Internship Report

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Test & Instrumentation Dept., Engineering Intern





Executive Summary

This report outlines my twelve-week internship experience at Piper Aircraft, Inc., located at Vero Beach Regional Airport (KVRB), during the summer of 2025. As a pilot and engineer, the location and the role offered a unique blend of opportunities. My responsibilities focused primarily on engineering tasks, including software setup, test design, and real-time troubleshooting. I also had the rare chance to participate in test flights, pre-flight and post-flight briefings, which broadened my exposure to flight testing beyond regular flight training.

The experience began with a week-long orientation, thoughtfully arranged by the HR team. It included safety protocol briefings, math and measurement training, assessments, and even golf cart training—one of the most engaging orientations I've attended. Throughout the internship, I encountered technical challenges but learned to problem-solve through consultation and hands-on effort. The supportive and positive work environment made professional growth enjoyable and impactful. I would strongly recommend Piper Aircraft Inc. as a rewarding and dynamic place to work.

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Introduction

Piper Aircraft, Inc. is a renowned American manufacturer of general aviation aircraft, headquartered in Vero Beach, Florida. Founded in 1937 by aviation pioneer William T. Piper, the company has played a pivotal role in making personal and training aviation more accessible. Piper is best known for iconic models like the J-3 Cub, PA-28 Cherokee, and the modern M-Class series, which have become staples in flight schools and private aviation worldwide. With a legacy of innovation and reliability, Piper Aircraft continues to shape the future of aviation through its commitment to safety, performance, and pilot-friendly design.

Having secured a summer internship in this company, I feel fortunate as this was a great learning experience. I, not only got to refresh my machining and fabrication skills by working on a manual lathe and other machinery in the machine shop, but also got to apply skills learned at Riddle to finish the given tasks in this role. This was eye-opening, as for the first time, I witnessed first-hand how an airplane company works on its entirety. Through a guided tour as part of the New Employee Orientation, I saw how an airplane goes from small parts fabrication to sub-assembly lines to main assembly lines, paint job, electrical, engine, upholstery, to final test flights, R&D, engineering and so many things in between.

I was placed primarily as a Test and Instrumentation engineer in their Test & Instrumentation Lab, which is a part of the company's "Experimental" wing. I was given to work on two Engineering Work Orders (EWOs). Mainly, one involved conducting tensile, flexural, and short beam shear tests, and the other one had fatigue test in it. All of these tests were supposed to be conducted on the specialized **MTS Landmark Servo-Hydraulic 370.25 load frame**, as shown in Figure 1.

I was directly responsible for executing two EWOs initiated by the Structural Department. Upon assignment by the Test & Instrumentation Department Manager, I took ownership of the entire testing process. Each EWO provided detailed parameters

and requirements from the initiating engineering team.

My responsibilities included:

- Designing comprehensive test setups tailored to each request
- Developing or sourcing necessary tools and fixtures
- Conducting in-depth research into applicable industry and non-industry standards and specifications
- Proactively identifying and resolving any conflicts or ambiguities with the initiating department
- Performing the tests and capturing accurate data for cross-functional review
- Documenting and signing off the EWO, ensuring it was verified and stamped by QC personnel
- Submitting the finalized work to the Data Release Specialist for closure

Duties and Lessons Learned

The key deliverables were:

1. Work Order One: Conditioning, tensile, flexural, short beam shear tests, get the stress versus displacement plots, find the Ultimate Tensile Strength (UTS) values, and run the calculations for finding the resin and fiber weight percentage. This process involved 36 specimens.

2. Work Order Two: Setup the TestWare Elite (TWE) proprietary software, design the test for the 6 fatigue test specimens. Conduct fatigue test on the specimens of the Vertical Aft Spar of the airplanes.

Work Order One

The objective of this work order was to characterize a new material for building the composites that go on the aircraft cowling. The test is vital for developing allowables for future composite structural analysis. There were 36 specimens/ coupons that were provided in total. Half of those were labeled as CS (Cowl Skin), and other half as RP (Resin infused Panels).

