Summary of the FAA's Commuter Airplane Crashworthiness Program

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PROGRAM OBJECTIVE

Evaluate adequacy of current certification standards for seat and restraint systems for small commuter category airplanes (14 CFR Part 23 and small Part 25).

Methodology

Conduct full-scale vertical drop tests of commuter airplanes to obtain data to supplement existing data bases.

BACKGROUND

The FAA William J. Hughes Technical Center has conducted tests on four regional commuter airplanes to characterize their impact response.

- ATR 42-300
- Short Brothers 3-30
- Beechcraft 1900C
- Raytheon/Fairchild Metro III

ATR 42-300

- High wing
- Curved belly
- 42 to 50 passengers
- Test Weight 33,200 lbs
- Drop height 14’
- Impact velocity 30 ft/s
- TC Part 25

SHORT BROTHERS 3-30

- High wing
- Flat belly
- 30 passengers
- Test Weight 21,200 lbs
- Drop height 14’
- Impact velocity 30 ft/s
- TC Part 25

BEECHCRAFT 1900C

- Low wing
- Flat belly
- 19 passengers
- Test Weight 8,500 lbs
- Drop height 11' 2"
- Impact velocity 27 ft/s
- TC Part 23 SFAR 41

RAYTHEON METRO III

- Low wing
- Curved belly
- 19 passengers
- Test Weight 7,500 lbs
- Drop height 11' 2"
- Impact velocity 27 ft/s
- TC Part 23 SFAR 41

