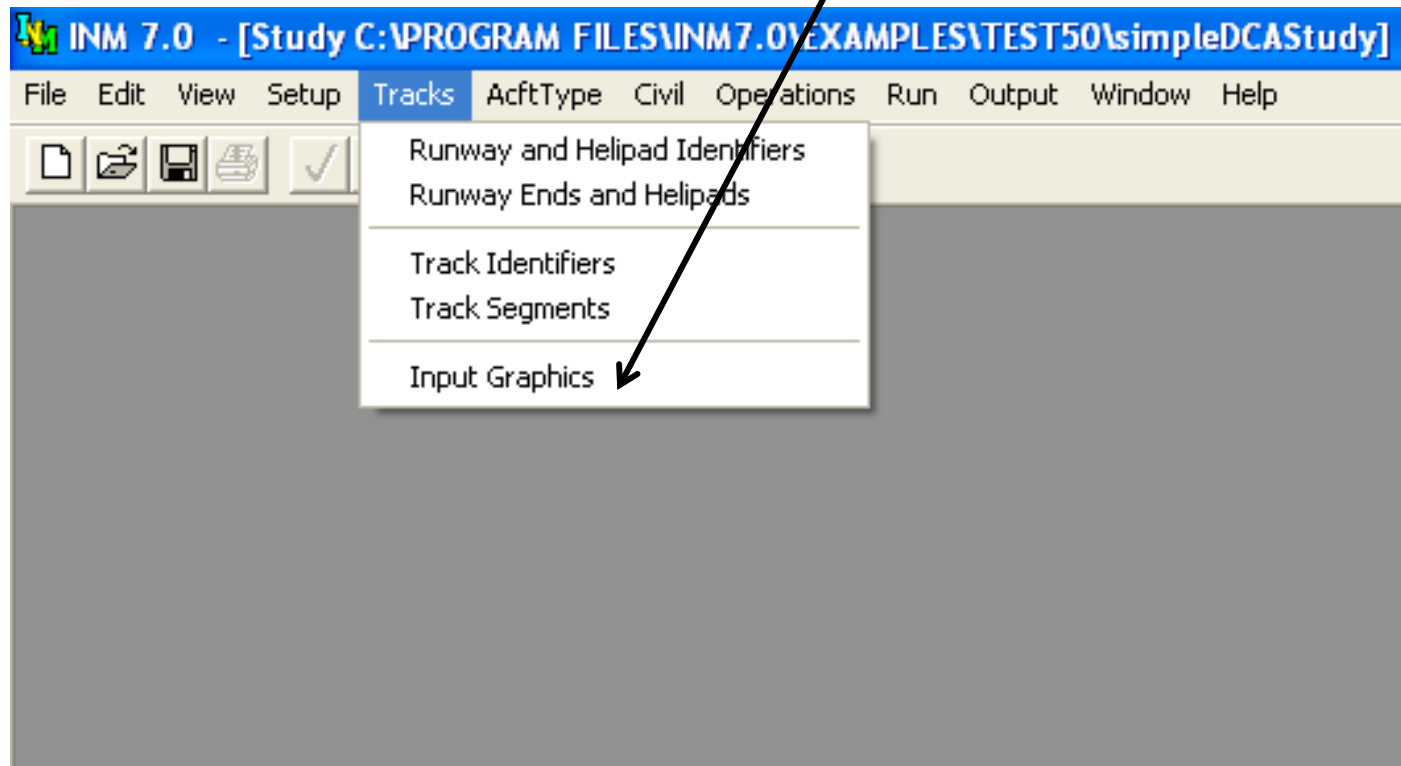
- Any INM study requires at least one noise metric to be defined. In the U.S. we use DNL

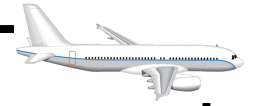




Define the Tracks Around the Airport

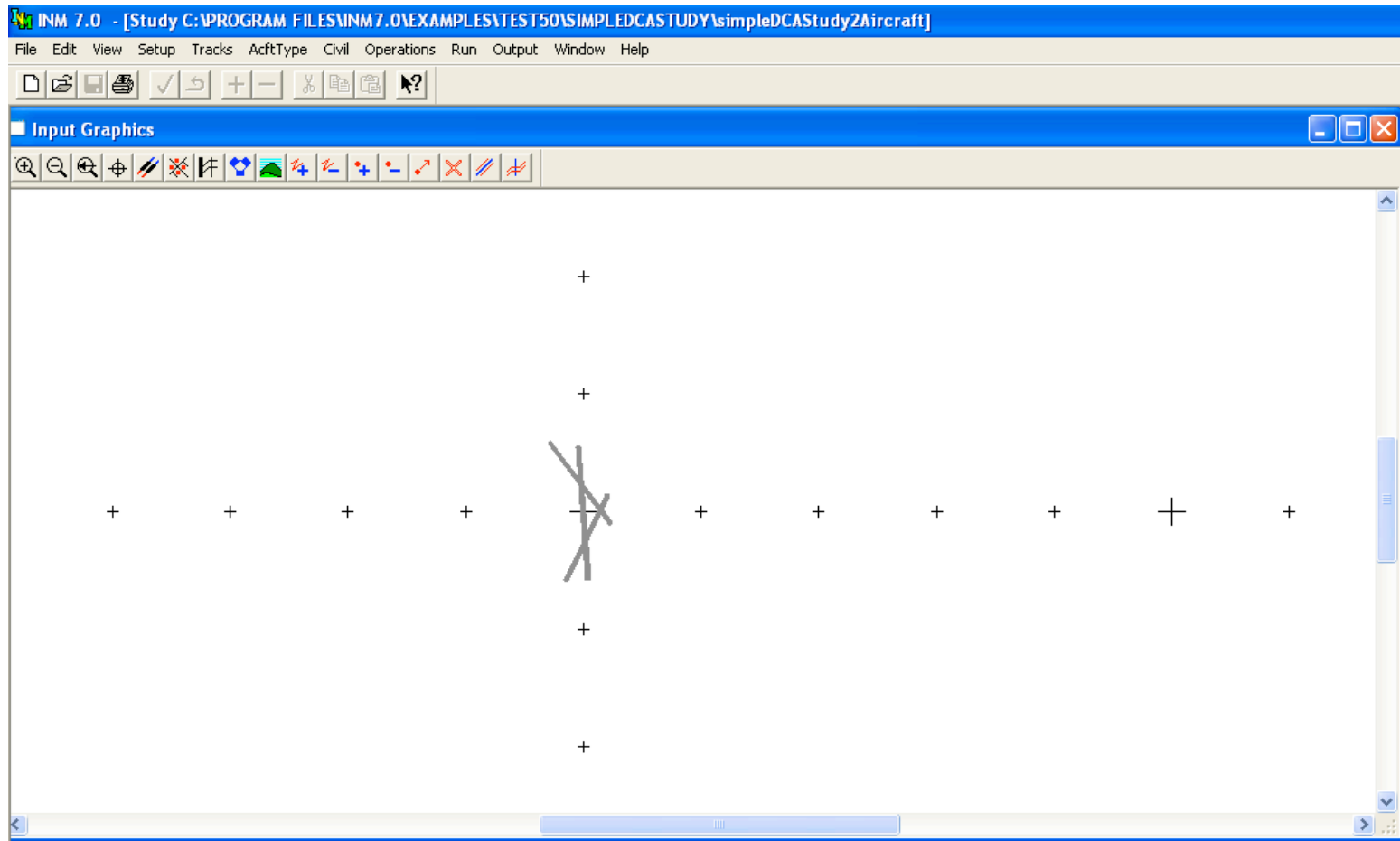
- Select the input graphics from the Tracks pull down menu