Tensile Test

10 specimens were to undergo tensile testing on the MTS. This task was approached step by step: familiarization with a new machine and software, reading through the ASTM standards mentioned on the work order, pre-conditioning of the samples, testing, and then post-processing. For the test, a few parameters specifically mentioned on the work order are shown in Table 1.

The softwares that go with the machine are the Station Manager, and TW Elite. This machine works on a Servo Hydraulic (SH) pressure system. I have worked on Instron 8516, and 5984 machines before so I did come in with some experience on these

machines. The major work was done on the software side. For this test, I used a company provided template, input the values from Table 1, inside the Procedure tab and ran the test.

The machine had two 100 kN load cells. The top load cell was connected to the crosshead via another 250 kN load cell. The bottom load cell was connected to an actuator. Before the beginning of the test, the top crosshead must be locked. The bottom actuator has the DAQ (Data Acquisition) ports connected to it and to the software. So, the displacement data is obtained from the displacement of the bottom actuator via LVDT (Linear Variable Differential Transformer) sensors. For this test and all the subsequent tests under this work order, the 2.5 Gallons Per Minute (GPM) flow channel was used.

Flexural Test

During flexural testing, I oversaw the failure of 10 specimens as part of routine structural destructive testing commonly conducted in the aerospace industry. This type of test can be performed using either 3-point or 4-point bending methods. I selected the 3-point bending setup, but initially, no suitable fixture was available.

Identifying this gap, I was tasked with designing a custom test fixture in compliance with relevant ASTM standards. I collaborated closely with the tooling department to fabricate the models based on the engineering drawings. This was also my first time working with Siemens NX; although new to the software, my certification and experience as a SolidWorks professional made the learning curve significantly smoother due to the similarities between the platforms.

In total, I designed eight part models. As expected—especially for someone new to the workflow—multiple iterations were required throughout the design-to-fabrication process. This hands-on experience became a major growth opportunity, deepening my understanding of how to interpret ASTM standards, extract critical parameters, and translate them effectively into practical, manufacturable design intent.

The parameters mentioned on the work order regarding this test are shown in Table 2.

Short Beam Shear Test

Although they look similar in setup, the difference between the flexural test and short beam shear test is the moment arm. The length of the moment arm is longer in flexural test which results in the bending forces being dominant, whereas, due to shorter moment arms, the shear forces dominate in short beam shear test.

The parameters mentioned on the work order for this test are shown in Table 3.

Work Order Two

The objective for this test was to configure the new and highly specialized MTS machine for fatigue tests in general and run a successful test. For this fatigue test, the given specimens were to be put under a cyclic load. 6 samples had been prepared: 3 High Torque with 90 in-lb torqued fasteners, and 3 Low Torque with 30 in-lb torqued fasteners to see the effects. Each sample had to be loaded on to the MTS machine and run for 20 million cycles at intervals of 5 million cycles and inspections. At the end of each interval, the nuts had to be un-torqued using a torque wrench, dial type with memory pointer, holes had to be measured, Surface Eddy Currents inspection had to be done, and then the bolts had to be torqued back at the rated torque value to go for the next 5 million cycles and so on.

The eddy currents inspection had to be done by an authorized inspector. I learned how to use a standard torque wrench, dial-type torque wrench and following the company specs, how to properly torque and un-torque these fasteners. One cycle was defined as going from 122.5 +/− 6.2 lbf to 1225 +/− 62 lbf and back to 122.5 +/− 6.2 lbf at a frequency of 20-25 Hz.

The most intense process in this was navigating the test design inside the proprietary software, TWE. This involved constantly communicating with the MTS tech support,

reading multiple documentations, and continuous testing and development. That was also the most hands-on part which gave me a chance to brainstorm ideas on my own. I also tried to implement Application Programming Interface (API) in pushing Python code into the TWE software. Albeit the hurdles that forced to take a different route, the struggle was good. A lot of real-time post processing had to be done, for which, I used MATLAB.

