



THESEUS/M7: Transient High Energy Sky and Early Universe Surveyor



Power Supply Units (PSUs) for THESEUS
M7 project – Phase A

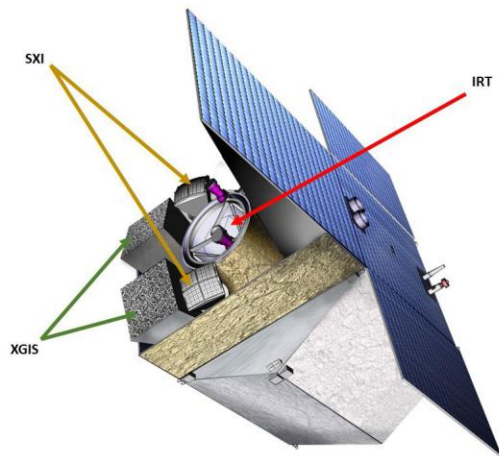
PRODEX Contract
1 November 2024 – 30 June 2026



Malgorzata Michalska malgosia@cbk.waw.pl
Witold Nowosielski witnow@cbk.waw.pl

THESEUS/M7: CBK PAN the closest co-operation

CBK is responsible for Power Supply Units (PSUs)
for 3 instruments: XGIS, IRT and SHI



- X-Gamma ray Imaging Spectrometer (XGIS)
- Soft X-ray Imager (SXI)
- InfraRed Telescope (IRT)

2 x PSUs for XGIS, PSU for XGIS DHU, SXI DHU & IRT DHU



IRT THESEUS/M7: Current CBK team



The team consists of three key persons

| | |
|----------------------|-----------------------------|
| Małgorzata Michalska | Project Manager |
| Witold Nowosielski | Senior Electronics Engineer |
| Paweł Baran | Electronic Engineer |

The new team member is electronic engineer Pawel Baran

He is graduated from the Faculty of Electronics of Warsaw University of Technology and he will take the role of the power supply designer