Adding Tracks Manually

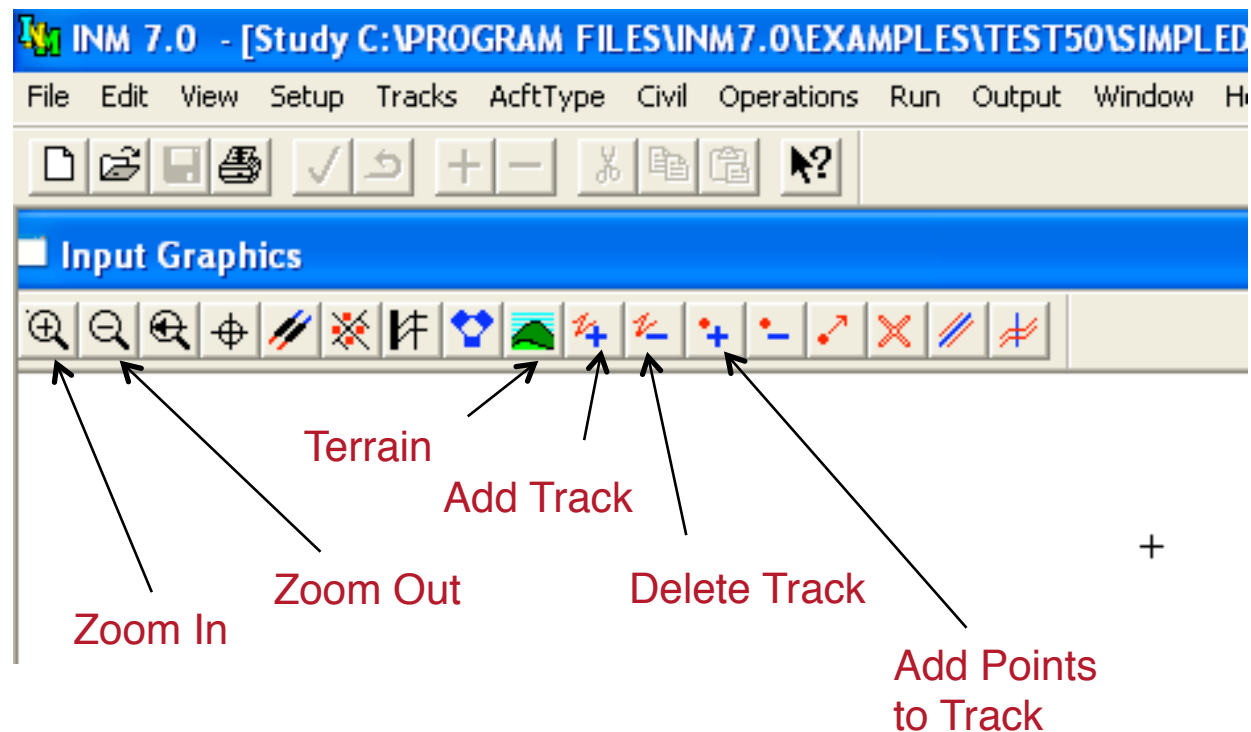
- Note the runways at DCA airport





Input Graphic Options

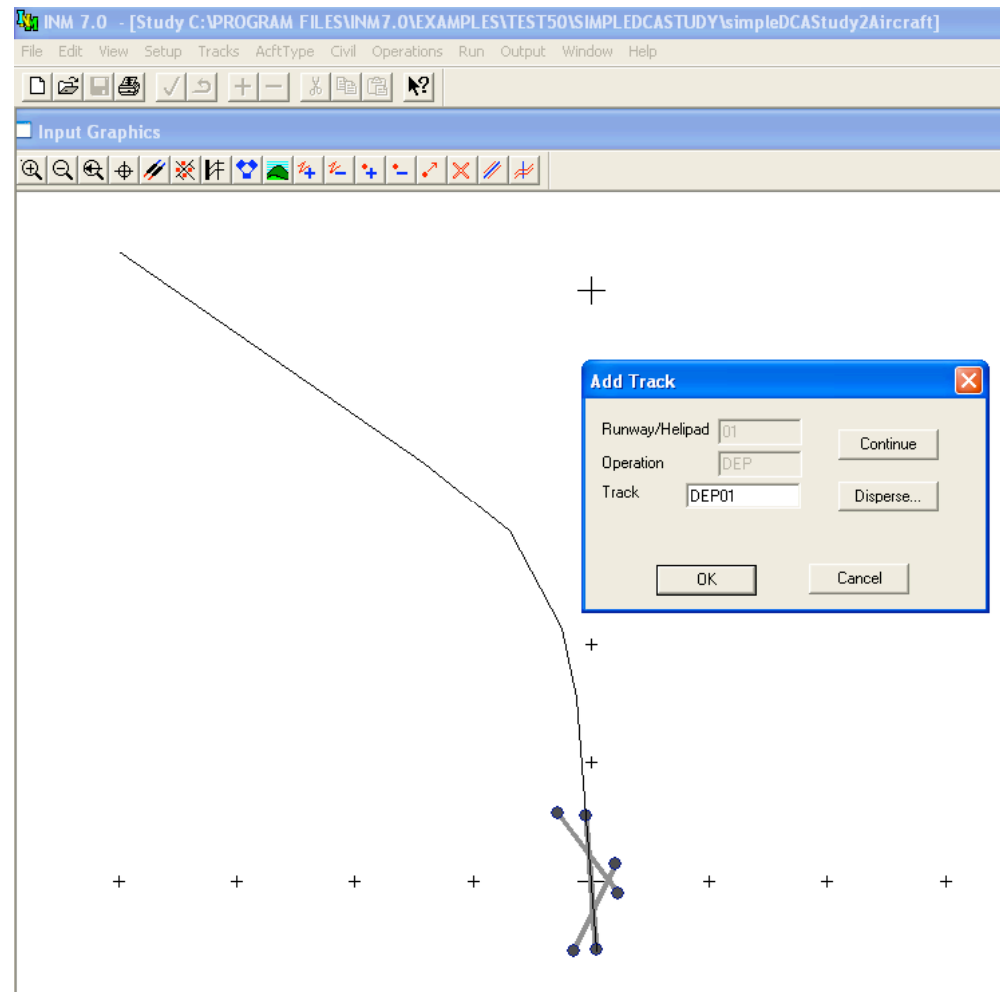
- Zoom in, Zoom out, terrain, adding tracks, deleting tracks are some of the options





Adding a Departure Track (DEP01)

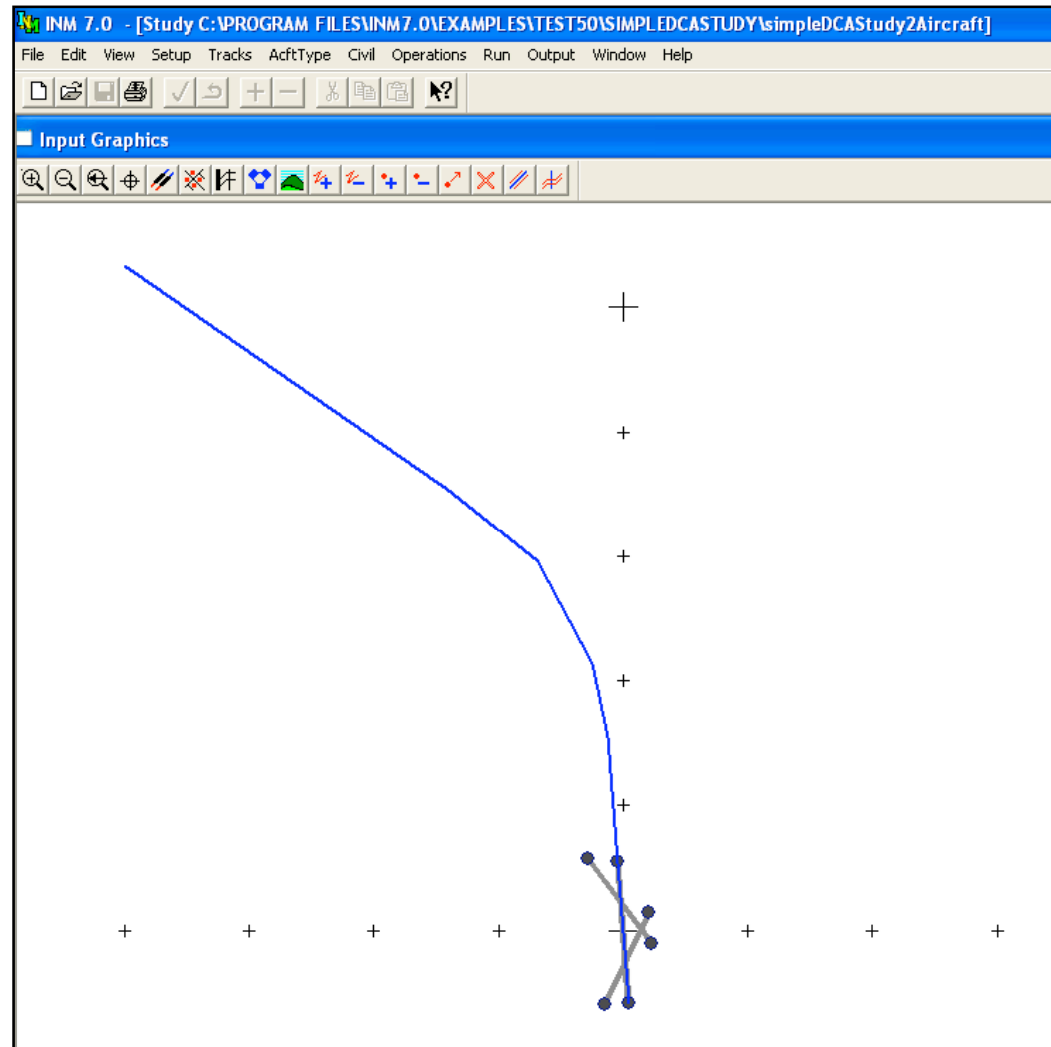
- Start the departure track at the beginning of the runway where the aircraft is supposed to depart
- Arrival tracks start in the airspace into the runway (make sure the arrival ends at the end of the runway – the final segment of the arrival is over the runway)

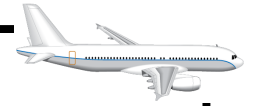




Departure Track Added (Note Color Change to Blue)

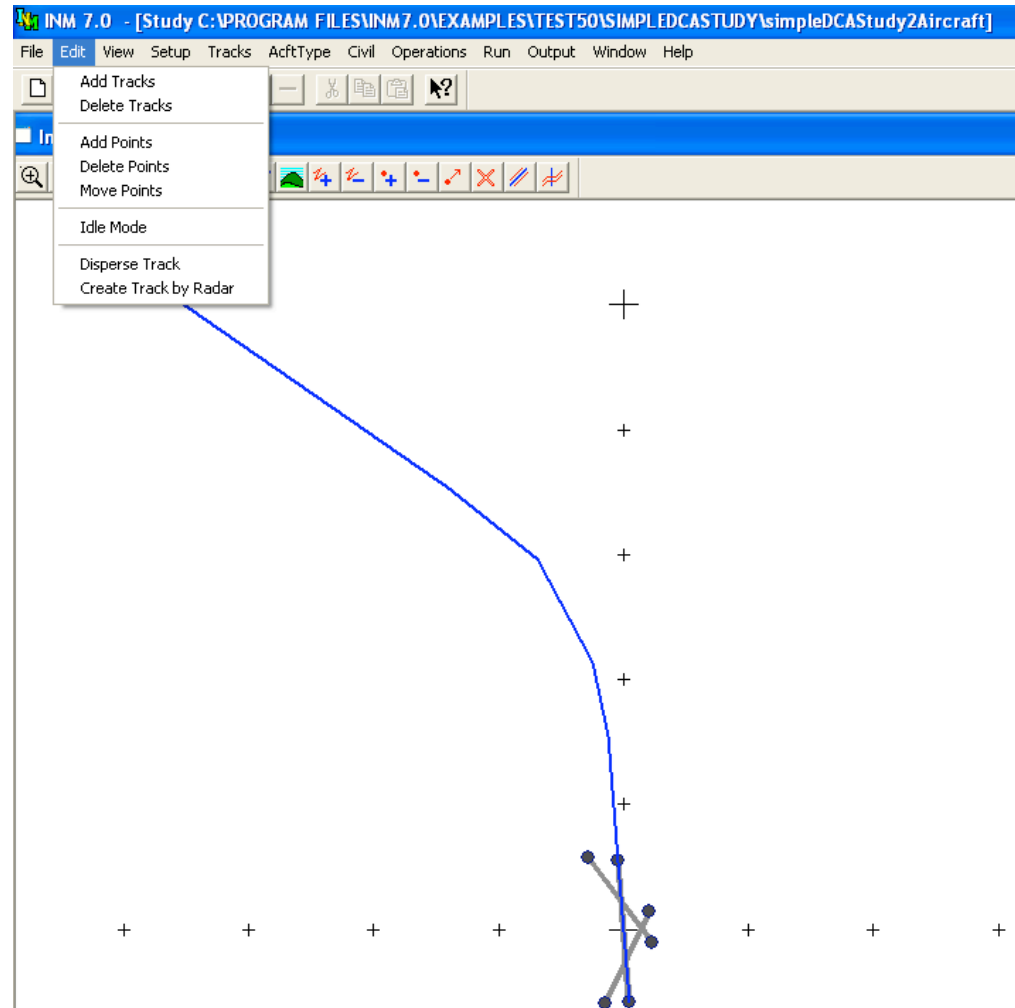
- Departure tracks are blue
- Arrival tracks show in red





