SECTION 4

"OWNING THE WEATHER--AN ARMY FORCE MULTIPLIER"*

INTRODUCTION

"Everyone talks about the weather - now we're going to do something about it. We're going to give the war-fighter the information he needs to fight under all weather conditions.".. *General Jimmy D. Ross, 1994*

Although we cannot change the weather, Army decision makers have the opportunity to do something about the weather. In much the same way that night vision equipment made it possible for late-20th century soldiers to own the night, U.S. Army planners hope to give early-21st century warriors advanced technology and capabilities that will enable them to own the weather.

Almost 200 years ago, it was the U.S. Army that first began to develop our Nation's weather collection and forecast capability. Weather is critical to Army tactical operations and strategic planning; weather affects virtually every operation, piece of equipment, and person on the battlefield. All weapons systems are affected in some way, directly or indirectly, by some form and degree of adverse weather. *Owning the Weather* is about understanding, anticipating and exploiting the impacts of weather to gain a war-fighting edge over enemy forces.

Army Weather Doctrine

Around 500 BC, Sun Tzu wrote in *The Art of War:*

"Know the enemy, know yourself; your victory will never be endangered. Know the ground, know the weather; your victory will then be total."

U. S. Army Field Manual 100-5 (FM 100-5) *Operations* in highlighting the importance of weather to the war-fighter states:

"…attacking forces exploit weather conditions that affect mobility, concealment, and air support whenever possible. Commanders and staffs demand tactical weather forecasts that will affect ground operations and operations by Army aviation in the ground environment, in addition to the more general theater weather patterns."

The commander who can best measure and take advantage of weather and terrain has a decided advantage over his opponent. By understanding the effects of weather, seeing the opportunities the effects offer, and anticipating when they will come into play, the commander can set the terms for battle. In so doing, the commander is able to maximize his advantages and exploit any limitations on opposing forces caused by the weather.

Historical Perspective

History documents the effects of weather on wars, war-fighters, and weapons. The outcome of many famous battles; such as, Waterloo, Trenton, Operation Overlord, and the Battle of the Bulge, all were impacted by weather. Prior to the D-Day invasion of Europe in June 1944, German weather forecasters advised that an Allied invasion was impossible because of stormy weather. However, Allied forecasters predicted 36 hours of clearing and their forces successfully attacked while the German defenses were down.

During the first 2 days of Operation Desert Storm, over 50 percent of the F-117 sorties were aborted over their targets due to weather. Similarly, only 37 percent of the scheduled A-10 close air support missions were completed due to low cloud cover. During the initial deployment in support of the Bosnian peace operation, a significant number of the air sorties into Tuzla aborted due to poor weather. The Army also encountered major difficulties in crossing the flooded Sava River. In each of these instances, weather had a favorable and unfavorable impact on the battlefield and operations, in general.

OWNING THE WEATHER

Owning the Weather (OTW) will soon provide the Army with an effective all-weather mission capability by giving war-fighters the information they need to fight and operate smart weapons under all weather conditions. A near all-weather operational capability can be achieved through the selection of the appropriate mix of battlefield sensors, weapon systems, and tactics. This

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* This section was prepared by Mr. Richard J. Szymber, a meteorologist at the U.S. Army Research Laboratory, Battlefield Environment Division, U.S. Army Intelligence Center, Fort Huachuca, Arizona. Mr. Szymber holds a bachelor's degree in Geography from Arizona State University and a master's degree in Atmospheric Sciences from the University of Arizona. He is involved in satellite meteorology research in addition to developing and promoting "*Owning the Weather*" concepts and programs. He previously worked in the former U.S. Army Atmospheric Sciences Laboratory, White Sands Missile Range, New Mexico, and has served as a professional meteorologist for the U.S. Air Force and Navy.

mix provides friendly forces with the ability to see, maneuver, fight, and win in all types of weather. OTW enables field commanders to anticipate the differential impacts of weather conditions on both sides; OTW will allow commanders to exploit these "weather windows of opportunity."

Definition and Process

OTW is the use of advance knowledge of battlefield environmental conditions and their effects on friendly as well as enemy soldiers, systems, operations, and tactics to gain a decisive advantage. It involves exploiting and improving weather-related technological advantages of our battlefield systems over hostile systems and, thereby, makes adverse weather a force multiplier. OTW enables the commander to quickly assess the impacts of weather on friendly and enemy capabilities by helping them to recognize and seize the military advantage. OTW technology can also be incorporated into training, combat simulations, weapons development, and system testing and evaluation.

