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ACOP

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Title :	INTEGRATION PLAN			

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CHANGE RECORD			
ISSUE	*DATE*	*CHANGE AUTHORITY*	*REASON FOR CHANGE AND AFFECTED SECTIONS*
1	October 2005		First issue

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SCOPE

The Integration Plan contains regulations governing the technical aspects for the assembly of the System, HW Units and the SW; the assembly of the integration products is defined per integration step.

1.1 DEFINITIONS

- Assembly – the build-up of the individual item
- Integration – the build-up of assembled items
- Manufacturing – the actual making of the items
- Test - the actual performance of an action/reaction on the item to ensure that the development , manufacture and assembly have been completed in an acceptable manner
- Verification – the proof that the items satisfy the requirements

1.2 LIST OF ACRONYMS

A

AAA	Avionics Air Assembly
ABCL	As-Built Configuration data List
ACOP	AMS-02 Crew Operation Post
ACOP-SW	ACOP Flight Software
ADP	Acceptance Data Package
AMS-02	Alpha Magnetic Spectrometer 02
APS	Automatic Payload Switch
AR	Acceptance Review
ASI	Agenzia Spaziale Italiana *(Italian Space Agency)*
ATP	Authorization To Proceed

B

BC	Bus Coupler
BDC	Baseline Data Collection
BDCM	Baseline Data Collection Model

C

CAD	Computer Aided Design
CCB	Configuration Control Board
CCSDS	Consultative Committee on Space Data Standards (standard format for data transmission)
C&DH	Command & Data Handling
CDR	Critical Design Review
CGS	Carlo Gavazzi Space
CI	Configuration Item
CIDL	Configuration Item data List
CM	Configuration Management
COTS	Commercial Off The Shelf
cPCI	CompactPCI (Euro Card sized standard interface to the PCI)
CSCI	Computer Software Configuration Item
CSIST	Chung Shan Institute of Science and Technology

D

DCL	Declared Components List
DIL	Deliverable Items List
DIO	Digital Input / Output
DML	Declared Materials List
DMPL	Declared Mechanical Parts List
DPL	Declared Processes List
DRB	Delivery Review Board
DRD	Document Requirements Description

E

EEE	Electrical, Electronic & Electromechanical

EGSE	Electrical Ground Support Equipment
EM	Engineering Model
ER	EXPRESS Rack
ERL	EXPRESS Rack Laptop
ERLC	EXPRESS Rack Laptop Computer
ERLS	EXPRESS Rack Laptop Software
EMC	Electro-Magnetic Compatibility
ESA	European Space Agency
EXPRESS	EXpedite the PRocessing of Experiments to Space Station

F

FEM	Finite Element Model
FFMAR	Final Flight Model Acceptance Review
FLASH	Rewriteable persistent computer memory
FM	Flight Model
FMECA	Failure Modes, Effects & Criticalities Analysis
FPGA	Field Programmable Gate Array
FSM	Flight Spare Model

G

GIDEP	Government Industry Data Exchange Program
GSE	Ground Support Equipment

H

HCOR	HRDL Communications Outage Recorder
HD	Hard Drive
HDD	Hard Disk Drive
HRDL	High Rate Data Link
HRFM	High Rate Frame Multiplexer
HW	Hardware

I

ICD	Interface Control Document
I/F	Interface
IRD	Interface Requirements Document
ISPR	International Space-station Payload Rack
ISS	International Space Station

J

JSC	Johnson Space Center

K

KIP	Key Inspection Point
KSC	Kennedy Space Center
KU-Band	High rate space to ground radio link

L

LAN	Local Area Network
LCD	Liquid Crystal Display
LFM	Low Fidelity Model
LRDL	Low Rate Data Link

M

MDL	Mid-Deck Locker
MGSE	Mechanical Ground Support Equipment
MIP	Mandatory Inspection Point
MMI	Man Machine Interface
MPLM	Multi-Purpose Logistic Module
MRDL	Medium Rate Data Link

N

NA	Not Applicable
NASA	National Aeronautics and Space Administration

NCR	Non Conformance Report
NDI	Non Destructive Inspection
NRB	Non-conformance Review Board
NSTS	National Space Transportation System (Shuttle)

O

OLED	Organic Light-Emitting Diode
ORU	Orbital Replacement Unit

P

PA	Product Assurance
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect (personal computer bus)
PCS	Personal Computer System
PDR	Preliminary Design Review
PEHB	Payload Ethernet Hub Bridge
PEHG	Payload Ethernet Hub Gateway
PFMAR	Preliminary Flight Model Acceptance Review
PLMDM	Payload Multiplexer De-Multiplexer
PMC	PCI (Peripheral Component Interconnect) Mezzanine Card
PMP	Parts, Materials & Processes
PROM	Programmable Read Only Memory
PS	Power Supply

Q

QM	Qualification Model

R

RFA	Request For Approval
RFD	Request For Deviation
RFW	Request For Waiver
RIC	Rack Interface Controller
ROD	Review Of Design
ROM	Read Only Memory
RX	Reception

S

SATA	Serial Advanced Transfer Architecture (disk interface)
S-Band	Space to ground radio link
SBC	Single Board Computer
SC MDM	Station Control Multiplexer De-Multiplexer
ScS	Suitcase Simulator
SDD	Solid-state Disk Drive
SIM	Similarity Assessment
SIO	Serial Input Output
SOW	Statement Of Work
SPF	Single Point Failure
SRD	Software Requirements Document
STS	Space Transportation System (Shuttle)
SW	Software

T

TBC	To Be Confirmed
TBD	To Be Defined
TBDCM	Training & Baseline Data Collection Model
TBDCMAR	TBDCM Acceptance Review
TBP	To Be Provided
TCP/IP	Transmission Control Protocol / Internet Protocol
TFT	Thin Film Transistor
TM	Telemetry
TRB	Test Review Board
TRR	Test Readiness Review
TRM	Training Model
TX	Transmission

U

UIP	Utility Interface Panel
UMA	Universal Mating Assembly
USB	Universal Serial Bus

#

100bt	Ethernet 100Mbit Specification
1553	Reliable serial communications bus

2. DOCUMENTS

2.1 APPLICABLE DOCUMENTS

AD	Doc. Number	Issue / Date	Rev.	Title / Applicability
1	SSP 52000-IDD-ERP	D / 6/08/03		EXpedite the PRocessing of Experiments to Space Station (EXPRESS) Rack Payloads Interface Definition Document
2	NSTS/ISS 13830	C / 01/12/1996		Implementation Procedures for Payloads System Safety Requirements – For Payloads Using the STS & ISS.
3	JSC 26493	17/02/1995		Guidelines for the preparation of payload flight safety data packages and hazard reports.
4	SSP 50004	April 1994		Ground Support Equipment Design requirements
5	SSP-52000-PDS	March 1999	B	Payload Data Set Blank Book
6	SSP 57066	October 28, 2003		Standard Payload Integration Agreement for EXPRESS/WORF Rack Payloads
7	GD-PL-CGS-001	3 / 17/03/99		PRODUCT ASSURANCE & RAMS PLAN
8	SSP 52000 PAH ERP	Nov. 1997		Payload Accommodation Handbook for EXPRESS Rack
9	SSP 50184	D / Feb. 1996		Physical Media, Physical Signaling & link-level Protocol Specification for ensuring Interoperability of High Rate Data Link Stations on the International Space Program
10	SSP 52050	D / 08/06/01		S/W Interface Control Document for ISPR ***ONLY FOR HRDL, SECTION 3.4 ***
11	ECSS-E-40	A / April 1999	13	Software Engineering Standard
12	AMS02-CAT-ICD-R04	29/08/2003	04	AMS02 Command and Telemetry Interface Control document. Section AMS-ACOP Interfaces
13	SSP 52000-PVP-ERP	Sept. 18, 2002	D	Generic Payload Verification Plan EXpedite the PRocessing of Experiments to Space Station (EXPRESS) Rack Payloads
14	NSTS 1700.7B	Rev. B Change Packet 8 / 22.08.00		Safety Policy and Requirements for Payloads using the STS
15	NSTS 1700.7B Addendum	Rev. B Change Packet 1 01.09.00		Safety Policy and Requirements for Payloads using the International Space Station
16	SSP 52005	Dec. 10, 1998		Payload Flight equipment requirements and guidelines for safety critical structures
17	NSTS 18798B	Change Packet 7 10.00		Interpretation of NSTS Payload Safety Requirements
18	MSFC-HDBK-527	15/11/86	E	Materials selection list for space hardware systems Materials selection list data
19	GD-PL-CGS-002	1/ 12-02-99		CADM Plan
20	GD-PL-CGS-004	2/07-04-03		SIW Product Assurance Plan
21	GD-PL-CGS-005	2/09-05-03		SW CADM Plan
22	00-ACP-00.002	OCT 2005	DRAFT	ACOP MECHANICAL ICD

