More than games for flying planes

Almost any parent of a preteen or teenager knows how powerful computer games are. In terms of graphics, they have come quite far from the early days of Myst; in terms of fun, from the days of PacMan; and in terms of annoyance, from Pong—one of the very first "computer" games. Much of this progress can be attributed to the pure processing power PCs hold today, and to the imagination of the programmers and game designers.

Many of these games, under the guise of fun, are actually educational. They can help preschoolers learn to add and subtract, teach them the alphabet, and help them learn to read. Some aid in problem solving, whether from a mechanical perspective (Thinkin' Things), business perspective (Roller Coaster), or social perspective (The Sims).

But none of these compare to the power of a software program that has been around for nearly two decades and is helping people learn how to fly planes: Microsoft's Flight Simulator.

Real-world use for simulation

Today, Flight Simulator is being used to help train pilots. The Navy, for example, issues the program to its student aviators. As part of the Career Pilot Program at the FlightSafety International Academy in Vero Beach, Fla., students must complete 27 hours of instruction in a Microsoft Flight Simulator lab. Working under the direct supervision of flight safety instructors, the students practice running checklists, following ATC (air traffic control) clearances, performing basic flight maneuvers, and polishing IFR (instrument flight rules) flying skills.

The Training Center elements of Flight Simulator offer a variety of flight paths, a choice of weather conditions, a map view (which allows the "trainer" to see the terrain from a 30,000-ft altitude), flight videos, and an IFR training panel.

The latest version of Microsoft's Flight Simulator is titled Century of Flight. Previous versions had provided a set of core features that have now been improved or enhanced. These include worldwide scenery, with accurate 3D terrain and autogenerated objects that fill in the world with appropriate buildings and vegetation no matter where you fly. The Jeppesen NavData database, including VORs, NDBs, and ILS, provides low- and high-altitude airways and intersections. There are approximately 24,000 airports worldwide (increased from about 22,000 in Microsoft Flight Simulator 2002).

The software's Flight Planner feature allows users to create realistic VFR (visual flight rules), IFR flight plans, and navigation logs. Also provided is flight analysis that lets the user play back a flight on a moving map that shows ground track, key flight data, and a vertical profile. There is an instructor's station that lets users link two PCs so that one pilot can observe a Flight Simulator session, change weather and fail systems, and provide comments or help via a chat window.

Another new feature is a dynamic weather system based on realistic atmospheric physics, with "true" 3D clouds that form and dissipate, and automatic real-world weather updates when the user is connected to the Internet. It also provides weather "themes" that generate a wide variety of stunning—and challenging—flying conditions with just a few clicks of a mouse. An enhanced interactive ATC now includes traffic at all airports around the world (including nontowered airports), altitude changes en route, pop-up IFR clearances, and precision and nonprecision approaches to multiple runways.

Scenery improvements include taxiway and runway signs, enhanced autogenerated 3D objects, more high-detail airports, and improved lighting and sky effects. The Garmin 500 and 295 series GPS with color moving maps and airport/facility information assists in the navigation. The full-color map view with terrain display is drastically improved.

The new release also includes a Learning Center, which is basically a "Web site on the disc" that is available while the simulation is running. It includes a key topics visual guide to the features in Microsoft Flight Simulator, direct links to flights and lessons, flight briefings, how-to procedures, and aircraft handbooks.

Cockpit view with additional window shows the spot plane view.

An instructor can monitor another Flight Simulator pilot…

Or see a graphical analysis of the flight.

The core product comes with the ability to fly (or attempt to fly) 24 aircraft. The Century of Flight version will also allow aviation enthusiasts to experience being at the controls of historic aircraft, such as Charles Lindbergh's Ryan NYP Spirit of St. Louis, the Douglas DC-3, and the world's first successful powered aircraft, the Wright Flyer. Other historical aircraft include the Piper Cub, deHavilland Comet, Lockheed Vega, and Ford Tri-Motor.

Modern aircraft dynamics and graphics include Cessnas, Beechcraft, and, of course, the Boeing 737, 747, and 777. Many other aircraft and terrains can be acquired through add-ons to this core product.

Origin of Flight Simulator

The genesis of the software product was a master's degree thesis written by an electrical engineering student from the University of Illinois. In May of 1975, Bruce Artwick focused on the principles of flight in his paper, "A Versatile Computer-generated Dynamic Flight Display." This model was developed on a 6800 processor, one of the first PCs available at the time.

By 1978, Artwick had founded a company, SubLOGIC, with Stu Moment. The following year he decided to take the model from his thesis one step further and developed the first Flight Simulator program for the Apple II (based on the 6502 processor), followed soon by a version for the Radio Shack TRS-80.

In early 1980, this Flight Simulator package was gaining quite a bit of attention. A bidding war took place to see who would obtain a license to market the software product, also known as FS. Microsoft won the battle over IBM. In November 1982 Microsoft Flight Simulator 1.01 hit the stores as one of the first PC entertainment titles, followed shortly afterwards by version 2.

In the next few years SubLOGIC itself first released a parallel line in the form of a new version, FS II, for the Apple II (1984), which itself was an improved version of Microsoft Flight Simulator 2, made possible by the superior color display of the Apple. Between 1984 and 1987 another 14 versions followed for a lot of different PCs, notably the Commodore 64 and Amiga, Atari 800 and ST, and Apple MacIntosh.

