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AIRFRAME DIGITAL TWIN (ADT)

Delivery Order 0002: Demonstration of Prognostic and Probabilistic Individual Aircraft Tracking (P^2IAT)

Final Report and Appendices A (Test Requirements Document) and B (Instrumentation Plan)

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Northrop Grumman Corporation
Northrop Grumman Aerospace Systems (NGAS)

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Final Report

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14. ABSTRACT
Task 1 developed a methodology to automatically generate flight spectra that is statistically similar to twelve example flights provided as Government Furnished Information. Task 2 developed Version 1.0 of the P2IAT process and identified the main sources of uncertainty. Task 3 developed a Bayesian updating procedure that fuses current-state health assessments produced by models. Task 4 developed fleet management criteria for both safety and economic strategies and a decision-making process. Task 5 demonstrated the end-to-end P^2IAT process using randomly generated and gap-filled flight data from the statistically derived flight spectrum.

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1.0 SUMMARY

The objective of Task Order (TO) 0002 of the Air Force Research Laboratory (AFRL) Airframe Digital Twin (ADT) Spiral 1 Contract as stated in AFRL's Statement of Objectives is "to develop the requirements and plans for the experiments to demonstrate the Prognostic, Probabilistic Individual Aircraft Tracking (P^2IAT) process developed in TO 0001, and to prepare an F-15C outer wing to be used in the demonstration experiment. The demonstration experiment will consist of fatigue loading of the outer wing (from XW155 outboard to the wing tip) of two (2) F-15 C/D wings in a ground test". The F-15 was chosen by AFRL only as an example on which to demonstrate P^2IAT. The reader is reminded that P^2IAT is not exclusively intended for the F-15. However, since the contract specifies the F-15 and its associated documents as the test article in the task requirements, Government Furnished Information and Reference Materials, there are references to these data in this report.

Northrop Grumman Systems Corporation (NGSC) Aerospace Systems (NGAS) has developed the necessary information and has acquired and installed the necessary instrumentation to conduct a pair of full-scale tests that will exercise the P^2IAT paradigm on an example F-15 outer wing. We have leveraged our experience conducting similar tests to avoid the common pitfalls encountered in test setup and execution and have confidence that the control points (CPs) selected, test procedures and instrumentation will lead to a successful conclusion. The test points we have chosen together with the test spectrum are intended to exhibit a distribution in lifetimes that spans the full range of outcomes needed to demonstrate the benefits of P^2IAT.

Efforts under this TO recommended a mix of five internal and five external CPs to be tracked based on the condition of the test articles (both left and right wings), available information from the Damage Tolerance Analysis (DTA), Force Structural Maintenance Plan (FSMP), Wing Stress Analysis reports, and other available sources together with a comprehensive analysis of the stresses produced by distributed loads from Stick-to-Stress Real-time Simulator (StS RtS) as calculated by the finite element model (FEM). It's worth noting that considerable effort was expended to make both the StS RtS and FEM sufficiently usable for calculating accurate stresses. Next, a comprehensive Test Requirements Document (TRD) was created to determine how loads should be applied to the test article to faithfully reproduce the aero loads predicted by StS RtS for the usage baseline developed under TO 0001 [see Appendix A]. A method was developed to synthesize Flight Data Recorder (FDR) data as would normally be available from a legacy aircraft to simulate inputs to P^2IAT for the full-scale experiment. An instrumentation plan was developed to verify that the loads applied were as intended and to simulate nondestructive inspections (NDI) for internal CPs without the need to dissemble the test articles [see Appendix B]. An inspection plan was created to emulate NDIs as prescribed by the P^2IAT methodology [see Appendix C in Volume 1 of this series]. Two sensor systems were installed on both wings. The planning and coordination of CPs and sensor installation by both the GE and NGAS teams was coordinated by AFRL.

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2.0 INTRODUCTION

ADT TO 0002 is comprised of seven tasks intended to prepare the groundwork for a full-scale experiment of P^2IAT involving two retired F-15 wings. In Task 1, we executed a comprehensive study that identified 10 locations to be tracked as CPs during the full-scale experiment. Since the choice of locations was dependent on the condition of the test articles, we initially identified 26 points and down-selected to the required ten as we discovered the actual condition of the candidate locations. This set of CPs was chosen to cover an even mix of internal and external locations having a broad range of damage outcomes from minor to major crack growth using the TO 0001 baseline spectrum. Our selection ensures that P^2IAT will be fully exercised during the experiment. Details describing the selection procedure and analysis are provided in Section 3.1.

In Task 2, we leveraged our corporate experience with design and implementation of full-scale tests and utilized in-house software tools designed to automatically compute actuator loads, actuator zone pad arrangements and pad loads. Our approach for designing the test is described in Section 3.2. The main product of this effort was the Test Requirements Document.

The methodology for generating simulated FDR data corresponding to the applied test load was developed in Task 3 and described in Section 3.3. Ten key parameters for each maneuver in the baseline spectrum were extracted from StS RtS and captured as a sequence of five snapshots in time. Parameters and snapshot times were designed to mimic the data that would come from an onboard event recorder.

In Task 4 an Instrumentation and Data Acquisition Plan was created that incorporates the use of in situ sensing. We have chosen the Jentek Meandering Wire Magnetometer (MWM) sensor system for the five internal CPs to avoid the need to disassemble the test article to perform NDI. We have also chosen the Luna fiber optic sensor system to provide strain monitoring over critical areas of the structure. The Task 4 approach is discussed in Section 3.4.

Task 5 produced an Inspection Plan that describes how each CP should be inspected when P^2IAT recommends inspections. External CPs will use the equipment and procedure called out in the FSMP. Internal points will use the Jentek sensor system using signal thresholds that equate to the sensitivity of the NDI equipment called out in the FSMP. The approach for inspections and the characterization of the Jentek sensor for this purpose is discussed in Section 3.5..

The full scale experiment originally involved both GE and NGAS exercising their respective versions of P^2IAT on both wings. Task 6 was intended to ensure noninterference between teams regarding their respective installations, operation of instrumentation and the acquisition of data during the test. Several joint meetings, onsite surveys and follow up telecons were conducted to develop a plan that considered both the physical location of sensors and wiring and a collaborative schedule of noninterfering access for installation purposes. A record of the dates and topics of formal exchanges is documented in Section 3.6. Physical locations for NGAS sensors and wiring and the schedule for their installation is included in the Instrumentation Plan (see Appendix B).

In Task 7, the NGAS Team participated in onsite meetings in both locations (at the overhaul facility in Warner Robins and WPAFB) to survey the condition of both wings, down select CPs, develop an instrumentation plan, install sensor systems and perform readiness checks. A record of these meetings is included in Section 3.7.

The following sections discuss these tasks in detail.

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3.0 METHODS, ASSUMPTIONS, AND PROCEDURES

3.1 Selection of Locations to be Tracked (Task 1)

Ten locations in the outer wing (XW155 to the wing tip) have been selected in order to monitor and track crack growth during the full scale experiments. The primary goal in the selection process was to ensure that desirable fatigue cracking at the selected outer wing locations will be attained within the duration of the experiment in order to successfully demonstrate the predictive, updating, and decision making capabilities of P^2IAT. Since the choice of locations is somewhat dependent on the condition of the test articles, we initially identified twenty-six points and down-selected to the required ten as we discovered the actual condition of the candidate locations based on the outcome of the modified Program Depot Maintenance (PDM). Crack growth analysis models and local stress histories for the candidate locations were developed as described in Section 3.2 in order to verify that the locations experience a desirable amount of fatigue crack growth but not so much that they grow to failure or require repair during the 12-month test period. The process considered in selecting the control points is described below.

3.1.1 CP Selection Process

Tracked locations were selected by primarily considering fatigue critical locations from the safety-of-flight list that are tracked and/or inspected and the durability critical lists that are subjected to inspections. We first considered safety-of-flight locations that are being tracked (e.g., Rear Spar Lower Flange XW 167.3 and Lower Forward Wing Skin XW188). We then data mined the DTA, FSMP, Wing Stress Analysis reports, and other available sources to obtain relevant information for selecting the locations.

Since the condition of the panel may affect our selection, we initially selected 26 locations by considering the following:

1) Detailed teardown inspection data from the wing structural disassembly report.
2) Detailed teardown inspection data and crack growth analyses from full-scale fatigue tests.
3) Locations with the highest design limit stresses such as the Rear Spar Lower Flange XW 167.3.
4) DTA fatigue critical locations lists such as safety-of-flight items list, durability critical items list, and direct tracked locations list.
5) FSMP Inspection requirements list.
6) Safety limits of fatigue critical areas obtained from analytical crack growth life predictions.
7) Initial conditions of the holes in terms of induced residual stresses due to cold worked holes or holes with TaperLoks.
8) Material systems that are well characterized. This allowed us to leverage information on statistical distributions of microstructural parameters, microstructurally sensitive damage mechanisms, and small/large crack growth rate data.
9) Geometry and loading that is less complicated. This reduced the cost associated with designing coupon tests for model validation and sensor characterization.
10) Availability of internal stress transfer functions. This provides a baseline for verification.

The 26 locations were down-selected to 10 locations based on the outcome of the modified PDM performed during Task 7 and wing finite element analysis (FEA) results. The down-selection process considered the following:

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1) Left wing FEA results.
2) Existing damage found.
3) If a repair is needed.
4) Ease of designing a repair (if one does not exist) to support disposition of damage.
5) Prior repair that is not documented.
6) Repairs that prevent tracking during the duration of the test.
7) Introduction of damage if damage is not found or after a repair, if required.
8) End of test damage condition.
9) Ease of gathering geometric properties.
10) Cost factors associated with sensor design.
11) Ease of sensor instrumentation and accessibility.
12) Ease of inspection during the full-scale experiment.

The ten selected locations to track are summarized in Table 1 and shown in Figure 1.

Table 1. Summary of Selected CPs to Track

Control Point	Description	Location	Reason for Selection
NG1	Front Spar Lower Flange	XW 165.52	Highest FEM stress on flange, DTA Item
NG2	Front Spar Tooling Hole	XW 200.0	FSMP Item, Cracks found during full-scale durability testing
NG3	Front Spar Lower Flange	XW 169.5	High FEM stress, DTA Item
NG4	Rear Spar Lower Flange	XW 167.3	DTA Item, highest design limit stress, available internal stress transfer function
NG5	Rear Spar Lower Flange	XW 174	Highest FEM stress on rear spar lower flange
NG6	Lower Forward Wing Skin	XW 188	Cracks found during full-scale durability testing, DTA Item
NG7	Lower Forward Cover at Front Spar	XW 167-172	Cracks reported under the wing structural disassembly report
NG8	Lower Aft Cover Skin at Main Spar	BL 163.6 & XW 167.06	Cracks found during full-scale durability testing, DTA Items
NG9	Lower Trailing Edge Skin at TE Spar	XW 157.7	Highest FEM stress on outer wing skin, DTA Items
NG10	Lower Trailing Edge Skin at Rear Spar	BL 167.3	High FEM Stress, cracks found on full-scale durability testing, DTA Item

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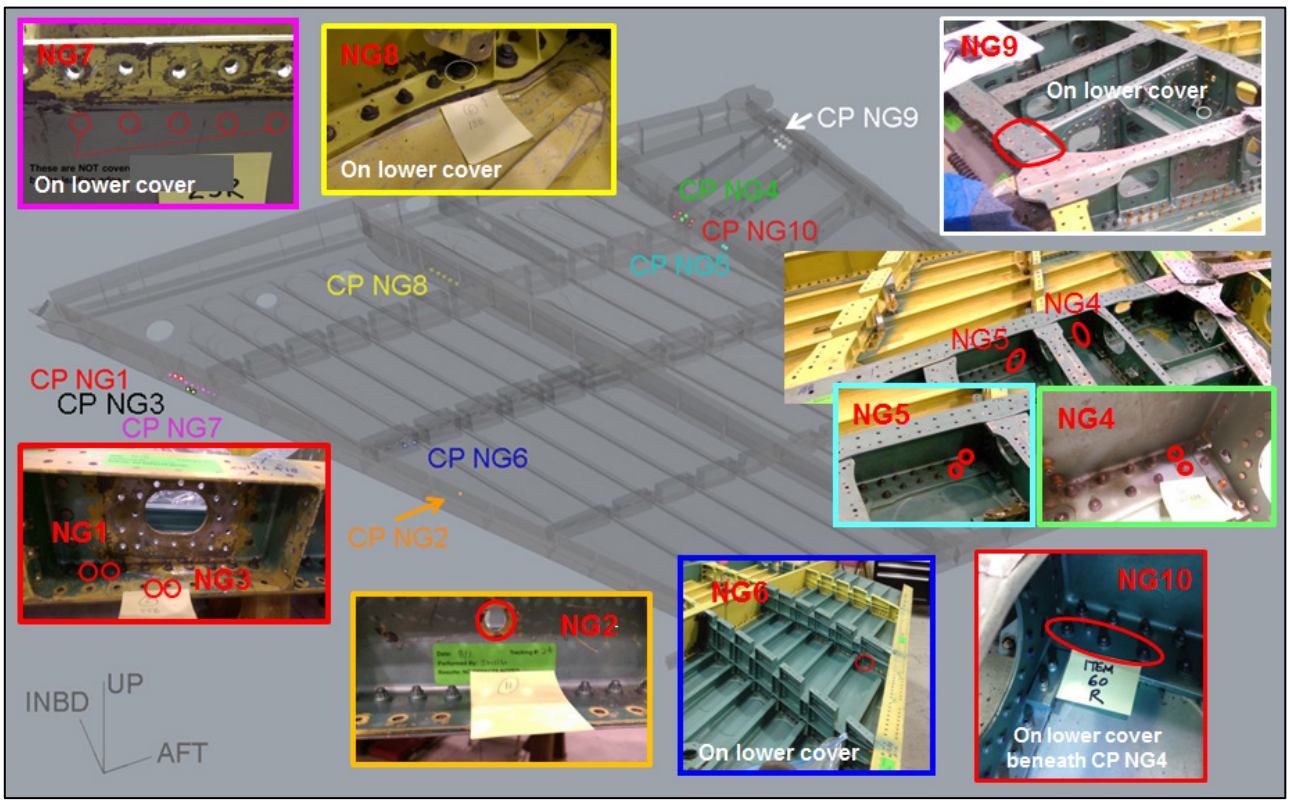

Figure 1. Selected CPs to Track

3.1.2 Wing FEM

To assist in the down-selection process the left wing model was analyzed using a reference condition corresponding to an Nz = 8.4g, Altitude = 20,000 feet, Mach = 0.9 symmetric maneuver. The left wing was developed by detaching it from the AFRL-provided air vehicle FEM and applying the appropriate boundary conditions to mimic the test conditions as shown in Figure 2. The fixture attachment was modelled by constraining the wing at the lugs and loads were applied only to the outer wing portion of the wing. The FEM as provided could only be analyzed using a NASTRAN command PARAM, BAILOUT,-1 which allows the analysis to continue with near singularities in the stiffness matrix and in general is required when something is wrong with the model. Corrective action was taken to fix the issues as follows:

1) Fixed model inconsistencies at the trailing edge spar connections between 3-D and 2-D elements.
2) Fixed element connectivity issues predominantly on the wing tip.
3) Fixed rigid body load transfer elements that were not connected to the model.

The left wing model was then able to run successfully without the need of the BAILOUT parameter. The right wing model was also corrected to assure the BAILOUT parameter is not required.

FEA results were used to correlate areas of high stress with DTA fatigue critical locations and teardown inspection data from full-scale fatigue tests and from the wing structural disassembly report. Principal stresses on the outer wing spars, ribs, and lower cover are shown in Figure 3 and Figure 4.

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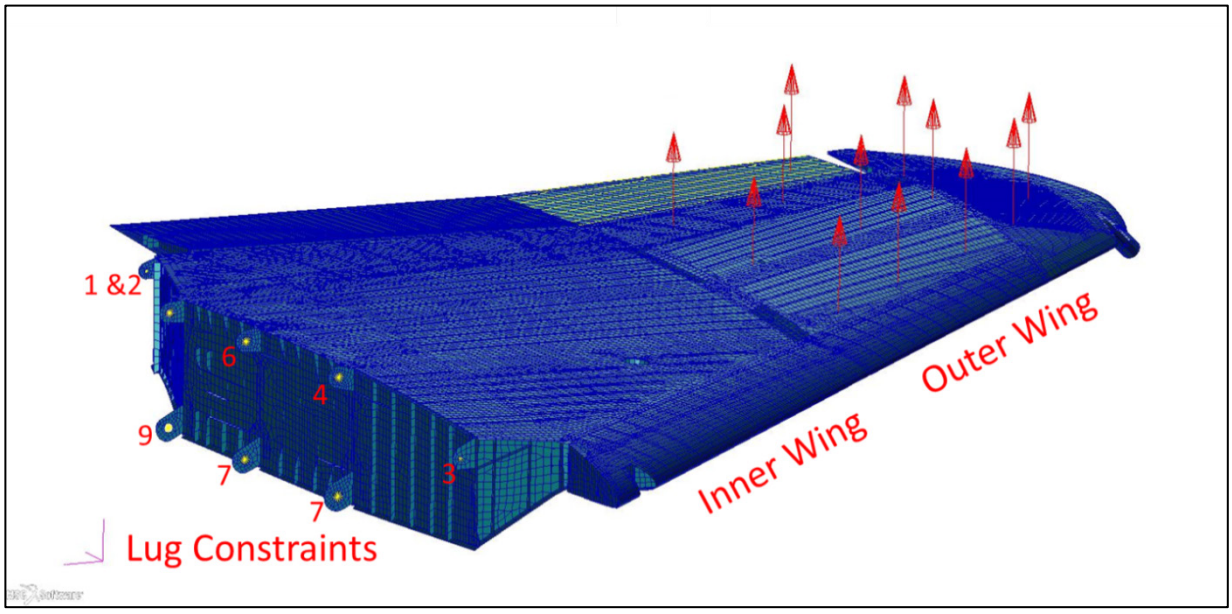

Figure 2. F-15C Left Wing FEM

Figure 3 shows the principal stresses along the front spar, main spar, rear spar, and ribs and Figure 4 shows the stresses on the lower cover. The lower cover includes the forward, aft, and trailing edge skins. The maximum stress on the outer wing occurs on the trailing edge skin along the trailing edge spar as shown in Figure 4, corresponding to selected location CP NG9.

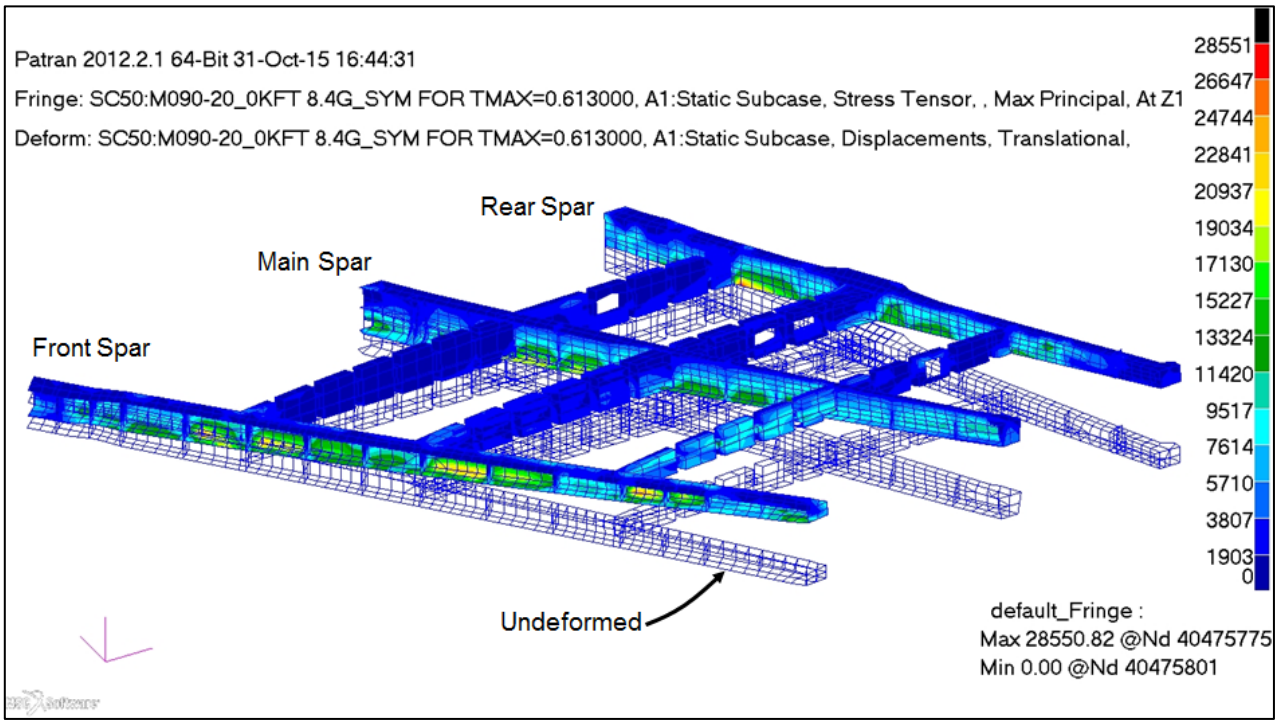

Figure 3. Principal Stresses at Outer Wing Spars and Ribs

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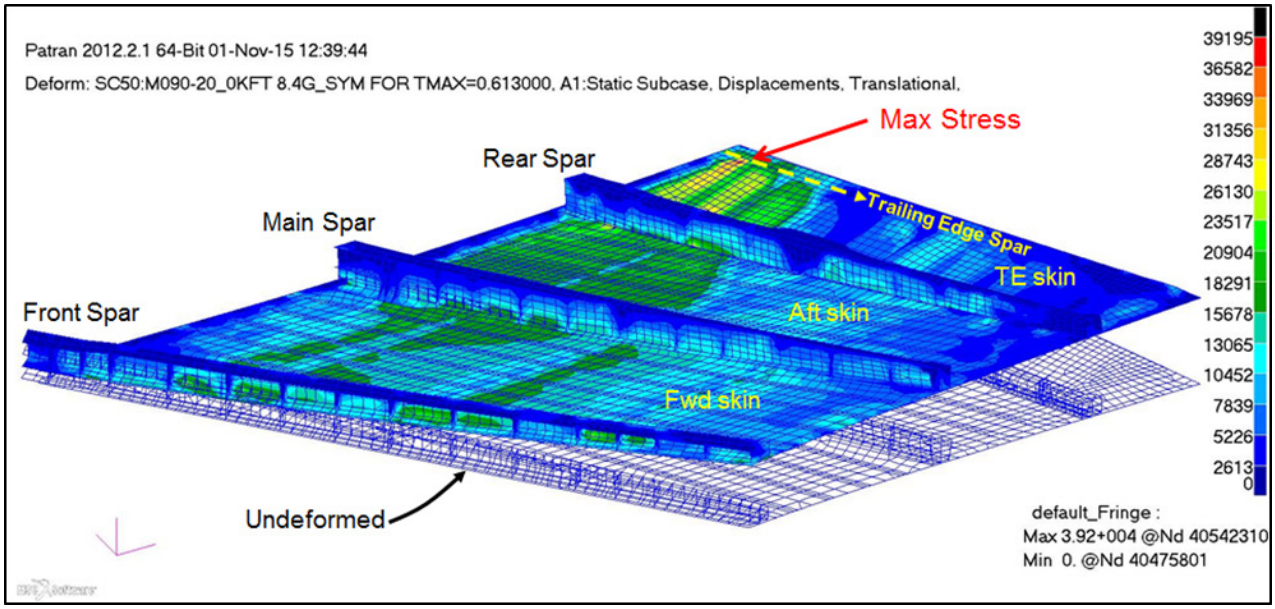

Figure 4. Principal Stresses at Outer Wing Lower Cover

3.1.3 Front and Rear Spar Control Points NG1, NG2, NG3, NG4, NG5 (Internal CPs)

Based on the FEM stress profile and correlation to DTA fatigue critical locations and teardown inspection data, three CPs were selected on the front spar as shown in Figure 5 and two CPs were selected on the rear spar as shown in Figure 6. Fiber distances Z1 and Z2 are at –t/2 and t/2.

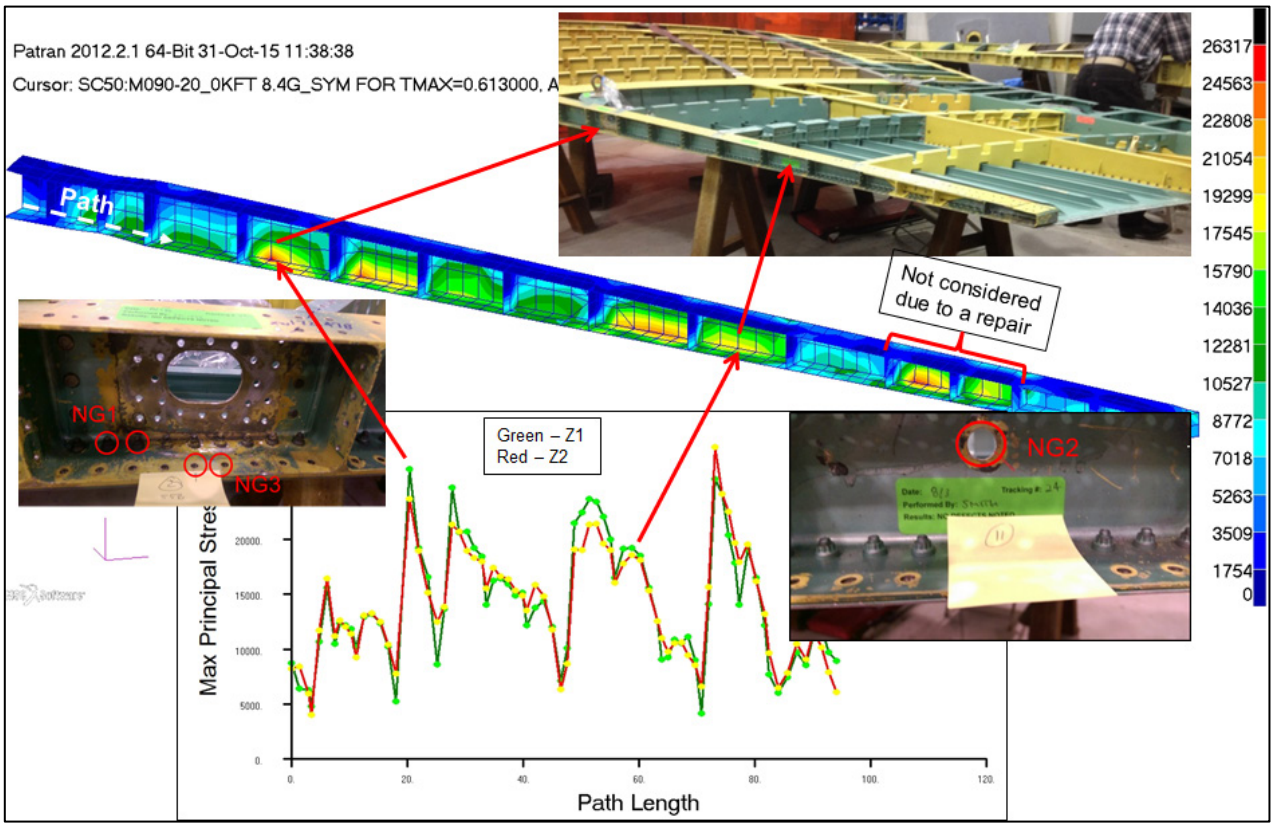

Figure 5. CPs at Outer Wing Front Spar

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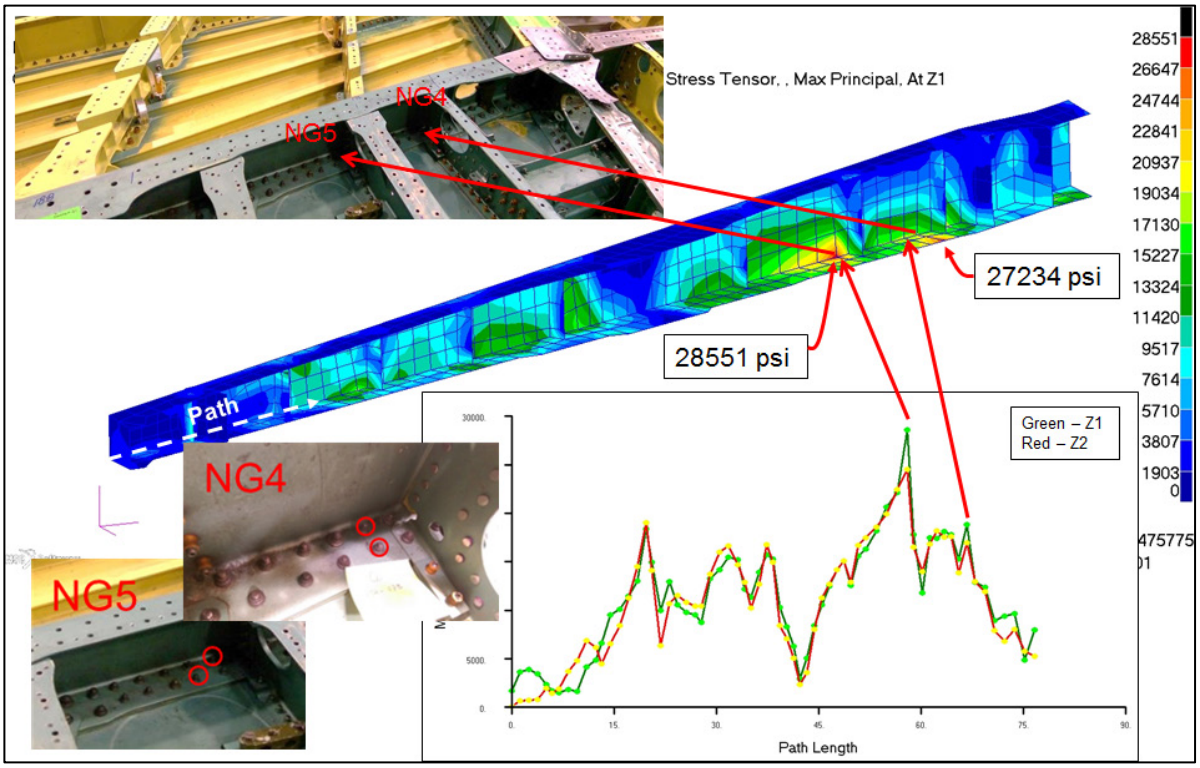
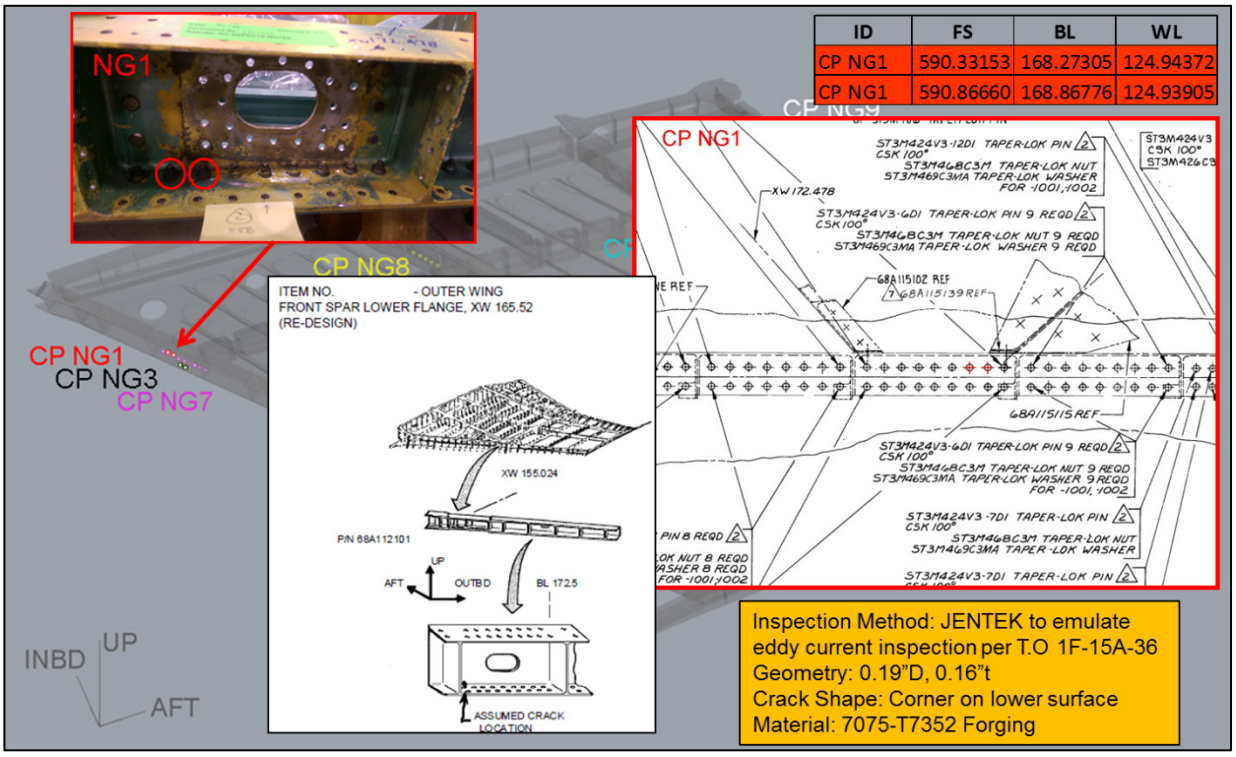


Figure 6. CPs at Outer Wing Rear Spar

Details for CP NG1-NG5 are shown in Figure 7 through Figure 11 including identification of the fuselage station, butt line, and water line coordinates, CP geometry, initial crack shape, material, and a portion of drawing and DTA Item showing the geometry and part numbers.



ID	FS	BL	WL
CP NG1	590.33153	168.27305	124.94372
CP NG1	590.86660	168.86776	124.93905

Figure 7. CP NG1 at Front Spar Lower Flange

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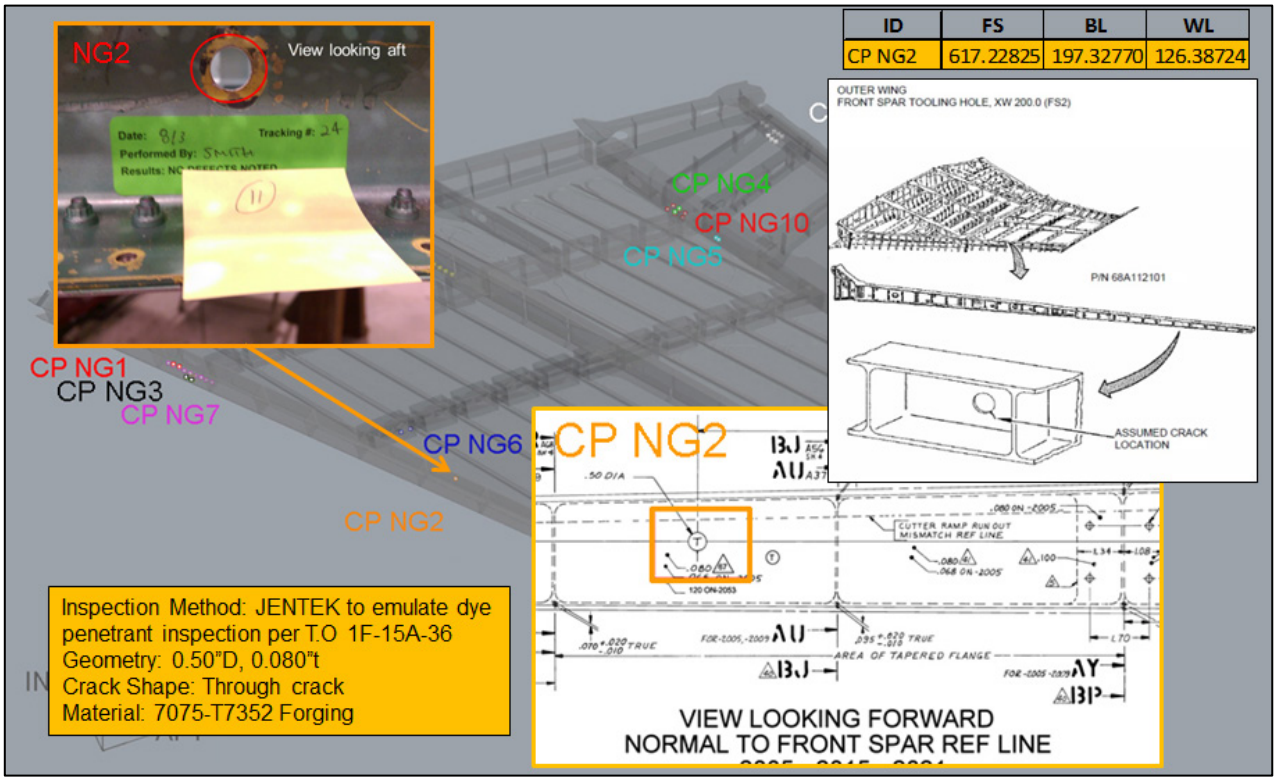

Figure 8. CP NG2 at Front Spar Tooling Hole

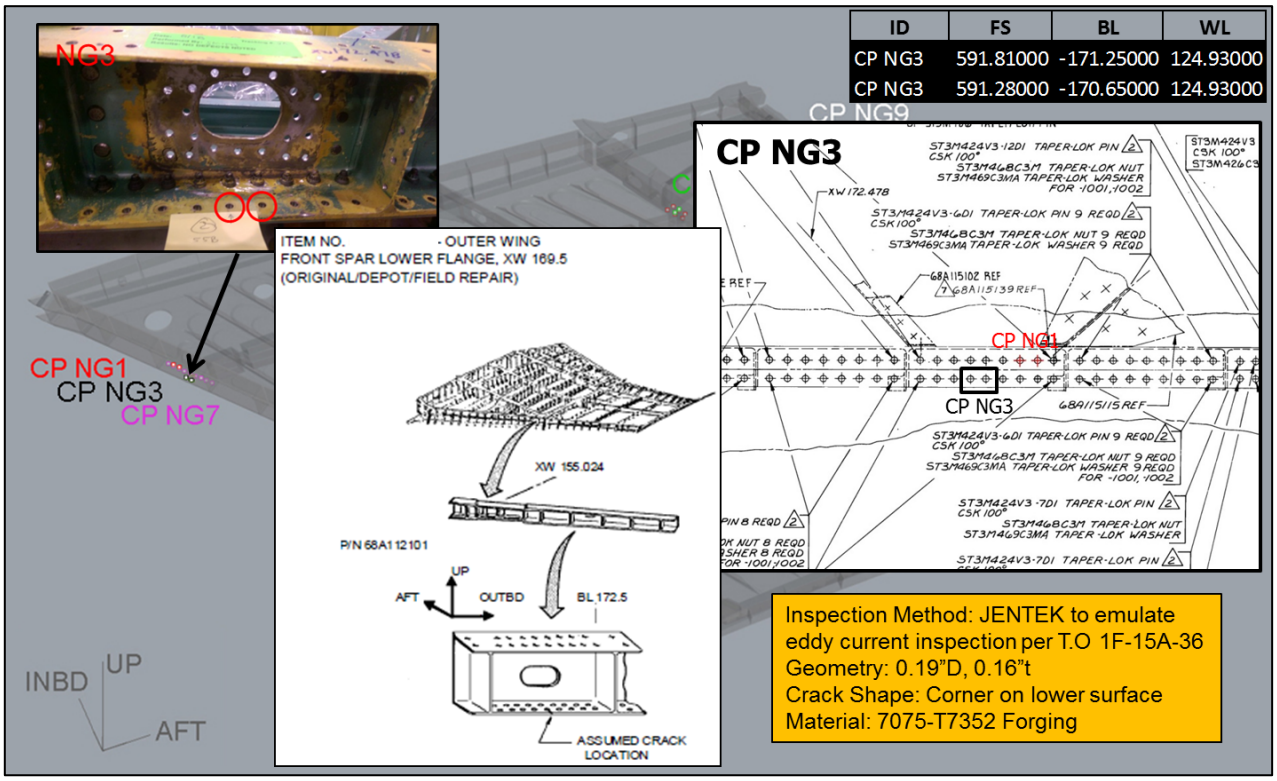

Figure 9. CP NG3 at Front Spar Lower Flange

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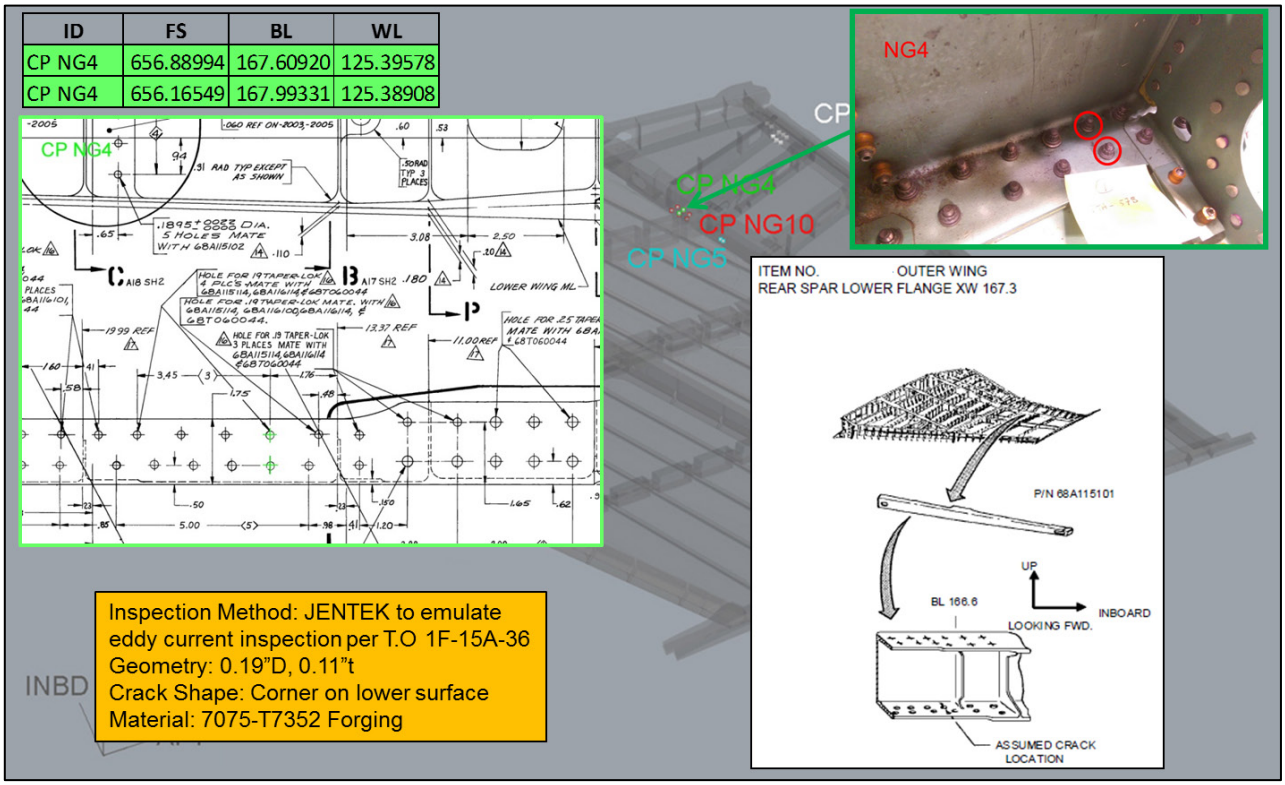

Figure 10. CP NG4 at Rear Spar Lower Flange

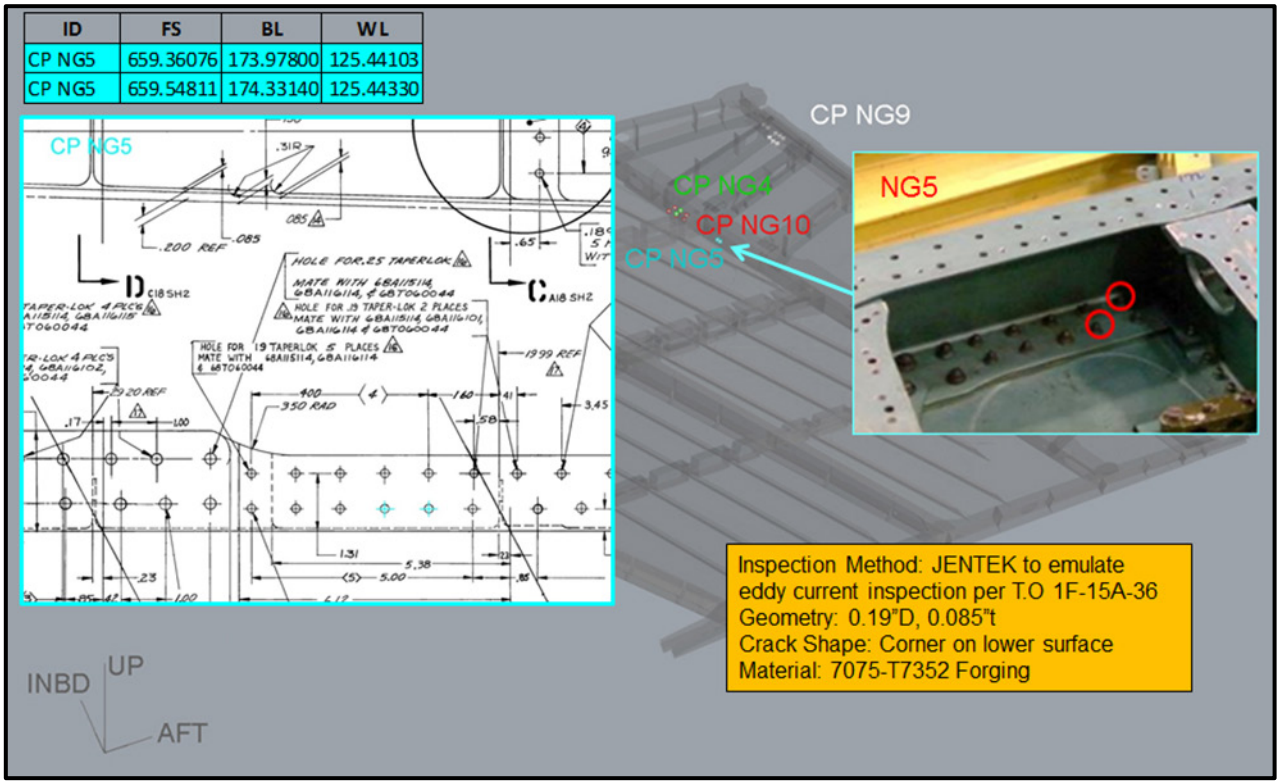

Figure 11. CP NG5 at Rear Spar Lower Flange

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3.1.4 Lower Cover CPs NG6, NG7, NG8, NG9, NG10 (External CPs)

Figure 12 shows stress profiles on the forward skin along four ribs. CP NG6 along rib WS 188 was selected based on the FEA stress profile and correlation to a DTA FCL and cracks found during full-scale fatigue tests. Cracks were reported in the wing structural disassembly report for the other locations shown with high stresses along ribs WS 206 and 224 but those locations were not considered as candidates. Details for CP NG6 are shown in Figure 13.

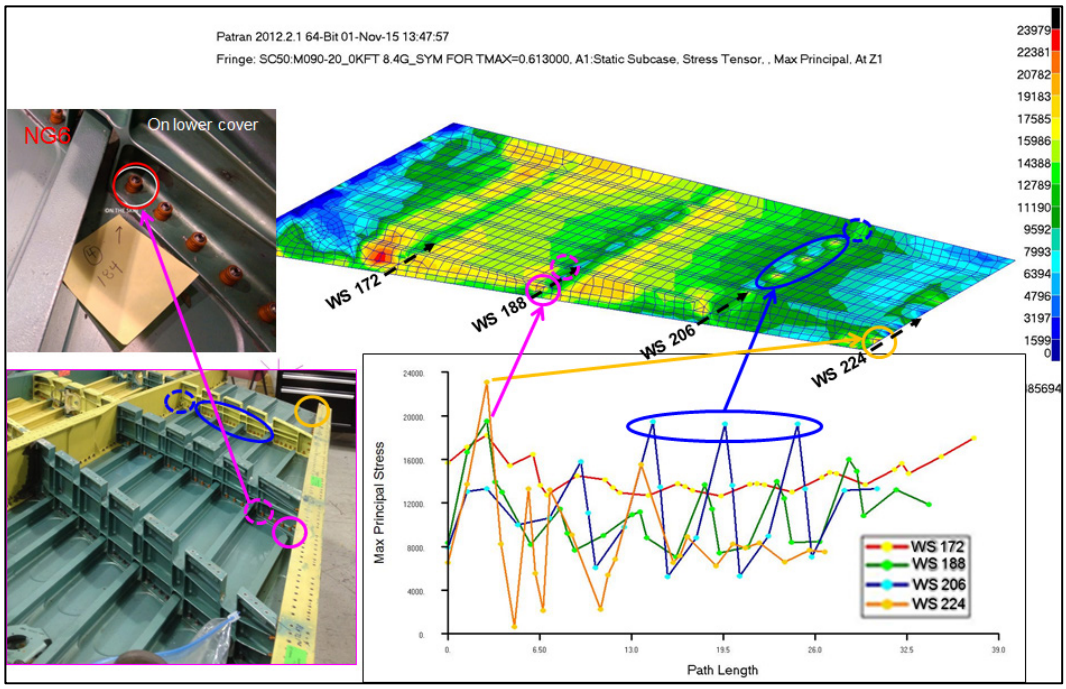

Figure 12. Outer Wing Lower Forward Cover Principal Stresses along Ribs

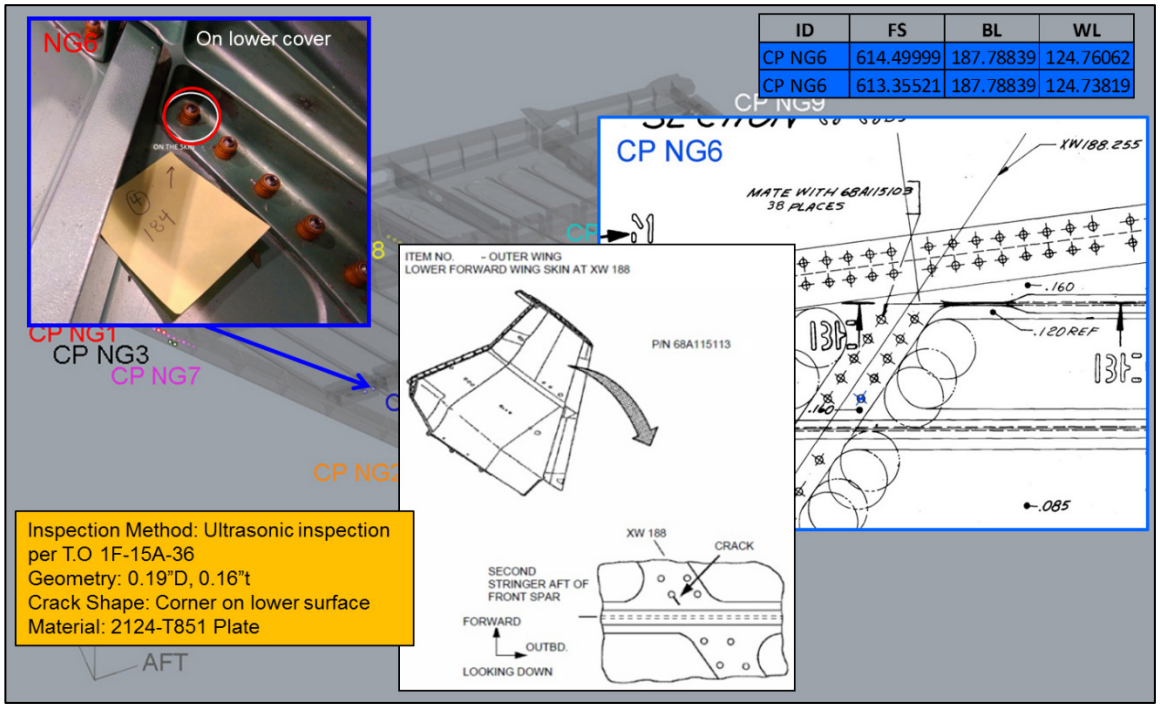

Figure 13. Control Point NG6 at Lower Forward Cover at XW 188

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Figure 14 shows stress profiles on the forward skin along the front and main spars. CP NG7 on the forward lower cover along front spar was selected based on the FEA stress profiles and cracks reported on the Wing Structural Disassembly and Analysis Support report as shown in Figure 15.

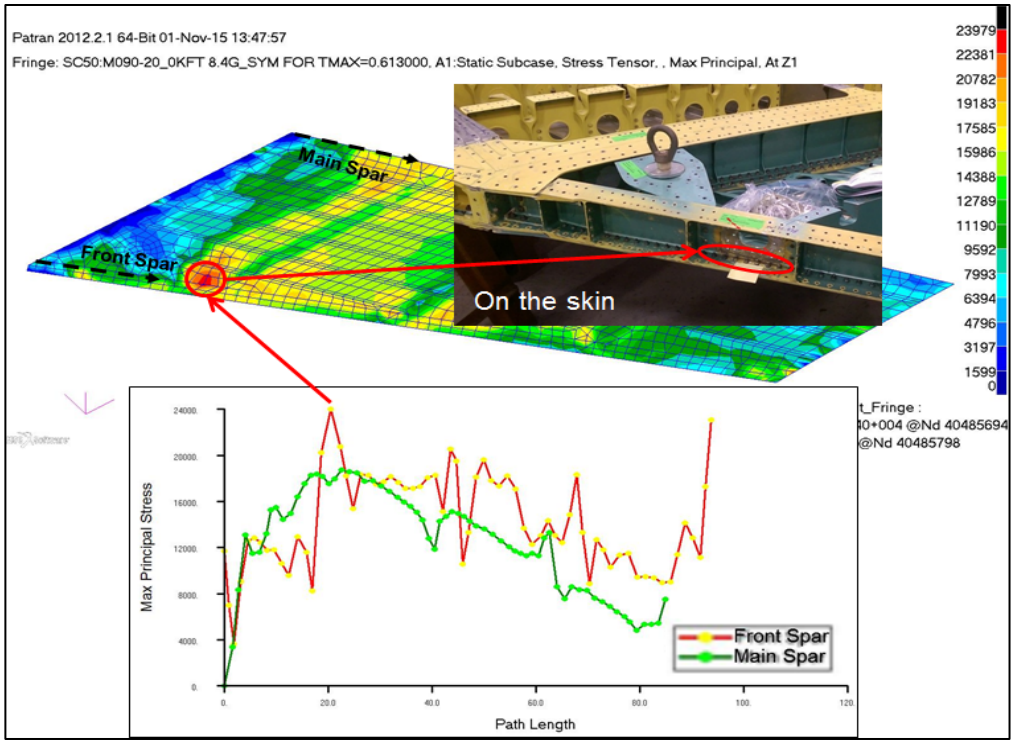
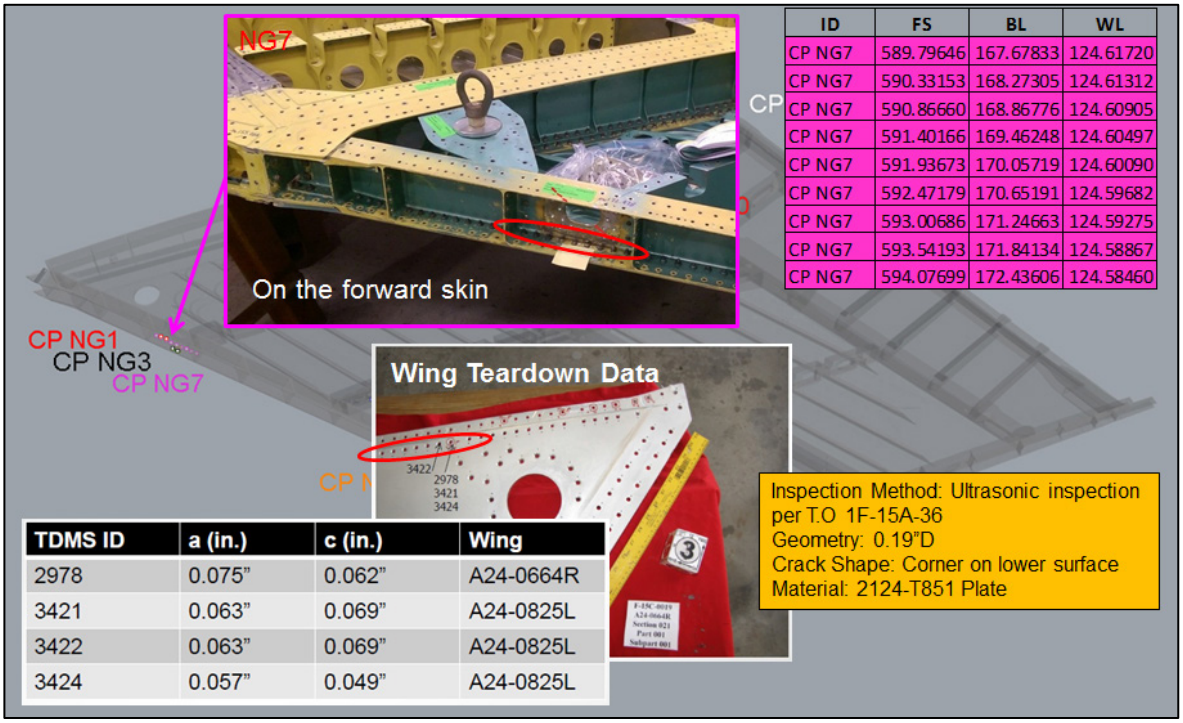


Figure 14. Outer Wing Lower Forward Cover Principal Stresses along Spars



ID	FS	BL	WL
CP NG7	589.79646	167.67833	124.61720
CP NG7	590.33153	168.27305	124.61312
CP NG7	590.86660	168.86776	124.60905
CP NG7	591.40166	169.46248	124.60497
CP NG7	591.93673	170.05719	124.60090
CP NG7	592.47179	170.65191	124.59682
CP NG7	593.00686	171.24663	124.59275
CP NG7	593.54193	171.84134	124.58867
CP NG7	594.07699	172.43606	124.58460

TDMS ID	a (in.)	c (in.)	Wing
2978	0.075"	0.062"	A24-0664R
3421	0.063"	0.069"	A24-0825L
3422	0.063"	0.069"	A24-0825L
3424	0.057"	0.049"	A24-0825L

Figure 15. CP NG7 at Lower Forward Cover Front Spar

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Figure 16 shows stress profiles on the aft skin along the main and rear spars. CP NG8 at the lower cover along the main spar was selected based on correlation to two DTA FCLs and cracks found during full-scale fatigue tests. The location of high stress along the rear spar was not a good candidate because it is difficult to inspect; the aft skin is covered by the rear spar and trailing edge skins. The location of highest stress (26,862 psi) on the aft skin was not correlated to any prior history and was not considered. Details for CP NG8 (includes 5 fasteners) are shown in Figure 17.

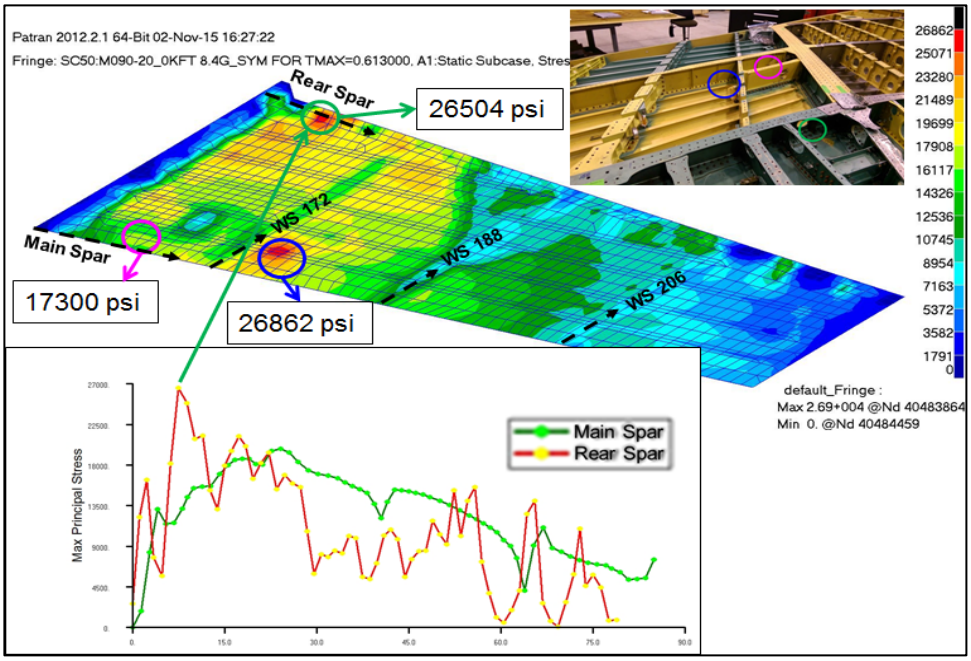

Figure 16. Outer Wing Lower Aft Cover Principal Stresses along Spars

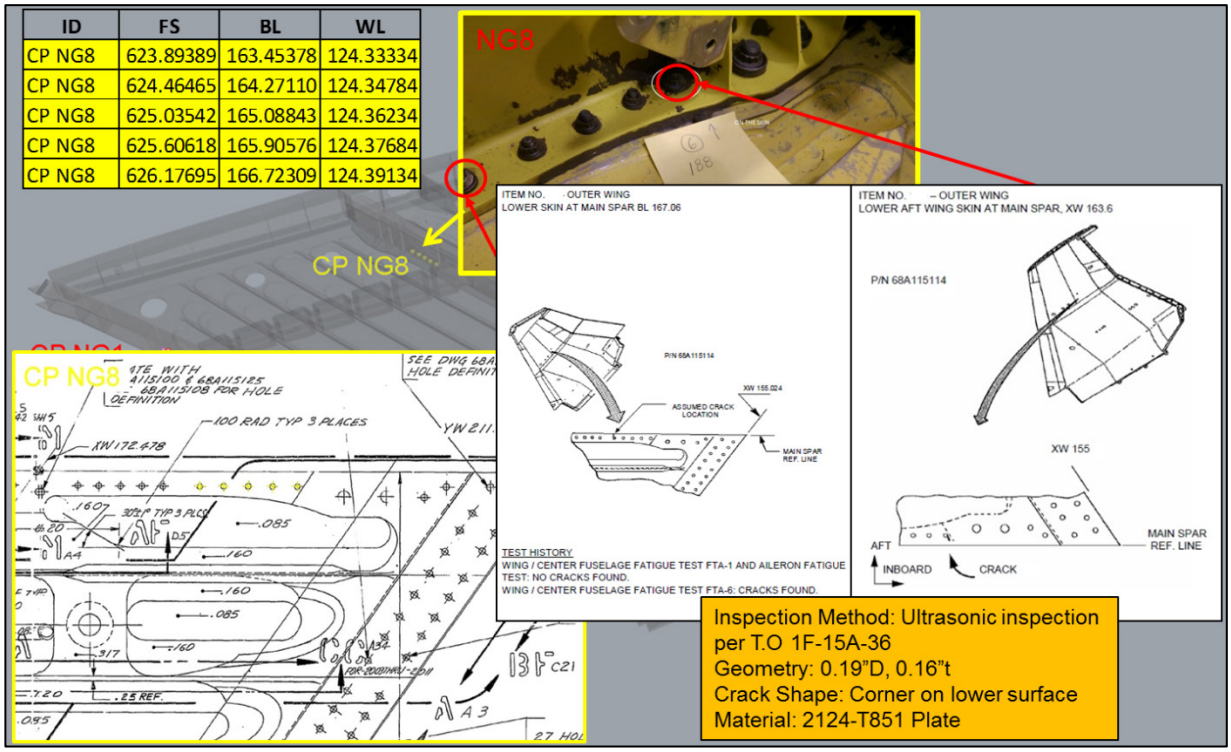

Figure 17. CP NG8 at Lower Aft Cover Main Spar

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Figure 18 shows stress profiles on the trailing edge skin along the rear and trailing edge spars. CP NG9 on the trailing edge skin along trailing edge spar was selected based on the FEA stress profile and correlation to three DTA locations and cracks found during full-scale durability testing. This location experiences the highest stress on the outer wing and has the lowest reported safety limit. The details of CP NG9 are shown in Figure 19, this location includes eight fasteners. CP NG10 on the trailing edge skin along the rear spar was selected based on the FEA stress profile and correlation to a DTA location and cracks found during full-scale durability testing. CP NG10 includes 3 fasteners which are beneath CP NG4, shown in Figure 20. The other two locations on the trailing edge skin with high stresses as shown in Figure 18 were not considered as good candidates.

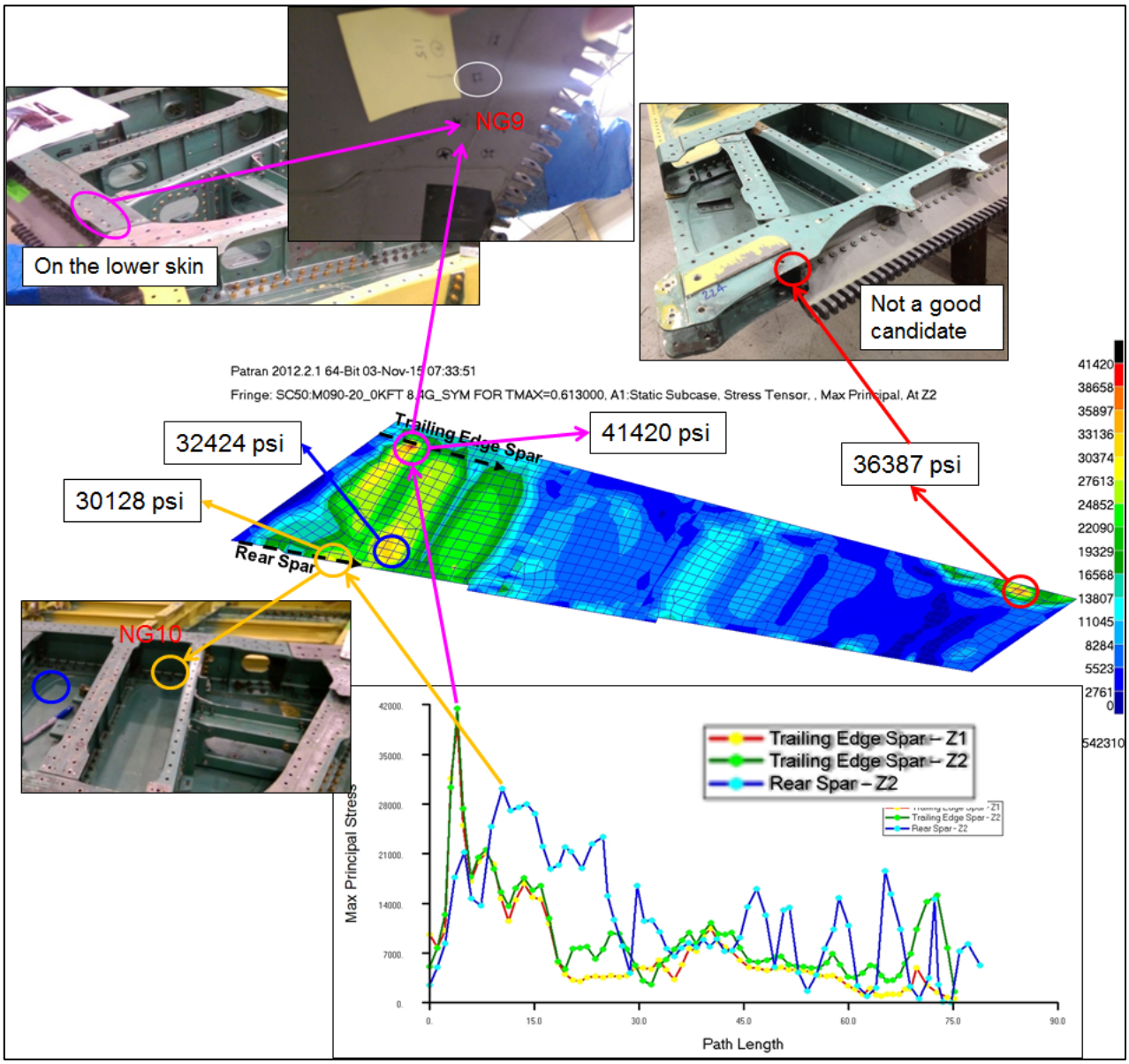

Figure 18. CPs NG9 and NG10 at Trailing Edge Skin

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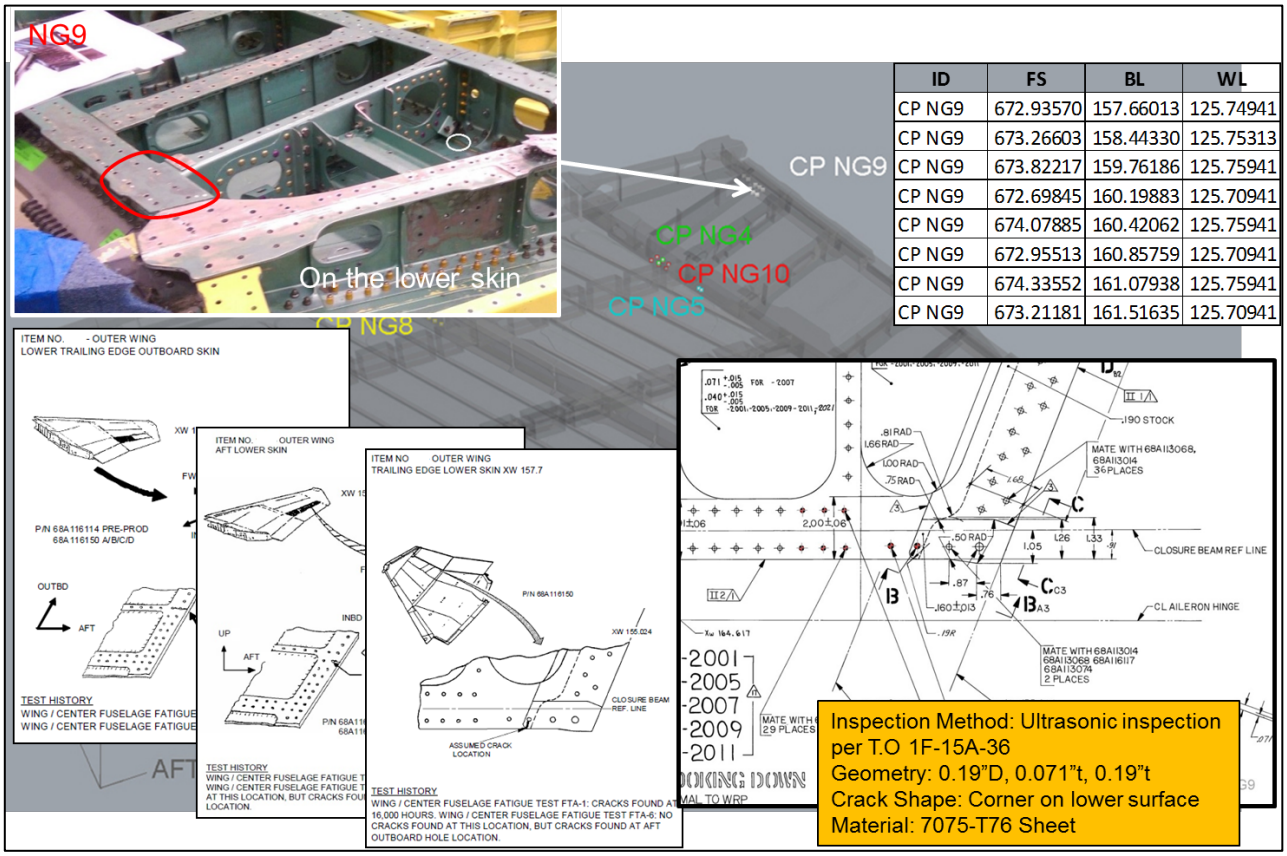

Figure 19. CP NG9 at Trailing Edge Skin along TE Spar

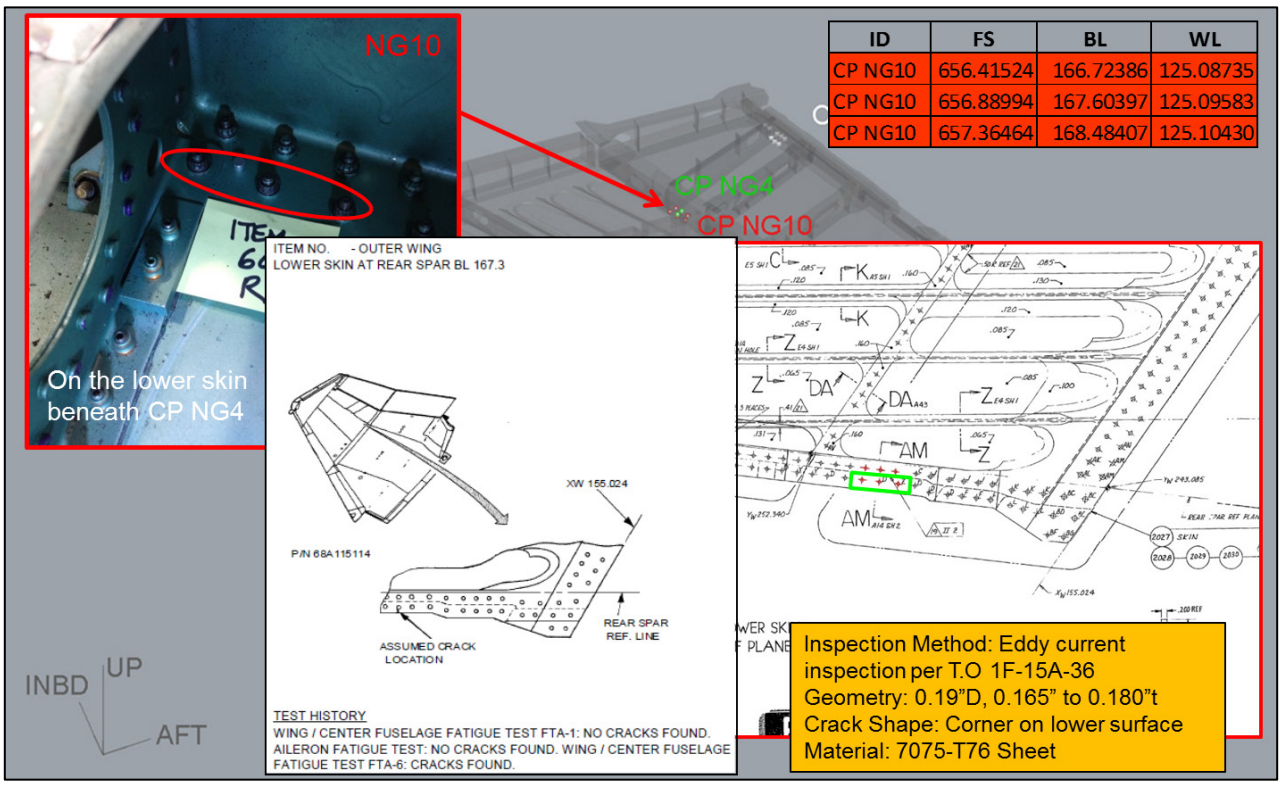

Figure 20. CP NG10 at Trailing Edge Skin along Rear Spar

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3.1.5 Summary

A comprehensive evaluation to select locations to be tracked during the experiment has been completed. We initially identify 26 candidate locations using 10 consideration factors. After examining the condition of the test articles and correlating high FEM stresses to DTA FCLs and teardown inspection data, we down select to the required 10 locations to track using 12 decision criteria. The ten locations to be tracked are fully identified by part number, fuselage station, butt line, and water line coordinates. All relevant information pertaining to the crack growth analyses are documented in Section 3.2 including model inputs such as geometric properties, material properties, and stress analysis results. Desirable fatigue damage progression is verified in Section 3.2 by developing crack growth life curves that estimate damage progression from a 0.005-inch initial semi-circular corner crack to failure.

3.2 Wing Load Application Plan (Task 2)

Loading information has been developed to be applied to the outer wing (XW155 to the wing tip) for the demonstration full-scale experiment. The information was provided to AFRL/RQVV in Appendix A. This section describes the process of converting the baseline spectrum developed under TO 0001 into the test loading information for the experiment. Our approach in developing the baseline spectrum has been described in the TO 0001 final report [1]. As previously described, our approach utilized the recorded data for the twelve flights provided by AFRL in conjunction with the StS maneuver simulator to define the loading time history and consequently the local stress histories at fatigue critical locations to be tracked. This section describes the process to convert the maneuver loads into loading information for the test, summarizes the results of local stress analyses performed at the selected control points to develop the inputs to crack growth models, and provides crack growth life curves for both the aero FEM and the test rig FEM.

We recognize that cracks at the tracked locations will not be repaired during the test nor will cracks at other locations if they are not likely to have adverse effect on the experiment. Our primary goal for developing the test spectrum was to ensure that desirable fatigue cracking at the selected outer wing tracked locations is attained within the duration of the experiment in order to successfully demonstrate P^2IAT. Desirable fatigue damage progression was verified by developing crack growth life curves that estimate damage progression from a 0.005-inch initial semi-circular corner crack to failure. The end of test damage condition at the tracked locations will also be considered so as to attain useful information during the destructive teardown process to validate P^2IAT.

3.2.1 Wing Load Application Guidelines

The wing load application plan was developed by leveraging NGSC's Subject Matter Experts (SMEs) with expertise in developing jack loads and load pad arrangements and extensive experience in fatigue testing on Air Force platforms. The load application plan was developed with close coordination with AFRL. We utilized the guidelines provided by AFRL in terms of the test fixture and loading as follows:

1) AFRL will design the test fixture and will provide design details to the contractors upon completion of the design.
2) The wing will be attached to the fixture using the lugs normally used to attach the wing to the fuselage.

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3) The inner wing (XW155 inboard to the lugs) will serve as transition structure; no loads will be applied to the inner wing.
4) The aileron will be installed in the wing and loaded during the experiments.
5) The loads will be applied with tension/compression actuators.
6) The test fixture will be the same for both test articles; however load pad arrangements are permitted to be different for each test article.
7) Load distribution whiffletrees for each actuator zone will be designed by AFRL/RQVV in coordination with NGAS.
8) Number of actuators between 10 to14.
9) Pad constraints: 7x7 inch pads, 25psi maximum pressure, 1225 pounds per pad.
10) Groups of 3 pads preferred, 4 acceptable.
11) Groups may be combined to a single actuator but no more than 6 to 8 pads per cylinder.

3.2.2 Wing Load Application Development Process

Figure 21 depicts the overall process for developing outer wing loads for the experiment. As described in the TO 0001 final report [1] the component loads (surface pressures) were calculated for the outer wing utilizing the StS maneuver simulator, shown in the upper part of Figure 21. As shown in the middle of Figure 21 the jack loads were determined using a NGAS-developed code called OPTICAL (OPTImum for a Constrained And Linear system). OPTICAL automatically computes jack loads based on: 1) the force and moment resultants (Fx, Fy, Fz, Mx, My, Mz), referred to as MVT's along a summation axis on the outer wing for all loading conditions, 2) the geometry and capacity of the independent jacks and, 3) an initial pad arrangement. OPTICAL then assembles the geometry and capacities of the jacks to simulate the distributed loads and performs a constrained minimization analysis to obtain the jack loads through a least square fit to the MVT curves that also adheres to the physical constraints of the test setup.

The test rig FEM using the initial pad arrangement was developed and jack loads were applied on the outer wing FEM. The final pad arrangement was designed using an iterative process in conjunction with the outer wing test rig FEM to verify a good match between the aero FEM and test rig FEM MVTs and keeping the pad pressures and loads within the constraints. Local stresses and crack growth curves at selected control points were compared between the Aero FEM and the test rig FEM for verification.

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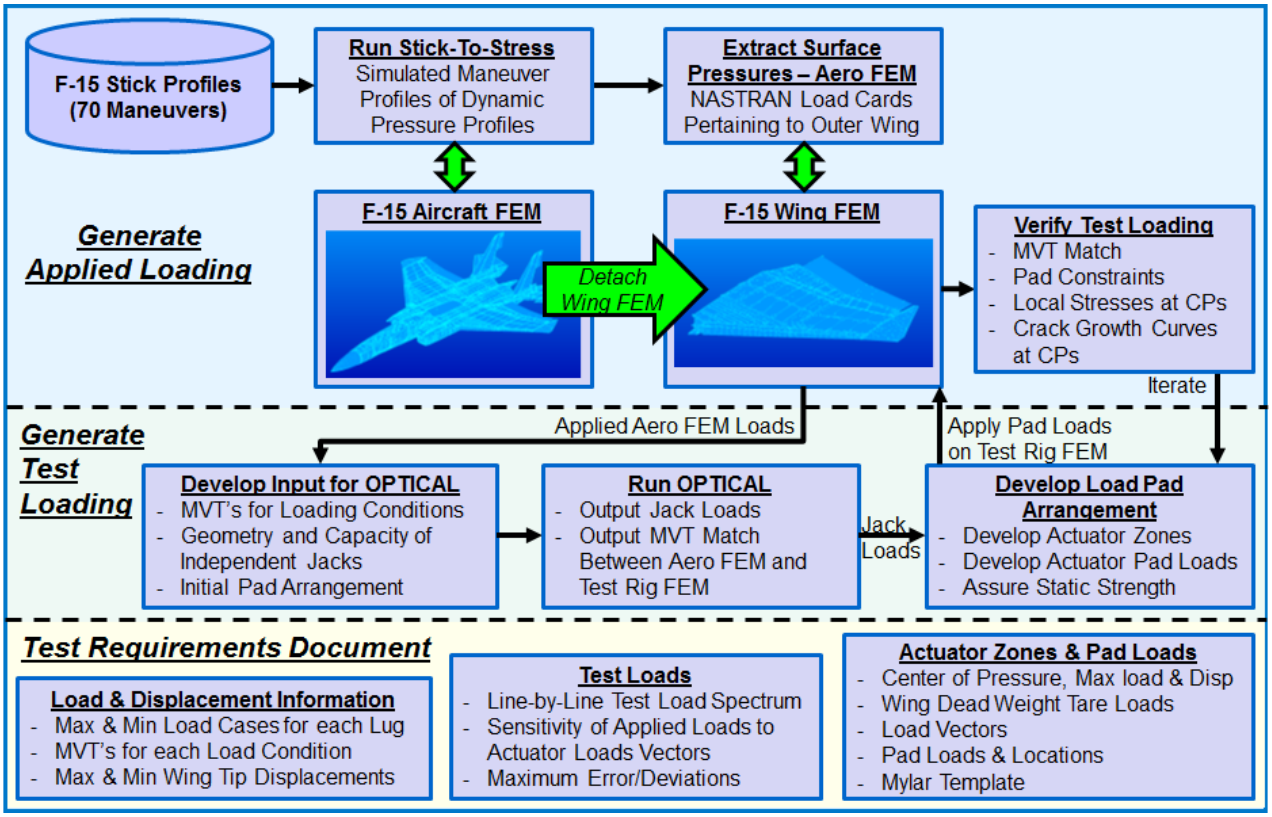

Figure 21. Wing Load Application Development Process

An iterative process was carried-out in developing the jack loads and pad arrangement that included the following steps:

1) Develop MVTs for all fatigue conditions.
2) Define initial jack locations and pad arrangement and capacities.
3) Calculate initial jack loads and match MVTs using OPTICAL.
4) Finalize arrangement by iterating on jack locations and pad layout using OPTICAL.
5) Develop test rig FEM and apply the jack loads.
6) Develop local stress histories at each CP using the test rig FEM.
7) Perform local stress analysis using the aero FEM.
8) Develop crack growth models for each CP.
9) Verify test loading by comparing MVTs, local stresses, and crack growth life curves between the aero FEM and test rig FEM.

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3.2.3 Outer Wing Test Loads and Test Rig FEM Development

The process for the selection of maneuvers and the development of the fatigue conditions is described in the TO 0001 final report [1]. As described, 70 maneuvers were selected and analyzed individually to define 140 fatigue conditions at max-min time stamps corresponding to the maximum and minimum loads of the StS maneuver time history as shown in Figure 22.

A ModelCenter flow shown in Figure 22 was developed using the NASTRAN monitor points function to sum the outer wing surface pressures at max-min time stamps along a summation axis and develop the MVTs. The summation axis is defined by the 65% chord on the outer wing from B.L. 155.024 to the wing tip. The ModelCenter flow generates a NASTRAN input file to automatically process 70 maneuvers and output MVTs for 140 fatigue conditions on a single NASTRAN run. Figure 23 shows an example output excel file for one maneuver which includes the MVT data and plots for the maximum and minimum fatigue conditions. The ModelCenter flow generated all 70 excel files automatically.

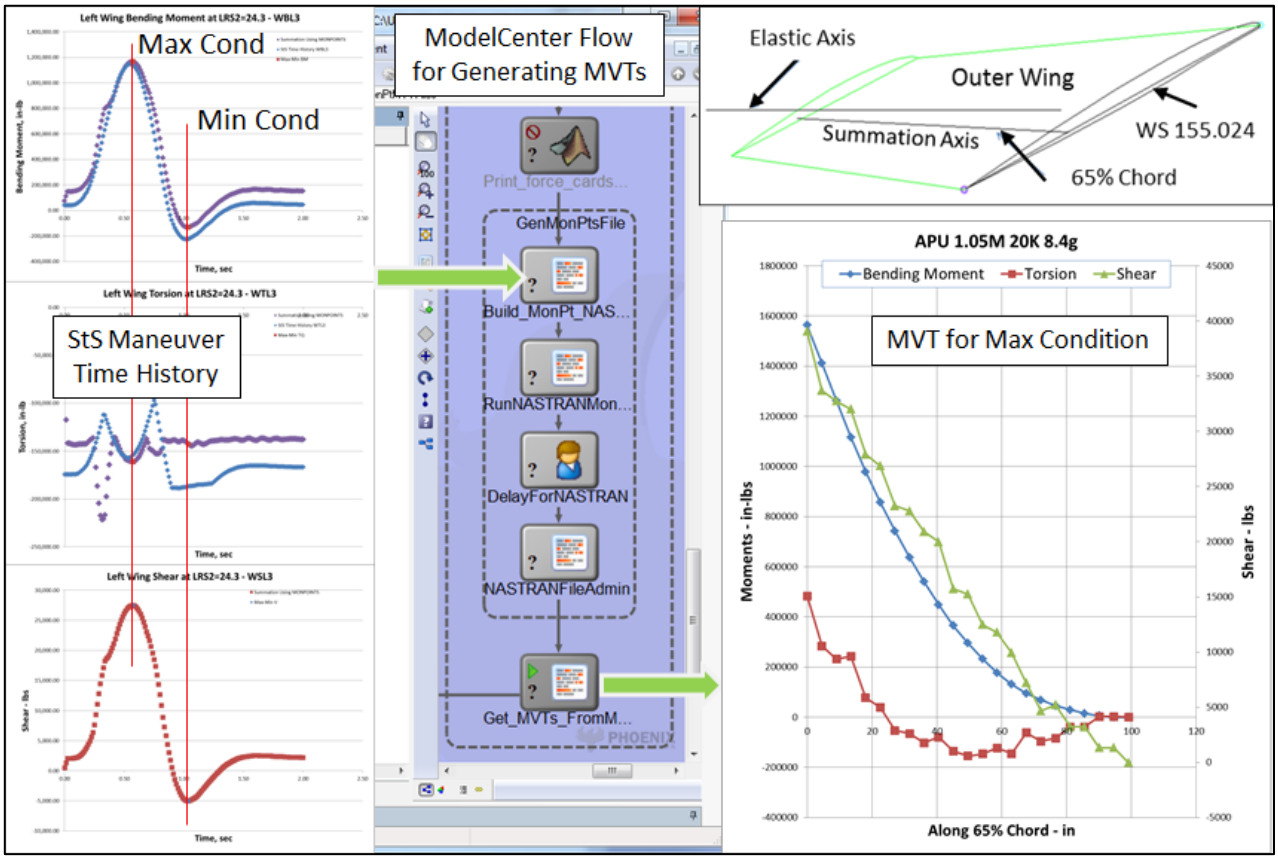

Figure 22. ModelCenter Flow to Generate MVTs

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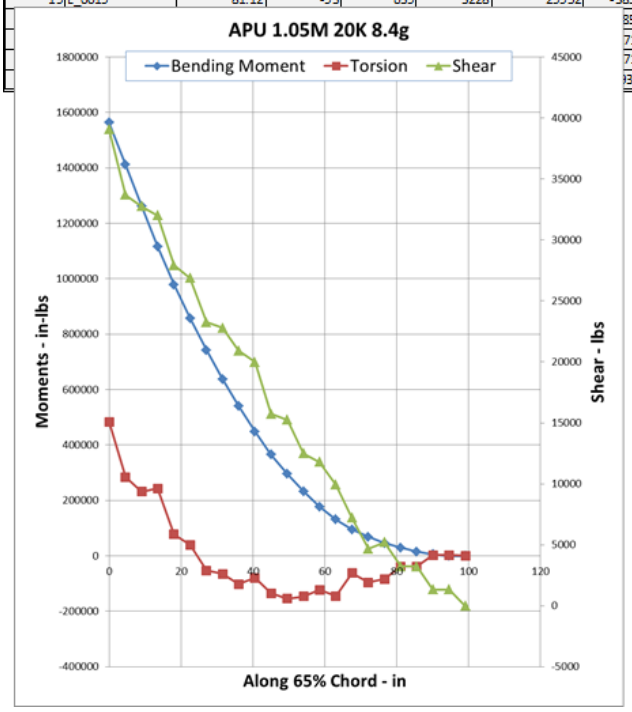
Developing the inputs to OPTICAL consisted of reformatting the MVT Excel files to data files as shown in Figure 24. Figure 24 shows the data files for the maximum and minimum fatigue conditions for the maneuver shown in Figure 23. A total of 140 data files were created.