DROP TEST OF ATR 42 - VIDEO

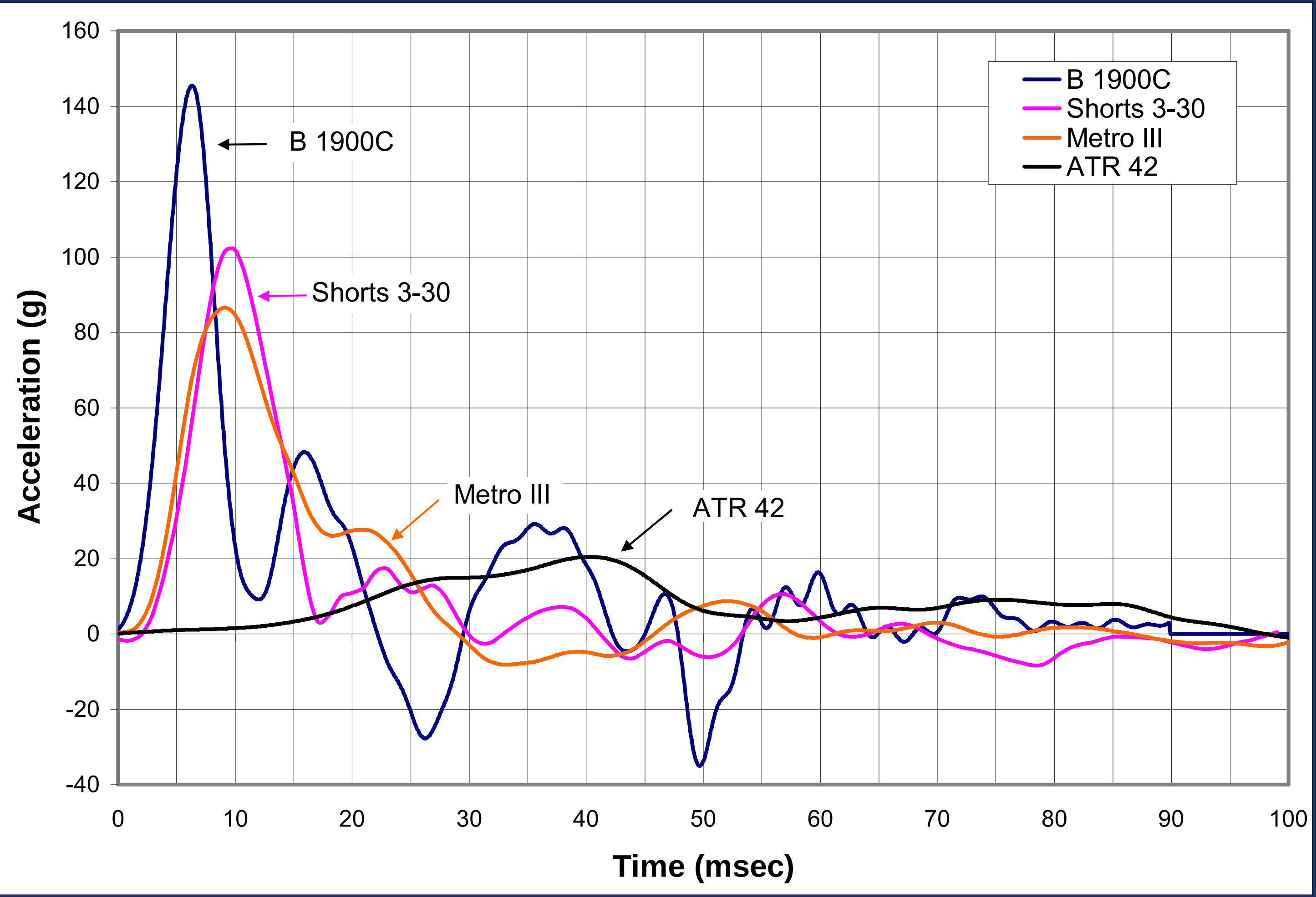
Video Deleted

POST-TEST DATA

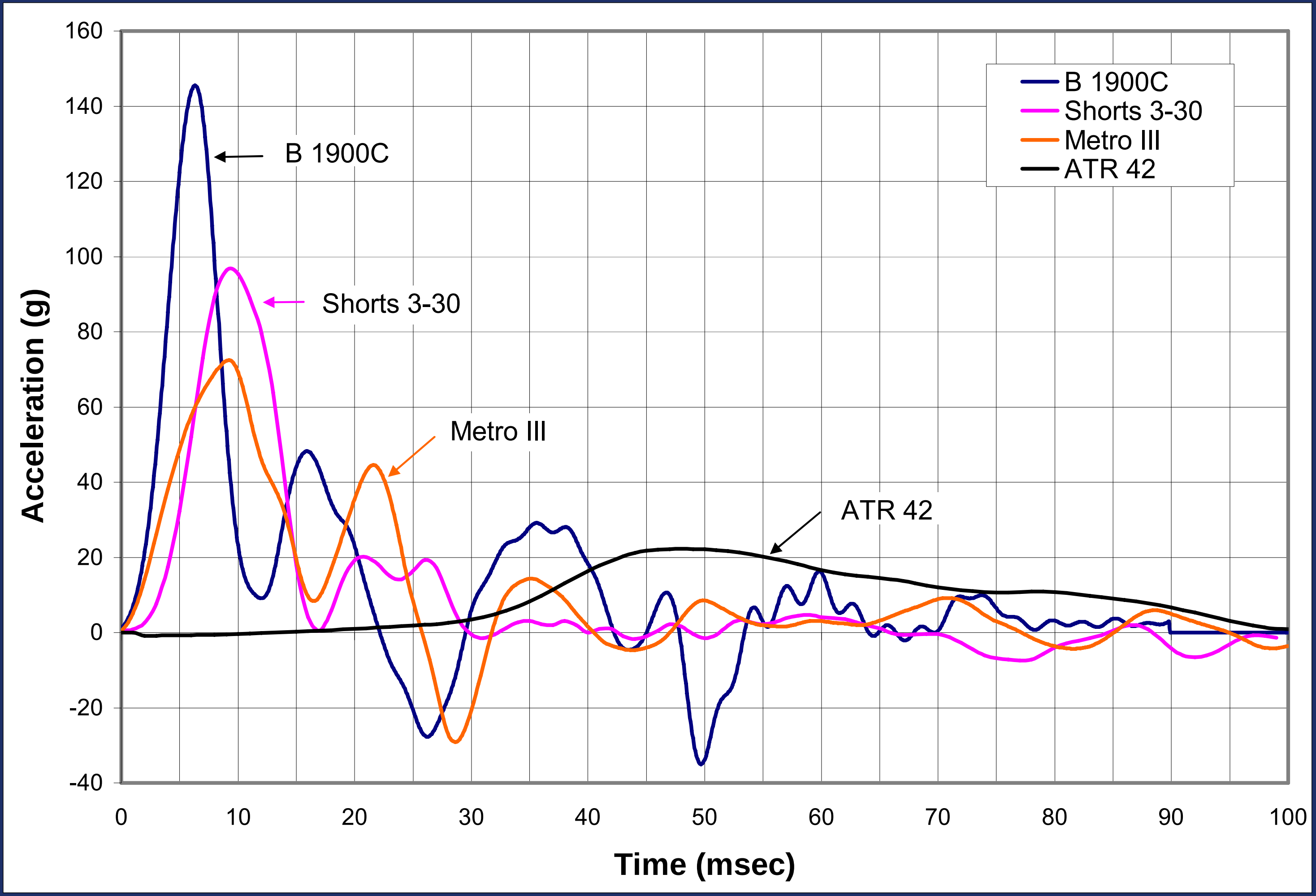
Test Article	B 1900C	SHORTS 3-30	METRO III	ATR 42
Primary Pulse Acceleration (g)	154	94	56	20
Primary Pulse Duration (msec)	9	17	31	84
*Primary Pulse ΔV (ft/sec)	23/27	25/30	27/27	26/30

