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## Paper Session I-B - Industrial Reflight of Eureka Platform in 1998

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## Industrial Reflight of EURECA Platform in 1998

**Following its first and highly successful mission in 1992/93 the European Retrievable Carrier EURECA will be taken over by industry, which will operate the platform and make it available to a broad range of users.**

Wolfram Lork and Karl Hochgartz

The reusable space platform Eureka was developed under the authority of the European Space Agency Esa and had its 11 months maiden flight in 1992/93. Launched and retrieved by the Shuttle the 4.5 ton-platform is capable of free-flying in a low earth orbit for a period of some 6-9 months and provides a stable high quality microgravity environment, good attitude accuracy and large payload resources. Together with the remote science operation capabilities, these features allow a wide range of scientific applications, i.e. astronomy, solar and atmospheric physics, earth observation, space technology, physical and life sciences under microgravity conditions.

Based on Esa's intention to foster the industrialization of space programmed, Esa intends to transfer the Eureka spacecraft and Esa's core payloads to Daimler-Benz Aerospace AG (Dasa), which has been the prime contractor for this platform. By this transfer (entered into force since January 1st 1996), Dasa has the responsibility and risk for overall mission implementation and the freedom to assemble a payload in accordance with user demands. It is planned that this will be performed by an international team of aerospace companies headed by Dasa.

### Payloads

The payloads of this first reflights are not finally defined. The majority of payloads are expected to come from the major space agencies, such as Esa, national European space agencies, Nasa and Nasda: In addition could participate other countries, who do not require a complete spacecraft but are interested in providing a payload for technology tests or application projects, e.g. in earth observation, communication or science. Interested users can assess the general capabilities of Eureka by comparing their payload requirements with the services offered

by Eureka and described in the payload accommodation handbook. The utilization of the following existing facilities from the Eureka- 1 microgravity payload complement is foreseen and Esa already indicated an interest in a partial reflight utilization: the automatic mirror furnace AMF, the multi-furnace assembly MFA and the exobiology and radiation research assembly ERA. With these instruments, Dasa can offer proven microgravity facilities.

