This distribution contains several simulation models created for the hybrid simulation language, Hybrid Concurrent Constraint (HCC). An HCC model contains the information specified in the widely-accepted academic definition of a hybrid system: this includes expressions for the modes of the systems to be simulated and the differential equations that apply in each mode. These expressions are written in the HCC syntax. The models included here were created by either applying basic physical laws or implementing equations listed in previously published papers.

The systems modeled are:

1) PSA (Personal Satellite Assistant)

The PSA is currently under development at NASA Ames, and is intended to be an autonomous robotic assistant to astronauts on the International Space Station. It would fly inside the ISS and accomplish various tasks, possibly including environment monitoring, inventory tracking, and video teleconferencing. As an internal device, it will propel itself by means of fans. This simulation models the motion of the PSA, incorporating the dynamics of a weightless sphere (the PSA body) with six rotating components (the six propulsion fans).

2) Adsorbtion Pump

The adsorbtion pump, or sorbtion pump, is part of the Mars In-Situ Resource Utilization (ISRU) effort. The idea is to use the resources found on Mars, such as the carbon dioxide atmosphere, to generate resources needed by a mission, such as propellant for a sample return. The specific task of generating propellants is referred to as In-Situ Propellant Production (ISPP). The adsorption pump uses a bed of zeolite to capture the carbon dioxide from the Mars atmosphere, and sends it for use by other systems. The HCC model implements the chemical and thermodynamic equations listed in a paper by Jonathan Whitlow at the Florida Institute of Technology, "Software Development for an Autonomous Control of an ISPP Plant on Mars".

3) RWGS (Reverse Water Gas Shift)

The RWGS system is part of the ISRU effort. It uses the carbon dioxide produced by the adsorbtion pump and a supply of hydrogen to produce oxygen. A good paper describing the components of such a system is AIAA 97-2767, "Mars In-Situ Resource Utilization Based on the Reverse Water Gas Shift: Experiments and Mission Applications", by Robert Zubrin, et. al. The HCC model implements the chemical reactions given in this paper.

4) Simple WRS (Water Recycling System)

The WRS was created as an exploratory effort on modeling a water recycling system. The system would purify water for reuse. All components are modeled at a high level, without using accurate, detailed equations.

5) Liquid Oxygen Tank Conditioning (in X34 domain)

The Liquid Oxygen Tank conditioning simulates the opening and closing of a vent relief valve of a liquid oxygen tank, to condition the liquid oxygen to within certain temperature and pressure limits. The thermodynamic equations used in the model are described in several AIAA papers: AIAA-98-3518, AIAA-98-3519, AIAA-98-4032, and AIAA-97-3304.