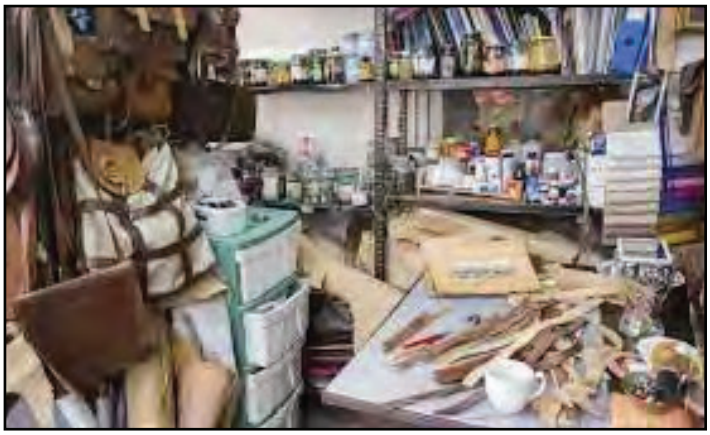
FOD...*Foreign Object Debris Leads to Foreign Object Damage*

My intent with this article is not to tell you how to organize and run a FOD program, but I do want to provoke some thinking for readers based on my aviation career and experience in the quality assurance field.

Beginning with our advanced individual training (AIT) when we started our aviation careers, our instructors, leaders, and supervisors have cautioned us about foreign object debris and foreign object damage (FOD). Remove watches, rings and identification tags before performing maintenance they would say. Empty all pockets of loose change and personal items would be the follow-on commands. But why … we would ask? We made promises like "I promised my wife/husband I would never remove my ring." Being good leaders, we explain the safety considerations and we show them the picture of the individual with the skin removed from their ring finger. How about the whole finger?

DA Pam 385-90, Chapter two defines FOD as – damage to or malfunction of an aircraft caused by an object that is alien to an area or system or is ingested by or lodged in a mechanism of an aircraft or strikes the aircraft. Some examples of FOD are ingestion of loose hardware or grass by an engine, flight controls jammed by hardware or tools, and tires cut or propellers or tail rotors damaged by debris on the ramp or taxiway.

It isn't until we begin maturing that we fully understand the dangers of "stuff" getting caught in moving parts and the potential damage it can cause. For some of us, it doesn't really hit home until we are involved, whether directly or indirectly, with an incident, accident, or a catastrophic event. Below I will discuss a few items that fall under a FOD prevention program.



Housekeeping

Let's start with housekeeping. Housekeeping is a general term, so let's just focus on FOD related. Clean as you go. How hard can it be? What are some excuses we may hear on why we can't do housekeeping?

- Operation tempos are high so we just do it once a week.
- I don't have time for daily clean-up as it is and now you want to add more clean-up?

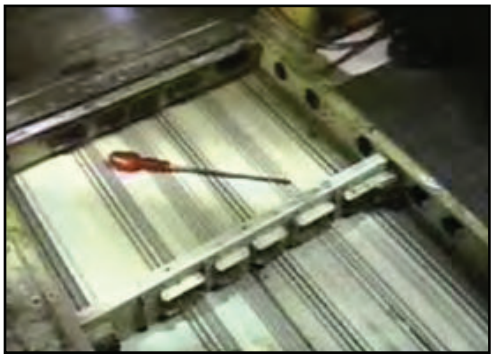
Experience has taught me that the cleaner we keep our work areas while performing maintenance, the less time it takes at the end of the shift to wrap it up and secure equipment and any possible FOD. How many of us have seen or contributed to throwing safety wire and cotter pins on the floor? We'll sweep it up at the end of the day we figure. Oh wait, we don't have time for clean up so now that wire or cotter pin sticks in the mechanic's, inspector's or flight crew's boot as we continue maintenance or prepare for a follow-on mission. If we don't catch it, it may end up in the driveshaft area or flight controls.

