

Response from a Range of Occupants in Fokker F28 Full-Scale Crash Test



Federal Aviation Administration

2019 FAA International Fire and Cabin Safety Conference

By: Amanda Taylor
Research Engineer
Civil Aerospace Medical Institute

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Meet the ATDs

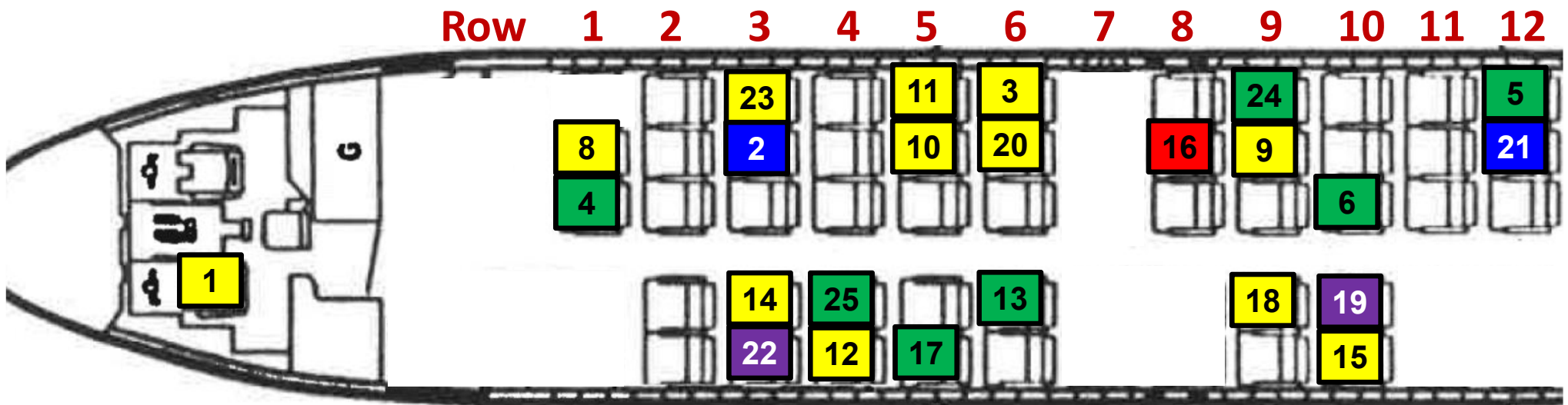


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Meet the ATDs



NASA
FAA
ARL
NHTSA
Humanetics



Meet the ATDs

- **Pilot**
 - 50th percentile male
 - Hybrid II

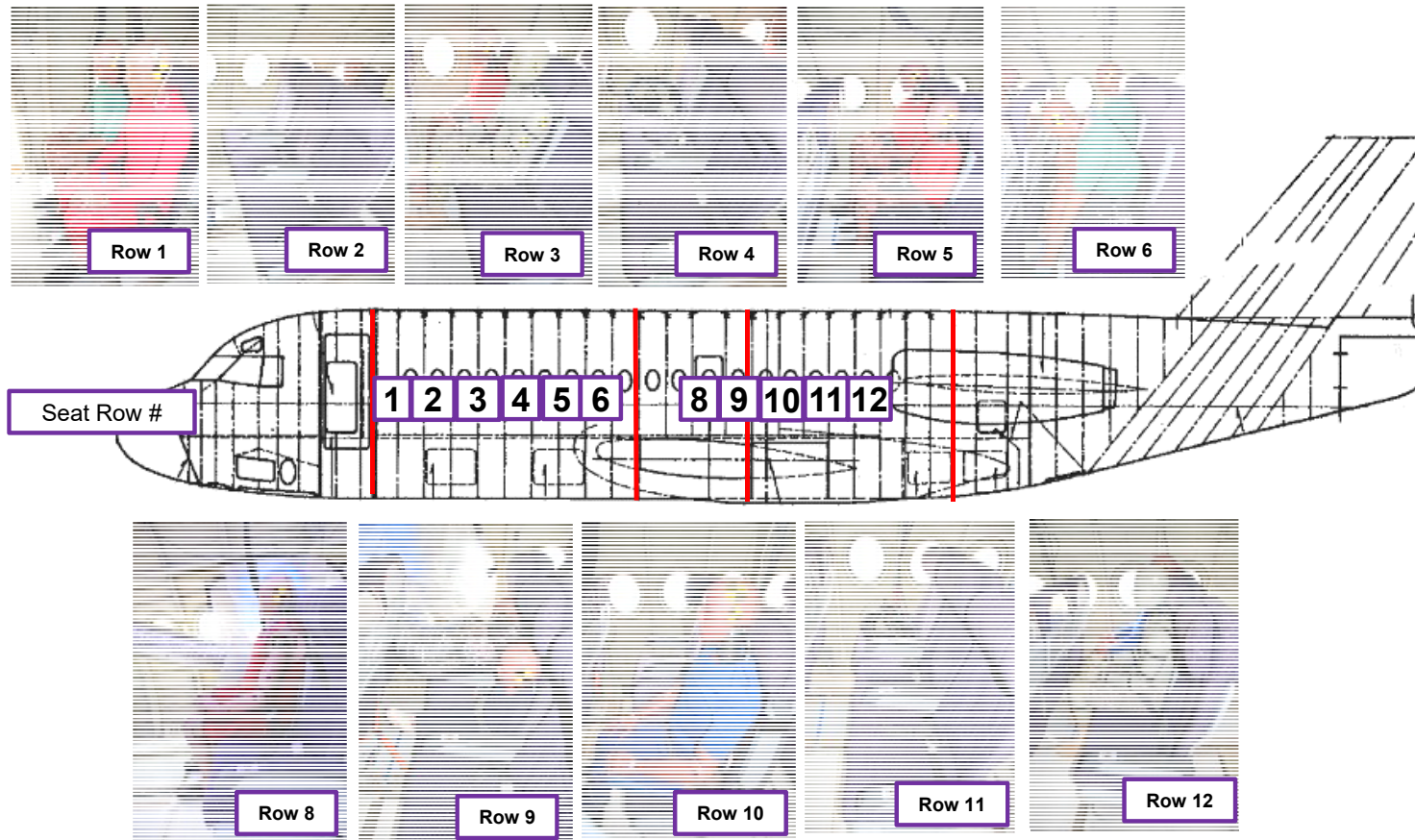


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Starboard Side ATDs



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Meet the ATDs – 1A 1B

