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

# NATIONAL TRANSPORTATION SAFETY BOARD WASHINGTON, D.C.

## ATTACHMENT 4

BPS/NTSB 2015 Parachute Component Pull Testing Report

17 Pages

## **Static Test Report**

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 1 of 17

Date: 2/5/2015 Test Document Number: 60-1042 Rev. A Project No. 15-002

**Test Plan Number:** N/A **Date Conducted:** January 16, 2015 **Test Director:** Roberto Montañez

Test Name: SpaceShipTwo Bailout Oxygen Sub-System Investigation

**Test Plan:** See test plan #60-1040 dated 1/7/2015 and #60-1041 dated 1/13/2015.

#### **Test Objective:**

 Evaluate functionality of the Oxygen System on the bailout parachute system used by Pete Siebold.

#### **Test Articles:**

- Emergency Bailout Parachute PN 101-14241.75(AAD 02) SN 30246
- Oxygen Bottle SN M486157

### Reference Drawing(s):

N/A

#### **Test Points:**

- Handle extraction by BPS Personnel using load cell.
- Oxygen Bottle cable pull and activation using load cell.
- Video recording of bottle empty process. Timing at different levels on the gauge.
- Handle extraction (non-instrumented) by Scaled Composites representative.

## **Static Test Report**

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 2 of 17

### **Test Summary:**

The following test points were conducted. Handle pulls were categorized as:

Straight pull: Inboard and outward motion to extract the handle from the pocket.

Chest pull: Right to left (as worn) motion against chest. Outside: Pull away from body normal to the chest.

Test Number	Subject	Test Point	Resulting Force (lbs)	Data File	Video File	Comments
025	Fowler	Green Handle Pull – Straight	18.4	st025.xls	Attch C	
026	Fowler	Green Handle Pull – Straight	18.5	st026.xls	Attch C	
027	Fowler	Green Handle Pull – Straight	14.1	st027.xls	Attch C	
028	Fowler	Green Handle Pull – Chest	22.2	st028.xls	Attch C	
029	Fowler	Green Handle Pull – Chest	20.4	st029.xls	Attch C	
030	Fowler	Green Handle Pull – Chest	23.1	st030.xls	Attch C	
031	Fowler	Green Handle Pull – Outside	22.5	st031.xls	Attch C	
032	Fowler	Green Handle Pull – Outside	22.1	st032.xls	Attch C	
033	Fowler	Full O2 Bottle	57.8	st033.xls	Attch C	Reference video for discharge time.
034	Fowler	Pull with Both Handle stowed and empty bottle	34.9 to peel handle 55.3 to break nipple	st034.xls	Attch C	Used to characterize pull force with both components connected
035	Stinemetze	Green Handle Pull – Both	N/A	N/A	Attch C	Successfully extracted.
036	Stinemetze	Green Handle Pull – Right Hand	N/A	N/A	Attch C	Successfully extracted.
037	Stinemetze	Green Handle Pull – Right Hand	N/A	N/A	Attch C	Successfully extracted.
038	Stinemetze	Green Handle Pull – Left Hand	N/A	N/A	Attch C	Successfully extracted.
039	Stinemetze	Green Handle Pull – Left Hand	N/A	N/A	Attch C	Successfully extracted.

#### **Test Conditions / Environmental/Location:**

Ambient: Temperature not recorded. 1012.1hPa Atmospheric Pressure (0.999 atm). NTSB Headquarters Building 490 L'Enfant Plaza, SW Washington, DC 20594

#### Data Acquired:

Photo: Still photos see Attachment A

Video: High-Definition digital video on file - 60-1042-IR-.

Data: Load cell summary on Attachment B. Raw data on files contained within:

60-1042-IR-NTSB-SS2-O2-Raw.zip

Instrumentation/Equipment: Load Cell DFG55-200 with BPS Data Recording Software.

### **Static Test Report**

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 3 of 17

#### Results:

1. Green Handle extraction required between 14 and 23 pounds of force. All subjects were able to extract handle from Velcro pocket.

The oxygen bottle activated, and the flow time exceeded 8 minutes. Actual useful time cannot be determined as it depends on ambient conditions and user's oxygen needs as to useful pressure and oxygen flow.

