AFRL-RH-WP-TR-2017-0044

Comparative Assessment of Torso and Seat Mounted Restraint Systems using Manikins on the Vertical Deceleration Tower

Mr. Chris Perry
Mr. Chris Burneka
Mr. John Buhrman
Warfighter Interface Division

Ms. Rachael Christopher
ORISE

Mr. Chris Albery
Infoscitex

Mar 2017
Interim Report

DISTRIBUTION STATEMENT A: Approved for public release: distribution unlimited.

STINFO COPY

AIR FORCE RESEARCH LABORATORY
711 HUMAN PERFORMANCE WING,
AIRMAN SYSTEMS DIRECTORATE,
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433
AIR FORCE MATERIEL COMMAND
UNITED STATES AIR FORCE

NOTICE AND SIGNATURE PAGE

AFRL-RH-WP-TR-2017-0044 HAS BEEN REVIEWED AND IS APPROVED FOR PUBLICATION IN ACCORDANCE WITH ASSIGNED DISTRIBUTION STATEMENT.

//signed//
CHRIS BURNEKA
Work Unit Manager
Applied Neuroscience Branch

//signed//
DOUGLAS FRANCK
Acting Chief, Applied Neuroscience Branch
Warfighter Interface Division

//signed//
KRISTOFFER SMITH RODRIQUEZ, LTCOL, USAF
Acting Chief, Warfighter Interface Division
Airman Systems Directorate

REPORT DOCUMENTATION PAGE	*Form Approved* *OMB No. 0704-0188*

1. REPORT DATE ***(DD-MM-YY)***	**2. REPORT TYPE**	**3. DATES COVERED (*From - To*)**
01-04-17	Interim	July 2014 to May 2015

4. TITLE AND SUBTITLE Comparative Assessment of Torso and Seat Mounted Restraint Systems using Manikins on the Vertical Deceleration Tower	**5a. CONTRACT NUMBER** FA8650-14-D-6500-0001
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER 62202F
6. AUTHOR(S) Mr. Chris Perry* Mr. Chris Burneka* Mr. John Buhrman* Ms. Rachael Christopher** Mr. Chris Albery***	**5d. PROJECT NUMBER** 5329
	5e. TASK NUMBER 08
	5f. WORK UNIT NUMBER H0GW (53290812)
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) ORISE** Oak Ridge Institute for Science and Education Oak Ridge, TN 37831 USA Infoscitex Corporation*** Colonel Glenn Hwy, Suite 210 Dayton , Oh 45431-4027	**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Materiel Command* Air Force Research Laboratory 711 Human Performance Wing Airman Systems Directorate Warfighter Interface Division Applied Neuroscience Branch Wright-Patterson AFB, OH 45433	**10. SPONSORING/MONITORING AGENCY ACRONYM(S)** 711 HPW/RHCP
	11. SPONSORING/MONITORING AGENCY REPORT NUMBER(S) AFRL-RH-WP-TR-2017-0044

12. DISTRIBUTION/AVAILABILITY STATEMENT DISTRIBUTION STATEMENT A. Approved for public release: distribution unlimited.

13. SUPPLEMENTARY NOTES 88ABW Cleared 09/19/2017; 88ABW-2017-4562.

14. ABSTRACT An experimental effort involving a series of +z-axis impact tests was conducted on the 711th Human Performance Wing's Vertical Deceleration Tower (VDT). The purpose of the tests was to perform a comparative assessment of seat and torso mounted restraint systems during the simulated catapult phase. Parametric assessment was also conducted with other parameters including catapult acceleration, headrest position relative to seatback tangent plane, and head supported mass (helmet system). Overall, the series of comparative assessments indicated that a forward headrest of 2.5" relative to the seat back and a heavy helmet of 5 lb with a forward cg shift generate greater biodynamic responses during the catapult phase of ejection for both the LOIS and the LARD manikin . The comparative assessment with the SCH indicated that it provided equivalent control of head and torso motion for each manikin relative to the torso harness except for allowing larger shoulder loads for LARD at the 15 G impact level. Risk of neck injury as determined by the AFRL Neck Injury Criteria (primarily MANICxz or Nij) for those comparative assessments were below establish AFRL risk of injury values. The Nij compression/flexion values were the most critical in all cases. Comparing a baseline ejection seat configuration (combined baseline test parameters) and a JSF-styled ejection seat configuration (combined non-baseline test parameters) produced similar biodynamic response parameters for the LOIS and the LARD, but the JSF-styled seat generated a greater risk of neck injury to the occupant at all impact levels. Maximum lumbar loads produced by LARD at 15 G for the harness configuration comparison and the seat configuration comparison were greater for the SCH and the JSF-styled seat, but still below accepted AFRL lumbar load limits. All the data sets collected for this effort will be used in a future human impact study with similar comparative assessments for prediction of biodynamic response at acceleration levels beyond what is allowed for human test subjects.

15. SUBJECT TERMS Vertical Impact Acceleration, Vertical Deceleration Tower, Catapult Acceleration, LOIS Manikin, LARD Manikin, Forward Headrest, HGU-55/P Helmet, JSF Helmet, Torso Harness, Simplified Combined Harness, SCH, Comparative Assessment

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT:**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON** (Monitor)
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			Chris Burneka
Unclassified	Unclassified	Unclassified	SAR	196	**19b. TELEPHONE NUMBER** *(Include Area Code)*

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39-18

TABLE OF CONTENTS

LIST OF FIGURES

FIGURE PAGE

LIST OF TABLES

TABLE PAGE

ACKNOWLEDGMENTS

The authors would like to thank the following people for their expertise and assistance during this study in helping to: develop and design test fixtures, install and calibrate instrumentation, set-up and run data collection systems, and process data:

- Mr. Delane “Bull” Bullman, Mr. Greg Thompson, Mr. Glenn Thomas, Mr. Brian Grattan, Mr. Eric Master (Infoscitex Corporation)

- MSgt Clifford Hatch, TSgt James Chase, TSgt Filmon Yosief (Aircrew Biodynamics and Protection Team within the 711th Human Performance Wing (711 HPW))

- Mr. Joseph Strzelecki (Aircrew Biodynamics and Protection Team within the 711 HPW)

1.0 OVERVIEW

The Aircrew Biodynamics and Protection (ABP) Team of Air Force Research Laboratory (AFRL) (711 HPW/RHCPT) and their in-house technical support contractor, Infoscitex, conducted an experimental effort involving a series of +z-axis impact tests conducted on the Vertical Deceleration Tower (VDT). The purpose of the tests was to perform a comparative assessment of seat and torso mounted restraint systems during the simulated catapult phase. Parametric assessment was also conducted with other parameters including catapult acceleration, headrest position relative to seatback tangent plane, and head supported mass (helmet system). A Lightest Occupant in Service (LOIS) and a Large Anthropometric Research Device (LARD) instrumented manikins were used in this test program to simulate human response. Data collection on the VDT consisted of manikin upper cervical spine loads and moments, manikin lumbar loads, manikin head accelerations, shoulder straps and lap belt loads, seat pan and cushion accelerations, seat pan loads, carriage acceleration, carriage velocity, and high speed video.

This effort was internally funded by the United States Air Force (USAF), Air Force Research Laboratory, 711th Human Performance Wing, Airman Systems Directorate. The results provided in this report will be used as a reference for future test programs addressing parametric assessment of ejection configuration parameters using volunteer human subjects on the VDT.

2.0 BACKGROUND

The new Joint Strike Fighter (JSF) aircraft will employ a Martin-Baker Mk-US16E ejection seat, which is expected to accommodate the full range of aircrew (103-245 pounds (lb)). However, preliminary rocket sled qualification tests of this seat have shown that the neck forces and head rotations as measured by instrumented manikins may be unacceptably high for small human occupants. In addition, recent publications have reported a higher than expected 28% injury rate for all size occupants in Royal Air Force aircraft using Martin Baker Mk series seats, which has been documented from 232 mishaps through 2002. Most of the injuries occurred in the region of T4-L1 (Lewis, 2006). The Italian Air Force also documented a high spinal injury rate of 40% during 20 ejections in Mk series seats (Cangiano, 2011). Surprisingly, the risk of spinal injury for the above qualification and operational ejections was deemed acceptable (< 5%) when estimated by the USAF Dynamic Response Index (DRI), which is the primary method used by the USAF for estimating injury risk during aircraft ejections. There is great concern in both the operational and research communities regarding this gross underestimation of spinal injury risk.

It has been surmised by Tulloch (2011) that the reason for the spinal injury rate being greater than predicted by the DRI during Mk seat ejections is due to excessive upper torso motion generated by the combination of the new seat-mounted harness, forward-mounted headrest, and the new helmet-mounted systems being employed with these seats. The DRI limits were originally developed and validated based on seats using a standard torso-mounted harness, in-line headrest, a seatback angle relative to the catapult thrust line of 5° or less, and a standard flight helmet (Brinkley & Shaffer, 1971). These seat configuration limitations do not fully account for the cases where the seating/restraint system configuration allows increased upper-torso motion during ejection (Buhrman, 2012).

There are currently no data sets that allow the estimation or modeling of head accelerations and neck loads experienced by humans wearing the new seat-mounted restraint system in combination with a forward headrest and a new Helmet Mounted Display helmet system. The experimental effort focusing on parametric assessment of ejection configurations can now allow for analysis of the differences in accelerations and displacements due to the new seat and restraint parameters, and then determine their influence on risk of injury during ejection from the JSF and other high performance aircraft. The results will be used to ascertain whether a lowering of the DRI (currently at a value of 18) should be adopted for new seats such as the Mk-US16E, in order to maintain the 5% injury threshold which is normally required by the USAF for ejection injury risk.

The manikin tests provide estimates of tensile, compressive, and shear forces in the neck, and give a good indication of whole body response during simulated catapult phase of ejection. However, manikin neck data has traditionally been a weak indicator of torque and head rotation, and does not accurately duplicate the effects of human bracing and other variables. As a result, follow-on tests with human volunteers will be necessary in order to simulate the actual biodynamic response of the crewmember during an ejection environment. AFRL has conducted approximately 3,000 similar human tests at exposure levels of 8-12 G on these test facilities since 1976 with only four reported injuries, none of which required surgical intervention.

3.0 OBJECTIVES

The primary purpose of this effort is to investigate the effects of current and new ejection seat parameters on crewmembers under simulated ejection conditions based on instrumented manikin tests. The data collected during this test program will enable us to evaluate the potential for injury risk to crewmembers due to new seat geometries, restraint systems, and helmet systems during high-speed ejections. The data will also be used as a prediction of expected human test subject responses in a follow-up test program following the completion of the manikin testing.

The critical issues questions this test program answers include:

a. Does the positioning of the headrest affect the acceleration and motion of the head and torso during simulated catapult phase of ejection?
b. Do new helmet systems contribute to greater accelerations and displacements of the head and torso as compared to standard helmets and current helmet systems during simulated catapult phase of ejection?
c. Do new seat-mounted harnesses contribute to greater acceleration and motion of the head and torso as compared to traditional torso-mounted harnesses during simulated catapult phase of ejection?

4.0 TEST FACILITY AND EQUIPMENT

4.1 Vertical Deceleration Tower

The VDT was used for +Gz impact tests to evaluate acceleration response, neck and spine loading and restraint system loading during the simulated catapult phase of an ejection. The purpose of the VDT is to generate vertical impact acceleration profiles and evaluate their effects on human and manikin subjects, and define the effectiveness of operational and developmental crew protection concepts, for the purpose of improving warfighter performance. The VDT facility is a 50 ft vertical steel tower composed of two vertical rails and a 2,500 lb drop carriage (Figure 1). The carriage is allowed to enter a free-fall state (guided by the rails) from a pre-determined drop height. A plunger mounted on the rear of the carriage is guided into a cylinder filled with water located at the base and between the vertical rails. A +Gz acceleration pulse (actually a deceleration pulse) is produced when water is displaced from the cylinder by the carriage-mounted plunger. The pulse shape is controlled by varying the drop height, which determines the peak G-level, and also by varying the shape of the plunger, which determines the rise time of the pulse. Various plungers are available which allow the VDT hydraulic decelerator to generate pulses up to 80 G peak acceleration, maximum velocity changes up to 56 ft/s, and pulse durations of 40-180 ms.

The plunger used during this effort on the VDT was plunger # 102. The drop height of the carriage was determined by measuring the relative distance between the bottom of the plunger and the top of the water deceleration cylinder as the carriage was being raised to its final drop height prior to the initiation of free-fall.

Figure 1. 711th HPW VDT Tower Facility

4.2 VDT Configuration

A specially-designed generic seat, composed of a flat seat-pan perpendicular to a flat seat-back, was used to restrain the manikin in an upright, seated position (Figure 2 and 3). The seat was rigidly mounted to the front face of the VDT carriage such that the seat-back was in-line with the vertical acceleration vector generated during impact. A flat head rest plate was also positioned above the seat back plate. The front vertical plane of the headrest was able to be positioned from 0 to 3 inches forward of the vertical plane of the seat back. The seat fixture was designed to allow instrumentation with load cells and accelerometers to collect dynamic response data during the impact. The primary modification to the seat fixture for this series of tests was the positioning of the headrest either at 0" in front of the plane of the seat back (in-line), or at 2.5" in front of the plane of the seat back.

The positive axis of the coordinate system for the test configuration for this program is defined with respect to the front of the carriage, or with respect to the orientation of a manikin positioned in the seat mounted to the front fo the VDT carriage. The coordinate system is shown for this test configuration in Figure 3.

Figure 2. Generic Seat Fixture Mounted to Front of VDT Carriage

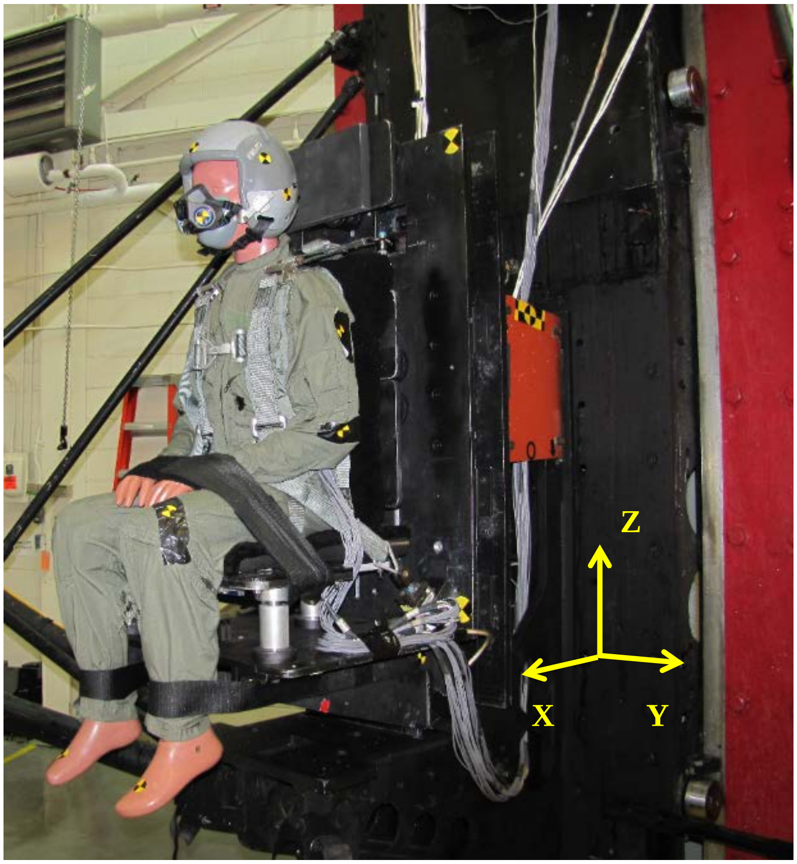


Figure 3. VDT with Generic Seat and Manikin Showing Impact Coordinate System

4.3 Manikins

All testing was conducted with an instrumented manikin. A LOIS instrumented manikin, nude weight of approximately 103 lb, and a LARD instrumented manikin, nude weight of approximately 245 lb, were both utilized in this test program. Each manikin was dressed in appropriately sized flight gear and helmet system defined below. Hybrid III 50th male Aerospace and Hybrid III 50th male Automotive manikins were also subjected to a limited number of impacts primarily for development of computational models.

4.4 Restraints and Related Flight Equipment

The test manikins were restrained with either the standard USAF torso harness configuration or the Simplified Combined Harness (SCH) which interfaces with the seat. The harness configuration is part of the parametric assessment and will be highlighted in the Experimental Design.

The USAF harness configuration is composed of parachute riser straps and Advanced Concept Ejection Seat or ACES II lap belt configuration that interfaces with either the Protective Combat

Uniform (PCU)-15/P or PCU-16/P torso harness depending on the subject size. The PCU harness configurations were fitted to each manikin prior to positioning in the seat. Once positioned, the lap belts were adjusted first, and attached to load cells mounted on each side of the seat pan and tightened securely with pre-tension levels of 20 ± 5 lb at each attachment point. The parachute riser straps are routed over each shoulder and secured to the load cells which were mounted just behind the seat back. The parachute riser straps were adjusted after the lap belts, and tightened securely with pre-tension levels of 20 ± 5 lb at each attachment point.

The SCH is integrated into the cushions of the Mk16 series seats, therefore both the restraint and the seat back and seat pan cushion from the Mk16 seat were integrated into the generic seat fixture on the VDT. The SCH also had its parachute riser straps routed over each shoulder and secured to load cells behind the seat back. The following set-up procedures are based on instruction from an on-site Martin-Baker representative in conjunction with the US16E Ejection Seat Aircrew Manual (Martin-Baker, 2013), within the limitations of using manikin subjects and laboratory test facilities. The seat pan was adjusted such that the inertia reel straps are parallel to the horizontal and the manikin's helmet was approximately centered in the headrest. The crotch straps were pulled up to remove excess slack. The test operator and tower technicians then routed the shoulder straps and lap belts through the belt loops, and locked the ends into the Quick Release Box. The technicians then placed their fingers between the two lap belt straps and pulled to remove excess slack. The test operator tightened the lap belt securely with pre-tension levels of 40 ± 5 lb measured at each attachment point. The technicians then grabbed the shoulder buckles and leaned the manikin forward to remove slack in the harness behind the seat back cushion. Then the technicians pushed the manikin back into the seat while pulling down on both shoulder strap adjusters. The test operator pushes to remove any excess slack in the rear of harness and checks to make sure that the upper rear cross strap is firmly in place up against the Life Perserver Unit. The test operator then pulls the straps to obtain 20 ± 5 lb of tension as measured on each shoulder strap.

The manikins were dressed in a standard USAF flight suit, and then fitted with either Head Gear Unit (HGU)-55/P and Mask Breathing Unit (MBU)-20/P oxygen mask helmet configuration, or the JSF Gen II mock-up and MBU-20/P oxygen mask helmet configuration. The Gen II mock-up helmet weighed approximately 5 lb. with mask, and the HGU-55/P helmet weighed approximately 3 lb. with mask. The Gen II mock-up helmet had a forward center-of-gravity (CG) shift in the head anatomical x-axis of approximately 0.8 inches.

5.0 INSTRUMENTATION AND DATA COLLECTION

Transducers were chosen to provide the optimum resolution over the expected test acceleration ranges. Full-scale data ranges were selected to provide the expected full-scale range plus 50% to assure the capture of peak signals. All transducer bridges were balanced for optimum output prior to the start of the program. The appropriate accelerometers were adjusted with software for the effect of gravity by adding the component of a 1 G vector in-line with the force of gravity along the accelerometer axis.

The coordinate system (shown in Figure 3) used was the Right-Hand Rule with the z-axis parallel to the VDT guide rails, and with positive being up towards the top of the VDT facility. The x-axis is perpendicular to the z-axis and points outward away from the VDT impact carriage. The y-axis is perpendicular to the x- and z-axes according to the right-hand rule. The linear accelerometers were wired to provide a positive output voltage when the acceleration experienced by the accelerometer was applied in the +x, +y and +z directions.

The manikin coordinate system used was an inverted Society of Automotive Engineers or SAE J211 system (The moments were reverse from the SAE J211 system). Flexion (head rotation forward) was measured as positive, and extension (head rotation rearward) was measured as negative. Compression on the neck load cell and the lumbar load cell was negative, and tension was positive.

5.1 Facility Instrumentation

Acceleration measurements were taken on the VDT at different reference point locations on the carriage and at various locations on the seat structure. Load cells were also mounted on each seat structure to record reaction loads of the manikin restraint harness at the termination points for the shoulder straps and the lap belt straps. The specific instrumentation for this test series are detailed below.

The VDT carriage was instrumented with a tri-axial linear accelerometer package mounted behind the seat structure. An Endevco Model 7264-200 or an Entran Model EGE-72-200 accelerometer was installed to measure acceleration in the carriage z-axis. Entran Model EGE-72-200 accelerometers were installed to measure acceleration in the carriage y-axis and x-axis. A tri-axial accelerometer package was also mounted on the seat structure close to the seat reference point, and consisted of Entran Model EGV3-F-250 accelerometers for all three axes.

The restraint configurations were instrumented with specially designed tri-axial load cells. A Michigan Scientific Model 3000 load cell was installed to measure the reaction loads at the right and left lap belt termination points as shown in Figure 4. A Michigan Scientific Model 3000 load cell was installed to measure the reaction loads at the right shoulder belt termination point, and a Michigan Scientific Model 4000 load cell was installed to measure the reaction loads at the left shoulder belt termination point as shown in Figure 5.

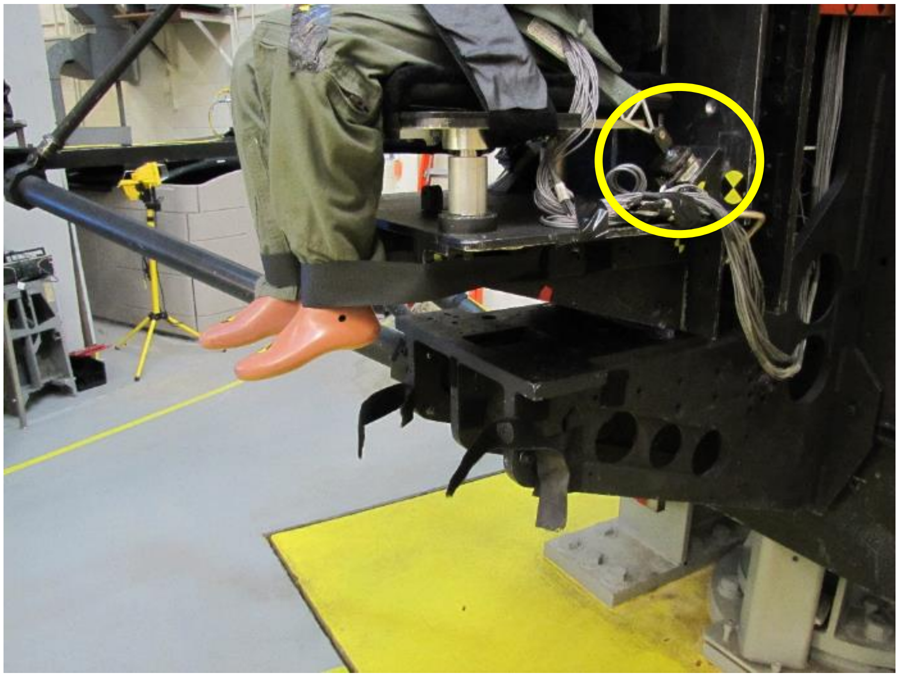


Figure 4. Location of Lap Belt Tri-axial Load Cell on Generic Seat Fixture

Figure 5. Location of Shoulder Belt Tri-axial Load Cell on Generic Seat Fixture

5.2 Manikin Instrumentation

The manikins were instrumented with tri-axial accelerometer packages located in the head, chest, and pelvis, and with 6-axis (3 orthogonal linear forces, 3 orthogonal moments) load cells in the upper neck and the lumbar spine/pelvis junction. The critical accelerations for this effort were the head z acceleration, head x acceleration, and the head angular acceleration (Ry). The critical bending moment for this effort was the bending moment that measured flexion and extension of the head on the neck (My) during impact.

The manikin heads were instrumented with a tri-axial linear accelerometer package and a single angular accelerometer measuring rotational acceleration around the head y-axis (flexion/extension motion of the head). The tri-axial accelerometer package was composed of Entran Model EGV3-F-250 linear accelerometers. A single Endevco Model 7302B angular accelerometer was mounted next to the tri-axial package to record the head angular acceleration around the y-axis. Tri-axial accelerometer packages composed of Entran Model EGV3-F-250 linear accelerometers were also mounted in the manikin's chest and in the manikin's lumbar spine/pelvis junction.

The upper neck of each manikin was instrumented with a Denton Model 1716A 6-axis load cell which measured the axial loads and angular torques in the three orthogonal axes. The lumbar spine of each manikin was instrumented with a Denton Model 1914A 6-axis load cell.

5.3 Transducer Calibration

On-site personnel from Infoscitex, Inc., conducted pre- and post-calibrations on all sensors used on the carriage and seat fixture. Calibration records of individual transducers as well as the Standard Practice Instructions are maintained in the biodynamic facility's Impact Information Center. For this test program, a record was made identifying the data channel, transducer manufacturer, model number, serial number, date and sensitivity of pre-calibration, date and sensitivity of post-calibration, and percentage change. Pre- and post-calibration information is maintained with the program data. The instrumentation used in this study is listed in the Electronic Instrumentation Data Sheets (See Appendix A).

5.4 Data Acquisition Control

The Master Instrumentation Control Unit in the Instrumentation Room located between the Horizontal Impulse Accelerator and the VDT test facility controlled the data acquisition. A test was initiated when the countdown clock reached zero using a comparator. The comparator was set to start data collection at a pre-selected time based on a positive reading of multiple safety inter-lock sensors used by the facility to protect the facility operators and human test subjects (not used for this program). Data were recorded to establish a zero reference for all transducers prior to restraining the manikin to the divan seat fixture. The reference data were stored separately from the test data and were used in the processing of the test data. A reference mark pulse was generated to mark the electronic data at a pre-selected time after test initiation to place the reference mark close to the impact point. The reference mark time was used as the start time for data processing of the electronic data.

5.5 Data Acquisition System

This research program used the Test Data Analysis System (TDAS) Pro manufactured by Diversified Technical Systems, Inc., to collect all the fixture and manikin data for each test as defined by the test matrix. The 64 channel TDAS Pro was mounted on-board the VDT at the top of the impact carriage (Figure 6). The TDAS Pro is a ruggedized, direct current powered, fully programmable signal conditioning and recording systems for transducers and events. The TDAS Pro was designed to withstand a 100 G shock. The TDAS unit is covered by plastic on the VDT to protect from water splash due to the water break system employed by the VDT facility.

The signal conditioning accepts a variety of transducers including full and partial bridges, voltage, and piezo-resistive sensors. Transducer signals are amplified, filtered, digitized and recorded in onboard solid-state memory. The data acquisition system is controlled through an Ethernet interface using the Ethernet instruction language. A desktop PC with an Ethernet board configures the TDAS Pro before testing and retrieves the data after each test. For this program, the Data Acquisition System (DAS) collected data at a 1K sample rate with a 120 Hz anti-aliasing filter.

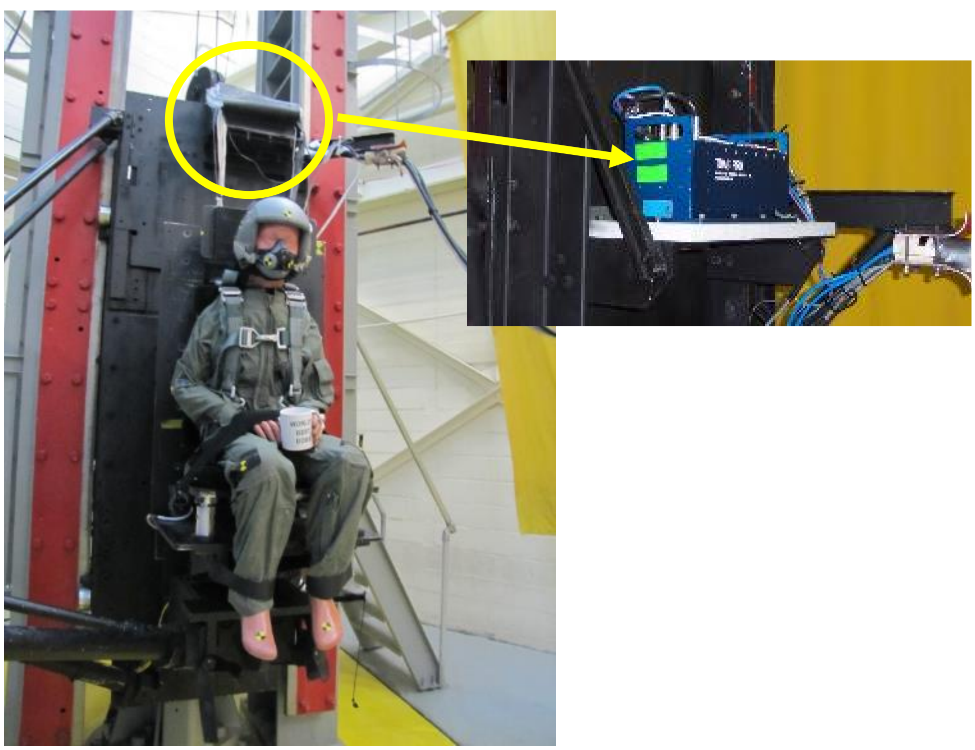


Figure 6. Location of TDAS PRO Data Collection System Mounted on VDT Carriage

5.6 Quick Look Data Plots

After each test, the filtered data were graphically plotted in a portrait format of 4-6 plots per page, and grouped with similar channels. The spreadsheet of plots also contained pertinent maxima, minima, and respective times of each occurrence. For all data, time = 0 was at initial carriage motion. The plots arranged in this fashion included: displacement versus time, force (load) versus time, and acceleration versus time.

5.7 High Speed Video and Photography

Two Phantom Miro-3 High-Speed digital cameras (Figure 7) were used to collect video of each test. The cameras were mounted on-board the VDT carriage at perpendicular and oblique angles relative to the manikin as shown in Figure 8.

The Phantom Micro line is a compact, light-weight, rugged family of cameras targeted at industrial applications ranging from biometric research to automotive crash testing. Rated to survive 100g acceleration this rugged camera can take 512x512 images at up to 2200 frames-per-second (fps). Reduce the resolution to 32 x 32 and achieve frame rates greater than 95,000 fps. With an ISO rating of 4800 (monochrome, saturation-based ISO 12232), the camera has the light sensitivity for the most demanding applications. With shutter speeds as low as 2 microseconds, the user can freeze objects in motion, eliminate blur, and bring out the image detail needed for successful motion analysis. The camera accepts any standard 1" C-mount lens. The Phantom Miro-3 member of the family is optimized for applications such as Hydraulically Controlled, Gas Energized crash simulations used in the automotive industry. Selectable 8-, 10- or 12-bit pixel depth allows the user to choose the dynamic range that best meets the demands of the application. The Miro-3 has a number of external control signals allowing for external triggering, camera synchronization, and time-stamping. The camera has both dynamic RAM and internal flash memory for non-volatile storage. Internal battery power allows the camera to be used in an un-tethered mode and ensures data survivability in case of loss of power.

The images for this study were collected at 500 fps. The video files were downloaded and converted to MP4 format, and stored in the Airman Systems Directorate Collaborative Biomechanics Data Bank. Photographs were taken of the test set-up prior to each test. Photographic and video data were stored on an internal network for downloads as requested.

Figure 7. Phantom Miro-3 High-Speed Digital Camera

Figure 8. Phantom Miro-3 Cameras Mounted On-Board VDT Carriage

6.0 EXPERIMENTAL DESIGN

6.1 Ejection Catapult Simulation Testing

A specially designed test matrix, Table 1; was developed addressing the program requirement to conduct a parametric assessment of manikin response based on restraint system, head rest position, and helmet system. The VDT generated an acceleration waveform that approximated a half-sine waveform with a peak acceleration that varied from 6 to 15 G, a velocity change that varied from 20 to 34 ft/s, and a time-to-peak acceleration that varied from 105 ms to 60 ms.

The cell designation for this program consisted of Cell ID (letter) and the peak G-level (number) required for the test. The test matrix was modified during the program due to preliminary assessment of some of the data, and other unforeseen circumstances; therefore, the data analysis contained in this report will focus on Cell's A, B, C, D, and E. Cell F was not run due to the unavailability of the Neck Protection Device (NPD), and Cells AN and CN (no seat cushion), and Cells H and I (no helmet) were not analyzed for this report as that data was collected for computational model development. Each size manikin ran once under each test condition with the exception of the 10G cells which called for 3 tests per manikin to assess repeatability.

Table 1. VDT Impact Test Matrix

TEST CELL	RESTRAINT HARNESS CONFIGURATION	HEADREST POSITION	HELMET/MASK CONFIGURATION
A6, A8, A10, A12, A15	PCU	0”	HGU-55/P
AN6, AN8, AN10, AN12, AN15	PCU	0”	HGU-55/P
B6, B8, B10, B12, B15	PCU	2.5”	HGU-55/P
C6, C8, C10, C12, C15	PCU	0”	JSF Gen II
CN6, CN8, CN10, CN12, CN15	PCU	0”	JSF Gen II
D6, D8, D10, D12, D15	SCH	0”	HGU-55/P
E6, E8, E10, E12, E15	SCH	2.5”	JSF Gen II
F6, F8, F10, F12, F15	SCH	2.5” w/ NPD	JSF Gen II
H6, H8, H10, H12, H15	PCU	0”	None
I6, I8, I10, I12, I15	PCU	2.5”	None

6.2 Risk Assessment Methodology

An initial assessment of head accelerations, neck loads & moments, and mask and helmet system interaction was conducted at the conclusion of each test. Analysis of the effect of head accelerations, neck loads and moments, and restraint harness effects on body injury risk was conducted at the end of the test program.

An analysis of potential neck injury due to imparted neck loads during the simulated ejection acceleration was conducted using neck injury risk assessment tools identified in the AFRL Ejection Injury Criteria. The combined cervical force and neck moment limits are expressed by the AFRL version of the Nij, and which has also been termed the Multi Axial Neck Injury Criteria (MANIC) for x-axis and z-axis impacts or MANICxz which is based on the work of Parr (2014). They are both calculated using the measured loads and moments from a special six-axis load cell (3 orthogonal axial loads, and 3 orthogonal rotational moments) mounted in the neck of the LOIS and LARD manikins. Axial tension and compression loads are measured in the z-axis of the neck (inferior/superior direction). Flexion and extension moments of the neck are measured about the y-axis of the head/neck junction (flexion is forward motion of the head towards the chest, extension is rearward rotation of the head towards the back or shoulder blades). The y-axis of the head runs from right ear canal to the left ear canal with positive towards the left.

The combined cervical force and cervical moment Nij value was calculated for each test on the VDT. The peak AFRL Nij limit for risk of injury in aerospace applications is 0.56 (Parr et al, 2013) for an AIS 2 injury at a probability level less than or equal to 5%. The Nij value was calculated throughout the time history of the impact test according to the following formula:

$$Nij = (F / F_{int}) + (M / M_{int}) \qquad (1)$$

where:

F is the measured manikin axial neck tension/compression load in pounds
F_{int} is the critical intercept load
M is the measured manikin flexion/extension bending moment in inch-pounds (in-lb)
M_{int} is the critical intercept moment

The Nij criteria do not apply to loading in pure tension or compression. Nij values are computed for each of the following combined neck loading cases:

N_{te} = Tension with Extension
N_{tf} = Tension with Flexion
N_{ce} = Compression with Extension
N_{cf} = Compression with Flexion

An analysis of potential lumbar spine injury during the simulated ejection was conducted using the compressive lumbar load limits as defined in the AFRL Ejection Injury Criteria document. The lumbar load limits are specified in Table 2:

Table 2. Lumbar Load Limits

Aircrew Size	5th % Female (103 lb)	50th % Male (172 lb)	95th % Male (245 lb)
Lumbar Load Limit (lb) (reduced 30%)	933 (653)	1395 (977)	1757 (1230)

In addition, the forward flexion or positive My torque measured in the lumbar spine is also evaluated due to its influence on the compressive load limit. For instance, it has been shown that when forward flexion of the torso is $\geq$15 degrees forward as measured from the frontal plane of the pelvis or from the angle at the base of the spine, the established lumbar load limits should be reduced by 30% from the values listed for each respective aircrew size. The positive My torque measurement is an indication of forward flexion of the torso.

6.3 Test Procedures

The following test procedures were used for all the manikin tests on the VDT.

a. Zeros were taken for channel calibration prior to each test.

b. After the manikin was properly dressed and configured with the correct mask, helmet, and restraint configuration, mechanical checks were performed, the manikin was placed in the seat. The lap belt and shoulder harness were attached and preloaded as previouly described.

c. The manikin's hands were placed in its lap and secured with Velcro straps (or similarly restrained) along with the manikin's ankles. The upper arms shall be parallel to the seat back.

d. Final checks were conducted to ensure that proper restraint fit and positioning were completed.

e. Still photographs were taken from the side and frontal views.

f. The test area around the VDT was evacuated and the Safety Officer checked all safety systems and assured that the test area is secured and ready for facility operation.

g. The VDT carriage was then raised to fill the cylinder with water, and then raised again to the specified drop height to achieve the desired G-level.

h. If all safety systems continued to be satisfactory, the Test Conductor instructed the operator to start the automatic countdown and activate the release of the VDT carraige and allow free-fall to impact.

i. After carriage impact, the manikin was removed from the seat and the seat, restraint system, and all other flight were inspected prior to the next test.

7.0 RESULTS

Over 100 impact tests were completed on the VDT in support of this effort to characterize the biodynamic response of the LOIS and LARD manikins to impact acceleration pulses generated by the VDT. Tests conducted in Test Cells A, B, C, D, and E, as defined in Table 1, were analyzed to assess the effects of the defined parameters, and the data analysis was completed using a comparative assessment with Test Cell A representing the baseline condition. Data from the remaining test cells were then compared to the baseline condition… Cell A vs Cell B, Cell A vs Cell C, Cell A vs Cell D, and Cell A vs Cell E.

Tests conducted at the 10 G impact level per test cell were the only impact level condition to have multiple tests completed to assess repeatability. The repeatability of the VDT impacts is shown below in Table 3. These peak acceleration level and velocity change summaries indicate that the VDT impact environment was well controlled during the duration of the program.

Table 3. VDT Carriage Parameters at 10G

TEST CELL	MANIKIN TYPE	PEAK CARRIAGE ACCELERATION (G)	TIME-TO-PEAK ACCELERATION (MS)	VELOCITY CHANGE (FT/S)
A10	LARD	9.95 ± 0.08	80.23 ± 0.68	27.17 ± 0.25
	LOIS	9.90 ± 0.05	72.50 ± 2.69	26.25 ± 0.07
B10	LARD	9.97 ± 0.12	74.53 ± 3.15	26.90 ± 0.05
	LOIS	9.93 ± 0.09	76.20 ± 1.73	26.36 ± 0.02
C10	LARD	10.00 ± 0.19	75.67 ± 3.71	27.61 ± 0.11
	LOIS	9.84 ± 0.10	79.53 ± 1.21	26.78 ± 0.11
D10	LARD	9.93 ± 0.08	80.97 ± 0.15	26.87 ± 0.11
	LOIS	9.96 ± 0.03	76.13 ± 0.45	26.40 ± 0.02
E10	LARD	9.93 ± 0.03	81.10 ± 0.92	27.37 ± 0.11
	LOIS	9.92 ± 0.16	78.17 ± 1.98	26.54 ± 0.13

7.1 VDT Impact Response: Test by Test Summary

A review of the specific test configuration for each of the impact tests conducted on the VDT with the LOIS and LARD manikins is documented with a test-by-test summary of the test conditions and a brief summary of the key data. The test-by-test summary is shown in Appendix B.

7.2 VDT Parametric Assessment: Headrest Position

A comparative assessment of the data from Test Cell A and Test Cell B evaluated the effects of positioning the headrest forward 2.5" from the baseline configuration defined as the headrest inline with the seat back (or 0" forward). The comparisons were conducted with both test cells using the torso-mounted harness and the HGU-55/P helmet. Data tables showing the response of the instrumented manikins as a function of impact level for specific measured variables are shown below.

The shoulder strap loads, chest acceleration, head x acceleration, head Ry angular acceleration, and calculated Nij neck tension/flexion and compression/flexion data, collected during impacts with the LOIS and LARD manikins, are presented in Tables 4 through 9 to evaluate the effect of the headrest positioned forward. The data is shown in the tables as a function of progressively increasing impact accelerations. The data was also plotted as a function of increasing impact acceleration for each of the 6 assessed parameters, and is shown in Figures 9 through 14.

Table 4. Headrest Variation Assessment: Shoulder Strap Load (lb)

IMPACT ACCELERATION (G)	LARD		LOIS	
	HEADREST: 0"	HEADREST: 2.5"	HEADREST: 0"	HEADREST: 2.5"
6	122	118	76	84
8	144	158	87	105
10	197 ± 9.3	218 ± 9.4	107 ± 3.9	129 ± 1.7
12	218	240	116	132
15	248	282	138	158

Table 5. Headrest Variation Assessment: Chest Acceleration (G)

IMPACT ACCELERATION (G)	LARD		LOIS	
	HEADREST: 0”	HEADREST: 2.5”	HEADREST: 0”	HEADREST: 2.5”
6	7.14	7.32	6.11	6.23
8	10.6	11.0	7.82	8.32
10	14.47 ± 0.60	14.7 ± 0.12	10.2 ± 0.10	10.5 ± 0.19
12	19.4	19.4	12.8	13.5
15	25.0	25.9	17.3	17.9

Table 6. Headrest Variation Assessment: Negative Head X Acceleration (G)

IMPACT ACCELERATION (G)	LARD		LOIS	
	HEADREST: 0”	HEADREST: 2.5”	HEADREST: 0”	HEADREST: 2.5”
6	3.58	4.23	2.87	3.10
8	5.46	6.25	4.06	4.48
10	7.29 ± 0.2	7.75 ± 0.2	5.09 ± 0.1	5.97 ± 0.1
12	8.74	9.16	5.94	7.29
15	10.3	11.1	7.48	8.91

Table 7. Headrest Variation Assessment: Positive Head Ry Angular Accel. (Rad/S^2)

IMPACT ACCELERATION (G)	LARD		LOIS	
	HEADREST: 0”	HEADREST: 2.5”	HEADREST: 0”	HEADREST: 2.5”
6	92.2	116	94.0	81.1
8	202	198	181	137
10	279 ± 9.3	242 ± 10	190 ± 46	268 ± 10
12	425	453	193	385
15	546	554	366	520

Table 8. Headrest Variation Assessment: Nij Compression/Flexion

IMPACT ACCELERATION (G)	LARD		LOIS	
	HEADREST: 0”	HEADREST: 2.5”	HEADREST: 0”	HEADREST: 2.5”
6	0.058	0.061	0.087	0.086
8	0.076	0.081	0.105	0.107
10	0.099 ± 0.009	0.102 ± 0.003	0.128 ± 0.003	0.127 ± 0.002
12	0.133	0.128	0.157	0.149
15	0.165	0.172	0.204	0.184

Table 9. Headrest Variation Assessment: Nij Tension/Flexion

IMPACT ACCELERATION (G)	LARD		LOIS	
	HEADREST: 0”	HEADREST: 2.5”	HEADREST: 0”	HEADREST: 2.5”
6	0.000	0.008	0.000	0.000
8	0.042	0.044	0.000	0.000
10	0.055 ± 0.001	0.061 ± 0.002	0.084 ± 0.002	0.099 ± 0.002
12	0.070	0.079	0.103	0.131
15	0.098	0.111	0.137	0.177

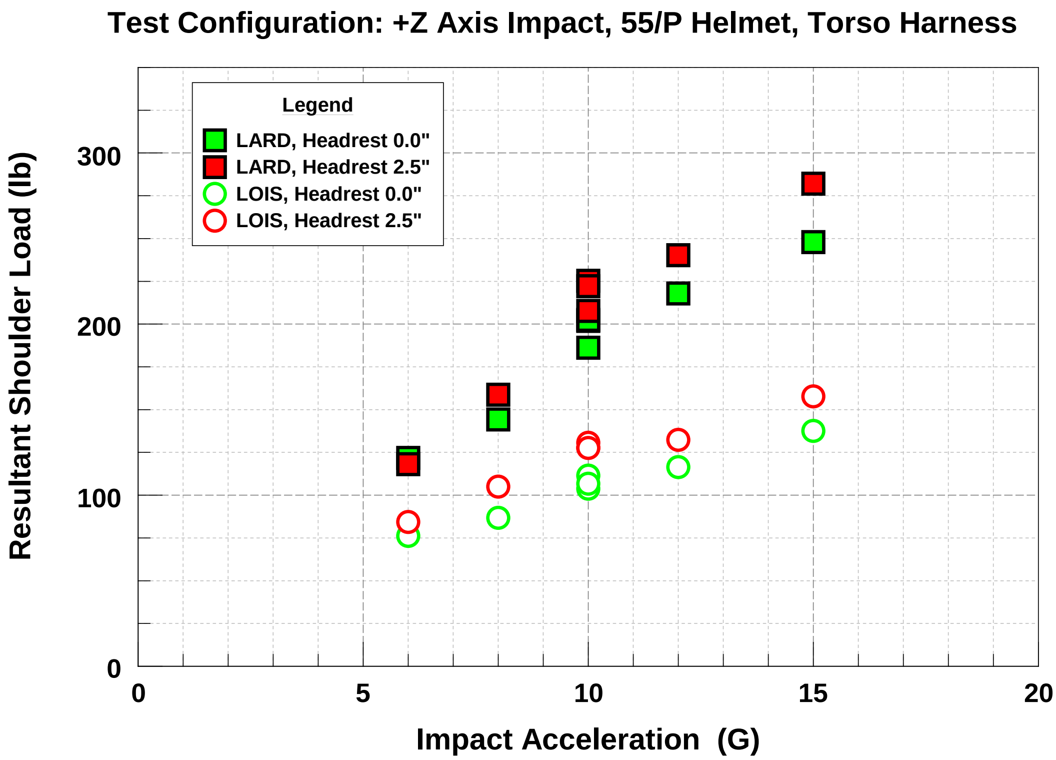


Figure 9. Resultant Shoulder Load as a Function of Impact Accel. and Headrest Position

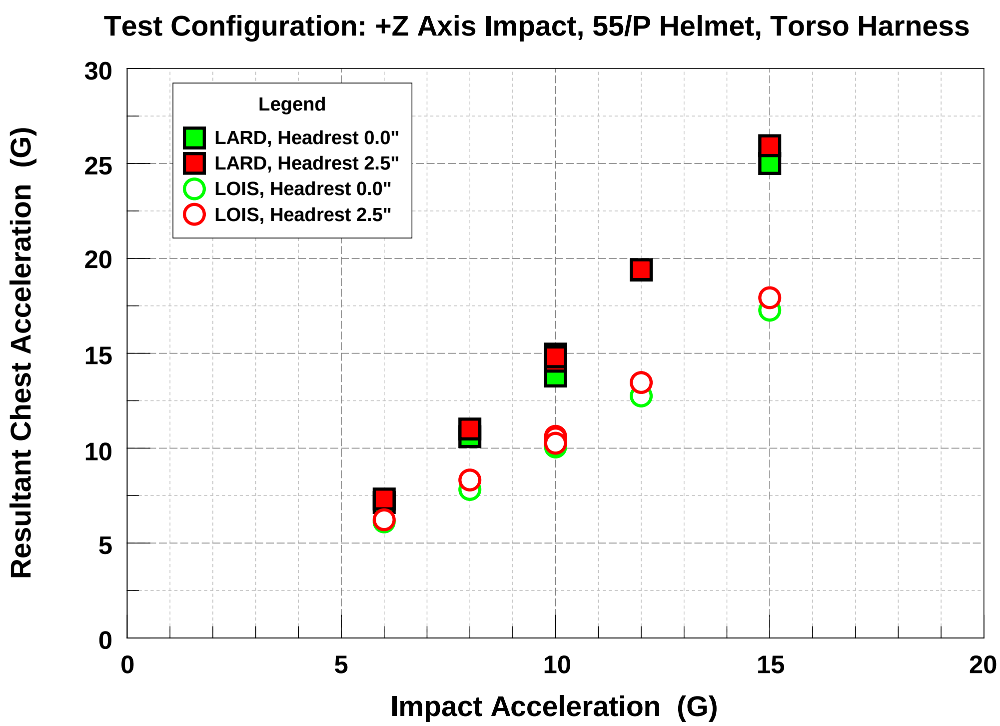


Figure 10. Resultant Chest Accel. as a Function of Impact Accel. and Headrest Position

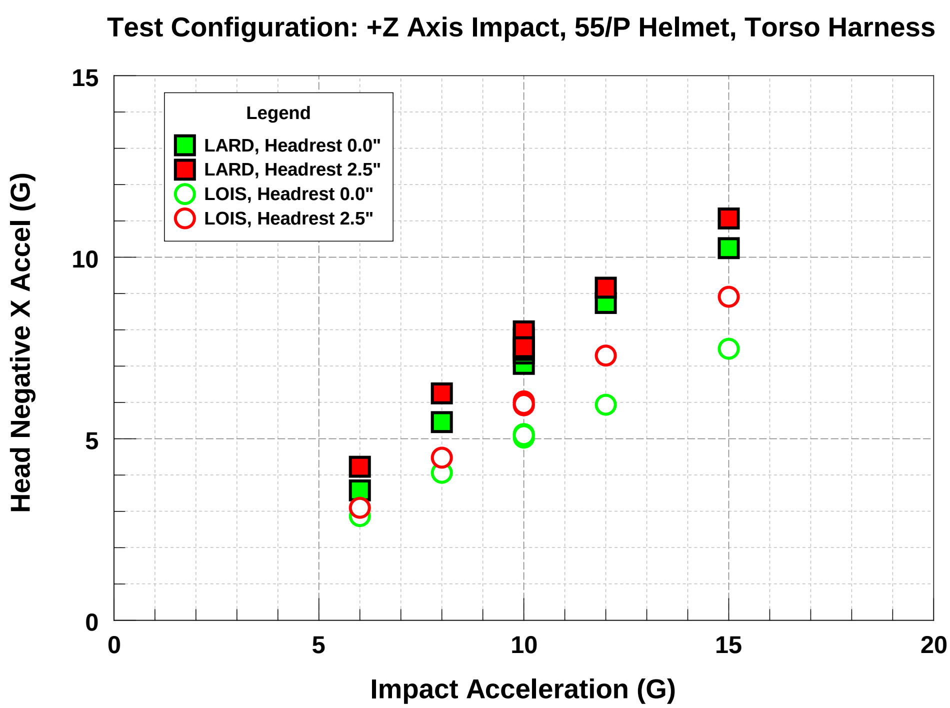


Figure 11. Head (-) X Acceleration as a Function of Impact Accel. and Headrest Position

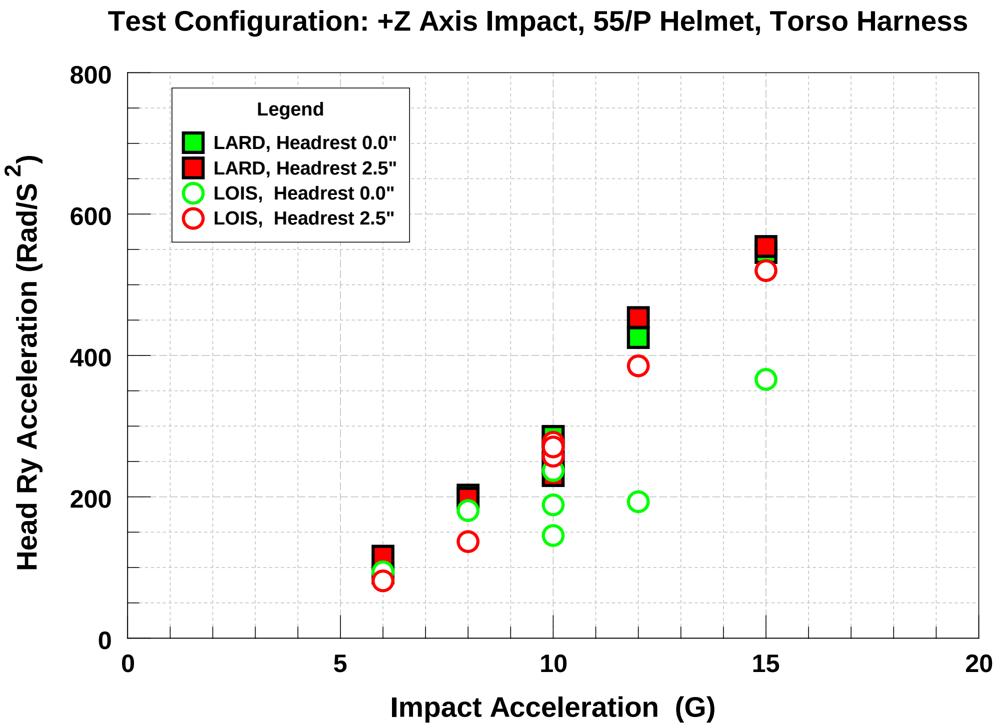


Figure 12. Head (+) Ry Acceleration as a Function of Impact Accel. and Headrest Position

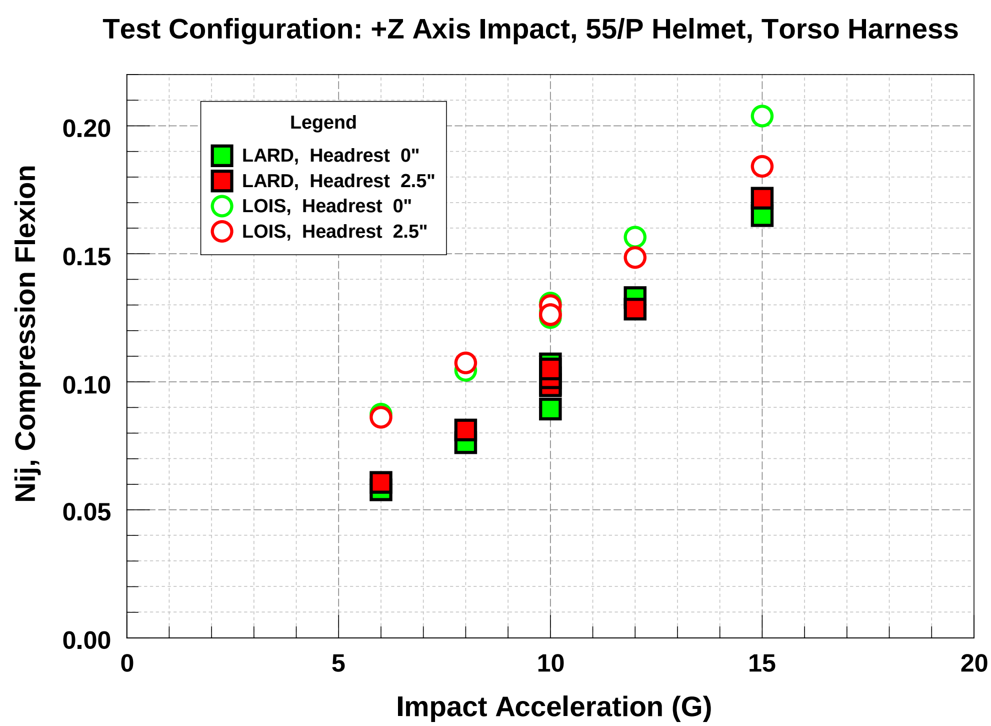


Figure 13. Nij Compression/Flexion as a Function of Impact Accel. and Headrest Position

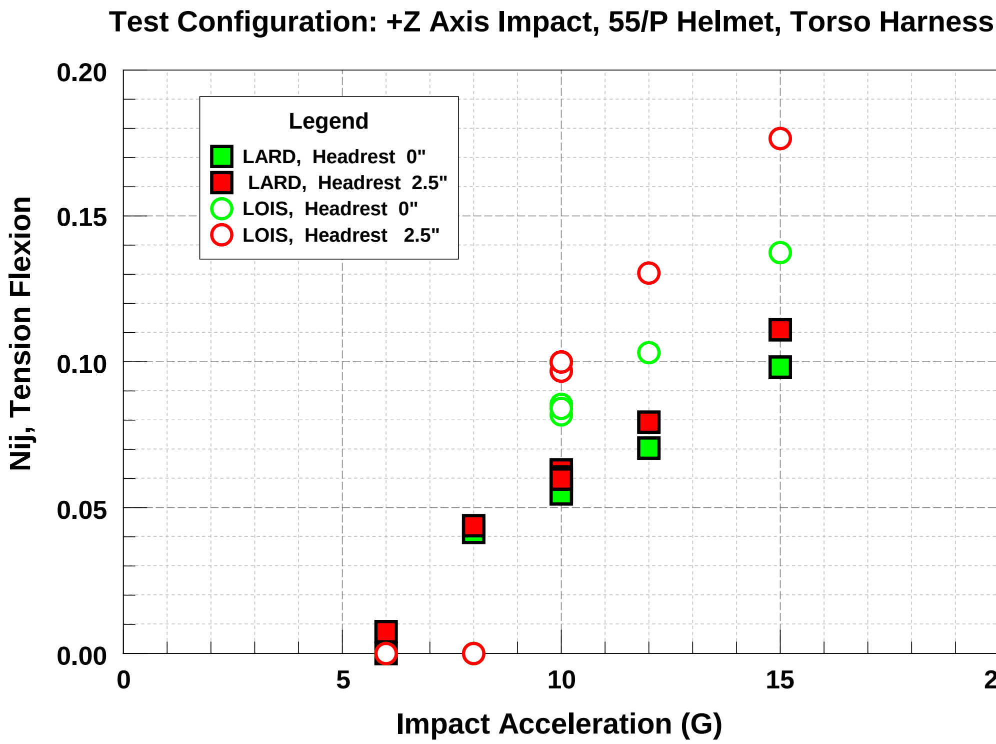


Figure 14. Nij Tension/Flexion as a Function of Impact Accel. and Headrest Position

Testing was successfully completed at all the impact accelerations (6, 8, 10, 12 and 15 G) for all the VDT impact configurations defined in Table 1 for Cells A and B. The six analyzed data sets indicate the consistent trend for measured accelerations and forces to increase as a function of impact acceleration for both the LOIS and LARD manikins, and in general follow a linear relationship which is consistent with the previous research with both manikins.

The shoulder load and the head and chest acceleration data sets indicate a greater response when the headrest is positioned 2.5" forward of the seat back when compared to the baseline position. This was true for both the LOIS and LARD manikins with the LOIS manikin indicating a greater relative response for the headrest shift. The increase in response was in the range of 5 to 15% over the baseline value. The exception was the LOIS head angular acceleration data which had an increase of 30 to 40% over the baseline values, particularly at the 10 G impact levels and greater. These data sets indicate that the headrest forward position increased forward motion of the upper torso (shoulder strap load and chest acceleration increase) and forward motion of the head (head x and head Ry).

The Nij was evaluated to provide an indication of the associated risk of neck injury to the occupant following ejection with a forward headrest. The Nij data sets, both Tension/Flexion and Compression/Flexion, indicated a greater risk for forward headrest position although both sets of values were less than the AFRL Nij limit of 0.56 for AIS 2 injury. It is interesting to note that the LOIS Nij values, at 10 G and greater, showed an increase in the relative values for tension/flexion for the shifted headrest versus baseline, but the compression/flexion values actually displayed the opposite relationship. This indicates the importance of the Nij tension/flexion values at the higher impact levels.

7.3 VDT Parametric Assessment: Heavy Helmet

A comparative assessment of the data from Test Cell A and Test Cell C evaluated the effects of wearing the JSF Gen II heavy helmet with forward shift CG compared to the HGU-55/P baseline helmet configuration (approximately 3 lb vs 5 lb including mask respectively). Data tables and plots showing the response of the instrumented manikins as a function of impact level for specific measured variables were developed and assessed.

The shoulder strap loads, chest acceleration, head x acceleration, head Ry angular acceleration, and calculated Nij neck tension/flexion and compression/flexion data, collected during impacts with the LOIS and LARD manikin, are presented in Tables 10 through 15 to evaluate the effect of the helmet weight and center-of-gravity shift. The data is shown in the tables as a function of progressively increasing impact accelerations. The data was also plotted as a function of increasing impact acceleration for each of the 6 assessed parameters, and are shown in Figures 15 through 20.

