

Practically everyone in aviation circles is aware of the Air Force's "Boneyard": 2,600 acres of Arizona desert where thousands of military aircraft, withdrawn from service, silently await their fate.

The facility, located at Davis-Monthan Air Force Base in Tucson, is commonly perceived as an airplane cemetery, where the denizens are doomed to be scrapped for their valuable metals. That's only a fraction of the story, however.

In fact, the 309th Aerospace Maintenance and Regeneration Group, or AMARG, conducts a wide variety of missions in support of the Air Force, other services, and allied nations. While the seemingly endless lines of airplanes stored here all look destined for Death Row, a sizable number are here only temporarily and will fly again.

"People think the Boneyard is where old planes come to die," said Col. Robert S. Lepper Jr., commander of the 309th. In a November interview, he said that at the AMARG, "we generate aircraft" for the Defense Department, NASA, and "right now, ... for five different nations. ... So lots of these aircraft that come in will be returned to flying status."

Besides storing aircraft until they're needed again, the AMARG has a dizzying list of other missions. The facility conducts overflow depot maintenance on the A-10 attack aircraft and variations of the C-130; it has a verification role to play in the Strategic Arms Reduction Treaty on nuclear arms; it hosts a program that converts old F-4 Phantoms—and soon F-16s—into aerial target drones; it stores and reconditions aircraft that will be transferred

"Jaws" prepares to take another bite out of a mighty C-5A Galaxy being reduced to scrap at Davis-Monthan AFB, Ariz. Disposing of old airplanes, however, is just a fraction of what the AMARG is all about.



Living Boneyard

By John A. Tirpak, Executive Editor

The Aerospace Maintenance and Regeneration Group runs a warehouse, not a graveyard.

to allies under the foreign military sales program; it is an auxiliary facility of the National Museum of the US Air Force; it stores tooling for out-of-production aircraft; disposes of aircraft the US military no longer needs; and it helps keep Air Force “heritage flight” aircraft available for special flying occasions.

Chief among its missions, however, is supporting the flying Air Force with parts. It frequently makes the difference between aircraft being operational or grounded.

In Fiscal 2012, for example, the Boneyard “pulled” more than 10,000 parts, with a value of \$472 million. That figure is down a bit from the totals of previous years, but Lepper said that’s due in part to reduced demand, following the end of US operations in Iraq. During Fiscal 2012, the five fleets calling

for the most parts, in order, were the F-15, B-1B, F-16, C-5, and C-135—collectively accounting for some 60 percent of the total. The only Navy airplane on the top 10 list, the P-3 Orion, came in sixth.

Moreover, those parts are usually pulled for an urgent need. Consistently over the last five years, “priority” orders accounted for an average of 76 percent of the parts pulled.

Lepper said the AMARG’s “core workload” has been “fairly constant for 15 to 20 years,” but “the fact that it’s remained steady while the rest of the force has continued to drop is kind of a de facto increase.”

When aircraft arrive at the AMARG, they are met by a small team under the direction of Gregorio Aguon, head of the receiving branch. Each aircraft brings along its entire



Staff photo by John A. Tirpak



Left: Joe Gasak removes a flaperon bracket from an F-16. Hill AFB, Utah, urgently needed the part. It would probably get there within three days of the request. Above, another heavily harvested F-16 looks less like a fighter all the time.

history of documentation: the write-ups and maintenance actions over, frequently, dozens of years of service.

“The Air Force airplanes, they usually come with boxes of paper,” he observed, while the Navy records are usually supplied on a disc. The records are kept in a special facility nearby.

Each aircraft is washed on arrival except for the giant C-5 transports; they get washed before they come. The washing is especially important for aircraft that have served aboard aircraft carriers or in tropical locations where they were subject to the corrosive effects of warm, salty air. Each airplane then gets a “flush” of its fuel and is run with a lightweight oil that puts a protective coating on all parts of the engine and fuel system. Explosive devices—ejection seat pyrotechnics, for example—are removed and any caustic chemicals drained. Other steps are taken to ensure the aircraft is safe for anyone to approach and work on. Also, the clocks and data plates are removed.

Why? “We have a high pilferage rate on these items” from visitors seeking

a memento of a particular aircraft they flew, Aguon said. The clocks work and make a nice desk decoration, he noted, while the data plates are specific to an individual aircraft.

Once all that’s done, the aircraft is then towed to wherever it will be stored.