Dispersing a Track

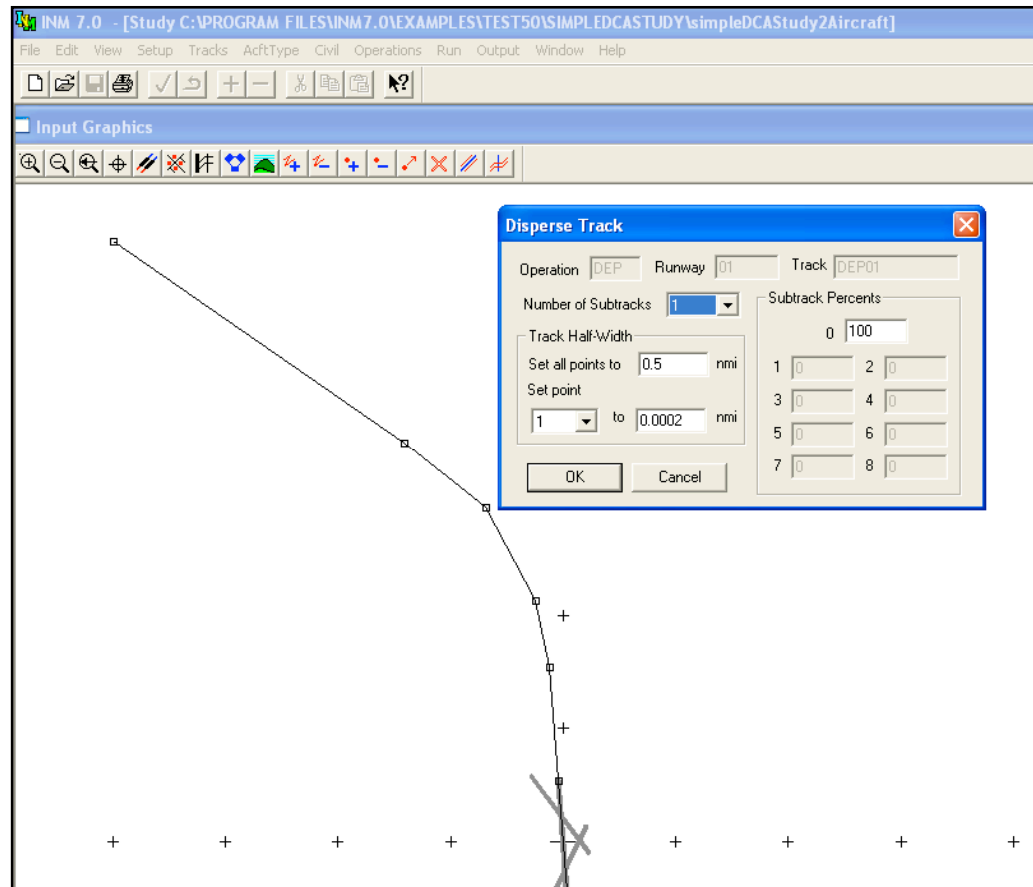
- Dispersion of a track is to realistically simulate stochastic profiles
- Go to Edit pull down menu and “Disperse Track”





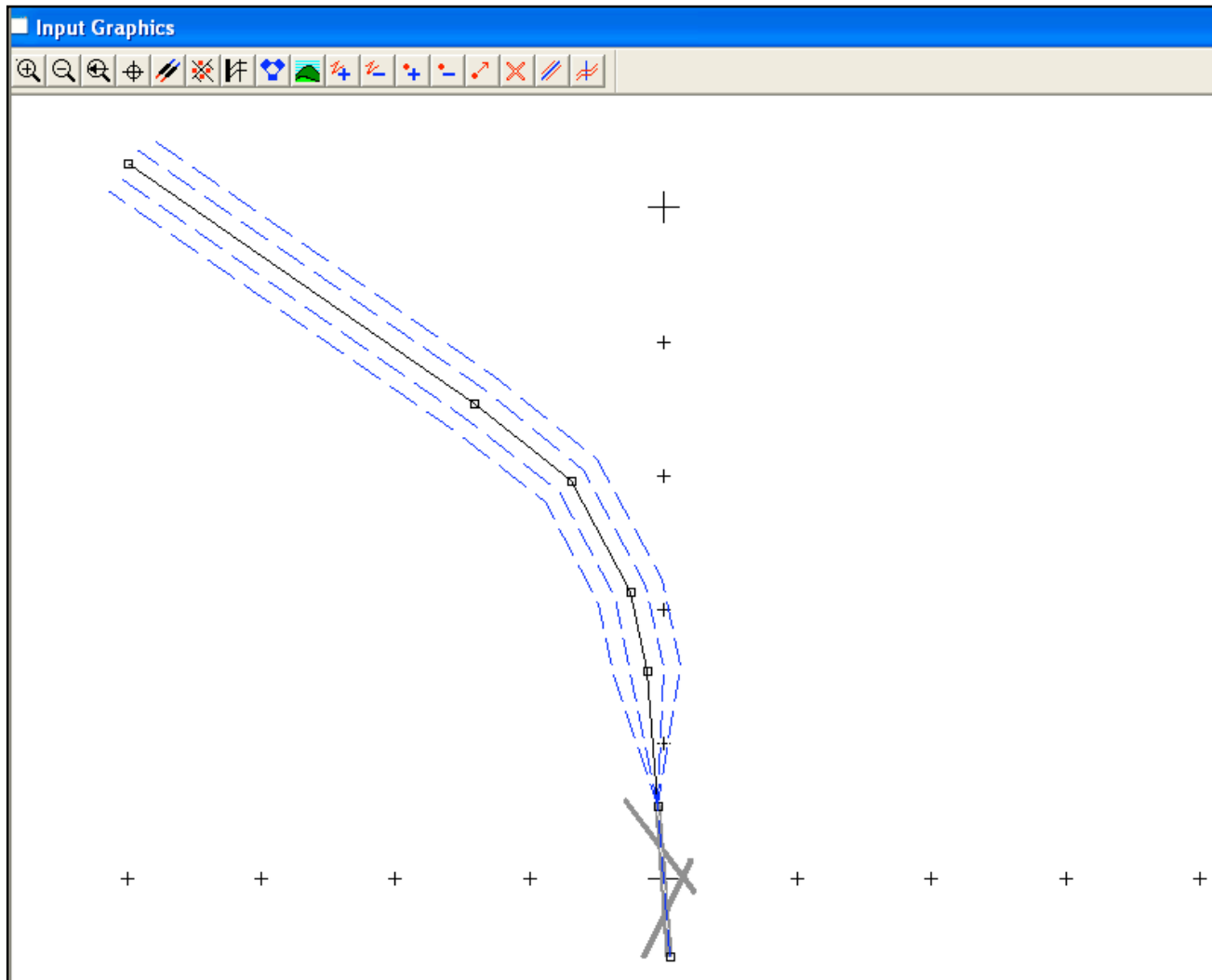
Specify the Dispersion Pattern

- The dispersion is accomplished by specifying the number of subtracks and their position from the original track





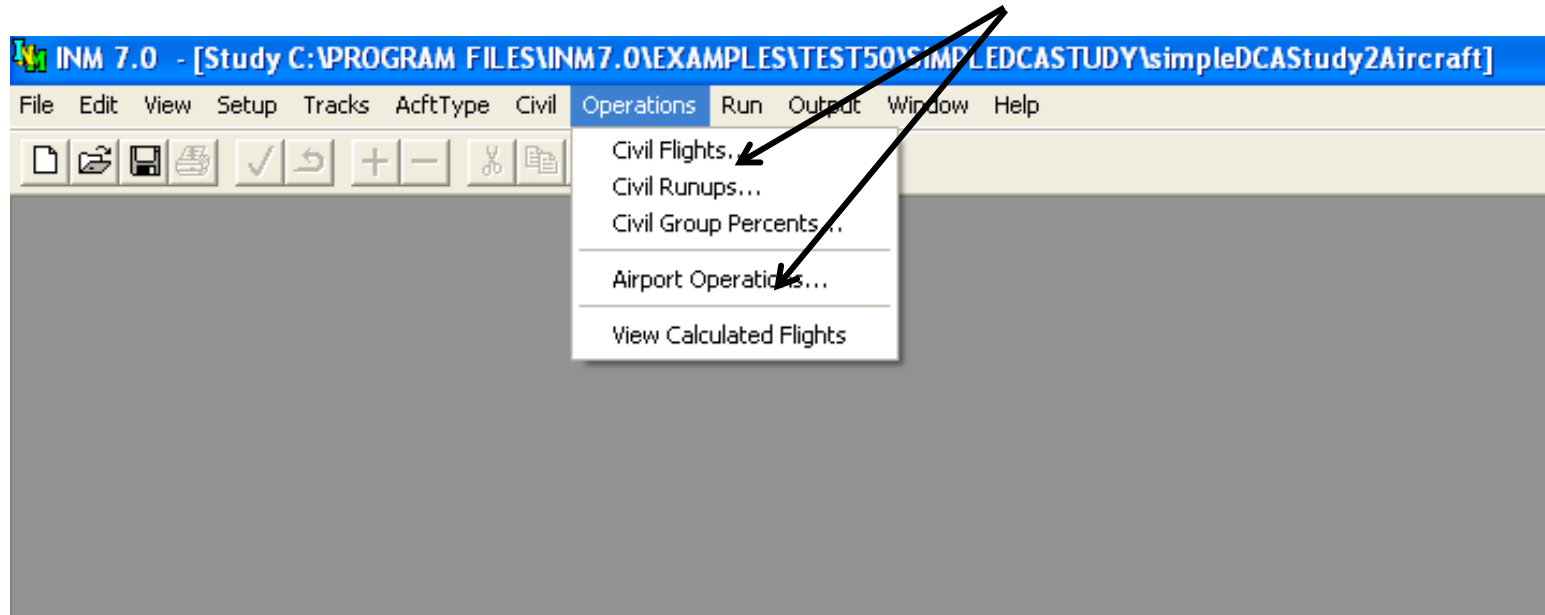
Dispersed Track (5 subtracks)