Table 2-1 Applicable Documents

2.2 REFERENCE DOCUMENTS

RD	Doc. Number	Issue / Date	Rev.	Title
1	GPQ-MAN-02	1		Commercial, Aviation and Military (CAM) Equipment Evaluation Guidelines for ISS Payloads Use
2	BSSC (96)2	1 / May 96		Guide to applying the ESA software engineering standards to small software projects
3	GPQ-MAN-01	2 / Dec. 98		Documentation Standard for ESA Microgravity Projects
4	MS-ESA-RQ-108	1 / 28-Sep-2000		Documentation Requirements For Small And Medium Sized MSM Projects
5	PSS-05			Software Engineering Standards
6	GPQ-010	1 / May 95	A	Product Assurance Requirements for ESA Microgravity Payload. Including CN 01.
7	GPQ-010-PSA-101	1		Safety and Material Requirements for ESA Microgravity Payloads
8	GPQ-010-PSA-102	1		Reliability and Maintainability for ESA Microgravity Facilities (ISSA). Including CN 01
9	SSP 52000-IDD-ERP	E / 09/09/03		EXpedite the PRocessing of Experiments to Space Station (EXPRESS) Rack Payloads Interface Definition Document
10	ACD-Requirements-Rev-BL	September 2005	Base Line	ACOP Common Design Requirements Document
11	AM9408-Z			ACOP ASSEMBLY
12	AM9408-01			CHASSIS ASSEMBLY
13	AM9408-08			DOOR ASSEMBLY
14	AM9408-12			FAN ASSEMBLY
15	ACP-PL-00.006	1 / Oct 05		INSPECTION PLAN
16	ACP-PL-CGS-009	1 / Oct 05		SW VERIFICATION PLAN
17	ACP-RP-CGS-003	2 / Oct 05		ACOP Design Report
18	ACP-RP-CGS-007	1 / Oct 05		ACOP Fracture Control Report

Table 2-2 Reference Documents

3. DESCRIPTION OF ACOP

The ACOP System is a reliable special purpose computer intended to fly on the International Space Station (ISS) as a payload installed into an EXPRESS ISPR in the NASA US laboratory module. The main objective of ACOP is to provide an ISS Internal Facility capable of supporting the AMS-02 experiment by recording the Science data.

In particular, ACOP shall allow a more flexible and efficient use of ISS telemetry downlink, providing a backup of data generated by AMS-02 and preventing, in this way, possible losses of valuable data. In addition, ACOP provides a control and monitoring interface for the on-board crew to the external AMS payload. It also permits large software uploads into AMS.

ACOP is not designed to provide safety critical commands to AMS-02.

The ACOP system shall be installed in the U.S. Laboratory Module, on the ISS, in one EXPRESS rack (see, for reference, Figure 3-1).

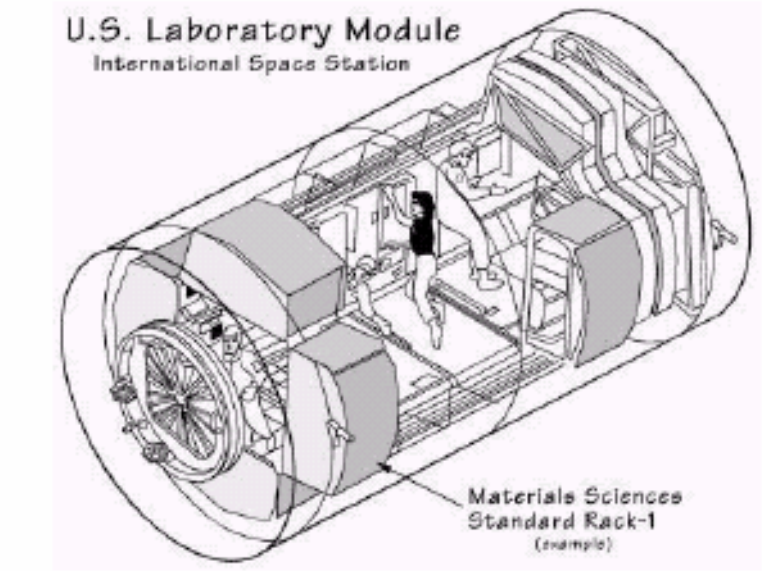


Figure 3-1 US Lab

The standard configuration of an EXPRESS Rack is commonly known as 8/2. This means the rack can accommodate eight ISS Locker / Middeck Locker (MDL) units and two International Subrack Interface Standard (ISIS) units, as shown in Figure 3-2 and Figure 3-3. Figure 3-4 shows ACOP installed in such a rack (the location within the rack is just an example, the actual location will be determined by the ISS program).

On-board spare parts, including hard drives shall be accommodated in a standard soft bag (CTB).

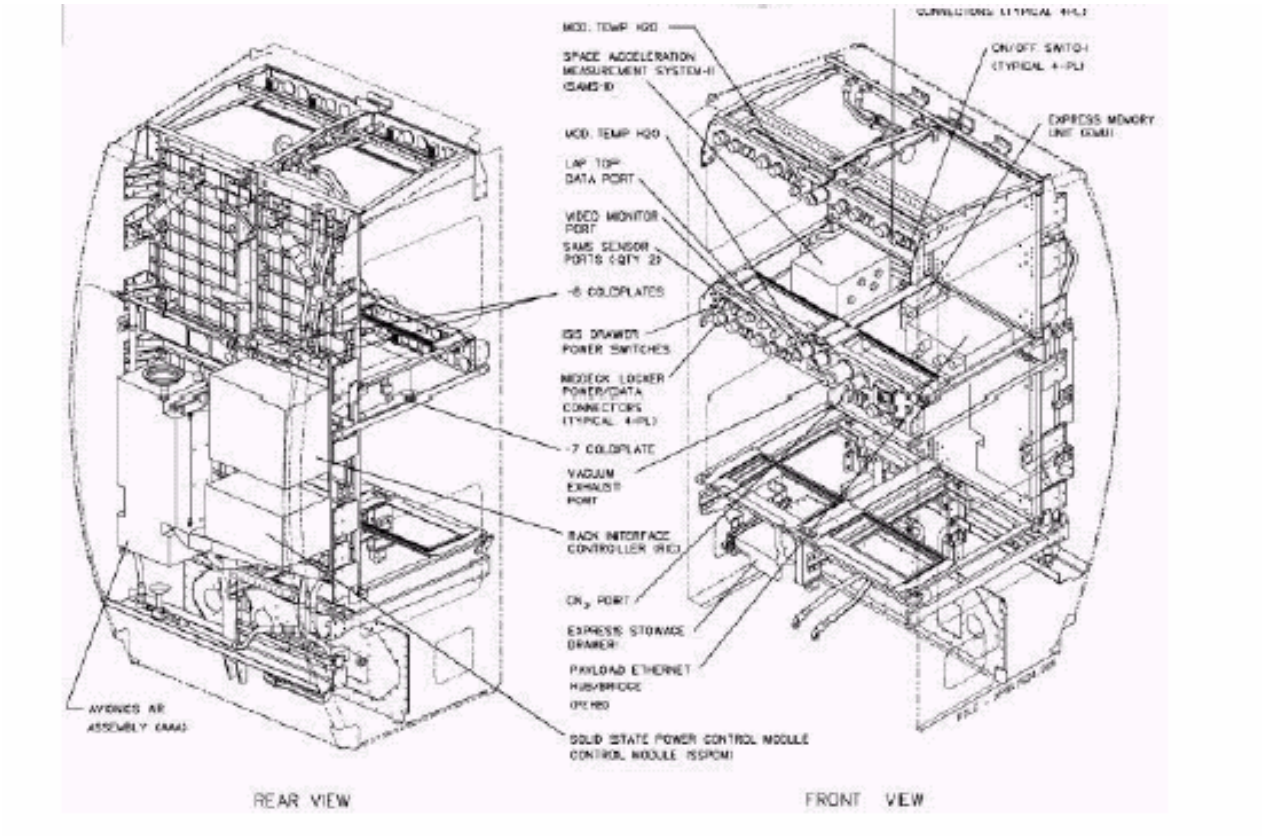


Figure 3-2 Example of an EXPRESS Rack (3D view)

