

# Upgrading the Mark5 motherboard to the SE7520BD2 Server Board

Joint Institute for VLBI in Europe  
Martin Leeuwinga (leeuwinga@jive.nl)  
February 2008

## 1. Introduction

This document describes how to upgrade your Mark5 unit from the old Micro motherboard to the new Intel SE7520BD2 Server board.

If you already have the all parts for the Mark5B in your possession, you can save a lot of time, by installing the Mark5B front panel status LED's at the same time as the motherboard upgrade.

## 2. Parts you need

Before you start taking your Mark5 unit apart you should make sure that you have the following parts on hand.

- Intel SE7520BD2 Server Board
- Sub frame to accommodate the new Server Board (bought or self-made)
- Power supply Antec TruePower Trio 650 Watts (or equivalent)
- FPDP cable that's long enough, at least 6 cm, to bridge the gap between the StreamStor card and the I/O board (these two cards are further apart on the new motherboard). First read chapter 8 to decide whether you need this part or not.
- Mark5B front panel status LED's (if available)

## 3. Dismantling the Mark5

The first thing that needs to be done is taking the Mark5 unit apart.

- Remove the metal bay that holds the system disk
- Remove the power supply.
  - Remove the green 8-way backplane connector from the power supply
- Disconnect the flat cables from the backplane (number the cables with a marker, so you know how to reconnect them later on) and take out the StreamStor card
- Disconnect the data cables from the I/O Panel on the rear (label these cables as well for ease of reconnecting) and remove the I/O board
- Remove any other PCI-card

- Disconnect the CDROM drive from the motherboard
- Disconnect the wires coming from the power and reset switch and the power LED from the motherboard
- Remove the motherboard from the Mark5 case
- Remove the support plate for the motherboard, if any

#### **4. Installing the Mark5B status LED's**

(Skip this part if you don't have the LED panel)

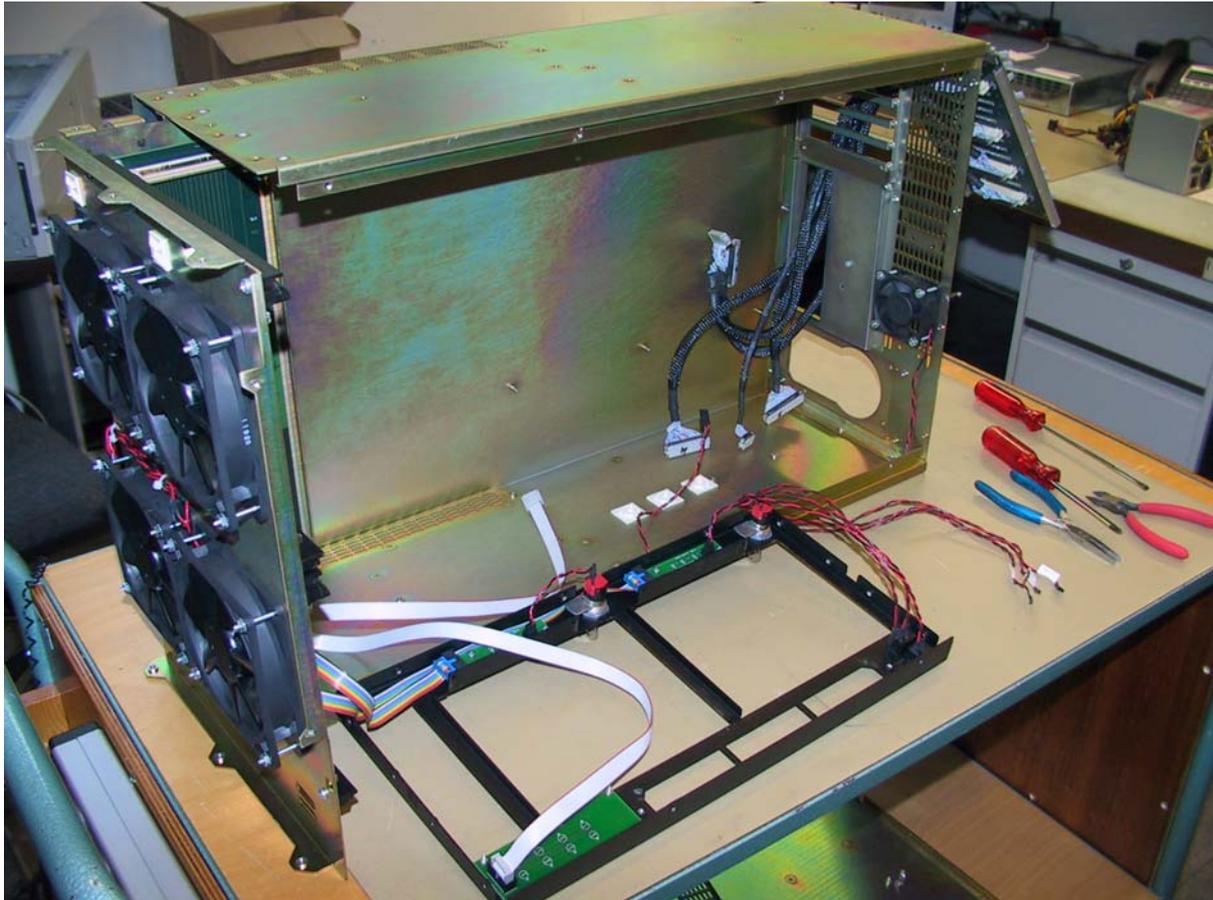
In order to install the Mark5B status LED panel onto the front of the case, we need to take the unit further apart. This is the reason why it's convenient to do this now instead of later on.

