

## VOLUME 4 AIRCRAFT EQUIPMENT AND OPERATIONAL AUTHORIZATION

### CHAPTER 1 AIR NAVIGATION, COMMUNICATIONS, AND SURVEILLANCE

#### Section 3 Class I Navigation

**4-51 GENERAL.** This section provides concepts, direction, and guidance that should be used by FAA inspectors when evaluating and approving or denying requests for authorization to conduct Class I navigation operations not previously approved for a particular operator. This includes proposed Class I navigation operations using aircraft and/or navigation systems new to that operator, as well as Class I navigation operations into areas of en route operation new to that operator using previously approved aircraft and navigation systems. This section amplifies the general concepts, policies, and guidance provided in section 1 of this chapter. Specific “standard practices” are provided in this section for evaluating Class I navigation operations using navigation systems that, within particular areas of en route operations, understand operational characteristics and limitations. When an operator requests approval to conduct Class I navigation using a means of navigation not addressed by these standard practices, a request for direction and guidance must be forwarded through Regional Flight Standards Division to the Air Transportation Division (AFS-200).

**4-52 VFR CLASS I NAVIGATION.** Visual flight rules (VFR) Class I navigation is any Class I navigation operation conducted under VFR in visual meteorological conditions (VMC). The primary objectives of VFR Class I navigation are as follows:

- Arrive at the intended destination with sufficient fuel remaining to safely complete a landing
- Operate with sufficient visual references to reliably “see and avoid” all obstacles along the actual routes of flight
- Operate with sufficient visibility to safely “see and avoid” all other aircraft
- Navigate with sufficient precision to avoid special area of operation areas and positive air traffic control (ATC) areas or to comply with the special requirements of those areas
- Protect persons and property on the ground, which is an important factor in route selection and route approval, especially for those aircraft that have inadequate performance capability with an engine inoperative

**A. Safe Separation of Aircraft Under VFR.** Since the safe separation of aircraft under VFR is provided by “see and avoid” procedures, an inspector must ensure that the flight conditions (ceiling and visibility) specified for an operation reliably permit application of this concept. In most cases, basic VFR weather minima (part 91, § 91.155) are sufficient for the “see and avoid” concept. However, the requirements to arrive at the intended destination, avoid obstacles along the actual route of flight, and adequately protect persons and property on the ground are more complex. In general, basic VFR weather minima are adequate to safely accomplish these objectives in uncongested areas that have numerous prominent landmarks and benign terrain/obstacle characteristics. However, operations in other areas generally require a case-by-case evaluation and may require flight conditions that require better seeing-conditions than that provided by basic VFR weather minima. In determining the degree of accuracy

required for VFR operations, the inspector must consider the minimum flight conditions (ceiling and visibility) required for safe operations.

**B. Conduct of VFR Flight.** In the conduct of VFR flight, the prevention of collisions (safe separation from other aircraft) is solely the responsibility of the pilot-in-command (PIC) to see and avoid. However, there are regulatory requirements for use of navigation systems such as VOR for VFR operations in oceanic or desolated land areas or for night VFR and VFR over the top operations. These regulatory requirements are related to locating the intended destination, avoiding obstacles along the actual route of flight, and the protection of persons and property on the ground.

**4-53 TYPES OF VFR CLASS I NAVIGATION.** These are two types of VFR Class I navigation. They are referred to as “pilotage” and “station-referenced.”

**A. Pilotage.** One of the primary means of conducting VFR Class I navigation is by pilotage. Pilotage is defined in Title 14 of the Code of Federal Regulations (14 CFR) part 1 as “navigation by visual reference to landmarks.”

1) Pilotage is an appropriate means of navigation only in those areas and/or situations where the flight conditions (ceiling and visibility) are sufficient to consistently identify prominent landmarks and to “see and avoid” obstacles and other aircraft. Examples of prominent landmarks include villages, rivers, roads, valleys, ridges, transmission lines, and in some cases, lighted objects at night.

2) Pilotage is not an appropriate means of VFR Class I navigation in areas or situations where prominent landmarks or lighted objects do not exist or where these visual references are widely separated. For example, desolate areas without prominent and permanent features, such as deserts, the Tar Pits in Canada, huge forests, certain Arctic areas, or large bodies of water (such as parts of the Great Lakes and the Gulf of Mexico), are areas where pilotage is not an appropriate means of navigation.

**B. Station-Referenced.** In situations where pilotage is not appropriate, it is necessary to use other means of conducting VFR Class I navigation to locate the intended destination, avoid obstacles, and protect persons and property on the ground. This is accomplished by using electronic station-referenced (nonvisual) navigational aids (NAVAID), such as VOR, DME, NDB, or LORAN-C, and GNSS.

1) Conventional ground-based NAVAIDs (VOR, DME, NDB) can be used to fly published routes. In this case, obstacle avoidance is provided if the operation is conducted at or above the published minimum en route IFR altitude minimum en route altitude (MEA) or (if appropriate) the minimum obstruction clearance altitude (MOCA).

2) Area navigation systems can be used to conduct VFR Class I navigation. Most area navigation systems are station-referenced systems; however, an inertial navigation system (INS) is self-contained and the Global Navigation Satellite System (GNSS) is space based. Although these systems are referenced to specific navigation stations (VOR, VOR/DME, and LORAN-C), area navigation systems permit point-to-point navigation and are not limited to

routes from one ground station to the next. Since the VFR navigation performance requirements are not as demanding as IFR requirements, operators can use area navigation systems for VFR that are not certificated for IFR en route operations. However, certain systems, such as LORAN-C and GPS, must be certified as airworthy for VFR and installed in accordance with approved documentation.