Table 10. Heavy Helmet Assessment: Shoulder Strap Load (lb)

IMPACT ACCELERATION (G)	LARD		LOIS	
	HELMET: 55/P	HELMET: JSF	HELMET: 55/P	HELMET: JSF
6	122	108	76	77
8	144	153	87	90
10	197 ± 9.3	185 ± 13	107 ± 3.9	123 ± 8.0
12	218	193	116	146
15	248	253	138	183

Table 11. Heavy Helmet Assessment: Chest Acceleration (G)

IMPACT ACCELERATION (G)	LARD		LOIS	
	HELMET: 55/P	HELMET: JSF	HELMET: 55/P	HELMET: JSF
6	7.14	8.1	6.11	6.66
8	10.6	12.1	7.82	8.68
10	14.47 ± 0.60	17.5 ± 0.60	10.2 ± 0.10	11.9 ± 0.22
12	19.4	21.2	12.8	15.2
15	25.0	28.2	17.3	20.9

Table 12. Heavy Helmet Assessment: Negative Head X Acceleration (G)

IMPACT ACCELERATION (G)	LARD		LOIS	
	HELMET: 55/P	HELMET: JSF	HELMET: 55/P	HELMET: JSF
6	3.58	2.41	2.87	2.43
8	5.46	3.71	4.06	3.20
10	7.29 ± 0.2	5.12 ± 0.13	5.09 ± 0.1	4.15 ± 0.11
12	8.74	6.24	5.94	5.04
15	10.3	7.40	7.48	6.29

Table 13. Heavy Helmet Assessment: Positive Head Ry Angular Accel. (Rad/S^2)

IMPACT ACCELERATION (G)	LARD		LOIS	
	HELMET: 55/P	HELMET: JSF	HELMET: 55/P	HELMET: JSF
6	92.2	101	94.0	79.4
8	202	156	181	115
10	279 ± 9.3	343 ± 53	190 ± 46	182 ± 10
12	425	334	193	261
15	546	579	366	380

Table 14. Heavy Helmet Assessment: Nij Compression/Flexion

IMPACT ACCELERATION (G)	LARD		LOIS	
	HELMET: 55/P	HELMET: JSF	HELMET: 55/P	HELMET: JSF
6	0.058	0.068	0.087	0.136
8	0.076	0.096	0.105	0.153
10	0.099 ± 0.009	0.133 ± 0.005	0.128 ± 0.003	0.191 ± 0.007
12	0.133	0.165	0.157	0.233
15	0.165	0.214	0.204	0.315

Table 15. Heavy Helmet Assessment: Nij Tension/Flexion

IMPACT ACCELERATION (G)	LARD		LOIS	
	HELMET: 55/P	HELMET: JSF	HELMET: 55/P	HELMET: JSF
6	0.000	0.007	0.000	0.000
8	0.042	0.000	0.000	0.000
10	0.055 ± 0.001	0.057 ± 0.015	0.084 ± 0.002	0.000
12	0.070	0.074	0.103	0.097
15	0.098	0.099	0.137	0.139

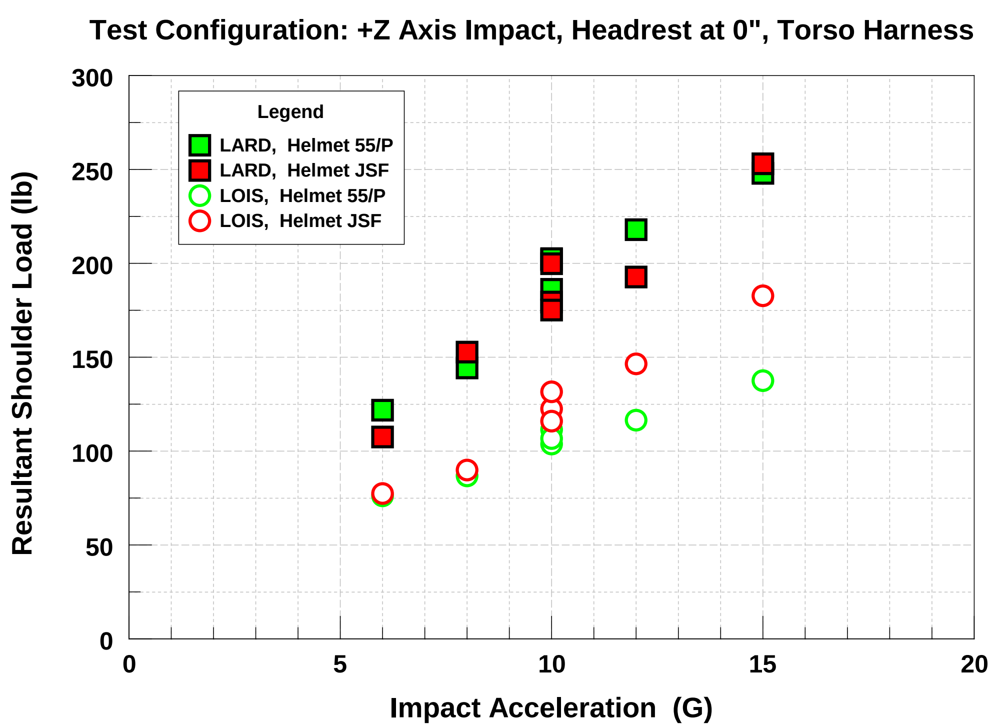


Figure 15. Resultant Shoulder Load as a Function of Impact Accel. and Helmet System

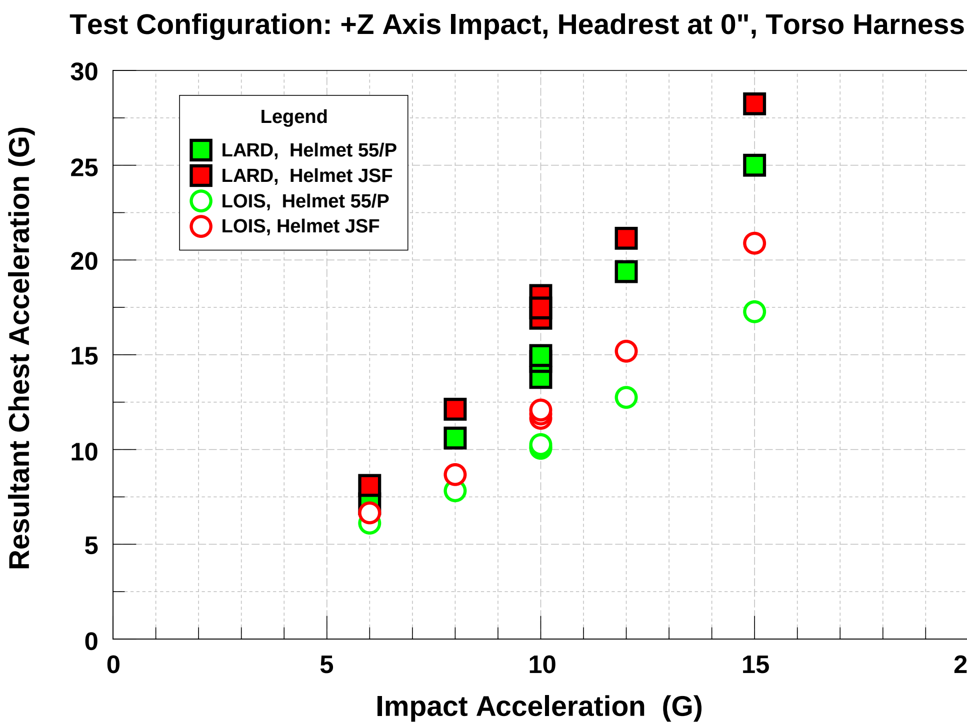


Figure 16. Resultant Chest Acceleration as a Function of Impact Accel. and Helmet System

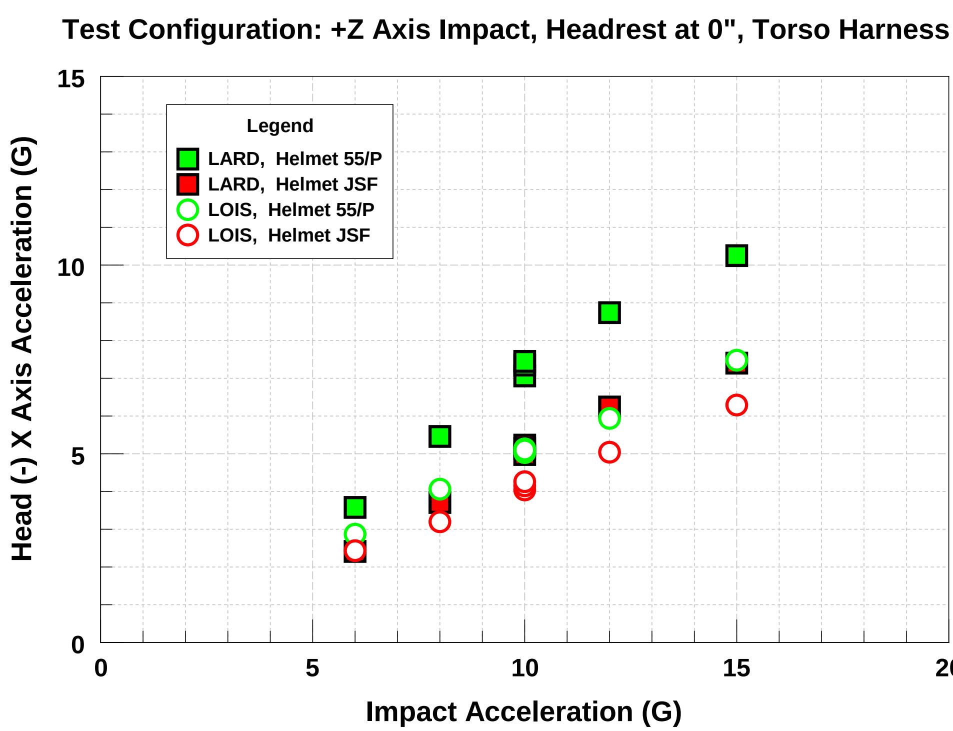


Figure 17. Head (-) X Acceleration as a Function of Impact Accel. and Helmet System

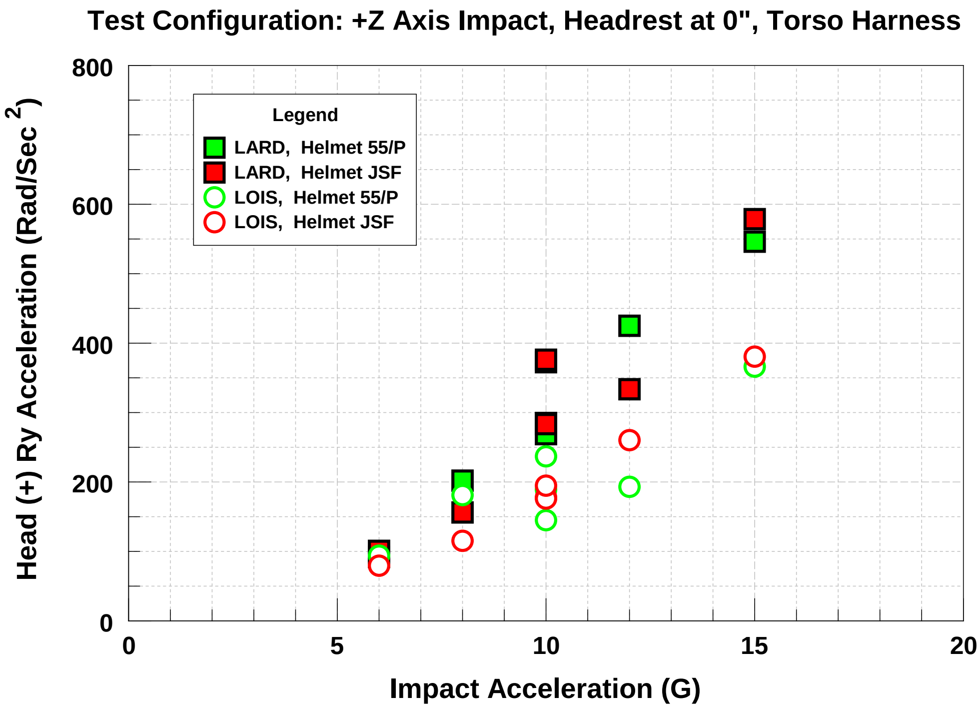


Figure 18. Head (+) Ry Acceleration as a Function of Impact Accel. and Helmet System

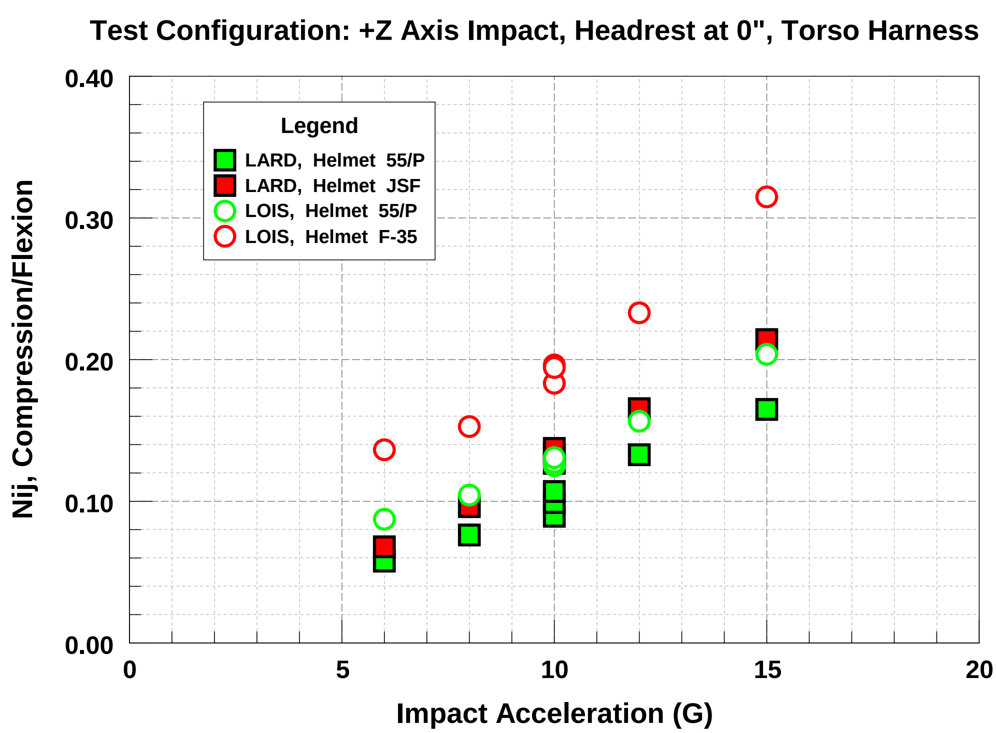


Figure 19. Nij Compression/Flexion as a Function of Impact Accel. and Helmet System

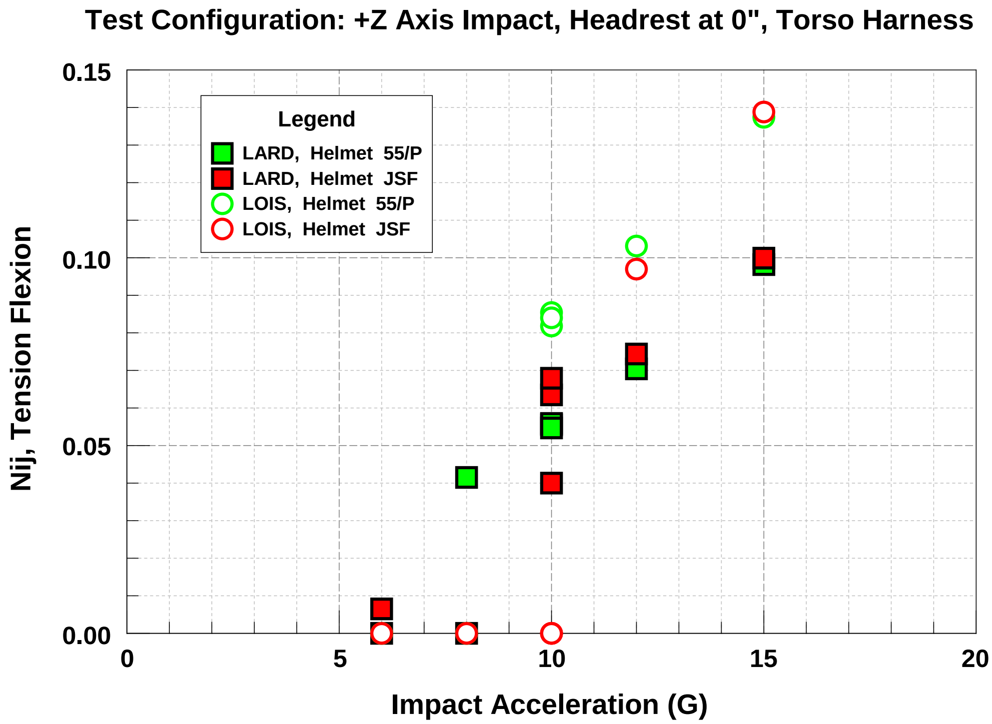


Figure 20. Nij Tension/Flexion as a Function of Impact Accel. and Helmet System

Testing was completed at all the impact accelerations levels (6, 8, 10, 12 and 15 G) for all VDT impact configurations defined in Table 1 for Cells A and C. The six analyzed data sets indicate a consistent trend for increased accelerations and forces as a function of impact acceleration for both the LOIS and LARD manikins, and in general follow a linear relationship which is consistent with previous research with both manikins.

The shoulder load and the head and chest acceleration data sets indicate a greater response for the heavier 5 lb helmet configuration with the forward cg shift when compared to the baseline helmet configuration. This was true for both the LOIS and LARD manikins with the LOIS manikin indicating a slightly greater relative response for the heavy helmet. However, both acceleration parameters displayed a smaller difference between the helmet configurations than what was shown with the headrest shift, and the head x acceleration actually displayed the opposite trend at some impact levels. The increase in response was upto 15% over the baseline value. The exception was the LOIS shoulder load and chest acceleration data which had an increase of between 20% and 50% over the baseline values, particularly at the 10 G impacts and greater. These data sets indicate that the heavy helmet configuration also increased forward motion of the torso (shoulder strap load and chest acceleration increase) and produced some forward motion of the head (head Ry).

The Nij was evaluated to provide an indication of the associated risk of neck injury to the occupant following ejection with a heavy helmet. The Nij data sets, both Tension/Flexion and Compression/Flexion, indicated a greater risk for the heavy helmet configuration during ejection, with the greatest risk shown by the Compression/Flexion values. The Nij values were all less than the AFRL Nij limit of 0.56 for AIS 2 injury. The LOIS with the heavy helmet generated the largest Nij value with a Compression/Flexion value of 0.32, and indicated the importance of the Nij Compression/Flexion values at the higher impact levels compared to the Nij Tension/Flexion values.

7.4 VDT Parametric Assessment: Restraint Harness

A comparative assessment of the data from Test Cell A and Test Cell D evaluated the effects of using a seat-mounted harness compared to the baseline torso-mounted harness configuration (Simplified Combined Harness vs PCU-15/P and -16/P respectively). Data tables and plots showing the response of the instrumented manikins as a function of impact level for specific measured variables were developed and assessed.

The shoulder strap loads, lumbar loads, lumbar My torque, head Ry angular acceleration, and calculated Nij neck tension/flexion and compression/flexion data, collected during impacts with the LOIS and LARD manikin, are presented in Tables 16 through 21 to evaluate the effect of the harness configuration. The lumbar load and lumbar My torque data were included in this assessment of the restraint harness configuration to determine any influence of upper torso restraint on spinal loading. The data is shown in the tables for each impact acceleration level. The data was also plotted as a function of increasing impact acceleration for each of the 6 assessed parameters, and are shown in Figures 21 through 26.

Table 16. Restraint Harness Assessment: Shoulder Strap Load (lb)

IMPACT ACCELERATION (G)	LARD		LOIS	
	Torso Harness	Seat Harness	Torso Harness	Seat Harness
6	122	96	76	71
8	144	157	87	89
10	197 ± 9.3	209 ± 17	107 ± 3.9	81.7 ± 3.8
12	218	247	116	91.3
15	248	412	138	111

Table 17. Restraint Harness Assessment: Lumbar Z-Axis Load (lb)

IMPACT ACCELERATION (G)	LARD		LOIS	
	Torso Harness	Seat Harness	Torso Harness	Seat Harness
6	535	476	253	251
8	736	686	341	334
10	860 ± 54.0	827 ± 4.8	453 ± 2.8	430 ± 16.1
12	1089	1013	575	564
15	1328	1424	772	727

Table 18. Restraint Harness Assessment: Lumbar (+) My Torque (in-lb)

IMPACT ACCELERATION (G)	LARD		LOIS	
	Torso Harness	Seat Harness	Torso Harness	Seat Harness
6	747	816	157	131
8	1131	1304	225	179
10	1667 ± 118	1730 ± 41	341 ± 19.9	312 ± 4.4
12	2240	2131	435	410
15	2786	2463	643	619

Table 19. Restraint Harness Assessment: Head (+) Ry Angular Acceleration (G)

IMPACT ACCELERATION (G)	LARD		LOIS	
	Torso Harness	Seat Harness	Torso Harness	Seat Harness
6	92.2	49	94	79
8	202	232	181	209
10	279 ± 9.3	328 ± 36	190 ± 46	179 ± 1.0
12	425	290	193	253
15	546	331	366	367

Table 20. Restraint Harness Assessment: Nij Compression/Flexion

IMPACT ACCELERATION (G)	LARD		LOIS	
	Torso Harness	Seat Harness	Torso Harness	Seat Harness
6	0.058	0.052	0.087	0.085
8	0.076	0.067	0.105	0.102
10	0.099 ± 0.009	0.074 ± 0.006	0.128 ± 0.003	0.121 ± 0.001
12	0.133	0.064	0.157	0.151
15	0.165	0.055	0.204	0.188

Table 21. Restraint Harness Assessment: Nij Tension/Flexion

IMPACT ACCELERATION (G)	LARD		LOIS	
	Torso Harness	Seat Harness	Torso Harness	Seat Harness
6	0.000	0.000	0.000	0.000
8	0.042	0.020	0.000	0.000
10	0.055 ± 0.001	0.035 ± 0.001	0.084 ± 0.002	0.022 ± 0.035
12	0.070	0.052	0.103	0.094
15	0.098	0.092	0.137	0.105

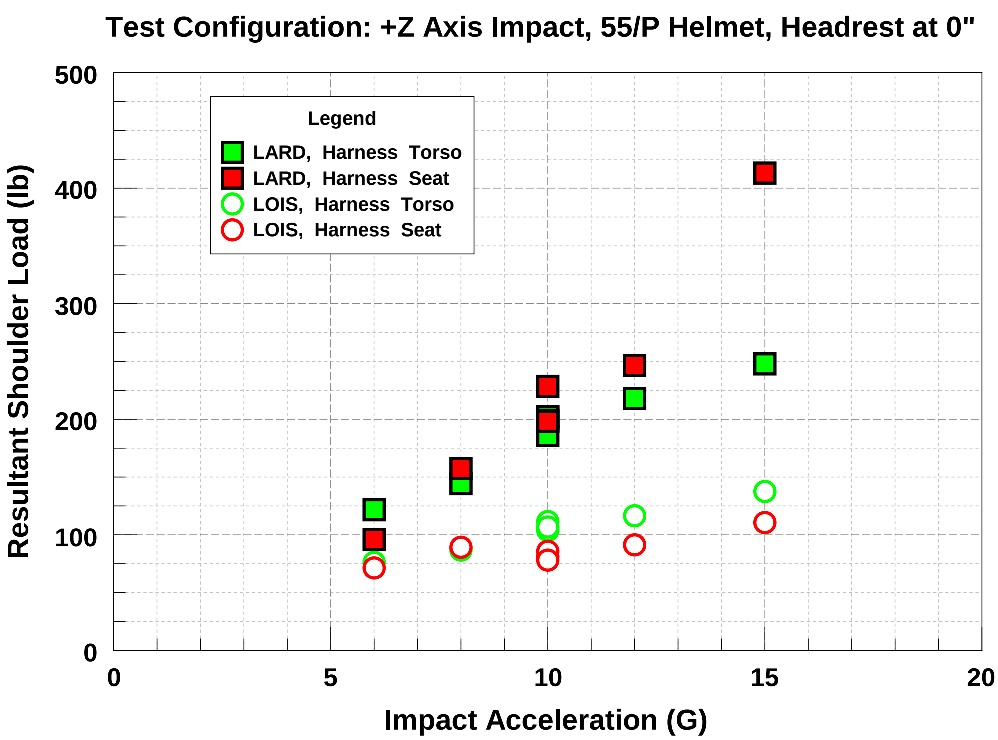


Figure 21. Resultant Shoulder Load as a Function of Impact Accel. and Restraint Harness

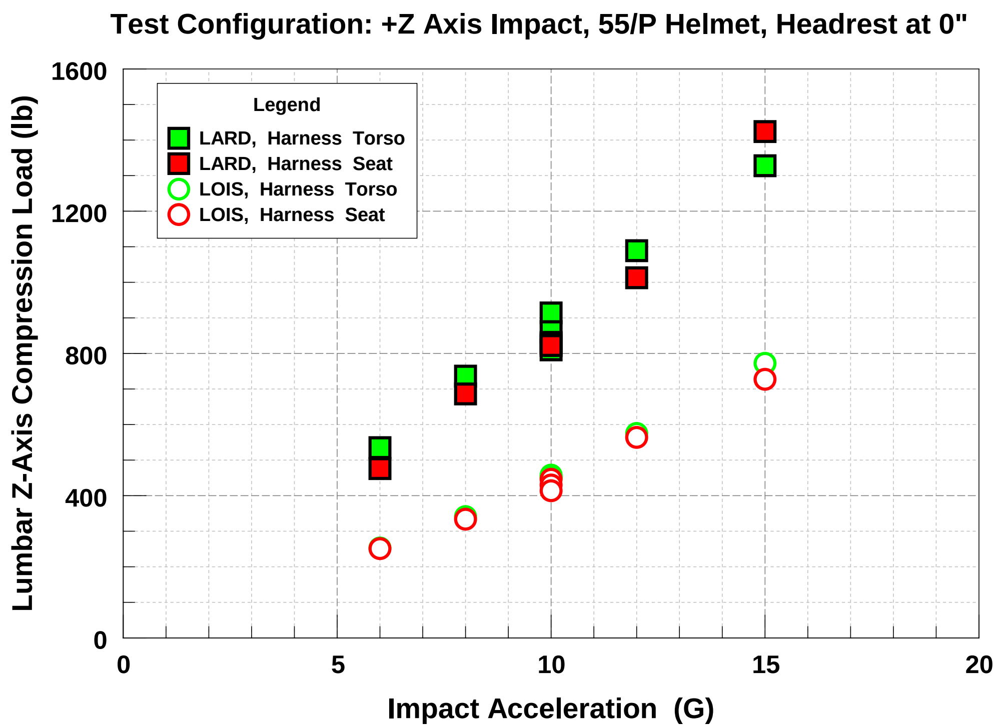


Figure 22. Lumbar Z Load as a Function of Impact Accel. and Restraint Harness

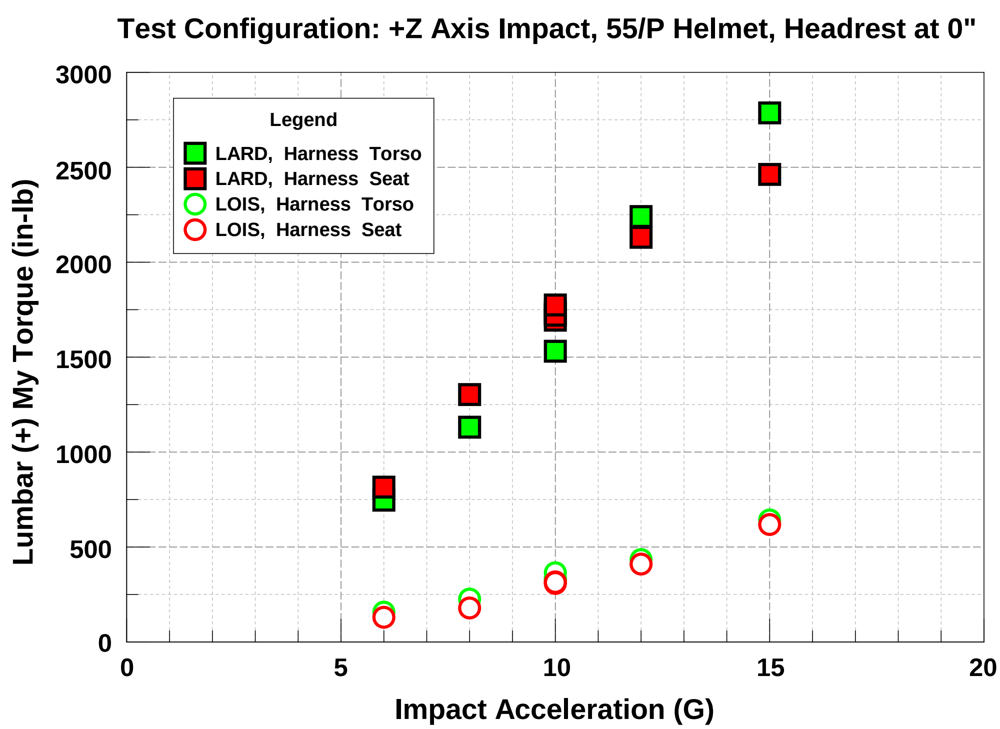


Figure 23. Lumbar My Torque as a Function of Impact Accel. and Restraint Harness

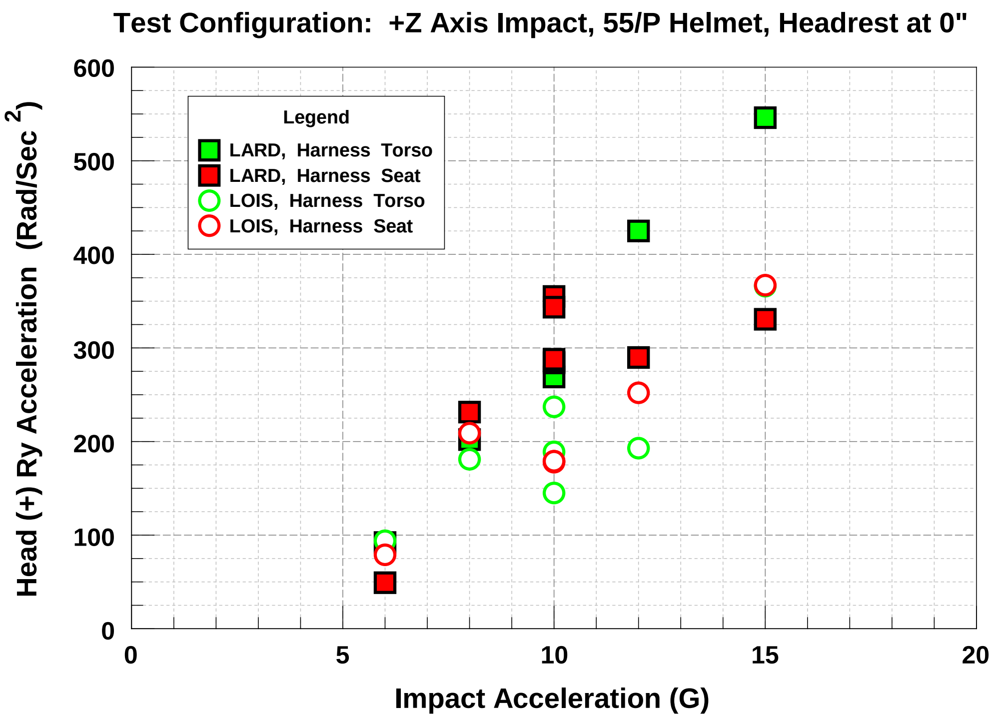


Figure 24. Head (+) Ry Acceleration as a Function of Impact Accel. and Restraint Harness

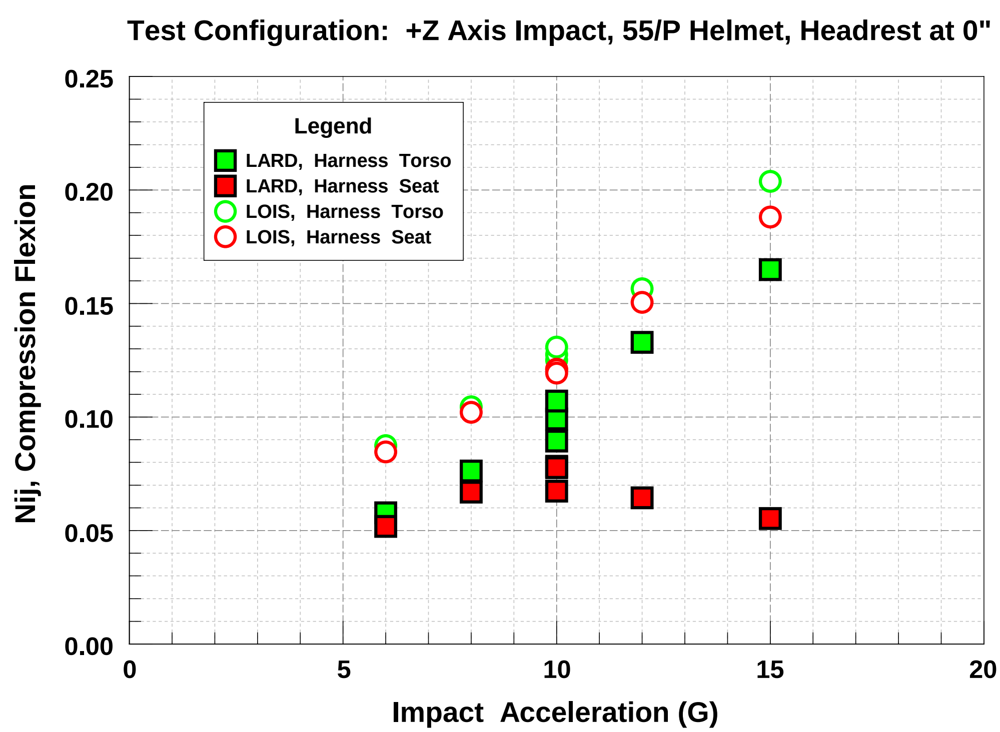


Figure 25. Nij Compression/Flexion as a Function of Impact Accel. and Restraint Harness

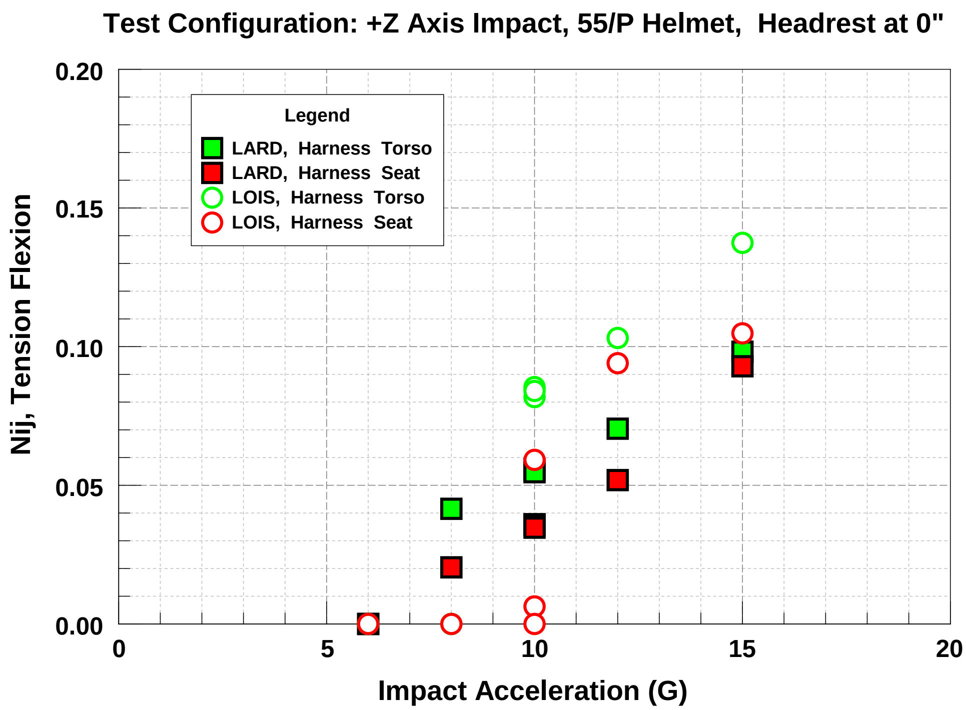


Figure 26. Nij Tension/Flexion as a Function of Impact Accel. and Restaint Harness

Testing was completed at all the impact accelerations (6, 8, 10, 12 and 15 G) for all the VDT impact configurations defined in Table 1 for Cells A and D. The six analyzed data sets indicate the consistent trend for increasing accelerations and forces as a function of impact acceleration for both the LOIS and LARD manikins, and in general follow a linear relationship which is consistent with the previous research with both manikins.

The shoulder load, lumbar load, lumbar My torque, and head Ry acceleration data sets indicated similar responses between the torso and the seat-mounted restraint harnesses. This was true for both the LOIS and LARD manikins. The exceptions were the LARD shoulder load with the seat harness at 15 G, and the head Ry data with some divergence past the 10 G input indicating greater responses with the torso harness on the LARD manikin. This was in contrast to what was shown with the headrest shift and the heavy helmet configuration. The LARD shoulder load with the seat harness exceeded the load with the torso harness by over 150 lb (approximately 60% increase), and the increase in head Ry acceleration response for LARD with the torso harness was approximately 50% over the response with the seat-mounted harness. These data sets appear to indicate that the torso and seat-mounted harness displayed similar control of the forward motion of the torso with the noted exceptions.

The lumbar load data was evaluated to provide an indication of the associated risk of lumbar spine injury to the occupant folloiwng ejection in the JSF ejection seat configuration as compared to the baseline ejection seat configuration. The lumbar load data was compared to the

AFRL load limits to determne if they exceeded the acceptable risk, and and was found that neither the LOIS or the LARD data exceeded their respective 933 lb and 1754 lb limits. The LARD generated a maximum lumbar load of 1424 lb at 15 G in the JSF seat configuration, which was within 20% of the limit. The LOIS generated lumbar loads of approximately 750 lb in the JSF and baseline seat configuraiton, which was within 25% of the limit.

The Nij was evaluated to provide an indication of the associated risk of neck injury to the occupant following ejection with the seat-mounted harness as compared to the baseline torso harness. The Nij data sets, both Tension/Flexion and Compression/Flexion, indicated a slightly greater risk of neck injury for the torso harness configuration during ejection, with the greatest risk shown by the Compression/Flexion values. The Nij values were all less than the AFRL Nij limit of 0.56 for AIS 2 injury. The LOIS with the torso harness generated the largest Nij value with a Compression/Flexion value of 0.21, and indicated the importance of the Nij Compression/Flexion values at the higher impact levels compared to the Nij Tension/Flexion values.

7.5 VDT Parametric Assessment: Simulated Seat Configuration

A comparative assessment of the data from Test Cell A and Test Cell E was conducted to evaluate the effects of the proposed JSF-style ejection seat configuration compared to the baseline USAF ejection seat configuration. The baseline seat configuration was defined as inline headrest (0”), HGU-55/P helmet, and torso harness. The JSF-style seat configuration was defined as forward headrest (2.5”), JSF Gen II mock-up helmet, and SCH harness (seat-mounted). Data tables and plots showing the response of the instrumented manikins as a function of impact level for specific measured variables were developed and assessed.

The shoulder strap loads, lumbar loads, lumbar My torque, head Ry angular acceleration, and calculated Nij neck tension/flexion and compression/flexion data, collected during impacts with the LOIS and LARD manikin, are presented in Tables 22 through 27 to evaluate the effect of the harness configuration. The lumbar load and lumbar My torque data were included in this assessment of the restraint harness configuration to determine any influence of upper torso restraint on spinal loading. The data is shown in the tables as a function of progressively increasing impact accelerations. The data was also plotted as a function of increasing impact acceleration for each of the 6 assessed parameters, and are shown in Figures 27 through 32. Note that no data was collected for the LARD manikin during the 6 G impact tests in the JSF seat configuration.

Table 22. Simulated Seat Configuration: Shoulder Strap Load (lb)

IMPACT ACCELERATION (G)	LARD		LOIS	
	Baseline	JSF	Baseline	JSF
6	122	N/A	76	59.9
8	144	253	87	75.1
10	197 ± 9.3	336 ± 16.7	107 ± 3.9	93.6 ± 7.9
12	218	423	116	112
15	248	571	138	133

Table 23. Simulated Seat Configuration: Lumbar Z-Axis Compression Load (lb)

IMPACT ACCELERATION (G)	LARD		LOIS	
	Baseline	JSF	Baseline	JSF
6	535	N/A	253	280
8	736	734	341	365
10	860 ± 54.0	922 ± 7.7	453 ± 2.8	448 ± 14.5
12	1089	1175	575	566
15	1328	1480	772	738

Table 24. Simulated Seat Configuration: Lumbar (+) My Torque (in-lb)

IMPACT ACCELERATION (G)	LARD		LOIS	
	Baseline	JSF	Baseline	JSF
6	747	N/A	157	241
8	1131	1430	225	339
10	1667 ± 118	1779 ± 12.6	341 ± 19.9	399 ± 52.8
12	2240	2112	435	453
15	2786	2457	643	616

Table 25. Simulated Seat Configuration: Head (+) Ry Angular Acceleration (G)

IMPACT ACCELERATION (G)	LARD		LOIS	
	Baseline	JSF	Baseline	JSF
6	92.2	N/A	94	71
8	202	244	181	109
10	279 ± 9.3	398 ± 30.7	190 ± 46	175 ± 43
12	425	495	193	217
15	546	614	366	323

Table 26. Simulated Seat Configuration: Nij Compression/Flexion

IMPACT ACCELERATION (G)	LARD		LOIS	
	Baseline	JSF	Baseline	JSF
6	0.058	N/A	0.087	0.134
8	0.076	0.094	0.105	0.165
10	0.099 ± 0.009	0.117 ± 0.002	0.128 ± 0.003	0.185 ± 0.005
12	0.133	0.156	0.157	0.217
15	0.165	0.191	0.204	0.268

Table 27. Simulated Seat Configuration: Nij Tension/Flexion

IMPACT ACCELERATION (G)	LARD		LOIS	
	Baseline	JSF	Baseline	JSF
6	0.000	N/A	0.000	0.009
8	0.042	0.055	0.000	0.017
10	0.055 ± 0.001	0.074 ± 0.003	0.084 ± 0.002	0.081 ± 0.006
12	0.070	0.088	0.103	0.106
15	0.098	0.117	0.137	0.148

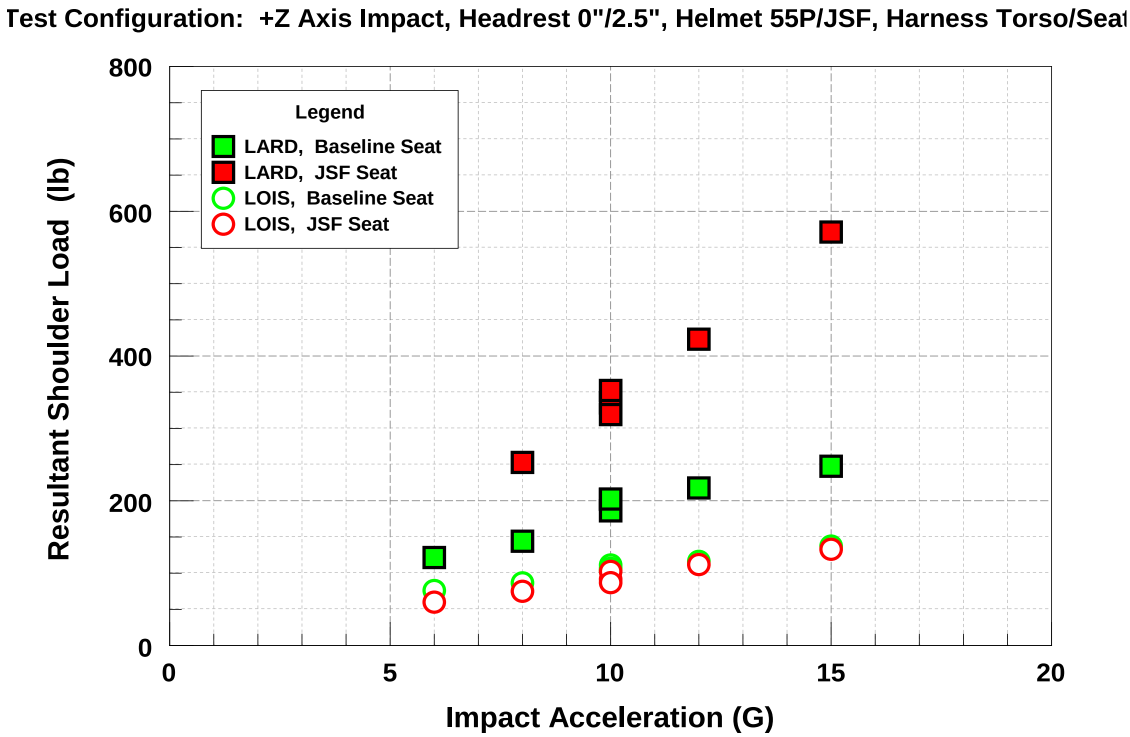


Figure 27. Shoulder Load as a Function of Impact Accel. and Seat Configuration

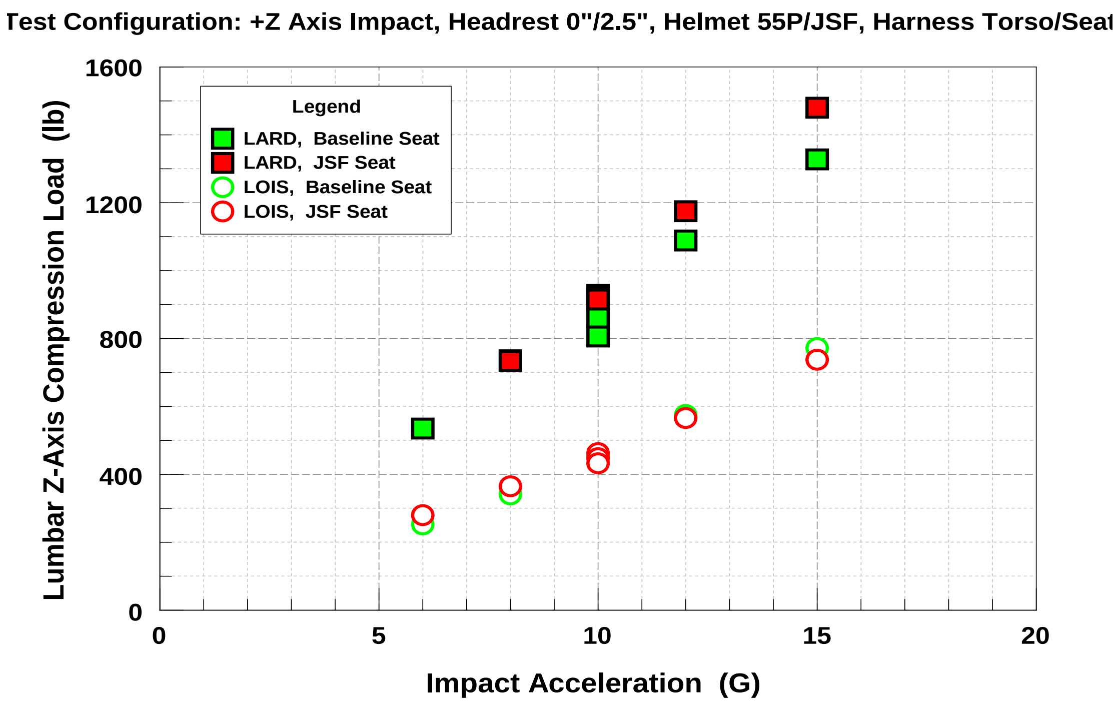


Figure 28. Lumbar Z-Axis Load as Function of Impact Accel. and Seat Configuration

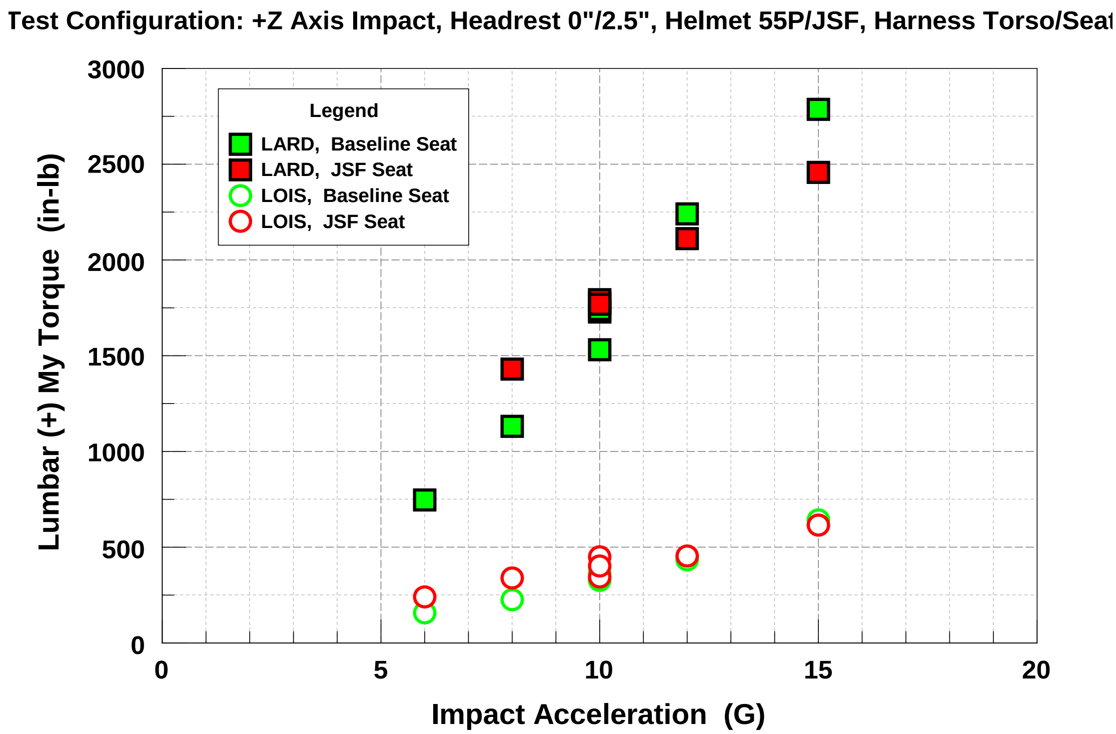


Figure 29. Lumbar (+) My Torque as Function of Impact Accel. and Seat Configuration

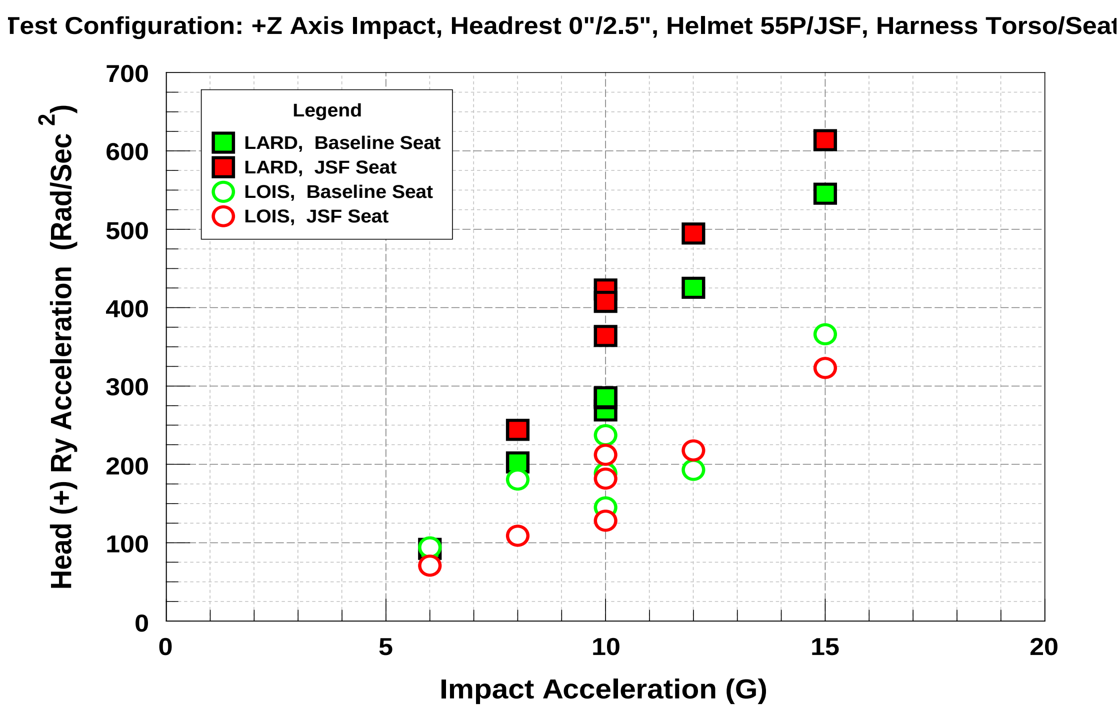


Figure 30. Head (+) Ry Acceleration as a Function of Impact Accel. and Seat Configuration

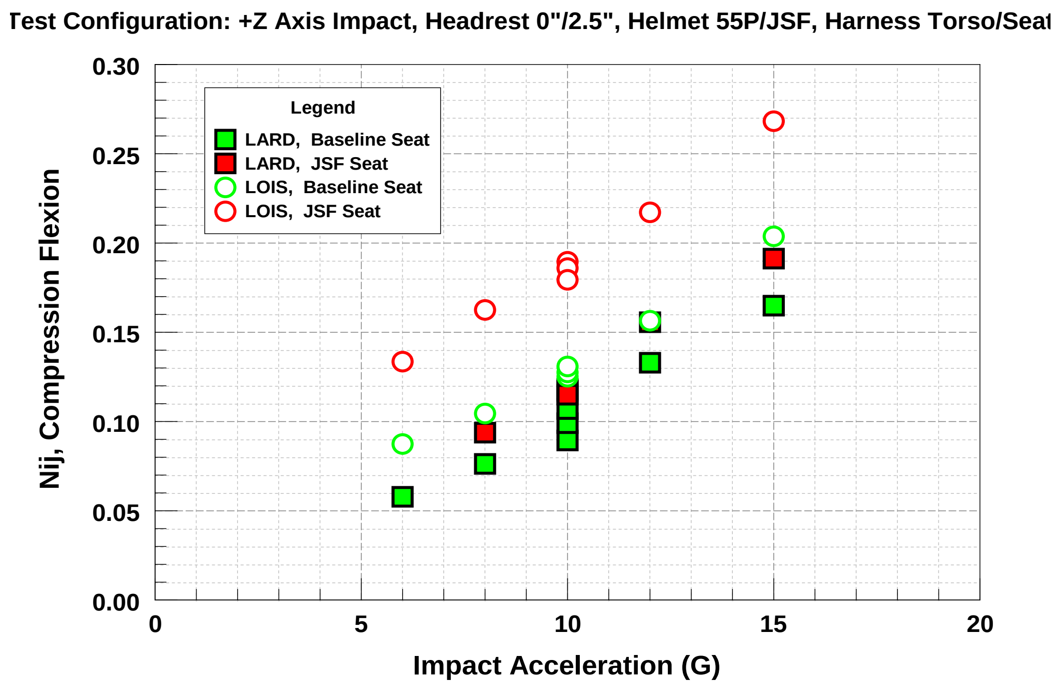


Figure 31. Nij Compression/Flexion as a Function of Impact Accel. and Seat Configuration

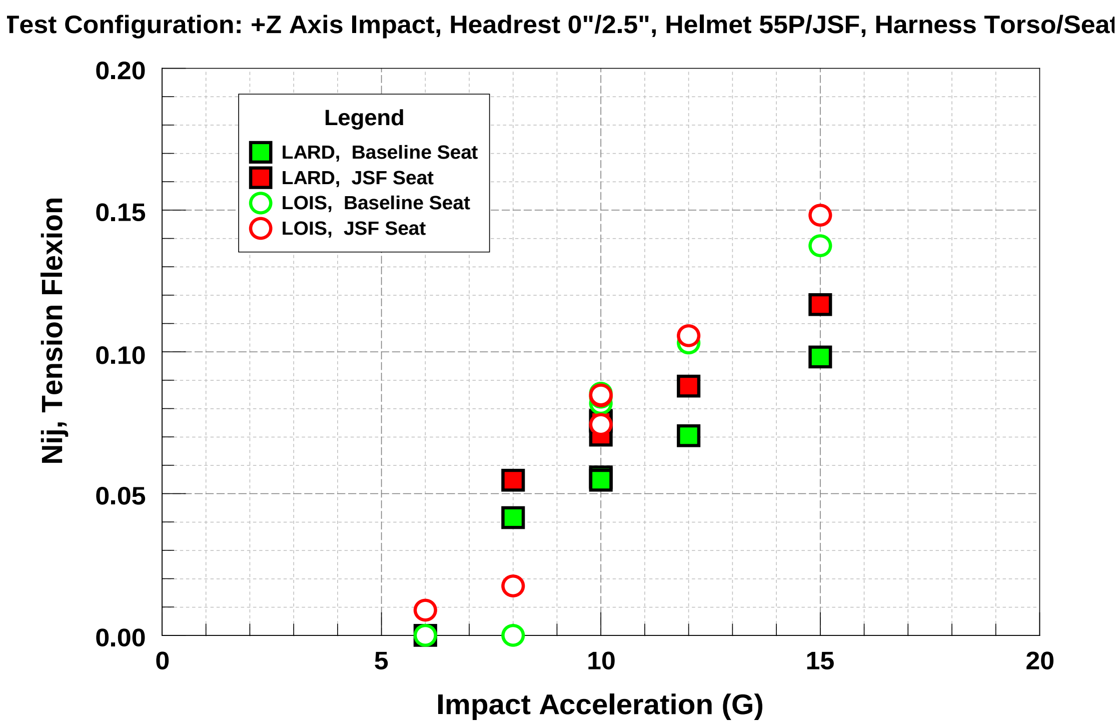


Figure 32. Nij Tension/Flexion as a Function of Impact Accel. and Seat Configuration

Testing was completed at all the impact accelerations (6, 8, 10, 12 and 15 G) for all the VDT impact configurations defined in Table 1 for Cells A and E; however, there was a problem with the LARD data for Cell E at 6 G; therefore, it was not included in the analysis. The six data sets indicate the consistent trend of increasing accelerations and forces as a function of impact acceleration for both the LOIS and LARD manikins, and in general follow a linear relationship which is consistent with the previous research with both manikins.

The shoulder load, lumbar load, lumbar My torque, and head Ry angular acceleration data sets indicated similar responses between the baseline and JSF seat configurations for the LOIS manikin. However, the same measured data sets indicated the LARD manikin had a greater response for the JSF seat configuration versus the baseline configuration. This was particularly true for both the shoulder loads and the head Ry accelerations. This indicates that the combination of the individual test parameters (headrest shift, heavy helmet, and harness) generated a greater response for the LARD compared to the respective baseline, versus what was previously observed for the test parameters seperately. These greater responses for the LARD were most apparent at impact levels of 10 G and greater. These data sets indicated that the baseline ejection seat configuration controlled forward motion of the torso better than the JSF ejection seat configuration for the LARD manikin, but the seat configuration had less of an effect on the measured response of the LOIS manikin.

The lumbar load data was evaluated to provide an indication of the associated risk of lumbar spine injury to the occupant folloiwng ejection in the JSF ejection seat configuration as compared to the baseline ejection seat configuration. The lumbar load data were compared to the AFRL load limits to determne if they exceeded the acceptable risk, and neither the LOIS or the LARD data exceeded their respective 933 lb and 1754 lb limits. The LARD generated a maximum lumbar load of 1480 lb at 15 G in the JSF seat configuration, which was within 16% of the limit. The LOIS generated lumbar loads of approximately 750 lb in the JSF and baseline seat configuration, which was within 25% of the limit.

The Nij was evaluated to provide an indication of the associated risk of neck injury to the occupant during ejection in the JSF ejection seat configuration as compared to the baseline ejection seat configuration. The Nij data sets, both Tension/Flexion and Compression/Flexion, indicated a greater risk for the JSF seat configuration during ejection, with the greatest relative risk shown by the Compression/Flexion values when compared to the baseline seat configuration. This risk was shown for both the LOIS and the LARD manikins, and the LOIS Nij data demonstrated the greatest relative difference between seat configurations. The Nij values were all less than the AFRL Nij limit of 0.56 for AIS 2 injury. The LOIS in the JSF seat configuration generated the largest Nij value with a Compression/Flexion value of 0.27, and indicated the importance of the Nij Compression/Flexion values at the higher impact levels compared to the Nij Tension/Flexion values.

8.0 SUMMARY AND CONCLUSIONS

Research was conducted involving a series of +z-axis impact tests conducted on the Vertical Deceleration Tower (VDT). The purpose of the research was to conduct a comparative assessment of seat and torso mounted restraint systems during the simulated catapult phase of ejection. The comparative assessment evolved into a parametric analysis that also included peak vertical impact acceleration, seat headrest position relative to seatback tangent plane, and head supported mass (helmet system). A Lightest Occupant in Service (LOIS) and a Large Anthropometric Research Device (LARD) instrumented manikins were used in this test program to simulate human response. This research effort was the first of a two phase effort where the second phase will conduct the same parametric analysis but in a horizontal impact environment.

The experimental design consisted of a specially designed test matrix developed to address the program requirement to conduct a parametric assessment of manikin response during a vertical impact simulating the catapult phase of ejection. The main parameters of interest were the restraint system, the head rest position, and the worn helmet system. The restraint system was either the baseline torso-mounted restraint harness or the seat-mounted restraint harness (Simplified Combined Harness (SCH)). The headrest position was either the baseline 0” position (headrest in-line with the seat back) or the headrest 2.5” forward of the seat back. The helmet system was either the baseline HGU-55/P helmet system (≈ 3 lb) or the JSF Gen II mock-up helmet system (≈ 5 lb) with the helmet systems including the mask. The VDT provided the vertical impacts that varied from 6 to 15 G peak acceleration. The analysis consisted of a comparative assessment of each parameter versus a baseline configuration, with a final analysis combining all the baseline and non-baseline parameters into resulting simulated ejection seat configurations. Analysis consisted of using both measured data from each manikin (loads and accelerations), and calculated data from each manikin (Nij), to determine data trends for specific data sets, and comparing injury risks using lumbar and neck load data.

Data from the first comparative assessment, the variable headrest position with the baseline headrest in-line with the seat back at 0” or the headrest 2.5” forward of the seat back, indicated the forward headrest position tended to cause the biodynamic response of the torso and the head to be greater than the baseline 0” configuration. Similar results were found by Perry (2001) and Brinkley et al (1982). All electronic data for both manikins followed the trend of linerly increasing accelerations and forces as a function of increasing impact level up to the maximum of 15 G. Review of high speed video indicated that the forward headrest position caused a greater forward motion of the shoulders during impact than the baseline configuration which in-turn caused greater motion of the head. This was true for both the LOIS and LARD manikins with the LOIS manikin indicating a greater relative response for variation of the headrest position. In addition, the LOIS head angular acceleration data had an increase of 30 to 40% over the baseline values, particularly at the 10 G impact level and greater. However, these increases did not generate any Nij neck injury risk values that exceed the AFRL limit value of 0.56, but they did indicate a greater risk for the forward headrest position compared to the baseline headrest position.

Data from the second comparative assessment, the variable helmet system with the baseline HGU-55/P helmet system (≈ 3 lb) or the JSF Gen II mock-up helmet system (≈ 5 lb), indicated the heavier helmet tended to cause greater biodynamic response of the torso and the head compared to the baseline helmet. Similar results were also documented by Perry (2001, 1999, 1993), Perry et al (1997), and Buhrman et al (1994). All evaluated electronic data for both manikins followed the trend to increase linerly as a function of increasing impact level up to the maximum of 15 G. Review of high speed video indicated that the heavy helmet, which also had a forward center-of-gravity shift, caused greater forward and rotational motion of the head during impact than the baseline helmet configuration. The heavier helmet system produced greater shoulder loads, and greater head and chest accerations for both the LOIS and LARD manikins. The LOIS manikin data indicated greater relative responses for the heavy helmet as shown by the shoulder load and chest acceleration data. However, as with the headrest position variation, these increases for both manikins did not generate any Nij neck injury risk values that exceeded the AFRL limit, but they did indicate a greater risk for the heavier helmet compared to the lighter baseline helmet. The LOIS manikin with the heavy helmet generated the largest Nij value with a Compression/Flexion value of 0.32 at 15 G.

