

Chapter 3

SERVICE AREA: Ceiling and Visibility

1. Problem Description Low ceiling and reduced visibility are safety hazards for all types of aviation. The NASDAC study of NTSB statistics indicated that ceiling and visibility were cited as contributing factors in 24 per cent of all general aviation accidents between 1989 and early 1997. They were also cited as contributing factors in 37 per cent of commuter/air taxi accidents during the same period. Low ceiling and poor visibility accidents occur when pilots who are not properly rated or are flying an aircraft not equipped with the necessary instrumentation encounter such conditions, resulting in loss of control or controlled flight into terrain.

The NTSB statistics also imply that air carriers have the expertise, procedures, and equipment necessary to fly safely in reduced visibility conditions. Low ceiling and poor visibility were cited as contributing factors in less than 2 per cent of the commercial air carrier (Part 121) accidents between 1989 and early 1997.

Low ceiling and poor visibility are not just a safety issue. They can also severely degrade the efficiency of commercial and military aviation. Reduced ceiling and/or visibility can severely reduce the capacity of an airport and lead to airborne or ground delays that result in diversions, cancellations, missed connections, and extra operational costs.

Ceiling and visibility issues are also a problem for military aviation, not only for reasons of flight safety but also for mission effectiveness. In order to effectively strike targets, military aircraft and weapons systems must be able to see them, either visually or through advanced sensors. An accurate knowledge of the conditions of ceiling and visibility in the vicinity of a target can play a role in the choice of ordnance used.

2. Objectives Because ceiling and visibility have a major impact on aviation, the *National Aviation Weather Initiatives* establishes a set of achievable objectives for the Ceiling and Visibility service area. These objectives are:

- reduce the rate of ceiling and visibility-related accidents and incidents for all aircraft operations in the National Airspace System, especially those involving helicopter, general aviation, and commuter/air taxi operations, and

“Visibility” is the farthest distance at which an observer can distinguish objects. “Ceiling” is the altitude to the nearest cloud layer that obscures at least half of the sky. A variety of phenomena fall into the “ceiling and visibility problems” category. The NTSB statistics list various conditions that fall into this category, including:

Low ceiling (37.3%)
Fog (34.4%)
Clouds (12.8%)
Obscuration (10.8%)
Haze/smoke (2.3%)
Below Approach Minimums (2.2%)
Sand/Dust Storm (0.2%)
Sun glare (0.1%)

- reduce unnecessary delays and diversions and maintain or increase airport capacities during low visibility/low ceiling conditions.

3. Operational Decision Makers The range of decision makers described in Chapter 2 applies in the case of ceiling/visibility.

4. Current Operations Concept

4.1 Preflight Operations. In preflight, operators rely heavily on ceiling and visibility information in planning their route of flight, destination, and alternate airport selection. Regulations require commercial air carriers and air taxi/commuter operators to consider the ceiling and visibility observations and forecasts at their intended destination and selected alternate destination prior to being dispatched. While there are no similar regulatory requirements for operators in other categories of aircraft, these same procedures are strongly recommended as a part of their pre-flight planning. Pilots should also take into account the presence of widespread low ceilings and visibility along their intended flight route(s).

4.2 En Route Operations. Once in flight, pilots need to obtain updated status reports on the destination and alternate airports. Airline operations centers today keep their fleets apprised of the latest weather-related developments at the destination airports. It is of paramount importance that general aviation pilots on visual flight rules (VFR) flights receive constant updates of weather developments such as widespread low ceilings and visibilities along their intended route of flight. Many general aviation accidents occur when pilots on VFR flights find themselves in instrument meteorological conditions (IMC).



Reduced ceiling and visibility can lead to delay or cancellation of vital missions in all categories of aviation.

4.3 Terminal Operations. In the current system, traffic management specialists, in the Air Traffic Control System Command Center (ATCSCC), in Traffic Management Units in Air Route Traffic Control Centers (ARTCC), and in Terminal Radar Approach Control Centers (TRACON), collaborate with supervisors in Air Traffic Control Towers (ATCT) to determine airport arrival (airport acceptance) and departure rates. Ceiling and visibility information plays a primary role in decisions leading to the movement of air traffic. Traffic management personnel use ceiling and visibility conditions, in conjunction with the runway configuration in use, to determine flow rates in and out of airports. In the future it is expected that ATC service providers and airline operations centers will make more collaborative decisions and exchange operationally significant information, such as ceiling and visibility.