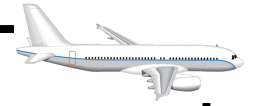




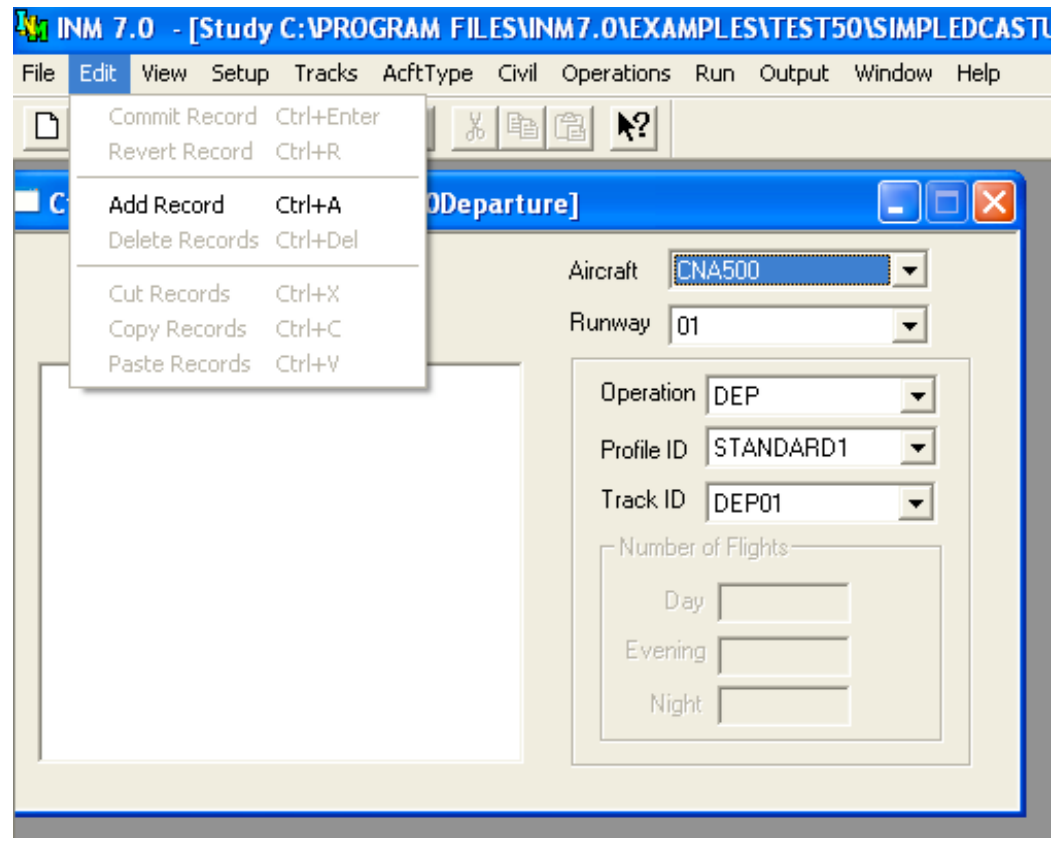
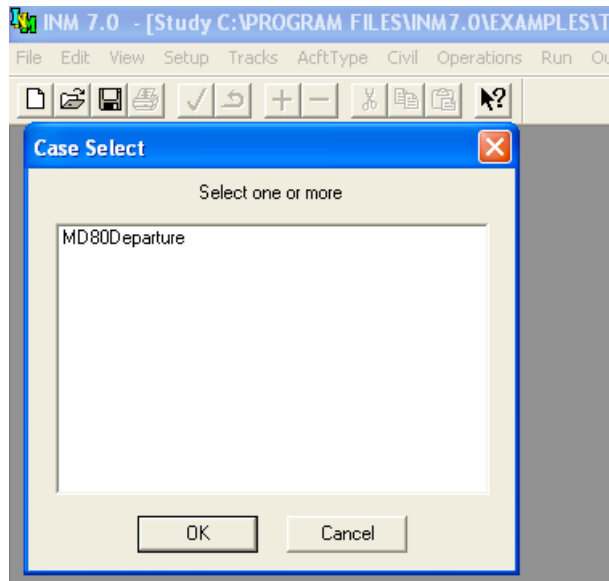
Adding Operations to the Case Study

- Use the Operations pull-down menu





Adding a Record for Aircraft Operations





Adding Number of Operations

- Add daily, evening and night operations for every aircraft and every track

INM 7.0 - [Study C:\PROGRAM FILES\INM7.0\EXAMPLES\TEST50\SIMPLECASTU

File Edit View Setup Tracks AcftType Civil Operations Run Output Window Help

Civil Flight Operations - [MD80Departure]

Aircraft: CNA500

Runway: 01

Operation: DEP

Profile ID: STANDARD1

Track ID: DEP01

Number of Flights:

Day: 10

Evening: 0

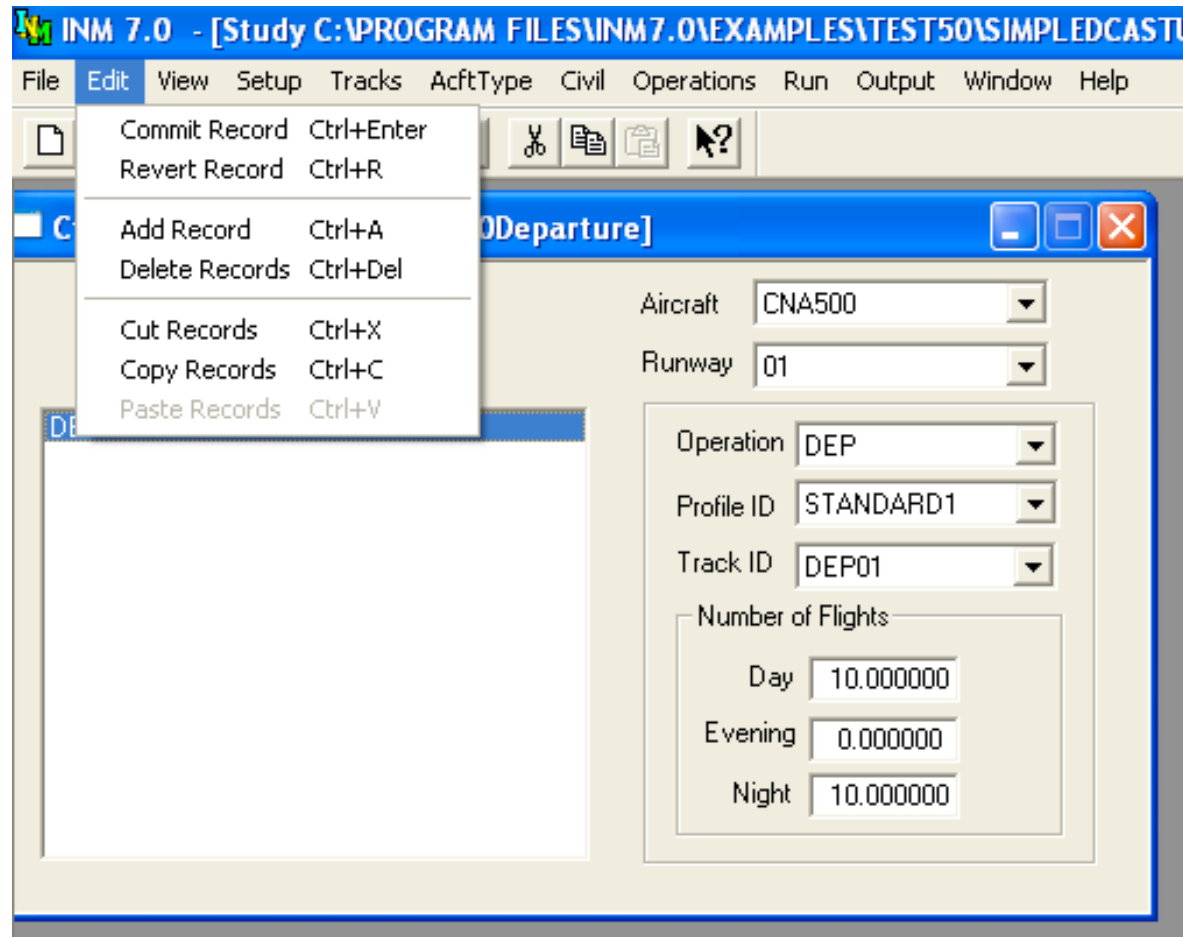
Night: 10

DEP-STANDARD1



Commit the Records Added

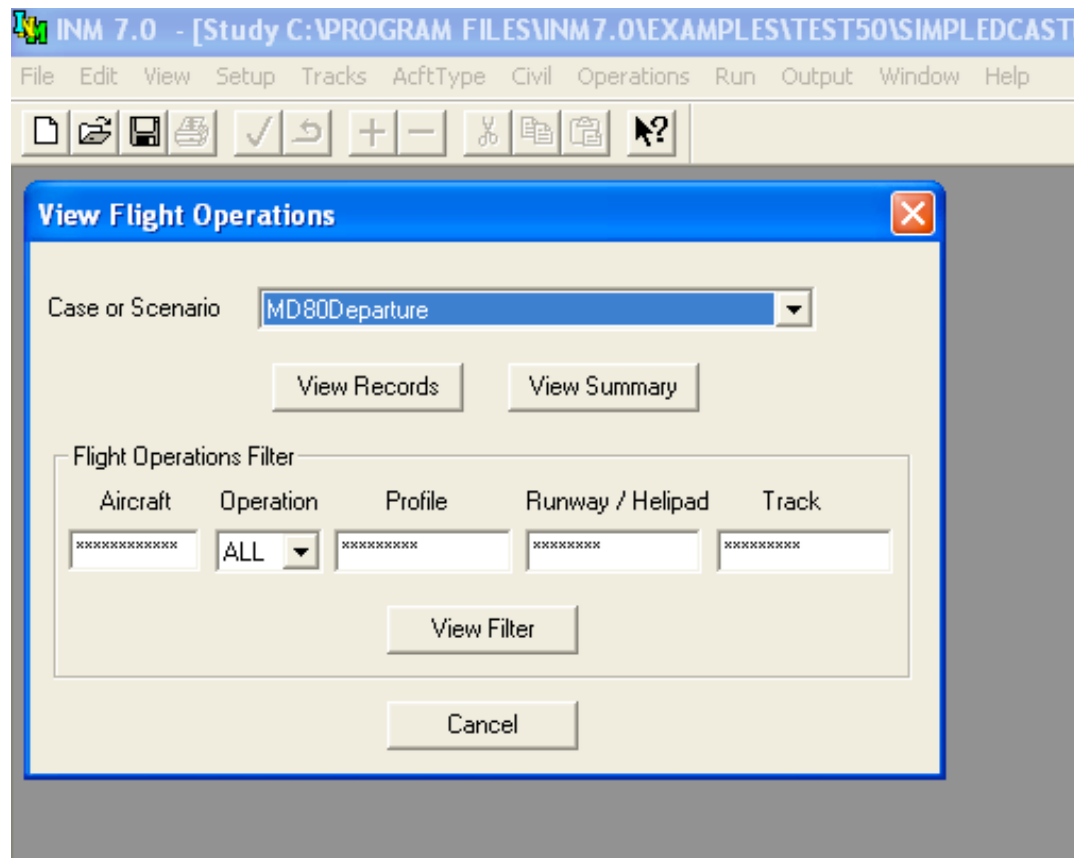
- Do not forget to commit the records added