Data from the third comparative assessment, the variable restraint system with the baseline torso-mounted restraint harness or the seat-mounted restraint harness (also refered to as the Simplified Combined Harness (SCH)), indicated that in general the SCH restrained the manikins slighly better during vertical impact, particularly the LOIS manikin. The head Ry acceleration response for LARD was more conclusive with the torso harness response approximately 50% over the response with the seat-mounted harness. Risk to the occupant was assessed by analyzing the lumbar load data and neither the LOIS or the LARD data exceeded their AFRL injury limits of 933 lb and 1754 lb respectively. In addition, the maximum loads developed at the 15 G impact level were only within 20 to 25% of these limits. The manikin's Nij data sets, both Tension/Flexion and Compression/Flexion, indicated a slightly greater risk for the torso harness configuration during ejection. The greatest risk was shown by the Compression/Flexion values which was also demonstrated in the previous comparative assessments, however, all the Nij values were less than the AFRL Nij limit.

Data from the fourth and final comparative assessment evaluated the combination of previous baseline and non-baseline parameters into resulting baseline ejection seat and JSF-style ejection seat configurations. The data indicated that the LOIS manikin response was not affected by the seat configuration, but the LARD manikin response was generally greater for the JSF-style ejection seat configuration versus the baseline seat. This indicates that the combination of the individual test parameters (headrest shift, heavy helmet, and harness) generated a greater response for the LARD compared to the respective baseline, versus what was previously observed for the test parameters seperately. Risk to the occupant was assessed by analyzing the lumbar load data and as demonstrated previously, neither the LOIS or the LARD data exceeded their AFRL injury limits of 933 lb and 1754 lb respectively. However, the data was closer to the injury limits (within 16%) with the LARD lumbar load at 15 G. The Nij data sets, both Tension/Flexion and Compression/Flexion, indicated a greater risk for the JSF-style seat configuration during ejection, with the greatest relative risk shown by the Compression/Flexion values. This risk was shown for both the LOIS and the LARD manikins with the LOIS Nij data demonstrating the greatest relative difference. As with previous comparative assessments, the largest relative differences between baseline and non-baseline Nij values were shown with the Compression/Flexion values indicating their importance at the higher impact levels compared to the Nij Tension/Flexion values.

Overall, the series of comparative assessments indicated that a forward headrest of 2.5" relative to the seat back and a heavy helmet system of 5 lb with a forward cg shift generate greater biodynamic responses during the catapult phase of ejection for both the LOIS and the LARD manikin . The comparative assessment with the seat harness or SCH indicated that it provided equivalent control of head and torso motion for each manikin relative to the torso harness except for allowing larger shoulder loads for LARD at the 15 G impact level. Risk of neck injury as determined by the Nij for those comparative assessments were below established AFRL risk of injury value. The Nij compression/flexion values were the most critical in all cases. Combining the baseline paramters and the non-baseline parameters into a baseline seat configuration and a JSF-style seat configuration produced similar biodynamic responses for the LOIS and the LARD, but the JSF-style seat configuration generated a greater risk of neck injury to the occupant at all impact levels. Maximum lumbar loads generated by LARD at 15 G for the harness configuration comparison were greater for the seat harness, and maximum lumbar loads generated by LARD for the seat configuration comparison were greater for the JSF-style seat configuration. However, the LARD lumbar loads in each case were still below the the accepted AFRL lumbar load limits. All the data sets collected for this effort will be used to complement a future human impact study with similar comparative assessments by allowing for prediction of human biodynamic responses at acceleration levels beyond what is allowed for human test subjects.

BIBLIOGRAPHY

Brinkley, J.W., B.F. Hearon, J.H. Raddin, L.A. McGowan, and J.M. Powers, (1982). Vertical Impact Tests of a Modified F/FB-111 Crew Seat to Evaluate Headrest Position and Restraint Configuration Effects (Technical Report AFAMRL-TR-82-51). Wright-Patterson AFB OH: Air Force Aerospace Medical Research Laboratory.

Brinkley J.W. and Shaffer J.T., (1971). Dynamic Simulation Techniques for the Design and Escape Systems: Current Applications and Future Air Force Requirements. AFAMRL-TR-71-29, 1971.

Buhrman J.R., Perry C.E., and Wright N.L., (2012). Ejection Back Injury Risk Factors for an Expanded Aircrew Population, 50th Annual SAFE Symposium, Reno, Oct 2012.

Buhrman, J.R., C.E. Perry, and F.S. Knox III (1994). Human and Manikin Head/Neck Response to +Gz Acceleration When Encumbered by Helmets of Various Weights. Aviation, Space, and Environmental Medicine, 65, 1086-1090.

Lewis M., (2006). Survivability and Injuries from Use of Rocket-Assisted Ejection Seats: Analysis of 232 Cases. Aviation, Space, and Environmental Medicine, 77(9), Sep 2006.

Parr, J.C. (2014). A Method to Develop Neck Injury Criteria to Aid Design and Test of Escape Systems Incorporating Helmet Mounted Displays. Dissertation to Air Force Institue of Technology, AFIT/DS/ENV/14-01, September 2014.

Parr, J.C., Miller, M.E., Pellettiere, J.A., and Erich, R.A. (2013). Neck Injury Criteria Formulation and Injury Risk Curves for the Ejection Environment: A Pilot Study. Aviation, Space, and Environmental Medicine, 84(12), Dec 2013.

Perry, C.E. (2001). Effects of Headrest Position and Helmet Weight on Human Dynamic Response During +Gz Impact Acceleration. Proceedings of the 2001 SAFE Symposium, September 2001.

Perry, C.E. (1999). Evaluation of the Effects of the Panoramic Night Vision Goggle on Dynamic Response During Vertical Impact. SAFE Journal, 29(2), 85-92.

Perry, C.E., J.R. Buhrman, and F.S. Knox III (1997). The Effect of Head Mounted Mass on Males and Females Under +Gz Impact Acceleration. Aviation, Space, and Environmental Medicine (ASEMCG 68 {5}:216), Presentation at Annual ASMA Meeting, May 1997.

Perry, Chris E. (1993). Evaluation of the Effects of Visually Coupled Systems on the Biodynamic Response to Simulated Ejection Accelerations. USAF Technical Report: AL/CF TR 1993 0159. Wright-Patterson AFB OH: Armstrong Laboratory.

Tulloch J., (2011). Ejection Seat Back Injuries During Catapult Phase. 49th Annual SAFE Symposium, Reno, Oct 2011.

APPENDIX A. ELECTRONIC DATA CHANNEL DESCRIPTIONS

PROGRAM: Comparative Assessment of Torso and Seat Mounted Restraint Systems using Vertical and Horizontal Impact Tests with Instrumented Manikins

TEST DATES: 24 JULY 2014 - 31 JULY 2014; 1 AUG 2014 - 6 AUG 2014

STUDY NUMBER: 201404

TEST NUMBERS: 6419 - 6468; 6469 - 6495

FACILITY: VERTICLE DROP TOWER

SAMPLE RATE: 1K

DATA COLLECTION SYSTEM: TDAS PRO

FILTER FREQUENCY: 120Hz

TRANSDUCER RANGE (VOLTS): +/- 5 V

DATA CHANNEL	DATA POINT	TRANSDUCER MFG. & MODEL	SERIAL NUMBER	PRE-CAL DATE	PRE-CAL SENS	POST-CAL DATE	POST-CAL SENS	% Δ	DAS SENSITIVITY	BRIDGE	FULL SCALE	NOTES
1	CARRIAGE X ACCEL (G)	ENTRAN EGE-72-200	93C93 C19-R02	25-Nov-13	2.2333 mv/v/g at 10V exc	26-Sep-14	2.2992 mv/g at 10V exc	2.9	.22333 mv/v/g	FULL	20 G	Used on all tests.
2	CARRIAGE Y ACCEL (G)	ENTRAN EGE-72-200	93C93 C19-R07	25-Nov-13	2.4095 mv/g at 10V exc	15-Aug-14	2.4485 mv/g at 10V exc	1.6	.24095 mv/v/g	FULL	20 G	Used on tests 6428 thru 6429. Changed to Carriage Z on test 6430.
2	CARRIAGE Y ACCEL (G)	ENDEVCO 7264-200	CC86H	14-Nov-13	2.8133 mv/g at 10V exc	26-Sep-14	2.8421 mv/g at 10V exc	1.0	.28133 mv/v/g	FULL	50 G	Used on tests 6430-6495
3	CARRIAGE Z ACCEL (G)	ENDEVCO 7264-200	CC99H	14-Nov-13	3.0231 mv/g at 10V exc	15-Aug-14	3.0189 mv/g at 10V exc	-0.4	.30231 mv/v/g	FULL	50 G	Used on tests 6419 thru 6427. Replaced on test 6427
3	CARRIAGE Z ACCEL (G)	ENDEVCO 7264-200	CC86H	14-Nov-13	2.8133 mv/g at 10V exc	26-Sep-14	2.8421 mv/g at 10V exc	1.0	.28133 mv/v/g	FULL	50 G	Used on tests 6428 thru 6429. Changed to Carriage Y on test 6430
3	CARRIAGE Z ACCEL (G)	ENTRAN EGE-72-200	93C93 C19-R07	25-Nov-13	2.4095 mv/g at 10V exc	15-Aug-14	2.4485 mv/g at 10V exc	1.6	.24095 mv/v/g	FULL	20 G	Used on tests 6430-6495
4	SEAT PAN X ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT06 (Z)	13-Sep-13	.8597 mv/g at 10V exc	8-Oct-14	.9081 mv/g at 10V exc	0.7	.08597 mv/v/g	FULL	100 G	Used on all tests.
5	SEAT PAN Y ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT06 (Y)	13-Sep-13	.9052 mv/g at 10V exc	8-Oct-14	.9169 mv/g at 10V exc	1.2	.09052 mv/v/g	FULL	100 G	Used on all tests.
6	SEAT PAN Z ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT06 (X)	13-Sep-13	.9016 mv/g at 10V exc	8-Oct-14	.8645 mv/g at 10V exc	0.6	.09016 mv/v/g	FULL	100 G	Used on all tests.
7	LEFT LAP X FORCE (LB)	MICH SCI 3000	112 (Y)	13-Feb-14	13.00 uv/lb at 10V exc	5-Nov-14	12.71 uv/lb at 10V exc	-2.2	.001300 mv/v/lb	FULL	1500 LB	Used on all tests.
8	LEFT LAP Y FORCE (LB)	MICH SCI 3000	112 (X)	13-Feb-14	12.99 uv/lb at 10V exc	5-Nov-14	13.26 uv/lb at 10V exc	2.1	.001299 mv/v/lb	FULL	1500 LB	Used on all tests.
9	LEFT LAP Z FORCE (LB)	MICH SCI 3000	112 (Z)	13-Feb-14	11.50 uv/lb at 10V exc	5-Nov-14	11.25 uv/lb at 10V exc	-2.2	.001150 mv/v/lb	FULL	1500 LB	Used on all tests.
10	RIGHT LAP X FORCE (LB)	MICH SCI 3000	111 (X)	13-Feb-14	13.20 uv/lb at 10V exc	5-Nov-14	12.96 uv/lb at 10V exc	-1.8	.001320 mv/v/lb	FULL	1500 LB	Used on all tests.
11	RIGHT LAP Y FORCE (LB)	MICH SCI 3000	111 (Y)	13-Feb-14	12.96 uv/lb at 10V exc	5-Nov-14	13.30 uv/lb at 10V exc	2.6	.001296 mv/v/lb	FULL	1500 LB	Used on all tests.
12	RIGHT LAP Z FORCE (LB)	MICH SCI 3000	111 (Z)	13-Feb-14	10.83 uv/lb at 10V exc	5-Nov-14	11.06 uv/lb at 10V exc	2.1	.001083 mv/v/lb	FULL	1500 LB	Used on all tests.
13	LEFT SHOULDER X FORCE (LB)	MICH SCI 4000	369 (Z)	13-Feb-14	10.89 uv/lb at 10V exc	5-Nov-14	10.58 uv/lb at 10V exc	-2.8	.001089 mv/v/lb	FULL	1500 LB	Used on all tests.
14	LEFT SHOULDER Y FORCE (LB)	MICH SCI 4000	369 (Y)	13-Feb-14	12.75 uv/lb at 10V exc	5-Nov-14	13.06 uv/lb at 10V exc	2.4	.001275 mv/v/lb	FULL	1500 LB	Used on all tests.

7 NOV 2014

15	LEFT SHOULDER Z FORCE (LB)	MICH SCI 4000	369 (X)	13-Feb-14	12.71 uv/lb at 10V exc	5-Nov-14	12.38 uv/lb at 10V exc	-2.6	.001271 mv/v/lb	FULL	1500 LB	Used on all tests.
16	RIGHT SHOULDER X FORCE (LB)	MICH SCI 3000	110 (Z)	13-Feb-14	11.05 uv/lb at 10V exc	5-Nov-14	10.86 uv/lb at 10V exc	-1.7	.001105 mv/v/lb	FULL	1500 LB	Used on all tests.
17	RIGHT SHOULDER Y FORCE (LB)	MICH SCI 3000	110 (Y)	13-Feb-14	13.19 uv/lb at 10V exc	5-Nov-14	12.89 uv/lb at 10V exc	-2.3	.001319 mv/v/lb	FULL	1500 LB	Used on all tests.
18	RIGHT SHOULDER Z FORCE (LB)	MICH SCI 3000	110 (X)	13-Feb-14	13.00 uv/lb at 10V exc	5-Nov-14	13.25 uv/lb at 10V exc	1.9	.001300 mv/v/lb	FULL	1500 LB	Used on all tests.
19	INT HEAD X ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT01 (X)	25-Nov-13	.8447 mv/g at 10V exc	8-Oct-14	.8371 mv/g at 10V exc	-0.9	.08447 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
19	INT HEAD X ACCEL (G)	ENTRAN EGV3-F-250	Y117Q (X)	16-Sep-13	.8142 mv/g at 10V exc	8-Oct-14	.8142 mv/g at 10V exc	0.0	.08142 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
20	INT HEAD Y ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT01 (Y)	25-Nov-13	.8614 mv/g at 10V exc	8-Oct-14	.8628 mv/g at 10V exc	0.2	.08614 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
20	INT HEAD Y ACCEL (G)	ENTRAN EGV3-F-250	Y117Q (Y)	16-Sep-13	.7969 mv/g at 10V exc	8-Oct-14	.7944 mv/g at 10V exc	-0.3	.07969 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
21	INT HEAD Z ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT01 (Z)	25-Nov-13	.8795 mv/g at 10V exc	8-Oct-14	.8843 mv/g at 10V exc	0.5	.08795 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
21	INT HEAD Z ACCEL (G)	ENTRAN EGV3-F-250	Y117Q (Z)	16-Sep-13	.8218 mv/g at 10V exc	8-Oct-14	.8218 mv/g at 10V exc	0.0	.08218 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
22	INT HEAD ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10178	19-Nov-13	3.44 uv/rad/sec2 at 10V exc	25-Oct-14	3.50 uv/rad/sec2 at 10V exc	1.7	.000344 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on LARD tests 6460-6495.
22	INT HEAD ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	TJ79	10-Jan-14	3.21 uv/rad/sec2 at 10V exc	NA	NA	NA	.000321 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on LOIS tests 6419 thru 6441. Broke on 6441.
22	INT HEAD ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10173	19-Nov-13	3.21 uv/rad/sec2 at 10V exc	25-Oct-14	3.50 uv/rad/sec2 at 10V exc	1.7	.000312 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on LOIS tests 6442-6495
23	INT NECK X FORCE (LB)	DENTON 1716A	473	27-Nov-13	8.24 uv/lb at 10V exc	10-Oct-14	8.28 uv/lb at 10V exc	0.5	.000824 mv/v/lb	FULL	2000 LB	Used on LARD tests 6460-6495.
23	INT NECK X FORCE (LB)	DENTON 1716A	121	15-Mar-13	8.21 uv/lb at 10V excd	10-Oct-14	8.35 uv/lb at 10V exc	0.2	.000821 mv/v/lb	FULL	2000 LB	Used on LOIS tests 6419-6459.
24	INT NECK Y FORCE (LB)	DENTON 1716A	473	27-Nov-13	8.33 uv/lb at 10V exc	10-Oct-14	8.42 uv/lb at 10V exc	1.1	.000833 mv/v/lb	FULL	2000 LB	Used on LARD tests 6460-6495.
24	INT NECK Y FORCE (LB)	DENTON 1716A	121	15-Mar-13	8.35 uv/lb at 10V exc	10-Oct-14	8.47 uv/lb at 10V exc	0.5	.000835 mv/v/lb	FULL	2000 LB	Used on LOIS tests 6419-6459.
25	INT NECK Z FORCE (LB)	DENTON 1716A	473	27-Nov-13	4.41 uv/lb at 10V exc	10-Oct-14	4.43 uv/lb at 10V exc	0.5	.000441 mv/v/lb	FULL	3000 LB	Used on LARD tests 6460-6495.
25	INT NECK Z FORCE (LB)	DENTON 1716A	121	15-Mar-13	4.57 uv/lb at 10V exc	10-Oct-14	4.63 uv/lb at 10V exc	0.2	.000457 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6419-6459.
26	INT NECK Mx TORQUE (IN-LB)	DENTON 1716A	473	27-Nov-13	6.67 uv/in-lb at 10V exc	10-Oct-14	6.68 uv/in-lb at 10V exc	0.1	.000667 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6460-6495.

7 NOV 2014

26	INT NECK Mx TORQUE (IN-LB)	DENTON 1716A	121	15-Mar-13	6.71 uv/in-lb at 10V exc	10-Oct-14	6.78 uv/in-lb at 10V exc	0.0	.000671 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6419-6459.
27	INT NECK My TORQUE (IN-LB)	DENTON 1716A	473	27-Nov-13	6.69 uv/in-lb at 10V exc	10-Oct-14	6.72 uv/in-lb at 10V exc	0.4	.000669 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6460-6495.
27	INT NECK My TORQUE (IN-LB)	DENTON 1716A	121	15-Mar-13	6.74 uv/in-lb at 10V exc	10-Oct-14	6.87 uv/in-lb at 10V exc	1.0	.000674 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6419-6459.
28	INT NECK Mz TORQUE (IN-LB)	DENTON 1716A	473	27-Nov-13	9.05 uv/in-lb at 10V exc	10-Oct-14	9.07 uv/in-lb at 10V exc	0.2	.000905 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6460-6495.
28	INT NECK Mz TORQUE (IN-LB)	DENTON 1716A	121	15-Mar-13	9.09 uv/in-lb at 10V exc	10-Oct-14	9.22 uv/in-lb at 10V exc	1.1	.000909 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6419-6459.
29	INT CHEST X ACCEL (G)	ENTRAN EGV3-F-250	98D98D25 TA03 (X)	24-Jan-14	.9341 mv/g at 10V exc	10--8-14	.9067 mv/g at 10V exc	-2.9	.09341 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
29	INT CHEST X ACCEL (G)	ENTRAN EGV3-F-250	99J99J30 TE03 (X)	10-Jan-14	.8730 mv/g at 10V exc	8-Oct-14	.8473 mv/g at 10V exc	-2.9	.08730 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
30	INT CHEST Y ACCEL (G)	ENTRAN EGV3-F-250	98D98D25 TA03 (Y)	24-Jan-14	.9397 mv/g at 10V exc	10--8-14	.9149 mv/g at 10V exc	-2.6	.09397 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
30	INT CHEST Y ACCEL (G)	ENTRAN EGV3-F-250	99J99J30 TE03 (Y)	10-Jan-14	.9629 mv/g at 10V exc	8-Oct-14	.9349 mv/g at 10V exc	-2.9	.09629 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
31	INT CHEST Z ACCEL (G)	ENTRAN EGV3-F-250	98D98D25 TA03 (Z)	24-Jan-14	.9740 mv/g at 10V exc	8-Oct-14	1.0025 mv/g at 10V exc	2.9	.09740 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
31	INT CHEST Z ACCEL (G)	ENTRAN EGV3-F-250	99J99J30 TE03 (Z)	10-Jan-14	.9629 mv/g at 10V exc	8-Oct-14	.9352 mv/g at 10V exc	-2.9	.09629 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
32	INT LUMBAR X ACCEL (G)	ENTRAN EGV3-F-250	S1103E (X)	25-Nov-13	.8258 mv/g at 10v exc	9-Oct-14	.8289 mv/g at 10V exc	0.4	.08258 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
32	INT LUMBAR X ACCEL (G)	ENTRAN EGV3-F-250	Y117L(X)	25-Nov-13	.5990 mv/g at 10V exc	8-Oct-14	.5973 mv/g at 10V exc	-0.3	.05590 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
33	INT LUMBAR Y ACCEL (G)	ENTRAN EGV3-F-250	S1103E (Y)	25-Nov-13	.9412 mv/g at 10V exc	9-Oct-14	.9395 mv/g at 10V exc	-0.2	.09412 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
33	INT LUMBAR Y ACCEL (G)	ENTRAN EGV3-F-250	Y117L(Y)	25-Nov-13	.6507 mv/g at 10V exc	8-Oct-14	.6499 mv/g at 10V exc	-0.1	.06507 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
34	INT LUMBAR Z ACCEL (G)	ENTRAN EGV3-F-250	S1103E (Z)	25-Nov-13	.7624 mv/g at 10V exc	9-Oct-14	.7636 mv/g at 10V exc	0.2	.07624 mv/v/g	FULL	100 G	Used on LARD tests 6460-6495.
34	INT LUMBAR Z ACCEL (G)	ENTRAN EGV3-F-250	Y117L(Z)	25-Nov-13	.8289 mv/g at 10V exc	8-Oct-14	.8252 mv/g at 10V exc	-0.4	.08289 mv/v/g	FULL	100 G	Used on LOIS tests 6419-6459.
35	INT LUMBAR X FORCE (LB)	DENTON 1914A	310	28-Jan-14	6.71 uv/lb at 10V exc	14-Oct-14	6.71 uv/lb at 10V exc	0.0	.000671 mv/v/lb	FULL	3000 LB	Used on LARD tests 6460-6495.
35	INT LUMBAR X FORCE (LB)	DENTON 1914A	503	19-Mar-13	6.54 mv/lb atr 10V exc	14-Oct-14	6.58 uv/lb at 10V exc	0.6	.000654 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6419-6459.
36	INT LUMBAR Y FORCE (LB)	DENTON 1914A	310	28-Jan-14	6.71 uv/lb at 10V exc	14-Oct-14	6.72 uv/lb at 10V exc	0.1	.000671 mv/v/lb	FULL	3000 LB	Used on LARD tests 6460-6495.
36	INT LUMBAR Y FORCE (LB)	DENTON 1914A	503	19-Mar-13	6.55 uv/lb at 10V exc	14-Oct-14	6.59 uv/lb at 10V exc	0.6	.000655 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6419-6459.
37	INT LUMBAR Z FORCE (LB)	DENTON 1914A	310	28-Jan-14	2.80 uv/lb at 10V exc	14-Oct-14	2.81 uv/lb at 10V exc	0.4	.000280 mv/v/lb	FULL	5000 LB	Used on LARD tests 6460-6495.
37	INT LUMBAR Z FORCE (LB)	DENTON 1914A	503	19-Mar-13	2.69 uv/lb at 10V exc	14-Oct-14	2.71 uv/lb at 10V exc	0.7	.000269 mv/v/lb	FULL	5000 LB	Used on LOIS tests 6419-6459.

7 NOV 2014

38	INT LUMBAR Mx TORQUE (IN-LB)	DENTON 1914A	310	28-Jan-14	5.20 uv/in-lb at 10V exc	14-Oct-14	5.23 uv/in-lb at 10V exc	0.6	.000520 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6460-6495.
38	INT LUMBAR Mx TORQUE (IN-LB)	DENTON 1914A	503	19-Mar-13	5.09 uv/in-lb at 10V exc	14-Oct-14	5.16 uv/in-lb at 10V exc	1.4	.000509 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6419-6459.
39	INT LUMBAR My TORQUE (IN-LB)	DENTON 1914A	310	28-Jan-14	5.18 uv/in-lb at 10V exc	14-Oct-14	5.20 uv/in-lb at 10V exc	0.4	.000518 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6460-6495.
39	INT LUMBAR My TORQUE (IN-LB)	DENTON 1914A	503	19-Mar-13	5.09 uv/in-lb at 10V exc	14-Oct-14	5.14 uv/in-lb at 10V exc	1.0	.000509 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6419-6459.
40	INT LUMBAR Mz TORQUE (IN-LB)	DENTON 1914A	310	28-Jan-14	8.73 uv/in-lb at 10V exc	14-Oct-14	8.70 uv/in-lb at 10V exc	-0.3	.000873 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6460-6495.
40	INT LUMBAR Mz TORQUE (IN-LB)	DENTON 1914A	503	19-Mar-13	8.38 uv/in-lb at 10V exc	14-Oct-14	8.51 uv/in-lb at 10V exc	1.6	.000838 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6419-6459.

7 NOV 2014

PROGRAM: Comparative Assessment of Torso and Seat Mounted Restraint Systems using Vertical and Horizontal Impact Tests with Instrumented Manikins (Part II)	TEST DATES: 23 March 2015 - 26 March 2015
STUDY NUMBER: 201502	TEST NUMBERS: 6598 - 6635
FACILITY: VERTICAL DROP TOWER	SAMPLE RATE: 1K
DATA COLLECTION SYSTEM: TDAS PRO	FILTER FREQUENCY: 120Hz
	TRANSDUCER RANGE (VOLTS): +/- 5 V

DATA CHANNEL	DATA POINT	TRANSDUCER MFG. & MODEL	SERIAL NUMBER	PRE-CAL		POST-CAL		% Δ	DAS SENSITIVITY	BRIDGE	FULL SCALE	NOTES
				DATE	SENS	DATE	SENS					
1	CARRIAGE X ACCEL (G)	ENTRAN EGE-72-200	93C93 C19-R02	25-Feb-15	2.2361 mv/g at 10V exc	26-Mar-15	2.2316 mv/g at 10V exc	-0.2	.22361 mv/v/g	FULL	50 G	Used on all tests.
2	CARRIAGE Y ACCEL (G)	ENTRAN EGE-72-200	93C93 C19-R07	25-Feb-15	2.4117 mv/g at 10V exc	26-Mar-15	2.4066 mv/g at 10V exc	-0.2	.24117 mv/v/g	FULL	50 G	Used on all tests.
3	CARRIAGE Z ACCEL (G)	ENDEVCO 2262A-200	MH82	25-Feb-15	2.0571 mv/g at 10V exc	26-Mar-15	2.0548 mv/g at 10V exc	-0.1	.20571 mv/v/g	FULL	50 G	Used on tests
5	SEAT PAN X ACCEL (G)	ENTRAN EGV3-F-250	02B02B08 TE02 (Z)	18-Feb-15	.9004 mv/g at 10V exc	26-Mar-15	.9064 mv/g at 10V exc	0.7	.09004 mv/v/g	FULL	100 G	Used on all tests.
6	SEAT PAN Y ACCEL (G)	ENTRAN EGV3-F-250	02B02B08 TE02 (Y)	18-Feb-15	.8804 mv/g at 10V exc	26-Mar-15	.8804 mv/g at 10V exc	0.0	.08804 mv/v/g	FULL	100 G	Used on all tests.
7	SEAT PAN Z ACCEL (G)	ENTRAN EGV3-F-250	02B02B08 TE02 (X)	18-Feb-15	.8925 mv/g at 10V exc	26-Mar-15	.8863 mv/g at 10V exc	-0.7	.08925 mv/v/g	FULL	100 G	Used on all tests.
8	LEFT LAP X FORCE (LB)	MICH SCI 3000	369 (Z)	05-Nov-14	10.21 uv/lb at 10V exc	27-Apr-15	10.05 uv/lb at 10V exc	-1.6	.001021 mv/v/lb	FULL	1500 LB	Used on all tests.
9	LEFT LAP Y FORCE (LB)	MICH SCI 3000	369 (X)	05-Nov-14	11.95 uv/lb at 10V exc	27-Apr-15	12.18 uv/lb at 10V exc	1.9	.001195 mv/v/lb	FULL	1500 LB	Used on all tests.
10	LEFT LAP Z FORCE (LB)	MICH SCI 3000	369 (Y)	05-Nov-14	12.75 uv/lb at 10V exc	27-Apr-15	13.12 uv/lb at 10V exc	2.9	.001275 mv/v/lb	FULL	1500 LB	Used on all tests.
11	RIGHT LAP X FORCE (LB)	MICH SCI 3000	111 (Z)	05-Nov-14	10.08 uv/lb at 10V exc	27-Apr-15	9.78 uv/lb at 10V exc	-3.0	.001008 mv/v/lb	FULL	1500 LB	Used on all tests.
12	RIGHT LAP Y FORCE (LB)	MICH SCI 3000	111 (Y)	05-Nov-14	12.17 uv/lb at 10V exc	27-Apr-15	12.05 uv/lb at 10V exc	-1.0	.001217 mv/v/lb	FULL	1500 LB	Used on all tests.
13	RIGHT LAP Z FORCE (LB)	MICH SCI 3000	111 (X)	05-Nov-14	12.40 uv/lb at 10V exc	27-Apr-15	12.13 uv/lb at 10V exc	-2.2	.001240 mv/v/lb	FULL	1500 LB	Used on all tests.
14	LEFT SHOULDER X FORCE (LB)	MICH SCI 4000	110 (Z)	05-Nov-14	10.08 uv/lb at 10V exc	27-Apr-15	9.94 uv/lb at 10V exc	-1.3	.001008 mv/v/lb	FULL	1500 LB	Used on all tests.
15	LEFT SHOULDER Y FORCE (LB)	MICH SCI 4000	110 (X)	05-Nov-14	12.23 uv/lb at 10V exc	27-Apr-15	12.58 uv/lb at 10V exc	2.9	.001223 mv/v/lb	FULL	1500 LB	Used on all tests.
16	LEFT SHOULDER Z FORCE (LB)	MICH SCI 4000	110 (Y)	05-Nov-14	12.34 uv/lb at 10V exc	27-Apr-15	12.38 uv/lb at 10V exc	0.3	.001234 mv/v/lb	FULL	1500 LB	Used on all tests.
17	RIGHT SHOULDER X FORCE (LB)	MICH SCI 3000	3 (Z)	18-Aug-14	10.97 uv/lb at 10V exc	27-Apr-15	10.65 uv/lb at 10V exc	-2.9	.001097 mv/v/lb	FULL	1500 LB	Used on all tests.
18	RIGHT SHOULDER Y FORCE (LB)	MICH SCI 3000	3 (Y)	18-Aug-14	13.65 uv/lb at 10V exc	27-Apr-15	13.24 uv/lb at 10V exc	-3.0	.001365 mv/v/lb	FULL	1500 LB	Used on all tests.

1 MAY 2015

19	RIGHT SHOULDER Z FORCE (LB)	MICH SCI 3000	3 (X)	18-Aug-14	13.77 uv/lb at 10V exc	27-Apr-15	13.37 uv/lb at 10V exc	-2.9	.001377 mv/v/lb	FULL	1500 LB	Used on all tests.
20	INT HEAD X ACCEL (G)	ENTRAN EGV3-F-250	97C97C20 TB04 (X)	2-Dec-14	1.0334 mv/g at 10V exc	6-Apr-15	1.0512 mv/g at 10V exc	1.7	.10334 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
20	INT HEAD X ACCEL (G)	ENTRAN EGV3-F-250	98D98D25 TA03 (X)	15-Dec-14	.8903 mv/g at 10V exc	6-Apr-15	.8755 mv/g at 10V exc	-1.7	.08903 mv/v/g	FULL	100 G	Used on LARD tests
21	INT HEAD Y ACCEL (G)	ENTRAN EGV3-F-250	97C97C20 TB04 (Y)	2-Dec-14	1.0178 v/g at 10V exc	6-Apr-15	1.0178 mv/g at 10V exc	0.0	.10178 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
21	INT HEAD Y ACCEL (G)	ENTRAN EGV3-F-250	98D98D25 TA03 (Y)	15-Dec-14	.8891 mv/g at 10V exc	6-Apr-15	.8685 mv/g at 10V exc	-2.3	.08891 mv/v/g	FULL	100 G	Used on LARD tests 6598-6610; 6626-6635
22	INT HEAD Z ACCEL (G)	ENTRAN EGV3-F-250	97C97C20 TB04 (Z)	2-Dec-14	1.0390 mv/g at 10V exc	6-Apr-15	1.0393 mv/g at 10V exc	0.1	.10390 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
22	INT HEAD Z ACCEL (G)	ENTRAN EGV3-F-250	98D98D25 TA03 (Z)	15-Dec-14	.9731 mv/g at 10V exc	6-Apr-15	.9499 mv/g at 10V exc	-2.4	.09731 mv/v/g	FULL	100 G	Used on LARD tests 6598-6610; 6626-6635
23	INT HEAD ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10175	19-Aug-14	3.45 uv/rad/sec2 at 10V exc	27-Apr-15	3.49 uv/rad/sec2 at 10V exc	1.2	.000345 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on LOIS tests 6611-6625
23	INT HEAD ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	A02Y	19-Aug-14	3.37 uv/rad/sec2 at 10V exc	27-Apr-15	3.38 uv/rad/sec2 at 10V exc	0.3	.000337 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on LARD tests 6598-6610; 6626-6635
24	INT NECK X FORCE (LB)	DENTON 1716A	934	28-Aug-14	8.50 uv/lb at 10V exc	29-Apr-15	8.32 uv/lb at 10V exc	-2.1	.000850 mv/v/lb	FULL	2000 LB	Used on LOIS tests 6611-6625
24	INT NECK X FORCE (LB)	DENTON 1716A	820	10-Oct-14	8.23 uv/lb at 10V exc	29-Apr-15	8.23 uv/lb at 10V exc	0.0	.000823 mv/v/lb	FULL	2000 LB	Used on LARD tests 6598-6610; 6626-6635
25	INT NECK Y FORCE (LB)	DENTON 1716A	934	28-Aug-14	8.59 uv/lb at 10V exc	29-Apr-15	8.51 uv/lb at 10V exc	-0.9	.000859 mv/v/lb	FULL	2000 LB	Used on LOIS tests 6611-6625
25	INT NECK Y FORCE (LB)	DENTON 1716A	820	10-Oct-14	8.49 uv/lb at 10V exc	29-Apr-15	8.43 uv/lb at 10V exc	-0.7	.000849 mv/v/lb	FULL	2000 LB	Used on LARD tests 6598-6610; 6626-6635
26	INT NECK Z FORCE (LB)	DENTON 1716A	934	28-Aug-14	4.58 uv/lb at 10V exc	29-Apr-15	4.55 uv/lb at 10V exc	-0.7	.000458 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6611-6625
26	INT NECK Z FORCE (LB)	DENTON 1716A	820	10-Oct-14	4.50 uv/lb at 10V exc	29-Apr-15	4.46 uv/lb at 10V exc	-0.9	.000450 mv/v/lb	FULL	3000 LB	Used on LARD tests 6598-6610; 6626-6635
27	INT NECK Mx TORQUE (IN-LB)	DENTON 1716A	934	28-Aug-14	6.83 uv/in-lb at 10V exc	29-Apr-15	6.82 uv/in-lb at 10V exc	-0.1	.000683 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6611-6625
27	INT NECK Mx TORQUE (IN-LB)	DENTON 1716A	820	10-Oct-14	6.71 uv/in-lb at 10V exc	29-Apr-15	6.73 uv/in-lb at 10V exc	0.3	.000671 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6598-6610; 6626-6635
28	INT NECK My TORQUE (IN-LB)	DENTON 1716A	934	28-Aug-14	6.88 uv/in-lb at 10V exc	29-Apr-15	6.90 uv/in-lb at 10V exc	0.3	.000688 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6611-6625
28	INT NECK My TORQUE (IN-LB)	DENTON 1716A	820	10-Oct-14	6.77 uv/in-lb at 10V exc	29-Apr-15	6.80 uv/in-lb at 10V exc	0.4	.000677 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6598-6610; 6626-6635
29	INT NECK Mz TORQUE (IN-LB)	DENTON 1716A	934	28-Aug-14	9.36 uv/in-lb at 10V exc	29-Apr-15	9.32 uv/in-lbat 10V exc	-0.4	.000936 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6611-6625

1 MAY 2015

29	INT NECK Mz TORQUE (IN-LB)	DENTON 1716A	820	10-Oct-14	9.16 uv/in-lb at 10V exc	29-Apr-15	9.17 uv/in-lb at 10V exc	0.1	.000916 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6598-6610; 6626-6635
30	INT CHEST X ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT06 (Z)	02-Dec-14	.8625 mv/g at 10V exc	31-Mar-15	.8713 mv/g at 10V exc	1.0	.08625 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
30	INT CHEST X ACCEL (G)	ENTRAN EGV3-F-250	93D93D22 TM01 (Z)	15-Dec-14	1.1436 mv/g at 10V exc	6-Apr-15	1.0667 mv/g at 10V exc	1.4	.11436 mv/v/g	FULL	100 G	Used on LARD tests 6598-6610; 6626-6635
31	INT CHEST Y ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT06 (Y)	2-Dec-14	.8886 mv/g at 10V exc	31-Mar-15	.9095 mv/g at 10V exc	2.4	.08886 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
31	INT CHEST Y ACCEL (G)	ENTRAN EGV3-F-250	93D93D22 TM01 (Y)	15-Dec-14	1.1366 mv/g at 10V exc	6-Apr-15	1.1408 mv/g at 10V exc	0.4	.11366 mv/v/g	FULL	100 G	Used on LARD tests 6598-6610; 6626-6635
32	INT CHEST Z ACCEL (G)	ENTRAN EGV3-F-250	95F95F30 PT06 (X)	2-Dec-14	.9027 mv/g at 10V exc	31-Mar-15	.9013 mv/g at 10V exc	-0.2	.09027 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
32	INT CHEST Z ACCEL (G)	MEAS SPEC EGCS-S425-250	T13132	12-Feb-15	.5775 mv/g at 10V exc	6-Apr-15	.5713 mv/g at 10V exc	-1.1	.05775 mv/v/g	FULL	100 G	Used on LARD tests 6598-6610; 6626-6635
33	INT LUMBAR X ACCEL (G)	ENTRAN EGV3-F-250	S1103E(X)	15-Dec-14	.8246 mv/g at 10V exc	6-Apr-15	.8365 mv/g at 10V exc	1.4	.08246 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
33	INT LUMBAR X ACCEL (G)	ENTRAN EGV3-F-250	Q1008N (X)	15-Jan-14	1.0005 mv/g at 10V exc	6-Apr-15	1.0017 mv/g at 10V exc	0.1	.10005 mv/v/g	FULL	100 G	Used on LARD tests 6598-6610; 6626-6635
34	INT LUMBAR Y ACCEL (G)	ENTRAN EGV3-F-250	S1103E (Y)	15-Dec-14	.9378 mv/g at 10V exc	6-Apr-15	.9418 mv/g at 10V exc	0.4	.09378 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
34	INT LUMBAR Y ACCEL (G)	ENTRAN EGV3-F-250	Q1008N (Y)	15-Dec-14	.8080 mv/g at 10V exc	6-Apr-15	.8077 mv/g at 10V exc	-0.1	.08080 mv/v/g	FULL	100 G	Used on LARD tests 6598-6610; 6626-6635
35	INT LUMBAR Z ACCEL (G)	ENTRAN EGV3-F-250	S1103E(Z)	15-Dec-14	.7491 mv/g at 10V exc	6-Apr-15	.7368 mv/g at 10V exc	-1.6	.07491 mv/v/g	FULL	100 G	Used on LOIS tests 6611-6625
35	INT LUMBAR Z ACCEL (G)	ENTRAN EGV3-F-250	Q1008N (Z)	15-Dec-14	1.0025 mv/g at 10V exc	6-Apr-15	1.0045 mv/g at 10V exc	0.2	.10025 mv/v/g	FULL	100 G	Used on LARD tests 6598-6610; 6626-6635
36	INT LUMBAR X FORCE (LB)	DENTON 1914A	154	4-Sep-14	6.61 uv/lb at 10V exc	1-May-15	6.64 uv/lb at 10V exc	0.5	.000661 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6611-6625
36	INT LUMBAR X FORCE (LB)	DENTON 1914A	390	3-Sep-14	6.82 uv/lb at 10V exc	1-May-15	.6.85 uv/lb at 10V exc	0.4	.000682 mv/v/lb	FULL	3000 LB	Used on LARD tests 6598-6610; 6626-6635
37	INT LUMBAR Y FORCE (LB)	DENTON 1914A	154	4-Sep-14	6.58 uv/lb at 10V exc	1-May-15	6.52 uv/lb at 10V exc	-0.9	.000658 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6611-6625
37	INT LUMBAR Y FORCE (LB)	DENTON 1914A	390	3-Sep-14	6.77 uv/lb at 10V exc	1-May-15	6.70 uv/lb at10V exc	-1.0	.000677 mv/v/lb	FULL	3000 LB	Used on LARD tests 6598-6610; 6626-6635
38	INT LUMBAR Z FORCE (LB)	DENTON 1914A	154	4-Sep-14	2.73 uv/lb at 10V exc	1-May-15	2.74 uv/lb at 10V exc	0.4	.000273 mv/v/lb	FULL	5000 LB	Used on LOIS tests 6611-6625
38	INT LUMBAR Z FORCE (LB)	DENTON 1914A	390	3-Sep-14	2.80 uv/lb at 10V exc	1-May-15	2.81 uv/lb at 10V exc	0.4	.000280 mv/v/lb	FULL	5000 LB	Used on LARD tests 6598-6610; 6626-6635
39	INT LUMBAR Mx TORQUE (IN-LB)	DENTON 1914A	154	4-Sep-14	5.18 uv/in-lb at 10V exc	1-May-15	5.11 uv/in-lb at 10V exc	-1.4	.000518 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6611-6625
39	INT LUMBAR Mx TORQUE (IN-LB)	DENTON 1914A	390	3-Sep-14	5.30 uv/in-lb at 10V exc	1-May-15	5.27 uv/in-lb at 10V exc	-0.6	.000530 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6598-6610; 6626-6635
40	INT LUMBAR My TORQUE (IN-LB)	DENTON 1914A	154	4-Sep-14	5.16 uv/in-lb at 10V exc	1-May-15	5.12 uv/in-lb at 10V exc	-0.8	.000516 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6611-6625
40	INT LUMBAR My TORQUE (IN-LB)	DENTON 1914A	390	3-Sep-14	5.29 uv/in-lb at 10V exc	1-May-15	5.28 uv/in-lb at 10V exc	-0.2	.000529 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6598-6610; 6626-6635
41	INT LUMBAR Mz TORQUE (IN-LB)	DENTON 1914A	154	4-Sep-14	8.61 uv/in-lb at 10V exc	1-May-15	8.46 uv/in-lb at 10V exc	-1.7	.000861 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6611-6625

1 MAY 2015

41	INT LUMBAR Mz TORQUE (IN-LB)	DENTON 1914A	390	3-Sep-14	8.85 uv/in-lb at 10V exc	1-May-15	8.72 uv/in-lb at 10V exc	-1.5	.000885 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6598-6610; 6626-6635

1 MAY 2015

PROGRAM: Comparative Assessment of Torso and Seat Mounted Restraint Systems using Vertical and Horizontal Impact Tests with Instrumented Manikins	TEST DATES:6 May 2015 - 13 May 2015
STUDY NUMBER: 201502	TEST NUMBERS: 6665 - 6738
FACILITY: VERTICAL IMPACT	SAMPLE RATE: 1K
DATA COLLECTION SYSTEM: TDAS PRO	FILTER FREQUENCY: 120Hz
	TRANSDUCER RANGE (VOLTS): +/- 5 V

DATA CHANNEL	DATA POINT	TRANSDUCER MFG. & MODEL	SERIAL NUMBER	PRE-CAL DATE	PRE-CAL SENS	POST-CAL DATE	POST-CAL SENS	% Δ	DAS SENSITIVITY	BRIDGE	FULL SCALE	NOTES
1	SLED X ACCEL (G)	ENDEVCO 2262A-200	HM75	26-Mar-15	4.3913 mv/g at 10V exc	17-Jun-15	4.4032 mv/g at 10V exc	0.3	.43913 mv/v/g	FULL	50 G	Used on alll tests
2	SLED Y ACCEL (G)	ENTRAN EGE-72-200	93C93 C19-R07	26-Mar-15	2.4066 mv/g at 10V exc	17-Jun-15	2.3984 mv/g at 10V exc	-0.3	.24066 mv/v/g	FULL	50 G	Used on alll tests
3	SLED Z ACCEL (G)	ENTRAN EGE-72-200	93C93 C19-R02	26-Mar-15	2.2316 mv/g at 10V exc	17-Jun-15	2.2191 mv/g at 10V exc	-0.6	.22316 mv/v/g	FULL	50 G	Used on alll tests
4	SEAT PAN X ACCEL (G)	ENTRAN EGV3-F-250	M090CH (X)	15-Feb-15	.7785 mv/g at 10V exc	18-Jun-15	.7814 mv/g at 10V exc	0.4	.09064 mv/v/g	FULL	100 G	Used on alll tests
5	SEAT PAN Y ACCEL (G)	ENTRAN EGV3-F-250	M090CH (Y)	15-Feb-15	.8020 mv/g at 10V exc	18-Jun-15	.8037 mv/g at 10V exc	0.2	.08804 mv/v/g	FULL	100 G	Used on alll tests
6	SEAT PAN Z ACCEL (G)	ENTRAN EGV3-F-250	M090CH (Z)	15-Feb-15	.6804 mv/g at 10V exc	18-Jun-15	.6801 mv/g at 10V exc	-0.1	.08863 mv/v/g	FULL	100 G	Used on alll tests
7	LEFT LAP X FORCE (LB)	MICH SCI 3000	3 (Z)	27-Apr-15	10.65 uv/lb at 10V exc	14-Nov-15	10.96 uv/lb at 10V exc	2.9	.001065 mv/v/lb	FULL	1500 LB	Used on alll tests
8	LEFT LAP Y FORCE (LB)	MICH SCI 3000	3 (Y)	27-Apr-15	13.24 uv/lb at 10V exc	14-Nov-15	13.47 uv/lb at 10V exc	1.7	.001324 mv/v/lb	FULL	1500 LB	Used on alll tests
9	LEFT LAP Z FORCE (LB)	MICH SCI 3000	3 (X)	27-Apr-15	13.37 uv/lb at 10V exc	14-Nov-15	13.77 uv/lb at 10V exc	3.0	.001337 mv/v/lb	FULL	1500 LB	Used on alll tests
10	RIGHT LAP X FORCE (LB)	MICH SCI 4000	110 (Z)	27-Apr-15	9.94 uv/lb at 10V exc	14-Nov-15	10.12 uv/lb at 10V exc	1.8	.000994 mv/v/lb	FULL	1500 LB	Used on alll tests
11	RIGHT LAP Y FORCE (LB)	MICH SCI 4000	110 (Y)	27-Apr-15	12.38 uv/lb at 10V exc	14-Nov-15	12.69 uv/lb at 10V exc	2.5	.001238 mv/v/lb	FULL	1500 LB	Used on alll tests
12	RIGHT LAP Z FORCE (LB)	MICH SCI 4000	110 (X)	27-Apr-15	12.58 uv/lb at 10V exc	14-Nov-15	12.88 uv/lb at 10V exc	2.4	.001258 mv/v/lb	FULL	1500 LB	Used on alll tests
13	LEFT SHOULDER X FORCE (LB)	MICH SCI 3000	369 (Z)	27-Apr-15	10.05 uv/lb at 10V exc	14-Nov-15	10.29 uv/lb at 10V exc	2.4	.00105 mv/v/lb	FULL	1500 LB	Used on alll tests
14	LEFT SHOULDER Y FORCE (LB)	MICH SCI 3000	369 (Y)	27-Apr-15	13.12 uv/lb at 10V exc	14-Nov-15	13.45 uv/lb at 10V exc	2.5	.001312 mv/v/lb	FULL	1500 LB	Used on alll tests
15	LEFT SHOULDER Z FORCE (LB)	MICH SCI 3000	369 (X)	27-Apr-15	12.18 uv/lb at 10V exc	14-Nov-15	12.46 uv/lb at 10V exc	2.3	.001218 mv/v/lb	FULL	1500 LB	Used on alll tests
16	RIGHT SHOILDER X FORCE (LB)	MICH SCI 3000	111 (Z)	27-Apr-15	9.78 uv/lb at 10V exc	14-Nov-15	10.02 uv/lb at 10V exc	2.5	.000978 mv/v/lb	FULL	1500 LB	Used on alll tests
17	RIGHT SHOULDER Y FORCE (LB)	MICH SCI 3000	111 (Y)	27-Apr-15	12.05 uv/lb at 10V exc	14-Nov-15	12.33 uv/lb at 10V exc	2.3	.001205 mv/v/lb	FULL	1500 LB	Used on alll tests

5 MAY 2015

18	RIGHT SHOULDER Z FORCE (LB)	MICH SCI 3000	111 (X)	27-Apr-15	12.13 uv/lb at 10V exc	14-Nov-15	12.41 uv/lb at 10V exc	2.3	.001213 mv/v/lb	FULL	1500 LB	Used on alll tests
19	INT HEAD X ACCEL (G)	MEAS SPEC EGCS-S425-250	R130NV	26-Mar-15	.6312 mv/g at 10V exc	27-May-15	.6304 mv/g at 10V exc	-0.1	.06312 mv/v/g	FULL	50 G	Used on AERO50 tests 6665-6699
19	INT HEAD X ACCEL (G)	MEAS SPEC EGCS-S425-250	S080A8	4-May-15	.5071 mv/g at 10V exc	17-Jun-15	.5068 mv/g at 10V exc	-0.1	.05071 mv/v/g	FULL	50 G	Used on AUTO50 tests 6700-6723
19	INT HEAD X ACCEL (G)	MEAS SPEC EGCS-S425-250	R13083	4-May-15	.5868 mv/g at 10V exc	1-Jun-15	.5871 mv/g at 10V exc	0.0	.05868 mv/v/g	FULL	50 G	Used on LARD tests 6724-6731
19	INT HEAD X ACCEL (G)	MEAS SPEC EGCS-S425-250	R130NQ	4-May-15	.5738 mv/g at 10V exc	2-Jun-15	.5795 mv/g at 10V exc	1.0	.0005738 mv/v/g	FULL	50 G	Used on LOIS tests 6732-6738
20	INT HEAD Y ACCEL (G)	MEAS SPEC EGCS-S425-250	R130NT	15-Aug-14	.5930 mv/g at 10V exc	27-May-15	.5888 mv/g at 10V exc	-0.7	.05930 mv/v/g	FULL	50 G	Used on AERO50 tests 6665-6699
20	INT HEAD Y ACCEL (G)	MEAS SPEC EGCS-S425-250	S080AG	4-May-15	.4355 mv/g at 10V exc	18-Jun-15	.4344 mv/g at 10V exc	-0.3	.04355 mv/v/g	FULL	50 G	Used on AUTO50 tests 6700-6723
20	INT HEAD Y ACCEL (G)	MEAS SPEC EGCS-S425-250	R1307Y	4-May-15	.5520 mv/g at 10V exc	1-Jun-15	.5532 mv/g at 10V exc	0.2	.05520 mv/v/g	FULL	50 G	Used on LARD tests 6724-6731
20	INT HEAD Y ACCEL (G)	MEAS SPEC EGCS-S425-250	R130NU	4-May-15	.5670 mv/g at 10V exc	2-Jun-15	.5741 mv/g at 10V exc	1.3	.05670 mv/v/g	FULL	50 G	Used on LOIS tests 6732-6738
21	INT HEAD Z ACCEL (G)	MEAS SPEC EGCS-S425-250	S080AE	4-May-15	.4417 mv/g at 10V exc	27-May-15	.4415 mv/g at 10V exc	-0.1	.04417 mv/v/g	FULL	100 G	Used on AERO50 tests 6665-6699
21	INT HEAD Z ACCEL (G)	MEAS SPEC EGCS-S425-250	M080XV	05-Apr-15	.5133 mv/g at 10V exc	17-Jun-15	.5127 mv/g at 10V exc	-0.1	.05133 mv/v/g	FULL	100 G	Used on AUTO50 tests 6700-6723
21	INT HEAD Z ACCEL (G)	MEAS SPEC EGCS-S425-250	S080AF	04-May-15	.4536 mv/g at 10V exc	1-Jun-15	.4539 mv/g at 10V exc	0.1	.04536 mv/v/g	FULL	100 G	Used on LARD tests 6724-6731
21	INT HEAD Z ACCEL (G)	MEAS SPEC EGCS-S425-250	R1307X	04-May-15	.5758 mv/g at 10V exdc	2-Jun-15	.5783 mv/g at 10V exc	0.4	.05758 mv/v/g	FULL	100 G	Used on LOIS tests 6732-6738
22	INT HEAD RY ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10214	12-Feb-15	3.66 uv/rad/sec2 at 10V exc	1-Jun-15	3.7 uv/rad/sec2 at 10V exc	1.1	.000366 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on AERO50 tests 6665-6699
22	INT HEAD RY ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	A20Y	27-Apr-15	3.38 uv/rad/sec2 at 10V exc	18-Jun-15	3.35 uv/rad/sec2 at 10V exc	-0.9	.000338 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on AUTO50 tests 6700-6723
22	INT HEAD RY ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10229	5-May-15	3.62 mv/rad/sec2	1-Jun-15	3.54 uv/rad/sec2 at 10V exc	-2.2	.000362 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on LARD tests 6724-6731
22	INT HEAD RY ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10203	5-May-15	4.28 uv/rad/sec2 at 10V exc	2-Jun-15	4.18 uv/rad/sec2 at 10V exc	-2.3	.000428 mv/v/rad/sec	FULL	5000 RAD?SEC2	Used on LOIS tests 6732-6738
23	INT NECK X FORCE (LB)	DENTON 1716A	624	30-Apr-15	8.23 uv/lb at 10V exc	3-Jun-15	8.20 uv/lb at 10V exc	-0.4	.000823 mv/v/lb	FULL	2000 LB	Used on AERO50 tests 6665-6699
23	INT NECK X FORCE (LB)	DENTON 1716A	553	30-Apr-15	8.17 uv/lb at 10V exc	18-Jun-15	8.14 uv/lb at 10V exc	-0.4	.000817 mv/v/lb	FULL	2000 LB	Used on AUTO50 tests 6700-6723
23	INT NECK X FORCE (LB)	DENTON 1716A	127	1-May-15	8.24 uv/lb at 10v exc	2-Jun-15	8.25 uv/lb at 10V exc	0.1	.000824 mv/v/lb	FULL	2000 LB	Used on LARD tests 6724-6731
23	INT NECK X FORCE (LB)	DENTON 1716A	469	1-May-15	8.20 uv/lb at 10V exc	3-Jun-15	8.20 uv/lb at 10V exc	0.0	.000820 mv/v/lb	FULL	2000 LB	Used on LOIS tests 6732-6738
24	INT NECK Y FORCE (LB)	DENTON 1716A	624	30-Apr-15	8.41 uv/lb at 10V exc	03-Jun-15	8.39 uv/lb at 10V exc	-0.4	.000841 mv/v/lb	FULL	2000 LB	Used on AERO50 tests 6665-6699
24	INT NECK Y FORCE (LB)	DENTON 1716A	553	30-Apr-15	8.65 uv/lb at 10V exc	18-Jun-15	8.60 uv/lb at 10V exc	-0.6	.000865 mv/v/lb	FULL	2000 LB	Used on AUTO50 tests 6700-6723

5 MAY 2015

24	INT NECK Y FORCE (LB)	DENTON 1716A	127	1-May-15	8.27 uv/lb at 10V exc	02-Jun-15	8.28 uv/lb at 10V exc	0.1	.000827 mv/v/lb	FULL	2000 LB	Used on LARD tests 6724-6731
24	INT NECK Y FORCE (LB)	DENTON 1716A	469	1-May-15	8.27 uv/lb at 10V exc	3-Jun-15	8.27 uv/lb at 10V exc	0.0	.000827 mv/v/lb	FULL	2000 LB	Used on LOIS tests 6732-6738
25	INT NECK Z FORCE (LB)	DENTON 1716A	624	30-Apr-15	4.63 uv/lb at 10V exc	03-Jun-15	4.67 uv/lb at 10V exc	0.9	.000463 mv/v//lb	FULL	3000 LB	Used on AERO50 tests 6665-6699
25	INT NECK Z FORCE (LB)	DENTON 1716A	553	30-Apr-15	4.03 uv/lb at 10V exc	18-Jun-15	4.04 uv/lb at 10V exc	0.2	.000403 mv/v/lb	FULL	3000 LB	Used on AUTO50 tests 6700-6723
25	INT NECK Z FORCE (LB)	DENTON 1716A	127	1-May-15	4.70 uv/lb at 10V exc	02-Jun-15	4.69 uv/lb at 10V exc	-0.2	.000470 mv/v/lb	FULL	3000 LB	Used on LARD tests 6724-6731
25	INT NECK Z FORCE (LB)	DENTON 1716A	469	1-May-15	4.03 uv/lb at 10V exc	03-Jun-15	4.02 uv/lb at 10V exc	-0.2	.000403 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6732-6738
26	INT Neck Mx TORQUE (IN-LB)	DENTON 1716A	624	30-Apr-15	6.81 uv/in-lb at 10V exc	03-Jun-15	6.81 uv/in-lb at 10V exc	0.0	.000681 mv/v/in-lb	FULL	2500 IN-LB	Used on AERO50 tests 6665-6699
26	INT Neck Mx TORQUE (IN-LB)	DENTON 1716A	553	30-Apr-15	6.72 uv/in-lb at 10V exc	18-Jun-15	6.68 uv/in-lb at 10V exc	-0.6	.000672 mv/v/in-lb	FULL	2500 IN-LB	Used on AUTO50 tests 6700-6723
26	INT Neck Mx TORQUE (IN-LB)	DENTON 1716A	127	1-May-15	6.72 uv/in-lb at 10V exc	02-Jun-15	6.62 uv/in-lb at 10V exc	-1.5	.000672 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6724-6731
26	INT Neck Mx TORQUE (IN-LB)	DENTON 1716A	469	1-May-15	6.57 uv-in-lb at 10V exc	03-Jun-15	6.57 uv/in-lb at 10V exc	0.0	.000657 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6732-6738
27	INT Neck My TORQUE (IN-LB)	DENTON 1716A	624	30-Apr-15	6.90 uv/in-lb at 10V exc	03-Jun-15	6.83 uv/in-lb at 10V exc	-1.0	.000690 mv/v/in-lb	FULL	2500 IN-LB	Used on AERO50 tests 6665-6699
27	INT Neck My TORQUE (IN-LB)	DENTON 1716A	553	30-Apr-15	6.81 uv/in-lb at 10V exc	18-Jun-15	6.73 uv/in-lb at 10V exc	-1.1	.000681 mv/v/in-lb	FULL	2500 IN-LB	Used on AUTO50 tests 6700-6723
27	INT Neck My TORQUE (IN-LB)	DENTON 1716A	127	1-May-15	6.65 uv/in-lb at 10V exc	02-Jun-15	6.71 uv/in-lb at 10V exc	0.9	.000665 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6724-6731
27	INT Neck My TORQUE (IN-LB)	DENTON 1716A	469	1-May-15	6.62 uv/in-lb at 10V exc	03-Jun-15	6.63 uv/in-lb at 10V exc	0.2	.000662 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6732-6738
28	INT Neck Mz TORQUE (IN-LB)	DENTON 1716A	624	30-Apr-15	9.21 uv/in-lb at 10V exc	03-Jun-15	9.19 uv/in-lb at 10V exc	-0.2	.000921 mv/v/in-lb	FULL	2500 IN-LB	Used on AERO50 tests 6665-6699
28	INT Neck Mz TORQUE (IN-LB)	DENTON 1716A	553	30-Apr-15	9.16 uv/in-lb at 10V exc	18-Jun-15	9.05 uv/in-lb at 10V exc	-1.2	.000916 mv/v/in-lb	FULL	2500 IN-LB	Used on AUTO50 tests 6700-6723
28	INT Neck Mz TORQUE (IN-LB)	DENTON 1716A	127	1-May-15	8.88 uv/in-lb at 10V exc	2-Jun-15	8.86 uv/in-lb at 10V exc	-0.2	.000888 mv/v/in-lb	FULL	2500 IN-LB	Used on LARD tests 6724-6731
28	INT Neck Mz TORQUE (IN-LB)	DENTON 1716A	469	1-May-15	8.83 uv/in-lb at 10V exc	3-Jun-15	8.82 uv/in-lb at 10V exc	-0.1	.000883 mv/v/in-lb	FULL	2500 IN-LB	Used on LOIS tests 6732-6738
29	INT CHEST X ACCEL (G)	MEAS SPEC EGCS-S425-250	M080XT	4-May-15	.4989 mv/g at 10V exc	27-May-15	.4991 mv/g at 10V exc	0.1	.04989 mv/v/g	FULL	50 G	Used on AERO50 tests 6665-6699
29	INT CHEST X ACCEL (G)	MEAS SPEC EGCS-S425-250	T13132	6-Apr-15	.5713 mv/g at 10V exc	17-Jun-15	.5775 mv/g at 10V exc	1.1	.05713 mv/v/g	FULL	50 G	Used on AUTO50 tests 6700-6723

