



# APTS Pressure Sensor Integration

Report to GRSP IG Meeting #47 Paris

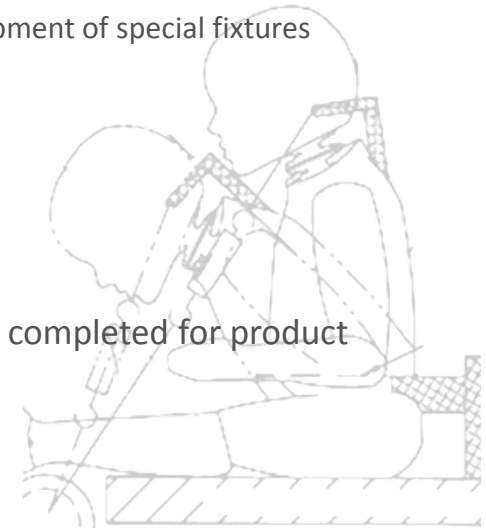


# Abdominal Sensor integration

Humanetics planned efforts



1. Updated mold design
  - include cavities, cable exist and means for fixation of two sensors
  - Assumed sensor diameter of 50 mm
  - Included spacing for Kevlar sock to minimize friction between sensor and skin
2. Produce prototype abdomens
  - Need for mass balance as sensors itself have higher density than foam
  - Produced prototypes with different foam types
  - This will also facilitate stiffness tuning to meet certification requirements
3. Evaluation testing
  - Thorax certification tests, static flexion tests, abdomen certification tests
  - The static flexion tests or any other new tests would need development of special fixtures
  - This task was originally planned for end 2013 / early 2014
4. All activities are supported by FE modelling
  - Investigations into contributions from shoulder belt, thorax, etc.
  - Studying possible risks for interactions with other dummy parts
  - Studying influence of foam density
5. Originally it was planned to have the Q10 abdomen tested and completed for product release early 2014
  - Other Q dummies to follow in 2014



# Challenges encountered



- Mass of sensor set is ~560 grams while mass of equivalent foam volume is ~280 grams
  - Lighter foams have to be applied which appear to suffer from post-curing and degradation of mechanical properties
  - Post curing results in smaller diameter of hole
- External diameter of sensor increases due to initial filling pressure
  - Nominal diameter of 50, actual diameter around 51,5 mm
- The above result in tolerance issues
  - Redesign of molds was needed introducing cavity with larger diameter (55 mm hole diameter for 50 mm sensor)
  - Updated molds available and two Q10 abdomens produced for testing at ADAC



Foam 1 - lightweight Foam 2 – standard



# Fit study

- Humanetics can integrate the APTS sensor in the Q dummy abdomens but
  - Mass specification to be redefined (adding ~500 grams)
  - Q3 and Q6 only allow for sensor of 40 mm instead of 50 mm
- Two Q10 abdomens using current foam will be delivered to ADAC for evaluation testing
  - Using original foam (hence resulting in heavier abdomen)

	Q1 036-0000	Q1.5 048-0000	Q3 020-0000	Q6 033-0000	Q10 010-0000
Abdomen					
Drawing number	036-5000		020-5000	033-5000	010-4300
Width (total)	152 mm		183 mm	173 mm	243 mm
Depth (total)	132 mm		153 mm	128 mm	153 mm
Depth (spine CL to front)	95.4 mm		132.7 mm	118.4 mm	137.3 mm
Height (total)	123 mm		178 mm	155 mm	202 mm
Mass	XXX ±XX gram		790 ±30 gram	XXX ±XX gram	1670 ±45 gram
Lumbar					
Diameter	44 mm		44 mm	44 mm	48 mm
Rubber column length	52.5 mm		52.5 mm	82.5 mm	82.5 mm
Pelvis					
ASIS Width	134 mm <i>ASIS defined as 45 degr tangent point</i>		157 mm	162 mm	192 mm
APTS					
Diameter	31 mm		51 mm 41 mm		51 mm
Length (total)	90 mm		140 mm 120 mm		140 mm
Length (cylindrical)	80 mm		113 mm 92 mm		113 mm
Dome (top)	5 mm		10.2 mm 8 mm		10.2 mm
Sensor Disk (btm)	14 mm		17 mm 15 mm		17 mm
Mass (single sensor)	81.5 gram		272 gram xxx gram		272 gram
Position in Abdomen					
Hole diameter	35 mm		45 mm	45 mm	55 mm
Pitch (CL-CL)	52 mm		62 mm	62 mm	94 mm
CL fwd of spine CL	52 mm		67 mm	67 mm	72 mm
ASIS position (X)					
ASIS position (Z)					
Ribcage overlap with sensors (should be small)					
Injury Risk Curve					



# Recommendation

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- Install sensors according to procedures as used in CHILD and CASPER
  - To be described in an Annex to draft regulation (IFSTTAR)
  - Meanwhile LIER, IFSTTAR and Humanetics will continue integration efforts continue efforts (reporting during Phase III)
- Mass increase needs to be listed in the annex added



# Thank you!

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