Results

Work Order One

Tensile Test

All the tests are performance and data collection heavy. The setup for the tensile test is shown in Figure 2.

Figure 3 shows a sample .txt data file, and the data collected had load (in lbf), displacement (in inches), and time (in seconds). This data file was then imported into Microsoft Excel as a tab delimiter import and post processing done to extract the Stress versus displacement plots and the UTS values. A sample plot is shown in Figure 4 that the TWE software generates after each test.

Flexural Test

The setup for the 3-point bend test or flexural test is shown in Figure 5. I modeled this setup on NX and the tooling department fabricated these.

Short Beam Shear Test

The setup for the short beam shear test which is similar to the flexural test is shown in Figure 6.

Work Order Two

This setup cannot be shown due to confidentiality. A sample data file is shown below. The TWE software had a convoluted way to conduct data post processing that created some technical issues. Due to limited help from the technicians from the parent MTS company, I chose an alternate route and typed a script on MATLAB that would take these big data files (of the order of magnitude 2-4 GB) and calculate number of valid cycles, plot load versus time, and check for consistency in the load values staying within

tolerances specified on the EWO. Later, I found a solution within the software that helped reduce the data files size to about 700 MB.

Due to the nature of this test, I could only finish a part of the EWO as this entire test was going to take over two months time to finish. I helped initiate the test and got one specimen entirely done for the 20 million cycles. The MTS and hydraulic pumps were on 24x7 for this test. Fatigue tests are usually of this nature. This was my first time doing a cyclic fatigue test so that was a learning curve.

Softwares learned through this internship are:

- Siemens NX
- Overleaf
- MTS's TW Elite
- MTS's Station Manager Interface

Conclusion/ Summary

- How ERAU education helped in this internship?

  Through ERAU's student access to MATLAB, I was able to conduct meaningful data analysis that helped answer critical questions and effectively communicate results to the structural engineering team. The hands-on experience gained from using MATLAB in Modern Controls and Linear Systems classes proved especially valuable.

  Additionally, my exposure to Overleaf through group projects in Numerical Algebra and Airplane Dynamic Stability classes sparked a deeper interest in mastering the platform. This led me to use Overleaf to write a comprehensive procedural manual for the MTS machine and the final internship report, further strengthening my technical documentation skills.

  Besides, troubleshooting skills and exposure to various lab equipment and machinery from working as a GTA (Graduate Teaching Assistant) for the Dynamics &Controls Lab proved to be crucial.

- Student experience at ERAU compared to professional internship experience:

  ERAU offers a strong foundation for students pursuing research-focused careers. However, when it comes to industry roles—particularly those that are hands-on—a noticeable gap persists. While I may not be the typical student to make this comparison, given my three years of prior professional experience, it's a trend I've observed widely among the student population: limited exposure to hand tools, power tools, and operational machinery.

  It often feels like the only machine the classroom truly prepares students to use is a computer, equipped with advanced software. Yet, the industry demands a familiarity with a much broader range of tools and equipment—many of which even I hadn't encountered before my internship.

This lack of practical skill development is particularly evident among women in STEM, where educational institutions still fall short in promoting technical confidence through hands-on learning. ERAU equips students with robust theoretical knowledge and analytical skills, but there's a clear gap when it comes to experiential learning—performing, conducting, and physically applying engineering concepts.

Industry experience plays a pivotal role in filling this gap. It doesn't just highlight the absence of certain skills—it actively cultivates them. A well-rounded engineer is shaped by both academic rigor and practical engagement, and when these two worlds come together, students are better prepared to thrive.

- Coping strategies about life both inside and outside the workplace:

  Some of the coping strategies that have worked for me are described below.

