

InSIM – Frankfurt, September 2014

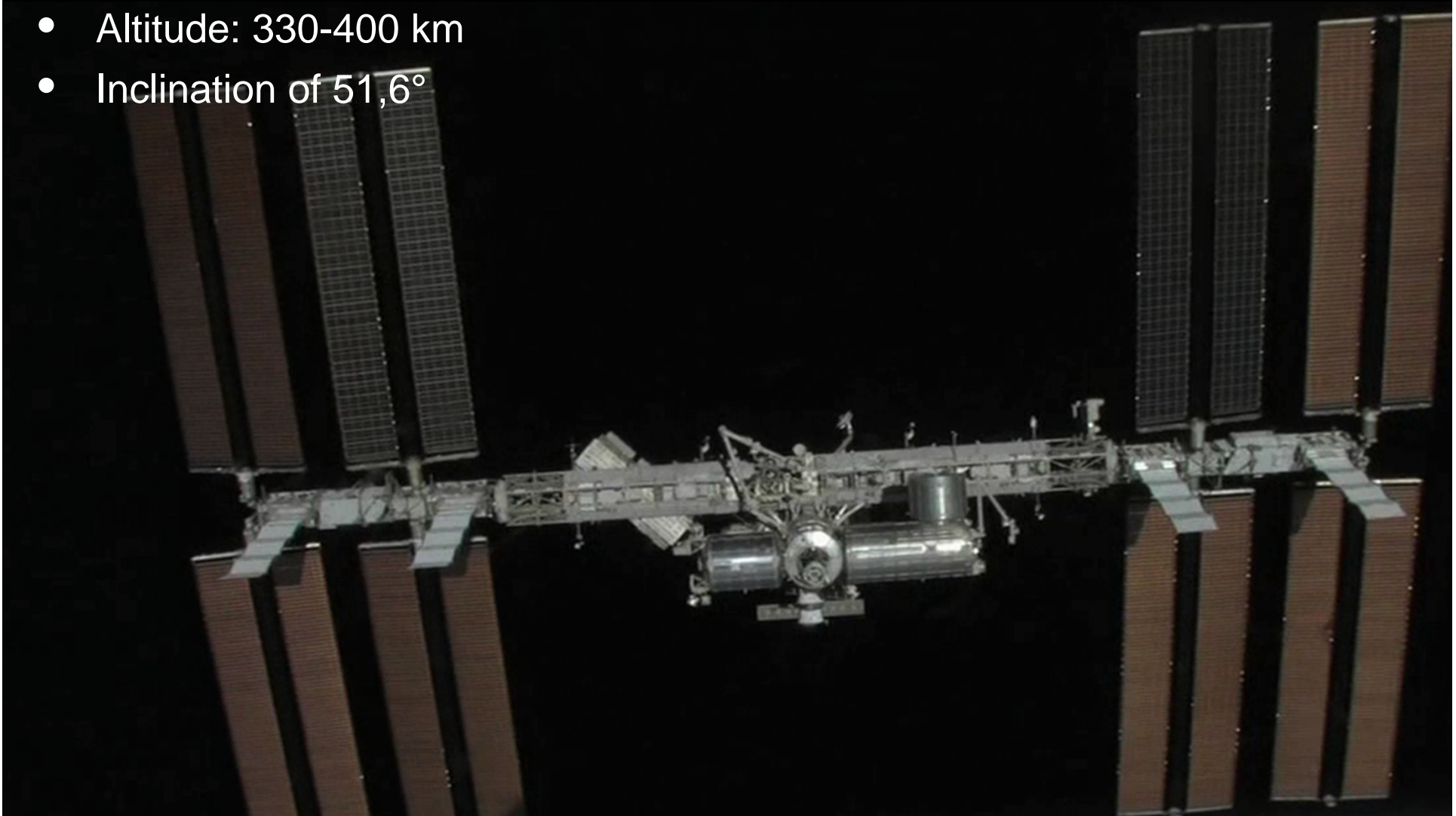
„Munich, we‘ve got a problem“

Dr.rer.nat. Thomas Uhlig, Flugdirektor Columbus

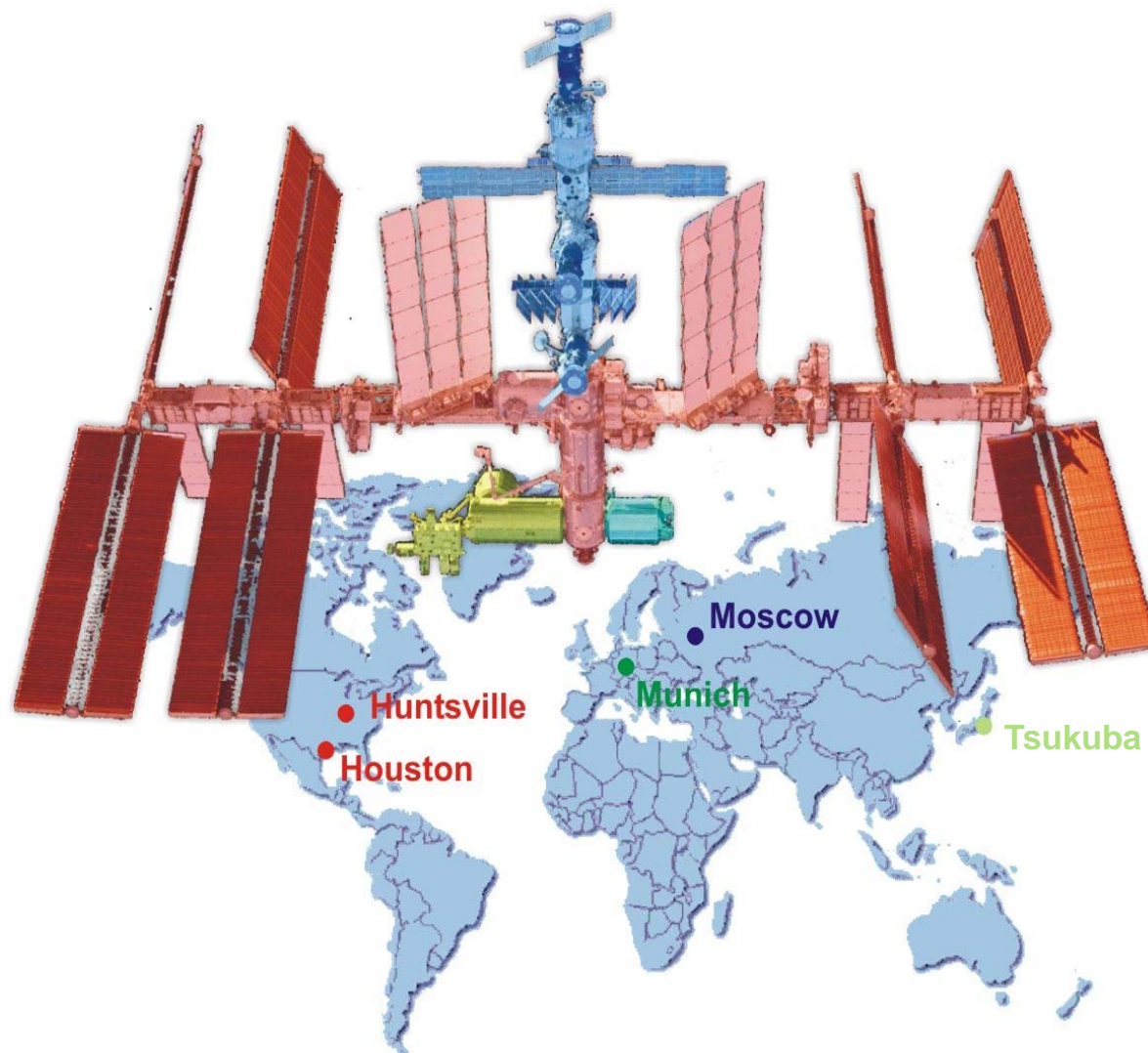


Knowledge for Tomorrow

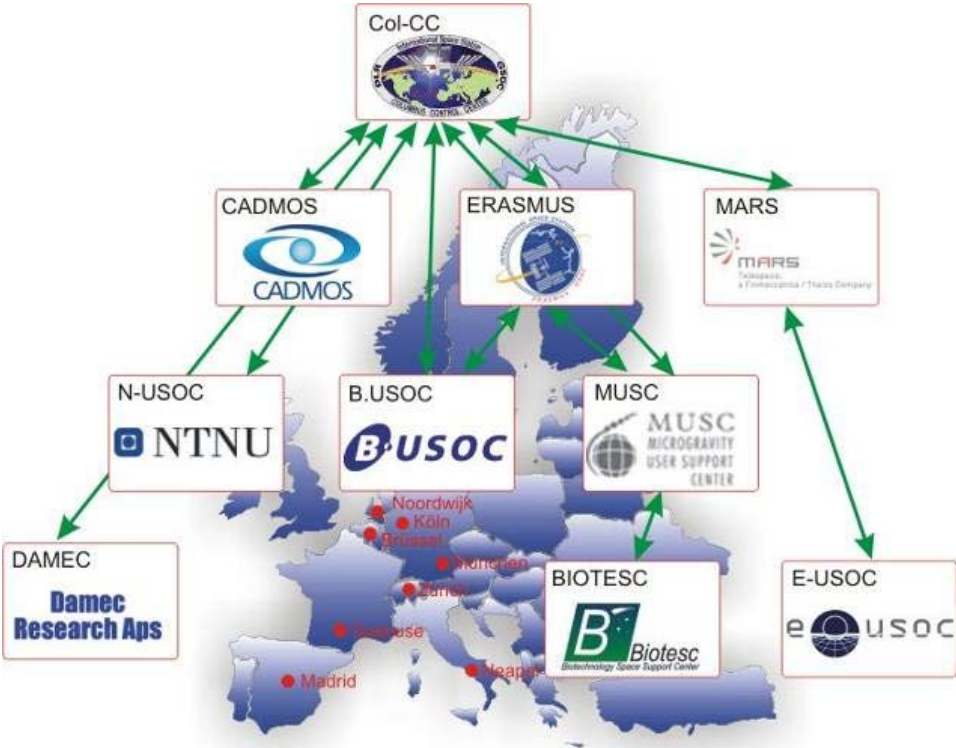
- Largest space object created by mankind
- Over 375t of mass
- Over 100 “visits” by other spacecrafts
- Almost 1000 hours of extravehicular activities
- Altitude: 330-400 km
- Inclination of 51,6°



International ISS operations network



Europe is diverse...



Rather complex setup on European side

Various USOCs (“User Support Operations Center”) operate the experiments (“payloads”) on board Columbus Control Center (Col-CC) as central node

T. Kuch, D. Sabath (2008), The Columbus-CC — Operating the European laboratory at ISS. Acta Astronautica, 63 (1-4), p. 204-212.



