Impact of safety related requirements and evolutions on LASS and LACS

By Rui NUNES
In the name of the Access Team
Current major issues

1. MAD
2. EIS-f bypass (in/out of chain)
3. Resectorisation needs
   - Access vs Ventilation
   - “Overpressure” doors
   - Maintenance
4. New Interlocks
5. Moving equipment due to R2E
6. New access points
7. Other Technical Improvements
LHC Access in numbers

- 35 Access points
- 44 PADs – 30 MADs
- 116 Sector doors
- 81 End-of-Zone doors
- 22 interlocked + 24 non-interlocked ventilation doors

- EIS-f/m interlocks (interfaces)
  - Magnets (6 Power converters & respective Cells )
  - Beam stoppers (2 TED)
  - Access Safety blocks (2 valves)
  - Electron stoppers (4 valves)
  - RF interlock
  - L BDS – LHC Beam dump system
  - BIS – Beam interlock System
  - SPS Access chains 3 & 5
LACS and LASS

- **LHC Access Control System (LACS)**
  - Authorise and authenticate the people who enter
    - Authorise = have the credentials
      - Valid Contract, Dosimeter, training, EDH, ADI, etc...
    - Authenticate = you are who you say you are
      - Biometrics

- **LHC Access Safety System (LASS)**
  - People => no beam
  - Beam => no people
MAD - Material Access Device

**Guarantee** that no person can enter through the MAD involuntarily or by mistake

Particularly in RESTRICTED MODE + PATROL:

Current solution is considered insufficient

- **Current approach**
  - fine Movement detection
- **but**
  - Flashing lights,
  - Snow melting & water
  - Light changes, etc...

- **Current difficulties include**
  - too lax detection
    - False acceptance risk
    - ➔ potential Safety problem
  - too strict detection
    - False rejection high
    - ➔ Availability problem
MAD with people

- Normal people trying to stay still
- Easily detectable target
- However we are now with increased sensitivity in order to detect even the finest movement
MAD extremes

![MAD Attempts vs Rejects](image)

Images from F. Valentini
MAD - Material Access Device

- Design modification

- Actions foreseen
  1. Make detection “failsafe”
  2. IR cells as complement
  3. Remote control
  4. 2\textsuperscript{nd} Redundant system of diverse technology (e.g. via thermal imaging)
EIS-f/m bypass

- 53 bypass action since June 2008
- 4 bypass actions in Jan 2010
- Each request is generally
  - Urgent
  - Moderately complex
    - 6-20 Cabled straps to execute each time
- If mistakes are made
  - Access forbidden in LHC
  - Evacuation sirens possible
- Status of EIS bypass available only in documentation

![EIS bypass in time](image)
EIS-f/m bypass

- Technical improvement

- Solution foreseen
  - Pre-cabled electrical relay bypass possibility on main EIS-f/m signals
  - On-line signalisation in the CCC LASS Console
  - System built-in bypass procedure to give the DSO full control
    - e.g. interlocked keys, etc...
Access Safety vs. Ventilation

• **Requirement**
  ▫ Align the Access sectorisation with the ventilation sectorisation
  ▫ This is no longer the case, mostly in the UAs, but maybe also some other areas

• **Consequence**
  ▫ If not done access to service areas shall be more limited than expected

• Let’s take the example for LHC2 – UA27
Access Safety vs. Ventilation

1. Access Point (PAD/MAD)

2. Cable passages not air tight

3. New “overpressure” door

4. Consequence = Not possible to access US-UA before long air-decay time
Access Safety vs. Ventilation - Option 1

Option 1. Make cable passages air-tight

Implications for cables to be studied. Cooling, modifs, etc..
Access Safety vs. Ventilation - Option 2

Option 2: Move or add access point next to door

Major review of access control & safety & interlocks
Access Safety vs. Ventilation

- This is not a new requirement
  - Non-air tightness has been known for a while
  - Must decide on course of action
    - Option 1 – make air-tight
    - Option 2 – modify Access
    - Option 3 – do nothing

- Study is necessary in 2010

- Design modification
“Overpressure” doors integration

• **Requirement**
  ▫ Acquire the status of new doors in a more reliable fashion
  ▫ related to previous issue on sectorisation and containment of a MCI

• **Consequence**
  ▫ Not technically complex
  ▫ Requires exhaustive non-regression testing
  ▫ ...New interlocks?