MVTs along 65% Chord from B.L 155.024 to wing tip
Data generated using Mointor Points in NASTRAN to sum the loads along the 65% chord

Maneuver: APU 1.05M 20K 8.4g

Along the 65% chord coordinate system			Time@Subcase 47 = 0.575500						Time@Subcase 84 = 1.038000					
Count	MonPt Label	|Y-coord|	CX	(-)CY	CZ = V	(-)CMX = M	CMY = T	CMZ	CX	CY	CZ = V	(-)CMX = M	CMY = T	CMZ
1	L_0001	0.00	-1029	3163	39072	1563827	483930	23384	1392	-853	-8611	-348187	-371805	26110
2	L_0002	4.51	-939	2874	33698	1411650	284772	10017	1342	-865	-7722	-313255	-335000	19604
3	L_0003	9.01	-912	2775	32750	1262042	231992	7372	1286	-821	-7302	-279994	-305199	18824
4	L_0004	13.52	-934	2766	32022	1116092	243270	11567	1256	-809	-7150	-247468	-305417	14036
5	L_0005	18.03	-770	2464	27928	978917	77505	-5326	1106	-677	-6039	-217366	-241696	18148
6	L_0006	22.53	-757	2404	26864	857862	39466	-3671	1107	-689	-5791	-191217	-233250	12835
7	L_0007	27.04	-658	2198	23258	742084	-52787	-8774	1072	-680	-5000	-166170	-209106	8441
8	L_0008	31.55	-685	2167	22799	637966	-64760	-6295	1066	-692	-4997	-143465	-204245	3394
9	L_0009	36.06	-607	2026	20914	541102	-101718	-11194	953	-587	-4325	-123428	-168875	5502
10	L_0010	40.56	-654	2023	19978	448579	-79322	-8374	925	-586	-4368	-103943	-165497	1196
11	L_0011	45.07	-496	1737	15742	365979	-134577	-14473	823	-509	-3318	-86203	-129957	1747
12	L_0012	49.58	-428	1651	15254	295750	-154153	-16572	738	-415	-2903	-71922	-104912	2609
13	L_0013	54.08	-385	1508	12500	232617	-145835	-17583	659	-374	-2550	-59253	-85293	1235
14	L_0014	58.59	-426	1535	11779	177161	-122794	-16533	646	-374	-2592	-47748	-84454	-1822
15	L_0015	63.10	-325	1376	9921	130920	-145230	-19222	600	-342	-2200	-37877	-63591	-3836
16	L_0016	67.60	-324	1165	7215	95654	-61843	-14577	459	-240	-1969	-29263	-41345	-2609
17	L_0017	72.11	-166	923	4679	68910	-96162	-19773	379	-177	-1334	-21814	-18338	-2637
18	L_0018	76.62	-186	970	5194	45535	-83807	-17795	341	-137	-1323	-15994	-18201	-3207
19	L_0019	81.12	-93	639	3228	29952	-38503	-10601	246	-83	-957	-11026	-16704	-2805



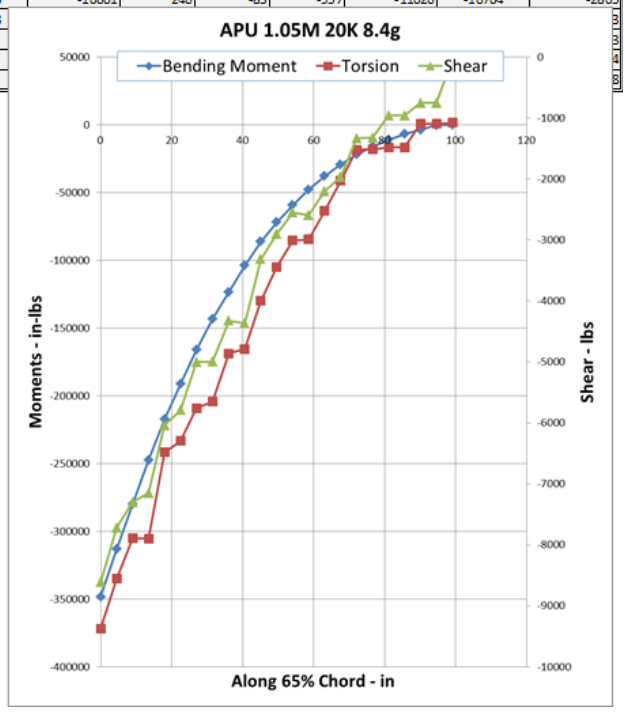


Figure 23. Aero MVTs for Max-Min Fatigue Conditions of a Maneuver

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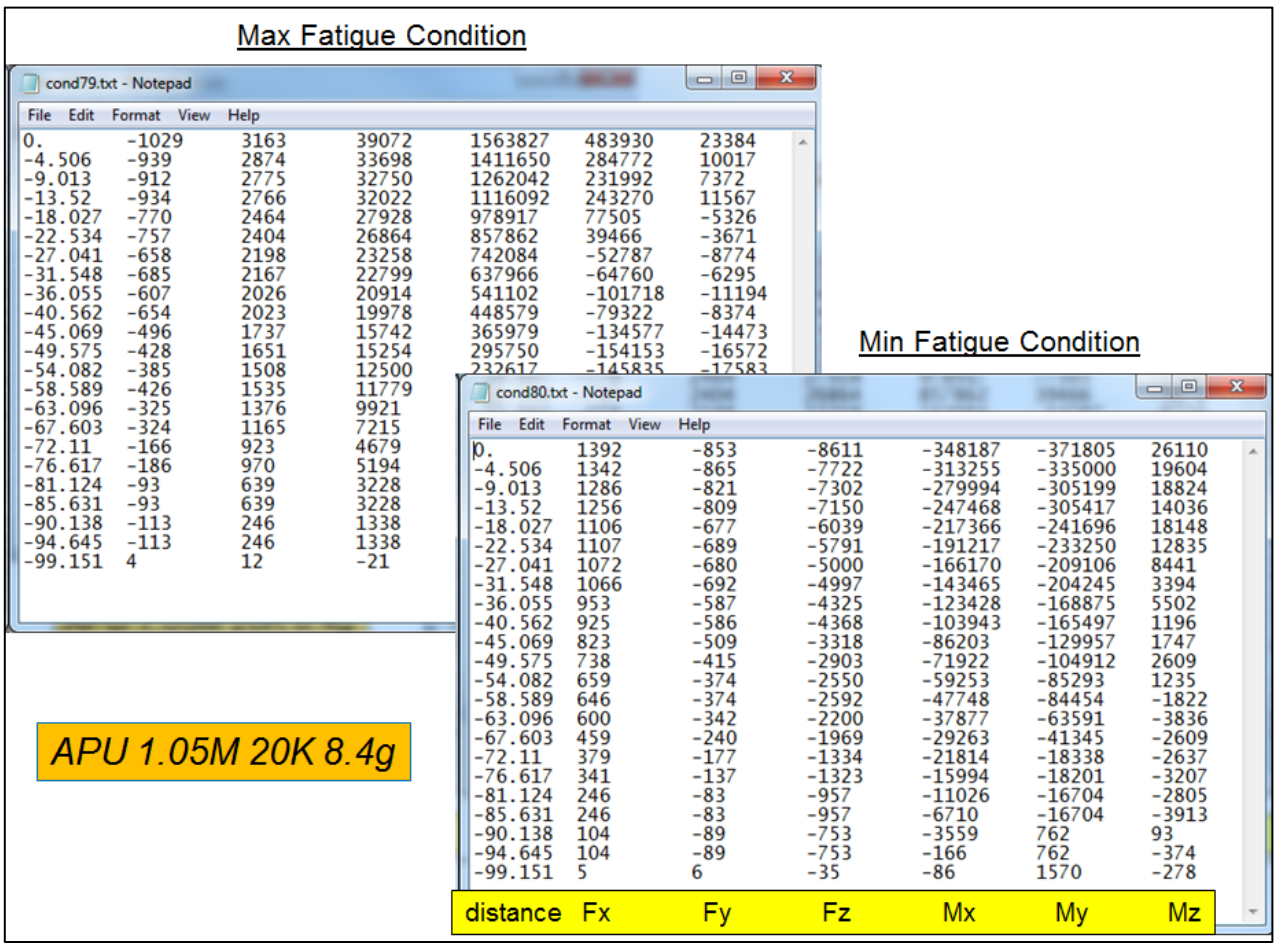

Figure 24. MVT Input Data Files for OPTICAL

An initial pad arrangement (12JacksV1) was developed as shown in Figure 25. The initial arrangement included a total of 12 actuators, 9 actuators with 2 sets of 3 pads, 2 actuators with a set of 3 pads, and 1 actuator with a set of 4 pads. OPTICAL results for the initial configuration indicated that the pad pressures were high in some locations and the test rig MVTs needed improvement to get a better match to the aero MVTs. Subsequently two variations of the initial configuration were studied as shown in Figure 25. Configuration 13JacksV2 included 13 jacks, 10 actuators with 2 sets of 3 pads and 3 actuators with a set of 3 pads. For this configuration the pad pressures for both tension and compression met the allowable and the test rig MVTs had a better match to the aero MVTs specifically for the shear loads (Fz) as shown in Figure 26 for three load cases. Configuration 13JacksV3 had a slight modification on jack number 3 to include 2 sets of 4 pads but with no additional improvements. At the conclusion of this study configuration 13JacksV2 was selected as the final configuration.

For all configurations the jack locations and capacities of the independent jacks were defined and OPTICAL input files where developed. Figure 27 shows the jack location inputs for the final configuration, 13JacksV2. The definition of the independent jacks consists of the following information: 1) X,Y,Z, locations in the aircraft reference system, 2) direction of applied loads, tension/compression capability, and 3) jack capacity.

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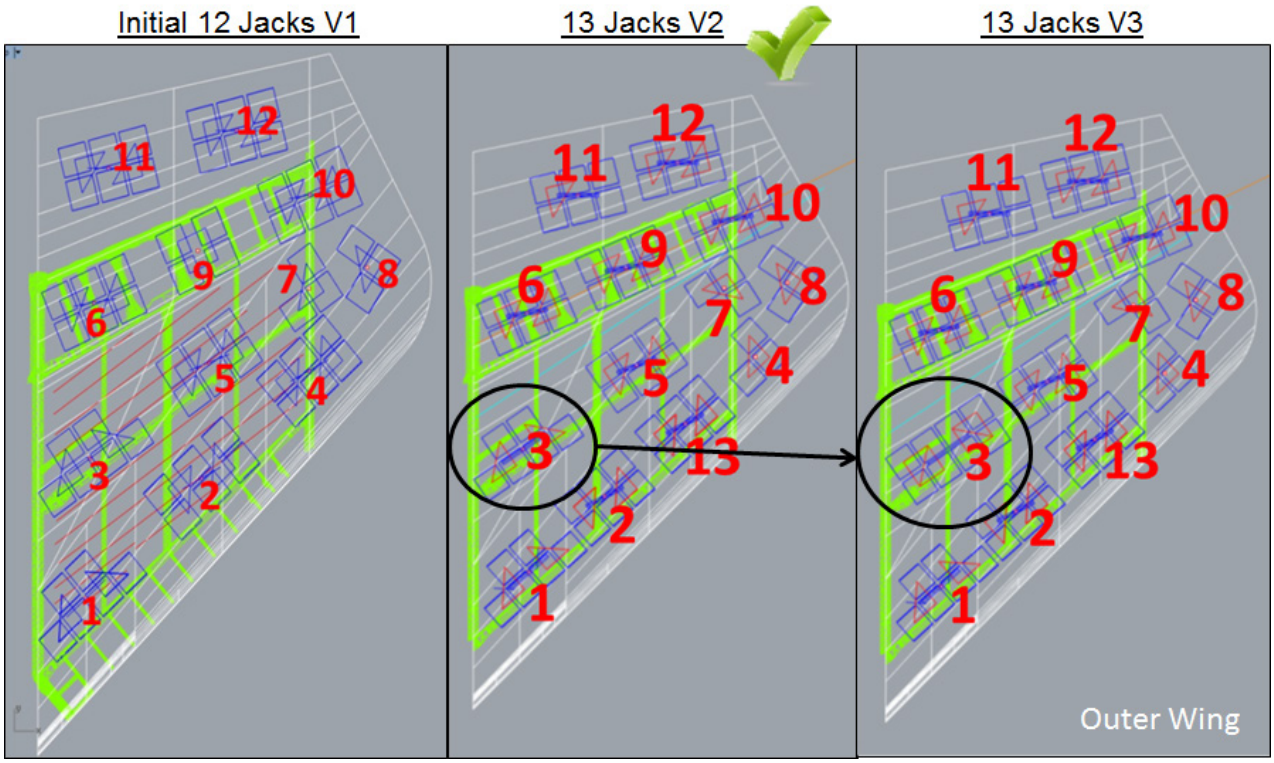

Figure 25. Jack Locations and Pad Arrangement Study

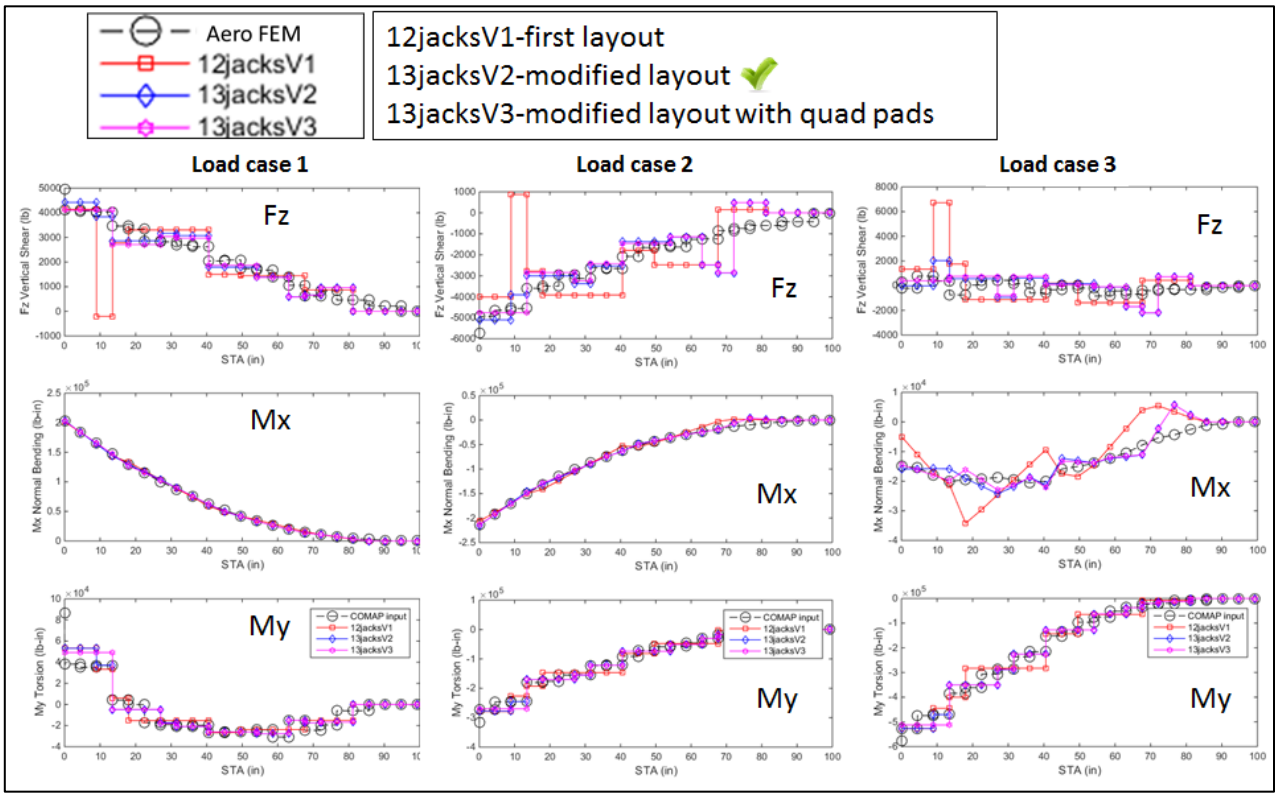

Figure 26. MVTs vs. Pad Configuration Study

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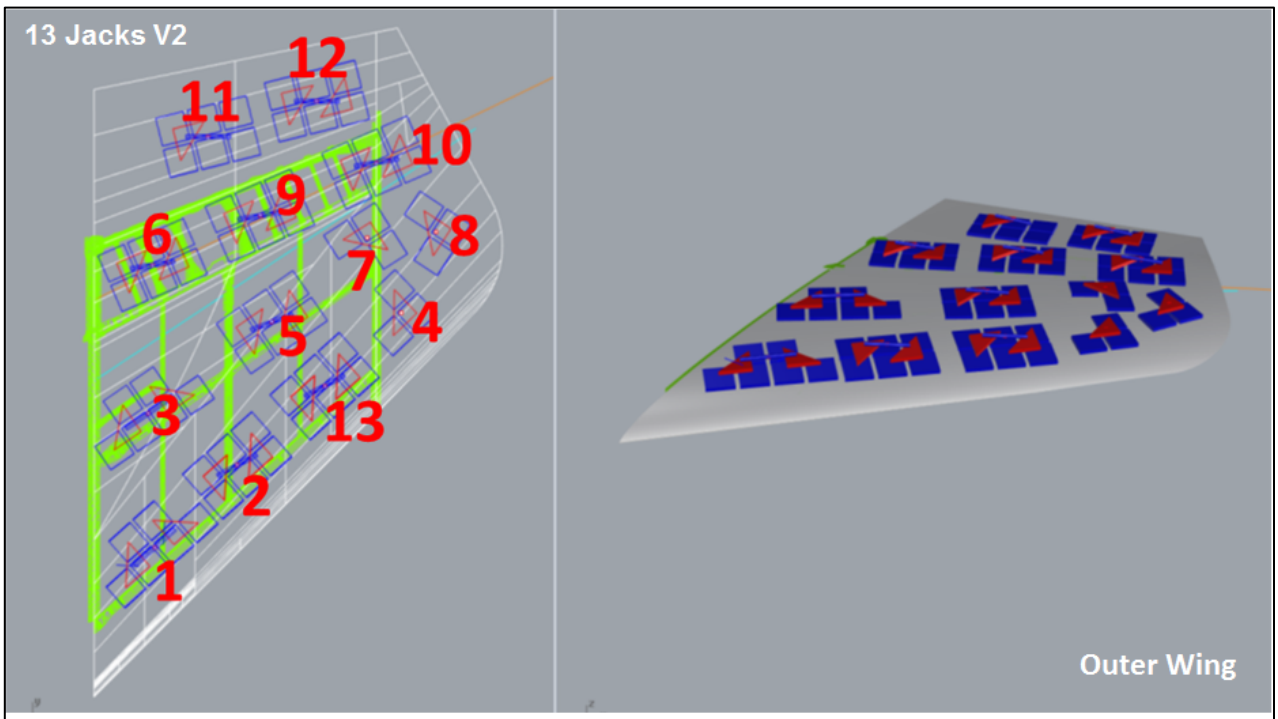

	1	2	3	4	5	6	7
1	597.32	-170.01	0	9	294	294	1
2	617.45	-190.36	0	9	294	294	1
3	630.22	-168.44	0	9	294	294	1
4	655.02	-230.98	0	9	147	147	1
5	652.71	-198.96	0	9	294	294	1
6	666.77	-169.52	0	9	294	294	1
7	673.63	-222.49	0	9	147	147	1
8	674.96	-239.53	0	9	147	147	1
9	678.92	-196	0	9	294	294	1
10	692.02	-224.82	0	9	294	294	1
11	698.37	-183.24	0	9	294	294	1
12	707.1	-210.1	0	9	294	294	1
13	636.98	-211.95	0	9	294	294	1

1 - x aircraft coordinates
2 - y aircraft coordinates
3 - z aircraft coordinates
4 - Jack direction: +/- Z
- 1,2,3 is –X,+X,+/-X respectively
- 4,5,6 is –Y,+Y,+/-Y respectively
- 7,8,9 is –Z,+Z,+/-Z respectively

5 - Lower pad area or negative jack capacity
6 - Upper pad area or positive jack capacity
7 – 0: jack loads, 1: pad areas

Figure 27. Final Jack Locations and Pad Arrangement (13JacksV2)

An excel sheet was developed to automate the process of processing all the data files including 140 MVT data files and the jack locations file through OPTICAL and develop output files for the jack loads with filenames consistent with the maneuvers. OPTICAL outputs an excel file with the jack loads and MVT match plots for all the fatigue conditions. Figure 28 shows the MVT match between the aero FEM and the test rig FEM for the maximum and minimum fatigue conditions of a maneuver. As shown the MVTs match very well for this maneuver. A complete list of the MVTs is included in the TRD that shows a good MVT match was obtained for all the fatigue conditions. Figure 29 shows the jack loads and pad pressures OPTICAL outputs for the maximum and minimum fatigue conditions for the same maneuver.

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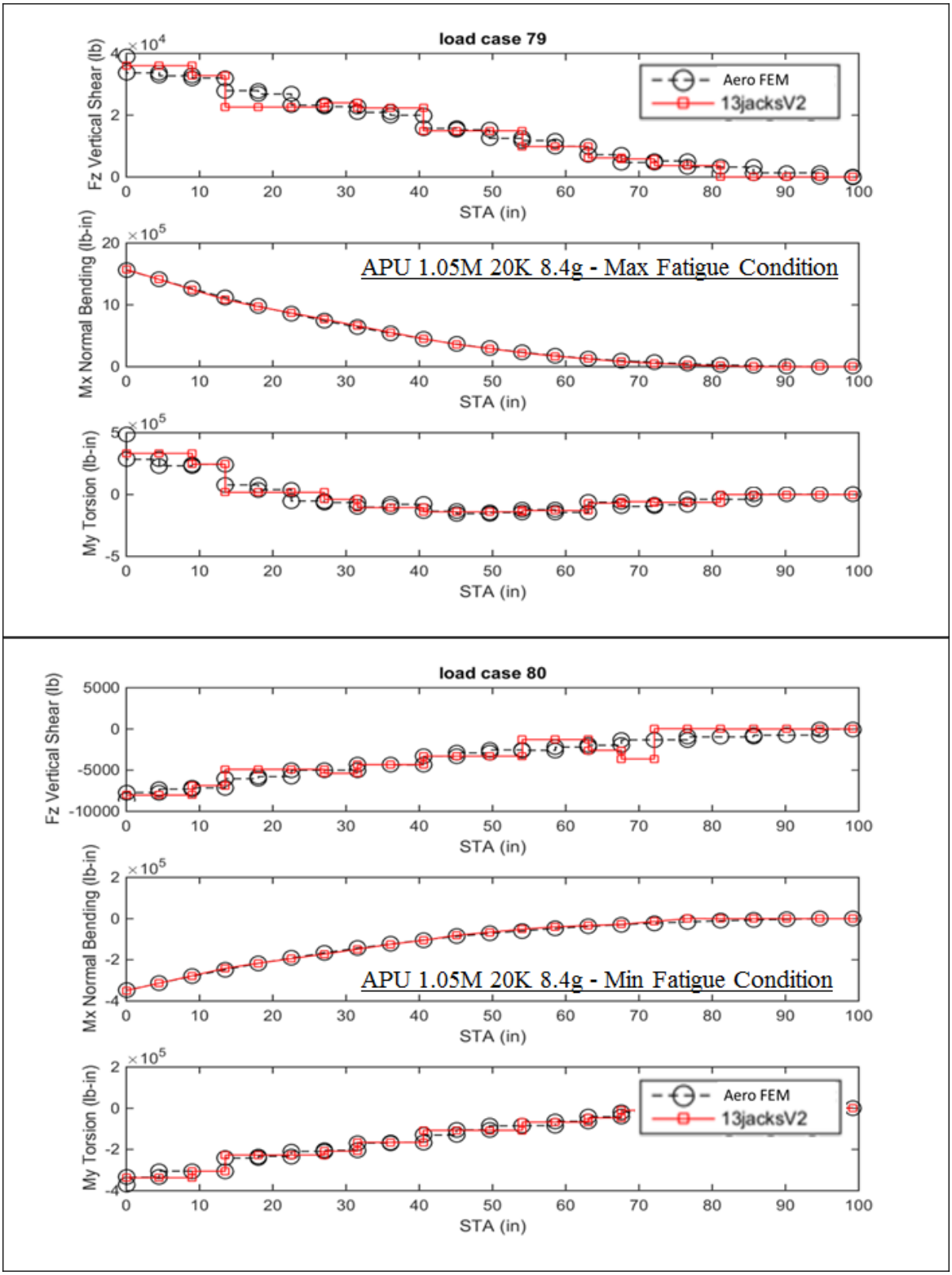

Figure 28. Match MVTs Output from OPTICAL

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APU 1.05M 20K 8.4g - Max Fatigue Condition

79l							
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	4628	294	16
2	617.45	-190.36	126.42	+/-Z	1630	294	6
3	630.22	-168.44	126.42	+/-Z	3213	294	11
4	655.02	-230.98	126.42	+/-Z	2161	147	15
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	5592	294	19
7	673.63	-222.49	126.42	+/-Z	3675	147	25
8	674.96	-239.53	126.42	+/-Z	3675	147	25
9	678.92	-196	126.42	+/-Z	87	294	0
10	692.02	-224.82	126.42	+/-Z	353	294	1
11	698.37	-183.24	126.42	+/-Z	-1393	294	-5
12	707.1	-210.1	126.42	+/-Z	1639	294	6
13	636.98	-211.95	126.42	+/-Z	3430	294	12

APU 1.05M 20K 8.4g - Min Fatigue Condition

80l							
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1389	294	-5
2	617.45	-190.36	126.42	+/-Z	-1047	294	-4
3	630.22	-168.44	126.42	+/-Z	-1148	294	-4
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-3077	294	-10
6	666.77	-169.52	126.42	+/-Z	-577	294	-2
7	673.63	-222.49	126.42	+/-Z	1308	147	9
8	674.96	-239.53	126.42	+/-Z	25	147	0
9	678.92	-196	126.42	+/-Z	2049	294	7
10	692.02	-224.82	126.42	+/-Z	1064	294	4
11	698.37	-183.24	126.42	+/-Z	474	294	2
12	707.1	-210.1	126.42	+/-Z	-32	294	0
13	636.98	-211.95	126.42	+/-Z	-1995	294	-7

Figure 29. Jack Loads and Pad Pressures Output from OPTICAL

OPTICAL also outputs the NASTRAN force cards for the jack loads for all the fatigue conditions to be used with the test rig FEM to develop stress histories at the tracked locations. An example is shown in Figure 30 where two files are shown, one for the maximum and one for the minimum fatigue condition of the maneuver. The NASTRAN force cards have a unique NASTRAN node id that corresponds to the appropriate jack number. The filenames are unique to the fatigue condition, in this way the ModelCenter flow that was developed in TO 0001 and described in the TO 0001 final report [1] can be used to develop the max-min stresses and stress histories at the CPs just by specifying the test rig FEM and the jack loads files in lieu of the Aero FEM and the force cards corresponding to the surface pressures. Figure 31 shows a file containing the jack loads for a partial list of fatigue conditions. This file is combined with the Master Event Schedule (MES) that was developed in TO 0001 to generate the baseline spectrum using the test rig FEM. A Microsoft Excel file containing the line-by-line load test spectrum for all actuators has been delivered to AFRL [see Appendix D].

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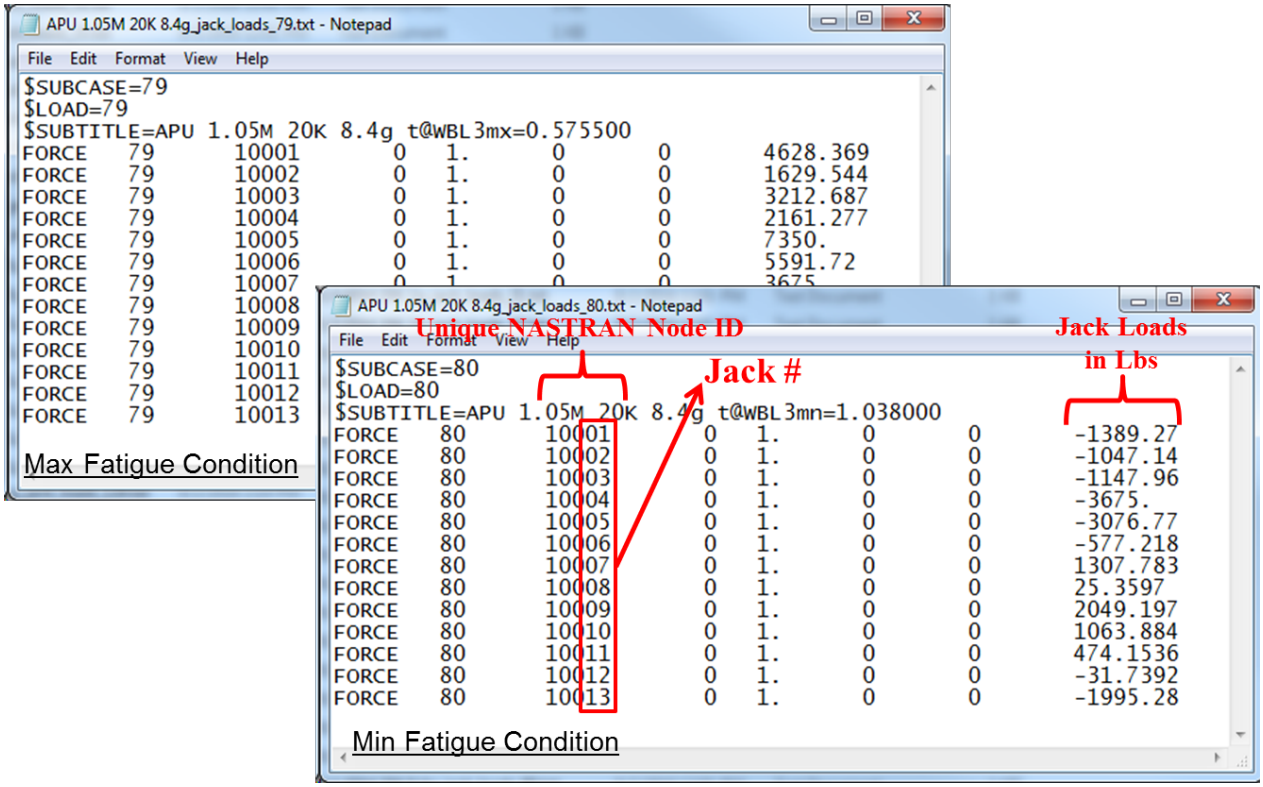

Figure 30. NASTRAN Force Cards for Jack Loads

Cond id	jack #1	jack #2	jack #3	jack #4	jack #5	jack #6	jack #7	jack #8	jack #9	jack #10	jack #11	jack #12	jack #13
1	588	-33	452	-431	1321	829	986	1076	324	-72	-295	135	281
2	-1010	-876	-1074	-3489	-2162	788	1705	887	1700	324	211	301	-355
3	599	-16	464	-369	1350	808	952	1049	292	-76	-296	130	284
4	-1020	-864	-1059	-3444	-2158	746	1661	850	1664	320	200	290	-354
5	617	-11	466	-426	1515	913	1119	1124	338	-71	-303	158	295
6	-1075	-880	-1099	-3405	-2258	743	1629	796	1680	324	242	282	-394
7	751	132	595	67	1857	794	874	937	79	-107	-327	125	341
8	-1200	-837	-1193	-3348	-2756	299	1327	486	1590	378	370	261	-474
9	114	-371	33	-1148	245	1174	1041	1064	846	-31	-106	135	52
10	-1859	-1362	-1385	-3675	-3019	1071	940	400	2659	1122	438	177	-1516
11	691	8	503	-235	1791	1155	1059	1105	323	-124	-319	154	324
12	-1389	-954	-1127	-3547	-2943	601	1194	508	1749	479	368	309	-451
13	175	-317	-48	-1116	500	1453	836	1198	921	134	-58	343	269
14	-1400	-1051	-1475	-3558	-3686	576	747	450	2103	686	534	417	-547
15	-710	-1012	-750	-3675	-1501	164	2087	937	2385	1158	253	68	-2010
...	...												
79	4628	1630	3213	2161	7350	5592	3675	3675	87	353	-1393	1639	3430
80	-1389	-1047	-1148	-3675	-3077	-577	1308	25	2049	1064	474	-32	-1995
...	...												
134	1564	580	1088	114	1639	-589	908	1634	-349	-245	-311	-16	641
135	-1747	-1482	-2052	-3675	-4024	3368	1359	636	4197	768	1527	1002	-794
136	-1130	-1076	-1166	-2962	-2355	2661	1389	1115	3058	502	1047	793	-480
137	-252	-387	42	-3675	-1899	-1189	1087	1557	564	529	-453	105	173
138	-74	-293	136	-3443	-1468	-1169	1052	1655	363	487	-578	71	308
139	-835	-913	-676	-3675	-2370	401	2166	892	2258	613	542	512	-945
140	-32	-448	-56	-2926	-592	223	1784	1307	998	316	-47	265	-86

Figure 31. Jack Loads for Fatigue Conditions

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A code was written to automatically generate the whiffle geometry as shown in Figure 32 and the NASTRAN Rigid Body Element (RBE) cards as shown in Figure 33 to define the jack locations and pad arrangement and generate the test rig FEM.

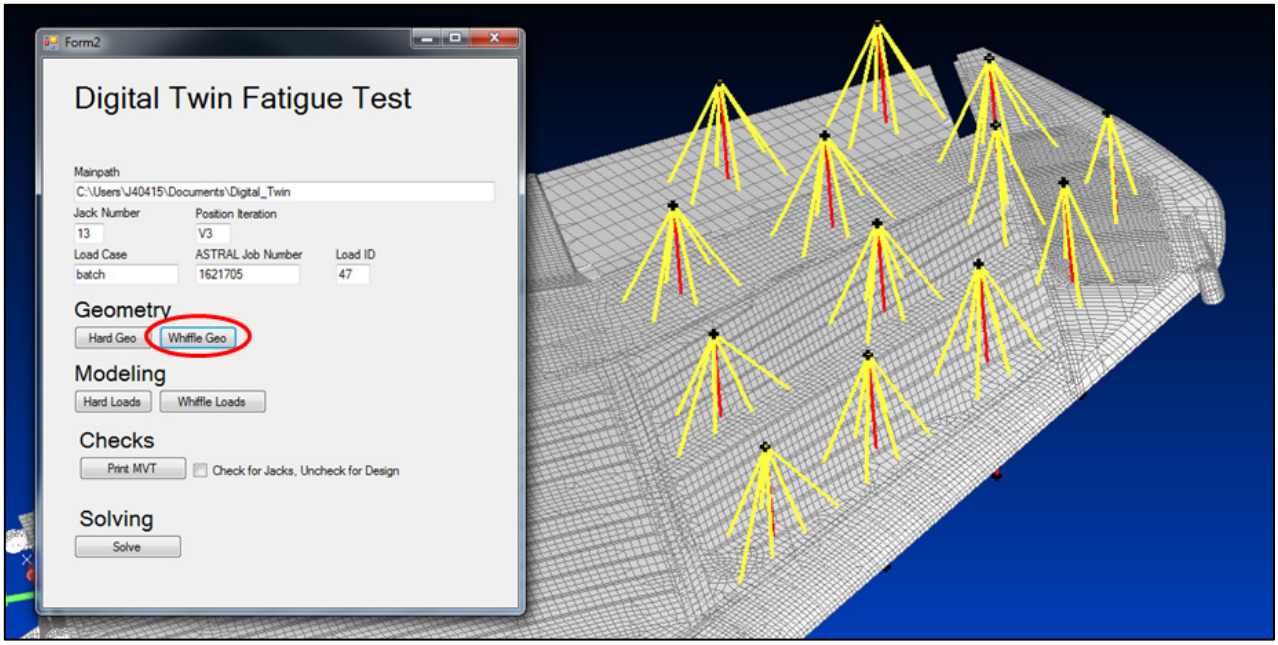

Figure 32. Whiffle Geometry on Left Wing FEM

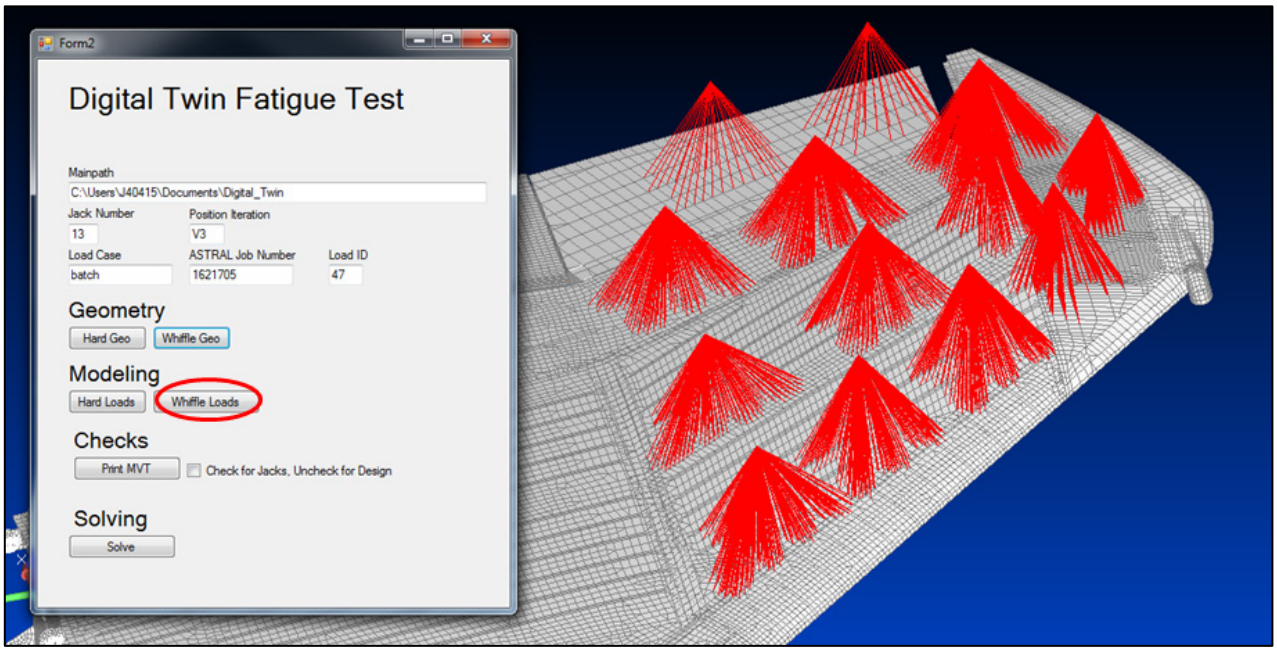

Figure 33. Test Rig FEM

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3.2.4 Local Stress Histories at Each CP Using the Test Rig FEM

The Spectrum Generation ModelCenter flow that was developed in TO 0001 and described in the TO 0001 final report [1] was used to develop the max-min stresses and stress histories at the CPs using the test rig FEM and the jack loads files as described in the previous section. The ModelCenter flow automatically generates the NASTRAN input file for all fatigue conditions, executes NASTRAN, and produces the internal max-min stresses at all CPs. The CP stress histories are automatically generated by combining the MES with the internal stresses at the CPs. The process generates FASTRAN and NASGRO formatted stress histories files and also generates the Extreme Value Distribution (EVD) to perform Single Flight Probability of Failure (SFPOF) calculations.

Figure 34 and Figure 35 show the comparison of maximum and minimum stresses at CP NG1 for the two FEM configurations for the 70 maneuvers utilized in the baseline spectrum. The results show that the test rig FEM stresses for all maneuvers are consistently slightly higher than the aero FEM stresses. As shown for the reference condition (Abrupt Pull-Up (APU) 1.05M 20K 8.4g) the test rig FEM stress at CP NG1 is 6% higher than the aero FEM stress. Figure 36 shows the comparison of maximum stresses for the reference condition at all control points for the two FEM configurations. As shown most of the CPs have a variation of less or equal to 12% except for CP NG2 which has a variation of 24%.

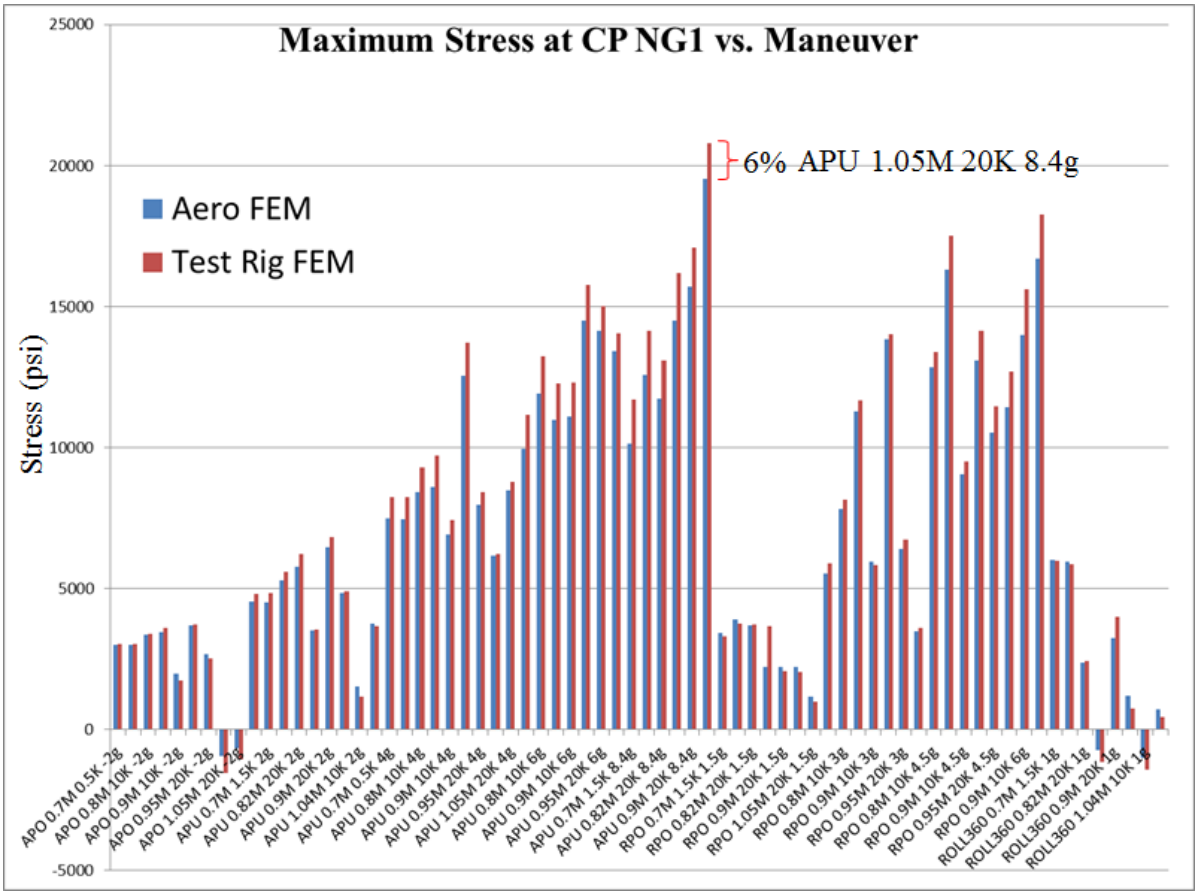

Figure 34. Aero vs. Test Rig FEM Maximum Stresses at CP NG1

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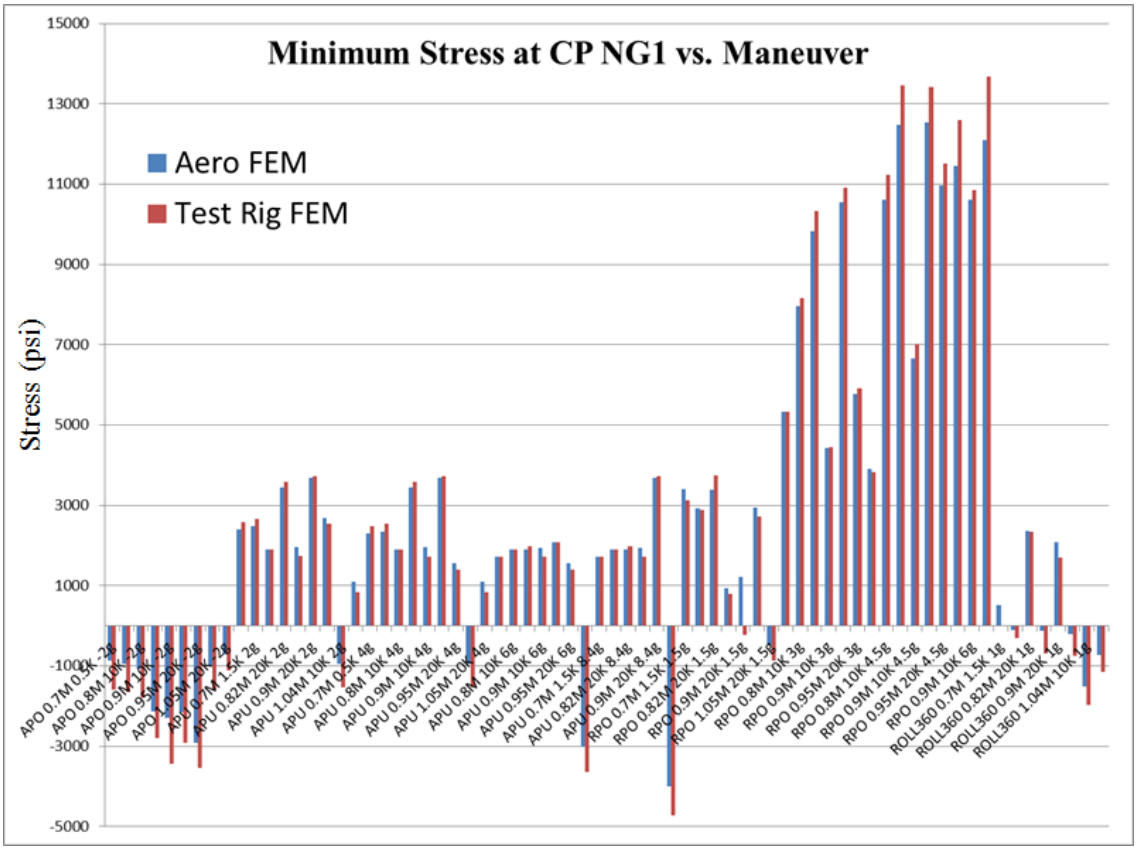

Figure 35. Aero vs. Test Rig FEM Minimum Stresses at CP NG1

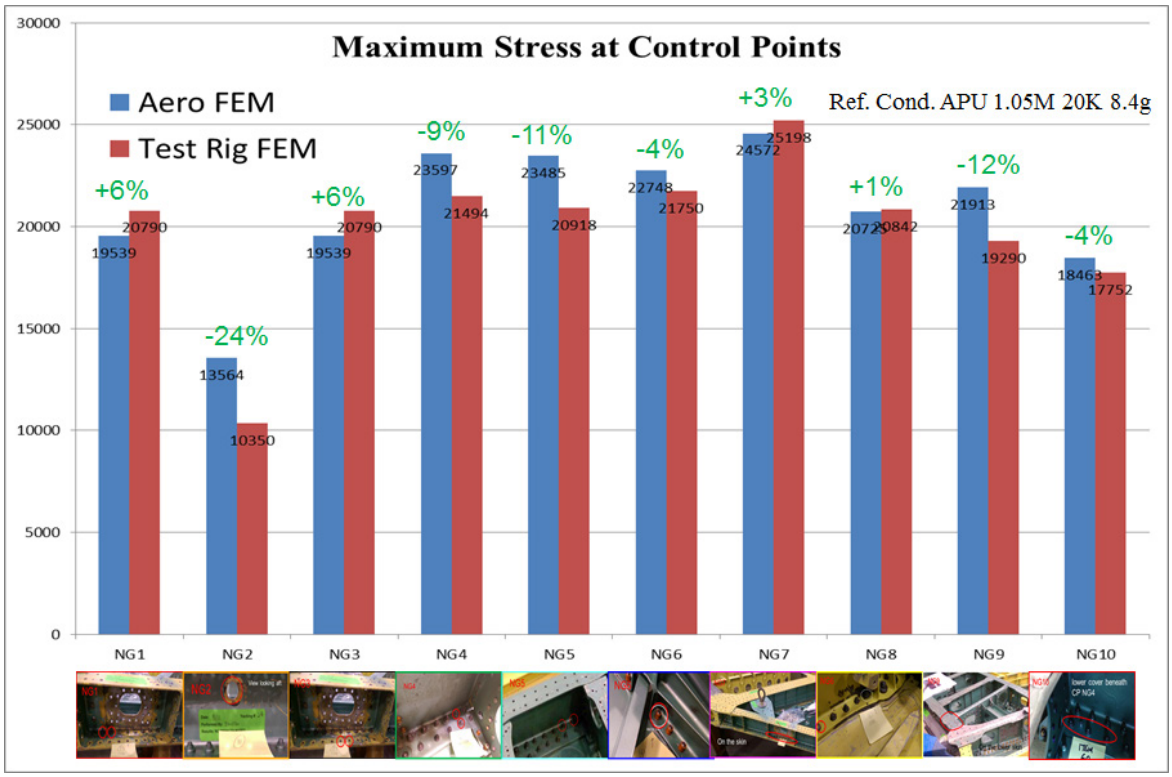

Figure 36. Aero vs. Test Rig FEM Reference Stresses at each CP

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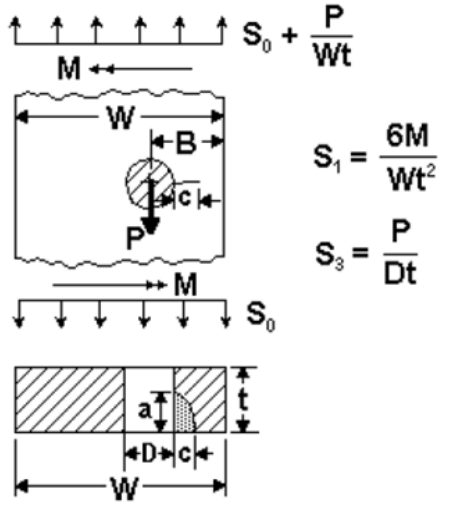
3.2.5 Crack Growth Life Predictions

The left wing aero FEM configuration was analyzed using the reference condition corresponding to an Nz = 8.4g, Altitude = 20,000 feet, Mach = 1.05 symmetric maneuver to develop the crack growth model inputs for NASGRO. The CP geometry for all locations was modelled with NASGRO's CC16 solution representing a corner crack at an offset hole in a plate as shown in Figure 37.



Description	Variable
Width	W (in)
Hole Center offset	B (in)
Thickness	t (in)
Bypass Stress	S0 (ksi)
Pin Load	P (kips)
Bearing Stress	S3 (Ksi)
Bending Stress	S1 (Ksi)
Total Stress	S0+P/WT (ksi)
Material	Selected from NASGRO library
Initial Crack Size	c = 0.005"
Initial Crack Aspect Ratio	a/c =1.0

Figure 37. Crack Growth Model Input Variables

A detailed stress analyses was performed at each CP utilizing the FEM results to develop the stress quantities (S0, S1, S3) and the CP geometry parameters, summarized in Figure 38. The Element Id shown in the figure corresponds to the selected finite element in the vicinity of the CP location that defines the response (max-min stresses) of the structure to external loads. The Element stress shown in the figure corresponds to the maximum stress of the reference condition and is used to normalize the stresses. The Spectrum Generation ModelCenter flow extracts, rainflows, and normalizes the max-min stresses at each CP to develop the peak-valley stress histories. CP stress histories were generated for both the aero FEM and the test rig FEM. The peak-valley stresses are scaled by NASGRO based on the appropriate stress quantities corresponding to each CP.

The NASGRO Generalized Willenborg model is used to account for load interaction. The model requires a shutoff overload ratio (Rs0) that ranges from a value of 2 to 4. Based on experimental results of a two-hole specimen designed to represent CP NG4 and a test spectrum appropriate to that location the value of Rs0 was calibrated to 3 and was used for all CPs.

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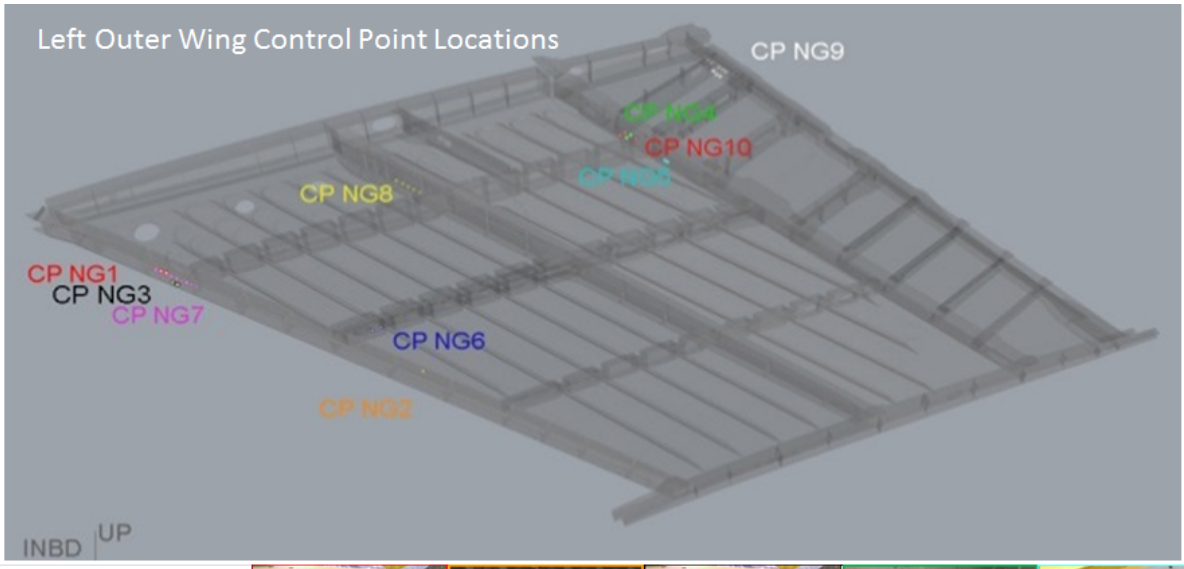

		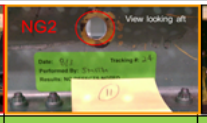			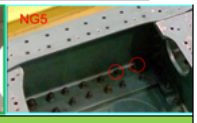
	CP NG1	CP NG2	CP NG3	CP NG4	CP NG5
Location	Front Spar Lwr Flange	Front Spar	Front Spar Lwr Flange	Rear Spar Lwr Flange	Rear Spar Lwr Flange
	Xw = 167	In work	Xw = 167	Xw = 167.3	Xw = 172.5
Element ID	40034734	40007812	40034734	40033063	40001535
Element stress (ksi)	19.54 (fy)	13.56 (fxy)	19.54 (fy)	23.60 (fx)	23.48 (fx)
NASGRO CC type	16	16	16	16	16
Width, W (in)	1.07	2.08	0.85	1.12	1.12
Hole Ctr offset, B (in)	0.42	1.04	0.42	0.43	0.42
Thickness, t (in)	0.16	0.08	0.16	0.19	0.136
Hole Diameter, d (in)	0.199	0.500	0.199	0.199	0.199
Bypass stress, S0 (ksi)	18.9	14.000	22.60	18.40	22.90
Pin load (kips)	0.317	0	0.181	0.723	0.364
Bearing Stress, S3 = P/dt (ksi)	9.60	0	6.00	19.10	13.50
Bending stress, S1 = 6M/Wt^2 (ksi)	0	0	0	0	0
Total Stress, S0 + P/Wt (ksi)	20.75	14.00	23.93	21.80	25.29
Material	7075-T7352 forging	7075-T7352 forging	7075-T7352 forging	7075-T7352 forging	7075-T7352 forging

		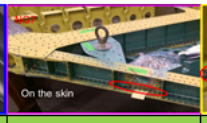		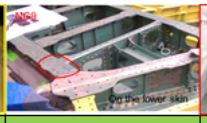	
	CP NG6	CP NG7	CP NG8	CP NG9	CP NG10
Location	Fwd Lwr Cover Str 2	Fwd Lwr Skin Fspar	Aft Lwr Skin MnSpar	TE Lower Skin	Aft Lwr Skin @ Rr Spar
	Xw = 188	Xw = 172.5	Xw = 163	Xw = 158.5	Xw = 167.3
Element ID	40037886	40011700	40035512	40039687	40036009
Element stress (ksi)	22.7 5(fy)	24.57 (fx)	20.73 (fy)	21.91 (fy)	18.46 (fx)
NASGRO CC type	16	16	16	16	16
Width, W (in)	1.00	0.988	1.45	0.96	1.11
Hole Ctr offset, B (in)	0.50	0.43	0.59	0.40	0.42
Thickness, t (in)	0.16	0.16	0.14	0.09	0.11
Hole Diameter, d (in)	0.199	0.199	0.199	0.199	0.199
Bypass stress, S0 (ksi)	10.20	22.60	17.69	16.60	25.60
Pin load (kips)	0	0.545	1.77	0.558	0.04
Bearing Stress, S3 = P/dt (ksi)	0	17.12	63.50	31.20	1.83
Bending stress, S1 = 6M/Wt^2 (ksi)	17.20	0	0	0	0
Total Stress, S0 + P/Wt (ksi)	10.20	26.05	26.41	23.06	25.93
Material	2124-T851 Plate	2124-T851 Plate	2124-T851 Plate	7075 - T76 Sheet	2124-T851 Plate

Figure 38. Crack Growth Model Inputs

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A comparison of crack growth life to failure using NASGRO for the two FEM configurations is shown in Figure 39. The predicted life initiates from a 0.005-inch semi-circular corner crack to failure. For both the aero FEM and test rig FEM configurations it is shown that a desirable amount of crack growth life to failure is attained at the selected outer wing tracked locations within the simulated usage of 8,000 flight hours. The results also show a desirable amount of variation of crack growth life across the control points was attained in order to successfully demonstrate the predictive, updating, and decision making capabilities of P^2IAT. The effectiveness of the test rig FEM to mimic the aero FEM is also demonstrated due to comparable variation of results between the two FEM configurations.

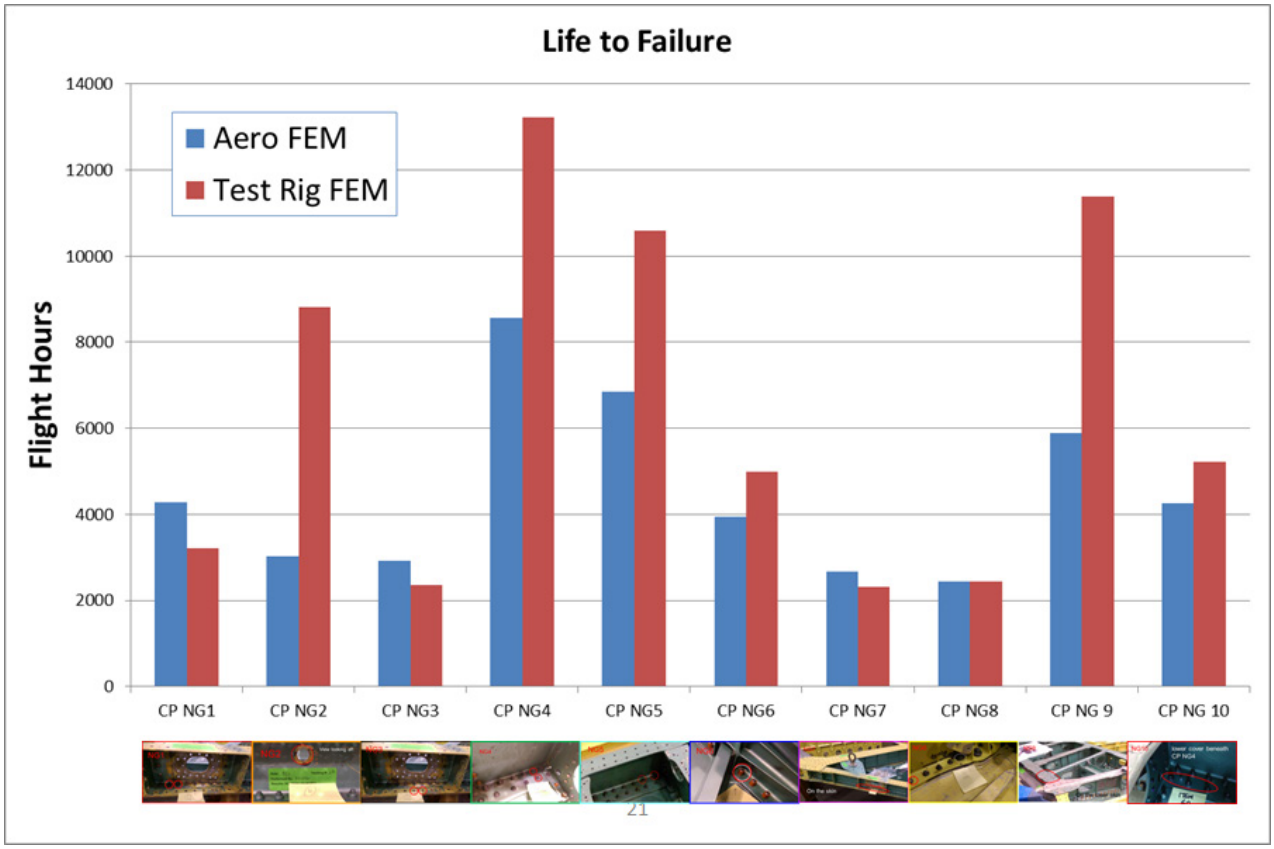

Figure 39. Life to Failure for the Selected Locations to Track

Figure 40 and Figure 41 show the NASGRO crack growth life curves for both the aero FEM and the test rig FEM for the tracked locations. Both FEM configurations exhibit a desirable amount of damage progression.

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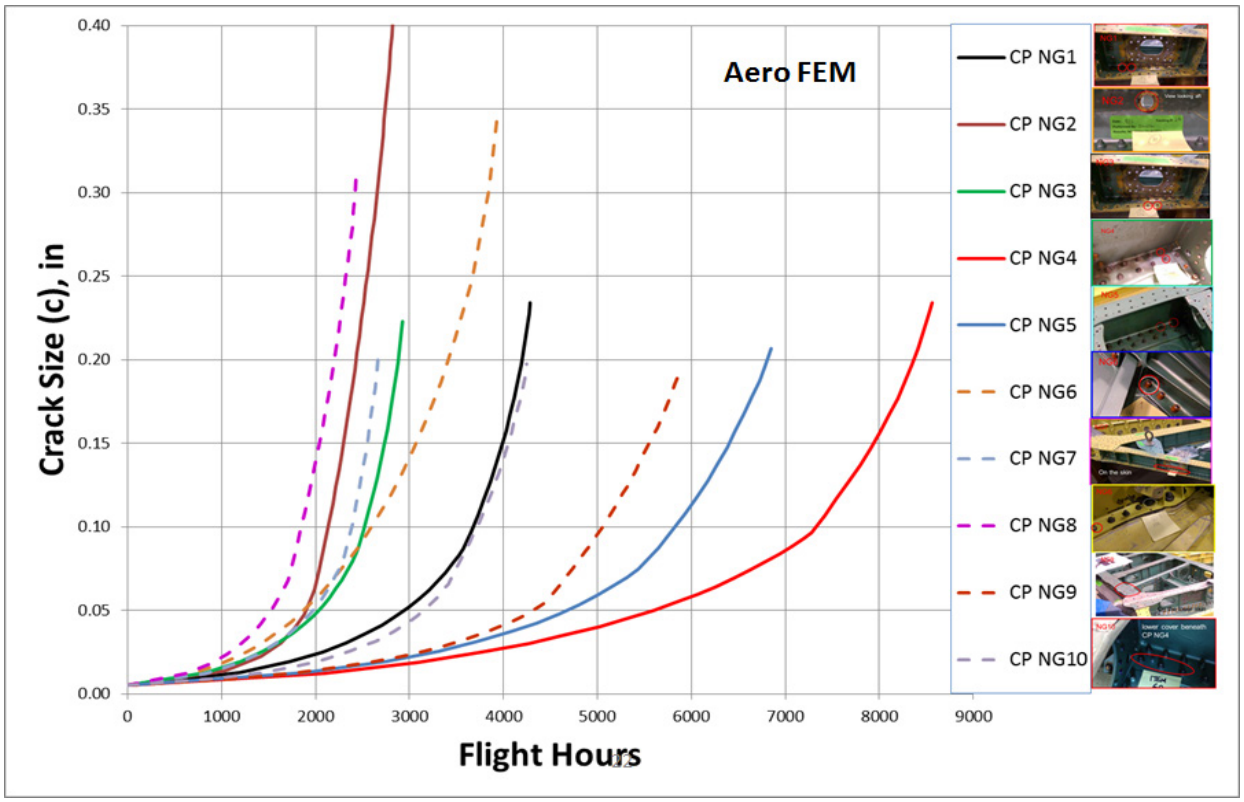

Figure 40. Crack Growth Life Curves at each CP using the Aero FEM.

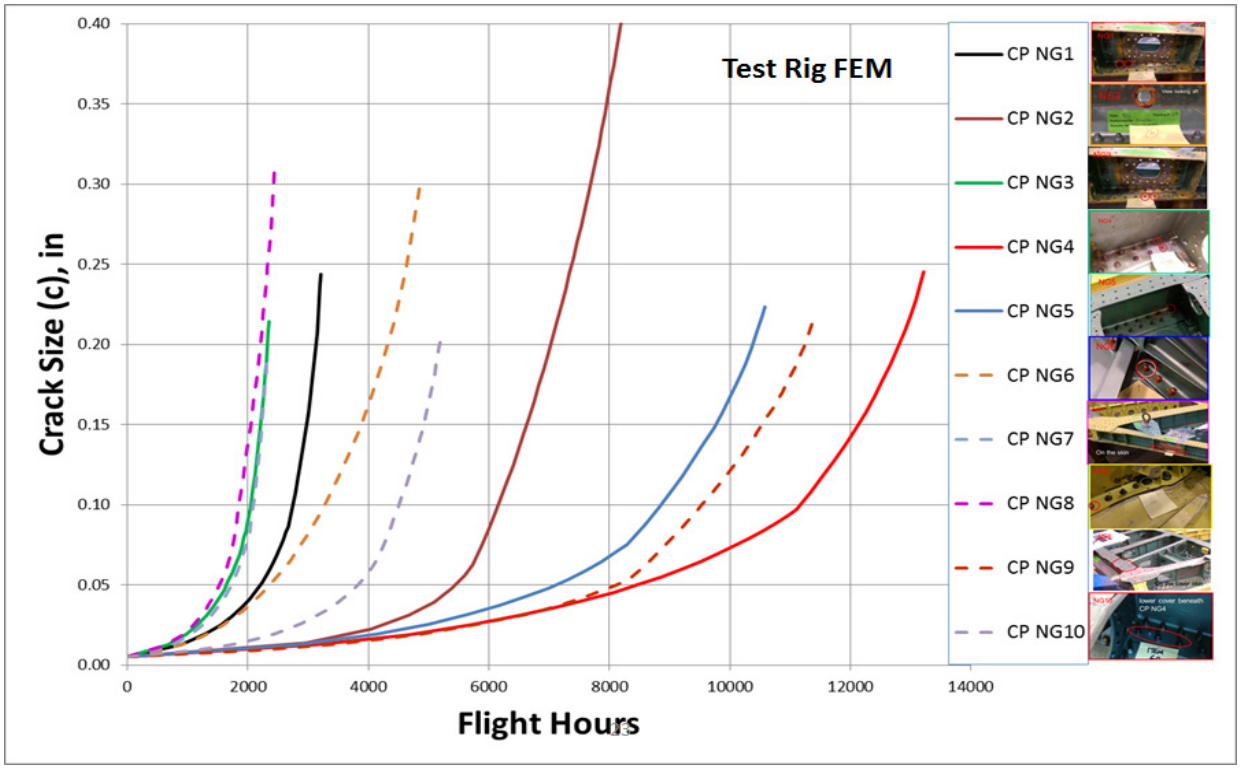

Figure 41. Crack Growth Life Curves at each CP using the Test Rig FEM

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3.2.6 Test Requirements Document

The details of the loading to be applied to the test article were provided to AFRL/RQVV in a Test Requirements Document (TRD). The loading details included the following:

1. The maximum and minimum load case for each wing lug to test fixture connection.
2. Wing bending moment, shear, and torsion (MVT) diagrams for each experimental load condition.
3. Maximum and minimum wing tip displacement for each experimental load condition.
4. Definition of actuator zones consisting of:
   a. Actuator center of pressure locations (fuselage station, butt line, water line).
   b. Maximum load and displacement per actuator zone (positive and negative).
   c. Individual pad loads and locations (fuselage station, butt line, water line).
   d. Geometric wing pad layout for each load zone with Mylar template.
   e. Actuator load vectors to incorporate drift angles, if warranted.
   f. Wing structural dead weight tare loads for each actuator zone.
5. Maximum error/deviations from nominal values as installation/application requirements for the experiment.
6. Sensitivity of the applied loads to the actuator load vectors.
7. A Microsoft Excel file containing the line-by-line load test spectrum for all actuators.

3.2.7 Summary

A comprehensive evaluation to generate the loading information to be applied to the outer wing (XW155 to the wing tip) for the demonstration full-scale experiment has been completed. The load application plan was developed leveraging NGSC's SME's with expertise in developing jack loads and load pad arrangements and extensive experience in fatigue testing on Air Force platforms and using the guidelines and with close coordination with AFRL. An iterative process was carried-out to develop the jack loads and pad arrangement using a NGAS-developed code called OPTICAL.

The test loading was verified by comparing MVTs, local stresses, and crack growth life curves between the aero FEM and test rig FEM:

- A complete list of the MVTs is included in the TRD that shows a good MVT match was obtained for all the fatigue conditions
- Test rig FEM maximum and minimum stresses for all maneuvers are consistently slightly higher than the aero FEM stresses.
- For both FEM configurations a desirable amount of crack growth life to failure is attained at the selected outer wing tracked locations, within the simulated usage of 8,000 flight hours.
- A desirable amount of variation of crack growth life across the control points was attained in order to successfully demonstrate the predictive, updating, and decision making capabilities of P^2IAT during the full-scale experiment.

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3.3 Conversion of Test Spectrum to Simulated Recorded Flight Data (Task 3)

In ADT TO 0001, a methodology was developed to process flight recorded data provided by AFRL from 12 test flights that contained 96 parameters sampled at approximately 10 Hz. These data were searched to find maneuvers resembling those in the 110 StS RtS repertoire, and their occurrences were characterized for the development of a baseline spectrum to be used in TO 0002 and 0003. Since these were the only examples provided as flight data, our initial efforts in Task Orders 0001 and 0002 assumed that this would be the intended level of fidelity for FDR data to be used for TOs 0002 and 0003. At a workshop in May 2016, AFRL decided that the FDR data should be event driven and only contain the following parameters to make a more realistic demonstration for TO 0003:

- Altitude
- Mach
- Nz
- Nx
- Ny
- Roll Rate
- Pitch Rate
- Roll Acceleration
- Pitch Acceleration
- Time (added later per NGAS request)

The decision to define events for data capture was left to the contractors. Five key events within the maneuver were identified by NGAS to capture the parameters above. These are:

1. Start of maneuver
2. Peak of the absolute value of Nz
3. Peak roll acceleration
4. Peak roll rate
5. End of maneuver
   Note: Events 2 through 4 may not occur in time order.

As described in Section 3 of the TO 0001 report, a sequence of flights comprised of a sequence of maneuvers derived from statistics was created to form the baseline usage. In TO 0002 Task 3, each maneuver in that sequence was converted into a five-event sequence of snapshots of the 10 parameters as calculated by StS RtS. The baseline spectrum expressed as FDR data was then assembled by concatenating snapshots of the sequence of maneuvers in the baseline spectrum. Each maneuver in the sequence was started at a 35-second boundary so that the total cumulative time in the record for each flight spanned approximately one hour. The FDR data for the entire baseline spectrum (1,000 flights) is included in Appendix E. The FDR data for each maneuver (listed by ID) is also included in Appendix F.

The algorithm for converting the reduced-fidelity FDR data back into standard maneuvers for the purpose of developing stress histories during the test is as follows:

1. The altitude and Mach number are identified from the first snapshot in the maneuver sequence.

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2. The maneuver is identified as symmetric if the maximum roll rate entry in the five snapshots is greater than 50 degrees per second. If not, the maneuver is identified as symmetric.
3. The Nz, Mach and Altitude labels are identified using the same bin boundaries and labels for symmetric and asymmetric maneuvers derived in TO 0001 to classify maneuvers in the 12 flights (see Figure 42 and Figure 43).
4. All 110 maneuvers were given a unique ID listed in Appendix G. The Maneuver ID table is then searched using the identified labels to find the corresponding maneuver ID.
5. Maneuver IDs are then used to assemble stress sequences for each CP.

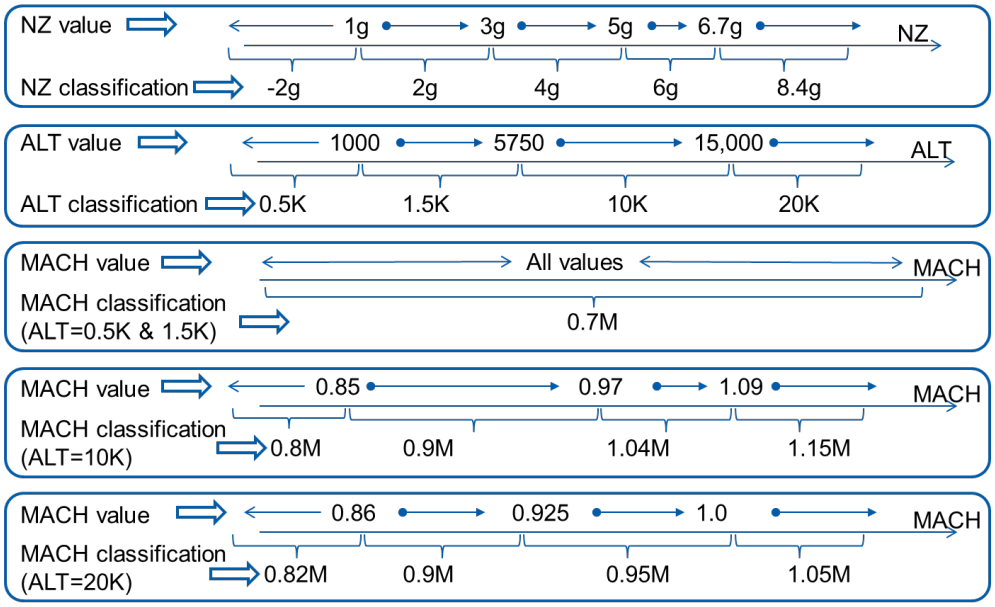

Figure 42. Nz, Altitude, and Mach Classifications for Symmetric Maneuvers

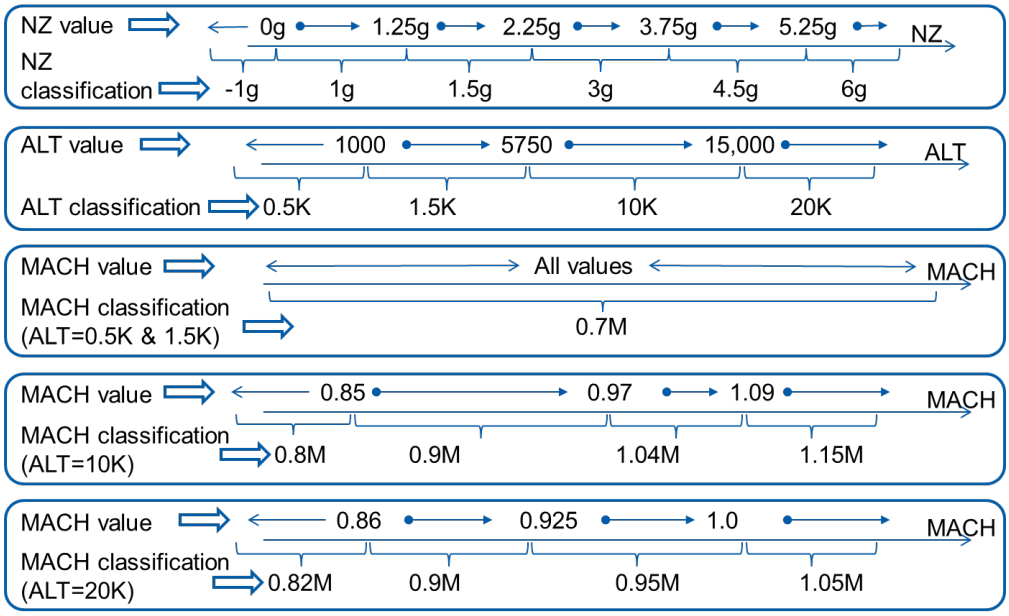

Figure 43. Nz, Altitude, and Mach Classifications for Asymmetric Maneuvers

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3.4 Instrumentation and Data Acquisition Plan (Task 4)

The Instrumentation Plan developed under TO 0002 outlines the location (fuselage station, butt line, water line) and orientation of all installed sensors as well as other pertinent information about the sensor including sensitivities, signal conditioning requirements, power requirements, how it is attached to the structure, where any wires will run and how it operates. The plan also specifies data storage requirements and data formats (data acquisition rates and schedules are specified in the Inspection Plan). The following is a modified excerpt from the Instrumentation Plan that was delivered as CDRL A0015 and included in Appendix B.

3.4.1 Instrumentation Description

NGAS identified two types of sensors for the full-scale test: crack detection sensors for internal control points and strain sensors. Each sensor system was chosen for specific purposes from the best technologies available at the time of selection. Based on prior laboratory and full-scale testing experience, the Jentek system was identified as the best candidate for monitoring cracks at internal locations and emulating the results that would be found if NDI was performed according to maintenance technical orders. The installation of Jentek sensors precludes the need for disassembly when NDI is prescribed during the full scale test. The Luna system was chosen to provide strain profiles across large areas of the outer wing to verify that structural reaction to applied loads is consistent with the FEM. Strain monitoring also provides an alert if the test does not proceed as expected in the event that damage occurs in unanticipated areas. A detailed description of these sensor systems follows.

3.4.2 Jentek System

The sensor system selected for local crack detection was the Jentek GridStation 8200a+ Meandering Wire Magnetometer (MWM). The system is comprised of sensors, Modular Probe Electronics Units (MPEUs), the 8200 Instrument, and a laptop controller/data acquisition computer as shown in Figure 44. The system's electrical parameters (input voltage range, input frequency range, operating power) are 100 to 250 VAC, 50 to 60 Hz, 1500 W. Signal conditioning is accomplished by the Jentek instrumentation, and no external conditioning is required.

Figure 44. Jentek Sensor System Components

Two MWM-Rosettes (MWM-Arrays with a circular drive and annular sense element configuration) have been produced for this application, shown in Figure 45. These sensors were designed to monitor the growth of subsurface cracks that form either at the interface between the spar and lower wing cover (the FA248) or at the tooling hole in the web of the spar (the FA250). The designs are constrained, particularly for the FA248, by the variable geometry of the regions of

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interest (e.g., the center-to-center spacing of neighboring fasteners and thicknesses of the spar and wing skin).

MWM sensors configured for permanently installed applications are mounted to specimens, components, or structures using adhesives from Vishay M-Bond 200 (cyanoacrylate) for temporary installations and two-part epoxies and polysulfide adhesives and sealants for permanent installations. Figure 46 shows MWM-Rosettes mounted to an aircraft during a recently completed flight test conducted over a period of 22 months.

For installations such as the test at hand, where several sensors are required to be separated over some distance, MWM sensors were daisy-chained together in series via an MPEU-to-sensor cable (see Figure 47). The MPEU-to-sensor cable allows a single drive to excite each sensor connected to the cable. At the same time the cable supports simultaneous measurement, in parallel, for the responses from each sense element for all the sensors.

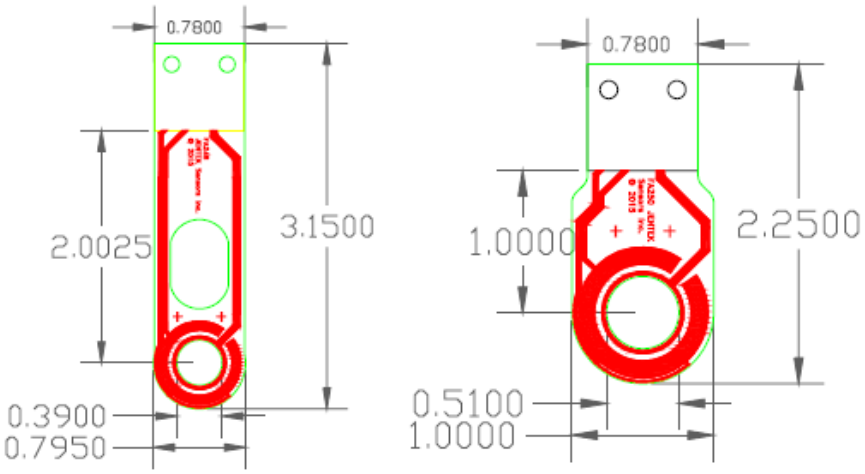

Figure 45. FA248 and FA250 MWM-Rosettes Adapted for the ADT Application

Figure 46. An Example of the FA170 and FA172 MWM-Rosettes Mounted to an Aircraft

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Figure 47. Sensor-to-MPEU Cables Being Evaluated for Long-Duration Data Acquisition

During operation, a host laptop computer running the GridStation software environment controls the instrumentation. The GridStation software and instrumentation together perform the signal conditioning and data analysis. The MWM sensor responses are amplified by the MPEU and transimpedances are measured by the instrument. The transimpedances for each sensing element are converted into material or geometric properties using Jentek's grid-based inverse methods. These grids are two dimensional databases of sensor responses that are used to convert two measured quantities, such as the magnitude and phase (or real and imaginary parts) of the sensor transimpedance, into properties of interest, such as electrical conductivity and sensor lift-off. The change in the electrical conductivity, through time, due to the initiation and growth of a crack may then be monitored. These changes, for a given geometry of sensor and underlying structure, are repeatable. Note that two frequency methods may also be used to provide improved results under some conditions, and in particular for buried crack detection.

Operation of the GridStation System in this manner has been used to demonstrate a practical and cost-effective procedure for POD curve generation that fits well into a methodology such as recommended in MIL-HDBK-1823A.

The specific capabilities of the 8200, along with the MPEU, shown in Figure 44, include:

- A wide measurement frequency range from 0.625 Hz to 21 MHz, allowing sensitivity to defects buried in thick metal structures or near-surface for a wide range of metal properties.
- Data acquisition rates of up to 1,000 samples/second (with the capability to increase this to 10,000 samples/second for dedicated single frequency applications—making real time diagnostic fault detection practical)
- Extremely low noise and low thermal drift
- Modular PEU that enables scaling of channel count and addition of new features

The Jentek System is controlled with a PC running the GridStation software. The PC to be used as the controller meet these minimum requirements:

- Laptop PC Workstation (i.e., Dell Latitude E5450/5450)
- Intel Core i7-5600 CPU @ 2.60 GHz
- 8 GB, 1600MHz, DDR3L RAM

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- Hard Drive, 500GB, AQUACSLIM
- Windows 7 Professional, 64 Bit

3.4.3 Luna System

The sensor system selected for multi-site strain measurement was the Luna Technologies Optical Distributed Sensor Interrogator (ODiSI-B). This system is comprised of a sensor(s), interrogator, and controller (Figure 48 and Figure 49).

Figure 48. Luna Sensor System Components

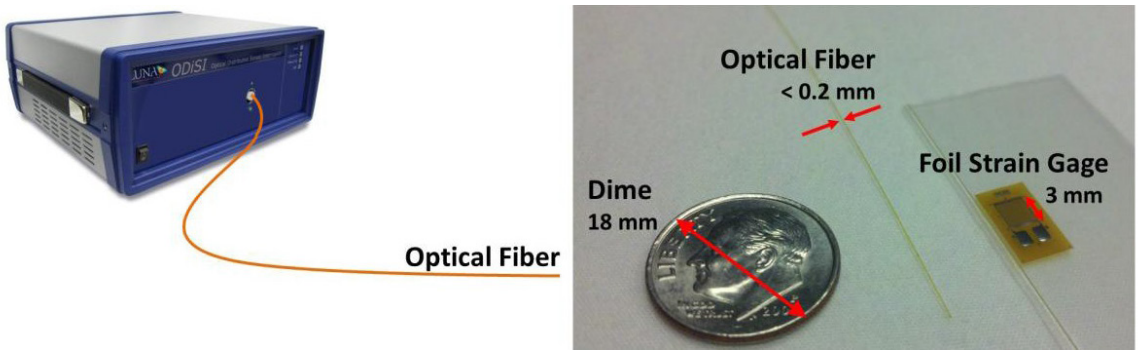

Figure 49. Luna Optical Fiber Sensor

The optical fiber strain sensor is made of polyimide-coated, low-bend loss, single-mode fiber with an outer diameter of 155 microns. Within the core of the optical fiber are minute variations in index of refraction, a natural process of the drawing of fiber during manufacturing. These minute variations result in a random but repeatable Rayleigh backscatter when swept with a tunable laser. This scatter pattern is unique to each length of fiber sensor, and is called the fiber fingerprint. The frequency content of this fingerprint changes in a predictable way with strain, with the change being measured in frequency shift and output in units of GHz. The fiber's strain sensitivity (also termed strain coefficient or calibration factor) is -6.668 microstrain/GHz. It was bonded to the surface using a commercial strain gage epoxy, either M-Bond AE-10 or GA-2. The sensor is connected to the interrogator (ODiSI-B) through an optical switch.

Internal to the ODiSI-B interrogator is a Class I tunable laser source. The laser's wavelength accuracy (which defines system accuracy) is maintained by an internal NIST-traceable HCN gas cell. Raw optical data as collected at the detectors is converted to spectral shift through computation on the GPU. The maximum strain range of the interrogator is +/-10,000 microstrain.

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The interrogator's electrical parameters (input voltage range, input frequency range, operating power) are 100-250 VAC, 50-60 Hz, 65 VA.

The ODiSI-B interrogator is controlled with a PC running the ODiSI-B software. The PC to be used as the controller meets these minimum requirements:

- Desktop PC Workstation (i.e., Dell Precision T3500)
- Quad Core Xeon Processor at 3GHz per core (minimum) NVIDIA Quadro 4000 Display Adapter
- PCIe x1 slot free
- 4 GB, 1333MHz, DDR3 RAM
- Minimum 120 GB Solid State Drive in addition to HDD that contains Windows
- Windows 7 Professional, 32-bit OS Monitor – Resolution 1280 X 1024.

Raw data are logged in a *.odb format. The .odb file extension is most commonly associated with the OpenOffice database application, and contains XML-based database information that can be used across multiple database software programs. This data can then be post-processed using the Post Processor. The ODiSI-B post processor allows you to take the *.odb raw data files that were created using the sample or event triggers and review the scans taken or create text files. Text files created contain a matrix of Strain, Temperature, Frequency Shift, Delay, or Quality Factor values as selected from the parameter pull down menu at the top of the Graph. This matrix is arranged by both time and location along the fiber. As described in the controller section above, a minimum 120 GB of data storage space is required. The data acquisition rate can be varied from 100Hz to much slower rates depending on the application. The rate chosen for this test is not critical, as we do not plan to continuously acquire this data. But, instead will take data at short intervals spaced out over the course of the test. The spacing will be determined based on probabilistic analysis of the previous acquired data.

3.4.4 Instrumentation Locations - Crack Detection Sensors

The Jentek MWM sensors were installed on the interior structure of the outer wing panel at a total of nine holes covering five CP locations for each wing to monitor for cracks. Eight of the holes are fastener holes, and one is an open tooling hole. Four are located in the front spar lower cap, four on the rear spar lower cap, and one on an open tooling hole on the front spar web. Two holes each are instrumented at locations CP NG1, CP NG3, CP NG4, and CP NG5. A single open tooling hole is instrumented at CP NG2. The hole locations are defined in aircraft coordinates (fuselage station, butt line, water line) in Table 2. Jentek Sensor Locations (in aircraft coordinates)., and a graphic representation of the wing test setup and Jentek sensor locations are shown in Figure 50 through Figure 53.

Table 2. Jentek Sensor Locations (in aircraft coordinates)

Forward Spar

ID	FS	BL	WL
CP NG1	590.33153	168.27305	124.94372
CP NG1	590.86660	168.86776	124.93905
CP NG2	617.22825	197.32770	126.38724
CP NG3	591.81000	-171.25000	124.93000
CP NG3	591.28000	-170.65000	124.93000

Aft Spar

ID	FS	BL	WL
CP NG4	656.88994	167.60920	125.39578
CP NG4	656.16549	167.99331	125.38908
CP NG5	659.36076	173.97800	125.44103
CP NG5	659.54811	174.33140	125.44330

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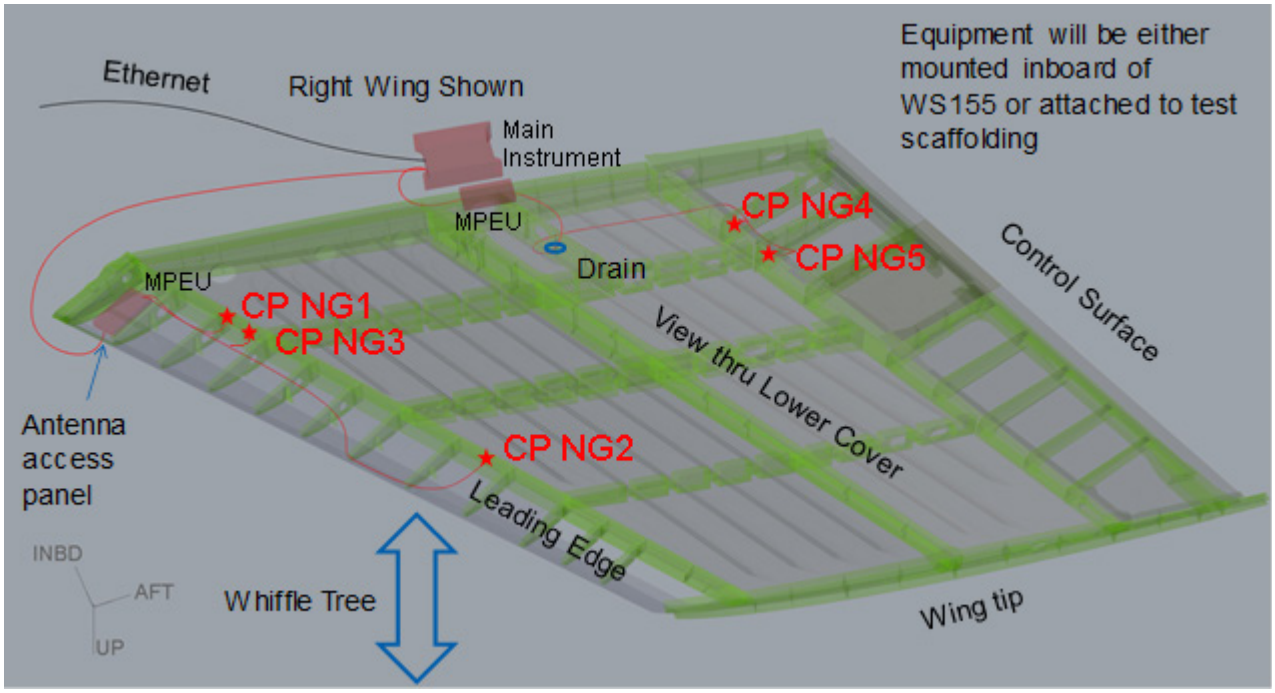

Figure 50. Jentek Sensor Location (stars) and Sensor Cable Routing

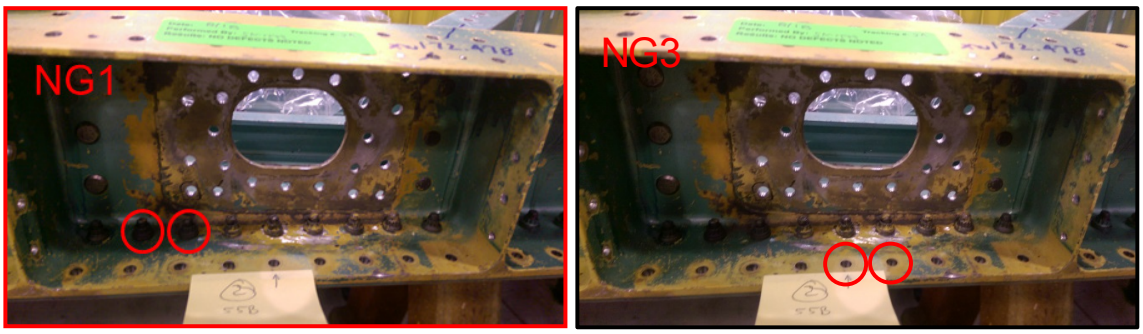

Figure 51. Jentek Sensor Locations CP NG1 and NG3 (left hand wing shown)

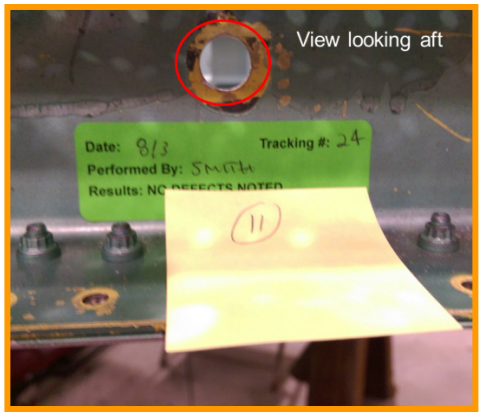

Figure 52. Jentek Sensor Location CP NG2

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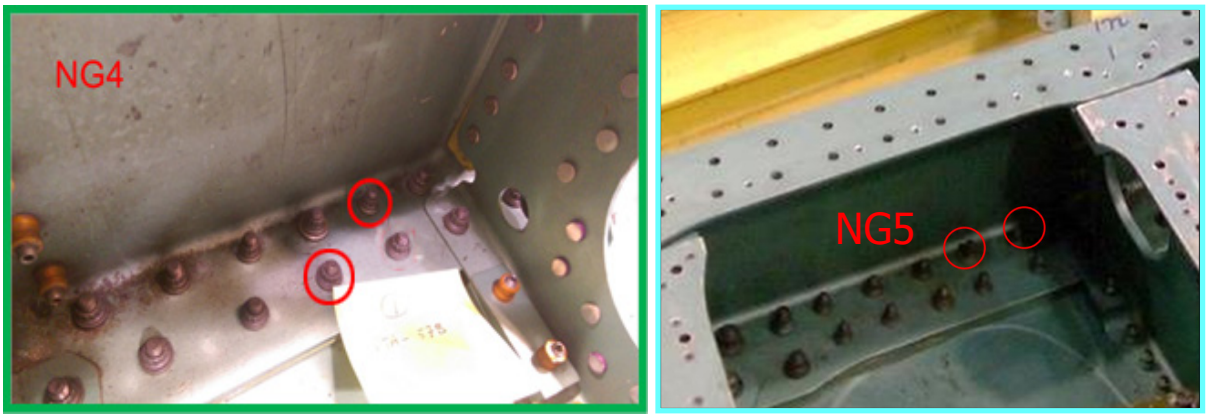

Figure 53. Jentek Sensor Locations CP NG4 and NG5 (left hand wing shown)

3.4.5 Instrumentation Locations - Strain Sensors

The Luna Technologies ODiSI-B optical fiber cable sensors are located inside the torque box structure, and on the exterior of the lower covers. There are a total of four 10-m-long fiber-optic sensors on each outer wing panel, two interior and two exterior.