THESEUS/M7: CBK PAN

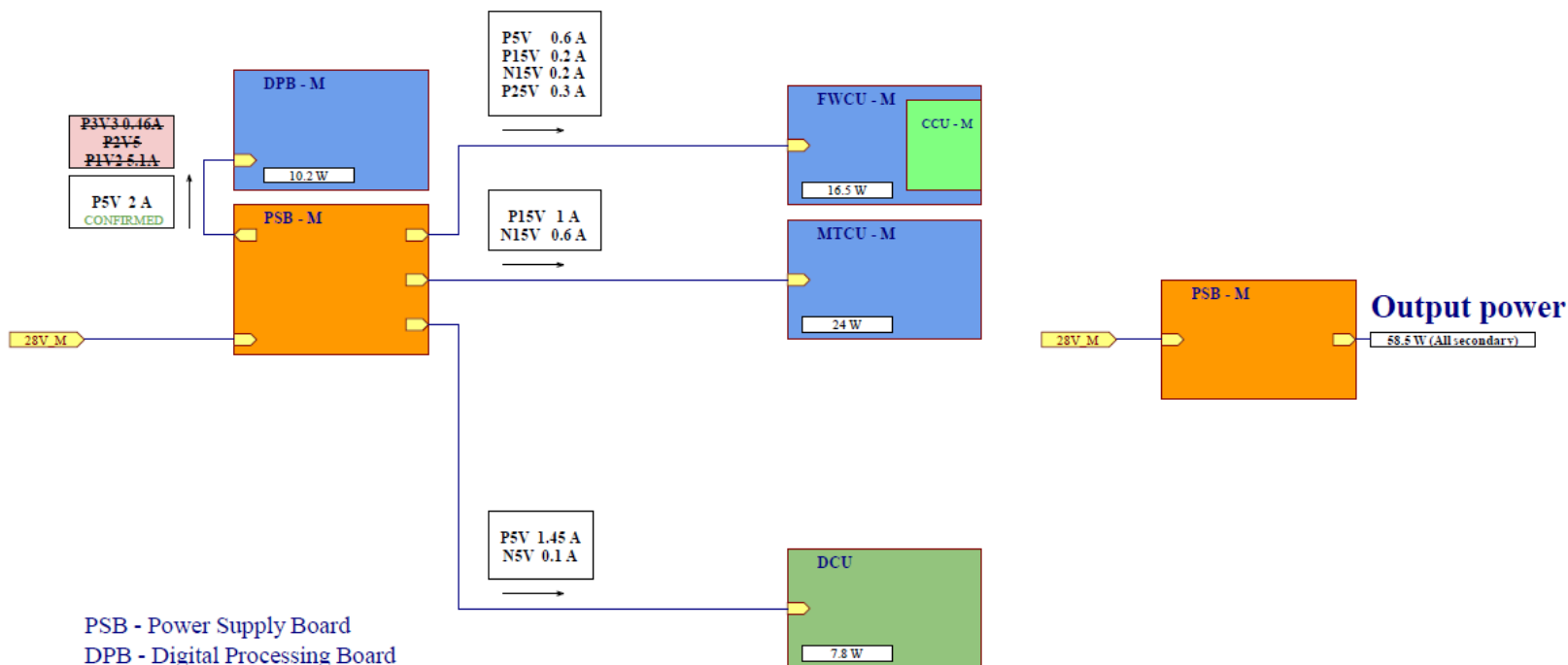
IRT PSU work plan – summary



- PSB parameters for IRT defined (*IRT Power Supplies definition v1.doc - draft 2 prepared by CEA*)
- Current changes in the PSU block schemes according to the parameters update of the requirements (eg. **relaxed values for DPB in IRT DHU – 1 line 5 V, 2 A instead of 3 lines**)
- CBK team continues to focus on the components and converters trade-off issue
- Volume issue for the PSB
- Request to ESA through CPSA about the converters with high efficiency (contact with Alter Co) – component screening, class of the components (DCDC converters).

IRT connections scheme without redundancy

All IRT instrument is powered from PSB (Power Supply Board) secondary lines



PSB - Power Supply Board
DPB - Digital Processing Board
FWCU - Filter Wheel
CCU - Calibration Unit Control
MTCU - M2 mirror Thermal Control
DCU - Detector Control Unit

CBK 15.10.2025



THESEUS/M7: CBK PAN

IRT PSB power interfaces



| PSB | Self-consummation Power (W) (30%) | | | Secondary Power (W) (70%) | | |
|----------------|-----------------------------------|---------|-------|---------------------------|------|------|
