

AVIONICS magazine TECH REPORT



Field Loadable Software

The right system can manage software updates on numerous aircraft, for numerous systems, cutting costs and improving operational efficiency

Picture two PCs on a desk. They're both from the same manufacturer; they're the same model and on the surface they seem to be loaded with the same software.

But ask your IT department whether the machines are, in fact, identical and they generally can't tell. They can't be 100 percent sure that Internet Explorer, for example, has exactly the same options turned on in both machines. Maybe one has the option turned on to signal an alert when leaving a secure page, and the other has it turned off. The IT department would have to spend quite some time to determine that information.

It's the same problem with software developed for aviation equipment. The number of applications developed to control aircraft systems and flight functions has grown exponentially in just the last decade. Older Boeing 737s and Airbus A320s were loaded with, maybe 30 pieces of software that changed fairly infrequently. They could be kept track of on a sheet of paper.

With the introduction of the Boeing 777 in the mid-1990s, the number increased to 120+ pieces of software. Fast forward to today's newest airliners like the Boeing 787, and not only has the quantity of software jumped to as high as 500 pieces, but those 500 pieces of software are not loaded to just 500 locations, they're being loaded onto 800 to 900 locations.

This has created a huge responsibility for maintenance operations to properly manage the configuration of loadable software.

"Software has been a part of this industry and is spreading," said David Seymour, senior vice president of Technical Operations at US Airways, speaking in March 2010 at the ARINC Avionics Maintenance Conference¹. "While it's been around for decades, it only has been the last 10 or 15 years that software loads have now worked their way into the line maintenance environment. We find aircraft maintenance technicians of the not-too-distant future are not only going to need their A&P credentials, but are going

to need a background in Information Technology (IT) to really master the profession."

Software management has clearly become challenging, especially since most airlines are still using archaic distribution methods. Imagine piles of floppy disks, hours spent loading software parts into multiple Line Replaceable Units (LRUs) on multiple aircraft in multiple locations, while still being able to keep track of all aircraft configurations and aircraft equipment loaded. With such a cumbersome process no wonder some airlines are giving up on important software revisions.

"The downside of aircraft software is that when things do not go correctly the aircraft simply sits on the ground, and our passengers end up paying the price," Seymour said². "We are right now in the middle of one of those experiences. We are currently loading a fifth version (of an integrated avionics software package) to fix some onerous aircraft dispatch problems. After an internal review inside US Airways in our engineering group and talking with our pilot group, we have decided to suspend any further upgrades to our aircraft."

With such experiences becoming more commonplace in the industry, the need for software distribution process tools to manage the configuration of loadable software is no longer an option, it is a necessity.

Struggling with Software Management

Airplanes aren't falling out of the sky for lack of a proper software configuration management tool, so why should airlines care?

"Planes may not fall out of the sky but airlines experience delays, turn flights around in the air and can't take advantage of upgrades because they are not running the right software," said Marshall Dormire, business development director for Data Loading Solutions at Teledyne Controls, based in El Segundo, Calif. "And when they do have an airworthiness directive for software, it is costing them an

immense amount of money to comply. Unfortunately, they assume everybody is struggling with the exact same problem and there is no better way to do it. But the answer is that there is a better way."

That better way is a new process tool from Teledyne Controls called LoadStar® Server Enterprise (LSE). LSE provides an important leap in network-based distribution and control of aircraft software parts, as it eliminates the need to manually carry and load hundreds of floppies onto aircraft every month.

This was a key driver in KLM Royal Dutch Airline's decision to convert to LSE. "We migrated to LSE to eliminate the time-consuming and cumbersome process of manually updating our fleet's software databases and to avoid future obsolescence issues with floppy disks and other media," said Marco Kwikkers, KLM avionics engineer. "Teledyne's system supports an entirely electronic data distribution process and LSE is the bridge that provides a link to download new software parts directly from the OEM to our aircraft, compressing our data loading cycle engineering preparations from 2 days to 4 hours. Another consideration was integration. LSE will be compatible with our evolving IT infrastructure, allowing the addition of new and future aircraft. LSE will help us maintain a modern fleet which is one of our main objectives."

LSE enables operators to securely

LSE Key Benefits

- Distributes Software Parts (SPs) electronically to eliminate physical media
- Configures SPs by equipment, aircraft type and tail number
- Tracks delivery and provides reports of loaded aircraft
- Maintains SP library for the entire fleet in a central location
- Collects and returns QAR data and aircraft downloads from the field
- Manages high volumes of data/programs (e.g. EFBs)
- Increases process efficiency to reduce costs

configure, store and electronically distribute software parts from desktop to aircraft automatically. Through a Teledyne onboard communication device, such as the Wireless GroundLink® or AirLAN system, the software parts can be wirelessly transferred from LSE directly to an airborne data loader – e.g. Teledyne’s eADL (enhanced Airborne Data Loader), which carries out the final step of loading the parts into the target LRUs.

