

UPDATE20

How do you eat an elephant? One bite at a time.

These past several weekends, we've had elephant for dinner. Baked elephant, boiled elephant, elephant gumbo, steamed elephant, elephant etouffe, elephant sandwiches...

The stars, the full moon, and high tide all aligned, and we had a couple of great working parties. That manpower allowed us to completely bleed the hydraulic system and service the system, after the numerous emergency extension tests. We now have complete confidence that should we need an emergency gear extension, it will work. This is almost a certain guarantee we will never need it.

When I say "bleed the system" that is no small task. Almost everything in the airplane is hydraulic powered, mostly by the HYD 1 system that suffered the failure. Nose wheel steering, brakes, landing gear, flaps, speed brake, and a WINDSHIELD WIPER system all work on the HYD 1 system. They all needed to be properly bled and serviced. In the end, we just removed the windshield wiper motor. If it's raining that hard, I will just stay on the ground. We used over 8 gallons of hydraulic fluid to replenish all that was lost from the failure and reservicing.



Our test brake cable is ready to be tested.



Pete and Mike are removing lots of rivets to make way for a new sheet metal repair.

A major portion of our reaction control system was removed, inspected, and reinstalled. It's a very tight fit and the fit is critical. We now consider ourselves lucky that our previous hydraulic repairs required 9" fingers and long, skinny arms. For this operation, we needed tiny, tiny fingers to work in between all the hydraulic lines. You can see from one of the photos that some work requires VERY long arms.

Our mechanics were inventing new curse words because the clearances are so tight, and the installation so tedious. The standard, run-of-the-mill curse words were clearly inadequate. Multi-syllables, with hyphens, maybe with a foreign accent, seem to work best. As soon as we finished and the last bolts were torqued, a visiting Marine took a look at it and said, "We have a tool to compress the bellows. That makes this job super simple and easy." Now we find this out. The next time, we'll have the proper tools for the job, another guarantee that we won't need it.

When we taxi, we'll check all those reaction control system connections for leaks. No leaks are acceptable. None. The crew is really looking forward to this because it's called "a muff check." (I'll just let you muse on this in silence for a moment.)

I'm quite sure they think it's something else, since they go around all day, counting the minutes until we do the "muff check." I've reiterated to them that it's quickly becoming a lost skill, and haven't got the heart to inform them it's something entirely different from what they're expecting. I have to keep them motivated the best I can.

During the course of our rework, we discovered that a brake cable was broken. Better to discover it now, than in the air. Normally, Harrier brakes are at best, well below average. They have been described as everything from poor to non-existent. Really, they just give the pilot a false sense of security. We even have a brake pressure gage in the cockpit to verify that anything is happening at all. They won't hold the airplane beyond 55% RPM, and skid the tires when coming into the chocks. There isn't any differential braking, and they are least effective at high speed. What good are they? So brakes are not the most critical item for the airplane, but the crew has seen me taxi and determined that I could benefit from them, if only to protect their automobiles in the parking lot and the hangar wall.

We went to our GR-3 as a spare parts donor, but determined that the cables are different. I could have guessed as much. We had originally thought that the GR-3 was 95% common, but our math was in error. It's more like 5% common and 95% different. We needed one of those 95% different parts. Back to square one.



Once the airplane was on jacks, we were able to disassemble the nose and begin our detailed inspections. The reaction controls, nose landing gear doors and all panels were removed.

So we tried to make them ourselves. It's only a cable, right? The fittings are unique, the cable is metric and it has to be fabricated in the housing. It then seemed we should try to locate the parts from a supplier and managed to obtain a set. But when they arrived, the ends were not a match and some of the strands were frayed. No good. Back to square one.



Christian Vlahos is laying out one of several repairs to the inner structure. The forklift is an excellent workbench.

We located some ends that were close enough and some cable to match and fabricated a test cable. How much force would they need to sustain? There are no statistics in any of our manuals, so we don't even know what standard to test to. So we came up with our own. We needed to improvise.....

