SimStation

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The SimStation Project has developed a Systems-Thinking Workbench on a laptop for the International Space Station. This Engineering Decision Support tool integrates technologies in the service of four functionalities (i.e., visual, functional, behavioral, and informational) detailed in the table below.

The SimStation user can:

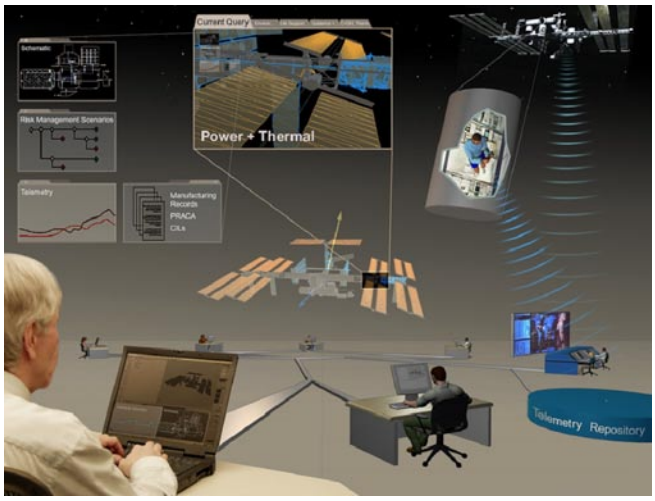
- Navigate freely around a 3D Space Station model, viewing and controlling the vehicle's attitude
- See pointing vectors, or colored arrows, tracking the Earth's center, Sun, vehicle motion direction, communication satellites, and ground stations
- Monitor solar angles by seeing how one part of the Space Station (or visiting vehicle) shadows another part
- Selectively activate/deactivate/fail components and observe the result in the causal, numeric, and geometric models
- Click on a component to:
- Find its parameters (name, part number, mean time between failures, etc.)
- Find its state (off/on/stand-by/survival-mode; either in the model or from Space Station telemetry)
- Change its parameters, state, and position
- Hyperlink to other online information about the component (photography, computer-aided design, mass properties, procedures)

The integration of high-fidelity numerical models is computationally intractable. Their modeling, validation, and use are labor intensive. The SimStation framework integrates multiple lesser-fidelity simulation models with 3D graphics and portaling. Our research hypothesis is that our approach will

- Be achievable
- Prove computationally feasible and valid
- Take much less labor to build
- Require less specialized user knowledge to operate
- Provide most of the functionality desired out of integrated high-fidelity models
- Gain greater user acceptance and adoption

	Current	Planned
Visual:	3D exterior geometry, Orbital dynamics, vehicle attitude and articulation, some shadowing, Earth view	3D interior geometry, visiting vehicles, more Earth view, EVA procedures, avatars, beta-angle tracking
Functional:	Functional connectivity - power and thermal utilities, causal flows	Data and command functional connectivity, redundancy, survival mode, load sheds.
Behavioral:	First-order numeric simulations of PhotoVoltaics, batteries, power and thermal loads	ITCS/ETCS Heat Exchanger, Exterior thermal, c&dh models on cots simulation tools; Kinematics & Dynamics Module
Informational:	Portaling to Space Station online databases ddms/edms, orudd, pals, edms, praca, photography and others. Equipment state, parameters	Active schematics, Web search, textual analysis, real-time or recorded telemetry module, failure modes

The major customer is the Space Station Vehicle Integrated Performance and Resources (VIPER) Team at Johnson Space Center (JSC). VIPER uses SimStation to plan complex operations that cut across many subsystems, such as the upcoming deployment of the P6 solar array wing on the International Space Station. The SimStation Team collaborates with the Neutral Buoyancy Lab and DigitalSpace.com to model the Space Station control moment gyroscope changeout procedure. The team is also planning work on haptic modeling with JSC QUEST Lab and Langley Research Center's Haptics Lab.



SimStation – Virtual vehicle in a system of systems.