- **Plinth Experiment**
- **Hybrid II 50th Percentile males**

Height 5' 9"
Weight 168 lbs



Meet the ATDs - 3A 5A 5B



FAA Hybrid III 50%

13 Channels - Head, Upper Neck, Chest, Lumbar, Pelvis

Height 5' 9"
Weight 178 lbs

Height 6' 1"
Weight 225 lbs

Hybrid III 5%

13 Channels - Head, Upper Neck, Chest, Lumbar, Pelvis

Hybrid III 95%

13 Channels - Head, Upper Neck, Chest, Lumbar, Pelvis



Meet the ATDs - 3B



WIAMan ATD

Warrior Injury Assessment Manikin
146 Embedded Channels

Height 5' 11"
Weight 185 lbs



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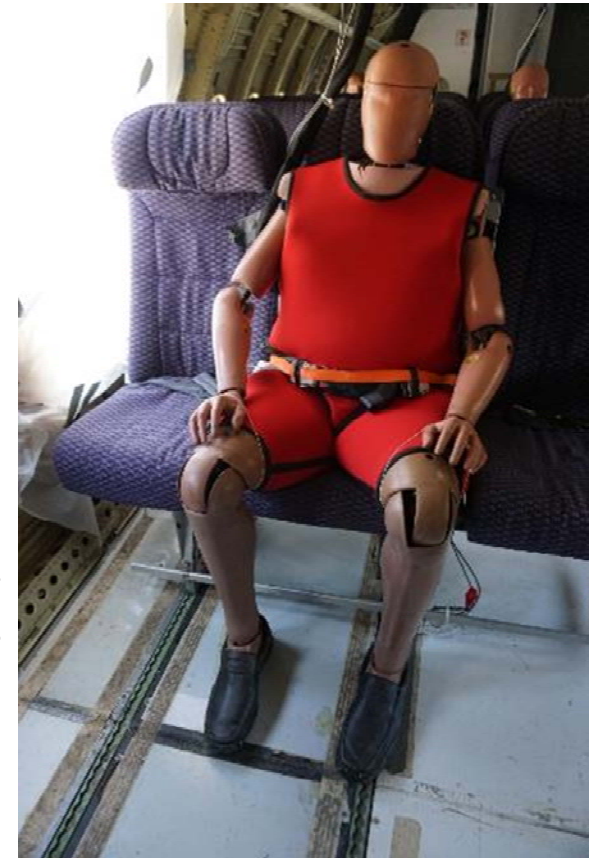
Meet the ATDs - 6A 6B 8B