In addition, LSE keeps track of the software parts loaded on each aircraft in the fleet to provide up-to-the-minute loading status reports and aircraft configuration information. Once the aircraft are loaded, they can be safely dispatched and operators have the records to easily demonstrate regulatory compliance.

Even though there’s no standard regulatory requirement calling for such an electronic configuration control tool, operators are still required to show compliance and transparency, and they often struggle doing so.

A concrete example of how the lack of software control impacts flight readiness was discussed at a recent meeting held by the ARINC Field Loadable Software committee, which has produced a number of documents describing the configuration control problem that airlines experience when classifying all different types of loadable software.

The example referred to the cabin temperature controller – of which there are two, a primary and a backup – on the Boeing 777. When something goes wrong with the primary, it is designed to continue flying with the backup. What happens at least a couple times per year, according to the airline, is that the primary cabin temperature controller gets loaded with a new piece of software, but for some reason the backup doesn’t receive the same software version. Nobody notices because the design of the backup controller makes it difficult to investigate and determine its exact configuration.

If the primary controller goes off line during a flight, then the secondary

takes over and the airplane’s software becomes out of configuration. The pilot gets a warning on his display, and because cabin temperature control is necessary for safe flight, the flight crew is forced to divert the flight and land.

Making the Business Case

That type of issue is not uncommon and can occur with a variety of systems.

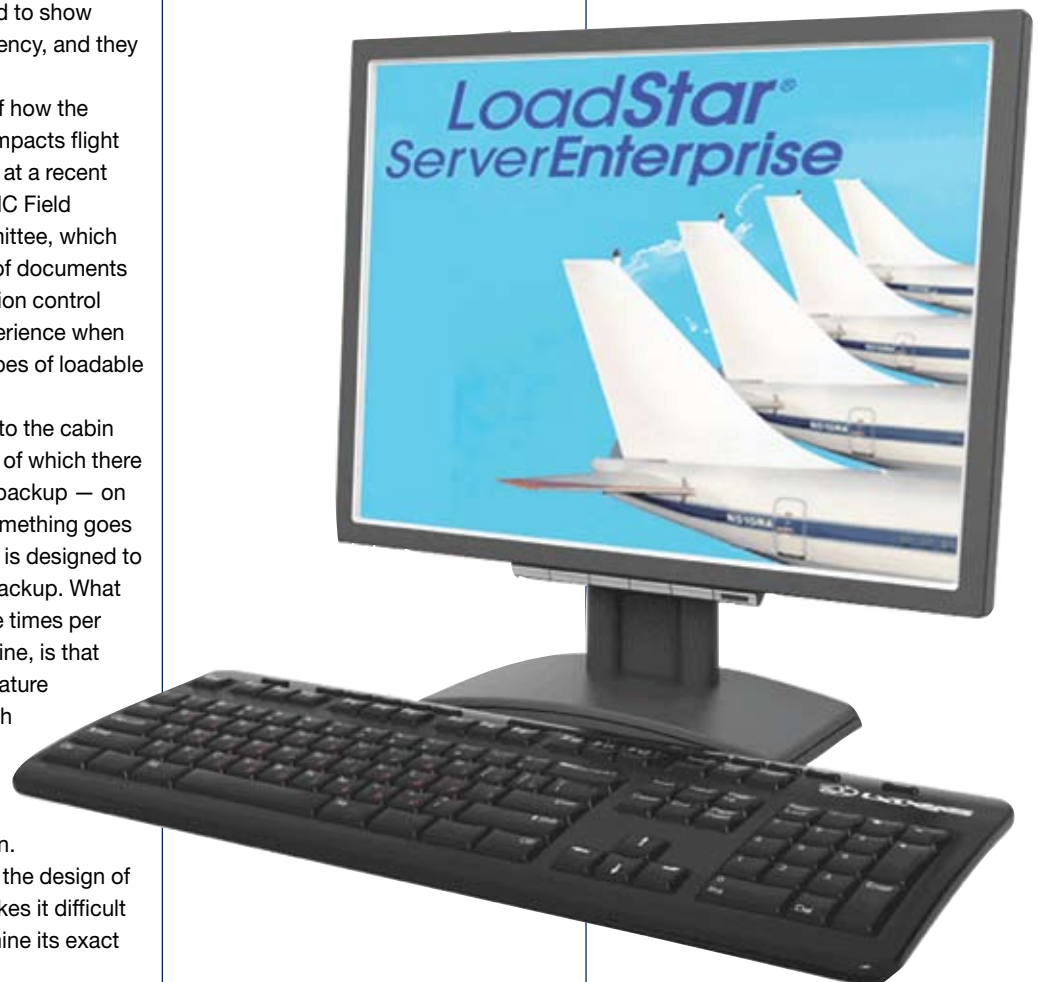
Much more common and costly issues affecting every passenger plane in the world are those resulting from the monthly navigation database updates. The Aeronautical Information Regulation and Control (AIRAC) requires this cycle to occur every 28 days, for a total of 13 updates a year. The purpose of this monthly update is to synchronize all aircraft equipment around the world and across all operators, and this is a regular time challenge.

