



A Time & Space Partitioned DO-178 Level A Certifiable RTOS



- Designed to Save Money from Plans — to — Certification
- Field Proven on Hundreds of Aircraft World-wide
- State-of-the-Art Time and Space Partitioning Capabilities
- Patented Slack Scheduling Mechanism Allows for 100% Processor Utilization
- Support for popular avionics standards, ARINC-653 Specification Part 1 and Part 4
- Superior Patented Technology for Less

Deos™ is a time & space partitioned RTOS, which has been certified to DO-178 Level A since 1998. Built from day one using Level A certification processes, Deos features hard real-time response and employs “slack scheduling” to deliver higher CPU utilization than any other certifiable safety-critical COTS RTOS.

Additionally, Deos users have the ability to add on optional ARINC-653 personality modules designed to fit different application needs.

- Deos supports the full ARINC Specification 653 Part 1, which is designed to enhance software portability to avionics operating systems. Applications needing to utilize this full spec can choose this Deos personality module which delivers standards conformance combined with patented Deos technology.
- Other applications may only need a lightweight version, ARINC Specification 653 Part 4. This module is the right choice for less complex applications such as the majority of Line Replaceable Units. Deos is the only COTS RTOS vendor supporting this strict subset, delivering the value added features of Deos, and the portability of the popular avionics standards.



Robust, Reliable Technology Designed to Save Money



Deos Key Features & Benefits

- **Harmonic Rate Monotonic Scheduling and Optional ARINC Scheduling** ... Delivers the best of both worlds to avionics systems developers!
- **ARINC Specification 653 Part 1 (Optional Module)** ... Delivers the standard avionics interfaces for enhanced portability, and allows designers to take advantage of the advanced features of Deos.
- **ARINC specification 653 Part 4 (Optional Module)** ... Delivers a streamlined subset of the standard avionics interfaces for less complex systems and the value added features of Deos.
- **Object Code Structural Coverage Tool** ... Eliminates the need for expensive source to object code traceability analysis; creates better and safer software.
- **Run-time Linkable Libraries** ... Saves valuable space, increases modularity, and can enable customer binary software & artifact reuse.
- **Slack Scheduling** ... Allows for upwards of 100% processor utilization without jeopardizing hard deadlines.
- **Unlimited Processes and Threads** ... No artificial limits on the number of processes and threads allows great flexibility in the design of an application.
- **Factoring** ... Configuration of Deos for a specific application is done outside of Deos proper. Therefore, certification artifacts can be used unchanged even when the configuration changes.
- **Larger Memory Address** ... Up to 4GB memory address space, maximizes available user memory and allows for larger programs, data and future growth.
- **OS Binary Modularity** ... Deos components are delivered as binary runtime linkable modules, each with their own certification artifacts.

Patented Slack Scheduling Technology

Adding Slack Scheduling to RMS



- By using slack, thread Medium might receive CPU time that would have been lost to Idle to complete its execution for period
- Thread consumed budget but is allowed to continue using slack time
- Thread is executing
- Thread is ready for execution but has not yet been activated by scheduler
- Thread has been preempted by higher priority thread
- Slack time execution
- Thread has completed for period
- Thread completes for period, activate another thread
- Thread preempted by higher priority thread

- Gives you the ability to budget in order to meet your safety requirement, but enable slack in order to get the most out of your processor.
- Allows a client & server to exchange data, perhaps multiple times, back-to-back, within the same period, in order to complete a transaction.
- Enables the removal of lower criticality applications from the high criticality, fixed budget time line.

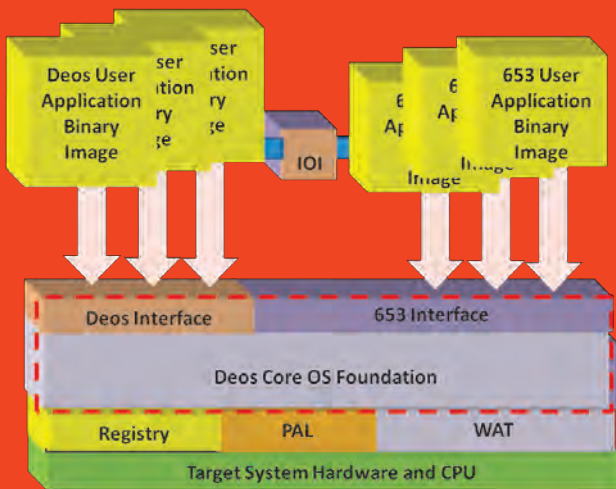
Software designers can now leverage all the power of today's modern processors, without sacrificing the safety of space & time partitioning.