5 MAY 2015

29	INT CHEST X ACCEL (G)	MEAS SPEC EGCS-S425-250	S080A7	4-May-15	.4386 mv/g at 10V exc	1-Jun-15	.4386 mv/g at 10V exc	0.0	.04386 mv/v/g	FULL	50 G	Used on LARD tests 6724-6731
29	INT CHEST X ACCEL (G)	MEAS SPEC EGCS-S425-250	96j996j 15tb04 (X)	18-Feb-15	.7817 mv/g at 10V exc	2-Jun-15	.7834 mv/g at 10V exc	0.2	.07817 mv/v/g	FULL	50 G	Used on LOIS tests 6732-6738
30	INT CHEST Y ACCEL (G)	MEAS SPEC EGCS-S425-250	S080A9	4-May-15	.5526 mv/g at 10V exc	27-May-15	.5526 mv/g at 10V exc	0.0	.05526 mv/v/g	FULL	50 G	Used on AERO50 tests 6665-6699
30	INT CHEST Y ACCEL (G)	MEAS SPEC EGCS-S425-250	R130NP	12-Feb-15	.6100 mv/g at 10V exc	18-Jun-15	.6103 mv/g at 10V exc	0.1	.06100 mv/v/g	FULL	50 G	Used on AUTO50 tests 6700-6723
30	INT CHEST Y ACCEL (G)	MEAS SPEC EGCS-S425-250	S080AC	4-May-15	.5399 mv/g at 10V exc	1-Jun-15	.5407 mv/g at 10V exc	0.2	.05399 mv/v/g	FULL	50 G	Used on LARD tests 6724-6731
30	INT CHEST Y ACCEL (G)	MEAS SPEC EGCS-S425-250	96j996j 15tb04 (Y)	18-Feb-15	.7797 mv/g at 10V exc	2-Jun-15	.7780 mv/g at 10V exc	-0.2	.07797 mv/v/g	FULL	50 G	Used on LOIS tests 6732-6738
31	INT CHEST Z ACCEL (G)	MEAS SPEC EGCS-S425-250	M080XU	4-May-15	.4460 mv/g at 10V exc	27-May-15	.4465 mv/g at 10V exc	0.1	.04460 mv/v/g	FULL	100 G	Used on AERO50 tests 6665-6699
31	INT CHEST Z ACCEL (G)	MEAS SPEC EGCS-S425-250	R13086	4-May-15	.5877 mv/g at 10V exc	18-Jun-15	.5874 mv/g at 10V exc	-0.1	.05877 mv/v/g	FULL	100 G	Used on AUTO50 tests 6700-6723
31	INT CHEST Z ACCEL (G)	MEAS SPEC EGCS-S425-250	R130P1	4-May-15	.6360 mv/g at 10V exc	1-Jun-15	.6388 mv/g at 10V exc	0.4	.06360 mv/v/g	FULL	100 G	Used on LARD tests 6724-6731
31	INT CHEST Z ACCEL (G)	MEAS SPEC EGCS-S425-250	96j996j 15tb04 (Z)	18-Feb-15	.8164 mv/g at 10V exc	2-Jun-15	.8156 mv/g at 10V exc	-0.1	.08164 mv/v/g	FULL	100 G	Used on LOIS tests 6732-6738
32	INT CHEST Ry ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10178	26-Feb-15	3.58 uv/rad/sec2 at 10V exc	01-Jun-15	3.57 uv/rad/sec2 at 10V exc	-0.3	.000358 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on AERO50 tests 6665-6699
32	INT CHEST Ry ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10175	27-Apr-15	3.49 uv/rad/sec2 at 10V exc	18-Jun-15	3.38 uv/rad/sec2 at 10V exc	-3.0	.000349 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on AUTO50 tests 6700-6723
32	INT CHEST Ry ANG ACCEL (RAD/SEC2)	ENDEVCO 7302BM4	10213	13-May-15	6.11 uv/rad/sec2 at 10V exc	1-Jun-15	4.95 uv/rad/sec2 at 10V exc	-2.6	.000611 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on LARD tests 6724-6731
32	INT CHEST Ry ANG ACCEL (RAD/SEC2)	ENDEVCO 7302B	10020	12-Feb-15	4.77 uv/rad/sec2 at 10V exc	2-Jun-15	4.80 uv/rad/sec2 at 10V exc	0.6	.000477 mv/v/rad/sec2	FULL	5000 RAD/SEC2	Used on LOIS tests 6732-6738
33	INT LUMBAR X ACCEL (LB)	ENTRAN EGV3-F-250	Y1117L (X)	12-Feb-15	.5976 mv/g at 10V exc	27-May-15	.5998 mv/g at 10V exc	0.4	.05976 mv/v/g	FULL	100 G	Used on AERO50 tests 6665-6699
33	INT LUMBAR X ACCEL (LB)	MEAS SPEC EGCS-S425-250	R1307Z	4-May-15	.6179 mv/g at 10V exc	18-Jun-15	.6176 mv/g at 10V exc	-0.1	.06179 mv/v/g	FULL	100 G	Used on AUTO50 tests 6700-6723
33	INT LUMBAR X ACCEL (LB)	ENTRAN EGV3-F-250	M110KX (X)	15-Feb-15	.7440 mv/g at 10V exc	01-Jun-15	.7449 mv/g at 10V exc	0.1	.07440 mv/v/g	FULL	100 G	Used on LARD tests 6724-6731
33	INT LUMBAR X ACCEL (LB)	ENTRAN EGV3-F-250	Y117Q (X)	18-Feb-15	.8015 mv/g at 10V exc	02-Jun-15	.8133 mv/g at 10V exc	1.5	.08015 mv/v/g	FULL	100 G	Used on LOIS tests 6732-6738
34	INT LUMBAR Y ACCEL (LB)	ENTRAN EGV3-F-250	Y1117L (Y)	12-Feb-15	.6499 mv/g at 10V exc	27-May-15	.6519 mv/g at 10V exc	0.3	.06499 mv/v/g	FULL	100 G	Used on AERO50 tests 6665-6699
34	INT LUMBAR Y ACCEL (LB)	MEAS SPEC EGCS-S425-250	R130P2	4-May-15	.5896 mv/g at 10V exc	18-Jun-15	.5894 mv/g at 10V exc	-0.1	.05896 mv/v/g	FULL	100 G	Used on AUTO50 tests 6700-6723
34	INT LUMBAR Y ACCEL (LB)	ENTRAN EGV3-F-250	M110KX (Y)	15-Feb-15	.7203 mv/g at 10V exc	01-Jun-15	.7121 mv/g at 10V exc	-1.1	.07203 mv/v/g	FULL	100 G	Used on LARD tests 6724-6731
34	INT LUMBAR Y ACCEL (LB)	ENTRAN EGV3-F-250	Y117Q (Y)	18-Feb-15	.7924 mv/g at 10V ex	02-Jun-15	.7941 mv/g at 10V exc	0.2	.07924 mv/v/g	FULL	100 G	Used on LOIS tests 6732-6738
35	INT LUMBAR Z ACCEL (LB)	ENTRAN EGV3-F-250	Y1117L (Z)	12-Feb-15	.8278 mv/g at 10V exc	27-May-15	.8295 mv/g at 10V exc	0.2	.08278 mv/v/g	FULL	100 G	Used on AERO50 tests 6665-6699
35	INT LUMBAR Z ACCEL (LB)	MEAS SPEC EGCS-S425-250	R13087	4-May-15	.5755 mv/g at 10V exc	17-Jun-15	.5707 mv/g at 10V exc	-0.8	.05755 mv/v/g	FULL	100 G	Used on AUTO50 tests 6700-6723

5 MAY 2015

35	INT LUMBAR Z ACCEL (LB)	ENTRAN EGV3-F-250	M110KX (Z)	15-Feb-15	.6892 mv/g at 10V exc	01-Jun-15	.6895 mv/g at 10V exc	0.0	.06892 mv/v/g	FULL	100 G	Used on LARD tests 6724-6731
35	INT LUMBAR Z ACCEL (LB)	ENTRAN EGV3-F-250	Y117Q (Z)	18-Feb-15	.8238 mv/g at 10V exc	02-Jun-15	.8235 mv/g at 10V exc	0.0	.08238 mv/v/g	FULL	100 G	Used on LOIS tests 6732-6738
36	INT LUMBAR X FORCE LB)	DENTON 1914A	154	1-May-15	6.64 uv/lb at 10V exc	05-Jun-15	6.61 uv/lb at 10V exc	-0.5	.000664 mv/v/lb	FULL	3000 LB	Used on AERO50 tests 6665-6699
36	INT LUMBAR X FORCE LB)	DENTON 1842	DP1102	3-Dec-13	3.25 uv/lb at 10V exc	21-Jul-15	3.25 uv/lb at 10V exc	0.0	.000325 mv/v/lb	FULL	3000 LB	Used on AUTO50 tests 6700-6723
36	INT LUMBAR X FORCE LB)	DENTON 1914A	390	1-May-15	6.85 uv/lb aat 10V exc	04-Jun-15	6.81 uv/in-lb at 10V exc	-0.6	.000685 mv/v/lb	FULL	3000 LB	Used on LARD tests 6724-6731
36	INT LUMBAR X FORCE LB)	DENTON 1914A	400	13-Mar-15	6.63 uv/lb at 10V exc	05-Jun-15	6.65 uv/lb at 10V exc	0.3	.000663 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6732-6738
37	INT LUMBAR Y FORCE LB)	DENTON 1914A	154	1-May-15	6.52 uv/lb at 10V exc	5-Jun-15	6.49 uv/lb at 10V exc	-0.5	.000652 mv/vlb	FULL	3000 LB	Used on AERO50 tests 6665-6699
37	INT LUMBAR Y FORCE LB)	DENTON 1914A	390	1-May-15	6.70 uv/lb at 10V exc	4-Jun-15	6.69 uv/lb at 10V exc	-0.2	.000670 mv/v/lb	FULL	3000 LB	Used on LARD tests 6724-6731
37	INT LUMBAR Y FORCE LB)	DENTON 1914A	400	13-Mar-15	6.69 uv/lb at 10V exc	5-Jun-15	6.71 uv/in-lb at 10V exc	0.3	.000669 mv/v/lb	FULL	3000 LB	Used on LOIS tests 6732-6738
38	INT LUMBAR Z FORCE LB)	DENTON 1914A	154	1-May-15	2.74 uv/lb at 10V exc	5-Jun-15	2.73 uv/lb at 10V exc	-0.4	.000274 mv/v/lb	FULL	5000 LB	Used on AERO50 tests 6665-6699
38	INT LUMBAR Z FORCE LB)	DENTON 1842	DP1102	3-Dec-13	3.25 uv/lb at 10V exc	21-Jul-15	3.25 uv/lb at 10V exc	0.0	.000325 mv/v/lb	FULL	5000 LB	Used on AUTO50 tests 6700-6723
38	INT LUMBAR Z FORCE LB)	DENTON 1914A	390	1-May-15	2.81 uv/lb at 10V exc	4-Jun-15	2.80 uv/lb at 10V exc	-0.4	.000281 mv/v/lb	FULL	5000 LB	Used on LARD tests 6724-6731
38	INT LUMBAR Z FORCE LB)	DENTON 1914A	400	13-Mar-15	2.73 uv/lb at 10V exc	5-Jun-15	2.73 uv/lb at 10V exc	0.0	.000273 mv/v/lb	FULL	5000 LB	Used on LOIS tests 6732-6738
39	INT LUMBAR Mx TORQUE (IN-LB)	DENTON 1914A	154	1-May-15	5.11 uv/in-lb at 10V exc	05-Jun-15	5.14 uv/in-lb at 10V exc	0.6	.000511 mv/v/in-lb	FULL	3000 IN-LB	Used on AERO50 tests 6665-6699
39	INT LUMBAR Mx TORQUE (IN-LB)	DENTON 1914A	390	1-May-15	5.27 uv/lb at 10V exc	4-Jun-15	5.28 uv/in-lb at 10V exc	0.2	.000527 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6724-6731
39	INT LUMBAR Mx TORQUE (IN-LB)	DENTON 1914A	400	13-Mar-15	5.19 uv/in-lb at 10V exc	5-Jun-15	5.16 uv/in-lb at 10V exc	-0.6	.000519 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6732-6738
40	INT LUMBAR My TORQUE (IN-LB)	DENTON 1914A	154	1-May-15	5.12 uv/in-lb at 10V exc	5-Jun-15	5.12 uv/in-lb at 10V exc	0.0	.000512 mv/v/in-lb	FULL	3000 IN-LB	Used on AERO50 tests 6665-6699
40	INT LUMBAR My TORQUE (IN-LB)	DENTON 1842	DP1102	3-Dec-13	3.64 uv/in-lb at 10V exc	21-Jul-15	3.67 uv/in-lb at 10V exc	0.8	.000364 mv/v/in-lb	FULL	3000 IN-LB	Used on AUTO50 tests 6700-6723
40	INT LUMBAR My TORQUE (IN-LB)	DENTON 1914A	390	1-May-15	5.28 uv/in-lb at 10V exc	4-Jun-15	5.28 uv/in-lb at 10V exc	0.0	.000528 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6724-6731
40	INT LUMBAR My TORQUE (IN-LB)	DENTON 1914A	400	13-Mar-15	5.16 uv/in-lb at 10V exc	5-Jun-15	5.15 uv/in-lb at 10V exc	-0.2	.000516 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6732-6738
41	INT LUMBAR Mz TORQUE (IN-LB)	DENTON 1914A	154	1-May-15	8.46 uv/in-lb at 10V exc	5-Jun-15	8.41 uv/in-lb at 10V excv	-0.6	.000846 mv/v/in-lb	FULL	3000 IN-LB	Used on AERO50 tests 6665-6699
41	INT LUMBAR Mz TORQUE (IN-LB)	DENTON 1914A	390	1-May-15	8.72 uv/in-lb at 10V exc	4-Jun-15	8.66 uv/in-lb at 10V exc	-0.7	.000872 mv/v/in-lb	FULL	3000 IN-LB	Used on LARD tests 6724-6731

5 MAY 2015

41	INT LUMBAR Mz TORQUE (IN-LB)	DENTON 1914A	400	13-Mar-15	8.60 uv/in-lb at 10V exc	5-Jun-15	8.56 uv/in-lb at 10V exc	-0.5	.000860 mv/v/in-lb	FULL	3000 IN-LB	Used on LOIS tests 6732-6738
42	SLED VELOCITY (FT/SEC)	GLOBE 22A672-2	5	30-Mar-15	24.683 mv/ft/sec				24.683 mvft/sec	FULL	100 FT/SEC	

5 MAY 2015

APPENDIX B. TEST-BY TEST SUMMARY OF VDT TESTS

The following is a review of the test configuration for each of the impact tests conducted on the VDT with a test-by-test summary and brief summary of the data. Tests below that are highlighted as "NO TEST" were not used in the data analysis. Testing was conducted in three groups of tests: 6420 – 6495, 6604 – 6635, and 6724 - 6738.

- **VDT6420** - Cell B6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 6.0 G, Carriage Velocity = 19.50 ft/s, Time-to-Peak = 94.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6421** - Cell B8, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 8.21 G, Carriage Velocity = 23.79 ft/s, Time-to-Peak = 78.4 ms. **No Test –Desired conditions were not achieved, G level too high.**

- **VDT6422** - Cell B8, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 7.96 G, Carriage Velocity = 23.5 ft/s, Time-to-Peak = 73.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6423** - Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.62 G, Carriage Velocity = 27.55 ft/s, Time-to-Peak = 66 ms. **No Test - Desired test conditions were not achieved, G level not met.**

- **VDT6424** - Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 11.1 G, Carriage Velocity = 27.79 ft/s, Time-to-Peak = 72.9 ms. **No Test - Desired test conditions were not achieved, G level too high.**

- **VDT6425** - Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.28 G, Carriage Velocity = 27.68 ft/s, Time-to-Peak = 69.3 ms. **No Test - Desired test conditions were not achieved, G level too high.**

- **VDT6426** - Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.41 G, Carriage Velocity = 27.55 ft/s, Time-to-Peak = 66.7 ms. **No Test - Desired test conditions were not achieved, G level too high.**

- **<u>VDT6427</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.78 G, Carriage Velocity = 27.79 ft/s, Time-to-Peak = 56.7 ms. **No Test - Desired test conditions were not achieved, G level not met.**

- **<u>VDT6428</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.6 G, Carriage Velocity = 27.86 ft/s, Time-to-Peak = 69.6 ms. **No Test - Desired test conditions were not achieved; G level too high, carriage package moved to new DAS channel.**

- **<u>VDT6429</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.08 G, Carriage Velocity = 28.56 ft/s, Time-to-Peak = 72.8 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **<u>VDT6430</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.9 G, Carriage Velocity = 27.83 ft/s, Time-to-Peak = 69.4 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **<u>VDT6431</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.61 G, Carriage Velocity = 27.41 ft/s, Time-to-Peak = 72 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **<u>VDT6432</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.38 G, Carriage Velocity = 26.92 ft/s, Time-to-Peak = 71.8 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **<u>VDT6433</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.72 G, Carriage Velocity = 26.15 ft/s, Time-to-Peak = 76.7 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **<u>VDT6434</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.01 G, Carriage Velocity = 26.35 ft/s, Time-to-Peak = 74.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6435</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.23 G, Carriage Velocity = 26.36 ft/s, Time-to-Peak = 67.9 ms. **No Test - Desired test conditions were not achieved; G level too high due to noise spike on carriage Z accel.**

- **<u>VDT6436</u> -** Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.96 G, Carriage Velocity = 26.35 ft/s, Time-to-Peak = 77.7 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6437</u>** - Cell B10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.83 G, Carriage Velocity = 26.38 ft/s, Time-to-Peak = 76.6 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6438</u>** - Cell B12, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 12.23 G, Carriage Velocity = 29.74 ft/s, Time-to-Peak = 66.7 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6439</u>** - Cell B15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 15.15 G, Carriage Velocity = 33.8 ft/s, Time-to-Peak = 60.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6440</u> -** Cell A6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 6.26 G, Carriage Velocity = 19.59 ft/s, Time-to-Peak = 84.5 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **<u>VDT6441</u>** - Cell A6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 6.09 G, Carriage Velocity = 19.14 ft/s, Time-to-Peak = 85.2 ms. **No Test - Desired test conditions were not achieved; incorrect head Ry angular accel data.**

- **VDT6442** - Cell A6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 5.83 G, Carriage Velocity = 19.14 ft/s, Time-to-Peak = 95.5 ms. **No Test - Desired test conditions were not achieved; incorrect chest accel data.**

- **VDT6443** - Cell A6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 6.29 G, Carriage Velocity = 19.39 ft/s, Time-to-Peak = 106.3 ms. **No Test - Desired test conditions were not achieved; incorrect chest accel data.**

- **VDT6444** - Cell A6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 6.03 G, Carriage Velocity = 19.22 ft/s, Time-to-Peak = 96.7 ms. **No Test - Desired test conditions were not achieved; incorrect chest accel data.**

- **VDT6445** - Cell A6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 6.19 G, Carriage Velocity = 19.38 ft/s, Time-to-Peak = 85.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6446** - Cell A8, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 8.19 G, Carriage Velocity = 23.14 ft/s, Time-to-Peak = 73.4 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **VDT6447** - Cell A8, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 7.9 G, Carriage Velocity = 22.9 ft/s, Time-to-Peak = 84.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6448** - Cell A10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.9 G, Carriage Velocity = 26.18 ft/s, Time-to-Peak = 75.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6449</u> -** Cell A10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.85 G, Carriage Velocity = 26.26 ft/s, Time-to-Peak = 72. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6450</u> -** Cell A10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.95 G, Carriage Velocity = 26.32 ft/s, Time-to-Peak = 70.1 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6451</u> -** Cell A12, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 12.18 G, Carriage Velocity = 29.39 ft/s, Time-to-Peak = 63.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6452</u> -** Cell A15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 15.19 G, Carriage Velocity = 33.24 ft/s, Time-to-Peak = 61.6 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6453</u> -** Cell D6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 6.1 G, Carriage Velocity = 19.44 ft/s, Time-to-Peak = 104.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6454</u> -** Cell D8, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 8.04 G, Carriage Velocity = 23.03 ft/s, Time-to-Peak = 88 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6455</u> -** Cell D10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.93 G, Carriage Velocity = 26.39 ft/s, Time-to-Peak = 75.7 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6456** - Cell D10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.98 G, Carriage Velocity = 26.39 ft/s, Time-to-Peak = 76.6 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6457** - Cell D10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.98 G, Carriage Velocity = 26.42 ft/s, Time-to-Peak = 76.1 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6458** - Cell D12, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 12.2 G, Carriage Velocity = 29.66 ft/s, Time-to-Peak = 69.7 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6459** - Cell D15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 14.8 G, Carriage Velocity = 33.74 ft/s, Time-to-Peak = 67.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6460** - Cell D6, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 6.2 G, Carriage Velocity = 19.82 ft/s, Time-to-Peak = 105.9 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **VDT6461** - Cell D6, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 6.05 G, Carriage Velocity = 19.45 ft/s, Time-to-Peak = 107.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6462** - Cell D8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 7.81 G, Carriage Velocity = 23.07 ft/s, Time-to-Peak = 91.8 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **<u>VDT6463</u> -** Cell D8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 7.88 G, Carriage Velocity = 23.27 ft/s, Time-to-Peak = 90.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6464</u> -** Cell D10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.85 G, Carriage Velocity = 26.74 ft/s, Time-to-Peak = 81.1 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6465</u> -** Cell D10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 10.0 G, Carriage Velocity = 26.96 ft/s, Time-to-Peak = 80.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6466</u> -** Cell D10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.93 G, Carriage Velocity = 26.9 ft/s, Time-to-Peak = 81 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6467</u> -** Cell D12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 11.9 G, Carriage Velocity = 29.95 ft/s, Time-to-Peak = 73.5 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6468</u> -** Cell D15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 14.99 G, Carriage Velocity = 34.17 ft/s, Time-to-Peak = 63.6 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6469</u> -** Cell A6, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 5.99 G, Carriage Velocity = 19.47 ft/s, Time-to-Peak = 107.8 ms. **No Test - Desired test conditions were not achieved; inaccurate neck My data.**

- **<u>VDT6470</u> -** Cell A6, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 6.05 G, Carriage Velocity = 19.45 ft/s, Time-to-Peak = 106.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6471</u> -** Cell A8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 8.01 G, Carriage Velocity = 23.48 ft/s, Time-to-Peak = 90.5 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6472</u> -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.04 G, Carriage Velocity = 27.04 ft/s, Time-to-Peak = 81 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6473</u> -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.23 G, Carriage Velocity = 27.04 ft/s, Time-to-Peak = 81.6 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **<u>VDT6474</u> -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.38 G, Carriage Velocity = 27.3 ft/s, Time-to-Peak = 66.8 ms. **No Test - Desired test conditions were not achieved; G level not met, replaced bad carriage Z accel.**

- **<u>VDT6475</u> -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 11.26 G, Carriage Velocity = 27.38 ft/s, Time-to-Peak = 81.6 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **<u>VDT6476</u> -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.77 G, Carriage Velocity = 27.04 ft/s, Time-to-Peak = 81.1 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **VDT6477 -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.9 G, Carriage Velocity = 27.01 ft/s, Time-to-Peak = 80 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6478 -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.67 G, Carriage Velocity = 27.02 ft/s, Time-to-Peak = 81.5 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **VDT6479 -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.73 G, Carriage Velocity = 27.23 ft/s, Time-to-Peak = 80.2 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **VDT6480 -** Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.70 G, Carriage Velocity = 27.24 ft/s, Time-to-Peak = 80.5 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **VDT6481** - Cell A10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.91 G, Carriage Velocity = 27.46 ft/s, Time-to-Peak = 79.7 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6482** - Cell A12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 11.61 G, Carriage Velocity = 30.08 ft/s, Time-to-Peak = 73.6 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **VDT6483 -** Cell A12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 11.7 G, Carriage Velocity = 30.33 ft/s, Time-to-Peak = 72.6 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **VDT6484** - Cell A12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 11.51 G, Carriage Velocity = 29.84 ft/s, Time-to-Peak = 69.9 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **<u>VDT6485</u> -** Cell A12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 12.09 G, Carriage Velocity = 30.31 ft/s, Time-to-Peak = 67.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6486</u> -** Cell A15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 14.88 G, Carriage Velocity = 33.87 ft/s, Time-to-Peak = 58 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6487</u> -** Cell B6, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 6.03 G, Carriage Velocity = 19.37 ft/s, Time-to-Peak = 111.1 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6488</u> -** Cell B8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 8.05 G, Carriage Velocity = 23.44 ft/s, Time-to-Peak = 82.6 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6489</u> -** Cell B10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.35 G, Carriage Velocity = 27.27 ft/s, Time-to-Peak = 69.8 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **<u>VDT6490</u> -** Cell B10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.06 G, Carriage Velocity = 26.94 ft/s, Time-to-Peak = 71.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6491</u> -** Cell B10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.83 G, Carriage Velocity = 26.85 ft/s, Time-to-Peak = 74.5 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6492** - Cell B10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.02 G, Carriage Velocity = 26.9 ft/s, Time-to-Peak = 77.7 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6493** - Cell B12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 12.37 G, Carriage Velocity = 30.35 ft/s, Time-to-Peak = 65 ms. **No Test - Desired test conditions were not achieved; G level too high.**

- **VDT6494** - Cell B12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 11.93 G, Carriage Velocity = 30.07 ft/s, Time-to-Peak = 68.6 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6495** - Cell B15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 14.85 G, Carriage Velocity = 33.91 ft/s, Time-to-Peak = 56.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

BREAK IN TESTING FOR THIS SPECIFIC PROGRAM… STARTED BACK WITH TEST 6604

- **<u>VDT6604</u> -** Cell E8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 7.77 G, Carriage Velocity = 23.46 ft/s, Time-to-Peak = 92.2 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **<u>VDT6605</u> -** Cell E8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 8.17 G, Carriage Velocity = 23.93 ft/s, Time-to-Peak = 81.1 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6606</u> -** Cell E10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.95 G, Carriage Velocity = 27.46 ft/s, Time-to-Peak = 80.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6607</u> -** Cell E10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.94 G, Carriage Velocity = 27.41 ft/s, Time-to-Peak = 80.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6608</u> -** Cell E10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.89 G, Carriage Velocity = 27.25 ft/s, Time-to-Peak = 82.1 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6609</u> -** Cell E12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 12.12 G, Carriage Velocity = 30.54 ft/s, Time-to-Peak = 67.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6610</u> -** Cell E15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 14.97 G, Carriage Velocity = 34.38 ft/s, Time-to-Peak = 60 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6611</u> -** Cell E6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 5.91 G, Carriage Velocity = 19.45 ft/s, Time-to-Peak = 106.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6612</u> -** Cell E8, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 8.0 G, Carriage Velocity = 23.14 ft/s, Time-to-Peak = 84.2 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6613</u> -** Cell E10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.79 G, Carriage Velocity = 26.4 ft/s, Time-to-Peak = 77.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6614</u> -** Cell E10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 10.1 G, Carriage Velocity = 26.63 ft/s, Time-to-Peak = 76.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6615</u> -** Cell E10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 9.88 G, Carriage Velocity = 26.6 ft/s, Time-to-Peak = 80.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6616</u> -** Cell E12, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 11.82 G, Carriage Velocity = 29.43 ft/s, Time-to-Peak = 70.7 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6617</u> -** Cell E15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 14.82 G, Carriage Velocity = 33.58 ft/s, Time-to-Peak = 62 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6618 -** Cell CN6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 6.02 G, Carriage Velocity = 19.69 ft/s, Time-to-Peak = 104.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6619** - Cell CN8, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 7.87 G, Carriage Velocity = 23.13 ft/s, Time-to-Peak = 90.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6620** - Cell CN10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 10.11 G, Carriage Velocity = 26.7 ft/s, Time-to-Peak = 76.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6621** - Cell CN10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 9.88 G, Carriage Velocity = 26.6 ft/s, Time-to-Peak = 80 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6622** - Cell CN10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 9.73 G, Carriage Velocity = 26.58 ft/s, Time-to-Peak = 82.4 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **VDT6623** - Cell CN10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 9.93 G, Carriage Velocity = 26.71 ft/s, Time-to-Peak = 80.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6624** - Cell CN12, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 11.96 G, Carriage Velocity = 29.63 ft/s, Time-to-Peak = 71.5 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6625** - Cell CN15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 15.02 G, Carriage Velocity = 33.8 ft/s, Time-to-Peak = 61.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6626** - Cell CN6, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 5.94 G, Carriage Velocity = 19.56 ft/s, Time-to-Peak = 105.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6627** - Cell CN8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 7.77 G, Carriage Velocity = 23.79 ft/s, Time-to-Peak = 89.4 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **VDT6628** - Cell CN8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 8.11 G, Carriage Velocity = 24.03 ft/s, Time-to-Peak = 82.5 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6629** - Cell CN10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 9.87 G, Carriage Velocity = 27.43 ft/s, Time-to-Peak = 78.2 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6630** - Cell CN10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 10.09 G, Carriage Velocity = 27.44 ft/s, Time-to-Peak = 77.6 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6631** - Cell CN10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 9.82 G, Carriage Velocity = 27.42 ft/s, Time-to-Peak = 77.6 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **<u>VDT6632</u> -** Cell CN10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 9.98 G, Carriage Velocity = 27.54 ft/s, Time-to-Peak = 77.5 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6633</u> -** Cell CN12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 11.91 G, Carriage Velocity = 30.68 ft/s, Time-to-Peak = 70.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6634</u> -** Cell CN15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 14.52 G, Carriage Velocity = 34.26 ft/s, Time-to-Peak = 64.7 ms. **No Test - Desired test conditions were not achieved; G level not met.**

- **<u>VDT6635</u> -** Cell CN15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: None. Input summary: Carriage Z Accel. = 14.79 G, Carriage Velocity = 34.34 ft/s, Time-to-Peak = 64.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

BREAK IN TESTING FOR THIS SPECIFIC PROGRAM… STARTED BACK WITH TEST 6724

- **VDT6724** - Cell C6, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 5.95 G, Carriage Velocity = 19.69 ft/s, Time-to-Peak = 104.5 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6725** - Cell C8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 7.82 G, Carriage Velocity = 23.79 ft/s, Time-to-Peak = 81.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6726** - Cell C8, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 7.84 G, Carriage Velocity = 23.91 ft/s, Time-to-Peak = 83.3 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6727** - Cell C10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.81 G, Carriage Velocity = 27.51 ft/s, Time-to-Peak = 78.1 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6728** - Cell C10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.18 G, Carriage Velocity = 27.72 ft/s, Time-to-Peak = 71.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6729** - Cell C10, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 10.02 G, Carriage Velocity = 27.6 ft/s, Time-to-Peak = 77.5 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **VDT6730** - Cell C12, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 11.91 G, Carriage Velocity = 30.51 ft/s, Time-to-Peak = 71 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6731</u> -** Cell C15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 14.74 G, Carriage Velocity = 34.6 ft/s, Time-to-Peak = 64 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6732</u> -** Cell C6, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 6 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 5.98 G, Carriage Velocity = 19.63 ft/s, Time-to-Peak = 103.9 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6733</u> -** Cell C8, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 8 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 7.89 G, Carriage Velocity = 23.17 ft/s, Time-to-Peak = 83 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6734</u> -** Cell C10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.78 G, Carriage Velocity = 26.67 ft/s, Time-to-Peak = 79.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6735</u> -** Cell C10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.78 G, Carriage Velocity = 26.78 ft/s, Time-to-Peak = 78.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6736</u> -** Cell C10, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 10 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 9.96 G, Carriage Velocity = 26.88 ft/s, Time-to-Peak = 80.8 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6737</u> -** Cell C12, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 12 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 11.83 G, Carriage Velocity = 29.65 ft/s, Time-to-Peak = 72.1 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

- **<u>VDT6738</u> -** Cell C15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 14.72 G, Carriage Velocity = 33.69 ft/s, Time-to-Peak = 65.4 ms. **Successful Test – All electronic data channels were present and continuous, data was successfully collected, desired test condition was achieved.**

APPENDIX C. SAMPLE DATA SHEETS

Examples of test data collected during the program will show the post-test processed data for the five different data sets used for the comparative assessments including baseline, headrest, helmet, harness, and combined equipment configurations. A example 15 G test will be shown for each test series, and are identified below.

VDT PARAMETRIC ASSESSMENT: BASELINE

- **TEST 6452** - Cell A15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 15.19 G

VDT PARAMETRIC ASSESSMENT: HEADREST FORWARD

- **TEST 6439** - Cell B15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5” forward from seatback; RESTRAINT: Torso Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 15.15 G

VDT PARAMETRIC ASSESSMENT: HEAVY HELMET

- **TEST 6738** - Cell C15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Torso Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: ACES II. Input summary: Carriage Z Accel. = 14.72 G

VDT PARAMETRIC ASSESSMENT: SEAT MOUNTED HARNESS

- **TEST 6468** - Cell D15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, seatback and headrest inline; RESTRAINT: Simplified Combined Harness; HELMET/MASK: HGU-55/P, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 14.99 G

VDT PARAMETRIC ASSESSMENT: JSF CONFIGURATION

- **TEST 6617 (LOIS)** - Cell E15, VDT Plunger 102; SUBJECT: LOIS manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 14.82 G

- **TEST 6610 (LARD)** - Cell E15, VDT Plunger 102; SUBJECT: LARD manikin; IMPACT: 15 G; CONFIGURATION: +z-axis impact, Zero degree offset, headrest extended 2.5" forward from seatback; RESTRAINT: Simplified Combined Harness; HELMET/MASK: JSF Gen II, MBU-20P; SEAT CUSHION: MB. Input summary: Carriage Z Accel. = 14.97 G

201404 Test: 6452 Test Date: 140729 Subj: LOIS Wt: 108.0
Nom G: 15.0 Cell: A15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
Kodak Start Time (Ms)				-2466.0	
Reference Mark Time (Ms)				-96.0	
Drop Height (In)		84.65			
Impact Rise Time (Ms)				61.6	
Impact Duration (Ms)				124.7	
Velocity Change (Ft/Sec)		33.24			
CARRIAGE X ACCEL (G)	0.00	4.80	-4.65	49.0	53.0
CARRIAGE Y ACCEL (G)	-0.01	0.87	-1.03	44.0	70.0
CARRIAGE Z ACCEL (G)	0.02	15.19	0.49	59.0	0.0
CARRIAGE RESULTANT (G)	0.12	15.32	0.51	60.0	0.0
INTEGRATED ACCEL (FT/SEC)	32.70	33.24	1.42	5.0	244.0
SEAT X ACCEL (G)	-0.01	4.25	-2.66	16.0	22.0
SEAT Y ACCEL (G)	0.01	0.86	-2.21	14.0	67.0
SEAT Z ACCEL (G)	0.01	15.93	0.30	63.0	0.0
SEAT RESULTANT	0.14	16.10	0.44	54.0	0.0
LEFT LAP X FORCE (LB)	-2.65	-1.97	-8.76	145.0	55.0
LEFT LAP Y FORCE (LB)	6.11	6.97	1.04	11.0	67.0
LEFT LAP Z FORCE (LB)	-28.26	3.95	-30.42	54.0	11.0
LEFT LAP RESULTANT (LB)	29.04	31.44	5.51	11.0	36.0
RIGHT LAP X FORCE (LB)	-3.54	-2.14	-8.45	27.0	54.0
RIGHT LAP Y FORCE (LB)	-0.59	2.20	-0.73	43.0	1.0
RIGHT LAP Z FORCE (LB)	-32.23	2.74	-32.83	54.0	0.0
RIGHT LAP RESULTANT (LB)	32.43	33.04	4.69	1.0	28.0
LEFT SHOULDER X FORCE (LB)	-12.09	-12.01	-60.81	2.0	142.0
LEFT SHOULDER Y FORCE (LB)	3.68	9.80	0.87	88.0	27.0
LEFT SHOULDER Z FORCE (LB)	4.24	43.15	4.51	62.0	2.0
LEFT SHOULDER RESULTANT (LB)	13.33	66.82	13.39	68.0	2.0
RIGHT SHOULDER X FORCE (LB)	-16.15	-10.47	-56.09	244.0	68.0
RIGHT SHOULDER Y FORCE (LB)	-1.89	2.85	-4.25	88.0	26.0
RIGHT SHOULDER Z FORCE (LB)	4.87	43.74	5.01	71.0	1.0
RIGHT SHOULDER RESULTANT (LE	16.98	70.72	11.67	68.0	244.0
INT HEAD X ACCEL (G)	-0.01	1.52	-7.48	51.0	133.0
INT HEAD Y ACCEL (G)	0.00	0.47	-0.39	163.0	78.0
INT HEAD Z ACCEL (G)	-0.02	17.68	-0.22	64.0	129.0
INT HEAD RESULTANT (G)	0.04	17.69	0.01	64.0	0.0
INT HEAD HIC		26.96		46.0	76.0

Page 1 of 3

201404 Test: 6452 Test Date: 140729 Subj: LOIS Wt: 108.0
Nom G: 15.0 Cell: A15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
INT HEAD Ry ANG (RAD/SEC2)	-0.07	366.06	-484.97	70.0	126.0
INT NECK X FORCE (LB)	4.20	17.95	-75.69	49.0	122.0
INT NECK Y FORCE (LB)	0.87	5.12	-5.19	139.0	72.0
INT NECK Z FORCE (LB)	10.18	45.80	-169.79	130.0	65.0
INT NECK RESULTANT (LB)	11.06	169.96	6.59	65.0	235.0
INT NECK Mx TORQUE (IN-LB)	4.62	30.33	-12.54	84.0	145.0
INT NECK My TORQUE (IN-LB)	-12.97	93.24	-15.80	105.0	244.0
INT NECK Mz TORQUE (IN-LB)	-3.54	0.94	-12.19	90.0	153.0
INT NECK TORQUE RES (IN-LB)	14.24	94.77	4.29	105.0	224.0
INT CHEST X ACCEL (G)	-0.01	0.77	-2.48	33.0	73.0
INT CHEST Y ACCEL (G)	-0.07	1.20	-0.27	86.0	35.0
INT CHEST Z ACCEL (G)	0.00	17.22	0.07	62.0	0.0
INT CHEST RESULTANT (G)	0.10	17.27	0.11	62.0	1.0
INT LUMBAR X ACCEL (G)	0.01	3.99	-0.30	72.0	13.0
INT LUMBAR Y ACCEL (G)	-0.06	2.19	-0.61	51.0	29.0
INT LUMBAR Z ACCEL (G)	0.00	18.26	0.09	59.0	2.0
INT LUMBAR RESULTANT (G)	0.09	18.37	0.13	59.0	2.0
INT LUMBAR X FORCE (LB)	-11.30	233.23	-11.95	66.0	4.0
INT LUMBAR Y FORCE (LB)	-2.53	-0.98	-43.60	11.0	61.0
INT LUMBAR Z FORCE (LB)	0.95	2.89	-771.68	7.0	62.0
INT LUMBAR FORCE RESULTANT (	11.68	805.34	9.35	62.0	15.0
INT LUMBAR Mx TORQUE (IN-LB)	50.16	60.89	-178.34	15.0	72.0
INT LUMBAR My TORQUE (IN-LB)	35.05	41.43	-642.58	243.0	63.0
INT LUMBAR Mz TORQUE (IN-LB)	5.68	6.19	-42.80	0.0	74.0
INT LUMBAR TORQUE RESULTANT	61.48	666.73	26.74	63.0	222.0

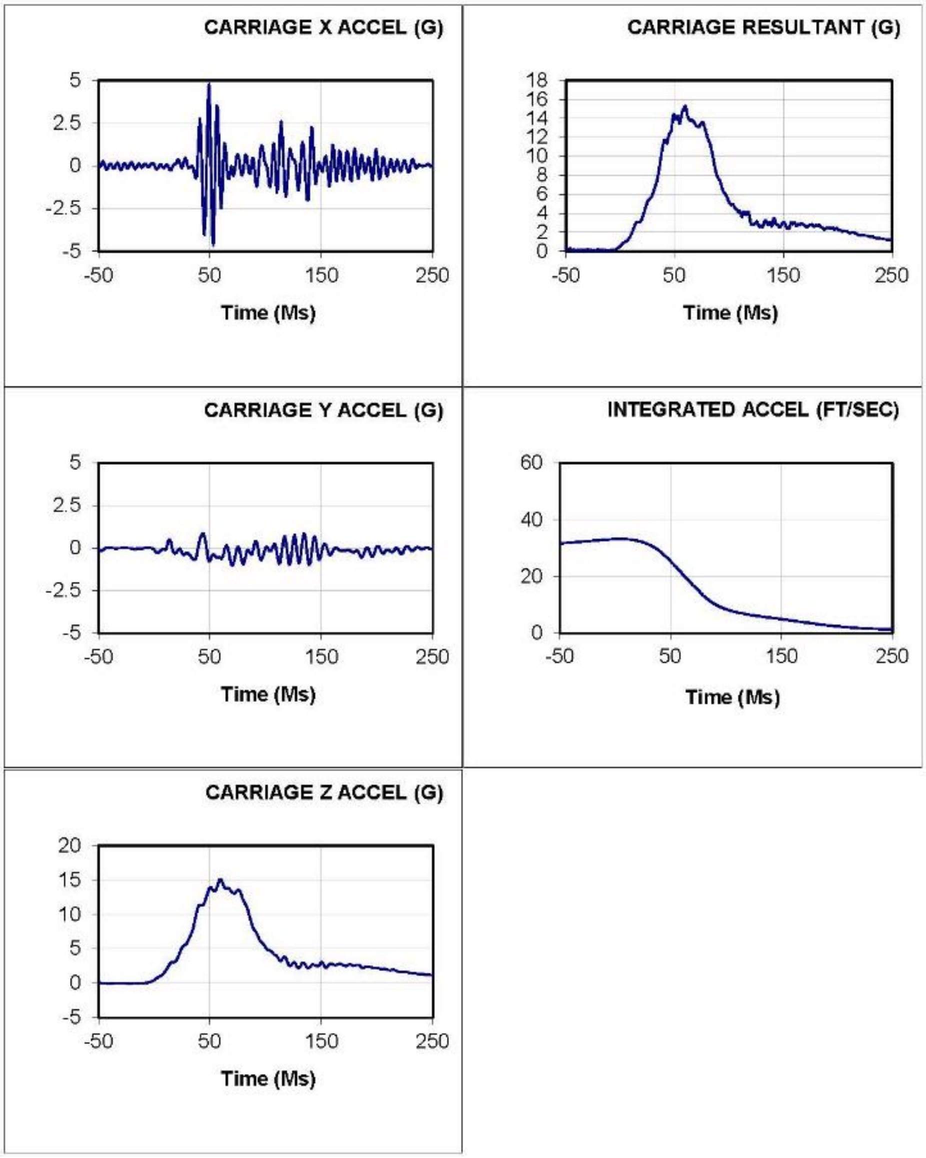
Page 2 of 3

201404 Test: 6452 Test Date: 140729 Subj: LOIS Wt: 108.0
Nom G: 15.0 Cell: A15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
NIJ SHEAR (LB)		17.95	-75.69	49.0	122.0
NIJ TENSION (LB)		45.80		130.0	
NIJ COMPRESSION (LB)		-169.79		65.0	
NIJ FLEXION (IN-LB)		136.14		108.0	
NIJ EXTENSION (IN-LB)		22.83		253.0	
NIJ NTF	0.0000	0.1374	0.0000	129.0	0.0
NIJ NTE	0.0374	0.0396	0.0000	0.0	21.0
NIJ NCF	0.0000	0.2038	0.0000	64.0	0.0
NIJ NCE	0.0000	0.0846	0.0000	34.0	0.0
NIJ NTF AIS >= 2		0.13			
NIJ NTF AIS >= 3		0.05			
NIJ NTF AIS >= 4		0.07			
NIJ NTF AIS >= 5		0.03			
NIJ NTE AIS >= 2		0.12			
NIJ NTE AIS >= 3		0.04			
NIJ NTE AIS >= 4		0.07			
NIJ NTE AIS >= 5		0.02			
NIJ NCF AIS >= 2		0.14			
NIJ NCF AIS >= 3		0.06			
NIJ NCF AIS >= 4		0.08			
NIJ NCF AIS >= 5		0.03			
NIJ NCE AIS >= 2		0.12			
NIJ NCE AIS >= 3		0.04			
NIJ NCE AIS >= 4		0.07			
NIJ NCE AIS >= 5		0.02			
MNIx	0.0078	0.0512	0.0000	84.0	178.0
NMIz	0.0060	0.0206	0.0000	153.0	29.0

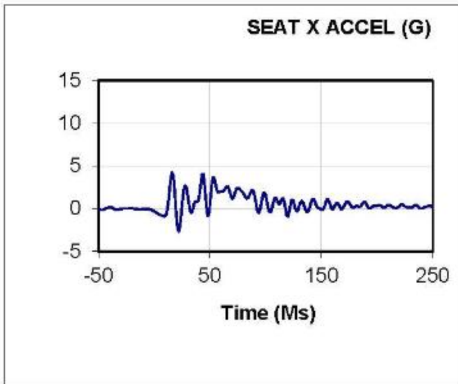
Page 3 of 3

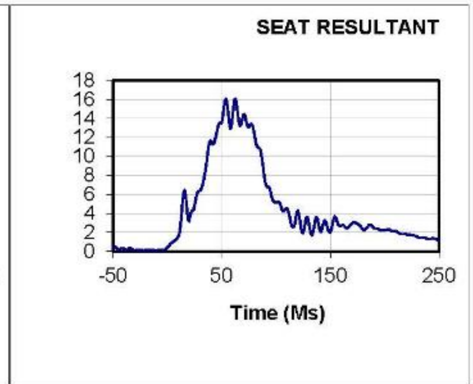
201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15

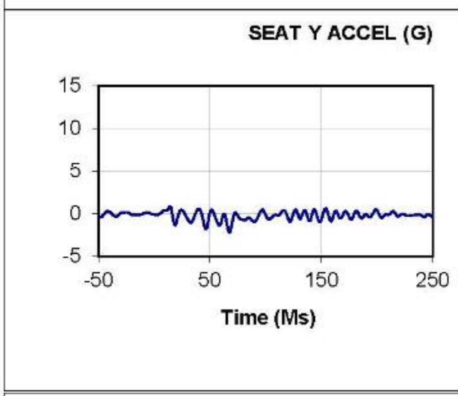


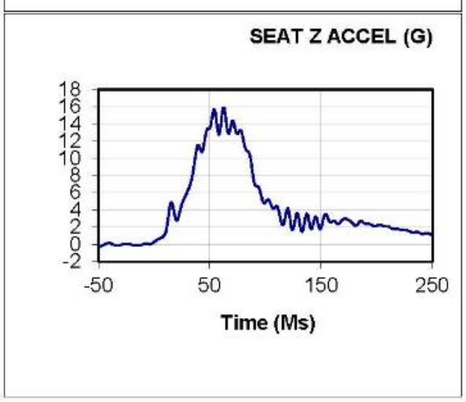
Page 1 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



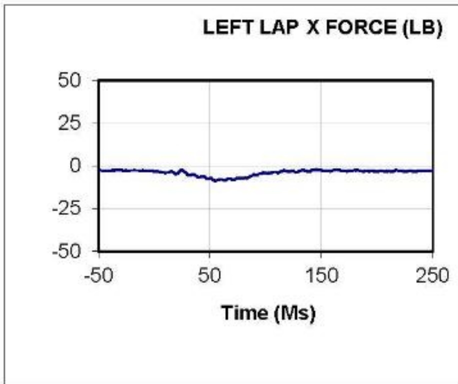


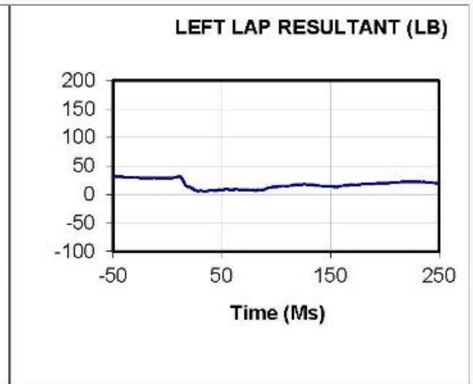


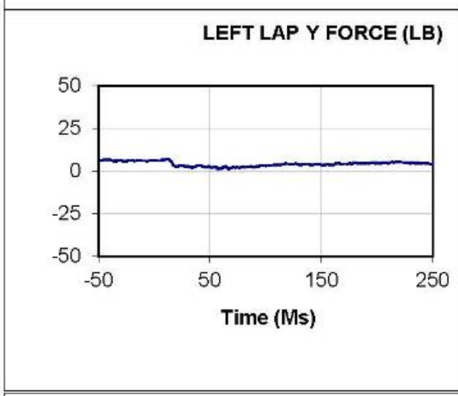


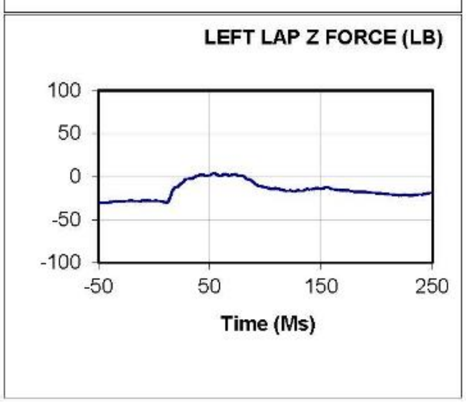
Page 2 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



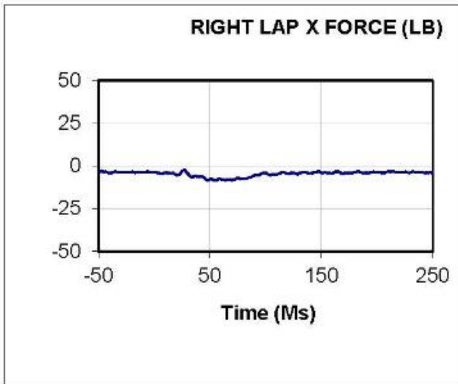


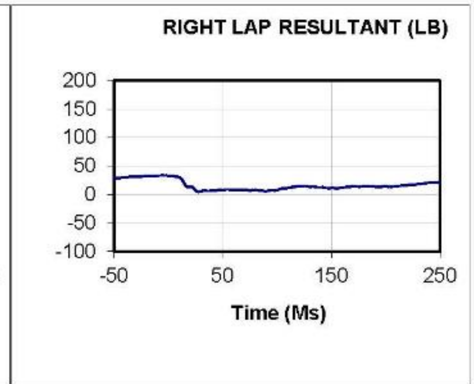


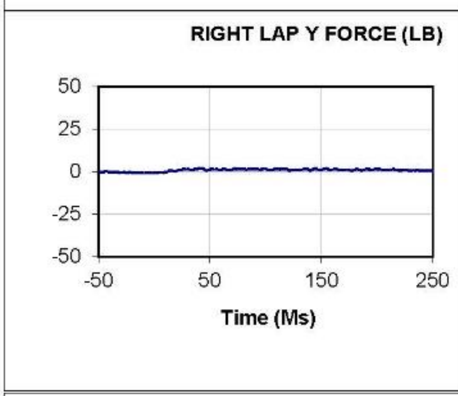


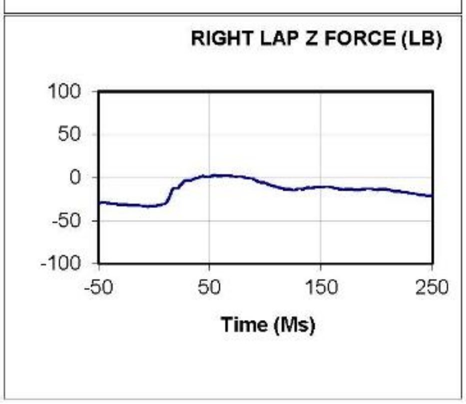
Page 3 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



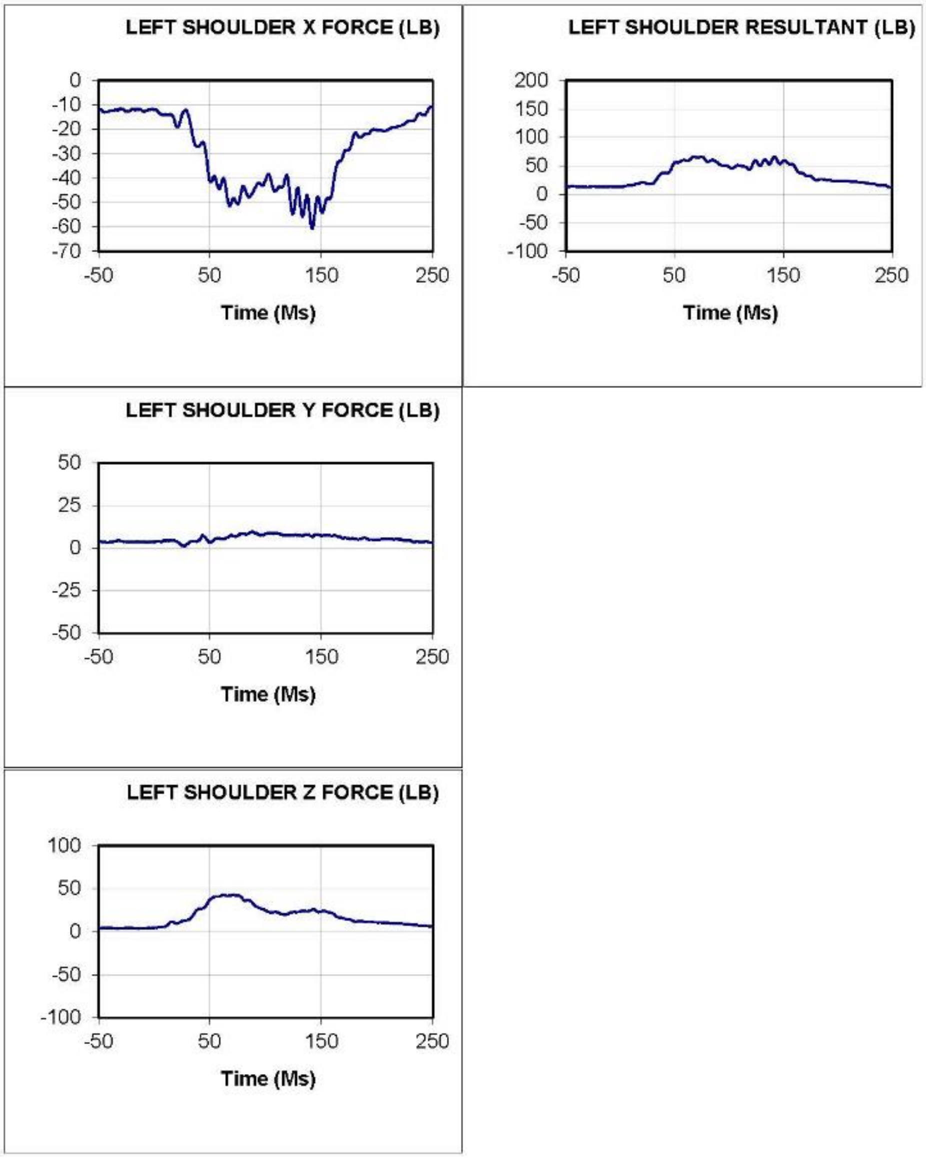




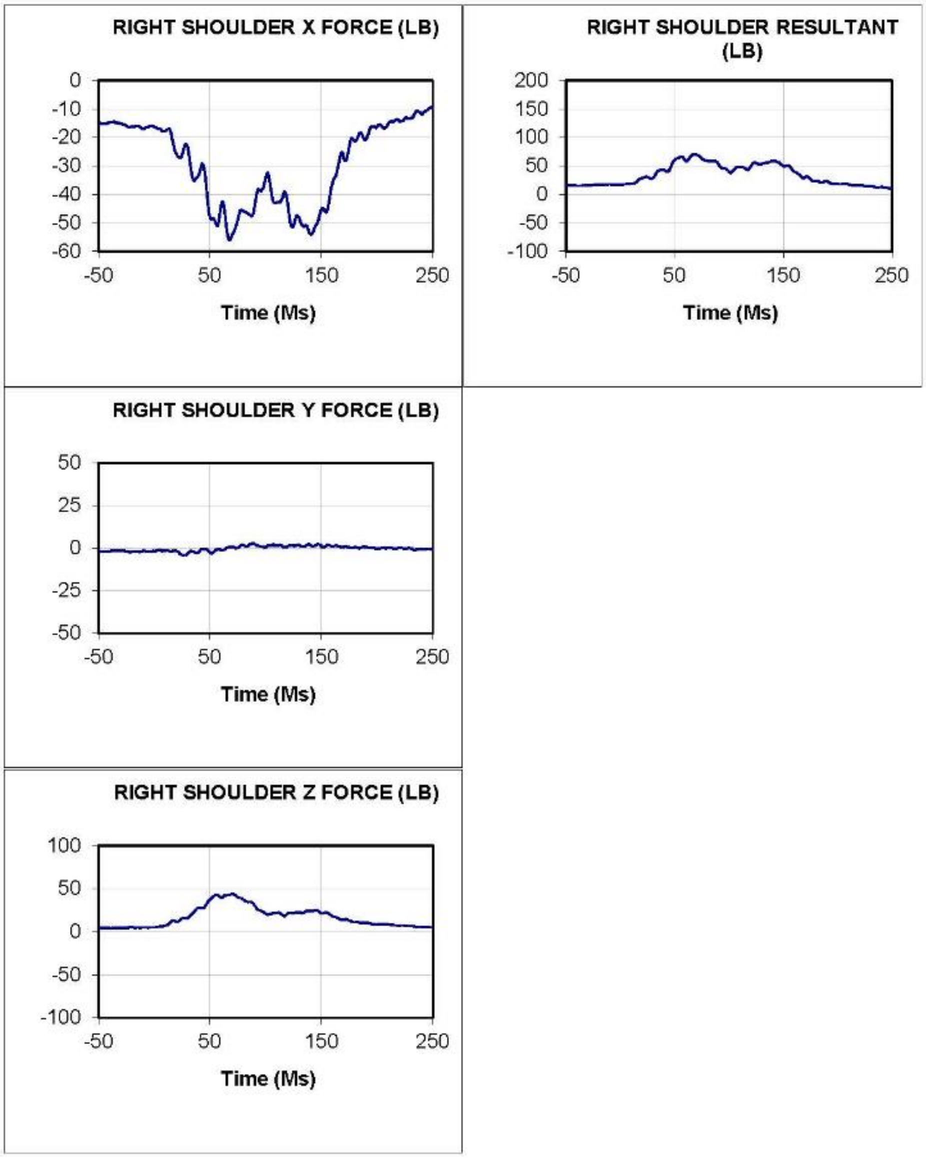


Page 4 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15

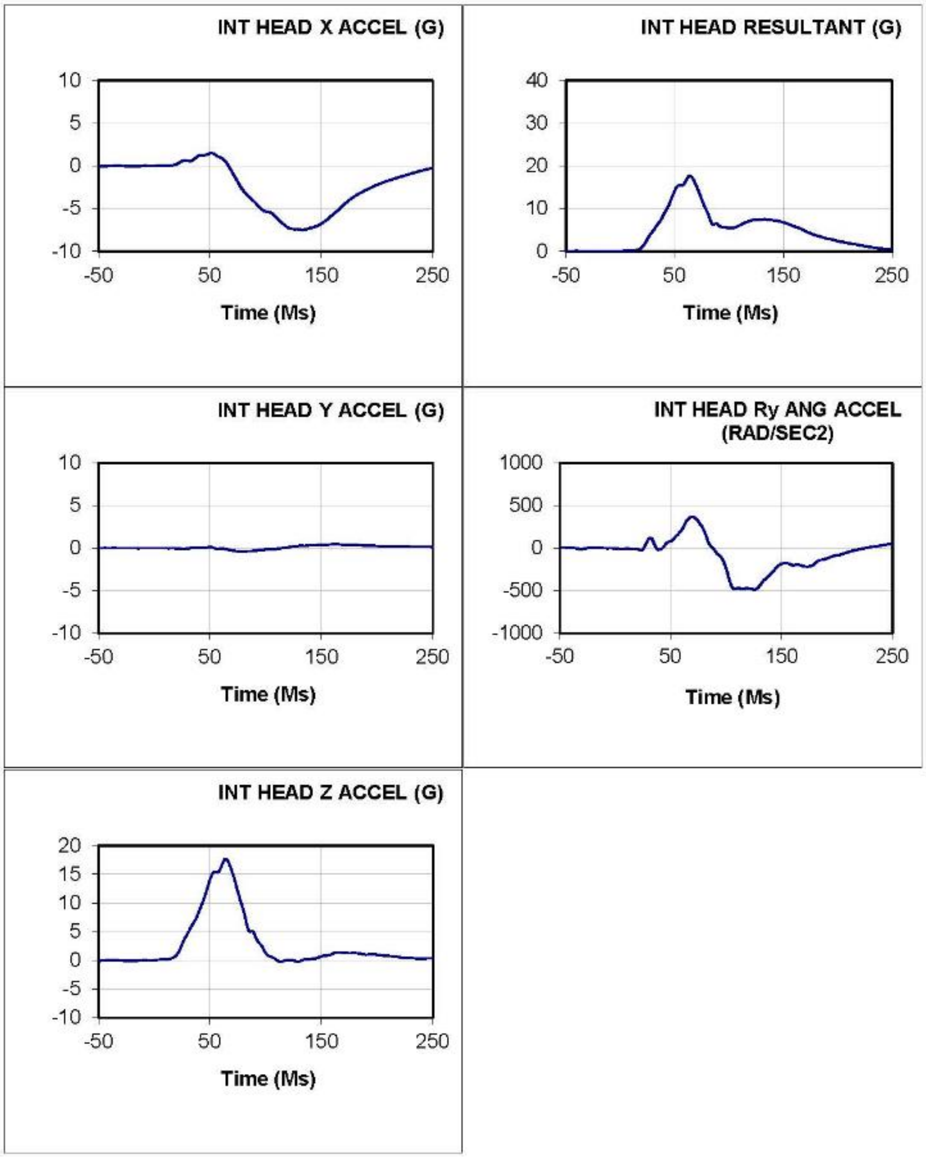


201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



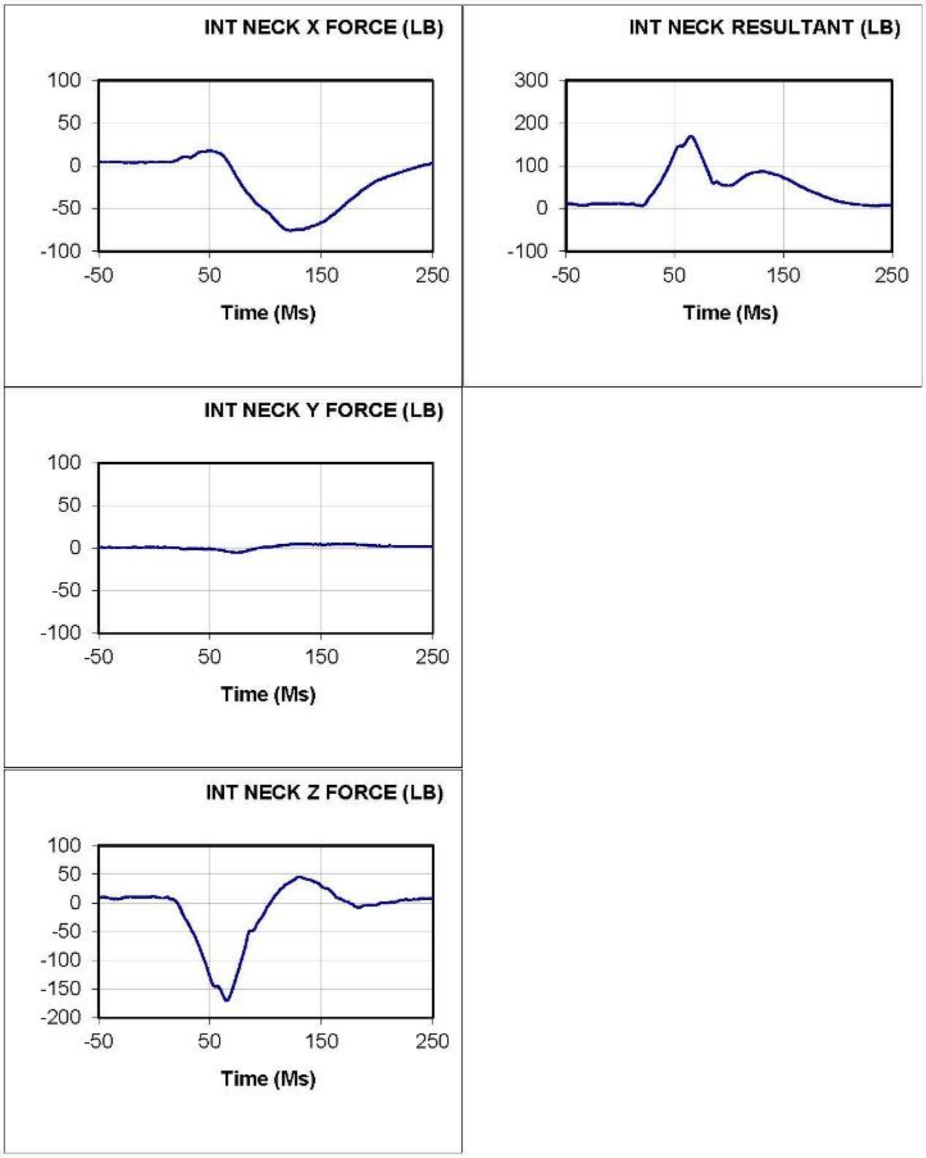
Page 6 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



