Turbine Jet Maintenance (or How to Prepare for the Next Big Event)

By Craig Gottschang

R/C turbine jets are complex machines operated in a harsh environment of high speed/ high G flight, dirty runways and pit areas and sometimes less than perfect landings. As such they require more care and preventive maintenance than your average flying model. Failure to do so will at best result in a frustrating flying session as you deal with nuisance problems and at worst with the total loss of your model. There are enough challenges that we cannot control when flying jets that make it imperative to minimize the ones we can. In full scale aviation, this is known as "threat and error management". For these reasons it is good to have a maintenance routine or checklist prior to flying your turbine jet. I always try to accomplish the following items before packing up my jets and "stuff" and heading out for a jet event.

<u>Batteries</u>

Batteries are the life blood of our turbines and may be the single most important items to maintain to avoid catastrophic mishaps. Larger jets and smaller batteries have made it more practical to provide dual power sources for our receivers and servos but due to space limitations, many jets still have single receiver batteries and most have only a single battery to power the ECU. For this reason, it is critical to ensure all batteries are properly charged and in top condition prior to flight. Because of the number of batteries involved, not only for the receiver and ECU but also for smoke pumps and lights as well as for the transmitter and various support equipment you will need to start checking and charging batteries a few days before the event. Here are some specific suggestions:

- Fully charge and then cycle each of your nickel-cadmium and nickel-metal-hydride battery packs. This is a check and precaution that should be accomplished at least every two or three months and cycling before a big event is a good reminder in case you have not done it recently. If you discover a pack that will not charge at least at (or very close) to it's rated capacity, or has dropped significantly since last cycling, replace it now. Multiple cycles may restore some capacity but it is generally not worth the risk to fly with a suspect battery.

- Newer technology batteries such as Li-ion, Li-Poly, Li-Manganese, and Nanophosphate (A123) each have their own charging requirements and characteristics. You must be familiar with the battery type you are using and only use an approved charger. Most of these batteries are not normally cycled and you will need to determine their status with an ESV under a 1 amp load after charging and before each flight.

- Don't forget to charge/cycle your transmitter battery as well as batteries for your fuel pump, air pump, smoke pump, blower, field charging system and another support equipment you may have.

> *TIP: If you have difficulty remembering the number of cells, type and capacity of your various batteries (many of which are not readily visible) try this; use a fine tip marker and write the number of cells and capacity on the onboard connector used to charge the battery. Alternately, write the same information on a small strip of masking tape (or use a label maker and ¼" tape) and loop it around the lead or stick it close to the charge receptacle. Keeping a written record of battery cycling dates and results is also helpful.*

<u>Landing Gear</u>

No single system causes more problems at the flying field than the landing gear and door mechanisms. These components are subjected to a multitude of forces, even on the smoothest of flights, which can result in misalignment, loose parts, breakage, and general wear and tear. Regular inspection and maintenance are essential to avoid problems.

- Start by placing your model on a stand and cycling the gear. Observe that all gear and doors open and close without binding or friction. Gear should lock (over-center) both up and down and doors should be flush when closed. You may need to turn your model over to closely observe gear and door operation in all phases of movement. If anything is not perfect, trouble shoot the problem and make adjustments as necessary.

> *TIP: Air loads, G loads and dynamic (in flight) loading of the wings can change the geometry of the wing/fuselage structure enough to cause a gear system with marginal clearance to malfunction in flight. Try to allow some "margin for error" during ground testing and setup.*

- While your model is upside down check for loose gear mount bolts, cracked/loose or damaged mounting blocks and/or flex plates, damaged/loose hinges, security of air cylinder actuator mounts and general condition of gear and door components. If the wheel well area is dirty, as they usually are from debris kicked up by the tires, clean them out and lube the appropriate rotating parts. Before flipping your airplane upright, verify that all air lines, brake lines and transiting servo leads are well secured and not in a position to foul or interfere with gear/door operation.

- Once satisfied that your gear and doors are functioning properly, it's time to charge your air system to normal max pressure (100 to 110 lbs) and check for leaks. The best way to do this is to leave the model undisturbed for an hour or two and then recheck the pressure. If you experience a loss of more than 5 to 10 lbs of pressure you will need to find the source of the leak and correct it. Check the gear both extended and retracted and you may find the leak only occurs in one direction. In any case it will help you narrow your search to the "up" side, "down" side or "supply" side (i.e. the lines, air tank(s) and components up stream of and including the air valves). You can further refine your search by using hemostats to clamp off individual components, for example; the nose gear, to isolate the leak.

