
Carousel INS

Delco Carousel IV-A Inertial Navigation System for *Microsoft Flight Simulator*

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Introduction to the INS system

Welcome to Inertial Navigation. This package includes a replica of the famous Delco Carousel IV-A Inertial Navigation System (INS) built as a set of gauges for Microsoft Flight Simulator. These gauges let any Flight Simulator user learn and practice inertial navigation as performed by professional pilots for more than thirty years.

Basically, an Inertial Navigation System is a device capable of sensing and measuring any change in its current gravitational environment. Once aligned, while steady on ground, it measures and quantifies any acceleration in x/y/z axis and it is, consequently, able to provide position (latitude and longitude) and attitude references. It also provides navigation capabilities based on a sequence of waypoints (lat/long positions) which could be defined by the crew. Physically the "core" of the system, the Navigation Unit (NU), is a gyroscope based Inertial Platform coupled with a (80486 class) computer. A complete INS system, as the one these gauges reproduce, is obtained by adding input/output gauges (to control the NU) and a battery.

The unique and huge advantage an INS provides, when compared to "traditional", ground stations radio signals based, navigation, is that the INS has autonomous positioning/navigation capabilities so it is able to provide relatively precise (aircraft, in our case,) position even in those areas where nav aids (or even ground visual references) are not present, like oceans for example.

Many liners were equipped with this unit, the Boeing 707, Douglas DC-8, Lockheed L1011, Douglas DC-10, Boeing 727, Boeing 747 (not the -400 model), just to mention the most famous. It could be easily found installed also on smaller jet aircrafts (like the DC-9 or the B737) or even on executive class jets. You'll never see it installed on small aircrafts as the cost of the unit would be higher than the value of the whole plane. Actually using these gauges you have the chance to install this unit into any aircraft, even a Cessna C152, as it comes for free. Gauge requires only that the plane/panel has to be equipped with the standard Flight Simulator autopilot with Heading Hold capability.

Included gauges implement every functionality normally available in a Carousel IV-A CIVA 28 A, program number 11 17 instrument, which is only a specific version of a whole family of famous and successful Carousel models. Beware these gauges are not simple to manage, they replicate an instrument designed to be operated by professionals and errors are not admitted as in most cases they will cause the unit to become no longer usable, a big problem if it happens during flight. Serious studying and practicing is needed to master this instrument which is as fascinating as hard. To help the novice user we have tried to establish a suggested learning path. It will guide you through a very basic system and gauges training course, the minimum sufficient to bring you in flight and start practicing instrument management using supplied tutorial flight. Again, it will not be easy but it will

largely repay you, that's guaranteed! If interested refer to the "How to proceed" chapter.

Authors

Gianfranco Corrias, Rome, Italy

Main technical consultant, documentation, testing.

Marco Ravanello, Milan, Italy

Gauge development, graphics, documentation, testing.

Credits

Ed Williams, USA

Many algorithms used by the INS gauges were derived from formulas provided by Ed through his great "Aviation Formulary" and via email. Without his contribution these gauges would probably not exist.

Alkit Chan, Hong Kong, ROC

Digital photos of real CDU and MSU instruments. Main tester for the Chinese Windows environment.

Steve Smith, USA

Digital images of a real C/DU instrument

Luciano Solimena, Rome, Italy

Official beta tester

Marco Balzarotti - SimuFly.com, Milan, Italy

High quality hosting, html pages and scripts development, forum management and support.

Compatibility

The INS gauges are compatible with Microsoft Flight Simulator 2002, both Standard and Professional Editions, Flight Simulator 2004 and Flight Simulator X, running on Microsoft Windows 98/98SE/ME/2000/XP.

Distribution Rules

Distribution of the CIVA archive is LIMITED to <http://www.simufly.com/ins> WEB site. Distribution through ANY other "Publishing Service" (either via Internet as WEB/FTP/P2P or via any other "media" including BBSs, CD-ROMs etc.), being free or not, is NOT allowed without obtaining explicit permission (in advance) from the authors.

Technical Support

Thanks to SimuFly.com the INS project owns a technical support forum:

<http://www.simufly.com/cgi-local/YaBB/YaBB.cgi/YaBB.cgi?board=INS>

where INS users can find help and report problems and also take advantage of Gianfranco real life flying experience and huge CIVA knowledge, as he is normally available to help. In addition authors can be reached using ins@simufly.com email address.

Available Manuals

To learn how to operate the system:

Operations Manual OperationsManual.pdf

This manual is about the real unit but everything written in it also applies to the gauges. It contains a global system description, all needed operating instructions and all normal, conditional and abnormal procedures the crew must know. This is the most important INS manual, a must read for everyone willing to use the gauges.

Gauges User Manual GaugesUserManual.pdf

Once real unit operations are known, the user must learn how they apply to included Flight Simulator gauges. This is another very important manual which must be read otherwise it will be difficult to operate the gauges, even for somebody having real unit experience.

To practice INS management

Tutorial Flight Tutorial.pdf

Step by step guide illustrating how to operate INS instruments during a complete INS-based flight from Boston to Miami.

Tutorial Flight Plan KBOS-KMIA.pdf

Tutorial Flight plan in printable single-page format

To learn how to install/use supplied panel.cfg samples:

Sample Panel.cfg Files SamplePanelCfgs.pdf

Describes all included sample panel.cfg files and explains how to install them.

To learn how to manually install the INS gauges into a panel:

Panel Integration Manual PanelIntegrationManual.pdf

This document has been written to help panel developers or users willing to manually add the INS gauges to a panel. It contains detailed information on all gauges provided with this package.

Reference Guides/Charts

Action & Malfunction Codes ActionAndMalfunctionCodes.pdf
Same doc, compact format ActionAndMalfunctionCodesCompact.pdf

List of all supported Action and Malfunction codes, the compact version uses less paper if printed.

Abnormal Procedures AbnormalProcedures.pdf

Abnormal procedures as reported in the Operations Manual.

Quick & Dirty Reference Guide QuickReferenceGuide.pfd
Same doc, compact format QuickReferenceGuideCompact.pfd

For beginners, step by step guide to operate the INS, the compact version uses less paper if printed

Displayed Status Guide DisplayedStatus.pdf

Guide explaining how to read the INS Displayed Status

Situation Save/Load SituationSaveAndReload.pdf

Guide and checklists to save current INS state and reload it

How to proceed

This is the suggested way of getting familiar with the INS unit(s), after these 5 steps have been completed you should have sufficient INS knowledge to start using it in your favorite aircraft/panel and routes.

- 1) Learn how the real unit works (read OperationsManual.pdf).
- 2) Learn how gauges were implemented and how to operate them (read GaugesUserManual.pdf).
- 3) Print out Action and Malfunction codes (ActionAndMalfunctionCodes.pdf) and Abnormal Procedures (AbnormalProcedures.pdf)
- 4) Print out tutorial flight (Tutorial.pdf) and its associated flight plan (kbos-kmia.pdf)
- 5) Read Supplied panel.cfg installation guide (SamplePanelCfgs.pdf) to install the patched panel.cfg the tutorial flight requires.
- 6) Practice using the tutorial flight