Hybrid II 50%
13 Channels
One in the brace position

Height 6' 2"
Weight 273 lbs
BMI 35

Humanetics® Obese ATD
Prototype



Meet the ATDs - 9A 9B 10C



Hybrid III 3 y/o

14 Channels (9A) – Head

Upper Neck Chest, ASIS

3 Channels (9B) -Head

1 in CARES

Height 3' 1"

Weight 45 lbs

FAA Hybrid III 50%

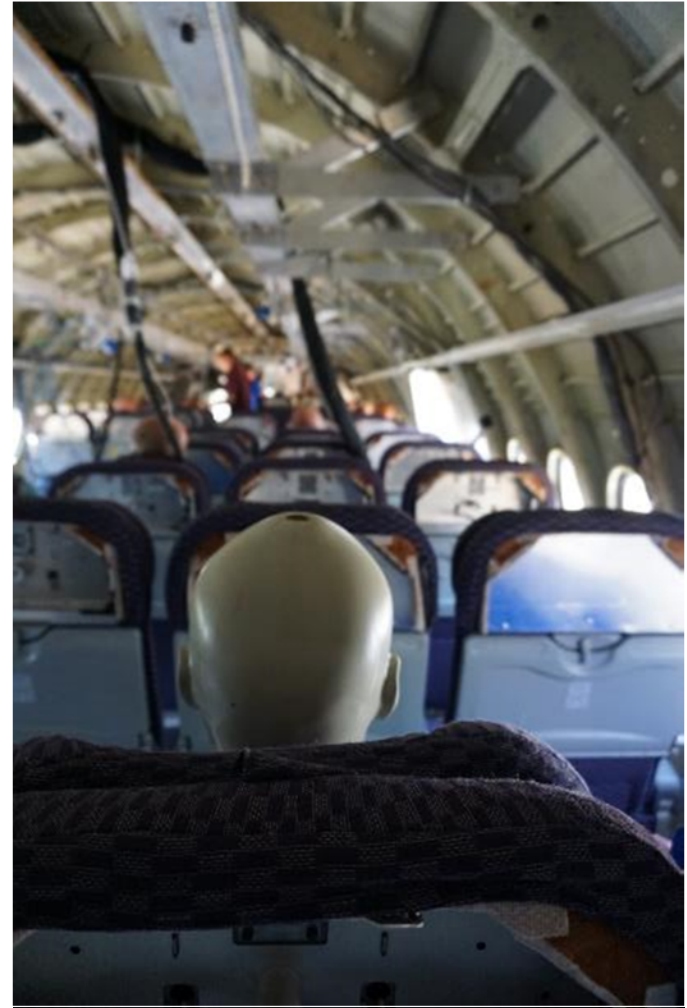
14 Channels – Head,
Upper Neck, Chest, Lumbar



Meet the ATDs - 12A 12B



WIAMan ATD
FAA Hybrid III 50%
70 Channels – Head, Upper Neck, Lower Neck, Chest, Thoracic, Lumbar, Pelvis, Femur, Tibia

