Scaled Composites, LLC
Koehn Dry Lake, CA
October 31, 2015
DCA15MA019

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ATTACHMENT 2

Butler Parachute Systems 2014 Pull Test Report

2 Pages

Butler Parachute Systems, Inc.

1820 Loudon Ave, Roanoke, VA 24015 • 540-342-2501 • 540-342-4037 (FAX) • tom@butlerparachutes.com

Test Report

Oxygen Activation Pull Force
Butler Parachute Systems High Altitude Back Pack

Date Conducted: 11/14/13 to 2/4/14

Test Director: Roberto Montanez
Test Administrator: Tom Fowler

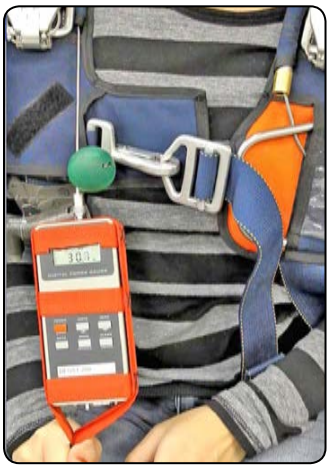
Test Objective: To determine the pull force necessary to activate the oxygen bailout bottle installed on Butler Parachute Systems High Altitude Back Pack, and to explore possible design changes that would lessen the pull force necessary to active the oxygen bottle.

Test Method: An empty oxygen bottle assembly was installed in a fully assembled and packed High Altitude Back Pack. The bottle was rigged as flight-ready. The bottle was considered to be activated when the internal brass break-off nipple failed. The oxygen bottle is designed to deliver oxygen when the break-off nipple fails.

A test subject donned the parachute and attempted to activate the bottle by pulling on the oxygen activation handle as outlined in the *High Altitude Emergency Parachute System, User Guide*. Seven tests were attempted using a one handed pull. The subjects used a two handed pull for the remaining tests or if they could not activate the bottle with one hand. All tests were conducted with the subject in the seated position.

Four tests were conducted with the current design where the activation cable turns ninety degrees 3/8" from where it exits the bottle. Ten tests were conducted with a redesigned bracket where the activation cable turns ninety degrees 2 1/2" from where it exits the bottle.

The manufacturer of the bailout bottles tested six units that were not installed into a parachute system. These test were naked bottle bench tests.



Test pull with digital gauge.

Current bracket design.

Test bracket design.

Test Results:

DATE	TEST ARTICLE	TEST SUBJECT	PULL FORCE	REMARKS
11/22/13	Current Design	Roberto Montanez	NO SCALE	COULD NOT PULL WITH ONE HAND
11/25/13	Current Design	Tom Fowler	37 LB.	COULD NOT PULL WITH ONE HAND
11/25/13	Current Design	Kay Myint	37 LB.	COULD NOT PULL WITH ONE HAND
11/26/13	Current Design	Roberto Montanez	38 LB.	DID NOT ATTEMPT ONE HANDED PULL
12/10/13	Test Design	Tim McCord	33 LB.	COULD NOT PULL WITH ONE HAND
12/18/13	Test Design	Tim McCord	30 LB.	DID NOT ATTEMPT ONE HANDED PULL
12/18/13	Test Design	Tim McCord	35 LB.	DID NOT ATTEMPT ONE HANDED PULL
12/19/13	Test Design	Kay Myint	33 LB.	COULD NOT PULL WITH ONE HAND
12/19/13	Test Design	Tim McCord	31 LB.	DID NOT ATTEMPT ONE HANDED PULL
1/18/14	Test Design	Kay Myint	31 LB.	DID NOT ATTEMPT ONE HANDED PULL
1/18/14	Test Design	Tim McCord	32 LB.	COULD NOT PULL WITH ONE HAND
2/3/14	Test Design	Tom Fowler	35 LB.	COULD NOT PULL WITH ONE HAND
2/4/14	Test Design	Tom Fowler	33 LB.	DID NOT ATTEMPT ONE HANDED PULL
2/4/14	Test Design	Tom Fowler	36 LB.	DID NOT ATTEMPT ONE HANDED PULL

Fluid Power naked bottle bench test pull forces:

18.5 lb.	19 lb.	18 LB.	19.5	19	18.5

Conclusion: While no one was able to activate the bottle with one hand, all subjects reported that activating the bottle was easy with two hands. The test design bracket marginally reduced the pull force necessary to activate the bottle by approximately 10% (4 lb.). The test design bracket compromises the profile of the parachute system; the cable housing creates a snagging hazard because it routes out-and-up the pack where the current design routes straight up the parachute pack.

Given the ease at which everybody was able to activate the bottle with two hands and the marginal improvement in pull force with the test design, along with the profile compromise, Butler Parachute Systems abandoned the consideration of switching to the new bracket. We have established a maximum acceptable pull force of forty pounds for the High Altitude Back Pack.