  - Inside the workplace:
    * Being a workaholic worked to my advantage. I naturally take initiative, seek out tasks, and don't wait around to be told what to do.
    * Take time to meet people and have those small talks and get to know what their roles in the company are, what they do, how they contribute, etc. Goes a long way. Plus, we are not robots, we are social people.
    * Whenever you have downtime, in a company like Piper, you can and should go around on the production side for a walk. It is a surreal feeling to see all those airplanes coming to life from scratch, one behind the other, and you realize why you are doing what you are doing in the big world.
    * Every once in a while, ask for feedback from supervisors (sups) , managers, or from people who have done the work that you are doing to find room for improvement and work on those pointers.
    * If you prefer, let the sup know that you would like one-on-one check-ins

with them. In my previous job, since I would not see my sup daily, these 1-on-1's were a great help, both work related and emotionally, just to get it all out from my system.

    * If you have any inconvenience, it is OK to talk about these and better to get these out of your head in front of your sup than other random people.
    * If you do not know anything, no matter how dumb it may sound, be honest about it. Everybody would love that and be willing to teach you. This is easier and better to do earlier in your career than later.
    * Lastly, always keep thinking, how can I improve this place where I am working.

- Outside the workplace:
    * These are the best opportunities to explore the town/ city around. No matter if you are in a new town/ city or your own, there are always places that are yet to be discovered. And the best way to do it is, by doing it alone, on your own (of course if possible and with all due safety in mind), figuring it all out by yourself.
    * Prioritize work but once off the clock, it is OK to work more, maybe on developing skills like self training cool software, working towards certifications, flying, reading about airplanes, volunteering, etc. It is equally important to give sometime to yourself, catch up on your thoughts, and nurture and keep a tab on your mental health.
    * It is easy to stay stuck in work mode, especially with a workaholic mindset. Over time, it's possible to train your brain to pause, reset, and seek out little adventures.
    * Most importantly, appreciate what's in front of you. Don't waste energy on complaints or trivial distractions. Focus on the present. Saying that to yourself every morning shifts your mindset and changes everything.

- How did the internship improve your technical knowledge level?

  This internship significantly expanded my technical capabilities beyond what I previously knew, and reaffirmed that learning is a lifelong process. Many of the skills I honed here simply aren't taught in a traditional classroom setting—they're cultivated through real, hands-on engagement. It's comparable to learning how to drive: you don't master driving by reading PhD-level texts or practicing in simulators; you get better by getting behind the wheel, again and again. That's how this experience felt.

  My foundational knowledge in structures was reinforced through direct involvement in new types of testing, such as fatigue testing and short beam shear testing—both of which I performed for the first time. I gained valuable insight into composite materials and developed a deeper understanding of machining and fabrication work in the machine shop. I logged over 100 additional hours on the shop floor and became familiar with new and specialized tools, machines, and software.

  These experiences gave me more than technical growth—they reignited my confidence and solidified my readiness to return to the industry with fresh momentum.

- Will this internship help in being a better student?

  Absolutely. For students like me, industry exposure doesn't just complement academic learning—it supercharges it. My experience working in the industry has given me a clearer sense of purpose and direction within the classroom. I perform better, strive harder, and pursue technically challenging roles like Graduate Teaching Assistant and lab technician precisely because I have a solid foundation shaped by real-world experience.

  I've always had a deep love for working with machines—breaking them, repairing

them, rebuilding them, and asking why they broke in the first place. That cycle of hands-on learning is my strength, and it's something only the industry can offer in full. Thanks to this internship, my practical toolbox has grown significantly, and now, when I step back into the classroom, I do so with sharpened curiosity. The 'why' behind every lesson is clearer than ever.

Armed with this experience, I can ask more insightful, grounded questions over the next two semesters—questions rooted in doing, not just reading. This internship didn't just develop my skillset; it elevated the kind of student I am and aspire to continue being.

- Did this internship contribute to your preparation as a potential future employee?

