Report on Extreme Weather Damage to Military Installations

A Briefing to the House Committee of the Armed Services

Pursuant to House Report 118-529, page 377, accompanying H.R. 8070, the National Defense Authorization Act for Fiscal Year 2025

Office of the Under Secretary of Defense

for Acquisition and Sustainment

April 2025

The estimated cost of this report or study for the Department of Defense is approximately $12,000 for the 2025 Fiscal Year. This includes $5,000 in expenses and $6,890 in DoD labor.
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Overview

This briefing fulfills the requirements of House Report 118-529, page 377, on H.R. 8070, the Servicemember Quality of Life Improvement and National Defense Authorization Act for Fiscal Year 2025, requesting the Secretary of Defense to provide a briefing on the damage to military installations caused by extreme weather events and associated financial costs. This briefing includes the following:

1. Cost analysis of damage to military installations caused by extreme weather events over the last 10 years;
2. Analysis of whether damage to military installations resulted from or was exacerbated by deferred maintenance or modernization;
3. The current estimate of maintenance backlogs by military department and steps each Department will take to address such backlogs; and
4. A list of installation resilience plans that have been completed pursuant to the requirement in the National Defense Authorization Act for Fiscal Year 2020, and a list of installation resilience plans the military departments plan to undertake over the next five years.

Extreme Weather Introduction

- Extreme weather[1] causes significant damage and disruption at DOD installations and impairs military readiness through impacts to service member health and safety; mission-critical range training and testing operations; equipment performance and reliability; and infrastructure.
- In the last decade alone, extreme weather events cost DOD over $15B in reported damage.
- In addition to these damages, installations report disruptions and impacts ranging from completely interrupted military operations, to delays in providing health services to installation personnel and family members, to degraded infrastructure performance life.
- OSD carefully assesses exposure to hazards, including extreme weather, so they do not compromise DOD's ability to execute its mission or otherwise impact readiness.
- These analyses are necessary so that the DOD can plan, design, estimate return on investment, and implement measures to improve resilience and avoid costly damages such as the loss of aircraft during Hurricane Michael.

[1] Per 10 USC 101 (a) (20), "extreme weather" means recurrent flooding, drought, desertification, wildfires, thawing permafrost, sea level fluctuation, changes in mean high tides, or any other weather-related event, or anticipated change in environmental conditions, that present (or are projected to present) a recurring annual threat to the climate security of the United States or of allies and partners of the United States.

Extreme Weather Impact Examples

HURRICANE HELENE, 2024

"Significant damage to both garrison and municipal water and power infrastructure, causing...failure of systems leading to a complete halt of operations ...for [multiple] days."

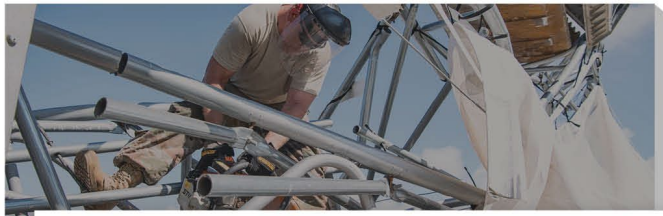
COLORADO MICROBURST*, 2024

"44 Airframes were extensively damaged. Total for the single event was more than $125 million."

*A microburst is an intense, highly localized downward atmospheric flow with velocities of 2000 to 6000+ feet per minute.

TYPHOON MAWAR, 2023

"[The] roof experienced significant failure…The asset experienced significant water intrusion to roof, doors, and windows. The building will need to be demolished and replaced with new construction."



HURRICANE MICHAEL, 2018

"With limited Security Forces present and widespread damage to perimeter fencing, securing the base and controlling access presented immediate challenges. Government vehicles were strategically parked at entry points to deter unauthorized entry."

(1) Cost analysis of damage to military installations caused by extreme weather events over the last 10 years

- The analysis extracted costs associated with damage to military installations caused by extreme weather events from Appropriations bills.
- There were no Disaster nor Hurricane Relief funds in FY 2015, FY 2016, and FY 2017.

