



WEATHER EFFECTS ON AIR OPERATIONS

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Weather has a profound effect on flight operations. Even on a clear day, the impact of something as simple as the speed and direction of the wind can significantly affect operations. Severe weather such as large hail, high winds, and heavy rains can halt flying operations and damage unprotected aircraft on the ground. Communication within the air domain is also susceptible to space weather effects such as ionosphere scintillation. This phenomenon affects the air operator's ability to effectively communicate with other airborne assets, ground forces, and can alter the effect of other services such as position, navigation, and timing (PNT).

Weather support to air operations focuses on three broad areas: protecting air assets, personnel, and base infrastructure from hazardous weather; maximizing aircraft performance and the effectiveness of the aircraft's weapons systems; and assisting during mission planning and execution.

PROTECTING AIR ASSETS, PERSONNEL, AND BASE INFRASTRUCTURE

Helping protect personnel, equipment, and base infrastructure from the effects of hazardous weather is a continuous responsibility of all-weather personnel. Weather personnel monitor weather conditions and alert the installation's personnel when hazardous weather is forecast or occurring. Depending upon the type and intensity of weather conditions and the installation's mission assets, commanders may exploit decision-grade weather information by directing a series of actions to mitigate risk ranging from moving, tying down, or sheltering aircraft to a full-scale evacuation of aircraft and personnel.

Aircraft are susceptible to hazardous weather. For example, the sudden onset of a thunderstorm could require aircraft to change their route of flight or divert to an alternate base. Weather personnel routinely monitor weather along planned flight routes, alerting decision makers to the onset of hazardous weather conditions such as turbulence, icing, and thunderstorms.

MAXIMIZING AIRCRAFT AND WEAPON SYSTEM PERFORMANCE

During short-term mission planning (one to three days) and execution, weather personnel play a vital role in helping maximize aircraft and weapons system performance based on observed and forecast weather. Airborne intelligence collection platforms; for example, are uploaded with appropriate sensor packages and plan their flight routes based on cloud cover and flight-level wind forecasts. Weather personnel use sophisticated computer models that help aircrews choose the best approach to their targets or provide a simulated picture of what a target might look like through a specific targeting pod based on environmental factors. Terminal aerodrome forecasts providing detailed forecast take-off and landing conditions can assist aircrew with choosing suitable alternate recovery locations. Flight-level wind forecasts help air planners determine the range and optimized flight routes for aircraft, potentially saving precious time and fuel by exploiting favorable winds. [Drop zone](#) forecasts help enable airdropped cargo and personnel to land safely on the target area. These weather products, as well as many others, help decision makers exploit terrestrial and space environmental conditions to maximize aircraft and weapons system performance, giving aviators a relative advantage over their adversaries.

Space Weather Effects

Space Weather. Having the proper understanding of space weather is critical when planning and conducting military operations. It also helps contribute to good [space domain awareness](#), which is crucial when air and ground operators experience interference and degradation to radio signals, satellite communications, Global Positioning System signals, or radar operations. Knowledge of the space environment can help personnel mitigate the effects of space weather, and help differentiate between equipment malfunctions, natural interference, and man-made interference (intentional and unintentional). Being able to distinguish between intentional interference and natural sources of interference on space systems (whether on the ground or in space) enables the [commander, Air Force forces](#), the commander, Space Force forces (if one is appointed), and the Combined Space Operations Center to identify threat trends to better protect US and partner nation space centers of gravity.

ASSISTING IN PLANNING AND EXECUTION

Weather information, integrated at every decision point during the planning, execution, assessment, and sustainment of military operations, is a key enabler of airpower. Weather forces directly support air planning and execution at the strategic, operational, and tactical levels. Well before hostilities begin, they provide weather effects analyses, forecasts, long-range outlooks, and climatological assessments that help shape future operations. Weather information such as historical crosswind trends and low ceiling information can affect decisions regarding aircraft deployment and staging operations. Persistent heavy cloud cover can hamper intelligence collection efforts, possibly driving major changes to a proposed campaign plan.

An example of the effectiveness of integration during planning is the contribution of the [air operations center's](#) weather personnel. These personnel can provide target area weather forecasts, predictions of weather effects on precision-guided munitions, and assessments of weather effects on intelligence, surveillance, and reconnaissance sensors. In addition, they provide weather-effect decision aids, including electro-optical and space weather effects guidance to planners during master air attack plan and air tasking order development. These products are vital in determining the timing of operations and selection of the appropriate weapons system to meet the [joint force commander's](#) objectives.