The LED panel needs to be mounted from the inside onto the front of the case. It replaces the rectangular metal cover on the lower right corner of the Mark5. The wires running to the switches and the power LED do not provide enough slack to simply remove the front of the case. The entire metal bay, that normally accommodates the disk packs, needs to be taken out as well. An advantage of this method is that it's very easy to tie up the flat cable of the LED panel before putting everything back together.

- First remove the filter covers from the air intakes at the front and the sides
- Remove the carrying handles from each side
- Remove the CDROM drive (four small screws at the right outside of the case)
- Undo the two small screws that are located underneath the front-side filter cover
- Flip the case over to one side and undo the two screws in the bottom at the front-end of the unit
- Place the unit back on its bottom and undo all the screws on both sides that hold the disk pack bay and the black front plate in place (10 screws on each side of the unit)
- Disconnect the cable from the mark5 backplane that powers the small fan in the back of the unit

You should now be able to carefully remove the entire front, together with the disk pack area from the rest of the cabinet. Remember that the wires to the switches still tie these two parts together.

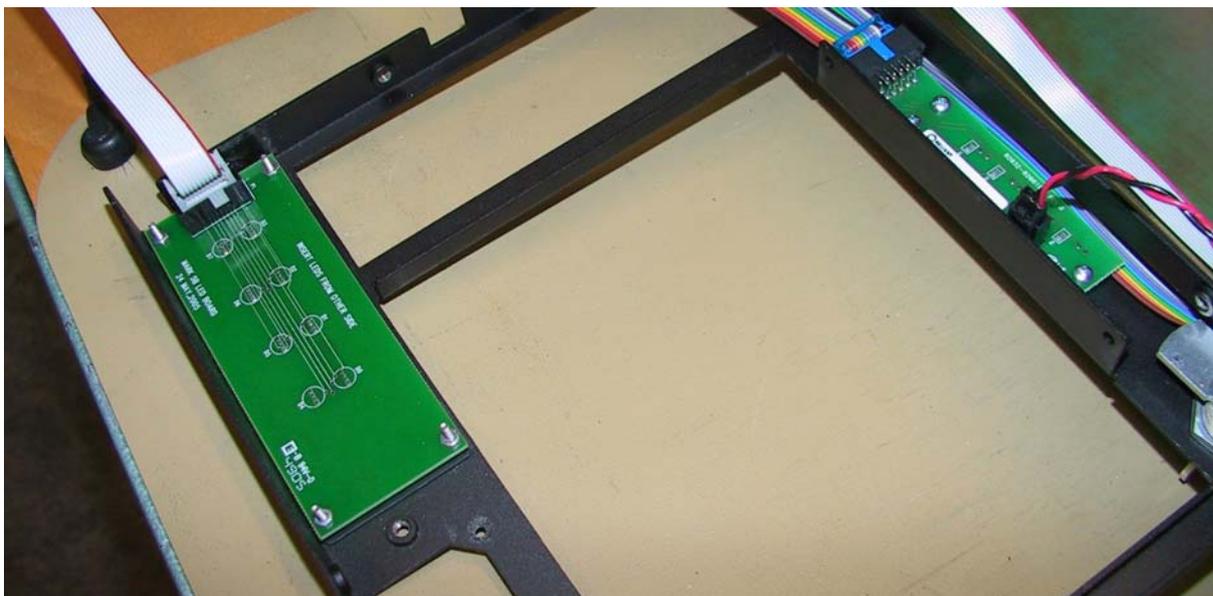
On the underside of the disk pack compartment, where the four big fans are located, you can see how the wires to the switches and power LED are tied to the case. Clip the plastic ties to release the wires and remove the front panel. Your Mark5 unit should now look something like the one in Picture1.



**Picture 1: Mark5 stripped for installation of Status LED panel.**

Next remove the black rectangular metal cover by undoing the four tiny nuts and replace it with the 8 tri-colored LED panel and its corresponding metal cover with the 8 holes in it.

The flat cable runs to the back of the unit and later on mates with connector J18 on the Mark5B I/O card.



**Picture 2: View of solder side LED panel. Red lead of ribbon cable marks pin 1.**

With the LED panel in place, we can start putting this end of the unit back together. First we mount the black front plate back on the disk bay area using the small screws that are normally hidden below the front side filter cover.

Before sliding this whole thing back into the case, we need to tie the red/black wires from the switches and power LED back onto the fasteners. The ribbon cable can be tied to the openings under the CDROM drive. It can be very useful for future maintenance to give the wires a few centimeters of slack, but make sure they can not get caught up in the fans, or block any air intake.

## 5. Motherboard Support frame

The new Intel server board supports two processors, each with its own heat sink. The weight of the copper heat sinks requires extra support underneath the motherboard. The original Mark5 case does not provide enough standoffs for this motherboard. Even the later models with the extra metal base plate on the bottom are not suited for this motherboard.

There are two solutions:

- 1) Make your own support frame.
- 2) Order a new Base plate from Conduant that will accommodate the SE7520BD2 Server Board.

Both solutions require a bit of work.

- 1) The self-made support frame is especially handy when your Mark5 is of an earlier model, where the motherboard is mounted on “long” standoffs directly on the bottom of the case. The support frame consists of an aluminum plate with standoffs mounted using the same spacing as the heat sinks mounting holes.