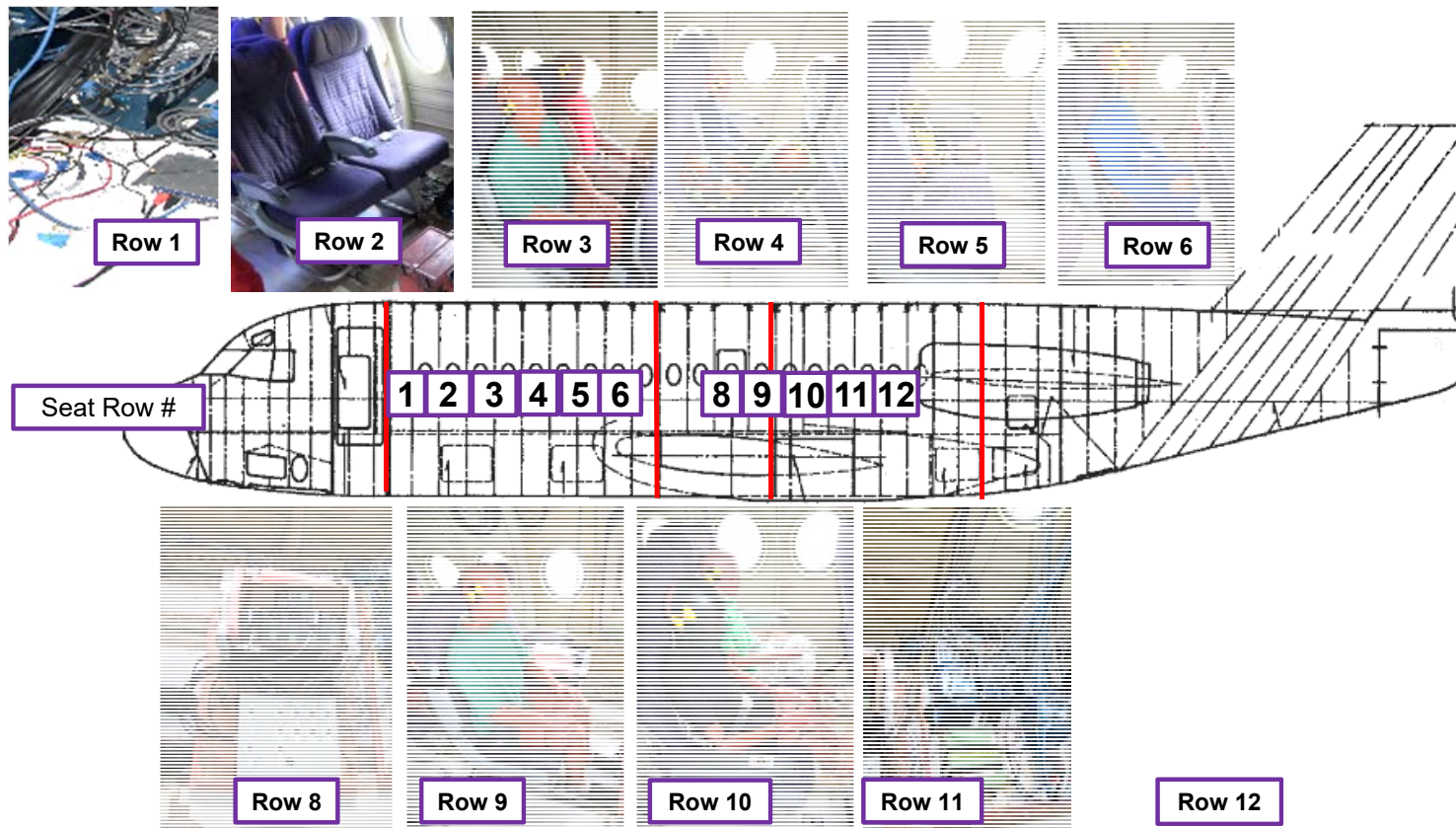


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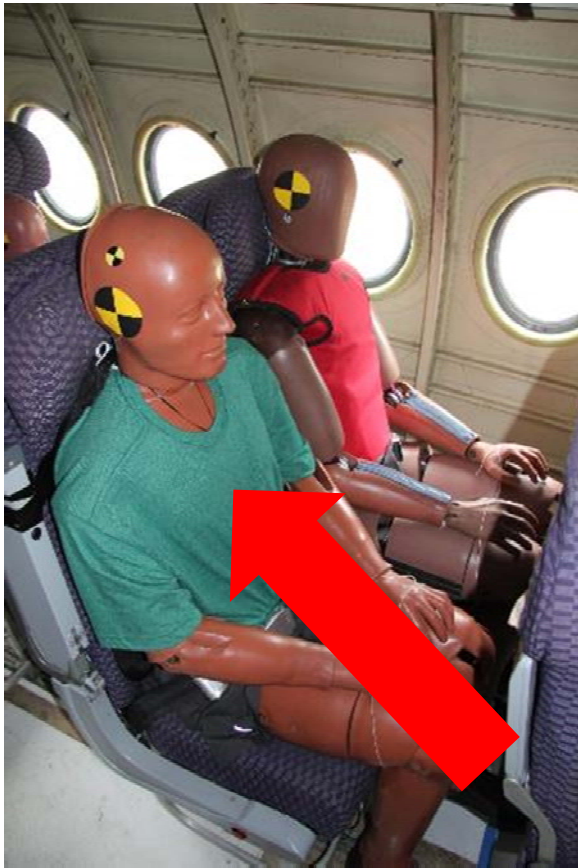