The tasks of the Columbus Control Centers:

- Commanding and controlling of the Columbus subsystems (TCS¹, EPDS², ECLSS³, DMS⁴, COMMS⁵)
- Coordination of the scientific experiments
- Support of astronauts during their work in Columbus
 - Responsibility for the safety of the crew in Columbus
 - Planning of European ISS activities
 - Provision of the European ground network

¹ Thermal Control System

² Electrical Power Distribution Subsystem

³ Environmental Control and Life Support System

⁴ Data Management System

⁵ Communications

At Col-CC...



COL DMS

COSMO

COL SYSTEMS

EUROCOM

COL FLIGHT

COL OC

COL DMS

Responsible for the availability of the Columbus DS computers

Responsible for the health of Columbus on board

Responsible for the configuration of the Columbus payload

Responsible for the maintenance of the Columbus team

Responsible for the plug-in plan

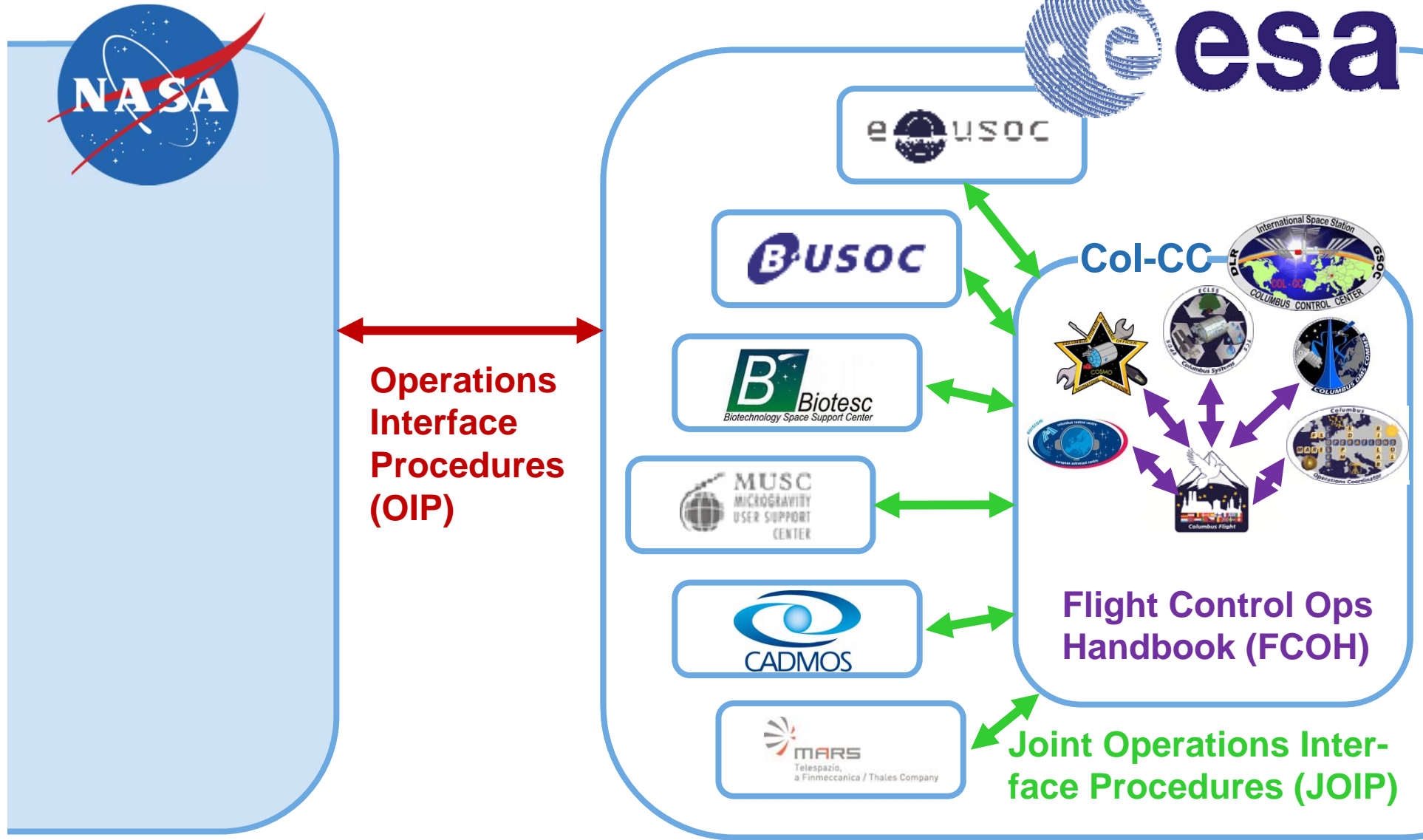
Responsible for the contact of the Columbus flight station

Responsible for the direction of the Columbus flight

Planning function



Interaction Descriptions



Interface Definition Documents

7.2.1 Payload Commanding

PURPOSE

To define the command policy and required coordination between Col-CC and USOCs for all command operations concerning Columbus ESA payloads, either performed from the Col-CC, or from the USOCs.

PARTICIPANTS

COL FLIGHT <SITE> OPS

COL OC <SITE> GC

GSOC GC

GENERAL

The Operations Interface Procedures (OIP), §8.8.1.1.1, "IP Commanding via US assets", applies between MCC-H and Col-CC.

