



CARLO GAVAZZI SPACE SpA

ACOP

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Title : FEEDBACK ON ACOP NASA ICD			

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CHANGE RECORD

<i>ISSUE</i>	<i>DATE</i>	<i>CHANGE AUTHORITY</i>	<i>REASON FOR CHANGE AND AFFECTED SECTIONS</i>
Draft	9 Sept 05		
1	Sept 05	First issue	Updated images and minor modifications in the text

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ANNEX 1: ACOP NASA ICD

ANNEX 2: Interface Control Drawings

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1. SCOPE OF THE DOCUMENT

This document provides CGS comments to the document SSP 53101-ICD :

Expedite the Processing of Experiments to Space Station (EXPRESS) Rack Interface Control Document for Alpha Magnetic Spectrometer (AMS-02) Crew Operations Post (ACOP),

simply referred to ACOP NASA ICD and included in annex 1.

2. DOCUMENTS

2.1 APPLICABLE DOCUMENTS

AD	Doc. Number	Issue / Date	Rev.	Title / Applicability
1	SSP 52000-IDD-ERP	E / 09/09/03		EXpedite the PProcessing 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 52000-EIA-ERP	Feb. 2001	A	Express Rack Integration Agreement blank book for Express Rack payload
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 PProcessing 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		SW Product Assurance Plan
21	GD-PL-CGS-005	2/09-05-03		SW CADM Plan

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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 PProcessing 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

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3. COMMENTS TO ACOP NASA ICD

3.1 GENERAL COMMENTS

- 1) Paragraph 1.2, Page 1-1 : I would add the following sentence: The stowage bag will contain also spare boards for replacement of ACOP boards in case of failure. Also, table 1.2-1 should contain rows for spare boards (one per type) and fans.

- 2) Current ACOP design is assuming EXPRESS rack as launch baseline. NASA should specify all the requirements related to soft stowing (including qualification, launch loads etc.) and CGS will evaluate the impact of implementing them. There are of course no problems in being soft stowed, as long as all requirements are less critical than EXPRESS rack baseline.

- 3) Table 1.2.1.2-1, figure 1.2.1.2-1 and following tables/figures: old versions (elements missing). In general, the description of ACOP shall be replaced with the new version in line with CDR design. Refer to the following documents:

ACOP Design Report	ACP-RP-CGS-003 issue 2 (October 2005)
ACOP Operational Report	ACP-RP-CGS-002 issue 2 (October 2005)
ACOP Electrical Analysis and Design Report	ACP-RP-CGS-004 issue 2 (October 2005)

- 4) Paragraph 1.2.2.1: “and an inlet fan assists with directing airflow.”
 The design foresees two fans, one at inlet port and one at outlet port. Suggested modification: “and inlet and outlet fans assist with directing airflow. The duty cycle for these fans is still under study.”

 Paragraph 1.2.2.4: The USB interface connector is located on the ACOP front panel.

3.2 COMMENTS TO TABLE 3.1-1

- Req. 3.3.1 and 3.3.1.1: maybe N/A? Same reason as 3.3.1.2
- Req. 3.4.1.1: should be A, at least for the sentence “*Payloads shall be compatible with the mechanical interfaces defined in Figure 3-5*”. In fact ACOP (single) locker is custom design, intended for mounting into 8/2 Express Rack and we are currently designing according to Figures 3-5. The comment in the draft ICD is therefore correct, but it should be a reason for “A”, not for “N/A”.
- Req. 3.4.2: should be N/A. The requirement says ACOP shall be compliant with Figure 3-6, depicting a specific Locker type. ACOP includes a “custom locker single MDL size” that will provide all mounting i/f to ER backplate according figures 3-5. Therefore the specific locker P/N, the notes etc. are all N/A.
- Req.3.4.2.2 should be N/A.
- Req. 3.4.2.3B and 3.4.2.3C should be N/A. No drawers or trays (as defined in the IDD paragraph) are currently foreseen. Nominal operations foresee extraction and substitution of HDD caddies and of fans (TBC), non-nominal operation foresee extraction and substitution of boards and of fans.
- Req.3.4.2.5 should be N/A : ACOP is a “custom locker single MDL size”. See previous comments.
- Req. 3.4.3 through 3.4.3.4 : should be NAR (or N/A). In fact the IDD often uses MAY and therefore we don't consider these as requirements. Not clear the rationale for which ACOP should use

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VPMP. We understand these are only for launch in middeck, correct? Current design in line with Figure 3-5, using B-Type fasteners (TBC) but providing also holes for A-Type fasteners. Please clarify.

- Req. 3.4.3.6.3 as above
- Req. 3.4.3.5 A-B as above
- Missing Req. 3.4.4.2H : deleted
- Req.3.6.2.1 : Clarification required: two handles are screwed on the front panel. They protrude less than one inch, therefore we are within Plane of “GSE Boss Fittings” in figure 3-17. We don’t plan to remove them on orbit because they are used also for maintenance (filter cleaning, fans replacement). They are fixed to the front door by normal (non captive) screws. Are the handles to be considered permanent protrusions?
- Req.3.6.2.2A,B: Clarification required: What ACOP HW is considered semi-permanent protrusion? The HRDL cable?