View Flight Operations

- You should always view the flight operations before running a case study





Summary of Flight Operations

- This window shows the summary of the flights added to the case study

INM 7.0 - [Study C:\PROGRAM FILES\INM7.0\EXAMPLES\TEST50\SIMPLEDCASTUDY\simpleDCASudy2Aircraft]

File Edit View Setup Tracks AcftType Civil Operations Run Output Window Help

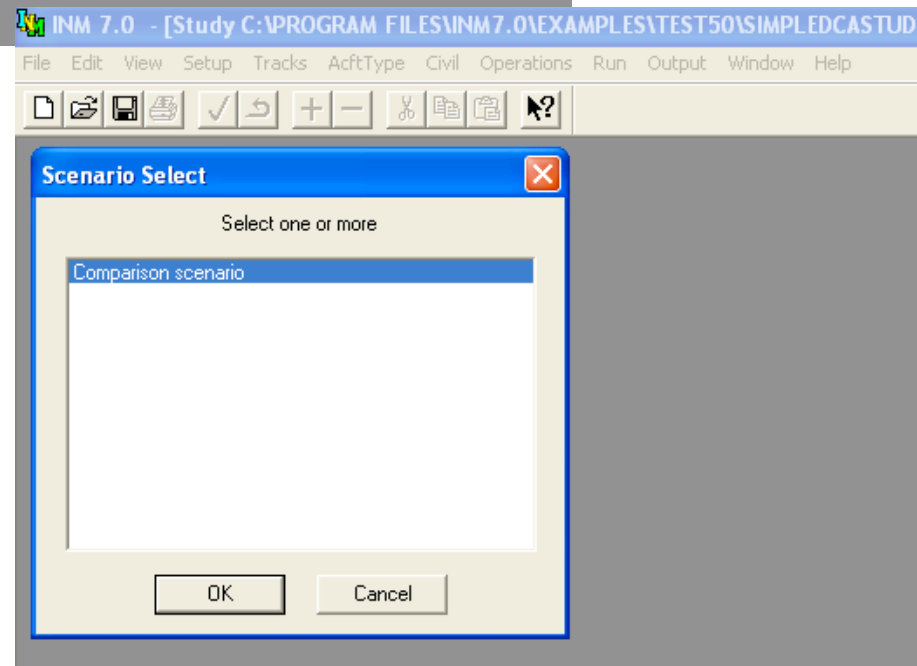
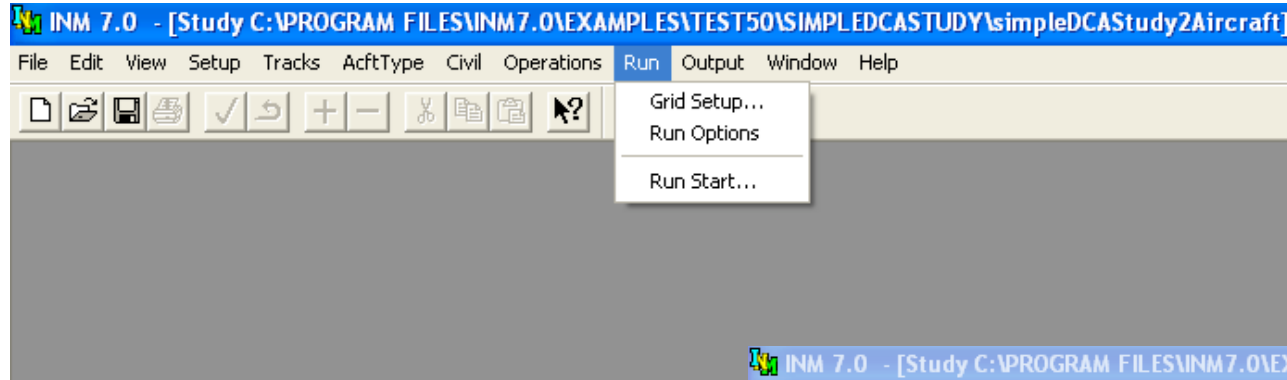
Filtered Flight Operations - [MD80Departure] "*****_*_*****_*****_*****"

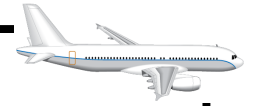
ACFT	OP	PROFILE	S	RWY	TRACK	S	GRP	DAY	EVENING	NIGHT
CNA500	D	STANDARD	1	01	DEP01	0	—	3.860000	0.000000	3.860000
CNA500	D	STANDARD	1	01	DEP01	1	—	2.440000	0.000000	2.440000
CNA500	D	STANDARD	1	01	DEP01	2	—	2.440000	0.000000	2.440000
CNA500	D	STANDARD	1	01	DEP01	3	—	0.630000	0.000000	0.630000
CNA500	D	STANDARD	1	01	DEP01	4	—	0.630000	0.000000	0.630000



Setup the Airport Grid for Noise Calculations

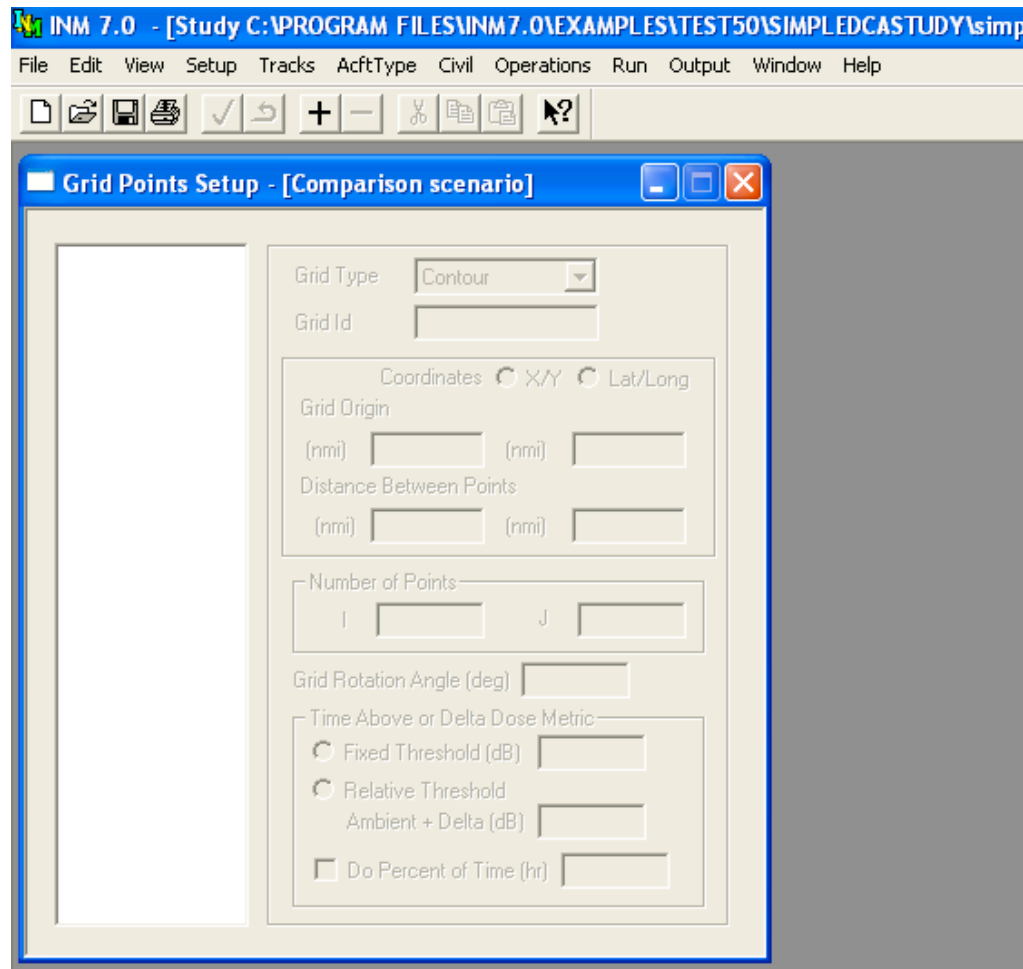
- Here we tell INM about the specific grid to calculate noise