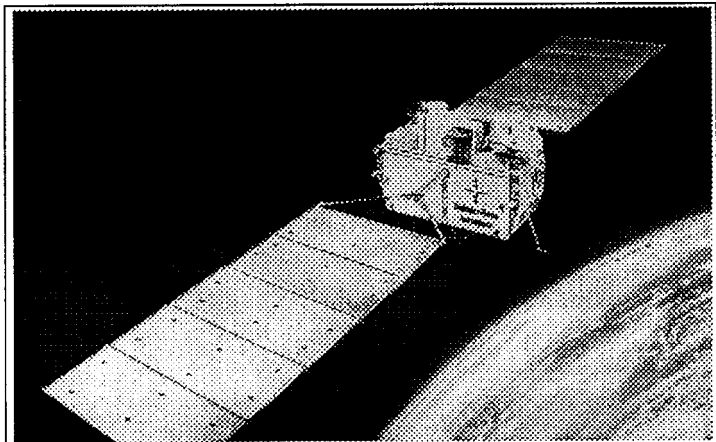


Fig. 1: Eureka, European Retrievable Carrier

### Payload Accommodation Capabilities and Utilization Opportunities

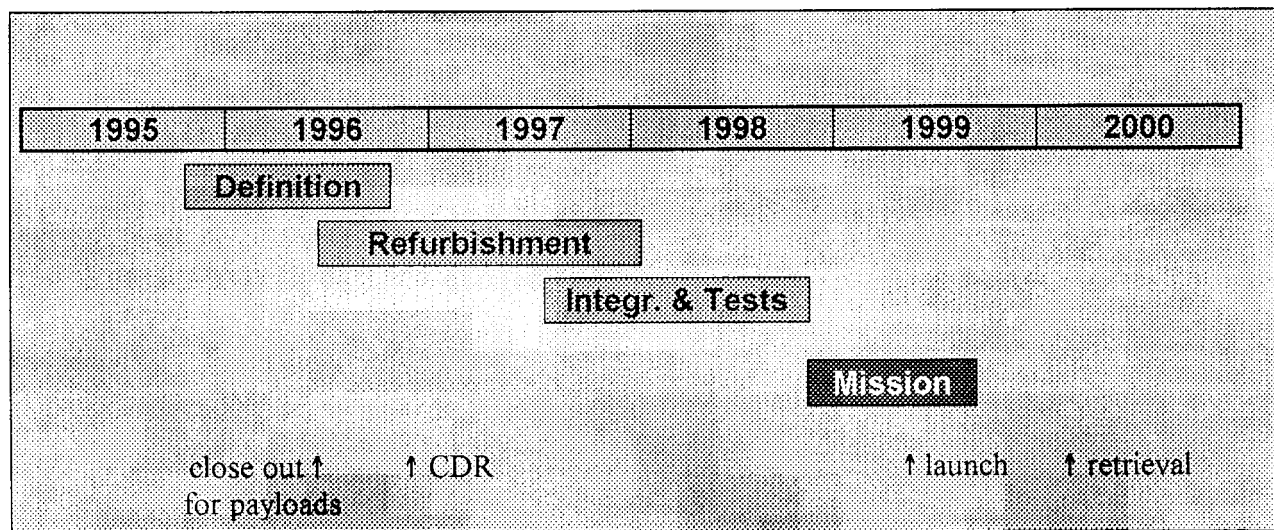
For the next mission a mixed payload from different customers is expected. Such a payload complement may include:

- microgravity facilities
- earth observation facilities
- space science instruments
- communications payloads
- technology demonstrations
- exposure facilities
- other applications

These facilities may be refurbished facilities from the Eureka-1 mission or new developed ones. Facilities can be provided by the customers or leased from Dasa. Agency experiments are as welcome as projects from the private sector. The programme is open for new ideas and corresponding proposals are welcome.

Eureka will be a complementary element in the utilization scenario of the Space Station, as a manned station base. As a co-orbiting platform it could serve in different roles in the overall scenario, from scientific use to operational and technological tests, where an independent powerful test vehicle is required. The co-orbiting feature may mean physically co-orbiting at a given distance to the Space Station, but may also mean using the same transport nodes in the logistics scenario or just offering an quiet undisturbed unmanned platform. For Europe it offers opportunities before the Columbus orbital facility is attached to the Space Station.

### Preparatory Schedule



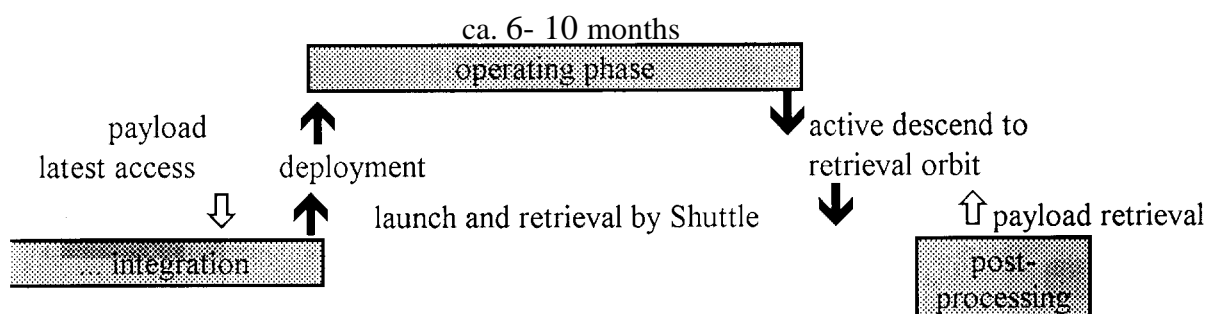
The first flight can be in 1998 with retrieval in 1999. Early 1996 will be reserved for the definition of the mission, i.e. announcement of flight opportunity, feasibility studies for accommodation of payloads, negotiations with customers and launch services and other planning and long lead items management.

Starting in 1996, 1997 will be required for the refurbishment of the spacecraft and of the existing Esa payloads. Manufacturing, integration and tests of new payloads has to occur in the same time frame at the payload manufacturers' sites. Integration of payloads and corresponding tests will be finalized in 1998 to be ready for launch. Currently the EURECA platform is not visible in the planning manifest as Esa's old launch date in 1997 is no longer feasible. The Shuttle flight manifest shows a tight schedule but ideas for appropriate slots are already existing, The payload shall be

defined by mid-1996, i.e. customers' firm commitments are required by this date to proceed with a proper mission preparation.