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Port Side ATDs



Meet the ATDs - 3D 9D



Hybrid II 50%

9 Channels – Head, Chest, Lumbar,
Pelvis



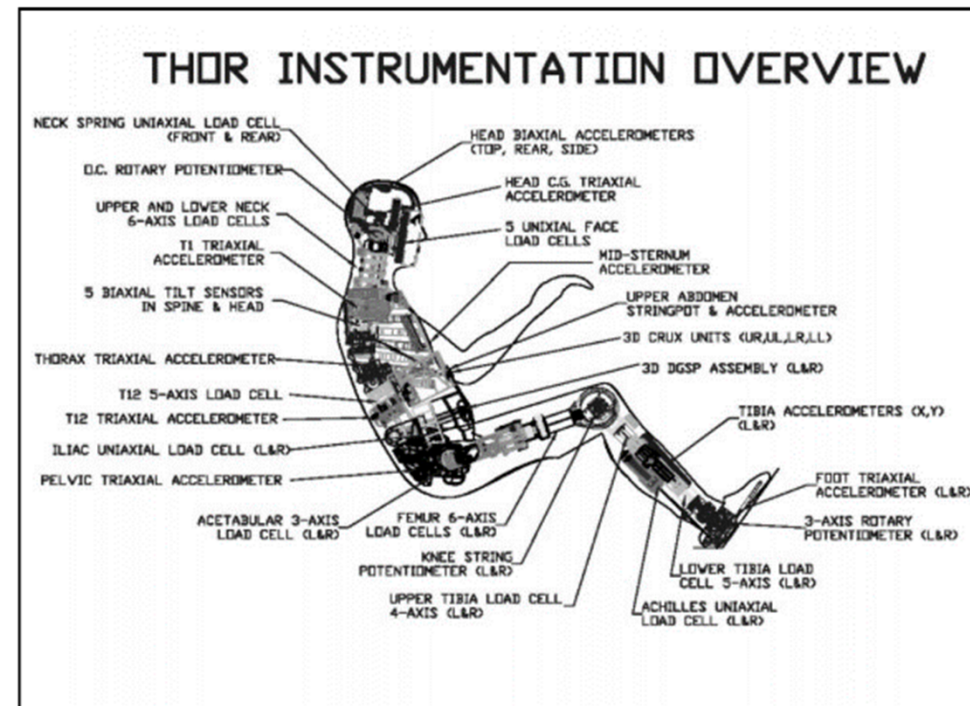
Meet the ATDs - 3E



THOR
Test device for
Human Occupant
Restraint

16 Channels –
Head, Upper and
Lower Neck, Chest,
Lumbar, Pelvis

Height 5' 9"
Weight 175 lbs



Meet the ATDs - 4D 4E 5 E

CRABI 18 Month
No Instrumentation
Hybrid III 6 y/o
No Instrumentation

Height 3' 9"
Weight 52 lbs

Height 2' 5"
Weight 23 lbs

Q1

7 Channels – Head,
Upper Neck, Chest
CARES Device

Height 2' 8"
Weight 25 lbs

