**The Impact of Weather on Air Traffic Management**

**Section 2: The NAS and the FAA**

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The NAS is a complex set of systems, procedures, facilities, aircraft, and people that create an environment for the safe operation of all types of aircraft throughout the country. As the agency tasked specifically with responsibility for the safety of civil aviation, the FAA is inextricably linked with the NAS. This section will give you a good understanding of the various components of the NAS and the FAA and how you, as a weather forecaster, fit into the system. It will **not**, however, go into detail about the products you issue (for information on products, see the [Aviation Operations Course](http://www.nwstc.noaa.gov/METEOR/AvnOps/aoc_webpage.htm)). Instead, your main objective in this section and the rest of the module (including the Job Sheets and WIP) is to find out:

* What the FAA's decision points are
* What information the FAA needs to make these decisions, and
* How and when they need the information delivered

**2.2 The NAS and FAA Operational Infrastructure**

**Dispatch Operations**

Dispatchers plan commercial flights by taking into consideration the current and forecast weather, NOTAMS (Notices to Airmen), Center Weather Advisories (CWAs), Meteorological Impact Statements (MISs), Air Traffic Control (ATC) delays and severe weather avoidance plans, and other factors. Safety is the number one priority, but efficiency (meeting schedules and being cost-effective) is also very important. One of the most difficult tasks for a flight dispatcher is fuel load planning, which requires the most accurate information possible on observed and forecast weather. This is because adverse weather will necessitate taking on additional fuel in case the airplane has to hold or divert to an alternate airport. Some major airline companies still have their own weather units to help with this planning, however, most airlines now contract for weather services from private vendors or rely exclusively on NWS products. The NWS TAF is their “bread and butter product” for fuel load planning.

**Automated Flight Service Station (AFSS) and DUATS**

AFSS services, which are available to pilots anywhere in the country, include:

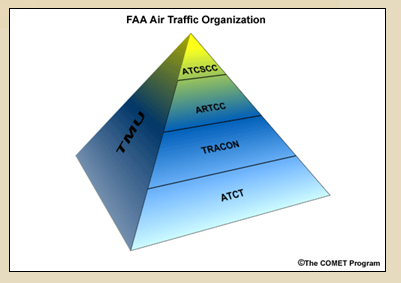
* Pre-flight weather briefings
* In-flight weather updates
* Aircraft emergency search and rescue
* Flight plan filing, activation, and cancellation

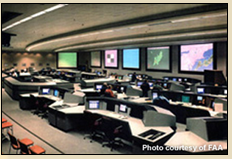
In the past, all AFSSs were operated by the FAA. However, the FAA is transitioning to a system where most AFSS services will be contracted. In either case, the AFSS Specialists rely on products from the NWS and private contractors for their weather information. They are required to relay TAFs, CWAs, and Significant Meteorological Statements (SIGMETs) during their briefings. They also refer to Transcribed Weather Enroute Broadcast (TWEB) products, WFO Area Forecast Discussions (AFDs), and many other NWS aviation products. The Specialists also use satellite and weather radar data. **It is important for CWSU and WFO meteorologists to routinely coordinate with AFSS Specialists to ensure they are interpreting the weather situation properly.**

DUATS provides direct access to weather briefing, flight planning, and flight plan filing information to allow pilots to obtain a self briefing and file a flight plan prior to flying. The service is free to qualified pilots, dispatchers, and other authorized users.

**2.2.2 The FAA Operational Structure**

The FAA operational structure can be viewed as a pyramid, with the national facility on top, regional units in the middle, and local control facilities on the bottom. The TMUs along the side of the pyramid meter and coordinate traffic flows system wide. Keep in mind that the information is **generally** true, but some facilities operate differently, are responsible for different sized areas, or provide different combinations of services.