3.3 TABLE 3.1-2

ACOP Installation Torque Requirements:

ASSEMBLY	FASTENER TYPE (A286, etc.)	NUMBER REQUIRED	INSTALLATION LOCATION (Middeck, ETR, etc.)	REQUIRED TORQUE VALUE (INCLUDE TOLERANCE) (Note 1)	REMARKS (ABOVE RUNNING TORQUE, etc.)	CONSTRAINTS (TORQUE CYCLE LIMITATION, POSTIVE LOCKING FEATURES)
ACOP Core	CS5108C-4-5	4	EXPRESS Rack	10.5Nm	EXPRESS Rack Backplate insert: MS21209-C0410	TBD (data on the MS21209-C0410 not allowable)

3.4 COMMENTS TO TABLE 4.1-1

- Req. 4.7.2.2: this is not a structural requirement (noise limit), this must be verified by the fans.
- Req. 4.8.4: should be N/A (no PFE access port)

3.5 COMMENTS TO TABLE 5.1-1

- 5.3.1.1.2 A (indicated as A), 5.3.1.1.2 B (indicated as N/A) : it is not clear to what A and B are referring: only 5.3.1.1.2 is in the IDD text
- 5.3.1.2.1 no interface with cabin . only the sentence should be considered applicable.
- TBD 16 and be removed only after CDR analysis. More information can be provided beginning of October.
- data in 5.3.1.2.1 refer to cabin air. There is no information on the IDD on how dirty the AAA is. How often air filters of EXPRESS Rack P/L’s using AAA need cleaning ? What is the common practise ?

3.6 COMMENTS TO TABLE 6.1-1

- Req. 6.2.2.1.4: should be N/A (no fuse)

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- Req. 6.4.1/2: should be A

3.7 COMMENTS TO PARA. 9 AND TABLE 9.1-1

HRDL I/F not included since it's not a standard I/F reported in the IDD. Will the corresponding requirements be included somewhere in this ICD or not?

- Req. 9.1.1/2/3/4, Req. 9.1.5.1: should be N/A. The RS-422 I/F will be used only for test and debugging on ground. No use on orbit is foreseen, therefore the requirements about transmission format and pin function are not applicable.

3.8 COMMENTS TO TABLE 10.1-1

- Req. 10.2.3: "No ACOP light sources" Should the LCD be considered light source?

3.9 COMMENTS TO TABLE 11.1-1

- Req. 11.2.2: should be N/A (as Req. 9.1.1/2/3/4)

3.10 COMMENTS TO TABLE 12.1-1

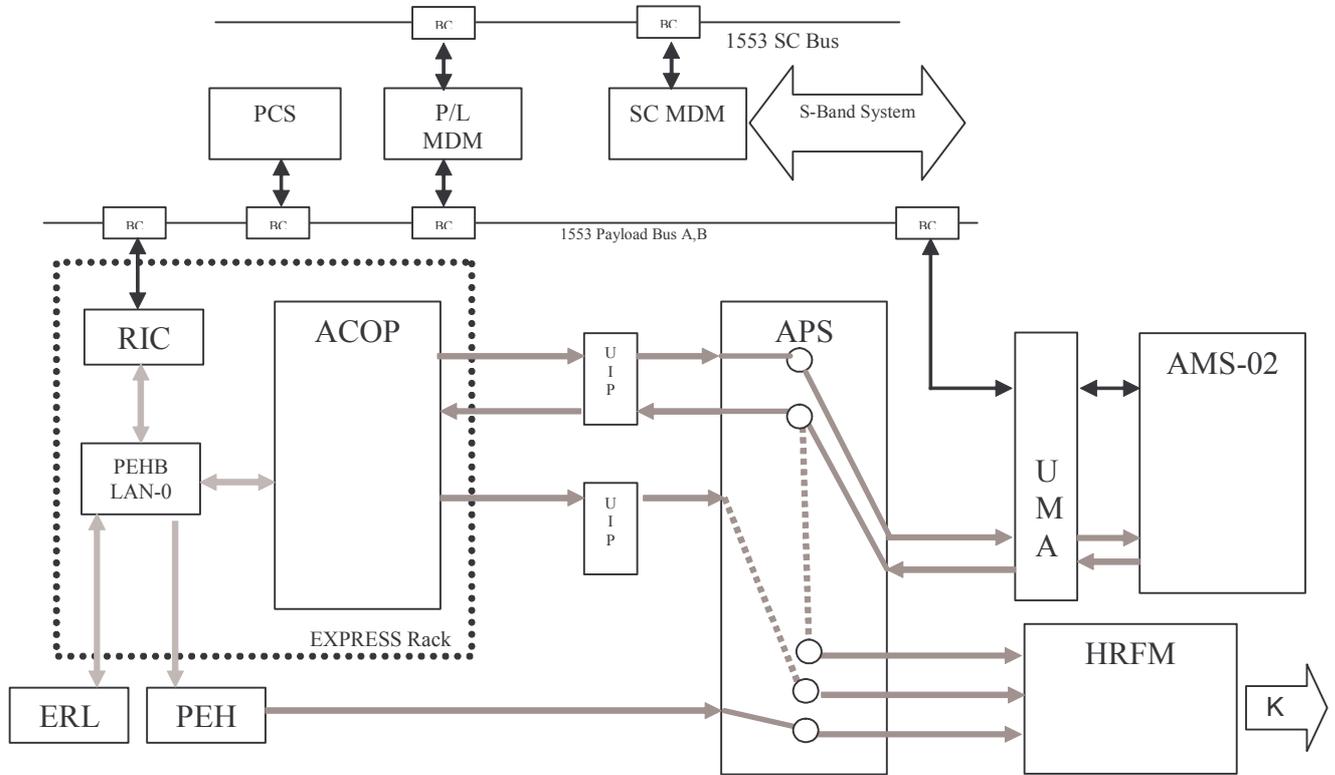
- Req. 12.6.2.1B/C/D: should be NAR. Req. 12.6.2.1 ask to use one OR more of the protective methods listed in sub-paragraphs A through G. So, the sub-paragraphs are suggestions and one of them can be chosen as protective method as a minimum.
- Req. 12.6.2.4: should be A (a toggle switch is present)
- Req. 12.9.2B: comment for N/A is "No capture elements", but what about fan screen?