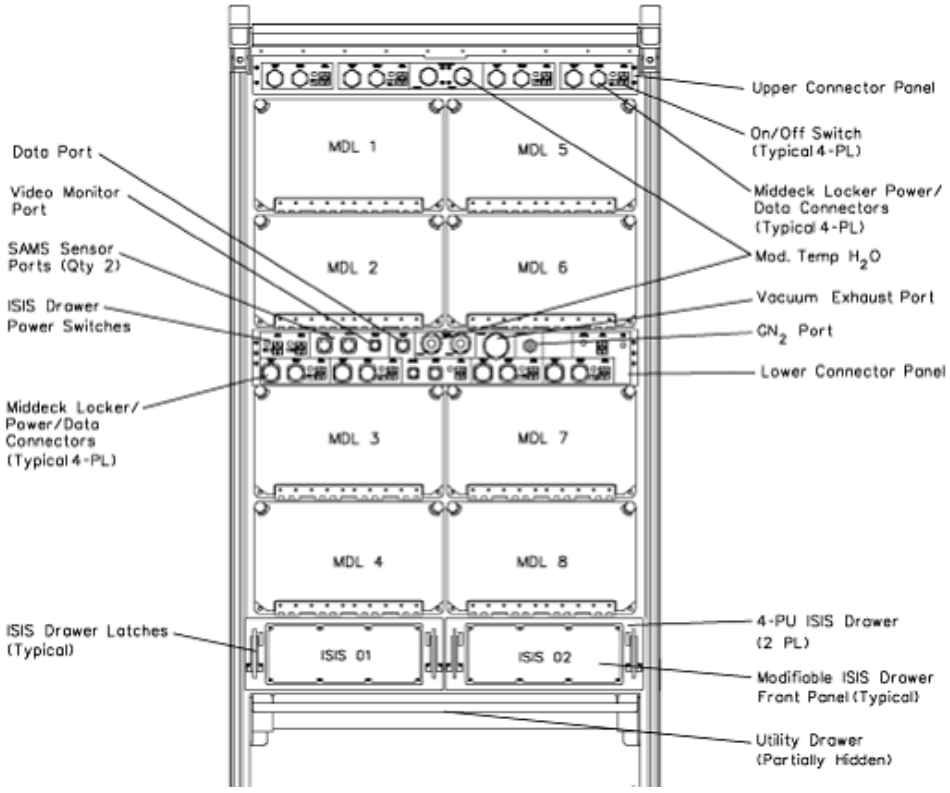


Figure 3-3 Example of an EXPRESS Rack (front view)

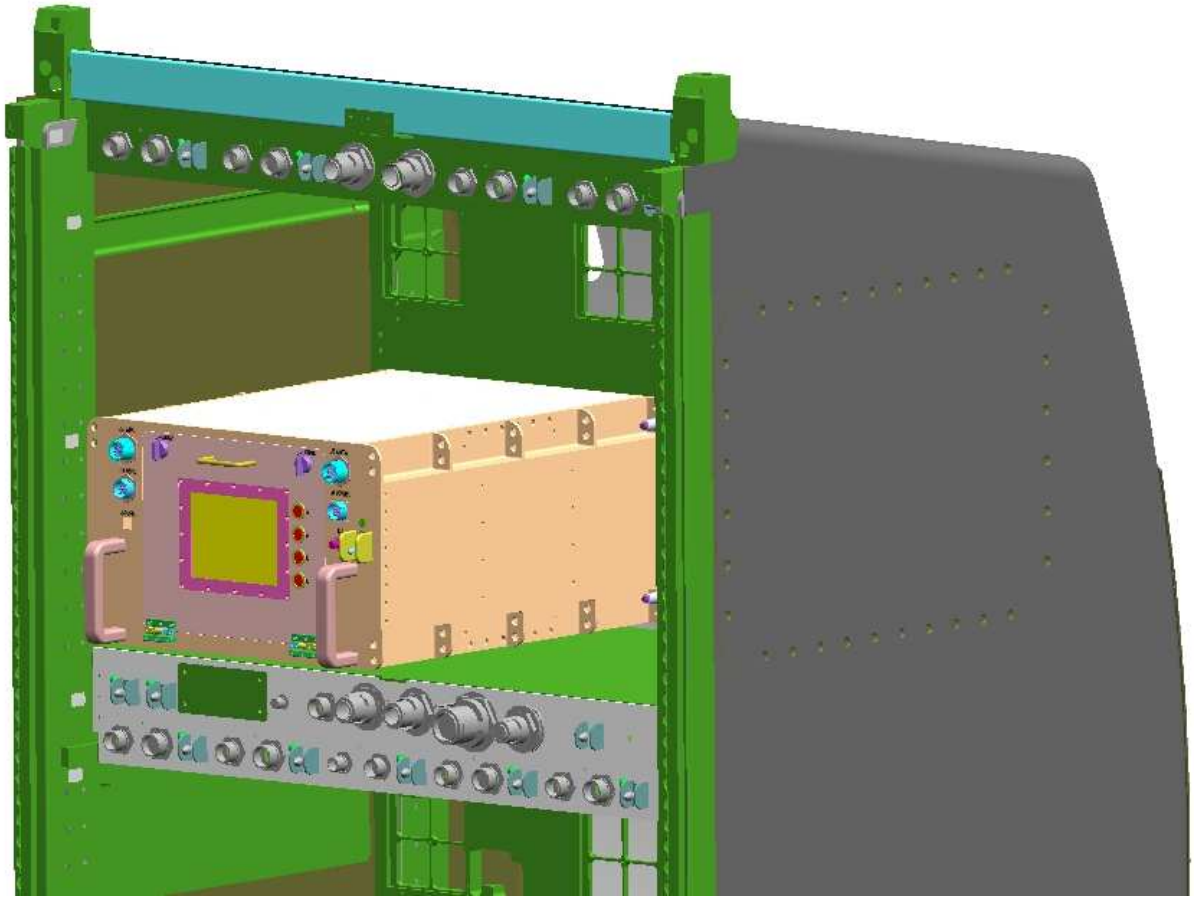


Figure 3-4 ACOP installed in an EXPRESS Rack (example of possible location)

ACOP provides these services:

1. On-orbit recording mechanism for large volumes of data at high rates
2. Play back for downlink of the recorded data at high rates
3. A crew interface for complex experiments
4. General computing facilities
5. Alternate bi-directional commanding path via the HRDL interface

ACOP will initially support a state-of-the-art particle physics detector, the Alpha Magnetic Spectrometer (AMS-02) experiment. AMS-02 uses the unique environment of space to study the properties and origin of cosmic particles and nuclei including antimatter and dark matter, to study the actual origin of the universe and potentially to discover antimatter stars and galaxies.

After the AMS-02 experiment, ACOP will remain in the US Lab as a general use computer for recording and managing large data volumes on the ISS. It will also allow a flexible and extensible control and monitoring interface for future payloads and, by using the large buffering capacity (> 1 TB), it will improve the data communication between Earth and the Space Station.

In addition to the ACOP system itself, shown in Figure 3-5 and Figure 3-6, a stowage bag will be sent to ISS with additional hard drives that can be exchanged with the hard drives in ACOP. From time to time the astronauts will perform this exchange enabling ACOP to record all of the AMS-02 data onto fresh hard drives. Once recorded, data will not be overwritten; rather the hard drives will be transported to ground as a permanent archive. The stowage bag will also contain spare parts for ACOP.