Two types of payload commands may be sent only from the Col-CC:

- 1) payload LAN rate control commands (used to control the packet transmission rate on the on-board LAN by the payload rack or external platform),
- 2) payload file transfer commands (used to transfer files between the Columbus MMU and the payloads).

Payload command activities covered by this JOIP are a set of commands corresponding to scheduled and un-scheduled activities. Scheduled activities are those, which are planned in the OSTP. Any other activities are considered as un-scheduled (e.g. execution of malfunction procedures, saving of equipment/payload in case of anomalies, etc).

PROCEDURE

A. SCHEDULED COMMAND ACTIVITIES

- 1) COL OC will coordinate internally the command enabling of the required USOC and will inform the dedicated <SITE> OPS that the site has been enabled for commanding.
- 2) Minimum 5 minutes before the start of the command activity, the FRC <SITE> OPS will contact COL OC to get a "GO" from Col-CC to begin the upcoming nominal commanding activity. When applicable, COL OC may give a "GO" for dedicated steps only, and/or request regular updates during a commanding activity.



Principal operational concept (1/3)

The image displays a mission planning software interface with a timeline from GMT 96 to 15. The interface includes rows for Day/Night, TDRS ALL, TLM FORMAT, Attitude, SAA, ISS CDR, FE-1, FE-2, COL, Munich 96, and MCC COORD. A modal window titled "Activity Name: HMS-PHS w/BLD-S, U" is open, displaying tabs for General, Operators, Schedule Time, and Notes & Attachments. The Notes section contains an Execution Note and an OpsNote. The Attachments section shows two attachment slots with "Add" buttons. At the bottom of the modal are buttons for Edit, Apply, Save, Procedure, ShowNote, and Cancel.

J. Campan et al., „Human Spaceflight Operations“ in T. Uhlig, F. Sellmaier, M. Schmidhuber, „Spacecraft Operations“, Springer-Verlag Wien, 2014.



Principal operational concept (2/3)

All activities are performed via approved and validated procedures

Procedures enable the crew to a certain extent to work autonomously, but include ground steps/coordination

1.101 COL VIDEO CASSETTE RECORDER SERVICING (IFM/1E-ALL/FIN) Page 1 of 4 pages

OBJECTIVE:

Perform a routine servicing of a Columbus Video Cassette Recorder (VCR) by cleaning the VCR tape heads using a cleaning tape.

LOCATION:

Installed: COL1SCAO.

DURATION:

10 minutes

CREW:

One

MATERIALS:

VTR Cleaning Tape
Marking Pen

1. CHECKIING VCR STATUS



Principal operational concept (3/3)

B2-108

ISS MODULE STOWAGE CONSTRAINTS AND RESTRICTIONS

[RI] [E] [A] [062603-6027] [012606-6672C] [ED]

GENERAL [011801-7284B]

A. MAINTAIN A MINIMUM EMERGENCY TRANSLATION CORRIDOR OF 32 X 45 INCHES (81 X 114 CM) WITHIN THE FGB AND USOS MODULES. [022604-6162A] [092806-7449A]

MAINTAIN A MINIMUM EMERGENCY TRANSLATION CORRIDOR OF 32 X 32 INCHES (81 X 81 CM) WITHIN THE SM. [092806-7449A]

The 32 X 45 in (81 X 114 cm) crew safety requirement allows for a crewmember to reverse direction at any point along the corridor a module during emergency situations. Stowage plans will protect for a 32 X 72 in (81 X 183 cm) crew translation path. Note: Prior to shuttle docking missions with MPLM's, a minimum 50 X 50 in (127 X 127 cm) corridor should be made available for rack transfers.

B. HATCH OPERATION ENVELOPES SHALL BE MAINTAINED FREE OF STOWED HARDWARE.

C. NO STOWAGE MAY PREVENT ACCESS TO THE QUICK DISCONNECTS ON DRAG-THROUGH LINES.

D. ENSURE EMERGENCY EGRESS LIGHTS AROUND HATCHWAYS ARE NOT BLOCKED.

Supports crew safety by maintaining egress path and quick hatch closure for a rapid depress event.

E. ACCESS TO PORTABLE FIRE EXTINGUISHERS (PFE), PORTABLE BREATHING APPARATUS (PBA), CSA-CP, FIRE PORTS, FLASHLIGHTS, GAS MASKS, IMV VALVE, REMOTE MANUAL OVERRIDES (RMO), AIR INLET AND OUTLET DIFFUSERS, SMOKE DETECTORS, MPEV, GLAS, O₂ PORTS, C&W PANELS, AUDIO TERMINAL UNITS (ATU), COLUMBUS STANDARD UTILITY PANELS (SUP), RACK POWER SWITCHES (RPS) AND UOP'S SHALL NOT REQUIRE REMOVAL OR RECONFIGURATION OF STOWED HARDWARE. [012606-6672C] [092806-7449A]

Clear access to hatches, fire suppression equipment, and control panels (to remove electrical ignition sources or airflow) must be maintained to suppress or isolate any fire occurrences.