| mode | Stand by | Average | Max | Stb | Avg | Max |
| PSB - DPB | 1,7 | 4,4 | 4,4 | 4 | 10,2 | 10,2 |
| PSB – FWCU/CCU | 4,4 | 5,3 | 7,1 | 10,2 | 12,4 | 16,5 |
| PSB - MTCU | 5,14 | 6,17 | 10,29 | 12 | 14,4 | 24 |
| PSB - DCU | 1,97 | 3,34 | 3,34 | 4,6 | 7,8 | 7,8 |
| PSB -control | 0,64 | 0,64 | 0,64 | 1,5 | 1,5 | 1,5 |
| Total Power | Stand by | Average | Max | | | |
| PSU | 46,15 | 66,15 | 85,77 | | | |

THESEUS/M7: CBK PAN

IRT PSB voltage & current interfaces

| Secondary interfaces | Secondary Power (W) | | | Voltage | Current (A) | | |
|----------------------|---------------------|------|------|---------|-------------|------|------|
| mode | Stb | Avg | Mx | mode | Stb | Avg | Max |
| DPB | 4 | 10,2 | 10,2 | P5V | 0,78 | 2 | 2 |
| FWCU/CCU | 10,2 | 12,4 | 16,5 | P5V | 0,58 | 0,58 | 0,6 |
| | | | | P15V | 0,2 | 0,2 | 0,2 |
| | | | | N15V | 0,1 | 0,1 | 0,2 |
| | | | | P25V | 0,11 | 0,2 | 0,3 |
| MTCU | 12 | 14,4 | 24 | P15V | 0,4 | 0,6 | 1 |
| | | | | N15V | 0,4 | 0,36 | 0,6 |
| DCU | 4,6 | 7,8 | 7,8 | P5V | 0,9 | 1,45 | 1,45 |
| | | | | N5V | 0 | 0,1 | 0,1 |
| PSB | 1,5 | 1,5 | 1,5 | P3V3 | 0,45 | 0,45 | 0,45 |