Fiscal Year	Legislation	Funding ($B)
FY 2018	P.L. 115-123	$1.2
FY 2019	P.L. 116-20	$2.7
FY 2020	P.L. 116-93; 116-94	$9.0
FY 2021	P.L. 116-453	$0.6
FY 2022	P.L. 116-43	$0.9
FY 2023	P.L. 117-263; 117-328	$0.5
FY 2024	P.L. 118-42	$0.2
	Total	$15.1

(1) Cost analysis of damage to military installations caused by extreme weather events over the last 10 years

- Current reporting of extreme weather impacts does not capture the full scope of disruption due to:
  - Widespread underreporting. Some weather events are not reported because "extreme weather" is not well-defined.
  - Delayed effects. Full impact may not manifest immediately when damages are reported.
  - Narrow understanding of an event's true impact. Reporting is often focused on specific monetary costs and casualties and does not capture the full range of direct and indirect consequences, including impacts to:

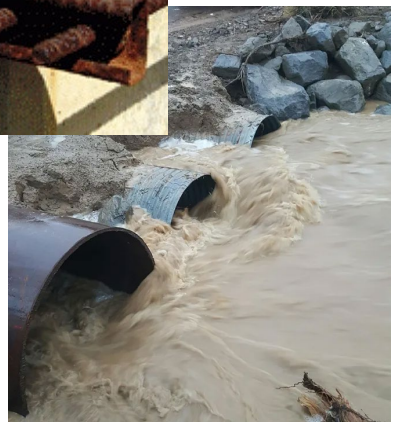
(1) Cost analysis of damage to military installations caused by extreme weather events over the last 10 years

- DOD is taking steps to expand extreme weather reporting and understanding, including establishing definitions, issuing data calls, and developing integrated reporting systems to show the full impact of an extreme weather event.
- The Department is already seeing improvements in extreme weather cost data as a result of these efforts: **damage costs for 2024 are far more accurate** and comprehensive than prior years.
- Examples of improved data collection in 2024 can be found in TAB C:
  - A case study of damage caused by Hurricane Helene.
  - A case study of damage caused by Typhoon Mawar.
  - A summary of 2024 extreme weather event damage by installation.

(2) Analysis of whether damage to military installations resulted from or was exacerbated by deferred maintenance or modernization

There are many ways in which deferred maintenance and modernization can exacerbate infrastructure damage during an extreme weather event:

- Undersized structures (e.g., stormwater drainage undersized for increased rainfall and runoff, worsening flooding)
- Undersized equipment (e.g., HVAC too small to maintain interior temp during heat wave, causing increased humidity and high energy bills and accelerating equipment failure)
- Broken or unmaintained equipment (e.g., broken or clogged sump pump can't remove water, leading to flooding)
- Deteriorated connectors (e.g., rusted rooftop equipment connectors fail during high wind event, and unsecured equipment damages roof, flashing, and gutters)

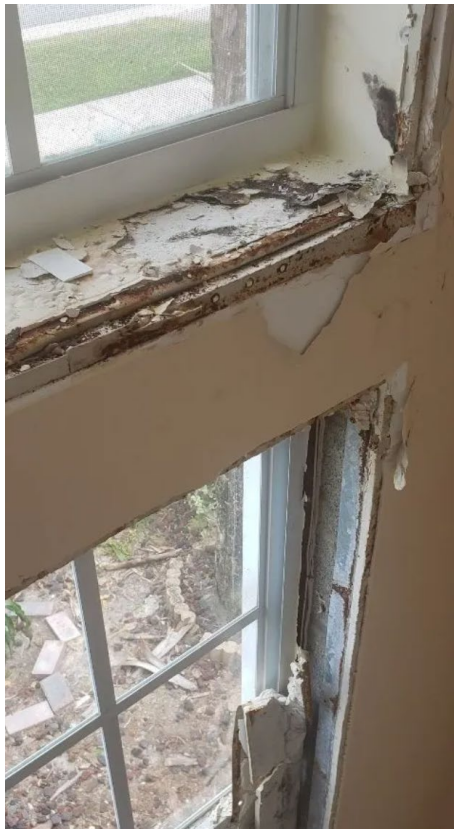


Images are illustrative and not from military installations

(2) Analysis of whether damage to military installations resulted from or was exacerbated by deferred maintenance or modernization

Continued:

- Deteriorated structural components (e.g., corroded footing fails due to saturated ground, collapsing structure)
- Broken seals allow for infiltration at windows, doors, and skylights, increasing interior water damage and mold growth
- Damaged concrete and asphalt continues to weaken and degrade due to freeze-thaw cycles, corrosive materials, and rebar rust
- Building Management Systems divert power to prevent outages, which can improve critical operations and continuity during a storm event
- Impact-resistant building envelope materials protect against water infiltration and damage from airborne objects



Images are illustrative and not from military installations

(2) Analysis of whether damage to military installations resulted from or was exacerbated by deferred maintenance or modernization

- Due to the many ways in which unmaintained equipment, systems, and structures can completely fail or operate sub-optimally during an extreme weather event, **it is highly likely that some amount of damage to military installations resulted from or was exacerbated by deferred maintenance or modernization.**
- However, it is infeasible to ascribe a specific amount of damage to deferred maintenance versus the extreme weather event because **evaluating and distinguishing effects from the various factors that lead to damage is not a simple feat.**

Kentucky National Guard Field Maintenance Shop 6. 43-foot rise of the North Fork Kentucky River. July 28, 2022.