THE FOLLOWING FIRE PORTS ARE PERMITTED TO BE COVERED BY

Flight rules define the
„operational envelope“





Off-nominal situations

- Automatic FDIR (Failure Detection, Isolation and Recovery) implemented in the vehicle
- Station-wide alarm system (3 levels: Cautions, Warnings and Emergencies) alerts crew and ground



ISS024E014952

- For each alarm a defined response procedure is available for crew and ground to react to the malfunction
- Goal: Bring the vehicle into a safe configuration (Priority: Crew – vehicle - mission) and hand over the detailed investigations to the Engineering community



Emergency operations (1/2)

- Three emergency scenarios are defined:
 - *Fire*
 - *Rapid Depress*
 - *Toxic Atmosphere*
- Common crew response (warn, gather, fight)
- Special crew response dependent on emergency
- Responses are already designed for independency
- „Escape to earth“ option available any time
- ISS CDR is leading the emergency response
- Challenging operations due to heavy communications, not possible to pause for S/G calls, English and Russian
- Regularly practiced, also while crew on board



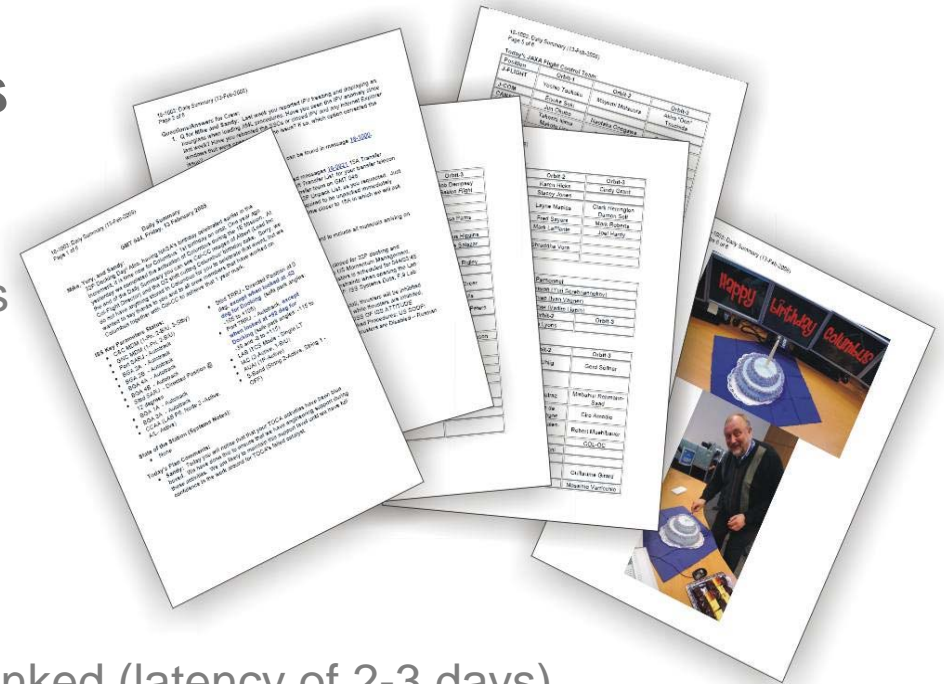
Emergency operations (2/2)

- Medical Emergencies are handled differently
 - Dedicated treatment procedures/equipment on board
 - Crew medical officers
 - Flight Surgeons available on ground
 - Privatized conferences, only ops impacts are communicated



Ways of Communications

- **Verbal communication (EUROCOM!)**
 - 4 „space to ground“ voice channels
 - Voice-over-IP capabilities
- **Visual communications**
 - 6 (+1) video channels (one-way)
 - Still photographs, which are downlinked (latency of 2-3 days)
- **Written communications**
 - Procedures, timeline, stowage note
 - „Daily Summary“ and other documents
 - Email (private and operationally)
 - „crew notes“




Kommunikationsmittel



Es ist genau festgelegt, welche Position welche Voice Loops mithören muss, wie jemand erreicht werden kann, welche Funktionen die Loops haben




Communications protocol


	"S/G 1" voice loop	"COL FD 1" voice loop	"COL OC 1" voice loop
Crew	Munich, Station on S/G1 for BLB		
MUSC Ops			MUSC Ops here
COL OC		COL OC here	
EUROCOM	Go ahead, Alex!		
Crew	Which user name am I supposed to use?		
MUSC Ops			The user "Astro123"
COL OC		COL FD, the user name is "Astro123"!	
EUROCOM	Alex, please use "Astro 123"		
MUSC Ops			Good words
COL OC		Good words	
Crew 	Copy, thanks!		



Flight Notes



Columbus Control Center
OPERATIONS SUPPORT TOOLS



GMT 078/21:52
COL-FD / uhlig [Log out]

CFN13623: GMT 079 Daily Summary Inputs Collection
Approved

To: COL-FD

From: COL-FD / Libby Jackson

Reviser: COL-FD / Libby Jackson

Activity: Real-Time Operations

<input type="checkbox"/> Anomaly	<input type="checkbox"/> FR	<input type="checkbox"/> ODF
<input type="checkbox"/> Change Request	<input type="checkbox"/> Temp	<input type="checkbox"/> Perm
<input type="checkbox"/> Timeline	<input type="checkbox"/> Others	

Opened	2013/078:18:08
Revision Time	2013/078:18:08
Last Update	2013/078:18:12

Please, provide here your inputs for tomorrow's GMT 079 Daily Summary. Thanks!

Cadmos Ops
Tom, in preparation of your ENERGY session starting on GMT085, we have uplinked message 34-0813 "ENERGY Big Picture Words", which we will be discussing with you on GMT081 during the ENERGY Big Picture Conference.

COL FD proposed wording:
Tom, in preparation for your upcoming ENERGY session, starting on GMT085, we have uplinked message 34-0813 "ENERGY Big Picture Words", which we will be discussing with you on GMT081 during the ENERGY Big Picture Words Conference.

