BioRID Update

- S1 Load Investigation During Head Restraint Tests
- Deceleration ETD Covering
- Cervical Pin Test Investigation
  - Normal vs Tight Cervical Pin
    - Dummy Certification with out Head Restraint
    - Dummy Certification with Head Restraint
  - Non Rusty vs Rusty Cervical Pin Test
    - Dummy Certification with out Head Restraint
    - Dummy Certification with Head Restraint
BioRID Update

► Probe Holder
► Head Rest Setup Scale Zeroing Tool
► Certification Manual Updates
► User Manual Updates
► Jacket Testing - No Update
► Future Plans
## BioRID Effects on Certification Test
### Summary

<table>
<thead>
<tr>
<th>Affect</th>
<th>Certification Tests</th>
<th>Headrest Cert Test</th>
<th>Sled Testing</th>
<th>Action Taken</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacket Stiffness</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Tighten Manufacturing Specs</td>
<td>Draft Stiffness Spec Due Sept 17</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dynamic stiffness test in development</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Add Weight spec for water install in jacket</td>
<td></td>
</tr>
<tr>
<td>Water amount in Jacket</td>
<td>No</td>
<td>No, Minor affect to rebound</td>
<td>?</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Head MMI</td>
<td>No</td>
<td>Minor Affect</td>
<td>?</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Damper Oil amount</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>None</td>
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<tr>
<td>Pelvis Stiffness</td>
<td>No</td>
<td>No</td>
<td>Concern about seating height</td>
<td>TBD for MFG</td>
<td>Group did not want test for Cert</td>
</tr>
<tr>
<td>Lateral tilt adjustment of OC Plate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Revised Adjustment procedure under development</td>
<td></td>
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<tr>
<td>Spine Set up</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>Due Feb 24</td>
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<tr>
<td>Bumper Stiffness</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>Due April 1</td>
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</tr>
<tr>
<td>Vertebra Fit</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
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</tr>
<tr>
<td>Muscle Spring Stiffness</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
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<tr>
<td>Cervical Pin Fit (Normal vs Tight)</td>
<td>Significant Differences</td>
<td>Small Differences</td>
<td></td>
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</tr>
<tr>
<td>Cervical Pin Fit (Normal vs Rusty)</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Cervical Pin Fit (Normal vs Loose)</td>
<td>TBD</td>
<td>TBD</td>
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<td></td>
<td>Due Feb 24</td>
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</tbody>
</table>
S1 Load Investigation During Head Restraint Tests

► Investigated the lumbar loads during engagement with dummy stop

► Recorded data during catcher impact
  – Large forces and moments seen during impact with catcher.

► Update dummy catcher to better control dummy loading
Redesigned the shape to reduce loading at S1
Deceleration ETD Covering

- Latex covered
  - Humidity Sealed
- Good test results
- Working on Head Restraint ETD

- Will be ready to ship next week
ETD Test
Performance within Acceptable limits

Deceleration ETD Covering
BioRID Cervical Pin Test Series

- Normal vs Tight Cervical Pins
- Dummy Certification without Head Restraint
- Tight pins were selected as being 0.018 mm larger than the normal pin to ensure an interference fit.
- Significant Differences in Dummy Performance
Pot A - Head Rotation about OC

- Normal-1
- Normal-13
- Normal-25
- Tight-8
- Tight-20

degrees vs Time (msec)
-25 25 75 125 175 225
Pot B - Neck Link Rotation about T1

Time (msec)

-40 -35 -30 -25 -20 -15 -10 -5 0 5 10

degrees

0 25 50 75 100 125 150 175 200 225

Normal-1
Normal-13
Normal-25
Tight-8
Tight-20
Total Head Rotation about T1
T1 X Acceleration

- Time (msec)
- m/s²

- Normal
  - Normal-1
  - Normal-13
  - Normal-25
- Tight
  - Tight-8
  - Tight-20

Graph showing acceleration over time with different conditions.
Lower Neck Force FX

The graph illustrates the force (N) over time (msec) for different conditions:
- Normal-1
- Normal-13
- Normal-25
- Tight-8
- Tight-20

The x-axis represents time in milliseconds (msec), ranging from 0 to 225, while the y-axis represents force in Newtons (N), ranging from -300 to 500.
Lower Neck Moment MY

![Graph showing Lower Neck Moment MY with different conditions labeled as Normal-1, Normal-13, Normal-25, Tight-8, and Tight-20. The x-axis represents Time (msec) ranging from -25 to 225, and the y-axis represents Nm ranging from -20 to 10.]
BioRID Cervical Pin Test Series

- Normal vs Tight Cervical Pins
- Dummy Certification with Head Restraint
- Tight pins were selected as being 0.018 mm larger than the normal pin to ensure a interference fit.
- Differences in Dummy Performance.
Pot A - Head Pot

The graph shows the degree of rotation over time for different conditions:
- **NORMAL PINS-3**
- **NORMAL PINS-15**
- **NORMAL PINS-27**
- **TIGHT PINS-9**
- **TIGHT PINS-21**

Time (msec) from -25 to 175 is displayed on the x-axis.
Degrees are displayed on the y-axis from -5 to 20.
Upper Neck Force FZ

Time (msec)

-25 -5 15 35 55 75 95 115 135 155 175

N

-400 -300 -200 -100 0 100 200 300 400 500 600

NORMAL PINS-3
NORMAL PINS-15
NORMAL PINS-27
TIGHT PINS-9
TIGHT PINS-21
Upper Neck Moment MY

Time (msec) vs. Nm

-25 -10 0 5 10 15 20 25 30

-10 -5 0 5 10 15 20 25 30

NORMAL PINS-3
NORMAL PINS-15
NORMAL PINS-27
TIGHT PINS-9
TIGHT PINS-21
Lower Neck Force FX (T1 load Cell)
Lower Neck Force FZ (T1 load Cell)
Lower Neck Moment MY (T1 Load Cell)
BioRID Cervical Pin Test Series

► Non Rusty vs Rusty Cervical Pins
► Dummy Certification without Head Restraint

► Test Results
  – No real significant differences
BioRID II Cervical Pin Test Series

- Non Rusty vs Rusty Cervical Pins
- Dummy Certification with Head Restraint
- Used modified dummy catcher

- Test Results
  - No real significant differences
Head Restraint Setup Zeroing Tool
Head Restraint Setup Zeroing Tool

Head Rest
Setup Scale
Zeroing Tool
Manual Updates

- Certification and User Manual Out for review and comments
- Receiving comments on each
Future Plans

► Continue Test Setup Investigations
► Corridor Reduction
Thank You!!