The first interior sensor enters the structure through the access opening for the Antenna Missile L/R, 3475-8000, -8001 (located in the leading edge just outboard of WS 155) as shown in Figure 11. It runs outboard between the fasteners along the lower cap of the front spar, then aft through the tooling hole at (approx.) FS 634, BL 215, WL 125, and aft along the lower cap of the rib at (approx.) BL 205, then inboard along the lower cap of the intermediate spar, forward along the lower cap of the rib at (approx.) BL 172, inboard along the forward spar then along the inboard closure rib and out the pylon fitting access hole at (approx.) FS 614, BL 161, WL 125 (see Figure 54 and Figure 55). One complication with this sensor is that the section inside the leading edge could not be installed until after the upper covers were installed, and the leading edge was partially installed (minus the upper access panels).

The second interior sensor enters the structure through the pylon fitting access hole at (approx.) FS 614, BL 161, WL 125, outboard along the lower cap of the intermediate spar, aft along the tip closure rib, inboard along the lower cap of the aft spar, the forward along the inboard closure rib and out the pylon fitting access hole at (approx.) FS 614, BL 161, WL 125. See Figure 54 and Figure 56. Note that Figures 55, 56, 59 and 62 are photographs taken prior to sensor installation. The orange string shows the intended path of the Luna fiber.

To facilitate security of the cables during shipping from Warner Robbins to Wright Patterson, the excess cable/fiber length were coiled up just inside the pylon fitting access holes and secured with strain reliefs attached to the structure with adhesive sealant. A drag line (polyethylene cord, or similar) was bonded to the inside of the pylon access cover with the same adhesive sealant and tied to the cable/fiber to allow them to be pulled out the access hole at WPAFB. The pylon access cover was then installed as normal to close up the wing.

Luna uses a procedure known as touch-to-locate to identify and define known points along the fibers (a point at each end of any straight runs of fiber), from which one can then interpolate the location of a strain reading to any arbitrary point along the straight sections of fiber. These touch-to-locate points are defined in Appendix H.

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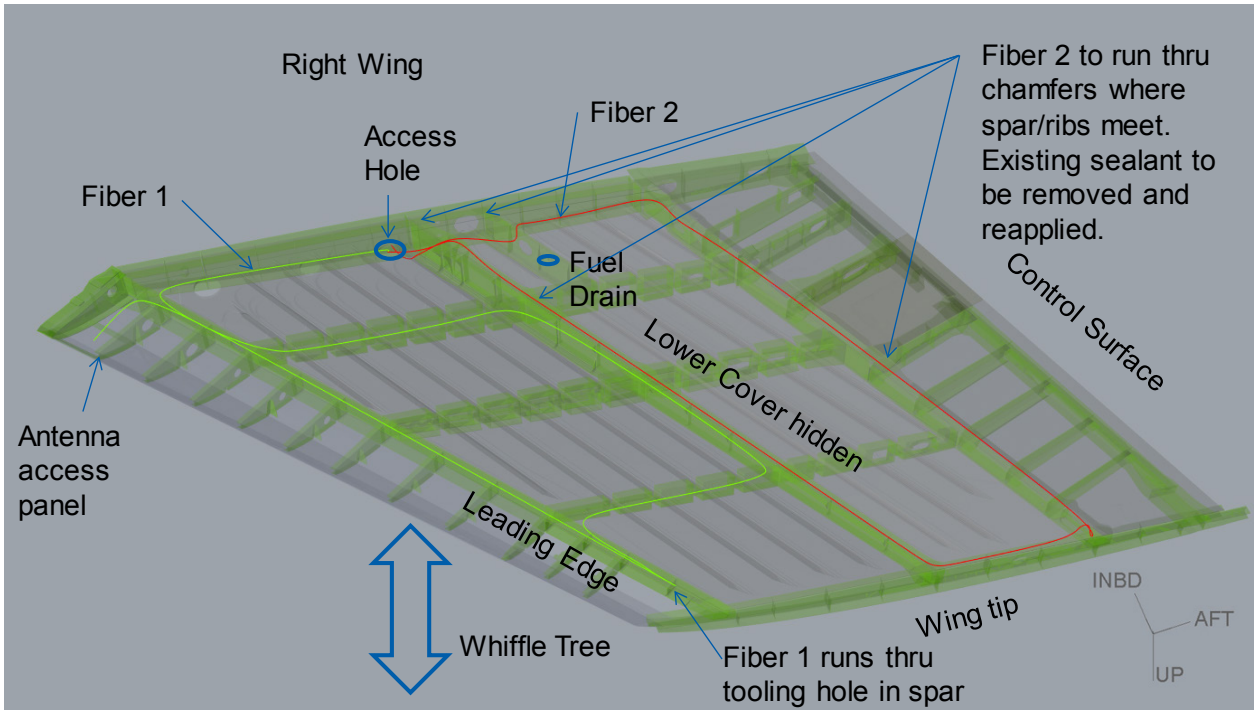

Figure 54. Luna Internal Optical Fiber Strain Sensor Cable Routing

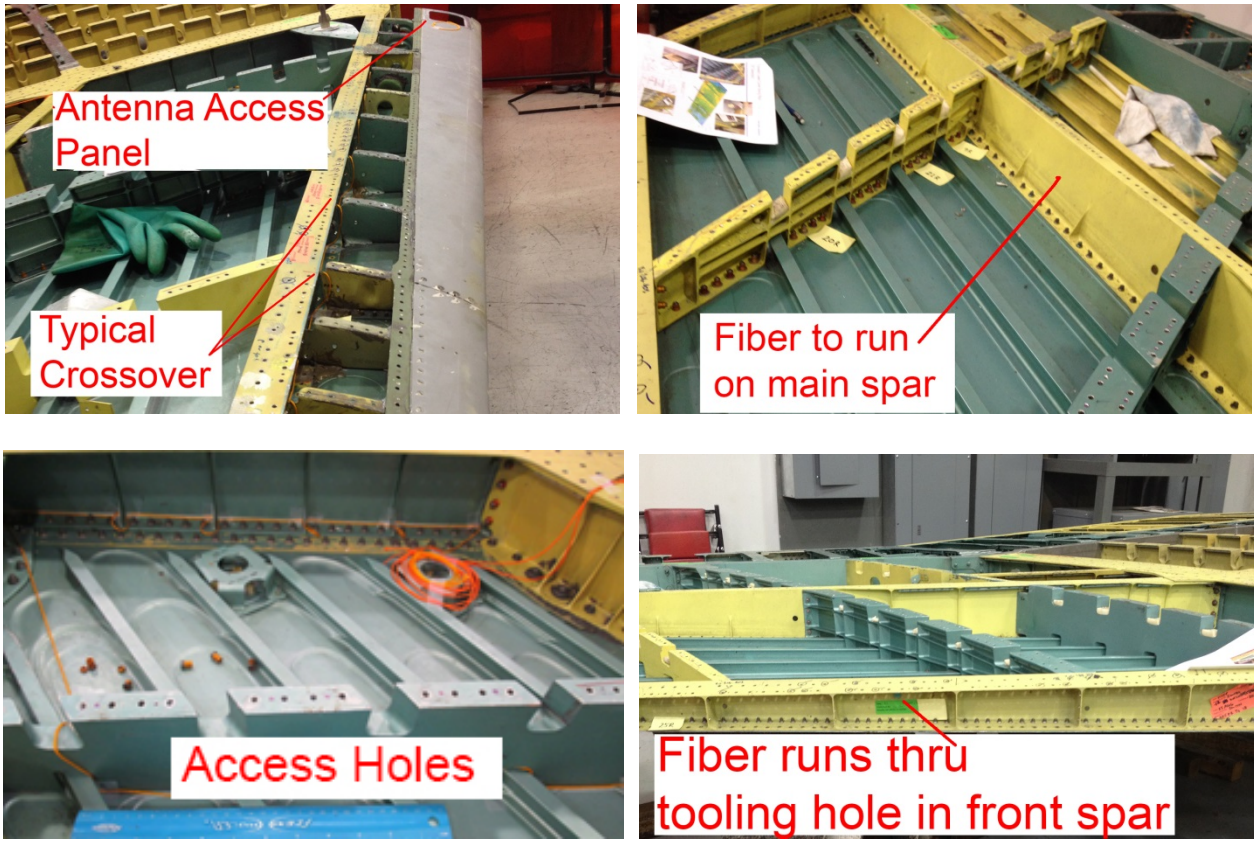

Figure 55. Luna Internal Optical Fiber 1 Strain Sensor Cable Routing Details

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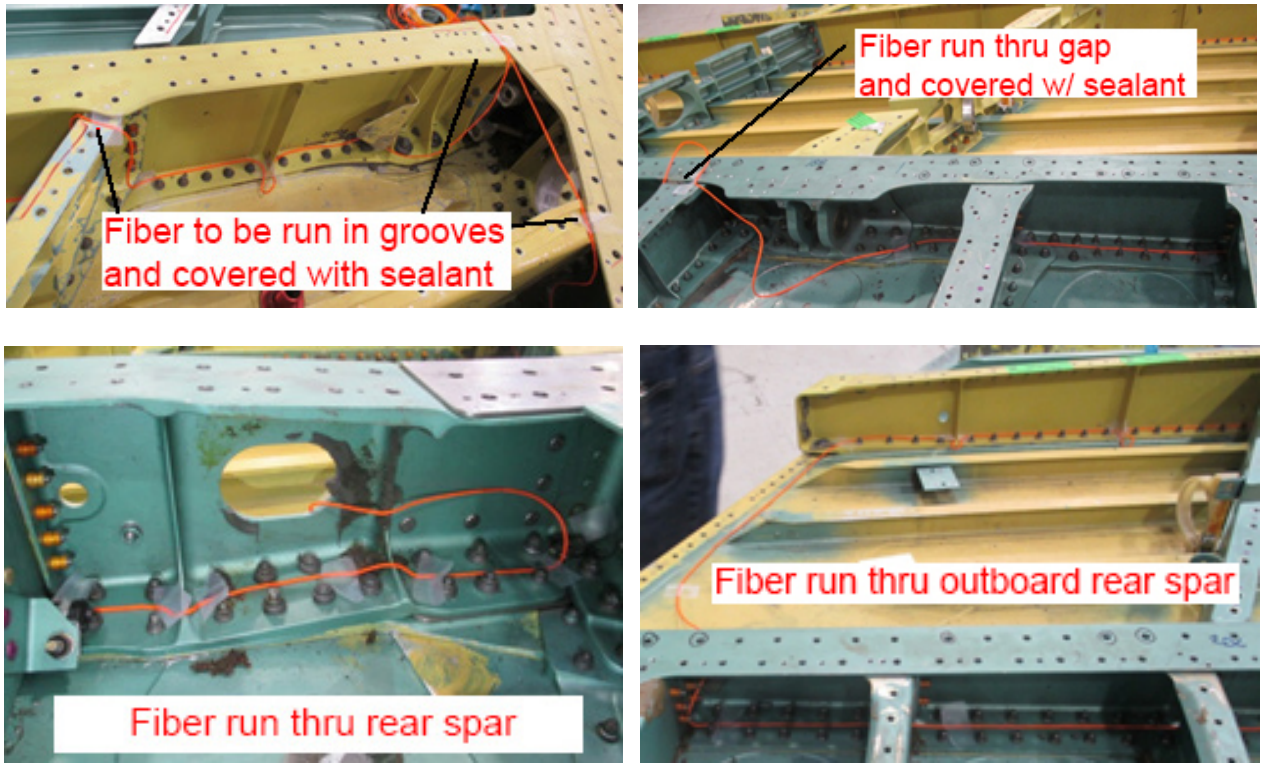

Figure 56. Luna Internal Optical Fiber 2 Strain Sensor Cable Routing Details.

The exterior sensors (Figure 57) are applied to the outer surface of the lower cover, and follow a path that closely parallels that of the interior sensors, avoiding the control points by a minimum clearance of 3 inches to allow for traditional NDI (Figure 58).

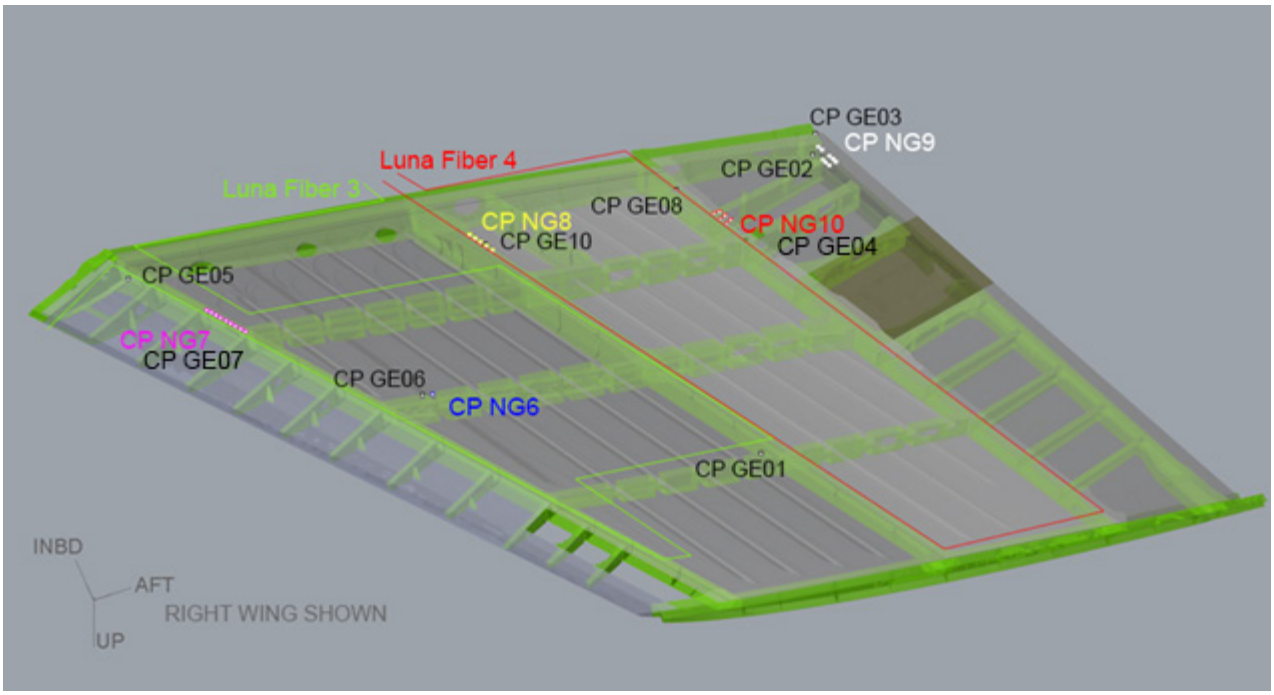

Figure 57. Luna External Optical Fiber Strain Sensor Cable Routing

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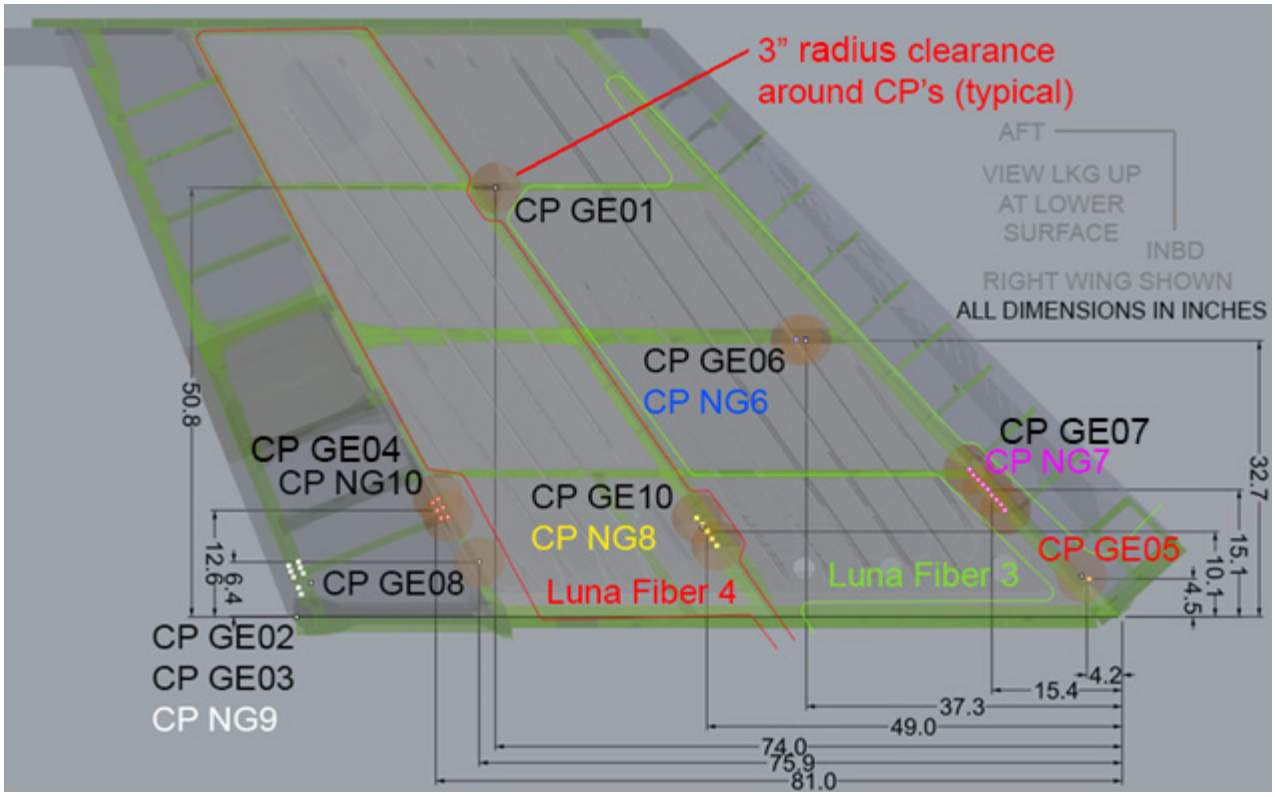

Figure 58. Luna External Optical Fiber Strain Sensor Cable Clearance from Control Points

The main Luna controller and interrogator are located over 50 feet away (for safety) from the test, and connected to the eight individual sensors via eight sheathed fiber optic standoff cables.

3.4.6 Wing Preparation for Instrumentation Installation

Basic Conditions

The following conditions were implemented during wing maintenance and build-up, in order to facilitate instrumentation installation.

1. Leading Edge Attachment used fasteners without washers.
2. Sealant was removed in affected areas on rear spar to allow routing LUNA fiber as shown in Figure 59.
3. Leading Edge Antenna Missile L/R, 3475-8000, -8001 panel was left off (see Figure 60) until the interior sensor installation was completed, and/or replaced with a reinforced version having a 3-inchdiameter hole for wiring. Note: neither team plans to attach load pads to this panel.
4. Fuel Drain Access Cover was left off (see Figure 61).
5. Round Access Covers on Lower Surface (adjacent to WS155) was left off (see Figure 62).

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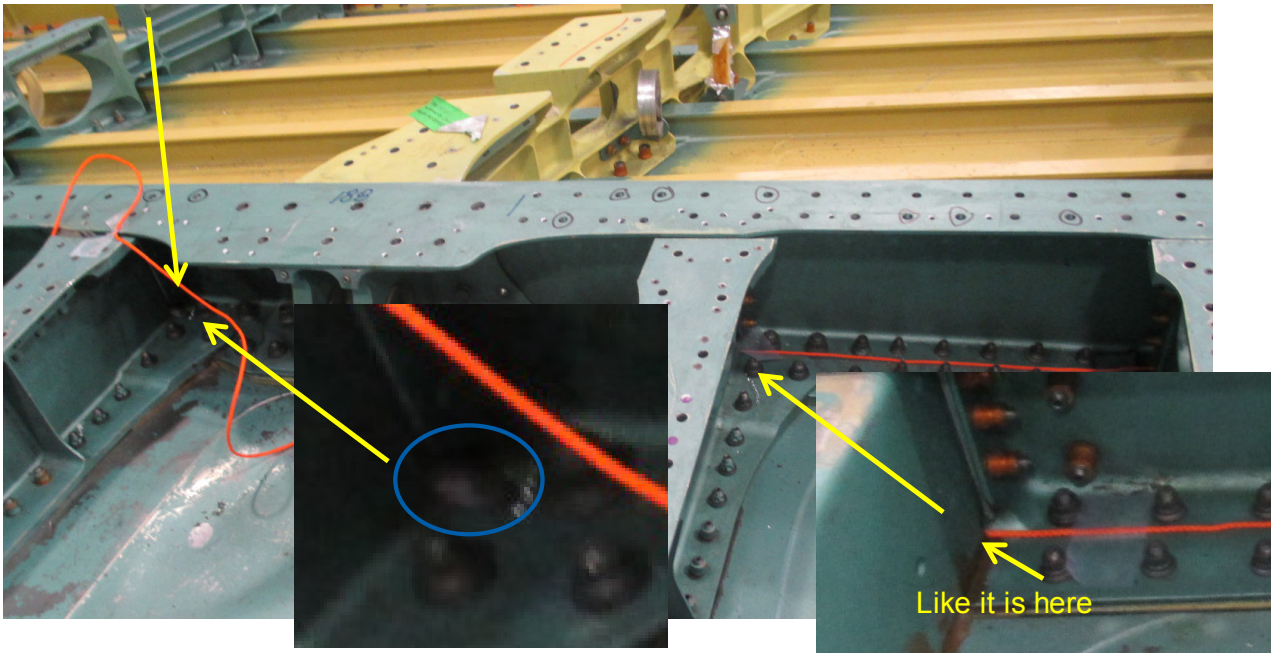

Figure 59. Area Where Sealant is to be Removed for Optical Fiber Access

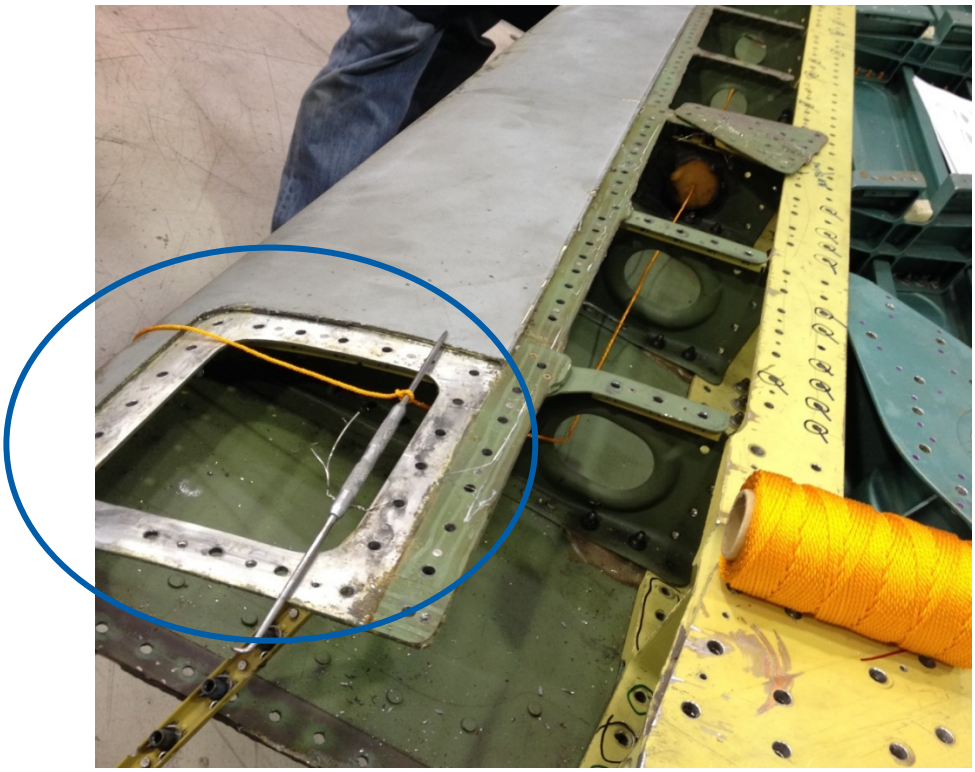

Figure 60. Antenna Missile L/R, 3475-8000, -8001 Panel in Leading Edge

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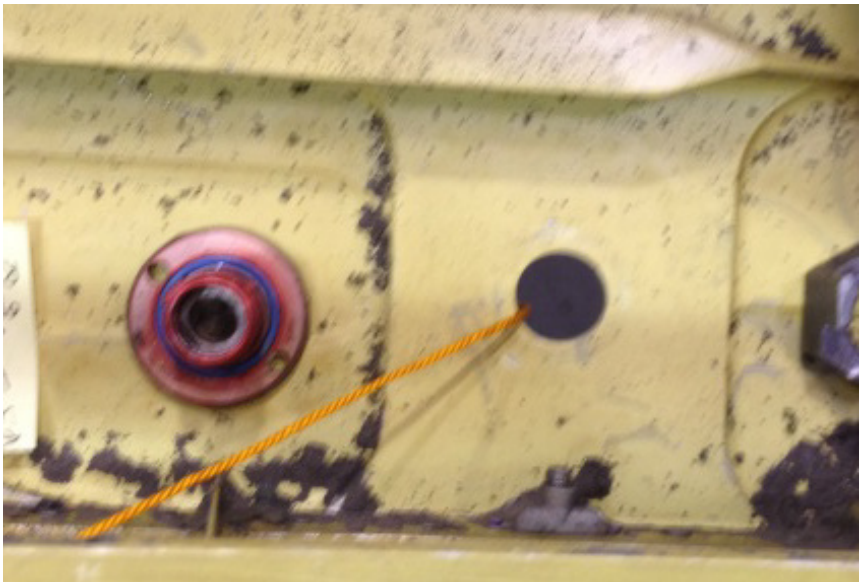

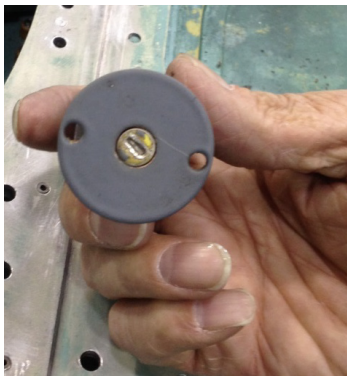

Figure 61. Fuel Drain Access Cover

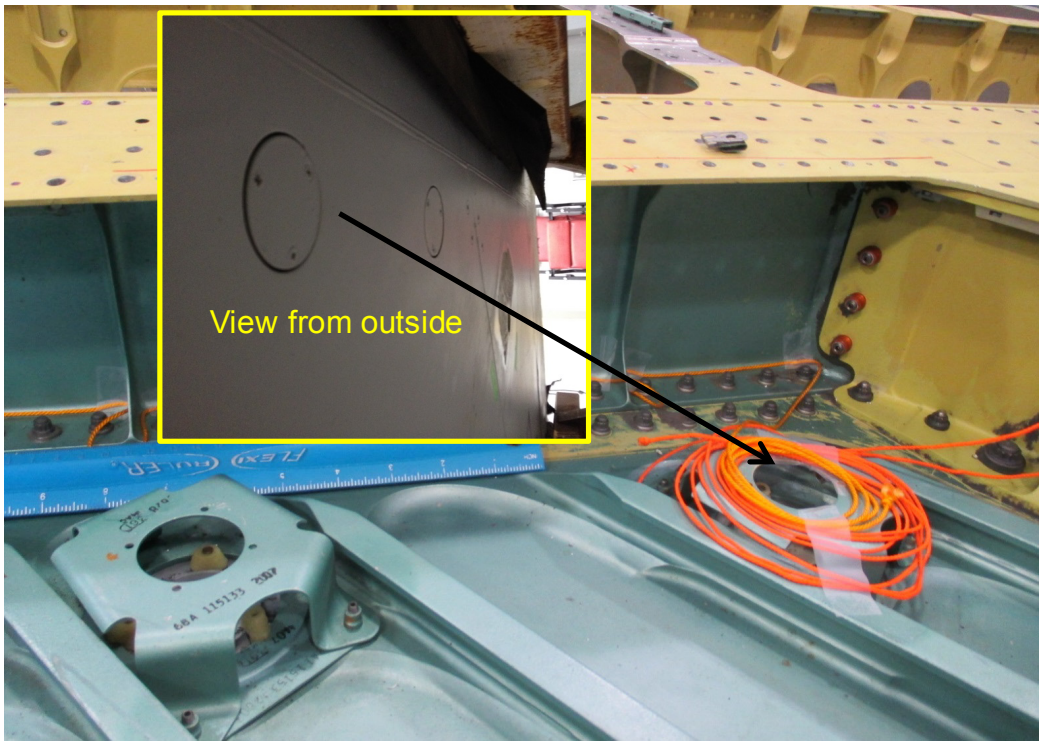

Figure 62. Pylon Fitting Access Covers on Lower Surface (adjacent to WS155)

Data Acquisition From Installed Sensors:

Data from both the Jentek and Luna systems should be acquired before the test to capture baseline values. Jentek data will be used for calibrating the no-crack condition of the test article. Data from the Luna system should be acquired under resting conditions as well as at key loading conditions to compare to the predicted strain profiles predicted in Task 2.

During the test, we recommend acquiring data from both sensor systems every 200 flight hours for the purpose of tracking the progress of the test. Luna data should be used to identify off-

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nominal load distributions caused by unanticipated damage progression. If the stress profiles no longer match predictions, the test article condition should be reevaluated to determine if repairs to unmonitored locations should be made so that the test can continue to completion. Data from the Jentek sensor should also be examined every 200 flight hours to determine if cracks are forming prematurely and may compromise safety or test objectives. Jentek data at times prescribed by P^2IAT for safety or economic criteria, should be provided as "go" or "no-go" indications to the P^2IAT algorithms to simulate real-world NDI operations.

3.5 Inspection Plan (Task 5)

The Inspection Plan developed under TO 0002 identifies the location (fuselage station, butt line, water line) frequency of inspection, the NDI technique, and how access to the location is to be achieved. The following is a modified excerpt from the Inspection Plan that was delivered as CDRL A0016 (and included in Appendix C of volume 1 of this series).

Table 3. CP Locations (all coordinates in inches)

ID	FS	BL	WL
CP NG1	590.33153	168.27305	124.94372
CP NG1	590.86660	168.86776	124.93905
CP NG2	617.22825	197.32770	126.38724
CP NG3	591.81000	-171.25000	124.93000
CP NG3	591.28000	-170.65000	124.93000
CP NG4	656.88994	167.60920	125.39578
CP NG4	656.16549	167.99331	125.38908
CP NG5	659.36076	173.97800	125.44103
CP NG5	659.54811	174.33140	125.44330
CP NG6	614.49999	187.78839	124.76062
CP NG6	613.35521	187.78839	124.73819
CP NG7	589.79646	167.67833	124.61720
CP NG7	590.33153	168.27305	124.61312
CP NG7	590.86660	168.86776	124.60905
CP NG7	591.40166	169.46248	124.60497
CP NG7	591.93673	170.05719	124.60090
CP NG7	592.47179	170.65191	124.59682
CP NG7	593.00686	171.24663	124.59275
CP NG7	593.54193	171.84134	124.58867
CP NG7	594.07699	172.43606	124.58460

ID	FS	BL	WL
CP NG8	623.89389	163.45378	124.33334
CP NG8	624.46465	164.27110	124.34784
CP NG8	625.03542	165.08843	124.36234
CP NG8	625.60618	165.90576	124.37684
CP NG8	626.17695	166.72309	124.39134
CP NG9	672.93570	157.66013	125.74941
CP NG9	673.26603	158.44330	125.75313
CP NG9	673.82217	159.76186	125.75941
CP NG9	672.69845	160.19883	125.70941
CP NG9	674.07885	160.42062	125.75941
CP NG9	672.95513	160.85759	125.70941
CP NG9	674.33552	161.07938	125.75941
CP NG9	673.21181	161.51635	125.70941
CP NG10	656.41524	166.72386	125.08735
CP NG10	655.56187	166.86894	125.07835
CP NG10	656.88994	167.60397	125.09583
CP NG10	656.16474	167.98668	125.08911
CP NG10	657.36464	168.48407	125.10430
CP NG10	656.71615	169.00899	125.09895
Jentek Sensors on CP NG1 thru CP NG5			

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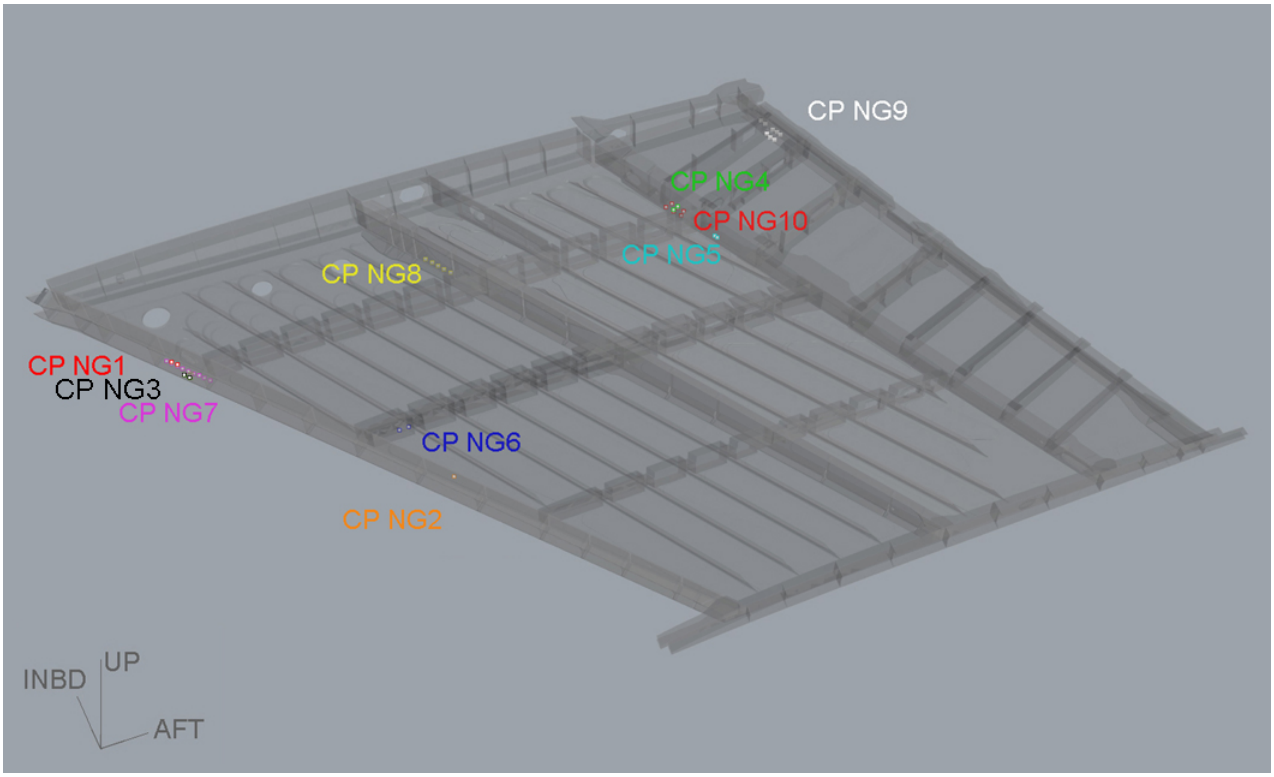

Figure 63. CP Locations on Cutaway View of Left Hand Outer Wing

CP NG1

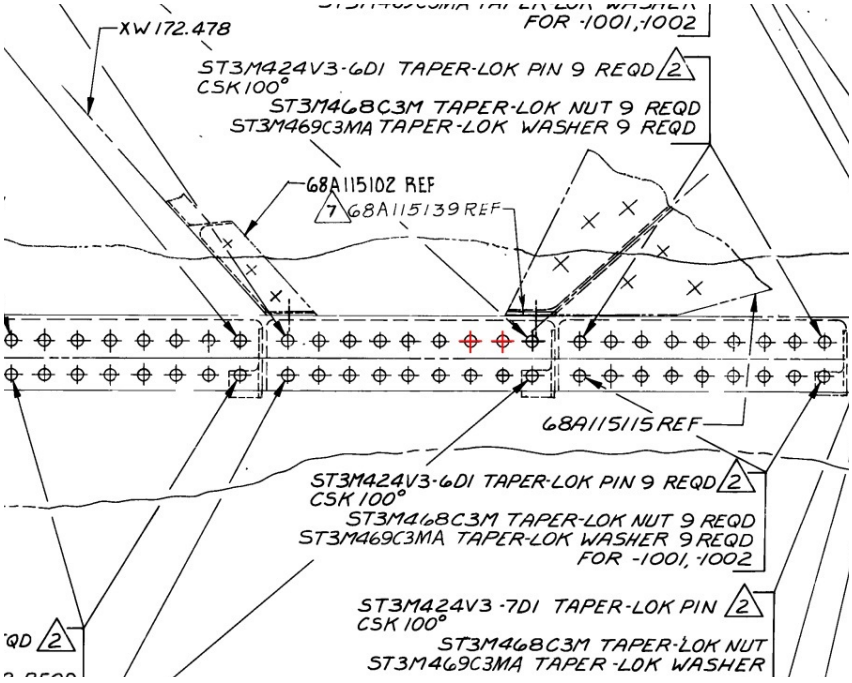

Figure 64. CP NG1 Identified on Engineering Drawing

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CP NG2

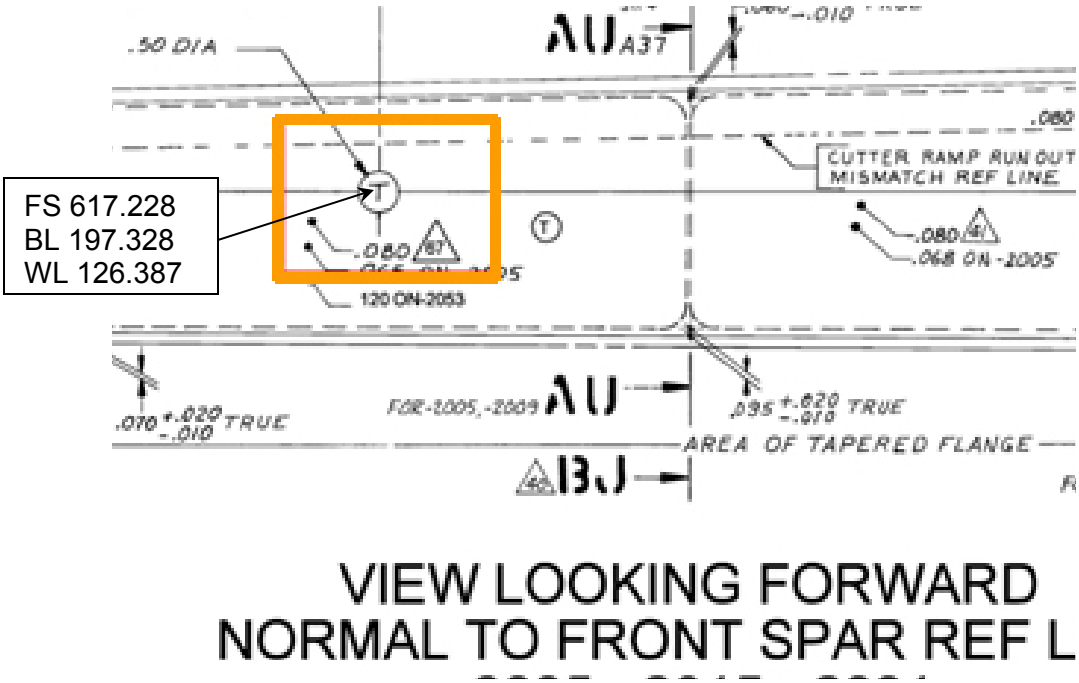

Figure 65. CP NG2 Identified on Engineering Drawing

CP NG3

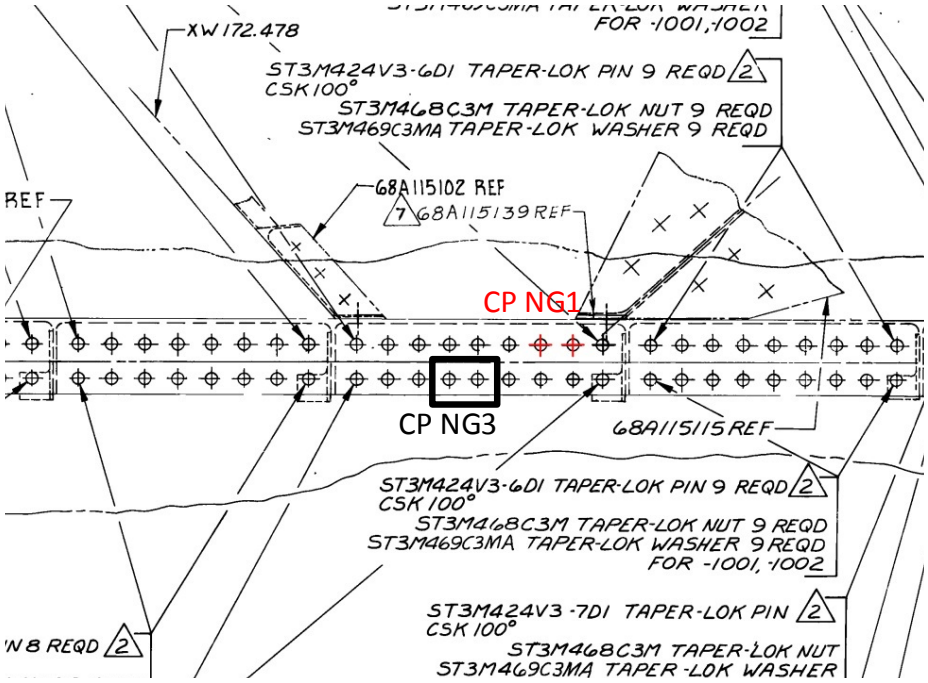

Figure 66. CP NG3 Identified on Engineering Drawing

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CP NG4

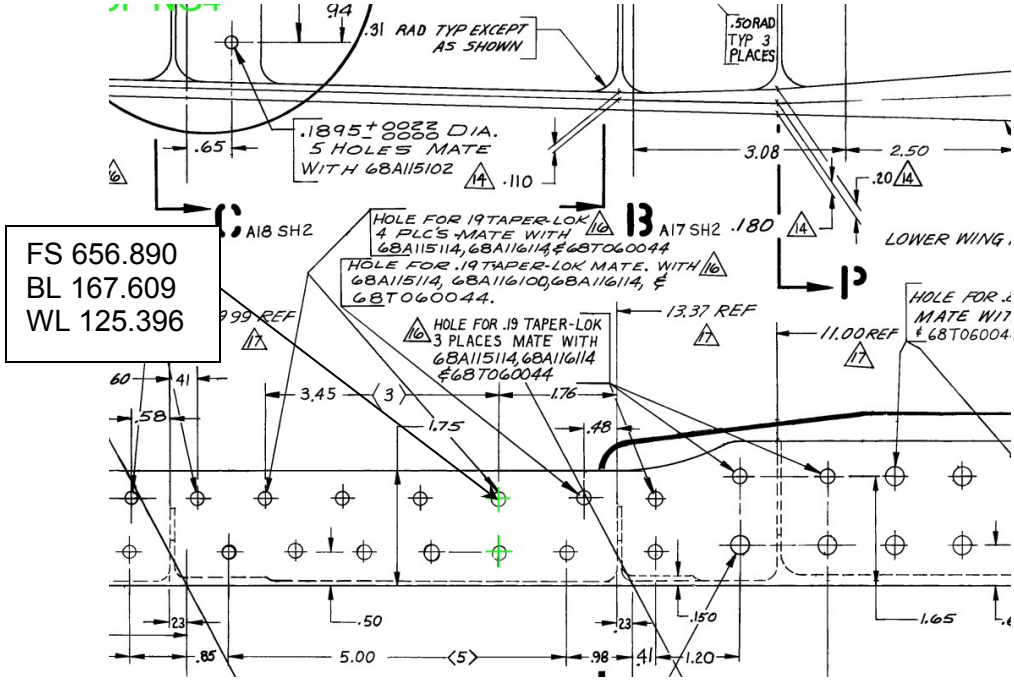

Figure 67. CP NG4 Identified on Engineering Drawing

CP NG5

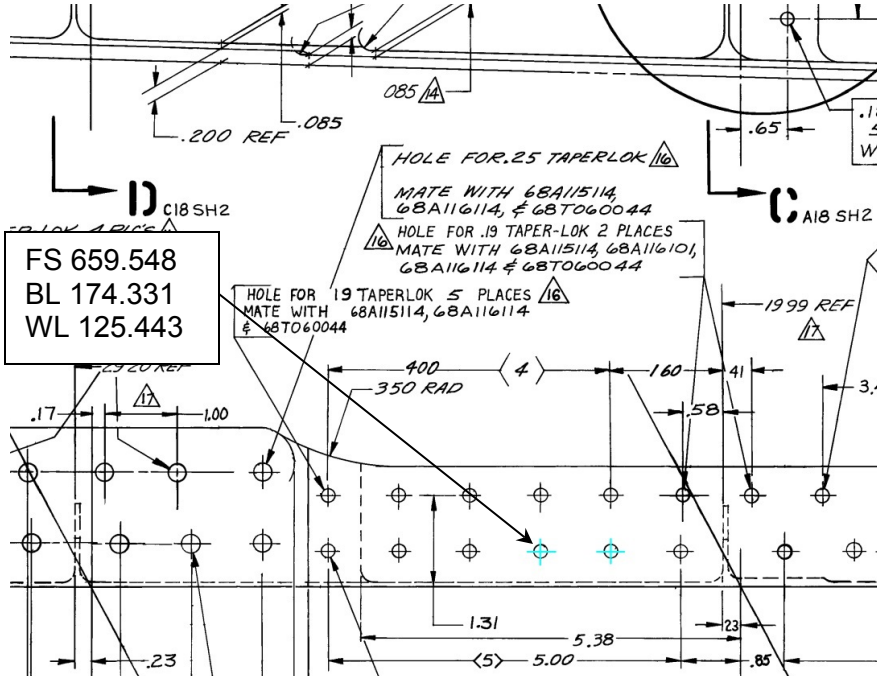

Figure 68. CP NG5 Identified on Engineering Drawing

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CP NG6

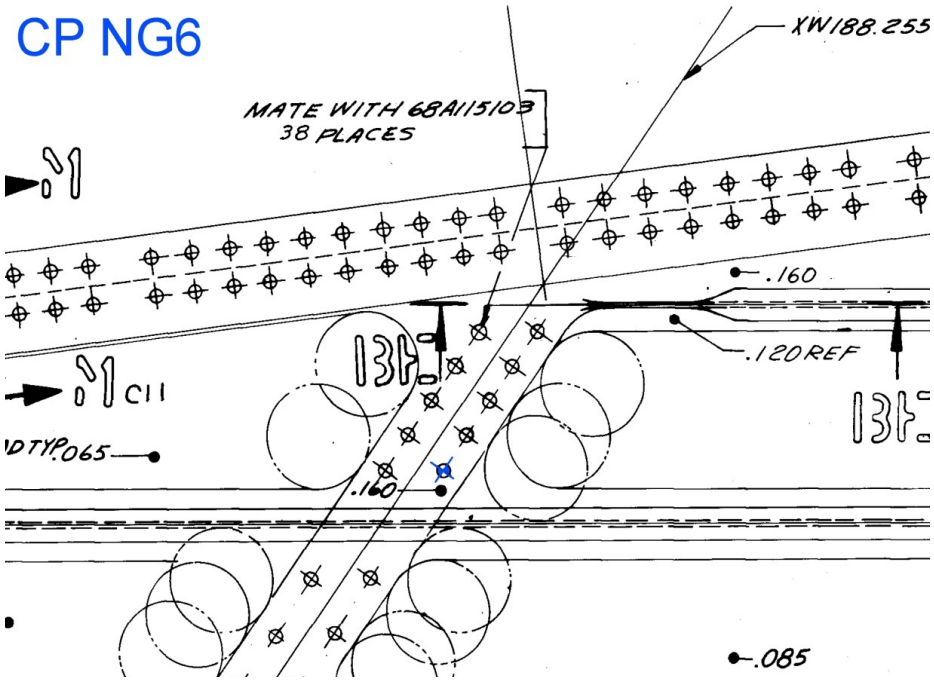

Figure 69. CP NG6 Identified on Engineering Drawing

CP NG7

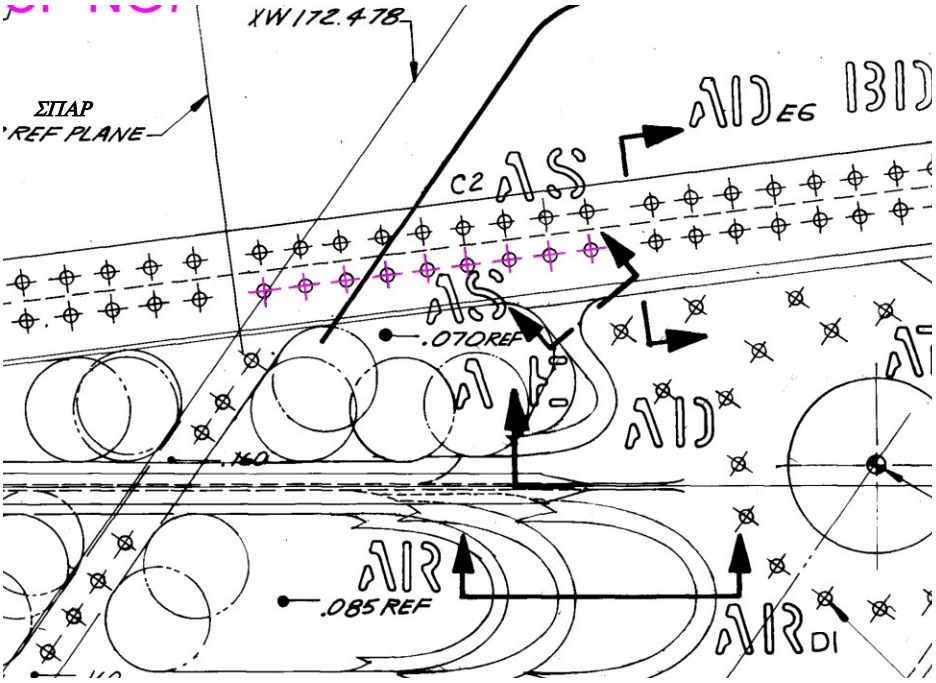

Figure 70. CP NG7 Identified on Engineering Drawing

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CP NG8

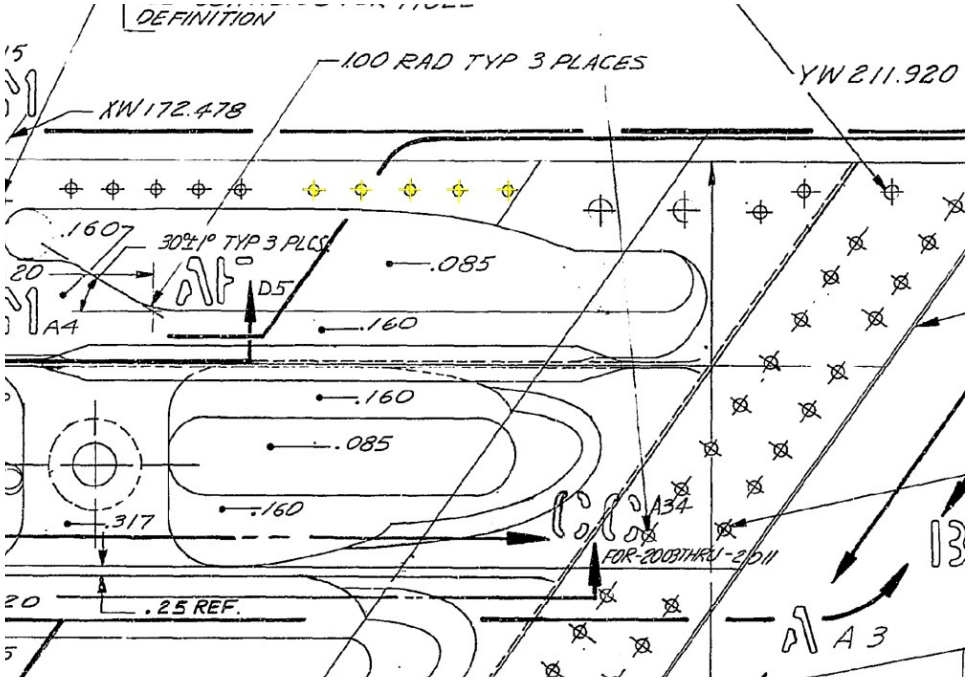

Figure 71. CP NG8 Identified on Engineering Drawing

CP NG9

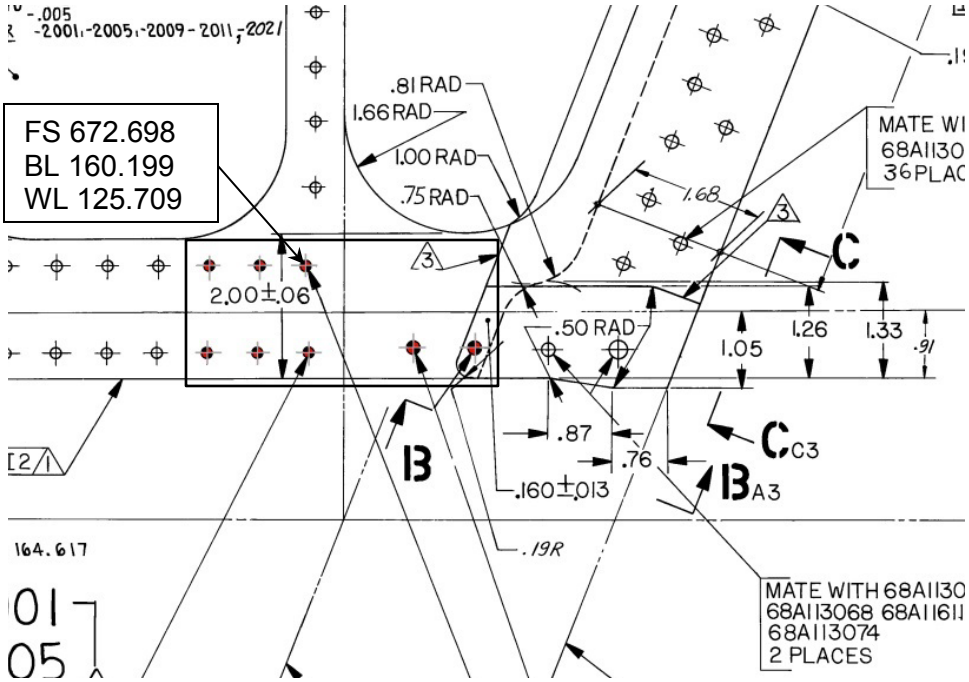

Figure 72. CP NG9 Identified on Engineering Drawing

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CP NG10

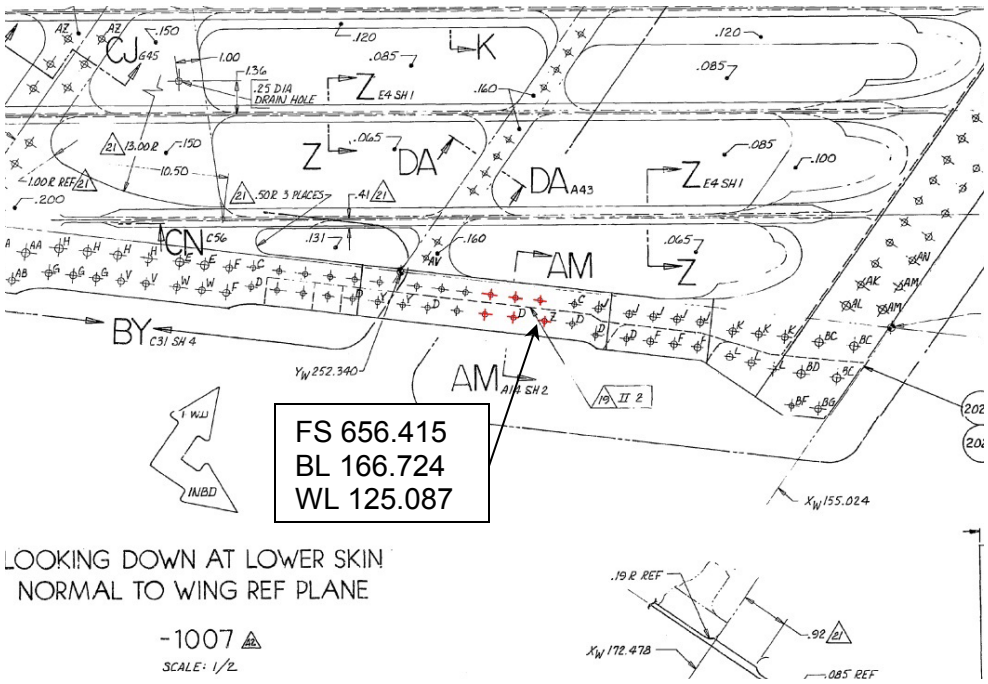

Figure 73. CP NG10 Identified on Engineering Drawing

3.5.1 Inspection

There will be no frequency of inspection since our process does not prescribe periodic inspections. Inspections will be made per the recommendations provided by our P^{2}IAT ModelCenter process based either on safety or economic criteria as described in the TO 0001 Final Report. All exterior CPs will use standard methods and equipment as dictated by the FSMP where specified to be consistent and directly comparable with current practice. External locations not covered by the FSMP will use the current methods as practiced or methods defined by the GE team at the discretion of AFRL.

CP NG1 through CP NG5

The Jentek sensors are located on the interior structure of the outer wing panel at a total of nine holes covering five CP locations for each wing to monitor for cracks. Eight of the holes are fastener holes, and one is the open tooling hole. Four are located in the front spar lower cap, four on the rear spar lower cap, and one on an open tooling hole on the front spar web. Two holes each were instrumented at locations CP NG1, CP NG3, CP NG4, and CP NG5. A single open tooling hole was instrumented at CP NG2. The hole locations for the Jentek Sensors are defined in aircraft coordinates (fuselage station, butt line, water line) in Table 3.

The remaining control points CP NG6, CP NG7, CP NG8, CP NG9, and CP NG10, are in the wing cover and accessible for exterior inspection.

3.5.2 Inspecting CP1-5

According to comments and recommendations made by AFRL (Eric Lindgren), the Jentek sensor system and conventional eddy current NDI are essentially equivalent technologies and thus may be used equivalently for crack detection. Rather than developing a full probability of detection (POD) curve as a function of the full range of crack sizes, all that was recommended was a sensitivity analysis around the crack size detection threshold prescribed in the FSMP. The

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FSMP procedure for the areas monitored by Jentek sensors prescribes the use of surface eddy current methods. Figure 12-2 of the FSMP lists the in-service detectable corner crack flaw size for surface eddy current around countersunk fastener heads as 0.23 inch (0.15 inch + 0.08 the fastener head overlap). The sensor characterization procedure performed under Task 5 determined the Jentek signal level when the crack reached the in-service detectable flaw size and verified that the POD at that size is at least 90/95. A "crack detected" finding consistent with the NDI method called out in the FSMP is indicated during the full-scale test when the Jentek sensor signal reaches this threshold. Until the signal reaches that threshold, the emulated NDI finding is "no crack detected".

3.5.3 Jentek Sensor Characterization Procedure

In order to generate realistic flaws for characterization purposes, test coupons were fabricated having the same local geometry as the control points to be monitored including multiple layers fastened together with the TaperLok fasteners called out in the F-15 assembly drawings. Seeded flaws were introduced to ensure that a corner crack forms in the same location found in field inspections. In addition to recording sensor data at the NDI-detectable size as recommended, Jentek sensor measurements were recorded during the whole progression from the start to end of cycling. Crack size measurements were also recorded periodically and registered with the sensor signal levels from the moment a visible crack emerged on the surface to the end of testing. A POD curve was also developed using a procedure developed by Jentek and Floyd Spencer. Details of the test results are included in Appendix I. Procedures are given below.

Pre-Test Setup

1- Scratch coupon on far side (away from TaperLok nut), roughly half way thru thickness (a consistent scratch is accomplished by dragging a boring bar thru the hole).
2- Assemble coupon with sensors & fasteners.
   a. Use TaperLok nut to locate sensor radially.
   b. Mark coupon to allow sensor to be repeatably clocked to same angular location.
3- Partially adhere sensor to allow easy removal.
   a. Double stick tape under one quadrant.
   b. Cellophane tape, or similar over the top.
   c. Rubber or foam pad to hold sensor in intimate contact with coupon.

During Test

1- Capture sensor data at start of the test
2- Measure crack when it comes out from under fastener head capturing sensor data with corresponding crack length at several points from first sighting to end of test.
3- Capture sensor data, save and backup using the following sensor system procedure:

System Procedures

1- Make all connections. Recommend having the sensors, probes, and cables as close to their final test positions as possible.
2- Power on instrument and computer.
3- Open GridStation and select the appropriate session for the sensors being used. The systems were delivered with "FA248 for NGAS Testing.ssn" and "FA250 for NGAS Testing.ssn".
4- Select "OK" on the "Session Settings" window.

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5- Range in air and on the part. The sensors can be held on the part by hand one-by-one. Typical ranging values are:
    a. Drive Level = 40. Values between 30 and 50 are acceptable.
    b. Reference = 1.229e3. This applies to reference 1 and reference 2. Values between 614.4 and 2458 are acceptable.
    c. Channel = 307.2 for all channels. Values between 153.6 and 614.4 are acceptable.
    d. Note that the maximum gain is 9.830e3. This channel gain would suggest a bad channel.
    e. The min/max values should be between 0.2 and 0.9 (example: -0.5 / 0.5 is acceptable). Low values (example: -0.1 / 0.1) suggest a bad channel. High values (example: -1.0 / 1.0) suggest a ranging error.
6- Select the "Calibration" tab. Verify that the sensors are in air. Click "Calibrate". You will likely see a window with a progress bar. When the progress bar finishes and the window disappears, click "Calibrate" again.
7- Verify the calibration. All channels should be grouped together. If one channel is significantly different, it might have a problem.
8- Select "Analysis". Verify that the "Sample Mode" is "Set". Verify that all sensors are in air. Select "Acquire Data". The system should take 200 points.
9- On the toolbar at the top of the screen, select the one that looks like a spreadsheet. It will say "Open New Table" when you mouse over it. The table this creates will allow you to make notes in the data file. For set 1, make the set ID "Air".
10- Take data with each sensor on the part with and without a shim. Jentek recommends using about 8mils of shim, which is 2 layers of normal printer paper. The sensor can be held on the part by hand as long as the sensor is flat and stationary.
11- Tape the sensors to the part. Ensure that the surfaces are clean and dry. Ensure that the sensor is centered on the hole. Ensure that there are no significant air bubbles between the sensor and the part.
12- Verify the channel map. Make a sketch of the part and the channel locations. One-by-one, take a piece of metal (screwdriver, etc.) and place it over a single channel. Take measurements and note which channel was affected. Mark the location of that channel on your sketch.
13- In the data acquisition window, set the "Periodic Measurements" interval. Jentek recommends between 60 and 120 seconds. Click the button beside the periodic measurements to begin periodic data acquisition.
14- Take at least 5 minutes of data prior to starting the test.
15- Make sure to use the table to make notes for each set, such as "Air", "Reference Point for Sensor 1", "Start of test", etc. Take note of any starts and stops, the applied loads, the cycling frequency, and any other information that could be helpful later on.

CP NG6 thru CP NG10

We recommend that control points 6 through 10 be inspected during the test per the standard procedure prescribed in the FSMP so that findings emulate real-world results. Additional

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inspection procedures may be performed at the discretion of AFRL however additional data will bias real-world results. Inspection for CP NG6-10 are described below.

CP NG6

This CP encompasses ITEM NO. 184 – OUTER WING, LOWER FORWARD WING SKIN AT XW 188, and can be found on page 5-237 in the FSMP. Details are as follows:

INITIAL INSPECTION: TRACKED LOCATION. INSPECT IN FIELD.
INSPECTION PROCEDURE:
ULTRASONIC INSPECT FASTENER HOLES IN THE INDICATED MAINTENANCE AREA.
DISPOSITION OF INSPECTION FINDINGS:

DAMAGE LESS THAN 0.13 INCH – SCHEDULE REINSPECTION OR REPAIR WITHIN THE PERIOD INDICATED IN THE FOLLOWING TABLE.

DETECTED FLAW SIZE	RE-INSPECTION/REPAIR PERIOD (1)
0.05 – 0.08 INCHES	600 FLIGHT HOURS
0.08 – 0.11 INCHES	200 FLIGHT HOURS
0.11 – 0.13 INCHES	100 FLIGHT HOURS

DAMAGE 0.13 INCHES OR GREATER – REPAIR IMMEDIATELY.

CP NG7

This CP does not encompass any FSMP tracked locations.

INSPECTION PROCEDURE:
ULTRASONIC INSPECT FASTENER HOLES IN THE INDICATED MAINTENANCE AREA.

CP NG8

This CP encompasses ITEM NO. 61 - OUTER WING, LOWER SKIN AT MAIN SPAR BL 167.06, and can be found on page 5-193 in the FSMP. Details are as follows:

INITIAL INSPECTION: NOT REQUIRED.
INSPECTION PROCEDURE: NOT REQUIRED
DISPOSITION OF INSPECTION FINDINGS: NOT REQUIRED
RECOMMENDATION: USE SAME PROCEDURE AS USED FOR ITEM NO. 188

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CP NG8 also encompasses ITEM NO. 188 – OUTER WING LOWER AFT WING SKIN AT MAIN SPAR, XW 163.6, and can be found on page 5-241 in the FSMP. Details are as follows:

INITIAL INSPECTION: TRACKED LOCATION. INSPECT IN FIELD.
INSPECTION PROCEDURE:
ULTRASONIC INSPECT FASTENER HOLES IN THE INDICATED MAINTENANCE AREA.
DISPOSITION OF INSPECTION FINDINGS:

DAMAGE LESS THAN 0.13 INCHES – SCHEDULE REINSPECTION OR REPAIR WITHIN THE PERIOD INDICATED IN THE FOLLOWING TABLE.

DETECTED FLAW SIZE	RE-INSPECTION/REPAIR PERIOD (1)
0.005 – 0.05 INCHES	600 FLIGHT HOURS
0.05 – 0.07 INCHES	400 FLIGHT HOURS
0.07 – 0.13 INCHES	100 FLIGHT HOURS

DAMAGE 0.13 INCHES OR GREATER – REPAIR IMMEDIATELY.

CP NG9

This CP encompasses ITEM NO. 63 – OUTER WING, TRAILING EDGE LOWER SKIN XW 157.7, and can be found on page 5-196 in the FSMP. Details are as follows:

INITIAL INSPECTION: NOT REQUIRED.
INSPECTION PROCEDURE: NOT REQUIRED
DISPOSITION OF INSPECTION FINDINGS: NOT REQUIRED
RECOMMENDATION: USE SAME PROCEDURE AS USED FOR ITEM NO. 115

CP NG9 also encompasses ITEM NO. 115 – OUTER WING AFT LOWER SKIN, and can be found on page 5-211 in the FSMP. Details are as follows:

INSPECTION PROCEDURE:
ULTRASONIC INSPECT SKIN FASTENER HOLES IN THE INDICATED MAINTENANCE AREA.
DISPOSITION OF INSPECTION FINDINGS:

DAMAGE LESS THAN 0.12 INCHES – SCHEDULE REINSPECTION OR REPAIR WITHIN THE PERIOD INDICATED IN THE FOLLOWING TABLE.

DETECTED FLAW SIZE	RE-INSPECTION/REPAIR PERIOD (1)
0.01 – 0.04 INCHES	600 FLIGHT HOURS
0.04 – 0.08 INCHES	200 FLIGHT HOURS
0.08 – 0.12 INCHES	100 FLIGHT HOURS

DAMAGE 0.12 INCHES OR GREATER – REPAIR IMMEDIATELY.

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CP NG9 also encompasses ITEM NO. 131 – OUTER WING, LOWER TRAILING EDGE INBOARD SKIN, and can be found on page 5-222 in the FSMP. Details are as follows:

INSPECTION PROCEDURE:
ULTRASONIC INSPECT SKIN FASTENER HOLES IN THE INDICATED MAINTENANCE AREA.
DISPOSITION OF INSPECTION FINDINGS:

DAMAGE LESS THAN 0.075 INCHES – SCHEDULE REINSPECTION OR REPAIR WITHIN THE PERIOD INDICATED IN THE FOLLOWING TABLE.

DETECTED FLAW SIZE	RE-INSPECTION/REPAIR PERIOD (1)
0.01 – 0.045 INCHES	200 FLIGHT HOURS
0.045 – 0.055 INCHES	150 FLIGHT HOURS
0.055 – 0.06 INCHES	100 FLIGHT HOURS
0.06 – 0.075 INCHES	50 FLIGHT HOURS

DAMAGE 0.075 INCHES OR GREATER – REPAIR IMMEDIATELY.

CP NG10

This CP encompasses ITEM NO. 60B – OUTER WING, LOWER SKIN AT REAR SPAR BL 167.3, and can be found on page 5-192 in the FSMP. Details are as follows:

INITIAL INSPECTION: NOT REQUIRED.
INSPECTION PROCEDURE: NOT REQUIRED
DISPOSITION OF INSPECTION FINDINGS: NOT REQUIRED
RECOMMENDATION: USE SAME PROCEDURE AS USED FOR ITEM NO. 188

3.6 Collaboration (Task 6)

During the period of performance for TO 0002, and Associate Contractor Agreement was executed on Sept 22, 2014 and several collaboration meetings were conducted involving NGAS, the GE team and AFRL. The objectives of these meetings were to ensure that plans and activities of each contractor do not impede the efforts of the other contractor and to identify any possible synergies between contractor activities. Table 4 lists the key meetings and a summary of the topics discussed. In addition, several informal telephone meetings and site visits were conducted to ensure non-interfering sensor installation both from scheduling and location perspectives. Detailed locations, wiring considerations and installation schedules are listed in the Instrumentation Plan (see Appendix B).

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Table 4. Coordination Meetings

Meeting Number	Date	Discussion Topics
1	5/8/2015	Kickoff Meeting
2	9/15/2015	Inspection Strategy
3	10/14/2015	Baseline prediction data requirements & demo goals
4	10/28/2015	Installation schedule coordination
5	11/4/2015	CP selection strategy
6	11/9/2015	CP selection details and instrumentation strategy
7	11/23/2015	NGAS and GE CP initial candidates
8	12/9/2015	CP candidate and requested test article measurements
9	12/16/2015	CP revision due to test article condition
10	1/13/2016	Instrumentation plan
11	1/20/2016	Collaborative instrumentation schedule
12	1/27/2016	Safety of test and test article prep for sensors
13	2/3/2016	Schedule update and coordination
14	2/10/2016	Sensor location coordination
15	3/30/2016	Inspection plans and sensor calibration
16	5/11-12/16	Data requirements discussion

The primary focus of these meeting was to coordinate efforts so that instrumentation associated with CPs did not interfere in physical space, installation scheduling or test operations.

Some external points on the lower skin are common to both teams, but these have no installed sensors associated with them except for the Luna fiber optic sensor. To ensure non-interference with NDI, external LUNA fibers are routed with a minimum 3 inch radial clearance around points where NDI may be performed during the test.

3.7 Oversight of the Test Article (Task 7)

During Task 7, several trips were made to inspect the test article and install sensors. Table 5 summarizes these trips.

Table 5. Test Article Oversight Visits

Trip Number	Date	Purpose
1	9/1/2015	Initial test article CP survey
2	11/18/2015	Sensor layout and wiring survey
3	3/28-31/2016	Surface preparation and first phase sensor installation
4	7/25-27/2016	Second phase sensor installation and wrap up
5	5/30-6/1/2017	Final phase exterior sensor installation and Check out

During trip 1, the 24 candidate control points were inspected to determine their suitability for the full scale test. Repairs made on the left wing ruled out certain locations that were being considered on the front spar. Differences between configurations between the left and right wings drove rejection decisions about specific locations since it was preferred that control points on both

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wings should have identical geometries including the size of their fasteners. Potential wire routing paths were identified for all candidate locations.

With 90% of the candidates identified, trip 2 provided an opportunity to determine specific sensor layouts and wiring paths. Colored string was used to simulate both fiber and copper routing and pictures of each path were taken to document in the instrumentation plan. Detailed photographs of each candidate CP were also taken, critical lengths were measured and equipment locations were identified.

During trip 3, all surfaces were prepared and the Jentek sensors for control points 4 and 5 along with redundant pairs of Luna optical fibers in the wing box were installed. Both Luna and Jentek systems passed their functional tests after installation.

The final installation for the remaining Jentek sensors and internal Luna fibers on the front spar were completed during trip 4. All systems passed functional tests and all Luna fiber location maps were created for the internal fibers.

The installation for the external Luna fibers was completed during trip 5. All systems passed functional tests and all Luna fiber location maps were created for the external fibers. Jentek also completed successful system checks on their (internal) sensors. Both Jentek and Luna completed system training with the WPAFB test lab personnel.

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4.0 RESULTS AND DISCUSSION

ADT TO 0002 was intended to perform the preparatory work required to perform the full-scale test in TO 0003. As such, there are no results other than the deliverables some of which are included in the appendices and the sensor calibration tests. These are summarized below:

Main Report:

Appendix A: Test Requirements Document

Appendix B: Instrumentation Plan

Volume 1

Appendix A: Test Requirements Document

Appendix B: Instrumentation Plan

Appendix C: Inspection Plan

Volume 2

Appendix D: Jack Loads for Baseline

Volume 3

Appendix E: FDR Data for Baseline

Volume 4

Appendix F: FDR Data per Maneuver ID

Appendix G: Maneuver ID Table

Appendix H: Luna “Touch-To-Locate” Points

Appendix I: Jentek Sensor Test Procedure

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5.0 CONCLUSIONS

During the course of this contract, NGAS successfully executed all TO 0002 program tasks and we are prepared to move forward with TO 0003. NGAS agreed to an AFRL no cost extension due to delays AFRL experienced during test preparation and successfully completed external sensor installation after the initially agreed upon technical period of performance. Our TO 0001 P^2IAT demonstration and the TO 0002 test preparation have positioned AFRL to substantiate the expected benefits of ADT for the DoD. We believe that our methodology along with the successful test preparation and sensor installation provide the greatest probability for a successful TO 0003.

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6.0 REFERENCES

1. Elias Anagnostou, Stephen Engel, “Northrop Grumman Task Order 0001 Final Report: Airframe Digital Twin (ADT) Delivery Order 0001: Prognostic and Probabilistic Individual Aircraft Tracking (P2IAT)”, AFRL-RQ-WP-TR-2016-0151 U.S. Air Force Research Laboratory, Wright-Patterson Air Force Base, OH, October 2016.

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LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS

Acronym	Definition	Acronym	Definition
ADT	Airframe Digital Twin	NASGRO	NASA Fatigue Crack Growth Software
AF	Air Force	NDI	Non-Destructive Inspection
AFRL	Air Force Research Laboratory	NGAS	Northrop Grumman Aerospace Systems
APU	Abrupt Pull-Up	NGSC	Northrop Grumman Systems Corporation
CDRL	Contract Data Requirements List	NGC	Northrop Grumman Corporation
CP	Control Point	OPTICAL	OPTImum for a Constrained And Linear system
DoD	Department of Defense	PDF	Probability Density Function
DT	Damage Tolerance	POD	Probability Of Detection
DTA	Damage Tolerance Analysis	POF	Probability Of Failure
EVD	Extreme Value Distribution	P^2IAT	Prognostic and Probabilistic Individual Aircraft Tracking
FASTRAN	FAtigue crack STRuctural ANalysis	RBE	Rigid Body Element
FCL	Fatigue Critical Location	SFPOF	Single Flight Probability of Failure
FDR	Flight Data Recorder	SME	Subject Matter Expert
FEA	Finite Element Analysis	StS-RtS	Stick-to-Stress Real-time Simulator
FEM	Finite Element Model	TO	Task Order
FSMP	Force Structural Maintenance Plan	TRD	Test Requirements Document
MES	Master Event Schedule	USAF	United States Air Force
MVT	Bending-Shear-Torsion		

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Appendix A

Test Requirements Document

A1. Introduction

The objective of Airframe Digital Twin (ADT) Task Order 0002 (TO2), AFRL FA8650-14-D-2413 0002, is to develop the requirements and plans for the experiments to demonstrate the Prognostic, Probabilistic Individual Aircraft Tracking (P^2IAT) process developed in Task Order 0001. The demonstration experiment will consist of fatigue loading of two (2) outer wings (each wing from XW155 outboard to the wing tip) in a ground test. Each wing will be loaded with a different load spectrum.

This Test Requirements Document (TRD) details the loading to be applied to the left hand wing, including the maximum and minimum load case for each wing lug-to-test fixture connection, wing shear, bending moment, and torsion diagrams for each experimental load condition, maximum and minimum wing-tip displacement for each experimental load condition, and the definition of actuator zones.

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A2. Applied Loads

Table A-1. Maneuver Name vs. Maximum and Minimum Load Case ID

Condition #	Maneuver	Max Load ID	Min Load ID	Condition #	Maneuver	Max Load ID	Min Load ID
1	APO 0.7M 0.5K -2g	1	2	36	APU 0.8M 10K 8.4g	72	71
2	APO 0.7M 1.5K -2g	3	4	37	APU 0.82M 20K 8.4g	74	73
3	APO 0.8M 10K -2g	5	6	38	APU 0.9M 10K 8.4g	76	75
4	APO 0.82M 20K -2g	7	8	39	APU 0.9M 20K 8.4g	78	77
5	APO 0.9M 10K -2g	9	10	40	APU 1.05M 20K 8.4g	79	80
6	APO 0.9M 20K -2g	11	12	41	RPO 0.7M 1.5K 1.5g	82	81
7	APO 0.95M 20K -2g	13	14	42	RPO 0.8M 10K 1.5g	84	83
8	APO 1.04M 10K -2g	15	16	43	RPO 0.82M 20K 1.5g	86	85
9	APO 1.05M 20K -2g	17	18	44	RPO 0.9M 10K 1.5g	88	87
10	APU 0.7M 0.5K 2g	20	19	45	RPO 0.9M 20K 1.5g	90	89
11	APU 0.7M 1.5K 2g	22	21	46	RPO 0.95M 20K 1.5g	92	91
12	APU 0.8M 10K 2g	24	23	47	RPO 1.05M 20K 1.5g	94	93
13	APU 0.82M 20K 2g	26	25	48	RPO 0.7M 1.5K 3g	96	95
14	APU 0.9M 10K 2g	28	27	49	RPO 0.8M 10K 3g	98	97
15	APU 0.9M 20K 2g	30	29	50	RPO 0.82M 20K 3g	100	99
16	APU 0.95M 20K 2g	32	31	51	RPO 0.9M 10K 3g	102	101
17	APU 1.04M 10K 2g	34	33	52	RPO 0.9M 20K 3g	104	103
18	APU 1.05M 20K 2g	36	35	53	RPO 0.95M 20K 3g	106	105
19	APU 0.7M 0.5K 4g	38	37	54	RPO 1.05M 20K 3g	108	107
20	APU 0.7M 1.5K 4g	40	39	55	RPO 0.8M 10K 4.5g	110	109
21	APU 0.8M 10K 4g	42	41	56	RPO 0.82M 20K 4.5g	112	111
22	APU 0.82M 20K 4g	44	43	57	RPO 0.9M 10K 4.5g	114	113
23	APU 0.9M 10K 4g	46	45	58	RPO 0.9M 20K 4.5g	116	115
24	APU 0.9M 20K 4g	48	47	59	RPO 0.95M 20K 4.5g	118	117
25	APU 0.95M 20K 4g	50	49	60	RPO 0.82M 20K 6g	120	119
26	APU 1.04M 10K 4g	52	51	61	RPO 0.9M 10K 6g	122	121
27	APU 1.05M 20K 4g	54	53	62	RPO 0.95M 20K 6g	124	123
28	APU 0.7M 1.5K 6g	56	55	63	ROLL360 0.7M 1.5K 1g	126	125
29	APU 0.8M 10K 6g	58	57	64	ROLL360 0.8M 10K 1g	128	127
30	APU 0.82M 20K 6g	60	59	65	ROLL360 0.82M 20K 1g	130	129
31	APU 0.9M 10K 6g	62	61	66	ROLL360 0.9M 10K 1g	132	131
32	APU 0.9M 20K 6g	64	63	67	ROLL360 0.9M 20K 1g	134	133
33	APU 0.95M 20K 6g	66	65	68	ROLL360 0.95M 20K 1g	136	135
34	APU 1.05M 20K 6g	67	68	69	ROLL360 1.04M 10K 1g	138	137
35	APU 0.7M 1.5K 8.4g	70	69	70	ROLL360 1.05M 20K 1g	140	139

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Table A-2. Maximum and Minimum Load Case for Each Wing Lug to Test Fixture Connection

	MIN MAX	X Load (lb)	X-Load ID #	Y Load (lb)	Y-Load ID #	Z Load (lb)	Z-Load ID #
LUG #1	MAX			177	132	451	122
	MIN			-1232	79	-2147	79
LUG #2	MAX			287	80	708	122
	MIN			-1410	79	-814	89
LUG #3	MAX	164	79	1948	89	10574	79
	MIN	-35	80	-1033	122	-1978	80
LUG #4	MAX	3817	79	17429	80	4466	79
	MIN	-704	80	-63328	79	-534	80
LUG #5	MAX	470	80	65400	79	4132	10
	MIN	-1943	79	-19288	80	-12862	122
LUG #6	MAX	3044	79	20568	80	11375	79
	MIN	-505	80	-94484	79	-2354	80
LUG #7	MAX	527	80	79316	79	5314	80
	MIN	-2917	79	-17998	80	-22622	79
LUG #8	MAX	3022	79	16481	80	11125	79
	MIN	-447	80	-86714	79	-2418	80
LUG #9	MAX	694	80	100631	79	6376	80
	MIN	-5187	79	-17880	80	-37432	79

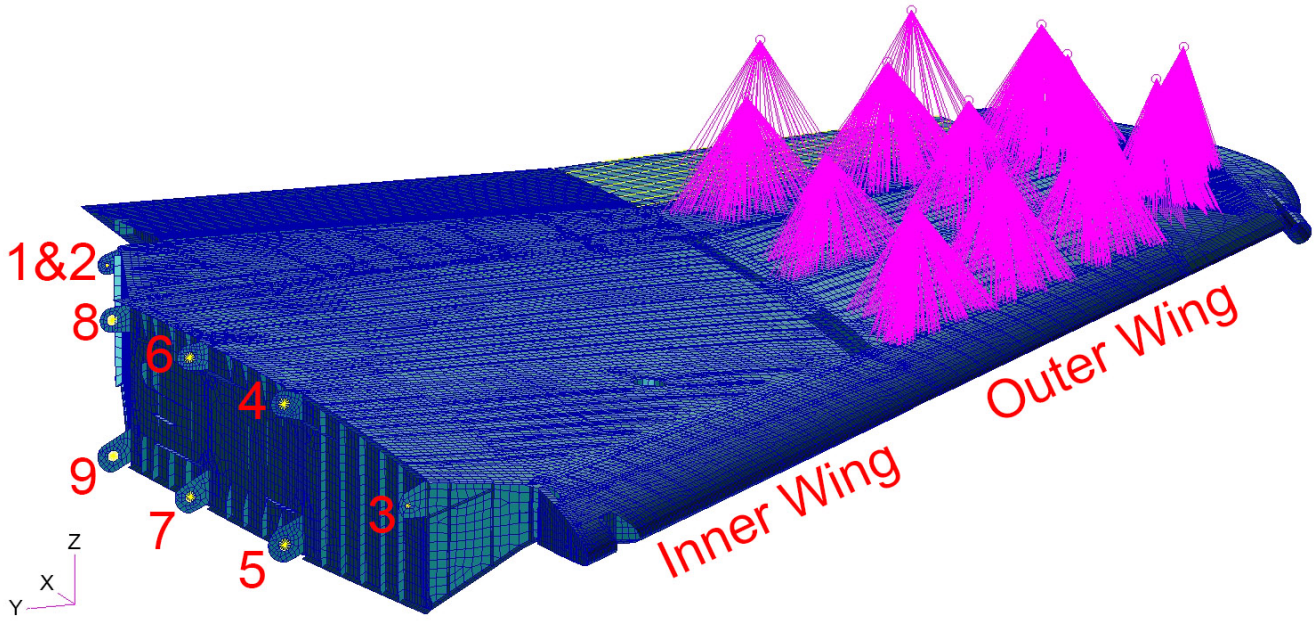

Figure A-1 Wing Lug Numbering & Whiffle Tree Depiction (in pink)

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A2.1 Wing Shear, Bending Moment, and Torsion Diagrams

Shown is maneuver APU 1.05M 20K 8.4g, condition 79 is max, condition 80 is min
For complete list see Appendix AB, "Wing Shear, Bending Moment, and Torsion Diagrams (for each experimental load condition)." See also Appendix AC, "Summary of Jack Loads vs. Experimental Load Condition."

