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P3E-Status

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On April 4 another meeting took place in Marburg to clarify the transponder situation and the antennas on P3E. On the previous day there was a meeting of the Board and the Project management to discuss the status of the modules and components of the P3E satellite and to deal with measures to take at the critical points.

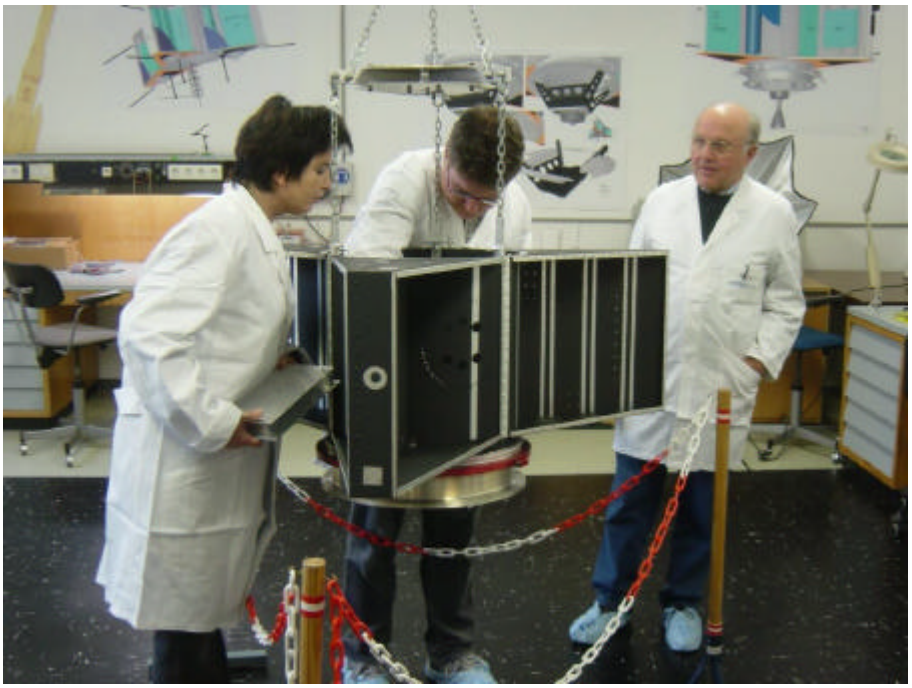

Fig 1: The mechanical integration of P3E makes progress in the integration of P3E in the AMSAT-DL laboratory in Marburg. (l. to r.: Heike Straube, Peter Osswald and Karl Meinzer)

The participants at the transponder meeting on April 4, 2004: Frank Sperber, Heike Straube, Ralph Lampenscherf, Karl Meinzer, Peter Gülzow, Henning Rech, Freddy de Guchteneire, Helmut Neidel, Ulrich Müller

Currently the U/V transponder and the S-band transponder are especially critical, however, a solution was found, to hopefully finish these projects in a timely fashion. Unfortunately, several HF specialists have left amateur radio completely, so we are experiencing these results. At earlier projects the module makers practically over-ran us, it now becomes more difficult to find competent people with suitable motivation. The general shortage of HF engineers as well as the economic conditions of many candidates is also felt here.

To help remedy this, there will be a cooperative work program with the technical college in Coburg. Project assignments for seventh semester students majoring in information and communication technology will be offered under the direction of Jochen Jirmann, DB1NT. A HF transponder that will fly on a satellite is certainly an interesting subject. At the meeting many questions presented by the module builders were clarified, especially in regard to space-qualified hardware requirements.

Battery Problem Solutions

Many members will certainly ask what after-effects followed from the failure of the batteries on AO-40. In the first instance it was planned to use only one main battery for P3E and to forgo a back-up battery based on space and weight considerations. This subject has to be viewed from a different aspect based on

Figure 2: The participants of the transponder meeting on April 4.: From left to right: Frank Sperber, Heike Straube, Peter Gülzow, Freddy de Guchteneire, Henning Rech, Helmut Neidel, Karl Meinzer, not in the picture Ulrich Müller, Ralph Lampescherf

the actual events on AO-40. The basic cause for the failure of the main battery on AO-40 is to be found in a short circuit in one of the three distributed battery banks with great probability, relative to the cabling, as a possible result of the propulsion system damage shortly after the launch. There is an apparent sudden voltage loss with that kind of a short circuit. In a normal 'death' of a battery in which several cells probably short circuit, there would be sufficient time to switch over to the back-up battery and to charge it up. The bi-state (latching) relays on AO-40 are fed from the bus voltage of 24 V, and still operate at 14 Volts according to brief experiments done at the previous P3D integration laboratory in Orlando, Florida, but not if the voltage is lower. The on-board computer receives its own 10 Volts, and obviously still operates, but this is not sufficient to switch over the batteries.