**Test Witnesses:** Roberto Montañez (BPS), Tom Fowler (BPS), Jason Fedok (NTSB), Matthew Stinemetze (Scaled Composites).

Prepared by: Roberto Montañez

Title: Vice-President & General Manager

Date: February 9, 2015

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# **Static Test Report**

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 4 of 17

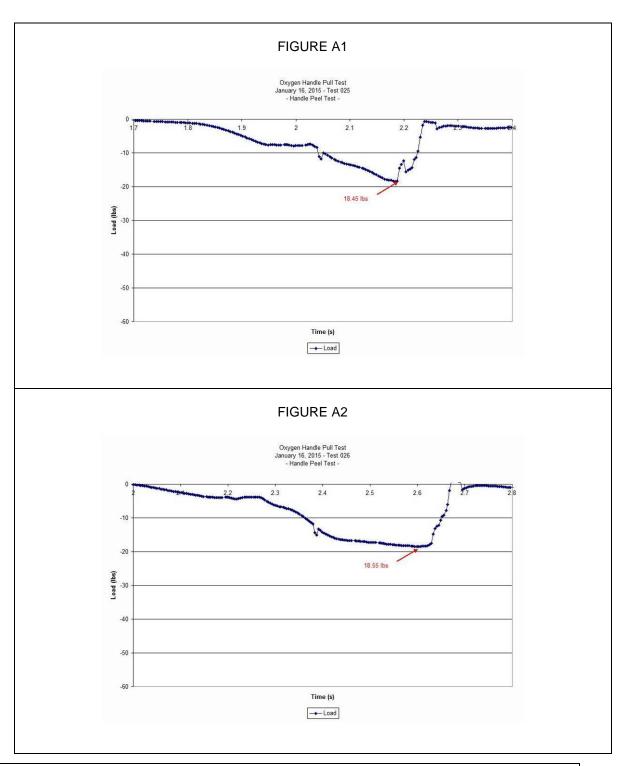
Attachment A: Test Results

# **Static Test Report**

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 5 of 17

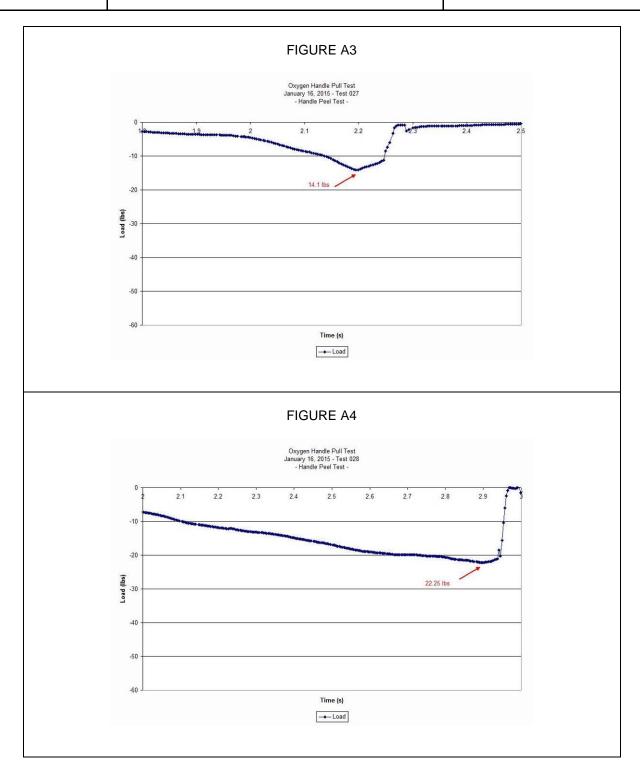


**Static Test Report** 

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 6 of 17