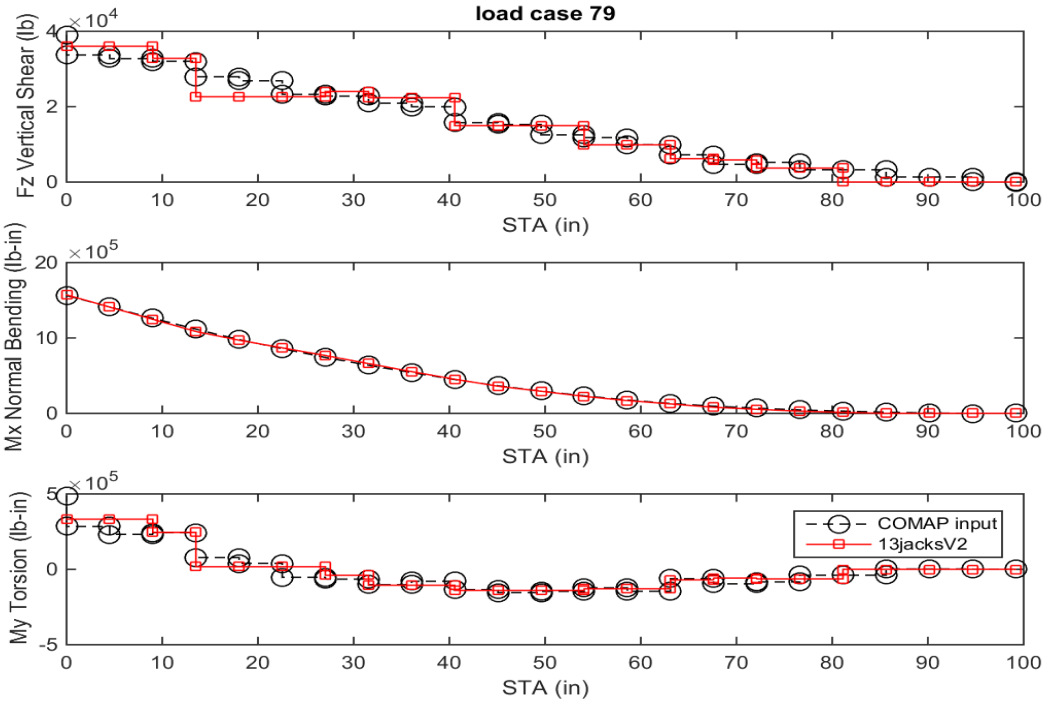

Figure A-2 MVT Diagrams for Load Case 79

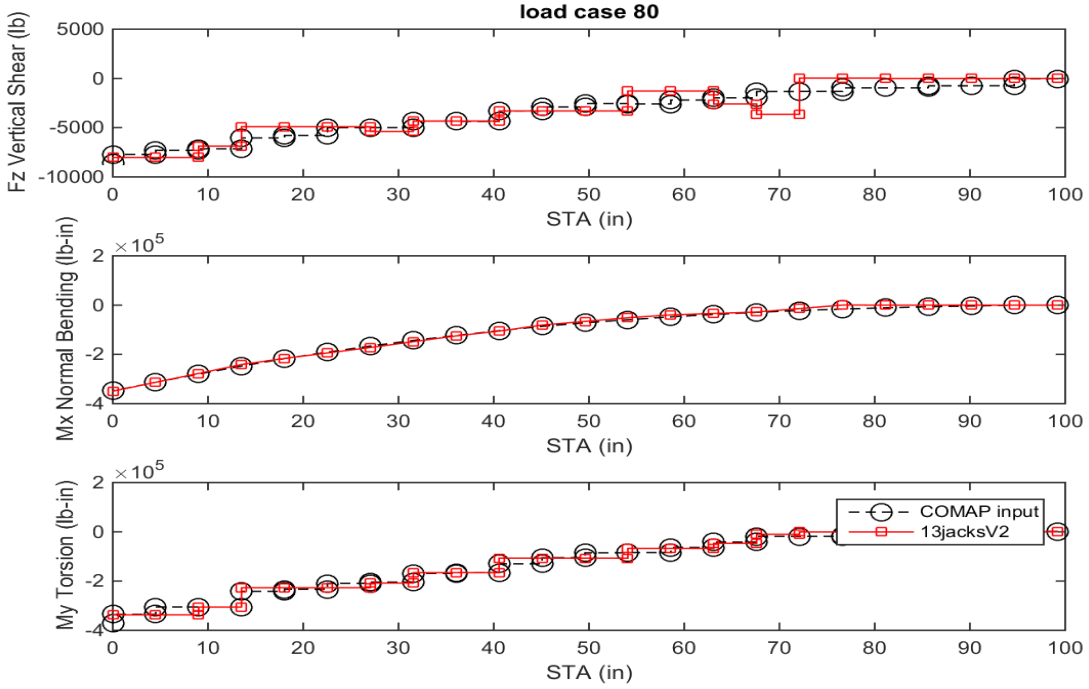

Figure A-3 MVT Diagrams for Load Case 80

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Table A-3. Maximum and Minimum Wing-Tip Displacement

ID	DISPL (in)	MAX/MIN	ID	DISPL (in)	MAX/MIN	ID	DISPL (in)	MAX/MIN
1	1.8320	MAX	48	7.2715	MAX	95	4.6088	MIN
2	-0.7294	MIN	49	1.3186	MIN	96	3.1968	MAX
3	1.8223	MAX	50	4.6542	MAX	97	-0.0663	MIN
4	-0.7671	MIN	51	-0.6455	MIN	98	4.4237	MAX
5	2.0369	MAX	52	4.2689	MAX	99	-0.0761	MIN
6	-0.8335	MIN	53	1.8691	MIN	100	6.3268	MAX
7	2.0549	MAX	54	5.1910	MAX	101	4.7891	MIN
8	-1.3405	MIN	55	-0.0124	MIN	102	2.7886	MAX
9	1.3982	MAX	56	5.8347	MAX	103	-0.0831	MIN
10	-1.6079	MIN	57	-0.0138	MIN	104	7.5014	MAX
11	2.1978	MAX	58	6.9842	MAX	105	4.5266	MIN
12	-1.4114	MIN	59	-0.0142	MIN	106	3.5758	MAX
13	2.0409	MAX	60	6.5772	MAX	107	4.0732	MIN
14	-1.6826	MIN	61	1.3884	MIN	108	2.1564	MAX
15	1.0973	MAX	62	6.4048	MAX	109	-0.0843	MIN
16	-0.6620	MIN	63	-0.0149	MIN	110	7.3434	MAX
17	1.1388	MAX	64	8.4014	MAX	111	-0.0976	MIN
18	-0.4876	MIN	65	1.3186	MIN	112	9.0760	MAX
19	-0.0189	MIN	66	8.1317	MAX	113	-0.0579	MIN
20	2.6942	MAX	67	8.0425	MAX	114	4.6743	MAX
21	-0.0195	MIN	68	-1.6755	MIN	115	-0.0977	MIN
22	2.6872	MAX	69	-0.0124	MIN	116	7.2637	MAX
23	-0.0138	MIN	70	6.0299	MAX	117	-0.0835	MIN
24	3.1279	MAX	71	-0.0138	MIN	118	5.9633	MAX
25	-0.0259	MIN	72	7.4611	MAX	119	-0.0920	MIN
26	3.3985	MAX	73	-0.0142	MIN	120	6.7053	MAX
27	1.3943	MIN	74	6.9432	MAX	121	-0.0813	MIN
28	2.1056	MAX	75	1.3870	MIN	122	7.7386	MAX
29	-0.0271	MIN	76	8.3843	MAX	123	-0.1015	MIN
30	3.7631	MAX	77	-0.0270	MIN	124	9.7070	MAX
31	1.9719	MIN	78	9.4361	MAX	125	-0.2247	MIN
32	2.8968	MAX	79	11.6877	MAX	126	2.9476	MAX
33	-0.6454	MIN	80	-2.2065	MIN	127	-0.3483	MIN
34	2.3511	MAX	81	4.1402	MIN	128	2.8933	MAX
35	1.8691	MIN	82	1.9357	MAX	129	-0.1822	MIN
36	2.9735	MAX	83	-0.0219	MIN	130	1.2868	MAX
37	-0.0182	MIN	84	2.1642	MAX	131	-0.4120	MIN
38	4.3917	MAX	85	-0.0273	MIN	132	-1.3659	MAX
39	-0.0186	MIN	86	2.0601	MAX	133	3.7992	MIN
40	4.3863	MAX	87	3.0001	MIN	134	2.3167	MAX
41	-0.0138	MIN	88	2.1918	MAX	135	-0.5004	MIN
42	4.9998	MAX	89	-0.3522	MIN	136	3.3282	MAX
43	-0.0259	MIN	90	1.6219	MAX	137	-0.8541	MIN
44	5.1752	MAX	91	1.9704	MIN	138	0.0105	MAX
45	1.3919	MIN	92	1.1038	MAX	139	-0.5314	MIN
46	3.9513	MAX	93	-0.4279	MIN	140	1.3230	MAX
47	-0.0271	MIN	94	1.2565	MAX			

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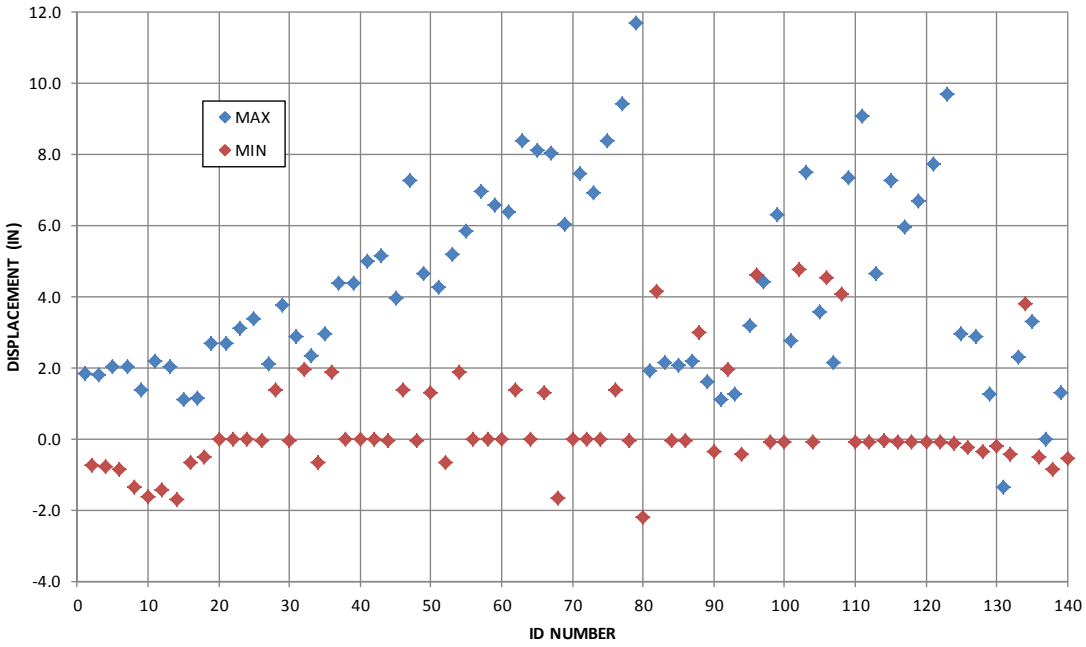

Figure A-4 Maximum and Minimum Wing Tip Displacements by Load Case ID

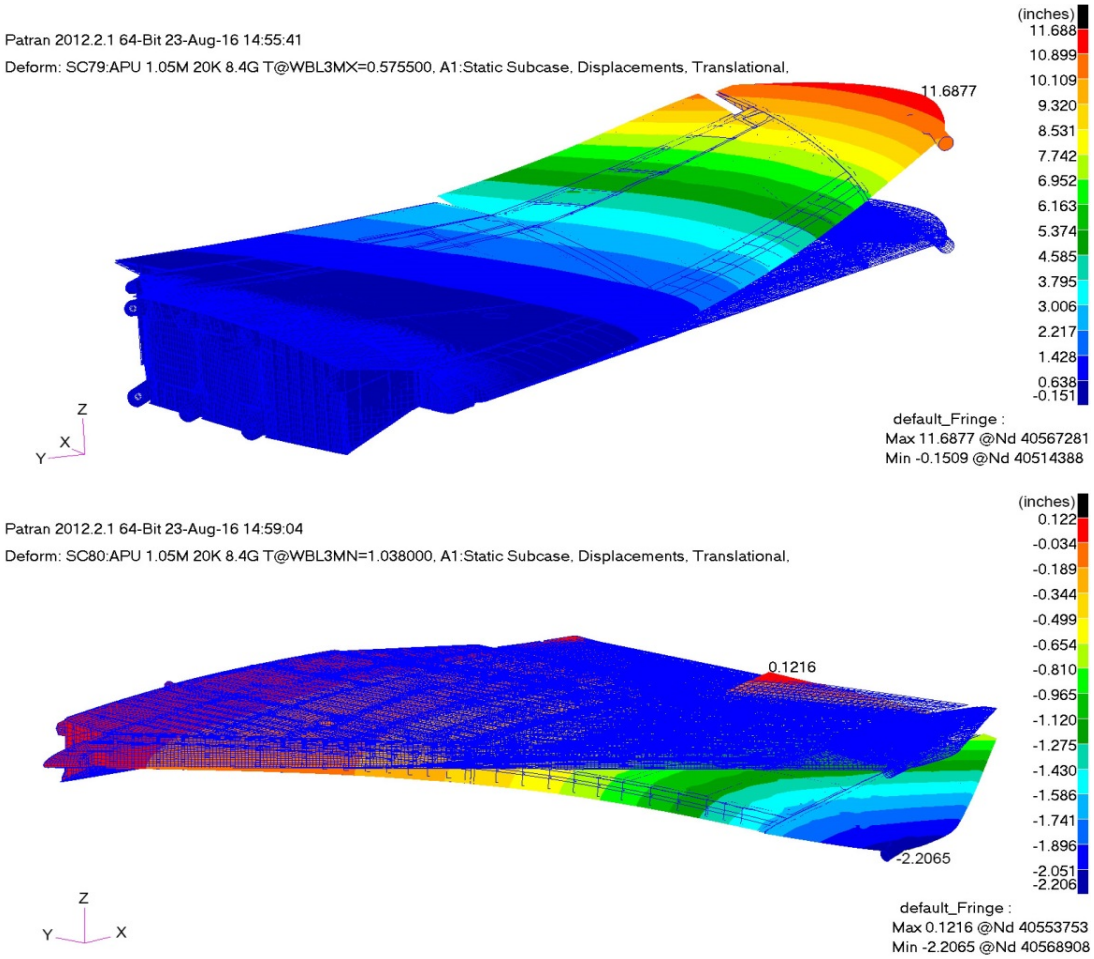

Figure A-5 Displacement Plot for Load Case ID 79 (top) and 80 (bottom)

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A3.2 Definition of Actuator Zones

Zones are comprised of one actuator acting on a group of 3, 4, or 6 pads on the outer wing upper surface as shown in Figure A-6 and Figure A-7. Individual load pad size: 49 in^2 (7 in. X 7 in.), with 1" gap. Whiffle trees are symbolically depicted in Figure A-1.

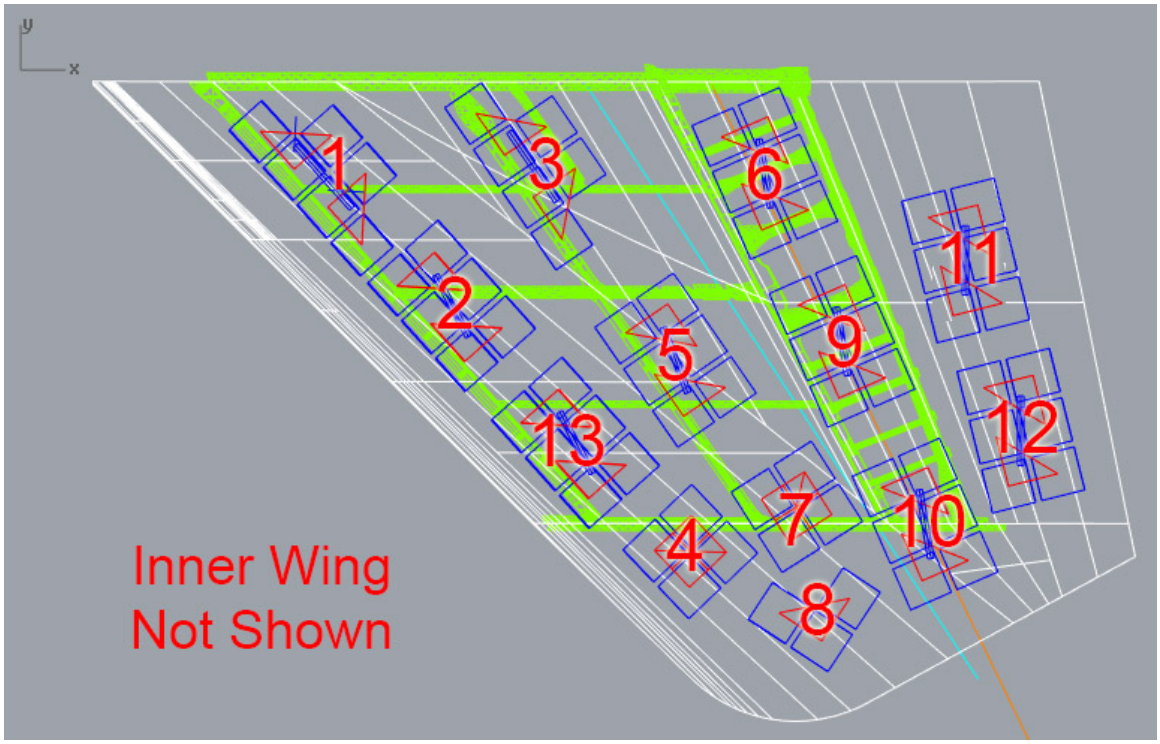

Figure A-6 Load pad groups with associated actuator zone numbers (top view, left side). Torque box and trailing edge spars and ribs highlighted in green

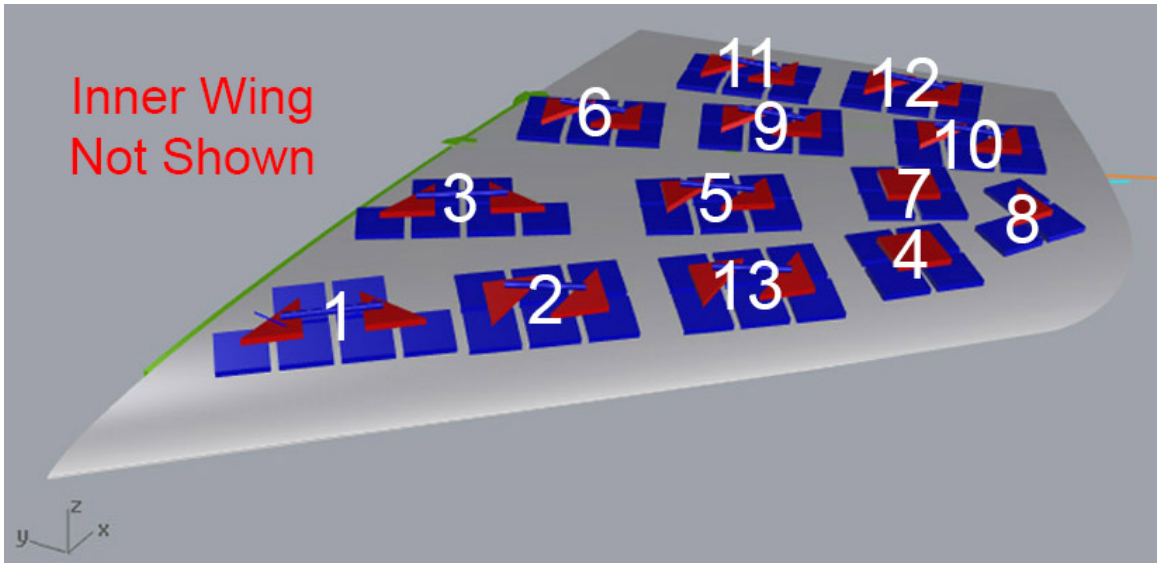

Figure A-7 Load pad groups (isometric view, left side, looking aft)

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Table A-4. Load pad locations are defined in the following table.

	Zone 1 (6 load pads)			Zone 2 (6 load pads)			Zone 3 (6 load pads)			Zone 4 (4 load pads)			Zone 5 (6 load pads)		
	FS	BL	WL	FS	BL	WL	FS	BL	WL	FS	BL	WL	FS	BL	WL
Center-Of-Pressure (in.)	597.32	-170.01	129.90	617.45	-190.36	128.92	630.22	-168.44	130.77	655.02	-230.98	127.26	652.71	-198.96	129.64
Pad 1 centroid (in.)	603.82	-169.55	131.24	625.71	-193.71	129.73	636.87	-168.74	131.35	660.69	-229.27	128.53	660.55	-203.27	130.14
Pad 2 centroid (in.)	598.49	-163.59	131.24	620.36	-187.77	129.89	632.35	-162.14	131.48	654.89	-234.79	128.16	656.00	-196.69	130.14
Pad 3 centroid (in.)	603.30	-180.78	129.75	615.01	-181.82	130.05	634.77	-179.87	131.00	649.36	-229.00	128.07	651.45	-190.10	130.14
Pad 4 centroid (in.)	597.97	-174.81	129.92	619.79	-198.99	128.53	630.25	-173.27	131.13	655.13	-223.50	128.61	653.95	-207.82	130.01
Pad 5 centroid (in.)	592.66	-168.85	130.00	614.45	-193.05	128.68	625.73	-166.68	131.25	-	-	-	649.41	-201.24	130.01
Pad 6 centroid (in.)	587.27	-162.94	130.17	609.10	-187.10	128.84	621.21	-160.08	131.38	-	-	-	644.86	-194.66	130.01
Max positive pad load (lb.)	913.5			493.0			844.5			1029.0			1225.0		
Max negative pad load (lb.)	-333.5			-337.7			-381.0			-1029.0			-695.3		
Max positive actuator load (lb.)	5481			2958			5067			4116			7350		
Max negative actuator load (lb.)	-2001			-2026			-2286			-4116			-4172		
Max pos. displacement (in.)	2.32			3.91			2.98			8.58			5.68		
Max neg. displacement (in.)	-0.58			-0.93			-0.61			-2.24			-1.07		
Structural dead weight (lb.)	71.0			50.0			61.0			7.0			32.0		

	Zone 6 (6 load pads)			Zone 7 (4 load pads)			Zone 8 (3 load pads)			Zone 9 (6 load pads)			Zone 10 (6 load pads)		
	FS	BL	WL	FS	BL	WL	FS	BL	WL	FS	BL	WL	FS	BL	WL
Center-Of-Pressure (in.)	666.77	-169.52	129.69	673.63	-222.49	128.67	674.96	-239.53	127.76	678.92	-196.00	129.69	692.02	-224.82	128.28
Pad 1 centroid (in.)	673.64	-175.25	130.19	673.02	-216.57	129.28	680.11	-236.57	128.53	685.79	-201.73	130.19	698.89	-230.54	128.78
Pad 2 centroid (in.)	670.43	-167.92	130.19	677.32	-223.32	129.11	675.71	-243.25	128.16	682.58	-194.40	130.19	695.68	-223.21	128.78
Pad 3 centroid (in.)	667.23	-160.59	130.19	670.57	-227.62	129.11	669.02	-238.86	128.07	679.38	-187.07	130.19	692.48	-215.88	128.78
Pad 4 centroid (in.)	666.32	-178.45	130.28	666.28	-220.87	129.26	-	-	-	678.47	-204.93	130.28	691.56	-233.75	128.78
Pad 5 centroid (in.)	663.12	-171.12	130.28	-	-	-	-	-	-	675.27	-197.60	130.28	688.35	-226.42	128.78
Pad 6 centroid (in.)	659.91	-163.79	130.28	-	-	-	-	-	-	672.06	-190.27	130.28	685.15	-219.09	128.78
Max positive pad load (lb.)	932.8			1029.0			1225.0			694.5			263.3		
Max negative pad load (lb.)	-281.8			-172.3			-211.3			-915.5			-363.3		
Max positive actuator load (lb.)	5597			4116			3675			4167			1580		
Max negative actuator load (lb.)	-1691			-689			-634			-5493			-2180		
Max pos. displacement (in.)	3.95			8.49			10.10			6.21			9.28		
Max neg. displacement (in.)	-0.58			-1.26			-1.70			-0.77			-1.13		
Structural dead weight (lb.)	48.0			6.0			1.0			25.0			2.0		

	Zone 11 (6 load pads)			Zone 12 (6 load pads)			Zone 13 (6 load pads)			-			-		
	FS	BL	WL	FS	BL	WL	FS	BL	WL						
Center-Of-Pressure (in.)	698.37	-183.24	127.87	707.10	-210.10	127.29	636.98	-211.95	127.89						
Pad 1 centroid (in.)	704.22	-190.03	128.21	712.95	-216.88	127.55	645.23	-215.31	128.72						
Pad 2 centroid (in.)	702.27	-182.27	128.21	711.00	-209.12	127.55	639.89	-209.36	128.87						
Pad 3 centroid (in.)	700.32	-174.51	128.21	709.06	-201.36	127.55	634.54	-203.41	129.01						
Pad 4 centroid (in.)	696.48	-191.97	128.59	705.20	-218.82	127.97	639.32	-220.59	127.52						
Pad 5 centroid (in.)	694.53	-184.21	128.59	703.25	-211.06	127.97	633.98	-214.64	127.66						
Pad 6 centroid (in.)	692.58	-176.45	128.59	701.30	-203.30	127.97	628.63	-208.69	127.80						
Max positive pad load (lb.)	264.0			239.3			1050.7								
Max negative pad load (lb.)	-388.0			-119.2			-275.2								
Max positive actuator load (lb.)	1584			1436			6304								
Max negative actuator load (lb.)	-2328			-715			-1651								
Max pos. displacement (in.)	5.70			8.72			6.19								
Max neg. displacement (in.)	-0.73			-0.97			-1.39								
Structural dead weight (lb.)	28.0			6.0			29.0								

Note: for Left hand wing BL dimensions are negative

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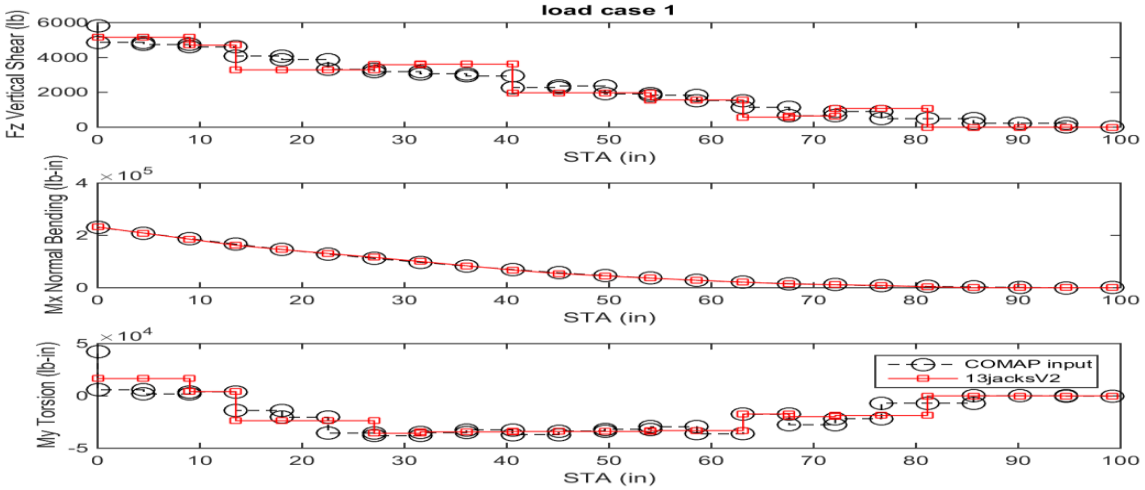
Appendix AB
Wing Shear, Bending Moment, and Torsion Diagrams

Condition ID 1

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	588	294	2
2	617.45	-190.36	126.42	+/-Z	-33	294	0
3	630.22	-168.44	126.42	+/-Z	452	294	2
4	655.02	-230.98	126.42	+/-Z	-431	147	-3
5	652.71	-198.96	126.42	+/-Z	1321	294	4
6	666.77	-169.52	126.42	+/-Z	829	294	3
7	673.63	-222.49	126.42	+/-Z	986	147	7
8	674.96	-239.53	126.42	+/-Z	1076	147	7
9	678.92	-196	126.42	+/-Z	324	294	1
10	692.02	-224.82	126.42	+/-Z	-72	294	0
11	698.37	-183.24	126.42	+/-Z	-295	294	-1
12	707.1	-210.1	126.42	+/-Z	135	294	0
13	636.98	-211.95	126.42	+/-Z	281	294	1



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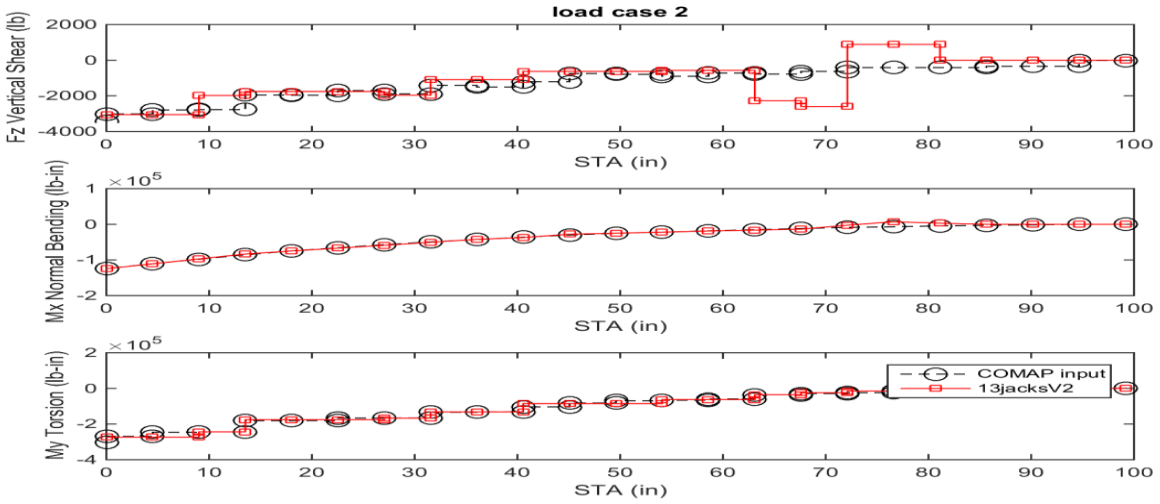
Condition ID 2

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1010	294	-3
2	617.45	-190.36	126.42	+/-Z	-876	294	-3
3	630.22	-168.44	126.42	+/-Z	-1074	294	-4
4	655.02	-230.98	126.42	+/-Z	-3489	147	-24
5	652.71	-198.96	126.42	+/-Z	-2162	294	-7
6	666.77	-169.52	126.42	+/-Z	788	294	3
7	673.63	-222.49	126.42	+/-Z	1705	147	12
8	674.96	-239.53	126.42	+/-Z	887	147	6
9	678.92	-196	126.42	+/-Z	1700	294	6
10	692.02	-224.82	126.42	+/-Z	324	294	1
11	698.37	-183.24	126.42	+/-Z	211	294	1
12	707.1	-210.1	126.42	+/-Z	301	294	1
13	636.98	-211.95	126.42	+/-Z	-355	294	-1



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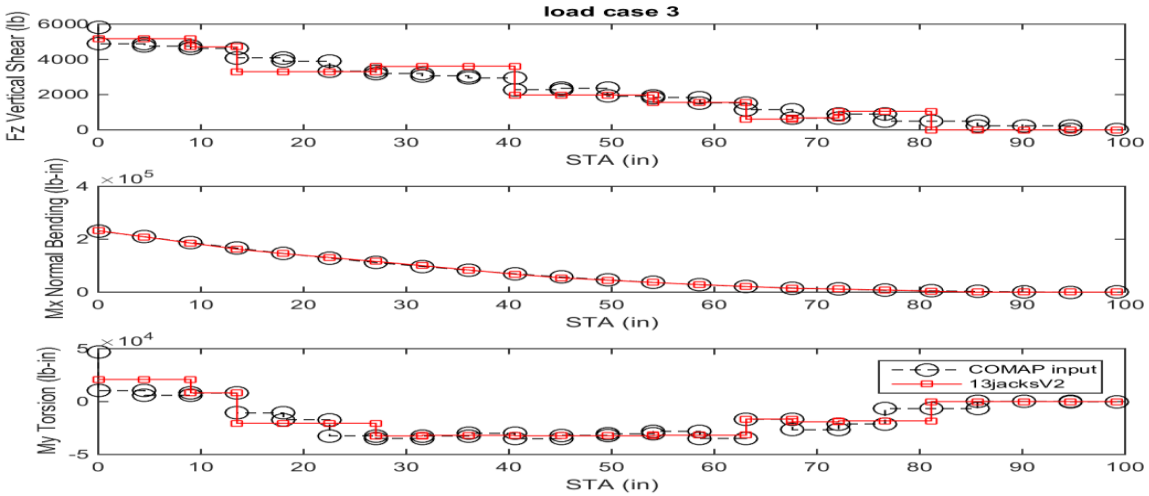
Condition ID 3

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	599	294	2
2	617.45	-190.36	126.42	+/-Z	-16	294	0
3	630.22	-168.44	126.42	+/-Z	464	294	2
4	655.02	-230.98	126.42	+/-Z	-369	147	-3
5	652.71	-198.96	126.42	+/-Z	1350	294	5
6	666.77	-169.52	126.42	+/-Z	808	294	3
7	673.63	-222.49	126.42	+/-Z	952	147	6
8	674.96	-239.53	126.42	+/-Z	1049	147	7
9	678.92	-196	126.42	+/-Z	292	294	1
10	692.02	-224.82	126.42	+/-Z	-76	294	0
11	698.37	-183.24	126.42	+/-Z	-296	294	-1
12	707.1	-210.1	126.42	+/-Z	130	294	0
13	636.98	-211.95	126.42	+/-Z	284	294	1



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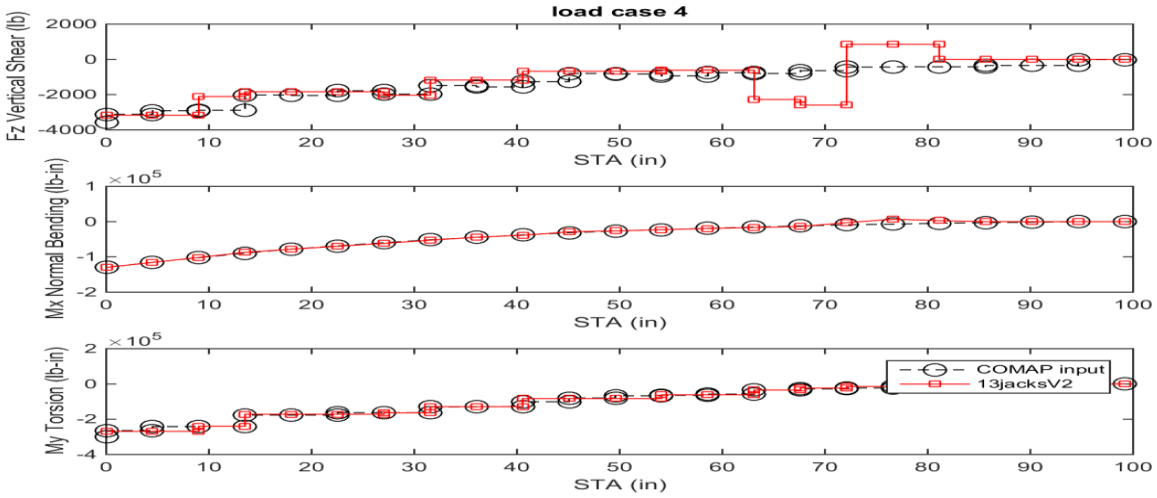
Condition ID 4

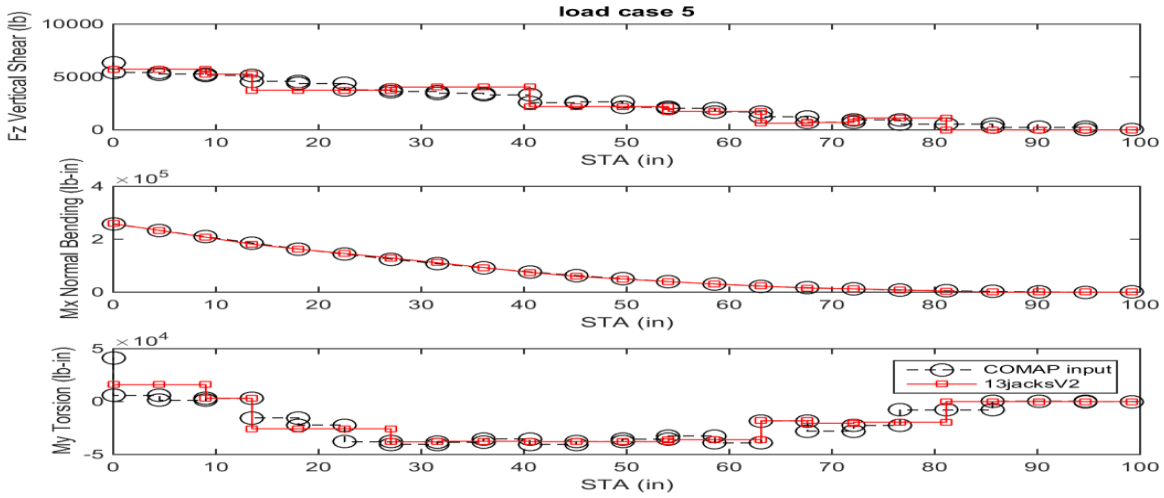
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1020	294	-3
2	617.45	-190.36	126.42	+/-Z	-864	294	-3
3	630.22	-168.44	126.42	+/-Z	-1059	294	-4
4	655.02	-230.98	126.42	+/-Z	-3444	147	-23
5	652.71	-198.96	126.42	+/-Z	-2158	294	-7
6	666.77	-169.52	126.42	+/-Z	746	294	3
7	673.63	-222.49	126.42	+/-Z	1661	147	11
8	674.96	-239.53	126.42	+/-Z	850	147	6
9	678.92	-196	126.42	+/-Z	1664	294	6
10	692.02	-224.82	126.42	+/-Z	320	294	1
11	698.37	-183.24	126.42	+/-Z	200	294	1
12	707.1	-210.1	126.42	+/-Z	290	294	1
13	636.98	-211.95	126.42	+/-Z	-354	294	-1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 5

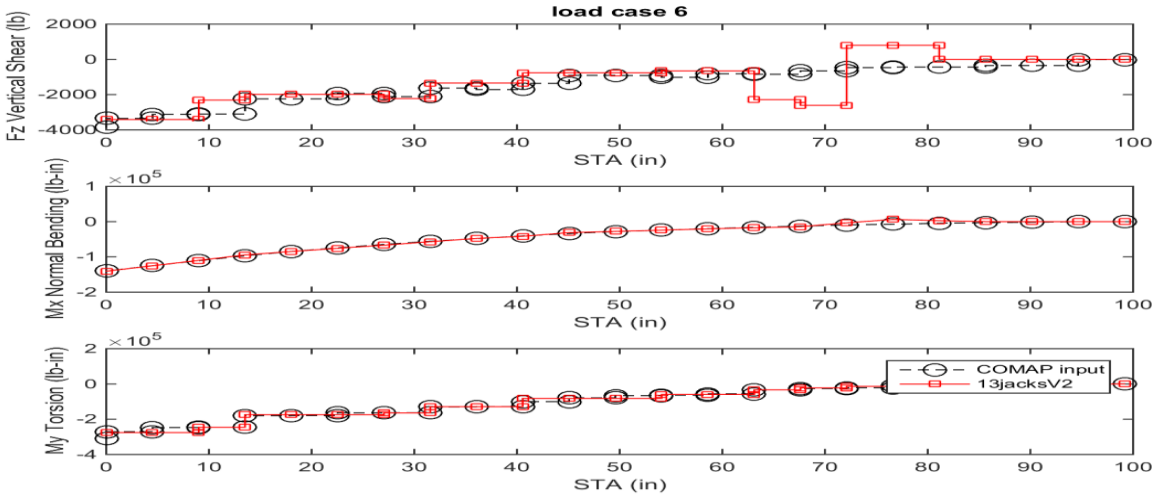
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	617	294	2
2	617.45	-190.36	126.42	+/-Z	-11	294	0
3	630.22	-168.44	126.42	+/-Z	466	294	2
4	655.02	-230.98	126.42	+/-Z	-426	147	-3
5	652.71	-198.96	126.42	+/-Z	1515	294	5
6	666.77	-169.52	126.42	+/-Z	913	294	3
7	673.63	-222.49	126.42	+/-Z	1119	147	8
8	674.96	-239.53	126.42	+/-Z	1124	147	8
9	678.92	-196	126.42	+/-Z	338	294	1
10	692.02	-224.82	126.42	+/-Z	-71	294	0
11	698.37	-183.24	126.42	+/-Z	-303	294	-1
12	707.1	-210.1	126.42	+/-Z	158	294	1
13	636.98	-211.95	126.42	+/-Z	295	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 6

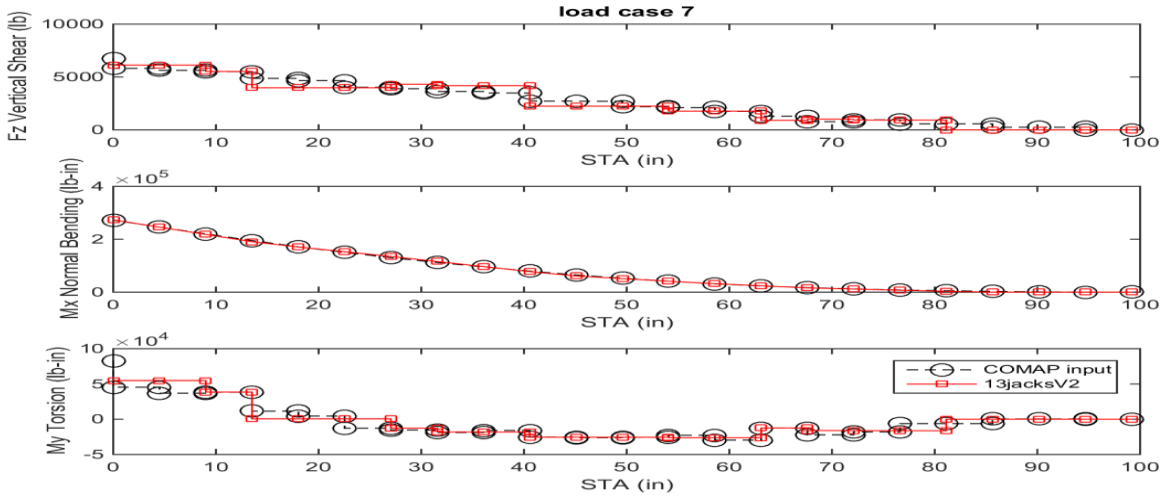
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1075	294	-4
2	617.45	-190.36	126.42	+/-Z	-880	294	-3
3	630.22	-168.44	126.42	+/-Z	-1099	294	-4
4	655.02	-230.98	126.42	+/-Z	-3405	147	-23
5	652.71	-198.96	126.42	+/-Z	-2258	294	-8
6	666.77	-169.52	126.42	+/-Z	743	294	3
7	673.63	-222.49	126.42	+/-Z	1629	147	11
8	674.96	-239.53	126.42	+/-Z	796	147	5
9	678.92	-196	126.42	+/-Z	1680	294	6
10	692.02	-224.82	126.42	+/-Z	324	294	1
11	698.37	-183.24	126.42	+/-Z	242	294	1
12	707.1	-210.1	126.42	+/-Z	282	294	1
13	636.98	-211.95	126.42	+/-Z	-394	294	-1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 7

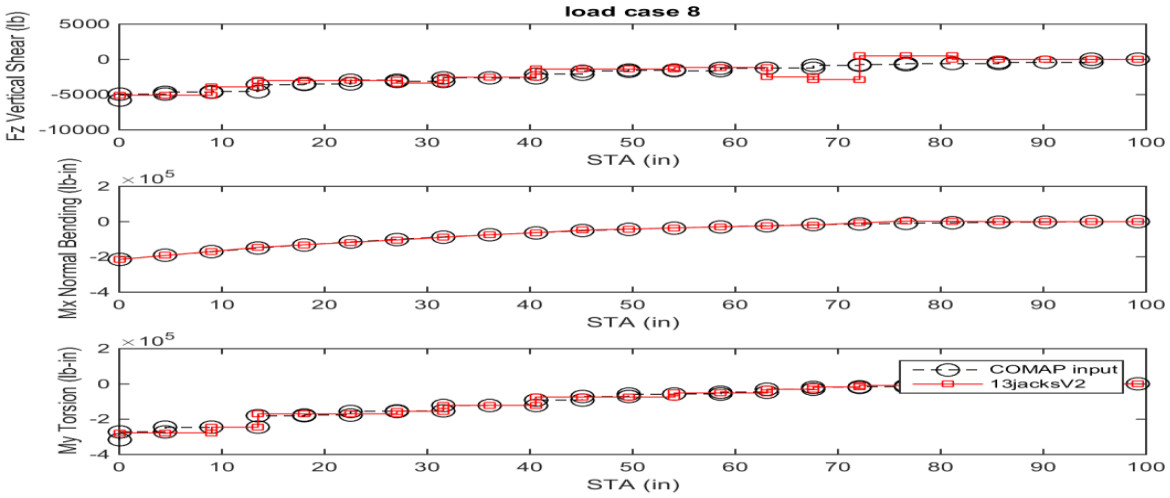
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	751	294	3
2	617.45	-190.36	126.42	+/-Z	132	294	0
3	630.22	-168.44	126.42	+/-Z	595	294	2
4	655.02	-230.98	126.42	+/-Z	67	147	0
5	652.71	-198.96	126.42	+/-Z	1857	294	6
6	666.77	-169.52	126.42	+/-Z	794	294	3
7	673.63	-222.49	126.42	+/-Z	874	147	6
8	674.96	-239.53	126.42	+/-Z	937	147	6
9	678.92	-196	126.42	+/-Z	79	294	0
10	692.02	-224.82	126.42	+/-Z	-107	294	0
11	698.37	-183.24	126.42	+/-Z	-327	294	-1
12	707.1	-210.1	126.42	+/-Z	125	294	0
13	636.98	-211.95	126.42	+/-Z	341	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 8

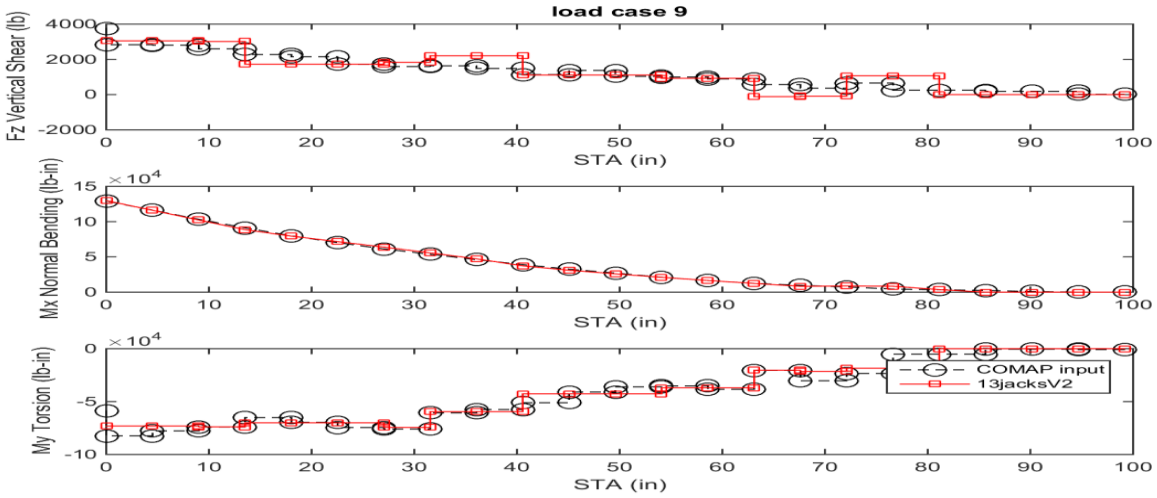
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1200	294	-4
2	617.45	-190.36	126.42	+/-Z	-837	294	-3
3	630.22	-168.44	126.42	+/-Z	-1193	294	-4
4	655.02	-230.98	126.42	+/-Z	-3348	147	-23
5	652.71	-198.96	126.42	+/-Z	-2756	294	-9
6	666.77	-169.52	126.42	+/-Z	299	294	1
7	673.63	-222.49	126.42	+/-Z	1327	147	9
8	674.96	-239.53	126.42	+/-Z	486	147	3
9	678.92	-196	126.42	+/-Z	1590	294	5
10	692.02	-224.82	126.42	+/-Z	378	294	1
11	698.37	-183.24	126.42	+/-Z	370	294	1
12	707.1	-210.1	126.42	+/-Z	261	294	1
13	636.98	-211.95	126.42	+/-Z	-474	294	-2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 9

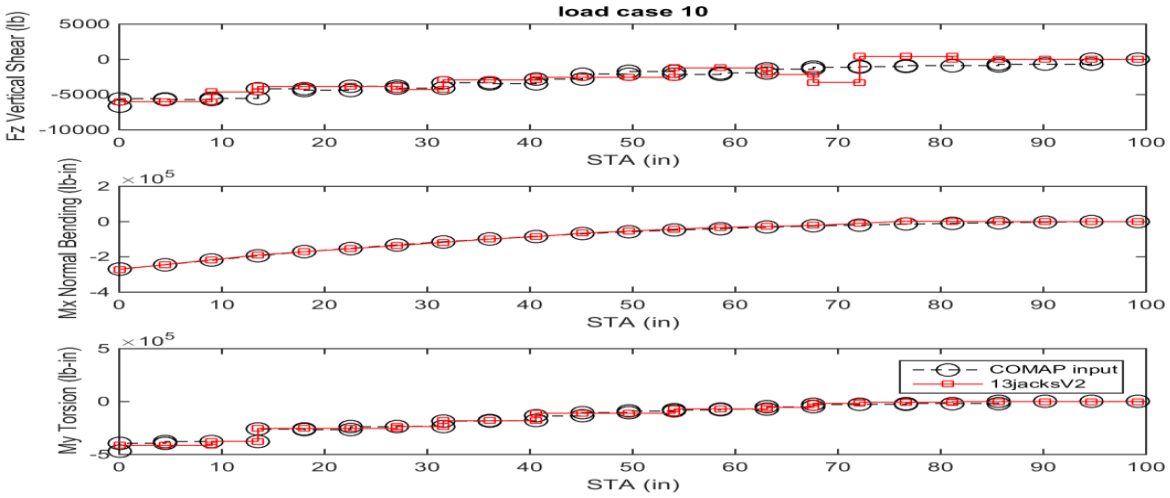
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	114	294	0
2	617.45	-190.36	126.42	+/-Z	-371	294	-1
3	630.22	-168.44	126.42	+/-Z	33	294	0
4	655.02	-230.98	126.42	+/-Z	-1148	147	-8
5	652.71	-198.96	126.42	+/-Z	245	294	1
6	666.77	-169.52	126.42	+/-Z	1174	294	4
7	673.63	-222.49	126.42	+/-Z	1041	147	7
8	674.96	-239.53	126.42	+/-Z	1064	147	7
9	678.92	-196	126.42	+/-Z	846	294	3
10	692.02	-224.82	126.42	+/-Z	-31	294	0
11	698.37	-183.24	126.42	+/-Z	-106	294	0
12	707.1	-210.1	126.42	+/-Z	135	294	0
13	636.98	-211.95	126.42	+/-Z	52	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 10

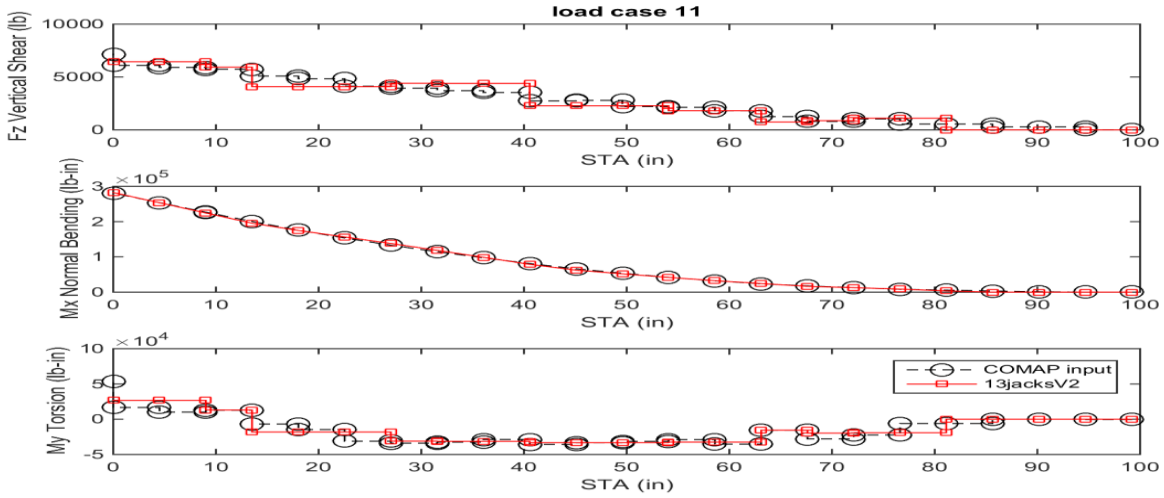
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1859	294	-6
2	617.45	-190.36	126.42	+/-Z	-1362	294	-5
3	630.22	-168.44	126.42	+/-Z	-1385	294	-5
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-3019	294	-10
6	666.77	-169.52	126.42	+/-Z	1071	294	4
7	673.63	-222.49	126.42	+/-Z	940	147	6
8	674.96	-239.53	126.42	+/-Z	400	147	3
9	678.92	-196	126.42	+/-Z	2659	294	9
10	692.02	-224.82	126.42	+/-Z	1122	294	4
11	698.37	-183.24	126.42	+/-Z	438	294	1
12	707.1	-210.1	126.42	+/-Z	177	294	1
13	636.98	-211.95	126.42	+/-Z	-1516	294	-5



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 11

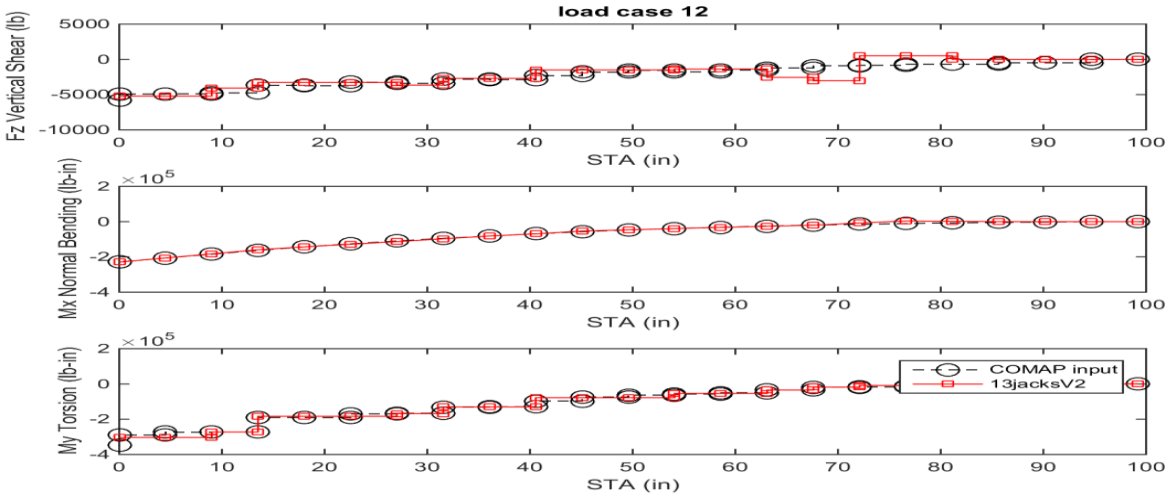
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	691	294	2
2	617.45	-190.36	126.42	+/-Z	8	294	0
3	630.22	-168.44	126.42	+/-Z	503	294	2
4	655.02	-230.98	126.42	+/-Z	-235	147	-2
5	652.71	-198.96	126.42	+/-Z	1791	294	6
6	666.77	-169.52	126.42	+/-Z	1155	294	4
7	673.63	-222.49	126.42	+/-Z	1059	147	7
8	674.96	-239.53	126.42	+/-Z	1105	147	8
9	678.92	-196	126.42	+/-Z	323	294	1
10	692.02	-224.82	126.42	+/-Z	-124	294	0
11	698.37	-183.24	126.42	+/-Z	-319	294	-1
12	707.1	-210.1	126.42	+/-Z	154	294	1
13	636.98	-211.95	126.42	+/-Z	324	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 12

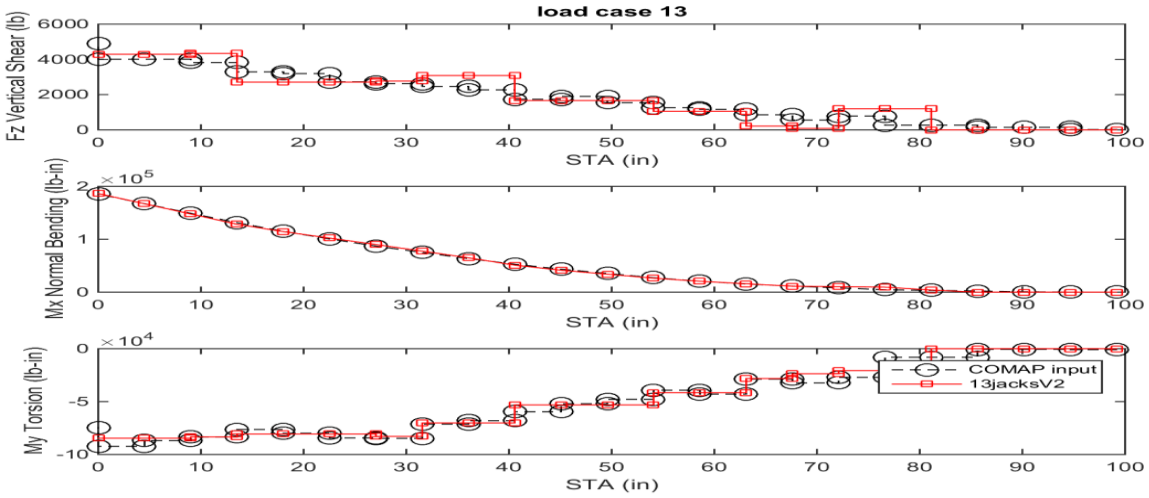
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1389	294	-5
2	617.45	-190.36	126.42	+/-Z	-954	294	-3
3	630.22	-168.44	126.42	+/-Z	-1127	294	-4
4	655.02	-230.98	126.42	+/-Z	-3547	147	-24
5	652.71	-198.96	126.42	+/-Z	-2943	294	-10
6	666.77	-169.52	126.42	+/-Z	601	294	2
7	673.63	-222.49	126.42	+/-Z	1194	147	8
8	674.96	-239.53	126.42	+/-Z	508	147	3
9	678.92	-196	126.42	+/-Z	1749	294	6
10	692.02	-224.82	126.42	+/-Z	479	294	2
11	698.37	-183.24	126.42	+/-Z	368	294	1
12	707.1	-210.1	126.42	+/-Z	309	294	1
13	636.98	-211.95	126.42	+/-Z	-451	294	-2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 13

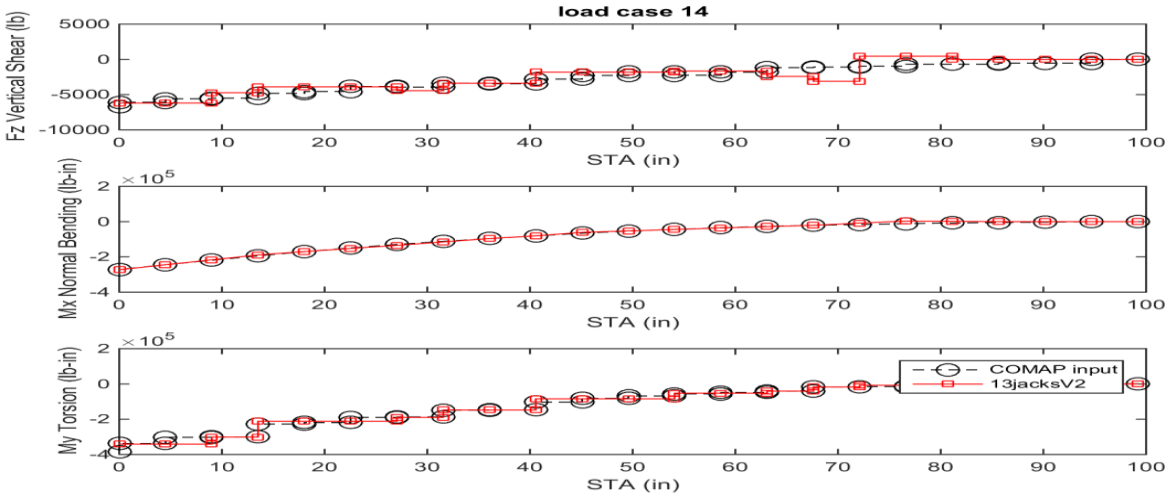
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	175	294	1
2	617.45	-190.36	126.42	+/-Z	-317	294	-1
3	630.22	-168.44	126.42	+/-Z	-48	294	0
4	655.02	-230.98	126.42	+/-Z	-1116	147	-8
5	652.71	-198.96	126.42	+/-Z	500	294	2
6	666.77	-169.52	126.42	+/-Z	1453	294	5
7	673.63	-222.49	126.42	+/-Z	836	147	6
8	674.96	-239.53	126.42	+/-Z	1198	147	8
9	678.92	-196	126.42	+/-Z	921	294	3
10	692.02	-224.82	126.42	+/-Z	134	294	0
11	698.37	-183.24	126.42	+/-Z	-58	294	0
12	707.1	-210.1	126.42	+/-Z	343	294	1
13	636.98	-211.95	126.42	+/-Z	269	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 14

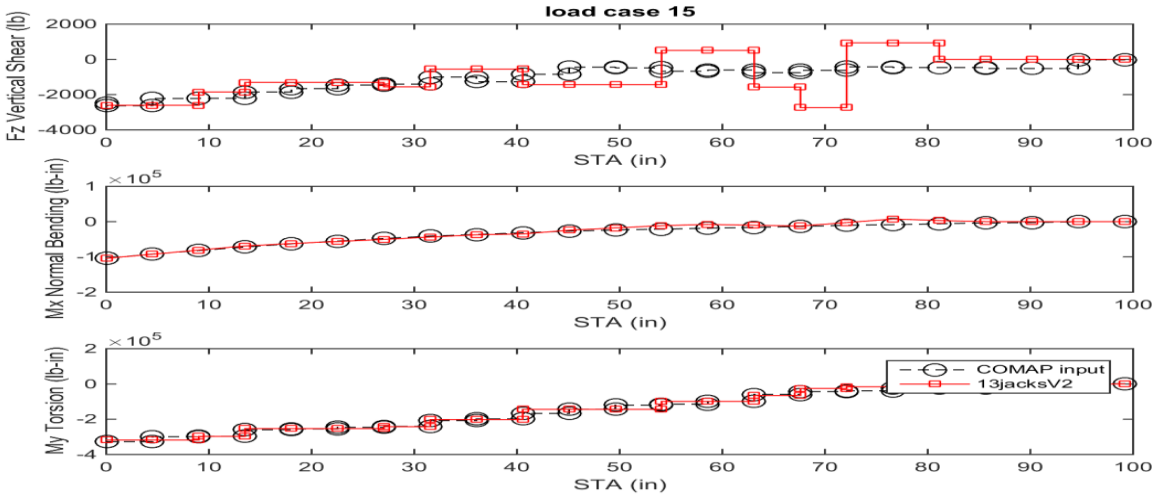
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1400	294	-5
2	617.45	-190.36	126.42	+/-Z	-1051	294	-4
3	630.22	-168.44	126.42	+/-Z	-1475	294	-5
4	655.02	-230.98	126.42	+/-Z	-3558	147	-24
5	652.71	-198.96	126.42	+/-Z	-3686	294	-13
6	666.77	-169.52	126.42	+/-Z	576	294	2
7	673.63	-222.49	126.42	+/-Z	747	147	5
8	674.96	-239.53	126.42	+/-Z	450	147	3
9	678.92	-196	126.42	+/-Z	2103	294	7
10	692.02	-224.82	126.42	+/-Z	686	294	2
11	698.37	-183.24	126.42	+/-Z	534	294	2
12	707.1	-210.1	126.42	+/-Z	417	294	1
13	636.98	-211.95	126.42	+/-Z	-547	294	-2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 15

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-710	294	-2
2	617.45	-190.36	126.42	+/-Z	-1012	294	-3
3	630.22	-168.44	126.42	+/-Z	-750	294	-3
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-1501	294	-5
6	666.77	-169.52	126.42	+/-Z	164	294	1
7	673.63	-222.49	126.42	+/-Z	2087	147	14
8	674.96	-239.53	126.42	+/-Z	937	147	6
9	678.92	-196	126.42	+/-Z	2385	294	8
10	692.02	-224.82	126.42	+/-Z	1158	294	4
11	698.37	-183.24	126.42	+/-Z	253	294	1
12	707.1	-210.1	126.42	+/-Z	68	294	0
13	636.98	-211.95	126.42	+/-Z	-2010	294	-7



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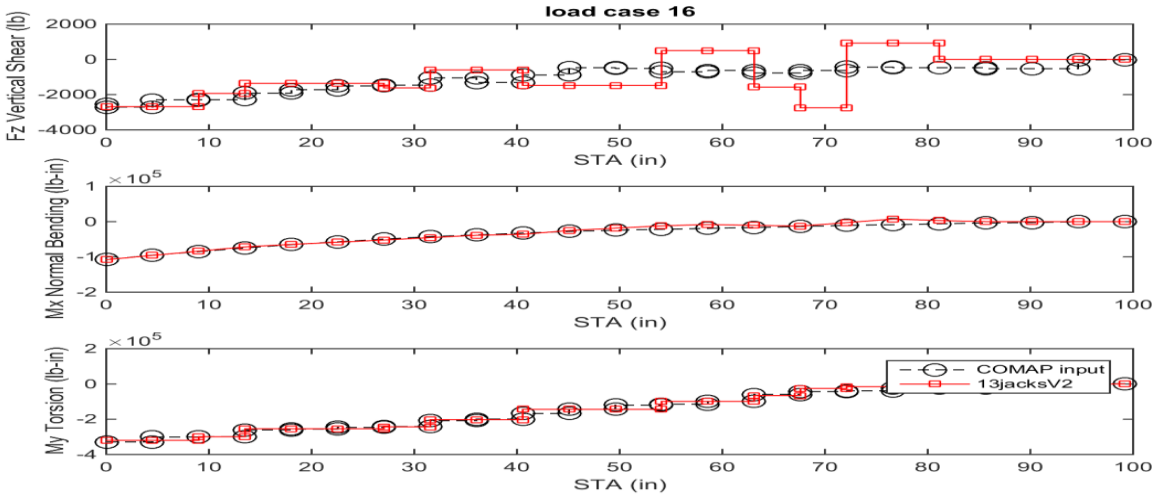
Condition ID 16

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-724	294	-2
2	617.45	-190.36	126.42	+/-Z	-1018	294	-3
3	630.22	-168.44	126.42	+/-Z	-752	294	-3
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-1516	294	-5
6	666.77	-169.52	126.42	+/-Z	150	294	1
7	673.63	-222.49	126.42	+/-Z	2073	147	14
8	674.96	-239.53	126.42	+/-Z	926	147	6
9	678.92	-196	126.42	+/-Z	2396	294	8
10	692.02	-224.82	126.42	+/-Z	1172	294	4
11	698.37	-183.24	126.42	+/-Z	257	294	1
12	707.1	-210.1	126.42	+/-Z	62	294	0
13	636.98	-211.95	126.42	+/-Z	-2037	294	-7



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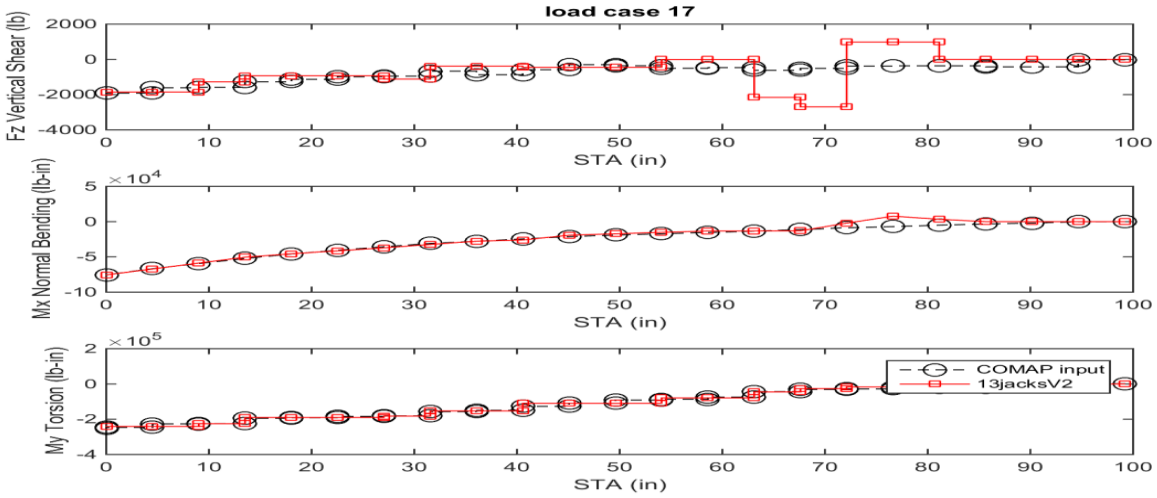
Condition ID 17

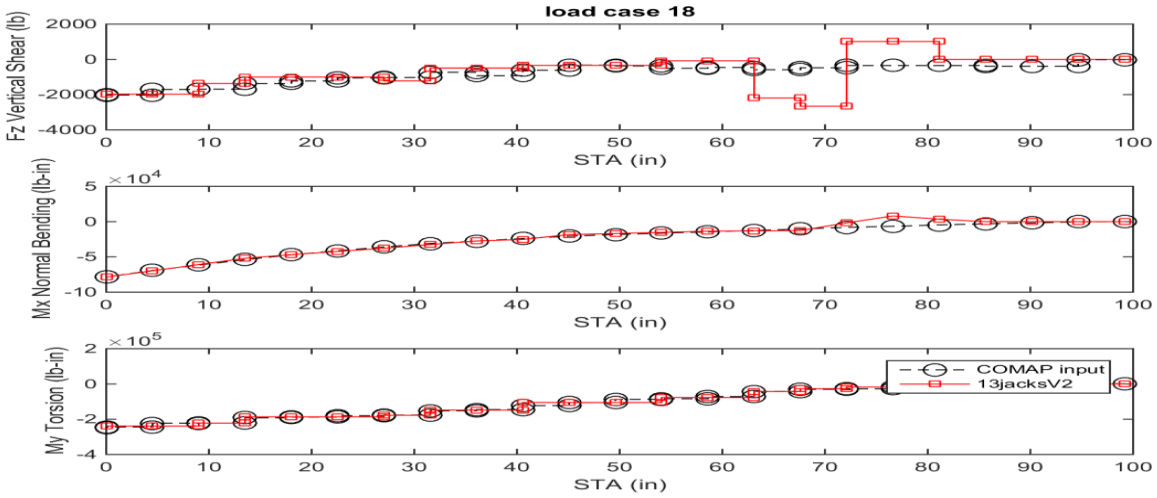
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-553	294	-2
2	617.45	-190.36	126.42	+/-Z	-733	294	-2
3	630.22	-168.44	126.42	+/-Z	-582	294	-2
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-1611	294	-5
6	666.77	-169.52	126.42	+/-Z	212	294	1
7	673.63	-222.49	126.42	+/-Z	2147	147	15
8	674.96	-239.53	126.42	+/-Z	980	147	7
9	678.92	-196	126.42	+/-Z	1670	294	6
10	692.02	-224.82	126.42	+/-Z	538	294	2
11	698.37	-183.24	126.42	+/-Z	189	294	1
12	707.1	-210.1	126.42	+/-Z	298	294	1
13	636.98	-211.95	126.42	+/-Z	-738	294	-3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 18

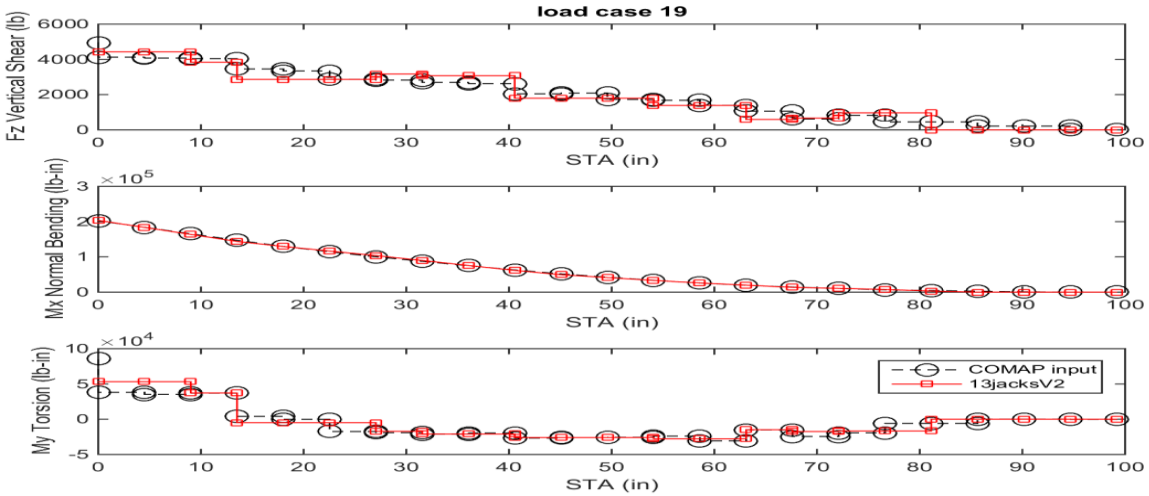
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-559	294	-2
2	617.45	-190.36	126.42	+/-Z	-727	294	-2
3	630.22	-168.44	126.42	+/-Z	-608	294	-2
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-1765	294	-6
6	666.77	-169.52	126.42	+/-Z	200	294	1
7	673.63	-222.49	126.42	+/-Z	2110	147	14
8	674.96	-239.53	126.42	+/-Z	1014	147	7
9	678.92	-196	126.42	+/-Z	1611	294	5
10	692.02	-224.82	126.42	+/-Z	471	294	2
11	698.37	-183.24	126.42	+/-Z	218	294	1
12	707.1	-210.1	126.42	+/-Z	327	294	1
13	636.98	-211.95	126.42	+/-Z	-589	294	-2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 19

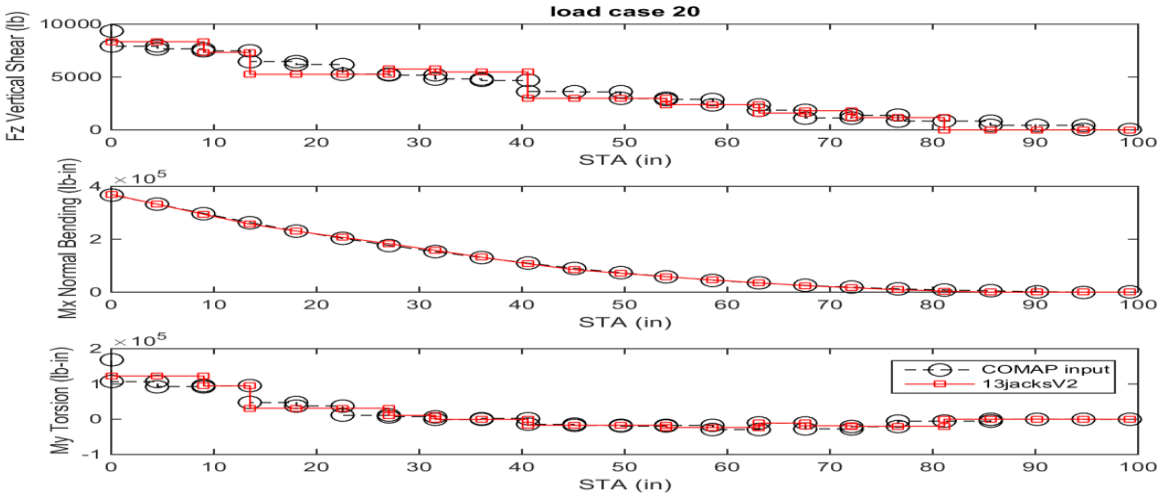
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	734	294	2
2	617.45	-190.36	126.42	+/-Z	91	294	0
3	630.22	-168.44	126.42	+/-Z	584	294	2
4	655.02	-230.98	126.42	+/-Z	-298	147	-2
5	652.71	-198.96	126.42	+/-Z	1235	294	4
6	666.77	-169.52	126.42	+/-Z	241	294	1
7	673.63	-222.49	126.42	+/-Z	796	147	5
8	674.96	-239.53	126.42	+/-Z	964	147	7
9	678.92	-196	126.42	+/-Z	48	294	0
10	692.02	-224.82	126.42	+/-Z	-74	294	0
11	698.37	-183.24	126.42	+/-Z	-305	294	-1
12	707.1	-210.1	126.42	+/-Z	95	294	0
13	636.98	-211.95	126.42	+/-Z	310	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 20

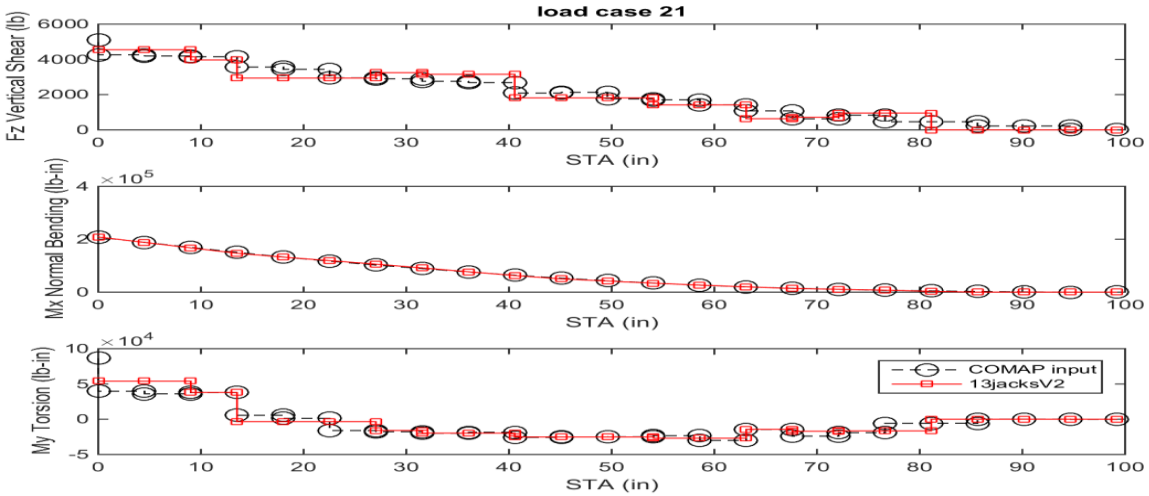
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1190	294	4
2	617.45	-190.36	126.42	+/-Z	277	294	1
3	630.22	-168.44	126.42	+/-Z	1011	294	3
4	655.02	-230.98	126.42	+/-Z	644	147	4
5	652.71	-198.96	126.42	+/-Z	2667	294	9
6	666.77	-169.52	126.42	+/-Z	880	294	3
7	673.63	-222.49	126.42	+/-Z	790	147	5
8	674.96	-239.53	126.42	+/-Z	1160	147	8
9	678.92	-196	126.42	+/-Z	-169	294	-1
10	692.02	-224.82	126.42	+/-Z	-214	294	-1
11	698.37	-183.24	126.42	+/-Z	-502	294	-2
12	707.1	-210.1	126.42	+/-Z	82	294	0
13	636.98	-211.95	126.42	+/-Z	517	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 21

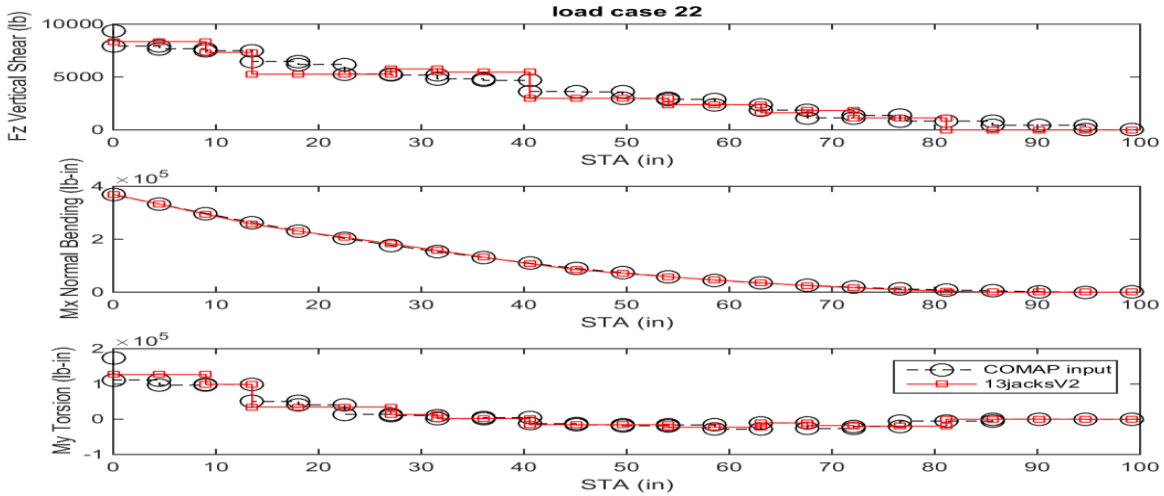
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	732	294	2
2	617.45	-190.36	126.42	+/-Z	96	294	0
3	630.22	-168.44	126.42	+/-Z	585	294	2
4	655.02	-230.98	126.42	+/-Z	-241	147	-2
5	652.71	-198.96	126.42	+/-Z	1287	294	4
6	666.77	-169.52	126.42	+/-Z	291	294	1
7	673.63	-222.49	126.42	+/-Z	782	147	5
8	674.96	-239.53	126.42	+/-Z	951	147	6
9	678.92	-196	126.42	+/-Z	45	294	0
10	692.02	-224.82	126.42	+/-Z	-79	294	0
11	698.37	-183.24	126.42	+/-Z	-306	294	-1
12	707.1	-210.1	126.42	+/-Z	94	294	0
13	636.98	-211.95	126.42	+/-Z	312	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 22

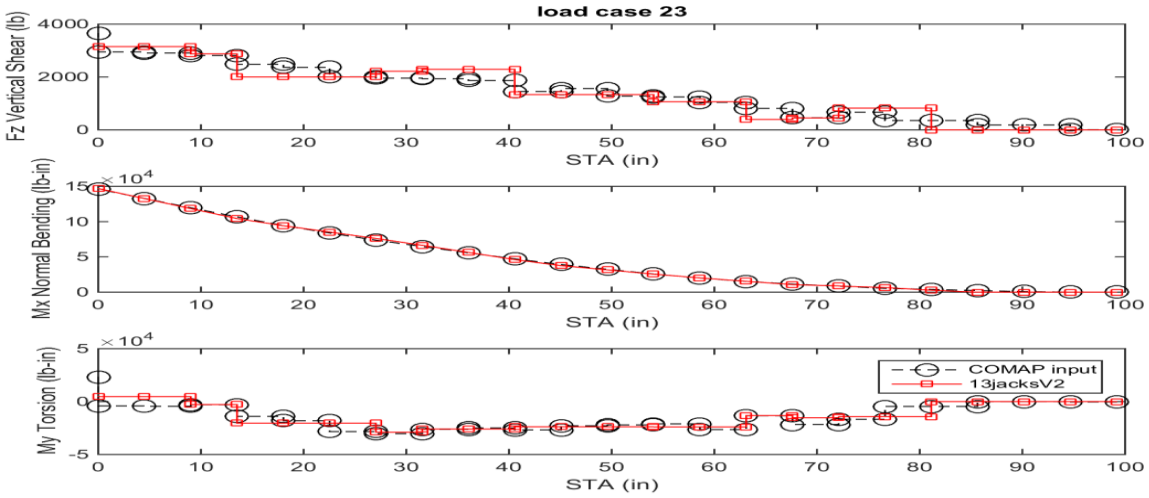
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1201	294	4
2	617.45	-190.36	126.42	+/-Z	294	294	1
3	630.22	-168.44	126.42	+/-Z	1023	294	3
4	655.02	-230.98	126.42	+/-Z	700	147	5
5	652.71	-198.96	126.42	+/-Z	2698	294	9
6	666.77	-169.52	126.42	+/-Z	860	294	3
7	673.63	-222.49	126.42	+/-Z	760	147	5
8	674.96	-239.53	126.42	+/-Z	1134	147	8
9	678.92	-196	126.42	+/-Z	-202	294	-1
10	692.02	-224.82	126.42	+/-Z	-218	294	-1
11	698.37	-183.24	126.42	+/-Z	-504	294	-2
12	707.1	-210.1	126.42	+/-Z	78	294	0
13	636.98	-211.95	126.42	+/-Z	522	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 23

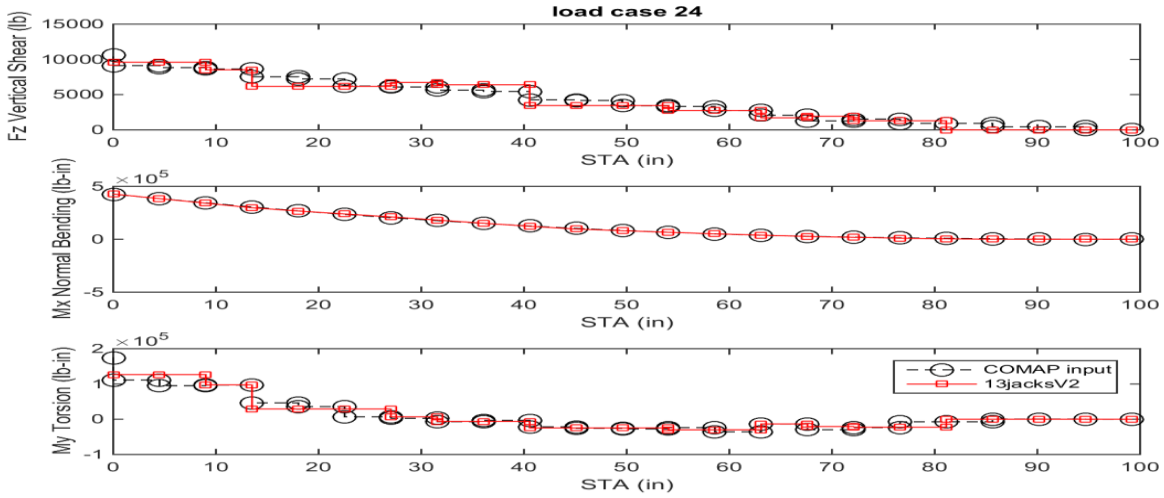
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	368	294	1
2	617.45	-190.36	126.42	+/-Z	-75	294	0
3	630.22	-168.44	126.42	+/-Z	276	294	1
4	655.02	-230.98	126.42	+/-Z	-371	147	-3
5	652.71	-198.96	126.42	+/-Z	699	294	2
6	666.77	-169.52	126.42	+/-Z	501	294	2
7	673.63	-222.49	126.42	+/-Z	667	147	5
8	674.96	-239.53	126.42	+/-Z	822	147	6
9	678.92	-196	126.42	+/-Z	257	294	1
10	692.02	-224.82	126.42	+/-Z	-57	294	0
11	698.37	-183.24	126.42	+/-Z	-209	294	-1
12	707.1	-210.1	126.42	+/-Z	79	294	0
13	636.98	-211.95	126.42	+/-Z	193	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 24

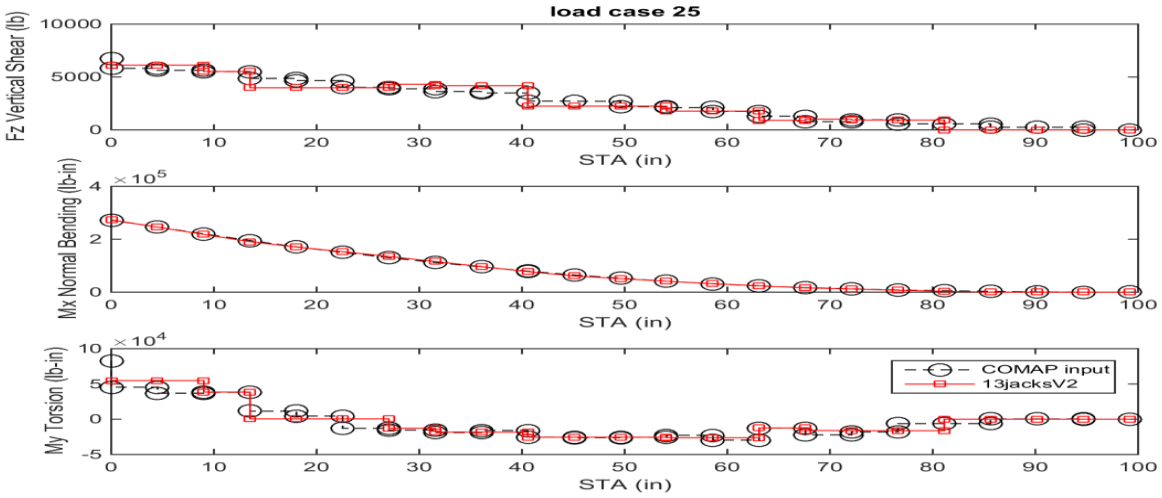
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1295	294	4
2	617.45	-190.36	126.42	+/-Z	323	294	1
3	630.22	-168.44	126.42	+/-Z	1069	294	4
4	655.02	-230.98	126.42	+/-Z	628	147	4
5	652.71	-198.96	126.42	+/-Z	3091	294	11
6	666.77	-169.52	126.42	+/-Z	1052	294	4
7	673.63	-222.49	126.42	+/-Z	1048	147	7
8	674.96	-239.53	126.42	+/-Z	1297	147	9
9	678.92	-196	126.42	+/-Z	-148	294	-1
10	692.02	-224.82	126.42	+/-Z	-218	294	-1
11	698.37	-183.24	126.42	+/-Z	-546	294	-2
12	707.1	-210.1	126.42	+/-Z	130	294	0
13	636.98	-211.95	126.42	+/-Z	572	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 25

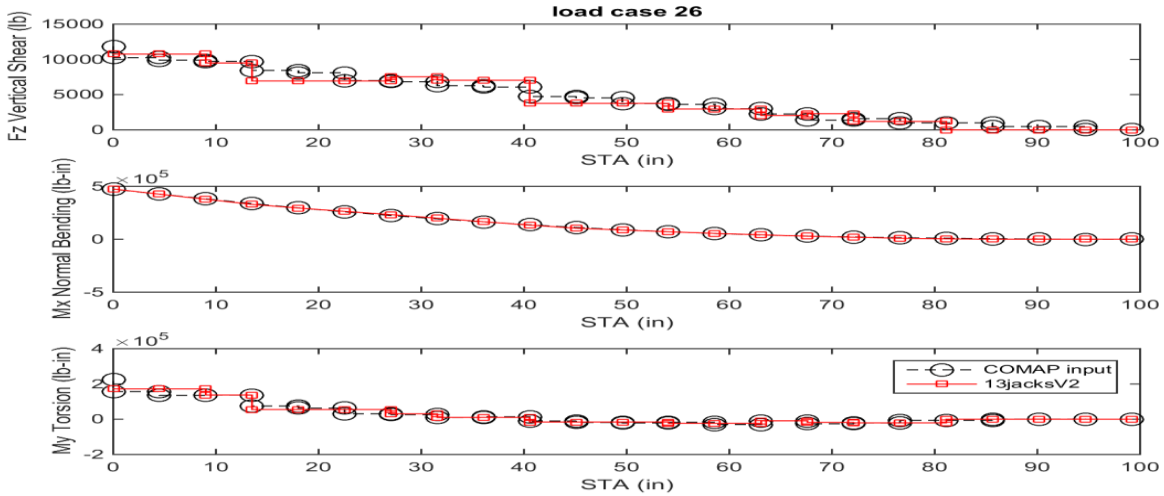
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	750	294	3
2	617.45	-190.36	126.42	+/-Z	132	294	0
3	630.22	-168.44	126.42	+/-Z	595	294	2
4	655.02	-230.98	126.42	+/-Z	67	147	0
5	652.71	-198.96	126.42	+/-Z	1857	294	6
6	666.77	-169.52	126.42	+/-Z	795	294	3
7	673.63	-222.49	126.42	+/-Z	875	147	6
8	674.96	-239.53	126.42	+/-Z	937	147	6
9	678.92	-196	126.42	+/-Z	80	294	0
10	692.02	-224.82	126.42	+/-Z	-107	294	0
11	698.37	-183.24	126.42	+/-Z	-327	294	-1
12	707.1	-210.1	126.42	+/-Z	125	294	0
13	636.98	-211.95	126.42	+/-Z	341	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 26

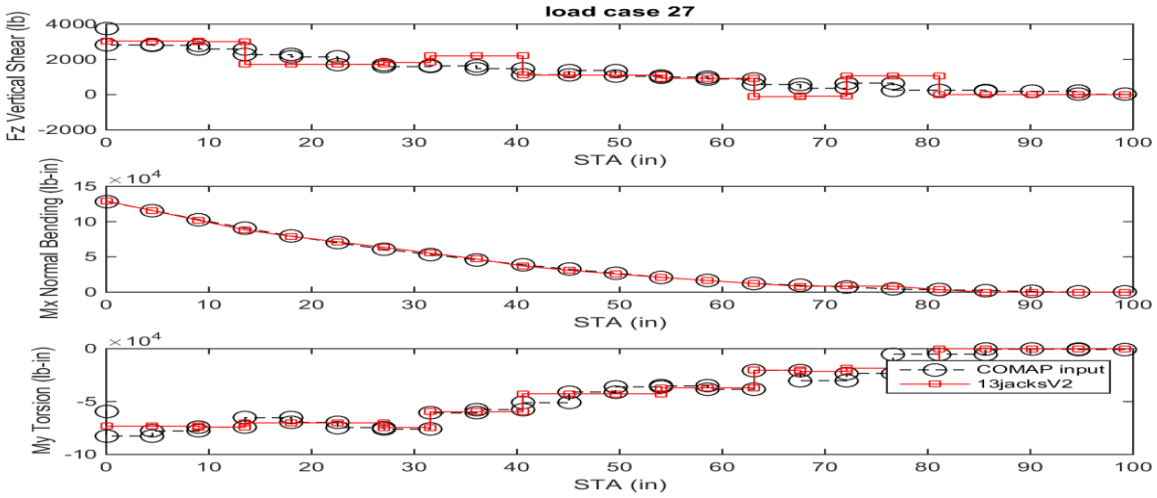
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1522	294	5
2	617.45	-190.36	126.42	+/-Z	496	294	2
3	630.22	-168.44	126.42	+/-Z	1267	294	4
4	655.02	-230.98	126.42	+/-Z	1093	147	7
5	652.71	-198.96	126.42	+/-Z	3689	294	13
6	666.77	-169.52	126.42	+/-Z	1031	294	4
7	673.63	-222.49	126.42	+/-Z	925	147	6
8	674.96	-239.53	126.42	+/-Z	1200	147	8
9	678.92	-196	126.42	+/-Z	-404	294	-1
10	692.02	-224.82	126.42	+/-Z	-258	294	-1
11	698.37	-183.24	126.42	+/-Z	-606	294	-2
12	707.1	-210.1	126.42	+/-Z	124	294	0
13	636.98	-211.95	126.42	+/-Z	669	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 27