Deos™ is a proven, full featured DO-178 Level A certifiable real-time operating system (RTOS) which addresses the issues of high robustness and formal certifiability for avionics and safety critical applications. Built from the ground up with these goals in mind, Deos is the only certifiable time and space partitioned COTS RTOS that has been created using RTCA DO-178, Level A processes from the very first day of its product development. Deos offers several unique fundamental and patented architectural advantages over all other competing RTOS's. The result is the best performance, lowest risk, easiest to certify, and lowest cost time & space partitioned COTS RTOS for airborne avionics and safety critical applications on the market today.

Deos supports popular avionics standards and other certifiable features allowing users to customize their Deos environment by choosing from a variety of optional modules:

- ARINC Specification 653 Part 1
- ARINC Specification 653 Part 4
- CFFS (Certifiable Fast File System)
- ARINC-615 Target Data Loader
- ARINC-664 Data Bus
- AFDX

Deos 653 Hybrid Architecture



The Best of Both Worlds...
ARINC portability & patented value added features of Deos!

The Deos 653 Hybrid Architecture allows the best of both worlds with the portability of the popular avionics standards, and the value added features of Deos, such as slack scheduling, it's modular architecture, application space device drivers and more.

Field Proven on Hundreds of Aircraft Around the World

- Airbus A320
- Airbus A330
- Airbus A340
- Airbus A380
- Airbus A400M
- Augusta AB-139 Helicopter
- Australia CASA
- Boeing 757
- Boeing 777
- Boeing 787
- Bombardier Global Express
- C-5
- C-17
- C-130J
- CV-22 Osprey
- Cessna Citation V
- Cessna Sovereign
- Dassault F7X
- Dassault F900
- Dassault F2000
- Embraer ERJ-170
- Embraer ERJ-175
- Embraer ERJ-190
- Embraer ERJ-195
- F-18
- Gulfstream G350
- Gulfstream G450
- Gulfstream G500
- Gulfstream G550
- Gulfstream GIV_X
- Gulfstream GV
- Raytheon Hawker Horizon
- Raytheon Hawker 450
- Pilatus

... partial list

Deos 653p4-Solo™ includes only the ARINC Specification 653 Part 4 interfaces at an exceptional value for small to medium complexity avionics LRU's that can benefit from standards conformance and the associated code portability.

Designed to Save Money on Software Development and Certification Costs

Reduced Software Development Cost

In addition to the typical RTOS services for memory management and synchronization, Deos has excellent support for hard-deadline deterministic periodic execution. Additionally, Deos provides highly efficient, deterministic inter-process/inter-processor, periodic & aperiodic communication mechanisms which enable the designer to isolate applications from changes in I/O format and bus hardware/source.

Reduced Integration Cost

It is common for resource contention conflicts, in otherwise well tested software, to manifest during integration. These errors can be difficult to locate because interactions are complex and rarely understood by any one individual. The Deos Integration Tool makes obvious, during development and design, an application's resources needs, this prevents contention while providing early warning of physical resource depletion. An application's memory, I/O, interrupt and processing time needs are defined early in the life cycle and follow it throughout development, testing & verification; thus reducing the time and cost of integration.

Reduced Recertification Cost

The cost to re-certify previously approved software is a function of the amount of change. Changing just a single module and then re-compiling / re-linking the whole system results in an entirely new executable. Deos solves this problem by supporting run-time linkable libraries and executables (i.e., it is a DO-178 Level-A Link/Loader). Consequently a change to one module within an executable impacts only that executable. The executables for the rest of the system, and even the run-time linkable libraries used by the application remain unchanged. This isolation of change impact results in a reduced re-certification cost thereby making it easier to embrace change and incrementally improve your product offerings.

Improved Programmer Efficiency

Of course, Deos comes with all the software development and debugging tools you've come to expect: IDE, Debugger, run-time system monitor/profiler, as well as integrated emulator support. Additionally, Deos provides integration and configuration tools which enable the designer to factor out what would otherwise be hard-coded constraints. This factoring ability not only speeds development, but also aids in verifying the correctness of the implementation, aided by Deos provided qualified verification tools.

The DDC-I Advantage

With over 30 years experience supplying complex COTS and custom development solutions, DDC-I provides long-term, strategic advantages to an ever changing safety critical industry.



Osprey & F-18 photos courtesy of
Department of Defense

Boeing 777 photo courtesy of Honeywell

Cessna photo from iStockphoto.com



Safety Critical Software Solutions
for Mission Critical Systems