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

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:

a) 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.

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.

Results:

1. Green Handle extraction required between 14 and 23 pounds of force. All subjects were able to extract handle from Velcro pocket.
2. 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

PROPRIETARY DATA STATEMENT

Attachment A:
Test Results

FIGURE A1

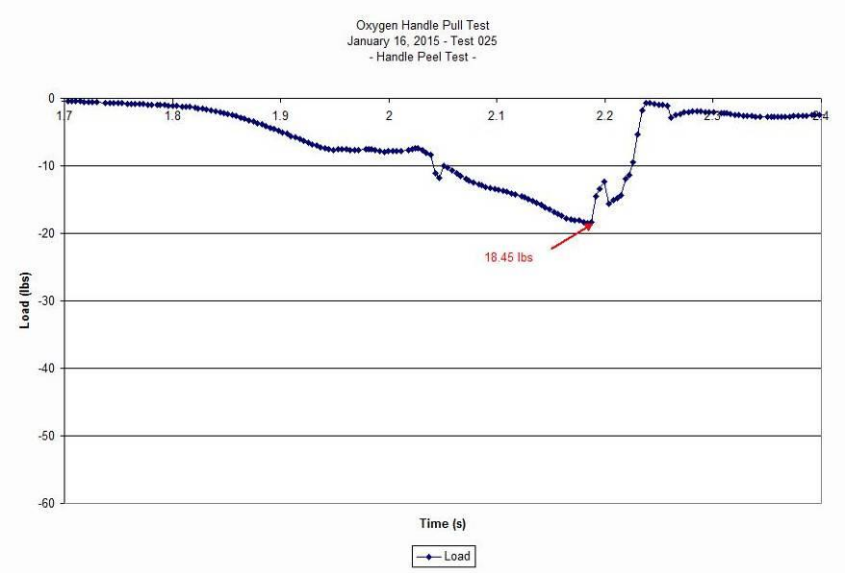


FIGURE A2

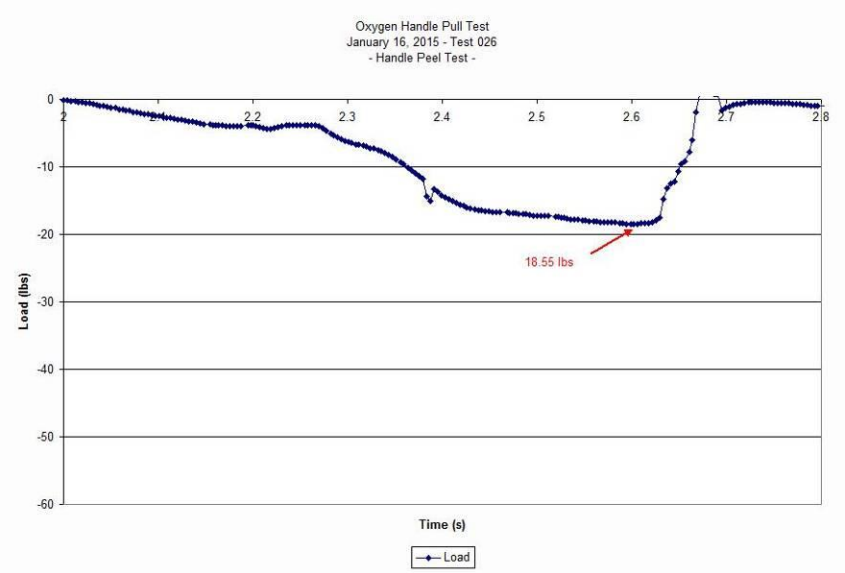


FIGURE A3

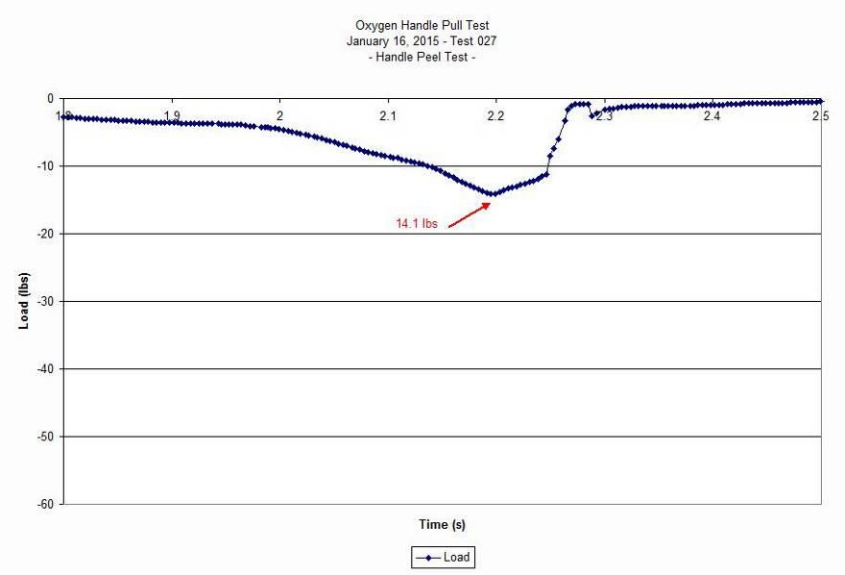


FIGURE A4

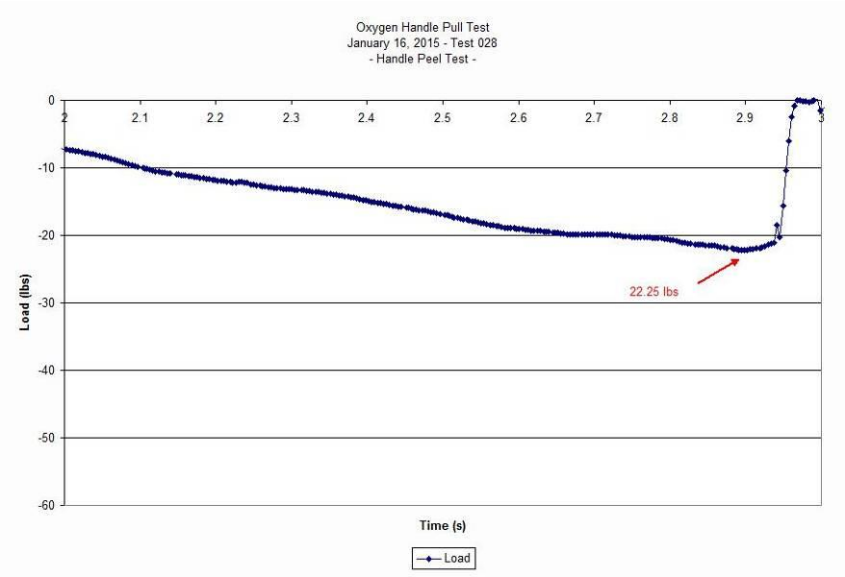


FIGURE A5