MCLB Albany. Tornado damage during severe thunderstorms. January 23, 2017.

(2) Analysis of whether damage to military installations resulted from or was exacerbated by deferred maintenance or modernization

- As an example, the 2024 DOD Disaster Relief Request reports storm damage from extreme weather events at a line-item level. Of the 624 Facility Sustainment, Restoration, and Modernization (FSRM) projects listed – amounting to $2.8B in requested funds – 143 FSRM projects describe the damage as only "repair building."
- Analysis of damages due to deferred maintenance or modernization requires more detailed knowledge of the building and project (e.g., facility/equipment age, condition index, maintenance status, etc.) in relationship to storm damage assessments and, as such, installations track each aspect separately.
- **DOD believes focusing resources on addressing maintenance backlogs may provide more helpful analysis.**

(3) The current estimate of maintenance backlogs by military department and steps each Department will take to address such backlogs

- Per DOD Financial Management Regulation 7000.14-R (December 2016), Volume 6B, Chapter 12; Para 120303, **DOD reporting entities are required to report material amount of Deferred Maintenance and Repairs (DM&R) on property, plant, and equipment** as supplementary information with their annual financial statements.
- DM&R is reported for three property categories:
  - Category 1: Buildings, Structures, and Linear Structures that are **active real property and enduring and required to support an ongoing mission**.
  - Category 2: Buildings, Structures, and Utilities that are **active real property and heritage assets**.
  - Category 3: Buildings, Structures, and Utilities that are **inactive real property**. This category is excess to requirements or planned for replacement or disposal.
- Each Military Department must include all buildings for which they have federal ownership interest and sustainment funding responsibility.
- DM&R may be measured by using condition assessment surveys, life-cycle cost forecasts, or other similar methods. Services use different business rules to gather these costs, which results in significant variance across the Services.

(3) The current estimate of maintenance backlogs by military department and steps each Department will take to address such backlogs

The Department of the Army estimates an overall repair backlog of **$149B**.

Department of the Army ($M) Real Property Deferred Maintenance and Repair (DM&R) for Fiscal Year 2024 Property, Plan and Equipment *General and Working Capital Fund Assets* As of September 30, 2024			
	Plant Replacement Value (PRV)	DM&R	Percentage (DM&R/PRV)
Active Real Property			
Category 1: Buildings, Structures, and Linear Structures (Enduring Facilities)	$559,136	$108,805	19%
Category 2: Buildings, Structures and Linear Structures (Heritage Assets)	$83,686	$21,179	25%
Inactive Real Property			
Category 3: Buildings, Structures, and Linear Structures (Excess Facilities or Planned for Replacement)	$31,674	$19,019	60%

(3) The current estimate of maintenance backlogs by military department and steps each Department will take to address such backlogs

- In FY 2025, Army requested $10.5B across all facility investment appropriations and components, and funding 87.2 percent of the sustainment requirement for FY 2025. This relatively high level of sustainment funding is intended to reduce growth of the backlog.
- Over the past five years, sustainment execution has averaged 79 percent and has trended up with increased funding and prioritization.
- Army will:
  - Invest over $2.1B/year across all Components for sustainment, restoration, modernization, and construction of all barracks types.
  - Meet 100 percent sustainment for all barracks types across Future Years Defense Program (FYPD) FY 2025-2029.
- These investments will improve conditions for unaccompanied Soldiers in Permanent Party, Institutional Training, and Collective Training barracks.
- In FY 2025, Army is implementing a mission dependency index to capture commanders' assessments of impact on mission and readiness resulting from these funding deficiencies.

(3) The current estimate of maintenance backlogs by military department and steps each Department will take to address such backlogs

The Department of the Air Force (DAF) estimates an overall repair backlog of **$49.5B**.