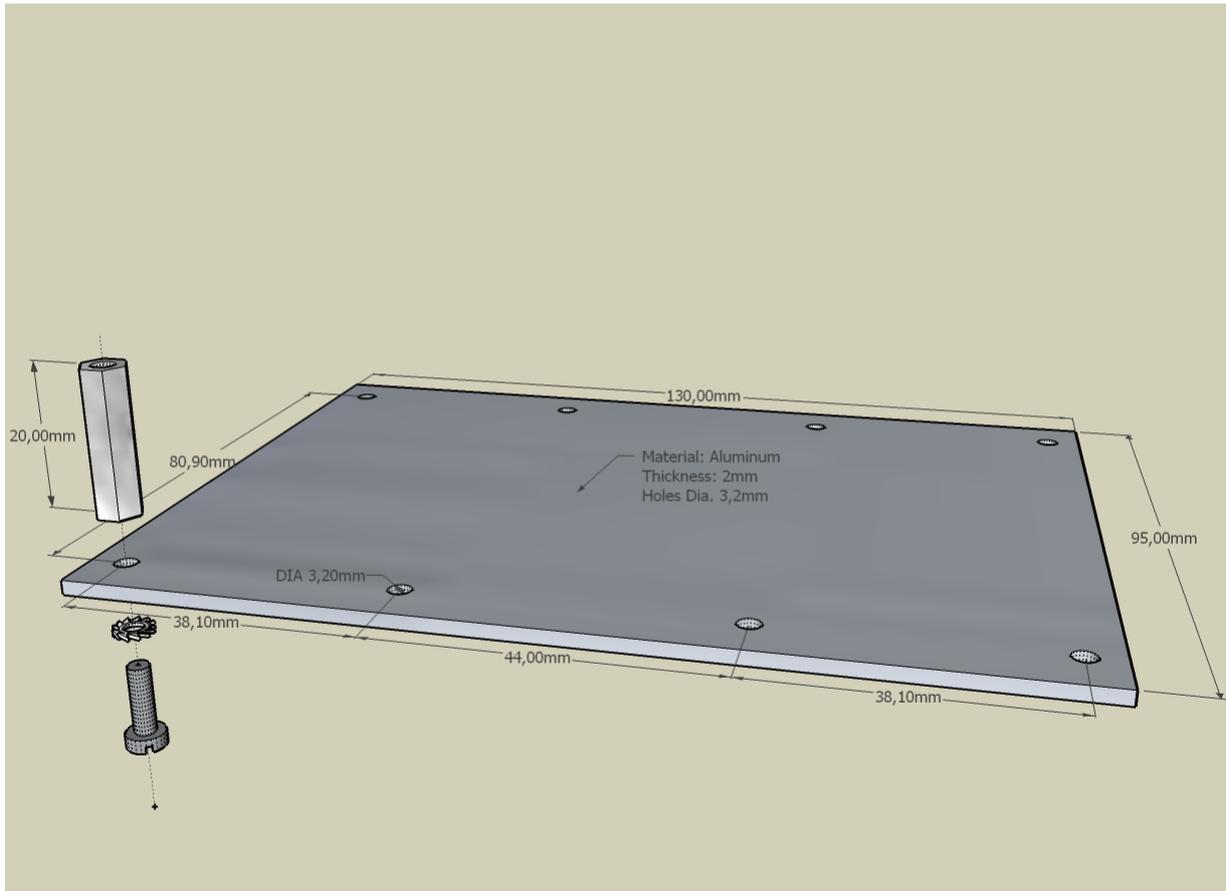
The length of the standoff plus the thickness of the aluminum plate plus the head of the bolt and washer add up to the total space between the motherboard and the bottom of the Mark5 case.

Picture 3 shows a mechanical drawing of the support frame with all the dimensions.

Because I didn't want any sharp nuts or bolts sticking out from underneath the bottom of the Mark5, I decided to use glue to secure the support frame to the bottom of the case. This way the underside of the Mark5 stays flat and even and you can still place it on a desk or a table without damaging the surface.

Fitting the support frame into the case so it lines up exactly with the holes in the motherboard is easy. Just mount the support frame to the underside of the motherboard, apply some glue and place the whole contraption into the Mark5. When the rest of the screws of the motherboard are in place, your support frame is automatically positioned right.

