

Chapter 5

SERVICE AREA: En Route Winds and Temperatures

1. Problem Description Winds and temperatures encountered en route play a role in determining the route an aircraft actually takes to reach its destination and how long it takes to get there. Pilots routinely take advantage of tail winds to increase over-the-ground speed while conserving fuel. On the other hand, head winds slow an aircraft's progress and require increased fuel usage to maintain a planned schedule. Strong head winds can lead to delays, diversions, and, in some cases, accidents.

Variations in temperatures aloft cause changes in engine efficiency and flight characteristics in some aircraft, which in turn may require changes to the intended route of flight.

The fundamental point is that pilots need to be continually aware of the changing nature of the atmosphere along their route in order to be able to react in a safe, efficient, and timely manner.

2. Objectives In order to mitigate the effects of changing winds and temperatures on en route operations, the *National Aviation Weather Initiatives* establishes the following objective:

- reduce the number of diversions and delays and, in some cases, accidents by improving wind and temperature information to enhance efficient flight planning, operations, and traffic management.

3. Decision Makers In this Service Area the range of decision makers is limited mostly to pilots, airline dispatchers, traffic management specialists, and the existing and planned variety of decision support systems.

4. Current Operations Concept

4.1 Preflight Operations. The preflight routine described in Chapter 2 applies to the area of en route winds and temperatures. The pilot needs to be familiar with both current and forecast weather conditions along the proposed route in order to maximize flight efficiency.

4.2 En Route Operations. The range of weather-related actions that pilots and aircrews need to take while en route are described in Chapter 2. Pilots must take advantage of incoming weather information and any additional information provided by on-board sensors and visual observations. Information provided by other aircraft along the same path, either during voice transmissions with ATC providers or in PIREPs, can also supply valuable perspectives on the

weather ahead of the aircraft.

5. Needed Service Improvements A number of improvements in this Service Area are called for, primarily in the area of producing weather-related information.

5.1 Production of Weather Information. The primary issue is one of data density and accuracy. The only way to produce timely and accurate analysis and forecast products is to obtain as much accurate information as possible and assimilate it in a timely fashion. This is especially important over oceanic and remote regions where ground-based reports are sparse. More types and greater numbers of aircraft need to be equipped to send automated PIREPs to the National Weather Service and to the airline operations centers. Aircraft-based reports of wind speeds, temperatures, humidity, and icing and turbulent conditions will prove to be a valuable adjunct to the existing network of observing stations. The observation network also needs to be expanded to include conditions at very high levels, above Flight Level 390¹³ and close to the ground, below 3,000 feet.

5.2 Weather Product Generation and Delivery. The comprehensive product suite developed for improved weather information needs to be delivered to users in formats that are both tailored to specific needs and readily understood without additional interpretation. Both graphical and textual products are needed as well as gridded products for computer flight planning systems. Communications systems need to be improved to deliver the products as rapidly as possible.

6. En Route Winds and Temperature Initiatives On page 5-3 are the initiatives which have been identified for this service area.

¹³ Flight Levels are expressed in three digits representing hundreds of feet of standard barometric altitude above the 1013.2 mb pressure datum (FL390 indicates 39,000 ft).

Number	En Route Winds and Temperature Initiatives	Relative Ranking*	Cooperating Organizations
1	Develop and implement en route wind and temperature products which are applicable for use by pilots, ATC service providers, airline operations centers, and others.	★★★★	NOAA/ NWS, FAA
2	Increase the types and number of aircraft with the capability for automatic reporting of winds and temperatures and ensure the widest dissemination possible to the National Weather Service and airline operations centers using established ground-based communication systems.	★★★★	Industry**, NASA, NOAA/NWS, FAA
3	Develop and implement ground-to-air Flight Information Service capabilities to readily disseminate en route wind forecast products within 15 minutes of product generation for strategic route planning.	★★★★	FAA, DoD, Industry, NASA
4	Develop and implement a multi-functional color cockpit display which includes en route wind and temperature information along with terrain and traffic hazards.	★★★★	NASA, Industry
5	Expand the collection of data for winds and temperature aloft to include flight levels above FL390 and below 3,000 feet above ground level.	★★	NOAA/NWS, Industry, DoD, FAA
6	Improve the resolution and accuracy of wind and temperature aloft observations.	★★	NOAA/NWS, FAA
7	Develop and implement forecasting and modeling techniques that will improve en route wind and temperature products, including resolution and accuracy in space and time, affecting en route operations.	★★	NOAA/NWS, DoD, FAA

* The relative rankings assigned to the initiatives are based on a qualitatively calculated benefit/cost ratio. It's possible that a high-benefit initiative which is costly to implement may rank lower than a medium- or low-benefit initiative which is medium or low in cost to implement. All these initiatives are considered to have a positive benefit to aviation; however, when benefits and costs are considered, some rank relatively higher than others. Details can be provided upon request. Four stars (★★★★) is the highest ranking.

** The term “Industry” in this context refers to private organizations (e.g., airlines, manufacturers, associations) which may represent both users and providers of weather information.