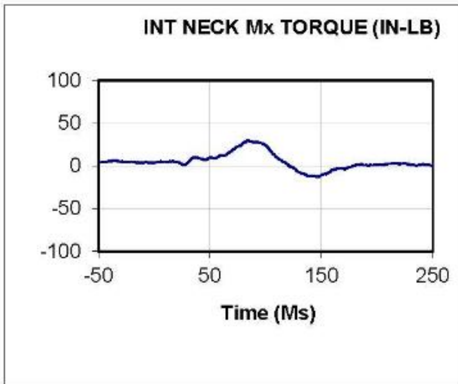
Page 7 of 14

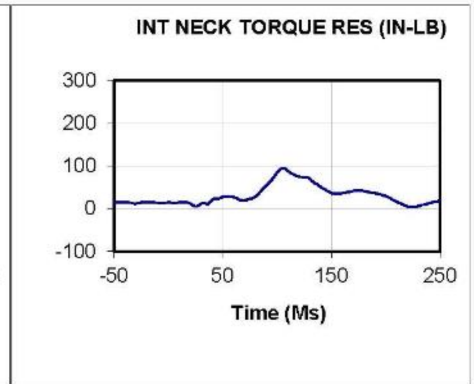
201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15

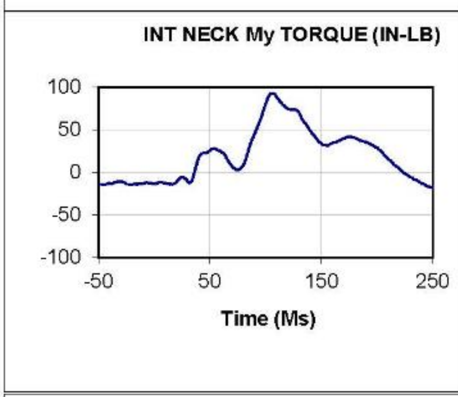


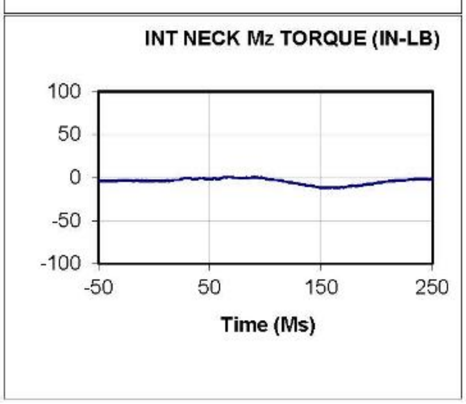
Page 8 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



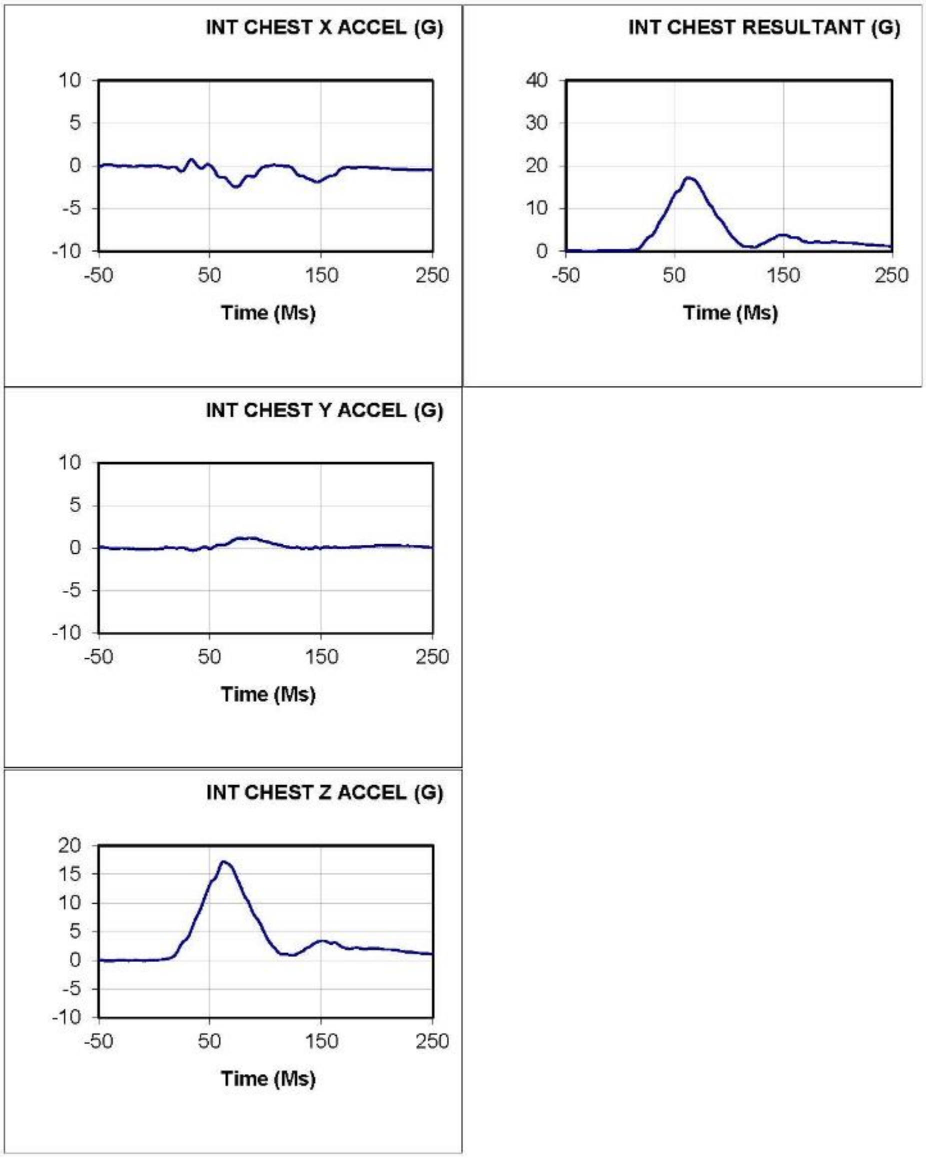






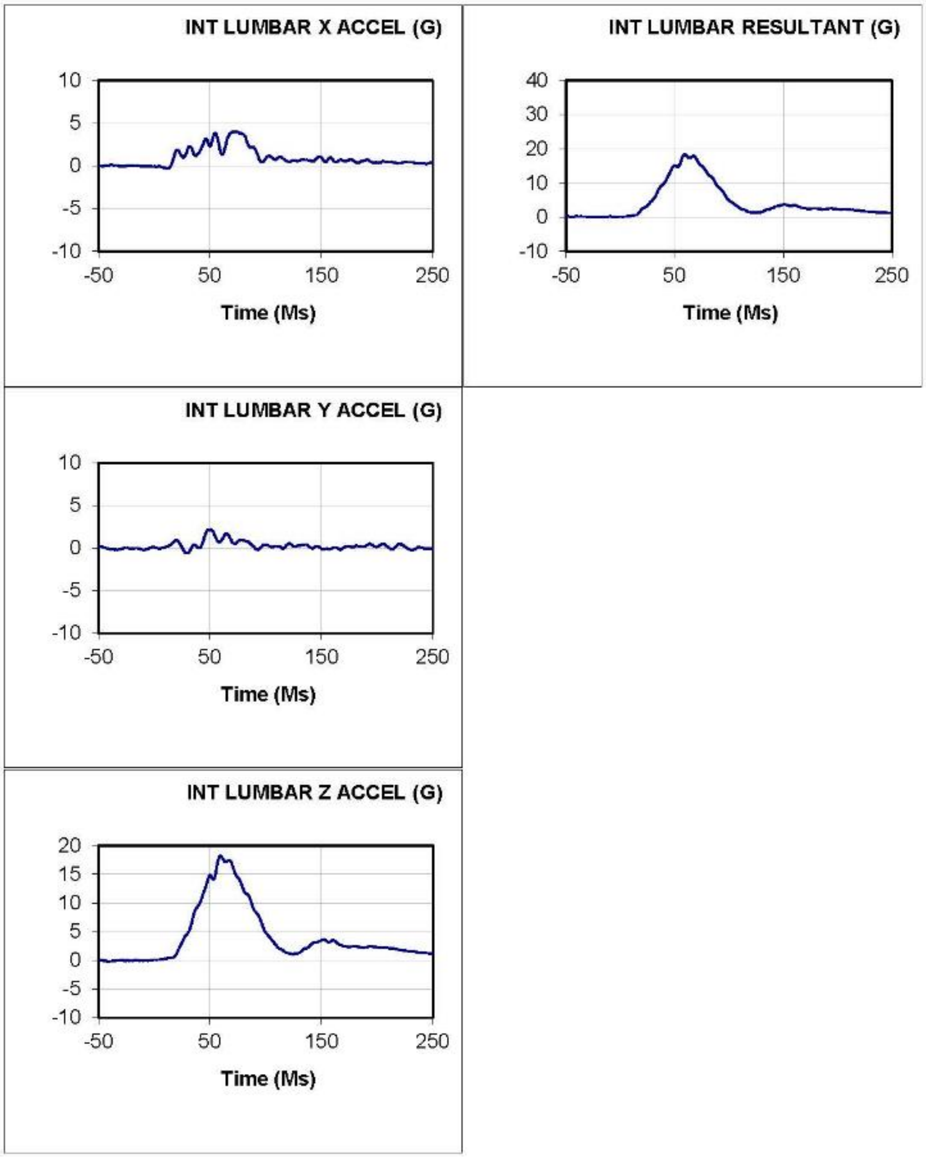
Page 9 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



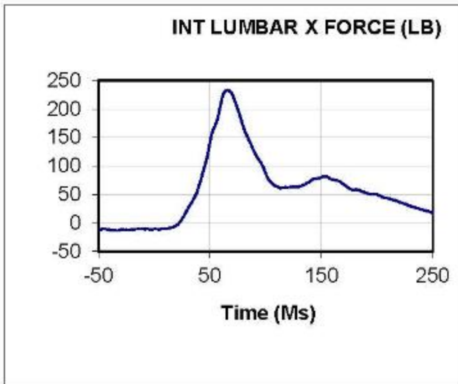
Page 10 of 14

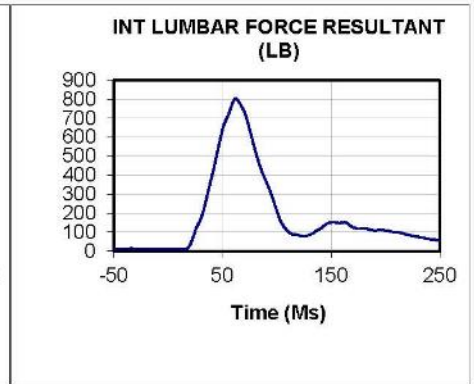
201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15

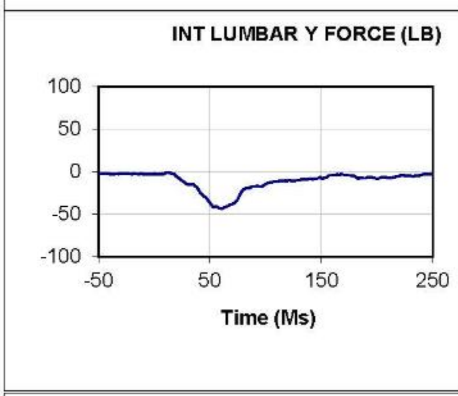


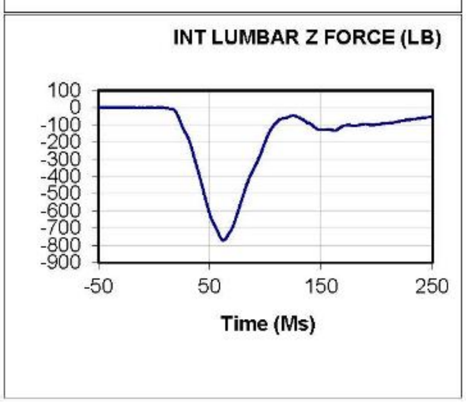
Page 11 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15

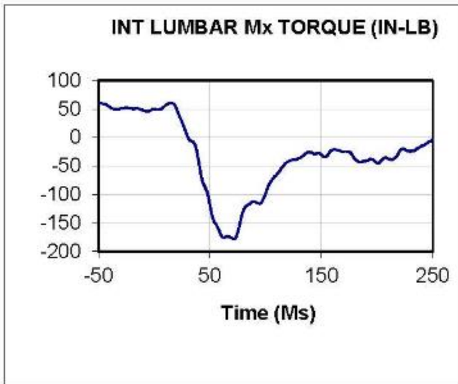


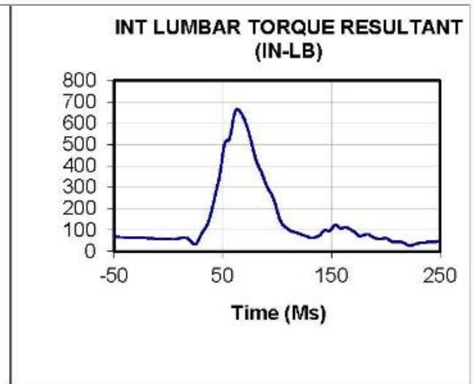


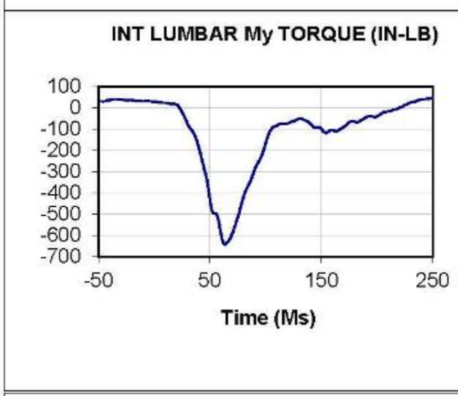


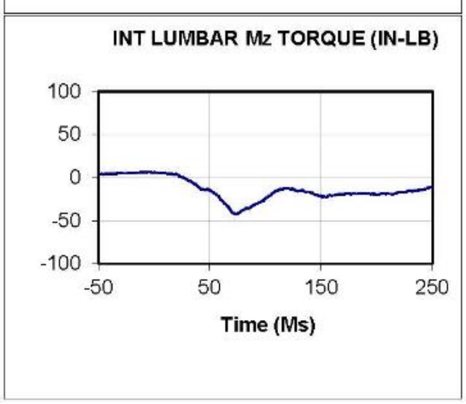


201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



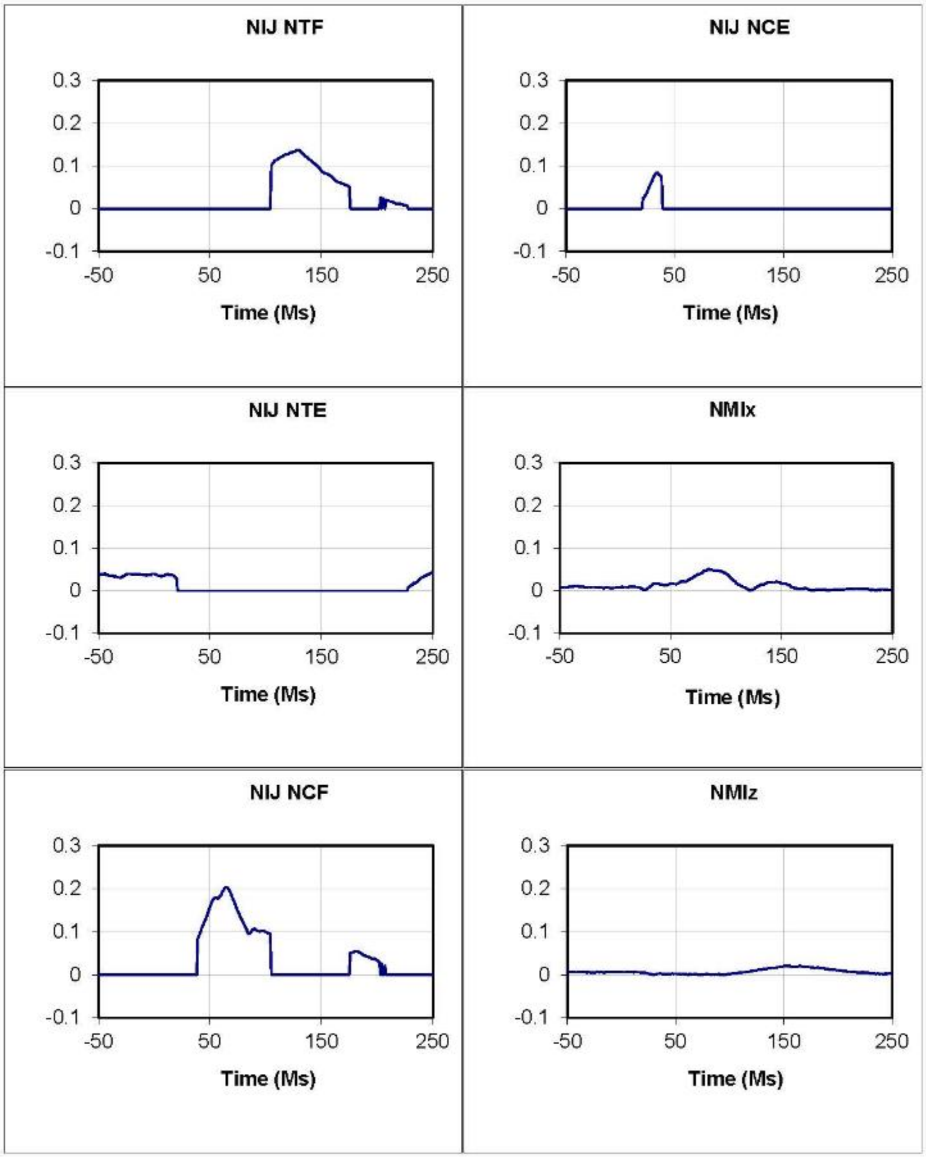






Page 13 of 14

201404 Test: 6452 Test Date: 140729 Subj: LOIS Cell: A15



Page 14 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Wt: 108.0
Nom G: 15.0 Cell: B15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
Kodak Start Time (Ms)				-2446.0	
Reference Mark Time (Ms)				-98.0	
Drop Height (In)		84.65			
Impact Rise Time (Ms)				60.9	
Impact Duration (Ms)				125.6	
Velocity Change (Ft/Sec)		33.80			
CARRIAGE X ACCEL (G)	-0.01	4.67	-4.13	50.0	53.0
CARRIAGE Y ACCEL (G)	0.00	1.29	-1.03	44.0	57.0
CARRIAGE Z ACCEL (G)	0.03	15.15	0.44	61.0	0.0
CARRIAGE RESULTANT (G)	0.09	15.31	0.44	61.0	0.0
INTEGRATED ACCEL (FT/SEC)	33.24	33.80	1.61	4.0	222.0
SEAT X ACCEL (G)	-0.02	4.59	-1.13	44.0	48.0
SEAT Y ACCEL (G)	0.03	0.84	-1.61	14.0	46.0
SEAT Z ACCEL (G)	0.01	15.16	0.39	56.0	0.0
SEAT RESULTANT	0.16	15.46	0.53	64.0	0.0
LEFT LAP X FORCE (LB)	-2.70	-2.47	-9.01	142.0	57.0
LEFT LAP Y FORCE (LB)	9.11	10.52	1.28	12.0	61.0
LEFT LAP Z FORCE (LB)	-27.59	3.33	-29.61	55.0	11.0
LEFT LAP RESULTANT (LB)	29.18	31.62	5.62	11.0	35.0
RIGHT LAP X FORCE (LB)	-4.17	-2.88	-8.45	27.0	57.0
RIGHT LAP Y FORCE (LB)	1.34	2.69	0.98	95.0	20.0
RIGHT LAP Z FORCE (LB)	-28.17	4.08	-28.87	65.0	0.0
RIGHT LAP RESULTANT (LB)	28.51	29.25	4.48	0.0	29.0
LEFT SHOULDER X FORCE (LB)	-12.06	-11.77	-63.52	218.0	72.0
LEFT SHOULDER Y FORCE (LB)	3.67	6.99	1.75	80.0	28.0
LEFT SHOULDER Z FORCE (LB)	4.15	50.52	4.70	63.0	2.0
LEFT SHOULDER RESULTANT (LB)	13.27	80.91	13.69	72.0	0.0
RIGHT SHOULDER X FORCE (LB)	-12.10	-12.04	-63.17	10.0	131.0
RIGHT SHOULDER Y FORCE (LB)	-0.96	1.82	-2.19	59.0	27.0
RIGHT SHOULDER Z FORCE (LB)	2.85	46.03	3.34	58.0	0.0
RIGHT SHOULDER RESULTANT (LE	12.47	76.80	13.03	71.0	7.0
INT HEAD X ACCEL (G)	-0.08	1.07	-8.91	52.0	127.0
INT HEAD Y ACCEL (G)	-0.06	0.59	-1.24	53.0	122.0
INT HEAD Z ACCEL (G)	0.02	17.35	-0.41	64.0	137.0
INT HEAD RESULTANT (G)	0.11	17.37	0.13	64.0	0.0
INT HEAD HIC		25.54		45.0	75.0

Page 1 of 3

201404 Test: 6439 Test Date: 140728 Subj: LOIS Wt: 108.0
Nom G: 15.0 Cell: B15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
INT HEAD Ry ANG (RAD/SEC2)	-1.26	519.97	-512.26	66.0	119.0
INT NECK X FORCE (LB)	4.70	15.96	-84.97	51.0	118.0
INT NECK Y FORCE (LB)	1.71	6.59	-12.02	52.0	132.0
INT NECK Z FORCE (LB)	8.60	66.63	-159.95	126.0	65.0
INT NECK RESULTANT (LB)	9.97	159.99	5.58	65.0	16.0
INT NECK Mx TORQUE (IN-LB)	4.05	17.88	-9.23	108.0	74.0
INT NECK My TORQUE (IN-LB)	-14.43	89.48	-13.56	121.0	1.0
INT NECK Mz TORQUE (IN-LB)	-3.69	7.71	-5.21	114.0	32.0
INT NECK TORQUE RES (IN-LB)	15.46	91.12	5.74	121.0	31.0
INT CHEST X ACCEL (G)	-0.05	0.37	-3.63	33.0	73.0
INT CHEST Y ACCEL (G)	0.00	0.19	-0.67	115.0	156.0
INT CHEST Z ACCEL (G)	0.02	17.67	0.04	63.0	0.0
INT CHEST RESULTANT (G)	0.10	17.93	0.06	63.0	0.0
INT LUMBAR X ACCEL (G)	-0.04	4.02	-0.26	67.0	7.0
INT LUMBAR Y ACCEL (G)	-0.04	1.17	-0.97	79.0	29.0
INT LUMBAR Z ACCEL (G)	0.03	18.77	0.04	60.0	0.0
INT LUMBAR RESULTANT (G)	0.14	18.90	0.10	60.0	0.0
INT LUMBAR X FORCE (LB)	-7.99	207.46	-8.29	64.0	0.0
INT LUMBAR Y FORCE (LB)	-7.13	-5.01	-39.57	172.0	68.0
INT LUMBAR Z FORCE (LB)	9.65	10.23	-722.77	0.0	62.0
INT LUMBAR FORCE RESULTANT (	14.44	752.12	8.23	62.0	15.0
INT LUMBAR Mx TORQUE (IN-LB)	-17.70	41.00	-69.82	171.0	62.0
INT LUMBAR My TORQUE (IN-LB)	-2.93	45.91	-548.91	222.0	63.0
INT LUMBAR Mz TORQUE (IN-LB)	1.84	2.40	-13.64	0.0	115.0
INT LUMBAR TORQUE RESULTANT	18.12	553.28	16.68	63.0	10.0

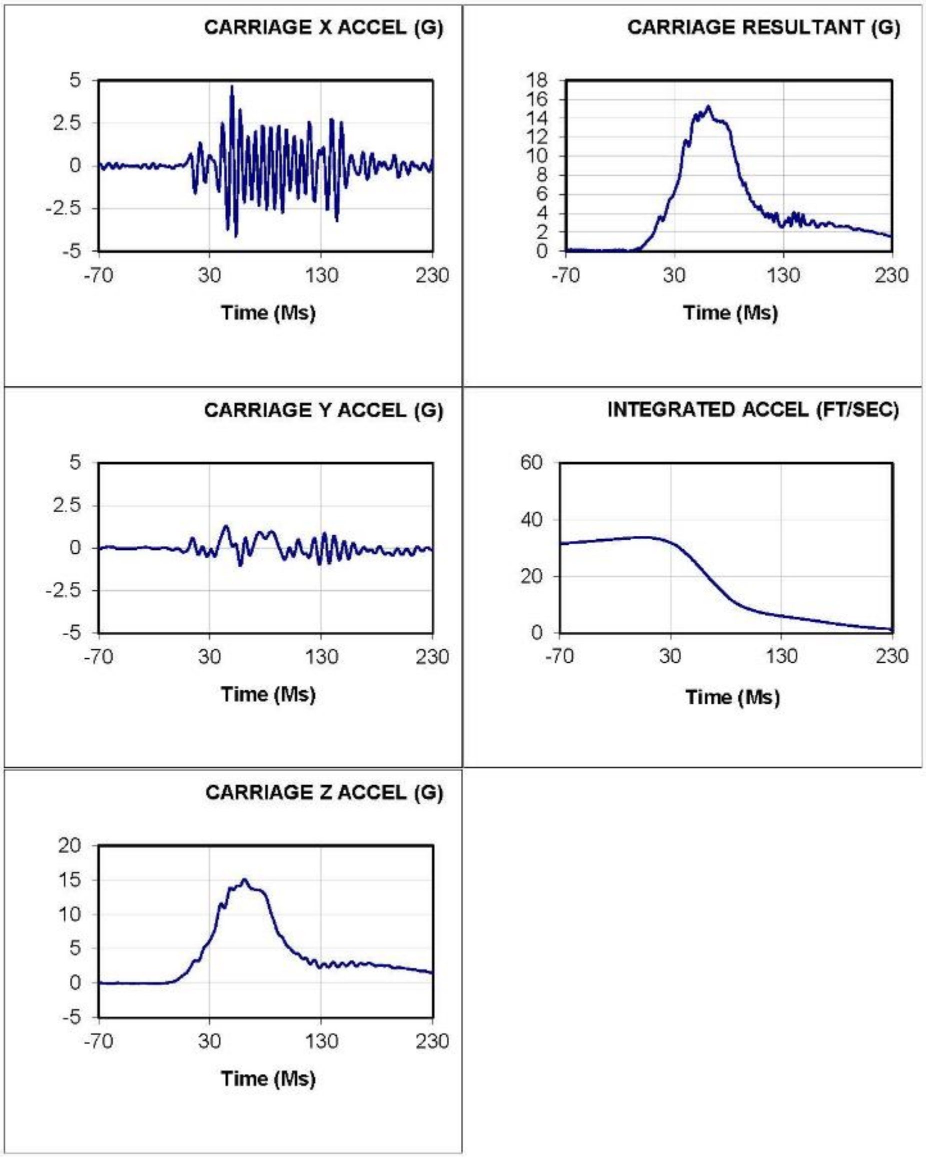
Page 2 of 3

201404 Test: 6439 Test Date: 140728 Subj: LOIS Wt: 108.0
Nom G: 15.0 Cell: B15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
NIJ SHEAR (LB)		15.96	-84.97	51.0	118.0
NIJ TENSION (LB)		66.63		126.0	
NIJ COMPRESSION (LB)		-159.95		65.0	
NIJ FLEXION (IN-LB)		148.69		121.0	
NIJ EXTENSION (IN-LB)		21.01		-46.0	
NIJ NTF	0.0000	0.1765	0.0000	121.0	0.0
NIJ NTE	0.0388	0.0346	0.0000	0.0	19.0
NIJ NCF	0.0000	0.1842	0.0000	65.0	0.0
NIJ NCE	0.0000	0.0563	0.0000	34.0	0.0
NIJ NTF AIS >= 2		0.14			
NIJ NTF AIS >= 3		0.05			
NIJ NTF AIS >= 4		0.08			
NIJ NTF AIS >= 5		0.03			
NIJ NTE AIS >= 2		0.12			
NIJ NTE AIS >= 3		0.04			
NIJ NTE AIS >= 4		0.07			
NIJ NTE AIS >= 5		0.02			
NIJ NCF AIS >= 2		0.14			
NIJ NCF AIS >= 3		0.05			
NIJ NCF AIS >= 4		0.08			
NIJ NCF AIS >= 5		0.03			
NIJ NCE AIS >= 2		0.12			
NIJ NCE AIS >= 3		0.04			
NIJ NCE AIS >= 4		0.07			
NIJ NCE AIS >= 5		0.02			
MNIx	0.0068	0.0302	0.0003	108.0	83.0
NMIz	0.0062	0.0130	0.0000	114.0	151.0

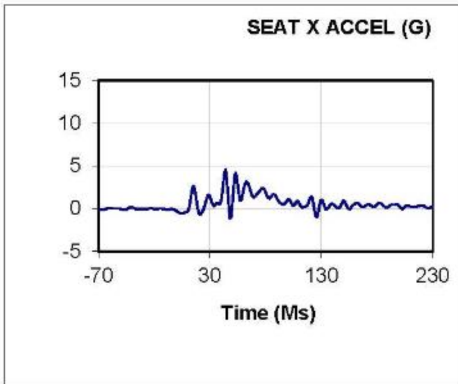
Page 3 of 3

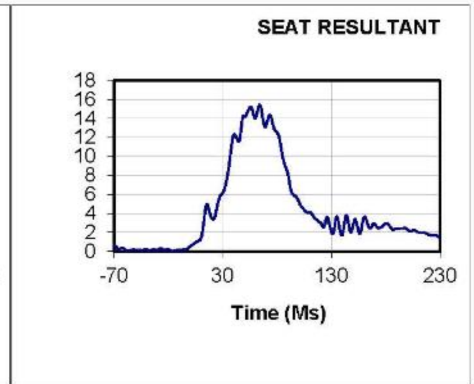
201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15

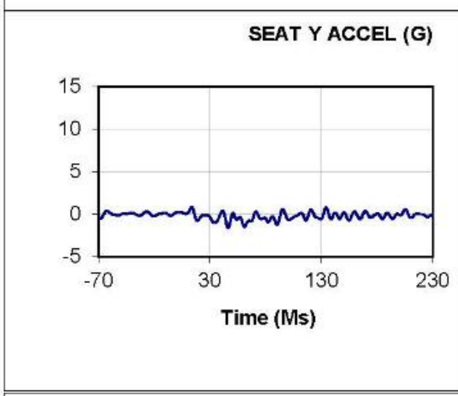


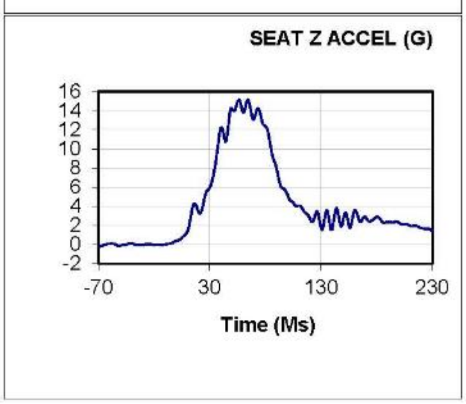
Page 1 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



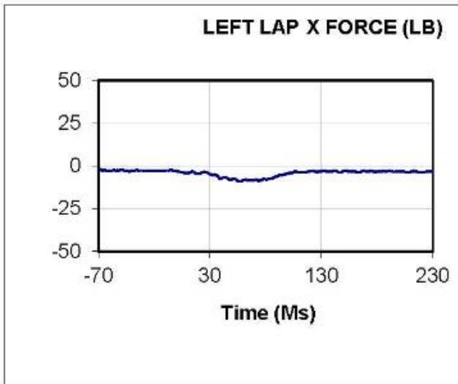


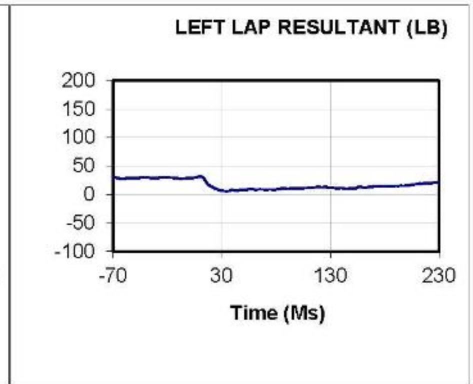


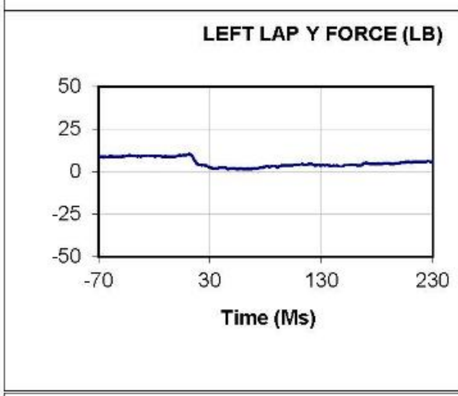


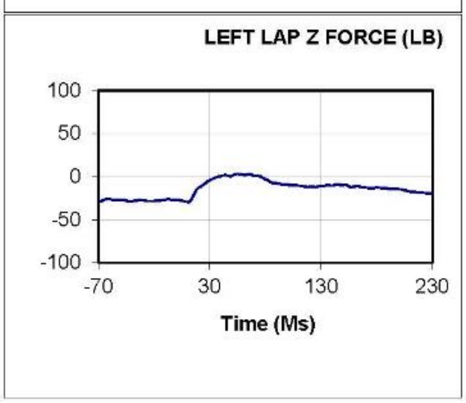
Page 2 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



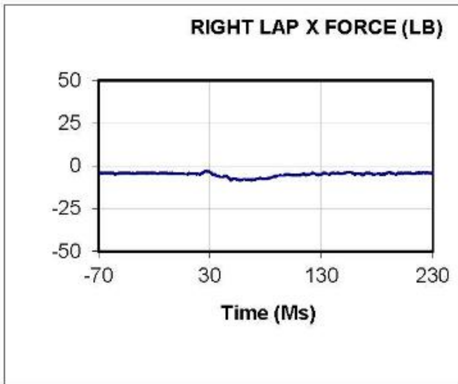


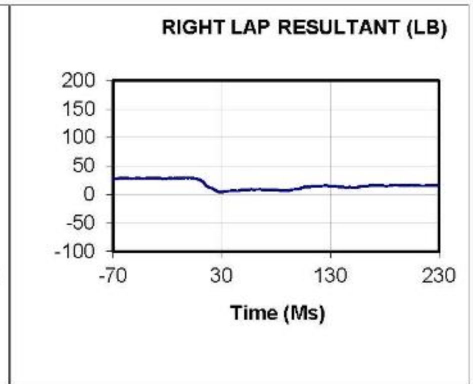


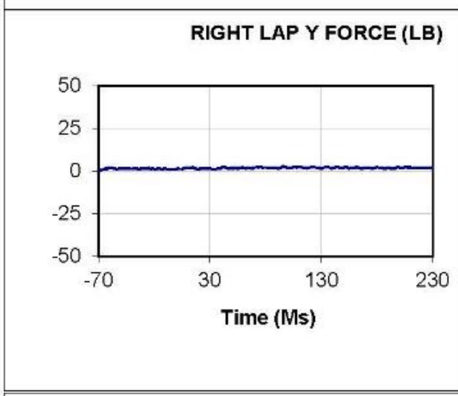


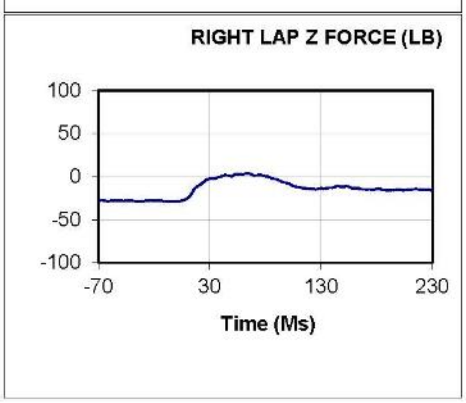
Page 3 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



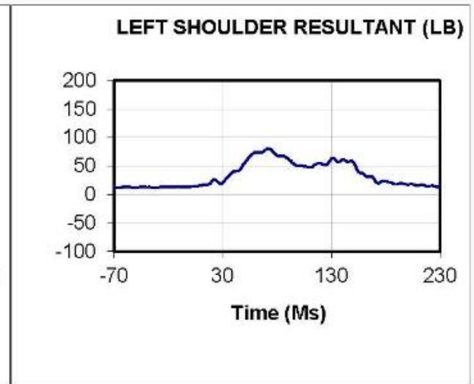


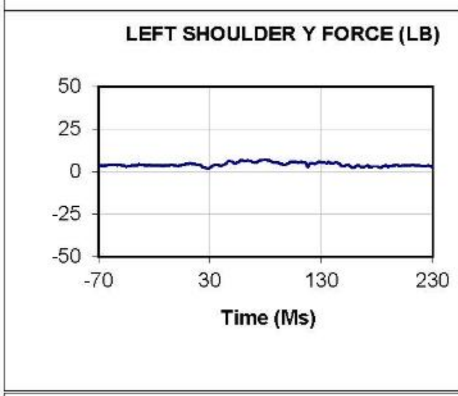




Page 4 of 14

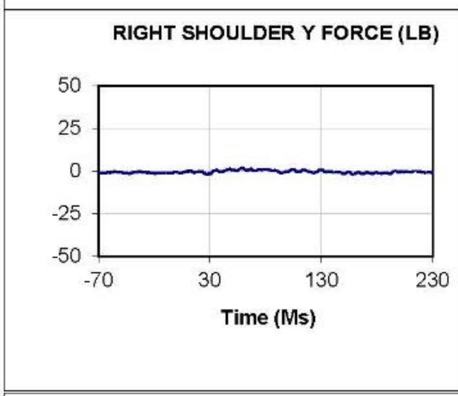
201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15





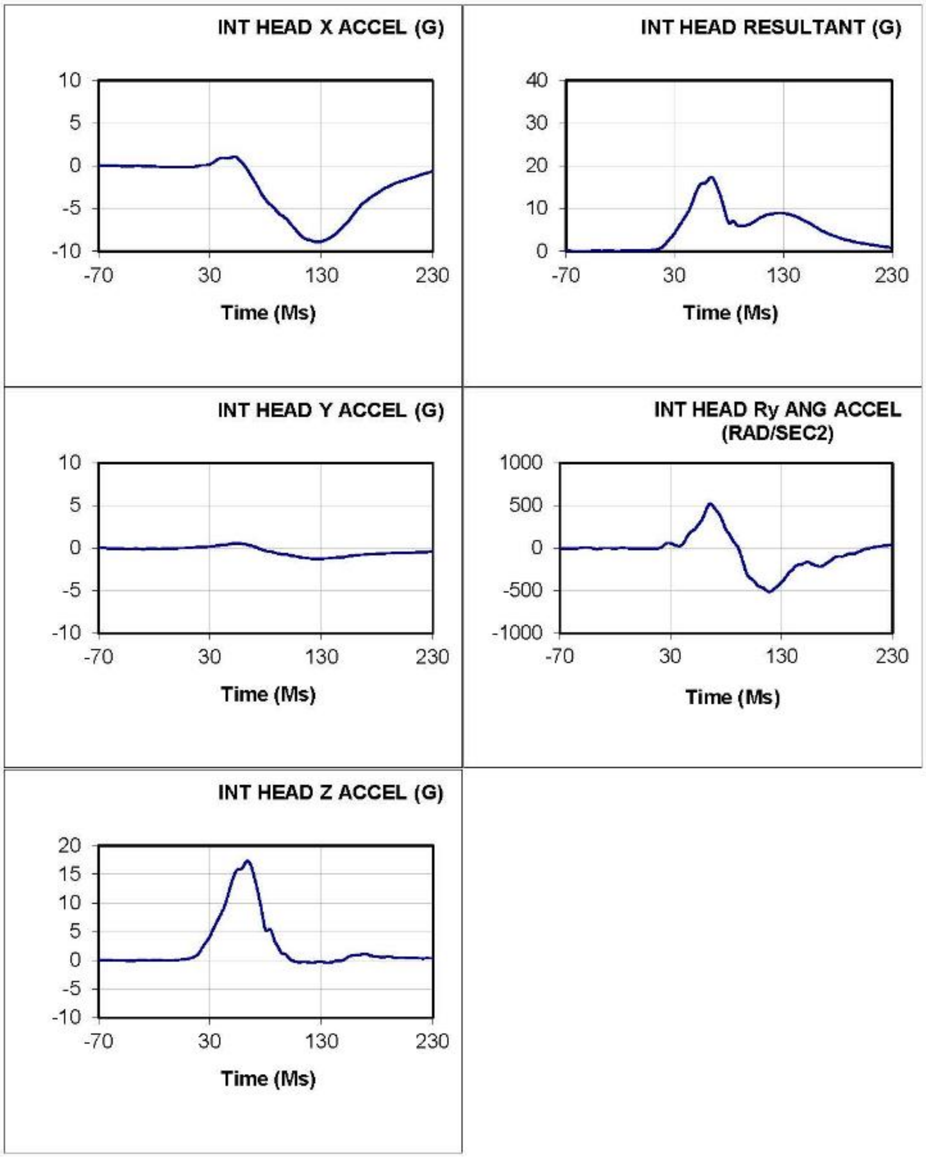
Page 5 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



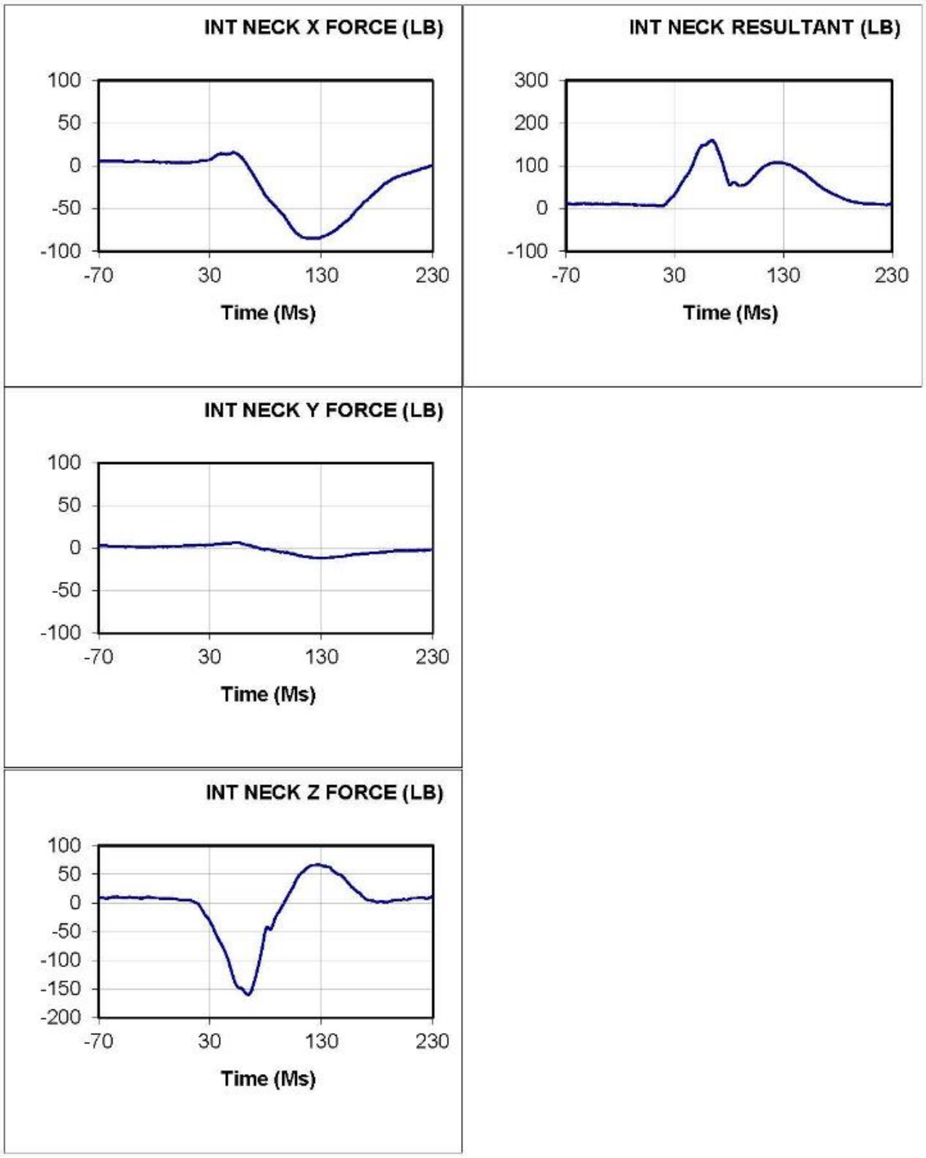
Page 6 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



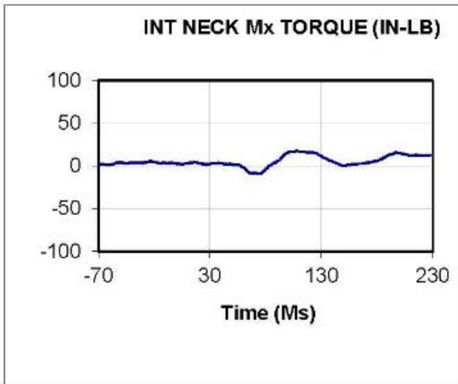
Page 7 of 14

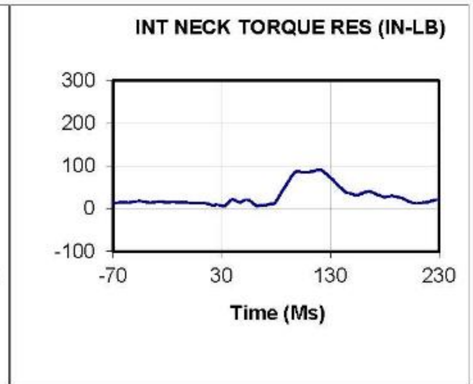
201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15

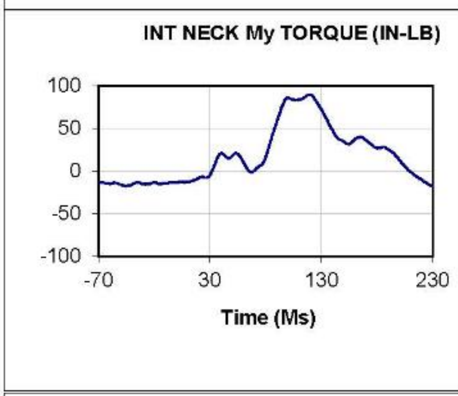


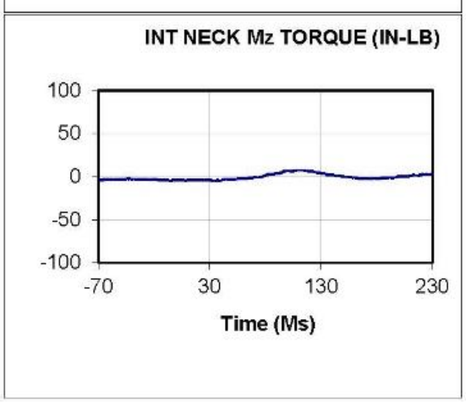
Page 8 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



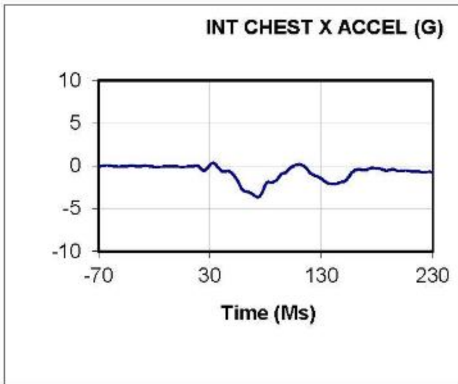


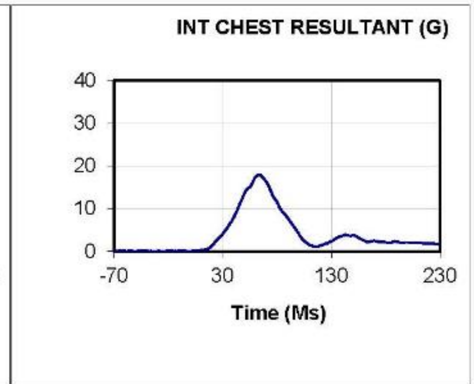


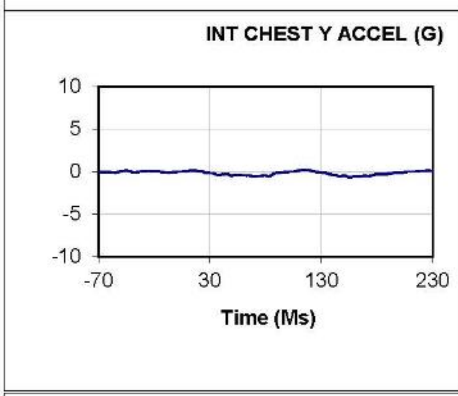


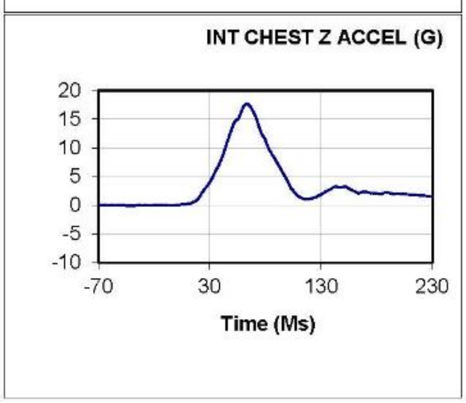
Page 9 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



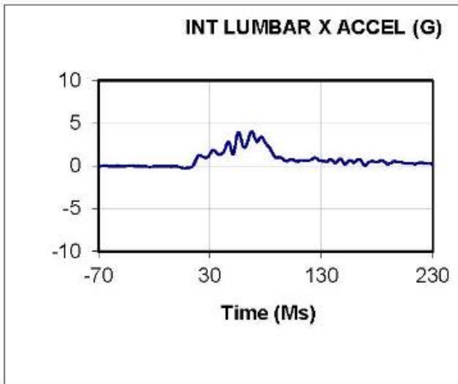


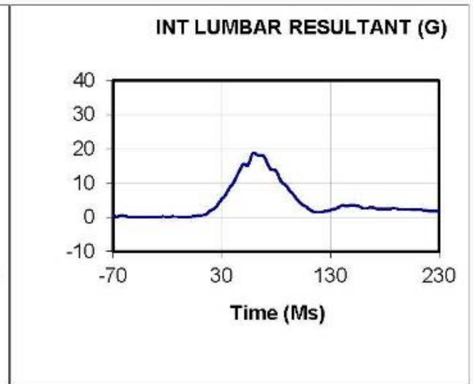


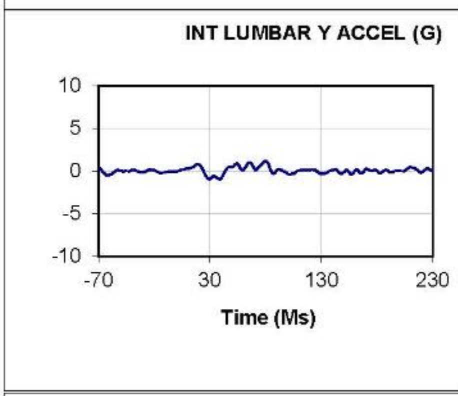


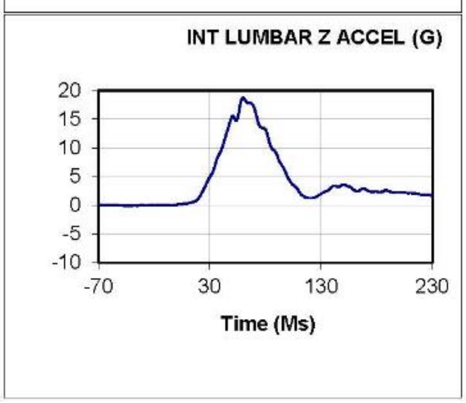
Page 10 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



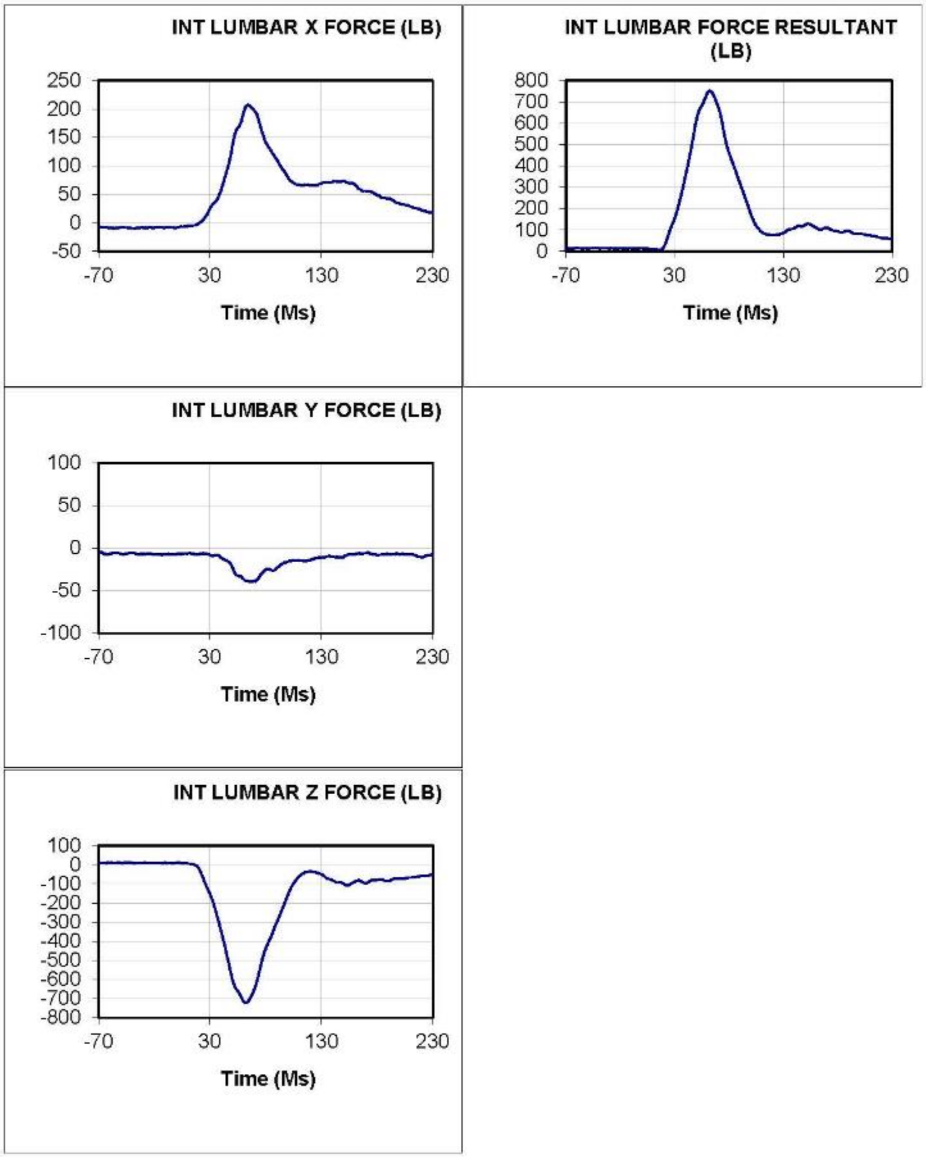






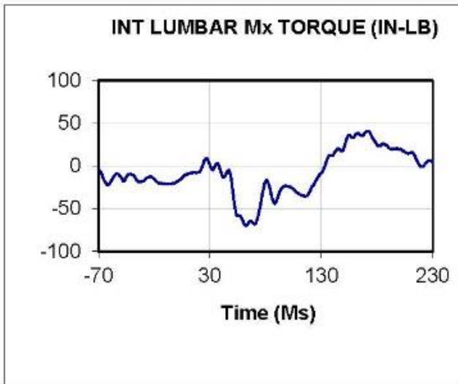
Page 11 of 14

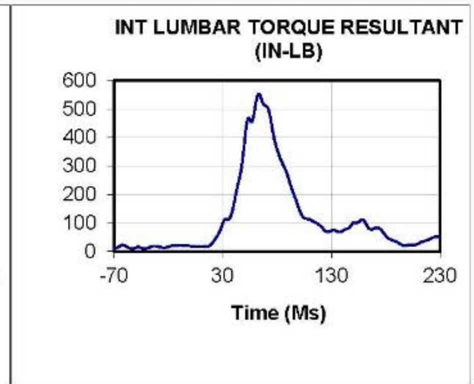
201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15

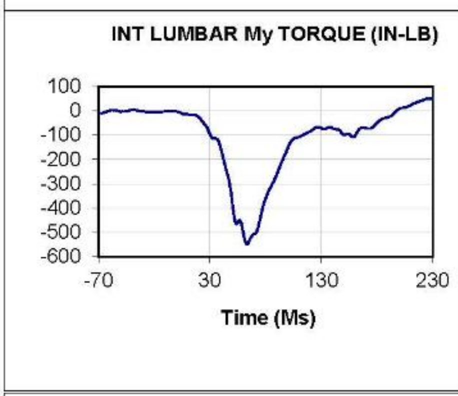


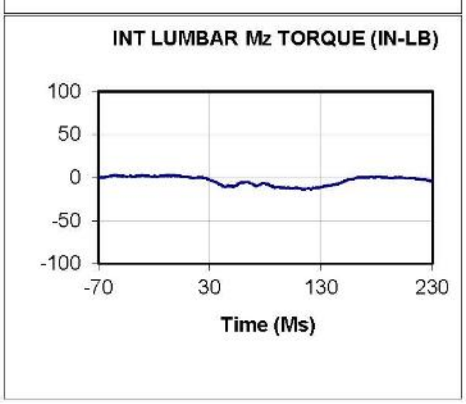
Page 12 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



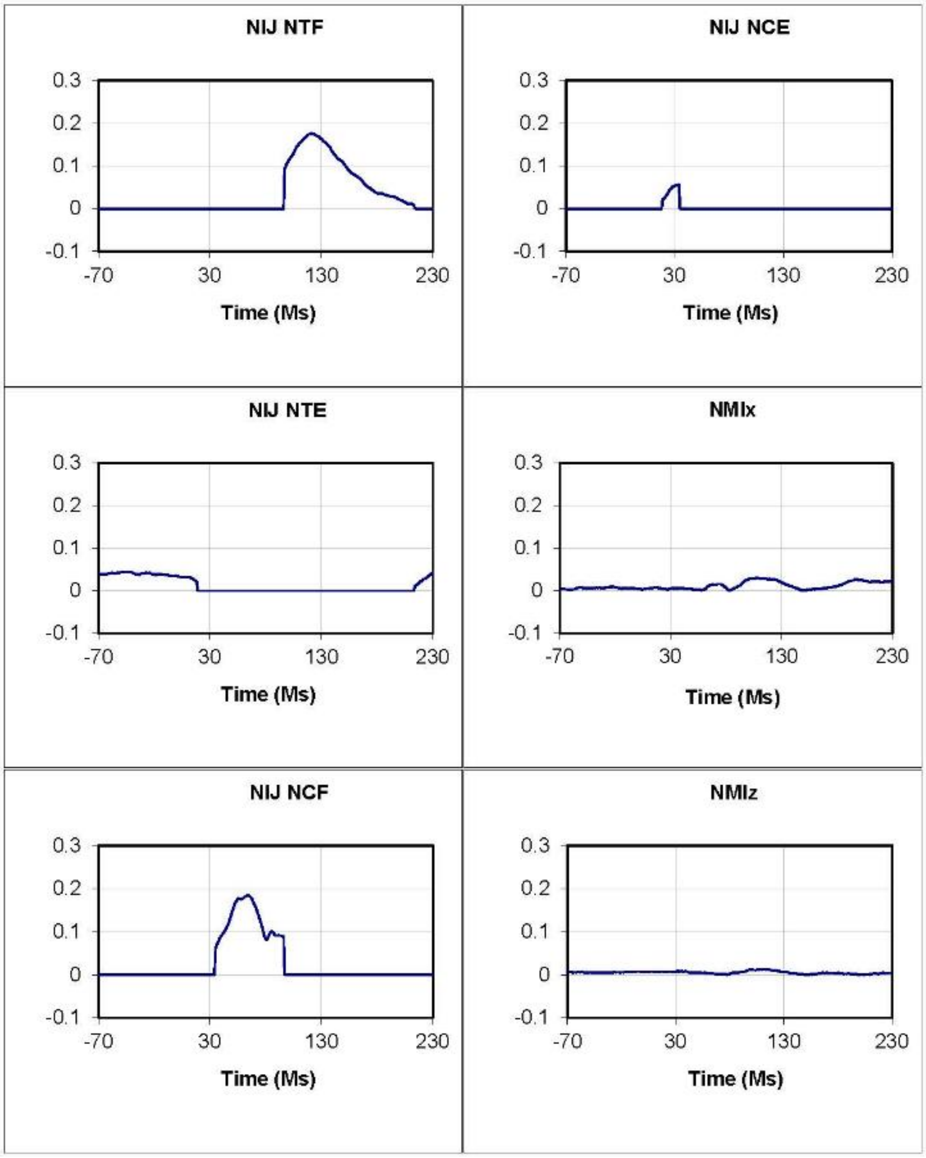






Page 13 of 14

201404 Test: 6439 Test Date: 140728 Subj: LOIS Cell: B15



Page 14 of 14

201502 Test: 6738 Test Date: 150513 Subj: LOIS Wt: 110.0
Nom G: 15.0 Cell: C15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
Kodak Start Time (Ms)				-2718.0	
Reference Mark Time (Ms)				-132.0	
Drop Height (In)		84.65			
Impact Rise Time (Ms)				65.4	
Impact Duration (Ms)				125.1	
Velocity Change (Ft/Sec)		33.69			
CARRIAGE X ACCEL (G)	0.05	3.28	-1.66	18.0	50.0
CARRIAGE Y ACCEL (G)	-0.04	0.75	-1.42	46.0	64.0
CARRIAGE Z ACCEL (G)	0.00	14.72	0.21	63.0	0.0
CARRIAGE RESULTANT (G)	0.10	14.78	0.21	63.0	0.0
INTEGRATED ACCEL (FT/SEC)	33.03	33.69	2.06	8.0	218.0
SEAT X ACCEL (G)	-0.05	0.77	-3.33	11.0	58.0
SEAT Y ACCEL (G)	-0.07	0.24	-3.21	109.0	54.0
SEAT Z ACCEL (G)	0.05	15.38	0.14	57.0	0.0
SEAT RESULTANT	0.16	15.85	0.16	57.0	0.0
LEFT LAP X FORCE (LB)	-27.84	6.12	-27.40	56.0	11.0
LEFT LAP Y FORCE (LB)	-1.69	-0.96	-3.00	43.0	37.0
LEFT LAP Z FORCE (LB)	-2.19	6.06	-2.14	64.0	2.0
LEFT LAP RESULTANT (LB)	27.98	27.52	2.58	11.0	34.0
RIGHT LAP X FORCE (LB)	-31.72	5.77	-32.02	57.0	0.0
RIGHT LAP Y FORCE (LB)	-1.92	6.22	-1.97	59.0	154.0
RIGHT LAP Z FORCE (LB)	3.91	4.10	1.39	9.0	55.0
RIGHT LAP RESULTANT (LB)	32.02	32.31	2.22	0.0	33.0
LEFT SHOULDER X FORCE (LB)	-10.31	-9.47	-68.64	7.0	63.0
LEFT SHOULDER Y FORCE (LB)	-2.11	3.03	-3.52	144.0	37.0
LEFT SHOULDER Z FORCE (LB)	-2.47	48.04	-2.59	65.0	1.0
LEFT SHOULDER RESULTANT (LB)	10.81	83.45	9.78	63.0	7.0
RIGHT SHOULDER X FORCE (LB)	-12.72	-12.30	-75.36	12.0	61.0
RIGHT SHOULDER Y FORCE (LB)	-1.11	4.09	-3.85	146.0	40.0
RIGHT SHOULDER Z FORCE (LB)	-0.12	66.30	0.18	67.0	2.0
RIGHT SHOULDER RESULTANT (LB)	12.77	99.30	12.37	68.0	12.0
INT HEAD X ACCEL (G)	0.07	1.92	-6.29	54.0	150.0
INT HEAD Y ACCEL (G)	-0.12	0.70	-0.11	78.0	10.0
INT HEAD Z ACCEL (G)	0.04	19.94	-0.21	66.0	132.0
INT HEAD RESULTANT (G)	0.15	19.98	0.16	66.0	2.0
INT HEAD HIC		34.33		49.0	79.0