> *TIP: If your system has held pressure since originally installed, a newly developed leak can often be traced to dried/worn plungers within the air cylinders or even the air valves. Refurbishing with an injection of light weight oil (such as BVM "Thin Lube") will often rejuvenate the internal "O" ring and reduce or eliminate the leak.*

- The last items to check in the landing gear system are the wheels and brakes. These components always collect dirt and grit and you will need to remove each of the wheels and thoroughly clean the axels and inner hubs. Check for galling (roughness) or pitting of the axels and/or wheel bushings and use a fine file and 400 grit wet/dry sandpaper to bring them back to smooth condition. Lube the axels with a light weight bearing grease, such as Power Glide from Robart, prior to reassembly. Finally, check that your brakes are working properly and grip equally on both main wheels. You may need to apply a very thin wipe of Vaseline or lightweight oil to the inside wheel hub to prevent the brakes from grabbing too abruptly.

<u>Structure and Flight Controls</u>
No single malfunction is as rapid or catastrophic as the loss of a flight control or structural failure in flight. Due to the high speeds encountered during turbine jet flight any slop or looseness in the control system or wing/stab attachment can quickly lead to flutter and destruction of the airframe. For this reason it is imperative that these items be checked on a regular basis.

- Check each flight control surface, starting with the security of the servo and its associated mount. If this means removing a cover panel, then do so since you will need to check the tightness of all screws and bolts, including the screw holding the servo arm to the servo. Check that slop has not developed in the servo arm or control arm holes and the connecting clevises are properly safetied. Check that clevis jam nuts are tight and look for any corrosion on or around soldered components. Complete the inspection by tugging firmly on each control surface to ensure that hinges are still secure. Don't forget to accomplish a similar inspection of your nose wheel steering servo and linkage.

- Carefully inspect your wing and stab attachment components for any sign of damage or unusual wear. Carbon fiber "blade" attachments must be free from large nicks, cut damage or delamanation. For components that you leave attached, such as horizontal or vertical stabilizers or even the wings, check the tightness and security of all attaching bolts, screws, set screws etc. As a final check, physically grip each structural component in turn (fixed and removable), and test for rigidity and lack of play. Any deficiencies discovered must be investigated and corrected.

- Finally, check all external and accessible internal areas for cracks, disfiguration, misalignment, heat blisters or any other physical irregularity. This check may be the only way to discover unsuspected or hidden damage from a hard landing, travel damage, pit damage or internal heating problems.

<u>Turbine, Fuel System and Internal</u>

One of the nice things about turbines is that they are relatively maintenance free and generally not prone to vibration induced problems. Nevertheless, there are some basic checks that should be performed on the turbine and associated support components.

- Check the security of the turbine mounting straps and mount attach bolts and insure the engine has not shifted position. If you have a bypass installed, check its mount attachment security as well. Also inspect the security of the tailpipe (if installed) at each attachment point. Remove the glow plug cap, check the tightness of the glow plug and reattach the cap. Check the alignment and security of the electric start motor and then insure all leads coming from the turbine (fuel, electrical, RPM, propane, air etc.) are bundled and routed clear of the intake area and free from obstruction.

- Next inspect the fuel system. The most obvious problem to check for is leaks and it may be necessary to fuel your system at least partially to insure that everything is absolutely dry. The most common cause of new leaks is cracks in the fuel tanks, normally along the seams where they are joined. These can be difficult to pinpoint and generally require the removal of the suspect tank in order to identify and repair the exact spot. Otherwise, just look for kinks or pinches in the fuel lines and verify that the fuel filter is clear of debris. If everything looks good it is generally not advisable to further disconnect or disassemble the fuel system as this will probably cause more problems than it reveals.

> *Tip: If you need to repair a leak in a fiberglass/Kevlar fuel cell, completely dry the tank and then flush with acetone. Next, apply some negative pressure (suction) to the tank and wick thin CA in and around the area of the leak. Follow up with a coating of BVM Aeropoxy or regular epoxy, allow to cure and your repair is finished!*

- Finally, perform an overall interior inspection to include your ECU tray, antenna routing, servo and electrical leads, air lines, fuel lines, propane lines etc. and all their associated connectors. Make sure that everything is in its place and secure from interference with each other and moving parts. Once again, it is not advisable to disconnect or disassemble any of the above unless you have reconfigured your installation or are attempting to correct a problem.

Conclusion

The recommendations in this article are not intended to be all inclusive or fool proof but they represent many of the "best practices" of jet modelers who have a track record of consistent success and own jets that have survived many seasons. Customize these suggestions into a routine of your own and learn from your experiences as well as from others. At all costs you must avoid the attitude of "It worked the last time I flew it so it will probably work today". That approach has lead to many accidents, of both models and full scale airplanes, that were completely avoidable if the pilot had followed a simple preventative routine.