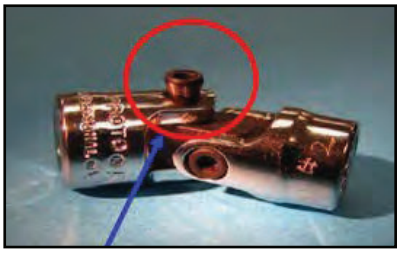
FOD containers are often common practice; we started with cans, but now we have the cool FOD bags that seal. But if we are not careful while performing maintenance and using the container, it's knocked over or we don't seal the bag, now we have all this loose debris in the component area we are working. Simple, let's put it in our tool bags. That doesn't work because now we have loose debris that poses not only a FOD hazard but a personal injury hazard as well. How many of us have unintentionally stuck safety wire up our fingernails?

Tool Control

Tool storage and accountability control have come a long way over the years. Back in the day, we were issued mechanics' toolboxes with a supply catalog (SC) to annotate monthly inventories, but no foam to shadow the tools. Back to our operation tempo – we don't have time for clean-up, how do we have time for our toolbox inventories? It was my experience back in my day that to lose a tool, a statement of charges was issued, but there seemed to be little concern from my leadership to locate the tool. Sure, we were asked questions, but we would convince our leaders, as well as ourselves, the tool is not on an aircraft. Sometimes the tool would come up during a short search, but I don't remember the administrative grounding of aircraft. Often it wasn't until the next time a panel was removed that an unmarked tool would turn up.

That's right, we didn't always mark our tools. A shadowed toolbox with daily/task complete inventories mitigates the risk substantially. Now let's go out to the flight line with a tool bag and the tools we will need to perform a maintenance task. We may not shadow our tool bags, but how about an inventory document to track our task-related tools? Without an accurate inventory, as we wait for an aircraft run-up to complete while pilots perform the maintenance operational checks (MOC), we may be thinking, "did we leave something out?" Lastly, what about tool serviceability? If we don't inspect and take care of our tools, they will fail us, possibly leaving fragments which can become FOD.





Caps, Plugs, Rags and Loose Hardware

Now we are getting into expendable items and bench stocked items. Bench stocked items are tracked for replenishing requirements, but who tracks plastic caps and plugs? Why do we need to track rags? If you take the time to go back into aircraft and ground equipment safety messages, you will see caps, plugs, and rags left in components during assembly and installation.

Now let's go back to the hardware. I need this bolt for a common installation, so I'm just going to grab a couple of extras so I have them on hand. I need washers, nuts and cotter pins to go with the common bolts; before you know it, I have five pounds of loose hardware in my toolbox! Worse, I carry some of that loose hardware onto the aircraft for maintenance, to include extra hardware so I don't climb up and down multiple times, without really knowing what I have because I didn't empty my tool bag from the last time.

Life event – Our team received an aircraft from overseas for major maintenance. The UH-60 arrived via C-17 air load, with some additional components removed, and placed in shipping boxes. The crew on the "disassembly" end, concerned with FOD, had plugged the two ends of a fuel cell vent tube. Without going into too much detail, and by no means is it any one individual's fault, but rather than use a threaded plug or cap, or cover ends with a barrier material, there were black plastic caps

pushed inside the line. The assembly crew assemble the aircraft after the scheduled major maintenance and fails to conduct a component inspection prior to install. The low-level fuel check was performed with no issues. Now we proceed to pressure refuel the aircraft. Servicing appears to be normal, but when the fuel level reaches the fuel cells interconnect valve, one cell was no longer venting. By the time the fueling crew realized what was happening, the structural damage was done. Fortunately, nobody was hurt, however, we had to explain what happened, determine the root cause, and develop preventive measures for future assembly operations. With that said, improper FOD protection can be as bad as no protection.

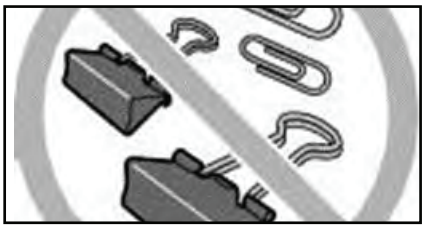
Aircraft Covers

Often expendable and usually on the DA Form 2408-17 inventory, aircraft covers typically aren't a concern. So who cares if the exhaust plug isn't tied to the aircraft, falls out over the weekend, and gets blown across the flight line. The typical procedure is, you just order a new one. Wind changes directions, the crew is taxiing during night operations, now the exhaust plug is rolling down the flight line with the potential to be drawn into the rotor system of the aircraft taxiing.