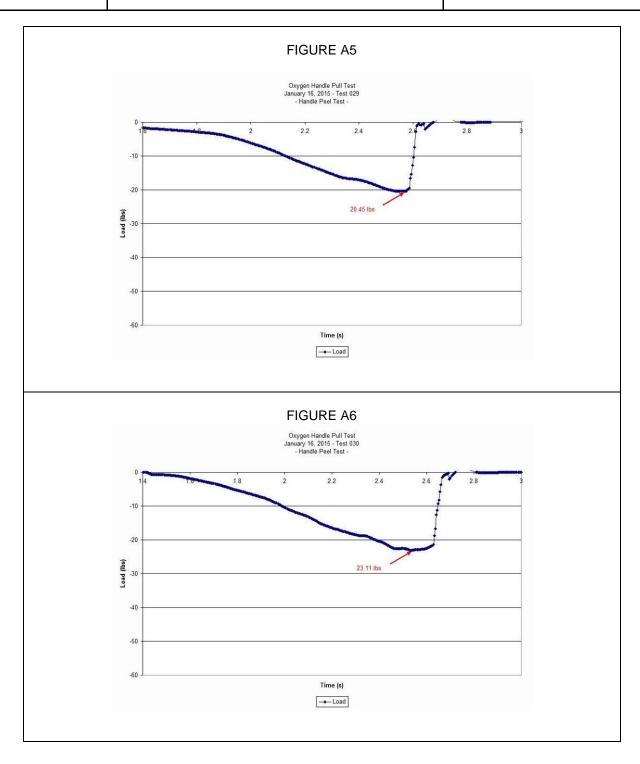


**Static Test Report** 

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 7 of 17

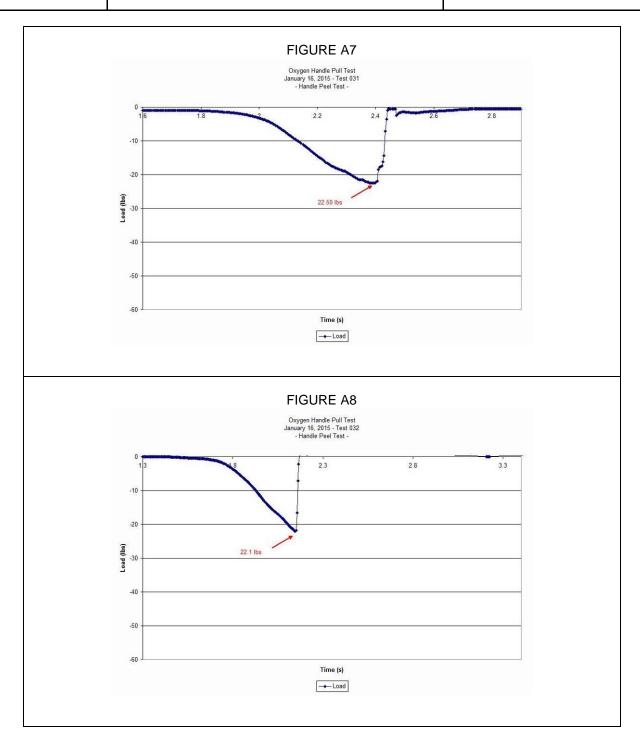


**Static Test Report** 

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 8 of 17

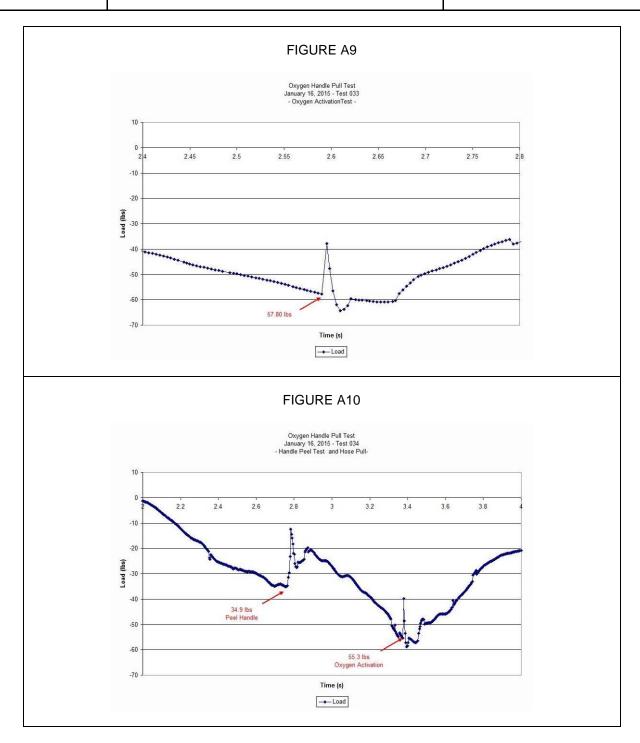


**Static Test Report** 

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 9 of 17



# **Static Test Report**

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 10 of 17

Attachment B: Pre-Test Photographs

# Static Test Report

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 11 of 17

#### FIGURE B1



Pete Siebold's Parachute (Container with Oxygen Bottle Only)