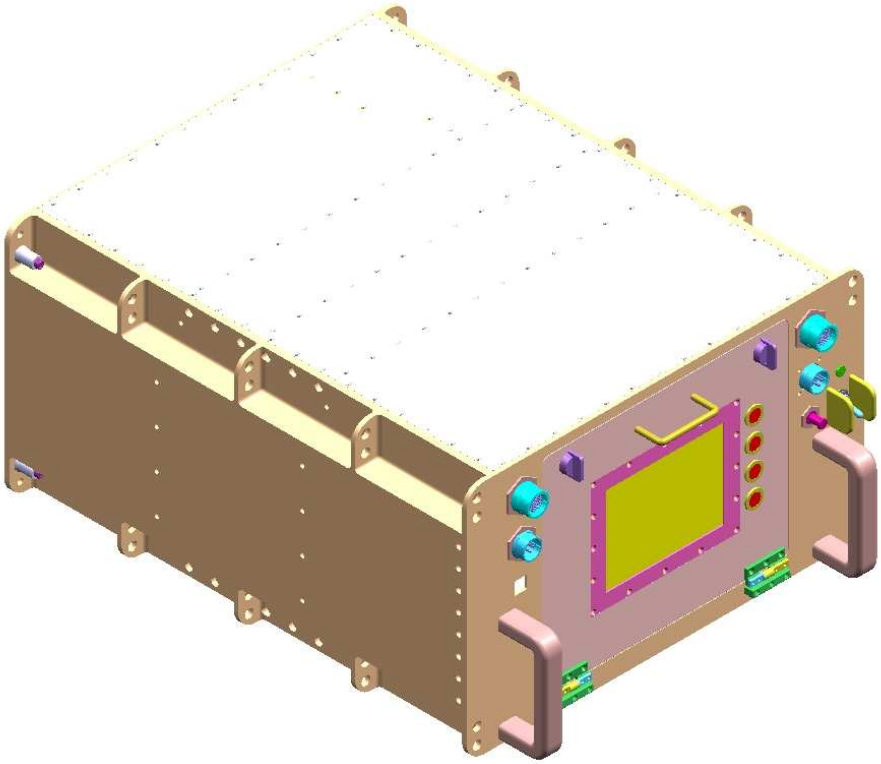


Figure 3-5 ACOP General Front View

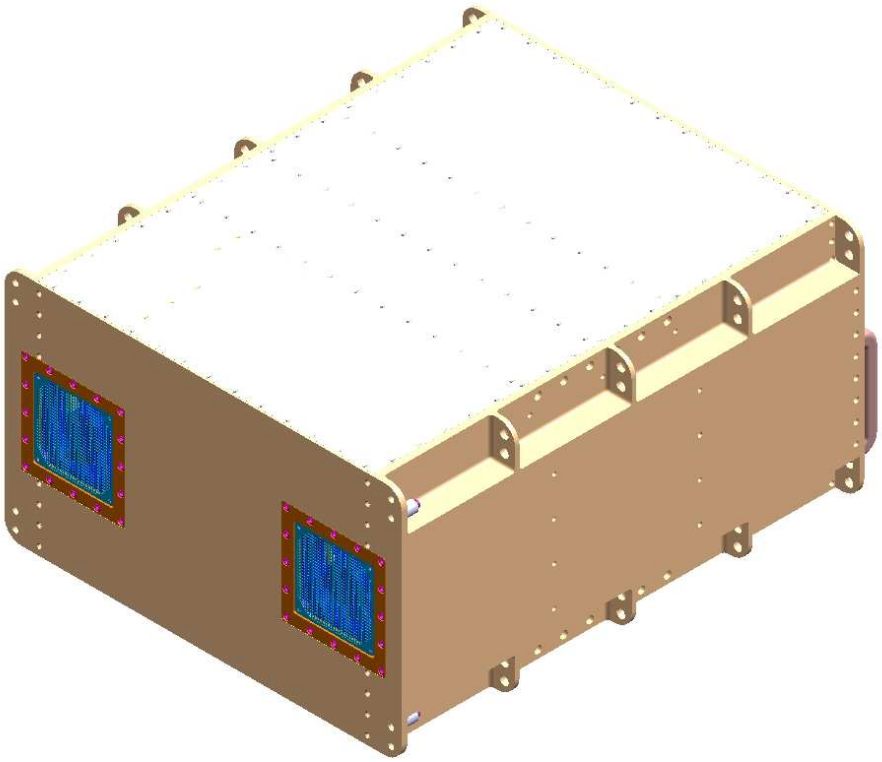


Figure 3-6 ACOP General Rear View

4. SYSTEM OVERVIEW

ACOP has been designed to fulfill the requirements generated by the AMS-02 Collaboration.

The main characteristics of ACOP are summarized here below:

Capacities

1. Operates effectively in the ISS space environment.
2. Creates, on-orbit, an archive of all AMS-02 science data on removable and transportable media, using high capacity (200 GB or more) SATA hard drives.
3. Provides (based on an average data rate of 2Mbit/s) at least 20 days of recording capacity without crew intervention[1].
4. Provides (based on an average data rate of 2Mbit/s) at least 120 days of on board recording media capacity within an additional single mid-deck locker equivalent soft sided storage unit[2].
5. Recorded data is an irreplaceable archive of science data. Once recorded, data will not be overwritten; rather the hard drives will be transported to ground as a permanent archive.

Rates

6. For recording ACOP supports an orbital average data rate of at least 4Mbit/s with bursts of up to 20Mbit/s[3].
7. Supports the playback of recorded data to ground systems at selectable data rates up to at least 20Mbit/s sustained while simultaneously recording at prescribed rates (per 6.).
8. Supports an alternate AMS-02 ground commanding and housekeeping report path via the HRDL interface.
9. Supports ACOP to AMS-02 commanding at selectable data rates up to at least 20Mbit/s sustained. No requirement for simultaneous recording or playback operations at higher rates.

Interfaces

10. Provides a continuous operations display of ad hoc AMS-02 data and ACOP status for the ISS crew to monitor, via a LCD on the front panel.
11. Provides a continuous means for the ISS crew to issue ad hoc commands immediately to ACOP and to AMS-02 (without the need to un-stow or attach external equipment), by using accessible push-buttons on the front panel.
12. Provides an exhaustive diagnostic, monitoring and operations environment via the EXPRESS laptop computer.

Form

13. Housed within an EXPRESS rack locker and based on a CompactPCI 6U form factor.
14. Crew serviceable for hardware upgrades and repairs.
15. Crew serviceable for software upgrades and repairs.
16. Upgradeable and expandable using COTS subsystems.
17. Provides support of ISS system upgrades (e.g. 100bt MRDL follow on systems).
18. ACOP is to weigh less than 35.5 kg without disks (launch weight)[4].

---

[1] Durations indicated are completely dependent on application implementation.

[2] See note 1.

[3] The AMS-02 experiment has been designed to meet its physics goals when producing data at an average rate of 2MBit/s. Data is produced continuously. However, the physics that will be measured is unknown, and so are the peak and average data rates − 2Mbit/s average is the best estimate. Within AMS-02 a four-fold redundant 1GByte buffer (JBU) is located to smooth the data flow and to allow for short term (less than an hour) interruptions in the data output from AMS, for example when the hard disk drives are being swapped within ACOP. After any such interruption, the data rate capability in ACOP must be able to make up for the lost time while not falling behind on the fresh data. Therefore ACOP is able to process data at a rate of at least twice the average data rate from AMS, namely 4Mbit/s.

[4] See ACOP Design Report for the actual mass budget

19. ACOP to consume less than 200 W (at 28Vdc)[5]
20. Launch compatible with MLPM mounting and dynamics.

UTILIZATION CONCEPT

The following are the key points of the ACOP operational concept as it pertains to the AMS-02 mission:

- ACOP is principally a ground operated payload
- ACOP provides the mechanism for the crew to monitor and control AMS-02. Both front panel and EXPRESS Rack laptop based interfaces are supported.
- ACOP is powered and active whenever AMS-02 is active. Only short (< 8 hours) outages.
- ACOP has continuous direct access to two physical HRDL connections (1 Tx/Rx pair plus an additional Tx, via UIP J7 connectors in other racks). By means of these interfaces:
  - maintains a continuous Tx/Rx connection via APS to AMS
  - provides intermittent, schedulable Tx connection for downlink.