OTW is a strategy for exploiting the battlefield environment in force projection operations, stability and support operations, and major regional conflicts. OTW is a four step process (See Figure 4.1):

- Battlespace sensing/data collection.
- Processing, analysis, forecasting, data/product generation, and dissemination.
- Battlefield visualization and tactical decisions.
- Combat weather exploitation and information operations.

The OTW process begins with observations of the weather and environmental conditions for the area of operations, including critical data-denied target areas. These conditions are observed and collected in real time from a variety of battlefield sensing systems. Next, these meteorological data are processed and analyzed by numerical weather prediction/forecast models prior to being disseminated to users. Finally, the observations, forecasts, and their resulting effects are transformed into weather intelligence. This weather intelligence takes the form of easily understood automated weather-effects decision aids and battlefield weather visualization products that are incorporated into tactical operations.

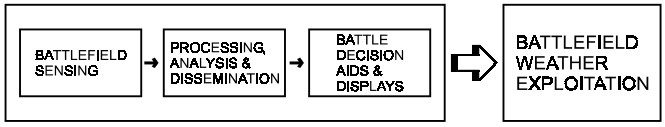

Figure 4-1. The *Own the Weather* Operational Process

No single-sensing system can supply all the essential observations. Rather, a suite of complementary sensing systems--space-based, airborne, and ground-based--is necessary to provide observations at the required accuracies, resolutions, and areal coverage.

The Integrated Meteorological System (IMETS) is a tactical system mounted on a High Mobility Multi-Purpose Wheeled Vehicle (HMMWV). IMETS uses existing Army common hardware/software, standard integrated command post shelters, tactical communications, and specialized software and weather products to provide a complete battlefield weather system. IMETS is a component of an Intelligence and Electronic Warfare (IEW) system of the Army Battle Command System (ABCS). IMETS is staffed and operated by U.S. Air Force weather teams assigned to various Army organizational levels--echelons above corps, corps, division, separate brigade, aviation brigade, armored cavalry regiment, and special forces ranger regiment. IMETS is now in production with fielding and upgrades to be completed by calendar year 2000. (Figure 4.2 shows an IMETS tactical configuration.)

IMETS will receive, process, analyze, generate, and distribute mission-specific observations, forecasts, advisories/warnings, and other weather intelligence products. As a mobile, automated weather information processing, and communications system, IMETS is designed to provide timely weather and environmental effects forecasts, observations, and decision aid information to appropriate command elements. It will collect data from various sources and distribute timely battle-scale weather information to multiple command elements via the ABCS. This information will be used in tactical decision aids (TDA) resident on other Army battlefield automated Command & Control (C^2) systems. These C^2 systems provide war-fighters with real time and predicted environmental effects on missions and systems. (Figure 4.3 Integrated Meteorological System)

Figure 4.2 IMETS tactical configuration.