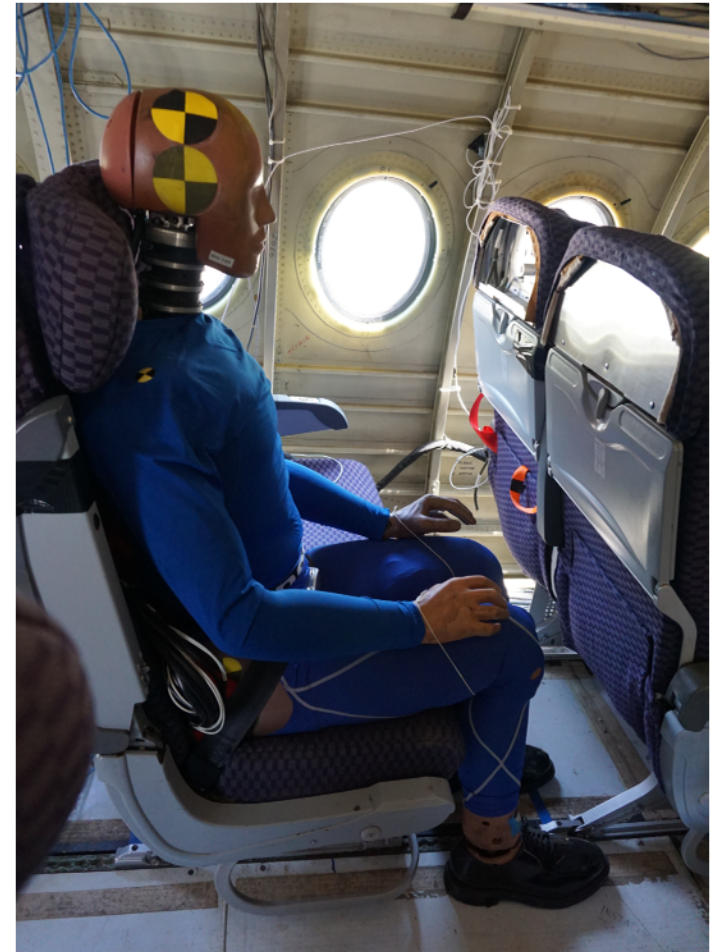


Meet the ATDs – 6D



FAA Hybrid III 50%

14 Channels – Head,
Upper Neck, Chest, Lumbar

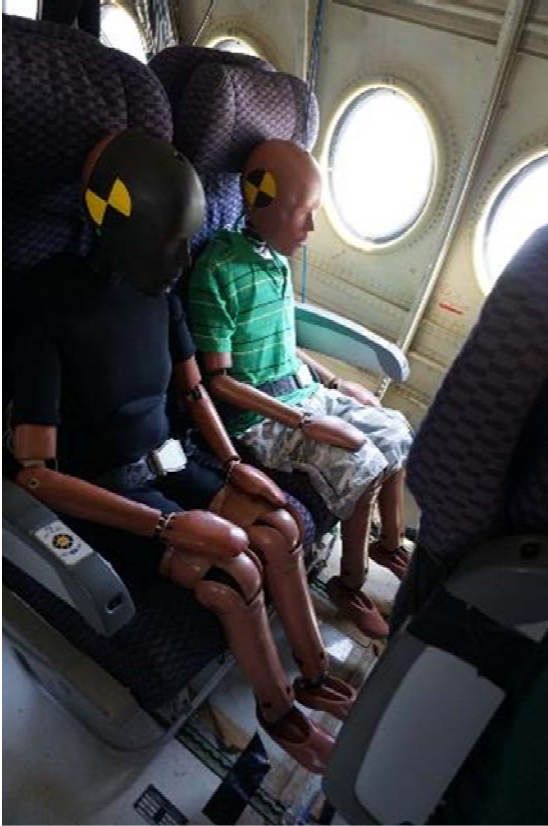


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Meet the ATDs - 10D 10E



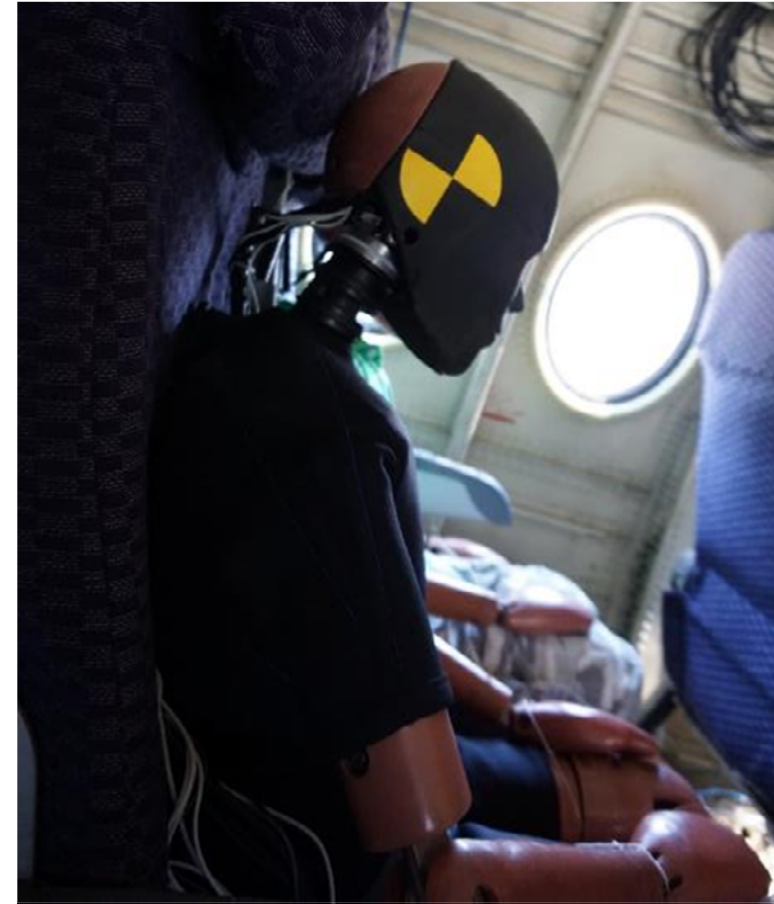
Hybrid III 10 y/o

14 Channels – Head, Upper Neck, Lumbar, Pelvis

Large Omidirectional Child (10 y/o)

15 Channels – Head, Upper Neck, Lower Neck, Abdomen, Pelvis

Height 4' 5"
Weight 78 lbs



Occupant Kinematics – THOR vs Hybrid II

Initial Position



Max Downward Travel



48 ms
Hybrid II downward
travel \approx 6.5"