The new nav database is released

LSE Key Features

- Supports new Boeing 787, 747-8, Airbus 380, A350
- Supports FlySmart with Airbus EFB and Boeing EFBs
- Links directly to Jeppesen DDM data distribution
- Supports all legacy aircraft A320, A330, B737, B747, etc.
- Supports Boeing 777 and Embraer ERJ 170/190 software parts
- Integrates with Teledyne’s ARINC 615-3/615A data loaders
- Integrates with the airline’s existing IT infrastructure

about nine days before it needs to be installed and active on the planes, and that begins the scramble. The database has to be brought in, validated by flight ops, and at same time distributed throughout the airline to all the various



aircraft and onboard systems where it will be loaded. This means it has to be duplicated, and physically taken to the airplanes for loading. This process usually takes days to accomplish and it expends an enormous amount of manpower. "There's a huge time pressure to get the job done," Dormier said. "If you don't send the database out in time it impacts operations. You can end up running your jet in a much less efficient fashion. You have to go back to old methods of navigating, and you can't take advantage of the efficiencies of RNP (Required Navigation Performance)."

Southwest Airlines, another Teledyne LoadStar® Server Enterprise customer, realized the time and cost savings possible with this software management tool.

"Southwest Airlines sets a high priority for maintaining current nav databases across our fleet, and this is a major undertaking when physically loading our onboard avionics," said Kirk Majors, avionics engineer with Southwest Airlines. "We had to implement an alternative loading method of manually copying and distributing floppy disk updates to the field in order to accomplish two 28 day cycle navigation database loads on 540 aircraft. With Teledyne's LSE and PMAT 2000® data loaders, loading software parts electronically to every aircraft in our fleet can be completed within hours instead of days."

Software Configuration and Loader Management

Teledyne Controls' LoadStar® Server Enterprise provides a comprehensive solution for all of the software management issues discussed in this paper. It offers an efficient tool to control aircraft software configurations, letting users organize and compare the software needed on an aircraft against the software already installed. LSE can manage and distribute numerous software parts to multiple LRUs on hundreds of aircraft around the world. It enables airlines to transition from manual software part distribution, based on floppy disks, CDs and paper-based methods, to a paperless and

automatic distribution process. This translates into benefits for the airlines. Automating electronic transfer speeds up information delivery so required monthly software updates can be completed on time. Tracking software updates reassures operators that their aircraft are properly loaded so they can dispatch them according to schedule and record keeping improves their ability to show regulatory compliance. LSE also

cuts costs by reducing manpower and wasted time. With Teledyne's LoadStar® Server Enterprise, airlines can truly take control of their aircraft software configuration management to ensure their aircraft have the latest software updates. And unlike the example of the 2 PCs on a desk, LSE enables airlines to quickly and accurately identify the software configuration of all and each of their aircraft.



Nav Database Distribution at the Press of a Button

Teledyne's LoadStar® Server Enterprise is the most comprehensive, integrated and secure way to manage and distribute software parts and aircraft data to your airplanes.

Using floppy disks and CDs to distribute Software Parts to one plane after the other wastes time and can lead to human error. LoadStar® Server Enterprise (LSE), Teledyne's scalable solution, automates the entire data distribution process.

With the press of a button, you can configure and store software parts once, and seamlessly distribute them

from desktop to data loaders across any size fleet. No more struggling with old media! And when a mechanic loads the distributed data, loading can be verified instantly.

Secure distribution, reduced man hours, lower costs, and improved regulatory compliance: that's what Teledyne's LoadStar® Server Enterprise delivers.

To find out how LoadStar® Server Enterprise from Teledyne will benefit your operation visit www.teledynecontrols.com/lse or call +1-310-765-3600

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