

AFT-Fathom and AFT Arrow Guide Rocket Design at KETEMA

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KETEMA serves the aerospace industry by producing build-to-print and custom engineered products for aircraft, launch vehicles, ducting assemblies, cryogenic valves, jet engine parts, electro-mechanical pumps, and flow control systems. They employ 500 people at their facility in El Cajon, California.

You don't have to be a rocket engineer to use AFT Fathom or AFT Arrow. . . unless your job is rocket engineering. KETEMA designs systems for reusable and expendable launch vehicles (RLV/ELV's), today's formal terms for rockets. The design of fluid and thermal aspects of the RLV/ELV systems at KETEMA is the responsibility of Ichi

Wakabayashi, Senior Mechanical Engineer. He chose AFT Fathom and AFT Arrow to help his group model the many fluid systems aboard RLV's and ELV's.

AFT Fathom predictions of the rocket engine propellant feed system pressure drop agreed within 5% with data collected during firing tests on an engine test stand.

Primary reasons he cited for choosing AFT software were ease of use and the extensive databases of fluid properties and component loss coefficients.

"Previously, analyses were done by hand, which was tedious and time consuming," Ichi said. "AFT [software] allows a repeatable tool for flow analysis that allows faster modeling of systems. . . with good graphical and tabulated outputs."

KETEMA has used AFT Fathom and Arrow on numerous systems including pressurization systems, nitrogen attitude control systems, and LO₂, RP-1 and Ethanol propellant feed systems. Figure 1 shows the AFT Fathom model of a liquid oxygen (LO₂) supply system, and Figure 2 shows the AFT Arrow model of a gaseous helium pressurization system for propellant tanks.

KETEMA has had the opportunity to check the AFT Fathom predictions against test data. AFT Fathom predictions of the rocket engine propellant feed system pressure

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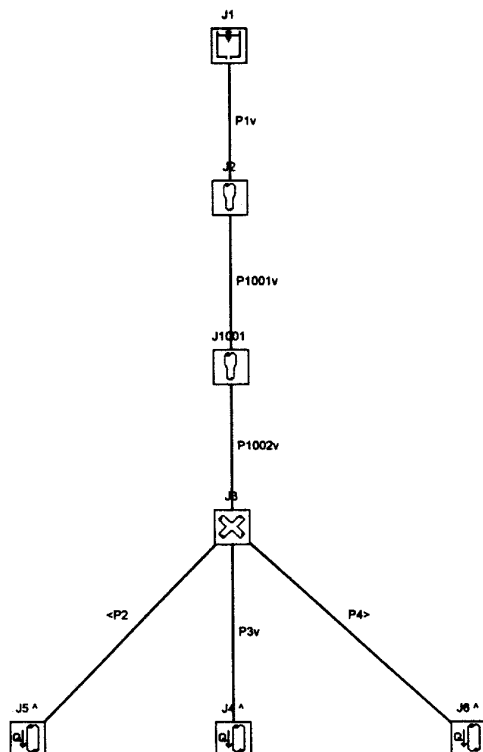


Figure 1. AFT Fathom 2.0 model of the Liquid Oxygen (LO₂) supply system for a reusable launch vehicle. The LO₂ tank is modeled as reservoir J1 while the three rocket engines are modeled as flow demands at J4-J6. Solution time: 0.11 sec. on a Pentium 166 MHz. Image printed by AFT Fathom 2.0. Modeled by KETEMA.

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With the many aerospace fluid systems encountered at KETEMA, it appears that AFT Fathom and AFT Arrow will be put to good use in the future as well. We're pleased to see KETEMA's unique piping systems demonstrating

the flexibility of AFT software as general purpose pipe flow analyzers.



For more information on AFT Arrow, contact Applied Flow Technology at (800) 589-4943 or look up our web site at www.aft.com.