Personal Property

Should we account for personal property such as hats, pens, keys and loose change? No hats on the flight line are often standard policy, but some folks like to wear hats; sun protection is important. Simple fix – add a lanyard with a couple of alligator clips. What about pens and pencils? What about the binder clips and rings for our checklists? Ever had to wonder "where is my pen?" You decide you must have left it at home; you then just go to supply and get a new one.

How many times have we started a daily/preflight, working in the cockpit, and find a writing utensil? Even with today's electronic media, we still carry notebooks and pens/pencils. Maybe not everyone is on board with electronic note pads…nothing wrong with that. Back to finding the pen/pencil; most of the time we think nothing of it. What harm can it do? Stuck in-flight controls, the hydraulics are powerful; they'll just crush it. Wrong answer! FOD is FOD.



Now, we get back to the binder clips and checklist rings and let's include the pens/pencils. We lay our checklist down while we inspect components, maybe take some notes, and continue the daily/preflight. The aircraft is signed off and departs, but for whatever reason, the clip, ring, or writing utensil is now laying in the driveshaft area. Vibrations from the thin-walled driveshaft spinning at thousands of RPMs send the FOD into the shaft. Items in our pockets can be just as dangerous, such as keys and loose change. If laying on the pilot seats, hanging upside down, those loose items in our pockets can fall and disappear into the flight controls and hidden spaces.

FOD Walks

Let's walk the flight line. Crazy some of the things we pick up. I've seen bullets, brass casings, rocks, and of course the dropped cotter-pins, safety wire, and hardware. As a leader walking behind the line, are we enforcing or watching the personnel socialize and walk right by the FOD. Sometimes we are even caught up in with the socializing, or maybe some impromptu counseling. Whether it is the weekly

scheduled FOD walk or just moving from an aircraft back to the hangar, we should train ourselves and our personnel to always pick up FOD whenever we see it.

Now, let's document and trend the debris. Some folks respond better to graphs and colors, and it can paint a picture of what is out there and is a potential hazard. With this information, we can develop mitigation, and educate our personnel, and maybe even figure out how it gets there.

One of the major contributors to FOD is vehicles. Who checks their tires before passing through the airfield gate? Speaking of vehicles – what about the sweeper? Are we talking to base ops? The sweeper can limit a lot of what we find on our walks.

FOD Prevention

So, what do we do to prevent FOD? DA Pam 385-90 gives guidance for a FOD prevention program. With this program, personnel are appointed in writing to implement the FOD prevention program. This program is tailored to the unit and requires training and education of our soldiers, contractors and DA civilians. Training is one way to look at it, but I like to think of it as education. We often learn from our own experience and even more from shared experiences. As leaders, we should share and entertain subordinates' experiences with FOD so we all continue to learn.

FOD prevention requires full support from unit maintenance and support personnel. But without leadership support, education and or enforcement, it isn't very effective. When unit personnel all understand FOD and the FOD program and leadership enforces it, we call this total buy-in or 100% buy-in.

Conclusion

As professional maintenance technicians, we put all our efforts into accomplishing our tasks correctly and fixing the aircraft. But to do it completely, we need to integrate FOD prevention into our programs, training and instructions. The days of missing a tool or object and lackadaisically relegating it to the belief that you left it at home or your tool will turn up are long past. Lives depend on your correct repairs to the aircraft or system. Just as many lives depend on your FOD prevention efforts. When that aircraft rolls back into parking after a mission and all crewmembers head home, your efforts in maintaining the aircraft and FOD prevention are a success! ■

Michael Ward
Academic Instructor
Eastern ARNG Aviation Training Site
Michael.g.ward1.ctr@mail.mil