5. Needed Service Improvements As the accident statistics presented in Section 1 indicate, the ceiling/visibility service area has significant room for improvement, especially with regard to the general aviation community. Ideally, aircraft should, with sufficient weather information and proper planning, be able to avoid conditions of low ceiling or poor visibility. In practice, this is not always possible. However, a number of improvements should serve to make this service area more effective.

5.1 Production of Weather Information. Weather observation and reporting systems need to be expanded to provide better resolution for ceiling and visibility observations and forecasts. Capabilities for accurate measurement of runway visual range (RVR) need to be extended to more airports and reporting systems developed to include this information in observation products. Capabilities for producing accurate localized forecasts of ceiling and visibility need to be refined for both civilian and military applications.

5.2 Weather Product Generation and Delivery. Ceiling/visibility observations, analysis, and forecast products need to be provided to decision makers in clear and understandable formats, both textual and graphic. Such products must be disseminated as rapidly as possible to ATC providers and airline operations centers, especially during periods when conditions are changing rapidly.

5.3 Pilot Training. Pilot training, especially for general aviation aircraft, helicopter, and commuter/air taxi ratings, must stress the need for constant awareness of current and expected ceiling/visibility conditions. Many accidents occur because pilots either underestimate the severity of conditions or fly into conditions they did not expect.

5.4 Information-Provider Training. Training for information providers should emphasize the dangers of rapidly changing ceiling/visibility conditions and help providers develop strategies for dealing with various scenarios that are likely to occur.

6. Ceiling/Visibility Initiatives On pages 3-4 and 3-5 are the initiatives which have been identified for this service area.

Number	Ceiling/Visibility Initiatives	Relative Ranking*	Cooperating Organizations
1	Develop and implement ceiling and visibility products which are applicable for use by ATC service providers, airline operations centers, and pilots.	★★★★	NOAA/NWS
2	Develop and implement ground to air Flight Information Services capabilities to disseminate observations within 5 minutes of availability and ceiling and visibility analyses/forecasts within 15 minutes of product generation to pilots, airline operations centers, and ATC service providers.	★★★★	FAA, DoD, Industry**, NASA
3	Increase the types and number of aircraft with the capability for automatic reporting of humidity and temperature.	★★★★	Industry, NASA, FAA
4	Develop and implement training packages that focus on rapidly changing ceiling/visibility scenarios for tactical use by ATC service providers, airline operations centers, and pilots.	★★★★	NOAA/NWS, NASA, FAA, DoD
5	Improve the reporting of widespread low ceilings and visibilities affecting en route operations.	★★★★	NOAA/NWS, FAA, States
6	Develop and implement a color cockpit multi-functional display which includes ceiling and visibility along with terrain, and other traffic hazards.	★★★★	NASA, Industry
7	Improve the resolution and accuracy of ceiling and visibility observations affecting terminal operations.	★★★★	NOAA/NWS, FAA
8	Develop and implement forecasting (for up to one hour) and modeling techniques that will improve ceiling and visibility products, including resolution and accuracy in time and space, affecting terminal operations.	★★★	NOAA/NWS, DoD, FAA

9	Improve current ground-based communications systems to readily disseminate observations, pilot reports, analyses, and forecasts of ceiling and visibility to pilots, airline operations centers, and ATC service providers.	★★	FAA, NOAA/NWS, NASA
10	Develop and implement forecast (for up to one hour) and modeling techniques that will improve ceiling and visibility products, including resolution and accuracy in time and space, affecting en route operations.	★★	NOAA/NWS, DoD, FAA
11	Develop and implement forecasting (for one hour or greater) and modeling techniques that will improve ceiling/visibility products, including resolution and accuracy in time and space, affecting terminal operations.	★★	NOAA/NWS, DoD, FAA
12	Implement the reporting, in compliance with ICAO requirements, of runway visual range (RVR) at all U.S. airports having New Generation RVR equipment.	★★	FAA
13	Develop and implement forecasting (for one hour or greater) and modeling techniques that will improve ceiling/visibility products, including resolution and accuracy in time and space, affecting en route operations.	★★	NOAA/NWS, DoD, FAA
14	Develop and implement capabilities for terminal operations in zero-ceiling/zero-visibility meteorological conditions.	★	NASA, DoD, FAA, Industry

Ceiling/Visibility Initiatives

* 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.