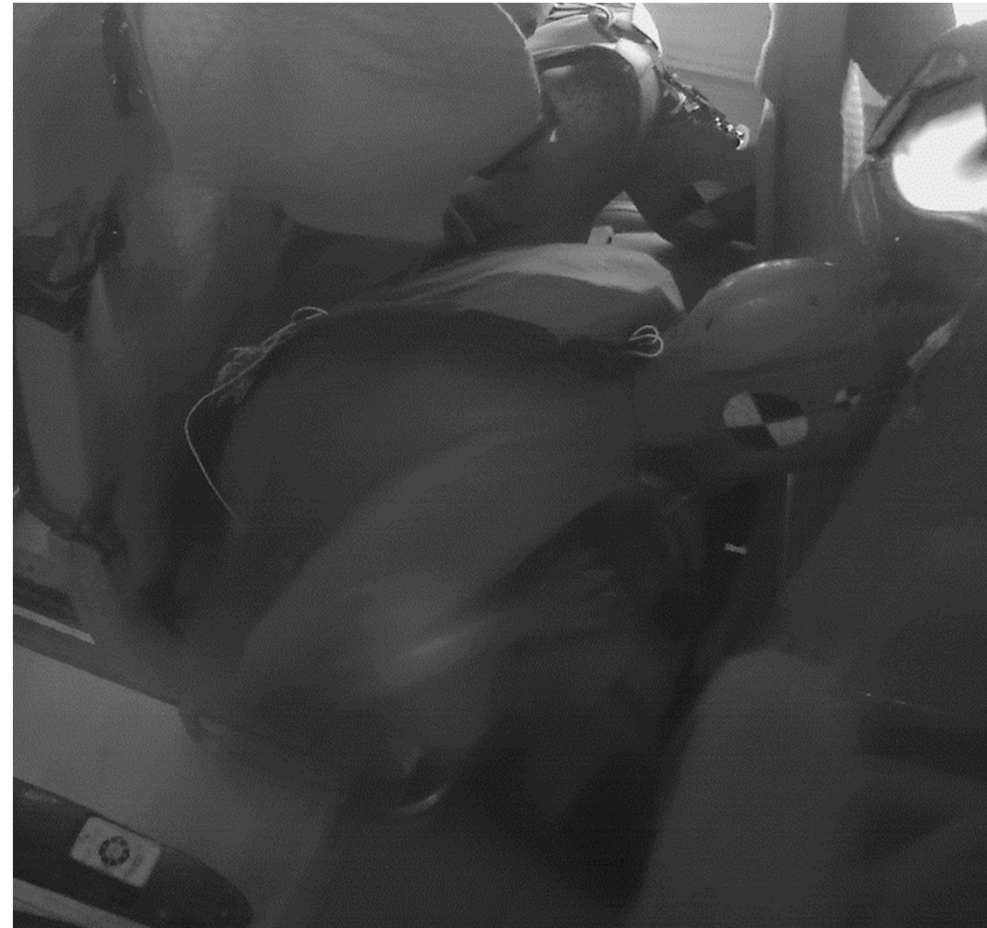
Occupant Kinematics

- 96 ms
- Head of THOR is on chest
- Hybrid II head is on seat back
 - HIC 428



Occupant Kinematics

- 120 ms
- THOR head impacts top of thigh
- Hybrid II has hit seat in front and is breaking the seat back over



Occupant Kinematics

- 546 ms
- THOR Head is jack-knifed against seat back
 - HIC 210
- Hybrid II has hit seat in front and rebounded



Occupant Kinematics

- 706 ms
- Final position



Occupant Kinematics – FAA Hybrid III vs Wiaman

Initial Position



Max Downward Travel



48 ms
WIAman
downward
travel \approx
2.0"

Occupant Kinematics

- 92 ms
- Head of Wiaman is rotated backwards
- FAA Hybrid III head is making contact with tray table latch
 - HIC 861



Occupant Kinematics

- 112 ms
- Wiaman hits seat back at upper right hand corner
- FAA Hybrid III has hit seat in front and is breaking the seat back over



Occupant Kinematics

- 480 ms
- Full rebound



Occupant Kinematics

Initial Position



Max Downward Travel



48 ms

Occupant Kinematics

- 82 ms
- Head of 5th female is on chest
- Head 95th is contacting tray table latch
 - HIC 383
- Braced 50th has begun sliding down seat back in front
 - HIC 268
- Upright 50th is just now rotating forwards



Occupant Kinematics

- 116 ms
- Head of 5th female is contacting seat back
 - HIC 188
- Upright 50th is contacting seat back
 - HIC 254