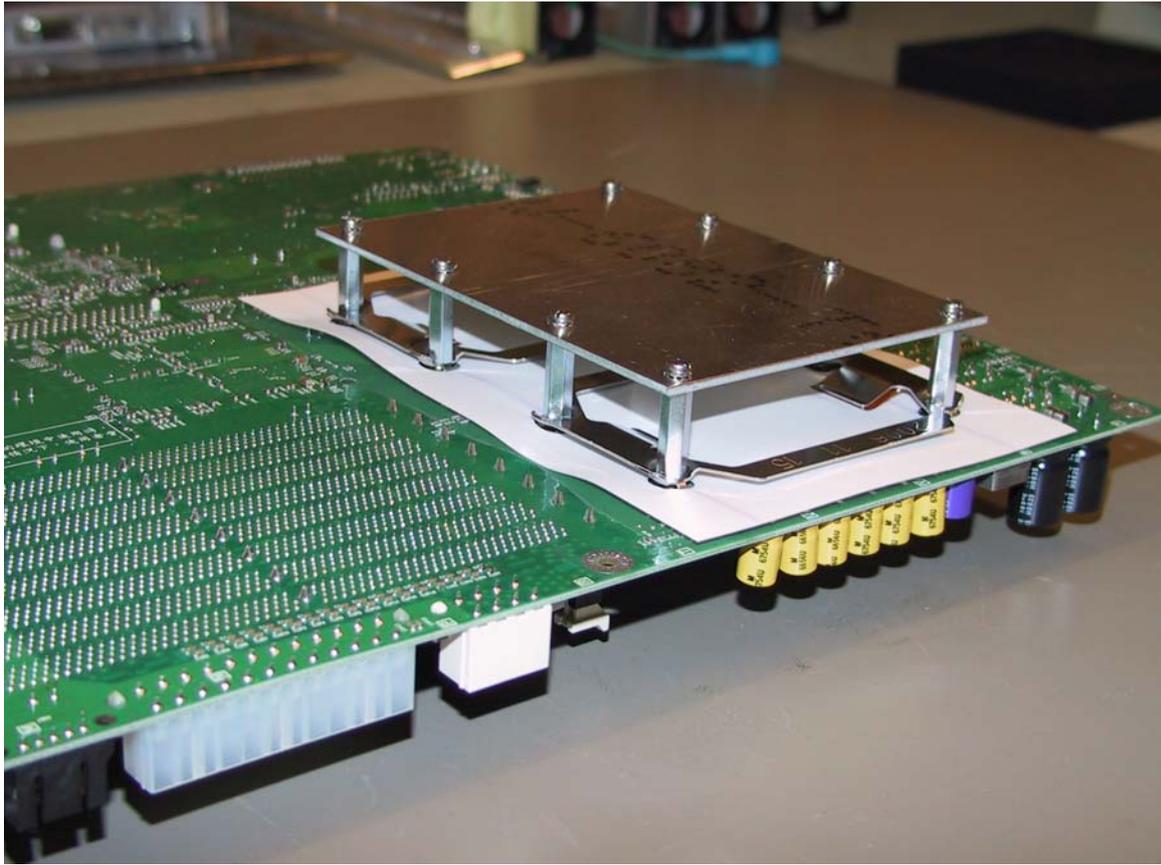
Pictures 4, 5 and 6 illustrate some of these steps.



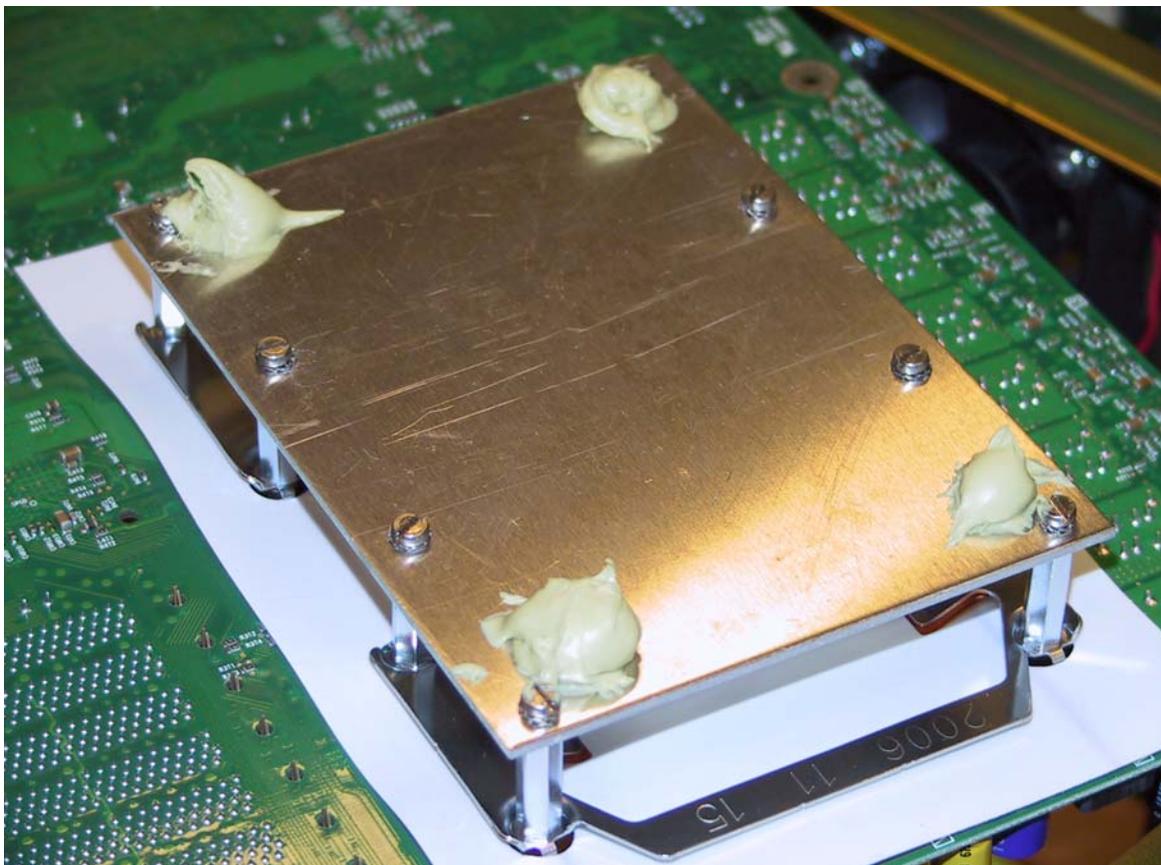
**Picture 3: Mechanical drawing of support frame with dimensions (zoom in)**