In 1988 Artwick split with Moment, left SubLOGIC, and started his own company, BAO (Bruce Artwick Organization), solely for the purpose of developing and marketing flight simulation products, concentrated on Microsoft Flight Simulator. Later that year Microsoft FS 3.0 was released.

New versions of Flight Simulator for the PC kept coming from the BAO/Microsoft tandem. The last version developed by Artwick (BAO) was FS for Windows 95. Shortly before its release, Artwick sold BAO to Microsoft. Artwick himself did not move to Microsoft, but he remained involved in the development of MS-FS as a consultant and supervisor.

Around the same time, SubLOGIC was taken over by Sierra, another big marketer of entertainment titles, to develop a rival flight simulation called Pro Pilot. Between 1996 and 2000, two new versions of MS Flight Simulator were released. One of these, Microsoft Flight Simulator 98, was brought to market in August 1997, the 15th anniversary of FS. More than 10 million copies sold worldwide.

Open source solution

The use of COTS (commercial off the shelf) software such as FS brings up a critical matter in the aerospace and defense industry: the open source issue. At the AIAA's recent Modeling and Simulation Technologies Conference, a panel discussion raised an important question: How can engineers use and modify COTS tools to best meet their needs? There are a number of approaches to solving this problem, but for each approach, someone has to give up some control, revenue, or features. Software vendors and customers must find a way to develop procedures to keep enhancing the state of technology, pro-

See where you are or drag your aircraft to a new place.

Software provides the weather main screen.

vide engineers with the tools they need, and allow the software vendors to make money so they can continue to grow.

An example of how this has worked involves the software product FlightGear, an open-source, multiplatform, cooperative flight simulator development project. Source code for the entire project is available and licensed under the GNU General Public License.

The goal of the FlightGear project is to create a sophisticated flight simulator framework for use in research or academic environments, for the development and pursuit of other interesting flight simulation ideas, and as an end-user application. This loosely organized group is developing a sophisticated, open simulation framework that can be expanded and improved by anyone interested in contributing.

The idea for FlightGear was born out of dissatisfaction with current commercial PC flight simulators. A big problem with the COTS simulators is their lack of extensibility and the proprietary attitude of their manufacturers. There are so many people across the world with great ideas for enhancing these simulators—people who have the ability to write code, and who have a desire to learn and contribute. Many people in education and research could use a spiffy flight simulator framework on which to build their own projects; but commercial simulators do not lend themselves to modification and enhancement. The FlightGear project is striving to fill this gap.

Commercial organizations must find ways to incorporate their proprietary products or features as extensions to lower cost product solutions. Control simulation software companies such as MathWorks, National Instruments, and others should provide low-level extensions to these existing products or open their algorithms so that others can use the technology to solve the technical aerospace and defense problems that engineers are working on today.

John Binder
jbinderaero@rcn.com
OnePIN: 2447-6000-4391

NOTED IN BRIEF

Mentor Graphics (Wilsonville, Ore.) [http://www.mentorgraphics.com] announced the availability of the **Capital Harness Systems (CHS)** product suite. CHS is a comprehensive data-centric, end-to-end software toolset for the design, analysis, engineering, and production of large-scale electrical interconnect systems. Users can select from a wide range of integrated point tools within CHS. These tools all act on a single data repository, thus eliminating data reentry and greatly simplifying the change management issues commonly encountered. It provides dynamic electrical simulation, to allow real-time feedback to design engineers, significantly speeding the process of designing complicated electrical circuits. An additional feature, design comparison, provides graphical representation of connectivity or differences between related designs. This simplifies the process of evaluating complex design changes. CHS also provides enhanced harness drawing features, such as display of composite wire tables, terminal materials, and nested dimensions for complex bundle configurations.

CoCreate Software (Fort Collins, Colo.) [http://www.cocreate.com] announced the latest release of **OneSpace.net**, its engineering collaboration toolset designed specifically for product development teams and their contributors. Built on Microsoft .NET technology, it includes a secure project workspace, an integrated meeting center for Web-based meetings, application sharing, instant messaging, decision and task tracking, and a three-dimensional model explorer for evaluating product designs. The OneSpace.net hosted service fits naturally within the information technology (IT) environment, providing an easy way for work groups to start project collaboration. CoCreate maintains all the hardware and software that are part of the OneSpace.net infrastructure, eliminating the need for companies to have internal IT skills or resources. Companies also receive automatic upgrades and full product support as part of the monthly subscription fee. OneSpace.net can be purchased as either a hosted service for $120 per user per month or as a licensed product for $995 per user.

HBM (Marlborough, Mass.) [http://www.hbm.com] has released the latest version of its measurement software, **catman 5.0**. Included in this package is a database that lets users simply select from a list of transducers, and catman automatically configures the amplifier, reducing the time needed to set up measurements. The software scans PC interfaces and automatically recognizes connected devices. Measurement runs can be defined, completed, and automated without any programming. Measured values can be visualized in real time, or the log files can be viewed when tests are complete. The system also provides the option of analyzing data and creating user-specific applications. Other new features include event monitoring of the measurement channels. Among other things, this allows limit values or digital inputs to be viewed. Additional test parameters can be included, such as operator, department, and test object, further improving software flexibility.