### FIGURE B2



Oxygen Handle Detail with black Supertack cord added for handle extraction

# **Static Test Report**

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 12 of 17

# Attachment C: Video File

(Reference Attached Video File)

# **Static Test Report**

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 13 of 17

# Attachment D: Equipment/Instrumentation List

# **Static Test Report** SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 14 of 17

<u> </u>	Test Instrumentation/Equipment Table					
Ck Mk	Description	Model or Designation	SN/BPS #	Calibration Due		
	Data Acquisition System	PDAS3	070201	Destroyed in		
	Data Acquisition System	1 DASS	PDAS#001	Test		
	Data Acquisition System	PDAS3	060303	N/A		
	1 ,		PDAS#002			
	Data Acquisition System	PDAS3	060302 PDAS#003	N/A		
			060301			
	Data Acquisition System	PDAS3	PDAS#004	N/A		
	Deta Association Contains	DD A C2	060303	NT/A		
	Data Acquisition System	PDAS3	PDAS#005	N/A		
	Data Acquisition System	PDAS3	060304	N/A		
			PDAS#006	IN/A		
	Data Acquisition Module	UD128A8D	0030184005	N/A		
	Vertical Speed Indicator	VSI-1000	050301	N/A		
	Vertical Speed Indicator  Vertical Speed Indicator	VSI-1000 VSI-1000	050301	N/A N/A		
	Vertical Speed Indicator  Vertical Speed Indicator	VSI-1000 VSI-1000	050302	N/A N/A		
	Vertical Speed Indicator  Vertical Speed Indicator	VSI-1000 VSI-1000	050304	N/A		
	Vertical Speed Indicator  Vertical Speed Indicator	VSI-1000 VSI-1000	050304	N/A		
	vertical Speed Indicator	V 51-1000	030303	IV/A		
	Load Cell 20,000Lb	SWO-20K	88697	5/3/07		
	Load Cell 20,000Lb	SWO-20K	157721	Broken During Test		
	Load Cell 50,000Lb	SWO-50K	88562	29 Apr '04		
				- F		
	Load Cell 300 Lb.	MLP-300	157825	30 Apr'04		
		0.5005.4				
	Strainsert Riser Pin Load Cell	05027-1	1	Due		
	Strainsert Riser Pin Load Cell	05027-1	2	Due		
	1-inch Riser Pin to Link Load Cell					
	10,000 Lb.	Ukn	1	29 Apr'04		
	1-inch Riser Pin to Link Load Cell	I II	2.	20 4 204		
	10,000 Lb.	Ukn		29 Apr'04		
	1-inch Link to Link Load Cell 10,000					
	Lb.	BPS #801087 Rev.A	DT-001	CALMTH1		
	1-inch Link to Link Load Cell 10,000	BPS #801087 Rev.A	DT-002	CALMTH1		
	Lb. 1-inch Link to Link Load Cell 10,000			Broken		
	Lb.	BPS #801087 Rev.A	DT-003	during Test		
	1-inch Link to Link Load Cell 10,000	BPS #801087 Rev.A	DT-004	CALMTH1		