Department of the Air Force ($M) Real Property Deferred Maintenance and Repair (DM&R) for Fiscal Year 2024 Property, Plan and Equipment *General Fund Assets* As of September 30, 2024			
	Plant Replacement Value (PRV)	DM&R	Percentage (DM&R/PRV)
Active Real Property			
Category 1: Buildings, Structures, and Linear Structures (Enduring Facilities)	$648,322	$43,856	7%
Category 2: Buildings, Structures and Linear Structures (Heritage Assets)	$61,871	$3,173	5%
Inactive Real Property			
Category 3: Buildings, Structures, and Linear Structures (Excess Facilities or Planned for Replacement)	$27,910	$2,476	9%

(3) The current estimate of maintenance backlogs by military department and steps each Department will take to address such backlogs

- In December 2024, DAF published an Installation Infrastructure Action Plan to re-optimize installations for Great Power Companioning.
  - The Action Plan guides investment decisions and aims to reduce the overall cost to operate installations.
  - It requires development of an annual Infrastructure Investment Plan to lay out investment priorities and align to DAF priorities.
- FY 2026 Program Objective Memorandum position funds FSRM to 1.8 percent of PRV. Mission Critical and Mission Generation Infrastructure will continue to degrade, but this slows the rate of free fall in infrastructure health if sustained across the FYDP.
- An investment of 2.0 percent would arrest degradation and backlog growth and enable funding of the highest priority projects.
- An annual execution rate of >2.3 percent PRV would permit DAF to sustain bases, buy down the maintenance and repair backlog, and provide discretionary funds necessary to prioritize critical R&M requirements.

(3) The current estimate of maintenance backlogs by military department and steps each Department will take to address such backlogs

The U.S Navy estimates an overall repair backlog of **$39.3B**.
The United States Marine Corps estimates an overall repair backlog of **$23.9B**.

Department of the Navy ($M) Real Property Deferred Maintenance and Repair (DM&R) for Fiscal Year 2024 Property, Plan and Equipment *General Fund Assets* As of September 30, 2024			
	Plant Replacement Value (PRV)	DM&R	Percentage (DM&R/PRV)
Active Real Property			
Category 1: Buildings, Structures, and Linear Structures (Enduring Facilities)	$610,817	$61,280	10%
Category 2: Buildings, Structures and Linear Structures (Heritage Assets)	$24	$1	3%
Inactive Real Property			
Category 3: Buildings, Structures, and Linear Structures (Excess Facilities or Planned for Replacement)	$17,118	$1,879	11%

(3) The current estimate of maintenance backlogs by military department and steps each Department will take to address such backlogs

- Navy will restore critical infrastructure that generates, sustains, and postures the force for the fight (piers, runways, utilities, and other shore capabilities with a condition of poor of less, and infrastructure that improves operational readiness in the Pacific).
- Navy will focus on facilities that impact quality of life (unaccompanied housing and sailor fitness).
- Navy will develop an annual investment plan and capabilities plan.

- USMC will implement the Capital Planning Tool to assess priority facilities to be renovated or replaced based on condition, mission, and usage to make the best use of the limited FSRM funds.
- At the current funding levels for the FSRM program, facilities will continue to deteriorate faster that the established life cycle.

(4a) A list of military installation resilience plans that have been completed pursuant to Section 2801 of the National Defense Authorization Act for Fiscal Year 2020

- Section 2801 of the FY2020 NDAA added a military installation resilience component (MIRC) to 10 USC 2864-Master plans for major military installations (MMIs).
- The summary below includes *all* MIRCs reported complete between September 2020[1] and December 2024. Section 2864 language did not specify that MIRCs are only for MMIs, and MilDeps may develop MIRCs based on mission need. As such, this list includes all installations with MIRCs, so the total count differs from the one reported in the annual 10 USC 2864(d) master plan report, which does specify MMI.
- A detailed list can be found in Appendix A.

MilDep/Agency	Component	Complete Installation Resilience Plans
DAF	Air Force	24
DAF	Space Force	2
DA	Army	13
DON	Navy	3
DON	USMC	1
DLA	DLA	3
WHS	WHS	0

[1] Unified Facility Criteria 2-100-01 Installation Master Planning was updated in September 2020 to incorporate the requirements of the FY 2020 NDAA.

(4b) A list of military installation resilience plans the military departments plan to undertake over the next five years

- In the next five years, Components plan to complete the below number of MIRCs.[1]
- A detailed list can be found in Appendix B.

MilDep/Agency	Component	Planned Installation Resilience Plans
DAF	Air Force	65
DAF	Space Force	4
DA	Army	62
DON	Navy	TBD
DON	USMC	TBD
DLA	DLA	1
WHS	WHS	1

[1] The five-year period extends from January 2025 to December 2029.