This internship was an invaluable opportunity for me to evaluate Piper Aircraft as a potential long-term employer. Having experienced toxic work environments in the past, I entered graduate school with the goal of using internships not only for technical growth but also for assessing workplace culture. I wanted to ensure I didn't fall into the cycle of underappreciated and unhealthy work settings again—and I'm glad to say this experience delivered something genuinely different.

Piper fosters a healthy, supportive environment that's ideal for budding engineers and early-career professionals. In my department especially, the openness to learning through mistakes stood out. I was explicitly told that making errors—within reason—is part of the learning process. That one statement was a turning point for me. It rewired how I think about engineering work culture, particularly as a woman entering the industry.

That sense of psychological safety, where growth is encouraged and perfection isn't demanded from the outset, is not universal. I speak from experience when I say that it's rare. And it makes a powerful difference in how confident and engaged a new professional feels. This internship didn't just add to my skill set—it restored my belief that healthy engineering spaces do exist.

- The most important thing I learned both technically and as a new professional:

  The utmost important thing is to know that there is always a bigger shark. Meaning, excelling in schools may create that false pride or ego that you are all ready to tackle the industrial world. Coming with that egoistic attitude may hurt you as a new professional. You may think that you know it all to survive but you don't. Always be humble enough to tell yourself that you do not know it all. In fact, that you do not know anything. What you know may also be challenged. Always be willing to ask and be ready to learn from others. Beyond technical expertise, there's a suite of soft skills that are just as vital—if not more so. Learning how to carry yourself professionally, how to separate personal and professional spheres, and how to mentally recharge so you're consistently alert and effective are all part of the job. Handling difficult people with composure, responding with logic instead of emotion, presenting yourself with confidence, and maintaining a commitment to self-improvement- all of these are actual skills that are equally important to a new professional engineer or anybody.

Table 1
Tensile Test Parameters

Parameter	**Value**
Constant cross-head speed	0.05 in/min
Initial spacing between test grips	4.5 in (includes 1 in grip on each side)
Standards to follow	ASTM D638

Table 2
Flexural Test Parameters

Parameter	**Value**
Span width	2.75 inches
Constant cross-head speed	0.075 inches/ min
Standards to follow	ASTM D790

Table 3
Short Beam Shear Test Parameters

Parameter	**Value**
Span width	2/3 of specimen length
Constant cross-head speed	0.050 inches/ min
Standards to follow	ASTM D2344



Figure 1
MTS Load Frame

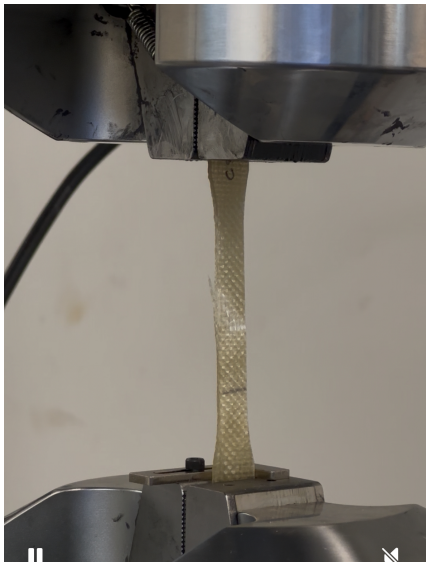

Figure 2
Tensile test setup. A dog bone specimen after failure.

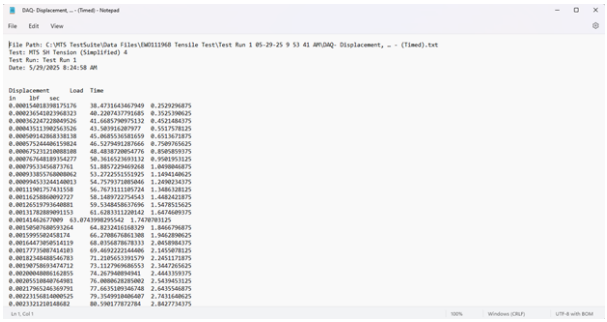

Figure 3

Tensile Test Sample data file.