3.11 COMMENTS TO TABLE 14.3-1

- Req. 14.3.1: should be N/A (ACOP does not require a PFE port)



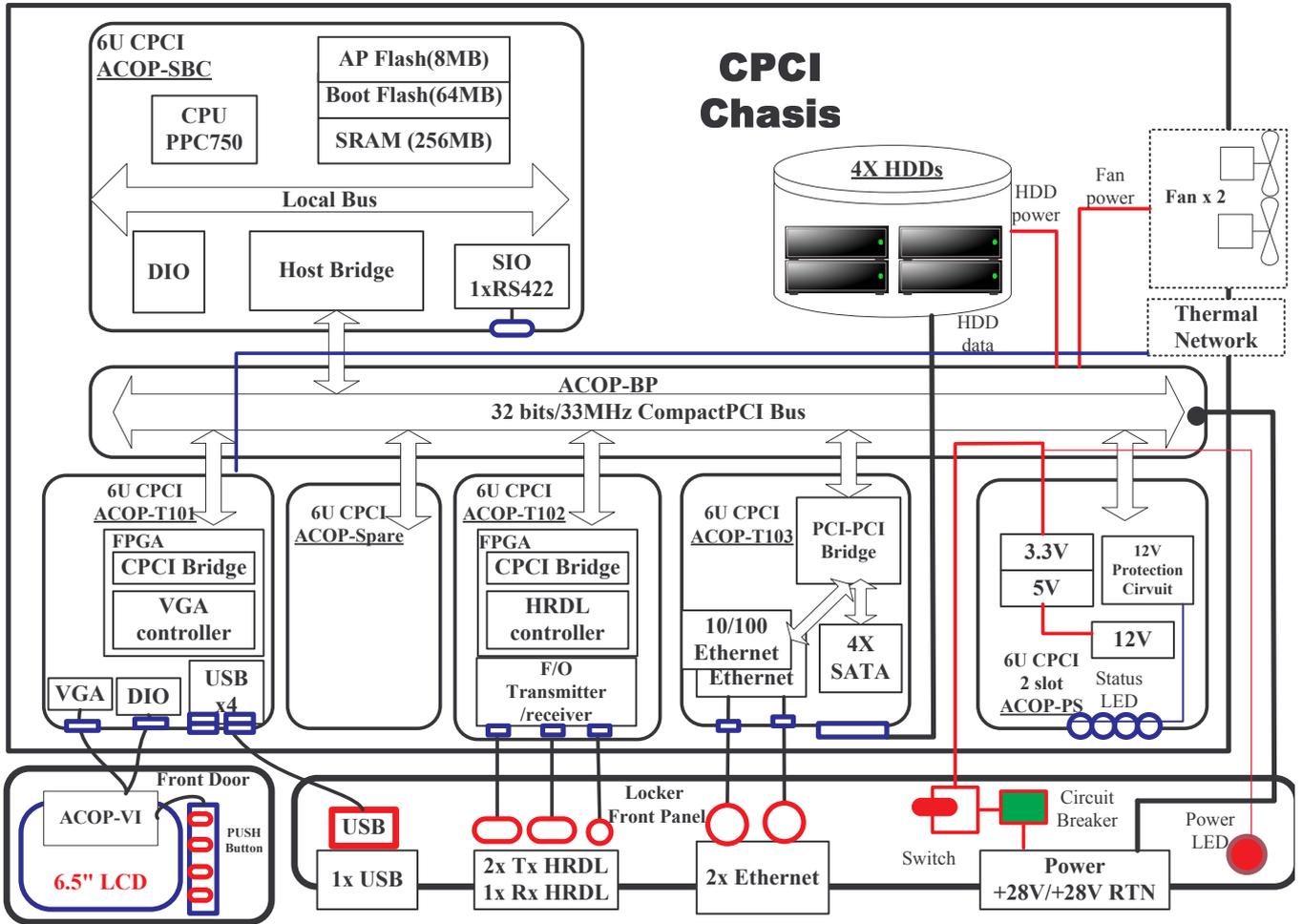
4. IMAGES FOR NASA ICD



ACOP C&DH INTERFACES WITH EXPRESS RACK, US LAB, AND AMS-02



ACOP