Appendices

Appendix A: Completed Military Installation Resilience Plans

MilDep/ Agency	Component	Installation Name
DA	ARMY	Anniston Army Depot
DA	ARMY	Fort Bliss
DA	ARMY	Fort Bragg
DA	ARMY	Fort Carson
DA	ARMY	Fort Cavazos
DA	ARMY	Fort Drum
DA	ARMY	Fort Eisenhower
DA	ARMY	Fort Leonard Wood
DA	ARMY	Fort Moore
DA	ARMY	Fort Riley
DA	ARMY	Fort Stewart
DA	ARMY	U.S. Army Garrison Alaska
DA	ARMY	U.S. Army Garrison Poland
DAF	AIRFORCE	Altus Air Force Base
DAF	AIRFORCE	Arnold AFB
DAF	AIRFORCE	Aviano AB
DAF	AIRFORCE	Barksdale AFB
DAF	AIRFORCE	Beale Air Force Base
DAF	AIRFORCE	Cannon Air Force Base
DAF	AIRFORCE	Columbus Air Force Base
DAF	AIRFORCE	Davis-Monthan AFB
DAF	AIRFORCE	Ellsworth AFB
DAF	AIRFORCE	Grand Forks Air Force Base
DAF	AIRFORCE	Hanscom AFB
DAF	AIRFORCE	Holloman Air Force Base
DAF	AIRFORCE	Hurlburt Field
DAF	AIRFORCE	Joint-Base Langley Eustis (Fort Eustis)
DAF	AIRFORCE	Joint-Base Langley Eustis (Langley AFB)
DAF	AIRFORCE	Kadena Air Base
DAF	AIRFORCE	Kunsan AB, South Korea
DAF	AIRFORCE	Lajes Field
DAF	AIRFORCE	Luke AFB
DAF	AIRFORCE	Moody Air Force Base
DAF	AIRFORCE	Osan AFB
DAF	AIRFORCE	Ramstein AB
DAF	AIRFORCE	Spangdahlem AB
DAF	AIRFORCE	Tyndall AFB
DAF	SPACEFORCE	Los Angeles Air Force Base

Appendix A: Completed Military Installation Resilience Plans (con't)

MilDep/ Agency	Component	Installation Name
DAF	SPACEFORCE	Vandenberg SFB
DLA	DLA	Defense Distribution Depot, San Joaquin
DLA	DLA	Defense Distribution Susquehanna
DLA	DLA	Defense Supply Center Richmond
DON	USMC	Marine Corps Recruit Depot Parris Island
DON	NAVY	Naval Base San Diego
DON	NAVY	Naval Station Newport
DON	NAVY	U.S. Naval Air Facility Atsugi

Appendix B: Planned Military Installation Resilience Plans

MilDep/ Agency	Component	Installation Name	MilDep/ Agency	Component	Installation Name
DA	Army	Aberdeen Proving Ground	DA	Army	Iowa Army Ammunition Plant
DA	Army	Blue Grass Army Depot	DA	Army	Joint Base Lewis McChord
DA	Army	Carlisle Barracks	DA	Army	Joint Base Myer-Henderson Hall
DA	Army	Detroit Arsenal	DA	Army	Joint System Manufacturing Center Lima
DA	Army	Dugway Proving Ground	DA	Army	Lake City Army Ammunition Plant
DA	Army	Fort Belvoir	DA	Army	Letterkenny Army Depot
DA	Army	Fort Campbell	DA	Army	McAlester Army Ammunition Plant
DA	Army	Fort Detrick	DA	Army	Milan Army Ammunition Plant
DA	Army	Fort George G Meade	DA	Army	Military Ocean Terminal Concord
DA	Army	Fort Gregg-Adams	DA	Army	Military Ocean Terminal Sunny Point
DA	Army	Fort Hamilton	DA	Army	Natick Soldier Systems Center
DA	Army	Fort Huachuca	DA	Army	Picatinny Arsenal
DA	Army	Fort Irwin	DA	Army	Pine Bluff Arsenal
DA	Army	Fort Jackson	DA	Army	Presidio Of Monterey
DA	Army	Fort Johnson	DA	Army	Pueblo Chemical Depot
DA	Army	Fort Knox	DA	Army	Radford Army Ammunition Plant
DA	Army	Fort Leavenworth	DA	Army	Red River Army Depot
DA	Army	Fort Novosel	DA	Army	Redstone Arsenal
DA	Army	Fort Sill	DA	Army	Rock Island Arsenal
DA	Army	Fort Walker	DA	Army	Scranton Army Ammunition Plant
DA	Army	Hawthorne Army Depot	DA	Army	Sierra Army Depot
DA	Army	Holston Army Ammunition Plant	DA	Army	Tobyhanna Army Depot