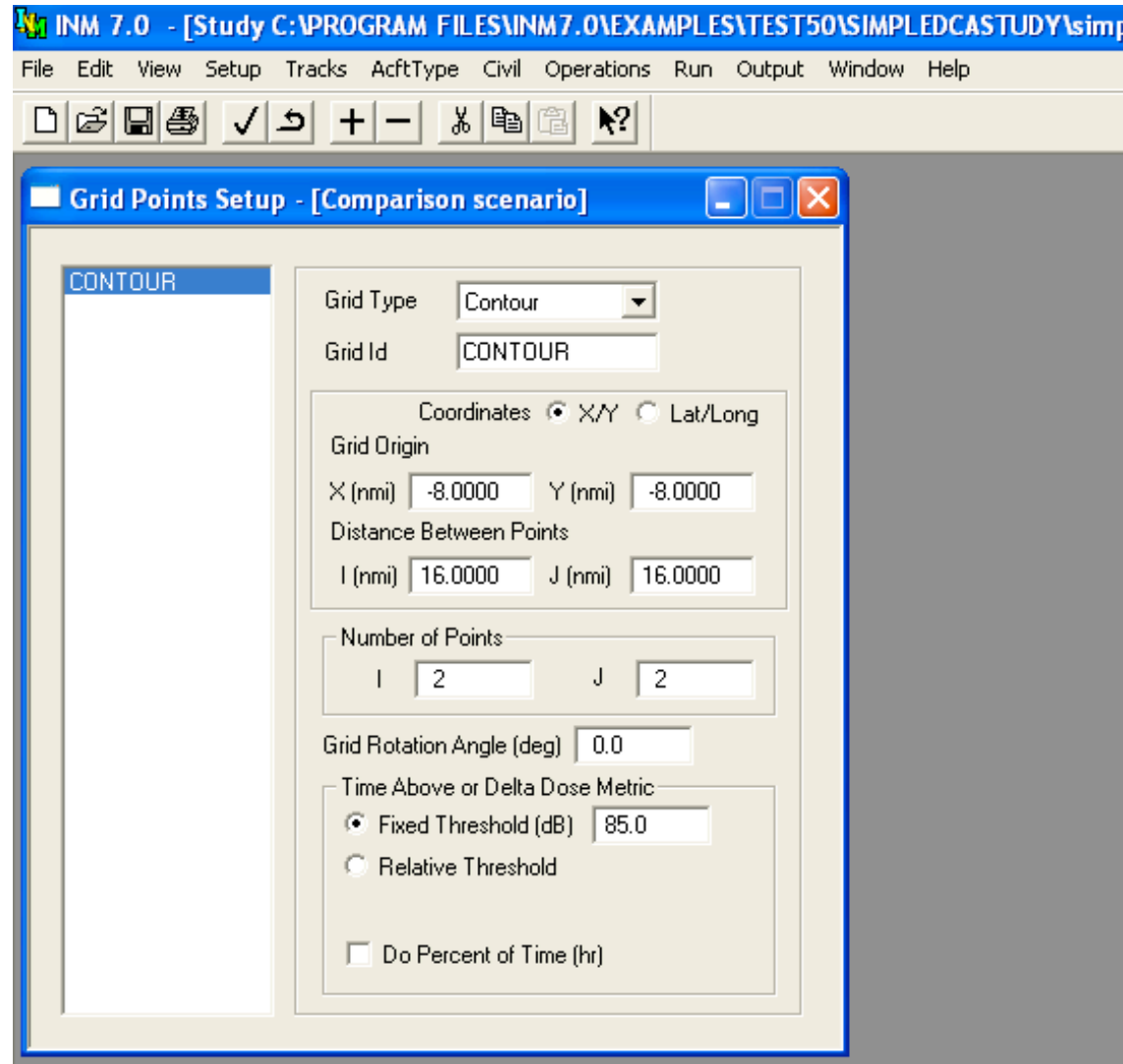
Grid Setup

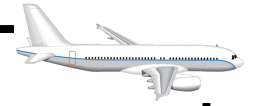
- You need to add a grid point setup
- Usually, defaults work well
- Sometimes if the noise contours go outside of the default grid, increase the grid size changing the distance between points





Adding a Grid Setup





Run Options

- Here we specify the metric to use and the noise calculation run parameters (contour, points)

INM 7.0 - [Study C:\PROGRAM FILES\INM7.0\EXAMPLES\TEST50\SIMPLEDCASTUDY\simpleDCASTudy2Aircraft]

File Edit View Setup Tracks AcftType Civil Operations Run Output Window Help

Run Options

Comparison scenario

Scenario: Comparison scenario

Run Type: Single-Metric

Noise Metric: DNL

Do Terrain

Do Population Points

Do Location Points

Lateral Attenuation: All-Soft-Ground

Use Bank Angle

Do Contours

Contour:

Use Boundary File

Recursive Grid Fixed Grid

Refinement Fixed Spacing

Spacing: 1000.0 (ft)

Number of Grid Points: 9604

Do Standard Grids

Do Detailed Grids

Save 100% Flights

Calculate Metrics:

DNL NEF

CNEL WECPNL

LAEQ EPNL

LAEQD PNLTM

LAEQN TAPNL

SEL CEXP

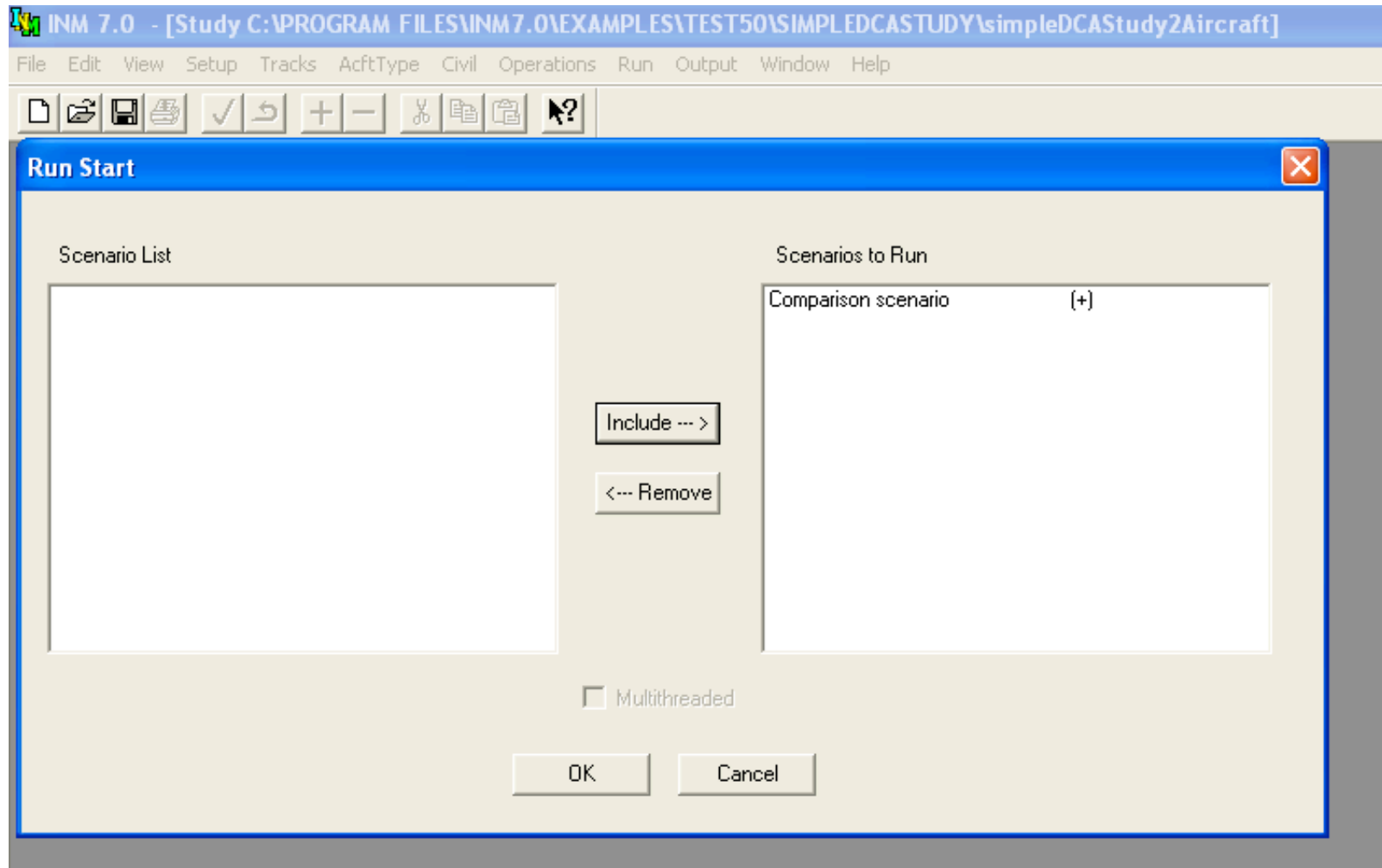
LAMAX LCMAX

TALA TALC

Last Run: _____ Duration: _____



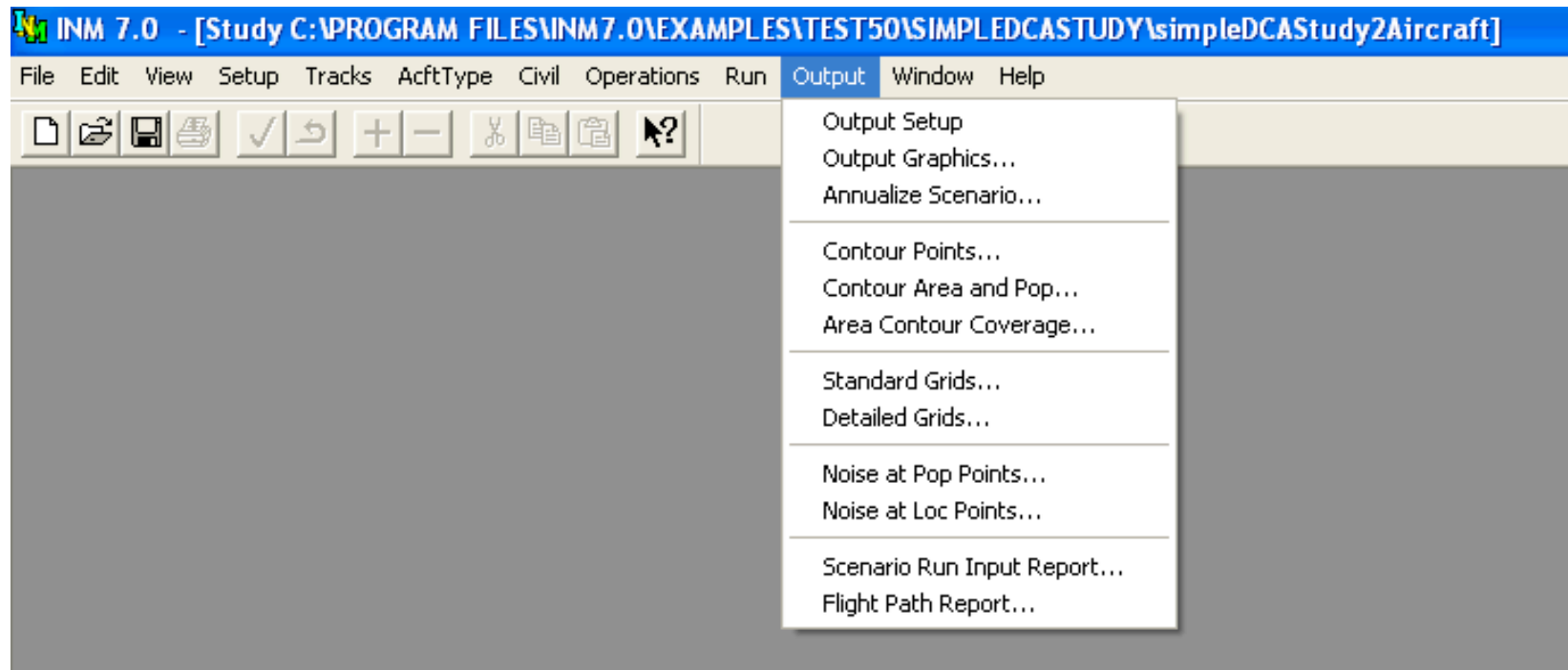
Specify What Scenario to Run





Specify the Output

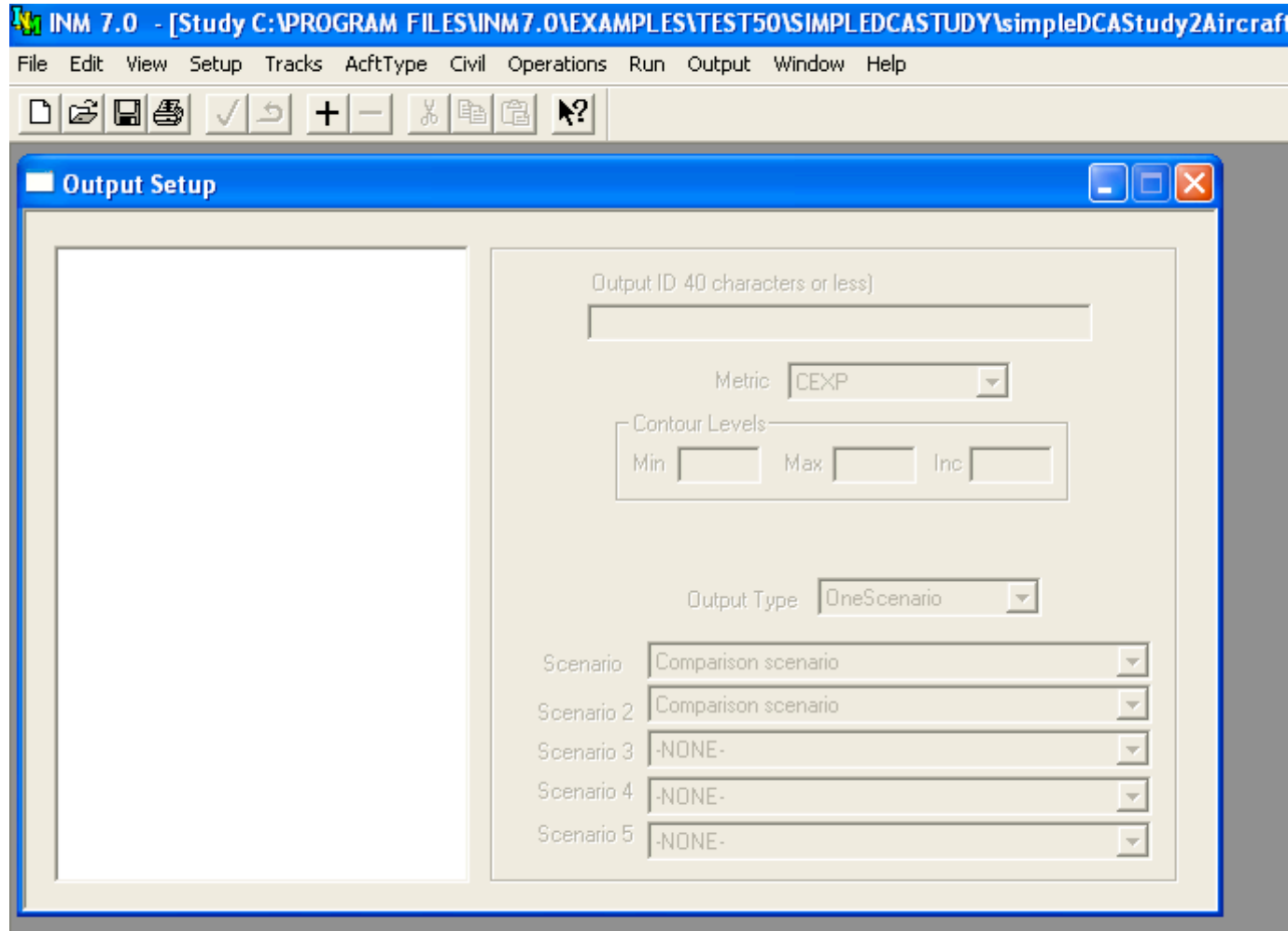
- Go to Output Setup to create a new output scenario for INM to save your results





Creating a New Output Scenario

- Add a new record to create a new output





Specifying the Output Scenario

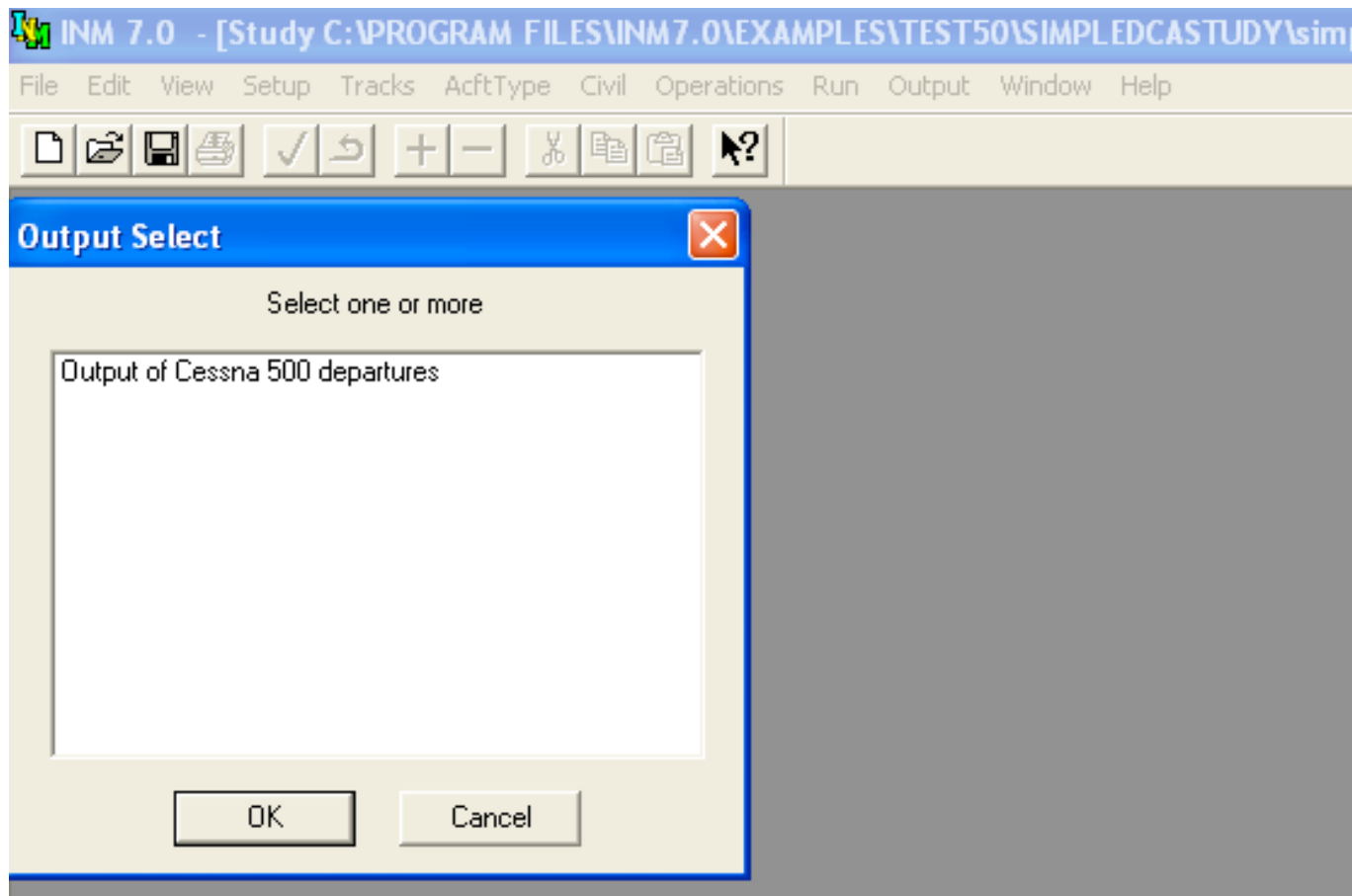
The screenshot shows the INM 7.0 software interface. The main window title is "INM 7.0 - [Study C:\PROGRAM FILES\INM7.0\EXAMPLES\TEST50\SIMPLEDCASTUDY\simpleDCASTudy2Aircraft]". The menu bar includes File, Edit, View, Setup, Tracks, AcftType, Civil, Operations, Run, Output, Window, and Help. The toolbar contains icons for file operations and navigation. The "Output Setup" dialog box is open, showing the following settings:

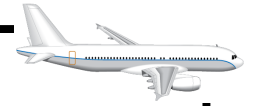
- Output ID 40 characters or less: Output of Cessna 500 departures
- Metric: DNL
- Contour Levels: Min 55.0, Max 85.0, Inc 5.0
- Output Type: OneScenario
- Scenario: Comparison scenario