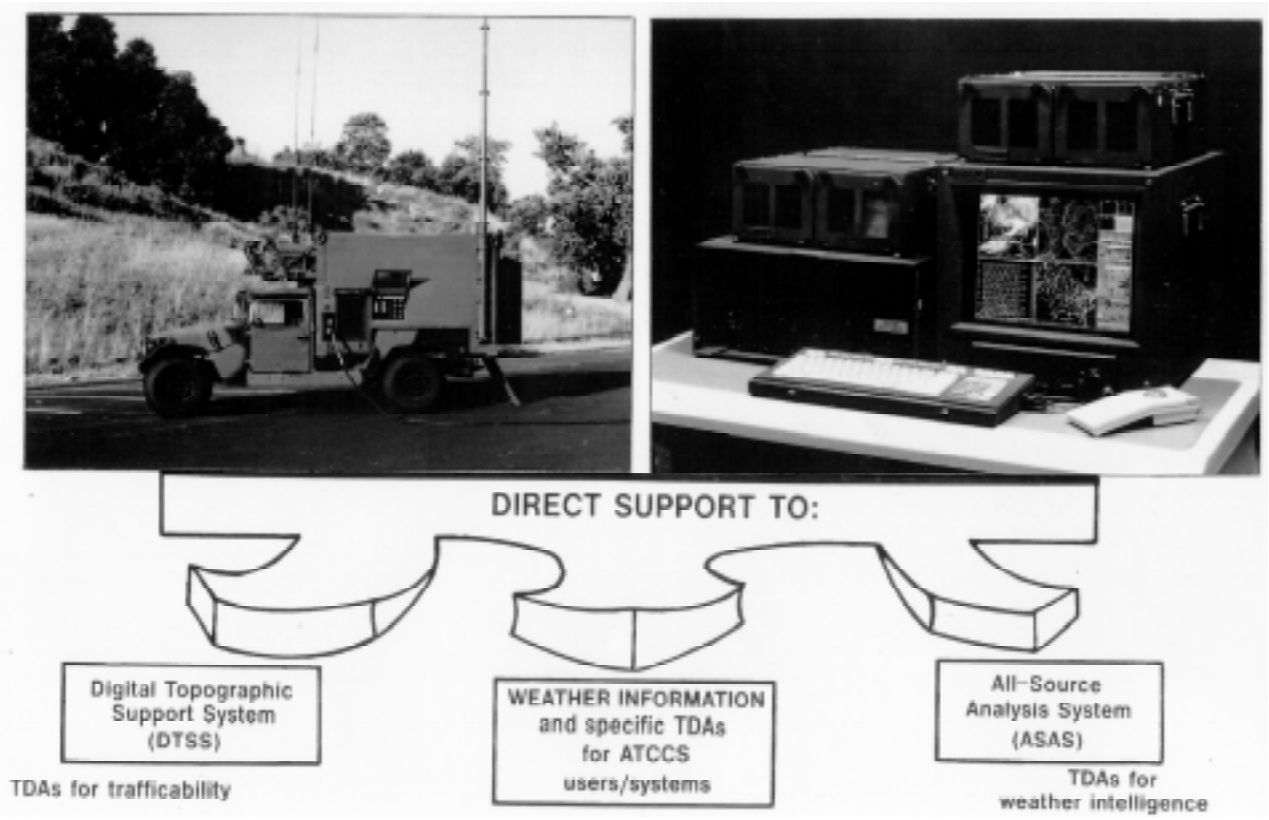

Figure 4.3 Integrated Meteorological System

IMETS will also provide weather forecasts tailored to the specific operational and tactical environment by using battle-scale or mesoscale meteorological models. These numerical weather models produce forecasts for a more limited region than those provided by the usual large-scale forecasts and include effects of complex terrain on atmospheric conditions.

The rapid generation of weather effects information for planning tactical operations and for making combat decisions is critical. This military decision-making process ranges from Intelligence Preparation of the Battlefield (IPB) to mission execution. IPB, TDAs, and war-gaming are all means by which commanders can quickly and accurately determine the weather effects on impending operations and, thereby, be provided with the opportunity to change or modify actions accordingly. TDAs not only provide information about weather effects on combat systems and terrain, but also show the commander if and when weather conditions give him an advantage over the enemy.

Weather-support TDAs also enable commanders to manipulate current and predicted weather effects information using "what-if" scenarios. This "what-if" war-gaming capability can lead to the development of alternative courses of action in anticipation of changes in the weather. The Integrated Weather Effects Decision Aid (IWEDA) is a sophisticated expert system that provides these capabilities. IWEDA automatically identifies and presents favorable, marginal, and unfavorable weather impacts based on operating limitations of friendly and enemy weapons systems with respect to time and area of operation. IWEDA is tailored to specific tactical operations and missions, and provides detailed weather impacts information in terms of what operations and equipment are affected, as well as when, where, and why they are affected.

Weather as a Force Multiplier

> *"An Army able to mount a coordinated attack night or day in any weather multiplies the force exchange ratio somewhere between 15- and 20-to-1."*
>
> Lieutenant General Jay Garner (1994)

The atmosphere affects nearly all Army systems. For example, haze and fog can severely degrade target recognition and acquisition devices; dense fog could render them useless. Precipitation is a primary

concern for trafficability, but precipitation also degrades optical and infrared devices. Precipitation can even incapacitate radar systems. Wind, turbulence, and temperature can move and disperse chemical agents, smoke, and other obscurants. Wind is also a major factor affecting artillery accuracy--as the range of the artillery weapon increases, so do the effects of atmospheric conditions on the projectiles. Advance knowledge of the weather and its impact on friendly and enemy matériel and operations provides an advantage and a combat multiplier.

FUTURE TRENDS

Training and Simulations

Realistic training and simulations can mitigate the detrimental effects of weather and contribute to increased overall combat readiness. For example, consider a case of reduced visibility and its impact on the outcome of a tank battle. Suppose, two opposing tanks are separated by 4 kilometers (km). One tank is equipped with infrared sights while the other tank has only visible, direct-view optics. If the visibility is 4 km, both tanks can see one another about equally well. When visibility drops to 2 km, the tank with the direct-view optical system can no longer fix its sights on the other tank. However, the other tank "can see" with its infrared sensor and has a clear advantage. A similar type of situation occurred in the Battle of 73 Easting during Operation Desert Storm (Figure 4.4).