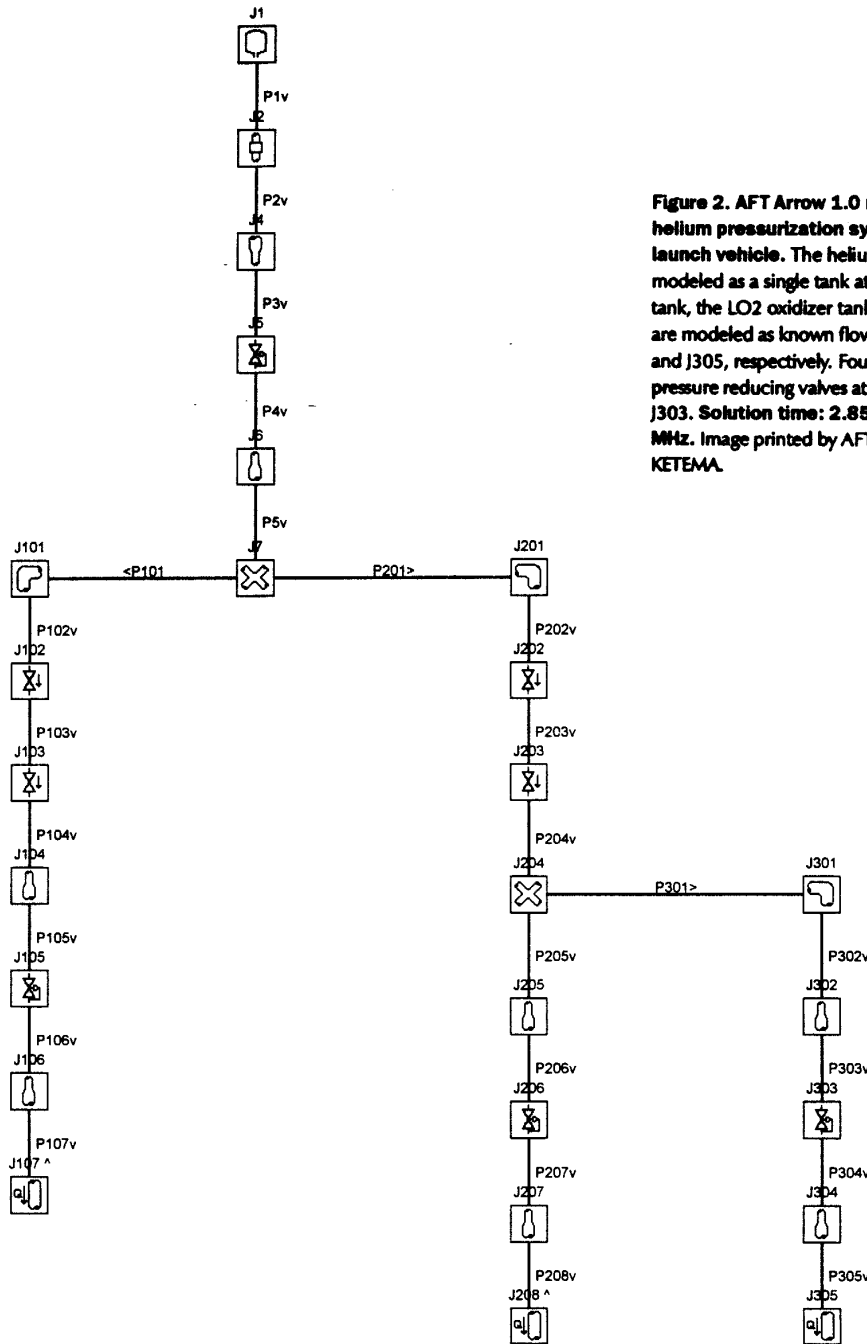


Figure 2. AFT Arrow 1.0 model of the 6000 psi helium pressurization system for a reusable launch vehicle. The helium supply bottles are modeled as a single tank at junction J1. The RP-1 fuel tank, the LO2 oxidizer tank and the LO2 restart tank are modeled as known flows at junctions J107, J208 and J305, respectively. Four regulators are modeled as pressure reducing valves at junctions J5, J105, J206 and J303. Solution time: 2.85 sec. on a Pentium 166 MHz. Image printed by AFT Arrow 1.0. Modeled by KETEMA.