DON'T TOUCH THAT! HOT AIRCRAFT SURFACES

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Don't Touch That! Hot Aircraft Surfaces

When we were children most of us were taught the difference between hot and cold. Whether it was a direct instruction from one of our parents or a personal experience with one of the extremes, it usually involved us touching something we weren't supposed to and quickly learning our mistake due to extreme pain. If the item was hot, your mom or dad came to you and likely put your hand under cold water. If you were lucky, they caught you before you touched the hot pan or stove by yelling "Don't touch that!" Using some form of personal protective gear before touching hot surfaces should be common knowledge. At home we usually avoid making these mistakes on a daily basis, but often fail when we are at work. The same concept can be applied to our daily work practices in aviation maintenance. Aircraft, support equipment and even weapons' hot surfaces are more heightened during the summer months and injuries from inattention tend to increase during this timeframe.

The aviation community encounters hot surfaces on a regular basis. Aircraft surfaces can be environmentally or mechanically heated. Surface temperatures in some cases can reach well beyond what you cook your pizza at in your home oven. Surface areas located near engines or dynamic components are most likely to become hot due to thermal energy involved in their operation. What is thermal energy? Thermal energy, also known as heat energy, is produced when a rise in temperature causes atoms and molecules to move faster and collide with each other. The energy that comes from the temperature of the heated substance is called thermal energy. A good example is an aircraft engine. The engine has a combustion section which creates heat and over time that heat transfers to surrounding areas. This heat transfer turns previously "cold" surfaces to "hot" surfaces with the thermal energy created by the engine. Environmental factors can impact the temperature of your exposed aircraft surfaces and that is typically what injures aviation maintenance technicians during the summer months. I have experienced these environmental effects caused by different climates while on deployment.

One of my most memorable experiences was in the middle of summer in the Iraq desert. Daily ambient air temperatures reached 120-plus degrees. The aircraft I was maintaining at the time had metal skin which was completely exposed to direct sunlight. During the dynamic environment of a deployment some common sense is overlooked to accomplish tasks at a rapid rate. Technicians can quickly forget the aircraft has been sitting in the baking sun when "launch the alert" is called. Technicians and launch crews often become a "toddler" touching the burning pot for the first time. Multiple Marines experienced the same painful burns as I did during this deployment; some injuries were so severe they were sent to medical for first- and second-degree burns on their hands, arms and knees.

Some of the burns required bandages and the technicians were unable to perform their daily duties with a mass of bandages atop painful swollen and blistered hands; it is nearly impossible. The story behind all the burns was the same; the maintainers did not wear gloves while climbing onto aircraft surfaces that were exposed to direct sunlight or they stepped off a maintenance stand and kneeled down on the aircraft's upper surfaces to remove panels. Most of our aircraft parked out in the full sunlight had aircraft surfaces reaching temperatures hot enough to cook food. Once the command found out about the injuries and their severity, a large shipment of mechanic gloves was immediately procured, as well as specialized knee pads that would not damage aircraft surfaces. All technicians that needed to climb on or touch an aircraft were instructed to wear gloves at a minimum and knee pads as required to prevent further burn injuries.

Another instance of hot surfaces came about during a deployment to Kuwait, where, during summer months, the ambient air temperatures can rise well above 110 degrees and the sun is shining down without any clouds to obstruct it. Heat and sand were a constant battle and hindrance to performing maintenance. We ran into issues with painting blades in this extreme environment. When blowing sand wasn't around, the high heat was curing our paint as it was introduced into the air dusting the blades instead of adhering. The aircrew also had a hard time keeping the avionics compartments cool enough to prevent damage and keep systems functioning properly while the aircraft was on deck and in an alert status.

Our operations department and a select few maintainers conducted a study on aircraft surface temperatures, collecting surface temperatures from 12 aircraft, to include cockpit instruments, internal cabins, aircraft skin and rotor blade surfaces. Across all surfaces the average temperatures did not drop below 110 degrees, some even exceeded the threshold temperature for contact burns of 140 degrees. Medical studies have proven that over five seconds of contact with surfaces at 140 degrees is highly likely to cause irreversible contact burns to any average human.

Appropriate measures were taken to ensure personnel did not get injured by simply touching aircraft and the aircrew's working environment was addressed upon startup and constraints on the operational capability of environmental control systems. Everyone in the squadron that touched aircraft were issued mechanic gloves. A standard operating procedure (SOP) to have giant mobile air conditioning units on site and attached to the aircraft was implemented to ensure temperatures stayed low enough on startup that the avionics systems would function properly and aircrew did not have heat-related injuries. Another SOP was put in place requiring personnel working atop aircraft to wear cushioned/non-scuffing knee pads to prevent knee and leg burns while working on top of aircraft.

Environment plays a huge role in effects on aircraft surfaces and extreme heat and cold also affects the way we perform our work. For example, extreme heat causes fatigue, sweat in eyes, and drenched clothes cause mental distractions. You could be located in a desert or aboard a ship and encounter hot aircraft surfaces and when these conditions exist, maintenance leaders and maintenance technicians must implement control measures to minimize the risks of injuries or errors associated with working in those environments. It is important maintenance leaders and managers provide the best possible conditions for technicians to carry out their daily duties, like moving aircraft into a shaded area when able or buying protective equipment like gloves, knee pads and water reservoir cooler fans.

There are various avenues at which control measures can be applied. The most common tool we use to assess hazards is the Risk Assessment Matrix. Using this simple system will allow you to determine what control measures are needed.