Appendix B: Planned Military Installation Resilience Plans (cont'd)

MilDep/ Agency	Component	Installation Name
DA	Army	Tooele Army Depot
DA	Army	U.S. Military Academy West Point
DA	Army	USAG Ansbach
DA	Army	USAG Bavaria
DA	Army	USAG Benelux
DA	Army	USAG Daegu and Area IV
DA	Army	USAG Hawaii
DA	Army	USAG Humphreys and Area III
DA	Army	USAG Italy
DA	Army	USAG Japan
DA	Army	USAG Kwajalein Atoll
DA	Army	USAG Miami
DA	Army	USAG Rheinland-Pfalz
DA	Army	USAG Stuttgart
DA	Army	USAG Wiesbaden
DA	Army	Watervliet Arsenal
DA	Army	White Sands Missile Range
DA	Army	Yuma Proving Ground
DAF	Air Force	Andersen AFB
DAF	Air Force	Camp Murray AGS
DAF	Air Force	Creech AFB
DAF	Air Force	Dover AFB
DAF	Air Force	Dyess AFB
DAF	Air Force	Edwards AFB
DAF	Air Force	Eglin AFB
DAF	Air Force	Eielson AFB
DAF	Air Force	Ellington Field
DAF	Air Force	Fairchild AFB
DAF	Air Force	Francis E Warren AFB
DAF	Air Force	Fresno Yosemite International ANG
DAF	Air Force	Goodfellow AFB
DAF	Air Force	Gulfport ANGB
DAF	Air Force	Hickam
DAF	Air Force	Hill AFB
DAF	Air Force	Homestead AFB
DAF	Air Force	Incirlik AB
DAF	Air Force	Jacksonville IAP
DAF	Air Force	JB Anacostia-Bolling
DAF	Air Force	JB Andrews
DAF	Air Force	JB Elmendorf-Richardson
DAF	Air Force	JB McGuire-Dix-Lakehurst
DAF	Air Force	JB San Antonio
DAF	Air Force	JRB New Orleans
DAF	Air Force	Keesler AFB

Appendix B: Planned Military Installation Resilience Plans (cont'd)

MilDep/ Agency	Component	Installation Name
DAF	Air Force	Kirtland AFB
DAF	Air Force	Klamath Falls Airport-Kingsley Field
DAF	Air Force	Laughlin AFB
DAF	Air Force	Little Rock AFB
DAF	Air Force	Macdill AFB
DAF	Air Force	Malmstrom AFB
DAF	Air Force	March AFB
DAF	Air Force	Maxwell AFB
DAF	Air Force	McConnell AFB
DAF	Air Force	McEntire JNGB
DAF	Air Force	Minot AFB
DAF	Air Force	Misawa AB
DAF	Air Force	Moffett Field
DAF	Air Force	Montgomery ANGB
DAF	Air Force	Moron AB
DAF	Air Force	Mountain Home AFB
DAF	Air Force	Muniz ANGB
DAF	Air Force	Nellis AFB
DAF	Air Force	Offutt AFB
DAF	Air Force	Portland IAP
DAF	Air Force	RAF Alconbury/Molesworth
DAF	Air Force	RAF Croughton
DAF	Air Force	RAF Fairford
DAF	Air Force	RAF Lakenheath
DAF	Air Force	RAF Mildenhall
DAF	Air Force	Robins AFB
DAF	Air Force	Scott AFB
DAF	Air Force	Selfridge ANGB
DAF	Air Force	Seymour Johnson AFB
DAF	Air Force	Shaw AFB
DAF	Air Force	Sheppard AFB
DAF	Air Force	St Croix ANG Station
DAF	Air Force	Tinker AFB
DAF	Air Force	Travis AFB
DAF	Air Force	USAF Academy
DAF	Air Force	Vance AFB
DAF	Air Force	Whiteman AFB
DAF	Air Force	Wright Patterson AFB
DAF	Air Force	Yokota AB
DAF	Space Force	Buckley SFB
DAF	Space Force	Patrick SFB
DAF	Space Force	Peterson SFB
DAF	Space Force	Schriever SFB
DLA	DLA	Defense Supply Center Columbus
WHS	WHS	Pentagon