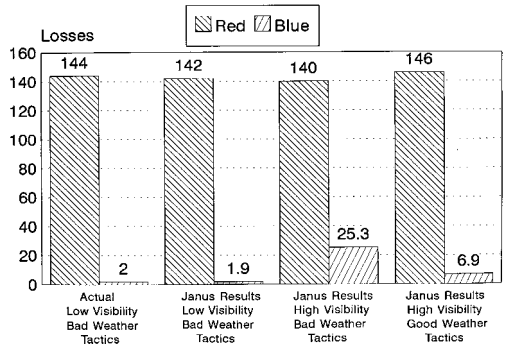

Figure 4.4 Janus Results of the Effects of Weather and Tactics on the Battle of 73 Easting

Battlespace Sensing Systems

OTW requires high quality measurements of atmospheric variables combined with appropriate models to obtain a detailed picture of current and future environmental conditions over the entire battlefield. Several sensing systems are planned to provide this capability. Figure 4.5 is a conceptual depiction of long-range OTW sensing systems for battlefield data collection.

Direct-readout observations from meteorological satellites provide the best areal coverage, globally, and in theater. IMETS will receive and process:

- Low and high resolution imagery (visible, infrared, and microwave) and atmospheric soundings from polar orbiting Defense Meteorological Satellite Program (DMSP) and National Oceanic and Atmospheric Administration (NOAA)/TIROS* satellites.
- High temporal resolution imagery from geostationary satellites.

Airborne meteorological observations will be provided by an automatic meteorological sensor on-board unmanned aerial vehicles (UAV). The UAVs will also have the capability to deliver dropsondes over critical target areas. In addition to atmospheric profiles and flight-path measurements, the UAVs will carry visible and infrared video cameras to return imagery of clouds, precipitation, and present weather, such as obstructions to vision. IMETS will also receive airborne observations, target weather information, and pilot reports from the Air Force and Army aviation units.

Army Artillery Meteorological (ARTYMET) sections, located near artillery units, will provide upper air observations over forward areas. Currently, these ARTYMET sections utilize the Meteorological Measuring System (MMS) along with radiosondes and the Computer Assisted Artillery Meteorology (CAAM) models and software to collect and process these upper air data. Eventually, tactical atmospheric profilers will provide upper air measurements with extremely rapid refresh rates. IMETS will also receive upper air profiles for rear areas taken at fixed airfields by Air Force weather teams.

Remote, automatic sensing systems will provide IMETS with surface weather and ground state observations from several areas on the extended battlefield. These unattended sensing systems will be selectively deployed throughout the depth of the

*DMSP and NOAA/TIROS satellites will be replaced by the converged National Polar-Orbiting Operational Environmental Satellite System (NPOESS) by 2010.