**Picture 4: Support frame**



**Picture 5: Support frame mounted on motherboard**



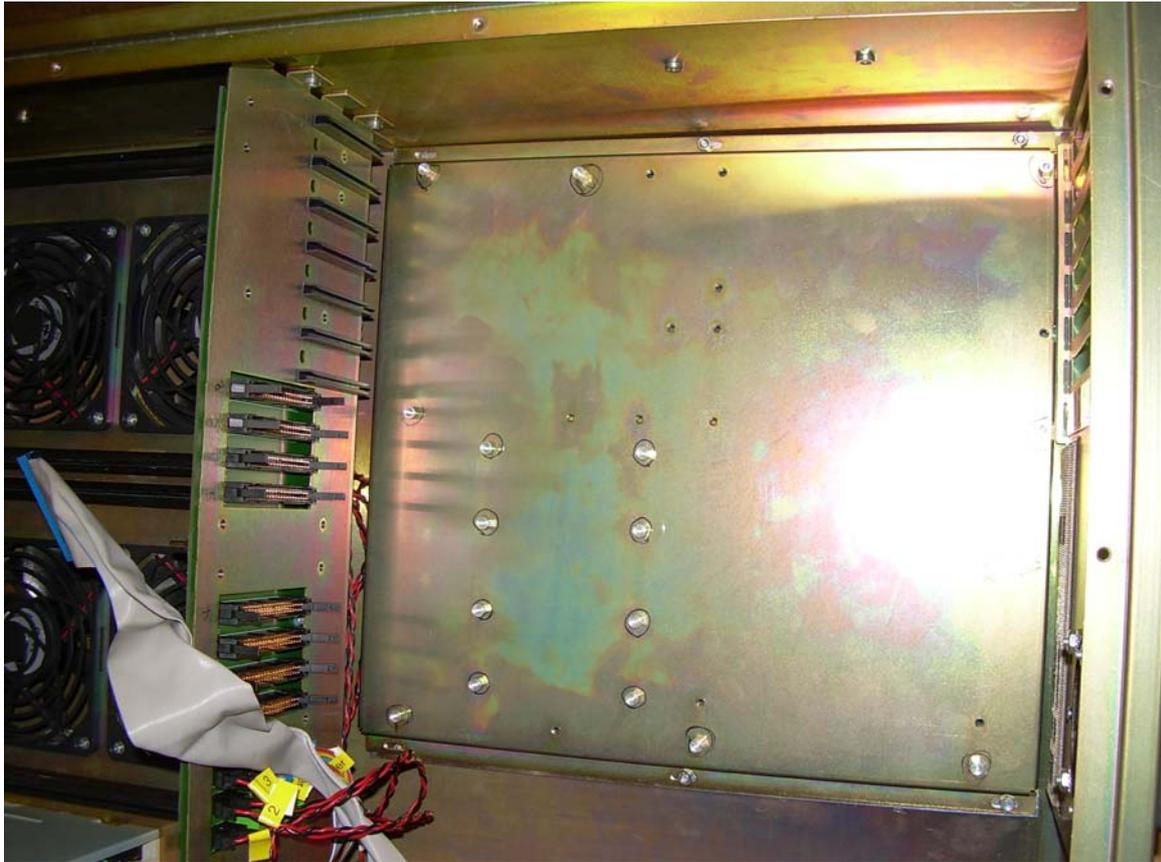
**Picture 6: Glue to fasten support frame to bottom of Mark5**

All the Mark5s here at Jive are fitted with the self-made support frame, even the ones that have the metal base plate on the bottom. I simply drilled eight 10mm holes in the metal plate, where the eight standoffs of the aluminum support frame stick through.

- 2) The ready-made base plate that you can order from Conduant can be fitted quite effortlessly in the Mark5, if it originally had such a base plate as well. Pictures 7 and 8 (courtesy of Roger Hammargren, Onsala Space Observatory, Sweden) show the new base plate with the proper standoffs for the new motherboard. But if your Mark5 didn't have the original base plate fitted, you will find that there are no posts on the bottom of the case to mount the new base plate on. Make sure that the new metal plate is delivered with the right size posts. You need to mount the posts in such a way that the metal plate is located exactly on the right spot and on the right height. Instead of posts Roger used a long aluminum rod on each side to fix the plate to the bottom of the case, as can be seen in pictures 7 and 8.



**Picture 7: Metal base plate with standoffs for server board. Note the long aluminum rod in the foreground, used to fix the plate to the bottom of the case.**



Picture 8: Plate mounted in case. Just visible are the aluminum rods underneath the base plate.

## 6. Temperature control

Before installing the motherboard, or even the support frame into the Mark5 case, it's wise to pay some attention to the internal airflow. With the new dual processor server board in place, the power dissipation will be much larger than with the old motherboard. Particularly when using two disk packs at the same time, the airflow inside the case does not provide enough cooling for the disk packs and overheating of the disks becomes a serious risk.

After carefully investigating we found out that the lower gap between the disk pack area and the mother board area needs to be closed of.

