# GCF-Globular Cooking Facility

*Georg Grillmayer, Sandra Podhajsky*

The Globular Cooking Facility (GCF) is our contribution to the 'SUCCESS Competition' amongst European students for experiments on the International Space Station. The proposal was presented during the 50th International Astronautical Federation Congress in Amsterdam in October 1999 as one of the 15 final proposals.

With the first hydrophonic gardens the astronauts will be able to get fresh potatoes, rice, spinach, wheat etc. The purpose of the GCF is to create a multifunctional tool for cooking, baking, stewing and frying all kinds of fresh, frozen or dried food in zero gravity. This will increase the nutrition possibilities in space. This is the first tool offering this wide variety of preparing any kind of food.

The food-contents in the GCF is heated by conduction from the inner surface of the sphere, which includes the heating layer. To ensure uniformly heating, the sphere is rotated, forcing the contents to come in contact with the surface. After cooking the water is able to be removed to the water reprocessing system by making use of centrifugal forces.

The hollow sphere consists of a fiberglass laminate of a high temperature cyanate ester resin with embedded carbon fibers used for resistance heating. To prevent heat loss a microporous structure insulation material is used as the outside layer. Temperature sensors are embedded in the laminate and also attached to the rotary unions. The electrical power, revolutions per minute, the water pumps and switches depending on different modes are controlled by a 80C161 microcontroller. The maximum heating power is 1200W at 28VDC which is 5650W/m$^2$. Six slip rings are required to supply the high heating current through the rotary coupling. To ensure no toxins enter the food the inner surface has an additional coating of silica glass. This is done in a plasma-activated chemical vapor deposition oven.

The liquid enters and leaves through rotary unions, also working as bearings. The rotation is changed periodically. This is achieved using a cog belt attached to a worm gearhead motor. The pot is designed to operate in pressure environments of 0.6 to 1.3bar and an overpressure of 1bar. The maximum bearable static g-loads during operation are 2.5g in every direction. For transport purposes a pressure of 0 to 1.77bar and loads up to 9g have to be sustained. The frame is a glass/carbon laminate. Food is accessed through a lid.

## Typical operation cycle

- Open lid and put in food (e.g. rice)
- Close the lid
- Water will be pumped into the right side (Figure)
- Heating starts and pot starts to rotate slowly
- Turn down the heat when temperature is reached. Heat will be stored inside.
- The GCF will change direction periodically according to a preset value. This cycle will continue until the cooking time has expired (e.g. after 15 minutes)
- Once the time has expired, the GCF will drain all surplus water. This is achieved by increasing the rotation rate of the pot to 83rpm (gravity 1g at the walls)
- Applying weak air pressure into the right hose to push the waste water through one of the three catchment filters (located on the equatorial line) which then exits out the left-hand side hose.

Hot liquids can be handled in weightlessness, which makes it possible for the crew to cook fresh food in contact with water or prepare tea. They can even sterilize medical instruments with steam or in cooked water.

As special price Ulf Merbold (ESA Astronaut) invited us to participate in a parabolic flight campaign using the A300 Zero-G Airbus in France in November 2000. A functional prototype has recently been built to demonstrate the described capabilities. Presently, the GCF is being redesigned to meet appropriate certification standards.

http://discus.wh.uni-stuttgart.de/gcf/

# Hitex unterstützt DAvE

*Hermann Sailer*

DAvE ist der Digitale Applikations-Ingenieur von Infineon Technologies. DAvE kennt die Peripheriemodule der Microcontroller von Infineon und hilft dem Anwender bei der Auswahl eines geeigneten Mikrocontrollers. Wenn DAvE vom Anwender genug Information über die gewünschte Funktionalität erfahren hat, hilft DAvE sogar bei der Programmierung der Peripheriemodule.

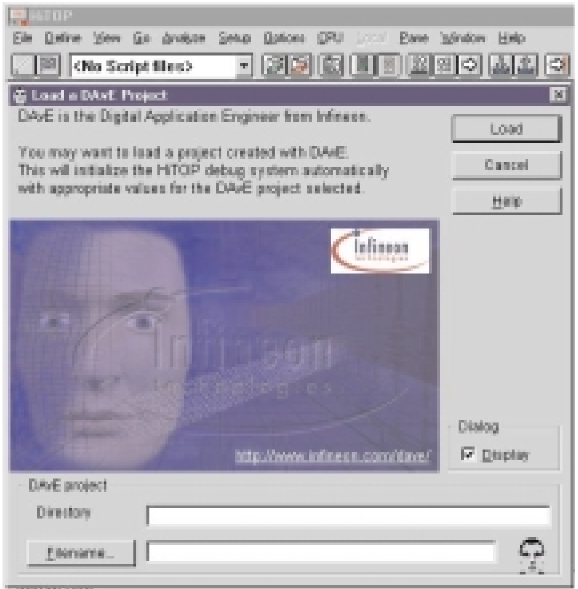


*Bild: Auswahl eines DAvE-Projekts beim Start von HiTOP*

HiTOP ist die Bedienoberfläche der In-Circuit-Emulatoren von Hitex. Ab Version V4.10 dieser Bedienoberfläche nutzt HiTOP das von DAvE gesammelte Wissen, um die In-Circuit-Emulatoren zu initialisieren. Wird beim Start von HiTOP ein DAvE-Projekt angegeben, ermittelt HiTOP hieraus z.B. das in diesem Projekt verwendete Mikrocontroller-Derivat. Dies erspart dem Anwender Arbeit, denn die Initialisierung des Emulators wird nun automatisch vorgenommen.

Die Test- und Analysewerkzeuge von Hitex gibt es für die TriCore-, C167- und C500-Familien von Infineon.

## Hitex

Die Hitex GmbH wurde im Jahre 1976 als Systemhaus gegründet und nimmt heute eine führende Position in der Entwicklung und Vermarktung von innovativen Softwareanalyse- und Testwerkzeugen im Bereich eingebetteter Systeme ein.

Als einer der "Top 5" - Hersteller weltweit reicht die Produktpalette von In-Circuit Emulatoren, Monitoren, Simulatoren, Debuggern und Evaluation Boards bis hin zu den passenden Adaptionen. Unterstützt werden Prozessoren und Mikrocontroller der wichtigsten Halbleiterhersteller wie AMD, Atmel, Dallas, Infineon, Intel, Motorola, NEC, Philips, STMicroelectronics und Texas Instruments.

Hitex ist mit eigenen Niederlassungen in USA, UK und Singapur vertreten und verfügt über ein dichtes Netz an internationalen Vertriebspartnern.

**Hitex Development Tools**
Greschbachstr. 12
D-76229 Karlsruhe
+49-721- 96 28–0, FAX:-149
E info@hitex.de
http://www.hitex.de