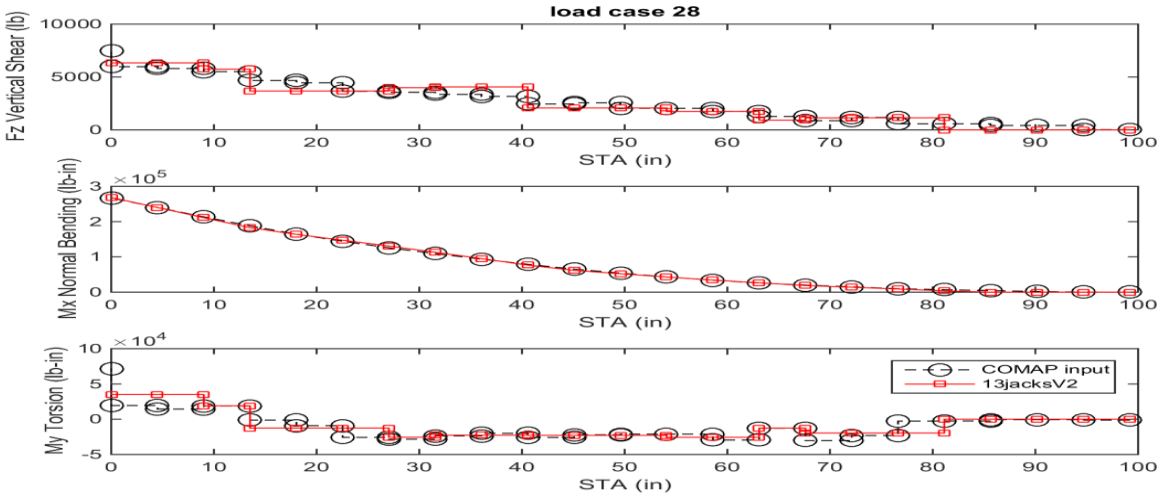
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	113	294	0
2	617.45	-190.36	126.42	+/-Z	-372	294	-1
3	630.22	-168.44	126.42	+/-Z	32	294	0
4	655.02	-230.98	126.42	+/-Z	-1148	147	-8
5	652.71	-198.96	126.42	+/-Z	239	294	1
6	666.77	-169.52	126.42	+/-Z	1172	294	4
7	673.63	-222.49	126.42	+/-Z	1039	147	7
8	674.96	-239.53	126.42	+/-Z	1061	147	7
9	678.92	-196	126.42	+/-Z	849	294	3
10	692.02	-224.82	126.42	+/-Z	-30	294	0
11	698.37	-183.24	126.42	+/-Z	-106	294	0
12	707.1	-210.1	126.42	+/-Z	135	294	0
13	636.98	-211.95	126.42	+/-Z	50	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 28

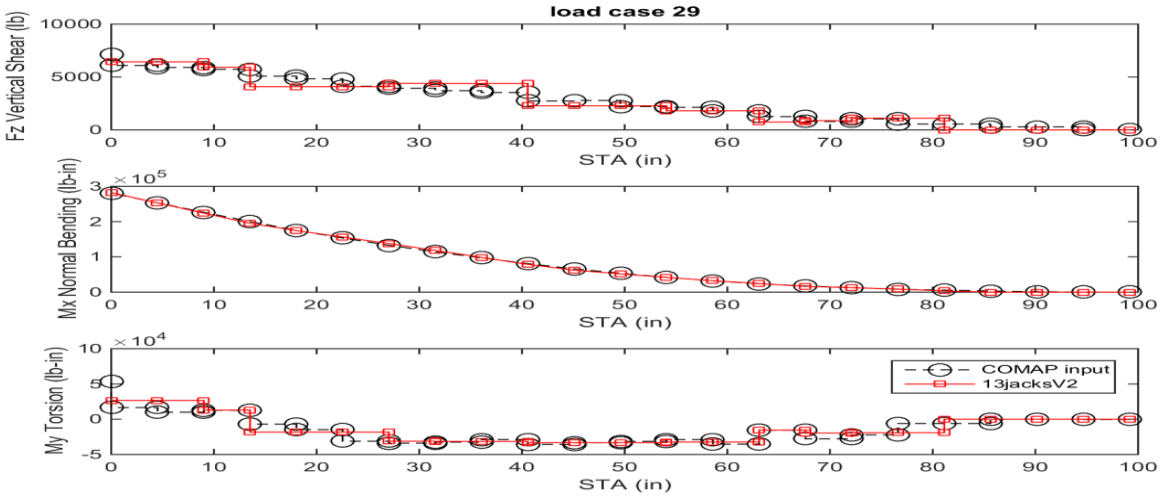
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	728	294	2
2	617.45	-190.36	126.42	+/-Z	-71	294	0
3	630.22	-168.44	126.42	+/-Z	584	294	2
4	655.02	-230.98	126.42	+/-Z	-4	147	0
5	652.71	-198.96	126.42	+/-Z	1626	294	6
6	666.77	-169.52	126.42	+/-Z	1344	294	5
7	673.63	-222.49	126.42	+/-Z	811	147	6
8	674.96	-239.53	126.42	+/-Z	1138	147	8
9	678.92	-196	126.42	+/-Z	363	294	1
10	692.02	-224.82	126.42	+/-Z	-205	294	-1
11	698.37	-183.24	126.42	+/-Z	-316	294	-1
12	707.1	-210.1	126.42	+/-Z	59	294	0
13	636.98	-211.95	126.42	+/-Z	275	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 29

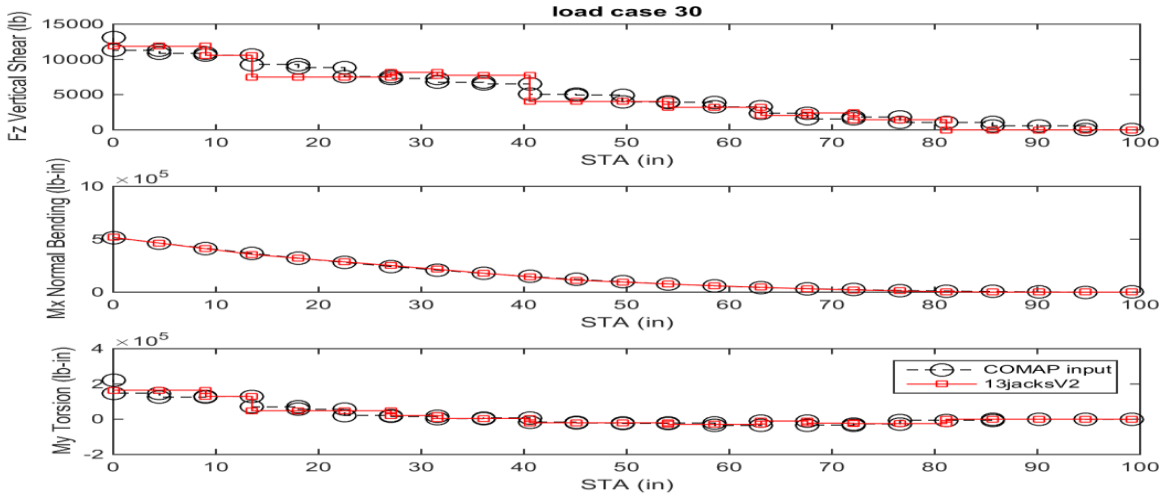
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	690	294	2
2	617.45	-190.36	126.42	+/-Z	8	294	0
3	630.22	-168.44	126.42	+/-Z	503	294	2
4	655.02	-230.98	126.42	+/-Z	-234	147	-2
5	652.71	-198.96	126.42	+/-Z	1788	294	6
6	666.77	-169.52	126.42	+/-Z	1153	294	4
7	673.63	-222.49	126.42	+/-Z	1057	147	7
8	674.96	-239.53	126.42	+/-Z	1103	147	8
9	678.92	-196	126.42	+/-Z	324	294	1
10	692.02	-224.82	126.42	+/-Z	-124	294	0
11	698.37	-183.24	126.42	+/-Z	-318	294	-1
12	707.1	-210.1	126.42	+/-Z	154	294	1
13	636.98	-211.95	126.42	+/-Z	323	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 30

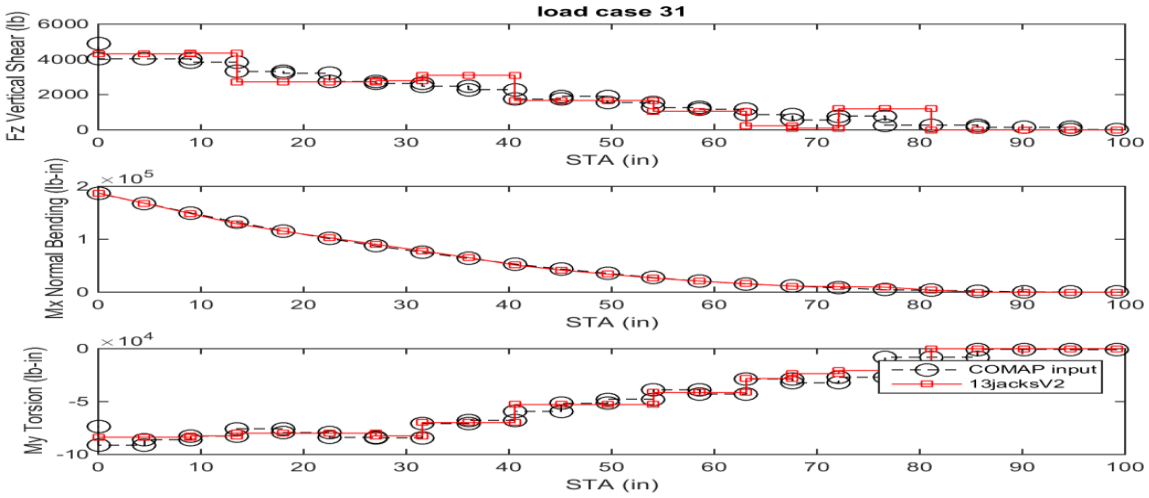
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1575	294	5
2	617.45	-190.36	126.42	+/-Z	418	294	1
3	630.22	-168.44	126.42	+/-Z	1285	294	4
4	655.02	-230.98	126.42	+/-Z	966	147	7
5	652.71	-198.96	126.42	+/-Z	3946	294	13
6	666.77	-169.52	126.42	+/-Z	1499	294	5
7	673.63	-222.49	126.42	+/-Z	1149	147	8
8	674.96	-239.53	126.42	+/-Z	1440	147	10
9	678.92	-196	126.42	+/-Z	-228	294	-1
10	692.02	-224.82	126.42	+/-Z	-351	294	-1
11	698.37	-183.24	126.42	+/-Z	-671	294	-2
12	707.1	-210.1	126.42	+/-Z	121	294	0
13	636.98	-211.95	126.42	+/-Z	698	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 31

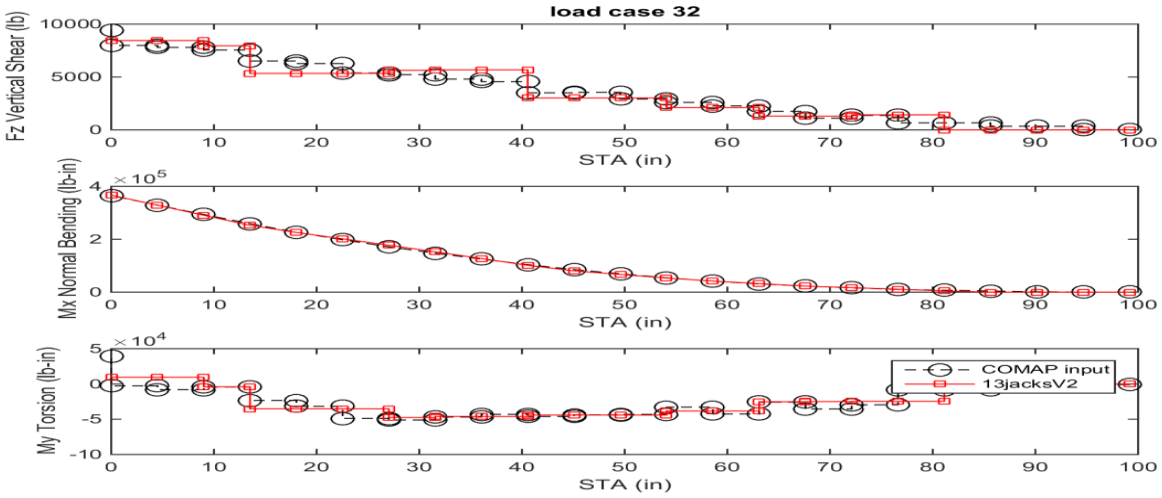
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	178	294	1
2	617.45	-190.36	126.42	+/-Z	-314	294	-1
3	630.22	-168.44	126.42	+/-Z	-42	294	0
4	655.02	-230.98	126.42	+/-Z	-1100	147	-7
5	652.71	-198.96	126.42	+/-Z	509	294	2
6	666.77	-169.52	126.42	+/-Z	1453	294	5
7	673.63	-222.49	126.42	+/-Z	827	147	6
8	674.96	-239.53	126.42	+/-Z	1195	147	8
9	678.92	-196	126.42	+/-Z	918	294	3
10	692.02	-224.82	126.42	+/-Z	134	294	0
11	698.37	-183.24	126.42	+/-Z	-61	294	0
12	707.1	-210.1	126.42	+/-Z	342	294	1
13	636.98	-211.95	126.42	+/-Z	271	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 32

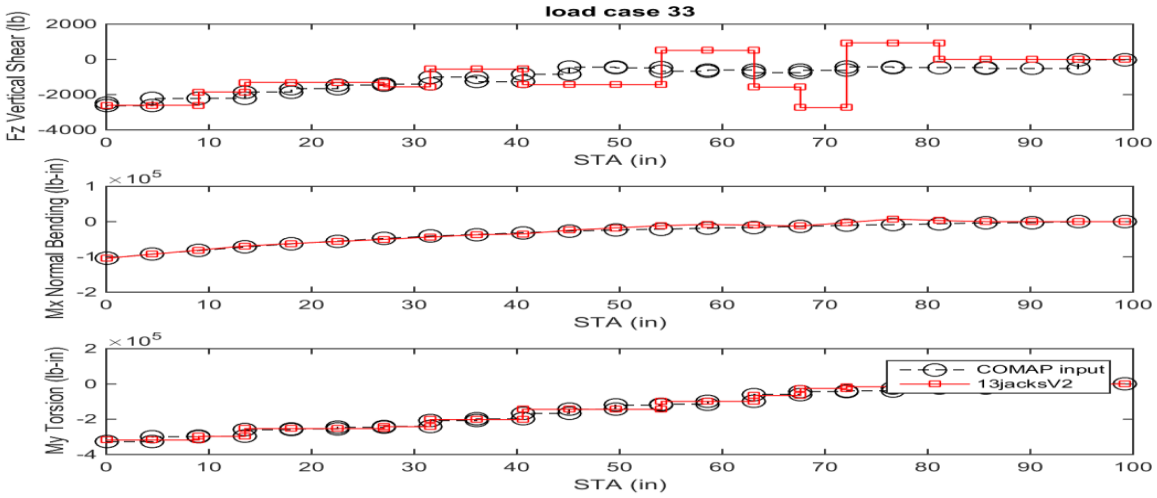
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	795	294	3
2	617.45	-190.36	126.42	+/-Z	-38	294	0
3	630.22	-168.44	126.42	+/-Z	493	294	2
4	655.02	-230.98	126.42	+/-Z	-134	147	-1
5	652.71	-198.96	126.42	+/-Z	2086	294	7
6	666.77	-169.52	126.42	+/-Z	1816	294	6
7	673.63	-222.49	126.42	+/-Z	821	147	6
8	674.96	-239.53	126.42	+/-Z	1420	147	10
9	678.92	-196	126.42	+/-Z	571	294	2
10	692.02	-224.82	126.42	+/-Z	8	294	0
11	698.37	-183.24	126.42	+/-Z	-300	294	-1
12	707.1	-210.1	126.42	+/-Z	346	294	1
13	636.98	-211.95	126.42	+/-Z	554	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 33

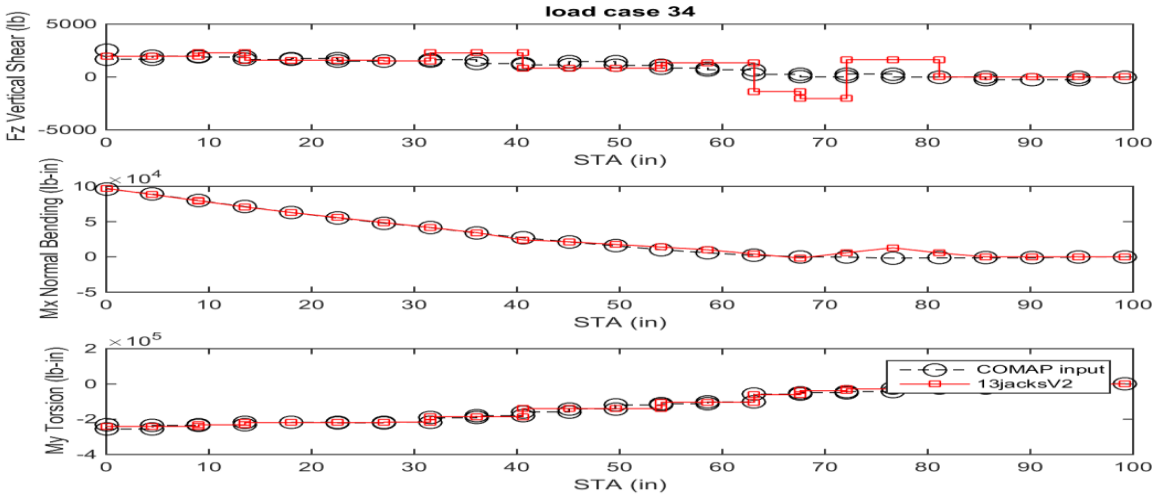
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-710	294	-2
2	617.45	-190.36	126.42	+/-Z	-1012	294	-3
3	630.22	-168.44	126.42	+/-Z	-750	294	-3
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-1501	294	-5
6	666.77	-169.52	126.42	+/-Z	164	294	1
7	673.63	-222.49	126.42	+/-Z	2087	147	14
8	674.96	-239.53	126.42	+/-Z	937	147	6
9	678.92	-196	126.42	+/-Z	2385	294	8
10	692.02	-224.82	126.42	+/-Z	1158	294	4
11	698.37	-183.24	126.42	+/-Z	253	294	1
12	707.1	-210.1	126.42	+/-Z	68	294	0
13	636.98	-211.95	126.42	+/-Z	-2010	294	-7



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 34

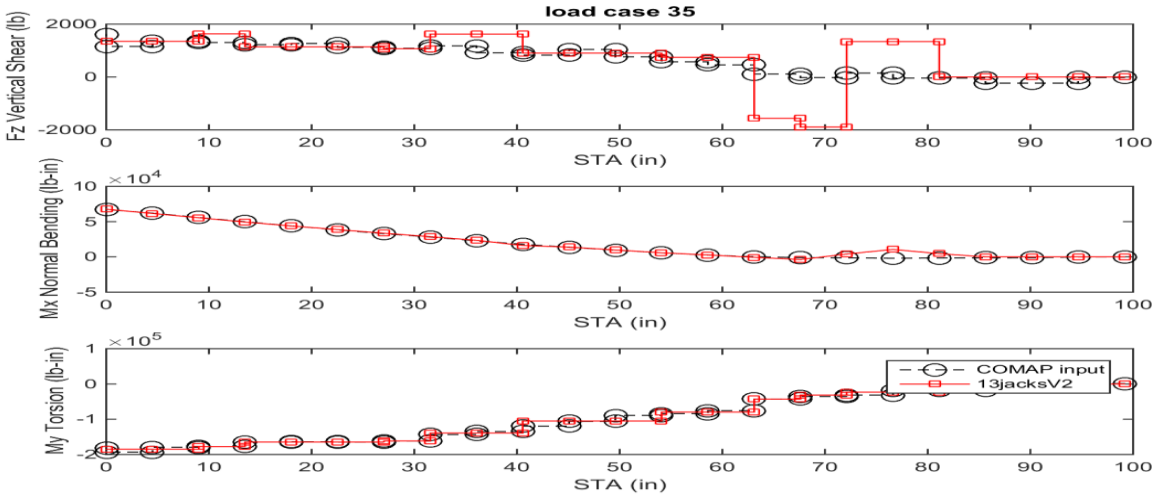
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-90	294	0
2	617.45	-190.36	126.42	+/-Z	-760	294	-3
3	630.22	-168.44	126.42	+/-Z	-336	294	-1
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-581	294	-2
6	666.77	-169.52	126.42	+/-Z	798	294	3
7	673.63	-222.49	126.42	+/-Z	2712	147	18
8	674.96	-239.53	126.42	+/-Z	1632	147	11
9	678.92	-196	126.42	+/-Z	2030	294	7
10	692.02	-224.82	126.42	+/-Z	667	294	2
11	698.37	-183.24	126.42	+/-Z	66	294	0
12	707.1	-210.1	126.42	+/-Z	360	294	1
13	636.98	-211.95	126.42	+/-Z	-868	294	-3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 35

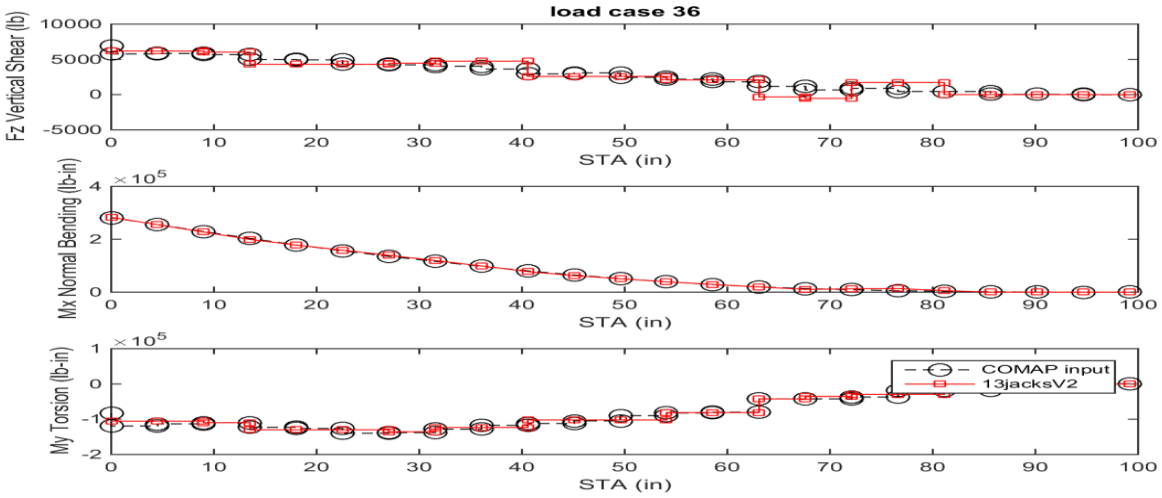
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-120	294	0
2	617.45	-190.36	126.42	+/-Z	-555	294	-2
3	630.22	-168.44	126.42	+/-Z	-282	294	-1
4	655.02	-230.98	126.42	+/-Z	-3234	147	-22
5	652.71	-198.96	126.42	+/-Z	-726	294	-2
6	666.77	-169.52	126.42	+/-Z	608	294	2
7	673.63	-222.49	126.42	+/-Z	2306	147	16
8	674.96	-239.53	126.42	+/-Z	1339	147	9
9	678.92	-196	126.42	+/-Z	1446	294	5
10	692.02	-224.82	126.42	+/-Z	333	294	1
11	698.37	-183.24	126.42	+/-Z	75	294	0
12	707.1	-210.1	126.42	+/-Z	403	294	1
13	636.98	-211.95	126.42	+/-Z	-246	294	-1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 36

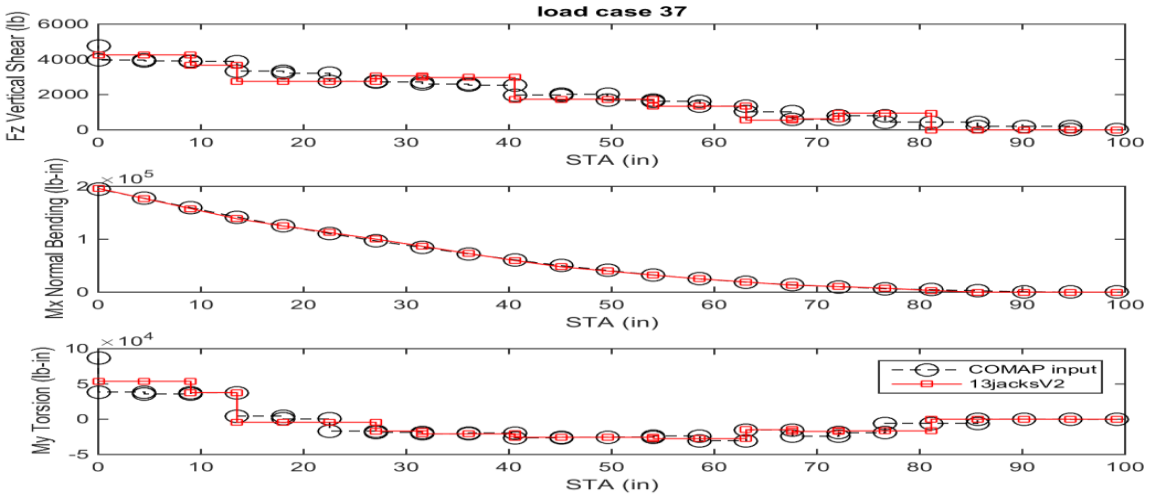
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	520	294	2
2	617.45	-190.36	126.42	+/-Z	-307	294	-1
3	630.22	-168.44	126.42	+/-Z	156	294	1
4	655.02	-230.98	126.42	+/-Z	-2254	147	-15
5	652.71	-198.96	126.42	+/-Z	949	294	3
6	666.77	-169.52	126.42	+/-Z	1205	294	4
7	673.63	-222.49	126.42	+/-Z	2430	147	17
8	674.96	-239.53	126.42	+/-Z	1710	147	12
9	678.92	-196	126.42	+/-Z	1216	294	4
10	692.02	-224.82	126.42	+/-Z	200	294	1
11	698.37	-183.24	126.42	+/-Z	-139	294	0
12	707.1	-210.1	126.42	+/-Z	444	294	2
13	636.98	-211.95	126.42	+/-Z	52	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 37

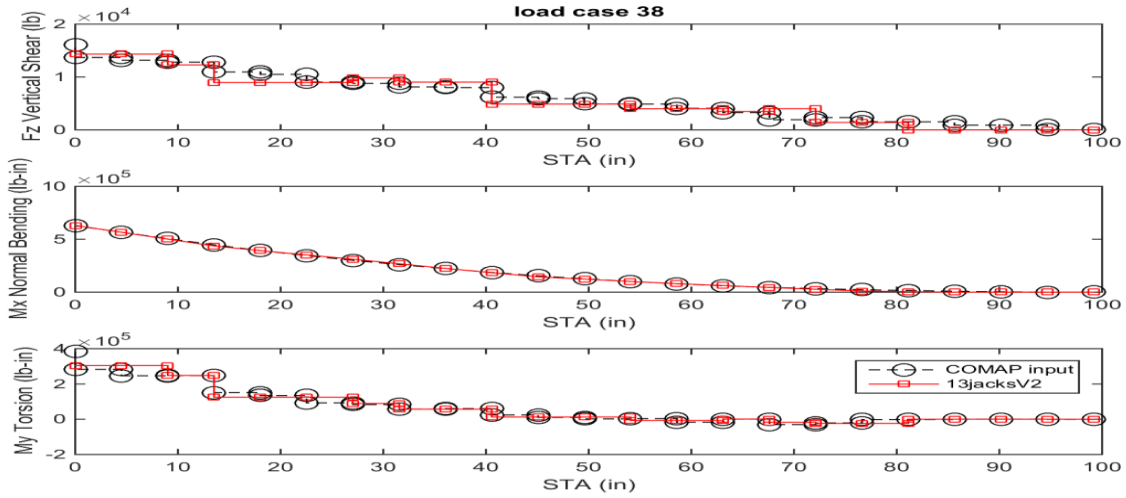
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	726	294	2
2	617.45	-190.36	126.42	+/-Z	92	294	0
3	630.22	-168.44	126.42	+/-Z	585	294	2
4	655.02	-230.98	126.42	+/-Z	-325	147	-2
5	652.71	-198.96	126.42	+/-Z	1192	294	4
6	666.77	-169.52	126.42	+/-Z	189	294	1
7	673.63	-222.49	126.42	+/-Z	785	147	5
8	674.96	-239.53	126.42	+/-Z	950	147	6
9	678.92	-196	126.42	+/-Z	38	294	0
10	692.02	-224.82	126.42	+/-Z	-70	294	0
11	698.37	-183.24	126.42	+/-Z	-307	294	-1
12	707.1	-210.1	126.42	+/-Z	91	294	0
13	636.98	-211.95	126.42	+/-Z	306	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 38

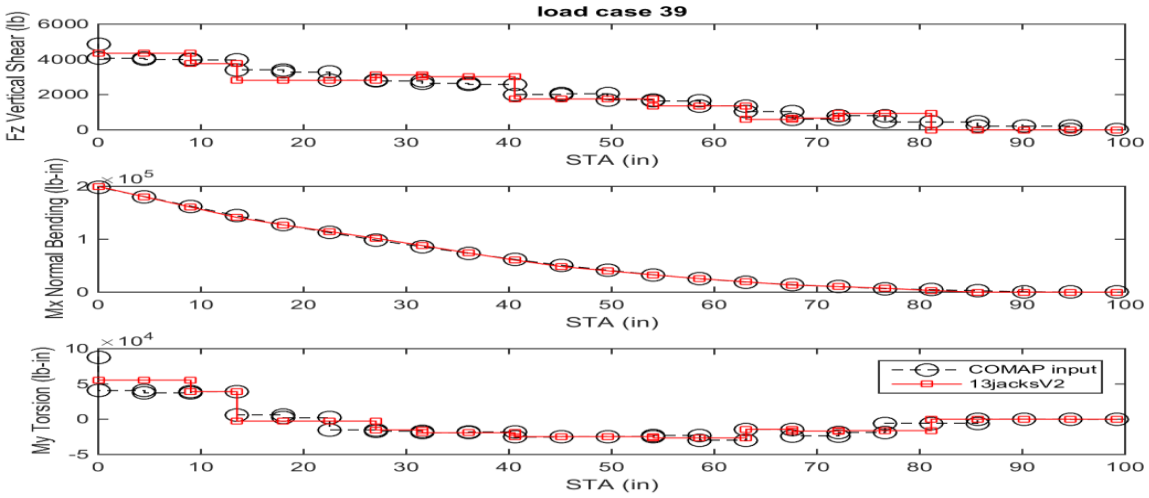
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2211	294	8
2	617.45	-190.36	126.42	+/-Z	800	294	3
3	630.22	-168.44	126.42	+/-Z	2050	294	7
4	655.02	-230.98	126.42	+/-Z	2615	147	18
5	652.71	-198.96	126.42	+/-Z	5071	294	17
6	666.77	-169.52	126.42	+/-Z	1116	294	4
7	673.63	-222.49	126.42	+/-Z	518	147	4
8	674.96	-239.53	126.42	+/-Z	1398	147	10
9	678.92	-196	126.42	+/-Z	-924	294	-3
10	692.02	-224.82	126.42	+/-Z	-535	294	-2
11	698.37	-183.24	126.42	+/-Z	-876	294	-3
12	707.1	-210.1	126.42	+/-Z	-21	294	0
13	636.98	-211.95	126.42	+/-Z	903	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 39

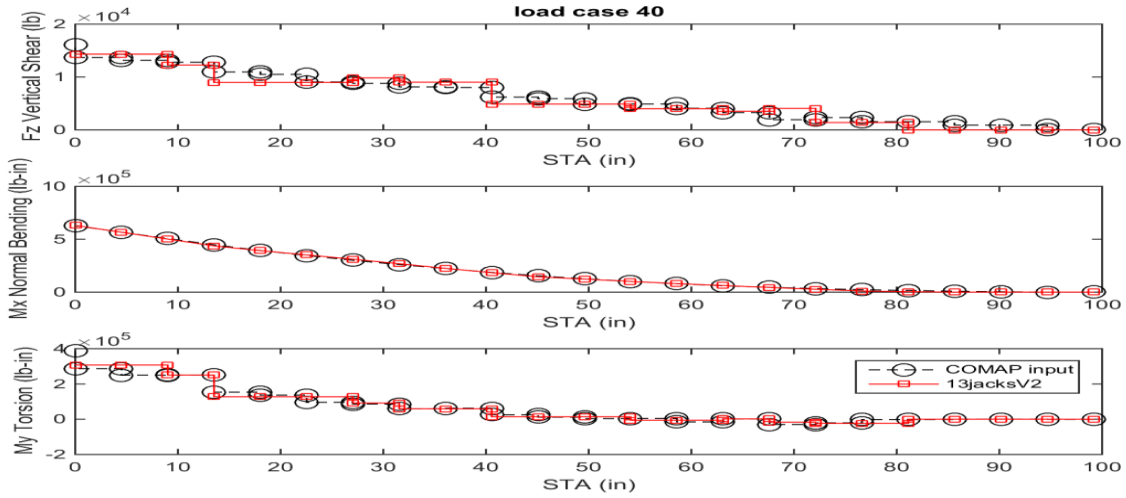
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	727	294	2
2	617.45	-190.36	126.42	+/-Z	99	294	0
3	630.22	-168.44	126.42	+/-Z	588	294	2
4	655.02	-230.98	126.42	+/-Z	-268	147	-2
5	652.71	-198.96	126.42	+/-Z	1236	294	4
6	666.77	-169.52	126.42	+/-Z	221	294	1
7	673.63	-222.49	126.42	+/-Z	766	147	5
8	674.96	-239.53	126.42	+/-Z	934	147	6
9	678.92	-196	126.42	+/-Z	28	294	0
10	692.02	-224.82	126.42	+/-Z	-75	294	0
11	698.37	-183.24	126.42	+/-Z	-307	294	-1
12	707.1	-210.1	126.42	+/-Z	90	294	0
13	636.98	-211.95	126.42	+/-Z	308	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 40

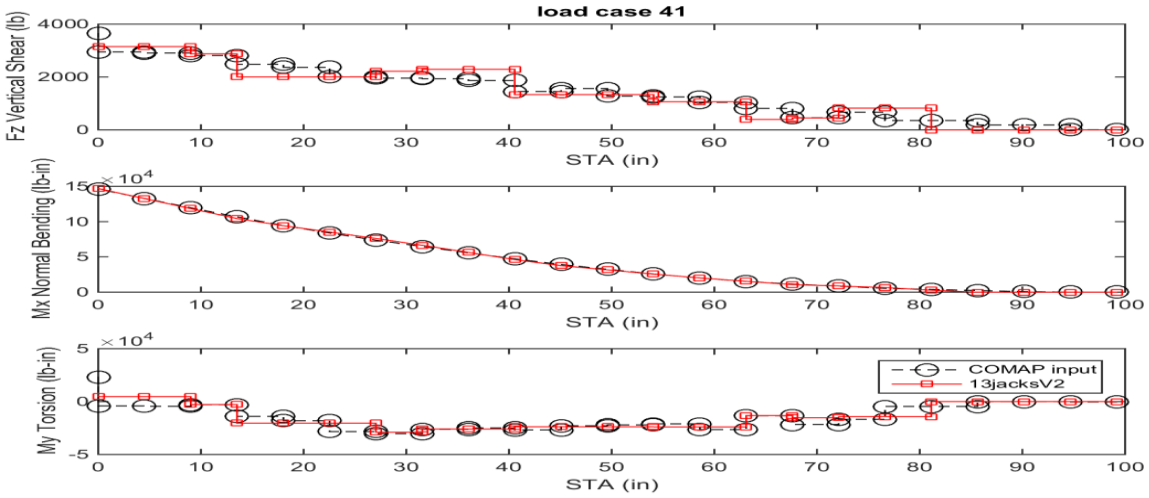
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2212	294	8
2	617.45	-190.36	126.42	+/-Z	812	294	3
3	630.22	-168.44	126.42	+/-Z	2062	294	7
4	655.02	-230.98	126.42	+/-Z	2677	147	18
5	652.71	-198.96	126.42	+/-Z	5086	294	17
6	666.77	-169.52	126.42	+/-Z	1092	294	4
7	673.63	-222.49	126.42	+/-Z	493	147	3
8	674.96	-239.53	126.42	+/-Z	1383	147	9
9	678.92	-196	126.42	+/-Z	-946	294	-3
10	692.02	-224.82	126.42	+/-Z	-547	294	-2
11	698.37	-183.24	126.42	+/-Z	-877	294	-3
12	707.1	-210.1	126.42	+/-Z	-28	294	0
13	636.98	-211.95	126.42	+/-Z	899	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 41

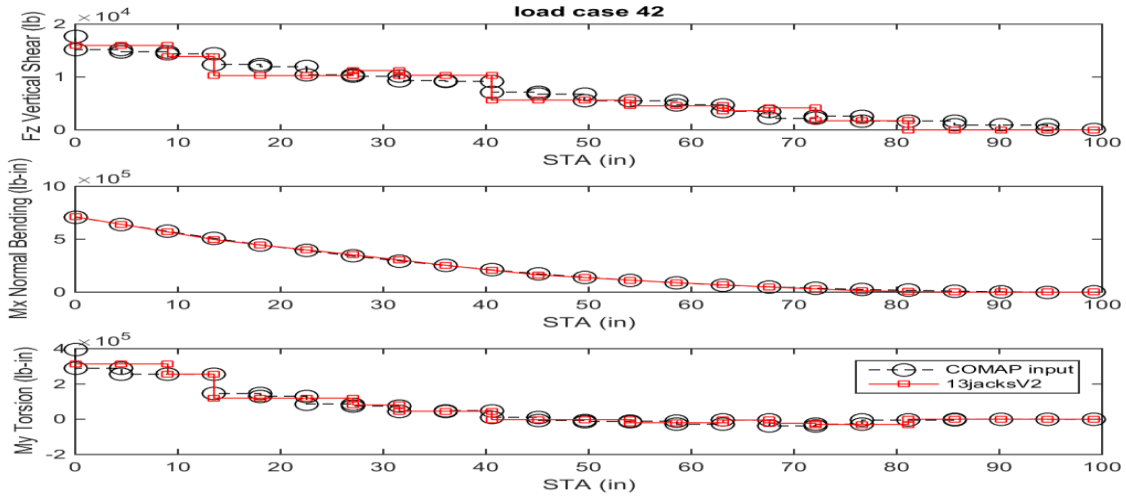
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	368	294	1
2	617.45	-190.36	126.42	+/-Z	-75	294	0
3	630.22	-168.44	126.42	+/-Z	276	294	1
4	655.02	-230.98	126.42	+/-Z	-371	147	-3
5	652.71	-198.96	126.42	+/-Z	699	294	2
6	666.77	-169.52	126.42	+/-Z	501	294	2
7	673.63	-222.49	126.42	+/-Z	667	147	5
8	674.96	-239.53	126.42	+/-Z	822	147	6
9	678.92	-196	126.42	+/-Z	257	294	1
10	692.02	-224.82	126.42	+/-Z	-57	294	0
11	698.37	-183.24	126.42	+/-Z	-209	294	-1
12	707.1	-210.1	126.42	+/-Z	79	294	0
13	636.98	-211.95	126.42	+/-Z	193	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 42

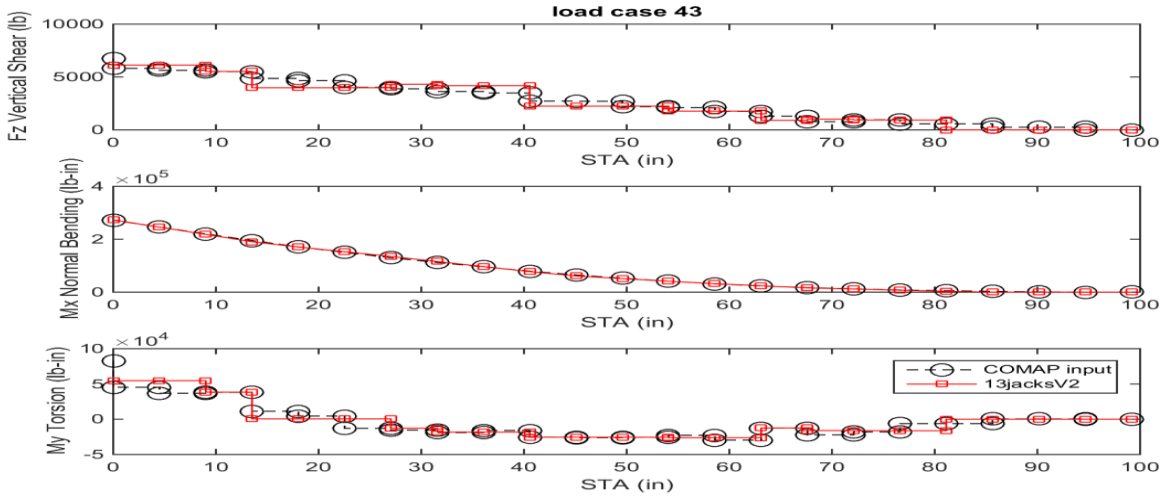
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2434	294	8
2	617.45	-190.36	126.42	+/-Z	894	294	3
3	630.22	-168.44	126.42	+/-Z	2104	294	7
4	655.02	-230.98	126.42	+/-Z	2437	147	17
5	652.71	-198.96	126.42	+/-Z	5627	294	19
6	666.77	-169.52	126.42	+/-Z	1147	294	4
7	673.63	-222.49	126.42	+/-Z	951	147	6
8	674.96	-239.53	126.42	+/-Z	1720	147	12
9	678.92	-196	126.42	+/-Z	-936	294	-3
10	692.02	-224.82	126.42	+/-Z	-545	294	-2
11	698.37	-183.24	126.42	+/-Z	-941	294	-3
12	707.1	-210.1	126.42	+/-Z	63	294	0
13	636.98	-211.95	126.42	+/-Z	998	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 43

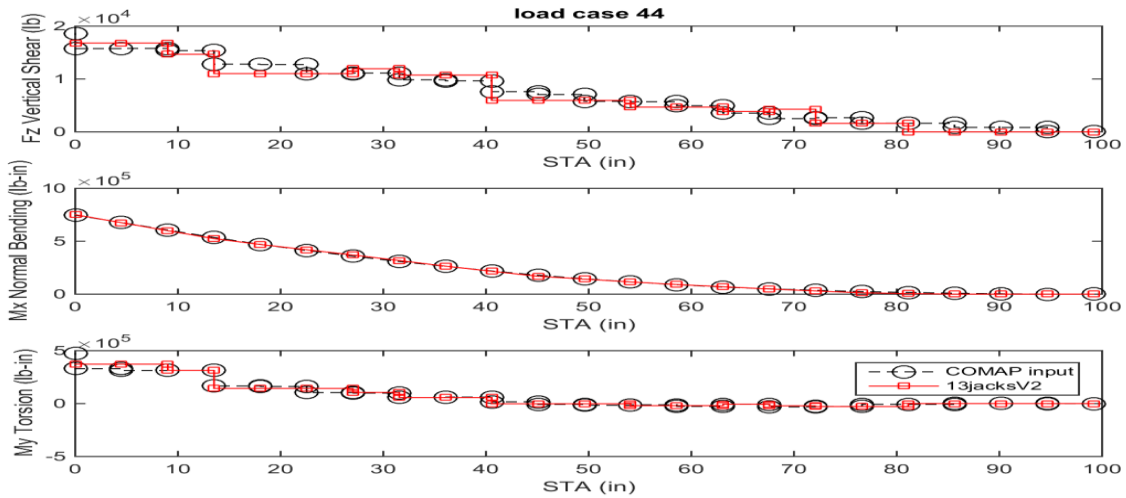
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	750	294	3
2	617.45	-190.36	126.42	+/-Z	132	294	0
3	630.22	-168.44	126.42	+/-Z	595	294	2
4	655.02	-230.98	126.42	+/-Z	66	147	0
5	652.71	-198.96	126.42	+/-Z	1856	294	6
6	666.77	-169.52	126.42	+/-Z	795	294	3
7	673.63	-222.49	126.42	+/-Z	875	147	6
8	674.96	-239.53	126.42	+/-Z	937	147	6
9	678.92	-196	126.42	+/-Z	80	294	0
10	692.02	-224.82	126.42	+/-Z	-107	294	0
11	698.37	-183.24	126.42	+/-Z	-327	294	-1
12	707.1	-210.1	126.42	+/-Z	125	294	0
13	636.98	-211.95	126.42	+/-Z	341	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 44

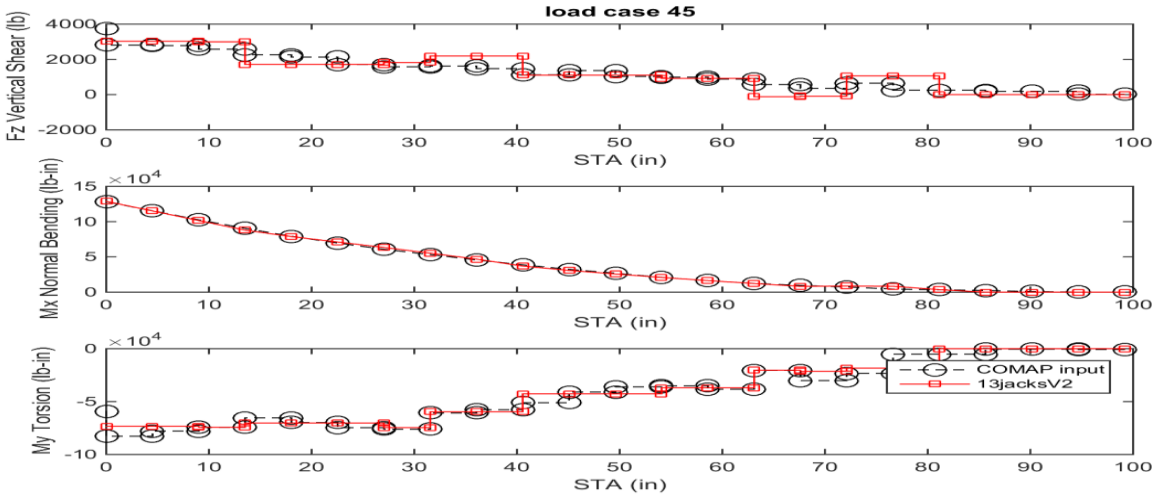
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2953	294	10
2	617.45	-190.36	126.42	+/-Z	1199	294	4
3	630.22	-168.44	126.42	+/-Z	2122	294	7
4	655.02	-230.98	126.42	+/-Z	2666	147	18
5	652.71	-198.96	126.42	+/-Z	6137	294	21
6	666.77	-169.52	126.42	+/-Z	696	294	2
7	673.63	-222.49	126.42	+/-Z	834	147	6
8	674.96	-239.53	126.42	+/-Z	1619	147	11
9	678.92	-196	126.42	+/-Z	-1353	294	-5
10	692.02	-224.82	126.42	+/-Z	-436	294	-1
11	698.37	-183.24	126.42	+/-Z	-917	294	-3
12	707.1	-210.1	126.42	+/-Z	117	294	0
13	636.98	-211.95	126.42	+/-Z	1151	294	4



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 45

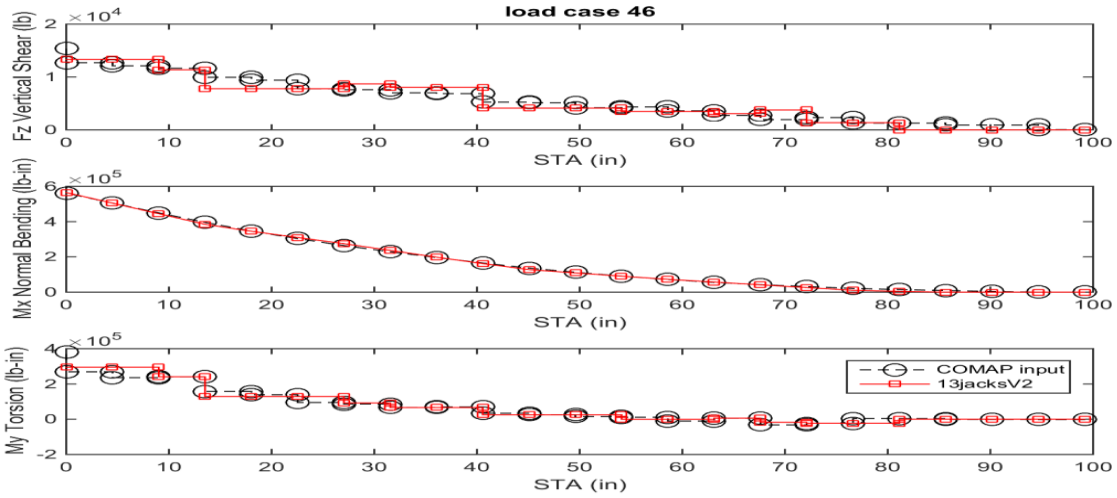
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	112	294	0
2	617.45	-190.36	126.42	+/-Z	-372	294	-1
3	630.22	-168.44	126.42	+/-Z	31	294	0
4	655.02	-230.98	126.42	+/-Z	-1147	147	-8
5	652.71	-198.96	126.42	+/-Z	235	294	1
6	666.77	-169.52	126.42	+/-Z	1170	294	4
7	673.63	-222.49	126.42	+/-Z	1038	147	7
8	674.96	-239.53	126.42	+/-Z	1059	147	7
9	678.92	-196	126.42	+/-Z	851	294	3
10	692.02	-224.82	126.42	+/-Z	-29	294	0
11	698.37	-183.24	126.42	+/-Z	-106	294	0
12	707.1	-210.1	126.42	+/-Z	135	294	0
13	636.98	-211.95	126.42	+/-Z	49	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 46

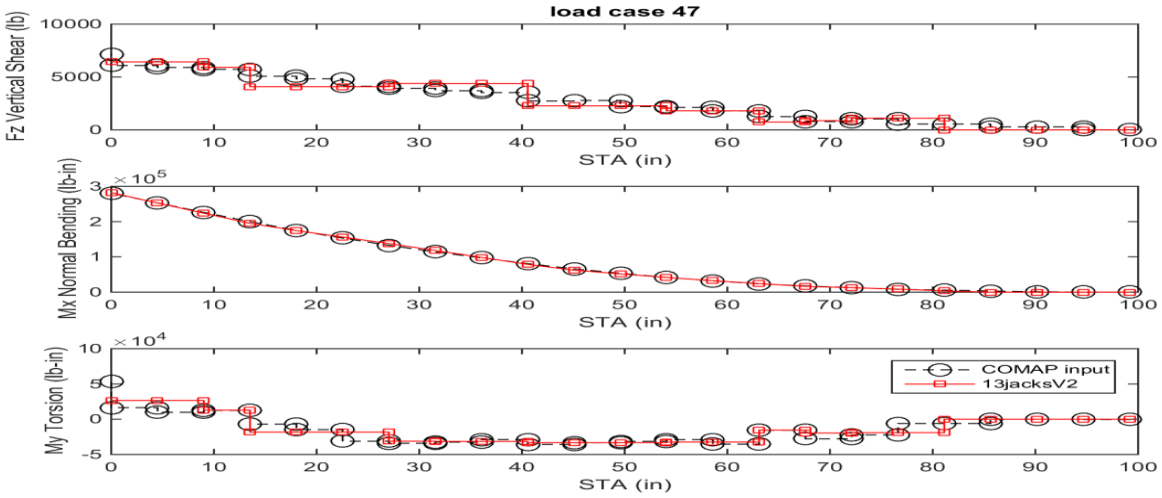
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2083	294	7
2	617.45	-190.36	126.42	+/-Z	644	294	2
3	630.22	-168.44	126.42	+/-Z	1978	294	7
4	655.02	-230.98	126.42	+/-Z	2402	147	16
5	652.71	-198.96	126.42	+/-Z	4743	294	16
6	666.77	-169.52	126.42	+/-Z	1494	294	5
7	673.63	-222.49	126.42	+/-Z	395	147	3
8	674.96	-239.53	126.42	+/-Z	1355	147	9
9	678.92	-196	126.42	+/-Z	-824	294	-3
10	692.02	-224.82	126.42	+/-Z	-678	294	-2
11	698.37	-183.24	126.42	+/-Z	-905	294	-3
12	707.1	-210.1	126.42	+/-Z	-175	294	-1
13	636.98	-211.95	126.42	+/-Z	819	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 47

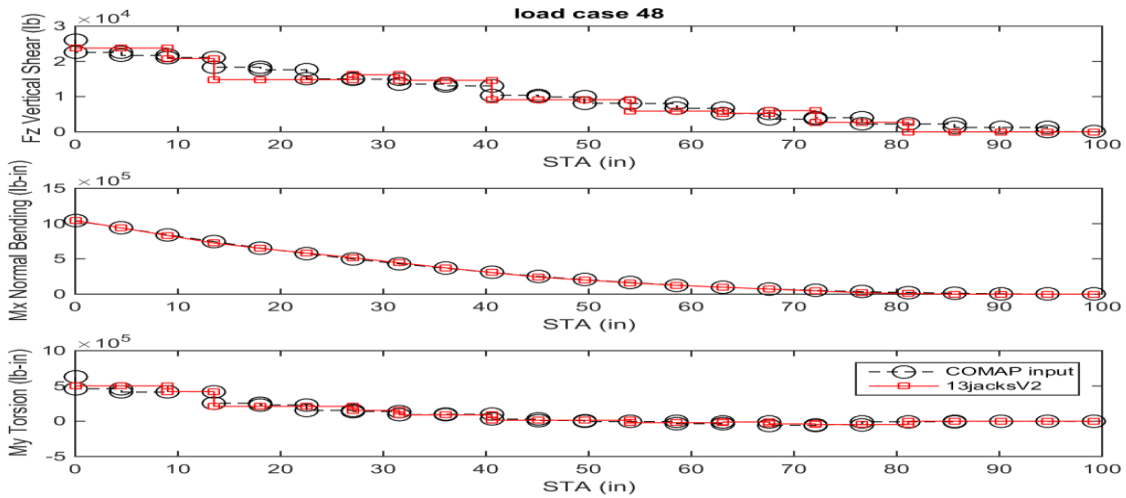
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	690	294	2
2	617.45	-190.36	126.42	+/-Z	8	294	0
3	630.22	-168.44	126.42	+/-Z	502	294	2
4	655.02	-230.98	126.42	+/-Z	-234	147	-2
5	652.71	-198.96	126.42	+/-Z	1785	294	6
6	666.77	-169.52	126.42	+/-Z	1152	294	4
7	673.63	-222.49	126.42	+/-Z	1056	147	7
8	674.96	-239.53	126.42	+/-Z	1101	147	7
9	678.92	-196	126.42	+/-Z	326	294	1
10	692.02	-224.82	126.42	+/-Z	-123	294	0
11	698.37	-183.24	126.42	+/-Z	-318	294	-1
12	707.1	-210.1	126.42	+/-Z	154	294	1
13	636.98	-211.95	126.42	+/-Z	323	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 48

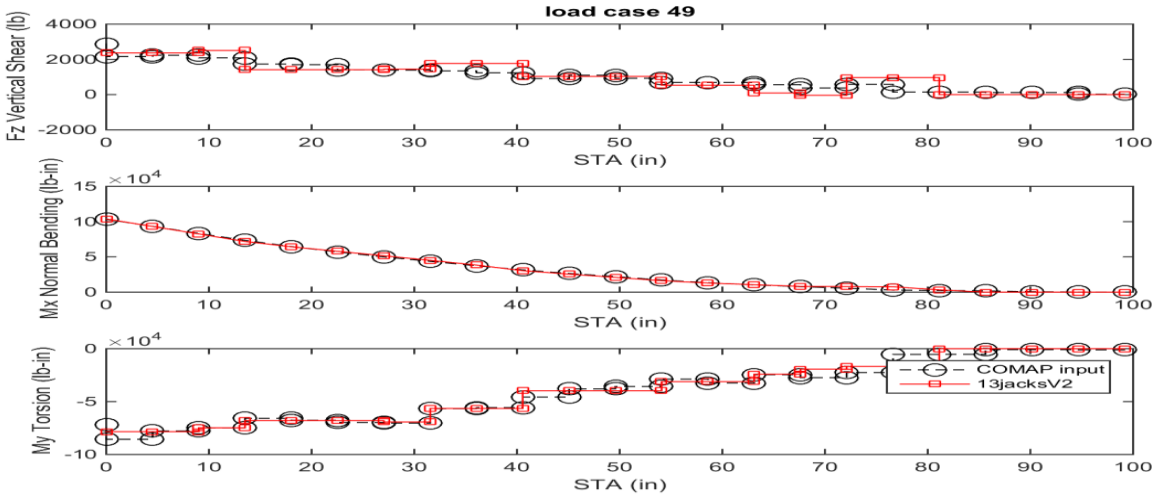
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3792	294	13
2	617.45	-190.36	126.42	+/-Z	1581	294	5
3	630.22	-168.44	126.42	+/-Z	2992	294	10
4	655.02	-230.98	126.42	+/-Z	3347	147	23
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	2197	294	7
7	673.63	-222.49	126.42	+/-Z	636	147	4
8	674.96	-239.53	126.42	+/-Z	2688	147	18
9	678.92	-196	126.42	+/-Z	-1865	294	-6
10	692.02	-224.82	126.42	+/-Z	-787	294	-3
11	698.37	-183.24	126.42	+/-Z	-1414	294	-5
12	707.1	-210.1	126.42	+/-Z	464	294	2
13	636.98	-211.95	126.42	+/-Z	2788	294	9



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 49

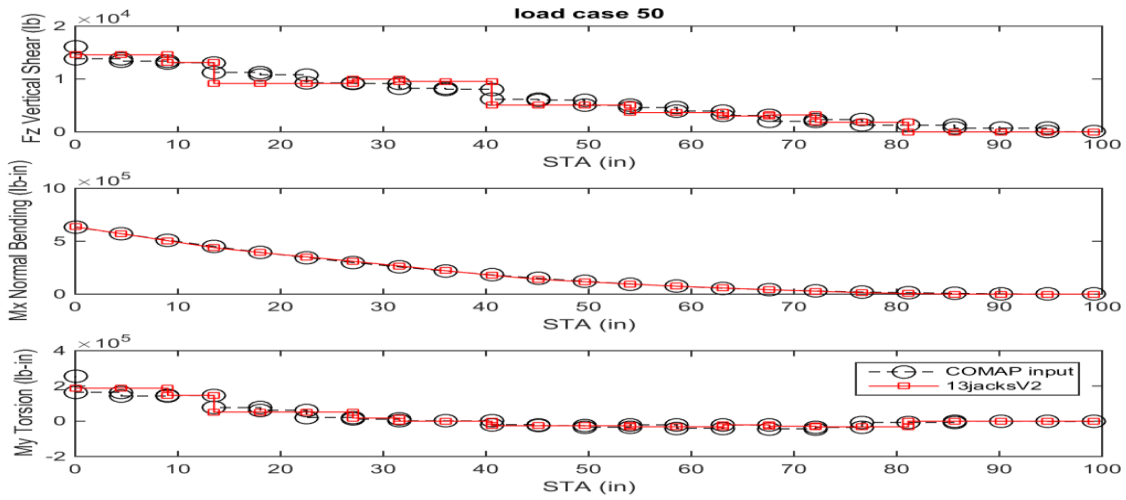
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	45	294	0
2	617.45	-190.36	126.42	+/-Z	-318	294	-1
3	630.22	-168.44	126.42	+/-Z	-134	294	0
4	655.02	-230.98	126.42	+/-Z	-1010	147	-7
5	652.71	-198.96	126.42	+/-Z	-44	294	0
6	666.77	-169.52	126.42	+/-Z	1043	294	4
7	673.63	-222.49	126.42	+/-Z	441	147	3
8	674.96	-239.53	126.42	+/-Z	966	147	7
9	678.92	-196	126.42	+/-Z	777	294	3
10	692.02	-224.82	126.42	+/-Z	138	294	0
11	698.37	-183.24	126.42	+/-Z	-33	294	0
12	707.1	-210.1	126.42	+/-Z	269	294	1
13	636.98	-211.95	126.42	+/-Z	228	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 50

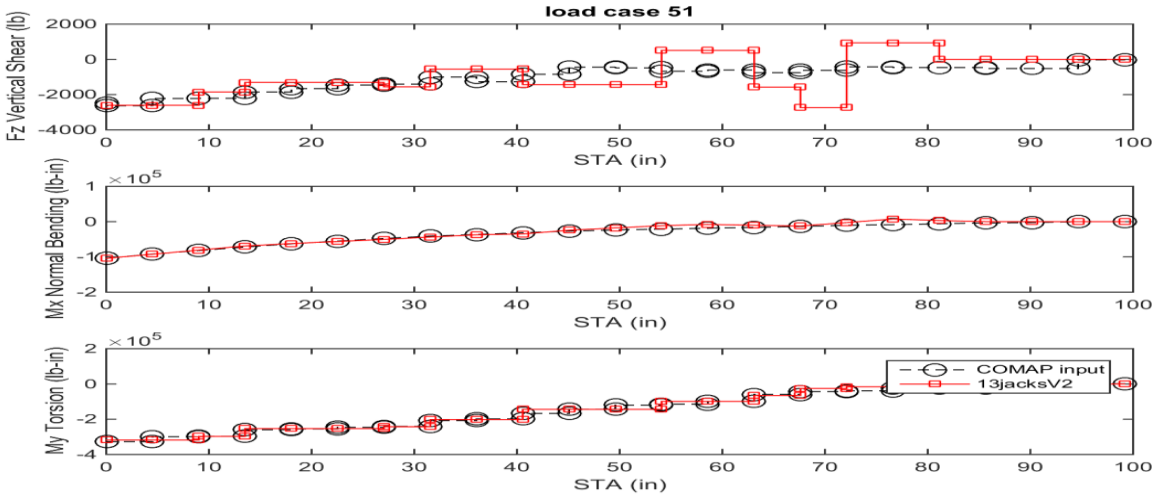
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1879	294	6
2	617.45	-190.36	126.42	+/-Z	452	294	2
3	630.22	-168.44	126.42	+/-Z	1476	294	5
4	655.02	-230.98	126.42	+/-Z	1378	147	9
5	652.71	-198.96	126.42	+/-Z	4626	294	16
6	666.77	-169.52	126.42	+/-Z	2076	294	7
7	673.63	-222.49	126.42	+/-Z	669	147	5
8	674.96	-239.53	126.42	+/-Z	1831	147	12
9	678.92	-196	126.42	+/-Z	-147	294	0
10	692.02	-224.82	126.42	+/-Z	-217	294	-1
11	698.37	-183.24	126.42	+/-Z	-836	294	-3
12	707.1	-210.1	126.42	+/-Z	333	294	1
13	636.98	-211.95	126.42	+/-Z	1067	294	4



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 51

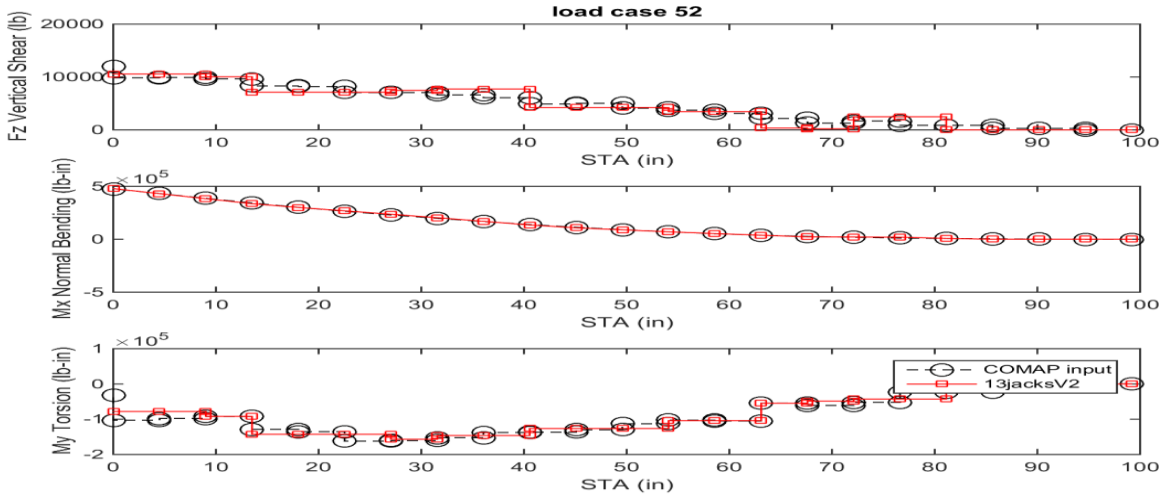
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-710	294	-2
2	617.45	-190.36	126.42	+/-Z	-1012	294	-3
3	630.22	-168.44	126.42	+/-Z	-750	294	-3
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-1501	294	-5
6	666.77	-169.52	126.42	+/-Z	164	294	1
7	673.63	-222.49	126.42	+/-Z	2087	147	14
8	674.96	-239.53	126.42	+/-Z	937	147	6
9	678.92	-196	126.42	+/-Z	2385	294	8
10	692.02	-224.82	126.42	+/-Z	1158	294	4
11	698.37	-183.24	126.42	+/-Z	253	294	1
12	707.1	-210.1	126.42	+/-Z	68	294	0
13	636.98	-211.95	126.42	+/-Z	-2010	294	-7



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 52

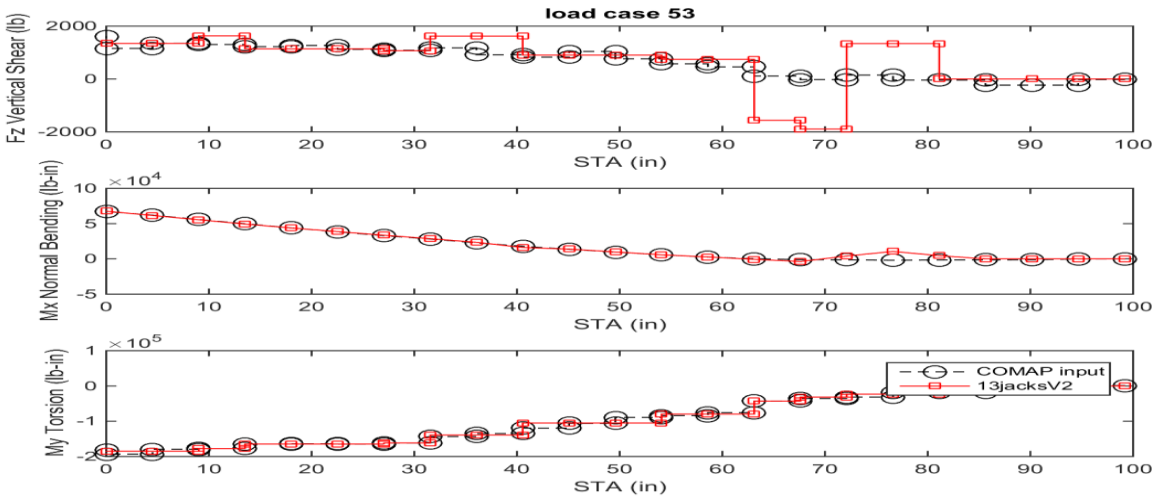
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1123	294	4
2	617.45	-190.36	126.42	+/-Z	-266	294	-1
3	630.22	-168.44	126.42	+/-Z	505	294	2
4	655.02	-230.98	126.42	+/-Z	-2300	147	-16
5	652.71	-198.96	126.42	+/-Z	2077	294	7
6	666.77	-169.52	126.42	+/-Z	1821	294	6
7	673.63	-222.49	126.42	+/-Z	3093	147	21
8	674.96	-239.53	126.42	+/-Z	2476	147	17
9	678.92	-196	126.42	+/-Z	1412	294	5
10	692.02	-224.82	126.42	+/-Z	164	294	1
11	698.37	-183.24	126.42	+/-Z	-344	294	-1
12	707.1	-210.1	126.42	+/-Z	549	294	2
13	636.98	-211.95	126.42	+/-Z	237	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 53

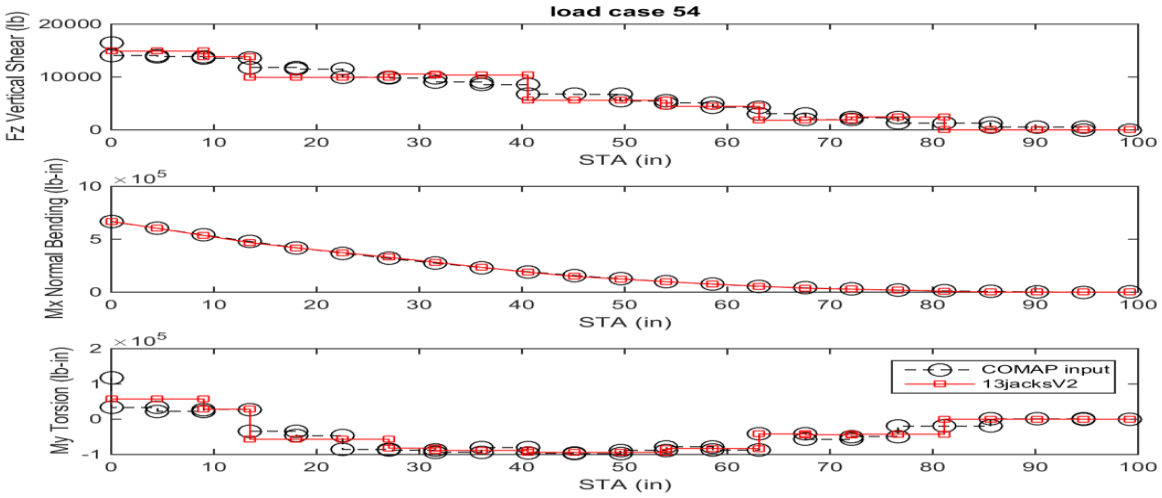
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-121	294	0
2	617.45	-190.36	126.42	+/-Z	-555	294	-2
3	630.22	-168.44	126.42	+/-Z	-282	294	-1
4	655.02	-230.98	126.42	+/-Z	-3234	147	-22
5	652.71	-198.96	126.42	+/-Z	-726	294	-2
6	666.77	-169.52	126.42	+/-Z	607	294	2
7	673.63	-222.49	126.42	+/-Z	2306	147	16
8	674.96	-239.53	126.42	+/-Z	1339	147	9
9	678.92	-196	126.42	+/-Z	1446	294	5
10	692.02	-224.82	126.42	+/-Z	333	294	1
11	698.37	-183.24	126.42	+/-Z	75	294	0
12	707.1	-210.1	126.42	+/-Z	403	294	1
13	636.98	-211.95	126.42	+/-Z	-246	294	-1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 54

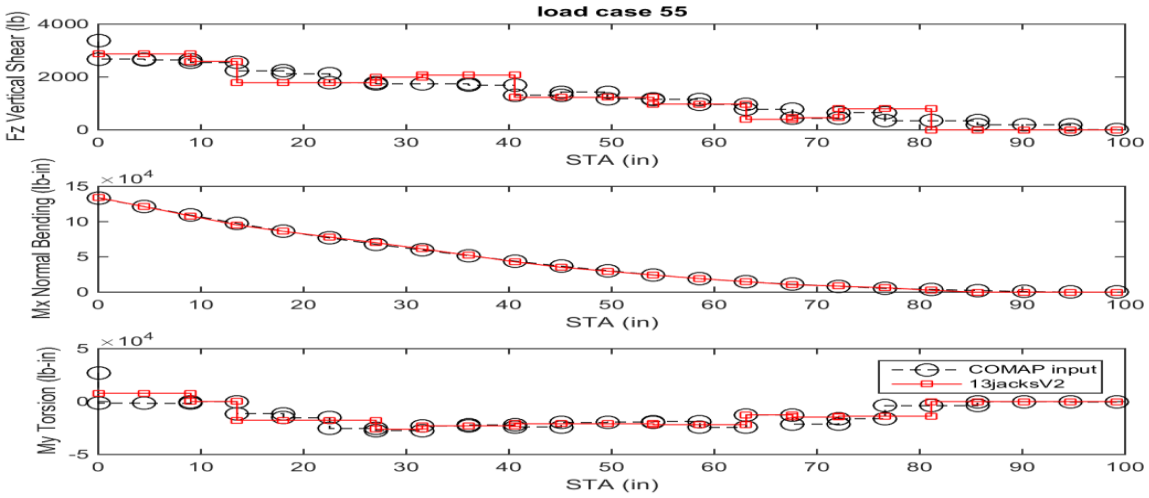
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1740	294	6
2	617.45	-190.36	126.42	+/-Z	169	294	1
3	630.22	-168.44	126.42	+/-Z	1058	294	4
4	655.02	-230.98	126.42	+/-Z	-554	147	-4
5	652.71	-198.96	126.42	+/-Z	4088	294	14
6	666.77	-169.52	126.42	+/-Z	2167	294	7
7	673.63	-222.49	126.42	+/-Z	2605	147	18
8	674.96	-239.53	126.42	+/-Z	2453	147	17
9	678.92	-196	126.42	+/-Z	697	294	2
10	692.02	-224.82	126.42	+/-Z	-73	294	0
11	698.37	-183.24	126.42	+/-Z	-619	294	-2
12	707.1	-210.1	126.42	+/-Z	496	294	2
13	636.98	-211.95	126.42	+/-Z	663	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 55

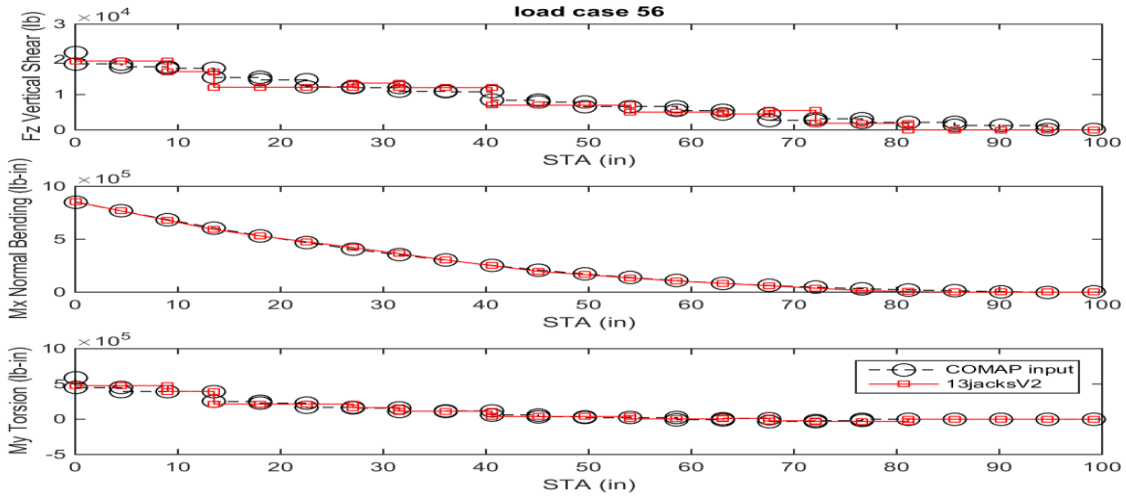
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	362	294	1
2	617.45	-190.36	126.42	+/-Z	-80	294	0
3	630.22	-168.44	126.42	+/-Z	282	294	1
4	655.02	-230.98	126.42	+/-Z	-337	147	-2
5	652.71	-198.96	126.42	+/-Z	612	294	2
6	666.77	-169.52	126.42	+/-Z	442	294	2
7	673.63	-222.49	126.42	+/-Z	578	147	4
8	674.96	-239.53	126.42	+/-Z	796	147	5
9	678.92	-196	126.42	+/-Z	232	294	1
10	692.02	-224.82	126.42	+/-Z	-61	294	0
11	698.37	-183.24	126.42	+/-Z	-208	294	-1
12	707.1	-210.1	126.42	+/-Z	63	294	0
13	636.98	-211.95	126.42	+/-Z	190	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 56

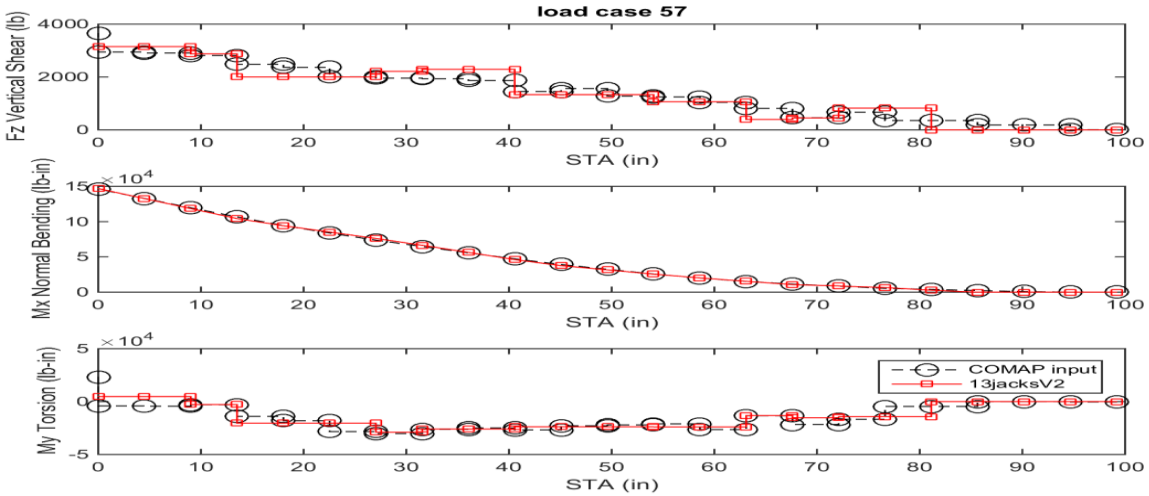
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3184	294	11
2	617.45	-190.36	126.42	+/-Z	1290	294	4
3	630.22	-168.44	126.42	+/-Z	3010	294	10
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	6816	294	23
6	666.77	-169.52	126.42	+/-Z	1266	294	4
7	673.63	-222.49	126.42	+/-Z	536	147	4
8	674.96	-239.53	126.42	+/-Z	1863	147	13
9	678.92	-196	126.42	+/-Z	-1847	294	-6
10	692.02	-224.82	126.42	+/-Z	-1035	294	-4
11	698.37	-183.24	126.42	+/-Z	-1196	294	-4
12	707.1	-210.1	126.42	+/-Z	69	294	0
13	636.98	-211.95	126.42	+/-Z	1899	294	6



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 57

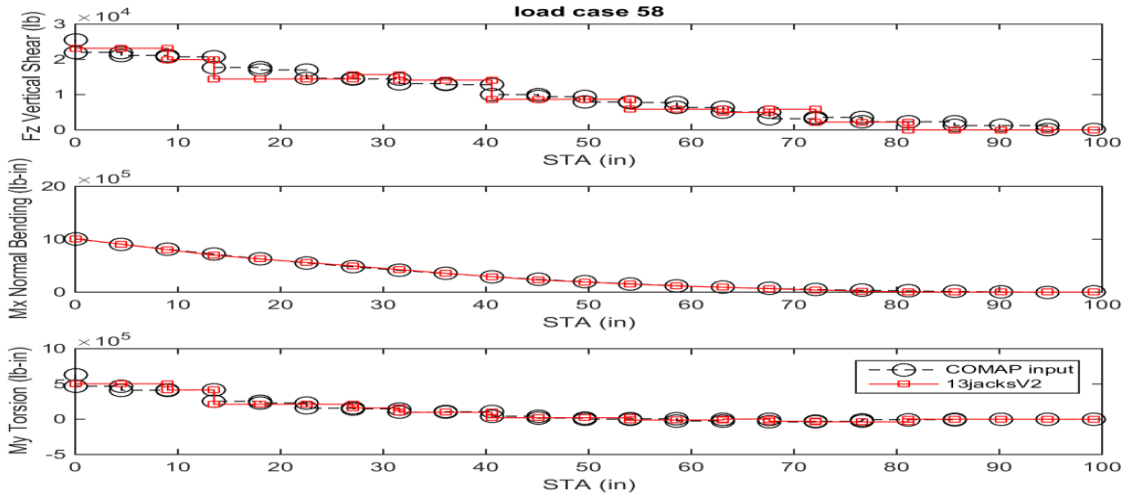
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	368	294	1
2	617.45	-190.36	126.42	+/-Z	-75	294	0
3	630.22	-168.44	126.42	+/-Z	276	294	1
4	655.02	-230.98	126.42	+/-Z	-371	147	-3
5	652.71	-198.96	126.42	+/-Z	699	294	2
6	666.77	-169.52	126.42	+/-Z	501	294	2
7	673.63	-222.49	126.42	+/-Z	667	147	5
8	674.96	-239.53	126.42	+/-Z	822	147	6
9	678.92	-196	126.42	+/-Z	257	294	1
10	692.02	-224.82	126.42	+/-Z	-57	294	0
11	698.37	-183.24	126.42	+/-Z	-209	294	-1
12	707.1	-210.1	126.42	+/-Z	79	294	0
13	636.98	-211.95	126.42	+/-Z	193	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 58

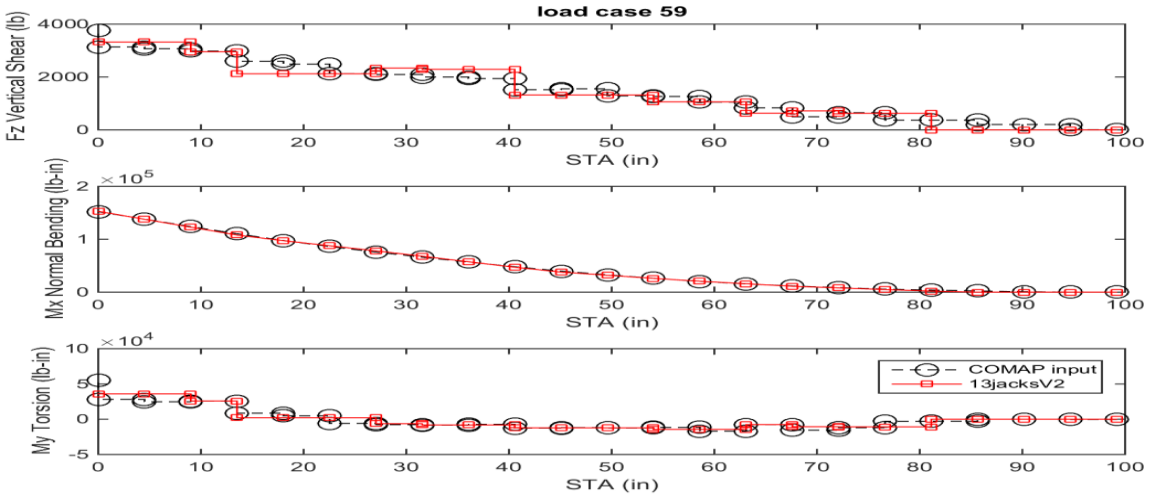
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3661	294	12
2	617.45	-190.36	126.42	+/-Z	1548	294	5
3	630.22	-168.44	126.42	+/-Z	3189	294	11
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	1872	294	6
7	673.63	-222.49	126.42	+/-Z	905	147	6
8	674.96	-239.53	126.42	+/-Z	2176	147	15
9	678.92	-196	126.42	+/-Z	-1895	294	-6
10	692.02	-224.82	126.42	+/-Z	-900	294	-3
11	698.37	-183.24	126.42	+/-Z	-1264	294	-4
12	707.1	-210.1	126.42	+/-Z	362	294	1
13	636.98	-211.95	126.42	+/-Z	2450	294	8



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 59

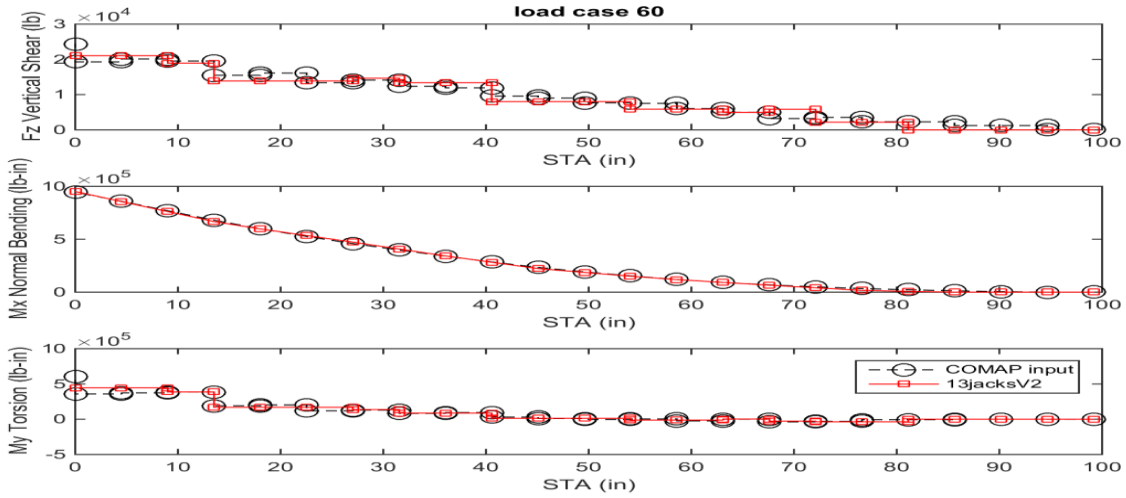
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	450	294	2
2	617.45	-190.36	126.42	+/-Z	45	294	0
3	630.22	-168.44	126.42	+/-Z	368	294	1
4	655.02	-230.98	126.42	+/-Z	91	147	1
5	652.71	-198.96	126.42	+/-Z	943	294	3
6	666.77	-169.52	126.42	+/-Z	380	294	1
7	673.63	-222.49	126.42	+/-Z	429	147	3
8	674.96	-239.53	126.42	+/-Z	625	147	4
9	678.92	-196	126.42	+/-Z	29	294	0
10	692.02	-224.82	126.42	+/-Z	-87	294	0
11	698.37	-183.24	126.42	+/-Z	-210	294	-1
12	707.1	-210.1	126.42	+/-Z	44	294	0
13	636.98	-211.95	126.42	+/-Z	215	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 60

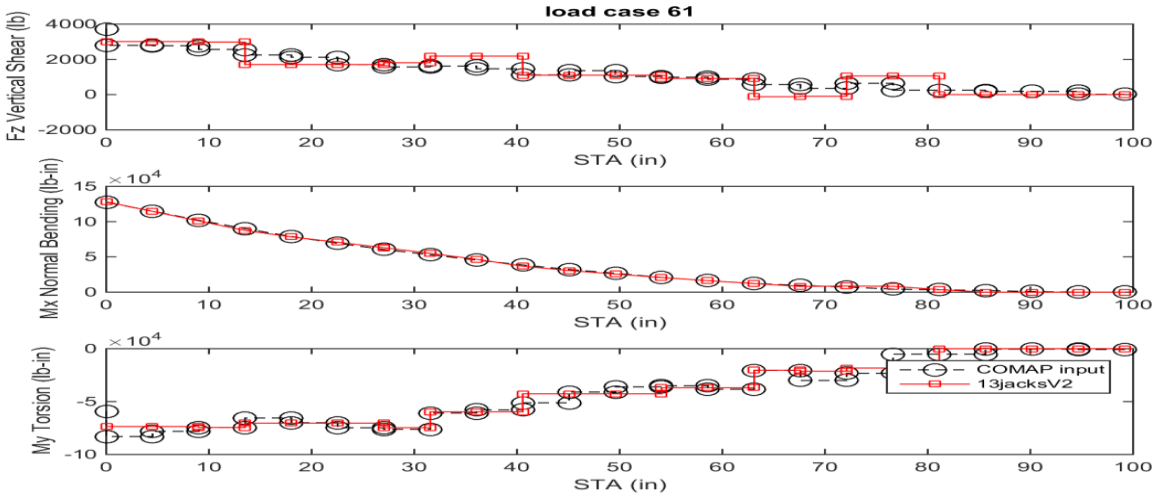
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3802	294	13
2	617.45	-190.36	126.42	+/-Z	1263	294	4
3	630.22	-168.44	126.42	+/-Z	2122	294	7
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7172	294	24
6	666.77	-169.52	126.42	+/-Z	1258	294	4
7	673.63	-222.49	126.42	+/-Z	914	147	6
8	674.96	-239.53	126.42	+/-Z	2166	147	15
9	678.92	-196	126.42	+/-Z	-1791	294	-6
10	692.02	-224.82	126.42	+/-Z	-877	294	-3
11	698.37	-183.24	126.42	+/-Z	-787	294	-3
12	707.1	-210.1	126.42	+/-Z	263	294	1
13	636.98	-211.95	126.42	+/-Z	1854	294	6



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 61

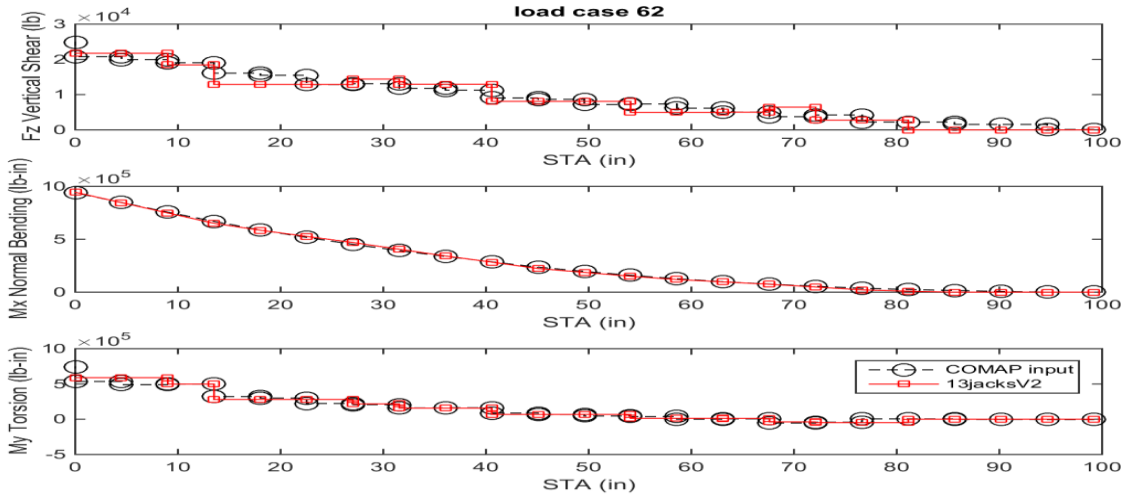
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	110	294	0
2	617.45	-190.36	126.42	+/-Z	-373	294	-1
3	630.22	-168.44	126.42	+/-Z	29	294	0
4	655.02	-230.98	126.42	+/-Z	-1147	147	-8
5	652.71	-198.96	126.42	+/-Z	229	294	1
6	666.77	-169.52	126.42	+/-Z	1168	294	4
7	673.63	-222.49	126.42	+/-Z	1035	147	7
8	674.96	-239.53	126.42	+/-Z	1055	147	7
9	678.92	-196	126.42	+/-Z	853	294	3
10	692.02	-224.82	126.42	+/-Z	-27	294	0
11	698.37	-183.24	126.42	+/-Z	-105	294	0
12	707.1	-210.1	126.42	+/-Z	136	294	0
13	636.98	-211.95	126.42	+/-Z	48	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 62