“Some of these aircraft never leave the apron, ... will never sit on the desert,” Aguon said, given that they may be shipped out again in a few weeks’ or months’ time.



This C-135—and one just like it—served as an Airborne Laser target. All three aircraft sit in the Boneyard. The ABL aircraft, not protected as a museum piece, could be a parts donor.



Staff photos by John A. Tirpak

means an aircraft will be maintained in a condition where it can be recalled to duty and fly again. This is called “inviolat” storage, meaning no parts can be pulled from these aircraft without the express permission of the type’s system program office at Wright-Patterson AFB, Ohio, which technically “owns” them. Only some 10 percent of the aircraft in the Boneyard are kept in Type 1000 condition.

Baking in the Sun

Type 2000 storage is similar to Type 1000, except the aircraft are designated as “cann birds” whose parts can be cannibalized for the flying fleet. Both Type 1000 and 2000 aircraft, after in-processing, will be given a treatment of “Spraylat”—short for sprayable latex—a two-stage sealing process covering gaps and holes and generally blocking the intrusion of moisture or wildlife. The bottom coat is black, but the topcoat is white. This tremendously aids in reducing the degradation of the aircraft in the desert heat. With the white coating, interior temperatures will usually remain within 15 degrees of the ambient air temperature. The Spraylat isn’t cheap—it runs about \$550 for a five-gallon bucket—but it lasts and pays back its cost in preservation of valuable parts that, as time goes by, may not be available anywhere else.

In summer, the spraylat also has to be applied before 10 a.m.; after that, aircraft

During the latter part of 2012, the accession work was limited to Navy aircraft. In recent years, a heavy flow of F-15s, F-16s, and A-10s came to the AMARG in the wake of the “Combat Air Forces Redux,” the early withdrawal from service of 250 front-line aircraft, to meet reduced operational funding. Last year, Congress balked

at further reductions that would have hit the Guard and Reserve hard and barred the Air Force from retiring any more aircraft until it can be decided how USAF’s three components will be equipped.

Aircraft at the AMARG are in-processed according to the type of storage they require. Type 1000 storage

This MiG-21—provenance not stated—served as an aggressor with an elite secret USAF squadron. A half-dozen Soviet fighters sit with it. It may go to a museum or “petting zoo.”





If asked, AMARG will test parts, looking for fatal flaws. Here, a part soaked in a fluorescent dye reveals cracks and other imperfections under black light.

skin temperatures can exceed 120 degrees Fahrenheit, and the material simply won't stick. As a result, summer shifts for those working in the field tend to be quite early. Most fighter aircraft need about 50 hours of labor to be prepared for storage; it's 80 hours for helicopters because a box has to be built to protect their rotor heads. Big aircraft such as the B-52 can require up to 300 hours for mothballing.

Type 3000 storage—considered “temporary” visitors to the Boneyard—receive the most active care. Every 30 days, their engines are run, they are towed to lubricate their bearings, and their fluids are serviced.

Aircraft receiving the least active care are Type 4000. They usually only get the Spraylat treatment on engines and canopies, and their engines may be removed for storage elsewhere. The Type 4000 aircraft are generally the oldest and those least likely to ever be recalled to service. When all useful parts have been harvested from them, they are scrapped.

Aircraft can be moved to different categories as well and return to duty even after decades. The record for an aircraft returned to flying status after extended storage was an F-4 brought out of Type 2000 status and reconditioned to be a target drone after more than 20 years in the desert.

Orders for spare parts come in on a Form 44. It documents who needs the part, its priority, whether it supports a combat mission, whether it's classified, whether it needs special handling, whether it's nuclear-related, etc., as well as whether substitutions in the form of similar parts are acceptable.

Before aircraft come to the Boneyard, maintenance crews at their last base will swap out whatever newer parts are on them for the aircraft remaining in the flying inventory, said James Fletcher, lead reclamation planner with the 577th Commodities and Reclamation Squadron.

“That only makes sense,” he said. “Why send new tires to the Boneyard?”

Source of Last Resort

As a result, most of the parts on the aircraft are not pristine. Requisi-

tions come in specifying a part in “A,” or like-new condition, and Fletcher's crews will try to find one that fits the bill. Sometimes, there must be some back and forth, Fletcher said, as in, “We don't have one from a Block 15. So we ask them if they can use a Block 10. And if they can, we ship it.”