On the Mars rovers, Spirit and Opportunity, the temperature is the determining factor for the life expectancy of the batteries and therefor a switch-over was provided, in which the battery is completely cut off from the supply bus if the battery voltage is too low because of a defect, for example. Only once the energy cells deliver energy again on the Mars day, Mars Rover and the on-board computer wake up. At night all systems are dead, but at least in the daytime experiments can be undertaken.

On our satellite it isn't quite as simple, because the linear transponder needs the battery as a buffer to filter out performance peaks for optimum energy supply from the solar cells. Very limited operation would be possible without the battery. An auxiliary logic system had been provided on AO-40 in which one or both of the batteries was always in operation but operation is never possible without a battery. A electronic switch with power MOSFETs is being developed

that will still operate at low voltages after a battery defect, for example, to disconnect the defective battery so that the AO-40 problem is not repeated on P3E or P5A. If the switching needs to operate reliably and actually increase the redundancy, then P3E will also get a supplementary back-up battery. This AUX battery will be smaller, however, so that certain limitations must be made.

France Telecom and AMSAT-DL Sign a License Agreement for the Use of Turbo-Codes

Shortly a license agreement for the use of Turbo-Codes could be signed between the intermediary license holder "France Telecom" and AMSAT-DL. Thereafter the non-commercial use of the so-called Turbo-Codes will be permitted by AMSAT-DL for its missions P3E (earth orbit, launch 2005/2006) and P5A (Mars mission, launch window 2007 or 2009) as well as the AO-40 satellite currently in orbit. The earth segments of satellite users are included as long as the use is limited to the designated space travel missions. Distribution of sub-licenses through AMSAT-DL is therefor not anticipated. AMSAT-DL has sole control for the use in conjunction with Turbo-Codes is special, rearward looking method to make radio signals robust against noise incursions and a very low signal/nose ratio. In comparison to the forward error correcting code (FEC) combined with a convoluted code (Viterbi) the use of the patent protected Turbo-Codes for the Mars mission promise a 3 –4 dB improvement in the signal paths over the on-going methods. The signal paths between earth and the AMSAT-DL Mars probe P5A will either transfer more data in the same length of time or the earth antenna requirements can be reduced by approximately one third, depending on which requirement is in place.

The first prototypes for encoding and decoding using Turbo-Codes signals by the AMSAT-DL team were developed immediately after the signing of the agreement, and have already demonstrated their usefulness for the Mars mission of AMSAT-DL

IHU-3 News

Meanwhile, Lyle Johnson, KK7P, has been able to make some progress in the implementation of the new IHU-3 prototype. Although there is a smaller number of building blocks, the design and implementation are quite complex. Many functions are buried in the FPGA's, the programmable building blocks.

A new IHU was necessary because the complete satellite bus of P3E is controlled through the CAN-bus and new paths are laid out in the communications techniques. The demands of Turbo-Code signals also require additional hardware and increased demands on the performance capabilities of the processor. The new IHU-3 will also be installed on the Mars mission. There will be at least two on P3E, maybe even three new IHU-3 computers that will fly, in which each IHU can be used as primary on-board computer. Compared to previous systems, this first became possible with the introduction of the CAN-bus on the satellite. The third IHU-3 will possibly function as a RUDAK system and transmit pictures from different cameras to ground, for example.

Naturally IPS will be introduced as the operating system again, in which several basic modifications in the structure will become necessary, since the modem is based completely on software and this part must consequently operate from a flash memory. The previous IHU-2 and IHU-3 could be fully reset and loaded with software, while the IHU-3 is dependent on the software in the flash memory. However, a combination of several software and hardware watchdogs and other mechanisms are provided, so that it cannot end up in a catastrophe, so the new IHU-3 offers the at least same reliability as the good, old IHU-1.

Karl Meinzer, DJ4ZC, will concern himself personally mostly with the adaptation of the hardware related parts of the IPS, supported by James Miller, G3RUH, and Stefan Eckart, DL2MDL, who has especially taken on the translation of the Turbo-Codes.