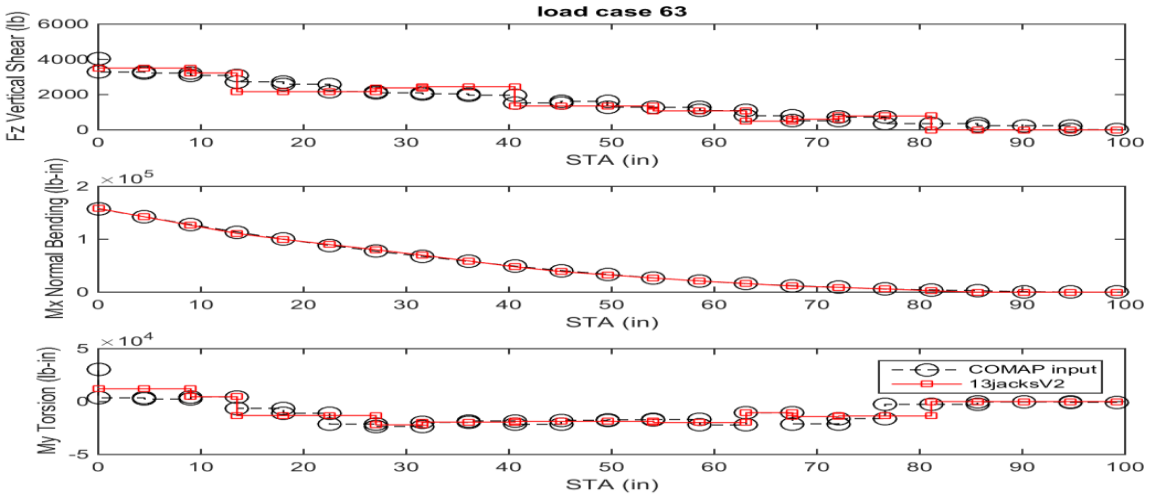
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3897	294	13
2	617.45	-190.36	126.42	+/-Z	1480	294	5
3	630.22	-168.44	126.42	+/-Z	3298	294	11
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	1643	294	6
7	673.63	-222.49	126.42	+/-Z	-66	147	0
8	674.96	-239.53	126.42	+/-Z	2777	147	19
9	678.92	-196	126.42	+/-Z	-2519	294	-9
10	692.02	-224.82	126.42	+/-Z	-1425	294	-5
11	698.37	-183.24	126.42	+/-Z	-1514	294	-5
12	707.1	-210.1	126.42	+/-Z	116	294	0
13	636.98	-211.95	126.42	+/-Z	3013	294	10



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 63

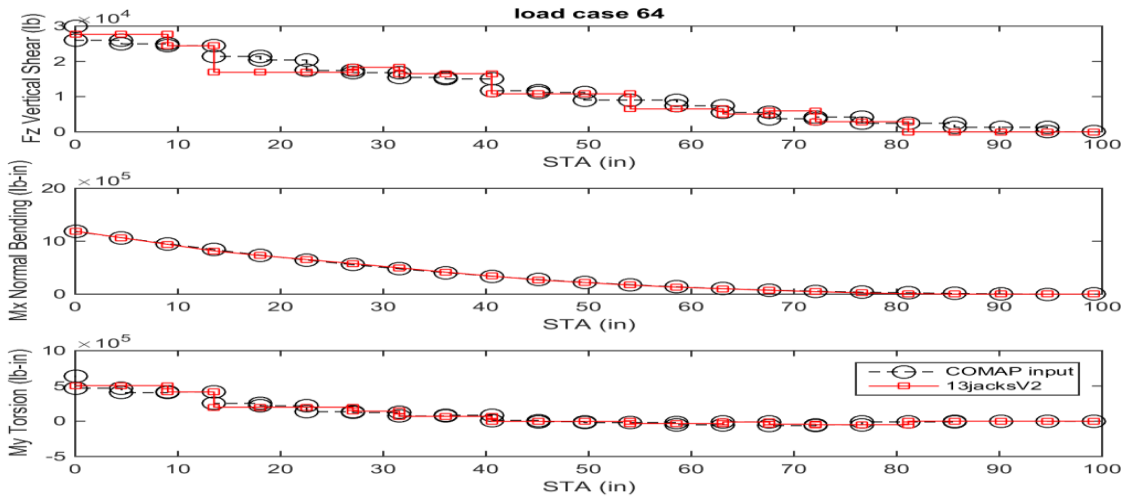
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	396	294	1
2	617.45	-190.36	126.42	+/-Z	-64	294	0
3	630.22	-168.44	126.42	+/-Z	275	294	1
4	655.02	-230.98	126.42	+/-Z	-186	147	-1
5	652.71	-198.96	126.42	+/-Z	859	294	3
6	666.77	-169.52	126.42	+/-Z	662	294	2
7	673.63	-222.49	126.42	+/-Z	581	147	4
8	674.96	-239.53	126.42	+/-Z	786	147	5
9	678.92	-196	126.42	+/-Z	232	294	1
10	692.02	-224.82	126.42	+/-Z	-107	294	0
11	698.37	-183.24	126.42	+/-Z	-215	294	-1
12	707.1	-210.1	126.42	+/-Z	67	294	0
13	636.98	-211.95	126.42	+/-Z	213	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 64

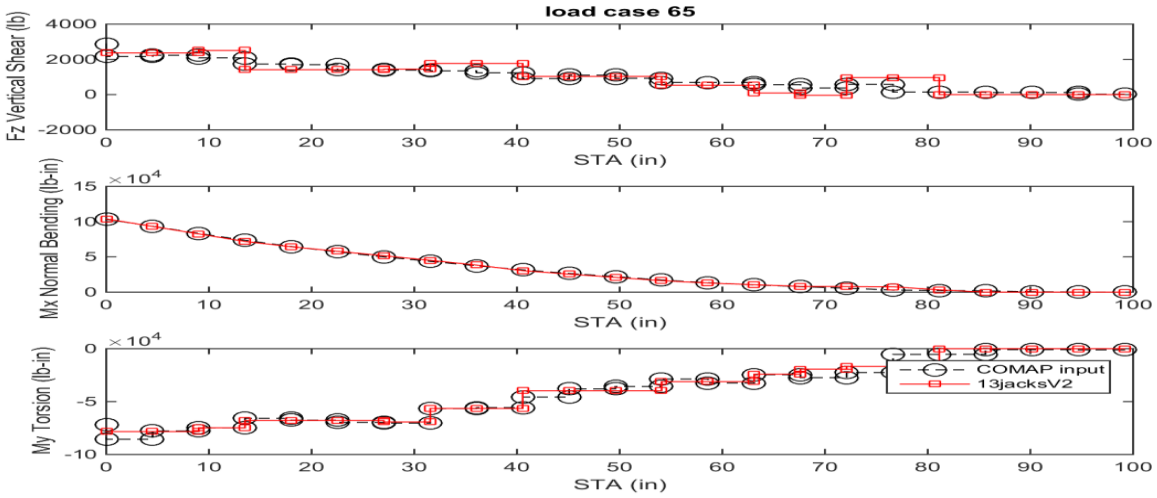
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	4098	294	14
2	617.45	-190.36	126.42	+/-Z	1810	294	6
3	630.22	-168.44	126.42	+/-Z	3259	294	11
4	655.02	-230.98	126.42	+/-Z	3067	147	21
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	3403	294	12
7	673.63	-222.49	126.42	+/-Z	1456	147	10
8	674.96	-239.53	126.42	+/-Z	2897	147	20
9	678.92	-196	126.42	+/-Z	-1640	294	-6
10	692.02	-224.82	126.42	+/-Z	-906	294	-3
11	698.37	-183.24	126.42	+/-Z	-1406	294	-5
12	707.1	-210.1	126.42	+/-Z	802	294	3
13	636.98	-211.95	126.42	+/-Z	3485	294	12



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 65

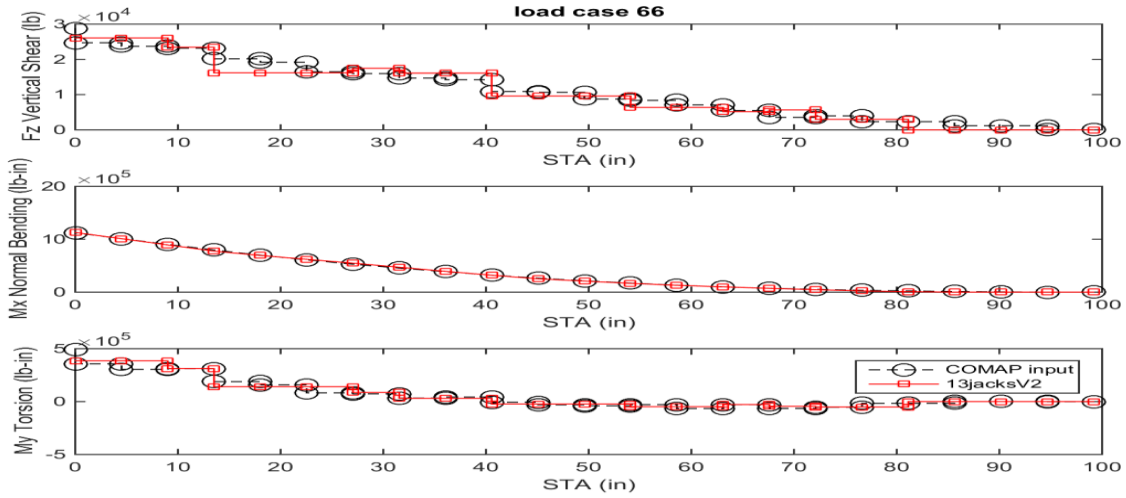
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	45	294	0
2	617.45	-190.36	126.42	+/-Z	-318	294	-1
3	630.22	-168.44	126.42	+/-Z	-134	294	0
4	655.02	-230.98	126.42	+/-Z	-1009	147	-7
5	652.71	-198.96	126.42	+/-Z	-44	294	0
6	666.77	-169.52	126.42	+/-Z	1043	294	4
7	673.63	-222.49	126.42	+/-Z	440	147	3
8	674.96	-239.53	126.42	+/-Z	966	147	7
9	678.92	-196	126.42	+/-Z	776	294	3
10	692.02	-224.82	126.42	+/-Z	138	294	0
11	698.37	-183.24	126.42	+/-Z	-34	294	0
12	707.1	-210.1	126.42	+/-Z	269	294	1
13	636.98	-211.95	126.42	+/-Z	228	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 66

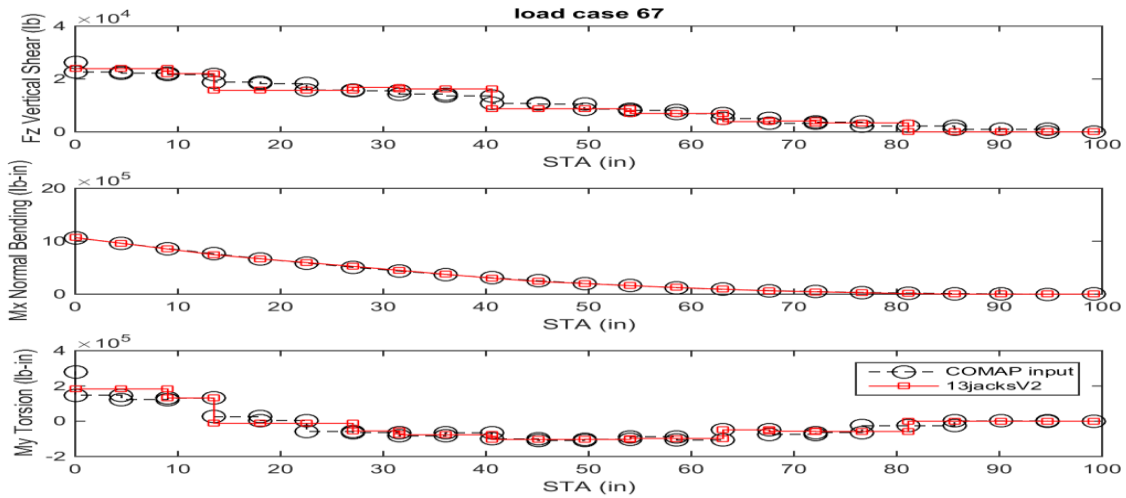
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3431	294	12
2	617.45	-190.36	126.42	+/-Z	1384	294	5
3	630.22	-168.44	126.42	+/-Z	2653	294	9
4	655.02	-230.98	126.42	+/-Z	2677	147	18
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	3823	294	13
7	673.63	-222.49	126.42	+/-Z	1214	147	8
8	674.96	-239.53	126.42	+/-Z	2976	147	20
9	678.92	-196	126.42	+/-Z	-874	294	-3
10	692.02	-224.82	126.42	+/-Z	-476	294	-2
11	698.37	-183.24	126.42	+/-Z	-1307	294	-4
12	707.1	-210.1	126.42	+/-Z	603	294	2
13	636.98	-211.95	126.42	+/-Z	2617	294	9



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 67

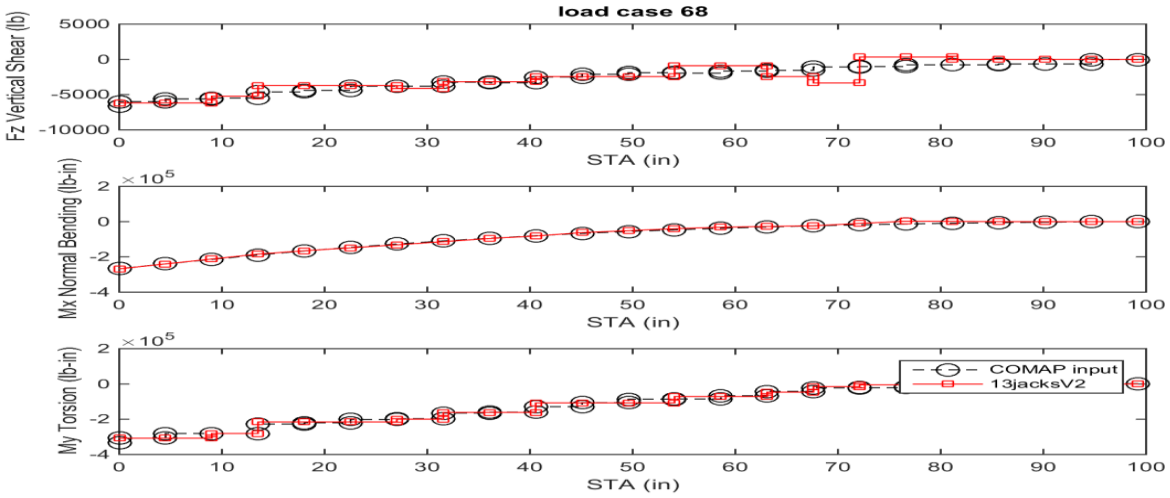
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2897	294	10
2	617.45	-190.36	126.42	+/-Z	544	294	2
3	630.22	-168.44	126.42	+/-Z	1870	294	6
4	655.02	-230.98	126.42	+/-Z	743	147	5
5	652.71	-198.96	126.42	+/-Z	7130	294	24
6	666.77	-169.52	126.42	+/-Z	3405	294	12
7	673.63	-222.49	126.42	+/-Z	3071	147	21
8	674.96	-239.53	126.42	+/-Z	3360	147	23
9	678.92	-196	126.42	+/-Z	396	294	1
10	692.02	-224.82	126.42	+/-Z	-220	294	-1
11	698.37	-183.24	126.42	+/-Z	-1063	294	-4
12	707.1	-210.1	126.42	+/-Z	599	294	2
13	636.98	-211.95	126.42	+/-Z	1166	294	4



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 68

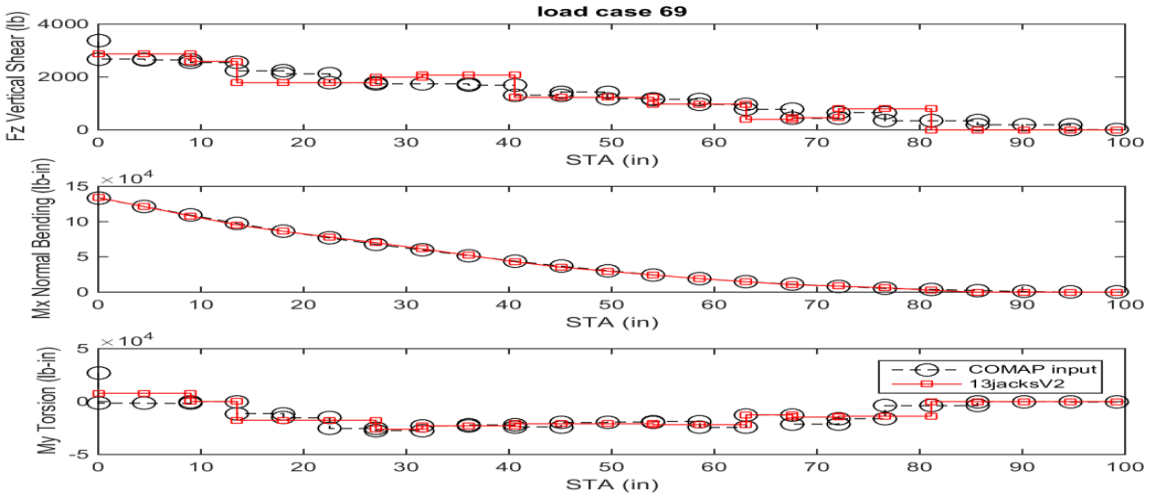
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1136	294	-4
2	617.45	-190.36	126.42	+/-Z	-950	294	-3
3	630.22	-168.44	126.42	+/-Z	-979	294	-3
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-2656	294	-9
6	666.77	-169.52	126.42	+/-Z	-353	294	-1
7	673.63	-222.49	126.42	+/-Z	1540	147	10
8	674.96	-239.53	126.42	+/-Z	327	147	2
9	678.92	-196	126.42	+/-Z	1928	294	7
10	692.02	-224.82	126.42	+/-Z	907	294	3
11	698.37	-183.24	126.42	+/-Z	395	294	1
12	707.1	-210.1	126.42	+/-Z	66	294	0
13	636.98	-211.95	126.42	+/-Z	-1606	294	-5



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 69

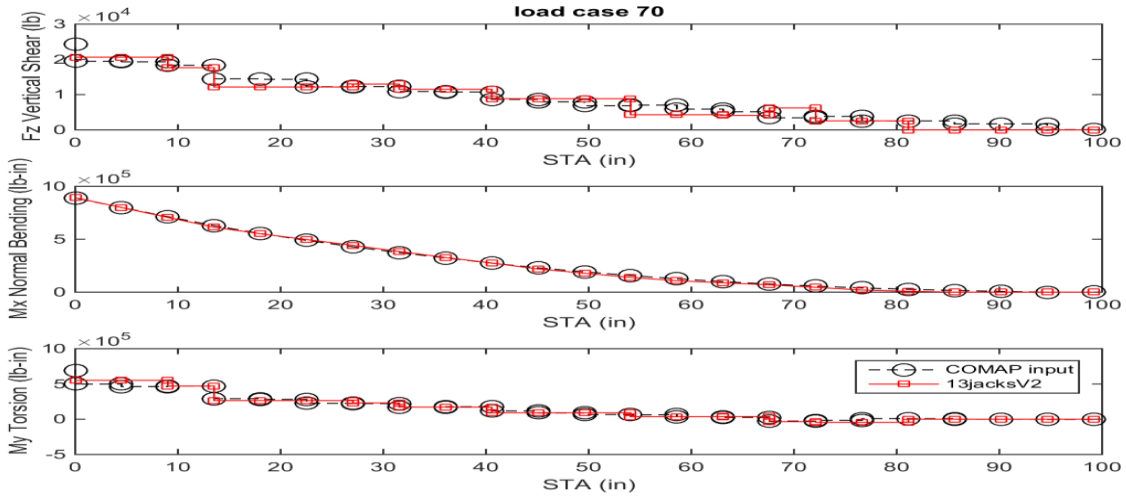
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	362	294	1
2	617.45	-190.36	126.42	+/-Z	-80	294	0
3	630.22	-168.44	126.42	+/-Z	282	294	1
4	655.02	-230.98	126.42	+/-Z	-337	147	-2
5	652.71	-198.96	126.42	+/-Z	612	294	2
6	666.77	-169.52	126.42	+/-Z	442	294	2
7	673.63	-222.49	126.42	+/-Z	578	147	4
8	674.96	-239.53	126.42	+/-Z	796	147	5
9	678.92	-196	126.42	+/-Z	232	294	1
10	692.02	-224.82	126.42	+/-Z	-61	294	0
11	698.37	-183.24	126.42	+/-Z	-208	294	-1
12	707.1	-210.1	126.42	+/-Z	63	294	0
13	636.98	-211.95	126.42	+/-Z	190	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 70

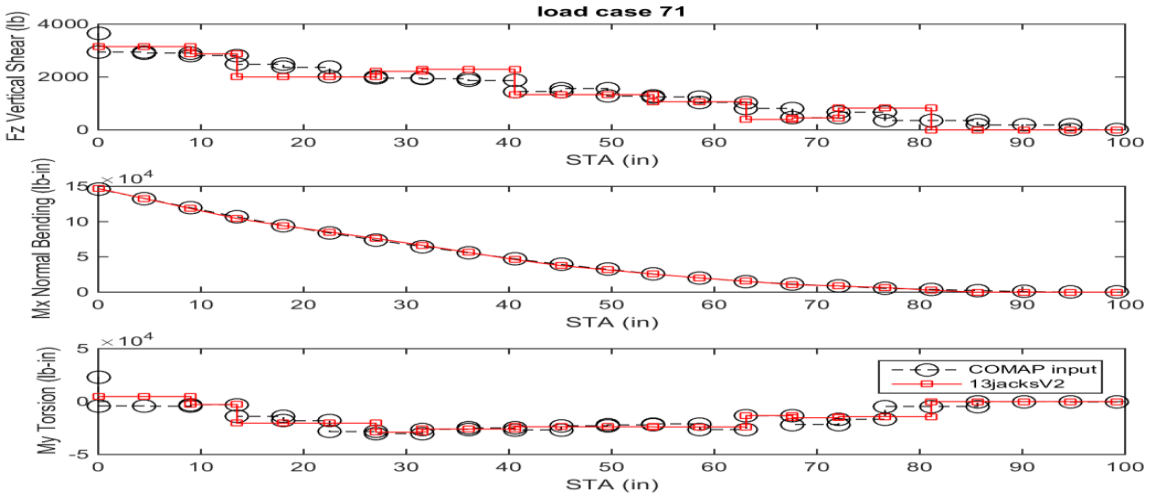
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3678	294	13
2	617.45	-190.36	126.42	+/-Z	1473	294	5
3	630.22	-168.44	126.42	+/-Z	2980	294	10
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	5199	294	18
6	666.77	-169.52	126.42	+/-Z	1790	294	6
7	673.63	-222.49	126.42	+/-Z	181	147	1
8	674.96	-239.53	126.42	+/-Z	2545	147	17
9	678.92	-196	126.42	+/-Z	-2510	294	-9
10	692.02	-224.82	126.42	+/-Z	-2101	294	-7
11	698.37	-183.24	126.42	+/-Z	-832	294	-3
12	707.1	-210.1	126.42	+/-Z	518	294	2
13	636.98	-211.95	126.42	+/-Z	4015	294	14



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 71

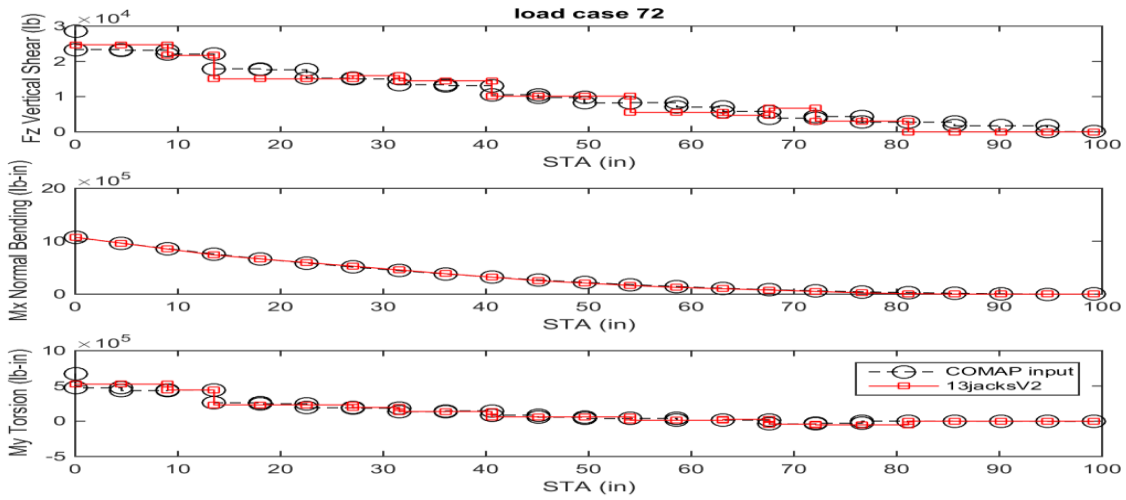
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	368	294	1
2	617.45	-190.36	126.42	+/-Z	-75	294	0
3	630.22	-168.44	126.42	+/-Z	276	294	1
4	655.02	-230.98	126.42	+/-Z	-371	147	-3
5	652.71	-198.96	126.42	+/-Z	699	294	2
6	666.77	-169.52	126.42	+/-Z	501	294	2
7	673.63	-222.49	126.42	+/-Z	667	147	5
8	674.96	-239.53	126.42	+/-Z	822	147	6
9	678.92	-196	126.42	+/-Z	257	294	1
10	692.02	-224.82	126.42	+/-Z	-57	294	0
11	698.37	-183.24	126.42	+/-Z	-209	294	-1
12	707.1	-210.1	126.42	+/-Z	79	294	0
13	636.98	-211.95	126.42	+/-Z	193	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 72

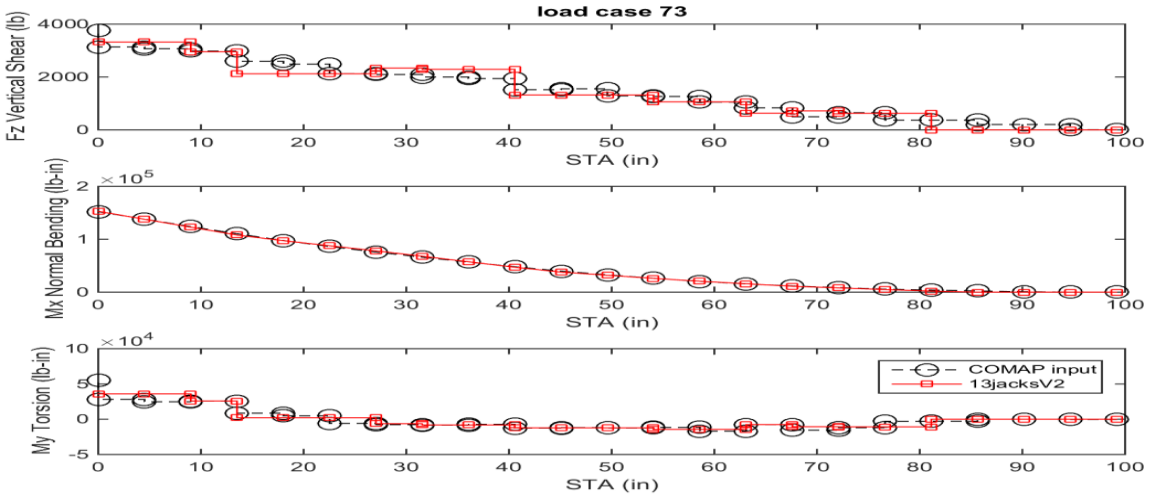
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3909	294	13
2	617.45	-190.36	126.42	+/-Z	1450	294	5
3	630.22	-168.44	126.42	+/-Z	3020	294	10
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	6444	294	22
6	666.77	-169.52	126.42	+/-Z	2705	294	9
7	673.63	-222.49	126.42	+/-Z	826	147	6
8	674.96	-239.53	126.42	+/-Z	3016	147	21
9	678.92	-196	126.42	+/-Z	-2097	294	-7
10	692.02	-224.82	126.42	+/-Z	-1994	294	-7
11	698.37	-183.24	126.42	+/-Z	-876	294	-3
12	707.1	-210.1	126.42	+/-Z	671	294	2
13	636.98	-211.95	126.42	+/-Z	3947	294	13



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 73

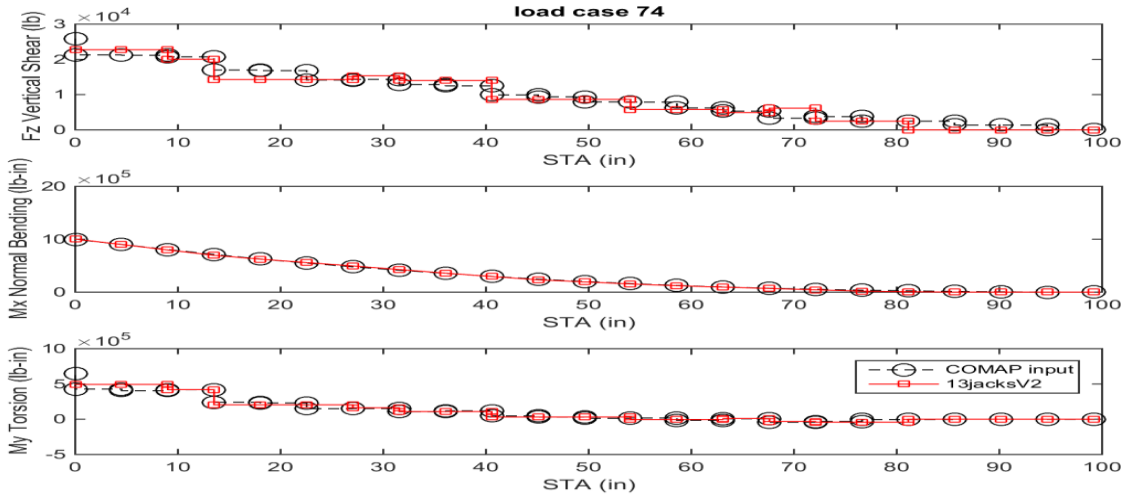
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	450	294	2
2	617.45	-190.36	126.42	+/-Z	45	294	0
3	630.22	-168.44	126.42	+/-Z	368	294	1
4	655.02	-230.98	126.42	+/-Z	91	147	1
5	652.71	-198.96	126.42	+/-Z	943	294	3
6	666.77	-169.52	126.42	+/-Z	380	294	1
7	673.63	-222.49	126.42	+/-Z	429	147	3
8	674.96	-239.53	126.42	+/-Z	625	147	4
9	678.92	-196	126.42	+/-Z	29	294	0
10	692.02	-224.82	126.42	+/-Z	-87	294	0
11	698.37	-183.24	126.42	+/-Z	-210	294	-1
12	707.1	-210.1	126.42	+/-Z	44	294	0
13	636.98	-211.95	126.42	+/-Z	215	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 74

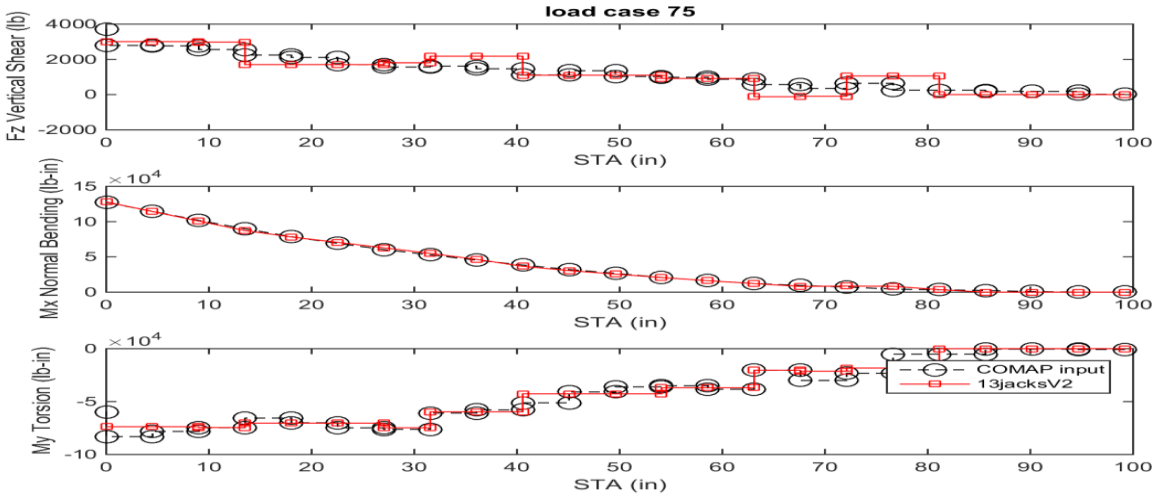
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3847	294	13
2	617.45	-190.36	126.42	+/-Z	1302	294	4
3	630.22	-168.44	126.42	+/-Z	2705	294	9
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	1919	294	7
7	673.63	-222.49	126.42	+/-Z	879	147	6
8	674.96	-239.53	126.42	+/-Z	2462	147	17
9	678.92	-196	126.42	+/-Z	-1971	294	-7
10	692.02	-224.82	126.42	+/-Z	-1251	294	-4
11	698.37	-183.24	126.42	+/-Z	-1055	294	-4
12	707.1	-210.1	126.42	+/-Z	341	294	1
13	636.98	-211.95	126.42	+/-Z	2534	294	9



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 75

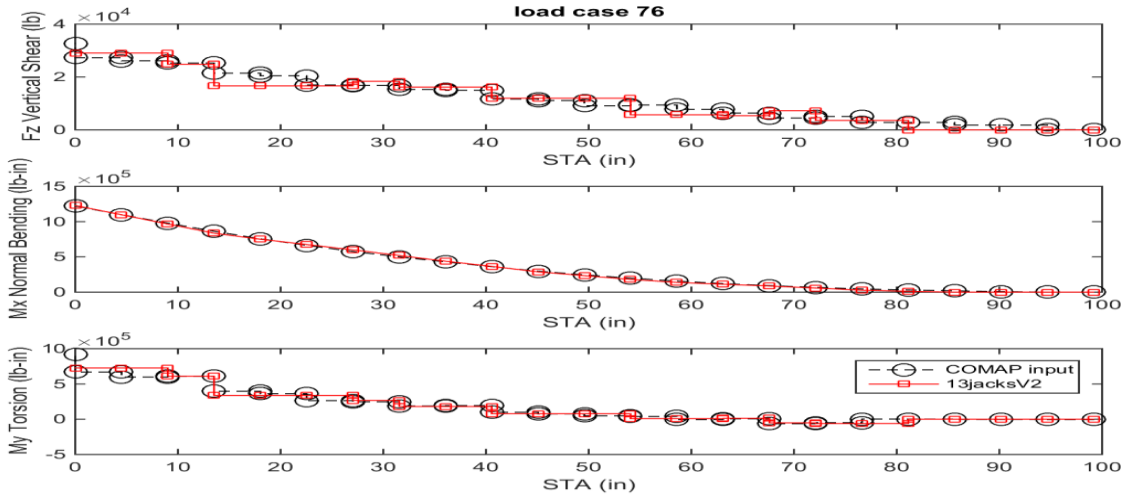
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	110	294	0
2	617.45	-190.36	126.42	+/-Z	-373	294	-1
3	630.22	-168.44	126.42	+/-Z	29	294	0
4	655.02	-230.98	126.42	+/-Z	-1146	147	-8
5	652.71	-198.96	126.42	+/-Z	226	294	1
6	666.77	-169.52	126.42	+/-Z	1167	294	4
7	673.63	-222.49	126.42	+/-Z	1035	147	7
8	674.96	-239.53	126.42	+/-Z	1054	147	7
9	678.92	-196	126.42	+/-Z	854	294	3
10	692.02	-224.82	126.42	+/-Z	-27	294	0
11	698.37	-183.24	126.42	+/-Z	-105	294	0
12	707.1	-210.1	126.42	+/-Z	136	294	0
13	636.98	-211.95	126.42	+/-Z	47	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 76

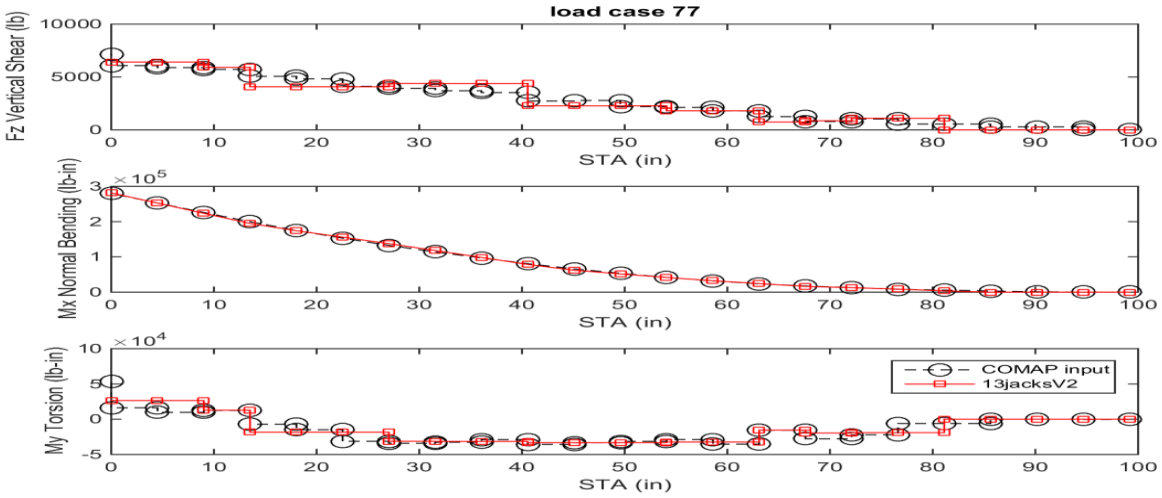
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	5010	294	17
2	617.45	-190.36	126.42	+/-Z	2168	294	7
3	630.22	-168.44	126.42	+/-Z	4231	294	14
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	3168	294	11
7	673.63	-222.49	126.42	+/-Z	350	147	2
8	674.96	-239.53	126.42	+/-Z	3563	147	24
9	678.92	-196	126.42	+/-Z	-3115	294	-11
10	692.02	-224.82	126.42	+/-Z	-1893	294	-6
11	698.37	-183.24	126.42	+/-Z	-1730	294	-6
12	707.1	-210.1	126.42	+/-Z	843	294	3
13	636.98	-211.95	126.42	+/-Z	5416	294	18



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 77

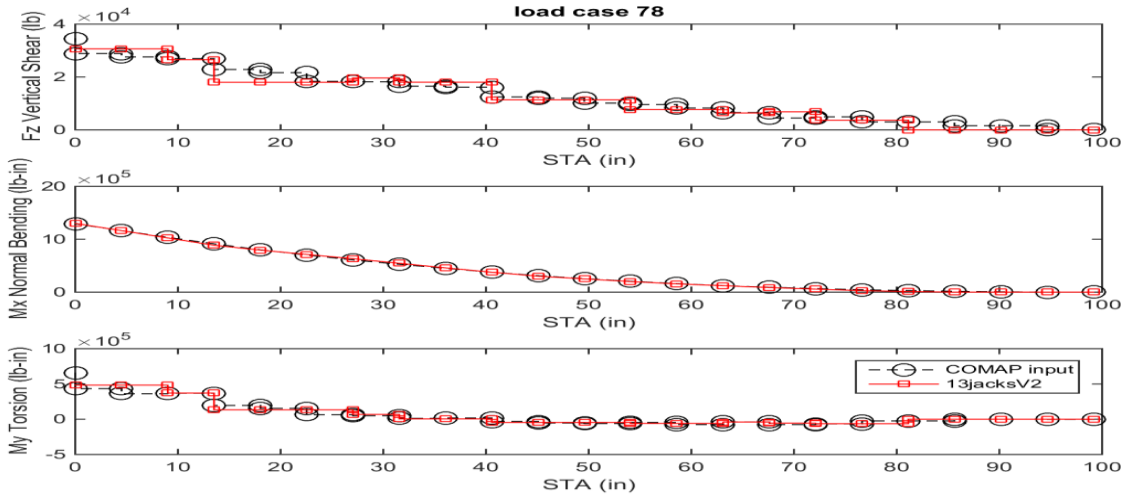
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	689	294	2
2	617.45	-190.36	126.42	+/-Z	7	294	0
3	630.22	-168.44	126.42	+/-Z	501	294	2
4	655.02	-230.98	126.42	+/-Z	-234	147	-2
5	652.71	-198.96	126.42	+/-Z	1781	294	6
6	666.77	-169.52	126.42	+/-Z	1151	294	4
7	673.63	-222.49	126.42	+/-Z	1055	147	7
8	674.96	-239.53	126.42	+/-Z	1099	147	7
9	678.92	-196	126.42	+/-Z	327	294	1
10	692.02	-224.82	126.42	+/-Z	-122	294	0
11	698.37	-183.24	126.42	+/-Z	-318	294	-1
12	707.1	-210.1	126.42	+/-Z	154	294	1
13	636.98	-211.95	126.42	+/-Z	322	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 78

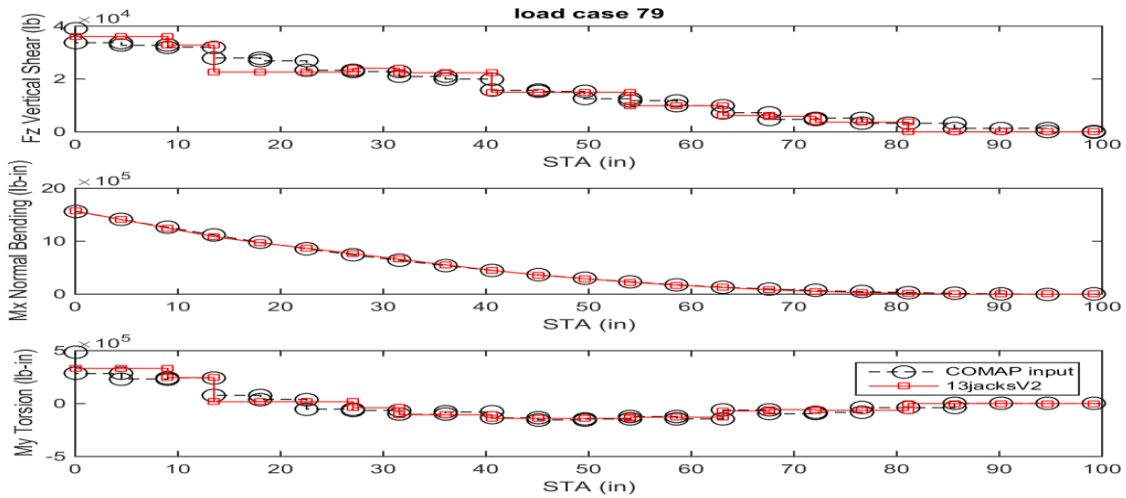
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	4531	294	15
2	617.45	-190.36	126.42	+/-Z	1592	294	5
3	630.22	-168.44	126.42	+/-Z	4085	294	14
4	655.02	-230.98	126.42	+/-Z	3153	147	21
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	4010	294	14
7	673.63	-222.49	126.42	+/-Z	1262	147	9
8	674.96	-239.53	126.42	+/-Z	3675	147	25
9	678.92	-196	126.42	+/-Z	-656	294	-2
10	692.02	-224.82	126.42	+/-Z	-439	294	-1
11	698.37	-183.24	126.42	+/-Z	-1615	294	-5
12	707.1	-210.1	126.42	+/-Z	866	294	3
13	636.98	-211.95	126.42	+/-Z	2802	294	10



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 79

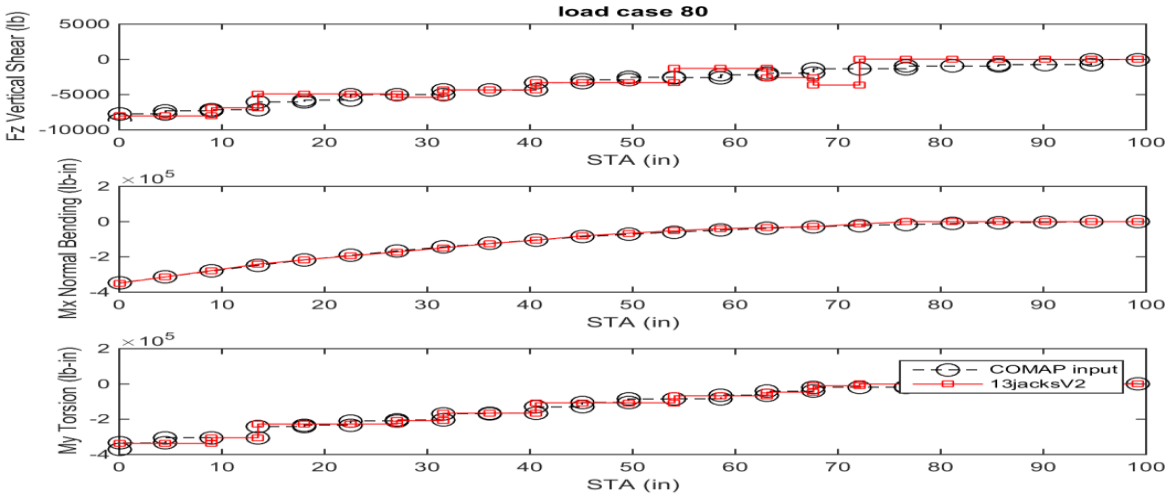
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	4628	294	16
2	617.45	-190.36	126.42	+/-Z	1630	294	6
3	630.22	-168.44	126.42	+/-Z	3213	294	11
4	655.02	-230.98	126.42	+/-Z	2161	147	15
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	5592	294	19
7	673.63	-222.49	126.42	+/-Z	3675	147	25
8	674.96	-239.53	126.42	+/-Z	3675	147	25
9	678.92	-196	126.42	+/-Z	87	294	0
10	692.02	-224.82	126.42	+/-Z	353	294	1
11	698.37	-183.24	126.42	+/-Z	-1393	294	-5
12	707.1	-210.1	126.42	+/-Z	1639	294	6
13	636.98	-211.95	126.42	+/-Z	3430	294	12



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 80

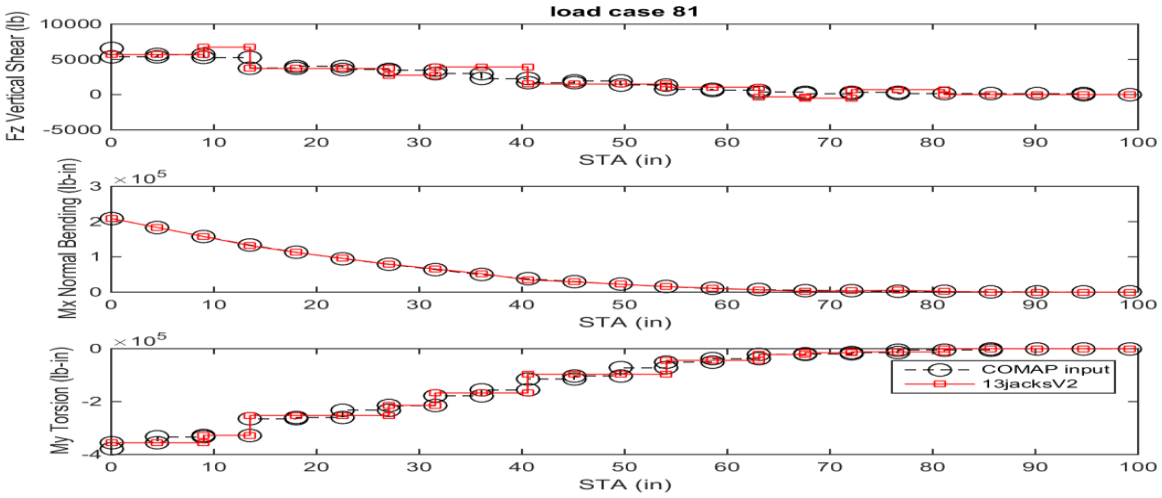
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1389	294	-5
2	617.45	-190.36	126.42	+/-Z	-1047	294	-4
3	630.22	-168.44	126.42	+/-Z	-1148	294	-4
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-3077	294	-10
6	666.77	-169.52	126.42	+/-Z	-577	294	-2
7	673.63	-222.49	126.42	+/-Z	1308	147	9
8	674.96	-239.53	126.42	+/-Z	25	147	0
9	678.92	-196	126.42	+/-Z	2049	294	7
10	692.02	-224.82	126.42	+/-Z	1064	294	4
11	698.37	-183.24	126.42	+/-Z	474	294	2
12	707.1	-210.1	126.42	+/-Z	-32	294	0
13	636.98	-211.95	126.42	+/-Z	-1995	294	-7



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 81

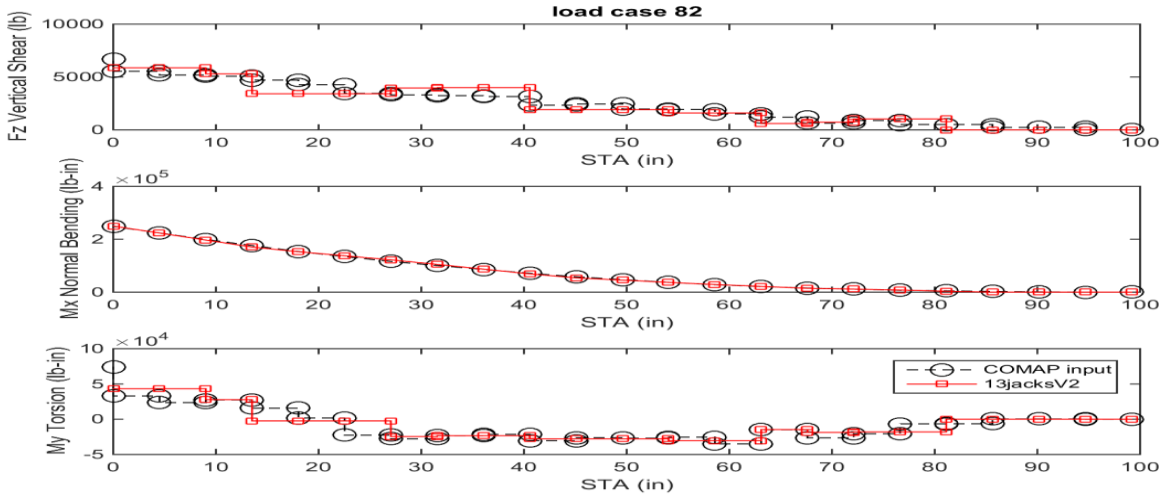
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-680	294	-2
2	617.45	-190.36	126.42	+/-Z	-1167	294	-4
3	630.22	-168.44	126.42	+/-Z	-1026	294	-3
4	655.02	-230.98	126.42	+/-Z	-1224	147	-8
5	652.71	-198.96	126.42	+/-Z	-735	294	-3
6	666.77	-169.52	126.42	+/-Z	3700	294	13
7	673.63	-222.49	126.42	+/-Z	1377	147	9
8	674.96	-239.53	126.42	+/-Z	700	147	5
9	678.92	-196	126.42	+/-Z	3159	294	11
10	692.02	-224.82	126.42	+/-Z	194	294	1
11	698.37	-183.24	126.42	+/-Z	941	294	3
12	707.1	-210.1	126.42	+/-Z	883	294	3
13	636.98	-211.95	126.42	+/-Z	-434	294	-1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 82

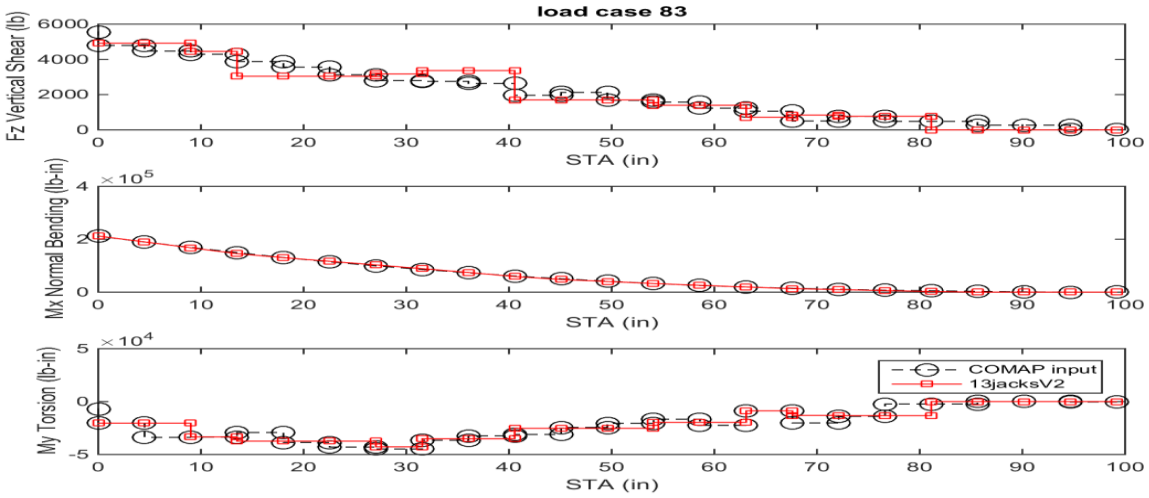
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	681	294	2
2	617.45	-190.36	126.42	+/-Z	-32	294	0
3	630.22	-168.44	126.42	+/-Z	570	294	2
4	655.02	-230.98	126.42	+/-Z	-314	147	-2
5	652.71	-198.96	126.42	+/-Z	1862	294	6
6	666.77	-169.52	126.42	+/-Z	1204	294	4
7	673.63	-222.49	126.42	+/-Z	991	147	7
8	674.96	-239.53	126.42	+/-Z	1035	147	7
9	678.92	-196	126.42	+/-Z	221	294	1
10	692.02	-224.82	126.42	+/-Z	-120	294	0
11	698.37	-183.24	126.42	+/-Z	-546	294	-2
12	707.1	-210.1	126.42	+/-Z	54	294	0
13	636.98	-211.95	126.42	+/-Z	262	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 83

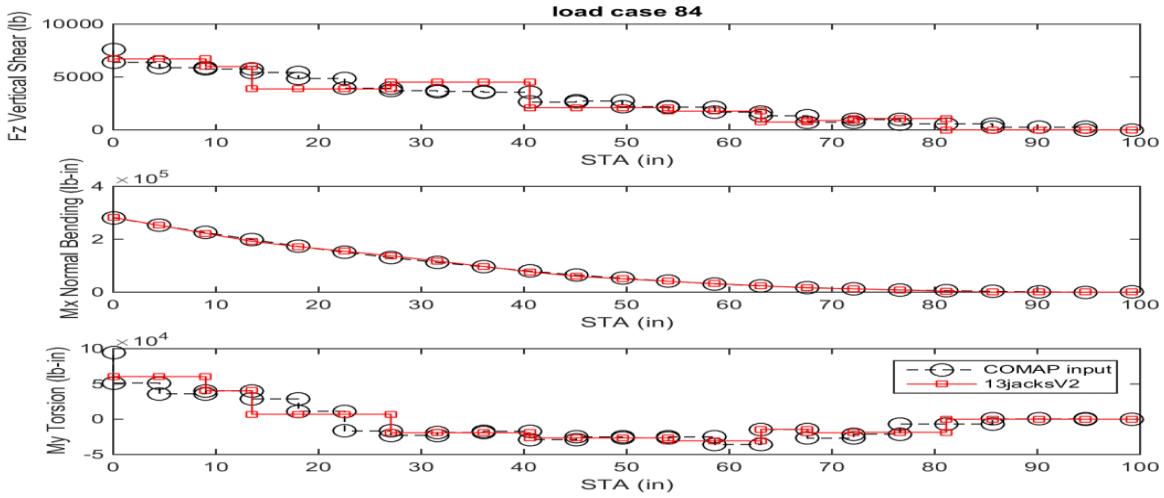
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	243	294	1
2	617.45	-190.36	126.42	+/-Z	-191	294	-1
3	630.22	-168.44	126.42	+/-Z	473	294	2
4	655.02	-230.98	126.42	+/-Z	73	147	0
5	652.71	-198.96	126.42	+/-Z	984	294	3
6	666.77	-169.52	126.42	+/-Z	1164	294	4
7	673.63	-222.49	126.42	+/-Z	681	147	5
8	674.96	-239.53	126.42	+/-Z	768	147	5
9	678.92	-196	126.42	+/-Z	687	294	2
10	692.02	-224.82	126.42	+/-Z	-127	294	0
11	698.37	-183.24	126.42	+/-Z	-132	294	0
12	707.1	-210.1	126.42	+/-Z	169	294	1
13	636.98	-211.95	126.42	+/-Z	132	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 84

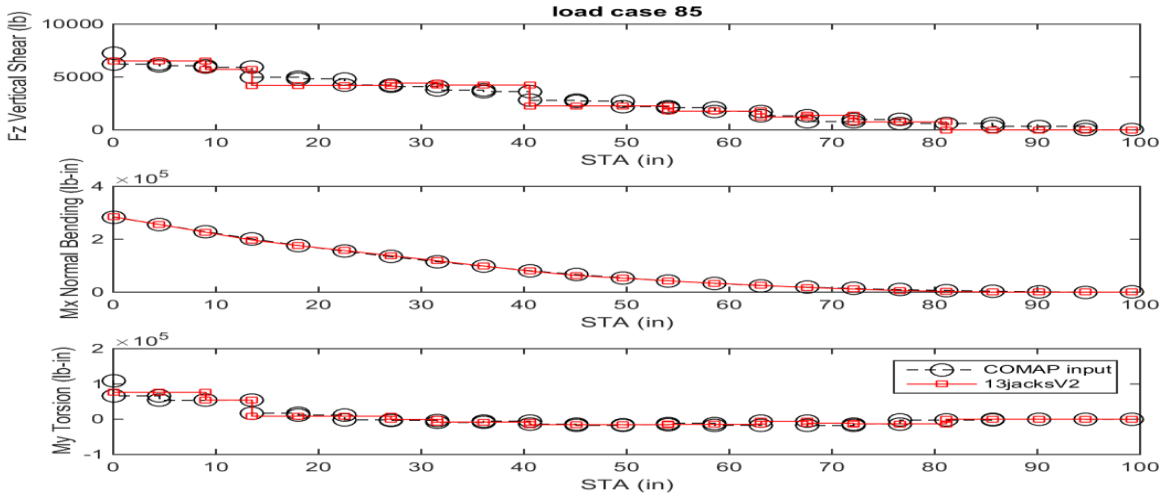
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	759	294	3
2	617.45	-190.36	126.42	+/-Z	-1	294	0
3	630.22	-168.44	126.42	+/-Z	729	294	2
4	655.02	-230.98	126.42	+/-Z	-190	147	-1
5	652.71	-198.96	126.42	+/-Z	2252	294	8
6	666.77	-169.52	126.42	+/-Z	1354	294	5
7	673.63	-222.49	126.42	+/-Z	1029	147	7
8	674.96	-239.53	126.42	+/-Z	1074	147	7
9	678.92	-196	126.42	+/-Z	165	294	1
10	692.02	-224.82	126.42	+/-Z	-139	294	0
11	698.37	-183.24	126.42	+/-Z	-642	294	-2
12	707.1	-210.1	126.42	+/-Z	35	294	0
13	636.98	-211.95	126.42	+/-Z	286	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 85

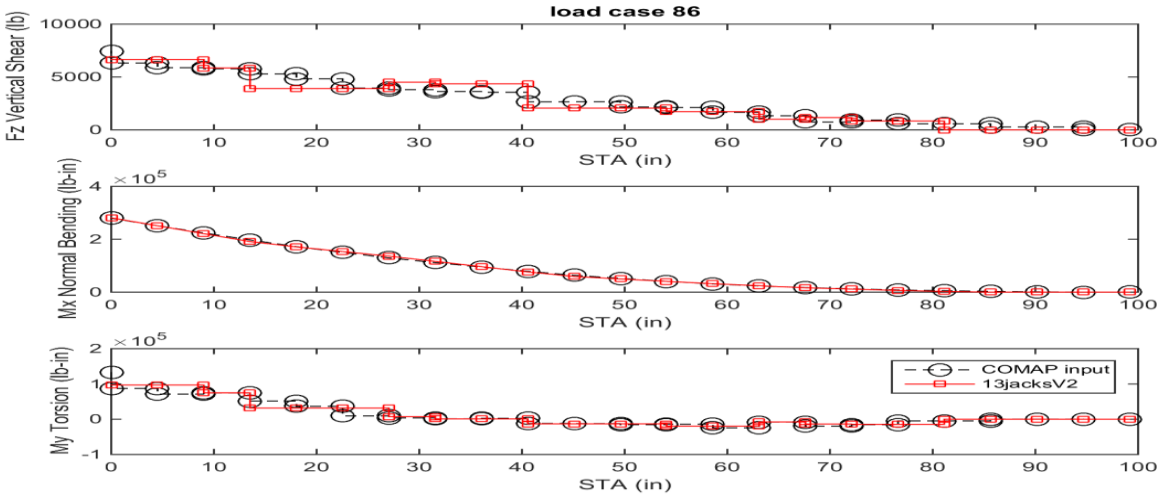
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	860	294	3
2	617.45	-190.36	126.42	+/-Z	187	294	1
3	630.22	-168.44	126.42	+/-Z	800	294	3
4	655.02	-230.98	126.42	+/-Z	622	147	4
5	652.71	-198.96	126.42	+/-Z	1882	294	6
6	666.77	-169.52	126.42	+/-Z	658	294	2
7	673.63	-222.49	126.42	+/-Z	548	147	4
8	674.96	-239.53	126.42	+/-Z	759	147	5
9	678.92	-196	126.42	+/-Z	86	294	0
10	692.02	-224.82	126.42	+/-Z	-166	294	-1
11	698.37	-183.24	126.42	+/-Z	-224	294	-1
12	707.1	-210.1	126.42	+/-Z	162	294	1
13	636.98	-211.95	126.42	+/-Z	342	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 86

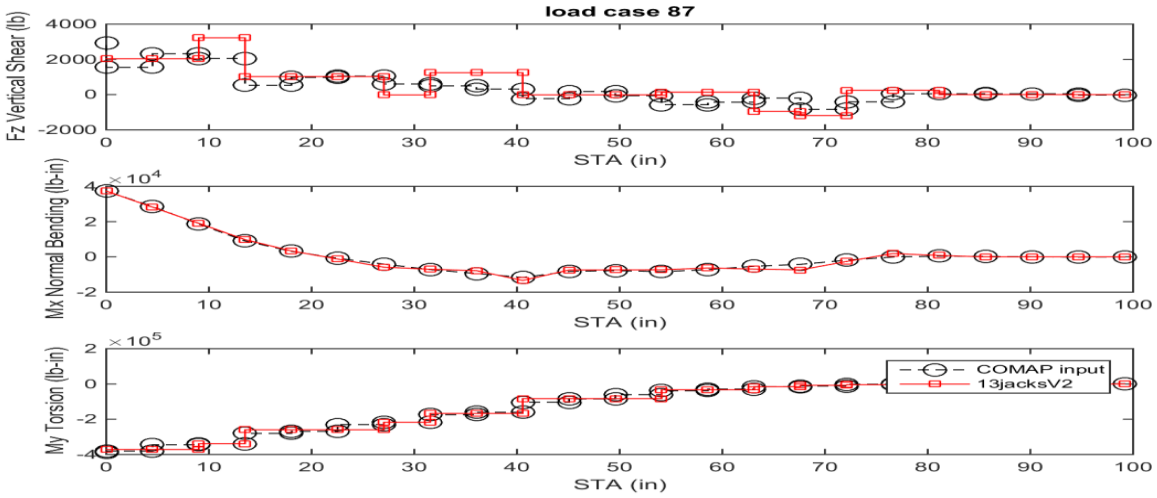
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	875	294	3
2	617.45	-190.36	126.42	+/-Z	156	294	1
3	630.22	-168.44	126.42	+/-Z	802	294	3
4	655.02	-230.98	126.42	+/-Z	327	147	2
5	652.71	-198.96	126.42	+/-Z	2400	294	8
6	666.77	-169.52	126.42	+/-Z	1069	294	4
7	673.63	-222.49	126.42	+/-Z	728	147	5
8	674.96	-239.53	126.42	+/-Z	837	147	6
9	678.92	-196	126.42	+/-Z	-108	294	0
10	692.02	-224.82	126.42	+/-Z	-170	294	-1
11	698.37	-183.24	126.42	+/-Z	-603	294	-2
12	707.1	-210.1	126.42	+/-Z	9	294	0
13	636.98	-211.95	126.42	+/-Z	326	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 87

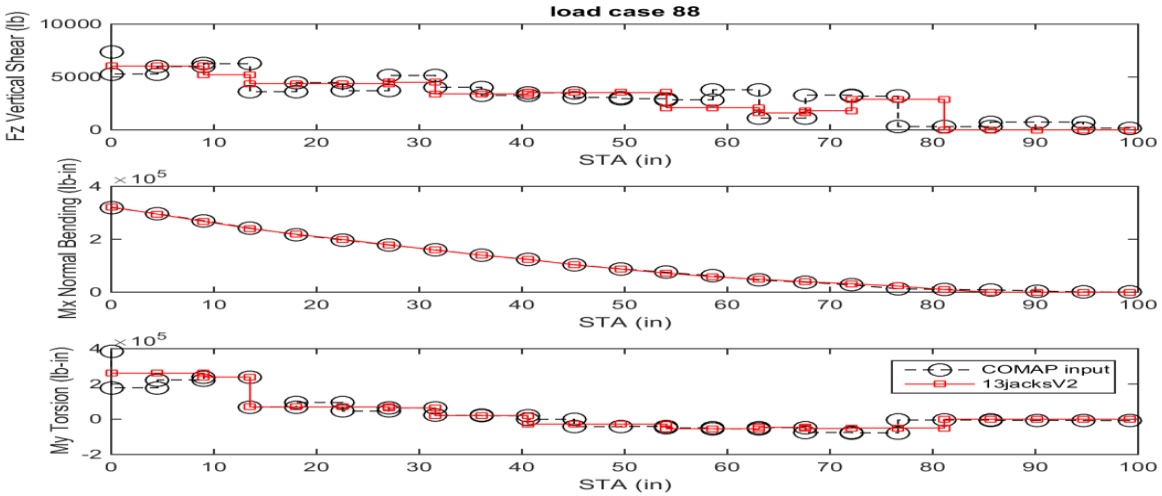
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-849	294	-3
2	617.45	-190.36	126.42	+/-Z	-1255	294	-4
3	630.22	-168.44	126.42	+/-Z	-1189	294	-4
4	655.02	-230.98	126.42	+/-Z	-1428	147	-10
5	652.71	-198.96	126.42	+/-Z	-2189	294	-7
6	666.77	-169.52	126.42	+/-Z	3049	294	10
7	673.63	-222.49	126.42	+/-Z	1088	147	7
8	674.96	-239.53	126.42	+/-Z	240	147	2
9	678.92	-196	126.42	+/-Z	3438	294	12
10	692.02	-224.82	126.42	+/-Z	235	294	1
11	698.37	-183.24	126.42	+/-Z	1038	294	4
12	707.1	-210.1	126.42	+/-Z	668	294	2
13	636.98	-211.95	126.42	+/-Z	-813	294	-3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 88

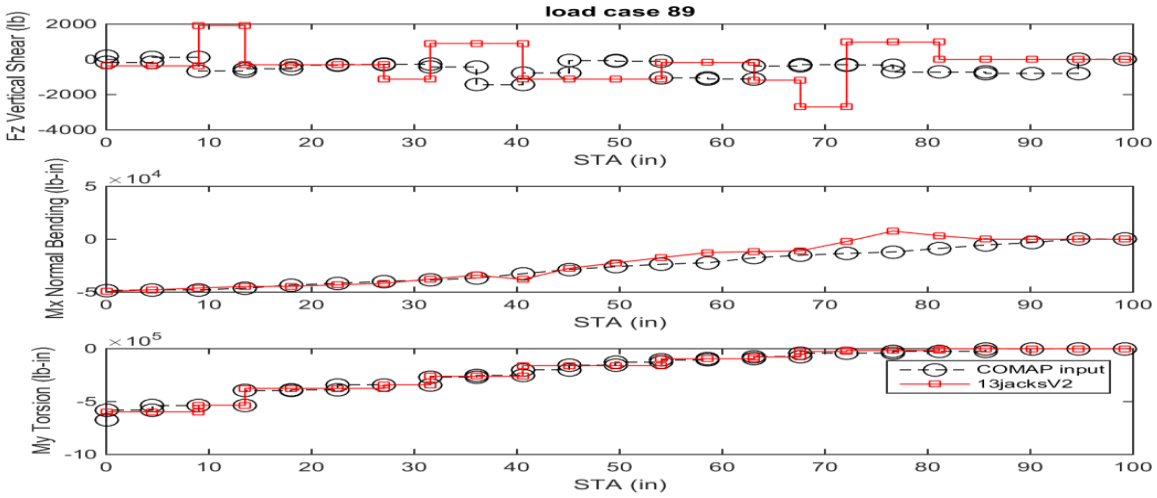
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2545	294	9
2	617.45	-190.36	126.42	+/-Z	1094	294	4
3	630.22	-168.44	126.42	+/-Z	823	294	3
4	655.02	-230.98	126.42	+/-Z	-1082	147	-7
5	652.71	-198.96	126.42	+/-Z	1747	294	6
6	666.77	-169.52	126.42	+/-Z	-1707	294	-6
7	673.63	-222.49	126.42	+/-Z	488	147	3
8	674.96	-239.53	126.42	+/-Z	2890	147	20
9	678.92	-196	126.42	+/-Z	-1873	294	-6
10	692.02	-224.82	126.42	+/-Z	-205	294	-1
11	698.37	-183.24	126.42	+/-Z	-123	294	0
12	707.1	-210.1	126.42	+/-Z	54	294	0
13	636.98	-211.95	126.42	+/-Z	1381	294	5



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 89

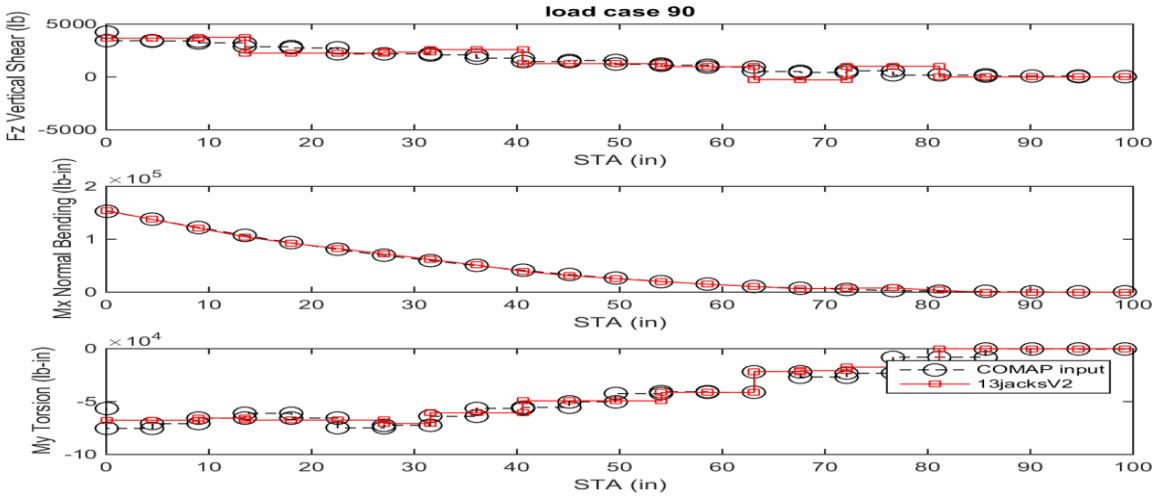
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-2004	294	-7
2	617.45	-190.36	126.42	+/-Z	-2030	294	-7
3	630.22	-168.44	126.42	+/-Z	-2286	294	-8
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-2152	294	-7
6	666.77	-169.52	126.42	+/-Z	4233	294	14
7	673.63	-222.49	126.42	+/-Z	1007	147	7
8	674.96	-239.53	126.42	+/-Z	978	147	7
9	678.92	-196	126.42	+/-Z	4182	294	14
10	692.02	-224.82	126.42	+/-Z	1516	294	5
11	698.37	-183.24	126.42	+/-Z	817	294	3
12	707.1	-210.1	126.42	+/-Z	665	294	2
13	636.98	-211.95	126.42	+/-Z	-1617	294	-6



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 90

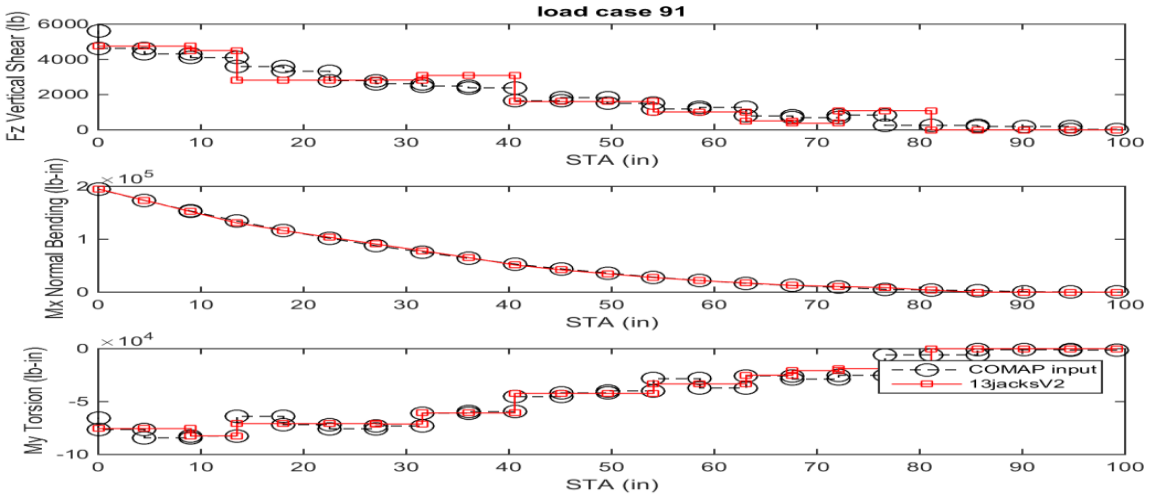
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	222	294	1
2	617.45	-190.36	126.42	+/-Z	-254	294	-1
3	630.22	-168.44	126.42	+/-Z	-73	294	0
4	655.02	-230.98	126.42	+/-Z	-1280	147	-9
5	652.71	-198.96	126.42	+/-Z	648	294	2
6	666.77	-169.52	126.42	+/-Z	1259	294	4
7	673.63	-222.49	126.42	+/-Z	1227	147	8
8	674.96	-239.53	126.42	+/-Z	1007	147	7
9	678.92	-196	126.42	+/-Z	681	294	2
10	692.02	-224.82	126.42	+/-Z	25	294	0
11	698.37	-183.24	126.42	+/-Z	-81	294	0
12	707.1	-210.1	126.42	+/-Z	198	294	1
13	636.98	-211.95	126.42	+/-Z	87	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 91

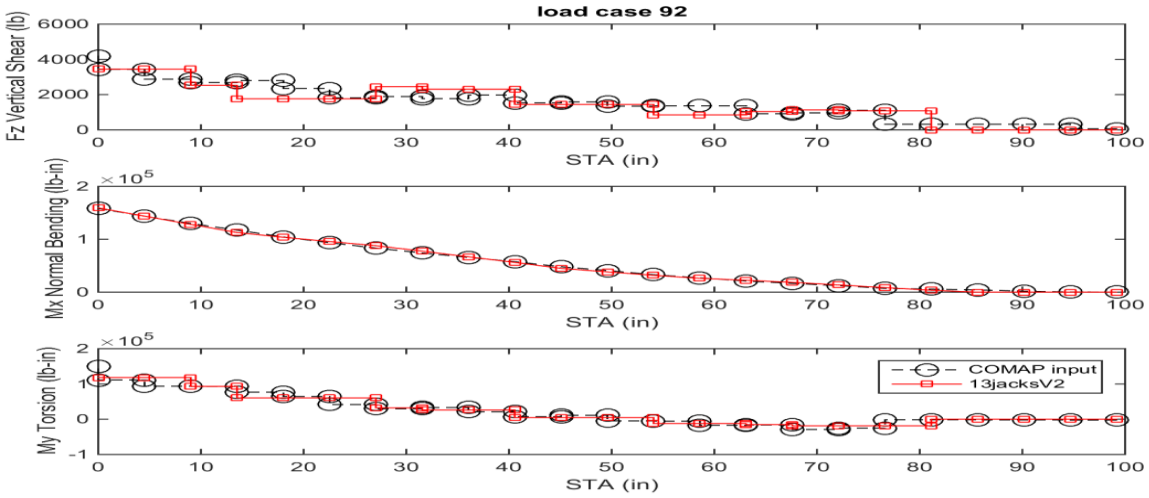
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	54	294	0
2	617.45	-190.36	126.42	+/-Z	-259	294	-1
3	630.22	-168.44	126.42	+/-Z	253	294	1
4	655.02	-230.98	126.42	+/-Z	-711	147	-5
5	652.71	-198.96	126.42	+/-Z	499	294	2
6	666.77	-169.52	126.42	+/-Z	1623	294	6
7	673.63	-222.49	126.42	+/-Z	510	147	3
8	674.96	-239.53	126.42	+/-Z	1090	147	7
9	678.92	-196	126.42	+/-Z	983	294	3
10	692.02	-224.82	126.42	+/-Z	128	294	0
11	698.37	-183.24	126.42	+/-Z	-8	294	0
12	707.1	-210.1	126.42	+/-Z	301	294	1
13	636.98	-211.95	126.42	+/-Z	287	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 92

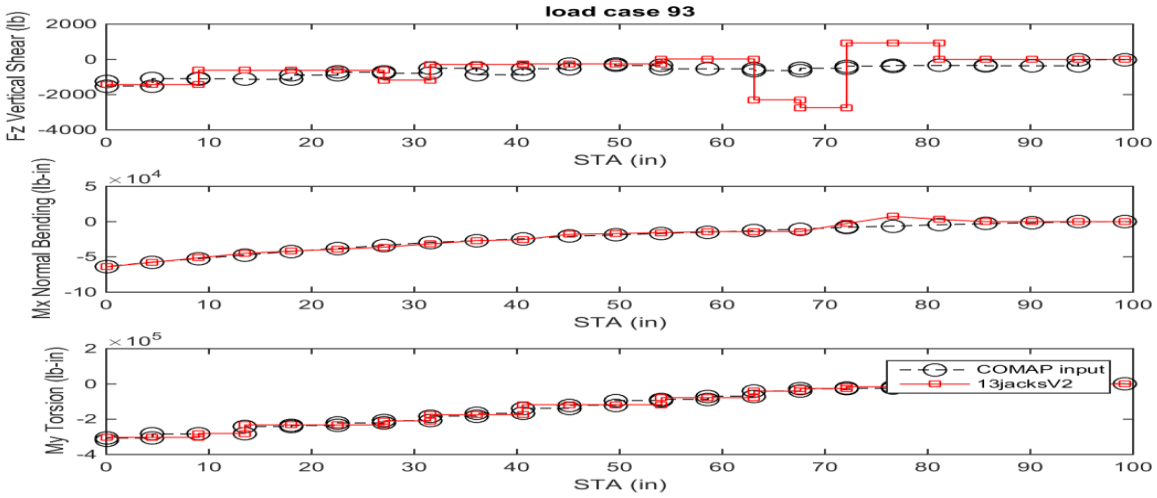
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	572	294	2
2	617.45	-190.36	126.42	+/-Z	146	294	0
3	630.22	-168.44	126.42	+/-Z	918	294	3
4	655.02	-230.98	126.42	+/-Z	51	147	0
5	652.71	-198.96	126.42	+/-Z	1527	294	5
6	666.77	-169.52	126.42	+/-Z	196	294	1
7	673.63	-222.49	126.42	+/-Z	-189	147	-1
8	674.96	-239.53	126.42	+/-Z	1082	147	7
9	678.92	-196	126.42	+/-Z	-665	294	-2
10	692.02	-224.82	126.42	+/-Z	-95	294	0
11	698.37	-183.24	126.42	+/-Z	-691	294	-2
12	707.1	-210.1	126.42	+/-Z	-68	294	0
13	636.98	-211.95	126.42	+/-Z	661	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 93

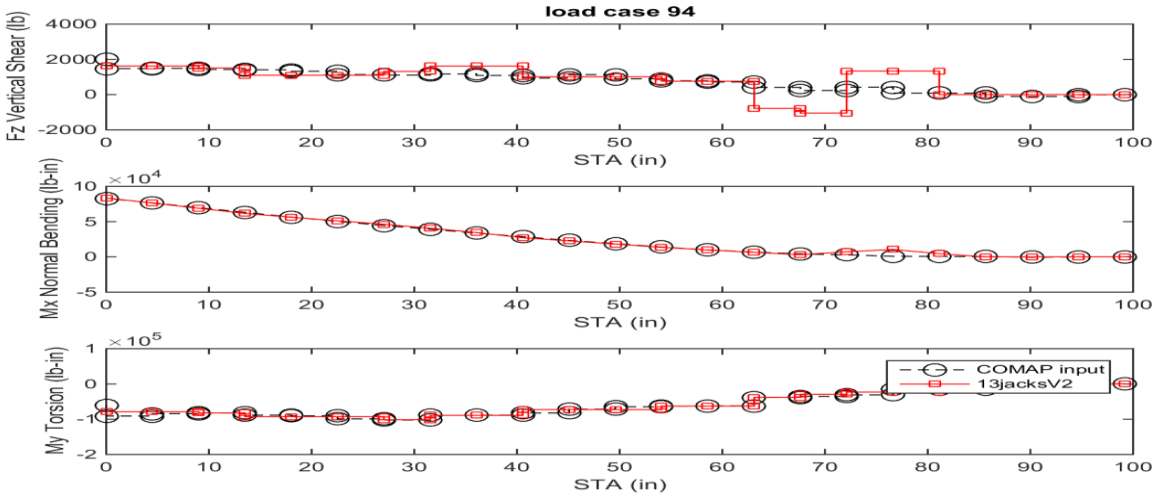
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-697	294	-2
2	617.45	-190.36	126.42	+/-Z	-889	294	-3
3	630.22	-168.44	126.42	+/-Z	-814	294	-3
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-2177	294	-7
6	666.77	-169.52	126.42	+/-Z	700	294	2
7	673.63	-222.49	126.42	+/-Z	2314	147	16
8	674.96	-239.53	126.42	+/-Z	933	147	6
9	678.92	-196	126.42	+/-Z	2142	294	7
10	692.02	-224.82	126.42	+/-Z	446	294	2
11	698.37	-183.24	126.42	+/-Z	559	294	2
12	707.1	-210.1	126.42	+/-Z	484	294	2
13	636.98	-211.95	126.42	+/-Z	-757	294	-3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 94

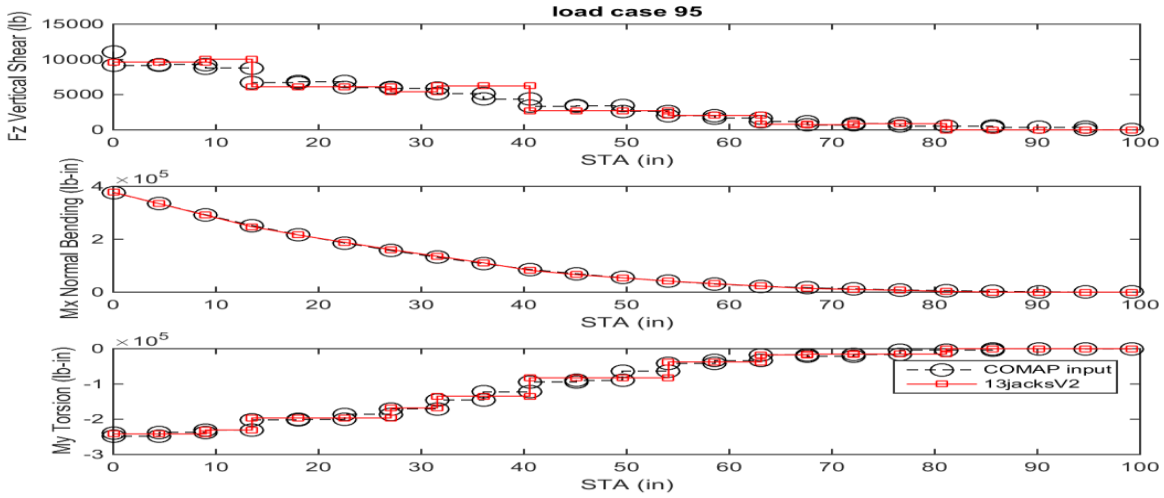
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	207	294	1
2	617.45	-190.36	126.42	+/-Z	-308	294	-1
3	630.22	-168.44	126.42	+/-Z	118	294	0
4	655.02	-230.98	126.42	+/-Z	-2376	147	-16
5	652.71	-198.96	126.42	+/-Z	-128	294	0
6	666.77	-169.52	126.42	+/-Z	199	294	1
7	673.63	-222.49	126.42	+/-Z	1541	147	10
8	674.96	-239.53	126.42	+/-Z	1330	147	9
9	678.92	-196	126.42	+/-Z	735	294	2
10	692.02	-224.82	126.42	+/-Z	263	294	1
11	698.37	-183.24	126.42	+/-Z	-211	294	-1
12	707.1	-210.1	126.42	+/-Z	216	294	1
13	636.98	-211.95	126.42	+/-Z	40	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 95

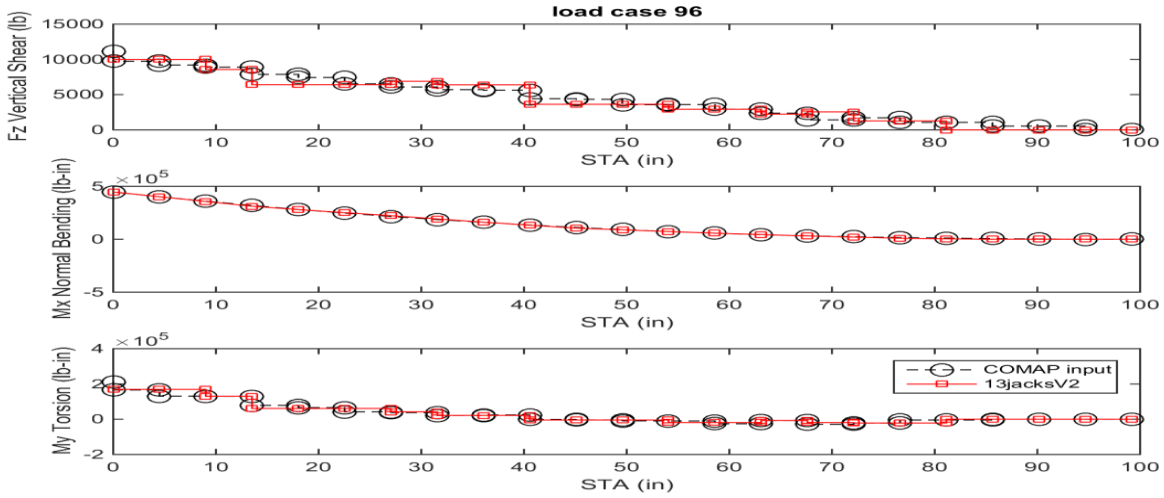
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	24	294	0
2	617.45	-190.36	126.42	+/-Z	-826	294	-3
3	630.22	-168.44	126.42	+/-Z	-397	294	-1
4	655.02	-230.98	126.42	+/-Z	-144	147	-1
5	652.71	-198.96	126.42	+/-Z	859	294	3
6	666.77	-169.52	126.42	+/-Z	3885	294	13
7	673.63	-222.49	126.42	+/-Z	1255	147	9
8	674.96	-239.53	126.42	+/-Z	882	147	6
9	678.92	-196	126.42	+/-Z	2648	294	9
10	692.02	-224.82	126.42	+/-Z	53	294	0
11	698.37	-183.24	126.42	+/-Z	703	294	2
12	707.1	-210.1	126.42	+/-Z	840	294	3
13	636.98	-211.95	126.42	+/-Z	-164	294	-1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 96

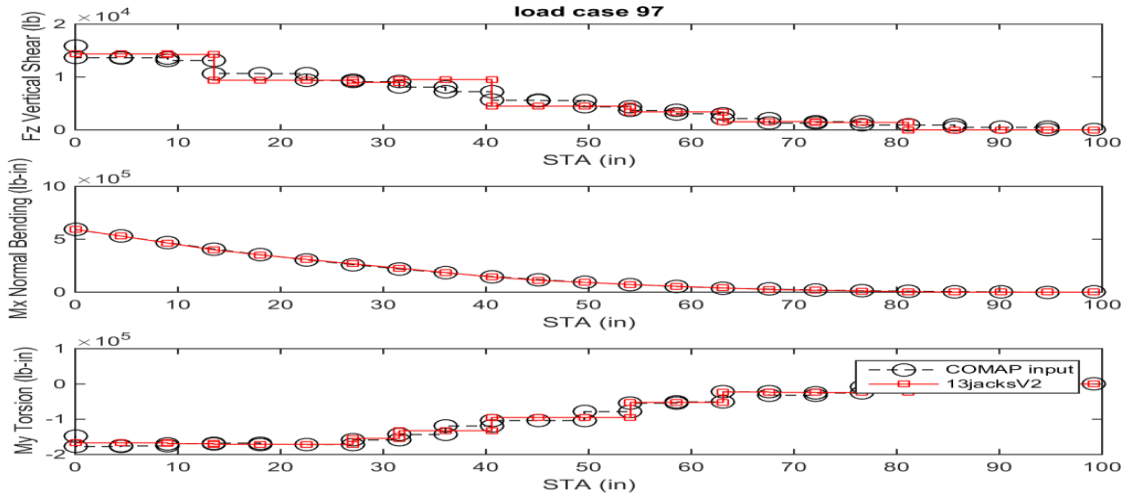
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1275	294	4
2	617.45	-190.36	126.42	+/-Z	502	294	2
3	630.22	-168.44	126.42	+/-Z	1432	294	5
4	655.02	-230.98	126.42	+/-Z	1294	147	9
5	652.71	-198.96	126.42	+/-Z	3233	294	11
6	666.77	-169.52	126.42	+/-Z	875	294	3
7	673.63	-222.49	126.42	+/-Z	700	147	5
8	674.96	-239.53	126.42	+/-Z	1261	147	9
9	678.92	-196	126.42	+/-Z	-478	294	-2
10	692.02	-224.82	126.42	+/-Z	-326	294	-1
11	698.37	-183.24	126.42	+/-Z	-480	294	-2
12	707.1	-210.1	126.42	+/-Z	8	294	0
13	636.98	-211.95	126.42	+/-Z	693	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 97