ACOP ELECTRICAL BLOCK DIAGRAM



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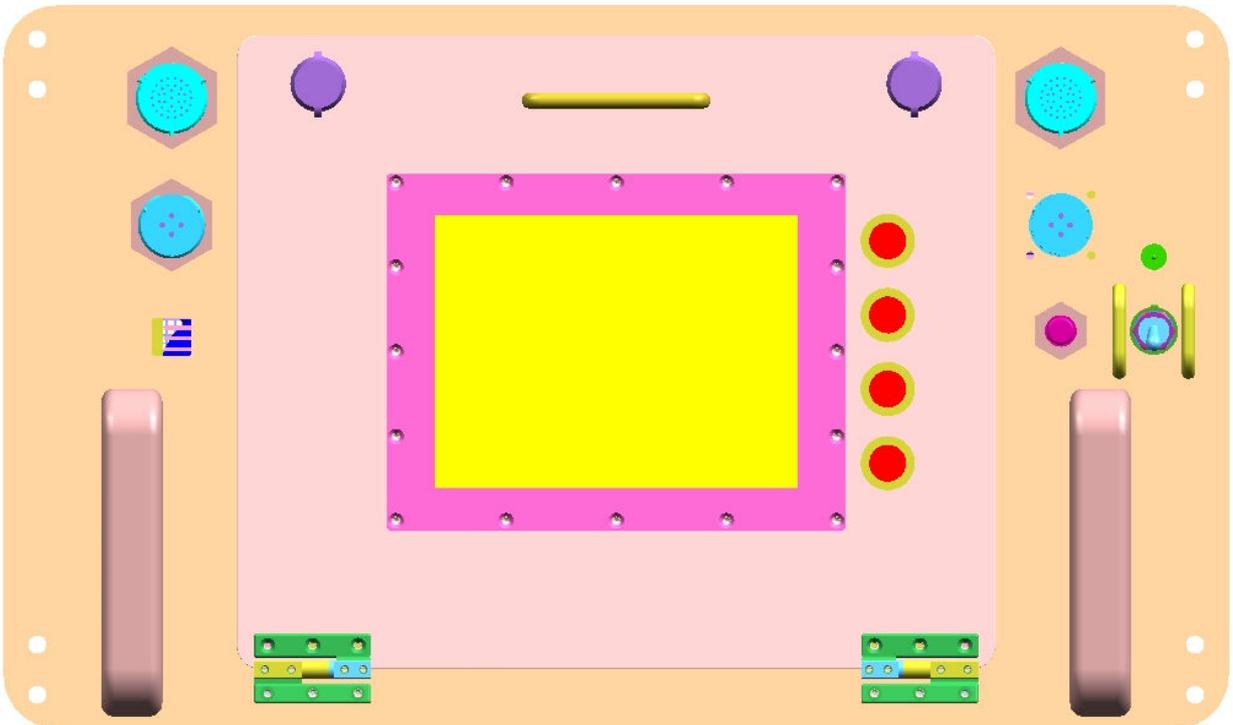
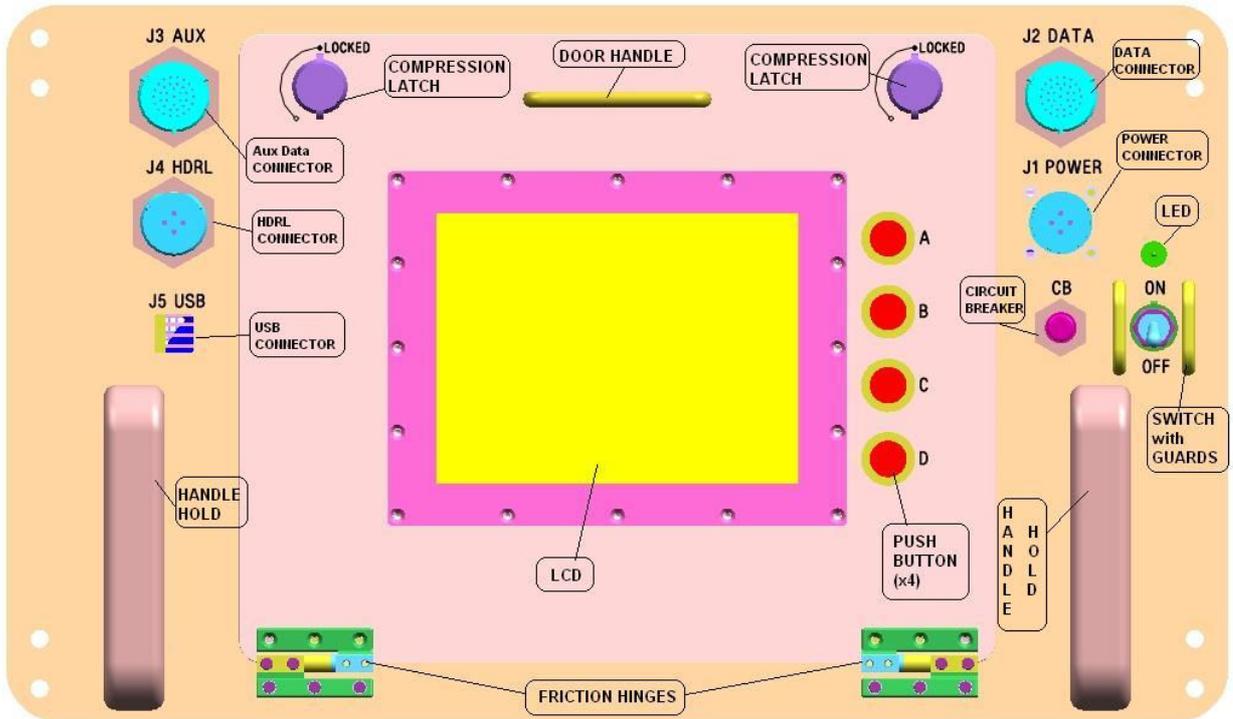
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ACOP FRONT PANEL