COL-FLIGHT DISPOSITION				
Timestamp	Position	Individual	Disposition	Attach
2013/078:18:10	COL-FD	jackson	Approved	
Comment: CADMOS has confirmed they are happy with the proposed wording.				

IMPLEMENTATION				
Timestamp	Position	Individual	Implement Status	Attach
2013/078:18:12	COL-FD	jackson	Implemented	
Comment: Comment provided in EFN 055918.				
2013/078:18:10	EUROCOM		Pending	
Comment:				

FN Review
FD Disposition
Implementation
Close Out
Event Log



Documentation: Clog

CLOG Version 2.95 - Microsoft Internet Explorer

Address: http://ost.col-cc.sup/cost/CLog/dog.php?SessionId=57023

Columbus Control Center
OPERATIONS SUPPORT TOOLS

Tools > COST > CLog

Columbus : Col-FD : uhlig

Time	Description	H/O	O/N	Actions
2010-278/16:01:14	Closed CFN2486.	<input type="checkbox"/>	<input type="checkbox"/>	Edit
2010-278/15:52:10	COL OC issued PPCR144 to add the 5mins crew activity on GMT280.	<input type="checkbox"/>	<input type="checkbox"/>	Edit
2010-278/15:51:38	MUSC came up with an 5mins crew activity in E-3 to remove the test cartridges from the TCUs before the PADIAC samples are inserted. On GMT281 the only trained crew member is already overbooked, thus OC is now investigating what to do.	<input type="checkbox"/>	<input type="checkbox"/>	Edit
2010-278/15:47:45	WPA2 checkout completed	<input type="checkbox"/>	<input type="checkbox"/>	Edit
2010-278/15:39:37	Aksed ISS FD for the go for the WPA2 s/o haz command. We are go for it.	<input type="checkbox"/>	<input type="checkbox"/>	Edit
2010-278/15:29:32	Go given for WPA checkout	<input type="checkbox"/>	<input type="checkbox"/>	Edit
2010-278/15:28:21	SD sync done, SYSTEMS did not see the peak, but the other phases of the test. Thus we consider it as successful.	<input type="checkbox"/>	<input type="checkbox"/>	Edit

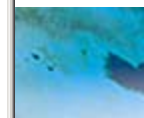
Event Time (UTC): Year* 2010 DOY* 349 Hour* Min* Sec (now) *obligatory Help