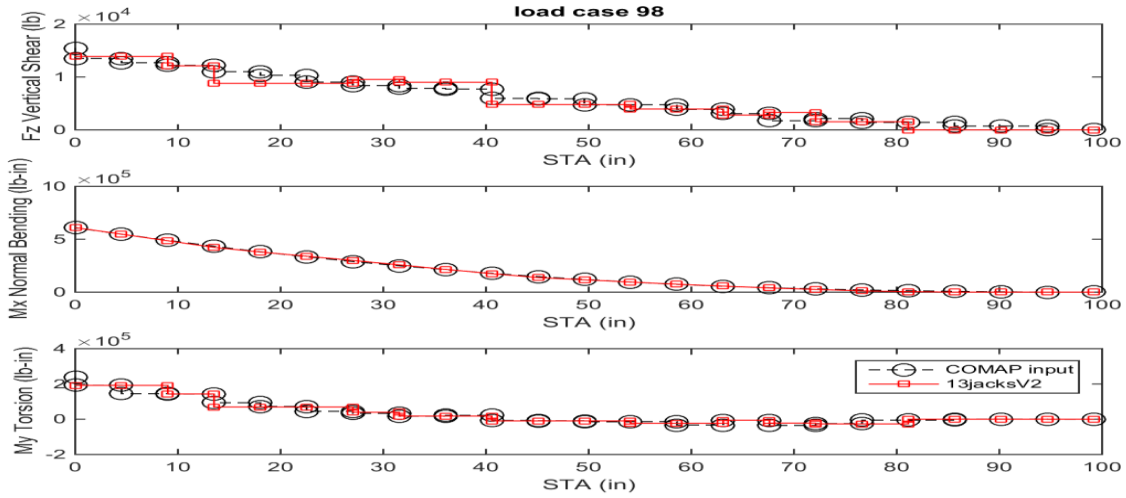
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	674	294	2
2	617.45	-190.36	126.42	+/-Z	-539	294	-2
3	630.22	-168.44	126.42	+/-Z	80	294	0
4	655.02	-230.98	126.42	+/-Z	166	147	1
5	652.71	-198.96	126.42	+/-Z	2650	294	9
6	666.77	-169.52	126.42	+/-Z	4215	294	14
7	673.63	-222.49	126.42	+/-Z	1862	147	13
8	674.96	-239.53	126.42	+/-Z	1400	147	10
9	678.92	-196	126.42	+/-Z	2372	294	8
10	692.02	-224.82	126.42	+/-Z	-32	294	0
11	698.37	-183.24	126.42	+/-Z	417	294	1
12	707.1	-210.1	126.42	+/-Z	928	294	3
13	636.98	-211.95	126.42	+/-Z	163	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 98

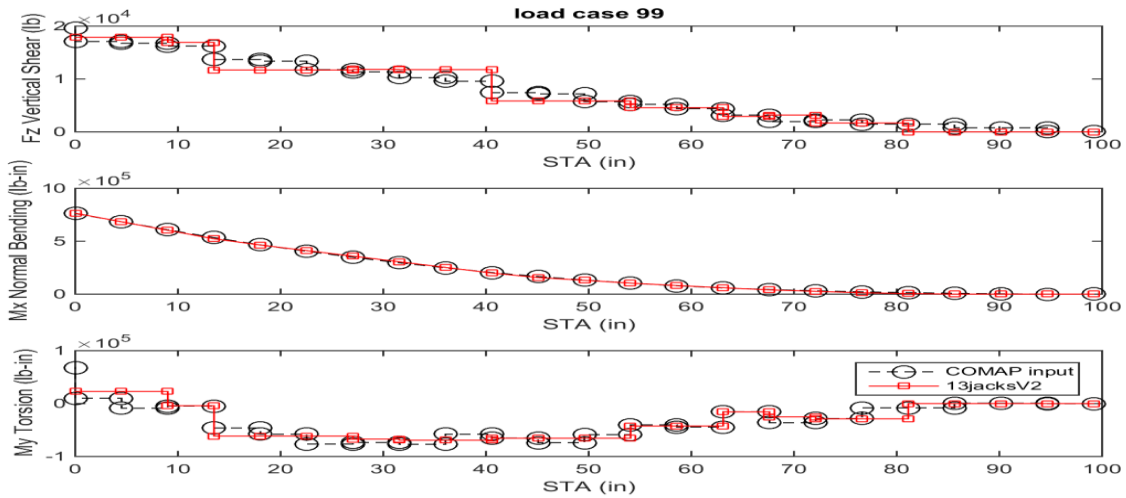
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1508	294	5
2	617.45	-190.36	126.42	+/-Z	533	294	2
3	630.22	-168.44	126.42	+/-Z	1767	294	6
4	655.02	-230.98	126.42	+/-Z	1747	147	12
5	652.71	-198.96	126.42	+/-Z	4486	294	15
6	666.77	-169.52	126.42	+/-Z	1806	294	6
7	673.63	-222.49	126.42	+/-Z	1127	147	8
8	674.96	-239.53	126.42	+/-Z	1540	147	10
9	678.92	-196	126.42	+/-Z	-265	294	-1
10	692.02	-224.82	126.42	+/-Z	-476	294	-2
11	698.37	-183.24	126.42	+/-Z	-729	294	-2
12	707.1	-210.1	126.42	+/-Z	47	294	0
13	636.98	-211.95	126.42	+/-Z	789	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 99

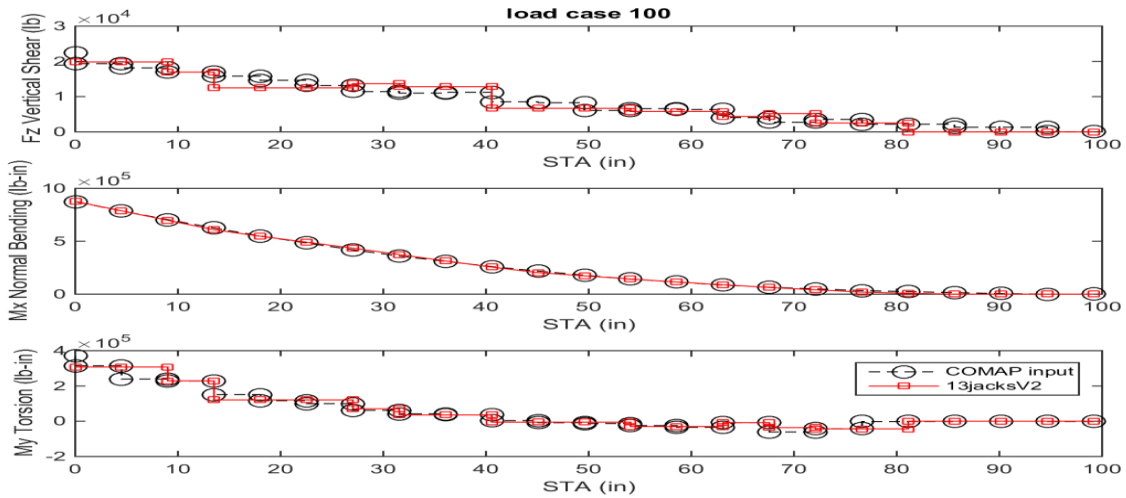
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1515	294	5
2	617.45	-190.36	126.42	+/-Z	53	294	0
3	630.22	-168.44	126.42	+/-Z	985	294	3
4	655.02	-230.98	126.42	+/-Z	1505	147	10
5	652.71	-198.96	126.42	+/-Z	4673	294	16
6	666.77	-169.52	126.42	+/-Z	3711	294	13
7	673.63	-222.49	126.42	+/-Z	1676	147	11
8	674.96	-239.53	126.42	+/-Z	1670	147	11
9	678.92	-196	126.42	+/-Z	1250	294	4
10	692.02	-224.82	126.42	+/-Z	-277	294	-1
11	698.37	-183.24	126.42	+/-Z	-139	294	0
12	707.1	-210.1	126.42	+/-Z	705	294	2
13	636.98	-211.95	126.42	+/-Z	564	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 100

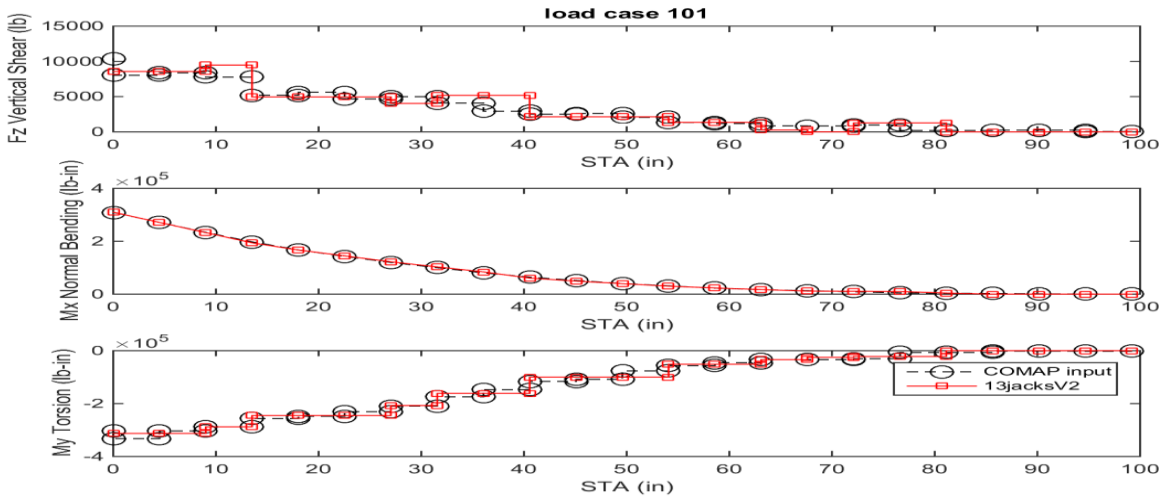
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2153	294	7
2	617.45	-190.36	126.42	+/-Z	876	294	3
3	630.22	-168.44	126.42	+/-Z	2860	294	10
4	655.02	-230.98	126.42	+/-Z	2683	147	18
5	652.71	-198.96	126.42	+/-Z	6564	294	22
6	666.77	-169.52	126.42	+/-Z	2337	294	8
7	673.63	-222.49	126.42	+/-Z	1398	147	10
8	674.96	-239.53	126.42	+/-Z	2498	147	17
9	678.92	-196	126.42	+/-Z	-433	294	-1
10	692.02	-224.82	126.42	+/-Z	-824	294	-3
11	698.37	-183.24	126.42	+/-Z	-1215	294	-4
12	707.1	-210.1	126.42	+/-Z	-82	294	0
13	636.98	-211.95	126.42	+/-Z	1001	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 101

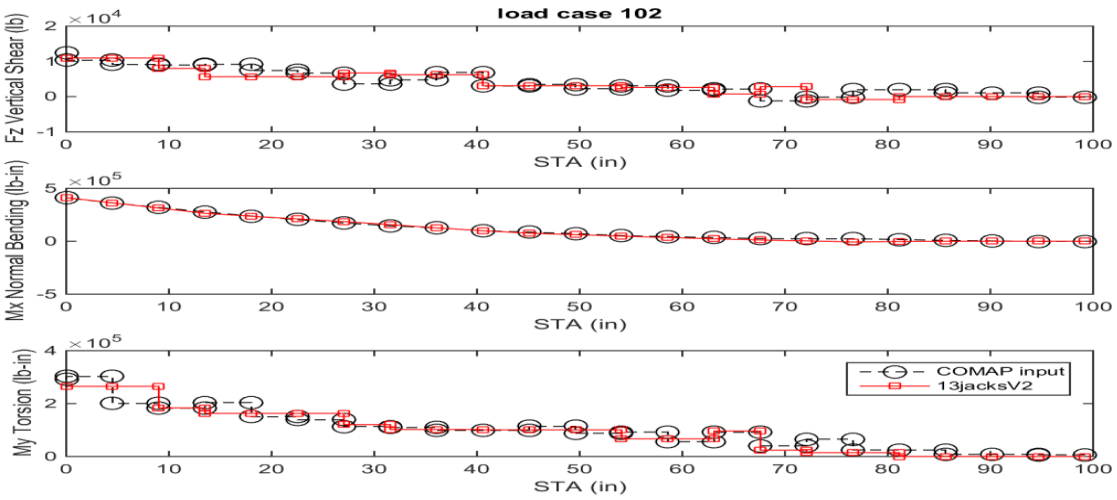
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-20	294	0
2	617.45	-190.36	126.42	+/-Z	-1142	294	-4
3	630.22	-168.44	126.42	+/-Z	-915	294	-3
4	655.02	-230.98	126.42	+/-Z	-1253	147	-9
5	652.71	-198.96	126.42	+/-Z	129	294	0
6	666.77	-169.52	126.42	+/-Z	4528	294	15
7	673.63	-222.49	126.42	+/-Z	1081	147	7
8	674.96	-239.53	126.42	+/-Z	1266	147	9
9	678.92	-196	126.42	+/-Z	2913	294	10
10	692.02	-224.82	126.42	+/-Z	254	294	1
11	698.37	-183.24	126.42	+/-Z	929	294	3
12	707.1	-210.1	126.42	+/-Z	928	294	3
13	636.98	-211.95	126.42	+/-Z	-142	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 102

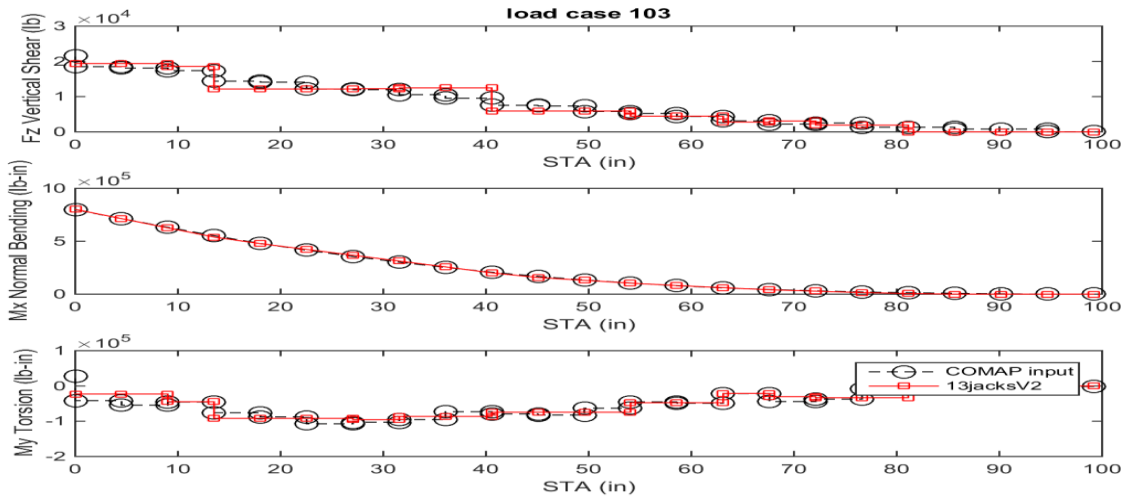
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	603	294	2
2	617.45	-190.36	126.42	+/-Z	467	294	2
3	630.22	-168.44	126.42	+/-Z	2984	294	10
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	2584	294	9
6	666.77	-169.52	126.42	+/-Z	1732	294	6
7	673.63	-222.49	126.42	+/-Z	1850	147	13
8	674.96	-239.53	126.42	+/-Z	-833	147	-6
9	678.92	-196	126.42	+/-Z	539	294	2
10	692.02	-224.82	126.42	+/-Z	-2106	294	-7
11	698.37	-183.24	126.42	+/-Z	-1035	294	-4
12	707.1	-210.1	126.42	+/-Z	-340	294	-1
13	636.98	-211.95	126.42	+/-Z	828	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 103

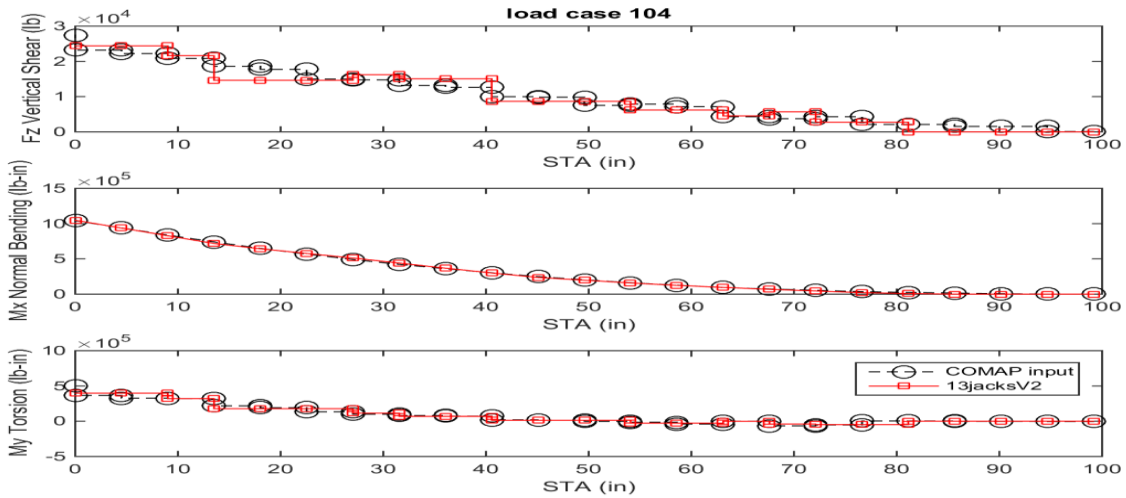
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1524	294	5
2	617.45	-190.36	126.42	+/-Z	-230	294	-1
3	630.22	-168.44	126.42	+/-Z	798	294	3
4	655.02	-230.98	126.42	+/-Z	1145	147	8
5	652.71	-198.96	126.42	+/-Z	4890	294	17
6	666.77	-169.52	126.42	+/-Z	4890	294	17
7	673.63	-222.49	126.42	+/-Z	1628	147	11
8	674.96	-239.53	126.42	+/-Z	1929	147	13
9	678.92	-196	126.42	+/-Z	1673	294	6
10	692.02	-224.82	126.42	+/-Z	-263	294	-1
11	698.37	-183.24	126.42	+/-Z	-89	294	0
12	707.1	-210.1	126.42	+/-Z	819	294	3
13	636.98	-211.95	126.42	+/-Z	649	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 104

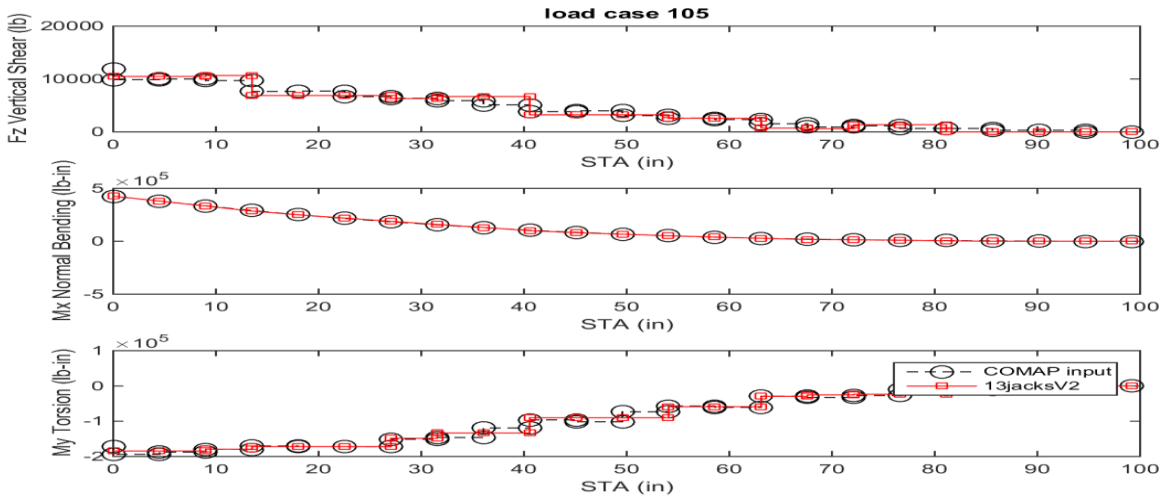
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2962	294	10
2	617.45	-190.36	126.42	+/-Z	1135	294	4
3	630.22	-168.44	126.42	+/-Z	2800	294	10
4	655.02	-230.98	126.42	+/-Z	2917	147	20
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	3994	294	14
7	673.63	-222.49	126.42	+/-Z	1680	147	11
8	674.96	-239.53	126.42	+/-Z	2755	147	19
9	678.92	-196	126.42	+/-Z	-939	294	-3
10	692.02	-224.82	126.42	+/-Z	-1154	294	-4
11	698.37	-183.24	126.42	+/-Z	-1572	294	-5
12	707.1	-210.1	126.42	+/-Z	152	294	1
13	636.98	-211.95	126.42	+/-Z	2311	294	8



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 105

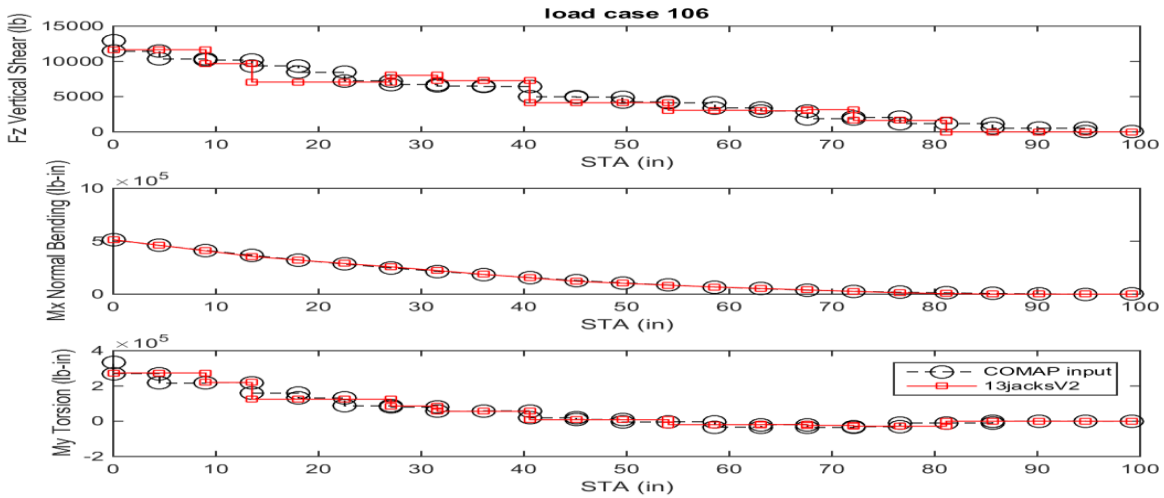
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	392	294	1
2	617.45	-190.36	126.42	+/-Z	-379	294	-1
3	630.22	-168.44	126.42	+/-Z	-185	294	-1
4	655.02	-230.98	126.42	+/-Z	-749	147	-5
5	652.71	-198.96	126.42	+/-Z	1158	294	4
6	666.77	-169.52	126.42	+/-Z	3400	294	12
7	673.63	-222.49	126.42	+/-Z	1837	147	12
8	674.96	-239.53	126.42	+/-Z	1355	147	9
9	678.92	-196	126.42	+/-Z	2295	294	8
10	692.02	-224.82	126.42	+/-Z	114	294	0
11	698.37	-183.24	126.42	+/-Z	574	294	2
12	707.1	-210.1	126.42	+/-Z	643	294	2
13	636.98	-211.95	126.42	+/-Z	20	294	0



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 106

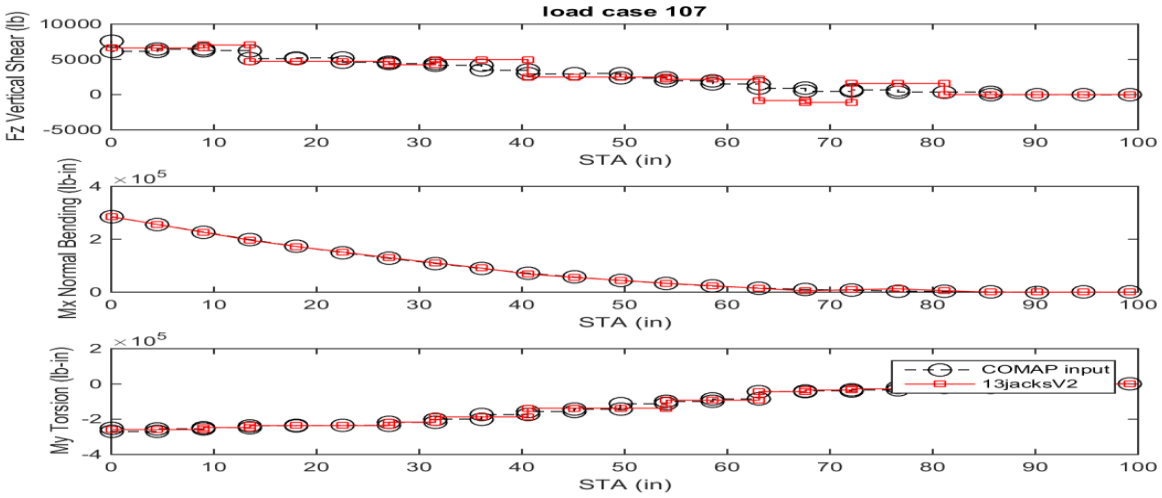
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1707	294	6
2	617.45	-190.36	126.42	+/-Z	742	294	3
3	630.22	-168.44	126.42	+/-Z	1975	294	7
4	655.02	-230.98	126.42	+/-Z	1527	147	10
5	652.71	-198.96	126.42	+/-Z	4365	294	15
6	666.77	-169.52	126.42	+/-Z	905	294	3
7	673.63	-222.49	126.42	+/-Z	55	147	0
8	674.96	-239.53	126.42	+/-Z	1620	147	11
9	678.92	-196	126.42	+/-Z	-1227	294	-4
10	692.02	-224.82	126.42	+/-Z	-155	294	-1
11	698.37	-183.24	126.42	+/-Z	-957	294	-3
12	707.1	-210.1	126.42	+/-Z	-81	294	0
13	636.98	-211.95	126.42	+/-Z	1170	294	4



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 107

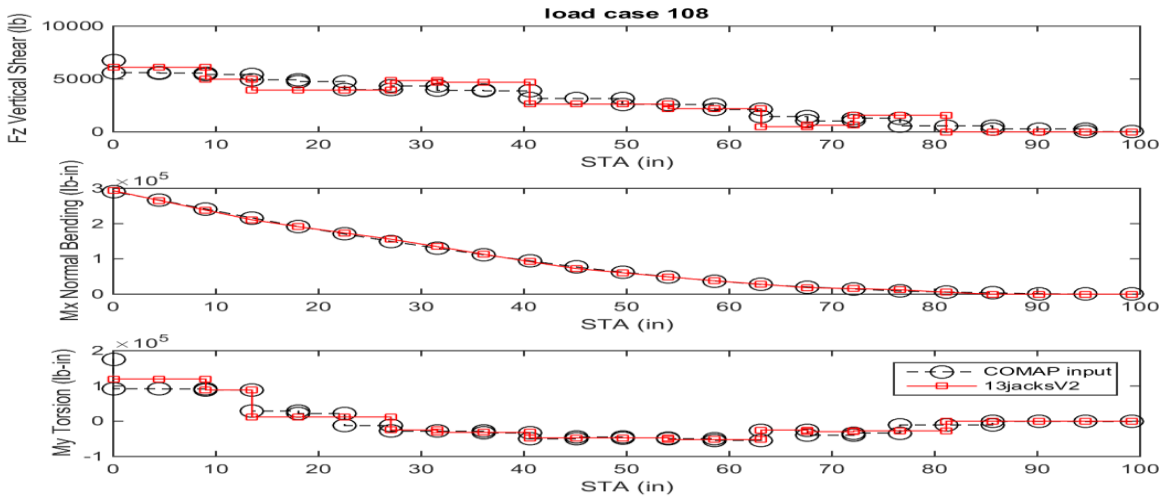
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	146	294	0
2	617.45	-190.36	126.42	+/-Z	-737	294	-3
3	630.22	-168.44	126.42	+/-Z	-423	294	-1
4	655.02	-230.98	126.42	+/-Z	-2697	147	-18
5	652.71	-198.96	126.42	+/-Z	128	294	0
6	666.77	-169.52	126.42	+/-Z	2186	294	7
7	673.63	-222.49	126.42	+/-Z	2999	147	20
8	674.96	-239.53	126.42	+/-Z	1588	147	11
9	678.92	-196	126.42	+/-Z	2349	294	8
10	692.02	-224.82	126.42	+/-Z	269	294	1
11	698.37	-183.24	126.42	+/-Z	481	294	2
12	707.1	-210.1	126.42	+/-Z	749	294	3
13	636.98	-211.95	126.42	+/-Z	-421	294	-1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 108

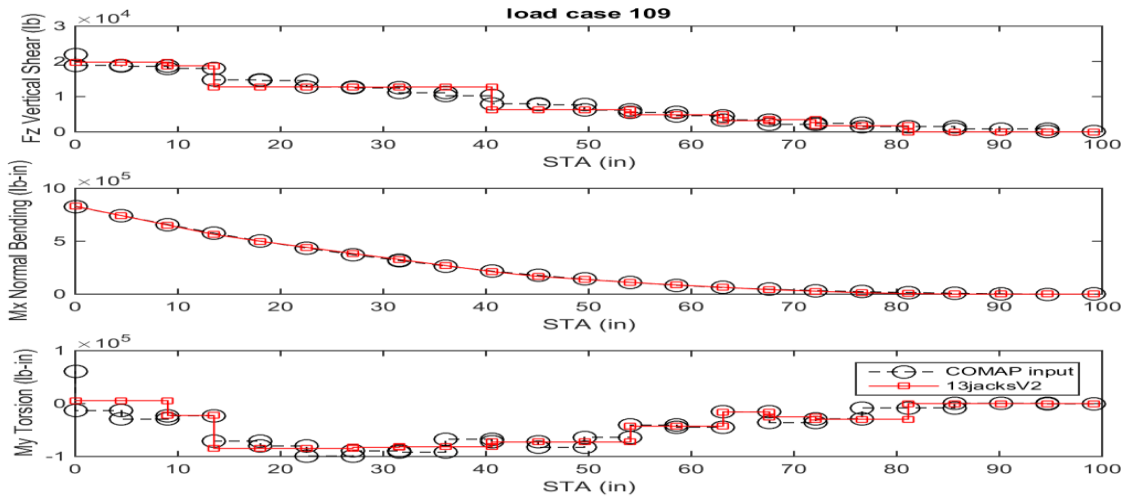
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1237	294	4
2	617.45	-190.36	126.42	+/-Z	166	294	1
3	630.22	-168.44	126.42	+/-Z	1131	294	4
4	655.02	-230.98	126.42	+/-Z	-944	147	-6
5	652.71	-198.96	126.42	+/-Z	2272	294	8
6	666.77	-169.52	126.42	+/-Z	-212	294	-1
7	673.63	-222.49	126.42	+/-Z	1699	147	12
8	674.96	-239.53	126.42	+/-Z	1570	147	11
9	678.92	-196	126.42	+/-Z	-207	294	-1
10	692.02	-224.82	126.42	+/-Z	-134	294	0
11	698.37	-183.24	126.42	+/-Z	-906	294	-3
12	707.1	-210.1	126.42	+/-Z	55	294	0
13	636.98	-211.95	126.42	+/-Z	378	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 109

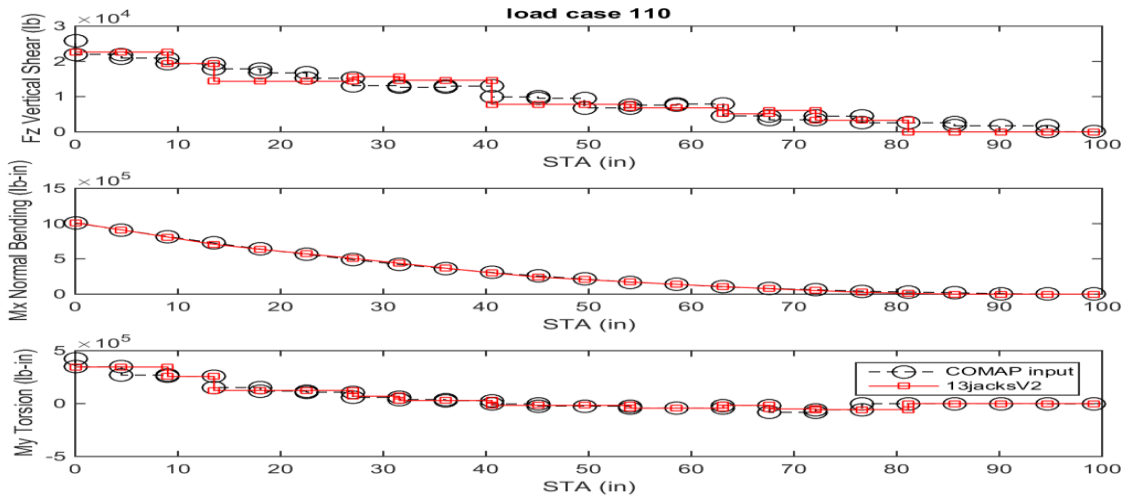
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1686	294	6
2	617.45	-190.36	126.42	+/-Z	-30	294	0
3	630.22	-168.44	126.42	+/-Z	1027	294	3
4	655.02	-230.98	126.42	+/-Z	1746	147	12
5	652.71	-198.96	126.42	+/-Z	4908	294	17
6	666.77	-169.52	126.42	+/-Z	4302	294	15
7	673.63	-222.49	126.42	+/-Z	1668	147	11
8	674.96	-239.53	126.42	+/-Z	1706	147	12
9	678.92	-196	126.42	+/-Z	1552	294	5
10	692.02	-224.82	126.42	+/-Z	-266	294	-1
11	698.37	-183.24	126.42	+/-Z	49	294	0
12	707.1	-210.1	126.42	+/-Z	843	294	3
13	636.98	-211.95	126.42	+/-Z	568	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 110

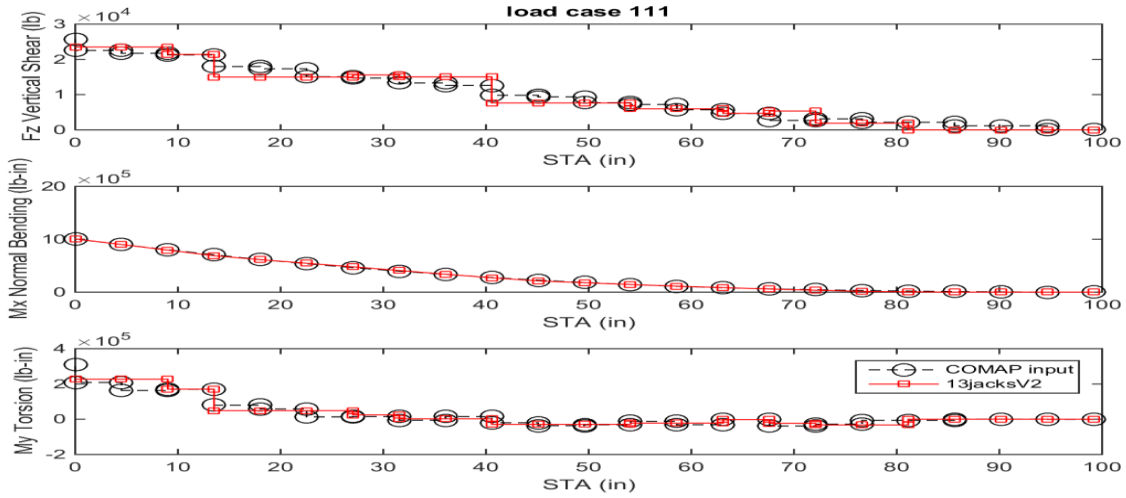
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2579	294	9
2	617.45	-190.36	126.42	+/-Z	1008	294	3
3	630.22	-168.44	126.42	+/-Z	3246	294	11
4	655.02	-230.98	126.42	+/-Z	2792	147	19
5	652.71	-198.96	126.42	+/-Z	7303	294	25
6	666.77	-169.52	126.42	+/-Z	2463	294	8
7	673.63	-222.49	126.42	+/-Z	1703	147	12
8	674.96	-239.53	126.42	+/-Z	3293	147	22
9	678.92	-196	126.42	+/-Z	-459	294	-2
10	692.02	-224.82	126.42	+/-Z	-964	294	-3
11	698.37	-183.24	126.42	+/-Z	-1324	294	-5
12	707.1	-210.1	126.42	+/-Z	-104	294	0
13	636.98	-211.95	126.42	+/-Z	1084	294	4



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 111

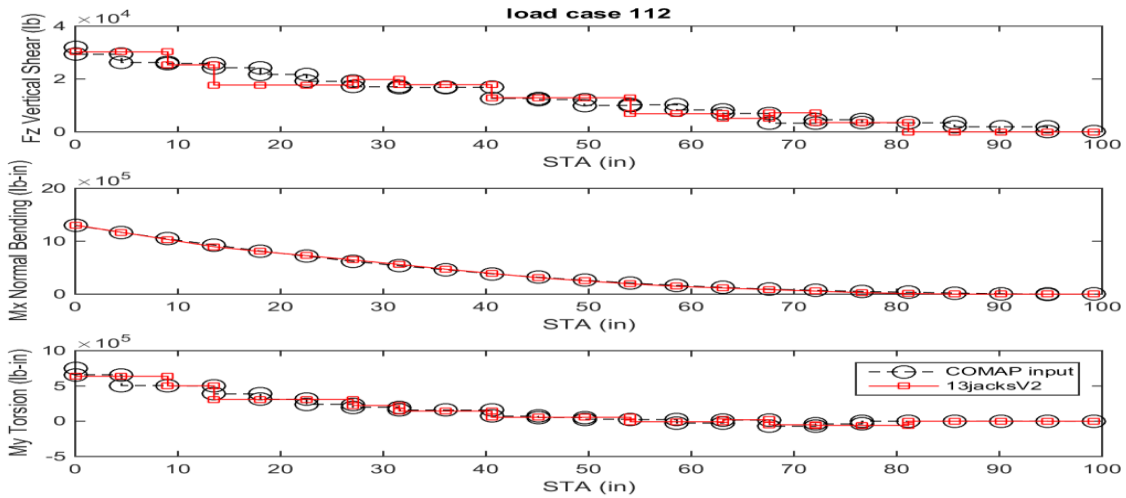
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2601	294	9
2	617.45	-190.36	126.42	+/-Z	549	294	2
3	630.22	-168.44	126.42	+/-Z	2072	294	7
4	655.02	-230.98	126.42	+/-Z	3448	147	23
5	652.71	-198.96	126.42	+/-Z	7216	294	25
6	666.77	-169.52	126.42	+/-Z	3793	294	13
7	673.63	-222.49	126.42	+/-Z	1267	147	9
8	674.96	-239.53	126.42	+/-Z	1898	147	13
9	678.92	-196	126.42	+/-Z	204	294	1
10	692.02	-224.82	126.42	+/-Z	-641	294	-2
11	698.37	-183.24	126.42	+/-Z	-592	294	-2
12	707.1	-210.1	126.42	+/-Z	581	294	2
13	636.98	-211.95	126.42	+/-Z	1069	294	4



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 112

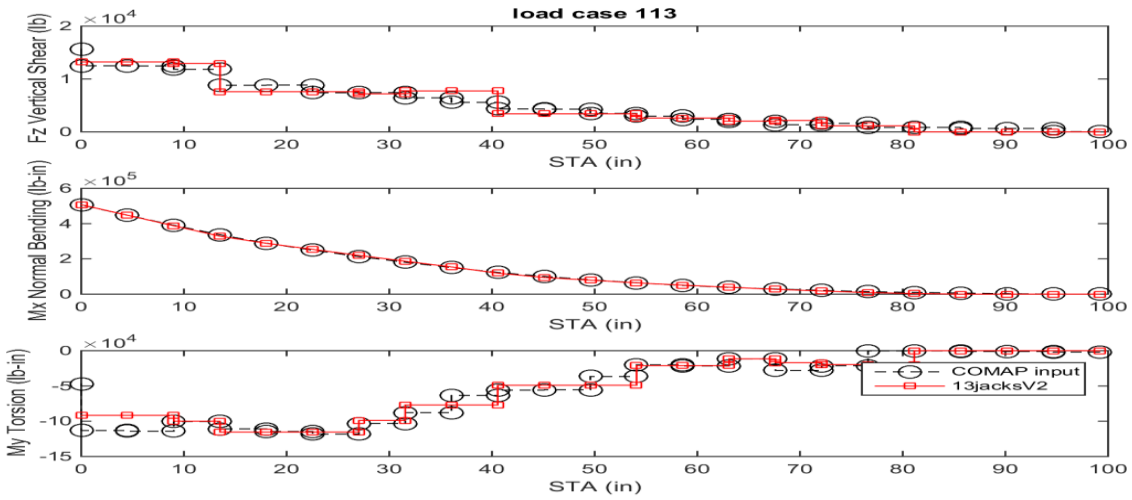
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3797	294	13
2	617.45	-190.36	126.42	+/-Z	1972	294	7
3	630.22	-168.44	126.42	+/-Z	4933	294	17
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	3841	294	13
7	673.63	-222.49	126.42	+/-Z	1760	147	12
8	674.96	-239.53	126.42	+/-Z	3516	147	24
9	678.92	-196	126.42	+/-Z	-2429	294	-8
10	692.02	-224.82	126.42	+/-Z	-2083	294	-7
11	698.37	-183.24	126.42	+/-Z	-2096	294	-7
12	707.1	-210.1	126.42	+/-Z	871	294	3
13	636.98	-211.95	126.42	+/-Z	5166	294	18



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 113

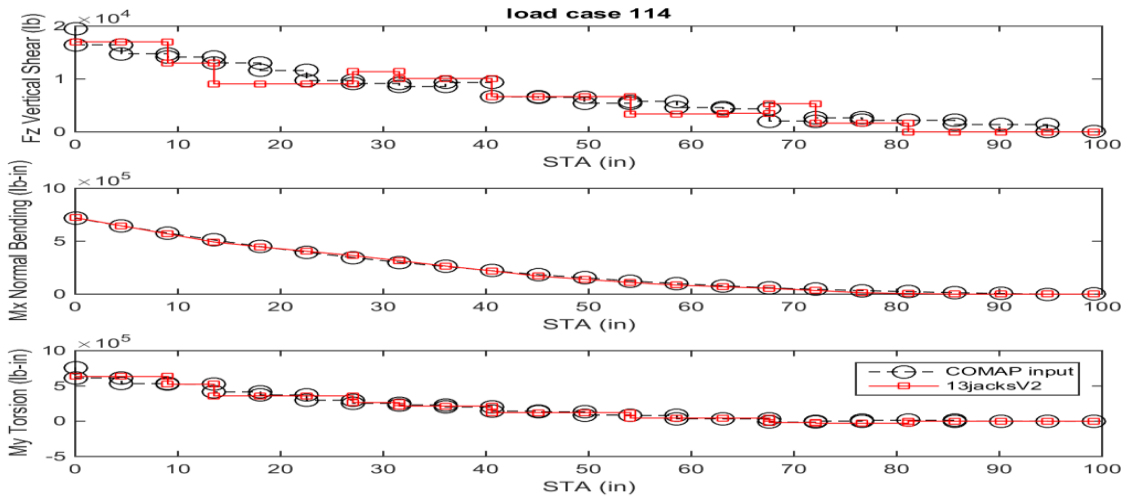
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	924	294	3
2	617.45	-190.36	126.42	+/-Z	-547	294	-2
3	630.22	-168.44	126.42	+/-Z	303	294	1
4	655.02	-230.98	126.42	+/-Z	1029	147	7
5	652.71	-198.96	126.42	+/-Z	2452	294	8
6	666.77	-169.52	126.42	+/-Z	4397	294	15
7	673.63	-222.49	126.42	+/-Z	603	147	4
8	674.96	-239.53	126.42	+/-Z	1143	147	8
9	678.92	-196	126.42	+/-Z	1874	294	6
10	692.02	-224.82	126.42	+/-Z	-166	294	-1
11	698.37	-183.24	126.42	+/-Z	406	294	1
12	707.1	-210.1	126.42	+/-Z	636	294	2
13	636.98	-211.95	126.42	+/-Z	169	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 114

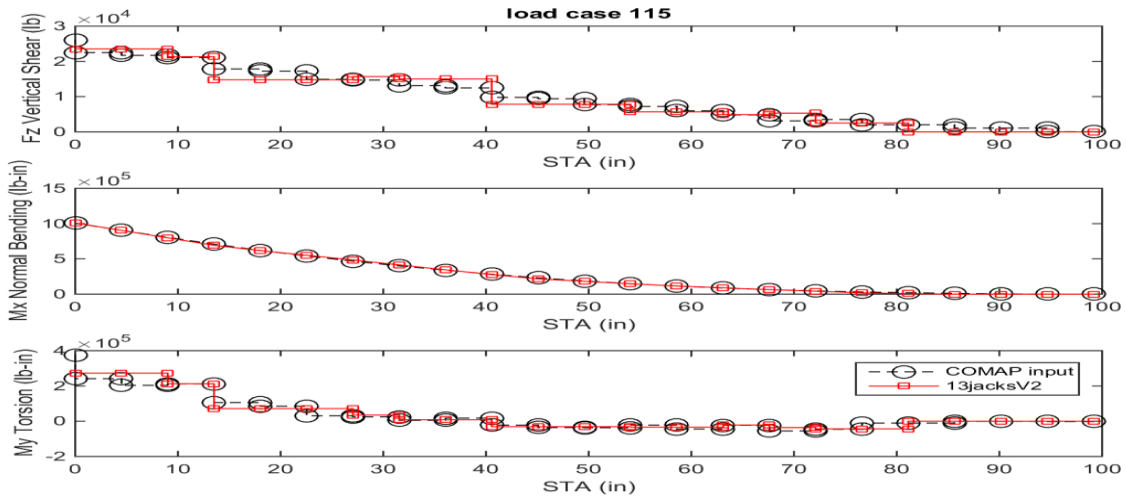
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2892	294	10
2	617.45	-190.36	126.42	+/-Z	1294	294	4
3	630.22	-168.44	126.42	+/-Z	4012	294	14
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	6242	294	21
6	666.77	-169.52	126.42	+/-Z	1047	294	4
7	673.63	-222.49	126.42	+/-Z	-104	147	-1
8	674.96	-239.53	126.42	+/-Z	1638	147	11
9	678.92	-196	126.42	+/-Z	-2819	294	-10
10	692.02	-224.82	126.42	+/-Z	-1815	294	-6
11	698.37	-183.24	126.42	+/-Z	-2317	294	-8
12	707.1	-210.1	126.42	+/-Z	-131	294	0
13	636.98	-211.95	126.42	+/-Z	3410	294	12



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 115

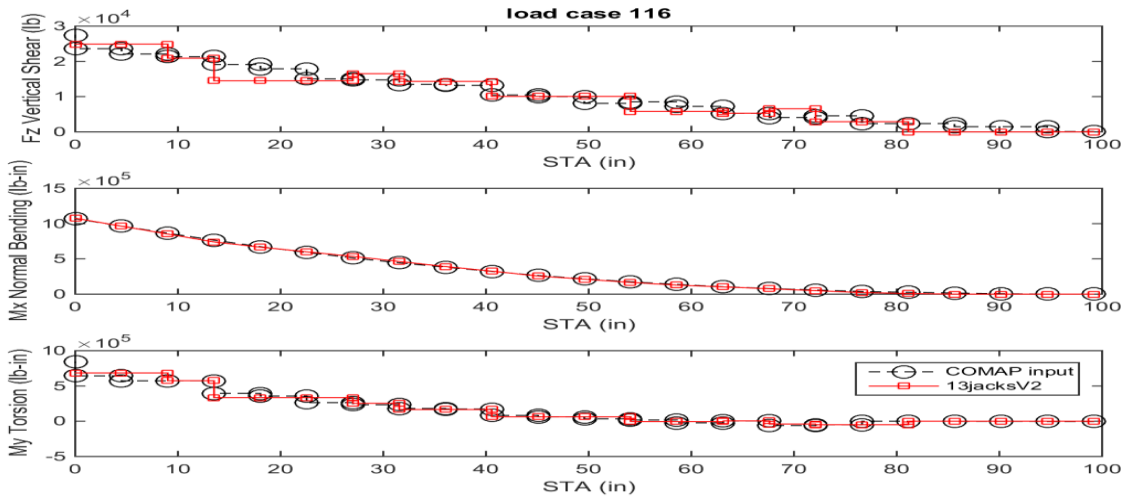
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2893	294	10
2	617.45	-190.36	126.42	+/-Z	648	294	2
3	630.22	-168.44	126.42	+/-Z	2198	294	7
4	655.02	-230.98	126.42	+/-Z	2811	147	19
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	3669	294	12
7	673.63	-222.49	126.42	+/-Z	780	147	5
8	674.96	-239.53	126.42	+/-Z	2494	147	17
9	678.92	-196	126.42	+/-Z	-161	294	-1
10	692.02	-224.82	126.42	+/-Z	-413	294	-1
11	698.37	-183.24	126.42	+/-Z	-909	294	-3
12	707.1	-210.1	126.42	+/-Z	590	294	2
13	636.98	-211.95	126.42	+/-Z	1565	294	5



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 116

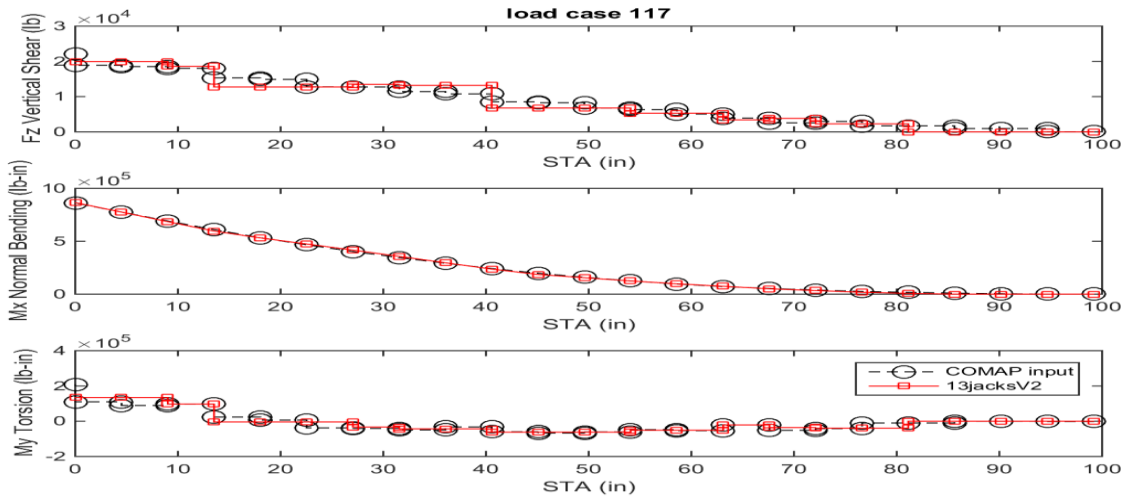
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	4301	294	15
2	617.45	-190.36	126.42	+/-Z	2187	294	7
3	630.22	-168.44	126.42	+/-Z	3986	294	14
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	2089	294	7
7	673.63	-222.49	126.42	+/-Z	509	147	3
8	674.96	-239.53	126.42	+/-Z	2884	147	20
9	678.92	-196	126.42	+/-Z	-3108	294	-11
10	692.02	-224.82	126.42	+/-Z	-1290	294	-4
11	698.37	-183.24	126.42	+/-Z	-1997	294	-7
12	707.1	-210.1	126.42	+/-Z	303	294	1
13	636.98	-211.95	126.42	+/-Z	3990	294	14



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 117

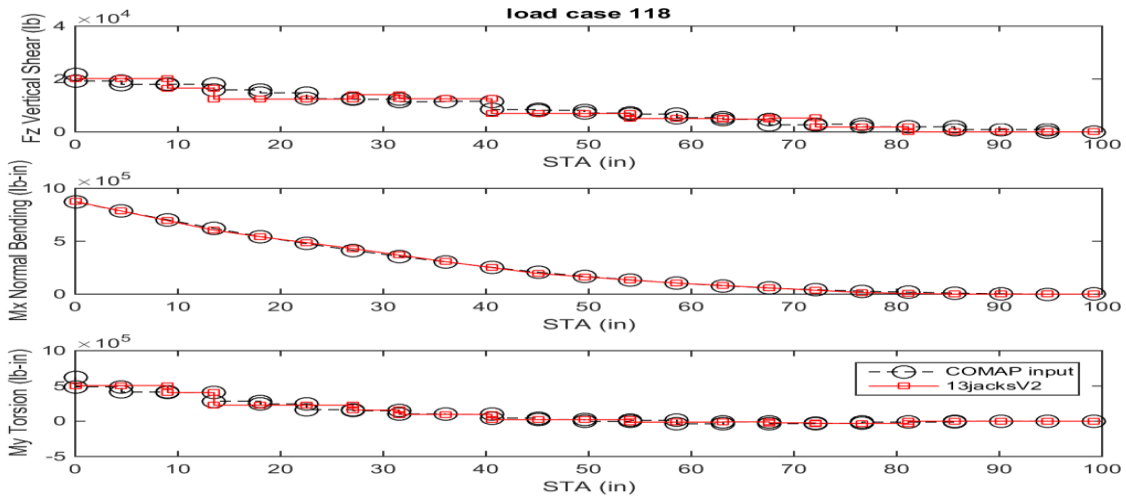
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	2241	294	8
2	617.45	-190.36	126.42	+/-Z	252	294	1
3	630.22	-168.44	126.42	+/-Z	1350	294	5
4	655.02	-230.98	126.42	+/-Z	1532	147	10
5	652.71	-198.96	126.42	+/-Z	5948	294	20
6	666.77	-169.52	126.42	+/-Z	3605	294	12
7	673.63	-222.49	126.42	+/-Z	1884	147	13
8	674.96	-239.53	126.42	+/-Z	2290	147	16
9	678.92	-196	126.42	+/-Z	480	294	2
10	692.02	-224.82	126.42	+/-Z	-422	294	-1
11	698.37	-183.24	126.42	+/-Z	-708	294	-2
12	707.1	-210.1	126.42	+/-Z	592	294	2
13	636.98	-211.95	126.42	+/-Z	892	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 118

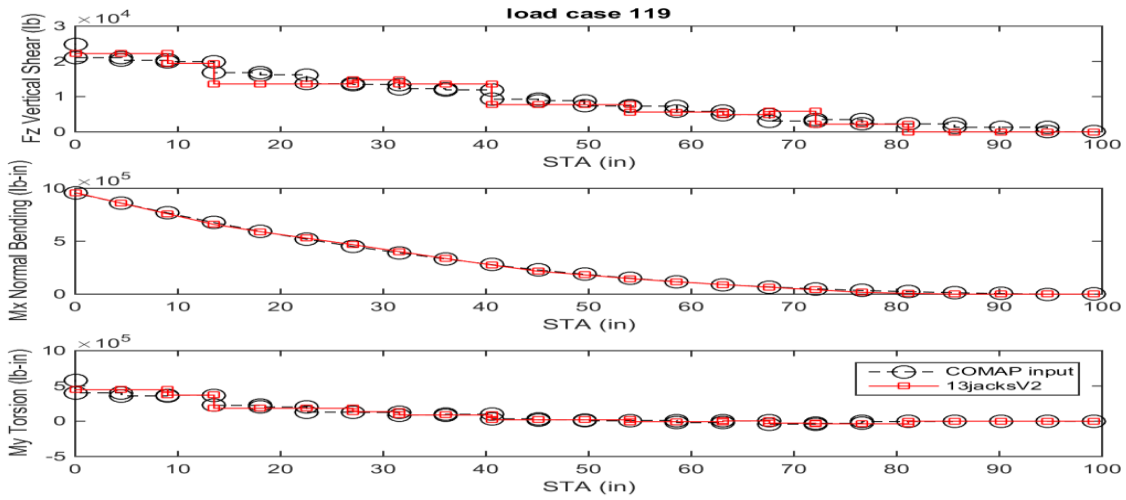
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3125	294	11
2	617.45	-190.36	126.42	+/-Z	1535	294	5
3	630.22	-168.44	126.42	+/-Z	3603	294	12
4	655.02	-230.98	126.42	+/-Z	3371	147	23
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	1068	294	4
7	673.63	-222.49	126.42	+/-Z	204	147	1
8	674.96	-239.53	126.42	+/-Z	1861	147	13
9	678.92	-196	126.42	+/-Z	-1744	294	-6
10	692.02	-224.82	126.42	+/-Z	-396	294	-1
11	698.37	-183.24	126.42	+/-Z	-1729	294	-6
12	707.1	-210.1	126.42	+/-Z	45	294	0
13	636.98	-211.95	126.42	+/-Z	1854	294	6



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 119

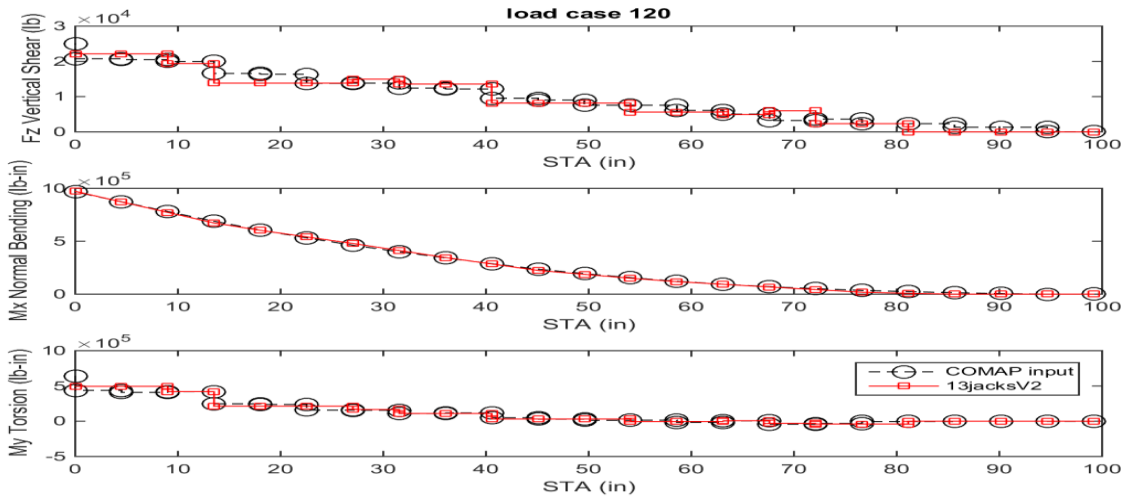
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3456	294	12
2	617.45	-190.36	126.42	+/-Z	1164	294	4
3	630.22	-168.44	126.42	+/-Z	2809	294	10
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	2374	294	8
7	673.63	-222.49	126.42	+/-Z	721	147	5
8	674.96	-239.53	126.42	+/-Z	2164	147	15
9	678.92	-196	126.42	+/-Z	-1505	294	-5
10	692.02	-224.82	126.42	+/-Z	-940	294	-3
11	698.37	-183.24	126.42	+/-Z	-1165	294	-4
12	707.1	-210.1	126.42	+/-Z	226	294	1
13	636.98	-211.95	126.42	+/-Z	1890	294	6



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 120

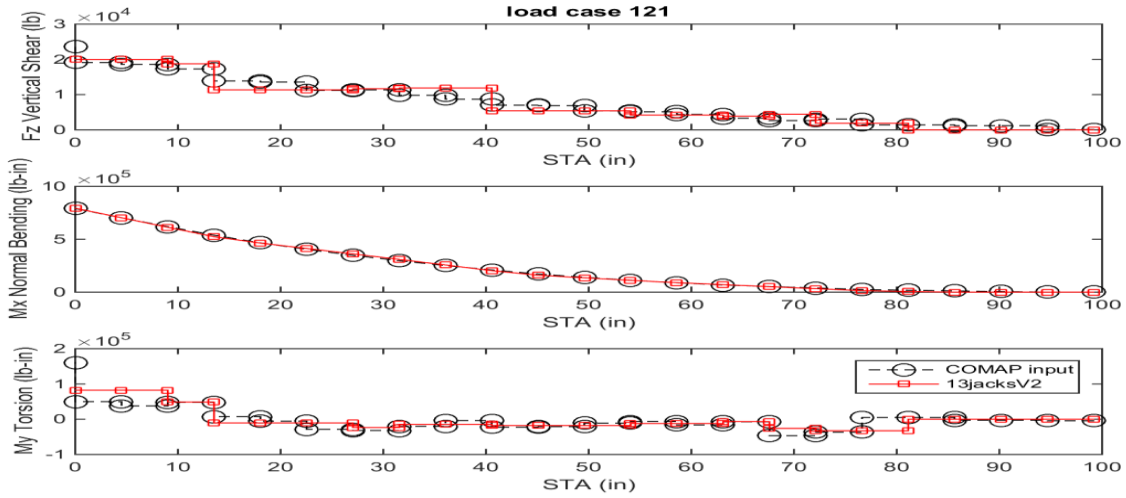
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3712	294	13
2	617.45	-190.36	126.42	+/-Z	1390	294	5
3	630.22	-168.44	126.42	+/-Z	2752	294	9
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	1839	294	6
7	673.63	-222.49	126.42	+/-Z	709	147	5
8	674.96	-239.53	126.42	+/-Z	2323	147	16
9	678.92	-196	126.42	+/-Z	-1964	294	-7
10	692.02	-224.82	126.42	+/-Z	-1096	294	-4
11	698.37	-183.24	126.42	+/-Z	-1142	294	-4
12	707.1	-210.1	126.42	+/-Z	243	294	1
13	636.98	-211.95	126.42	+/-Z	2323	294	8



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 121

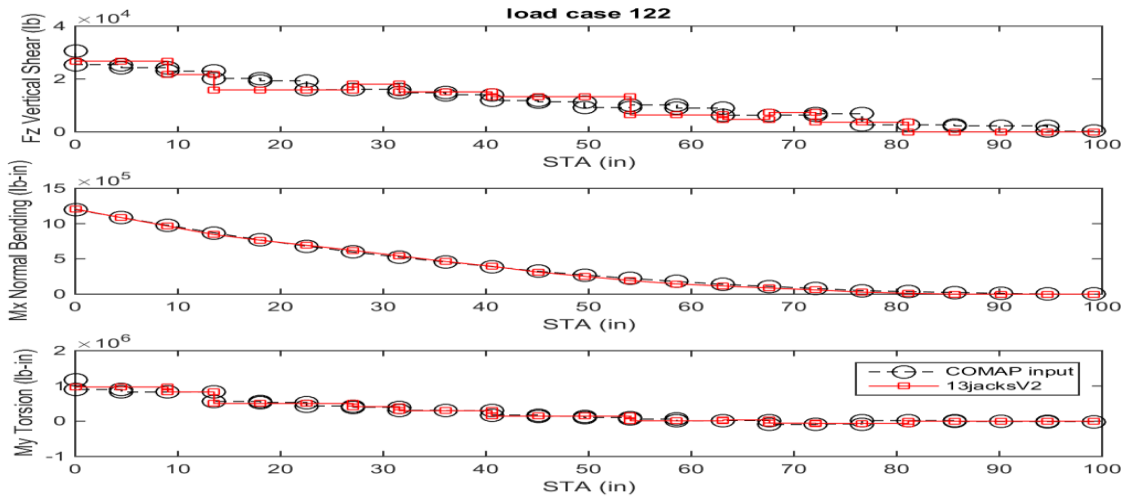
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1829	294	6
2	617.45	-190.36	126.42	+/-Z	-225	294	-1
3	630.22	-168.44	126.42	+/-Z	1225	294	4
4	655.02	-230.98	126.42	+/-Z	2541	147	17
5	652.71	-198.96	126.42	+/-Z	5395	294	18
6	666.77	-169.52	126.42	+/-Z	5555	294	19
7	673.63	-222.49	126.42	+/-Z	350	147	2
8	674.96	-239.53	126.42	+/-Z	1884	147	13
9	678.92	-196	126.42	+/-Z	1089	294	4
10	692.02	-224.82	126.42	+/-Z	-563	294	-2
11	698.37	-183.24	126.42	+/-Z	-315	294	-1
12	707.1	-210.1	126.42	+/-Z	429	294	1
13	636.98	-211.95	126.42	+/-Z	760	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 122

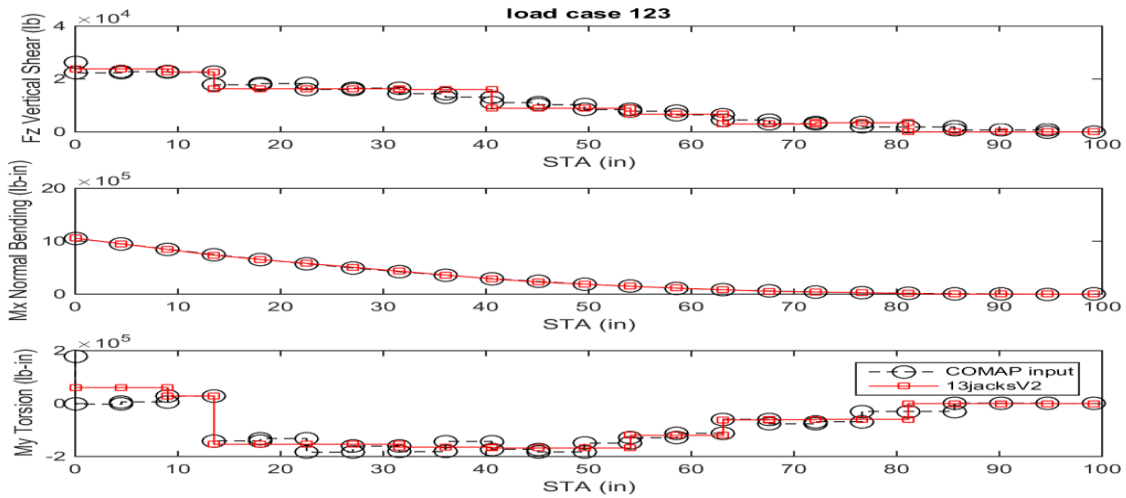
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	5473	294	19
2	617.45	-190.36	126.42	+/-Z	2923	294	10
3	630.22	-168.44	126.42	+/-Z	5067	294	17
4	655.02	-230.98	126.42	+/-Z	3675	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	339	294	1
7	673.63	-222.49	126.42	+/-Z	1659	147	11
8	674.96	-239.53	126.42	+/-Z	3675	147	25
9	678.92	-196	126.42	+/-Z	-5541	294	-19
10	692.02	-224.82	126.42	+/-Z	-2641	294	-9
11	698.37	-183.24	126.42	+/-Z	-2174	294	-7
12	707.1	-210.1	126.42	+/-Z	155	294	1
13	636.98	-211.95	126.42	+/-Z	6782	294	23



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 123

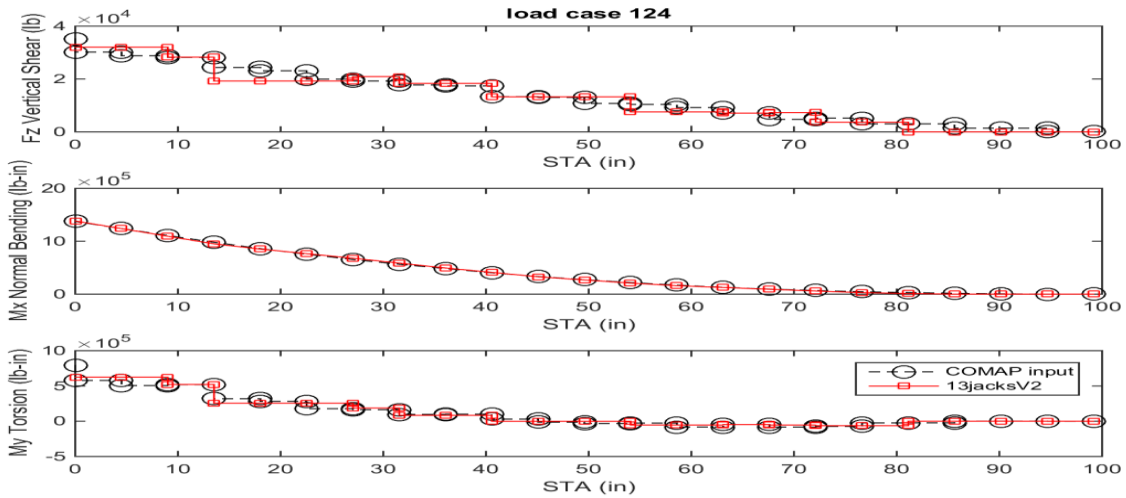
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	3470	294	12
2	617.45	-190.36	126.42	+/-Z	270	294	1
3	630.22	-168.44	126.42	+/-Z	1161	294	4
4	655.02	-230.98	126.42	+/-Z	-455	147	-3
5	652.71	-198.96	126.42	+/-Z	5885	294	20
6	666.77	-169.52	126.42	+/-Z	2900	294	10
7	673.63	-222.49	126.42	+/-Z	3675	147	25
8	674.96	-239.53	126.42	+/-Z	3430	147	23
9	678.92	-196	126.42	+/-Z	1197	294	4
10	692.02	-224.82	126.42	+/-Z	21	294	0
11	698.37	-183.24	126.42	+/-Z	2	294	0
12	707.1	-210.1	126.42	+/-Z	1346	294	5
13	636.98	-211.95	126.42	+/-Z	914	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 124

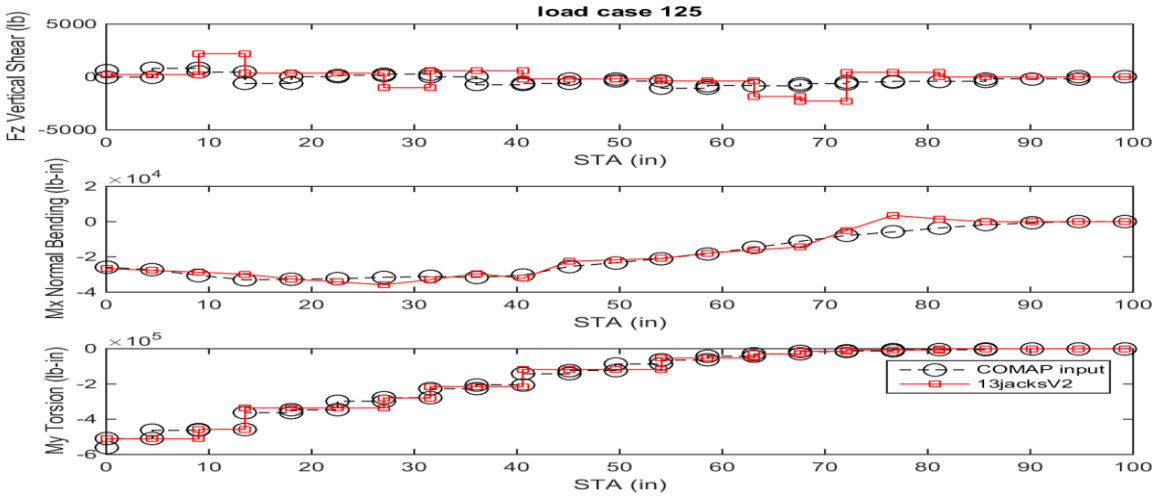
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	5020	294	17
2	617.45	-190.36	126.42	+/-Z	2556	294	9
3	630.22	-168.44	126.42	+/-Z	3759	294	13
4	655.02	-230.98	126.42	+/-Z	3632	147	25
5	652.71	-198.96	126.42	+/-Z	7350	294	25
6	666.77	-169.52	126.42	+/-Z	4024	294	14
7	673.63	-222.49	126.42	+/-Z	448	147	3
8	674.96	-239.53	126.42	+/-Z	3675	147	25
9	678.92	-196	126.42	+/-Z	-2261	294	-8
10	692.02	-224.82	126.42	+/-Z	-211	294	-1
11	698.37	-183.24	126.42	+/-Z	-1677	294	-6
12	707.1	-210.1	126.42	+/-Z	913	294	3
13	636.98	-211.95	126.42	+/-Z	4791	294	16



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 125

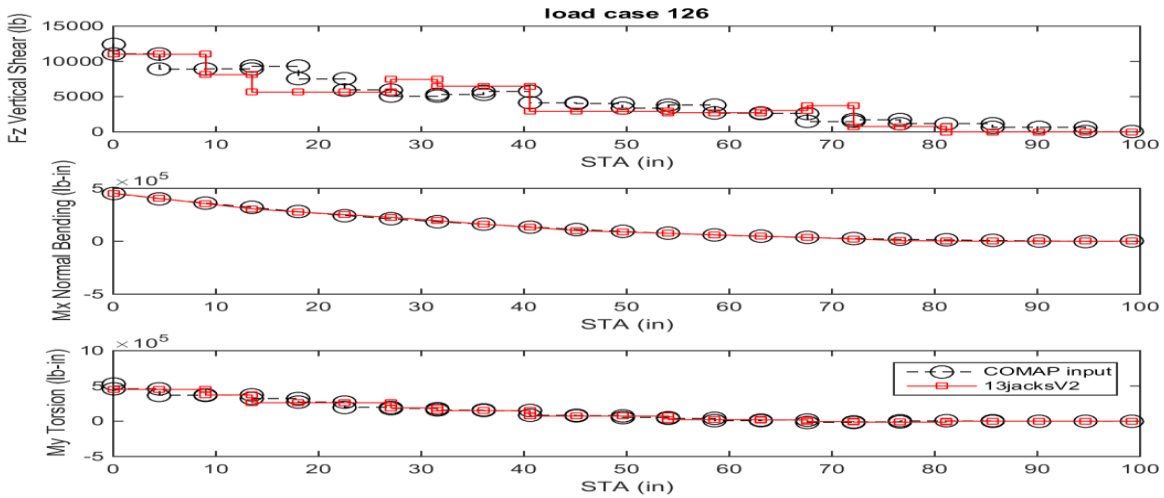
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1512	294	-5
2	617.45	-190.36	126.42	+/-Z	-1602	294	-5
3	630.22	-168.44	126.42	+/-Z	-1970	294	-7
4	655.02	-230.98	126.42	+/-Z	-2728	147	-19
5	652.71	-198.96	126.42	+/-Z	-3076	294	-10
6	666.77	-169.52	126.42	+/-Z	3347	294	11
7	673.63	-222.49	126.42	+/-Z	1462	147	10
8	674.96	-239.53	126.42	+/-Z	452	147	3
9	678.92	-196	126.42	+/-Z	3859	294	13
10	692.02	-224.82	126.42	+/-Z	434	294	1
11	698.37	-183.24	126.42	+/-Z	1371	294	5
12	707.1	-210.1	126.42	+/-Z	979	294	3
13	636.98	-211.95	126.42	+/-Z	-789	294	-3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 126

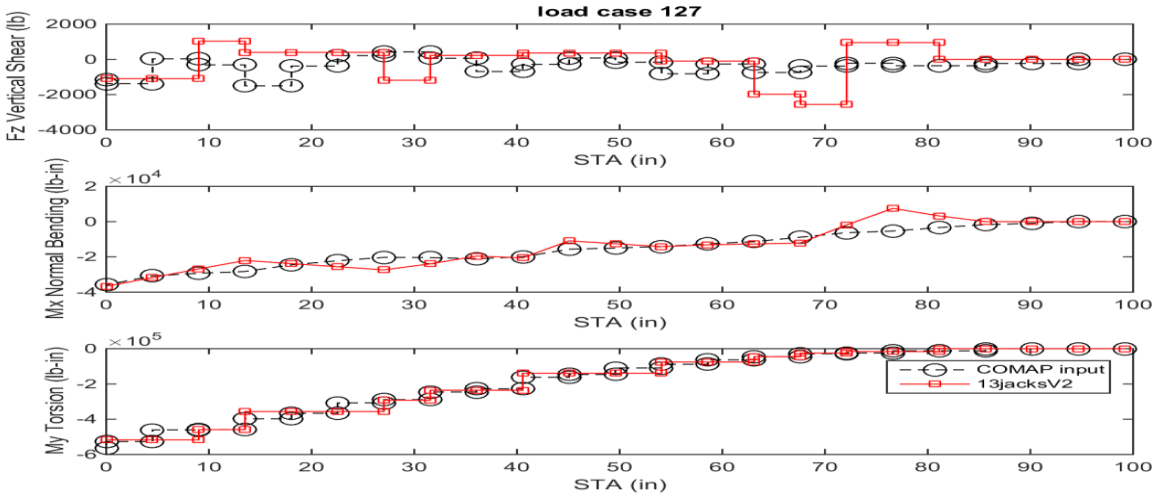
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1910	294	6
2	617.45	-190.36	126.42	+/-Z	961	294	3
3	630.22	-168.44	126.42	+/-Z	2887	294	10
4	655.02	-230.98	126.42	+/-Z	2953	147	20
5	652.71	-198.96	126.42	+/-Z	5860	294	20
6	666.77	-169.52	126.42	+/-Z	575	294	2
7	673.63	-222.49	126.42	+/-Z	-312	147	-2
8	674.96	-239.53	126.42	+/-Z	764	147	5
9	678.92	-196	126.42	+/-Z	-2294	294	-8
10	692.02	-224.82	126.42	+/-Z	-685	294	-2
11	698.37	-183.24	126.42	+/-Z	-1800	294	-6
12	707.1	-210.1	126.42	+/-Z	-652	294	-2
13	636.98	-211.95	126.42	+/-Z	837	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 127

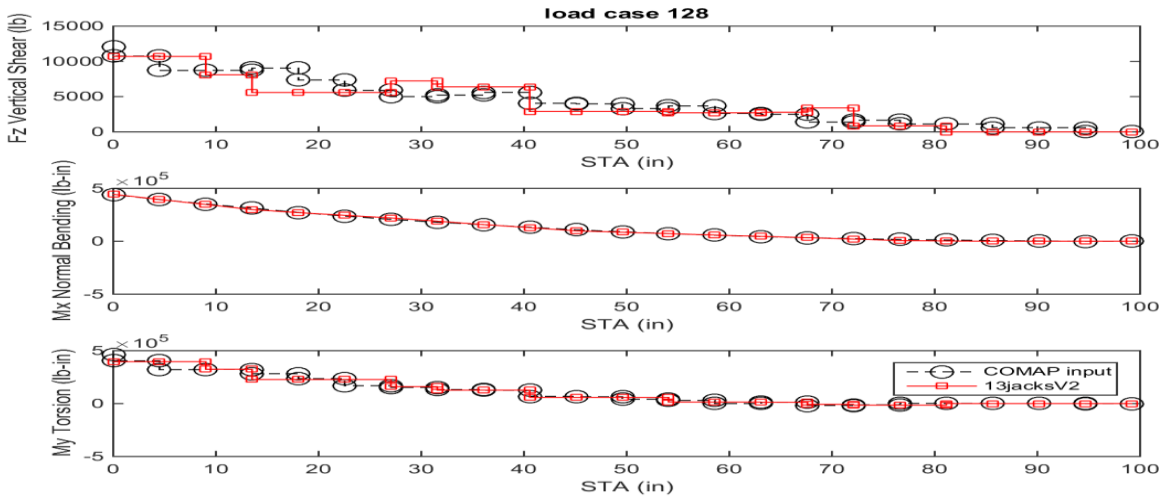
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1393	294	-5
2	617.45	-190.36	126.42	+/-Z	-1405	294	-5
3	630.22	-168.44	126.42	+/-Z	-2123	294	-7
4	655.02	-230.98	126.42	+/-Z	-3508	147	-24
5	652.71	-198.96	126.42	+/-Z	-3791	294	-13
6	666.77	-169.52	126.42	+/-Z	2028	294	7
7	673.63	-222.49	126.42	+/-Z	1881	147	13
8	674.96	-239.53	126.42	+/-Z	949	147	6
9	678.92	-196	126.42	+/-Z	3648	294	12
10	692.02	-224.82	126.42	+/-Z	581	294	2
11	698.37	-183.24	126.42	+/-Z	1581	294	5
12	707.1	-210.1	126.42	+/-Z	1044	294	4
13	636.98	-211.95	126.42	+/-Z	-583	294	-2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 128

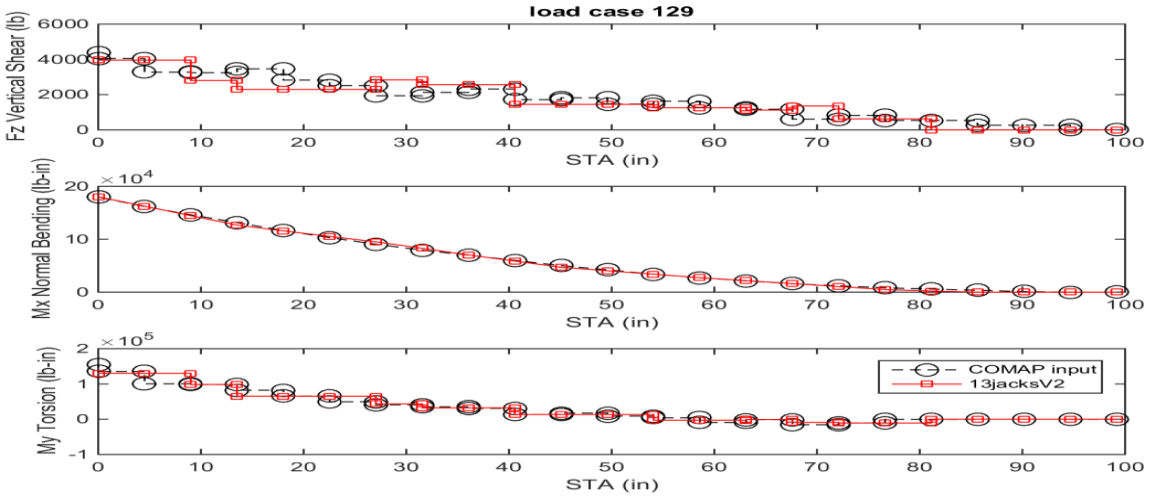
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1721	294	6
2	617.45	-190.36	126.42	+/-Z	832	294	3
3	630.22	-168.44	126.42	+/-Z	2622	294	9
4	655.02	-230.98	126.42	+/-Z	2560	147	17
5	652.71	-198.96	126.42	+/-Z	5464	294	19
6	666.77	-169.52	126.42	+/-Z	778	294	3
7	673.63	-222.49	126.42	+/-Z	-82	147	-1
8	674.96	-239.53	126.42	+/-Z	835	147	6
9	678.92	-196	126.42	+/-Z	-1959	294	-7
10	692.02	-224.82	126.42	+/-Z	-615	294	-2
11	698.37	-183.24	126.42	+/-Z	-1645	294	-6
12	707.1	-210.1	126.42	+/-Z	-568	294	-2
13	636.98	-211.95	126.42	+/-Z	754	294	3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 129

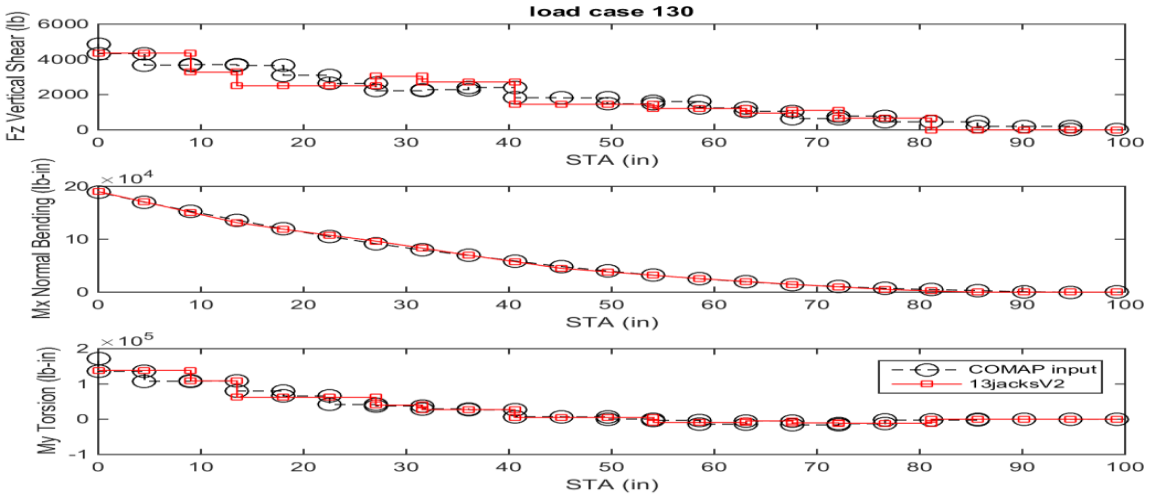
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	545	294	2
2	617.45	-190.36	126.42	+/-Z	272	294	1
3	630.22	-168.44	126.42	+/-Z	1154	294	4
4	655.02	-230.98	126.42	+/-Z	732	147	5
5	652.71	-198.96	126.42	+/-Z	1626	294	6
6	666.77	-169.52	126.42	+/-Z	-36	294	0
7	673.63	-222.49	126.42	+/-Z	128	147	1
8	674.96	-239.53	126.42	+/-Z	623	147	4
9	678.92	-196	126.42	+/-Z	-508	294	-2
10	692.02	-224.82	126.42	+/-Z	-233	294	-1
11	698.37	-183.24	126.42	+/-Z	-541	294	-2
12	707.1	-210.1	126.42	+/-Z	-176	294	-1
13	636.98	-211.95	126.42	+/-Z	372	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 130

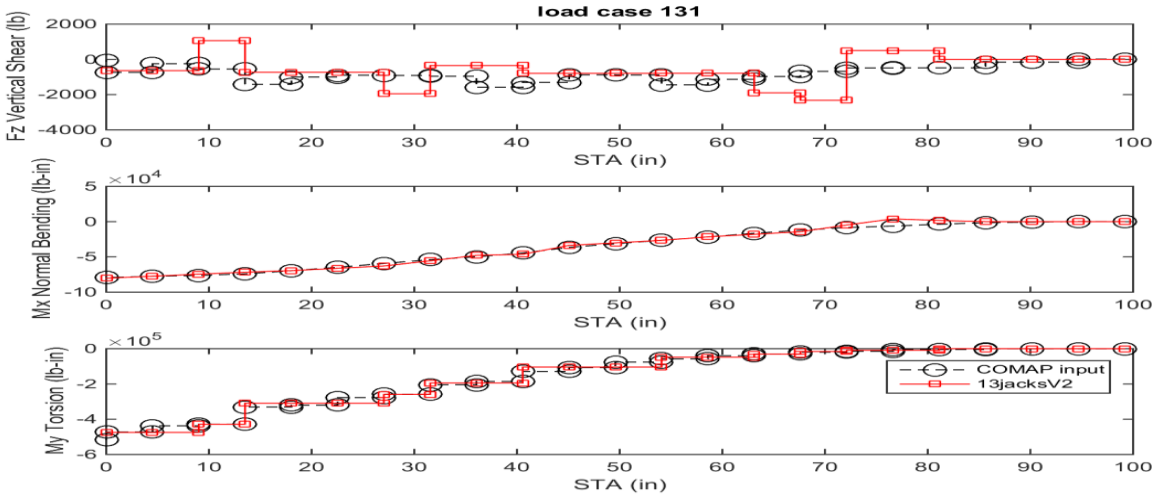
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	778	294	3
2	617.45	-190.36	126.42	+/-Z	320	294	1
3	630.22	-168.44	126.42	+/-Z	1077	294	4
4	655.02	-230.98	126.42	+/-Z	442	147	3
5	652.71	-198.96	126.42	+/-Z	1882	294	6
6	666.77	-169.52	126.42	+/-Z	-3	294	0
7	673.63	-222.49	126.42	+/-Z	265	147	2
8	674.96	-239.53	126.42	+/-Z	668	147	5
9	678.92	-196	126.42	+/-Z	-615	294	-2
10	692.02	-224.82	126.42	+/-Z	-164	294	-1
11	698.37	-183.24	126.42	+/-Z	-537	294	-2
12	707.1	-210.1	126.42	+/-Z	-129	294	0
13	636.98	-211.95	126.42	+/-Z	367	294	1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 131

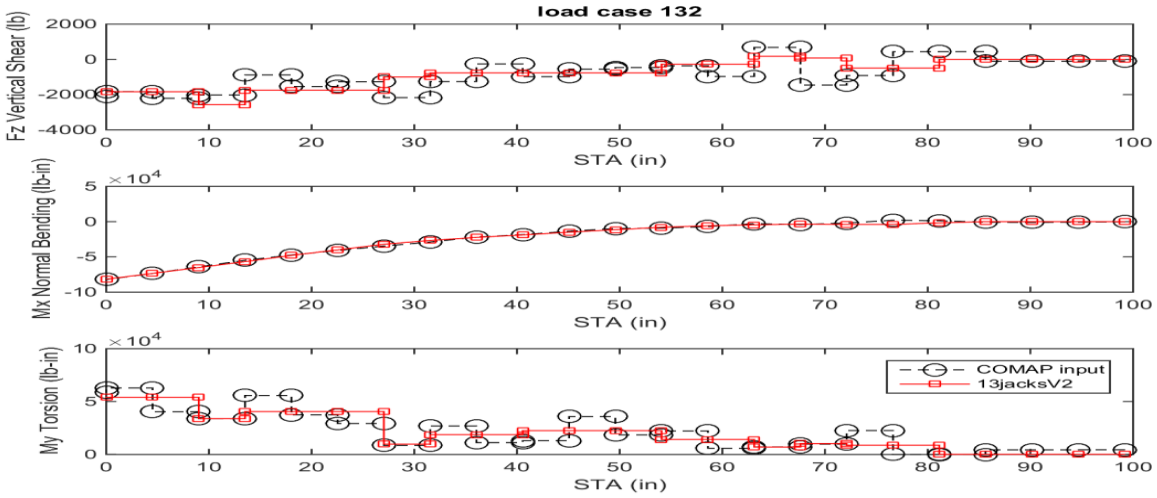
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1480	294	-5
2	617.45	-190.36	126.42	+/-Z	-1605	294	-5
3	630.22	-168.44	126.42	+/-Z	-1700	294	-6
4	655.02	-230.98	126.42	+/-Z	-2821	147	-19
5	652.71	-198.96	126.42	+/-Z	-3106	294	-11
6	666.77	-169.52	126.42	+/-Z	3271	294	11
7	673.63	-222.49	126.42	+/-Z	1107	147	8
8	674.96	-239.53	126.42	+/-Z	496	147	3
9	678.92	-196	126.42	+/-Z	3549	294	12
10	692.02	-224.82	126.42	+/-Z	429	294	1
11	698.37	-183.24	126.42	+/-Z	1221	294	4
12	707.1	-210.1	126.42	+/-Z	794	294	3
13	636.98	-211.95	126.42	+/-Z	-797	294	-3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 132

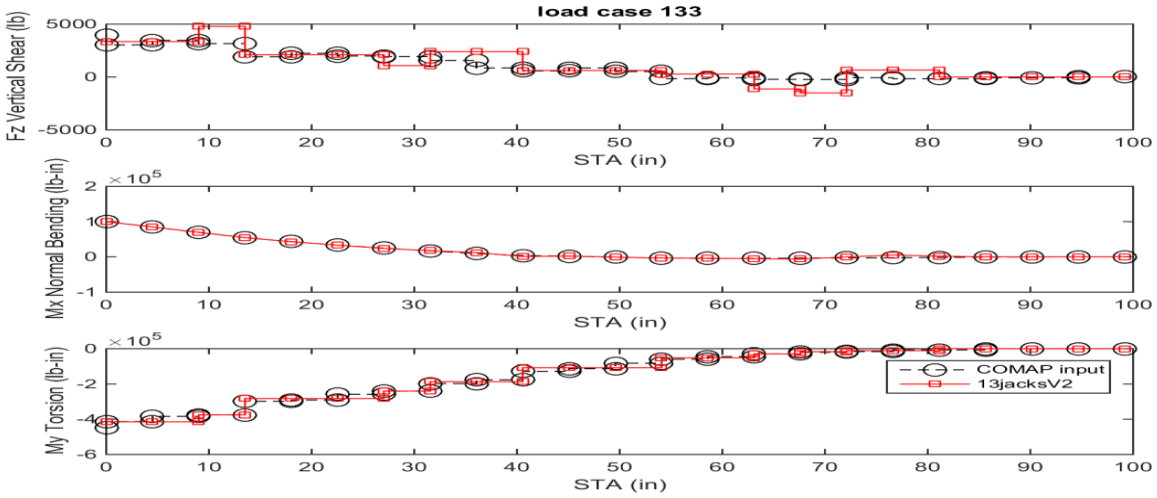
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-205	294	-1
2	617.45	-190.36	126.42	+/-Z	-224	294	-1
3	630.22	-168.44	126.42	+/-Z	736	294	3
4	655.02	-230.98	126.42	+/-Z	575	147	4
5	652.71	-198.96	126.42	+/-Z	-146	294	0
6	666.77	-169.52	126.42	+/-Z	-616	294	-2
7	673.63	-222.49	126.42	+/-Z	-446	147	-3
8	674.96	-239.53	126.42	+/-Z	-498	147	-3
9	678.92	-196	126.42	+/-Z	145	294	0
10	692.02	-224.82	126.42	+/-Z	96	294	0
11	698.37	-183.24	126.42	+/-Z	-758	294	-3
12	707.1	-210.1	126.42	+/-Z	-266	294	-1
13	636.98	-211.95	126.42	+/-Z	-232	294	-1



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 133

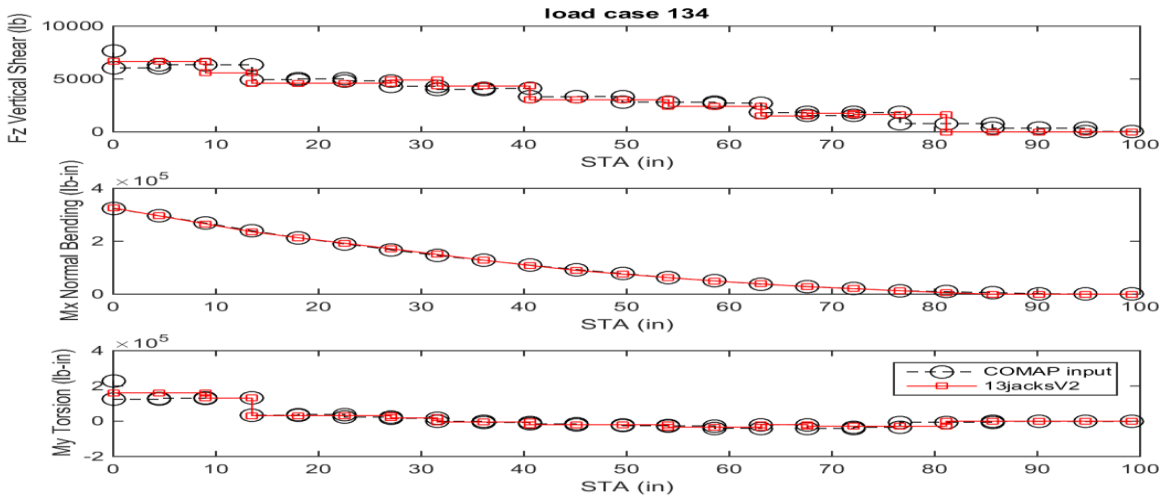
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-984	294	-3
2	617.45	-190.36	126.42	+/-Z	-1326	294	-5
3	630.22	-168.44	126.42	+/-Z	-1439	294	-5
4	655.02	-230.98	126.42	+/-Z	-2159	147	-15
5	652.71	-198.96	126.42	+/-Z	-1572	294	-5
6	666.77	-169.52	126.42	+/-Z	3656	294	12
7	673.63	-222.49	126.42	+/-Z	1412	147	10
8	674.96	-239.53	126.42	+/-Z	660	147	4
9	678.92	-196	126.42	+/-Z	3354	294	11
10	692.02	-224.82	126.42	+/-Z	364	294	1
11	698.37	-183.24	126.42	+/-Z	1033	294	4
12	707.1	-210.1	126.42	+/-Z	899	294	3
13	636.98	-211.95	126.42	+/-Z	-558	294	-2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 134

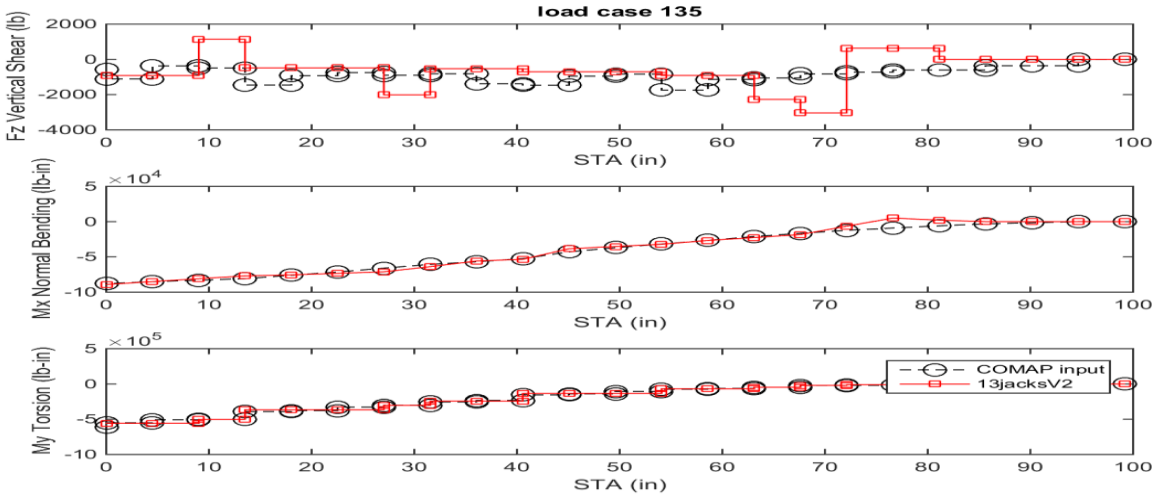
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	1564	294	5
2	617.45	-190.36	126.42	+/-Z	580	294	2
3	630.22	-168.44	126.42	+/-Z	1088	294	4
4	655.02	-230.98	126.42	+/-Z	114	147	1
5	652.71	-198.96	126.42	+/-Z	1639	294	6
6	666.77	-169.52	126.42	+/-Z	-589	294	-2
7	673.63	-222.49	126.42	+/-Z	908	147	6
8	674.96	-239.53	126.42	+/-Z	1634	147	11
9	678.92	-196	126.42	+/-Z	-349	294	-1
10	692.02	-224.82	126.42	+/-Z	-245	294	-1
11	698.37	-183.24	126.42	+/-Z	-311	294	-1
12	707.1	-210.1	126.42	+/-Z	-16	294	0
13	636.98	-211.95	126.42	+/-Z	641	294	2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 135

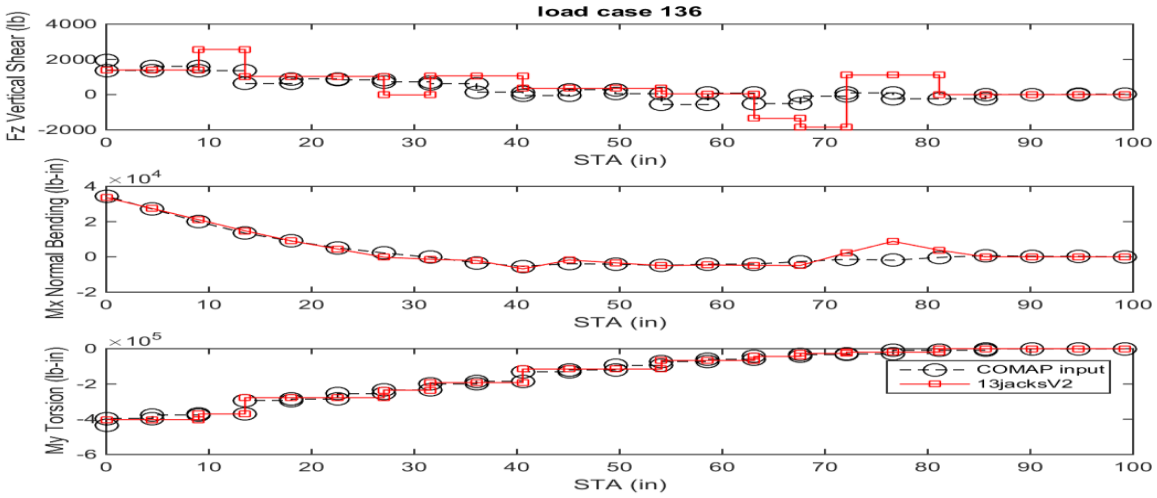
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1747	294	-6
2	617.45	-190.36	126.42	+/-Z	-1482	294	-5
3	630.22	-168.44	126.42	+/-Z	-2052	294	-7
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-4024	294	-14
6	666.77	-169.52	126.42	+/-Z	3368	294	11
7	673.63	-222.49	126.42	+/-Z	1359	147	9
8	674.96	-239.53	126.42	+/-Z	636	147	4
9	678.92	-196	126.42	+/-Z	4197	294	14
10	692.02	-224.82	126.42	+/-Z	768	294	3
11	698.37	-183.24	126.42	+/-Z	1527	294	5
12	707.1	-210.1	126.42	+/-Z	1002	294	3
13	636.98	-211.95	126.42	+/-Z	-794	294	-3



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 136

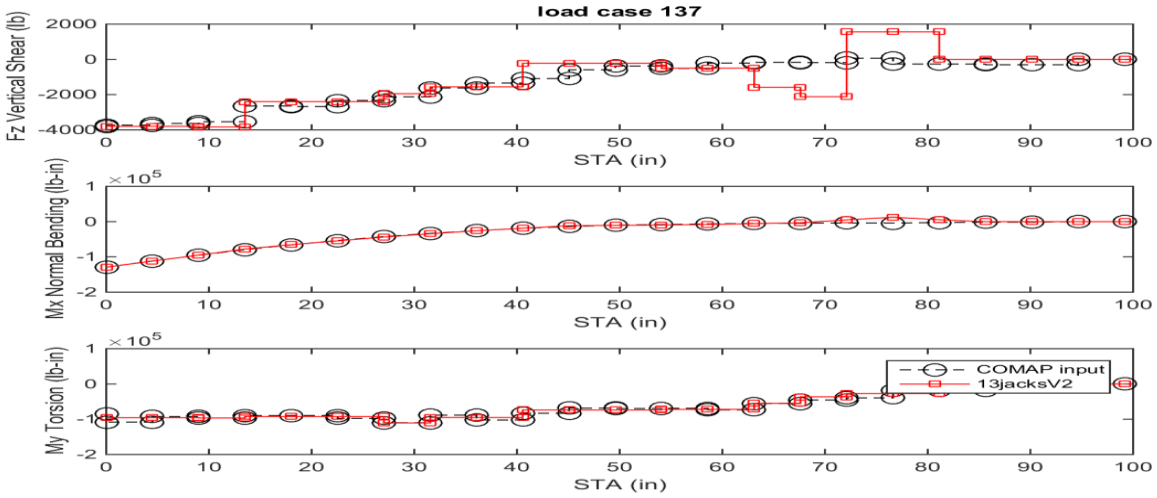
jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-1130	294	-4
2	617.45	-190.36	126.42	+/-Z	-1076	294	-4
3	630.22	-168.44	126.42	+/-Z	-1166	294	-4
4	655.02	-230.98	126.42	+/-Z	-2962	147	-20
5	652.71	-198.96	126.42	+/-Z	-2355	294	-8
6	666.77	-169.52	126.42	+/-Z	2661	294	9
7	673.63	-222.49	126.42	+/-Z	1389	147	9
8	674.96	-239.53	126.42	+/-Z	1115	147	8
9	678.92	-196	126.42	+/-Z	3058	294	10
10	692.02	-224.82	126.42	+/-Z	502	294	2
11	698.37	-183.24	126.42	+/-Z	1047	294	4
12	707.1	-210.1	126.42	+/-Z	793	294	3
13	636.98	-211.95	126.42	+/-Z	-480	294	-2



DISTRIBUTION STATEMENT A: Approved for public release. Distribution is unlimited.