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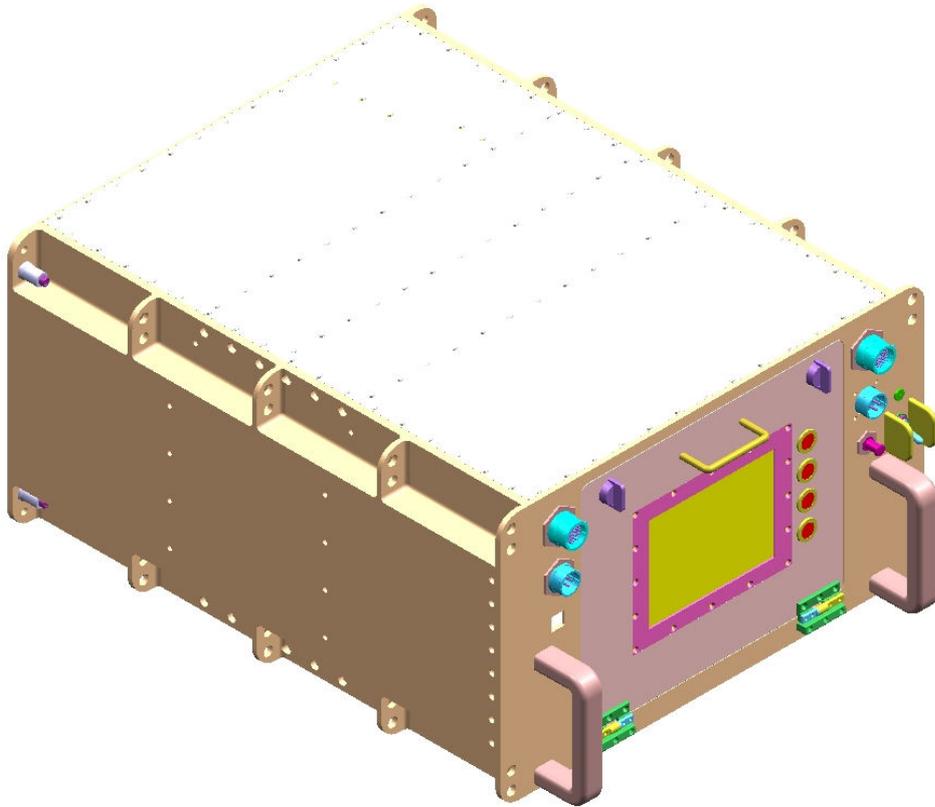
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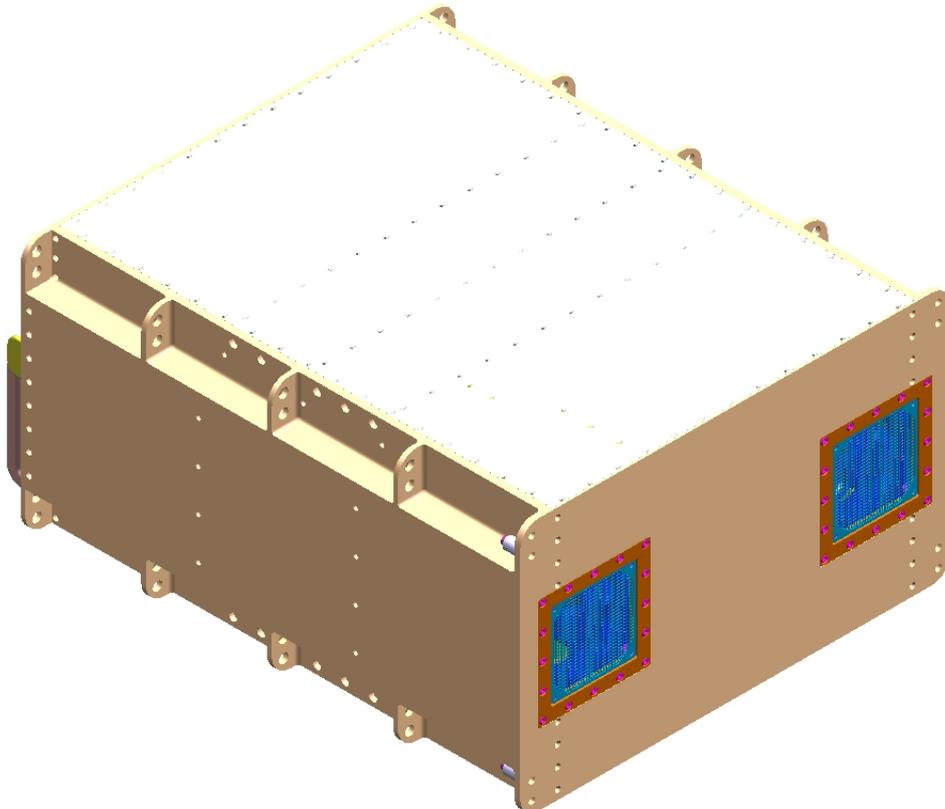
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ACOP CORE ISOMETRIC VIEW - FRONT