He said the Boneyard is the “source of last resort.” Generally, technicians in the active force will try to obtain brand-new parts, to keep their aircraft as up-to-date as possible. The AMARG comes into play when there is no other source for a part, or perhaps a temporary is needed until a new one can be acquired. The incentive is to buy new, because logisticians are charged the as-new price for parts that come from the AMARG.

Sometimes the AMARG supplies parts not usable in their existing condition but repairable.

At any given time, about 40 “parts-pullers” work among the vast rows of aircraft, Fletcher said, and they are extremely experienced. Many have prior Active Duty service and possess an encyclopedic knowledge of the aircraft they work on, and most work on several different types.

“The experience of our workforce is beyond that of almost any other maintenance group commander's in the entire Air Force,” said Lepper. In the Active





Duty force, he said, most maintainers work on, at most, two aircraft, but “my crews work on nine different airplanes in a day ... and take parts off of six or seven different kinds of aircraft.” He said, “Most of my people have 20 to 40 years of experience in aircraft maintenance. Most maintenance group commanders would kill for five years’ average experience” across a workforce.

“We get the call for about 35 to 38 parts a day,” Fletcher said, and his crews have some 100 parts requests in work at any given time. The busiest periods are just before holidays, when maintainers at

cargo or tanker aircraft headed to that base. A small assembly line of workers is busy most days building boxes, packing, and shipping them. It’s rare that there isn’t a stack of boxes on a pallet waiting for a pickup. Large parts—elevons, wing leading edges, propellers, and the like—go on pallets, covered in shrink wrap or other protective material.

When an aircraft has given up all the parts that anyone wants—and it’s not required for historical purposes or any other reason—it becomes a candidate for “de-miling,” or demilitarization.

Hazmat

“The first step is to take out anything hazardous,” said Richard Ruley, AMARG’s Demil Section supervisor with the 578th Storage and Disposal



Top: It’s not just old airplanes. The tooling for the B-2 stealth bomber cockpit sits near retired bombers. A special treatment helps protect it from the elements. Above, Carlo Marinaz applies Spraylat to the forward edge of a KC-135’s wing.



flying bases want to “clear their screens” and get any grounded aircraft back to flying status, he observed.

A parts call will often include a request that it be tested. One of the group’s capabilities is to check for hidden cracks or structural flaws. The part is soaked in a fluorescent dye, then examined under black light. Imperfections will glow.

Parts can often be shipped in three days or less. Based on the urgency of the request, a part can be shipped by a commercial overnight service. If it is going to a war zone where commercial service isn’t available, it’s routed on

Having given up everything usable, a forlorn F-16 awaits the scrapper. It must first be “de-miled,” meaning anything dangerous, such as toxic materials, will be removed.

Squadron. The list of potential hazards is long. It includes materials such as asbestos, chemicals, beryllium, radioactive materials, gases, and depleted uranium. The depleted uranium, for example, was used as armor on A-10s. Lead—another hazard—was used in the armor on C-130s. Special equipment and protective gear is needed for working with these materials. After the hazards are removed, a Wright-Patt manager decides what federally managed facilities they’ll go to for disposal and possible burial.

The AMARG used to separate critical materials from the aircraft, such as titanium, that are getting harder to obtain, under the Strategic Material Recovery and Reuse Program. However, that’s been abandoned since the



recommendation might be what the AMARG would have to do to get the aircraft in condition to be shown as a museum piece or a pole model that requires little but the shell.

The AMARG plays waystation for some aircraft. In the last year, the Marine Corps bought 58 GR-9 vertical takeoff and landing aircraft from Britain as a source of spare parts. The GR-9 is the

USAF mothballed hundreds of front-line fighters in recent years, under the "Combat Air Forces Redux." Aft of the F-15 radomes, dates of inspection are stamped. Left and below, rows of F-15s bake in the Arizona sun, back-to-back with C-5 Galaxys. In older aircraft, spraylat just covers canopies and engines. At bottom, stacks of fighter engines share space with scores of C-130 variants.

Defense Logistics Agency determined the labor costs were too high to make it a worthwhile effort. Now, buyers of the scrap can separate the metals themselves.

Once a carcass has been de-miled, the AMARG team signs a certificate that "all known hazards" have been removed, Ruley said. Then, scrappers make quick work of it. A mighty C-5 Galaxy, for example, can be reduced to flatbed-sized chunks in a matter of two or three days, using a giant apparatus known to the crews as "Jaws."