THESEUS/M7: CBK PAN IRT PSU activities for phase A



DCDC converters trade-off

Compromise between using DCDC converters from well known manufacturers and making our own design like for the previous ESA projects (Exo-Mars, Herschel, ...). **Now we are taking into account the DCDC for 25 V.**

Advantages of DCDC from market:

- smaller volume,

Advantages of customer design:

- Fulfill better EMC requirements.

Disadvantages of DCDC from market:

- additional input and output filters needed to fulfill EMC requirements,
- Lower efficiency

Disadvantages of customer design:

- require more volume.



IRT THESEUS/M7: CBK PAN

Contribution to payload



DCDC trade-off

We must consider the choice between of:

- electronic components with long heritage, verified already in space

versus

- new and modern design (new more efficient DCDC converters)

IRT THESEUS/M7: CBK PAN

DCDC trade-off

On the one hand, a block scheme of power supply has been investigated from the point of view of the converters selection, on the other hand, the parameters and the efficiency of the DCDC converters, as the devices ready-to-buy, were analysed.



| MODELS | |
|--------------------|------|
| OUTPUT VOLTAGE (V) | |
| SINGLE | DUAL |
| 3.3 | ±5 |
| 5 | ±12 |
| 5.2 | ±15 |
| 12 | |
| 15 | |



SVHF2800S – Exact marking may differ from that shown

SVHF2800S SERIES

SPACE QUALIFIED HYBRID DC-DC CONVERTERS

Models Available

Input: 15 V to 50 V continuous, 80 V transient

Single output: +2.5 V, +3.3 V, +5 V, +5.2 V, +5.7 V, +12 V, or +15 V

Wattage: 8 – 20 W

MIL-PRF-38534: Class H and Class K, RHA level L



THESEUS/M7: CBK PAN

IRT PSU prototype design - solution



We need for the PSB board:

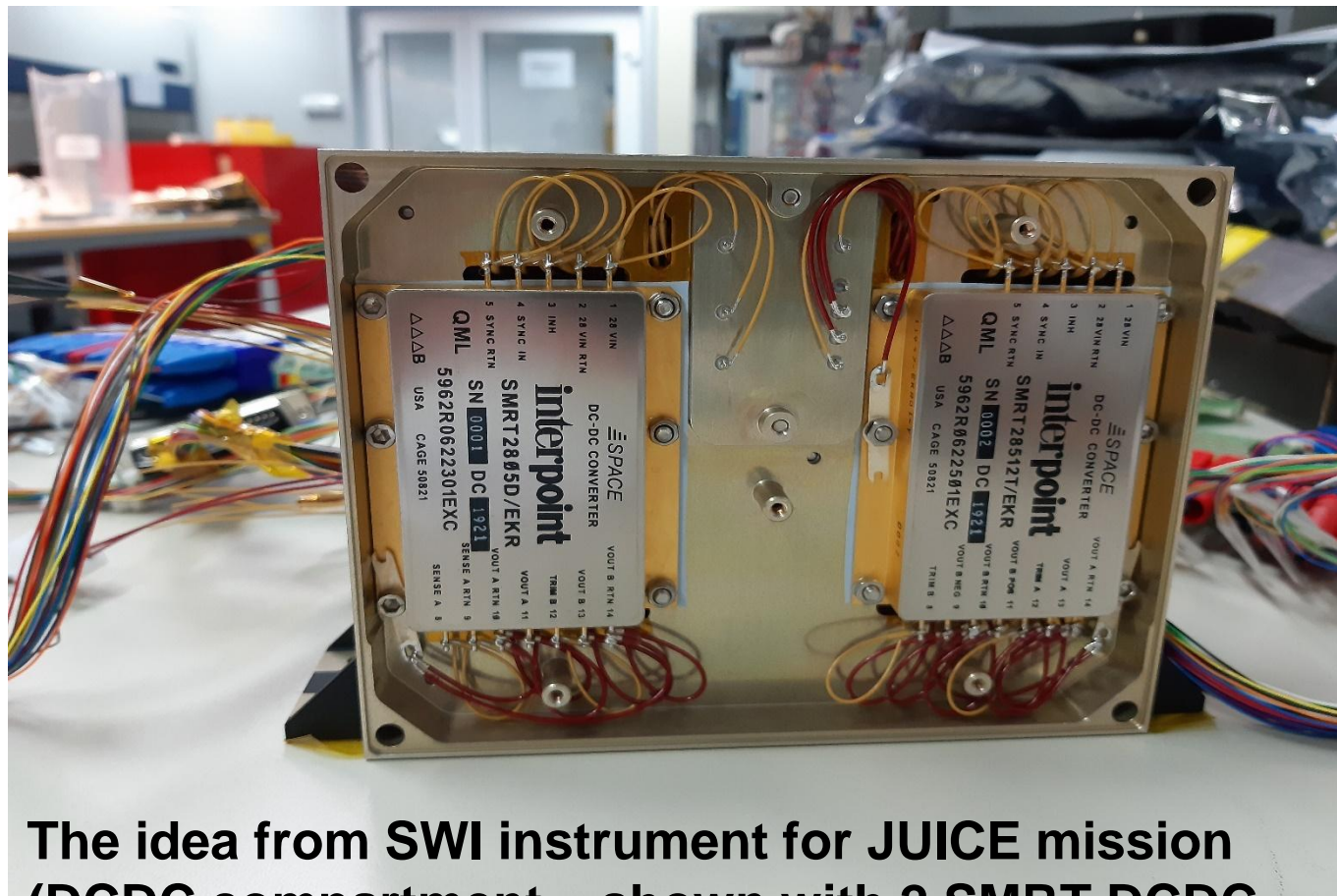
- Min. 5 DCDC converters type SVHF from VPT manufacture