ACOP CORE ISOMETRIC VIEW - REAR



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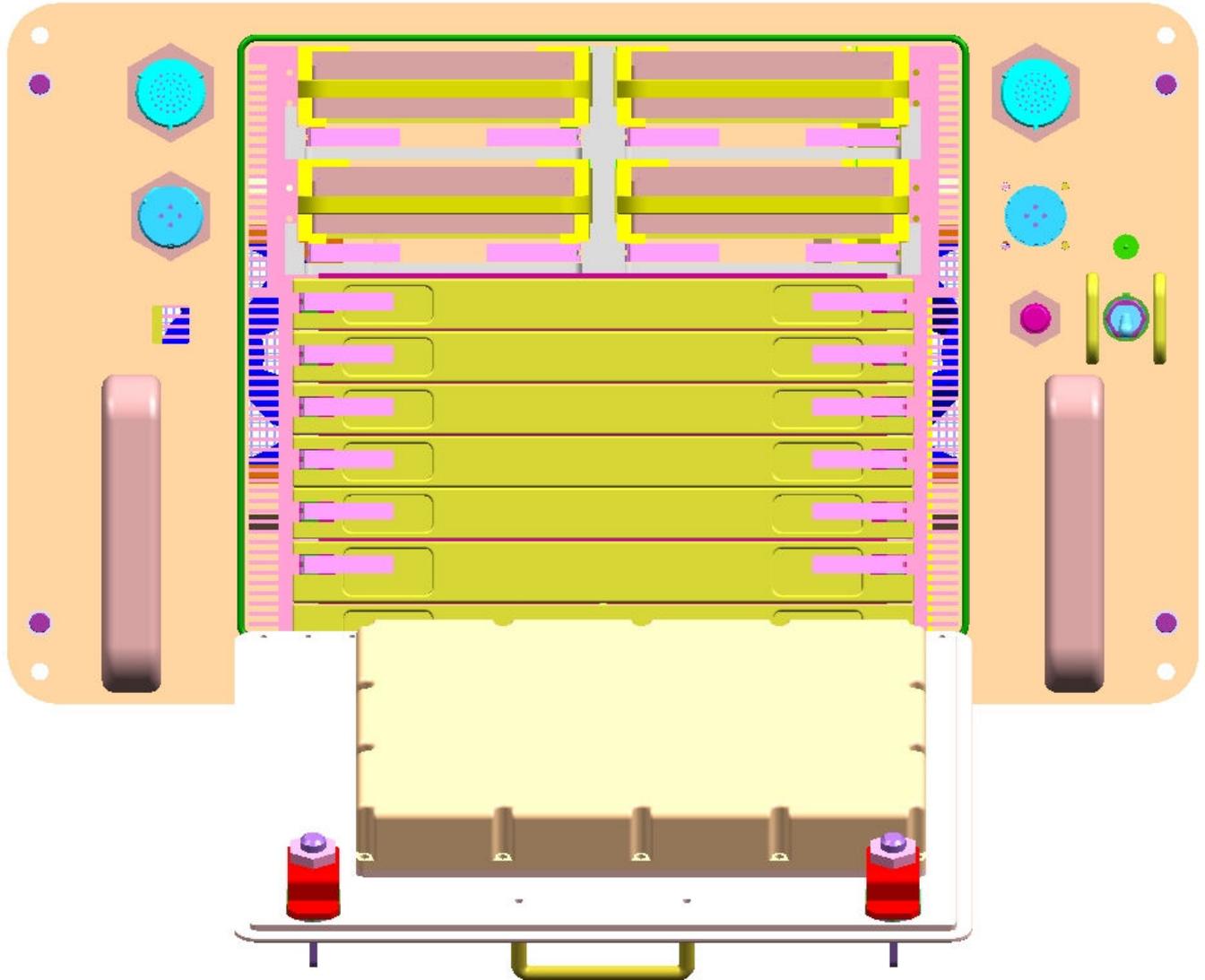
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ACOP FRONT VIEW, ACCESS DOOR OPEN (front panels of the boards not shown in detail)



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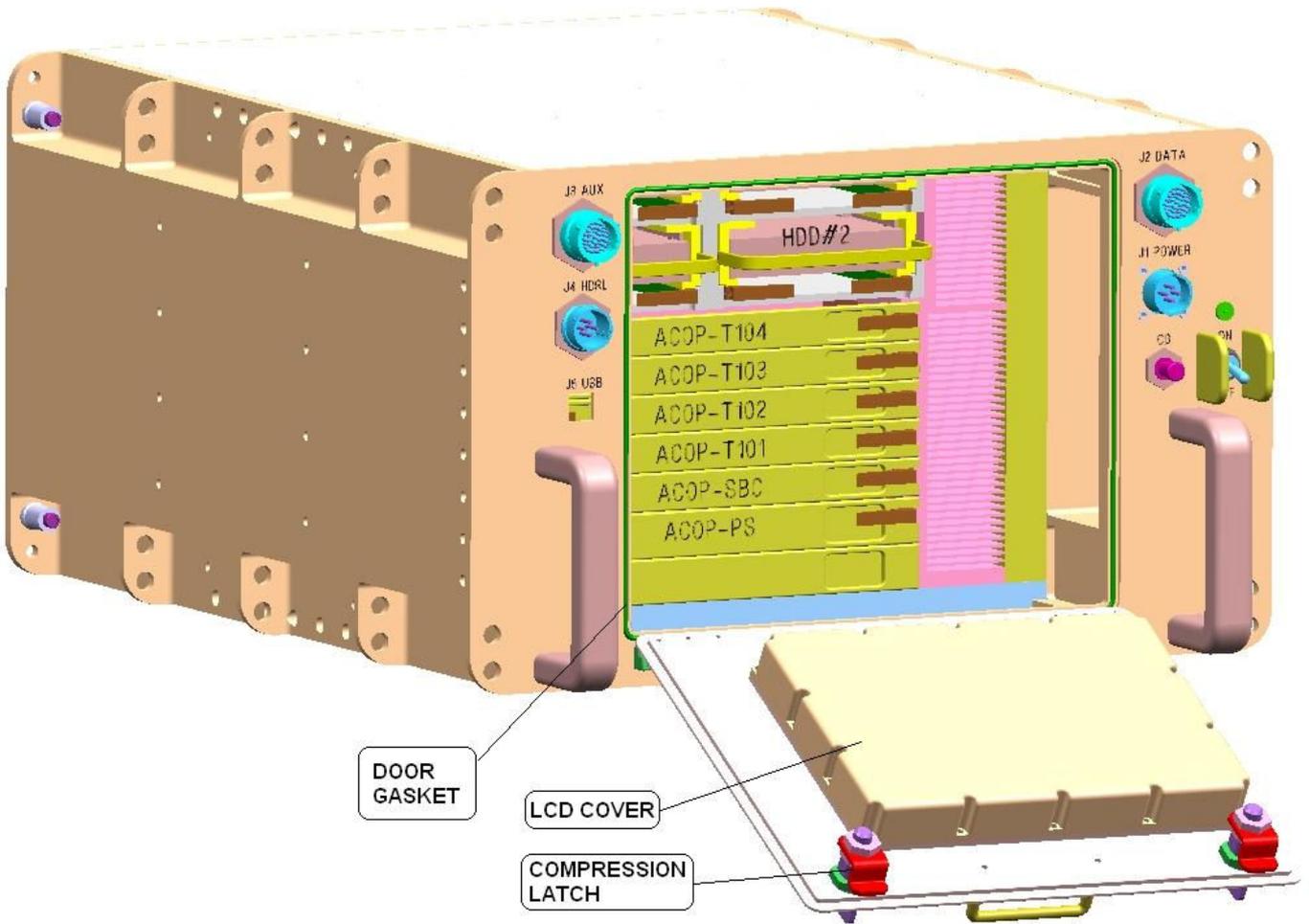
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ACOP FRONT DOOR OPEN DETAIL