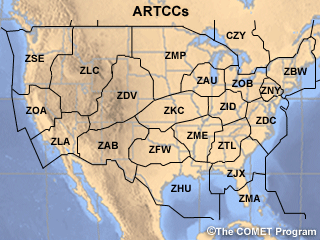


**Air Traffic Control System Command Center (ATCSCC)**

The ATCSCC, is located in Herndon, Virginia, oversees all air traffic control and regulates problematic air traffic situations. In coordination with air traffic facilities and users, the ATCSCC develops plans to modify traffic demands to fit the system's capacity. As the weather changes, the plan can be revised and, if necessary, new routings or restrictions are issued. The Severe Weather Unit in the ATCSCC is tasked with helping to minimize the impacts of severe weather on the NAS. Traffic Management Specialists collect meteorological information from a variety of sources and devise a suitable plan with other air traffic facilities and system users for routing traffic around the bad weather. The ATCSCC also coordinates the actions of the TMUs located in air traffic control (ATC) facilities across the country.

**Traffic Management Units (TMU)**

The TMUs and the traffic management coordinators (TMCs) in them monitor and balance traffic flows within their areas of responsibility and actively coordinate and communicate management actions with adjacent TMUs through the ATCSCC. Also, in conjunction with controllers and floor supervisors, weather service providers and the ATCSCC, they develop, implement, monitor, and analyze traffic management programs, procedures, and initiatives that are specific to the facility's area of responsibility. This includes coordinating with the Department of Defense on operations planned for Military Operations Areas (MOAs) within the Center's control spaces. They also manage the Special Traffic Management Programs (STMP) at airports where demand may exceed capacity. (A STMP is a reservation program that limits the number of aircraft landing at a particular airport.) TMCs coordinate their actions every two hours during a plan of operations (PO) teleconference call to create a strategic plan of operations (SPO). The TMCs reference Collaborative Convective Forecast Program (CCFP) graphics, Center Weather Advisories (CWAs), METAR observations, PIREPs, SIGMETs, NEXRAD products, and TAFs for major airports across the country to help them make decisions. All ARTCCs and some of the larger TRACONs have TMUs.

**Air Route Traffic Control Center (ARTCC)**

The ARTCC, often referred to as the "Center," has the primary responsibility for managing IFR traffic within the controlled airspace, principally during the en route phase of flight. This is usually beyond about 50 miles from the departure or arrival airport. There are presently 21 ARTCCs in the United States (including Anchorage).

Each ARTCC has an area of responsibility that covers thousands of square miles, encompassing all or parts of several states. The airspace of these centers is divided into "sectors." Using highly sophisticated, computerized radar systems and two-way radio communication with aircraft in his/her sector, the ARTCC controller ensures that the aircraft are appropriately separated, both laterally and vertically. The controller accomplishes this separation by issuing instructions to pilots regarding altitude assignments, speed adjustments, and radar vectors. The controller monitors the aircraft until it leaves his/her sector and then passes the aircraft off to the neighboring sector.

**Terminal Radar Approach Control (TRACON)**

TRACON controllers direct aircraft during the departure and arrival/approach phases of flight. The airspace of a TRACON varies in size depending on its location and the size and number of airports it serves, but generally has about a 40-50 mile radius. There are 185 TRACON facilities in the United States.

Using radar and two-way radio, TRACON controllers give pilots instructions regarding heading, speed, and rate of ascent or descent within the TRACON area. Typically, a series of TRACON controllers direct an approaching aircraft through two stages of descent. The high altitude controller hands off the aircraft to the low altitude controller, who then passes the aircraft to the approach controller. The approach controller merges the many descending aircraft flying toward the same destination airport into one line of air traffic, maintaining safe separation. When the aircraft is within the airport's air space (typically about 5 miles away), it is handed off to the local controller in the ATCT.

The TRACON also controls departing aircraft that are handed off from the local controller (in the ATCT) and are transitioning from the departure phase of flight (beyond about five miles of the airport) to the en route phase, when the flight is handed off to the ARTCC (at about 40-50 miles from the airport).