Or

- 2 SMRT DCDC converters from Crane and 1 DCDC converters type SVHF from VPT

At the same time, we are awaiting Alter's proposals regarding the availability of converters selected for maximum efficiency.

THESEUS/M7: CBK PAN IRT PSU prototype mech. design - ideas



The idea from SWI instrument for JUICE mission
(DCDC compartment – shown with 2 SMRT DCDC
and 1 SVHF DCDC in the middle)



THESEUS/M7: CBK PAN IRT PSU solution



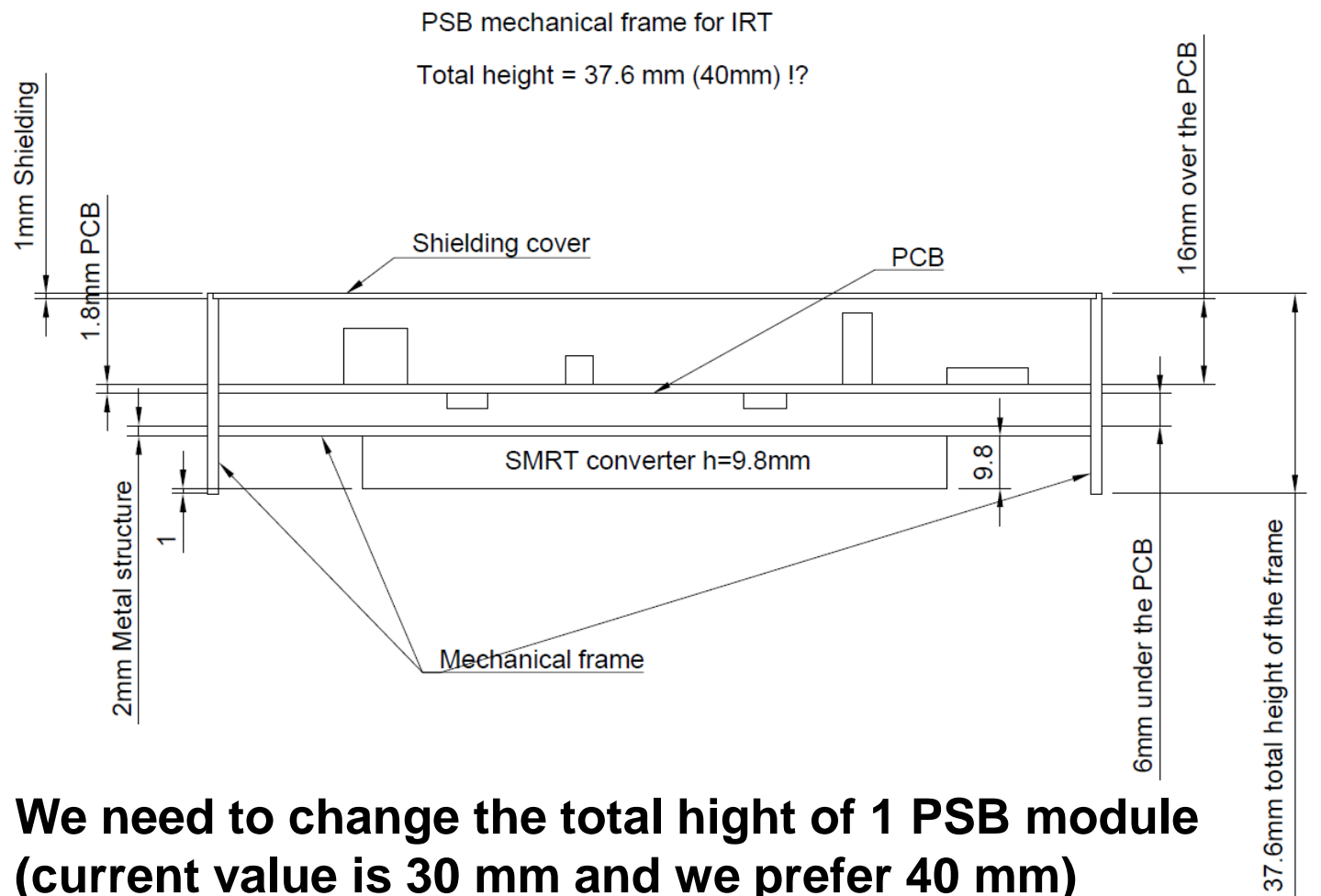
We need the extra volume for the DCDC compartment. It will be in the lower part of the module. The PCB for the rest of electronics will be mounted in the upper part of the module (over the DCDC compartment).

For the DCDC compartment we need additional 10 mm in height. It includes also shielding metallic plates between the modules.

So, we need to change the total height of 1 PSB module (current value is 30 mm and we prefer 40 mm) – next slide

THESEUS/M7: CBK PAN

IRT PSU conclusion - volume request



We need to change the total height of 1 PSB module (current value is 30 mm and we prefer 40 mm)



THESEUS/M7: CBK PAN IRT PSU ongoing activities



DOEEET
powered by ALTER

Dear CPSA user,

The following CRF has been submitted:

Task name: Selection of the high efficiency DCDC converters

Requester name: Witold Nowosielski

Company: Centrum Badań Kosmicznych PAN

Activities requested:

- CRF:

- Technical support
 - Parts Selection

[ACCESS THE SCIENTIFIC LOADING INSTRUMENTS CONSULTING PLATFORM](#)

The doEEEt.com TEAM.



THESEUS/M7: CBK PAN IRT PSU ongoing activities



Temat:RE: Doubt about CPA-ATN-CRF-0086

Data:Fri, 3 Oct 2025 07:38:02 +0000

Nadawca:Fernando ROMERO MADERA <fernando.romero@altertechnology.com>

Adresat:Witold Nowosielski <witnow@cbk.waw.pl>

Kopia:José ARROYO CASTILLO <jose.arroyo@altertechnology.com>

Dear Witold,

Thank you very much for the explanation, we can start working in your request now. However, could you clarify the quality level needed for the DC/DC converter? You have requested Class 1 components in the CRF, but we thought Theseus was a Class 3 missions. Are you searching for a QML K converter?

Best regards,
Fernando.

Our answer:

we confirm request on Class 1 component

THESEUS/M7: CBK PAN Warszawa



Thank you!