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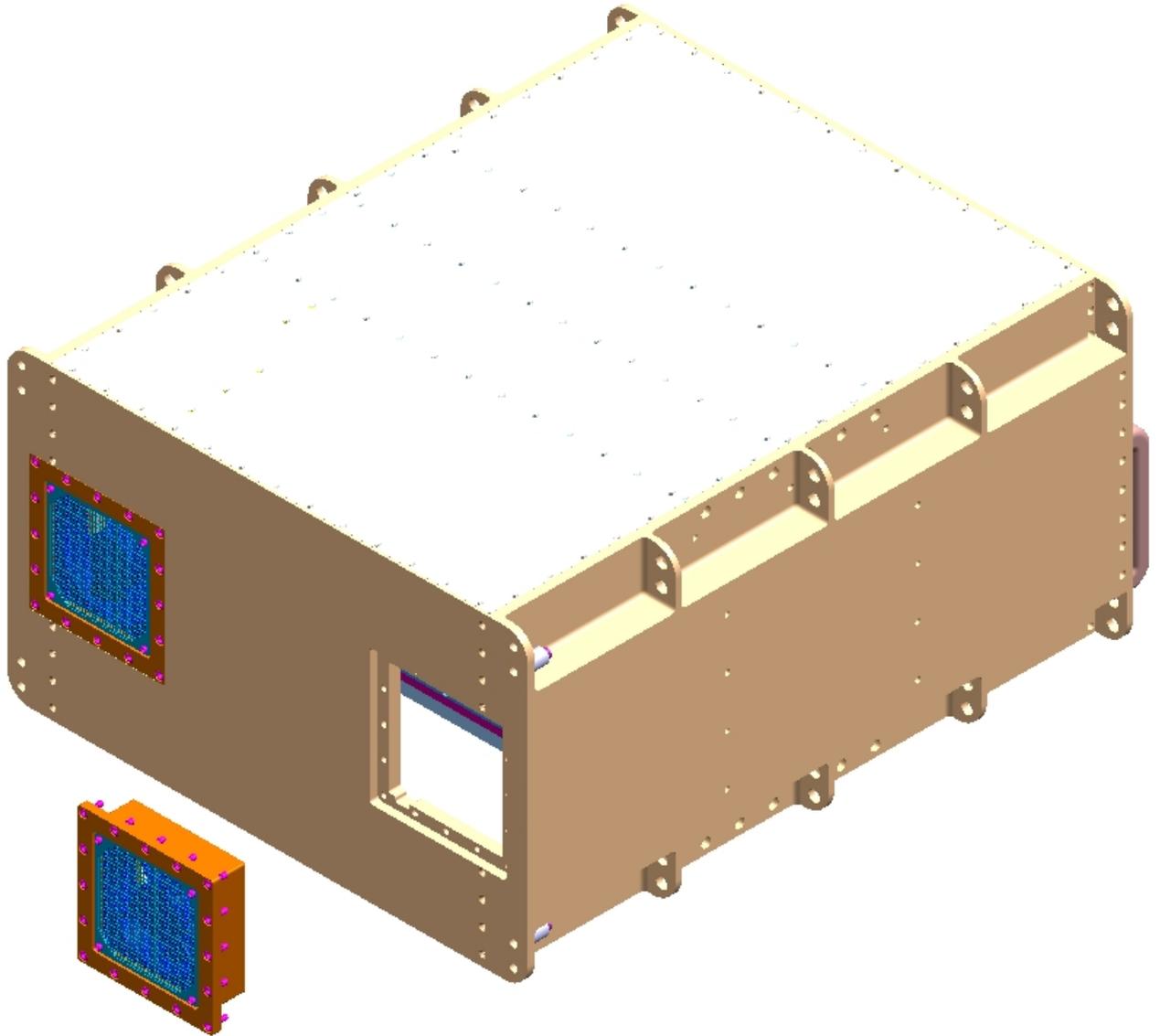
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FAN ASSEMBLY DETAIL