  The additional Tx connection may be replaced by connection to the upgraded 100BaseT MRDL, when available.
- The AMS-02 Tx connection may be tee'd within the APS to the HRFM/KU for direct downlink.
- As KU access is available, ACOP will be commanded to use its additional TX connection to down link data. ACOP will have the ability to burst this transmission (~20Mbits/sec).
- All data transmitted by AMS-02 is recorded onto ACOP hard drives as a master copy of the AMS-02 science data.
- When ACOP has acknowledged that the data is recorded, AMS-02 can release that data from its buffers.
- The four installed hard drives will require periodic exchange by the ISS crew from the onboard stock of empty drives (30 minute operation about every 20 days)
- A batch of 20 hard drives provides at least 120 days of recording capacity.
- New batches of hard drives will be delivered to ISS and the original master copies of the AMS-02 data will be returned to earth.

[5] See ACOP Design Report for the actual power budget

5. HW UNIT

ACOP can be installed in any one of the 8 locations for Lockers of an EXPRESS Rack [RD11], [AD22].
ACOP HW is mainly constructed by an outer structure (LOCKER) and an inner structure (CHASSIS) [RD12].

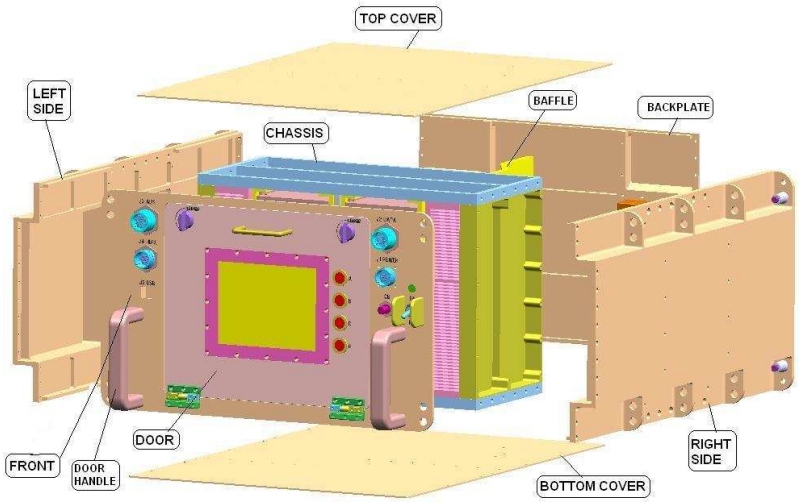


Figure 5-1 ACOP exploded view

5.1 LOCKER

Locker consists in:

- FRONT
- 2 SIDE PLATES (RIGHT and LEFT)
- TOP and BOTTOM COVER
- BACKPLATE

5.1.1 FRONT

In fixed part of front panels are located connectors for PWR, DATA, HDRL, USB and AUXILIARY data; a switch with led and circuit breaker are also mounted on that part. Two permanents hold handles are foreseen. LCD is mounted on the hinged front door of the locker for system monitoring and control [RD13]. Two compression latches hold the door in the normally close position.

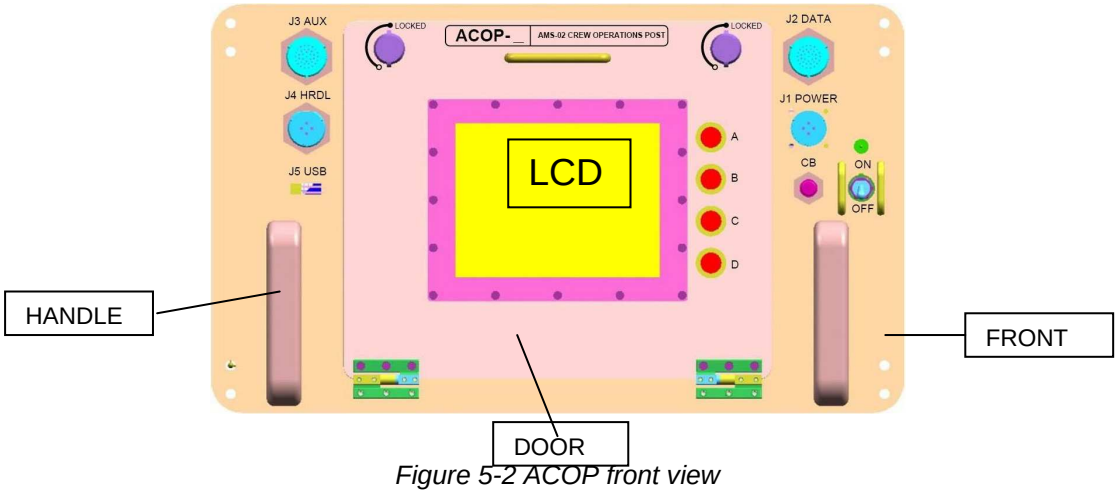


Figure 5-2 ACOP front view

5.1.2 BACK PLATE

The cooling air system is housed in the backplate : it consists in 2 FAN modules attached to backplate by means of captive screws[RD14].

5.1.3 SIDE PLATES

The captive mounting fasteners used to attach ACOP to the EXPRESS RACK are fixed on RIGHT and LEFT side beams [AD22]

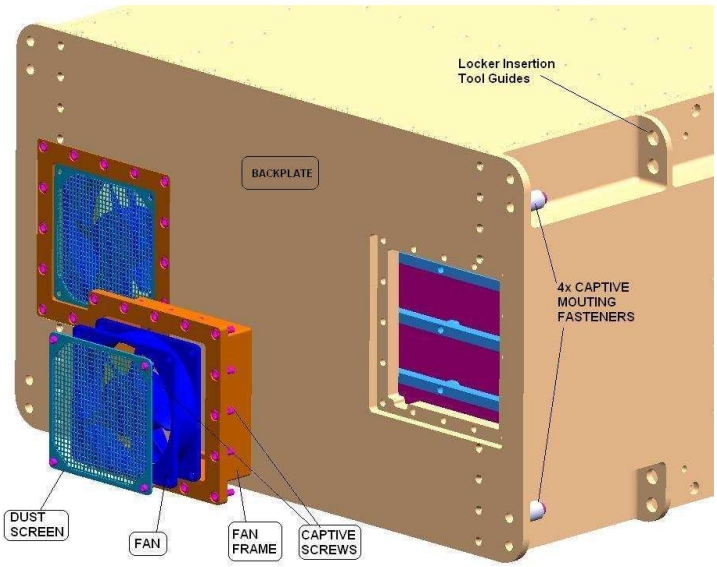


Figure 5-3 ACOP rear view

5.2 CHASSIS

Chassis provides the support for the electronic boards :

- Compact PCI cards
- hard drivers
- power supply
- backplane

it also provides the thermal path to the heat dissipation fins.