**Air Traffic Control Tower (ATCT)**

Most airports that have regularly scheduled flights have an ATCT, which basically handles all takeoff, landing, and ground traffic. There are four major controller positions at control towers:

* Flight Data Controller: Receives and relays Instrument Flight Rules (IFR) Departure Clearances, operates the Flight Data Processing Equipment, relays weather and NOTAM information, and is responsible for the Automatic Terminal Information Service (ATIS) equipment
* Clearance Delivery Controller: Responsible for obtaining and relaying departure clearance to pilots and checks to see that the route indicated for the flight requested conforms to established preferential routes
* Ground Controller: Responsible for the ground movement of aircraft taxiing between the boarding gates and the runways and other vehicles operating on taxiways or inactive runways. This is accomplished both visually and by use of ground radar.
* Local Controller: Watches the skies above the airfield and uses surface radar to track aircraft. This person's major responsibility is to provide appropriate separation between arriving and departing aircraft. The local controller also issues take off and landing clearances.

**2.3 Background and Skills of Air Traffic Personnel**

Air traffic personnel have to multitask, using a variety of skills and modes of communication to stay ahead of the traffic. This photo shows a TRACON controller working an approach sector.

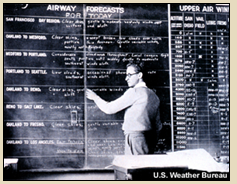
Whether an en route controller, tower controller, air traffic supervisor, or traffic management coordinator, air traffic personnel enter their career with the same general background, education, and experience. They begin as air traffic controller trainees, selected through the competitive Federal Civil Service system. They must pass physical and psychological examinations and a written test that measures their ability to learn the controller's duties. Requirements include three years of general work experience or four years of college, or a combination of the two. Applicants with experience as a pilot, navigator, or military controller can have points added to their rating by scoring well on the occupational knowledge portion of the examination. To be successful, any applicant must be proficient at

* Arithmetic computation
* Abstract reasoning
* Three-dimensional spatial visualization

Other necessary qualities include:

* Being articulate
* Having a good memory
* Being decisive

Previously, developmental controllers received a combination of on-the-job and formal training, including an intensive 11-17 week Air Traffic Basics course at the FAA Academy in Oklahoma City. With plans to hire a large number of tower and en route controllers over the next 10 years, the FAA is transitioning this course to the Web, and in the meantime is hiring mainly graduates from Collegiate Training Initiative (CTI) schools (Embry-Riddle Aeronautical University, University of North Dakota, etc.).

**2.3.1 Weather Knowledge**

All ATC personnel who attended the Air Traffic Basics course received basic weather training from NWS meteorologists at the FAA Academy, and in the future, a similar course will likely be taught via distance education. Topics include:

* *Fundamentals of Weather and Aviation Weather Services*, including
  + Basic weather principles
  + Temperature
  + Air masses
  + Fronts
  + Wind
  + Formation and types of clouds and precipitation
* *Hazardous Weather*, including
  + Turbulence
  + Thunderstorms
  + Low ceilings and visibilities
  + Icing
  + Wind shear
  + Volcanic ash
* *Current Weather and Observations*, including
  + METARs
* *Forecasts and Advisories*, including:
  + TAFs
  + Area forecasts (FAs)
  + Winds aloft (FDs)

Beyond that, knowledge of weather by ATC personnel is directly related to their "need to know." Controllers and Traffic Management Coordinators (TMCs) may take more specific weather courses at their own facility through computer-based instruction modules. TMCs have a much greater understanding of weather than other personnel, since they have to plan well ahead to minimize weather's impacts. They also learn a lot from informal training from CWSU meteorologists. The ATCT and TRACON controllers have a good understanding of the weather, but do not have to plan as far ahead as TMCs. They do not interact face-to-face with the CWSU nor receive as much weather training as the TMC.