Page 1 of 3

201502 Test: 6738 Test Date: 150513 Subj: LOIS Wt: 110.0
Nom G: 15.0 Cell: C15

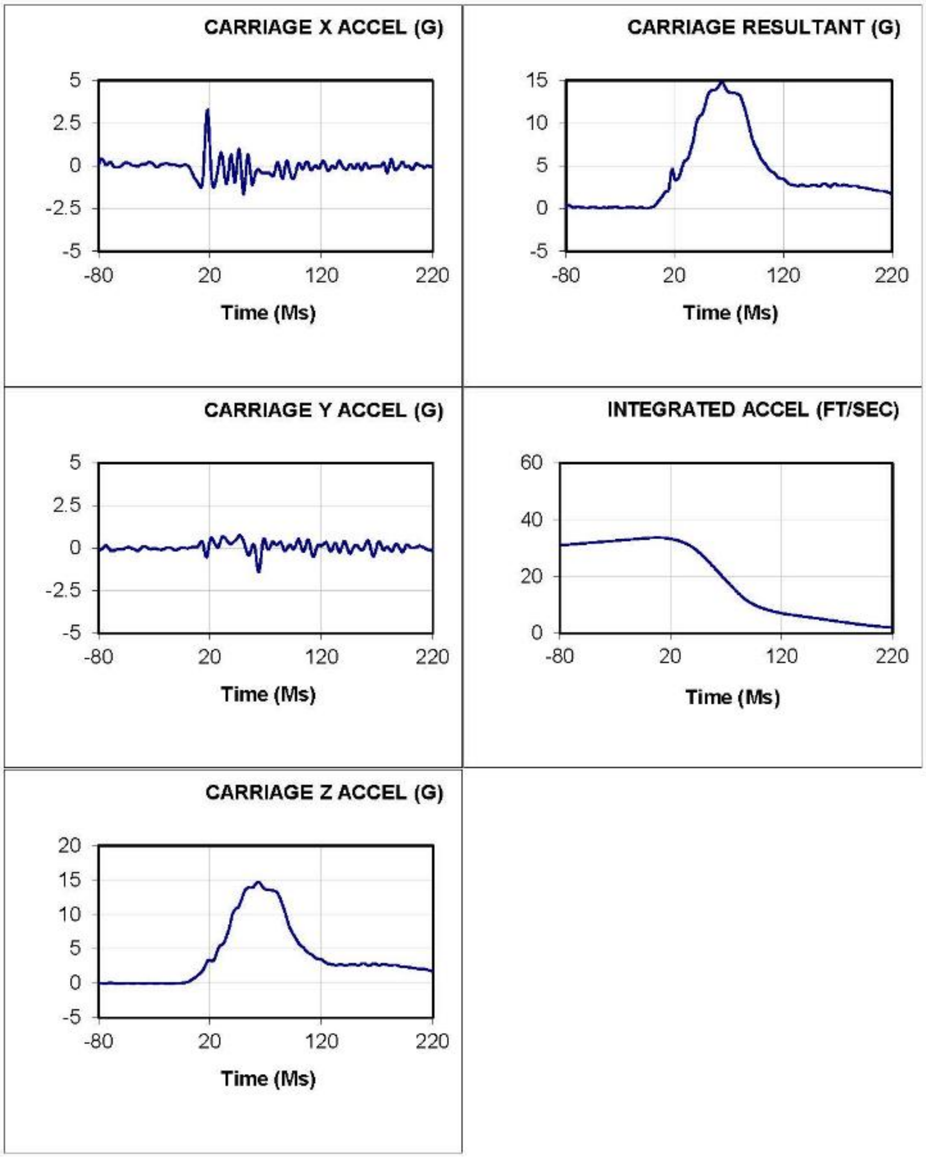
Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
INT HEAD Ry ANG (RAD/SEC2)	1.30	380.42	-309.13	75.0	128.0
INT NECK X FORCE (LB)	3.12	24.76	-86.63	58.0	133.0
INT NECK Y FORCE (LB)	-0.13	0.08	-12.25	7.0	104.0
INT NECK Z FORCE (LB)	5.46	40.05	-229.48	142.0	66.0
INT NECK RESULTANT (LB)	6.33	230.17	3.80	66.0	22.0
INT NECK Mx TORQUE (IN-LB)	5.16	11.14	-24.88	71.0	129.0
INT NECK My TORQUE (IN-LB)	-10.82	95.40	-11.02	95.0	0.0
INT NECK Mz TORQUE (IN-LB)	-1.92	-0.10	-14.21	48.0	141.0
INT NECK TORQUE RES (IN-LB)	12.27	96.90	4.66	95.0	33.0
INT CHEST X ACCEL (G)	0.05	20.68	0.13	66.0	2.0
INT CHEST Y ACCEL (G)	0.06	0.55	-0.15	69.0	0.0
INT CHEST Z ACCEL (G)	0.02	0.34	-2.94	115.0	65.0
INT CHEST RESULTANT (G)	0.10	20.89	0.14	66.0	2.0
INT CHEST Ry ANG ACCEL (RAD/SEC2)	-0.94	97.26	-170.52	56.0	74.0
INT LUMBAR X ACCEL (G)	0.07	3.88	-0.48	82.0	101.0
INT LUMBAR Y ACCEL (G)	0.15	1.97	-0.29	55.0	169.0
INT LUMBAR Z ACCEL (G)	0.03	19.87	0.12	65.0	0.0
INT LUMBAR RESULTANT (G)	0.18	19.89	0.20	65.0	0.0
INT LUMBAR X FORCE (LB)	-6.36	223.29	-6.15	70.0	13.0
INT LUMBAR Y FORCE (LB)	-4.70	7.11	-12.32	93.0	42.0
INT LUMBAR Z FORCE (LB)	36.87	38.21	-898.00	9.0	66.0
INT LUMBAR FORCE RESULTANT (LB)	37.72	923.22	4.90	66.0	25.0
INT LUMBAR Mx TORQUE (IN-LB)	10.69	60.60	-16.04	94.0	43.0
INT LUMBAR My TORQUE (IN-LB)	9.58	34.28	-581.61	218.0	68.0
INT LUMBAR Mz TORQUE (IN-LB)	1.44	1.98	-30.80	0.0	162.0
INT LUMBAR TORQUE RESULTANT (IN-LB)	14.56	581.97	15.64	68.0	6.0

201502 Test: 6738 Test Date: 150513 Subj: LOIS Wt: 110.0
Nom G: 15.0 Cell: C15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
NIJ SHEAR (LB)		24.76	-86.63	58.0	133.0
NIJ TENSION (LB)		40.05		142.0	
NIJ COMPRESSION (LB)		-229.48		66.0	
NIJ FLEXION (IN-LB)		145.23		125.0	
NIJ EXTENSION (IN-LB)		15.97		-44.0	
NIJ NTF	0.0000	0.1388	0.0000	135.0	0.0
NIJ NTE	0.0276	0.0272	0.0000	0.0	22.0
NIJ NCF	0.0000	0.3148	0.0000	66.0	0.0
NIJ NCE	0.0000	0.0590	0.0000	36.0	0.0
NIJ NTF AIS >= 2		0.13			
NIJ NTF AIS >= 3		0.05			
NIJ NTF AIS >= 4		0.07			
NIJ NTF AIS >= 5		0.03			
NIJ NTE AIS >= 2		0.12			
NIJ NTE AIS >= 3		0.04			
NIJ NTE AIS >= 4		0.07			
NIJ NTE AIS >= 5		0.02			
NIJ NCF AIS >= 2		0.16			
NIJ NCF AIS >= 3		0.07			
NIJ NCF AIS >= 4		0.09			
NIJ NCF AIS >= 5		0.03			
NIJ NCE AIS >= 2		0.12			
NIJ NCE AIS >= 3		0.04			
NIJ NCE AIS >= 4		0.07			
NIJ NCE AIS >= 5		0.02			
MNIx	0.0087	0.0420	0.0002	129.0	81.0
NMIz	0.0032	0.0240	0.0002	141.0	48.0

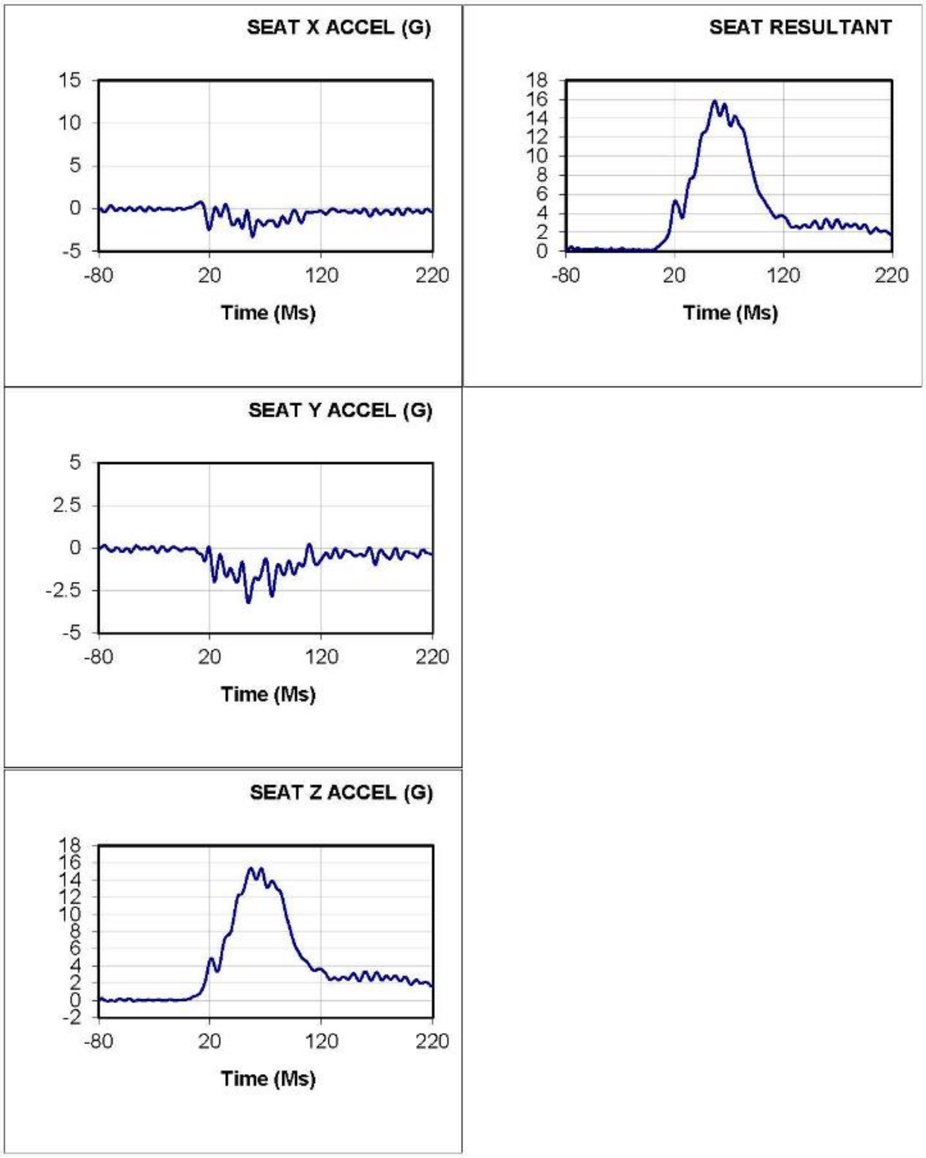
Page 3 of 3

201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

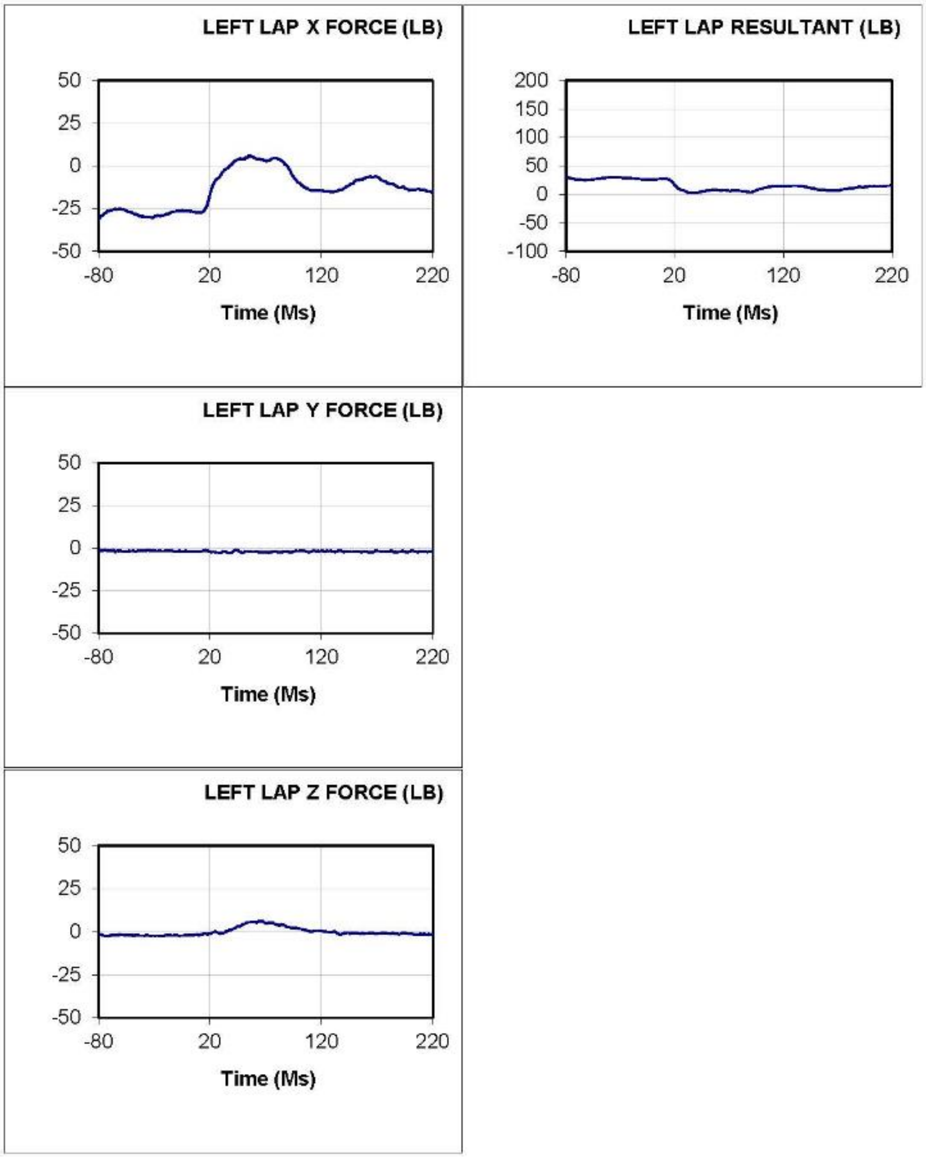


Page 1 of 14

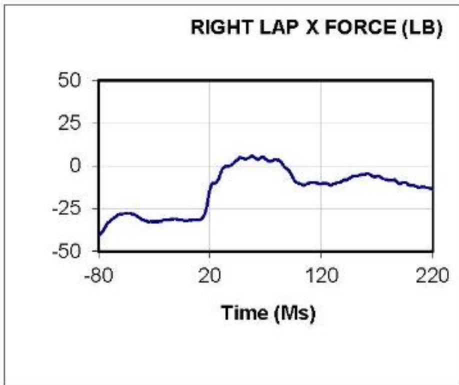
201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

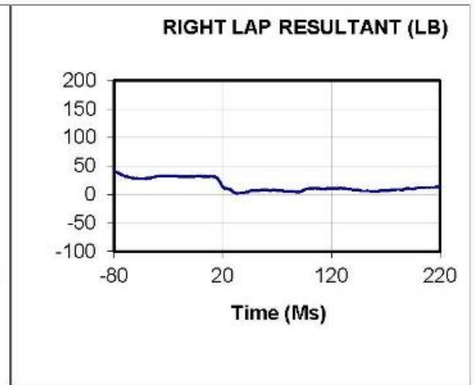


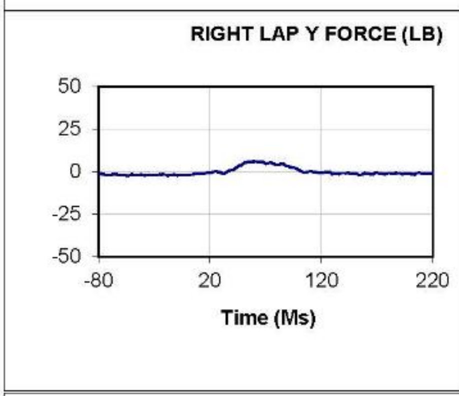
201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

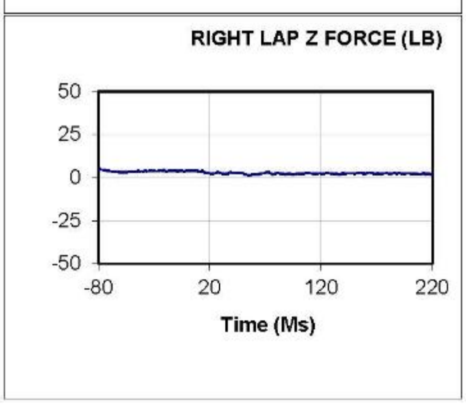


Page 3 of 14

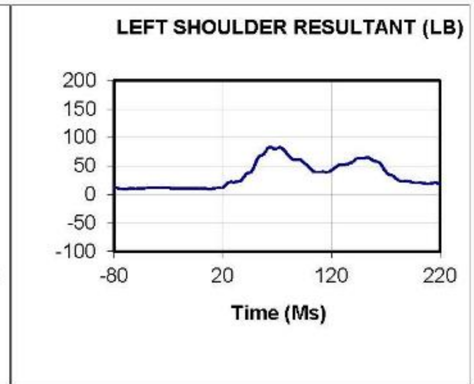

RIGHT LAP X FORCE (LB)
50
25
0
-25
-50
-80
20
120
220
Time (Ms)


RIGHT LAP RESULTANT (LB)
200
150
100
50
0
-50
-100
-80
20
120
220
Time (Ms)


RIGHT LAP Y FORCE (LB)
50
25
0
-25
-50
-80
20
120
220
Time (Ms)

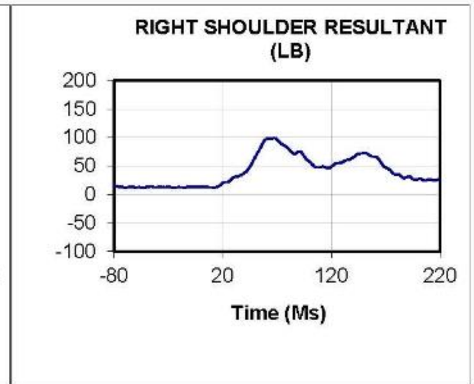

RIGHT LAP Z FORCE (LB)
50
25
0
-25
-50
-80
20
120
220
Time (Ms)

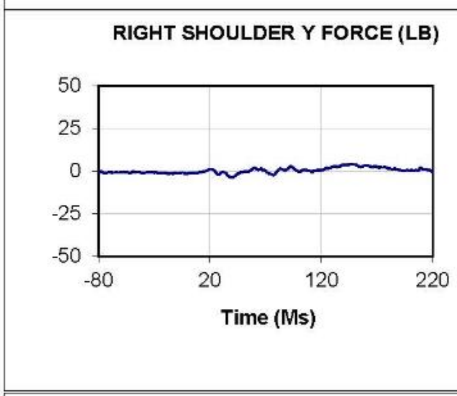
201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

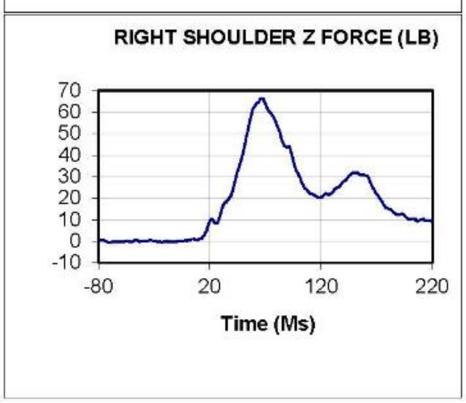


DISTRIBUTION STATEMENT A: Approved for public release. Cleared, 88PA, Case #2017-4562.

201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

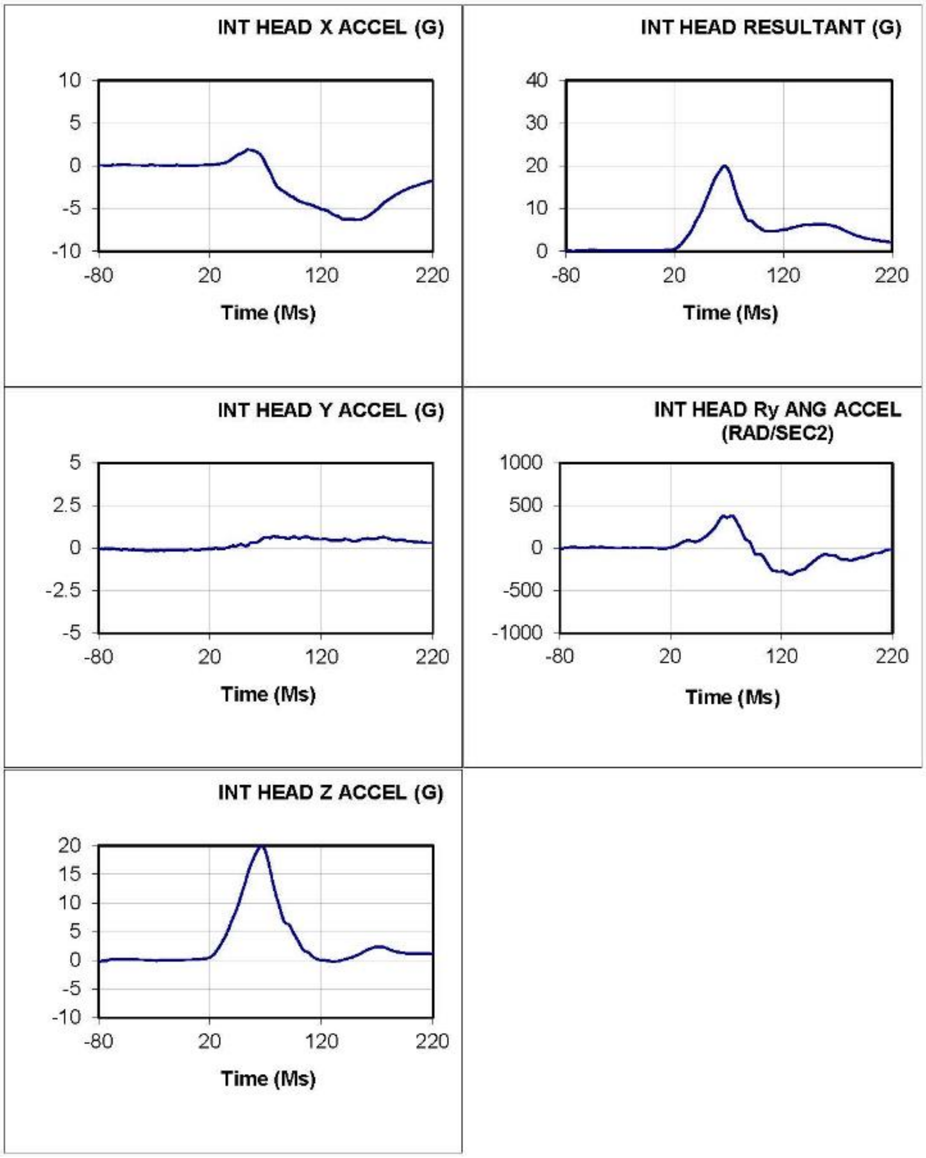






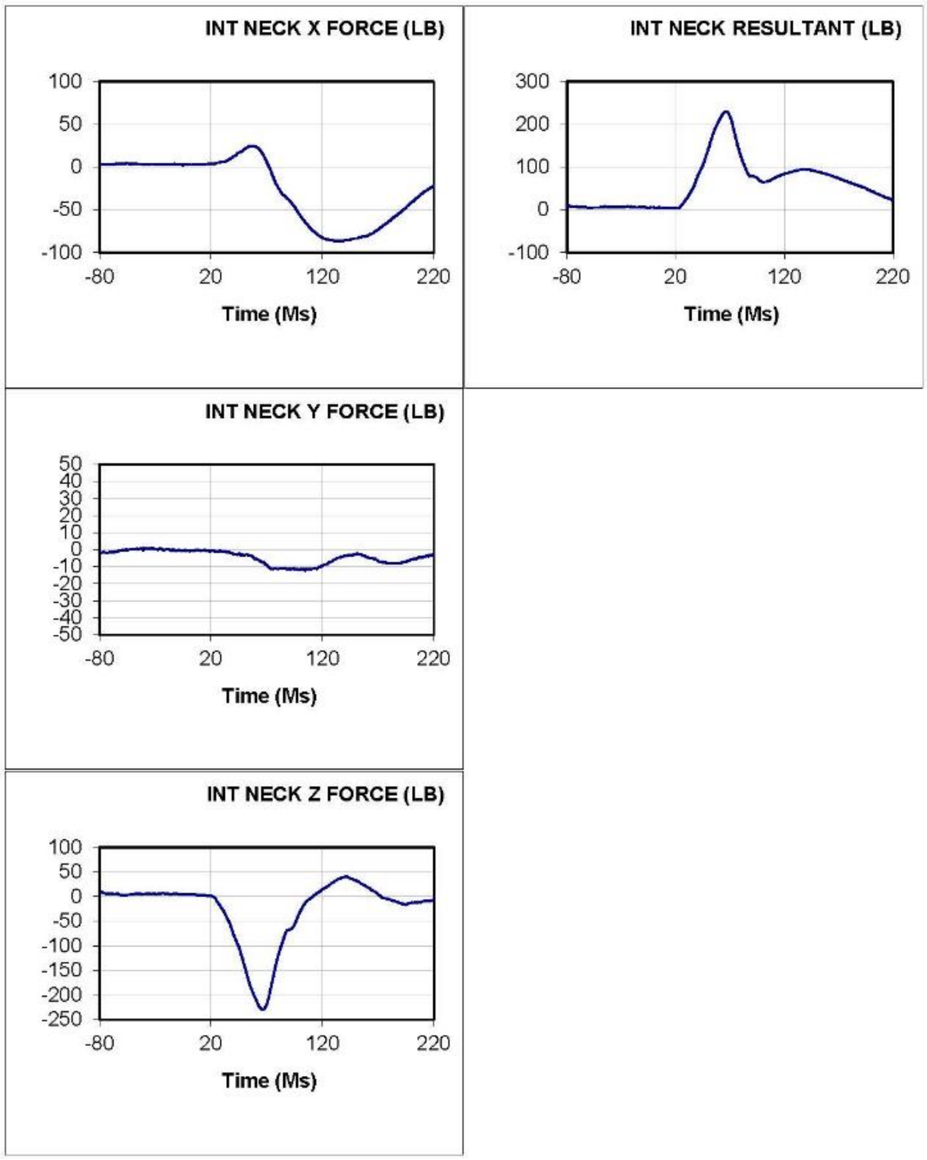
DISTRIBUTION STATEMENT A: Approved for public release. Cleared, 88PA, Case #2017-4562.

201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15



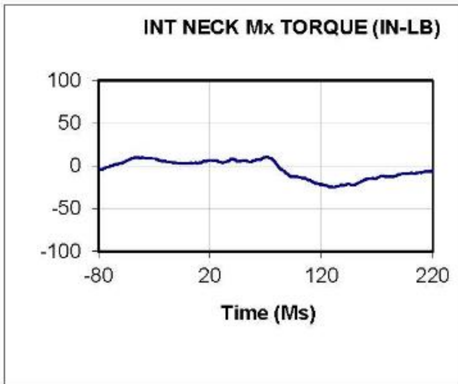
DISTRIBUTION STATEMENT A: Approved for public release. Cleared, 88PA, Case #2017-4562.

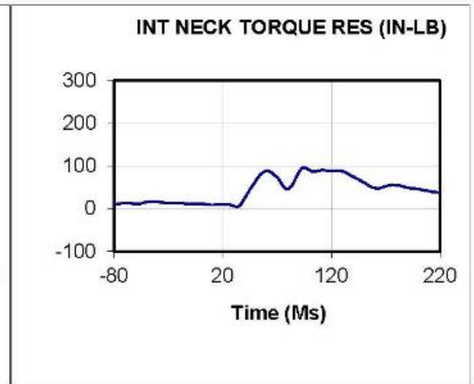
201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

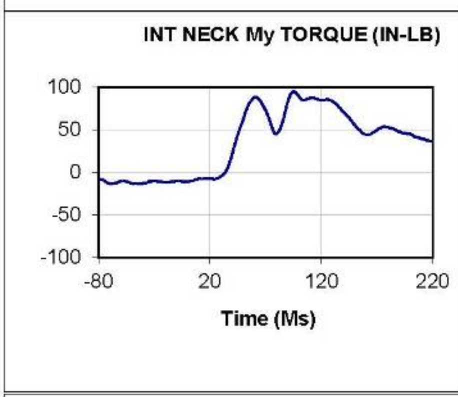


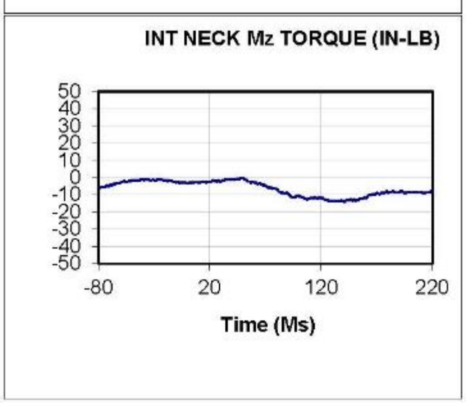
Page 8 of 14

201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

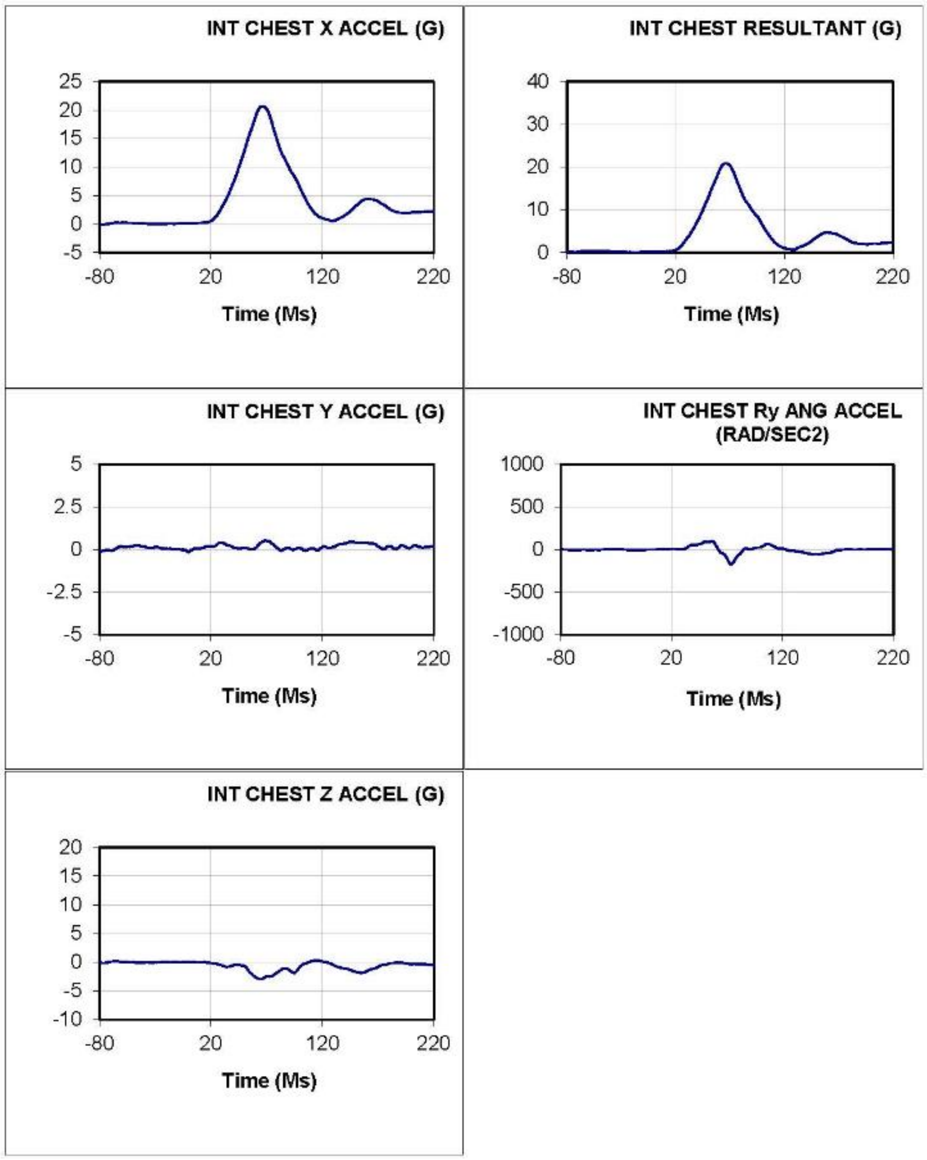






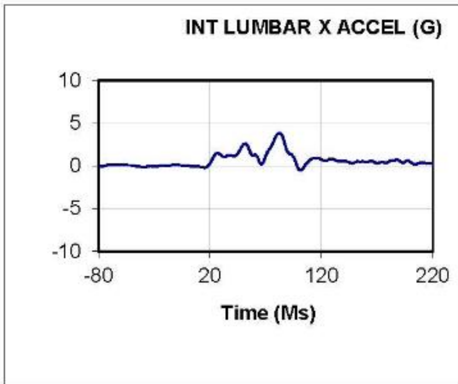


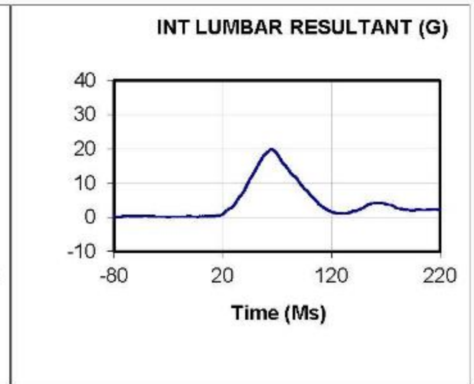
201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

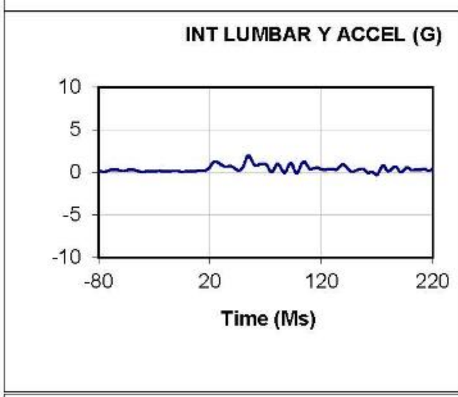


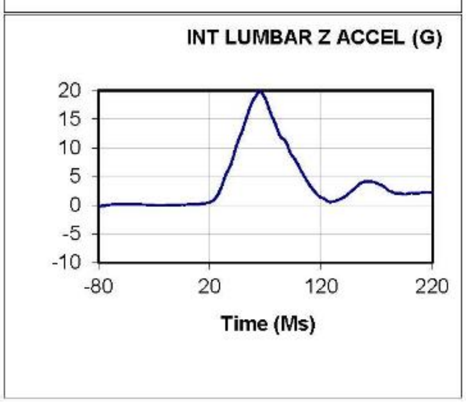
Page 10 of 14

201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15



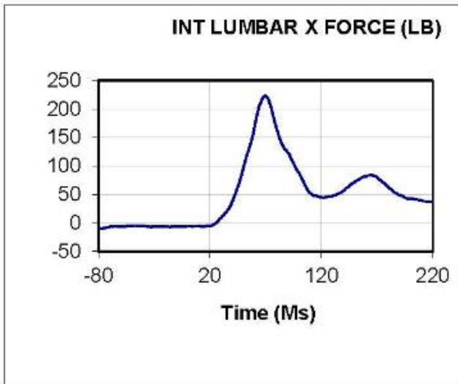


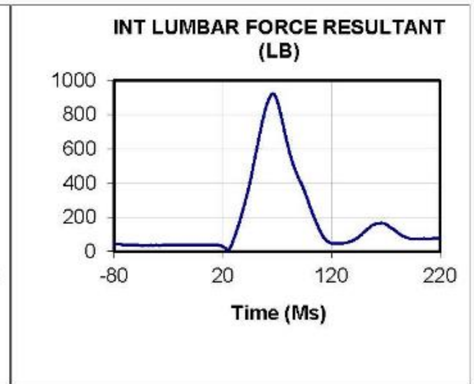


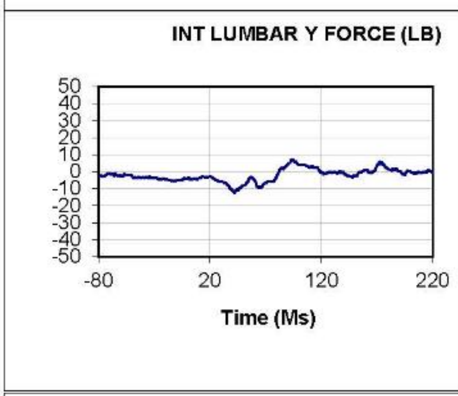


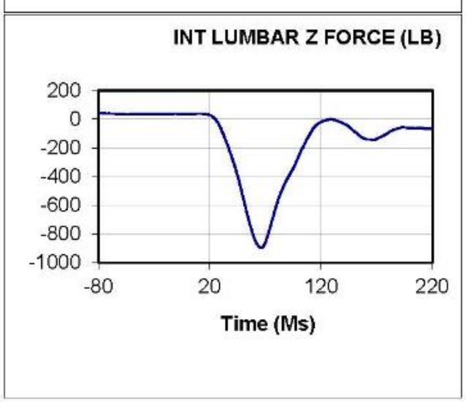
Page 11 of 14

201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15

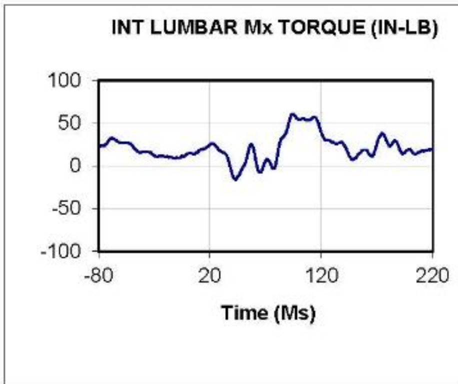


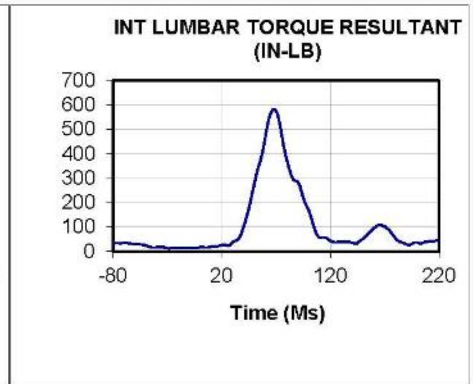


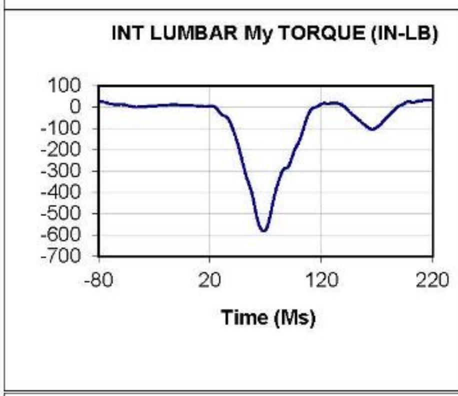


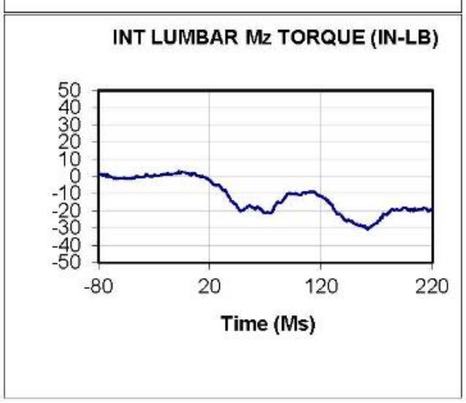


201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15



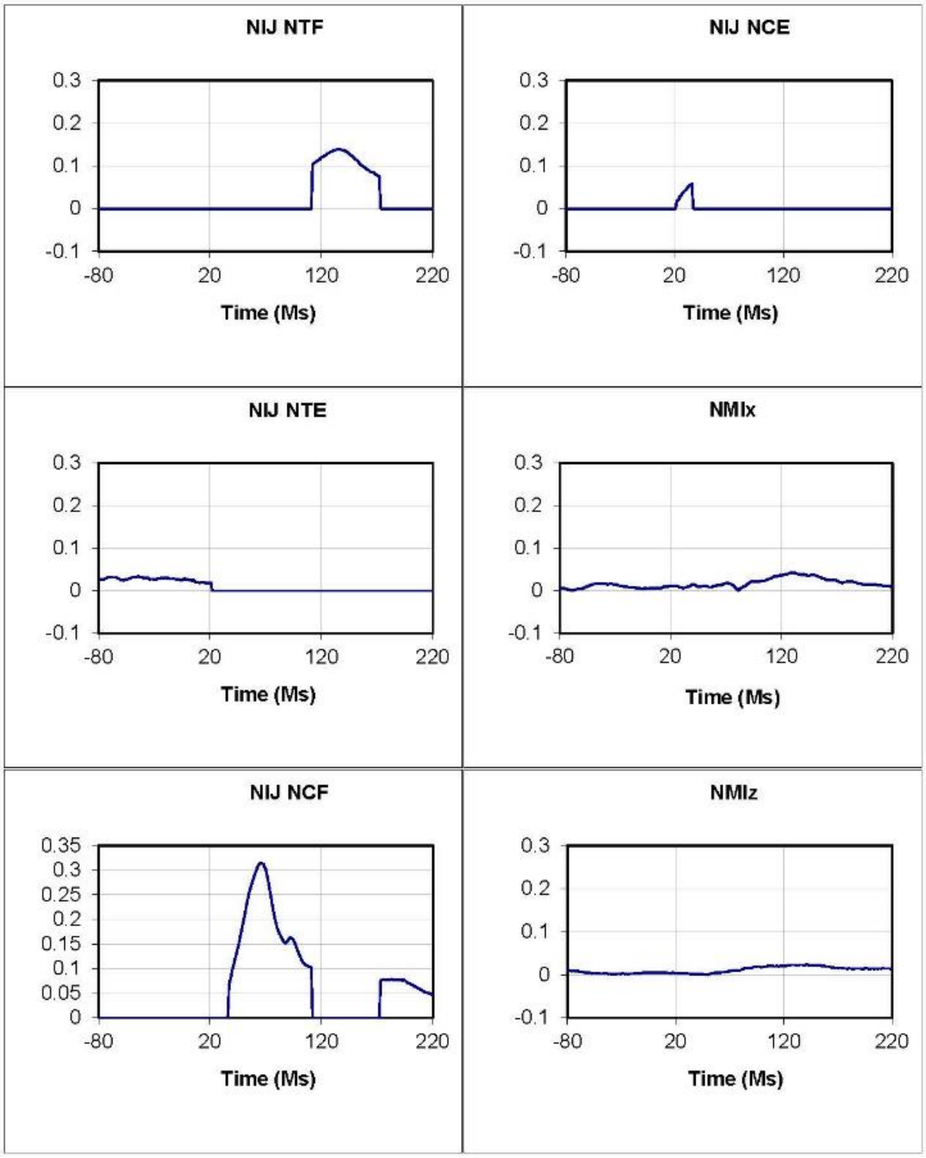






Page 13 of 14

201502 Test: 6738 Test Date: 150513 Subj: LOIS Cell: C15



Page 14 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Wt: 244.0
Nom G: 15.0 Cell: D15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
Kodak Start Time (Ms)				-1963.0	
Reference Mark Time (Ms)				-98.0	
Drop Height (In)		84.65			
Impact Rise Time (Ms)				63.6	
Impact Duration (Ms)				135.4	
Velocity Change (Ft/Sec)		34.17			
CARRIAGE X ACCEL (G)	0.02	4.12	-3.15	46.0	49.0
CARRIAGE Y ACCEL (G)	0.01	1.54	-1.39	39.0	72.0
CARRIAGE Z ACCEL (G)	0.00	14.99	0.23	64.0	0.0
CARRIAGE RESULTANT (G)	0.07	15.22	0.31	62.0	0.0
INTEGRATED ACCEL (FT/SEC)	33.50	34.17	-0.32	8.0	242.0
SEAT X ACCEL (G)	-0.03	4.53	-3.04	13.0	19.0
SEAT Y ACCEL (G)	0.01	1.29	-1.76	11.0	43.0
SEAT Z ACCEL (G)	0.02	14.34	0.44	60.0	0.0
SEAT RESULTANT	0.13	14.68	0.71	50.0	0.0
LEFT LAP X FORCE (LB)	-10.24	-6.35	-20.16	175.0	71.0
LEFT LAP Y FORCE (LB)	7.87	12.36	1.04	137.0	66.0
LEFT LAP Z FORCE (LB)	-32.03	6.52	-45.14	50.0	138.0
LEFT LAP RESULTANT (LB)	34.54	49.28	8.22	138.0	24.0
RIGHT LAP X FORCE (LB)	-6.02	-4.35	-19.42	24.0	80.0
RIGHT LAP Y FORCE (LB)	-1.92	5.08	-8.57	38.0	142.0
RIGHT LAP Z FORCE (LB)	-24.90	7.43	-32.28	50.0	242.0
RIGHT LAP RESULTANT (LB)	25.69	34.57	4.84	242.0	24.0
LEFT SHOULDER X FORCE (LB)	-19.42	-6.06	-211.11	40.0	144.0
LEFT SHOULDER Y FORCE (LB)	3.46	4.49	-14.54	17.0	144.0
LEFT SHOULDER Z FORCE (LB)	1.04	27.85	1.40	145.0	0.0
LEFT SHOULDER RESULTANT (LB)	19.76	213.37	12.46	144.0	27.0
RIGHT SHOULDER X FORCE (LB)	-18.01	-5.14	-199.17	26.0	144.0
RIGHT SHOULDER Y FORCE (LB)	-1.17	1.40	-2.97	65.0	242.0
RIGHT SHOULDER Z FORCE (LB)	-1.05	24.25	-0.74	80.0	2.0
RIGHT SHOULDER RESULTANT (LE	18.08	199.57	8.56	144.0	26.0
INT HEAD X ACCEL (G)	-0.19	6.13	-8.35	71.0	144.0
INT HEAD Y ACCEL (G)	0.13	1.86	-0.97	86.0	148.0
INT HEAD Z ACCEL (G)	0.03	22.43	-4.05	71.0	146.0
INT HEAD RESULTANT (G)	0.23	23.29	0.22	71.0	0.0
INT HEAD HIC		53.70		58.0	88.0

Page 1 of 3

201404 Test: 6468 Test Date: 140731 Subj: LARD Wt: 244.0
Nom G: 15.0 Cell: D15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
INT HEAD Ry ANG (RAD/SEC2)	-13.60	330.53	-694.75	87.0	130.0
INT NECK X FORCE (LB)	12.83	59.82	-93.70	69.0	141.0
INT NECK Y FORCE (LB)	-2.26	8.31	-23.68	148.0	87.0
INT NECK Z FORCE (LB)	7.48	67.71	-256.50	142.0	75.0
INT NECK RESULTANT (LB)	15.05	263.72	8.16	75.0	223.0
INT NECK Mx TORQUE (IN-LB)	-0.69	34.59	-33.20	136.0	111.0
INT NECK My TORQUE (IN-LB)	-8.20	179.19	-61.88	131.0	104.0
INT NECK Mz TORQUE (IN-LB)	-6.31	9.18	-10.90	130.0	164.0
INT NECK TORQUE RES (IN-LB)	10.45	179.93	4.28	131.0	239.0
INT CHEST X ACCEL (G)	-0.02	1.73	-3.24	67.0	149.0
INT CHEST Y ACCEL (G)	0.01	0.37	-0.41	80.0	107.0
INT CHEST Z ACCEL (G)	-0.02	22.14	-3.26	73.0	142.0
INT CHEST RESULTANT (G)	0.04	22.15	0.03	73.0	0.0
INT LUMBAR X ACCEL (G)	-0.01	7.09	-0.79	57.0	82.0
INT LUMBAR Y ACCEL (G)	-0.02	0.95	-1.33	132.0	152.0
INT LUMBAR Z ACCEL (G)	0.00	21.76	-3.60	77.0	147.0
INT LUMBAR RESULTANT (G)	0.09	21.76	0.08	77.0	0.0
INT LUMBAR X FORCE (LB)	2.85	432.60	1.54	78.0	2.0
INT LUMBAR Y FORCE (LB)	-7.71	-1.43	-19.55	59.0	188.0
INT LUMBAR Z FORCE (LB)	26.19	171.86	-1424.22	116.0	72.0
INT LUMBAR FORCE RESULTANT (	27.46	1480.33	12.82	73.0	17.0
INT LUMBAR Mx TORQUE (IN-LB)	-5.81	48.87	-55.29	68.0	195.0
INT LUMBAR My TORQUE (IN-LB)	-15.05	101.43	-2463.00	134.0	78.0
INT LUMBAR Mz TORQUE (IN-LB)	-13.68	0.61	-15.03	200.0	6.0
INT LUMBAR TORQUE RESULTANT	21.32	2463.21	19.66	78.0	3.0

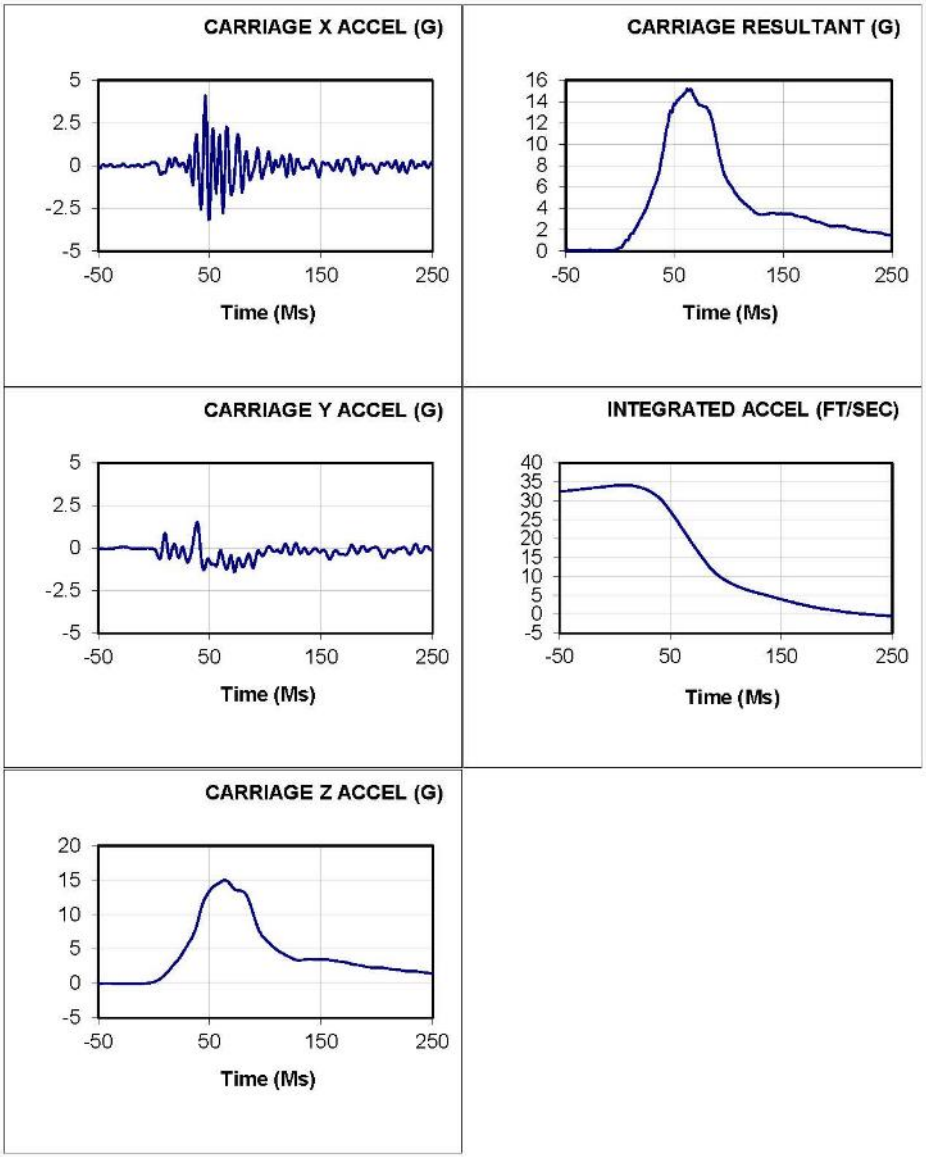
Page 2 of 3

201404 Test: 6468 Test Date: 140731 Subj: LARD Wt: 244.0
Nom G: 15.0 Cell: D15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
NIJ SHEAR (LB)		59.82	-93.70	69.0	141.0
NIJ TENSION (LB)		67.71		142.0	
NIJ COMPRESSION (LB)		-256.50		75.0	
NIJ FLEXION (IN-LB)		232.41		131.0	
NIJ EXTENSION (IN-LB)		83.16		86.0	
NIJ NTF	0.0000	0.0929	0.0000	134.0	0.0
NIJ NTE	0.0149	0.0213	0.0000	109.0	20.0
NIJ NCF	0.0000	0.0553	0.0000	187.0	0.0
NIJ NCE	0.0000	0.2023	0.0000	77.0	0.0
NIJ NTF AIS >= 2		0.13			
NIJ NTF AIS >= 3		0.05			
NIJ NTF AIS >= 4		0.07			
NIJ NTF AIS >= 5		0.02			
NIJ NTE AIS >= 2		0.12			
NIJ NTE AIS >= 3		0.04			
NIJ NTE AIS >= 4		0.07			
NIJ NTE AIS >= 5		0.02			
NIJ NCF AIS >= 2		0.12			
NIJ NCF AIS >= 3		0.04			
NIJ NCF AIS >= 4		0.07			
NIJ NCF AIS >= 5		0.02			
NIJ NCE AIS >= 2		0.14			
NIJ NCE AIS >= 3		0.06			
NIJ NCE AIS >= 4		0.08			
NIJ NCE AIS >= 5		0.03			
MNIx	0.0006	0.0218	0.0001	136.0	32.0
NMIz	0.0040	0.0069	0.0001	164.0	194.0

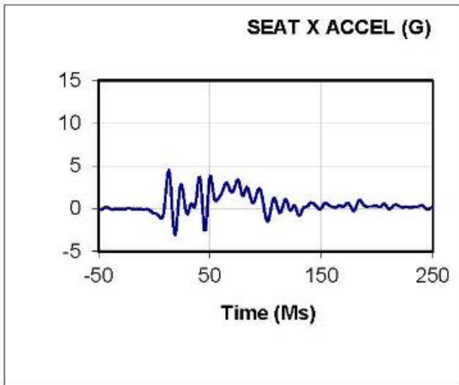
Page 3 of 3

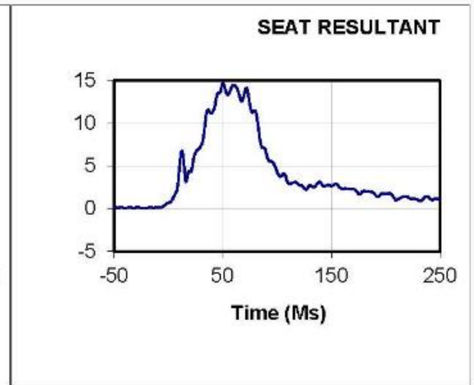
201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15

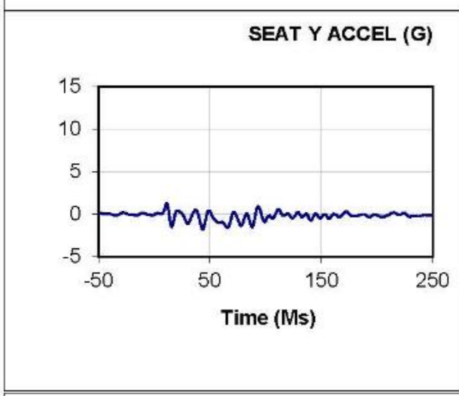


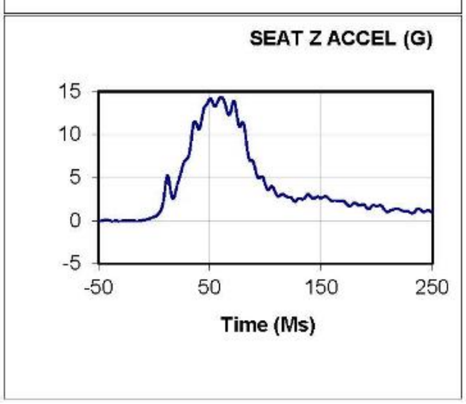
Page 1 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



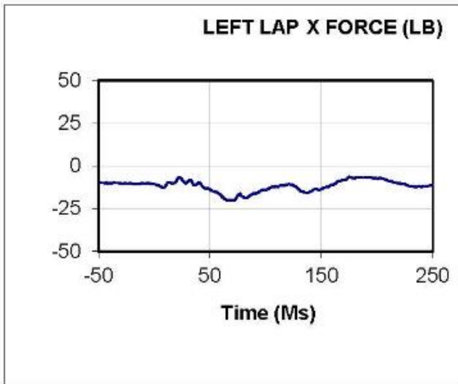


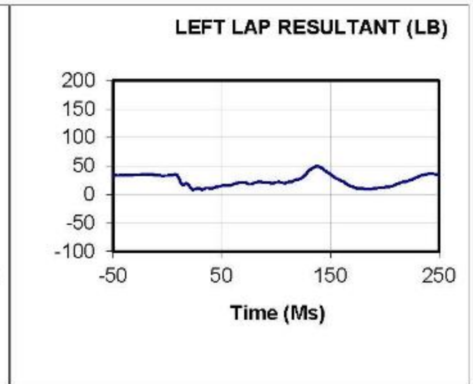


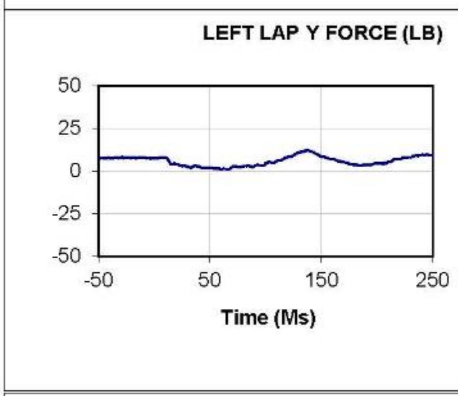


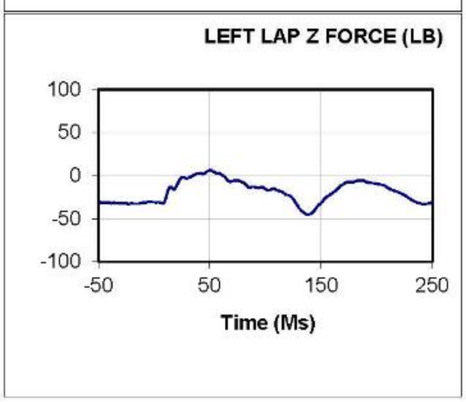
Page 2 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