If an aircraft seems to have some special significance, or features noteworthy nose art, the demil crew can recommend that the museum consider saving some or all of it. Part of the



Preserving History, Making It Accessible

One of the Boneyard's functions is to preserve at least one example of almost everything the Air Force has flown over its 65 years. In some ways it serves as an overflow of the National Museum of the US Air Force, located at Wright-Patterson AFB, Ohio.

"History row" includes a number of one-of-a-kind or historical aircraft, such as the Boeing YC-14 short takeoff craft and a T-46, the canceled successor to the T-37. The sole YAL-1, the Airborne Laser laboratory, is also at the AMARG, although it does not yet enjoy protected status and could conceivably be a parts donor without action by Congress. Significant examples of aircraft "nose art" are also sometimes preserved by the AMARG.

However, the base lacks the manpower or facilities to accommodate large numbers of visitors. Former military members routinely call the base and ask if they can walk around and take photos, but they would have to be escorted due to the sensitivity of some of the items stored, and the base has no manpower billets for that task.

"We rely on the Pima Air Museum to help us" with the strong public interest, said Teresa Pittman of the AMARG's business office.

Pima, located just across the highway from the AMARG, is one of the largest nongovernmental air museums in the world, boasting a collection of more than 300 aircraft. Visitors can sign up for a bus tour of the AMARG. The tour follows a prescribed route through some of the most interesting parts of AMARG's inventory. Those on the tour can take all the pictures they want, but may not get off the bus while it's on Davis-Monthan.

"We are seeing a steady increase in visitors," said Tim Vimmerstedt, Pima's director of operations and community affairs. The museum got started in 1968 and has grown steadily and set a record for attendance in 2012. Visitors routinely report that the museum was a big influence on their decision to visit Tucson.

nefarious purpose, looking for parts or technology that could be used in combat—and potentially against the US.

In a much-publicized case, agents of Iran were able to obtain parts for that country's fleet of aged F-14s. The parts were obtained through a series of middlemen who bought them illegally through government surplus agencies—long after they were beyond AMARG's control—but the case illustrated the potential for misuse of Boneyard material. As a result, Congress ordered all the remaining F-14s destroyed. Only a dozen still exist at the AMARG, and all are destined for museums or to become pole-mounted "gate guards."

Whither Stealth?

"The security is very good here," Lepper said. Security forces from Davis-Monthan patrol the barbed wire-topped chain-link fence perimeter constantly. However, now that more late-model aircraft are beginning to be stored at the facility, more consideration is being given to "an intrusion detection system with cameras that will allow us to increase the security even further."

Lepper said that because there are aircraft always going out—in pieces, to be melted down—space has not been an issue at the AMARG, and no thought has been given to expanding the facility.

"The amount of real estate here right now is sufficient to continue to bring in assets," he said. However, encroachment around the edges of the facility might make it difficult to expand if that were ever necessary, he said.

Asked about what changes may lie ahead for the Boneyard, Lepper said the Air Force has only just begun to think about what it needs to store aircraft with stealth qualities. The materials used in stealth aircraft have traditionally required climate-controlled facilities to prevent degradation of those materials, which can lose their shape under prolonged heat.

The F-117 attack aircraft the Air Force retired several years ago, for example, are stored in their original hangars at Tonopah Test Range in Nevada.

Air Force Materiel Command is "starting to look at what might be required here from a [military construction] perspective," Lepper said. "It's something we're thinking about." However, he sees no reason the AMARG's mission won't continue largely as it has for decades.

Fletcher observed that AMARG "is a supply warehouse. It's not a junkyard." ■



Staff photo by John A. Tirpak

This RF-4 is the last Phantom to be converted into a QF-4 target drone. They'll be supported through 2017; after that, some 210 QF-16s will take their place.

equivalent of the AV-8B Harrier that has been extended in USMC service due to delays with its replacement with F-35B strike fighters.

The AMARG is also used to store items that are not aircraft. Besides fuel tanks, missile bodies, and some vehicles, it also hosts rows of equipment that was used to build certain aircraft. The tooling for the B-2 bomber, for example, rests near B-52s and B-1s that are being

harvested for parts. One of those B-1 fuselages was recently packed up and sent to Washington state, where Boeing will subject it to a stress test to determine the long-term service life potential of the remaining B-1B bombers.

The Boneyard has 12 miles of fence line, and security is a constant concern. The facility certainly attracts aviation enthusiasts seeking souvenirs of favorite airplanes, but others may have a more