Depending on their position and the current situation, ATC personnel use weather products in certain ways. Controllers are required to relay advisory products, such as SIGMETs from the AWC or CWAs from a CWSU, to pilots. Area supervisors and STMCs are expected to interpret a suite of radar, satellite, and manually-generated CWSU guidance products for their tactical decision-making. They must also read the CWSU Meteorological Impact Statement (MIS) to help them make strategic decisions. Tower and TRACON personnel use METARs and TAFs to plan their operations. We discussed how AFSS controllers use weather products in a previous

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| 2.3.2 Air Traffic Controller    En route sector controllers closely watch Display System Replacement (DSR) situational monitors to ensure aircraft are spaced appropriately.  ATCT and ARTCC controllers usually direct several aircraft at a time; often, they have to make quick decisions about completely different activities. For example, a controller might direct a plane on its landing approach and at the same time provide pilots entering the airport's airspace with information about conditions at the airport. While instructing these pilots, the controller also observes other planes in the vicinity, such as those in a holding pattern waiting for permission to land, to ensure that they remain well separated. Obviously, this can be stressful when a controller is dealing with several aircraft. Stress can be high in the northeastern U.S. and around major airports, where traffic is dense. Adverse weather, when unexpected, pushes controller stress to its highest level.  Controllers work a basic 40-hour week; however, they may work additional hours for which they receive overtime pay or equal time off. Because most control towers and centers operate 24/7, controllers are members of crews that rotate night and weekend shifts. Each crew is assigned to a specific geographical area, so controllers can become knowledgeable of the unique traffic flow, terrain, and weather characteristics for that area.  2.3.3 ATCT, TRACON, and ARTCC Area Supervisors    Supervisors, such as the tower chief using the telephone, have to coordinate with other ATC facility personnel while observing and directing the activities of their own crews.  Operational supervisors are required in airport towers and en route centers to direct and coordinate controller activities. Airport tower supervisors, often called “chiefs,” coordinate activities between airport ground, TRACON control operations, and en route control operations. Center area supervisors open and close control positions as necessary, ensure they have enough controllers at all times, and coordinate their activities with other control areas and the center's TMU. TRACON supervisors oversee activities of radar approach controllers and coordinate their operations with those of the ATCT and ARTCC. The supervisors are more proactive than their controllers, since they have to plan for peaks, lulls, and specific patterns of air traffic arriving within and around their areas of responsibility. Since they bear the responsibility for each controller they oversee, their stress can also be high. When an operational error (OE) occurs that brings aircraft too close, they must work with FAA quality assurance personnel to report what happened to higher authorities.  2.3.4 Traffic Management Coordinator  TMCs working in the main operations area at the FAA ATCSCC. The ATCSCC has a Traffic Management Unit (TMU) in each of the 21 en route facilities.  The ATCSCC and each Center TMU have personnel who coordinate the management of air traffic throughout the NAS. In controlling capacity, the TMC is proactive in making decisions. The TMC has to be aware of daily and seasonal traffic patterns and plan accordingly and must also be effective at coordination and collaboration. The TMC coordinates with area supervisors within their Center, neighboring Center TMCs, and the Command Center. Stress is generally not as high as that of a controller. However, it can rise significantly when a plan goes awry such as when a thunderstorm pops up unexpectedly in a heavy traffic area. TMCs at en route facilities are expected to remain proficient at controlling aircraft, so they occasionally walk down to a control area and "plug in" for a few hours. (The term "plug in" is ATC jargon for when someone puts on the head set and plugs it in to monitor or participate in air traffic control. We will examine more FAA phraseology in the "Communication" section.)  