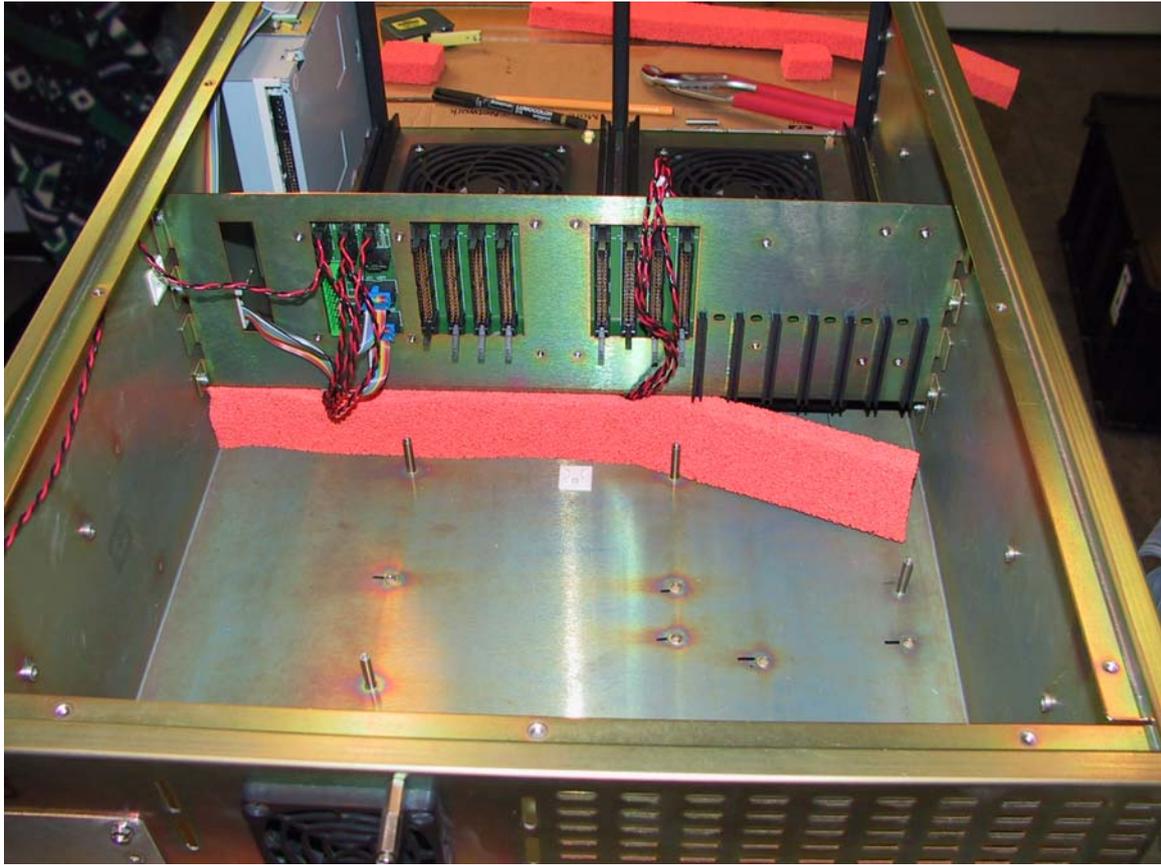
For a more detailed report on this subject click:

[evntog:mark5\\_disk\\_temperature2.pdf](evntog:mark5_disk_temperature2.pdf)

or

[http://www.jive.nl/dokuwiki/doku.php/evntog:mark5a\\_hardware](http://www.jive.nl/dokuwiki/doku.php/evntog:mark5a_hardware)

The solution to the airflow problem is shown in pictures 10 and 11.