*Primary ΔV corresponds with primary pulse duration, the second value is the impact velocity.

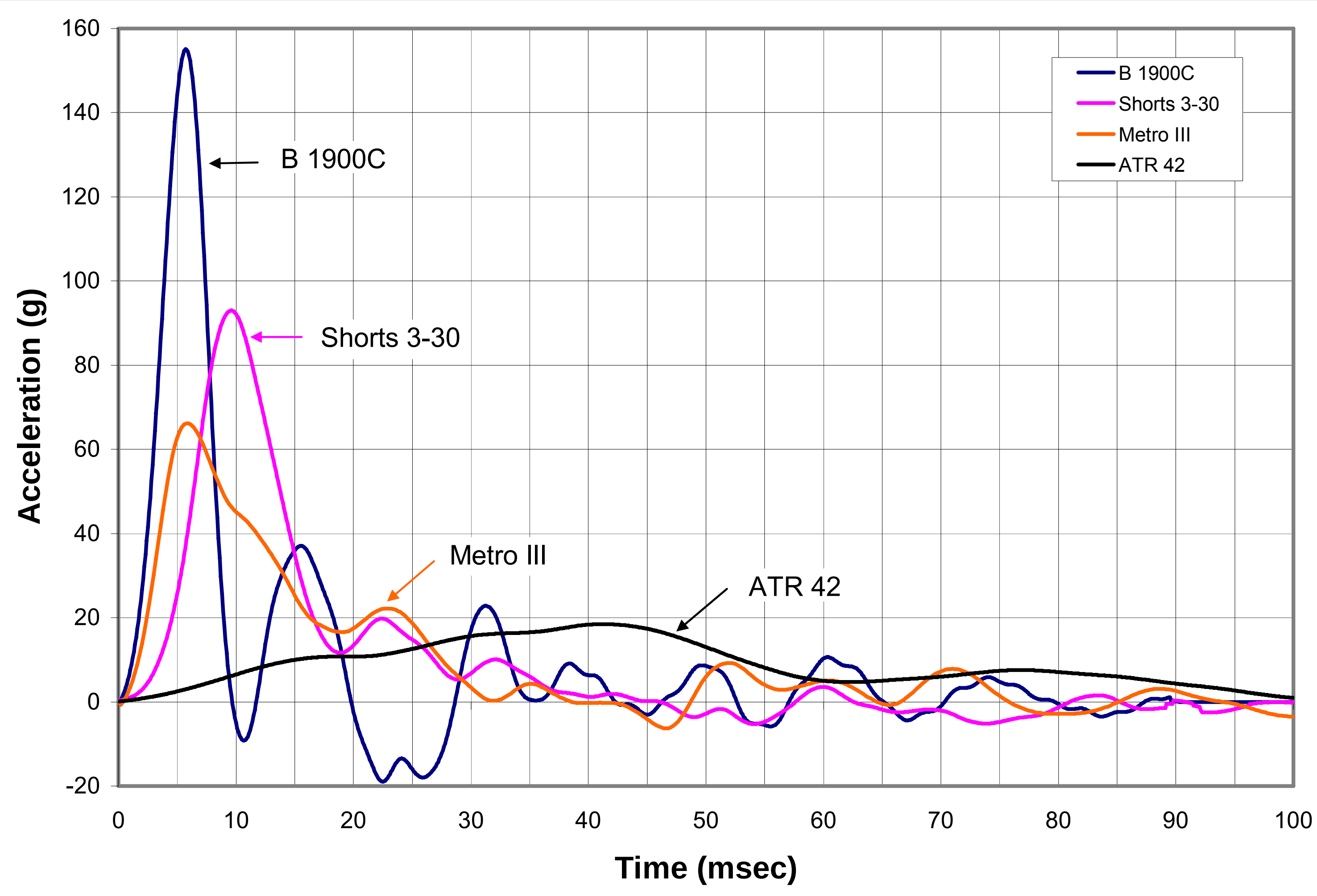
TYPICAL SIDEWALL ACCELERATIONS



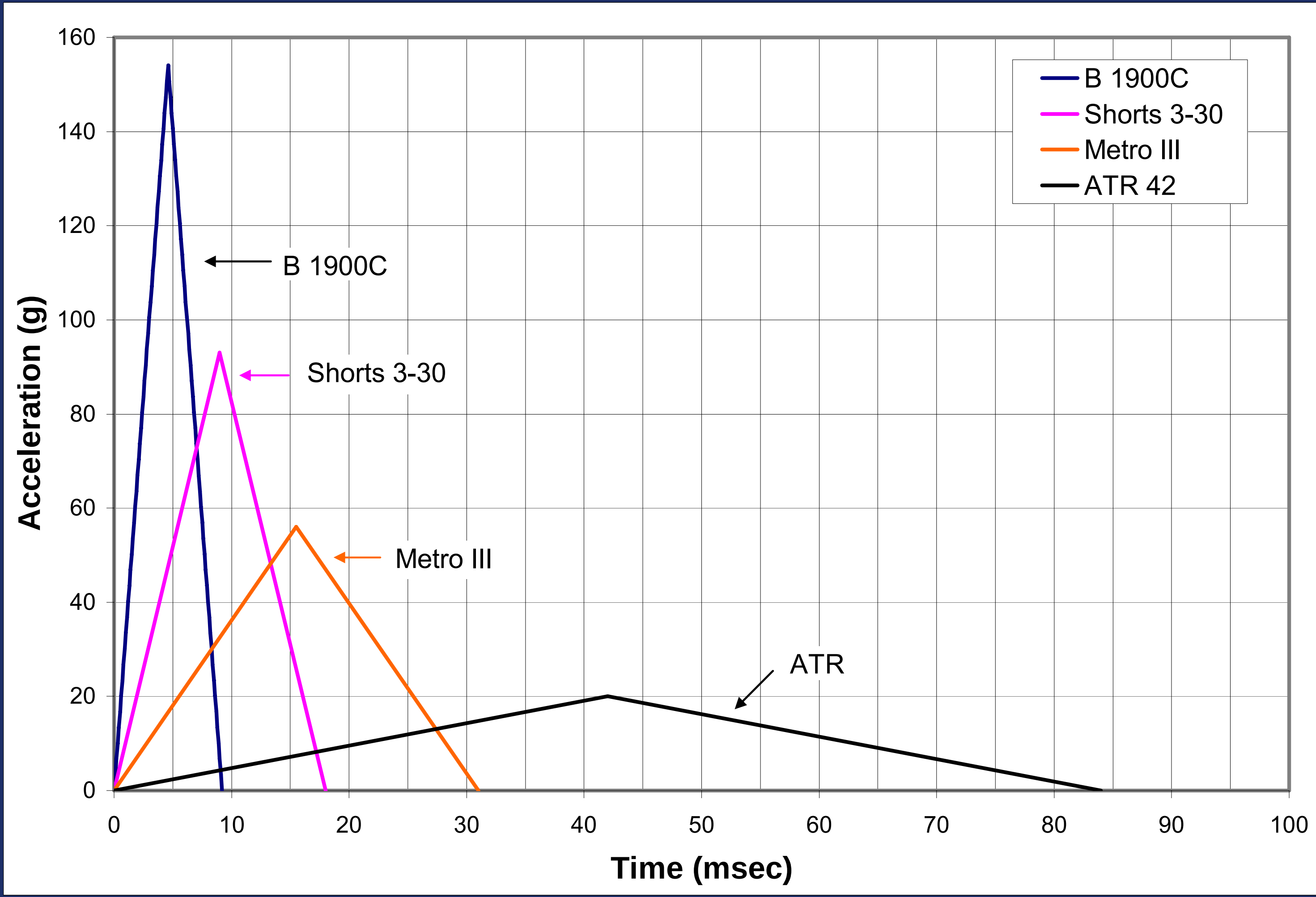
TYPICAL FLOOR TRACK ACCELERATIONS



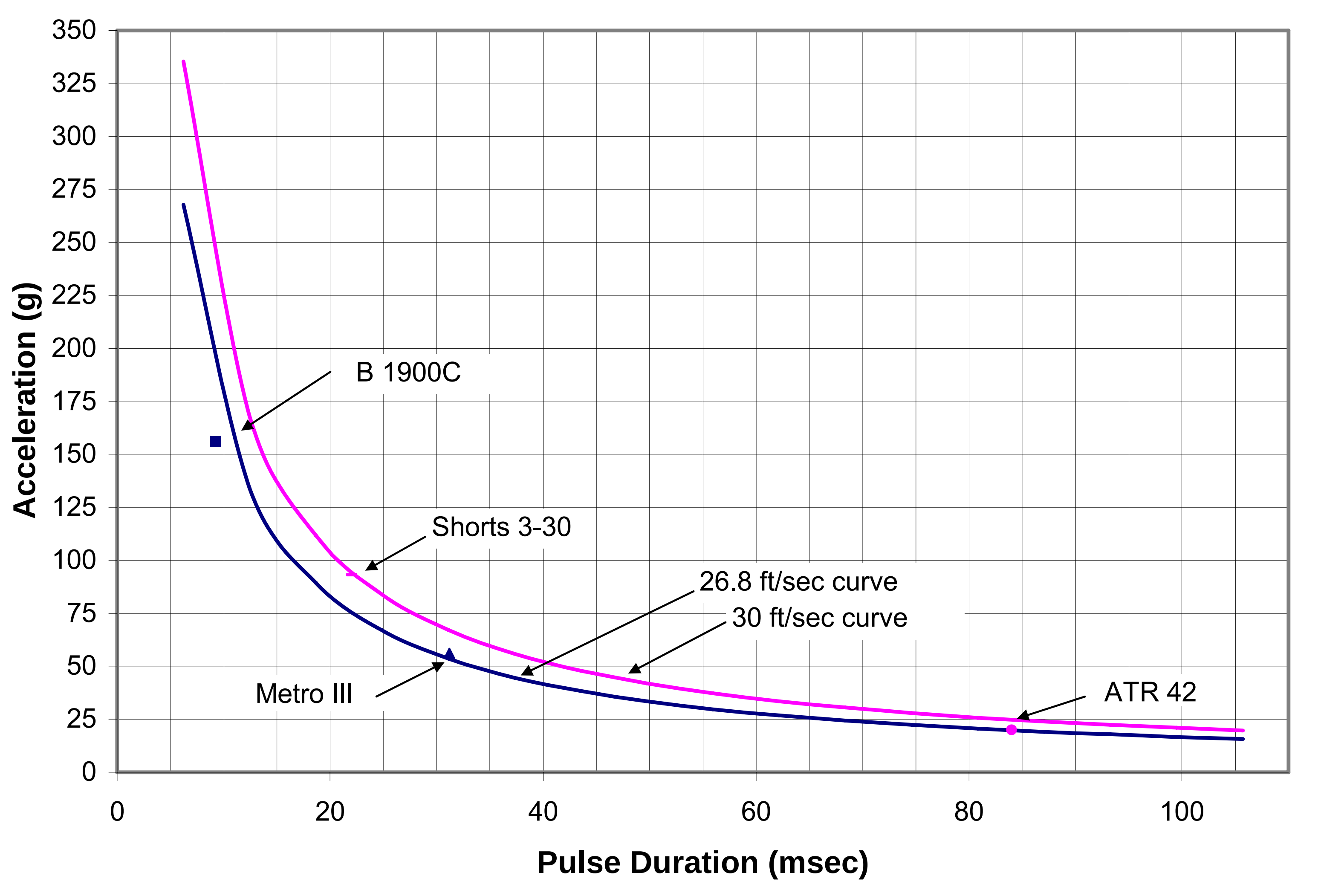
OVERALL FUSELAGE ACCELERATIONS



IDEALIZED TRIANGULAR FUSELAGE ACCELERATIONS



ACCELERATION VS PULSE DURATION

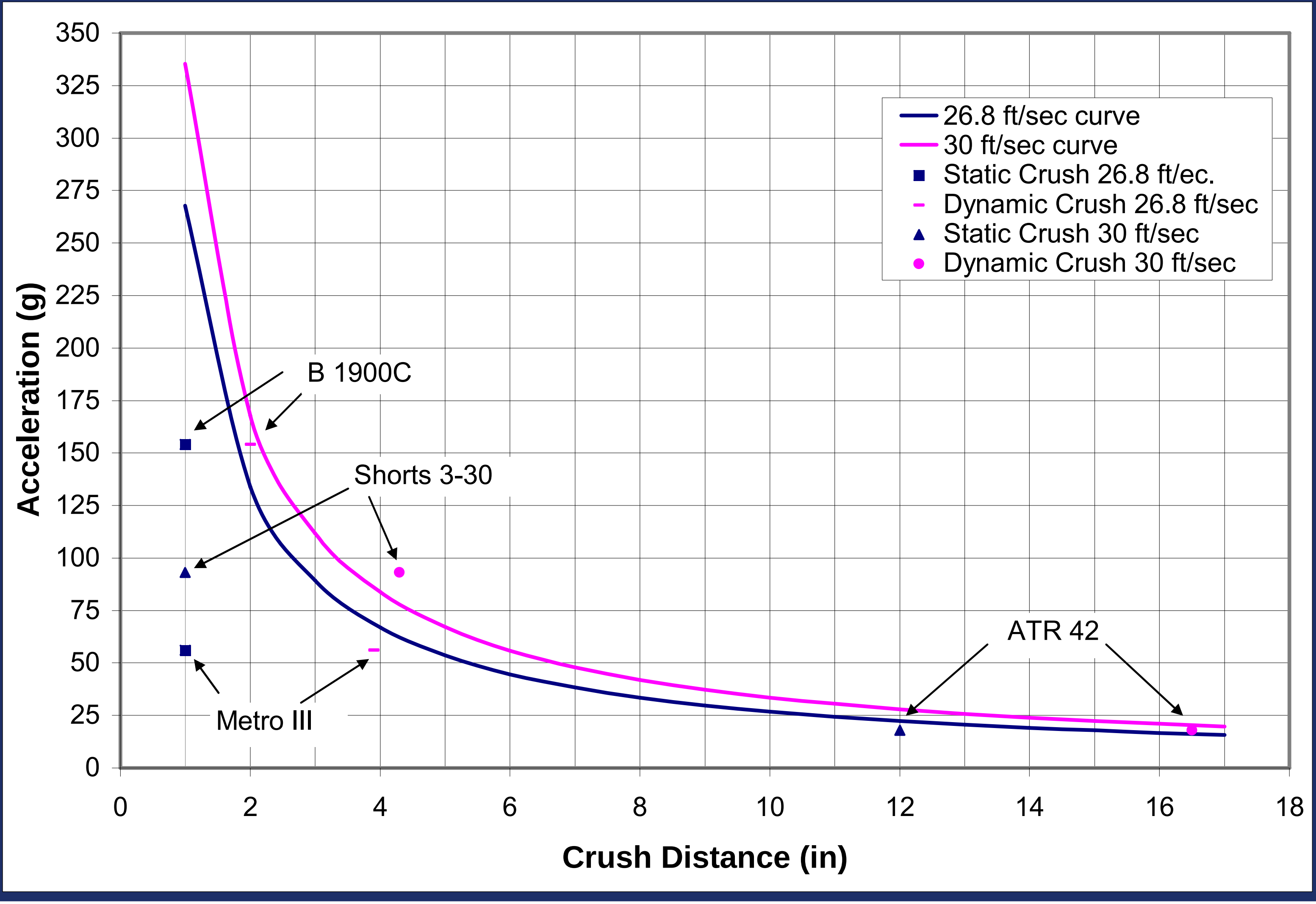


STATIC AND DYNAMIC CRUSH

Test Article	B 1900C	SHORTS 3-30	METRO III	ATR 42
App. Static Crush (in)	1	1	1	12