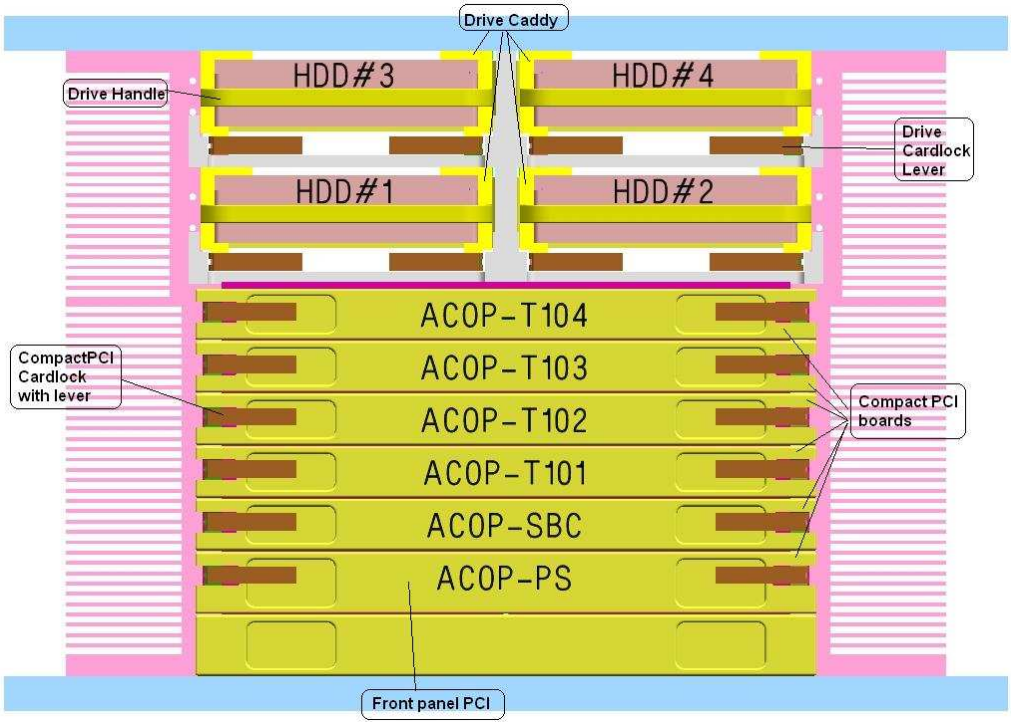


Figure 5-4 Front view of CHASSIS

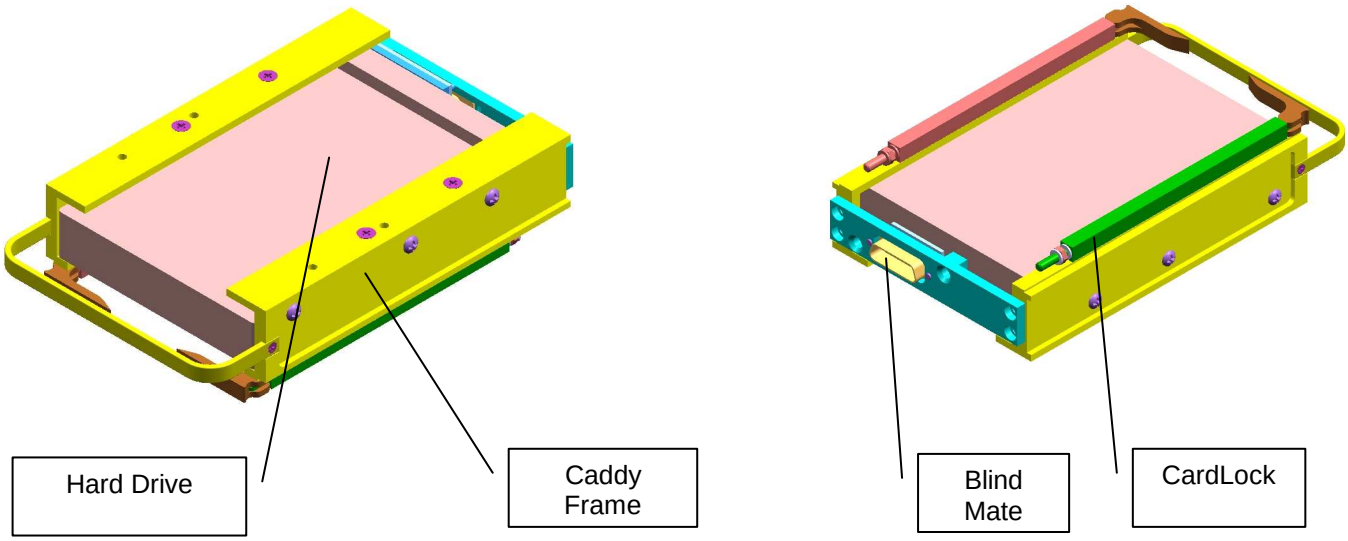


Figure 5-5 Hard Drive with Caddie

6. SW

ACOP-SW consists of three components:

- ACOP-SYS-SW providing low level functionality,
- ACOP-APP-SW providing the mission explicit application software functions on the ACOP hardware,
- ACOP-ERL-SW

ACOP-CORE is the entire body of embedded software running on the ACOP hardware and the two main components are ACOP-SYS-SW and ACOP-APP-SW.

ACOP-ERL-SW is an extension of ACOP-SW designed to provide ACOP HMI on the Express Rack Laptop

7. REQUIREMENTS / CONDITIONS

7.1 REQUIRED DOCUMENTS/ TOOLS/PERSONNEL

All activities necessary to perform the successful manufacture, assembly, integration and test of ACOP will be documented in advance.
The assembly activities are based on integration drawings [RD11-14] and on step-by step plan (see ANNEX 1) ; this documentation will accompany the integration and verification activities from start of integration to acceptance.
In general standard tools will be used according to the definitions in manufacturing and integration procedures. All tools which need calibration will be controlled by means of calibration lists and stickers on the tools.

Tool/Equipment	Requirements	Intended Application
Tools/calibrated drills	suitable for required fasteners	Install fasteners during assembly
Crane/Table Balance	suitable for the to be verified mass ranges	Mass measurement
Torque Wrenches	suitable for the required torque ranges	Torquing of joint bolts
Caliper Rules/ Depth Gages	Suitable for the to be verified/adjusted assy and I/F dimensions	Dimension measurement

Table 7-1 Required Tools

Where ever special tools are required, this will be defined in the regarding procedures.

For all processes and activities where it is required (e.g. crimping, soldering etc.), only properly trained personnel will perform the work.

7.2 HARDWARE PROTECTION

Protective devices (e.g. protective caps, connectors savers etc.) will be used to ensure that no damage of the H/W will lead the degradation of the items.

7.3 PRODUCT ASSURANCE

As a result of the design and development phase some safety aspects concerning qualification tests will be verified during integration and test to close the associated hazards of system safety analysis. Identified critical processes, functions and safety significant operations will be controlled by PA personnel during the activities. The MIP/KIP [AD14] procedure serves as the controlling document.

7.4 ENVIRONMENTAL CONDITIONS

All assembly activities will be performed in dedicated facilities at an ambient temperature of 20℃± 5° C. This is also the reference temperature for the manufacturing process.
It is important to perform the assembly activities at this specified temperature to prevent the generation of constraints and there-by built-in stresses. Recording of the ambient temperature during the dimensional verification is mandatory.

8. ORGANIZATION OF INTEGRATION

The integration steps are put into chronological order, according to strategies, risks, and other marginal conditions :

Production control is performed after a manufacturing release; each single selfstanding item is inspected and documented on an inspection record. Where the analysis requires a NDI-inspection [RD18] the manufacturers will perform such appropriate inspection. All materials for such items will be controlled beginning with the raw material manufacturing, during storage and until final manufacturing.

1. Pre-assembly phases for main CHASSIS and LOCKER structure before surface treatments
2. Final assembly of the complete structure inclusive all subassemblies
3. Dimension measurement in intermediate steps for the final I/F verification
4. Mass measurement after complete assembly
5. test phase for electronic units
6. Partial disassembly of units (i.e. HDD CADDIES, BOARDS; INTERNAL CABLING), set up of transport configuration, cleaning for preparation of delivery.
7. the operative system (part of Basic SW) is integrated on the SBC during ACOP CORE tests
8. Application SW is integrated on ACOP Core during ACOP CORE tests
9. ERLS SW is integrated on the EGSE simulating the Express Rack Laptop interface
10. Packaging and loading into Transport Containers for delivery
11. Delivery of all units :
    a. HW units with installed SW
    b. soft-bag with HDD & SPARES
    c. Loose delivered item that are packed separately in an suitable transport container
    d. GSE if any required
12. Integration of ACOP LOCKER on ER
13. ACOP CORE SW and ERLS are integrated as part of ACOP system tests

ANNEX 1 of this document containes the step-by step Assembly plan in form of Task sheets which describe each assembly sequence in detail and require all intermediate assembly inspections, measurements, also.

8.1 RISKS

If a special integration step happens to be risky the possibly existing problems and counter-measures have to be documented (e. g. danger for hardware during interaction with faulty software while no protection measures have been taken).
Non Conformance Reports (NCRs) are raised for all measurements values out of specified ranges and classified for minor/Major severity. A Review Board is to decide on the suggested recovery actions for the non conformances.

8.2 STAFF/RESPONSABILITIES

The organizational units/instances are allocated responsibilities within the scope of the integration (supervision of the time schedule, realization of certain integration steps, quality assurance measures, etc.).