**Picture 9: Closing the gap for a better airflow.**



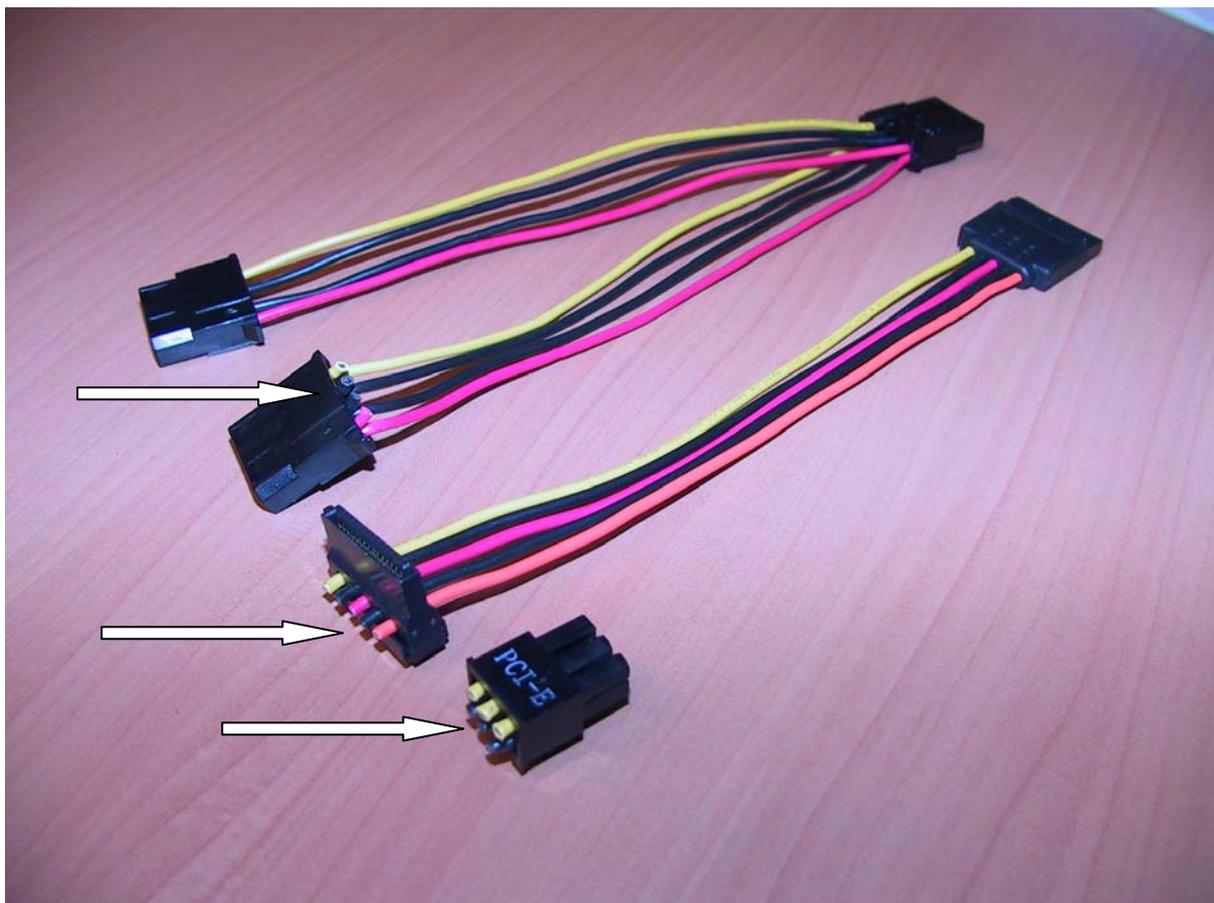
**Picture 10: Rubber foam in place**

## 7. Power supply

The Antec TruePower Trio 650 Watts needs a small modification before it can be put into the Mark5. The green 8-way power connector that feeds the backplane needs to be connected to the +12V, the +5V and the ground of the power supply.

It's important to divide the load for each voltage over several wires to the connector. Therefore we need to cut off some of the existing connectors of the power supply, but we want to keep the ones that we need for other purposes.

Picture 11 shows exactly which connectors we can cut off, without losing the possibility of powering the rest of the hardware.



**Picture 11: Arrows show where these connectors have been cut off from the power supply.**

Picture 12 shows a complete rebuild power supply. The orange 3.3V lead that originally belonged to the SATA power connector is insulated with a piece of shrink sleeve and tied up with the rest of the wires. The backplane connector now has 5x12V (yellow), 2x5V (red) and 7xGround (black) hooked up to it.



Picture 12: Power supply with backplane connector

## 8. StreamStor and I/O card

Figure 1 provides a high-level illustration of the Server Board SE7520BD2 with DDR2 memory (product codes SE7520BD2SATAD2, SE7520VD2SCSID2, SE7520BD2V2).

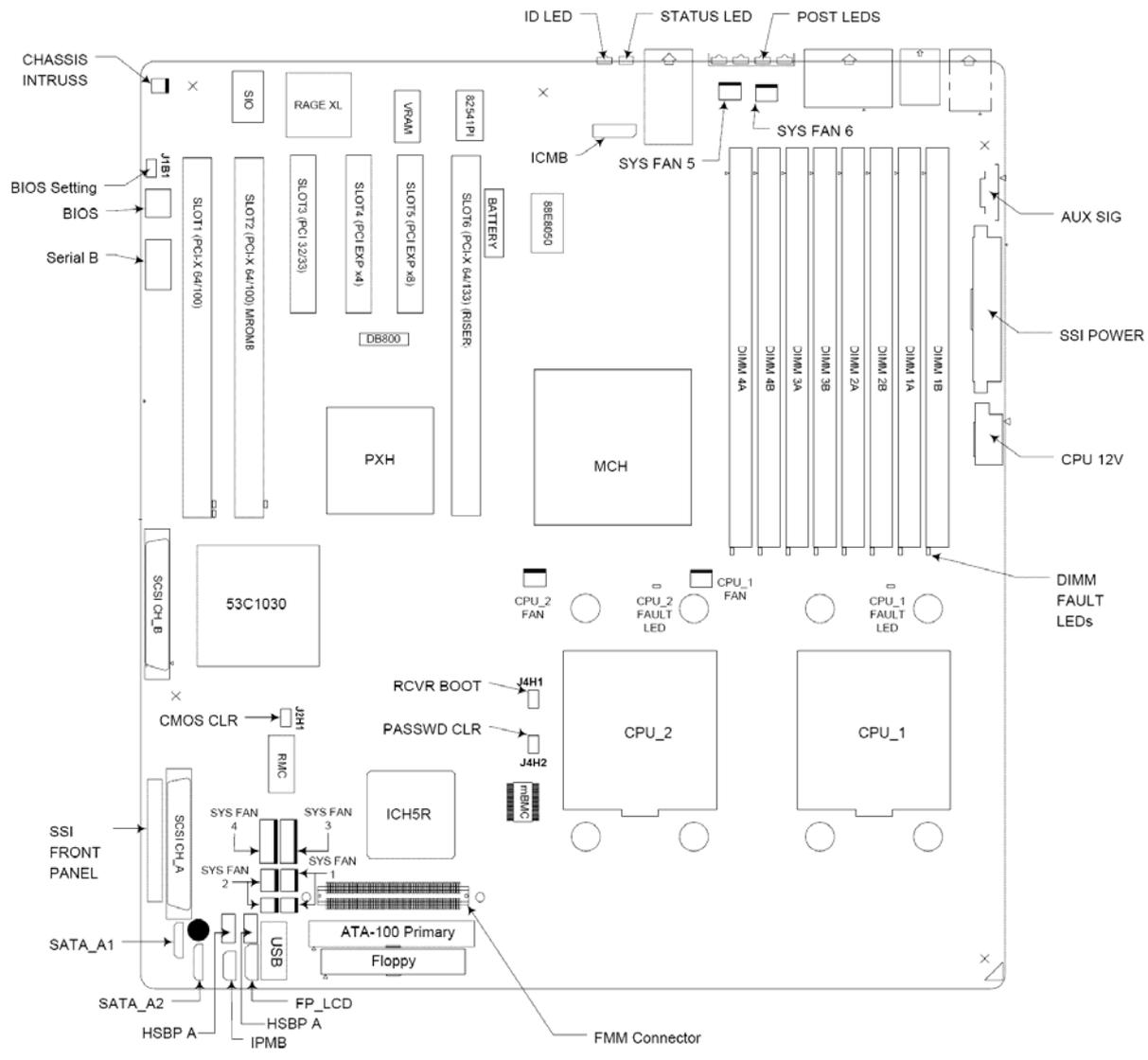
The Mark5A I/O board has a standard 32-bit PCI interface that plugs into slot 3 (PCI 32/33) of the motherboard.