App. Dynamic Crush (in)	2.0	4.3	3.9	16.4
Available Crush Depth	9.9	8.2	11.1	18
% Available Crush Height	20	52	35	92

Dynamic crush was calculated by integrating the overall acceleration response for each airplane.

ACCELERATION VS DISPLACEMENT



FUSELAGE PENETRATION

CONCLUSIONS

- The two Part 23 and the small Part 25 Shorts 3-30 commuter airplane with comparable crushable underfloor height yielded comparable vertical inertial loading.

- The two Part 23 and the small Part 25 Shorts 3-30 commuter airplane had pulse durations at the extreme range of the data used to develop current Part 23 airplane seat dynamic certification standards.

- The small Part 25 ATR 42 airplane duration was within the range and near the average used to develop current Part 23 airplane seat dynamic certification standards.

CONCLUSIONS

- **Acceleration and dynamic crush results were consistent with those of an idealized impact response**
- **Results yielded two groups of fuselage responses**
  - high acceleration, long pulse duration, small crush distance
  - low acceleration, shorter pulse duration, large crush distance
- **The ATR 42 was the most effective in using its underfloor crush space to reduce the vertical inertial load.**

CONCLUSIONS

- As expected the flat belly aircraft resulted in higher vertical inertial loading than the round belly aircraft.
- As expected the stiffer lighter aircraft resulted in higher vertical inertial loading.
- The overhead items of mass did not affect the overall fuselage response of the aircraft.
- High-wing airplanes have the potential of intrusion of heavy items of mass into the passenger cabin.

Thank You