Occupant Kinematics

- 550 ms
- Full rebound



Occupant Kinematics

- 696 ms
- Can see 5th female's belt is now unbuckled



Occupant Kinematics

Initial Position



48 ms

Max downward travel



Occupant Kinematics

- 64 ms
- Head of 10 year olds are on chest
- 50th is just now rotating forwards



Occupant Kinematics

- 496 ms
- Full Rebound



Occupant Kinematics – Wiaman vs FAA Hybrid III

Initial position



Max Downward Travel



48 ms

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Occupant Kinematics

- 72 ms
- Wiaman is leading with his chin
- Floor has begun to come up



Occupant Kinematics

- 106 ms
- Wiaman contacts seat back
- FAA Hybrid III is not quite to the seat back



Occupant Kinematics

- 116 ms
- FAA Hybrid III contacts seat back
- HIC 111



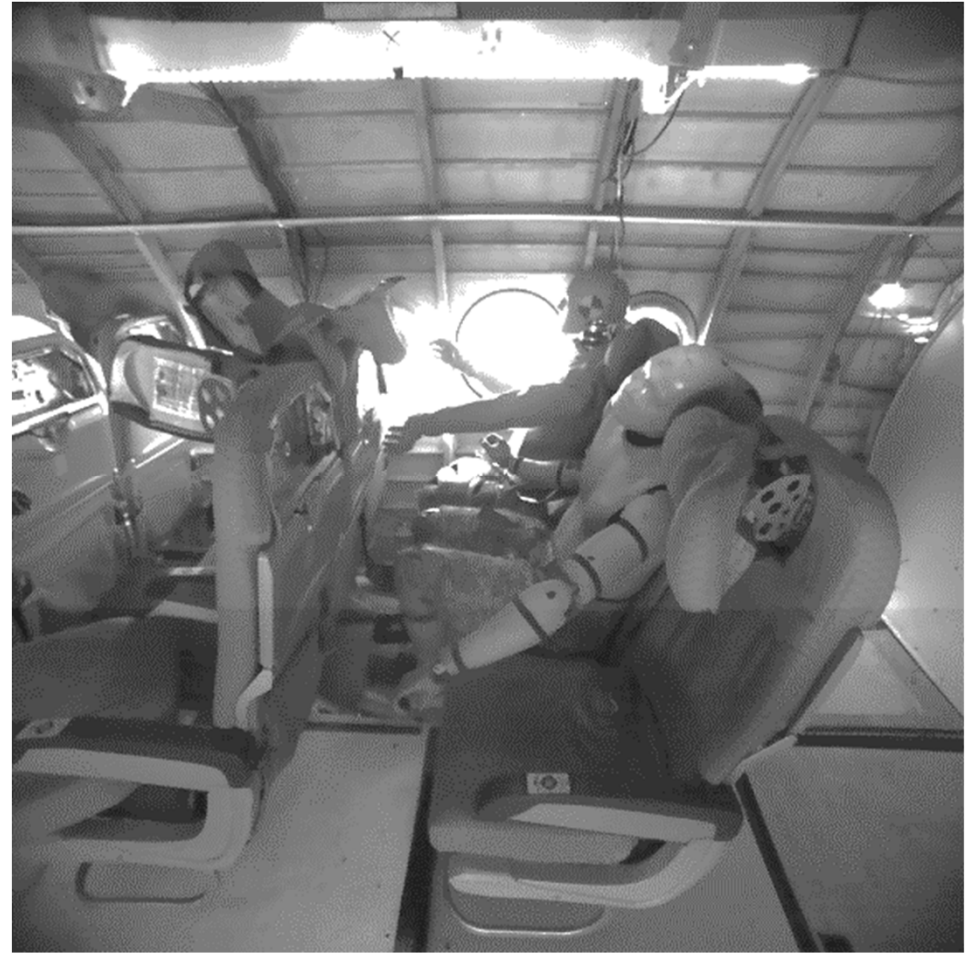
Occupant Kinematics

- 168 ms
- Floor disruption causes prolonged contact with the seat back
- Wiaman head rotates towards left shoulder



Occupant Kinematics

- 514 ms
- Full rebound



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ATD Damage

Only ATD to show damage was Obese



Summary

- **Fokker F-28**
- **24 ATDs on board (Over 3,000 lbs of Occupants)**
 - 4 Prototype ATDs
 - 6 Child ATDs
 - Small Female
 - Large Male
 - 12 Mid Sized Males
- **Over 100 accels through out aircraft**
- **Over 600 channels of data collected**



Next Steps

- **FAA is conducting several research programs to support development of future crashworthiness guidance for transport airplanes**
- **Results will be published and made available once ready**



Special Thanks To

- NASA
- DTS
- ARL
- Humanetics
- NHTSA

