

## PBS Professional at The Boeing Company: Workflow Management for R&D



### Key Highlights

#### Industry

Aerospace

#### Challenge

A reliable workload manager that can handle Boeing's distinct clusters.

#### Altair Solution

PBS Professional's Peer Scheduling feature enables Boeing to balance workload evenly across the clusters.

#### Benefits

- Optimizes several resources under one queue
- Faster performance to support CPU Sets on SGI Origin

### Customer Profile

The Boeing Information Technology group provides a wide range of computing services to the entire corporation from its Bellevue, Washington computing campus. For the engineers who design Boeing commercial aircraft, the heartbeat of this campus is the Data Center, which houses the high-performance computing (HPC) systems that they access to run engineering simulations and analyses.

The HPC systems of the Enterprise Servers subgroup are accessed by

all Boeing engineering departments, but the heaviest demand is from engineers running aerodynamics and structural models, particularly during the early stages of aircraft design. Most users log on from Boeing's four engineering and development locations around Puget Sound, but the servers are accessed by Boeing engineers in Philadelphia and other sites around the world.

### Managing HPC Workload with PBS Professional

Enterprise Servers have roughly

# Boeing Success Story



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**Barry Sharp,**  
Senior Software Engineer, Boeing

1,500 user accounts, with about 30 users active on each of the systems at any given time. Engineers access the systems to run NASTRAN, ANSYS, Fluent, Abaqus, Overflow, CFD++, CFL3D, and in-house applications. The HPC resources are primarily used for engineering studies and alterations to existing designs, such as stretched fuselages and additional seats. They are currently being used intensively for early new product development on the Boeing 787.

Enterprise Servers uses Altair's PBS Professional® for workload management on three HPC systems: a 64 MSP Cray X1, a 384-CPU SGI

Origin 3800 server, and five clusters purchased from Linux Networx that are maintained by Boeing: three 32-bit, 128-node, 256-CPU Xeon clusters and two 32/64-bit, 128-node, 256-CPU Opteron clusters. Engineers select the resources that they need.

“We’ve been aiming at this combination of hardware for a number of years,” says Boeing Senior Software Engineer Barry Sharp. “Each system carries a different cost that feeds back to our engineers. So they can look at all three platforms on a cost basis, or in terms of getting their work done in a specified turnaround time,

and if their application and their job can run on all three of them, they can select the one they want.

“Our workload management for the clusters is a bit unusual. They’re distinct clusters, operating separately, although they’re networked together. Engineers can submit a batch job to any cluster. Every job must fit completely within a single cluster — it cannot span clusters. PBS Professional’s Peer Scheduling feature enables us to balance the workload evenly across the five clusters.”

Peer-to-peer scheduling allows PBS Professional to optimize several



### A Reliable HPC Workload Manager

Boeing saw access to source code as one of the most powerful factors in favor of PBS Professional. "All in all, we've been very pleased with Altair's responsiveness to our product feedback," says Sharp.



resources under one queue where users submit jobs. Jim Glidewell, HPC systems analyst, also reports dramatic performance benefits with PBS Professional's support of CPU Sets on their SGI Origin. With PBS Professional running on both the SGI and Cray platforms, it was a logical step for Boeing to implement it on their Linux Network clusters.

### The Move to PBS Professional

In 2001, Enterprise Servers was running Network Queuing Environment (NQE) on its Cray T90 systems and on its SGI Origin 3800 server. Boeing learned that SGI was planning to drop support for NQE, and began an evaluation of other workload management systems

including Altair's PBS Professional and Platform LSF.

Boeing saw access to source code as one of the most powerful factors in favor of PBS Professional. Enterprise Servers wanted to be able to customize their workload management tools when necessary. They wanted deeper understanding of the program in case any issues arose so they could create a temporary workaround while the problem was resolved. "All in all," says Sharp, "we've been very pleased with Altair's responsiveness to our product feedback."

### The Future: Growth with PBS Professional

"We have found PBS Professional to be a very stable product that has lived up to its specifications," says Sharp. "That is extremely important to us. Our workload management system has to work. It's the vehicle we use to place work onto the machine and manage it. If that piece of software malfunctions, we pay a high price. We rely on our batch scheduling system for adopting and managing queuing policies, and that's what PBS Professional is all about. When we add clusters, we obviously will continue to use more PBS Professional."

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## About Altair

Altair empowers client innovation and decision-making through technology that optimizes the analysis, management and visualization of business and engineering information. Privately held with more than 1,800 employees, Altair has offices throughout North America, South America, Europe and Asia/Pacific. With a 27-year-plus track record for high-end software and consulting services for engineering, computing and enterprise analytics, Altair consistently delivers a competitive advantage to customers in a broad range of industries. Altair has more than 3,000 corporate clients representing the automotive, aerospace, government and defense, and consumer products verticals. Altair also has a growing client presence in the electronics, architecture engineering and construction, and energy markets.

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## About PBS Works

PBS Works™, Altair's suite of on-demand cloud computing technologies, allows enterprises to maximize ROI on existing infrastructure assets. PBS Works is the most widely implemented software environment for managing grid, cloud, and cluster computing resources worldwide. The suite's flagship product, PBS Professional®, allows enterprises to easily share distributed computing resources across geographic boundaries. With additional tools for portal-based submission, analytics, and data management, the PBS Works suite is a comprehensive solution for optimizing HPC environments. Leveraging a revolutionary "pay-for-use" unit-based business model, PBS Works delivers increased value and flexibility over conventional software-licensing models.

[www.pbsworks.com](http://www.pbsworks.com)



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