

Unpressurized Timed Demonstrations of Suited Individuals in Reclined Spacecraft Seat Simulator

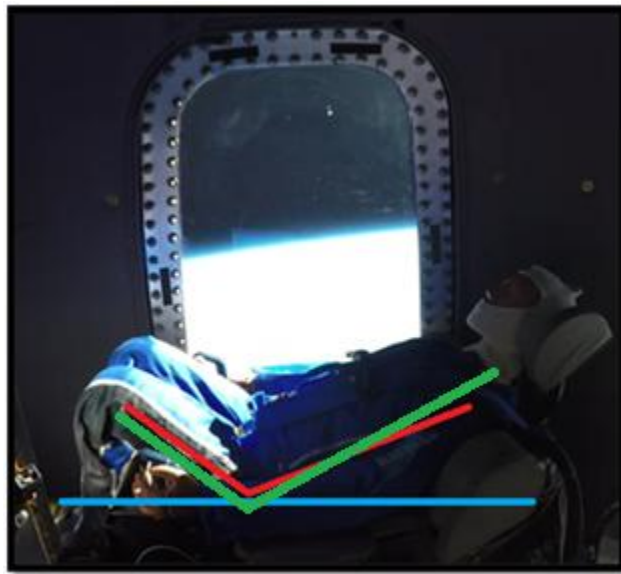
Trent Tresch

2025

If flying in a pressurized suit for launch, entry and abort of a spacecraft, it is advantageous to know how quickly a suited individual can unbuckle themselves upon landing to respond to any type of timely emergency. It is also useful to record and understand individual abilities to buckle up while suited.

The examples shown in this document were done at 1G without any induced stressors. The intention was to simply better ascertain approximately how long it could be expected for an unpressurized suited individual to buckle and unbuckle a five point harness in a reclined position.

The reclined position is seen in many spacecraft. The reclined position helps passengers endure acceleration forces more comfortably and safely. Our seat simulator is based off an approximation of the Blue Origin New Shepard capsule, anticipated to be about a 25 to 30 degree decline.



Blue: flat baseline, Red: ~25 degrees, Green: ~30 degrees

There are many variables that were uncontrolled, but again the purpose was to approximate the time it may take an individual to buckle and unbuckle while in a deflated pressure suit while in a reclined position. While inside of a suit, dexterity and movement are

restricted. Tasks requiring fine motor skills increase in difficulty so we expected to notice an increase in buckle and unbuckle time while suited.

In these demonstrations, we took three volunteers: 2 male, 1 female to show their abilities to quickly buckle and unbuckle a five-point seatbelt harness. Individuals were first timed while wearing athletic style clothing, then timed after donning a full pressure suit. The suit remained completely uninflated for the entirety of the exercise. Individuals were instructed to perform the tasks “quickly, with purpose”. All timing was done with a handheld stopwatch.



Unsuited vs suited in reclined sitting position.

Unsuited Results (seconds)

Person 1	Person 2	Person 3
Buckle Up	Buckle Up	Buckle Up
29.81	19.7	13.91
30.24	18.17	12.12
16.23	15.96	12.68
Unbuckle	Unbuckle	Unbuckle
12.38	3.58	4.11
7.00	2.86	3.2
3.99	3.58	3.00

Suited Results (seconds)

Person 1	Person 2	Person 3
Buckle Up	Buckle Up	Buckle Up
50.25	29.00	17.71
23.09	32.15	19.15
27.02	27.42	18.05
Unbuckle	Unbuckle	Unbuckle
4.38	3.7	2.20
3.79	2.59	2.65
2.60	4.26	4.92

Fixed Shoulder (seconds)

In some space capsule configurations, 5 point seatbelt harness's may be fixed on one side. Permanently connecting one shoulder strap to the same side of the waist belt. This may be for efficiency. Given this knowledge, person 3 did a brief demonstration suited and unsuited while buckling up with the fixed shoulder configuration for discussion.

Person 3, Buckle Up Only (seconds)
Unsuited
11.44
12.31
Suited
14.82
12.92

Discussion

These brief demonstrations show that all three individuals took longer to buckle up when suited versus unsuited, but not for unbuckling. We noticed, as one would anticipate, that with better understanding of the 5 point harness buckle assembly and practice, every person was able to increase the speed at which they buckled and unbuckled while both suited and unsuited. Person 3 showed that a fixed shoulder to waist configuration can increase your buckle up time by a few seconds.