There's a photo of our high-precision test rig - a forklift and a tow tractor. Aviation's version of a tractor pull, after all this is Southern Maryland. The tiny cable pulled our tow tractor backwards, and it takes two grown men to push that tractor. Three men, if one of them has forgotten to release the brake. Our test cable is clearly strong enough, but we went further. We tested it to destruction and the cable failed at the fitting. I believe that's more power than I'm capable of applying with my fat foot.

Once another, newly manufactured brake cable was reinstalled, and survived the “foot check,” we reinstalled the ejection seat and canopy. It’s starting to look like an airplane again.

We serviced all the struts, including the nose strut with its own, special silicone fluid, and after a good day, we lowered the airplane to the deck. After seven months on jacks, the airplane was on the deck. All the struts, tires, and systems serviced. We towed it from the hangar into the daylight and she looks great!

We started the Gas Turbine Starter (GTS) after a couple of warm up cycles to insure oil is up to the bearings. On the first attempt at a “real” start, it worked perfectly.

But we weren’t ready to start the main engine, because we still have some sheet metal repairs to be made and we want to thoroughly inspect EVERYTHING to avoid a chance of a stray rivet finding its way into the engine. That would be catastrophic. The main engine start would have to wait until the following weekend.

The following weekend, we reconvened our working party. Our first priority was to complete the sheet metal work under the nose. One of our Marines, who has recently transferred to Quantico, answered the call and had the nose repaired in a day. GySgt Mike Pintha, USMC, 1 each, jumped right in and did a superb job.

We were determined to start the main engine the following day.



This is our highly-sophisticated, experimental test rig for testing our brake cable.



You definitely need extra long arms to get this job done!

It took most of the day, Sunday, to thoroughly inspect all the affected maintenance areas, vacuum all the voids, safety wire connections, reinstall panels and attach the brand new radome. The radome was actually a first with this project. The radome fit and all the screws aligned. Everything on this plane was hand-built and so production parts have not fit on the first try. They’ve all required some minor “tweaking” to ensure a good fit. Even the landing gear doors, which are clearly labeled, “do not modify” required modification. However, the radome is a production nose radome and we have a new production radome ring on the fuselage, so it’s logical that they would mate. No cuss words needed.

Once that was complete, we towed the airplane outside to cycle the engine. On the first dry cycle, the hydraulic pressure reached a working pressure, just motoring the engine on the starter. That was a good sign.

When the engine came to life, the hydraulic pressures were all normal. We thoroughly exercised the system by cycling the flaps, flight controls, and brakes. Everything except the nose wheel steering and the landing gear because we stayed in the chocks. No leaks, no drips, no abnormal lights. All pressures and all indications were normal.

A quick note about removing the Head Up Display (HUD). We removed the military HUD and replaced it with a civilian Electronic Flight Instrument Display (EFIS). That EFIS is the Mac Daddy! It's mounted just below the original HUD location and can do more than the military HUD. For our purposes, since we're not delivering any weapons, the EFIS is better. It's lighter, uses less power, and probably more reliable. Rich Gill and Ben Travis did a fantastic job of the installation.

The following weekend, we again reconvened our working party, with the goal of taxiing the airplane to complete the "muff check." After a good main engine start, I taxied to the runway and checked all the main systems. Everything, including the intercom and the new EFIS, all worked perfectly. All pressures, temperatures, sights, sounds and smells were normal.

After checking the engine acceleration times, I returned to the chocks. Shortly after shutdown, the main wheel brakes started a very small fire, which was quickly extinguished. Taxi checks do generate a great deal of heat and any residual grease is a source of flame. As a result, we needed to change the two main tires and install new brakes, which we had in our spares. The total time was only a couple of hours delay and we're still on schedule. We've also modified our flight plan for the next flight, to allow adequate brake cooling time airborne.



Here we are on the ramp - ready to start!

We're doing a new weight and balance, since we've removed significant weight from the nose. We may need to ballast, but we don't know that, yet. Once that's complete, we're ready to fly.

As always, if you wish to be deleted from this mailing list, please send me an email.

Sincerely,

Art Nalls