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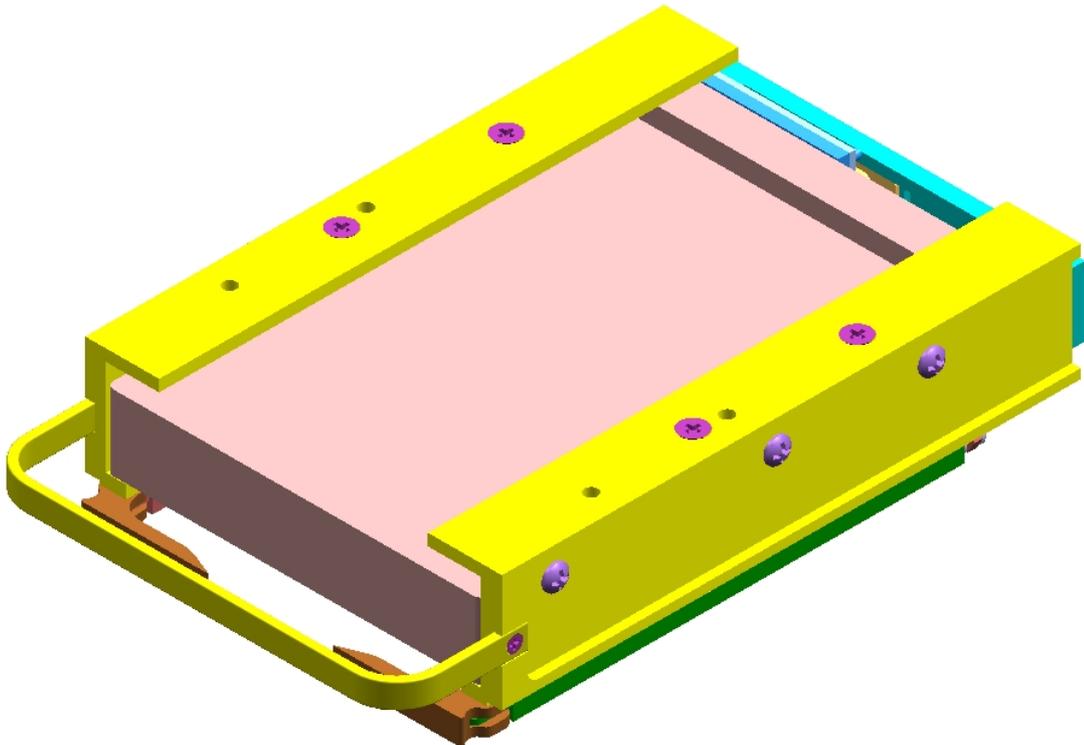
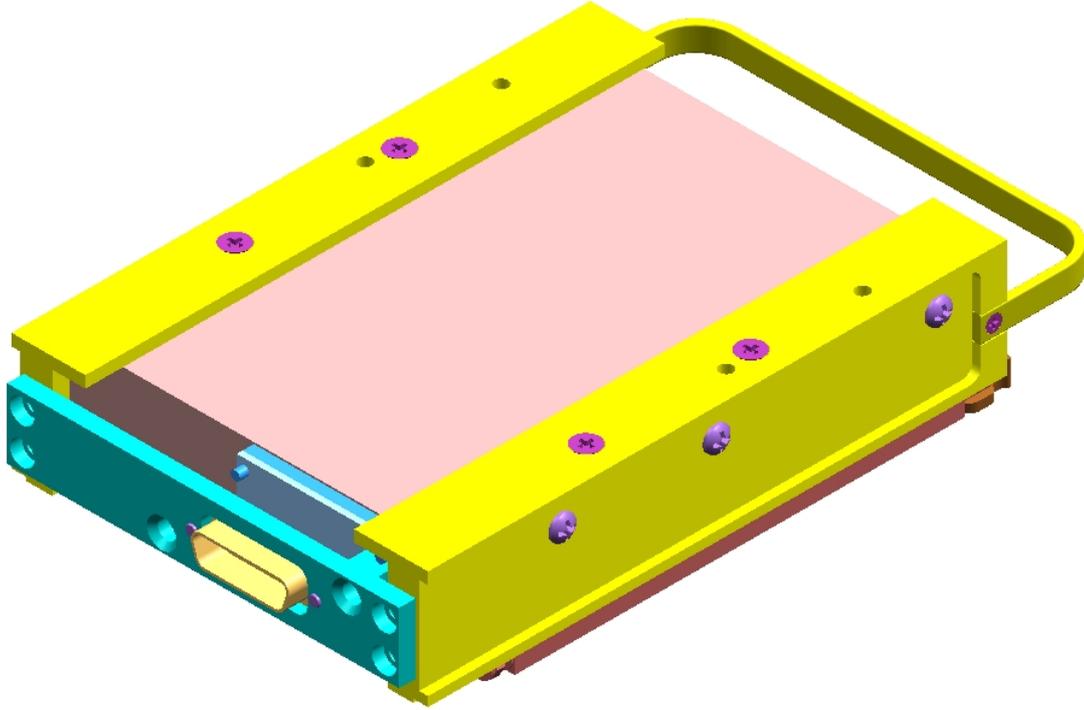
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HDD AND CADDY DESIGN

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