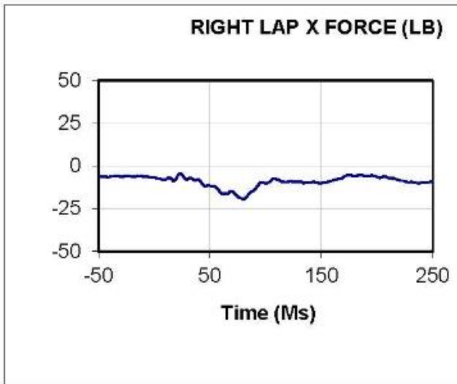


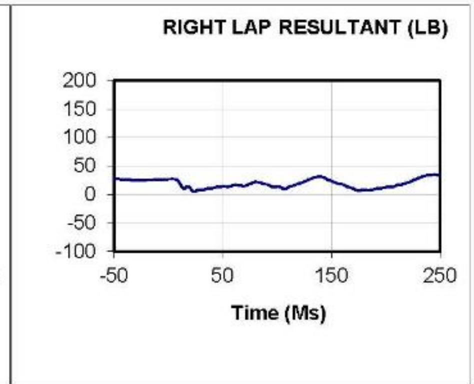


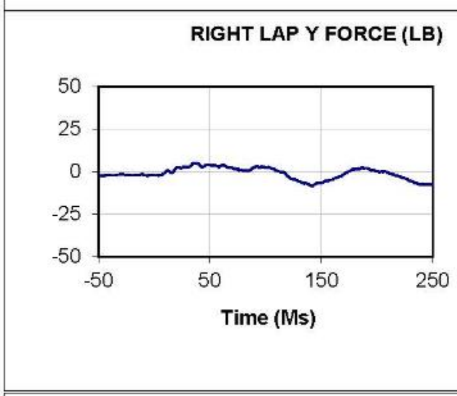


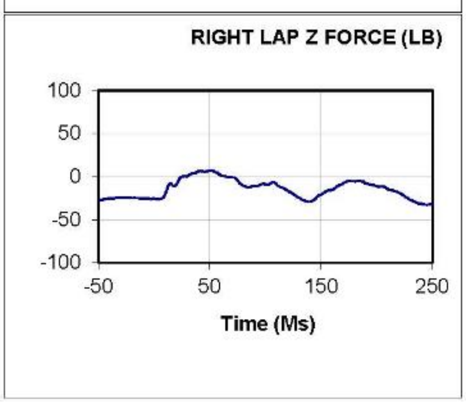
Page 3 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



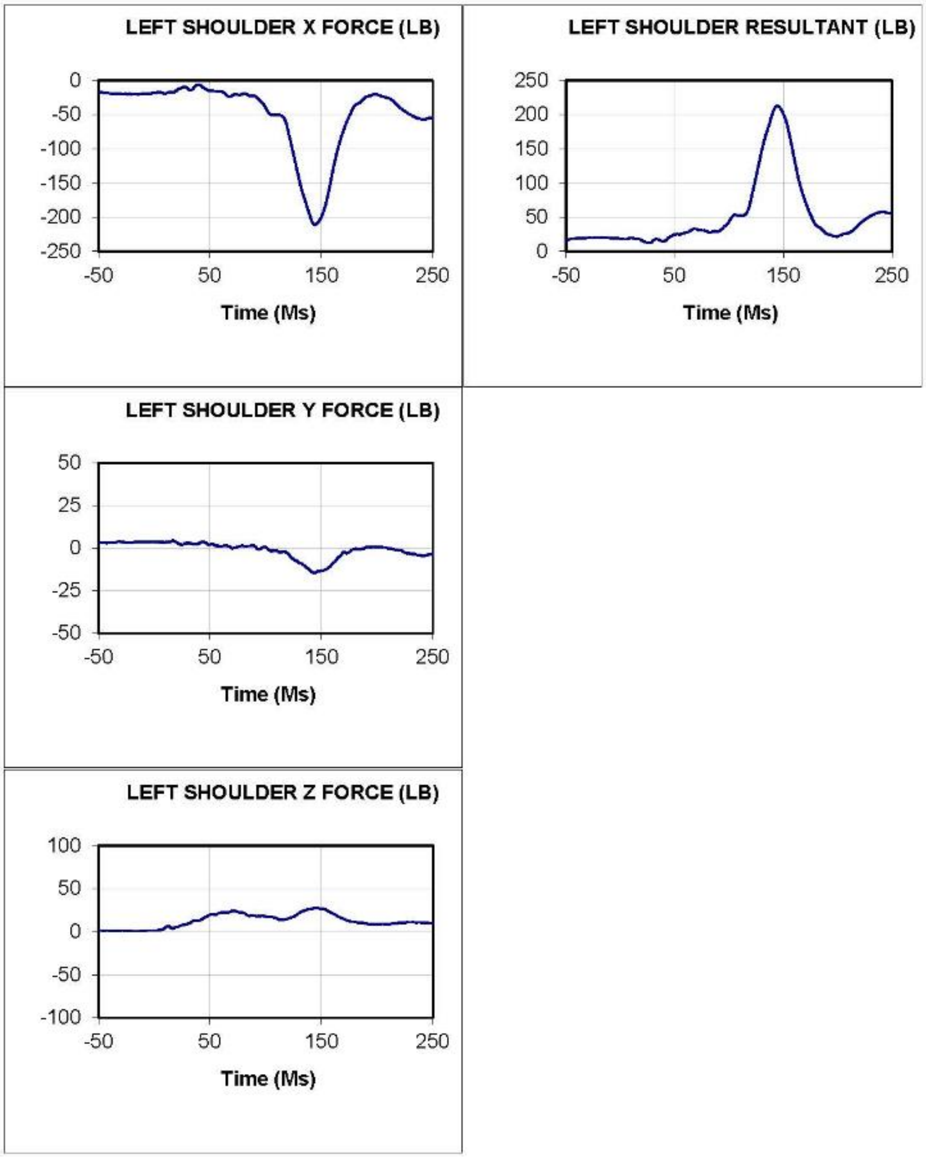






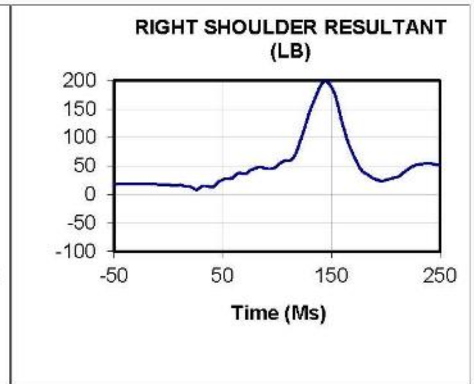
Page 4 of 14

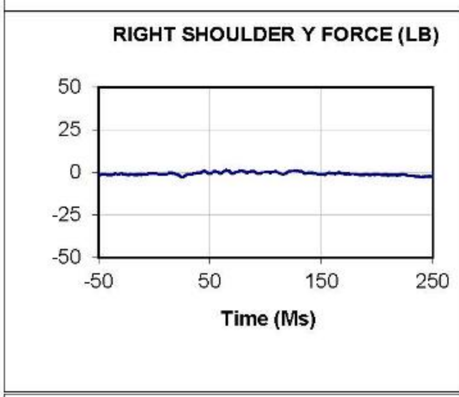
201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



Page 5 of 14

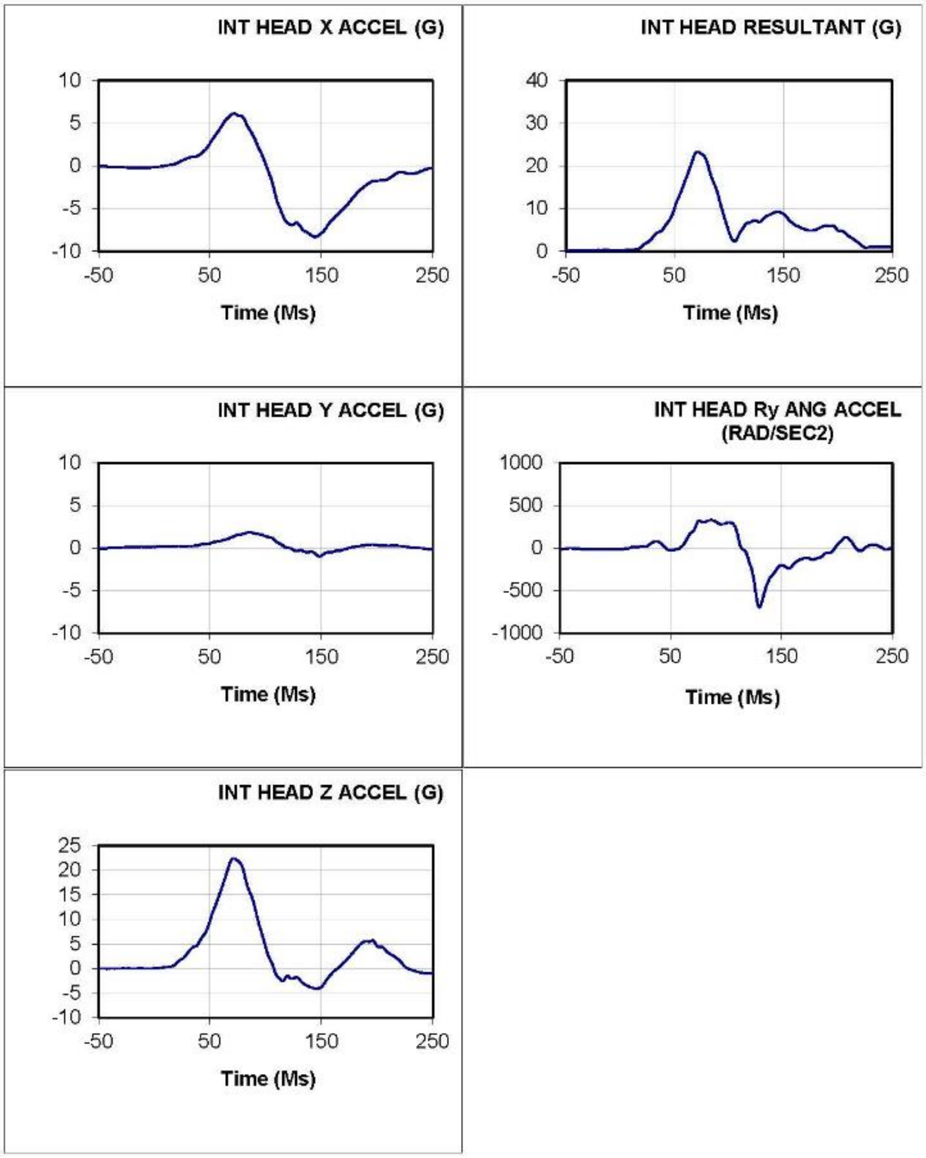
201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15





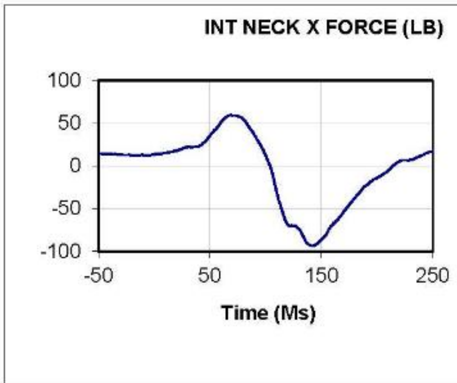
Page 6 of 14

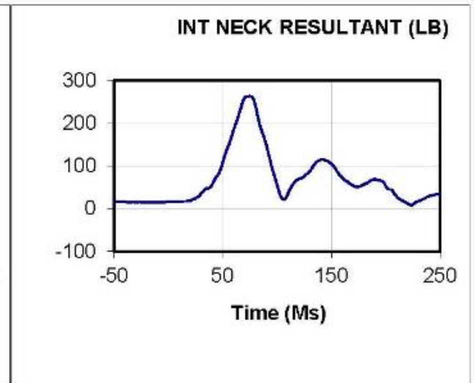
201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15

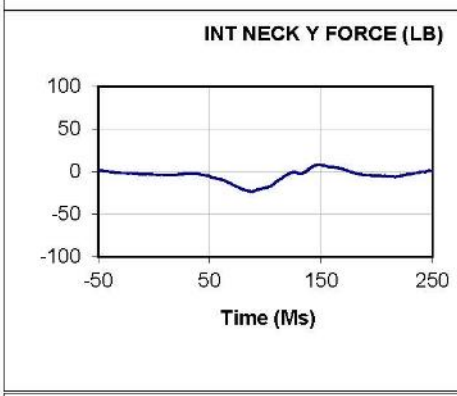


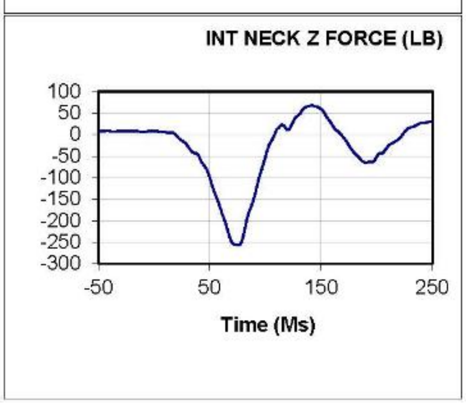
Page 7 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



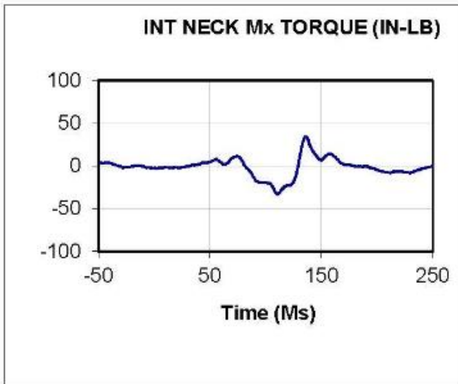


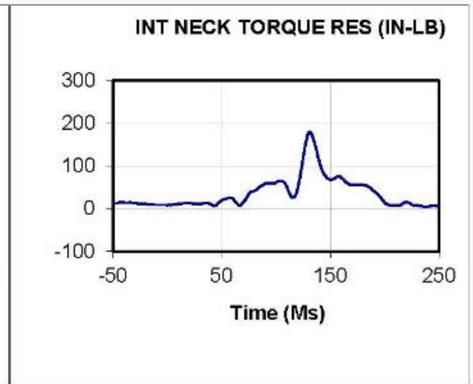


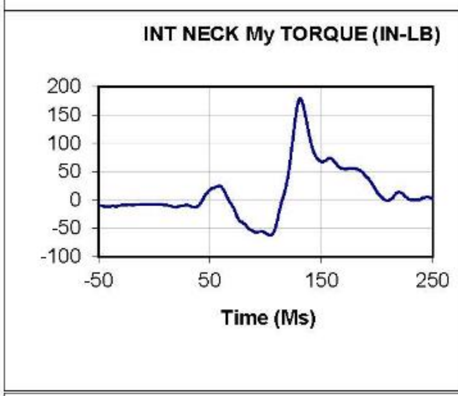


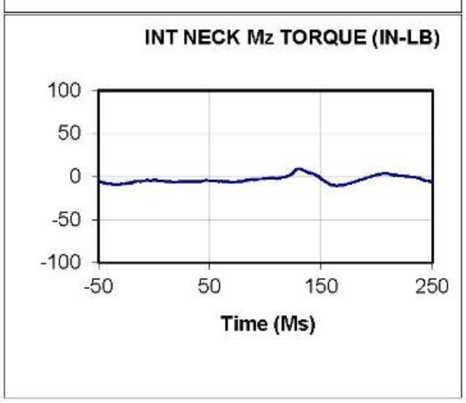
Page 8 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



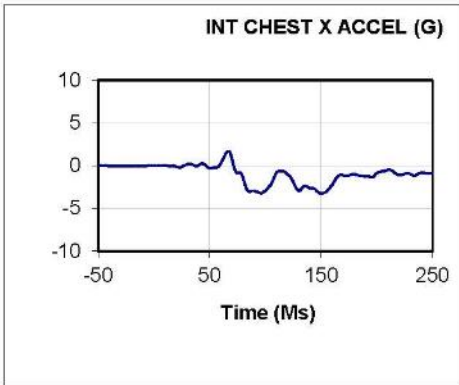


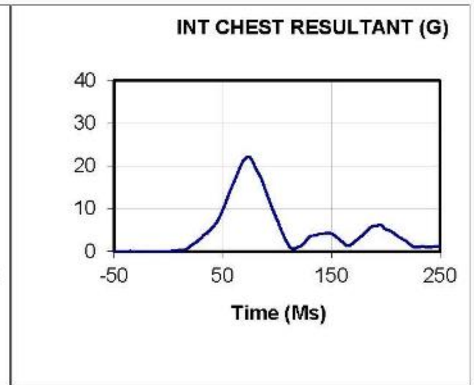


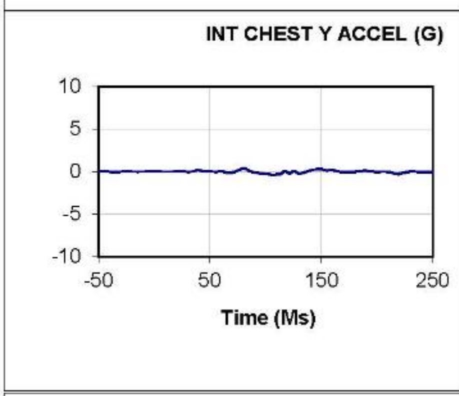


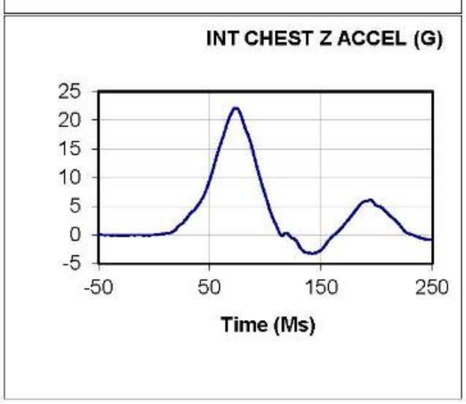
Page 9 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



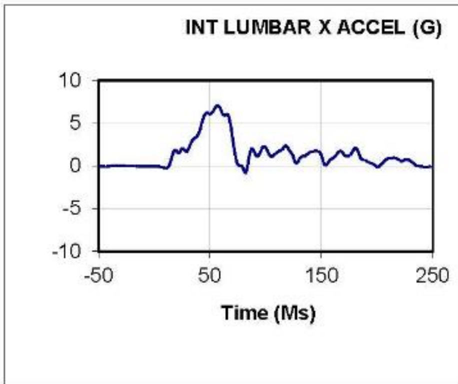


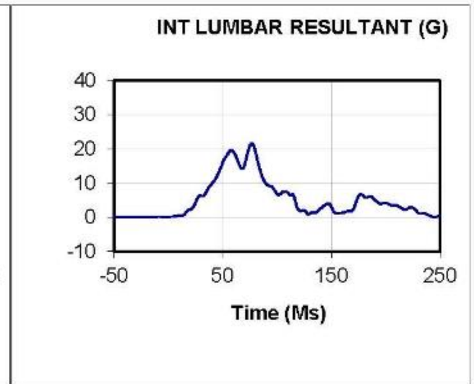


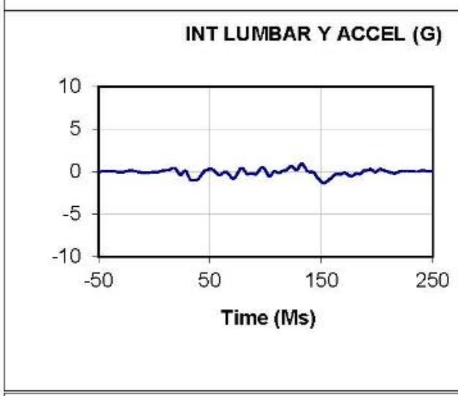


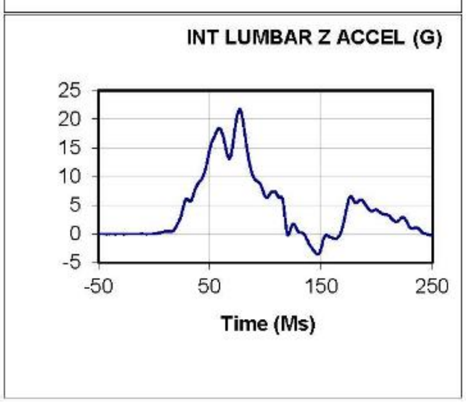
Page 10 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



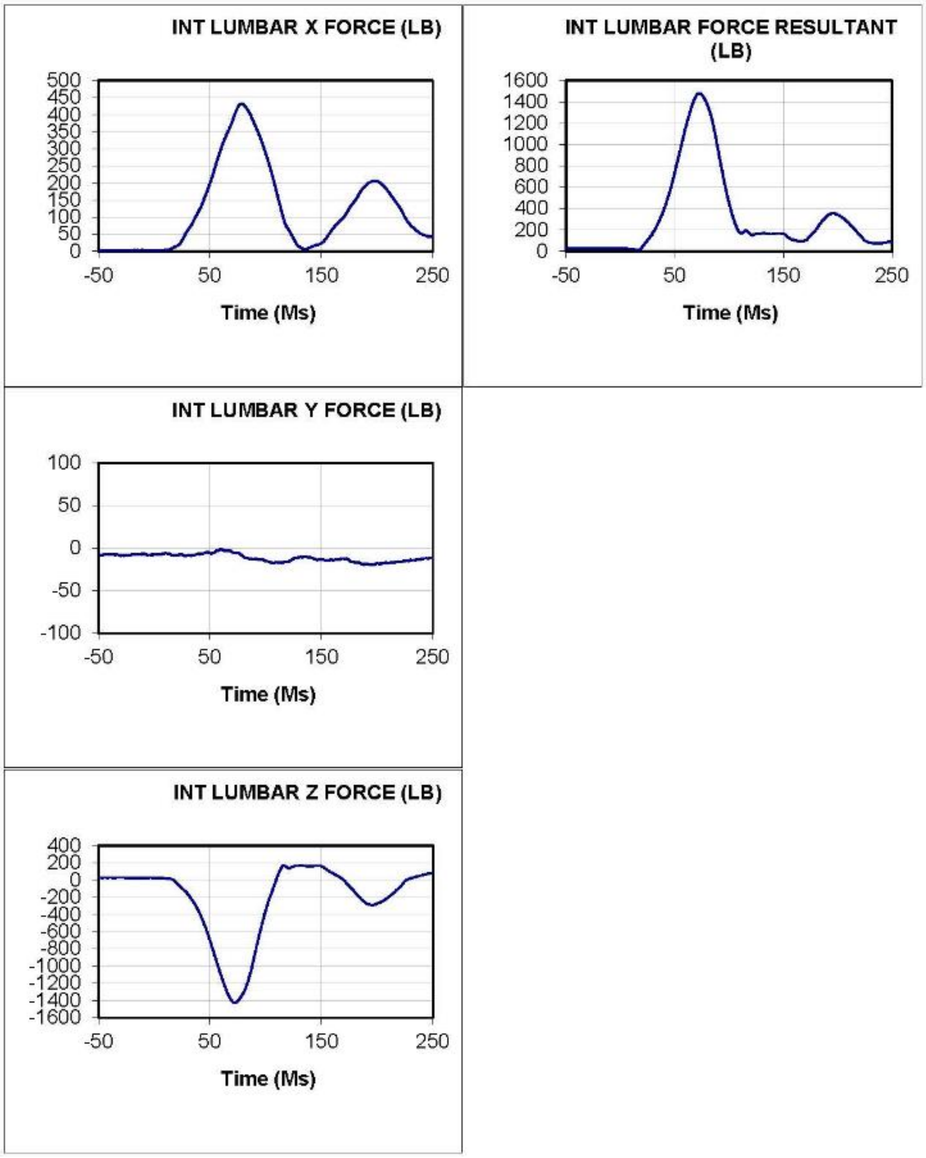






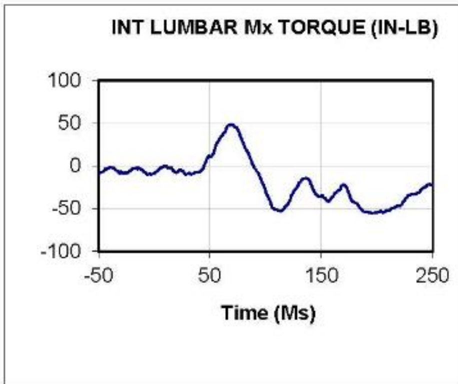
Page 11 of 14

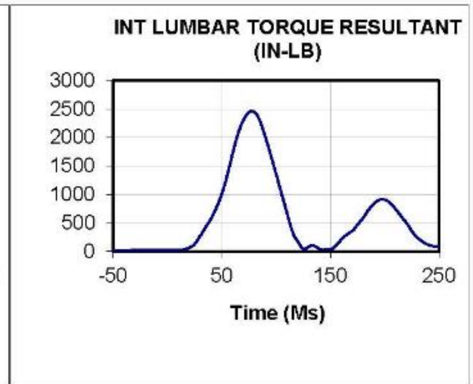
201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15

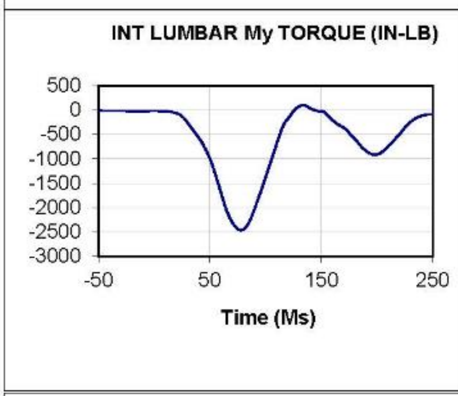


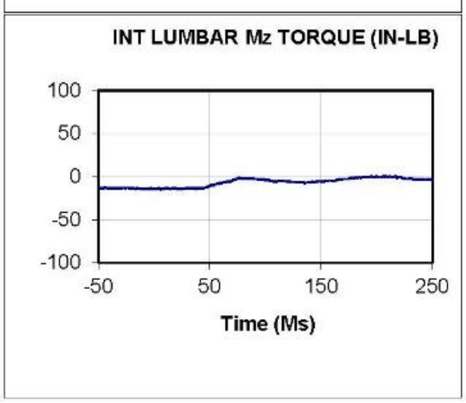
Page 12 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



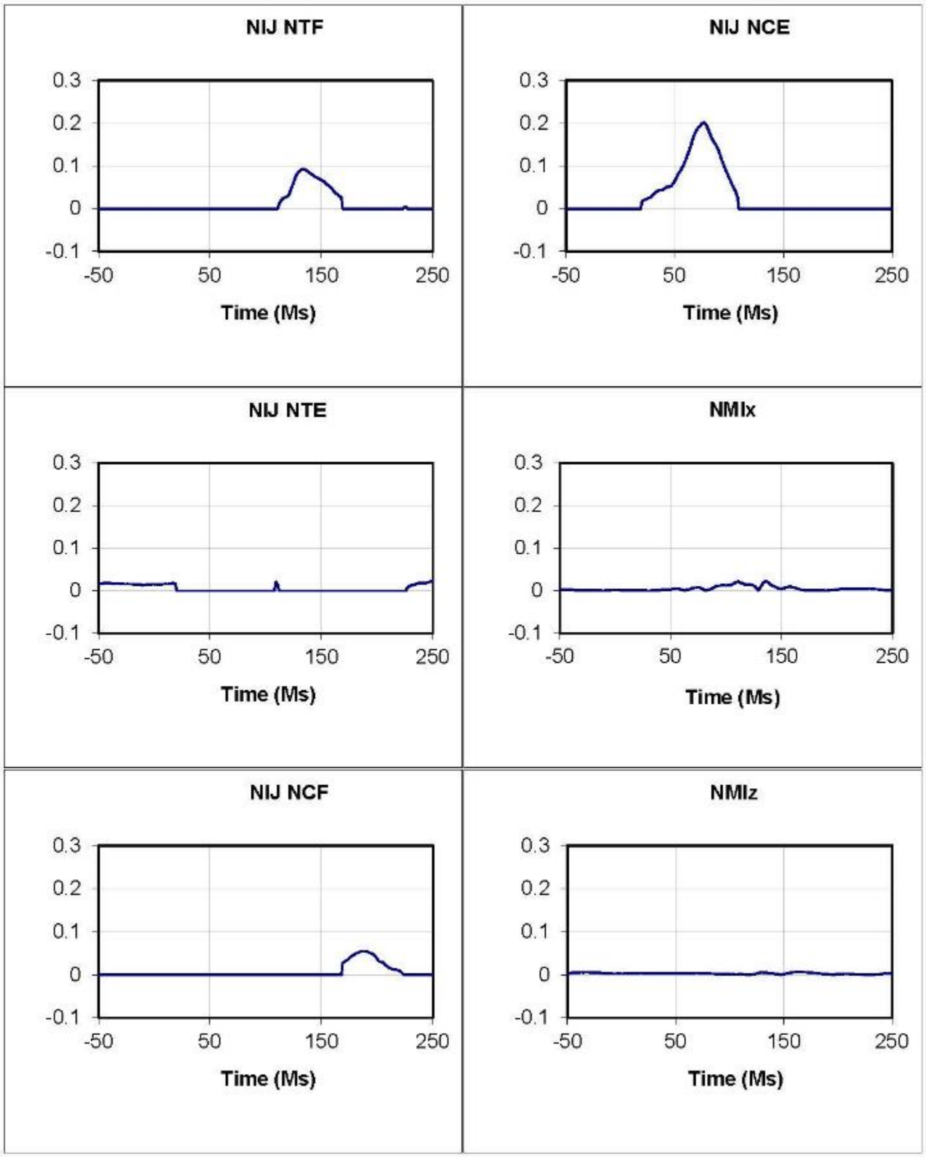






Page 13 of 14

201404 Test: 6468 Test Date: 140731 Subj: LARD Cell: D15



Page 14 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Wt: 104.0
Nom G: 15.0 Cell: E15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
Kodak Start Time (Ms)				-2435.0	
Reference Mark Time (Ms)				-96.0	
Drop Height (In)		84.65			
Impact Rise Time (Ms)				62.0	
Impact Duration (Ms)				127.8	
Velocity Change (Ft/Sec)		33.58			
CARRIAGE X ACCEL (G)	0.00	2.49	-5.42	59.0	56.0
CARRIAGE Y ACCEL (G)	-0.01	0.92	-0.85	69.0	75.0
CARRIAGE Z ACCEL (G)	0.00	14.82	0.25	63.0	0.0
CARRIAGE Z2 ACCEL (G)	0.01	14.77	0.32	61.0	0.0
CARRIAGE RESULTANT (G)	0.12	15.55	0.25	63.0	0.0
INTEGRATED ACCEL (FT/SEC)	32.93	33.58	1.65	8.0	234.0
SEAT X ACCEL (G)	0.00	2.60	-2.54	48.0	52.0
SEAT Y ACCEL (G)	-0.02	1.83	-0.76	64.0	55.0
SEAT Z ACCEL (G)	0.00	15.08	0.03	65.0	0.0
SEAT RESULTANT	0.13	15.17	0.15	65.0	0.0
LEFT LAP X FORCE (LB)	-27.30	7.22	-54.35	56.0	173.0
LEFT LAP Y FORCE (LB)	0.44	6.57	-3.50	173.0	70.0
LEFT LAP Z FORCE (LB)	7.05	15.53	5.01	63.0	31.0
LEFT LAP RESULTANT (LB)	28.20	56.64	5.76	173.0	33.0
RIGHT LAP X FORCE (LB)	-32.61	10.13	-42.18	65.0	154.0
RIGHT LAP Y FORCE (LB)	0.28	10.06	-0.18	73.0	30.0
RIGHT LAP Z FORCE (LB)	6.81	11.14	-3.28	160.0	44.0
RIGHT LAP RESULTANT (LB)	33.31	43.68	2.66	154.0	34.0
LEFT SHOULDER X FORCE (LB)	-10.98	-4.52	-43.74	222.0	152.0
LEFT SHOULDER Y FORCE (LB)	3.06	5.33	1.41	50.0	32.0
LEFT SHOULDER Z FORCE (LB)	2.22	26.82	2.21	66.0	0.0
LEFT SHOULDER RESULTANT (LB)	11.62	46.41	6.05	152.0	233.0
RIGHT SHOULDER X FORCE (LB)	-12.78	-7.96	-79.03	34.0	164.0
RIGHT SHOULDER Y FORCE (LB)	1.08	10.31	0.00	165.0	34.0
RIGHT SHOULDER Z FORCE (LB)	2.83	34.10	2.27	158.0	0.0
RIGHT SHOULDER RESULTANT (LB)	13.14	86.59	11.10	164.0	18.0
INT HEAD X ACCEL (G)	-0.09	0.42	-6.87	23.0	149.0
INT HEAD Y ACCEL (G)	0.00	1.12	-0.01	174.0	3.0
INT HEAD Z ACCEL (G)	0.05	15.77	-1.08	58.0	161.0
INT HEAD RESULTANT (G)	0.12	15.79	0.05	58.0	0.0

Page 1 of 3

201502 Test: 6617 Test Date: 150324 Subj: LOIS Wt: 104.0
Nom G: 15.0 Cell: E15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
INT HEAD HIC		23.05		47.0	77.0
INT HEAD Ry ANG (RAD/SEC2)	-1.85	322.85	-309.66	75.0	125.0
INT NECK X FORCE (LB)	-6.39	8.30	-89.94	48.0	134.0
INT NECK Y FORCE (LB)	-0.88	-0.17	-11.54	21.0	180.0
INT NECK Z FORCE (LB)	1.71	55.62	-184.74	158.0	59.0
INT NECK RESULTANT (LB)	6.79	184.87	1.37	59.0	25.0
INT NECK Mx TORQUE (IN-LB)	4.72	8.74	-15.25	37.0	141.0
INT NECK My TORQUE (IN-LB)	-6.68	80.08	-7.97	61.0	1.0
INT NECK Mz TORQUE (IN-LB)	3.96	1.53	-14.54	0.0	234.0
INT NECK TORQUE RES (IN-LB)	9.30	80.94	3.76	61.0	17.0
INT CHEST X ACCEL (G)	-0.04	0.09	-4.41	6.0	68.0
INT CHEST Y ACCEL (G)	-0.04	0.94	-0.13	60.0	112.0
INT CHEST Z ACCEL (G)	0.06	17.71	0.03	64.0	4.0
INT CHEST RESULTANT (G)	0.11	18.24	0.07	64.0	1.0
INT LUMBAR X ACCEL (G)	0.04	2.47	-0.25	83.0	98.0
INT LUMBAR Y ACCEL (G)	0.00	1.64	-0.52	78.0	64.0
INT LUMBAR Z ACCEL (G)	0.05	17.53	0.06	63.0	1.0
INT LUMBAR RESULTANT (G)	0.11	17.54	0.08	63.0	2.0
INT LUMBAR X FORCE (LB)	13.94	239.99	13.19	69.0	1.0
INT LUMBAR Y FORCE (LB)	-5.34	14.10	-13.74	173.0	36.0
INT LUMBAR Z FORCE (LB)	8.06	10.26	-738.36	0.0	64.0
INT LUMBAR FORCE RESULTANT (LB)	17.01	773.80	14.41	64.0	18.0
INT LUMBAR Mx TORQUE (IN-LB)	10.93	34.46	-63.60	75.0	230.0
INT LUMBAR My TORQUE (IN-LB)	14.20	218.02	-615.46	227.0	66.0
INT LUMBAR Mz TORQUE (IN-LB)	-3.94	-2.59	-41.39	64.0	193.0
INT LUMBAR TORQUE RESULTANT (IN-LB)	18.42	615.48	9.89	66.0	24.0

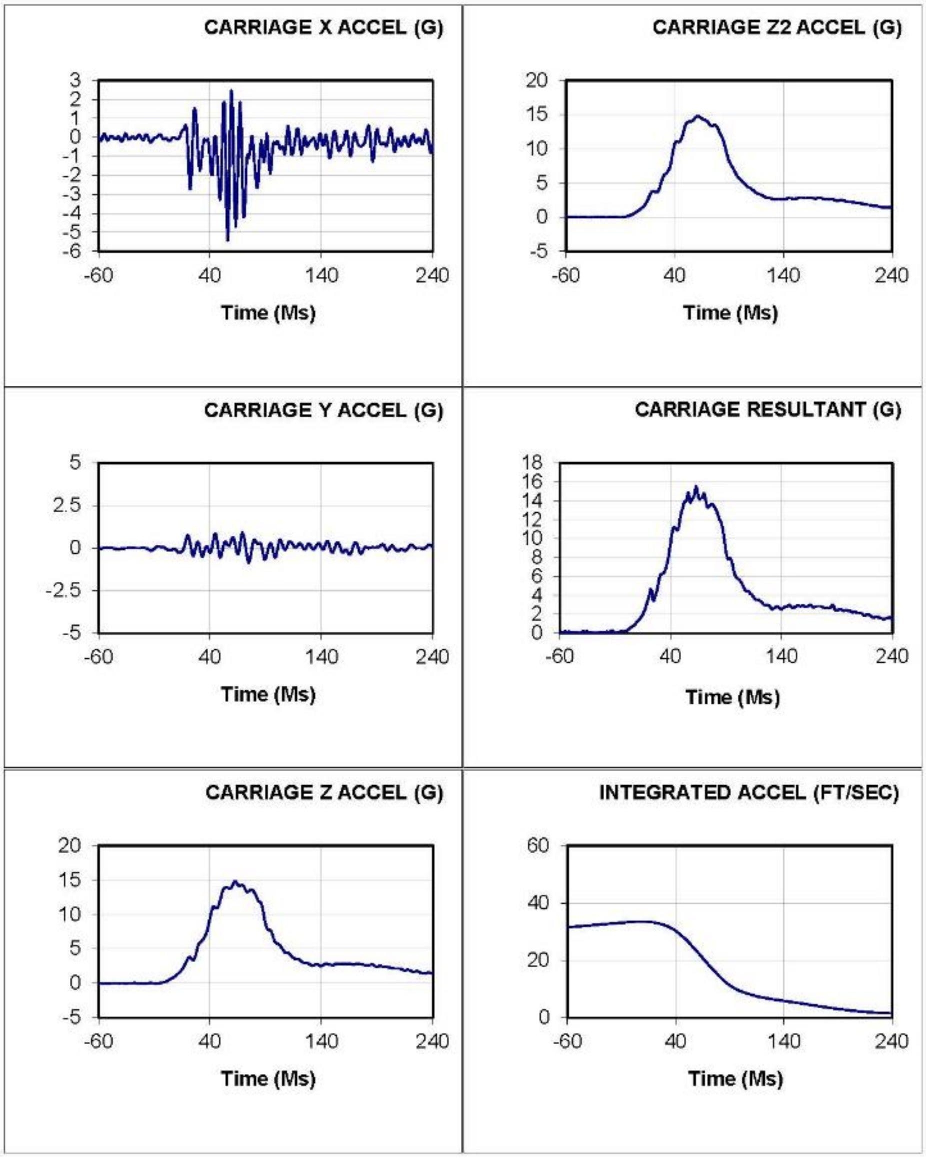
Page 2 of 3

201502 Test: 6617 Test Date: 150324 Subj: LOIS Wt: 104.0
Nom G: 15.0 Cell: E15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
NIJ SHEAR (LB)		8.30	-89.94	48.0	134.0
NIJ TENSION (LB)		55.62		158.0	
NIJ COMPRESSION (LB)		-184.74		59.0	
NIJ FLEXION (IN-LB)		130.15		121.0	
NIJ EXTENSION (IN-LB)		5.65		-55.0	
NIJ NTF	0.0000	0.1482	0.0000	126.0	0.0
NIJ NTE	0.0054	0.0090	0.0000	1.0	9.0
NIJ NCF	0.0000	0.2682	0.0000	61.0	0.0
NIJ NCE	0.0001	0.0000	0.0000	0.0	0.0
NIJ NTF AIS >= 2		0.13			
NIJ NTF AIS >= 3		0.05			
NIJ NTF AIS >= 4		0.07			
NIJ NTF AIS >= 5		0.03			
NIJ NTE AIS >= 2		0.12			
NIJ NTE AIS >= 3		0.04			
NIJ NTE AIS >= 4		0.06			
NIJ NTE AIS >= 5		0.02			
NIJ NCF AIS >= 2		0.15			
NIJ NCF AIS >= 3		0.06			
NIJ NCF AIS >= 4		0.09			
NIJ NCF AIS >= 5		0.03			
NIJ NCE AIS >= 2		0.11			
NIJ NCE AIS >= 3		0.04			
NIJ NCE AIS >= 4		0.06			
NIJ NCE AIS >= 5		0.02			
MNIx	0.0080	0.0257	0.0002	141.0	20.0
NMIz	0.0067	0.0245	0.0002	234.0	5.0

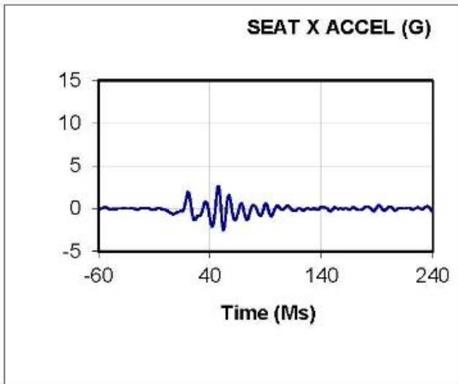
Page 3 of 3

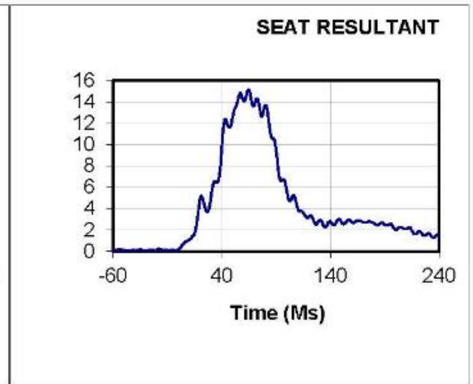
201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15

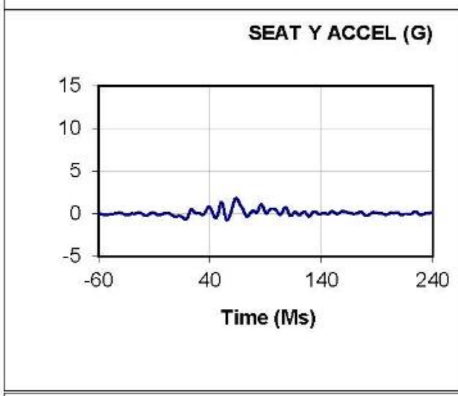


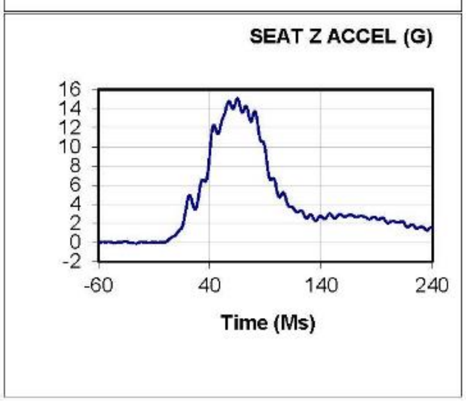
Page 1 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



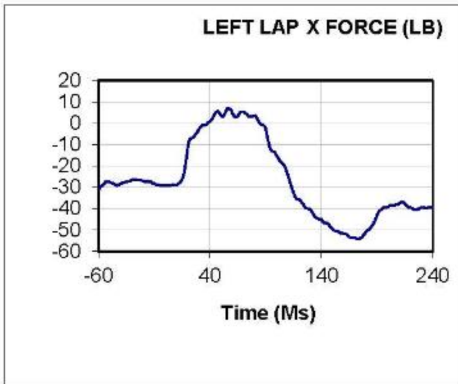


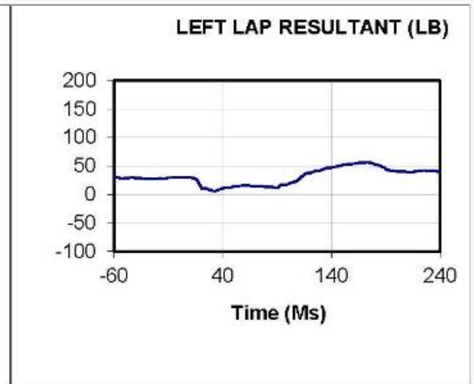


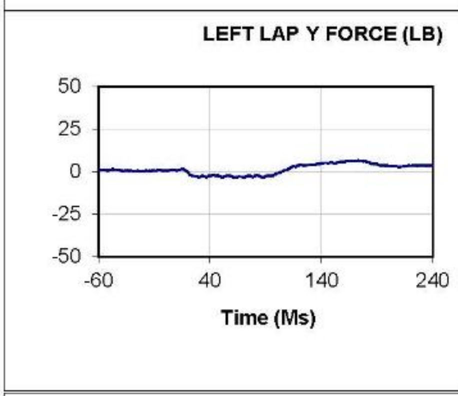


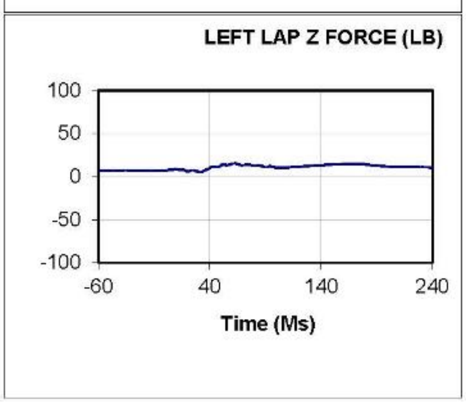
Page 2 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



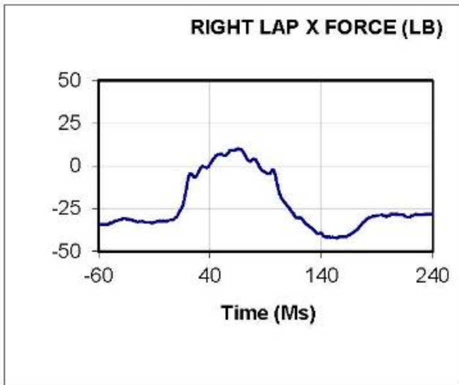


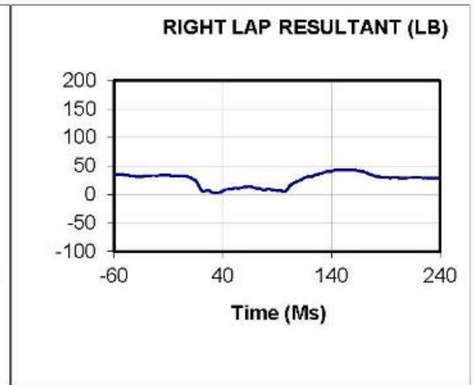


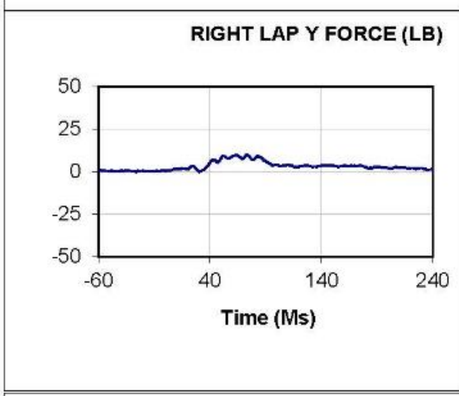


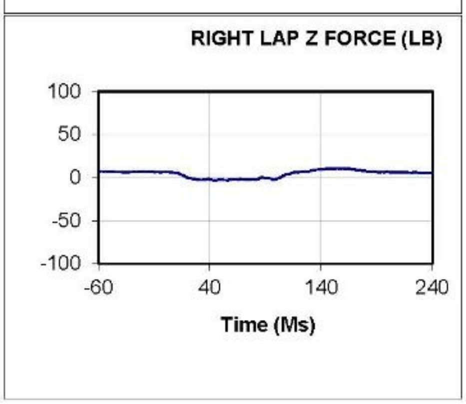
Page 3 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



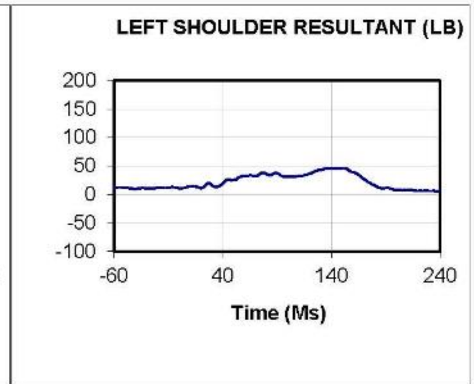


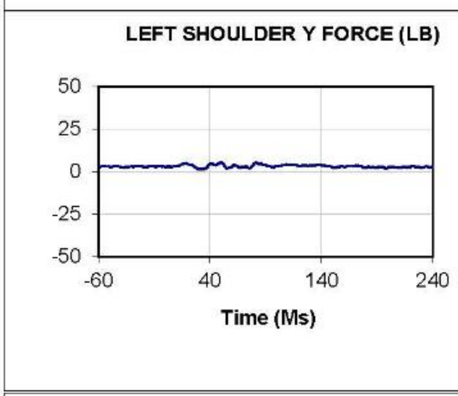




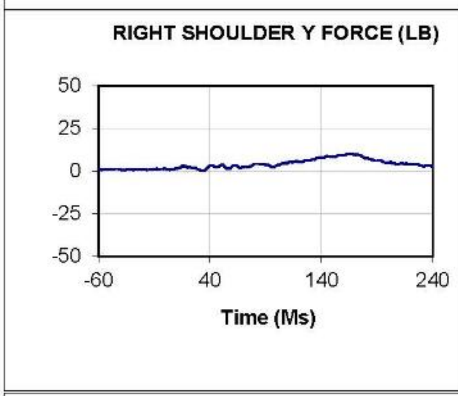
Page 4 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



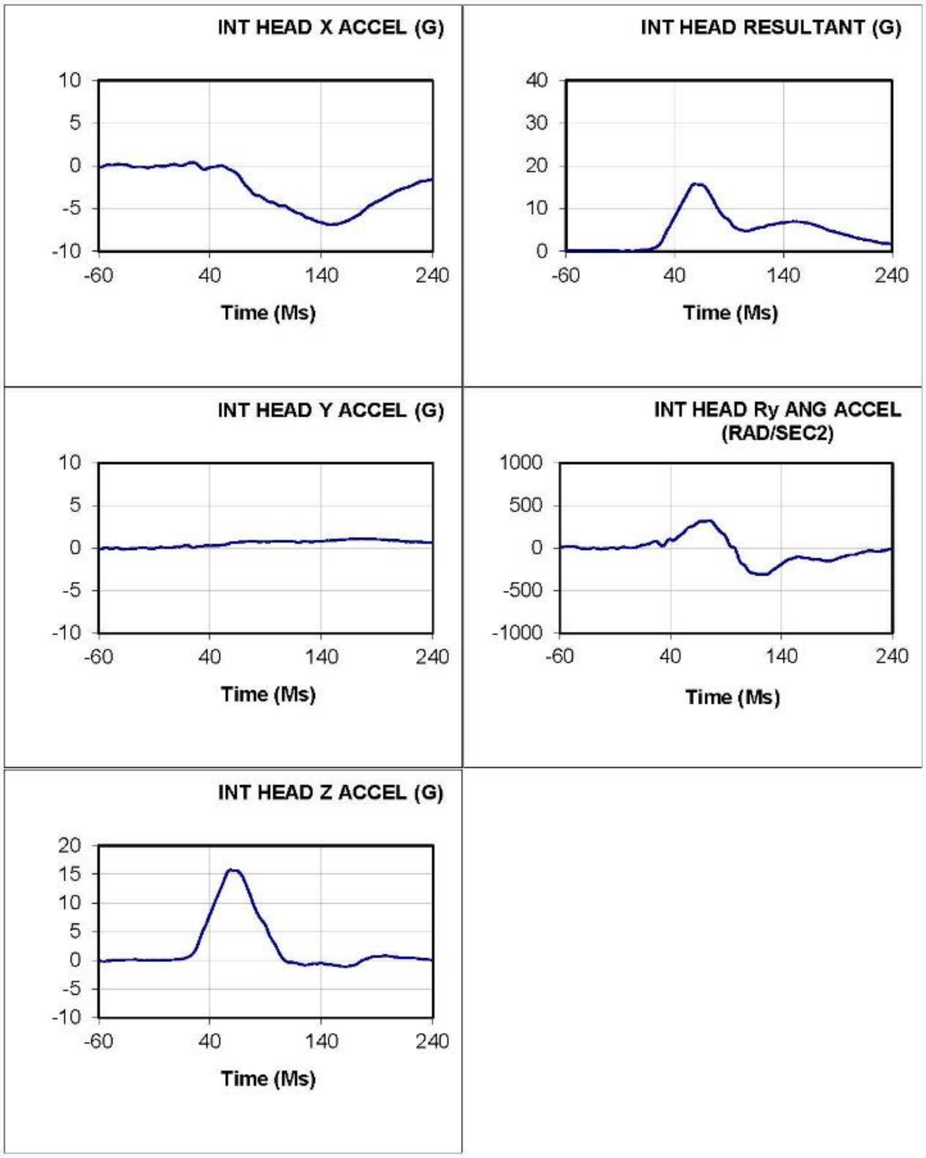


201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



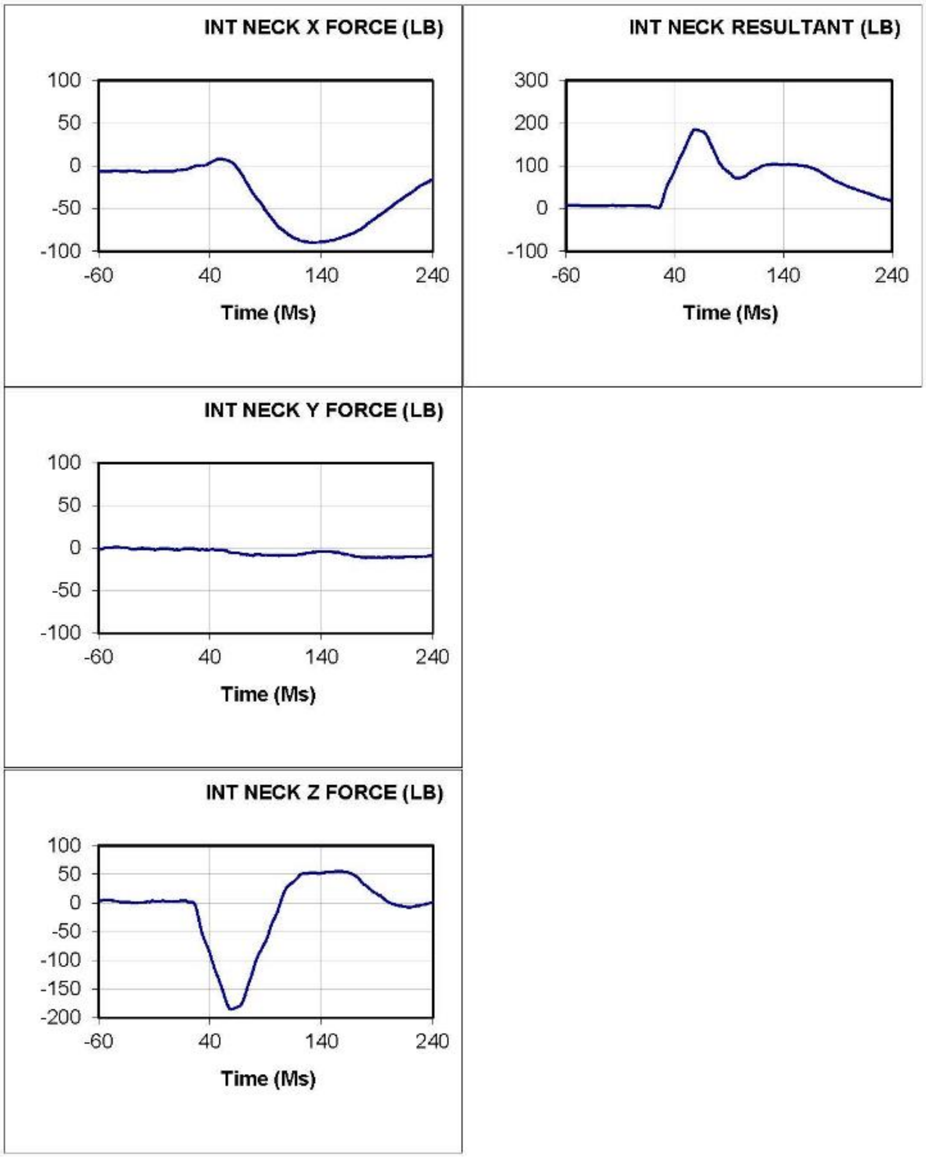
Page 6 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



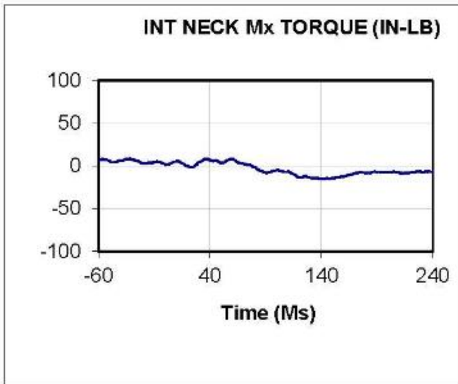
Page 7 of 14

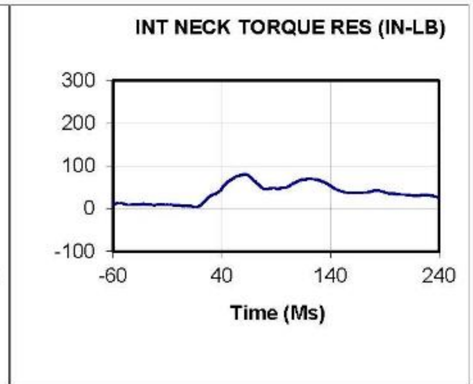
201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15

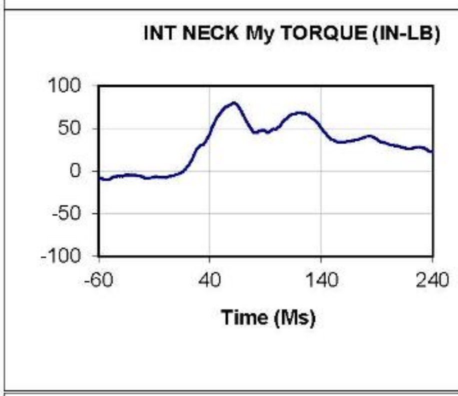


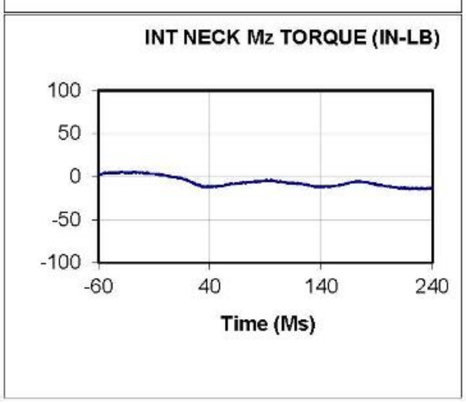
Page 8 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



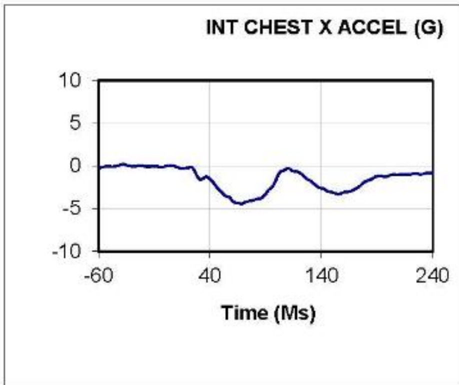


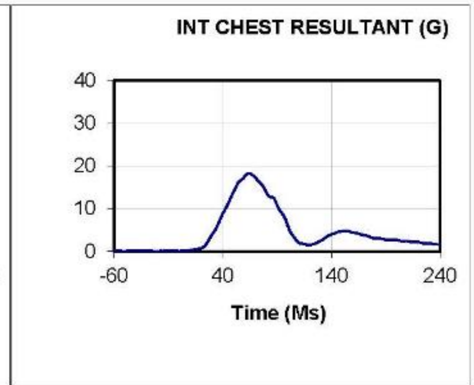


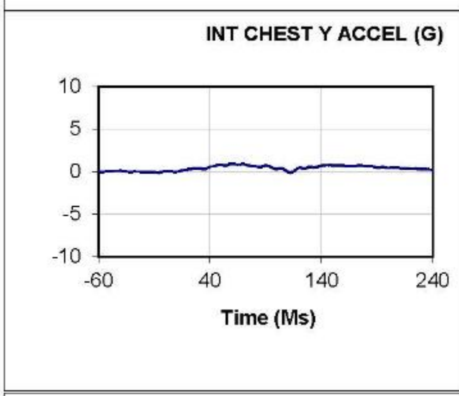


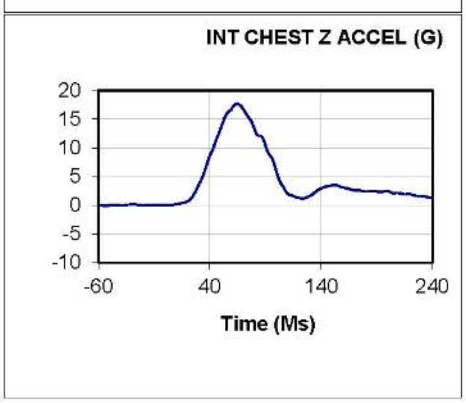
Page 9 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15

