ISS Facilities Hardware Catalogue Format for the Biotechnology Facility

I. Facility

1. Facility Full Name: The Biotechnology Facility

2. Sponsoring Agency: NASA

3. Co-Sponsors/Cooperation Agreements:

4. Builder/Main Contractor: TBD

5. Project Manager: Dr. Steve R. Gonda (JSC), Ron Porter (MSFC)

6. Project Scientist: Dr.Patton Downey (MSFC) - Protein Crystallization
   Dr. Neil Pellis (JSC) - Cell Culture and Tissue Engineering

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II. Facility Characteristics

1. Facility Type: The BTF is a permanent one-rack facility in which seven separate experiment modules can be integrated and exchanged with each Space Shuttle visit.

2. Targeted Research Fields: Protein Crystallization, Tissue Culture and Tissue Engineering.

3. Accommodation: US LAB

4. Launch Date: 2003

5. Status: The Biotechnology Facility (BTF) is nearing completion of definition (Phase A).

6. Facility Summary: The BTF is designed to meet the requirements of the science community for conducting low-gravity, long-duration biotechnology experiments. Changing science priorities and meeting advances in technology are easily accommodated by the BTF's modular design. Protein crystallization, cell culture and tissue engineering, and fundamental biotechnology experiments are supported by this facility.

The BTF is a one-rack facility in which seven separate experiment modules can be integrated and exchanged with each Space Shuttle visit. The BTF supports each experiment module with power conditioning and distribution, four different research grade gases, experiment computer control, and video signal switching and processing. A centralized command and data management interface with the Space Station, and limited data and video storage are provided.

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III. Facility Performance Data

PAYLOAD PARAMETER*	UNITS	OPERATIONAL REQUIREMENTS
Payload Mass (Including Rack Structure)	(kg)	800
Volume	(racks)	1
Run Duration	(hours)	720
Run Frequency	(runs/yr)	1
Nominal Power	(kW)	2
Nominal Power Duration	(hrs/run)	648
Peak Power	(kW)	2.6
Peak Power Duration	(hrs/run)	72
Nominal Data Generation Rate	(Kbits/s)	250
Nominal Data Generation Duration	(hrs/run)	648
Peak Data Generation Rate	(Kbits/s)	20,000
Peak Data Generation Duration	(hrs/run)	72
High Resolution Imagery Data Generation Rate	(Mbits/s)	20
High Resolution Imagery Data Generation Duration	(s/run)	615
Real-Time Downlink	(Y/N)	Y
Video Generation	(Y/N)	Y
Command Uplink/Transfer	(Y/N)	Y
Crew (Internal) Support	(hrs/run)	27
Resupply Logistics Mass/Year	(kg/yr)	210

Resupply Logistics Volume/Year	(middecks/yr)	7

** Resource required to operate all experiments.*

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IV. Resource Requirements

Duration: Longer-duration experimental runs will produce larger protein crystals and cell cultures, potentially making analysis more accurate, easier, and more plentiful.

Power: Experiments must be powered continually from launch until landing except for short transfer times between orbital vehicles. Biological samples are temperature sensitive and require a thermally controlled environment. Support systems that supply nutrients and oxygen are required to maintain cell viability.

Microgravity Environment: The quality of the microgravity environment required is probably less critical to Biotechnology than it is to other science disciplines. The microgravity environment is required to reduce buoyancy-driven flows and sedimentation.

Crew Availability: The BTF is being designed to minimize the amount of crew time required for facility maintenance. The amount of crew time required to support the resident experiments will vary, depending on the experiment complement.

Data: Each experiment is managed by a dedicated Experiment Control Computer (ECC) which captures all experiment data. The Facility Control Computer (FCC) receives and records all experiment and facility data and supports downlink of these data via standard International Space Station (ISS) means. The facility provides Ethernet and 1553 connections to the ISS and supports a variety of interfaces to resident experiments by means of the dedicated ECCs.

Telescience/Teleoperations: The BTF supports telescience by providing a network connection between the principal investigator (PI) and their experiment via the facility, ISS, Telescience Support Center, and Internet connections. This allows the PI to examine new data and safely interact with their experiment by examining readings, adjusting settings, and invoking changes in its operation without affecting other facility or experiment operations.

Additional Support: A glovebox is required to prepare and monitor samples on orbit and to conduct small science and technology investigations.

Access to Space and Rapid Return: Late access to the Shuttle middeck and early post-flight removal are required for biotechnology samples. Stability of protein crystals formed in space may begin to degrade when the crystallization process is terminated, limiting their utility for structural analysis. Three-dimensional tissue assemblies that are based upon delicate cellular interactions in the quiescent environment of space can be affected when exposed to Earth's gravitational environment. Samples are loaded 14 to 24 hours before launch, and removed 3 to 8 hours post-landing.

Keep Alive Power: The BTF requires power to be constantly supplied in order to ensure that no experiments are lost by compromising the experiment environment.

Low Temperature Storage: The BTF requires stowage in the Space Station's refrigerators and freezers. Cryogenic freezer volume is required for long-term storage of media components and some biological reagents and samples. Refrigerator/freezer volume is needed for the storage of experiment samples and for short-term storage of cell culture media and components. This stowage enables multiple crystallization and cell culture experiments to be completed during a single increment.