2.4 Communication    Air traffic personnel communicate in many ways—face to face, telephone, Voice Switching and Control System (VSCS), paper forms or strips, electronic monitors, and even e-mail. All ground-to-air, air-to-ground, and VSCS conversations are recorded and archived. Here's a summary of who talks to whom:   * ARTCC Controller: Coordinates with local towers, adjacent sectors, adjacent Centers, TRACON, and the area supervisor * ATCT Controller: Coordinates with TRACON, Center, ground, other tower controllers, and supervisor * Area Supervisor: Talks with their controllers, other supervisors, and TMCs. They also call in or hand-deliver PIREPs to TMCs, flight data specialists, or CWSU personnel * TMC: Coordinates via telephone or VSCS with area supervisors, ATCTs, or TRACONs in their area, TMUs in other areas, and the ATCSCC * CWSU: Coordinates with TMCs, AFSS Specialists, Center Area Supervisors, Center controllers, and occasionally with ATCT and TRACON supervisors   2.4.1 Phraseology    As with any culture, air traffic personnel have developed their own set of acronyms, words, and phrases to communicate effectively. For example:   * An observed or anticipated increase in traffic is called a “push.” * TMCs collaborate on which “playbook route” to use. * One example of a Traffic Management Initiative (TMI) is to ask for a Miles-in-Trail (MIT) restriction for traffic entering from another en route center. * TMCs monitor traffic flow via the Traffic Situation Display (TSD). * Each aircraft is identified on the controller's screen by its unique “squawk frequency” (transponder code). * When a controller holds an aircraft in flight, he/she “spins” it. * "Turn the boat around" means changing the direction of takeoffs and landings.   On the navigation bar to the left, you'll find a glossary that will help you understand acronyms and terms used by the FAA. Learning to speak their language is important in helping you to communicate effectively with your FAA partner.  Controller-to-pilot phraseology is regulated and monitored closely. A seemingly small misstatement or misunderstanding by either party can have a catastrophic result. “Descend to 310 and contact 127.25” is intended to have a different outcome than “Descend through 310 and contact 127.25,” but the phrases sound almost identical. Read-back is crucial for effective communication. In this process, the controller gives the pilot a directive and waits for the pilot to read back what was just said before assuming the directive was correctly understood.  In “controller-ese,” severe weather involves a different set of elements or criteria than the traditional NWS definitions for the public of surface winds 50 knots or greater or hail 3/4 inch in diameter or larger. Controllers and pilots consider any thunderstorm as severe and something that should be avoided. Turbulence, which is not a traditional public forecast element, is also important to pilots and controllers.  2.4.2 Practice  See if you can identify the air traffic terms, phrases, and acronyms in this puzzle. If you prefer, [print the puzzle](http://www.meted.ucar.edu/nas/crossword_print_ver.htm) and write the answers as you continue through the module. If you get stuck, you can also use the glossary or [look at the answers](http://www.meted.ucar.edu/nas/cross_print_ans.htm).   |  | | --- | | NAS Crossword Puzzle | |  | | **Across:**  1. Air traffic coming closer together because of changes in airspeed 2. Slang term for the ATCSCC, \_\_\_\_\_\_\_\_\_ Center 3. RRTES stands for \_\_\_\_\_\_\_\_\_\_\_\_\_ 4. Slang for operational error 5. Severe Weather \_\_\_\_\_\_\_\_\_ Plan 6. Uncontrolled user of the NAS 7. Operational Error Detection Program is the \_\_\_\_\_\_\_\_ 8. Term meaning that arrival traffic is rerouted under departing traffic from the same airport 9. Monitors and manages flow of air traffic throughout the NAS 10. ATC procedure to transition aircraft from en route to a fix or arrival waypoint in the terminal area 11. Sherlock Holmes of aviation might work for the \_\_\_\_\_\_\_\_\_ 12. Slang for increase of air traffic volume 13. Miles-in-Trail