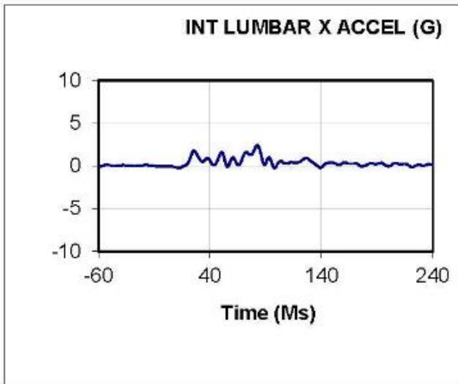


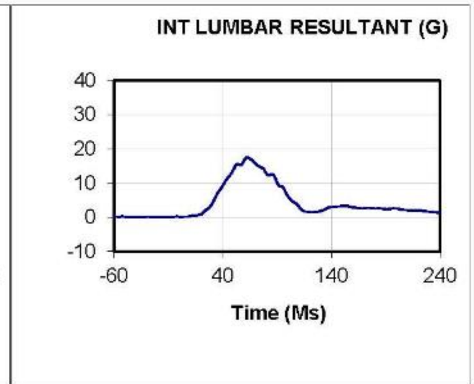


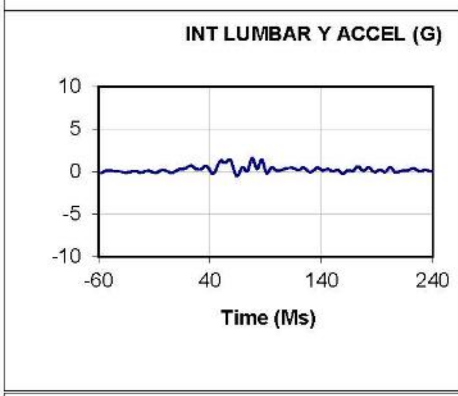


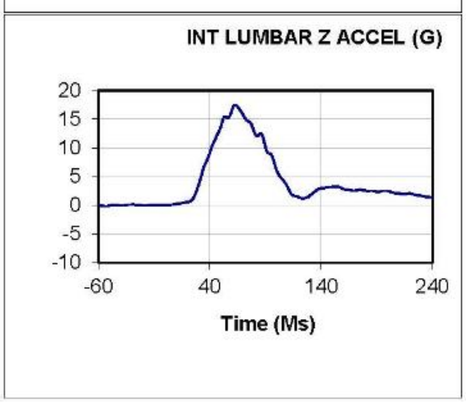


Page 10 of 14

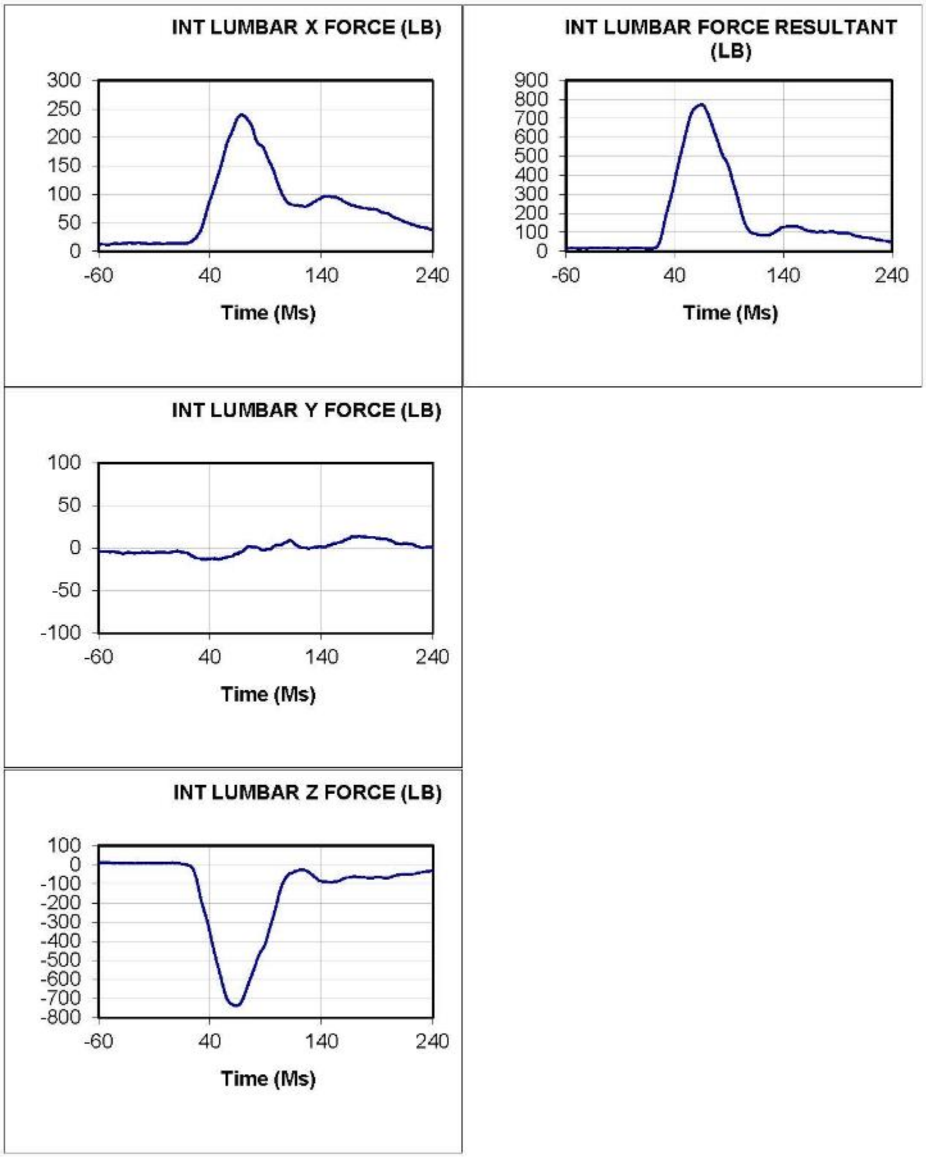

INT LUMBAR X ACCEL (G)
10
5
0
-5
-10
-60
40
140
240
Time (Ms)


INT LUMBAR RESULTANT (G)
40
30
20
10
0
-10
-60
40
140
240
Time (Ms)


INT LUMBAR Y ACCEL (G)
10
5
0
-5
-10
-60
40
140
240
Time (Ms)

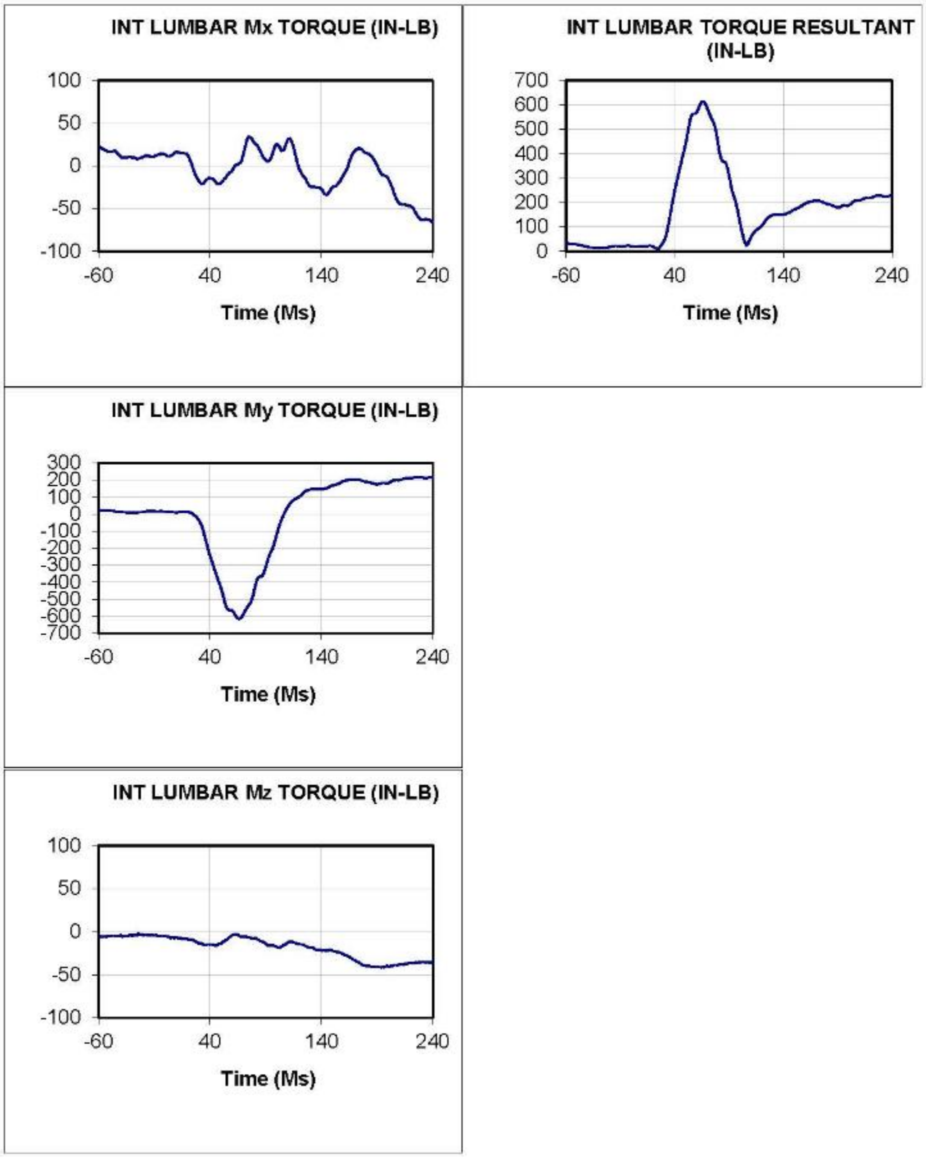

INT LUMBAR Z ACCEL (G)
20
15
10
5
0
-5
-10
-60
40
140
240
Time (Ms)

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



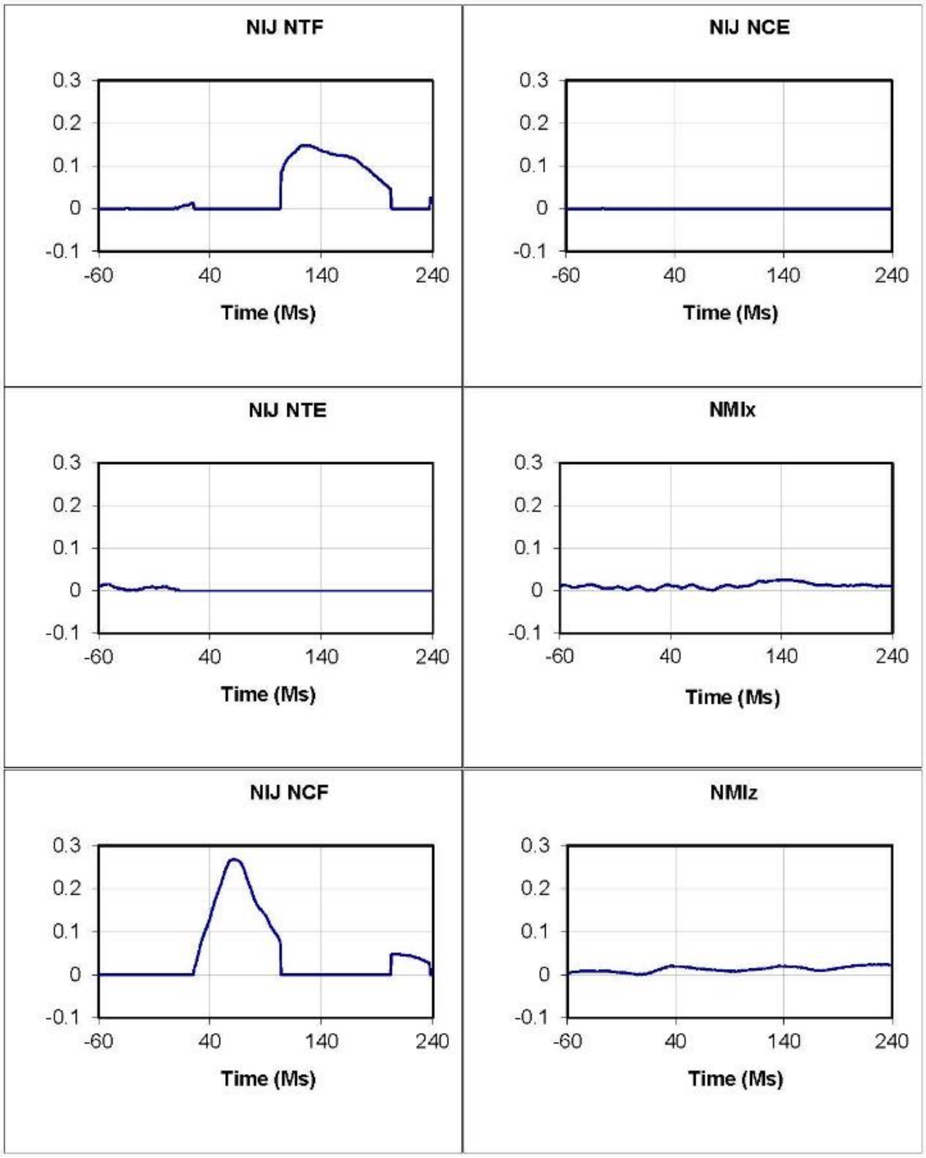
Page 12 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



Page 13 of 14

201502 Test: 6617 Test Date: 150324 Subj: LOIS Cell: E15



Page 14 of 14

201502 Test: 6610 Test Date: 150324 Subj: LARD Wt: 246.0
Nom G: 15.0 Cell: E15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
Kodak Start Time (Ms)				-2443.0	
Reference Mark Time (Ms)				-106.0	
Drop Height (In)		84.65			
Impact Rise Time (Ms)				60.0	
Impact Duration (Ms)				134.6	
Velocity Change (Ft/Sec)		34.38			
CARRIAGE X ACCEL (G)	0.01	2.80	-5.06	52.0	56.0
CARRIAGE Y ACCEL (G)	-0.01	0.98	-0.90	150.0	49.0
CARRIAGE Z ACCEL (G)	-0.01	14.97	0.21	62.0	0.0
CARRIAGE Z2 ACCEL (G)	0.00	14.34	0.30	59.0	0.0
CARRIAGE RESULTANT (G)	0.08	15.39	0.26	63.0	0.0
INTEGRATED ACCEL (FT/SEC)	33.71	34.38	1.84	8.0	234.0
SEAT X ACCEL (G)	0.04	4.31	-3.44	20.0	25.0
SEAT Y ACCEL (G)	0.01	1.38	-0.97	62.0	54.0
SEAT Z ACCEL (G)	0.02	14.51	0.17	55.0	0.0
SEAT RESULTANT	0.10	14.56	0.19	65.0	0.0
LEFT LAP X FORCE (LB)	-26.95	3.45	-43.44	56.0	138.0
LEFT LAP Y FORCE (LB)	0.91	8.14	-3.62	138.0	50.0
LEFT LAP Z FORCE (LB)	10.44	21.11	6.21	83.0	30.0
LEFT LAP RESULTANT (LB)	28.92	47.80	7.86	138.0	30.0
RIGHT LAP X FORCE (LB)	-30.42	1.32	-42.73	48.0	136.0
RIGHT LAP Y FORCE (LB)	5.86	19.23	0.59	85.0	30.0
RIGHT LAP Z FORCE (LB)	2.05	8.74	-4.22	140.0	32.0
RIGHT LAP RESULTANT (LB)	31.05	44.54	4.50	136.0	31.0
LEFT SHOULDER X FORCE (LB)	-20.10	-13.03	-302.06	45.0	145.0
LEFT SHOULDER Y FORCE (LB)	2.31	3.28	-10.66	43.0	141.0
LEFT SHOULDER Z FORCE (LB)	2.87	70.82	2.84	144.0	0.0
LEFT SHOULDER RESULTANT (LB)	20.44	310.22	19.84	145.0	0.0
RIGHT SHOULDER X FORCE (LB)	-20.30	-9.62	-257.08	46.0	148.0
RIGHT SHOULDER Y FORCE (LB)	1.08	7.60	0.41	234.0	28.0
RIGHT SHOULDER Z FORCE (LB)	1.32	45.43	1.28	146.0	0.0
RIGHT SHOULDER RESULTANT (LB)	20.37	261.07	13.12	148.0	35.0
INT HEAD X ACCEL (G)	-0.05	3.37	-6.73	68.0	153.0
INT HEAD Y ACCEL (G)	-0.14	0.65	-0.13	76.0	20.0
INT HEAD Z ACCEL (G)	0.02	23.90	-5.83	75.0	149.0
INT HEAD RESULTANT (G)	0.16	24.00	0.06	75.0	6.0

Page 1 of 3

201502 Test: 6610 Test Date: 150324 Subj: LARD Wt: 246.0
Nom G: 15.0 Cell: E15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
INT HEAD HIC		48.26		62.0	92.0
INT HEAD Ry ANG (RAD/SEC2)	1.57	613.59	-498.99	77.0	126.0
INT NECK X FORCE (LB)	-4.11	50.72	-94.57	70.0	155.0
INT NECK Y FORCE (LB)	-0.73	4.60	-13.19	153.0	75.0
INT NECK Z FORCE (LB)	4.36	97.81	-362.65	147.0	76.0
INT NECK RESULTANT (LB)	6.08	364.20	4.03	76.0	25.0
INT NECK Mx TORQUE (IN-LB)	5.98	31.53	-26.78	143.0	120.0
INT NECK My TORQUE (IN-LB)	0.45	217.93	-57.28	129.0	77.0
INT NECK Mz TORQUE (IN-LB)	0.50	10.81	-13.20	128.0	32.0
INT NECK TORQUE RES (IN-LB)	6.23	218.40	4.52	129.0	7.0
INT CHEST X ACCEL (G)	-0.06	4.23	-4.42	73.0	149.0
INT CHEST Y ACCEL (G)	0.05	0.63	-2.18	142.0	76.0
INT CHEST Z ACCEL (G)	0.03	26.70	-4.61	73.0	145.0
INT CHEST RESULTANT (G)	0.09	27.09	0.05	73.0	0.0
INT LUMBAR X ACCEL (G)	-0.04	6.04	-0.91	53.0	198.0
INT LUMBAR Y ACCEL (G)	0.07	2.32	-1.27	83.0	103.0
INT LUMBAR Z ACCEL (G)	0.04	23.34	-4.04	81.0	148.0
INT LUMBAR RESULTANT (G)	0.12	23.49	0.07	81.0	2.0
INT LUMBAR X FORCE (LB)	-12.86	439.26	-12.31	82.0	0.0
INT LUMBAR Y FORCE (LB)	-7.58	-6.79	-35.23	136.0	79.0
INT LUMBAR Z FORCE (LB)	37.03	172.86	-1479.90	133.0	78.0
INT LUMBAR FORCE RESULTANT (LB)	39.93	1538.74	11.46	78.0	24.0
INT LUMBAR Mx TORQUE (IN-LB)	8.75	129.03	9.83	80.0	5.0
INT LUMBAR My TORQUE (IN-LB)	8.15	4.14	-2456.57	2.0	82.0
INT LUMBAR Mz TORQUE (IN-LB)	-1.05	9.61	-6.13	83.0	39.0
INT LUMBAR TORQUE RESULTANT (IN-LB)	12.22	2459.97	10.78	82.0	5.0

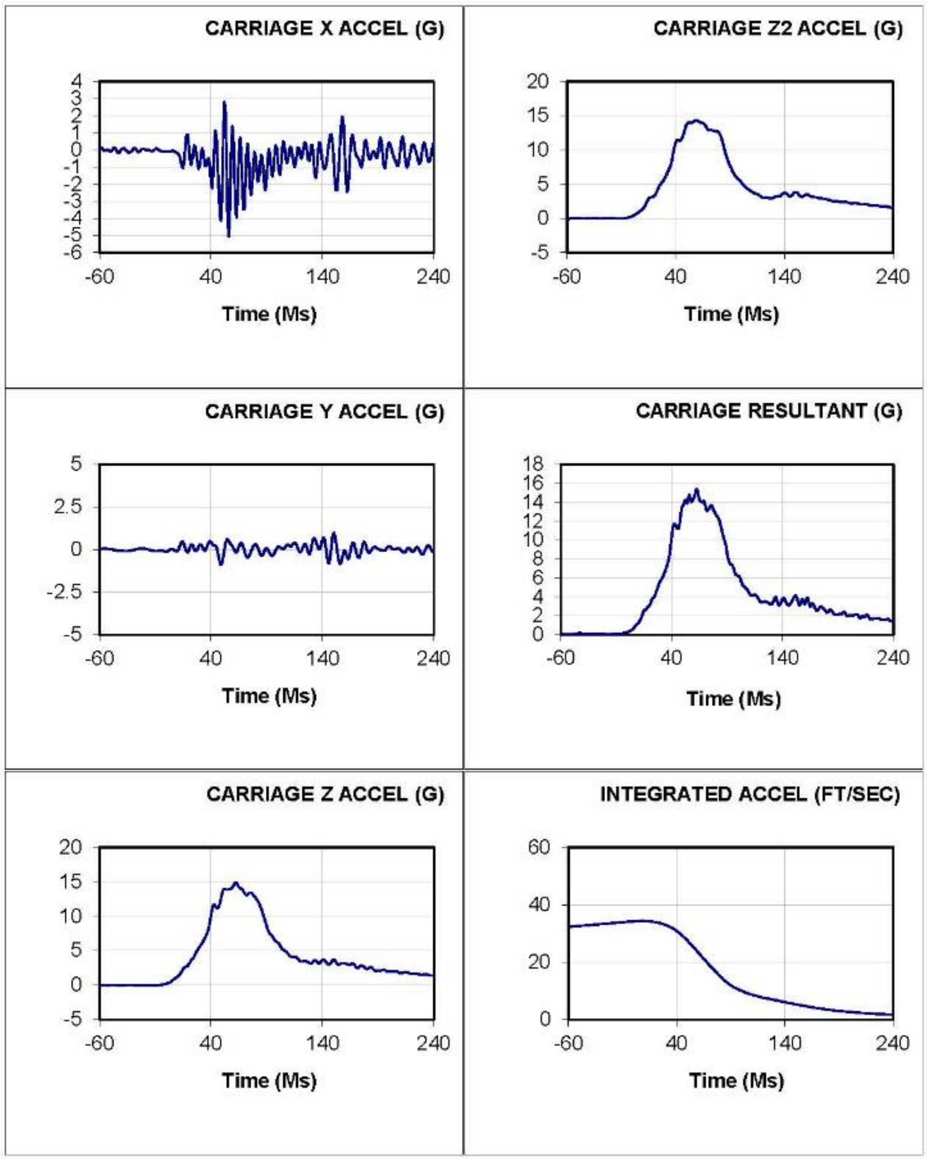
Page 2 of 3

201502 Test: 6610 Test Date: 150324 Subj: LARD Wt: 246.0
Nom G: 15.0 Cell: E15

Data ID	Immediate Preimpact	Maximum Value	Minimum Value	Time Of Maximum	Time Of Minimum
NIJ SHEAR (LB)		50.72	-94.57	70.0	155.0
NIJ TENSION (LB)		97.81		147.0	
NIJ COMPRESSION (LB)		-362.65		76.0	
NIJ FLEXION (IN-LB)		276.17		130.0	
NIJ EXTENSION (IN-LB)		75.86		77.0	
NIJ NTF	0.0033	0.1167	0.0000	145.0	26.0
NIJ NTE	0.0000	0.0000	0.0000	0.0	0.0
NIJ NCF	0.0000	0.1913	0.0000	83.0	0.0
NIJ NCE	0.0000	0.2646	0.0000	76.0	0.0
NIJ NTF AIS >= 2		0.13			
NIJ NTF AIS >= 3		0.05			
NIJ NTF AIS >= 4		0.07			
NIJ NTF AIS >= 5		0.02			
NIJ NTE AIS >= 2		0.11			
NIJ NTE AIS >= 3		0.04			
NIJ NTE AIS >= 4		0.06			
NIJ NTE AIS >= 5		0.02			
NIJ NCF AIS >= 2		0.14			
NIJ NCF AIS >= 3		0.05			
NIJ NCF AIS >= 4		0.08			
NIJ NCF AIS >= 5		0.03			
NIJ NCE AIS >= 2		0.15			
NIJ NCE AIS >= 3		0.06			
NIJ NCE AIS >= 4		0.08			
NIJ NCE AIS >= 5		0.03			
MNIx	0.0038	0.0199	0.0000	143.0	57.0
NMIz	0.0007	0.0083	0.0000	32.0	151.0

Page 3 of 3

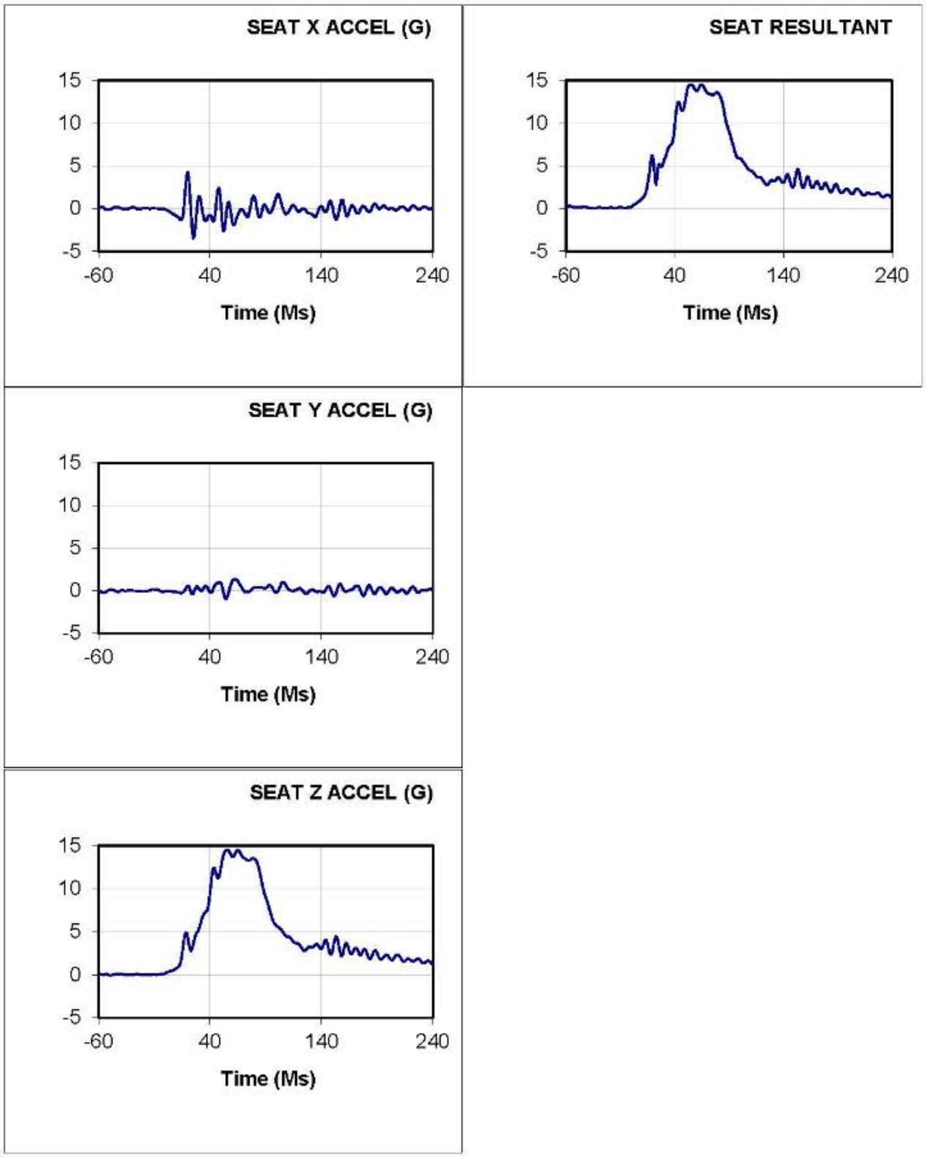
201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15



Page 1 of 14

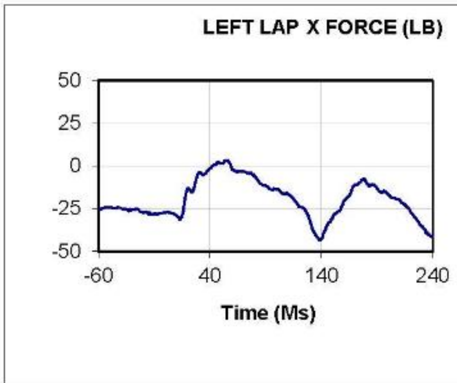
DISTRIBUTION STATEMENT A: Approved for public release. Cleared, 88PA, Case #2017-4562.

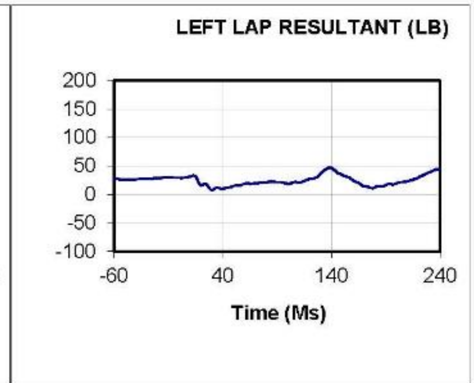
201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15

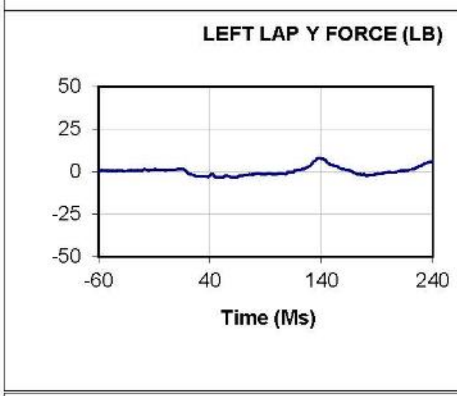


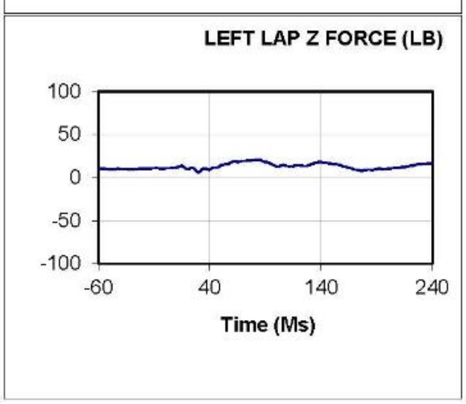
Page 2 of 14

201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15



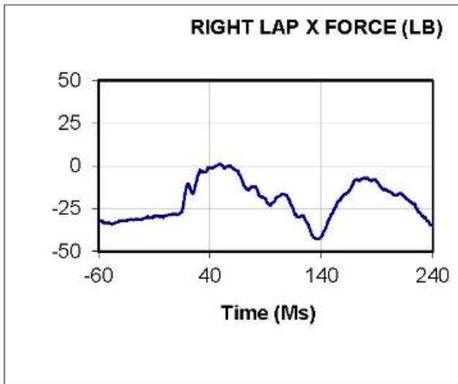


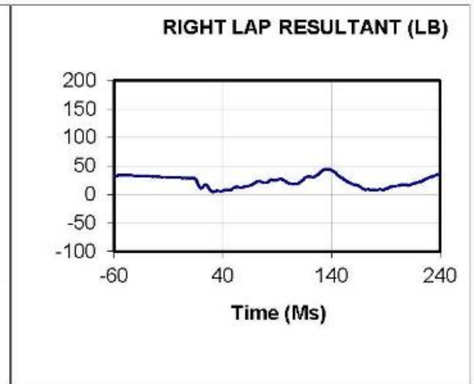


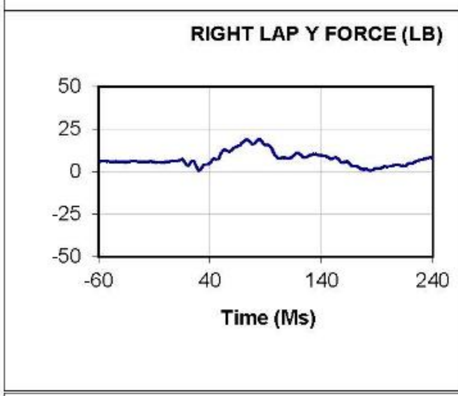


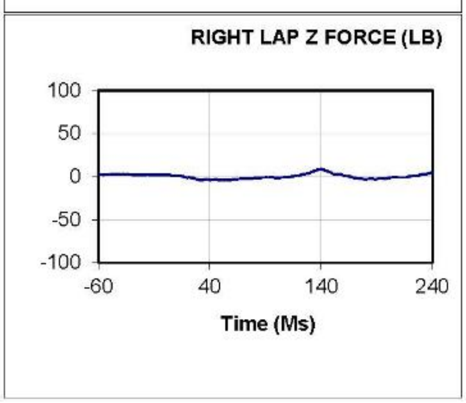
Page 3 of 14

201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15

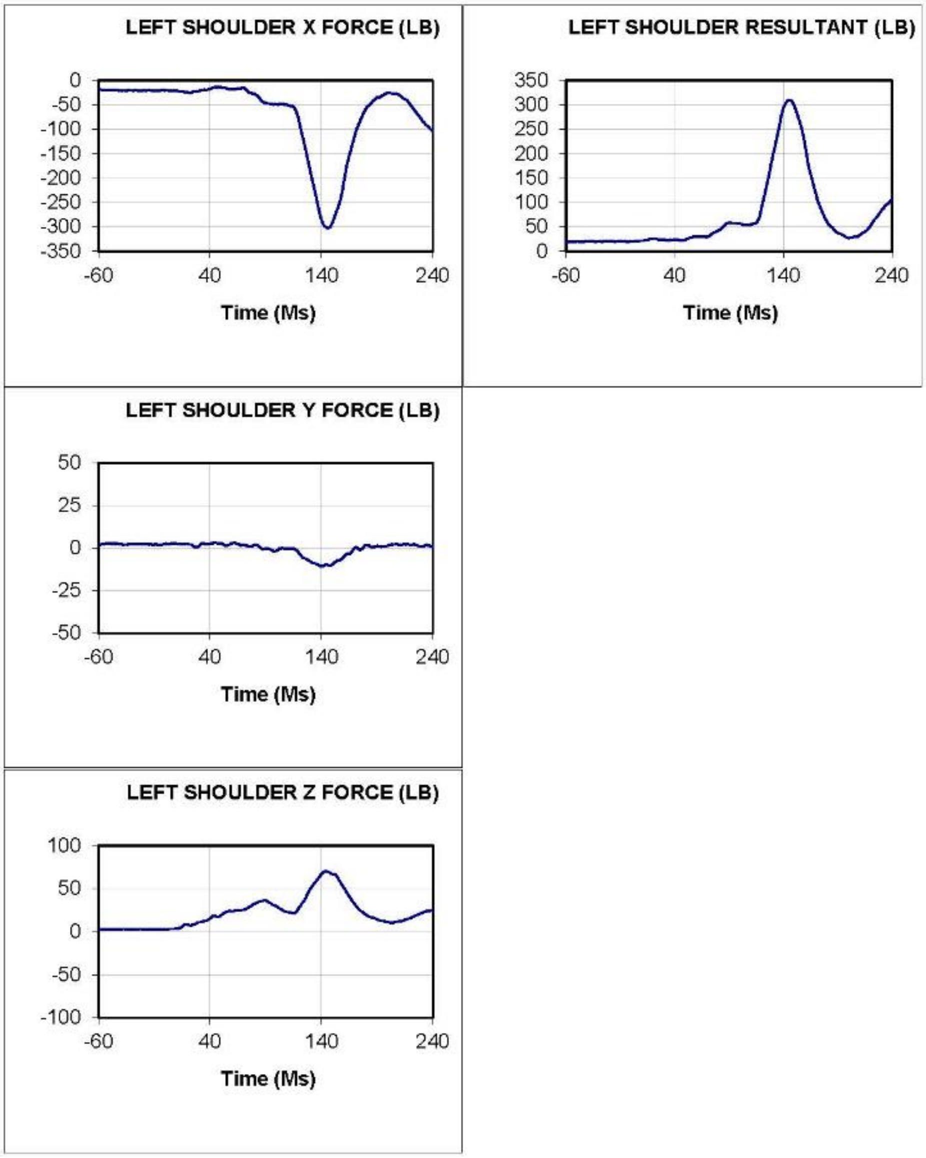






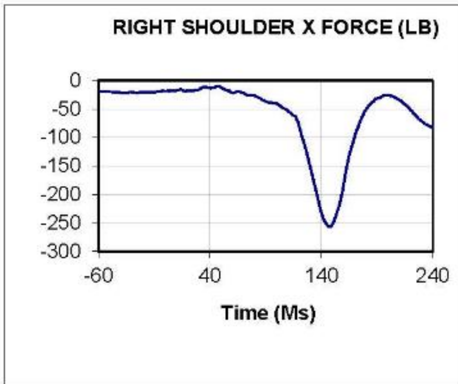


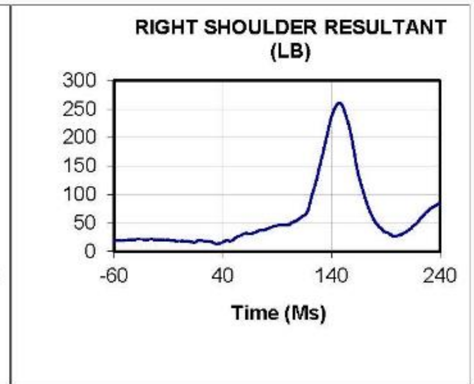
201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15

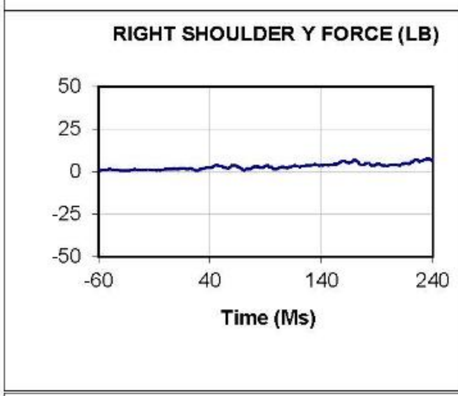


Page 5 of 14

201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15

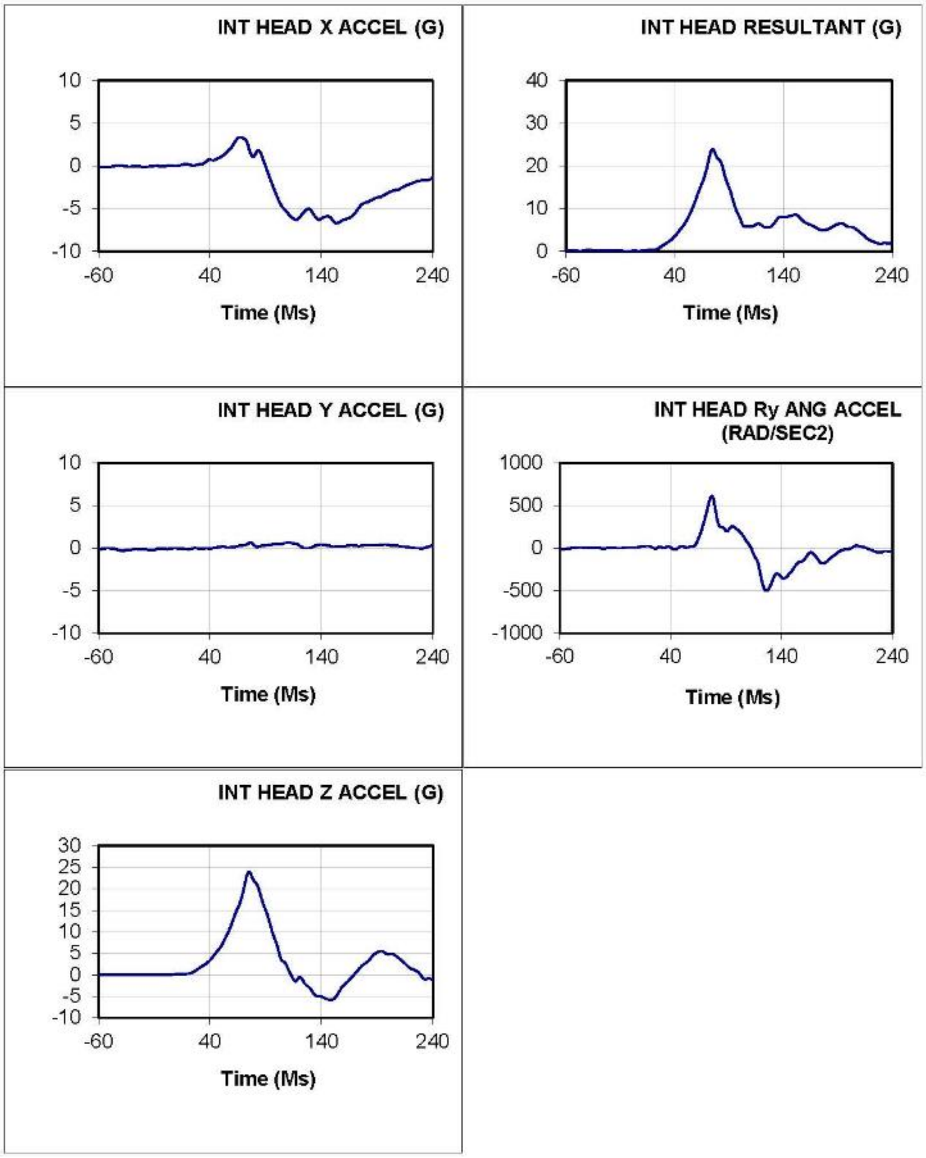






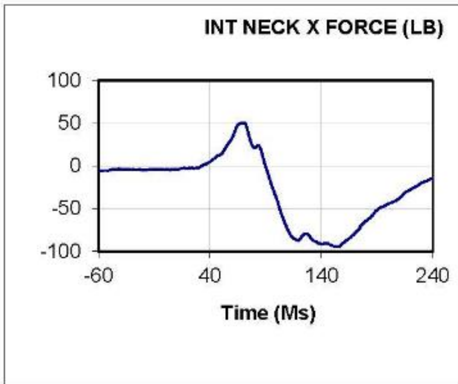
Page 6 of 14

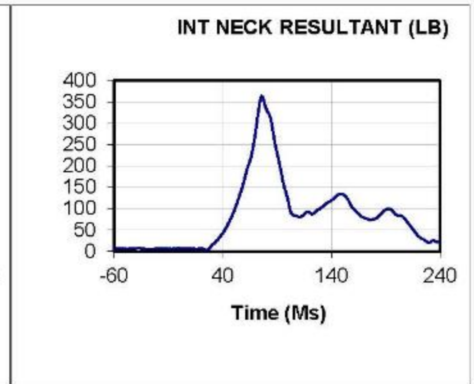
201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15

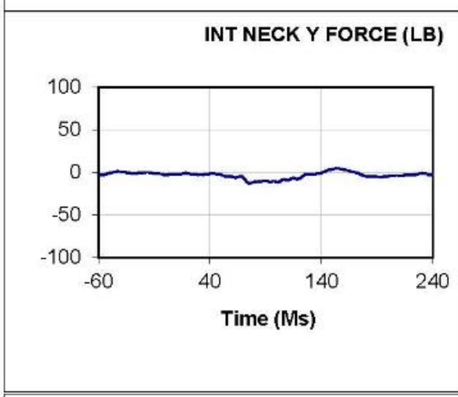


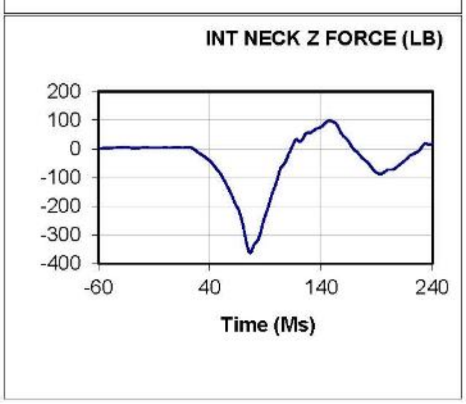
Page 7 of 14

201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15



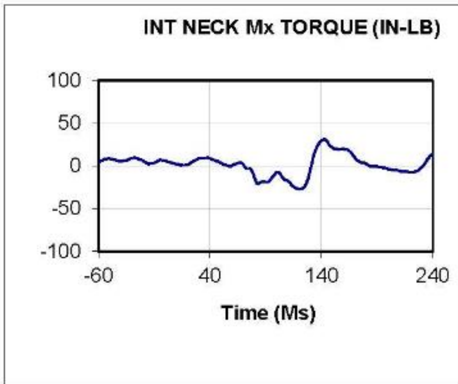


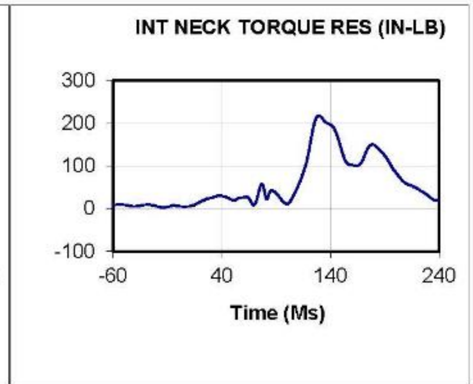


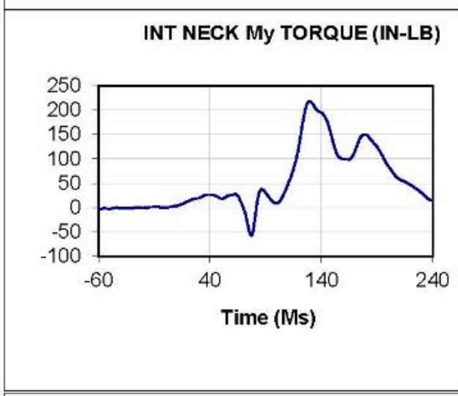


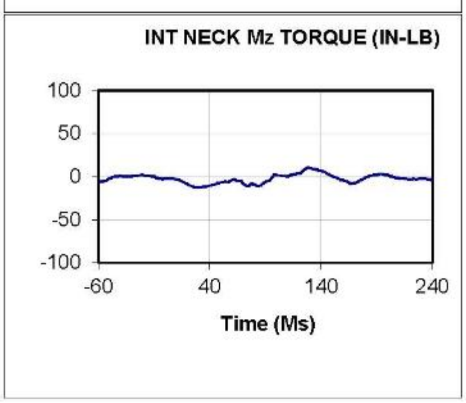
Page 8 of 14

201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15



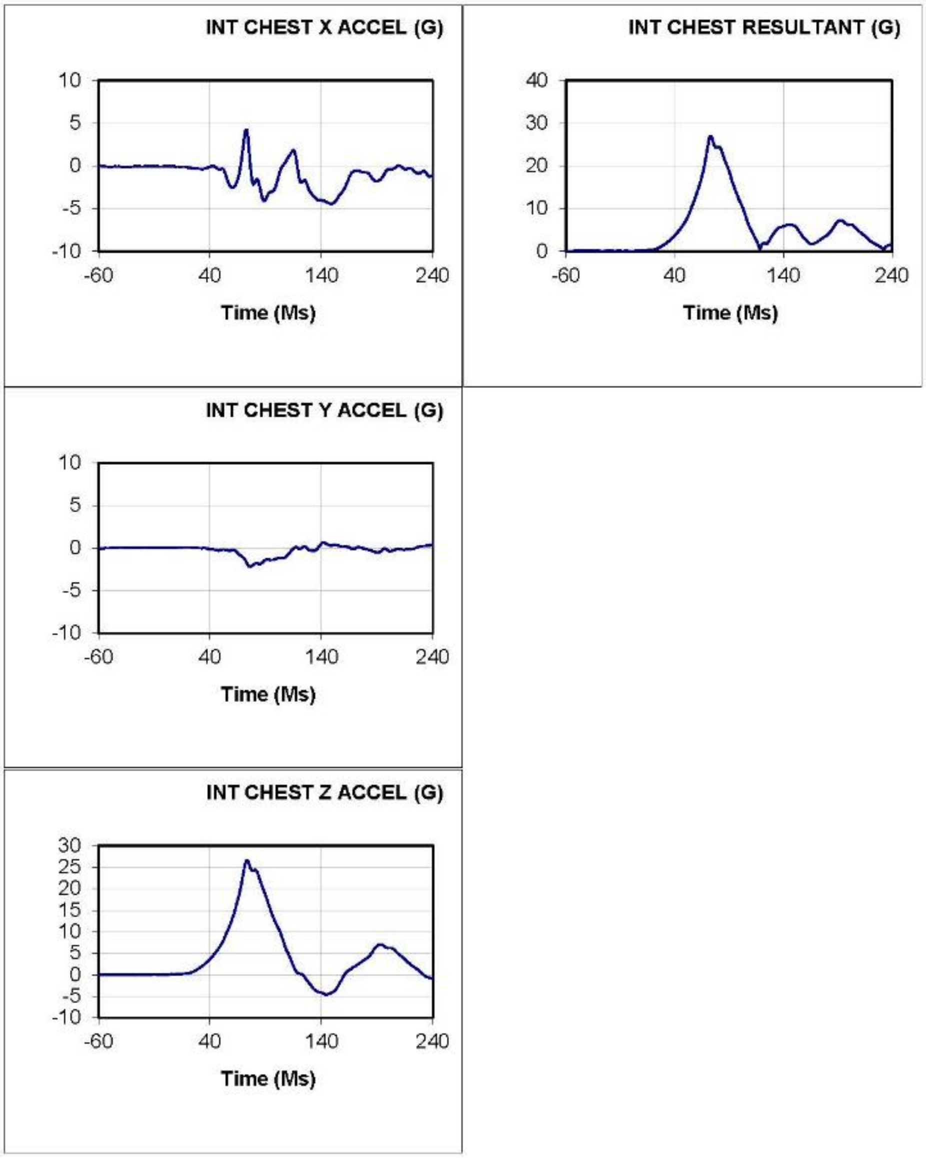






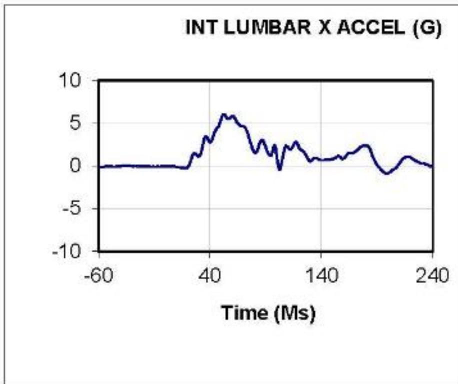
Page 9 of 14

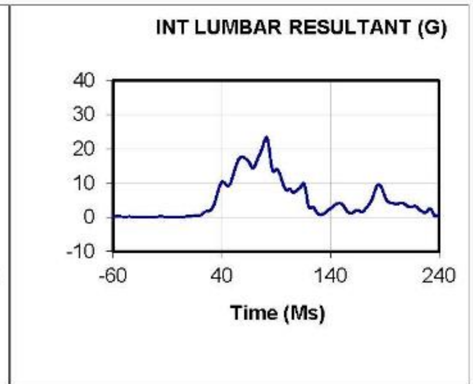
201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15

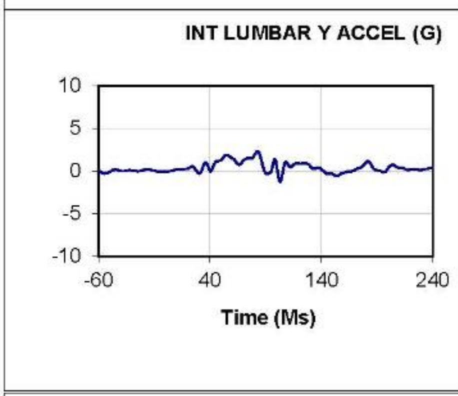


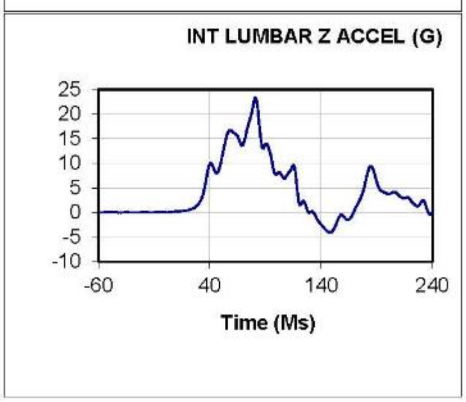
Page 10 of 14

201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15



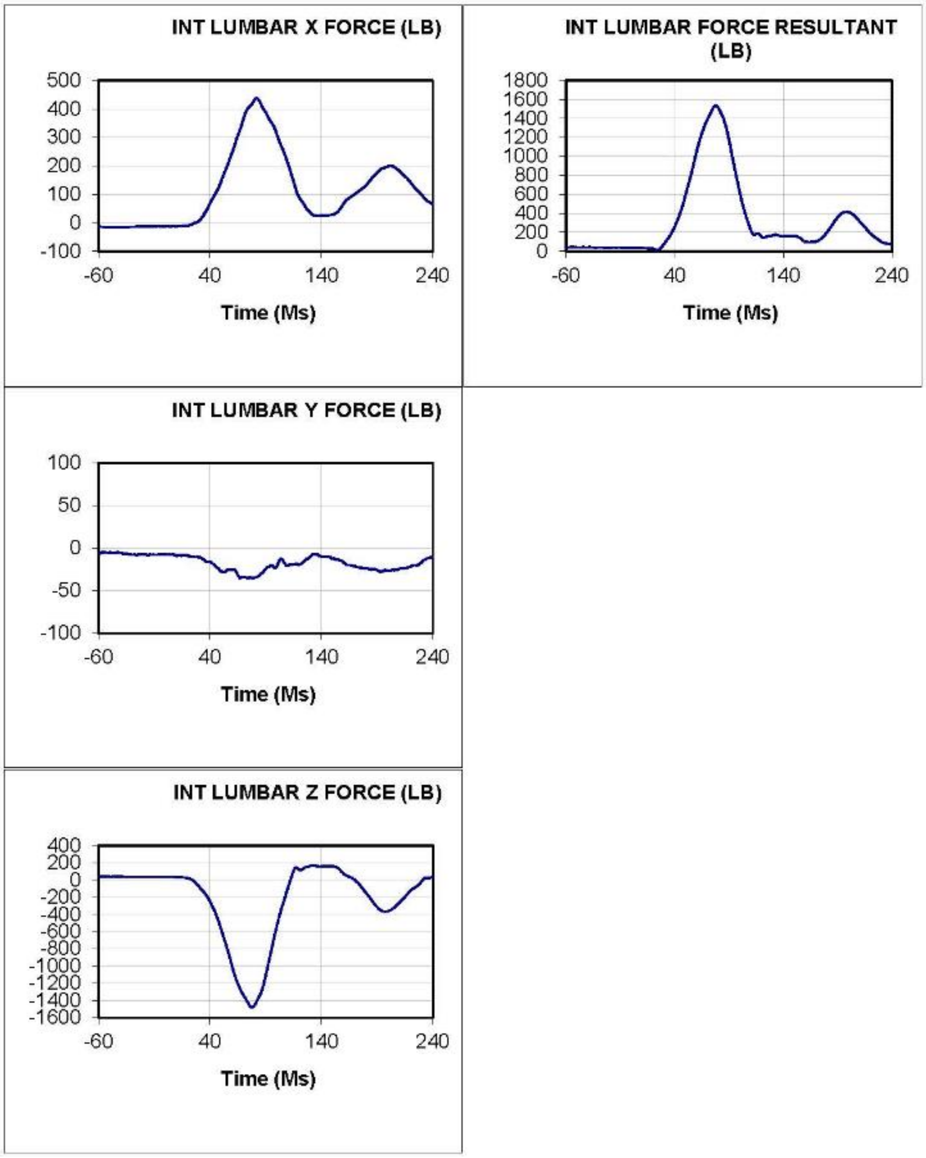




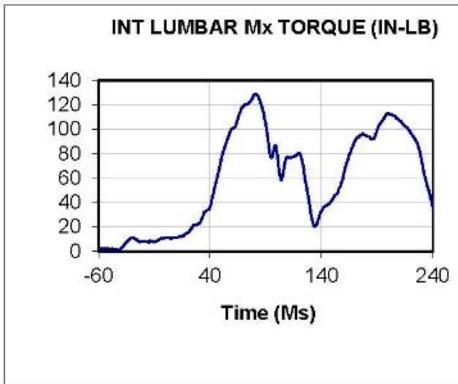


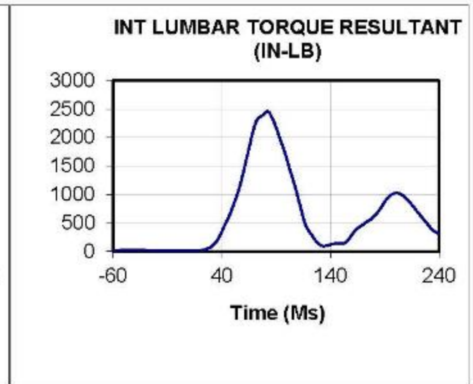
Page 11 of 14

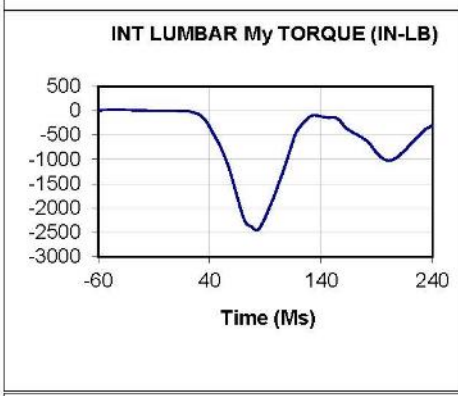
201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15

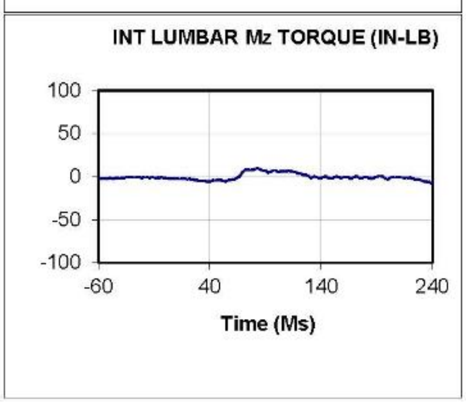


Page 12 of 14

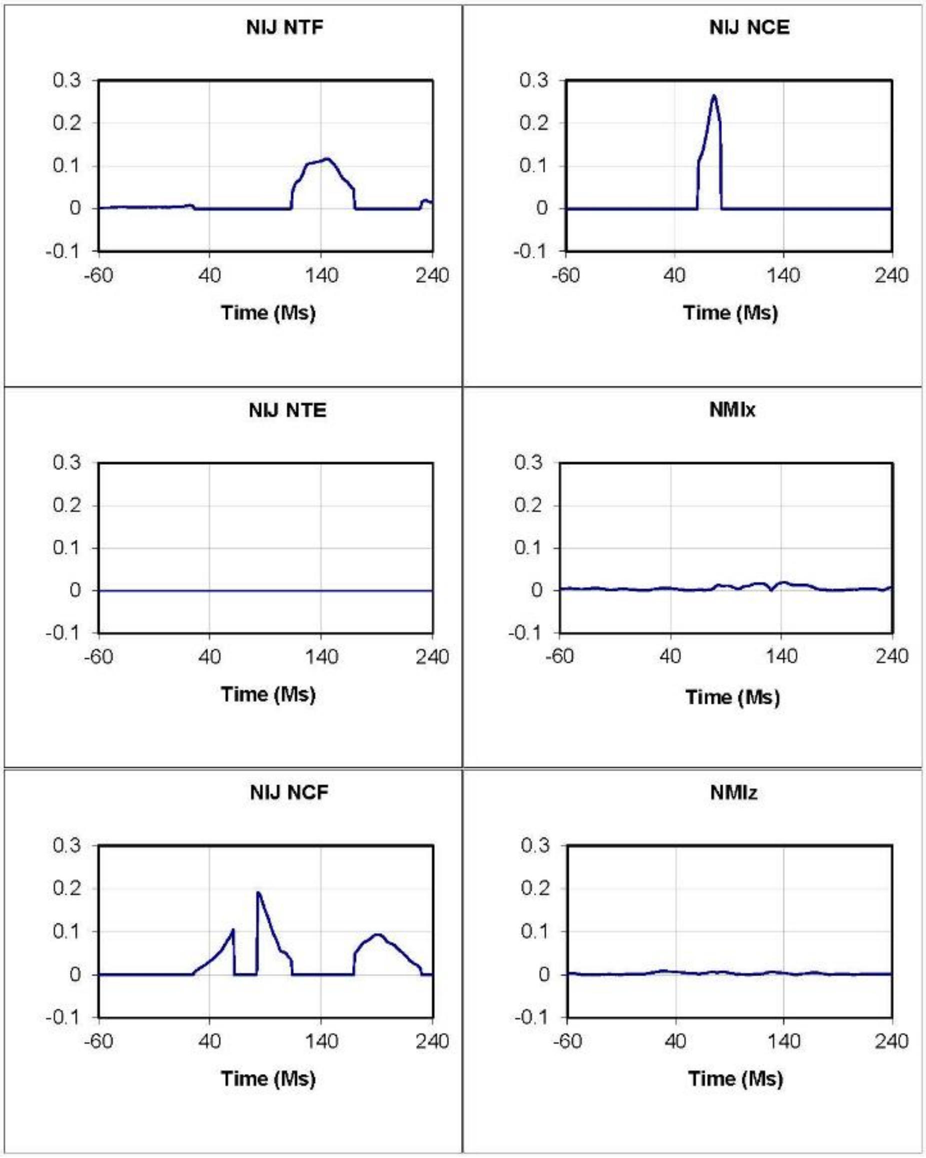

INT LUMBAR Mx TORQUE (IN-LB)
140
120
100
80
60
40
20
0
-60
40
140
240
Time (Ms)


INT LUMBAR TORQUE RESULTANT (IN-LB)
3000
2500
2000
1500
1000
500
0
-60
40
140
240
Time (Ms)


INT LUMBAR My TORQUE (IN-LB)
500
0
-500
-1000
-1500
-2000
-2500
-3000
-60
40
140
240
Time (Ms)


INT LUMBAR Mz TORQUE (IN-LB)
100
50
0
-50
-100
-60
40
140
240
Time (Ms)

201502 Test: 6610 Test Date: 150324 Subj: LARD Cell: E15



Page 14 of 14

LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMS

ABP	Aircrew Biodynamics and Protection
ABW	Air Base Wing
AFRL	Air Force Research Laboratory
AIS	Abbreviated Injury Scale
CG	Center of Gravity
DAS	Data Acquisition System
DRI	Dynamic Response Index
fps	symbol for frames-per-second: unit of video camera speed
HGU	Head Gear Unit
HPW	Human Performance Wing
Hz	symbol for Hertz: unit of frequency in the International System of Units (SI)
in-lb	symbol for inch-pounds: unit of torque
JSF	Joint Strike Fighter
LARD	Large Anthropomorphic Research Device
LOIS	Lightest Occupant In Service
LPU	Life Perserver Unit
lb	symbol for pounds: unit of weight
MANIC	Multi Axial Neck Injury Criteria
MBU	Mask Breathing Unit
Mk	nomenclature for Martin Baker ejection seat
My	Moment about Y-Axis
NPD	Neck Protection Device
PC	Personnel Computer
PCU	Protective Combat Uniform
Ry	Rotational Acceleration about Y-Axis
SAE	Society of Automotive Engineers
SCH	Simplified Combined Harness
TDAS	Test Data Analysis System
USAF	United States Air Force
VDT	Vertical Decleration Tower