Viewing the Output of INM

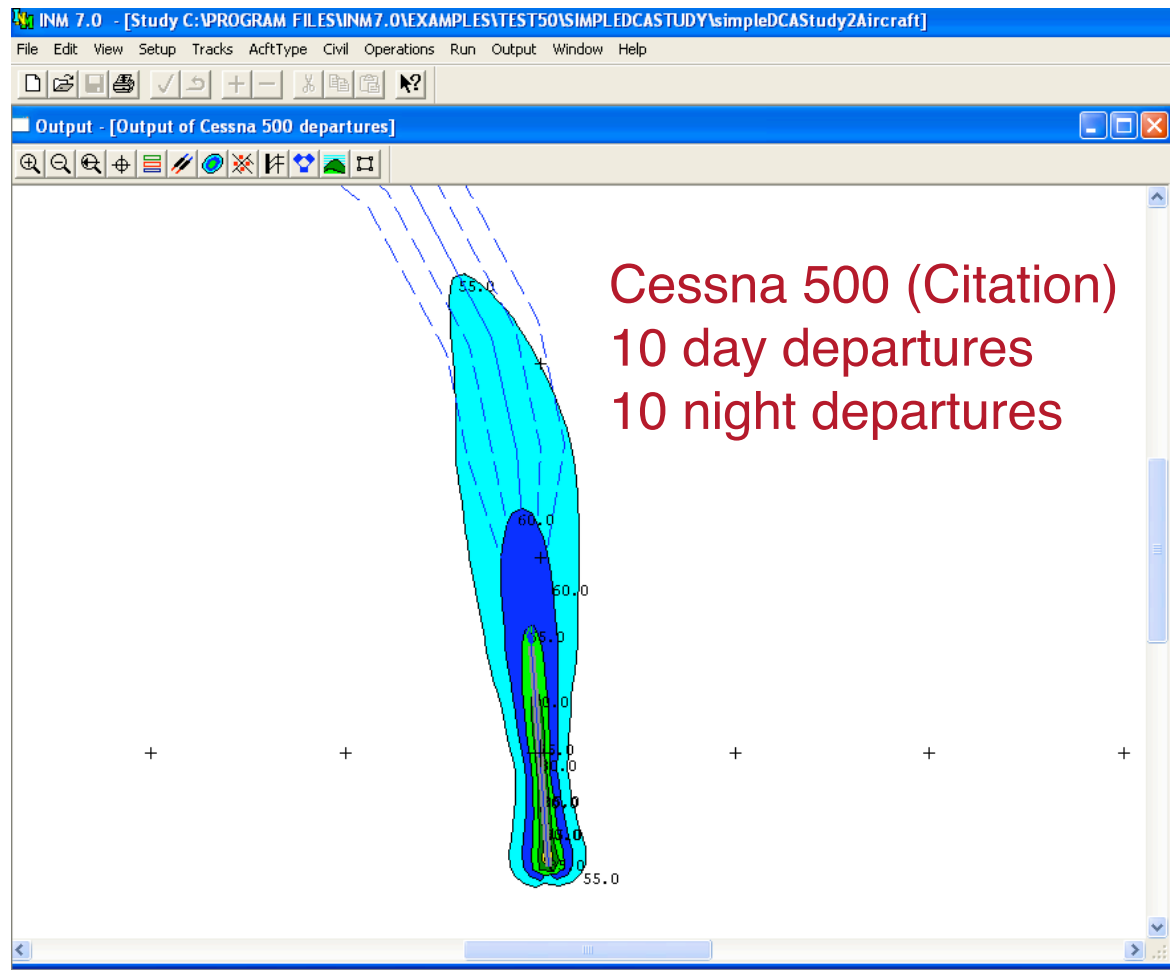
- Every output scenario created will show in the Output window





Output Graphics (Contour)

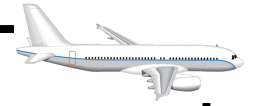
- Once the program runs, the noise contours are generated





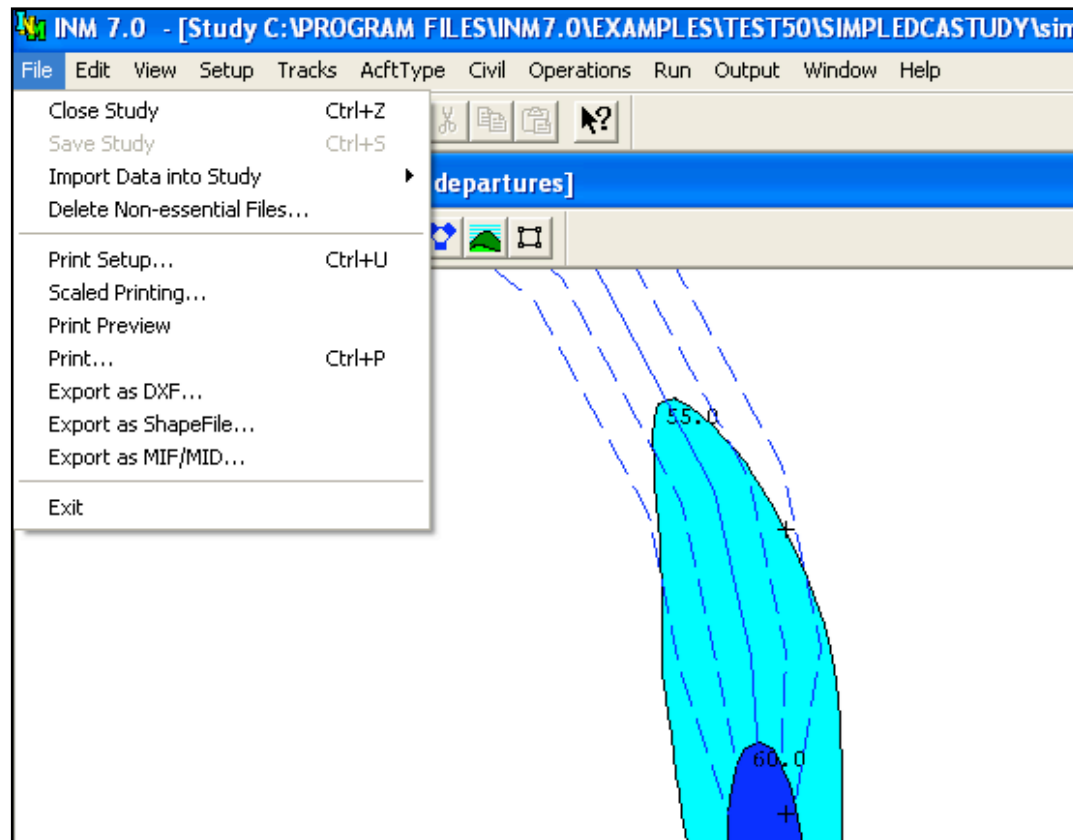
Next Steps

- Add other aircraft and other tracks
- Export to Autocad (DXF file)
- Perform sensitivity analysis (adding more scenarios)



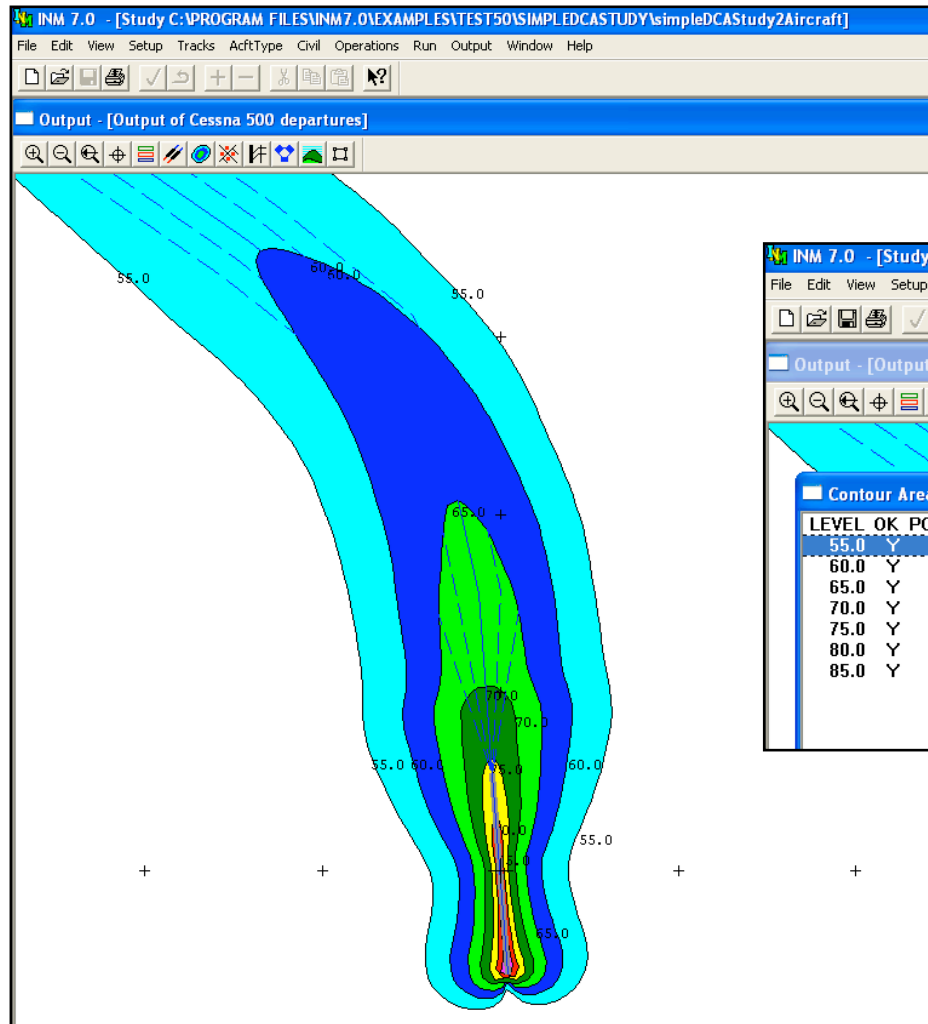
Exporting to Other Programs

- INM can export noise contours in DXF and Shape file formats





Running the MD-80 Contours



LEVEL	OK	POPULATION	SQ.KM	SQ.MI	M.SQ.FT	ACRES
55.0	Y	0	27.152	10.483	292.26	6709.4
60.0	Y	0	10.717	4.138	115.36	2648.2
65.0	Y	0	3.924	1.515	42.24	969.7
70.0	Y	0	1.444	0.557	15.54	356.7
75.0	Y	0	0.534	0.206	5.75	132.0
80.0	Y	0	0.197	0.076	2.12	48.7
85.0	Y	0	0.076	0.029	0.82	18.8



Comparing Noise Contours

- Ran the INM 7 model with individual profiles for MD-81 and the Cessna 500 (Citation)
- The results show the striking difference between two aircraft noise contours (at 55 DLN level)