or \_\_\_\_\_\_\_\_\_-In -Trail  **Down:**  1. FAA uses \_\_\_\_\_\_\_\_\_\_\_\_\_\_ decision making to form the best plan of operations 9. Acronym for tower 14. Another word for corner post 15. Passing of aircraft from one controller to another 16. \_\_\_\_\_\_\_\_\_ Delay Program 17. TMCs agree to use a \_\_\_\_\_\_\_\_\_\_\_ route 18. \_\_\_\_\_\_\_ point 19. Domestic Reduced Vertical \_\_\_\_\_\_\_\_\_ Minima 20. When its volume exceeds capacity, a sector is \_\_\_\_\_\_\_\_\_ 21. Not altitude, but flight \_\_\_\_\_\_\_\_ 22. \_\_\_\_\_\_\_\_ Departure Clearance Time 23. Can't walk the PIREP form to CWSU, so I'll use \_\_\_\_\_\_ 24. The "I" in TMI 25. System used by TMCs to monitor traffic flow 26. Slang for holding aircraft |   2.5 Questions  1. What is TMU?  **Feedback**: Traffic Management Unit.  2. What does the TMC do?  **Feedback**: The TMC controls capacity by coordinating the management of air traffic.  3. Who does the TMC coordinate with? (Choose all that apply.)  **a) Area supervisors within their Center b) Neighboring Centers' TMUs c) Command Center d) CWSU meteorologist**  **Feedback**: The best answers are a, b, c, and d.  4. What is the acronym for the Command Center? (Choose the best answer.)  a) ARTCC b) FAACC c) NASCC **d) ATCSCC**  **Feedback**: The best answer is d), ATCSCC (Air Traffic Control System Command Center).  5. What does the ARTCC controller do? (Choose the best answer.)  a) Coordinates the actions of all Center TMUs b) Manages all takeoffs and landings **c) Directs and separates several aircraft within their sector** d) Imposes Ground Delay Programs and oversees all air traffic control  **Feedback**: The best answer is c).  6. What does the ATCT controller do? (Choose the best answer.)  a) Coordinates the actions of all Center TMUs b) Directs aircraft during the approach and departure phase from an airport **c) Directs and separates several aircraft within their sector** d) Along with ground control, manages all aircraft takeoffs and landings  **Feedback**: The best answer is d).  7. What does the TRACON controller do? (Choose the best answer.)  **a) Directs aircraft during the approach and departure phase from an airport** b) Manages all takeoffs and landings c) Directs and separates several aircraft within their sector d) Imposes Ground Delay Programs and coordinates the actions of all Center TMUs  **Feedback**: The best answer is a).   8. What does the ATCSCC do? (Choose the best answer.)  a) Directs and separates several aircraft within their sector **b) Oversees all air traffic control, regulates problematic air traffic situations, and coordinates the actions of all Center TMUs** c) Manages all takeoffs and landings  d) Directs aircraft during the approach and departure phase from an airport.  **Feedback**: The best answer is b).  9. Who does the CWSU coordinate with? (Choose all that apply.) a) ATCSCC **b) TMCs c) TRACON  d) ATCT**  **Feedback**: The best answers are b), c), and d). The CWSUs coordinate with TMCs and occasionally with ATCT (Tower) and TRACON supervisors.   10. An ARTCC controller should know what CAPE means. (Choose the best answer.)  True  False  **Feedback**: False. ARTCC controllers deal with ongoing weather hazards and only need to have limited weather knowledge. Even if they understand CAPE, it does not apply directly to what they do.  2.6 Job Sheets/Exercises  **Job Sheets**  The following Job Sheets will help you complete portions of your Weather Impacts Playbook (WIP) Worksheet:   * + [Job Sheet 1](http://www.meted.ucar.edu/nas/jobsheets/js1.htm): Identify FAA Management at Your ARTCC  [Job Sheet 2](http://www.meted.ucar.edu/nas/jobsheets/js2.htm): Identify NOAA NWS Management at Your Supporting WFO   + [Job Sheet 3](http://www.meted.ucar.edu/nas/jobsheets/js3.htm): Know your local FAA personnel and what they do.   + [Job Sheet 4](http://www.meted.ucar.edu/nas/jobsheets/js4.htm): Become familiar with other operational FAA facilities that can have an impact on your ARTCC   **Additional Exercises:**   * 1. For CWSU forecasters: Identify any phraseology used by ATC personnel that is unique to your facility. What does each term mean?   2. Go through module Glossary; identify any terms you have heard but don't understand, and then find out what they mean.   3. Visit a TRACON, ATCT, and AFSS facility within your CWSU area. |