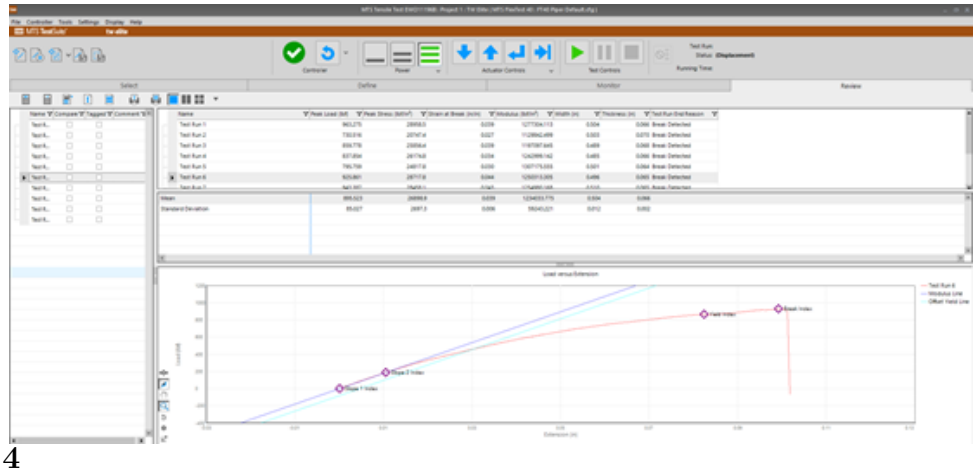

Figure 4

Sample tensile test plot. This is plotted as Load (in lbf) versus extension (inches).



Figure 5
Flexural test setup. The specimen is contacted at only 3 points.



Figure 6
Short beam shear test setup



```
"File Path: C:\MTS TestSuite\Data Files\EWO28074D Fatigue Testing\Hold Data.txt"
"Test: MTS_SH_FATIGUE_TEST"
"Test Run: Test Run 1"
"Date: 7/1/2025 7:22:51 PM"


"Load","Displacement","Running Time","Axial Integer Count","Rollover Running Time"
N,m,sec,segments,sec
-2.40048265457153,-1.52832876665343E-06,1.8212890625,0,1.8212890625
-3.78258180618286,-1.03887089153432E-06,1.822265625,0,1.822265625
-2.98474884033203,3.09296893874489E-07,1.8232421875,0,1.8232421875
-3.18808817863464,2.49637452043316E-07,1.82421875,0,1.82421875
-3.15114355087280,-3.60972506996404E-07,1.8251953125,0,1.8251953125
-3.97049689292908,-3.56679038304719E-07,1.8271484375,0,1.8271484375
-3.13111686706543,-5.04171623560978E-07,1.8291015625,0,1.8291015625
-3.24276781082153,-7.93704316492949E-07,1.830078125,0,1.830078125
-1.50560712814331,-8.48336924264004E-07,1.83203125,0,1.83203125
-1.93701577186584,-1.24832934034202E-06,1.8330078125,0,1.8330078125

"File Path: C:\MTS TestSuite\Data Files\EWO28074D Fatigue Testing\Hold Data.txt"
"Test: MTS_SH_FATIGUE_TEST"
"Test Run: Test Run 1"
"Date: 7/1/2025 7:22:51 PM"


"Load","Displacement","Running Time","Axial Integer Count","Rollover Running Time"
N,m,sec,segments,sec
2090.98413085938,3.81716708943713E-05,1.8876953125,2,1.8876953125
1823.54638671875,3.18847341986839E-05,1.9033203125,3,1.9033203125

"File Path: C:\MTS TestSuite\Data Files\EWO28074D Fatigue Testing\Hold Data.txt"
"Test: MTS_SH_FATIGUE_TEST"
"Test Run: Test Run 1"
"Date: 7/1/2025 7:22:51 PM"
```

Figure 7
Fatigue test sample data file.