### **Mission Profile of Eureca-2**

As the payload is not defined yet, the corresponding mission profile cannot be presented in detail. But as it is assumed that Eureca-2 will be a multi-disciplinary mission, the profile of the first mission may serve as a reference. Launch, deployment and retrieval will be performed by the US-Shuttle. Eureca will manoeuvre into its nominal orbit of about 500 km and will be operational for 6-10 months before it deorbits again.



An integrated payload timeline during the operational period will ensure that experiments do not disturb each other.

In contrast to this nominal schedule, requiring two Shuttle missions for deployment and retrieval, it can be also discussed (if a sufficient number of customers are interested) to use a long duration Shuttle mission and retrieve the platform after of two weeks with the same Shuttle, This would especially offer interesting opportunities for life sciences experiments.

The inclination of the mission depends on the customers' requirements and the available Shuttle missions (manifesting).

### **Eureca Service**

A sufficient number of customers assumed, the Dasa end-to-end service for the customers includes:

- pre-mission support (incl. testing of payload EMs and/or FMs; Nasa safety reviews)
- payload integration and tests, transport to launch site
- launch,
- operation of spacecraft and payload, delivery of experimental data
- retrieval,
- deintegration and shipment of instruments and samples to the customers
- (optional utilization of up to three microgravity payload facilities)

The service on development or modifications/refurbishment of other payloads and related services can be handled by a separate contract.

### **Customers' Commitments/Prices:**

The identification and selection of payload candidates will be done in the first half of 1996 in an integrative manner. Launch reservations are accepted from beginning of 1996.

- Closing date for Notifications of Interest: May 31st 1996
- Closing date for experiment proposals: Sep 30th 1996
- Formal contracts: Nov 30th 1996

Prices will be dependent on variable parameters, such as mass, power, data link requirements and other resources. Dependent on these requirements, the prices will be less than \$ 100K per kg payload for the total mission, a utilization level of 90% or higher assumed. The price can be reduced by contributions in kind, such as services, which are required by the industrial team. It is expected, that a barter agreement will be established with Nasa, which will provide a free launch and retrieval service for EURECA and a free of charge utilization of a portion of the platform's resources for Nasa users,

Proportionally to the rate of utilization, Esa and other users have to cover the cost for the effort to refurbish, launch and operate the offered existing payload facilities

### **The International Team**

Esa's negotiations with Dasa on the transfer of Eureka were finally approved by the member states in February 1996. The corresponding agreement was signed early March 1996.

Dasa has the objective to realize Eureka reflight missions with the support of an international team, participating in the financial burden and risks on the one hand and on the other hand in the potential benefits. In the pursuit of this approach, Dasa has already invited companies from the Eureka development phase to consider their participation. To improve the marketing power, it is also planned to involve foreign companies in the programme, e.g. Spacehab Inc. in the USA or Mitsubishi Corp. in Japan.

It is a general understanding that the principle of cost-effectiveness will guide the distribution of tasks and work instead of geographical return rules.

### **Typical platform and mission features of Eureka are:**

- orbit 500 km
- inclination of 28.5°  
(inclination of Space Station 51.6°  
feasible, if slots available)
- microgravity quality better than  $10^{-5}g$   
(below 1 Hz)
- total payload mass: 1000 kg
- total payload power: 1000 W (28 VDC)
- active liquid cooling loop with cold plates  
as payload interface available
- payload accommodation on up to 11  
standard panels of 0.7 x 0.7 m
- total payload volume:  $8.5 \text{ m}^3$
- pointing accuracy better than  $1^\circ$ ; actually  
achieved  $0.2-0.3^\circ$   
(stability  $0.5^\circ/h$ )
- data uplink (telecommanding): 1.5 kb/s
- average payload data downlink:  
1.5 kb/s
- data interface system/payload by remote  
acquisition units (RAU) as on Spacelab or  
IEEE-equipped PIA
- high rate downlink by additional systems  
can be investigated
- on board mass memory: 128 Mbits (solid  
state bubble memory)
- higher on board data storage by additional  
systems (tape recorders) can be  
investigated

**Point of contact:**

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