8.3 INTEGRATION INSTRUCTIONS

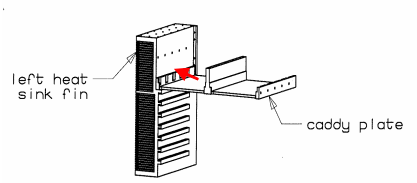
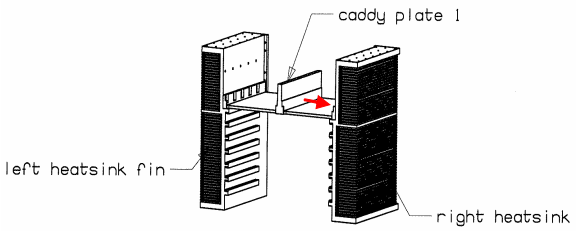
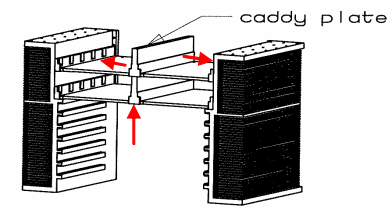
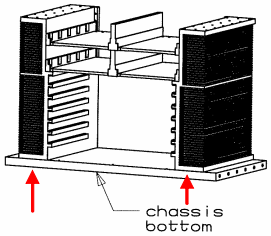
The technical instructions have to be generated on the basis of the integration strategies and marginal conditions. This includes procedures for the assembly of products as well as instructions for the integration equipment.
Assembly plan step-by step is available on ANNEX 1

8.4 SPECIAL MEASURES

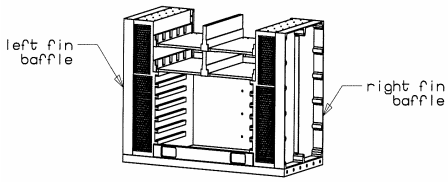
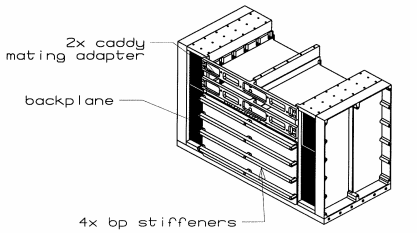
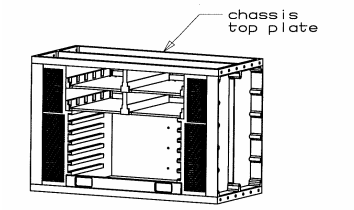
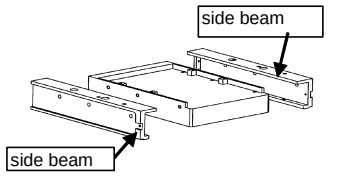
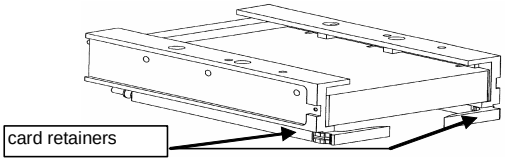
Special measures

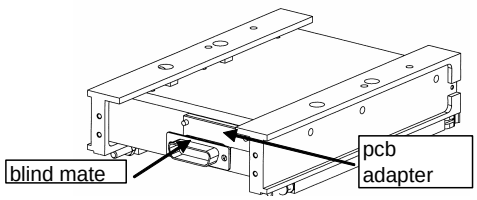
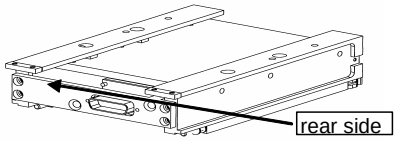
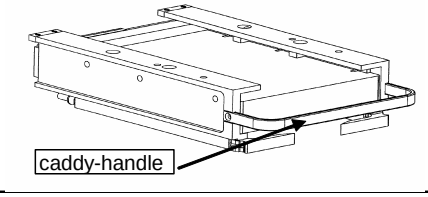
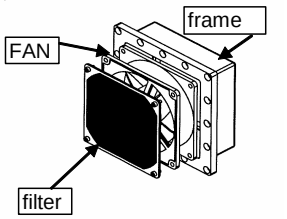
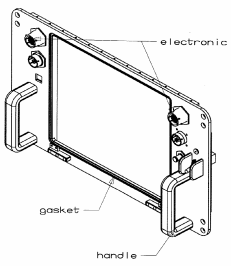
- switch on/off procedures
- Open/close front door : ¼ turn captive bolts

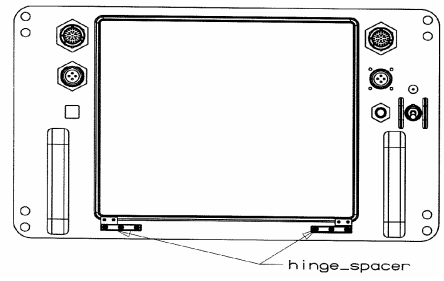
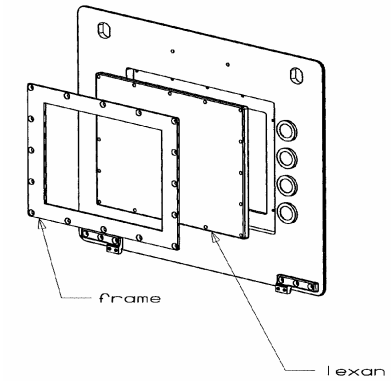
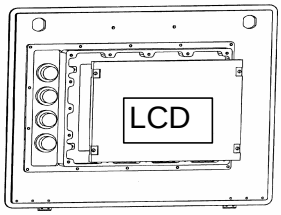
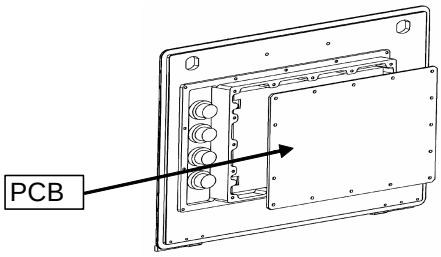
ANNEX 1. STEP-BY STEP ASSEMBLY PLAN

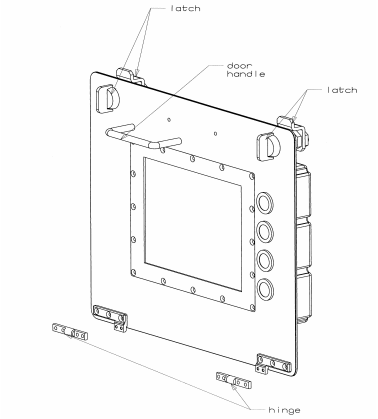
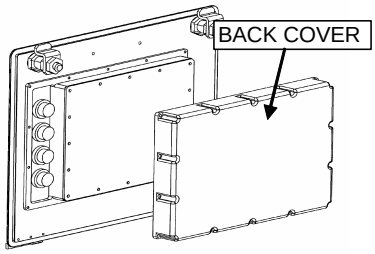
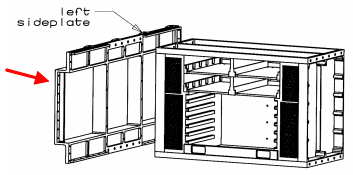
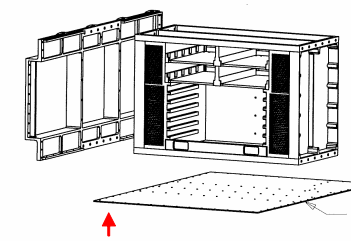
No.	Task	P/F	Date	Sign.	Stamp
1.	Prior to start of any assembly activity make sure that the required tools and equipment is available. Especially observe the calibration status of measuring and safety relevant equipment. If recalibration of any tool/equipment is overdue do not proceed beyond this point of the procedure				
2.	Record type and calibration data of tools and devices				
3.	The **CHASSIS** integration is to be performed according to assembly notes per assembly drawing **AM9408-01**				
3.1	join caddy plate 1 to left heatsink on work bench as shown in below schetch. 				
3.2	clamp right heatsink to caddy plate 1 : align the parts and join them . 				
3.3	Record the applied torques . Installation torque : .....Nm				
3.4	align the **caddy plate** and then joint it onto the assembled parts . 				
3.5	Record the applied torques . Installation torque : .....Nm				
3.6	move up carefull the parts and then join the **Chassis Bottom** part 				
3.7	Record the applied torques. Installation torque : .....Nm				