Following the Risk Assessment Matrix:
Step 1 - Identify Hazards

- List the major steps of the operation. (Maintenance tasks or operations to be performed)
- Analyze the hazards and their causes with each step.

You have already identified the hazards in this instance, which are hot surfaces and the cause is environment or mechanically created thermal energy.

Step 2 - Assess Hazards

- Determine each hazard's degree of risk and its severity or probability.
- Using a matrix is recommended, but not required.

Use the matrix in Figure 1 below to determine the severity of the environment or mechanical thermal energy for hot surfaces.
We must continually assess hazards in the dynamic environment in which we operate. Think about what is different today and this specific evolution.

Step 3 - Make a risk decision

- Develop controls for each hazard to eliminate or reduce risks until the benefit is greater than the risk.

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Risk Assessment Matrix

The Risk Assessment Code (RAC) Matrix is used to determine the RAC for a hazard. You must cross probability and severity to obtain this code.

Risk Assessment Matrix			PROBABILITY			
			Frequency of Occurrence Over Time			
			A Likely	B Probable	C May	D Unlikely
SEVERITY Effect of Hazard	I	Loss of Mission Capability, Unit Readiness or Asset; Death	1	1	2	3
	II	Significantly Degraded Mission Capability or Unit Readiness; Severe Injury or Damage	1	2	3	4
	III	Degraded Mission Capability or Unit Readiness; Minor injury or Damage	2	3	4	5
	IV	Little or No Impact to Mission Capability or Unit Readiness; Minimal Injury or Damage.	3	4	5	5

Risk Assessment Codes
1 – Critical 2 – Serious 3 – Moderate 4 – Minor 5 – Negligible

Figure 1

- Determine residual risk with controls in place. (Repeat step 2)
- Accept the risk at the appropriate level and communicate with higher authority your decision for controls.

With a 1 - Critical or 2 - Serious risk per the matrix, you must develop controls to mitigate the risk. In most cases personal protective equipment (PPE) will suffice as a control and eliminate risk. The PPE is worn to minimize exposure to a variety of hazards. Examples include gloves, safety shoes, eye protection, protective hearing devices (earplugs, muffs), hard hats, respirators and full body suits (for painters, fuel cell and liquid oxygen technicians).

Step 4 - Implement controls
- Incorporate selected controls.
- Communicate selected controls to the lowest level.

At this point you will make a decision about the risks and have developed controls. The controls could be a SOP or an engineering control to maintain caution in certain areas. If unable to properly mitigate risks via engineering controls like parking aircraft in hangars or under shade hangars to block the sun, then issue appropriate PPE to personnel and communicate its importance in all hot surface situations.

Step 5 - Supervise
- Enforce standards and controls.

- Remain alert for any changes or unexpected developments requiring additional risk management.

Most aviation publications have notes or cautions discussing hazards associated with hot surfaces or hot areas. Emphasis on enforcing and training to these hazards should be common practice across the naval enterprise. If ignored, the hazards could be inherently dangerous to the individuals who ignore them. The PPE is a common mitigation resource supervisors must provide to their workers per the Occupational Safety and Health Administration with gloves being one of the most common PPE issued to mitigate hot surface risks. While PPE is effective, it does nothing to actually eliminate the hazard and relies on worker compliance, which is where the supervisor comes into play. Between supervisors checking technicians to ensure they have the gloves on them, quality assurance representatives patrolling and verifying people are wearing the appropriate PPE for the tasks they are doing and Chiefs/SNCOs spot checking technicians are performing maintenance correctly; there should be no way junior technicians are getting injured because of not wearing proper PPE.

Supervisors are a key player in mitigating risk for hot surfaces and usually the ones most knowledgeable on the appropriate controls and issue the PPE. Also, supervisors should be the model for good practices, ensuring consistent and proper wear of PPE along with proper training on which PPE to use. Supervisors should explain the burn hazards associated with hot surfaces and where an individual may encounter one. Supervisors should take a few minutes to physically illustrate proper wear or witness application of control measures. Doing so could prevent someone from having to go to medical for a burn or irreversible injury they may incur. This is all part of the NAVOSH Indoctrination technicians receive when they check into a work center and anytime the working conditions change. As stated earlier, this does not fall solely on the supervisor nor the individual. Risk management and safety is a team effort from the most senior commanding officer all the way down to the newest, most junior member of the unit.

Maintainers are probably the most important people in risk mitigation of hot surfaces. This is the level at which the proverbial “rubber meets the road.” Maintainers are the ones performing the control application and verification. Do the controls work? Are the hazard areas actual hot surfaces? Is it safe? These are just a few questions that should materialize in a maintainer’s head when he or she is about to work on an aircraft, support equipment or weapon systems. As a maintainer you are not only a worker, you are the onsite safety representative. You are the one who can stop a maintenance action or implement a control measure on the spot (think about time critical risk management training you have to refresh on annually). It could be as simple as telling your buddy to put his gloves on before he climbs onto the aircraft or opening an engine work platform to cool down anarea that you will need to work in. Another instance could be an operational check on a component that you need to verify while it is running. The PPE, such as gloves, coveralls, knee pads or fire resistant mats, are your most vital protective control measure, in any hot surface encounter.

Hot surfaces can be unavoidable in aviation maintenance. Whether it be a hot work platform near an engine or aircraft skin that has been baking in the summer sun, these hot surface hazards are present across aviation regardless of military, commercial or private operations. The ways we assess risk and implement controls are how we address associated hazards and prevent injuries. Training to these using publications, proper PPE instructions and applying control measures will prevent most, if not all, injuries associated with hot aircraft surfaces.