The StreamStor card supports a 64-bit/66 MHz PCI bus, so in principle it could go in any of the three remaining PCI slots.

I've chosen for the traditional way of putting the I/O and the StreamStor boards in the motherboard, so the StreamStor card is placed in slot 6 (PCI-X 64/133).

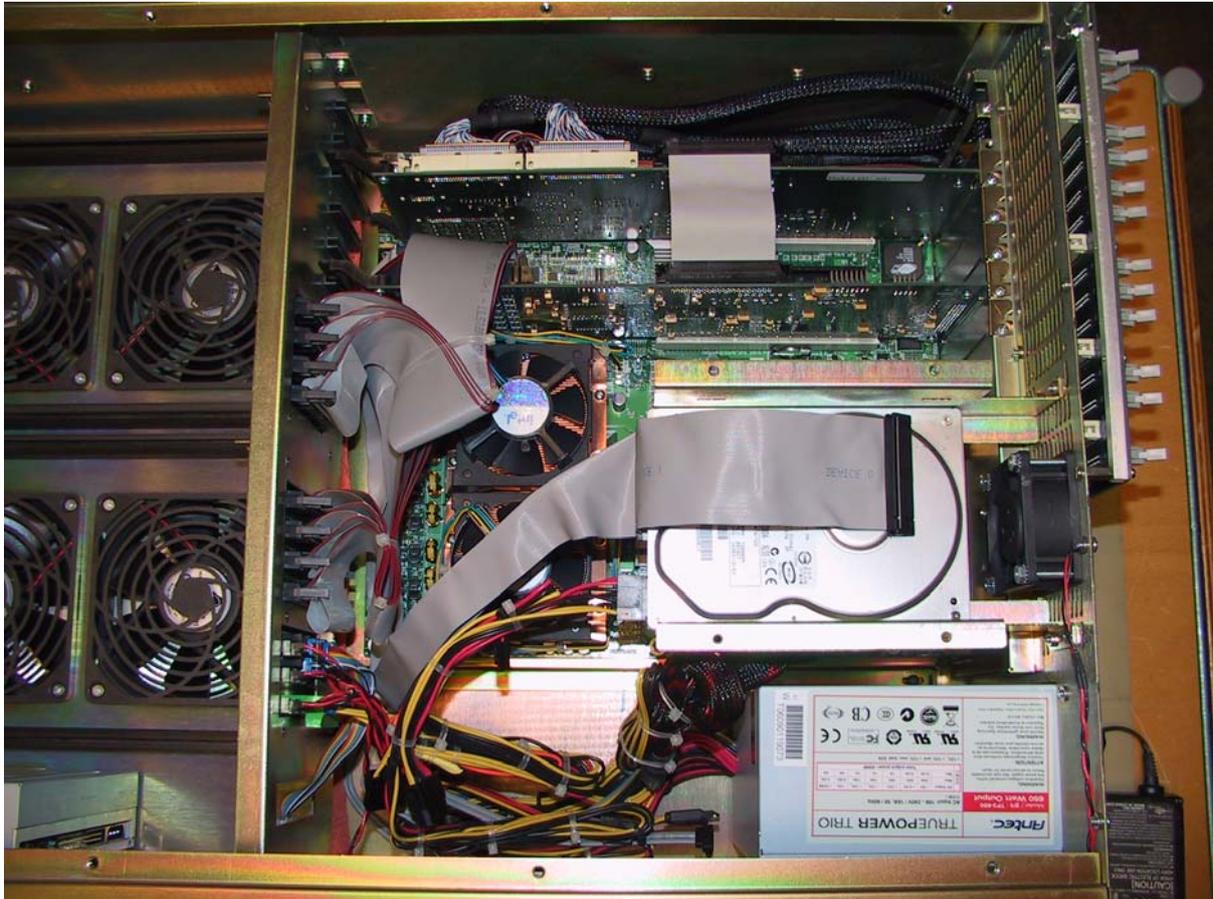
As a result of this placement, the original FPDP cable, which forms the 32-bit card-top bus, is not long enough to bridge the gap, between the StreamStor and the I/O card. Longer FPDP cables are available at Conduant, order code 300000001; they should be at least 6 cm long.

If you opt to put the StreamStor card in PCI slot 2, the short cable will do fine.



**Figure 1 Intel Server Board SE7520BD2 with DDR2 Memory**

Finally, picture 12 shows a completely refurbished Mark5. It's important to tidy up the inside of the unit after everything has been put in place. Tie up the cables and wires as much as you can to make sure they won't get caught up in the fans. This will also contribute to a better airflow inside the unit, and therefore better cooling.



Picture 13: Finished Mark5