**Static Test Report** SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 15 of 17

1-inch Link to Link Load Cell 10,000			
 Lb.	BPS #801087 Rev.A	DT-005	CALMTH
1-inch Link to Link Load Cell 10,000 Lb.	BPS #801087 Rev.A	DT-006	CALMTH
Omega Pressure Transducer 2,000 PSI	PX602-2KG5V	30602993	
Omega Pressure Transducer 10,000 PSI	PX602-10KG5V	30602993	
Dillon Universal Tester 10,000 Lb	LW	AP-7266T	9/23/11
TE : DIVACCE C		12251050150201	
Mini-DV 3CCD Camcorder Cannon	DM-GL2A	132510701782QK BPS GL2#1	N/A
Mini-DV 3CCD Camcorder Cannon	DM-GL2A	132480601594QH BPS GL2#2	N/A
Mini-DV 3CCD Camcorder Cannon	DM-GL2A	132640700153RD BPS GL2#3	N/A
Mini-DV 3CCD Camcorder Sony	DCR-TRV19	374543 BPS TRV19#1	N/A
Mini-DV 3CCD Camcorder Sony	DCR-TRV19	462669 BPS TRV19#2	N/A
Mini-DV 3CCD Camcorder Sony	DCR-TRV19	462662 BPS TRV19#3	N/A
Mini-DV 3CCD Camcorder Sony	DCR-TRV19	462663 BPS TRV19#4	N/A
Mini-DV 3CCD Camcorder Sony	DCR-TRV19	462675 BPS TRV19#5	N/A
Mini-DV 3CCD Camcorder Sony	DCR-TRV19	321067 BPS TRV19#6	N/A
HD/High Speed Video Camcorder Sanyo	XACTI	VPC-FH1 - BPS HD01	N/A
GPS Signal Re-Radiating Unit	RA-46	4600865 BPS-RR-01	N/A
Re-Radiating GPS Antenna	SM-66	7063733 BPS-GPS-RR-AT-01	N/A
GPS Flight Transmitter	STXx	GPS-BP1	N/A
GPS Flight Transmitter	STXx	GPS-BP2	N/A
CDG FILL I	DV D Q HQD	DDG CDG DY 01	27/4
GPS Flight Receiver	RX-Base3-USB	BPS-GPS-RX-01	N/A
GPS Flight Receiver	RX-Base3-USB	BPS-GPS-RX-02	N/A
GPS Flight Antenna	SA-76C	7601303 GPS-AT-01	N/A
GPS Flight Antenna	SA-76C	7601288 GPS-AT-02	N/A
 5-Event Module	Local fabricated	BPS-5EM-01	N/A

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 16 of 17

**Static Test Report** SpaceShipTwo Parachute Oxygen Sub-System Activation

	5-Event Module	Local fabricated	BPS-5EM-02	N/A
	5-Event Module	Local fabricated	BPS-5EM-03	N/A
	5-Event Module	Local fabricated	BPS-5EM-04	N/A
	5-Event Module	Local fabricated	BPS-5EM-05	N/A
X	Digital Force Gage	DFG51-200	47601	01Mar.'06
	Crossbow Tri-Axial Accl.	CXL25LP3	3015035	24 Dec'03
	Crossbow Tri-Axial Accl	CXL25LP3	3015036	24 Dec'03
	Crossbow Tri-Axial Accl	CXL25LP3	3015037	24 Dec'03
	Crossbow Tri-Axial Accl	CXL25LP3	4001762	13 Feb.'04
	Crossbow Tri-Axial Accl	CXL25LP3	4001763	13 Feb.'04
	LOGTRACK2		1	N/A
	LOGTRACK2		2	N/A
	LOGTRACK2		3	N/A
	LOGTRACK2		4	N/A
	LOGTRACK2		5	N/A
	LOGTRACK2		6	N/A
	LOGTRACK2		7	N/A
X	CANON XF100 Camcorder	XF100	JIM	N/A
	CANON XF100 Camcorder	XF100	BRUCE	N/A
	GoPro Hero 3		GP001	N/A
	GoPro Hero 3		GP002	N/A
	Contour Roam2		TOM	N/A
	Contour+2		TIM	N/A
X	Canon EOS Rebel T3i Still Camera		N/A	N/A
	Mecmesing 50KN Test Stand with			
	50KN Load Cell			
	Mecmesing 50KN Test Stand with			
	10KN Load Cell			

# Static Test Report

SpaceShipTwo Parachute Oxygen Sub-System Activation

60-1042-B DRAFT NTSB-SS2-OXYGEN-ONSITE-TEST-REPORT.doc

Page 17 of 17

# Attachment E: Document Revision List

REVISION	DATE	PAGES	CHANGES
Initial Release	2/10/2015	ALL	
Α	2/24/2015	3	Incorporated Changes Requested by the NTSB to remove
			comments.
В	3/6/2015	3	Incorporated changes requested to remove handle extraction difficulty characterization. Corrected "Both" to "Right Hand" or "Left Hand" where appropriate.