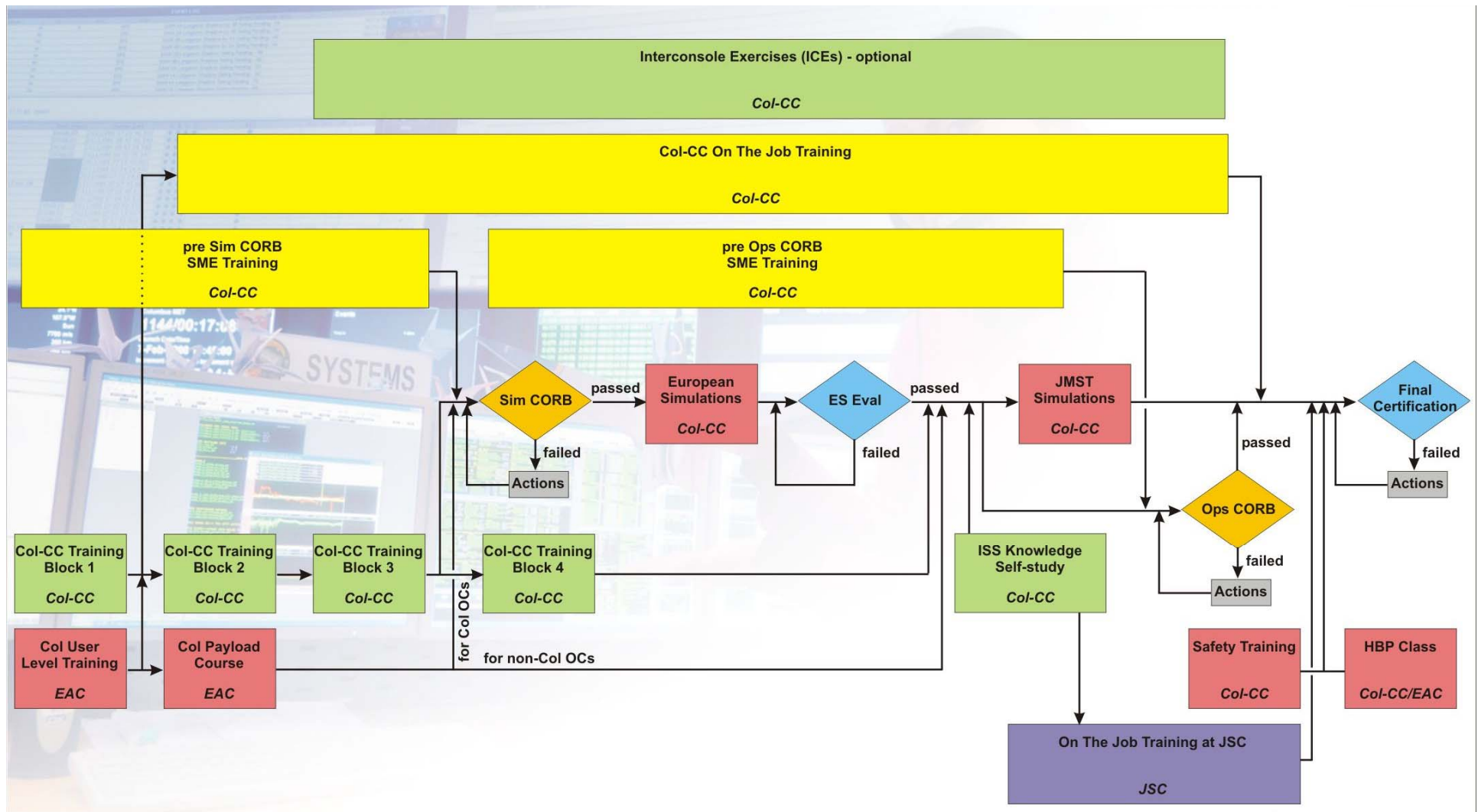
Options: Handover Off Nominal

Reference: #

Attachments: Browse... Attach File

Submit Entry





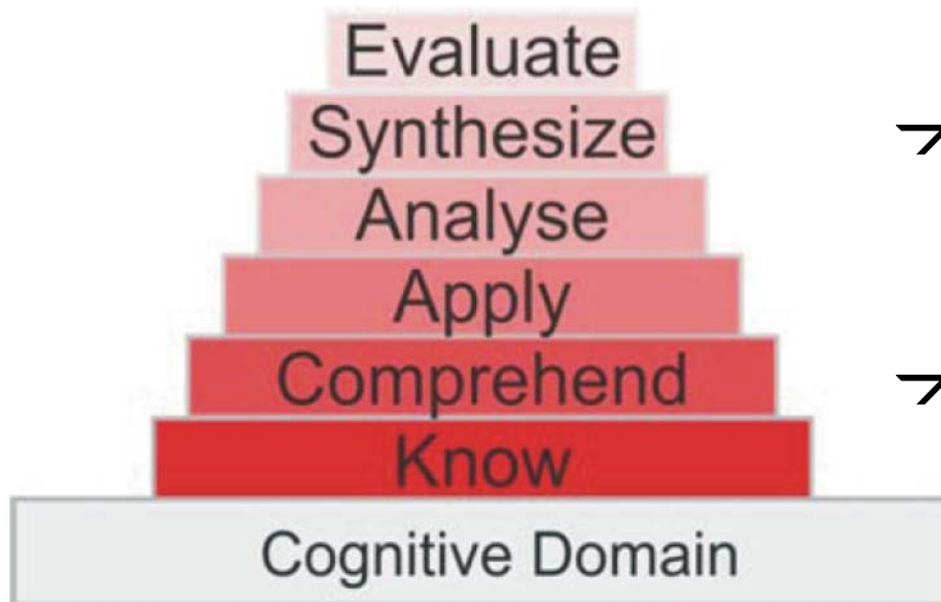
- Kandidaten: Absolventen mit Ingenieurs- oder naturwissenschaftlichen Abschluss
- Dauer der Ausbildung: Etwa 1 Jahr

T. Uhlig, K. Özdemir, D. Sabath (2011), Training concept of the Columbus Flight Control Team. Proceedings of IAC 2011, Cape Town (South Africa).