Condition ID 137

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-252	294	-1
2	617.45	-190.36	126.42	+/-Z	-387	294	-1
3	630.22	-168.44	126.42	+/-Z	42	294	0
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-1899	294	-6
6	666.77	-169.52	126.42	+/-Z	-1189	294	-4
7	673.63	-222.49	126.42	+/-Z	1087	147	7
8	674.96	-239.53	126.42	+/-Z	1557	147	11
9	678.92	-196	126.42	+/-Z	564	294	2
10	692.02	-224.82	126.42	+/-Z	529	294	2
11	698.37	-183.24	126.42	+/-Z	-453	294	-2
12	707.1	-210.1	126.42	+/-Z	105	294	0
13	636.98	-211.95	126.42	+/-Z	173	294	1



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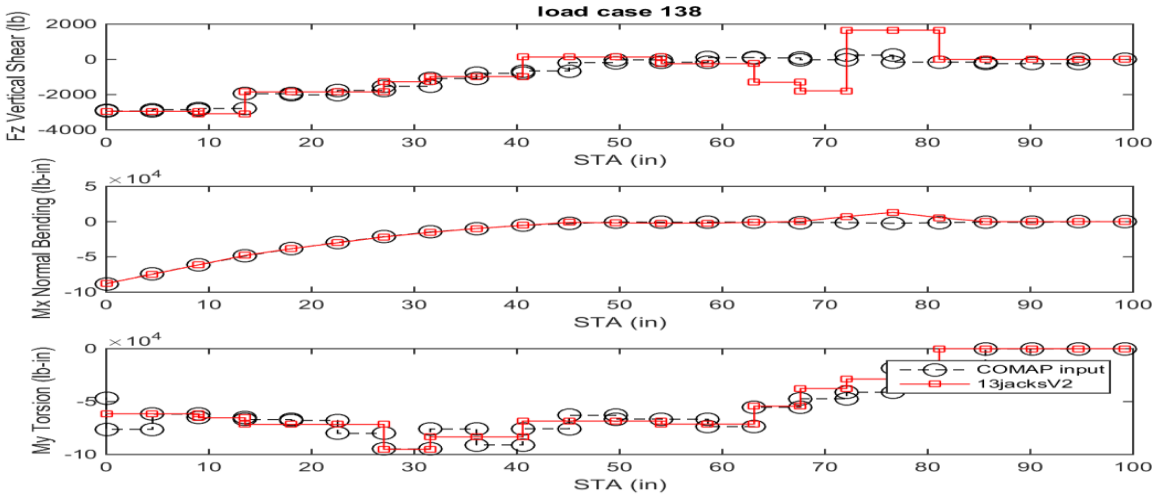
Condition ID 138

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-74	294	0
2	617.45	-190.36	126.42	+/-Z	-293	294	-1
3	630.22	-168.44	126.42	+/-Z	136	294	0
4	655.02	-230.98	126.42	+/-Z	-3443	147	-23
5	652.71	-198.96	126.42	+/-Z	-1468	294	-5
6	666.77	-169.52	126.42	+/-Z	-1169	294	-4
7	673.63	-222.49	126.42	+/-Z	1052	147	7
8	674.96	-239.53	126.42	+/-Z	1655	147	11
9	678.92	-196	126.42	+/-Z	363	294	1
10	692.02	-224.82	126.42	+/-Z	487	294	2
11	698.37	-183.24	126.42	+/-Z	-578	294	-2
12	707.1	-210.1	126.42	+/-Z	71	294	0
13	636.98	-211.95	126.42	+/-Z	308	294	1



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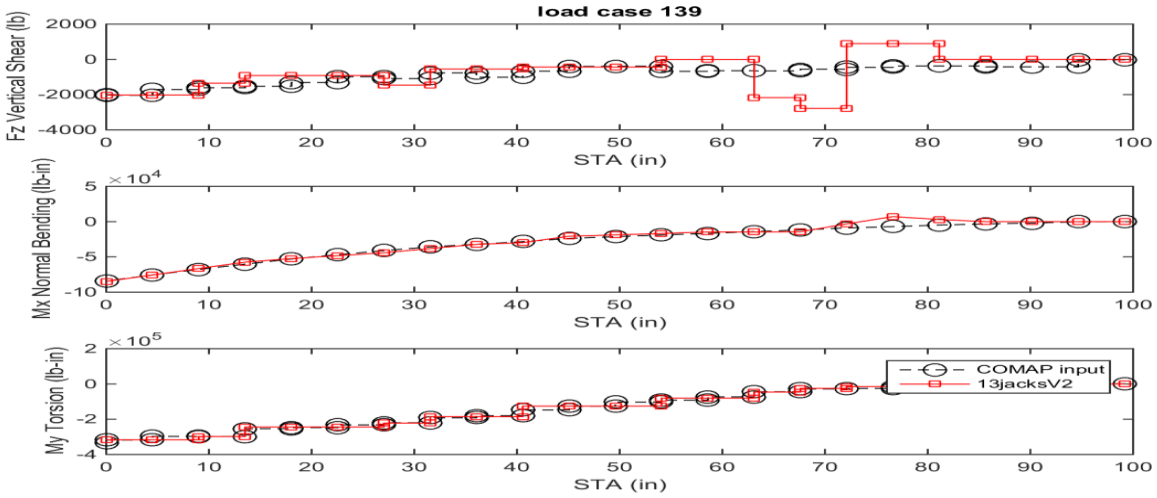
Condition ID 139

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-835	294	-3
2	617.45	-190.36	126.42	+/-Z	-913	294	-3
3	630.22	-168.44	126.42	+/-Z	-676	294	-2
4	655.02	-230.98	126.42	+/-Z	-3675	147	-25
5	652.71	-198.96	126.42	+/-Z	-2370	294	-8
6	666.77	-169.52	126.42	+/-Z	401	294	1
7	673.63	-222.49	126.42	+/-Z	2166	147	15
8	674.96	-239.53	126.42	+/-Z	892	147	6
9	678.92	-196	126.42	+/-Z	2258	294	8
10	692.02	-224.82	126.42	+/-Z	613	294	2
11	698.37	-183.24	126.42	+/-Z	542	294	2
12	707.1	-210.1	126.42	+/-Z	512	294	2
13	636.98	-211.95	126.42	+/-Z	-945	294	-3



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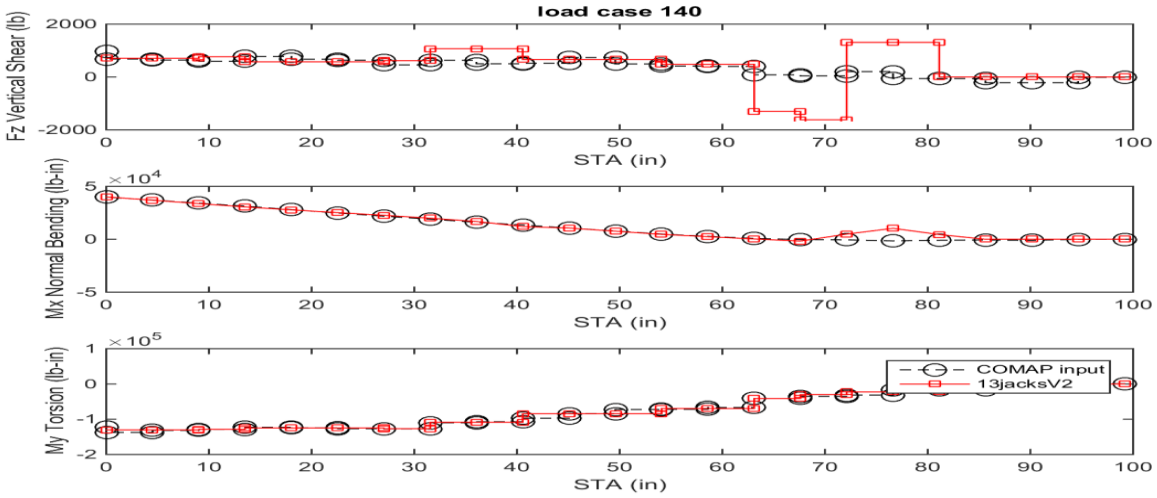
Condition ID 140

jacknum	x aircraft (in)	y aircraft (in)	z aircraft (in)	jack direction	jackload (lb)	Pad Area (in^2)	Pressure (psi) at Limit
1	597.32	-170.01	126.42	+/-Z	-32	294	0
2	617.45	-190.36	126.42	+/-Z	-448	294	-2
3	630.22	-168.44	126.42	+/-Z	-56	294	0
4	655.02	-230.98	126.42	+/-Z	-2926	147	-20
5	652.71	-198.96	126.42	+/-Z	-592	294	-2
6	666.77	-169.52	126.42	+/-Z	223	294	1
7	673.63	-222.49	126.42	+/-Z	1784	147	12
8	674.96	-239.53	126.42	+/-Z	1307	147	9
9	678.92	-196	126.42	+/-Z	998	294	3
10	692.02	-224.82	126.42	+/-Z	316	294	1
11	698.37	-183.24	126.42	+/-Z	-47	294	0
12	707.1	-210.1	126.42	+/-Z	265	294	1
13	636.98	-211.95	126.42	+/-Z	-86	294	0



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Appendix AC
Summary of Jack Loads vs. Experimental Load Condition

Cond id	jack #1	jack #2	jack #3	jack #4	jack #5	jack #6	jack #7	jack #8	jack #9	jack #10	jack #11	jack #12	jack #13
1	588	-33	452	-431	1321	829	986	1076	324	-72	-295	135	281
2	-1010	-876	-1074	-3489	-2162	788	1705	887	1700	324	211	301	-355
3	599	-16	464	-369	1350	808	952	1049	292	-76	-296	130	284
4	-1020	-864	-1059	-3444	-2158	746	1661	850	1664	320	200	290	-354
5	617	-11	466	-426	1515	913	1119	1124	338	-71	-303	158	295
6	-1075	-880	-1099	-3405	-2258	743	1629	796	1680	324	242	282	-394
7	751	132	595	67	1857	794	874	937	79	-107	-327	125	341
8	-1200	-837	-1193	-3348	-2756	299	1327	486	1590	378	370	261	-474
9	114	-371	33	-1148	245	1174	1041	1064	846	-31	-106	135	52
10	-1859	-1362	-1385	-3675	-3019	1071	940	400	2659	1122	438	177	-1516
11	691	8	503	-235	1791	1155	1059	1105	323	-124	-319	154	324
12	-1389	-954	-1127	-3547	-2943	601	1194	508	1749	479	368	309	-451
13	175	-317	-48	-1116	500	1453	836	1198	921	134	-58	343	269
14	-1400	-1051	-1475	-3558	-3686	576	747	450	2103	686	534	417	-547
15	-710	-1012	-750	-3675	-1501	164	2087	937	2385	1158	253	68	-2010
16	-724	-1018	-752	-3675	-1516	150	2073	926	2396	1172	257	62	-2037
17	-553	-733	-582	-3675	-1611	212	2147	980	1670	538	189	298	-738
18	-559	-727	-608	-3675	-1765	200	2110	1014	1611	471	218	327	-589
19	734	91	584	-298	1235	241	796	964	48	-74	-305	95	310
20	1190	277	1011	644	2667	880	790	1160	-169	-214	-502	82	517
21	732	96	585	-241	1287	291	782	951	45	-79	-306	94	312
22	1201	294	1023	700	2698	860	760	1134	-202	-218	-504	78	522
23	368	-75	276	-371	699	501	667	822	257	-57	-209	79	193
24	1295	323	1069	628	3091	1052	1048	1297	-148	-218	-546	130	572
25	750	132	595	67	1857	795	875	937	80	-107	-327	125	341
26	1522	496	1267	1093	3689	1031	925	1200	-404	-258	-606	124	669
27	113	-372	32	-1148	239	1172	1039	1061	849	-30	-106	135	50
28	728	-71	584	-4	1626	1344	811	1138	363	-205	-316	59	275
29	690	8	503	-234	1788	1153	1057	1103	324	-124	-318	154	323

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30	1575	418	1285	966	3946	1499	1149	1440	-228	-351	-671	121	698
31	178	-314	-42	-1100	509	1453	827	1195	918	134	-61	342	271
32	795	-38	493	-134	2086	1816	821	1420	571	8	-300	346	554
33	-710	-1012	-750	-3675	-1501	164	2087	937	2385	1158	253	68	-2010
34	-90	-760	-336	-3675	-581	798	2712	1632	2030	667	66	360	-868
35	-120	-555	-282	-3234	-726	608	2306	1339	1446	333	75	403	-246
36	520	-307	156	-2254	949	1205	2430	1710	1216	200	-139	444	52
37	726	92	585	-325	1192	189	785	950	38	-70	-307	91	306
38	2211	800	2050	2615	5071	1116	518	1398	-924	-535	-876	-21	903
39	727	99	588	-268	1236	221	766	934	28	-75	-307	90	308
40	2212	812	2062	2677	5086	1092	493	1383	-946	-547	-877	-28	899
41	368	-75	276	-371	699	501	667	822	257	-57	-209	79	193
42	2434	894	2104	2437	5627	1147	951	1720	-936	-545	-941	63	998
43	750	132	595	66	1856	795	875	937	80	-107	-327	125	341
44	2953	1199	2122	2666	6137	696	834	1619	-1353	-436	-917	117	1151
45	112	-372	31	-1147	235	1170	1038	1059	851	-29	-106	135	49
46	2083	644	1978	2402	4743	1494	395	1355	-824	-678	-905	-175	819
47	690	8	502	-234	1785	1152	1056	1101	326	-123	-318	154	323
48	3792	1581	2992	3347	7350	2197	636	2688	-1865	-787	-1414	464	2788
49	45	-318	-134	-1010	-44	1043	441	966	777	138	-33	269	228
50	1879	452	1476	1378	4626	2076	669	1831	-147	-217	-836	333	1067
51	-710	-1012	-750	-3675	-1501	164	2087	937	2385	1158	253	68	-2010
52	1123	-266	505	-2300	2077	1821	3093	2476	1412	164	-344	549	237
53	-121	-555	-282	-3234	-726	607	2306	1339	1446	333	75	403	-246
54	1740	169	1058	-554	4088	2167	2605	2453	697	-73	-619	496	663
55	362	-80	282	-337	612	442	578	796	232	-61	-208	63	190
56	3184	1290	3010	3675	6816	1266	536	1863	-1847	-1035	-1196	69	1899
57	368	-75	276	-371	699	501	667	822	257	-57	-209	79	193
58	3661	1548	3189	3675	7350	1872	905	2176	-1895	-900	-1264	362	2450
59	450	45	368	91	943	380	429	625	29	-87	-210	44	215
60	3802	1263	2122	3675	7172	1258	914	2166	-1791	-877	-787	263	1854
61	110	-373	29	-1147	229	1168	1035	1055	853	-27	-105	136	48

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62	3897	1480	3298	3675	7350	1643	-66	2777	-2519	-1425	-1514	116	3013
63	396	-64	275	-186	859	662	581	786	232	-107	-215	67	213
64	4098	1810	3259	3067	7350	3403	1456	2897	-1640	-906	-1406	802	3485
65	45	-318	-134	-1009	-44	1043	440	966	776	138	-34	269	228
66	3431	1384	2653	2677	7350	3823	1214	2976	-874	-476	-1307	603	2617
67	2897	544	1870	743	7130	3405	3071	3360	396	-220	-1063	599	1166
68	-1136	-950	-979	-3675	-2656	-353	1540	327	1928	907	395	66	-1606
69	362	-80	282	-337	612	442	578	796	232	-61	-208	63	190
70	3678	1473	2980	3675	5199	1790	181	2545	-2510	-2101	-832	518	4015
71	368	-75	276	-371	699	501	667	822	257	-57	-209	79	193
72	3909	1450	3020	3675	6444	2705	826	3016	-2097	-1994	-876	671	3947
73	450	45	368	91	943	380	429	625	29	-87	-210	44	215
74	3847	1302	2705	3675	7350	1919	879	2462	-1971	-1251	-1055	341	2534
75	110	-373	29	-1146	226	1167	1035	1054	854	-27	-105	136	47
76	5010	2168	4231	3675	7350	3168	350	3563	-3115	-1893	-1730	843	5416
77	689	7	501	-234	1781	1151	1055	1099	327	-122	-318	154	322
78	4531	1592	4085	3153	7350	4010	1262	3675	-656	-439	-1615	866	2802
79	4628	1630	3213	2161	7350	5592	3675	3675	87	353	-1393	1639	3430
80	-1389	-1047	-1148	-3675	-3077	-577	1308	25	2049	1064	474	-32	-1995
81	-680	-1167	-1026	-1224	-735	3700	1377	700	3159	194	941	883	-434
82	681	-32	570	-314	1862	1204	991	1035	221	-120	-546	54	262
83	243	-191	473	73	984	1164	681	768	687	-127	-132	169	132
84	759	-1	729	-190	2252	1354	1029	1074	165	-139	-642	35	286
85	860	187	800	622	1882	658	548	759	86	-166	-224	162	342
86	875	156	802	327	2400	1069	728	837	-108	-170	-603	9	326
87	-849	-1255	-1189	-1428	-2189	3049	1088	240	3438	235	1038	668	-813
88	2545	1094	823	-1082	1747	-1707	488	2890	-1873	-205	-123	54	1381
89	-2004	-2030	-2286	-3675	-2152	4233	1007	978	4182	1516	817	665	-1617
90	222	-254	-73	-1280	648	1259	1227	1007	681	25	-81	198	87
91	54	-259	253	-711	499	1623	510	1090	983	128	-8	301	287
92	572	146	918	51	1527	196	-189	1082	-665	-95	-691	-68	661
93	-697	-889	-814	-3675	-2177	700	2314	933	2142	446	559	484	-757

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94	207	-308	118	-2376	-128	199	1541	1330	735	263	-211	216	40
95	24	-826	-397	-144	859	3885	1255	882	2648	53	703	840	-164
96	1275	502	1432	1294	3233	875	700	1261	-478	-326	-480	8	693
97	674	-539	80	166	2650	4215	1862	1400	2372	-32	417	928	163
98	1508	533	1767	1747	4486	1806	1127	1540	-265	-476	-729	47	789
99	1515	53	985	1505	4673	3711	1676	1670	1250	-277	-139	705	564
100	2153	876	2860	2683	6564	2337	1398	2498	-433	-824	-1215	-82	1001
101	-20	-1142	-915	-1253	129	4528	1081	1266	2913	254	929	928	-142
102	603	467	2984	3675	2584	1732	1850	-833	539	-2106	-1035	-340	828
103	1524	-230	798	1145	4890	4890	1628	1929	1673	-263	-89	819	649
104	2962	1135	2800	2917	7350	3994	1680	2755	-939	-1154	-1572	152	2311
105	392	-379	-185	-749	1158	3400	1837	1355	2295	114	574	643	20
106	1707	742	1975	1527	4365	905	55	1620	-1227	-155	-957	-81	1170
107	146	-737	-423	-2697	128	2186	2999	1588	2349	269	481	749	-421
108	1237	166	1131	-944	2272	-212	1699	1570	-207	-134	-906	55	378
109	1686	-30	1027	1746	4908	4302	1668	1706	1552	-266	49	843	568
110	2579	1008	3246	2792	7303	2463	1703	3293	-459	-964	-1324	-104	1084
111	2601	549	2072	3448	7216	3793	1267	1898	204	-641	-592	581	1069
112	3797	1972	4933	3675	7350	3841	1760	3516	-2429	-2083	-2096	871	5166
113	924	-547	303	1029	2452	4397	603	1143	1874	-166	406	636	169
114	2892	1294	4012	3675	6242	1047	-104	1638	-2819	-1815	-2317	-131	3410
115	2893	648	2198	2811	7350	3669	780	2494	-161	-413	-909	590	1565
116	4301	2187	3986	3675	7350	2089	509	2884	-3108	-1290	-1997	303	3990
117	2241	252	1350	1532	5948	3605	1884	2290	480	-422	-708	592	892
118	3125	1535	3603	3371	7350	1068	204	1861	-1744	-396	-1729	45	1854
119	3456	1164	2809	3675	7350	2374	721	2164	-1505	-940	-1165	226	1890
120	3712	1390	2752	3675	7350	1839	709	2323	-1964	-1096	-1142	243	2323
121	1829	-225	1225	2541	5395	5555	350	1884	1089	-563	-315	429	760
122	5473	2923	5067	3675	7350	339	1659	3675	-5541	-2641	-2174	155	6782
123	3470	270	1161	-455	5885	2900	3675	3430	1197	21	2	1346	914
124	5020	2556	3759	3632	7350	4024	448	3675	-2261	-211	-1677	913	4791
125	-1512	-1602	-1970	-2728	-3076	3347	1462	452	3859	434	1371	979	-789

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126	1910	961	2887	2953	5860	575	-312	764	-2294	-685	-1800	-652	837
127	-1393	-1405	-2123	-3508	-3791	2028	1881	949	3648	581	1581	1044	-583
128	1721	832	2622	2560	5464	778	-82	835	-1959	-615	-1645	-568	754
129	545	272	1154	732	1626	-36	128	623	-508	-233	-541	-176	372
130	778	320	1077	442	1882	-3	265	668	-615	-164	-537	-129	367
131	-1480	-1605	-1700	-2821	-3106	3271	1107	496	3549	429	1221	794	-797
132	-205	-224	736	575	-146	-616	-446	-498	145	96	-758	-266	-232
133	-984	-1326	-1439	-2159	-1572	3656	1412	660	3354	364	1033	899	-558
134	1564	580	1088	114	1639	-589	908	1634	-349	-245	-311	-16	641
135	-1747	-1482	-2052	-3675	-4024	3368	1359	636	4197	768	1527	1002	-794
136	-1130	-1076	-1166	-2962	-2355	2661	1389	1115	3058	502	1047	793	-480
137	-252	-387	42	-3675	-1899	-1189	1087	1557	564	529	-453	105	173
138	-74	-293	136	-3443	-1468	-1169	1052	1655	363	487	-578	71	308
139	-835	-913	-676	-3675	-2370	401	2166	892	2258	613	542	512	-945
140	-32	-448	-56	-2926	-592	223	1784	1307	998	316	-47	265	-86

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B1. Introduction

The objective of Airframe Digital Twin (ADT) Task Order 0002 (TO2), AFRL FA8650-14-D-2413 0002, is to develop the requirements and plans for the experiments to demonstrate the Prognostic, Probabilistic Individual Aircraft Tracking (P2IAT) process developed in Task Order 0001. The demonstration experiment will consist of fatigue loading of the outer wing (from XW155 outboard to the wing tip) of two (2) F-15 C/D wings in a ground test. Each wing will be loaded with a different load spectrum. The SOW for TO 0002 covers the development of a plan for installing sensors on the wing that facilitate the experiments. Note that this was a plan developed as part of a deliverable and as such was written in the future tense.

This Instrumentation Plan outlines the location (fuselage station, butt line, water line) and orientation of all sensors (two types; crack detection sensors and strain sensors), as well as other pertinent information about the sensor including sensor sensitivities, signal conditioning requirements, power requirements, how it is attached to the structure, where any wires will run and how it operates. Displacement extremes, both positive and negative, at each sensor location are reported. The document also specifies data storage requirements and data formats (data acquisition rates and schedules are specified in the Inspection Plan).

B2. Instrumentation Description

B2.1 Crack Detection Sensors

The sensor system selected for local crack detection is the Jentek GridStation 8200a+ Meandering Wire Magnetometer (MWM). The system is comprised of sensors, Modular Probe Electronics Units (MPEUs), the 8200 Instrument, and a laptop controller/data acquisition computer. The system's electrical parameters (input voltage range, input frequency range, operating power) are 100-250 VAC, 50-60 Hz, 1500 Watts. Signal conditioning is accomplished by the Jentek instrumentation, and no external conditioning is required.

Figure B-1 Jentek sensor system components. (left to right) Laptop controller, 8200 Instruments, Modular Probe Electronics Units (MPEUs)

Two MWM-Rosettes (MWM-Arrays with a circular drive and annular sense element configuration) have been produced for this application, shown in Figure B-2. These sensors were designed to monitor the growth of subsurface cracks that form either at the interface between the spar and lower wing cover (the FA248) or at the tooling hole in the web of the spar (the FA250). The designs are constrained, particularly for the FA248, by the variable geometry of the regions of interest (e.g., the center-to-center spacing of neighboring fasteners and thicknesses of the spar and wing skin).

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MWM sensors configured for permanently installed applications are mounted to specimens, components, or structures using adhesives from Vishay M-Bond 200 (cyanoacrylate) for temporary installations and two-part epoxies and polysulfide adhesives and sealants for permanent installations. Figure B-3 shows MWM-Rosettes mounted to an aircraft during a recently completed flight test conducted over a period of 22 months.

For installations such as the test at hand, where several sensors are required to be separated over some distance, MWM sensors may be daisy-chained together in series via an MPEU-to-sensor cable (see Figure B-4). Two cable designs are under consideration. The MPEU-to-sensor cable allows a single drive to excite each sensor connected to the cable. At the same time the cable supports simultaneous measurement, in parallel, for the responses from each sense element for all the sensors.

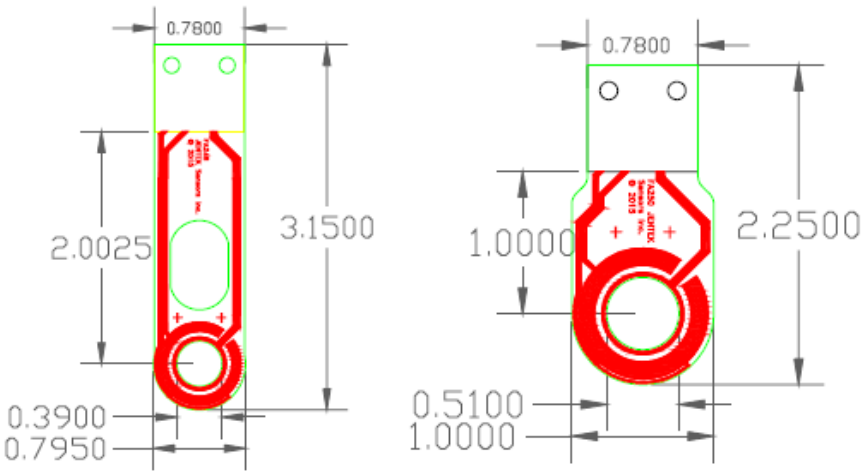

Figure B-2 FA248 and FA250 MWM-Rosettes adapted for the ADT application

Figure B-3 FA170 and FA172 MWM-Rosettes mounted to an aircraft using cyanoacrylate and polysulfide adhesives and sealants

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Figure B-4 Sensor-to-MPEU cables being evaluated for long-duration data acquisition for applications requiring permanently installed MWM sensor configurations

During operation, a host laptop computer running the GridStation software environment controls the instrumentation. The GridStation software and instrumentation together perform the signal conditioning and data analysis. The MWM sensor responses are amplified by the MPEU and transimpedances are measured by the instrument. The transimpedances for each sensing element are converted into material or geometric properties using JENTEK's grid-based inverse methods. These grids are two dimensional databases of sensor responses that are used to convert two measured quantities, such as the magnitude and phase (or real and imaginary parts) of the sensor transimpedance, into unknown properties of interest, such as electrical conductivity and sensor lift-off. The change in the electrical conductivity, through time, due to the initiation and growth of a crack may then be monitored. These changes, for a given geometry of sensor and underlying structure, are repeatable. Note that two frequency methods may also be used to provide improved results under some conditions, and in particular for buried crack detection.

Operation of the GridStation System in this manner has been used to demonstrate a practical and cost-effective procedure for POD curve generation that fits well into a methodology such as recommended in MIL-HDBK-1823A.

The specific capabilities of the 8200, along with the (MPEU), shown in Figure B-1, include:

- A wide measurement frequency range from 0.625 Hz to 21 MHz, allowing sensitivity to defects buried in thick metal structures or near-surface for a wide range of metal properties.
- Data acquisition rates of up to 1,000 samples/second (with the capability to increase this to 10,000 samples/second for dedicated single frequency applications—making real time diagnostic fault detection practical)
- Extremely low noise and low thermal drift
- Modular PEU that enables scaling of channel count and addition of new features

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The Jentek System is controlled with a PC running the GridStation software. The PC to be used as the controller will meet these minimum requirements:

- Laptop PC Workstation (i.e. Dell Latitude E5450/5450)
- Intel Core i7-5600 CPU @ 2.60 GHz
- 8 GB, 1600MHz, DDR3L RAM
- Hard Drive, 500GB, AQUACSLIM
- Windows 7 Professional, 64 Bit

See Jentek GridStation Software Environment General Use Manual reference 1 for details of the system and data file descriptions.

B2.2 Strain Sensors

The sensor system selected for multi-site strain measurement is the Luna Technologies Optical Distributed Sensor Interrogator (ODiSI-B). This system is comprised of a sensor(s), interrogator, and controller.

Figure B-5 Luna sensor system components

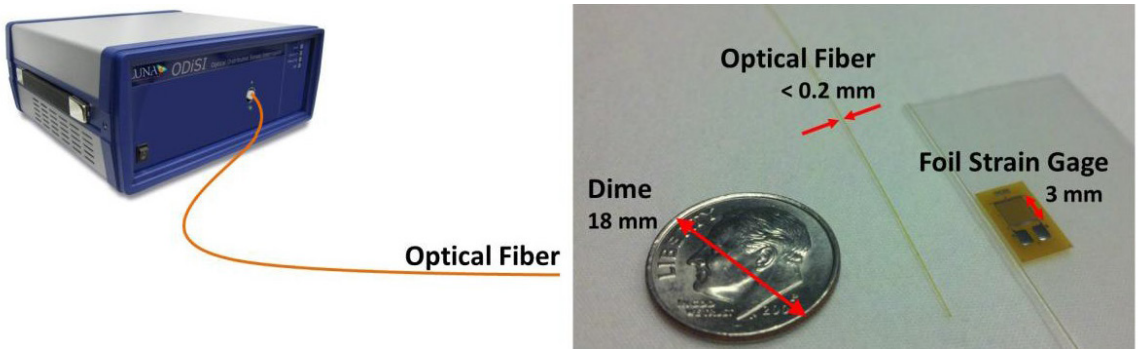

Figure B-6 Luna optical fiber sensor

The optical fiber strain sensor is made of polyimide coated, low bend loss, single mode fiber with an outer diameter of 155 microns. Within the core of the optical fiber are minute variations in index of refraction, a natural process of the drawing of fiber during manufacturing. These minute variations result in a random but repeatable Rayleigh backscatter when swept with a tunable laser. This scatter pattern is unique to each length of fiber sensor, and is called the fiber fingerprint. The

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frequency content of this fingerprint changes in a predictable way with strain, with the change being measured in frequency shift and output in units of GHz. The fiber's strain sensitivity (also termed strain coefficient or calibration factor) is -6.668 microstrain/GHz. It will be bonded to the surface using a commercial strain gage epoxy, either M-Bond AE-10 or GA-2. The sensor will be connected to the interrogator (ODiSI-B) through an optical switch.

Internal to the ODiSI-B interrogator is a Class I tunable laser source. The laser's wavelength accuracy (which defines system accuracy) is maintained by an internal NIST-traceable HCN gas cell. Raw optical data as collected at the detectors is converted to spectral shift through computation on the GPU. The maximum strain range of the interrogator is +/-10,000 microstrain. The interrogator's electrical parameters (input voltage range, input frequency range, operating power) are 100-250 VAC, 50-60 Hz, 65 VA.

The ODiSI-B interrogator is controlled with a PC running the ODiSI-B software. The PC to be used as the controller will meet these minimum requirements:

- Desktop PC Workstation (i.e. Dell Precision T3500)
- Quad Core Xeon Processor at 3GHz per core (minimum) NVIDIA Quadro 4000 Display Adapter
- PCIe x1 slot free
- 4 GB, 1333MHz, DDR3 RAM
- Minimum 120 GB Solid State Drive in addition to HDD that contains Windows
- Windows 7 Professional, 32-bit OS Monitor – Resolution 1280 X 1024

Raw data is logged in a *.odb format. The .odb file extension is most commonly associated with the OpenOffice database application, and contains XML-based database information that can be used across multiple database software programs. This data can then be post-processed using the Post Processor. The ODiSI-B post processor allows you to take the *.odb raw data files that were created using the sample or event triggers and review the scans taken or create text files. Text files created contain a matrix of Strain, Temperature, Frequency Shift, Delay, or Quality Factor values as selected from the parameter pull down menu at the top of the Graph. This matrix is arranged by both time and location along the fiber. As described in the controller section above, a minimum 120 GB of data storage space is required. The data acquisition rate can be varied from 100Hz to much slower rates depending on the application. The rate chosen for this test is not critical, as we do not plan to continuously acquire this data. But, instead will take data at short intervals spaced out over the course of the test. The spacing will be determined based on probabilistic analysis of the previous acquired data. See Luna ODiSI-B Optical Distributed Sensor Interrogator Users Guide (reference 2) for details of the system and data file descriptions.

B3. Instrumentation Locations

B3.1 Crack Detection Sensors

The Jentek MWM sensors will be placed on the interior structure of the outer wing panel at a total of nine holes covering five control point (CP) locations for each wing to monitor for cracks. Eight of the holes are fastener holes, and one is an open tooling hole. Four are located in the front spar lower cap, four on the rear spar lower cap, and one on an open tooling hole on the front spar web. Two holes each will be instrumented at locations CP NG1, CP NG3, CP NG4, and CP NG5. A

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single open tooling hole will be instrumented at CP NG2. The hole locations are defined in aircraft coordinates (fuselage station, butt line, water line) in Table B-1, and a graphic representation of the wing test setup and Jentek sensor locations are shown in Figure B-7 through Figure B-10.

Forward Spar

ID	FS	BL	WL
CP NG1	590.33153	168.27305	124.94372
CP NG1	590.86660	168.86776	124.93905
CP NG2	617.22825	197.32770	126.38724
CP NG3	591.81000	-171.25000	124.93000
CP NG3	591.28000	-170.65000	124.93000

Aft Spar

ID	FS	BL	WL
CP NG4	656.88994	167.60920	125.39578
CP NG4	656.16549	167.99331	125.38908
CP NG5	659.36076	173.97800	125.44103
CP NG5	659.54811	174.33140	125.44330

Table B-1 Jentek sensor locations (in aircraft coordinates)

In addition to sensors, the Jentek system includes several cables and equipment boxes. There are two Modular Probe Electronics Units (MPEU) and one main instrument box. The sensor-to-MPEU cable for CPs NG4 and NG5 will run through existing holes inside the torque box structure and exit through a fuel drain hole in the lower cover (approx. location FS 633, BL 167, WL 125) as shown in Figure B-7. To facilitate security of the cables during shipping from Warner Robbins to Wright Patterson, the excess cable length will be coiled up just inside the drain hole and secured with strain reliefs attached to the structure with adhesive sealant. A drag line (polyethylene cord, or similar) will be bonded to the inside of the fuel drain access cover (see Figure B-18) with adhesive sealant and tied to the cable to allow it to be pulled out the drain hole at a later date. The drain access cover will then be installed as normal to close up the wing. The sensor-to-MPEU cable for CPs NG1, NG2 and NG3 will run through existing holes inside the leading edge structure to the MPEU located just near the access opening for the Antenna Missile L/R, 3475-8000, -8001 (located in the leading edge just outboard of WS 155) as shown in Figure B-7. The MPEU's will not be installed until after the wing arrives at Wright Patterson, and the forward unit may be inside the antenna bay, or just outside on the inboard leading edge.

The MPEU-to-instrument cable for the forward MPEU mounted in/on the leading edge will loop around the onto the lower cover and over to the main Jentek instrument box. The aft MPEU will be located on the lower cover adjacent to the main instrument, just inboard of WS 155, and connected by an MPEU-to-instrument cable. Alternatively, the aft MPEU and main instrument box may be suspended below the lower cover on test scaffolding. The main instrument box will be connected to a data acquisition & control laptop located over 50 feet away (for safety) by a standard Ethernet cable.

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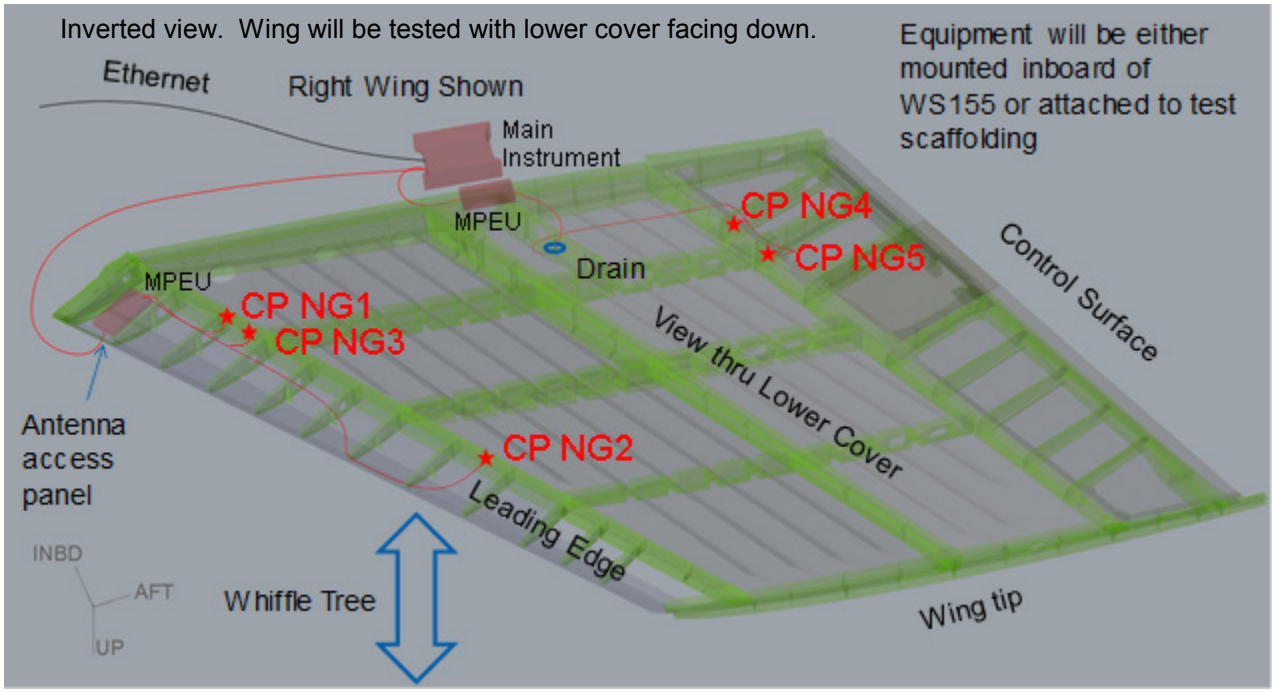

Figure B-7 Jentek sensor location (stars) and sensor cable routing

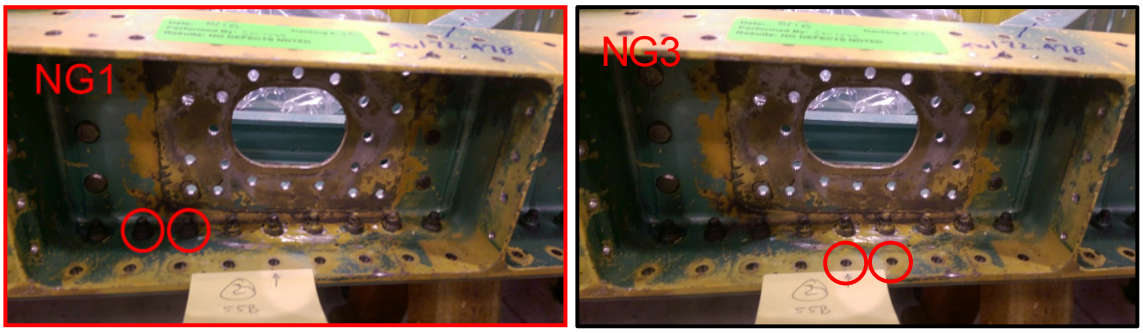

Figure B-8 Jentek sensor locations CP NG1 and NG3
(left hand wing shown)

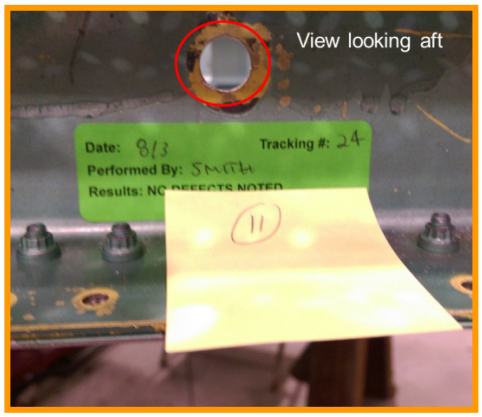

Figure B-9 Jentek sensor location CP NG2

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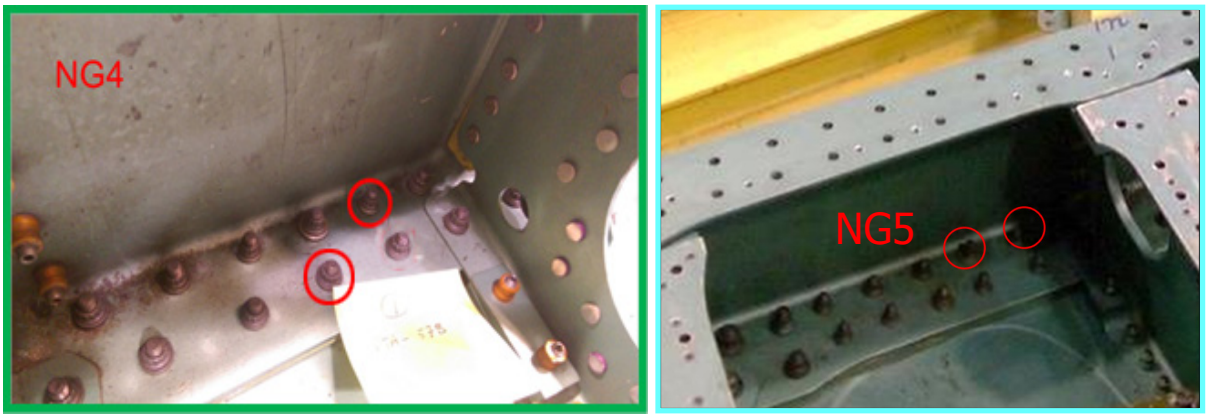

Figure B-10 Jentek sensor locations CP NG4 and NG5
(left hand wing shown)

B3.2 Strain Sensors

The Luna Technologies ODiSI-B optical fiber cable sensors will be located inside the torque box structure, and on the exterior of the lower covers. There will be a total of four 10m long fiber-optic sensors on each outer wing panel, two interior and two exterior.

The first interior sensor will enter the structure through the access opening for the Antenna Missile L/R, 3475-8000, -8001 (located in the leading edge just outboard of WS 155) as shown in Figure B-11. It will run outboard between the fasteners along the lower cap of the front spar, then aft through the tooling hole at (approx.) FS 634, BL 215, WL 125, and aft along the lower cap of the rib at (approx.) BL 205, then inboard along the lower cap of the intermediate spar, forward along the lower cap of the rib at (approx.) BL 172, inboard along the forward spar then along the inboard closure rib and out the pylon fitting access hole at (approx.) FS 614, BL 161, WL 125. See Figure B-11 and Figure B-12. One complication with this sensor is that the section inside the leading edge cannot be installed until after the upper covers are installed, and the leading edge is partially installed (minus the upper access panels). Therefore it will be run inside the torque box and up to the tooling hole at the outboard end of the front spar. It will be attached to a drag line (polyethylene cord, or similar) and coiled up aft of the front spar with the drag line protruding through the tooling hole so it can be pulled through and completed after the upper cover and leading edge are in place.

The second interior sensor will enter the structure through the pylon fitting access hole at (approx.) FS 614, BL 161, WL 125, outboard along the lower cap of the intermediate spar, aft along the tip closure rib, inboard along the lower cap of the aft spar, the forward along the inboard closure rib and out the pylon fitting access hole at (approx.) FS 614, BL 161, WL 125. See Figure B-11 and Figure B-13.

To facilitate security of the cables during shipping from Warner Robins to Wright Patterson, the excess cable/fiber length will be coiled up just inside the pylon fitting access holes and secured with strain reliefs attached to the structure with adhesive sealant. A drag line (polyethylene cord, or similar) will be bonded to the inside of the pylon access cover with the same adhesive sealant and tied to the cable/fiber to allow them to be pulled out the access hole at a later date. The pylon access cover will then be installed as normal to close up the wing.

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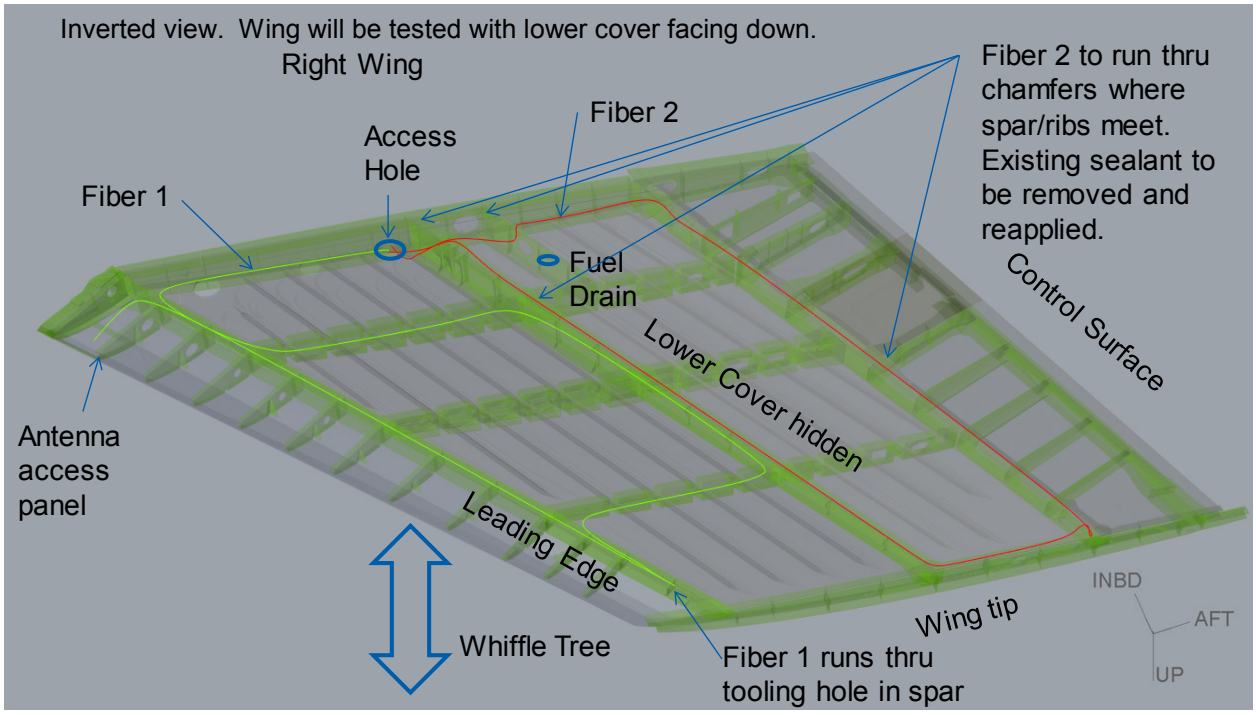

Figure B-11 Luna internal optical fiber strain sensor cable routing

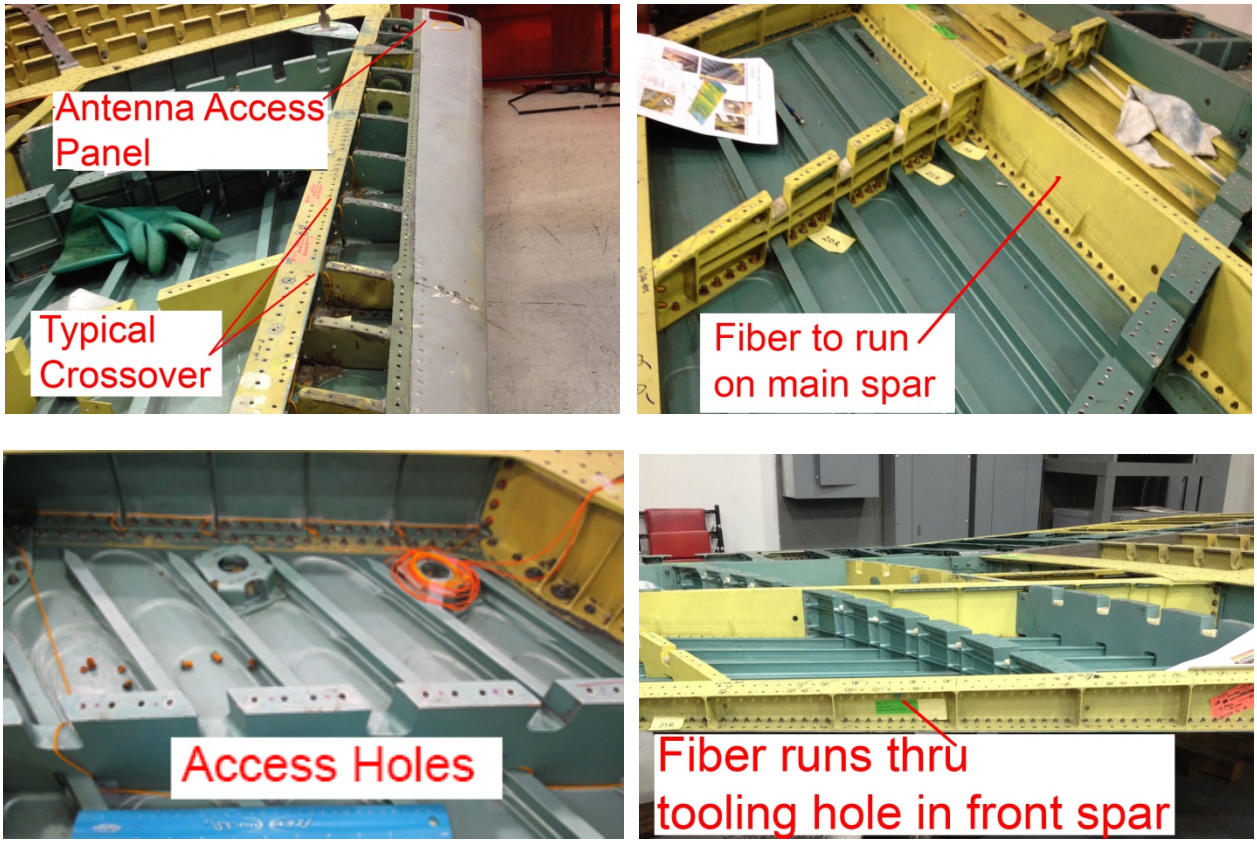

Figure B-12 Luna internal optical fiber 1 strain sensor cable routing details

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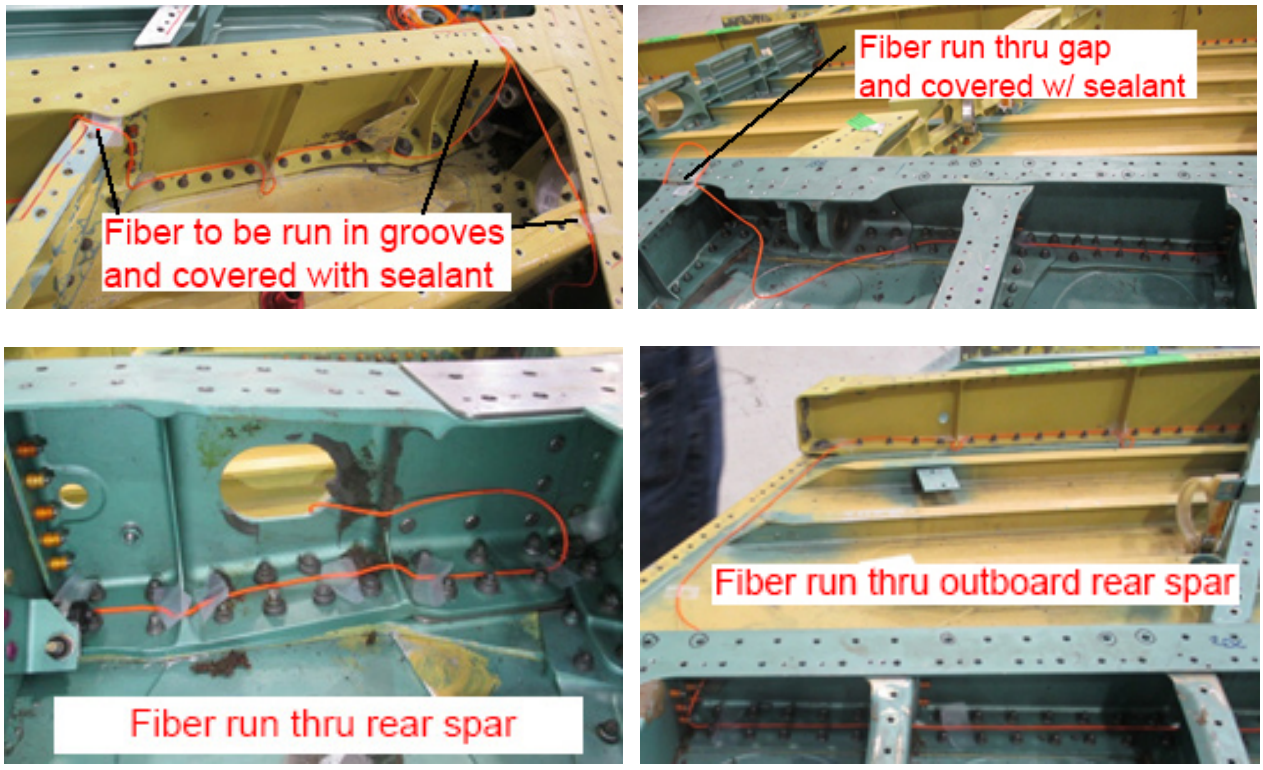

Figure B-13 Luna internal optical fiber 2 strain sensor cable routing details

The exterior sensors (Figure B-14) will be applied to the outer surface of the lower cover, and will follow a path that closely parallels that of the interior sensors, but avoids the control points by a minimum clearance of 3 inches to allow for traditional NDI (Figure B-15 through Figure B-20).

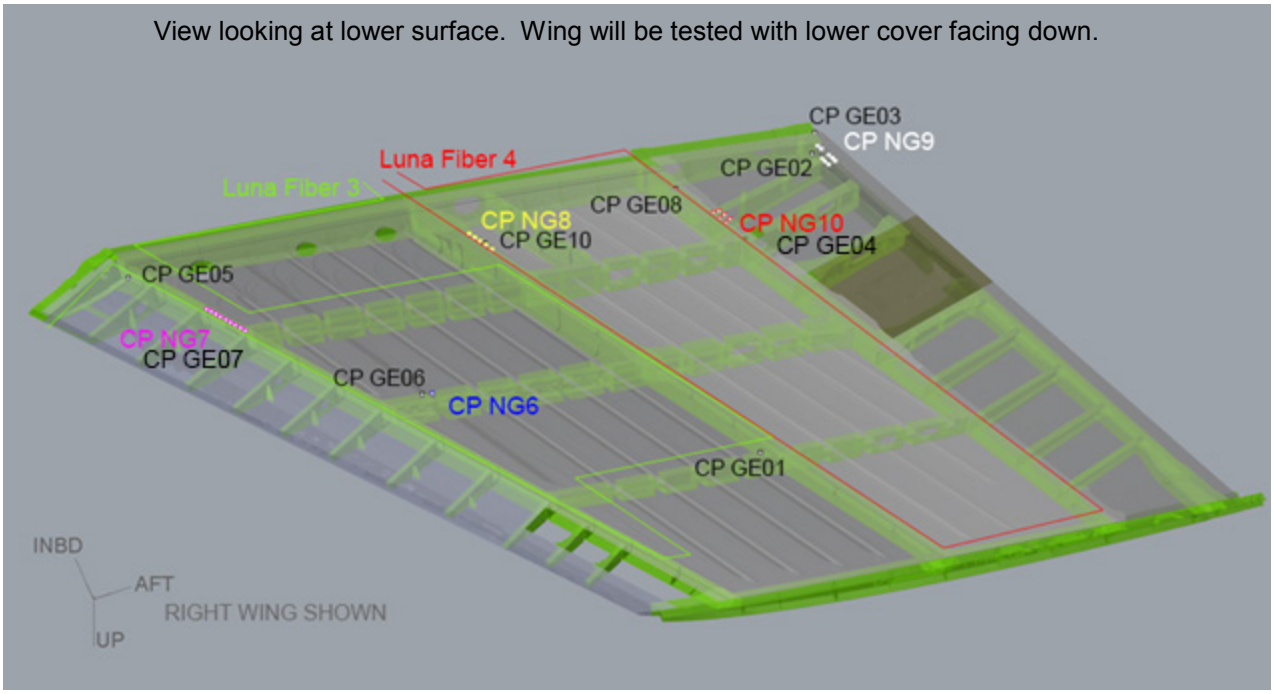

Figure B-14 Luna external optical fiber strain sensor cable routing

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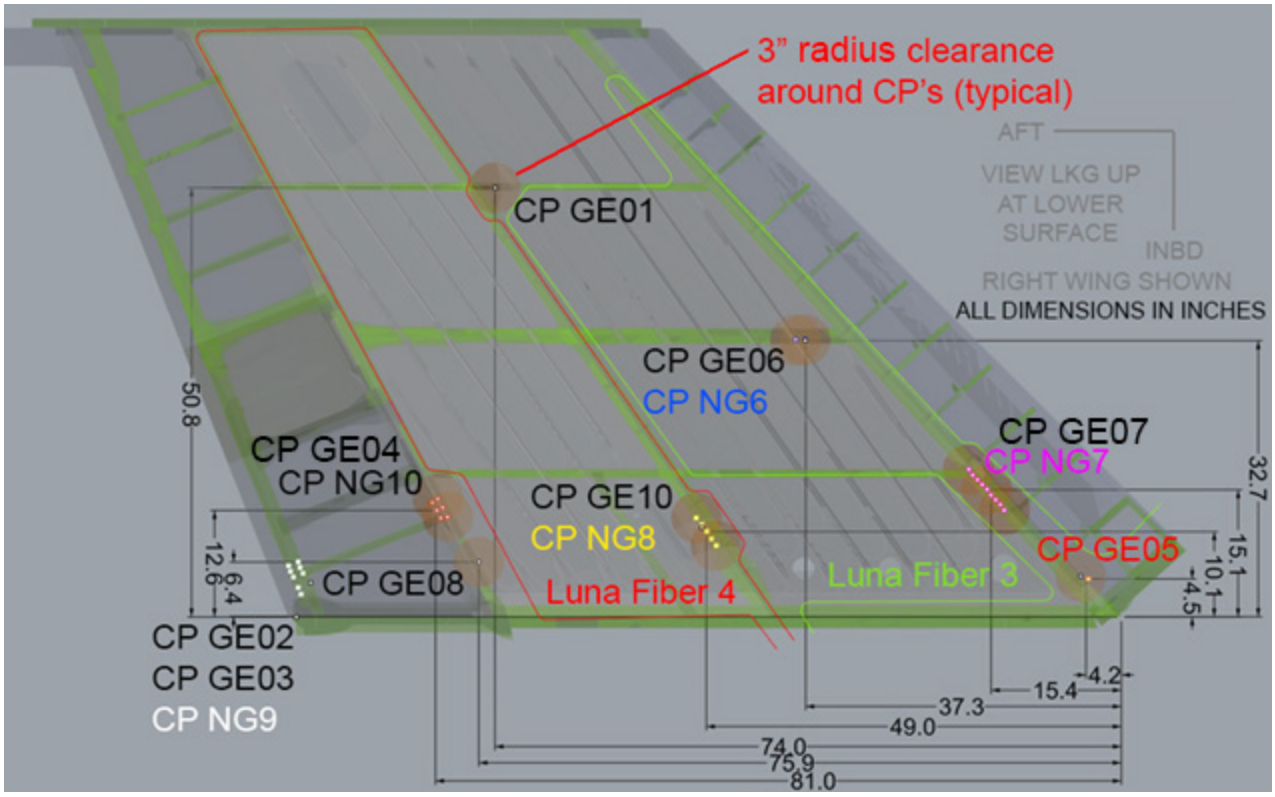

Figure B-15 Luna external optical fiber strain sensor cable clearance from control points

The main Luna controller and interrogator will be connected to located over 50 feet away (for safety) from the test, and connected to the eight individual sensors via eight sheathed fiber optic standoff cables.

B4. Wing Preparation for Instrumentation Installation

B4.1 Basic Conditions

The following conditions must be implemented during wing maintenance and build-up, in order to facilitate instrumentation installation.

1. Leading Edge Attachment will use fasteners without washers.
2. Sealant will be removed in affected areas on rear spar to allow routing LUNA fiber as shown in Figure B-16.
3. Leading Edge Antenna Missile L/R, 3475-8000, -8001 panel will be left off (see Figure B-17) until the interior sensor installation takes place, and/or replaced with a reinforced version having a 3 in. diameter hole for wiring. Note: neither team plans to attach load pads to this panel.
4. Fuel Drain Access Cover will be left off (see Figure B-18).
5. Round Access Covers on Lower Surface (adjacent to WS155) will be left off (see Figure B-19).

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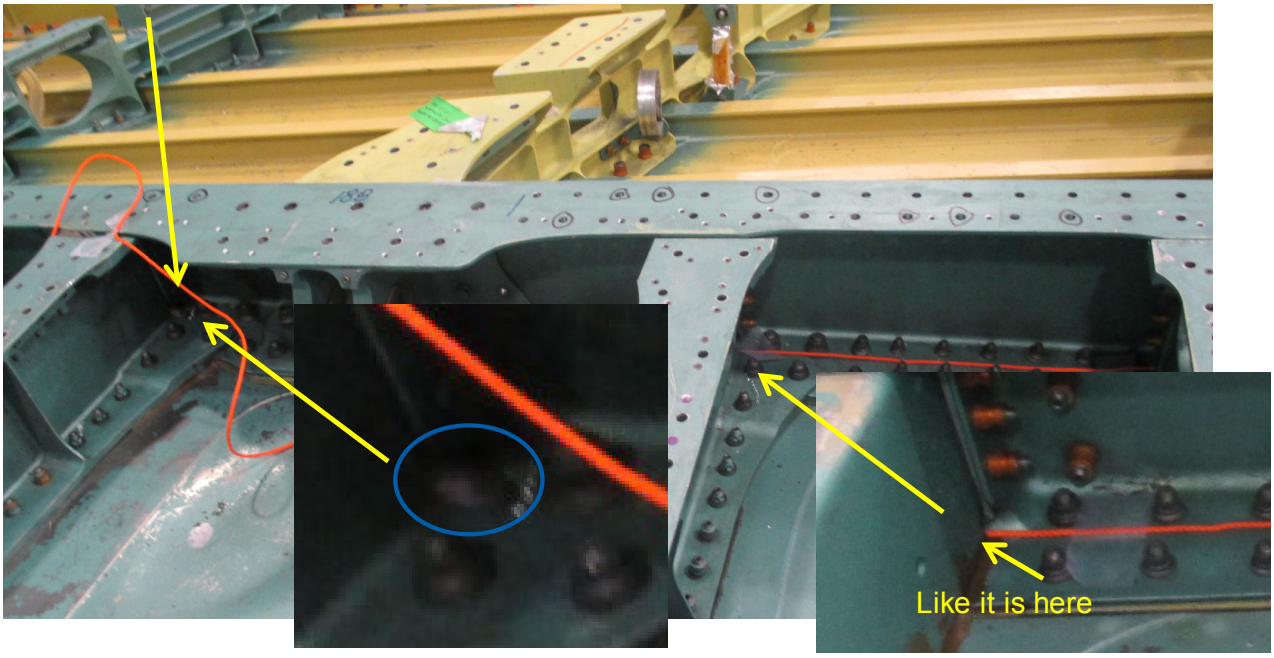

Figure B-16 Area where sealant is to be removed for optical fiber access

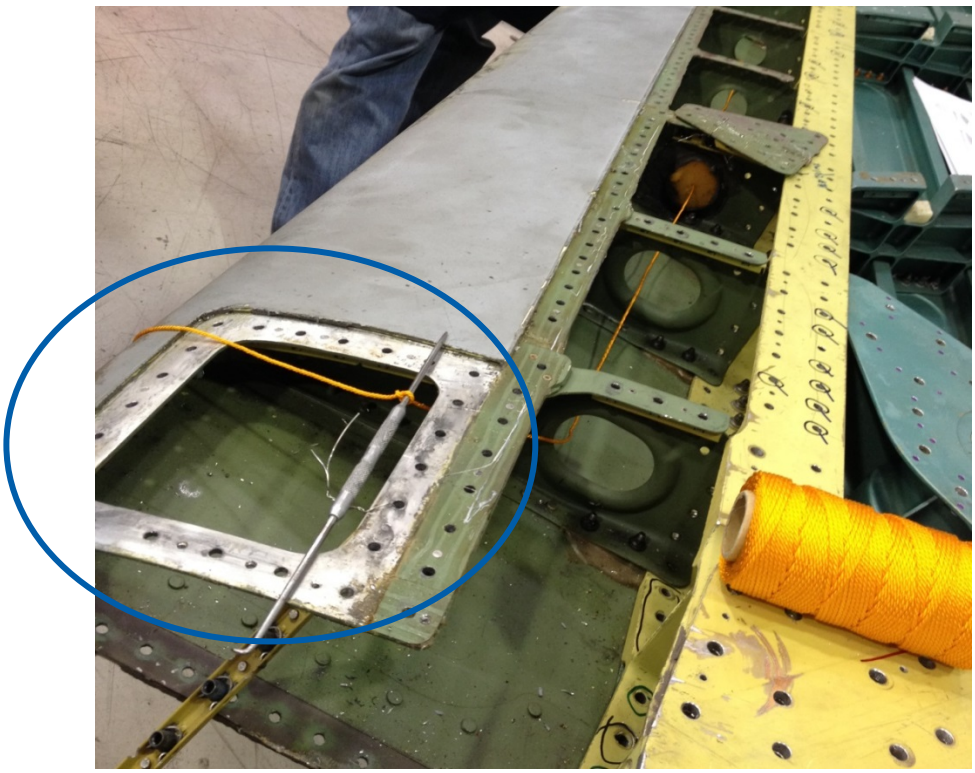

Figure B-17 Antenna Missile L/R, 3475-8000, -8001 panel in leading edge.
(Panel opening shown. Panel is removed in photo)

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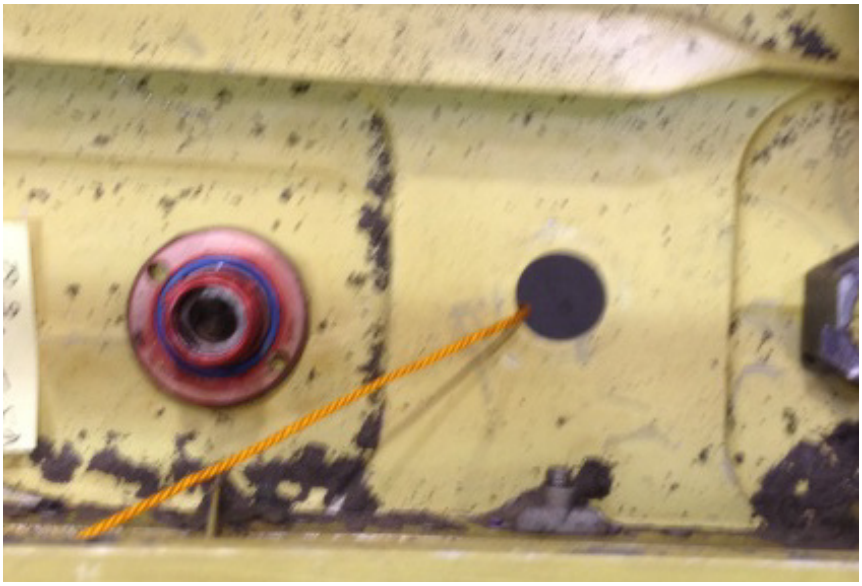

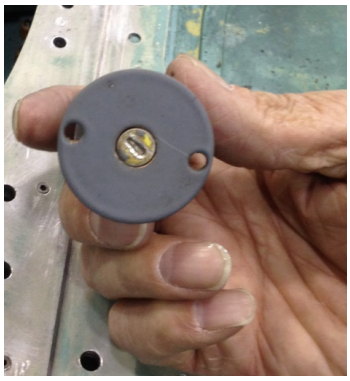

Figure B-18 Fuel Drain Access Cover

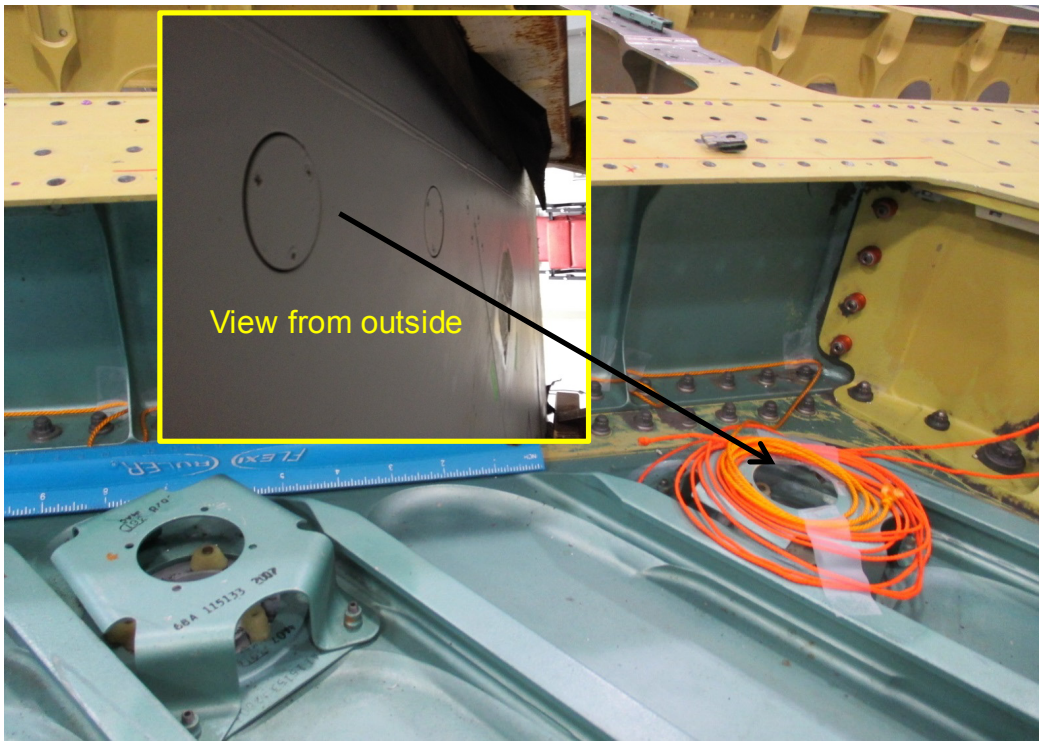

Figure B-19 Pylon Fitting Access Covers on Lower Surface (adjacent to WS155)

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B4.2 Additional Support Requests

The Mercer Engineering Research Center (MERC) is requested to provide the following to facilitate the NGC team working in the MERC facility:

- 110V electric power. Approximately 6 outlets.
- Several electric extension cords.
  (we will bring our own, but access to extras would be helpful).
- Compressed air for pneumatic tools
  (approx. 90 psi with enough SCFM to drive a die grinder, or similar).
- Several flexible ½" air lines
  (we will bring our own, but access to extras would be helpful).
- 1 lb. (approx.) triple beam balance scale (or similar)
  (to be used for weighing 2-part adhesive components).
- Several floor lamps for localized lighting of work area.
- Shop vacuum.
- Plywood, ½" to ¾" thick, 4 to 6 sheets.
- NGC and our subcontractors will collect and bag the waste materials by an approved process with an approved vacuum system that we will provide. We ask that MERC dispose of small amounts of these materials when we are finished with their collection.

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B5. Instrumentation Installation Materials

The installation of the crack and strain sensors will employ methods and materials similar to that for the attachment of standard foil strain gages.

The comprehensive list includes:

- PPG PR-1440B
- PPG ProSeal 870
- Vishay M-Coat J
- Vishay M-Bond 200
- Vishay M-Bond AE-10
- Vishay M-Bond GA-2
- Flamemaster CS5500 class A2 (per SAE 3276)
- Royal Adhesives WS8020RC
- Henkel (Loctite) EA9394
- Henkel/Turco Bonderite S-ST 6813E AERO
- 3M 5200 Adhesive Sealant
- Hardman Double Bubble two-part epoxy
- Methyl Alcohol
- Denatured Alcohol
- Acetone

Note that the team did not employ all these materials, but have included all potential choices to be sure to cover most contingencies that may arise in the field during installation.

The Luna strain sensors require that the painted coatings be removed down to bare metal to ensure accurate strain readings. The paint removal will be done by mechanical means as per HW-DES-617_0 Spot Removal of Paint from Flight Hardware, and chemical means as per MEPS 4000-47 Cleaning, Chemical Surface Treatment and Organic Coating Removal of Aircraft Surfaces. Installation will be as per applicable sections of E0-0701M Strain Gage Installation Manual.

The Jentek crack sensors do not require paint to be removed, unless it is found to be unstable and/or flaking in the immediate vicinity of the sensor. Paint adhesion will be determined by means of ASTM D 3359 Standard Test Methods for Measuring Adhesion by Tape Test. In the event that it is not well adhered it will be removed in the immediate as per HW-DES-617_0 Spot Removal of Paint from Flight Hardware, and installation as per applicable sections of E0-0701M Strain Gage Installation Manual.

B6. Instrumentation Installation Schedule

B6.1 Assumptions

- Installation work begins Feb 29 and wings are closed in series.
- Initial wing condition: leading, trailing edges and upper covers removed.
- Durations shown include installation on both wings.

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- Surface preparation complies with Eric Tuegel email dated Jan 14 subject: Paint Removal at MERC facility
- External sensor installation to be done at WPAFB not addressed in this schedule.
- Question marks indicate non-interfering contingency days.
- Two days off (July 4 and Memorial Day May 30, 2016).

B6.2 Sequence of Operations

Jentek sensors/wiring at CP NG4 and NG5 will be installed the week ending 4/1/16.
Jentek sensors/wiring at CP NG1, NG2, and NG3 will be installed 7/25 to 7/26/16.
Luna Fiber 1 (aft of front spar) and Fiber 2 will be installed the week ending 4/1/16.
Luna Fiber 1 (forward of front spar) will be installed 7/25 to 7/26/16.
Luna Fibers 3 and 4 will be installed after arrival at WPAFB (date TBD).

MERC is requested to leave any leading edge covers off (as it is now) so when the NGC team arrives to install the sensors, there will be ready access to the interior. The concern is that when MERC installs the leading edge (in their 70-day window), they might also install the access panels and covers (outboard end of the leading edge) as part of the install procedure. We require it to be left open as shown in Figure B-17 (entire upper leading edge open, including the antenna panel). When NGC is completed MERC will close up the leading edge so it can be de-painted. Additionally, NGC will stow away our wires/fiber and coordinate with MERC to seal all the associated openings for de-painting.

Regarding the antenna panel, the opening will either be closed with the existing (unaltered) panel (to be removed later at WPAFB), or an altered (or replacement) panel with a 3 inch hole will be installed at MERC. An analysis of the panel modified with the hole is to be submitted for review. If the panel with a 3 inch hole is installed at MERC, the opening will be sealed for de-painting.

After arrival at WPAFB the protection used to seal the openings for de-painting will be removed and the sensor wire and fiber connectors retrieved. Depending on what option is utilized for the antenna panel, it may have to remove it to retrieve the wires, or just uncover the 3 inch hole.

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Seq #	Responsible Party	Action	day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
			date	2/29	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27
1	MERC	Complete repairs, measurements and make ready for sensors		x																											
2	GE	Install GE sensors 1-14			I	I	I	R			R	R																				
3	NGC	Prep all surfaces on both wings for LUNA and JENTEK									L	L	L/R	R	R				?L	?L	?R	?R									
4	GE	Install GE sensor 15-38											L	L	L				R	R	L	L			L						
5	GE	Remaining GE gages arrive																							*						
6	GE	Install GE sensors 39-44 RW																								R	R	R			
7	NGC	Install JENTEK rear spar sensors & test																													
8	NGC	Install LUNA Torque box fiber & test																													
9	GE	Install GE sensors 45-66																											L		
10	GE	GE sensor checkout																													
11	MERC	MERC Install OW covers & leading edge wing 1 (35=28 +7 days)																													
12	MERC	MERC Install OW covers & leading edge wing 2 (35=28 +7 days)																													
15	NGC	Install JENTEK front spar & test																													
16	NGC	Install LUNA front spar & test																													
17	MERC	MERC Pack wing																													

Seq #	Responsible Party	Action	day	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	~	95	96	~	144	145	146	147	148	149	150
			date	3/28	###	###	###	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14		6/2	6/3		7/21	7/22	7/23	7/24	7/25	7/26	7/27
1	MERC	Complete repairs, measurements and make ready for sensors																														
2	GE	Install GE sensors 1-14																														
3	NGC	Prep all surfaces on both wings for LUNA and JENTEK																														
4	GE	Install GE sensor 15-38																														
5	GE	Remaining GE gages arrive																														
6	GE	Install GE sensors 39-44 RW																														
7	NGC	Install JENTEK rear spar sensors & test		?	R	L	?	?																								
8	NGC	Install LUNA Torque box fiber & test		R	R	R/L	L	L			?	?																				
9	GE	Install GE sensors 45-66			L	L	I	I			I	I	I																			
10	GE	GE sensor checkout											T	T				T	T	T										x	x	
11	MERC	MERC Install OW covers & leading edge wing 1 (35=28 +7 days)																			x	35	x									
12	MERC	MERC Install OW covers & leading edge wing 2 (35=28 +7 days)																						x	35	x						
15	NGC	Install JENTEK front spar & test																												x	x	
16	NGC	Install LUNA front spar & test																												x	x	
17	MERC	MERC Pack wing																														*

Figure B-20 Instrumentation Schedule.

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B7. References:

1- Jentek GridStation Software Environment General Use Manual (available upon request from JENTEK Sensors, Inc. 110-1 Clematis Avenue, Waltham, Massachusetts 02453-7013)

2- Luna ODiSI-B Optical Distributed Sensor Interrogator Users Guide (available upon request from LUNA 301 1st Street, SW, Suite 200, Roanoke, VA 24011

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