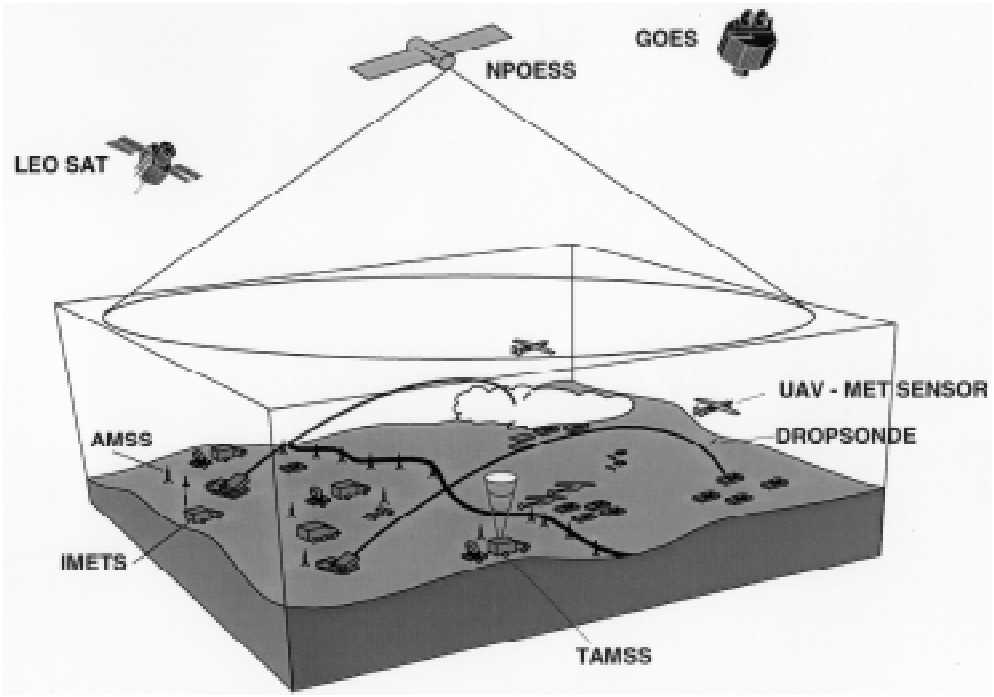

Figure 4.5 Generalized View of the Long-Range (2010) OTW Data Collection Concept

battlefield and tied into an automated communications system. The hand-emplaced or vehicle-mounted Automatic Meteorological Sensor System (AMSS) will provide surface observations at key terrain points. The Improved Remotely Monitored Battlefield Sensor System (IREMBASS) with AMSS (IRAMSS) will provide surface observations in forward flanking and close battle areas along likely enemy avenues of approach. The IRAMSS can be hand-emplaced or air delivered to areas deep behind enemy lines. Surface observations will also be taken by the ARTYMET sections equipped with MMS and Semi-Automatic Meteorological Station (SMS). Surface observations for deep areas will be received by IMETS via satellite link from the Remote Miniature Weather Sensor (RMWS) deployed by special operations forces. In addition to automated reports, manual surface observations will serve as another source of data for IMETS. These observations will be taken by long-range ground reconnaissance and surveillance elements, engineer units, air traffic controllers, and Air Force observers at airfields and IMETS locations.

Battlefield Visualization and Information Operations

Battlefield visualization of weather and its effects is an essential element of battle command and is necessary for gaining information dominance. Information dominance is achieved through the execution of information operations. Information operations, in turn, maximizes the capability to exploit the weather and, thereby, utilize future weather conditions as a force multiplier.

OTW information operations has three objectives (outlined in Figure 4.6). These objectives are accomplished by protecting access and use of weather information systems while exploiting and attacking the enemy's weather information assets. Exploiting and attacking involves intercepting, altering or denying, and influencing the enemy's picture of the weather. Weather information and information operations combined with knowledge of the limitations on war-fighting capabilities makes a powerful information warfare weapon.

WEATHER (WX) COMMAND AND CONTROL WARFARE (C2W) COMPONENTS		
WX C2W PROTECT	*	Protect and secure our weather support INFOSYS (system, databases, computers and communications, and personnel)
WX C2W EXPLOIT	*	Understand enemy weather INFOSYS
	*	Steal and utilize enemy weather data
WX C2W ATTACK	*	Deny enemy weather information
	*	Modify enemy weather data
	*	Influence enemy weather picture

Figure 4.6 Weather Information Command and Control Warfare C^2W Components

Other Operations and Applications

Although war remains the baseline objective for OTW support to the Army, many other missions are now likely. A major regional conflict is one of many new contingencies for which the Army requires weather support. Other mission areas are noncombat operations; such as, evacuation of civilians, peacekeeping, nation building, disaster relief, etc. These new missions require more flexible and mobile forces to respond to a wider range of unpredictable threats and situations. Tailored weather information is vital to the success of these noncombat operations.

Additional applications of noncombat operations in which OTW technologies and products can be utilized include air and noise pollution control, environmental cleanup, global climate change programs and experiments, transportation safety, forestry fire control, and agriculture.

CONCLUSION

OTW, the United States Army concept for future battlefield weather operations, will assist the Army in more effectively achieving its objectives through the use of advanced information age technology. It encompasses providing battlefield weather information never before available to commanders and soldiers, and assessing weather impacts on friendly and enemy equipment, operations, and tactics. Armed with this information, commanders can ascertain the critical time, place, and manner a decisive advantage can be gained to increase the likelihood of victory.

OTW will provide a digitized, common picture of the battlespace environment for mission planning and rehearsal, situational awareness, synchronized battle management, and advanced decision and execution support. OTW provides a "capability" solution to Army modernization which leverages and maximizes the capabilities of existing and programmed systems and equipment. It builds on over 25 years of shared Army effort and investment in meteorological research and development, and presents a low-cost, low-risk, high-payoff opportunity with a large battlefield return on investment.