Simulationen and training material

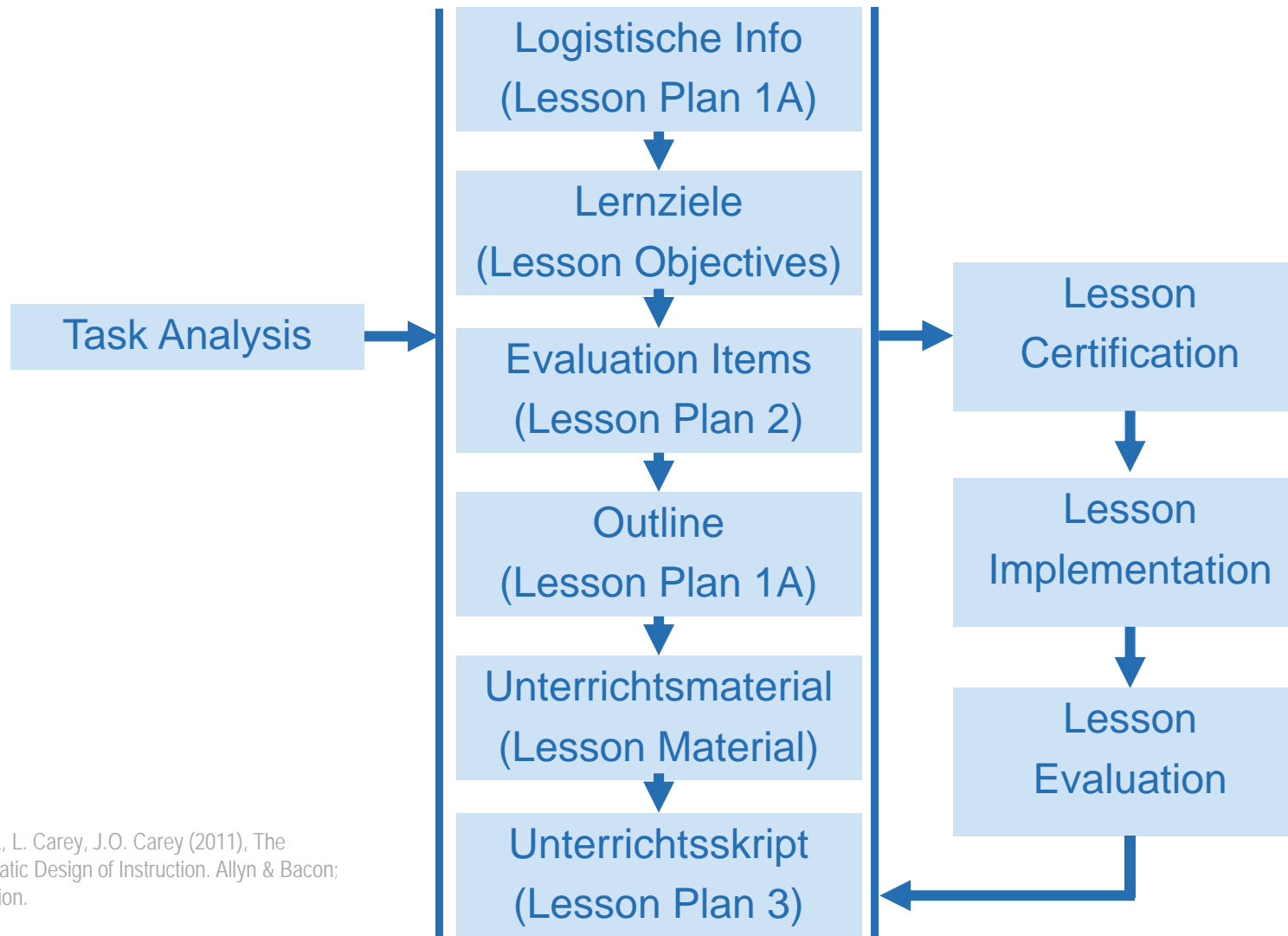


- Lowest two levels can be covered by classroom lessons and theoretical testing
- Application level requires practical training and testing

B. S. Bloom (1956), Taxonomy of Educational Objectives, Book I: Cognitive Domain. Addison Wesley Publishing Company; 2nd edition.



Training development



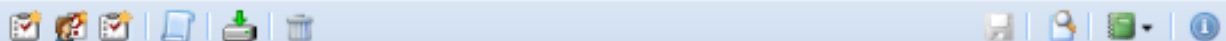
W. Dick, L. Carey, J.O. Carey (2011), The Systematic Design of Instruction. Allyn & Bacon; 7th edition.



Module Tree

- [-] Catalogue Manager
 - [-] CCC - Col-CC FCT training {AUT}
 - [-] COL-GSP - Columbus Systems Training
 - [-] GSP - Operations Training for GSP
 - [-] SPT - Supportive lessons
 - [-] OPS - Operational
 - [-] PLA - Planning
 - [-] ITR - Introductions
 - [-] DOC - Documents
 - [-] ITR - Ops Document Introduction
 - [-] ODF - Operations Data File Introduction
 - [-] UPD - Ops Documents
 - [-] ANO - Anomaly
 - [-] SKL - Skills
 - [-] MSC - Miscellaneous
 - [-] OST - Ops Support Tools
 - [-] SYS - Systems
 - [-] EME - Emergencies
 - [-] EVL - Evaluations
 - [-] ITC - ITC Student Catalogue {RDR}
 - [-] SIM - Simulation Training {RDR}
 - [-] TST - Test Catalogue. {RDR}
 - [-] USC - USOC Operations Training

Lesson [EDIT] Operations Data File Introduction [GSP-OPS-DOC-ODF] [last updated on 29-Jul-2014]



Certifications

Cert. Type	Cert. Status [Date]	Trg. Record (Completed)	Lesson Changes
Lesson Certification	Certified [23-Jul-2013]	[11-Feb-2014]	View Changes
Donnarumma, Anna Rita	Certified [23-Jul-2013]	[11-Feb-2014]	View Changes
Uhlig, Thomas	Certified [26-Mar-2014]	[Not defined]	View Changes

		FD	STRATOS			USOC			
		[COL FD] E01-5.2	Actively generate team awareness	Matrix	[STRATOS] E01-5.2	Actively maintain team awareness	Matrix	[USOC] E01-5.2	Actively maintain team awareness
PO1-6	Show leadership skills	All EOs need to be handled successfully			EO is not defined for STRATOS			EO is not defined for USOCs	
		[COL FD] E01-6.1	Demonstrate resolution strategies of conflicting interests	Matrix					
		[COL FD] E01-6.2	Demonstrate decision making capabilities	Matrix					
2 Execute scheduled activities under own responsibility									
PO2-1	Perform regular DMS activities	EO is not defined for COL FD			Two of the EOs need to be successfully handled			EO is not defined for USOCs	
		Linked to [COL FD]E03-3.1	Coordinate nominal commanding activities of STRATOS		[STRATOS] E02-1.1	Perform a PWS ground reboot	Response must be according to the corresponding checklist		
		Linked to [COL FD]E03-3.1	Coordinate nominal commanding activities of STRATOS		[STRATOS] E02-1.2	Perform LAN switch Readout	Response must be according to the corresponding checklist		
		Linked to [COL FD]E03-3.1	Coordinate nominal commanding activities of STRATOS		[STRATOS] E02-1.3	Perform a PWS Onboard Log File DL	Response must be according to the corresponding		



Vielen Dank für Ihre Aufmerksamkeit

ISS selber sehen: *<http://www.heavens-above.com>*

Unser Blog: *www.dlr.de/blogs/*

Unsere Homepage: *www.col-cc.de/*

Unser Tag d. offenen Türe: *12. Okt 2014*