• **Design modification/Scope increase**
Sectorisation for Maintenance

- **Requirement**
  - Allow for maintenance in external envelope during run periods (PM shafts)
  - Most solicited interlocked access points

- **Consequence**
  - Move the external envelope inwards
  - Add additional door like in SPS
  - Design modification
In 5 ½ month period
Aug 2009 – Jan 2010
New interlocks - Powering Tests

• Requirement
  ▫ Cover the risk of MCI during Phase 2 powering tests
  ▫ Interlock PCs in case of intrusion in (another) envelope

• Consequence
  ▫ Risk analysis necessary
  ▫ Can be extremely complex depending on the number of interlock points
  ▫ May require Power Converter modifications to provide safety interlocks
  ▫ May require re-sectorisation as before

• Scope increase/new risk
New interlock - fresh air supply

- **Requirement**
  - Stop people from entering LHC if the ventilation conditions are not OK

- **Consequence**
  - More complicated on the ventilation side than on the Access side.
  - Difficult to obtain this information
  - Technically not complex to implement for LACS

- **Scope increase**
R2E - Moving equipment

• Requirement
  ▫ Remove critical equipment from areas that are subject to R2E effects
  ▫ Areas concerned are
    1. UJ56
    2. UJ76.. ?
    3. UJ33, .... ?

• Consequence
  ▫ Moving equipment requires re-cabling and finding new locations (integration)

• Design modification
New access points (non-interlocked)

- **Requirement**
  - PM54 – CMS
  - Finish installation according to design so we can:
    - count underground occupants
    - Homogenise supervision & maintenance

- **Consequence**
  - Not technically complex
  - Civil engineering integration for new location requested by CMS
  - Can be done during beam

- **Technical Improvement**
New access points (interlocked)

- **Requirements**
  - TZ32 – CLIC alignment use
    - New PAD+MAD in US32
  - PZ65 to be confirmed
    - when PM65 unavailable

- **Consequence**
  - Moving of existing end-of-zone doors & new interlocked zone
  - Re-sectorization implications
  - Re-cabling from PZ33

- Design modification
Other technical improvements

- **PAD programme correction**
  - To avoid losing patrols on passage
- **Intercom improvement**
  - Noise reasons next to compressor areas
- **Video improvement**
  - Technological change to avoid freezing & improve fluidity
- **IHM improvement**
  - Capability of treating multiple access points simultaneously
- **Improve LACS-LASS interfaces**
  - Application of access modes
- **Improve interface with ATLAS SSA**
S1  include in list sharepoint as new item  
   Sedas, 1/19/2010

S2  include in list sharepoint as new item  
   Sedas, 1/19/2010
Thank you for your attention
Scale of graphs - example

<table>
<thead>
<tr>
<th>Scale</th>
<th>Safety</th>
<th>Scale Cost (CHF)</th>
<th>Delay</th>
<th>Complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>no improvement</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>minor improvement</td>
<td>1 &gt; 1 000</td>
<td>6 months</td>
<td>simple SW or HW</td>
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<tr>
<td>2</td>
<td>medium improvement</td>
<td>2 &gt; 10 000</td>
<td>1 year</td>
<td>SW or HW</td>
</tr>
<tr>
<td>3</td>
<td>major improvement</td>
<td>3 &gt; 100 000</td>
<td>2 years</td>
<td>Complex SW or HW</td>
</tr>
<tr>
<td>4</td>
<td>New safety function</td>
<td>4 &gt; 1 000 000</td>
<td>3 years</td>
<td>Re-Design issue</td>
</tr>
<tr>
<td>5</td>
<td>New risk covered</td>
<td>5 &gt; 10 000 000</td>
<td>&gt; 3 years</td>
<td>New concept</td>
</tr>
</tbody>
</table>

Other criteria: qualitative scale of 0-5
- Reliability
- Availability
- Maintainability
- Usability