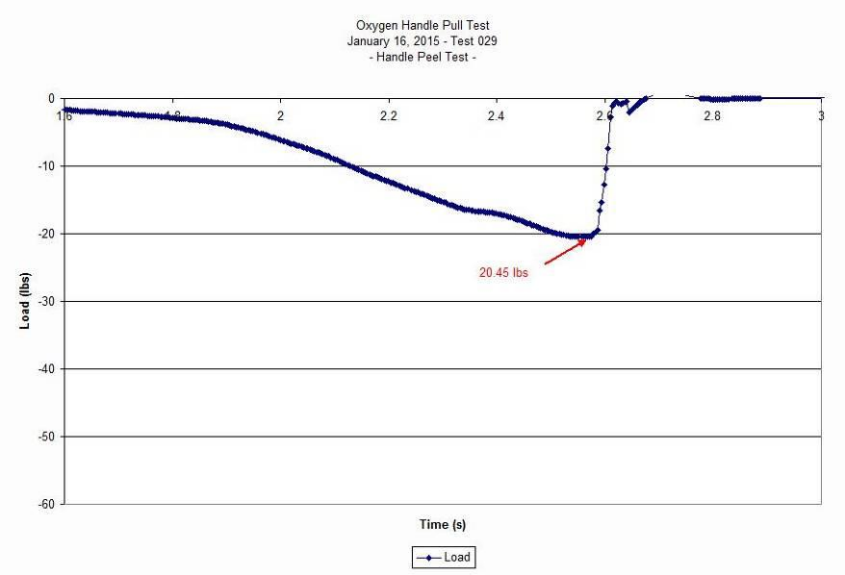


FIGURE A6

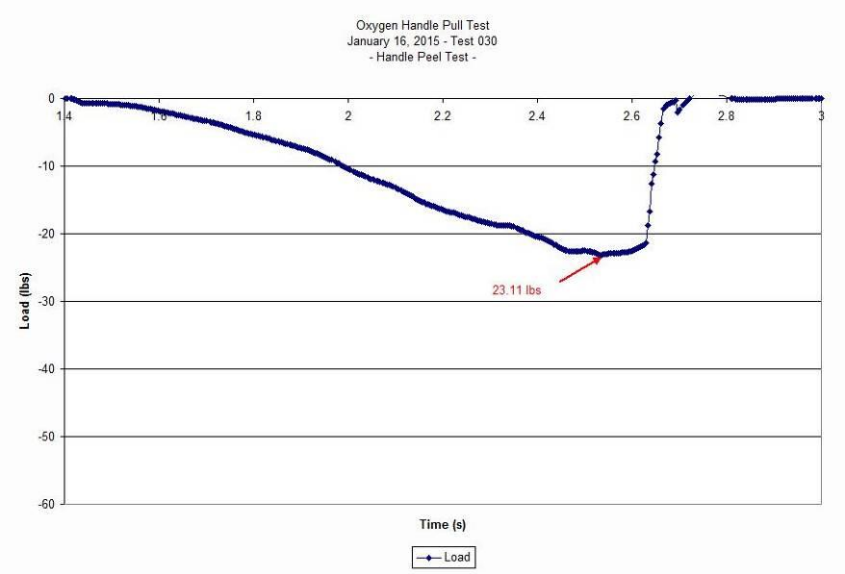


FIGURE A7

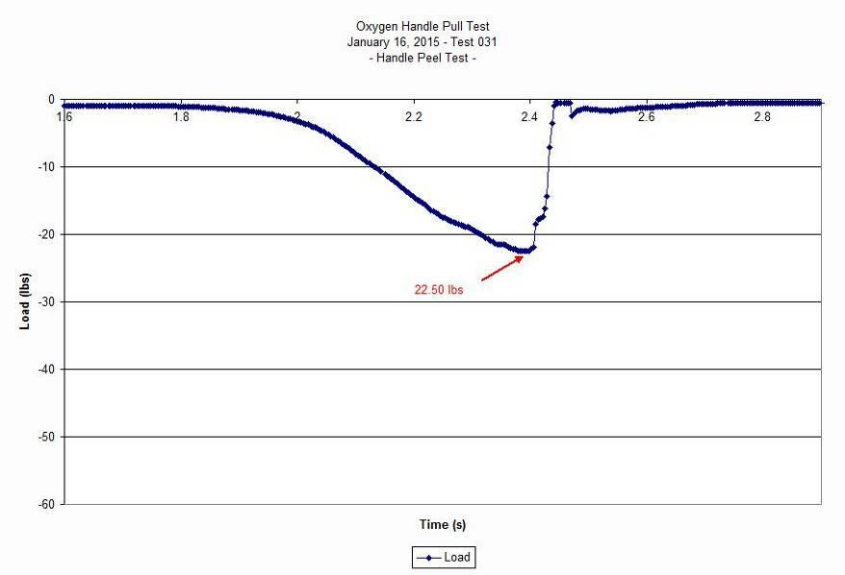


FIGURE A8

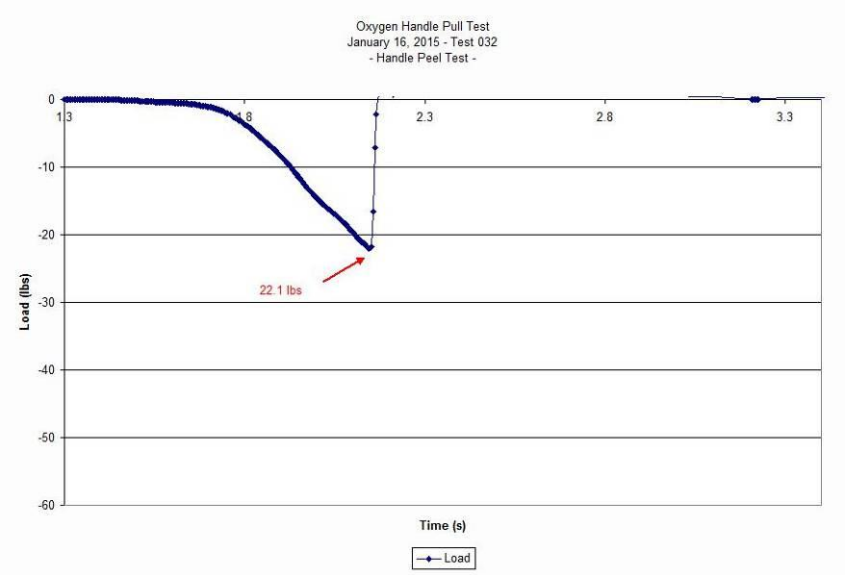


FIGURE A9

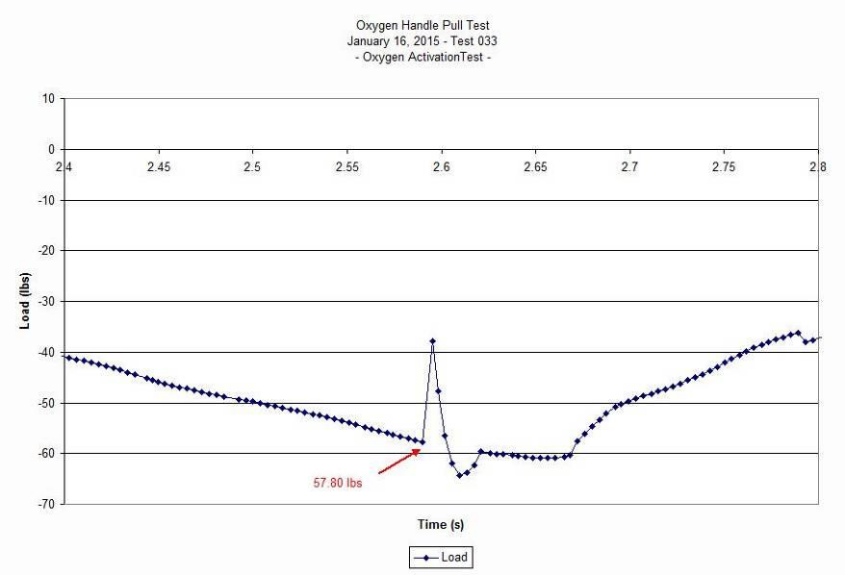
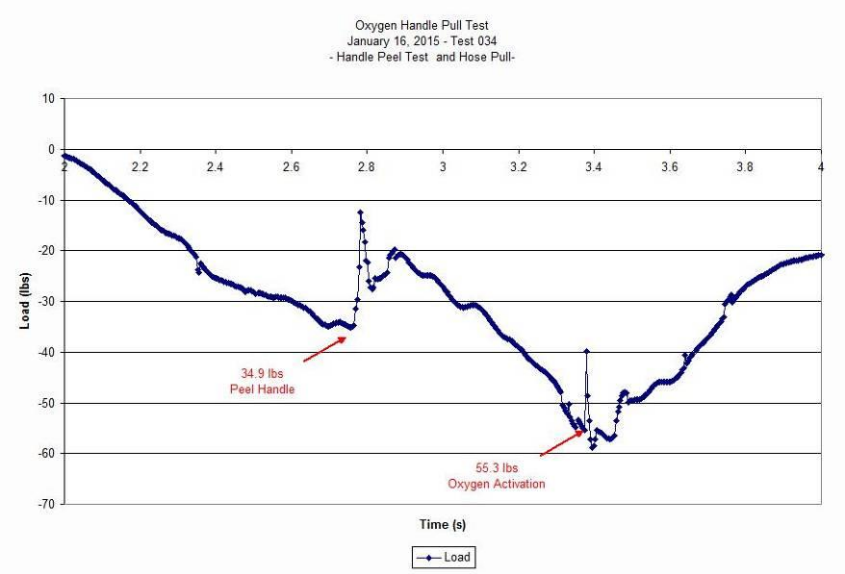


FIGURE A10



Attachment B:
Pre-Test Photographs

FIGURE B1

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

FIGURE B2

Oxygen Handle Detail with black Supertack cord added for handle extraction

Attachment C:
Video File

(Reference Attached Video File)

Attachment D:
Equipment/Instrumentation List

Test Instrumentation/Equipment Table

Ck Mk	Description	Model or Designation	SN/BPS #	Calibration Due
	Data Acquisition System	PDAS3	070201 PDAS#001	Destroyed in Test