Acronym P/F = **P**ast/**F**ailed

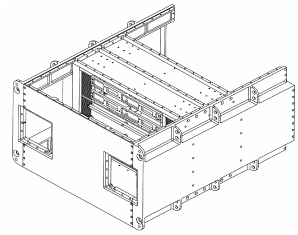
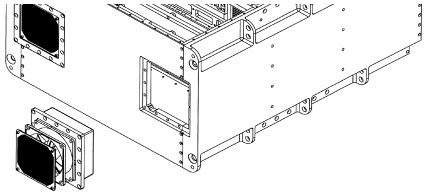
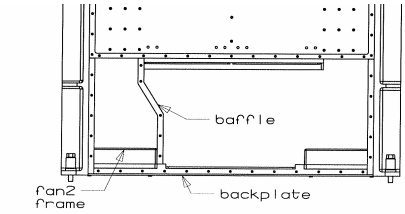
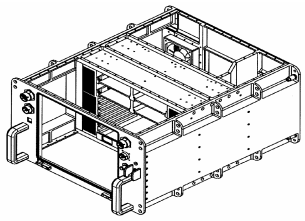
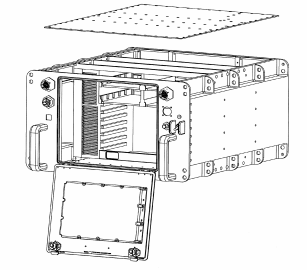
No.	Task	P/F	Date	Sign.	Stamp
3.8	align the **side baffle fins** and join to the assembled parts . 				
3.9	Record the applied torques . Installation torque : ……Nm				
3.10	On rear side of Chassis put the **backplane board** , the **bp stiffeners** an the **caddy mating adapter** 				
3.11	Record the applied torques . Installation torque : ……Nm				
3.12	join the **Chassis Top** part 				
3.13	Record the applied torques : Installation torque : ……Nm				
4.	In a separate work bench assembly the electronics boards as per dedicated assembly drawings : ACOP-T104 ACOP-T103 ACOP-T102 ACOP-T101 ACOP-T101 ACOP-T101				
5.	Assembly **HDD** on **CADDIES** according to assembly notes per dedicated assembly drawing				
5.1	join the 2 **side beams** to **HDD** as shown in below schetch. 				
5.1	Fix the **card retainers** to the side beams. 				
5.2	Record the applied torques : Installation torque : ……Nm				
Acronym P/F = **P**ast/**F**ailed					

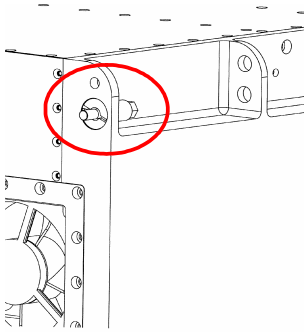
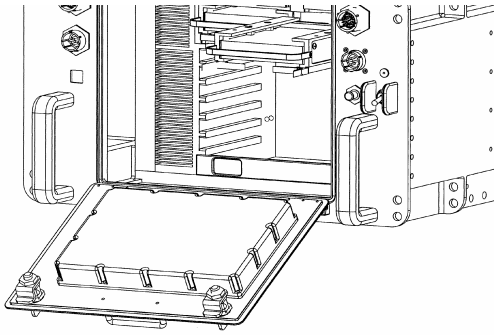
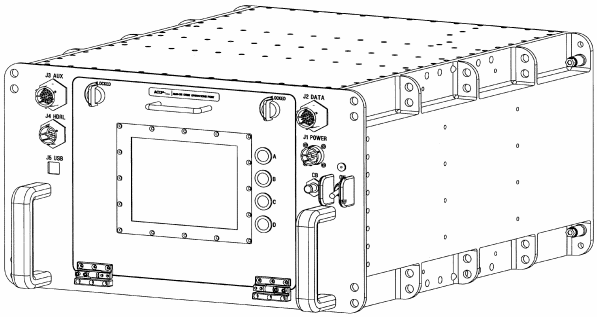
No.	Task	P/F	Date	Sign.	Stamp
5.3	On rear part fix **pcb adapter** and **connector**. 				
5.4	Join **the rear side** of caddy on side beams 				
5.5	Record the applied torques . Installation torque : ……Nm				
5.6	fix the **caddy handle** as last part 				
5.7	Record the applied torques : Installation torque : ……Nm				
6.	The **FAN** integration is to be performed according to assembly notes per assembly drawing **AM9408-12**				
6.1	fix the FAN on its Frame as shown in below schetch; cover with the FILTER DUST SCREEN. 				
6.2	Record the applied torques : Installation torque : ……Nm				
7.	The **FRONT PANEL** integration is to be performed according to assembly notes per dedicated assembly drawing				
7.1	In a separate work bench fix all electronic devices to **FRONT PANEL;** then joint the 2 **HANDLES** 				
7.2	Record the applied torques : Installation torque : ……Nm				
Acronym P/F = **P**ast/**F**ailed					

No.	Task	P/F	Date	Sign.	Stamp
7.3	attach the 2 **hinge-spacers** to the **FRONT**. If needed, reverse the task 7.2 and 7.3; protect connectors with caps and put in place the gasket 				
7.4	Record the applied torques . Installation torque : ……Nm				
8	The **DOOR** integration is to be performed according to assembly notes on assembly drawing **AM9408-08**				
8.1	In a separate work bench put the **LEXAN COVER** on the front side of DOOR; then fix the **FRAME** 				
8.2	Record the applied torques : Installation torque : ……Nm				
8.3	fix the apollo **LCD** on rear side of DOOR; fix all push buttoms; protect the LCD 				
8.4	Record the applied torques : Installation torque : ……Nm				
8.6	join PCB on DOOR as shown in below schetch; connect all wires 				
8.7	Record the applied torques : Installation torque : ……Nm				
Acronym P/F = **P**ast/**F**ailed					

No.	Task	P/F	Date	Sign.	Stamp
8.8	attach the 2 **hinge-spacers,** the door **HANDLE** to the **FRONT**, and then the compression lacthes; measure the grip and then tighten jam nuts against lock-washers and pawl using two wrenches. 				
8.9	Record the applied torques . Handle Installation torque : ……Nm Latch Installation torque : ……Nm Hinges Installation torque : ……Nm				
8.10	close with the **BACKCOVER** when internal cabling is done and tests are performed. 				
9	The overall **ACOP ASSEMBLY** integration is to be performed according to assembly notes on assembly drawing **AM9408-Z**				
9.1	Join the **LEFT SIDEPLATE** to the CHASSIS already assembled as shown in below schetch 				
9.2	Record the applied torques : Installation torque : ……Nm				
9.3	then fix the **BOTTOM plate** 				
9.4	Record the applied torques : Installation torque : ……Nm				

Acronym P/F = **P**ast/**F**ailed

No.	Task	P/F	Date	Sign.	Stamp
9.5	Fix the **RIGHT SIDEPLATE** ; align the **BACKPLATE** to the SIDEPLATEs : the three parts must be aligned flush; fix BACKAPLATE to the structure 				
9.6	fix the two **FAN** assembly to the back of the structure and the fix all cables 				
9.7	Record the applied torques . Installation torque : ……Nm				
9.8	join the BAFFLE to the backplate and the chassis as in schetch below 				
9.9	Record the applied torques : Installation torque : ……Nm				
9.10	Insert the BOARDs and CADDIES; route all internal cables and do the planned tests 				
9.11	Fix the DOOR on structure with HINGES and then the TOPCOVER 				
9.12	Record the applied torques : Installation torque : ……Nm				
Acronym P/F = **P**ast/**F**ailed					

No.	Task	P/F	Date	Sign.	Stamp
9.13	Install all 4 Captive Screws with their retainer part onto the 2 sideplates 				
9.14	Record the applied torques : Installation torque : ……Nm				
9.15	Disassemble all Loose Delivered Items from ACOP structure 				
9.16	clean complete ACOP structure				
9.17	Fix the DOOR in **CLOSED** position 				
9.18	Perform packaging of the ACOP box and Loose Delivered items into its Transport container.				

Acronym P/F = **P**ast/**F**ailed