	Data Acquisition System	PDAS3	060303 PDAS#002	N/A
	Data Acquisition System	PDAS3	060302 PDAS#003	N/A
	Data Acquisition System	PDAS3	060301 PDAS#004	N/A
	Data Acquisition System	PDAS3	060303 PDAS#005	N/A
	Data Acquisition System	PDAS3	060304 PDAS#006	N/A
	Data Acquisition Module	UD128A8D	0030184005	N/A
	Vertical Speed Indicator	VSI-1000	050301	N/A
	Vertical Speed Indicator	VSI-1000	050302	N/A
	Vertical Speed Indicator	VSI-1000	050303	N/A
	Vertical Speed Indicator	VSI-1000	050304	N/A
	Vertical Speed Indicator	VSI-1000	050305	N/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
	Load Cell 300 Lb.	MLP-300	157825	30 Apr’04
	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 10,000 Lb.	Ukn	2	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 Lb.	BPS #801087 Rev.A	DT-002	CALMTH1
	1-inch Link to Link Load Cell 10,000 Lb.	BPS #801087 Rev.A	DT-003	Broken during Test
	1-inch Link to Link Load Cell 10,000	BPS #801087 Rev.A	DT-004	CALMTH1

	Lb.			
	1-inch Link to Link Load Cell 10,000 Lb.	BPS #801087 Rev.A	DT-005	CALMTH1
	1-inch Link to Link Load Cell 10,000 Lb.	BPS #801087 Rev.A	DT-006	CALMTH1
	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
	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
	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

	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			

Attachment E:
Document Revision List

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