**4-54 VFR CLASS I NAVIGATION APPROVALS.** General direction and guidance on air navigation approvals is provided in section 2.

**A. Determining Degree of Accuracy.** In determining the degree of accuracy required for pilotage and station-referenced VFR Class I navigation, an inspector must consider the minimum flight conditions necessary for safe operations. If it is determined that flight conditions better than basic VFR weather minima are required for safe operations, the specific flight conditions (e.g., ceiling visibility) must be specified in the operations specifications (OpSpecs) for the pertinent area or route. When making this determination for station referenced Class I navigation, consideration should be given to the additional accuracy provided by the electronic navigation equipment. In addition, station referenced navigation requires that the navigational equipment used is airworthy for VFR operations within the proposed area of operation and installed in accordance with approved data. The operator must provide written evidence of the airworthiness approval for the required equipment. When a minimum flight condition for either pilotage or station referenced Class I navigation is specified in OpSpecs, it must provide for the following criteria:

- Meets regulatory requirements for the operation
- Meets the standard practices in this handbook
- Meets the requirements of part B of the OpSpecs
- Provides accepted, safe operating practice
- Permits “see and avoid”
- Permits the identification and avoidance of obstacles
- Ensures adequate protection of persons and property on the ground
- Permits reliable identification of prominent landmarks or lighted objects at night
- Permits reliable navigation to the intended destination

**B. Pilotage and Station-Referenced Approvals.** Pilotage and station-referenced approvals are granted by issuance or amendments to OpSpecs. The areas of operation authorized for pilotage or station-referenced Class I VFR navigation, along with any required minimum flight condition, must be specified in the OpSpecs.

**C. Area Navigation Systems.**

- VOR-DME
- DME-DME
- LORAN-C
- GPS
- INS/Inertial Reference System (IRS)

**4-55 INSTRUMENT FLIGHT RULES (IFR) CLASS I NAVIGATION.**

**A.** IFR Class I navigation is any Class I navigation operation conducted under IFR. The following are the primary objectives of IFR Class I navigation:

- Navigating with sufficient precision to permit ATC to safely separate IFR aircraft.
- Arriving at the intended destination with adequate fuel remaining to safely complete a landing.
- Avoiding all obstacles along the actual route of flight.
- Providing adequate protection for persons and property on the ground, especially for those aircraft with inadequate performance capability with an inoperative engine(s).
- Meeting the requirements of part B of OpSpecs.

**B. Safe Separation of Aircraft.** Since the safe separation of aircraft under IFR in controlled airspace is dependent on the aircraft's navigational performance, an inspector must determine that the navigational equipment and the navigation procedures and techniques used by the operator ensure that the operation will be conducted with the precision necessary to meet the objectives listed in the previous subparagraph. Inspectors must consider the following when approving IFR Class I navigation:

- Situations when the means of navigation is other than VOR or VOR/DME will normally require a case-by-case evaluation.
- In all cases, the means of navigation must enable navigation to the degree of accuracy required for the control of air traffic.
- IFR Class I navigation is only conducted within the operational service Volume of standard International Civil Aviation Organization (ICAO) NAVAIDs.

**4-56 TYPES OF IFR CLASS I NAVIGATION.** There are two generic types of IFR Class I navigation:

- Navigation by direct reference to ICAO standard NAVAIDs
- Navigation by use of RNAV systems.

**A. ICAO Standard NAVAIDs.** The primary means of conducting IFR Class I navigation has historically been station-referenced to ICAO standard ground-based NAVAIDs (VOR, VOR/DME, NDB). The route structure and the ATC separation standards in most countries are based on the use of these ground-based NAVAIDs. When operating within the operational service volumes of these ground-based NAVAIDs, these standard systems may be used to satisfy the objectives of IFR Class I navigation. However, with the implementation of GPS, ICAO now includes GPS as an additional standard NAVAID. Two subtypes of IFR Class I navigation can be conducted using ICAO standard NAVAIDs: ground-based or space-based. These subtypes are navigation on published IFR routes and point-to-point IFR navigation.

1) Within the United States and Canada, standard NAVAIDs may be used to conduct Class I navigation when flying any published IFR route or procedure, provided these operations

are conducted at or above the published minimum IFR altitudes. The following are examples of published IFR routes:

- Victor airways
- Colored airways
- Jet/high level routes
- Standard Instrument Departures (SID)
- Standard Terminal Arrivals (STAR)
- Instrument departures.

NOTE: This also includes those cases where the route is published with a “gap” in signal coverage.

2) In many foreign countries and in oceanic/remote areas, the situation is more complex. The determination of whether Class I navigation is appropriate must be based on ICAO standards or their equivalence to U.S. standards. In general, most published VOR and VOR/DME routes (airways) are equivalent to U.S. standards and IFR Class I navigation can be conducted over these routes using standard VOR, VOR/DME equipment. In many areas outside the United States and Canada, some of the published routes are based on NDBs. Any published route must be evaluated to determine whether the route involves Class I or Class II navigation, or both. For example, if the entire portion of a route based on NDB is determined to be Class I navigation, NDB equipment is usually sufficient to conduct airway navigation over that route when flying at or above the specified minimum IFR altitude. Point-to-point IFR Class I navigation based on NDBs generally requires a case-by-case evaluation to ensure the operation will be conducted in accordance with ICAO or U.S. standards. The fact that the route is approved by the ICAO contracting State does not automatically mean that the route meets these safety criteria.

3) IFR Class I navigation can be conducted over unpublished point to point routes (off airways), provided all of the following conditions are met:

- Positive course guidance is available from standard ICAO NAVAIDs.
- The routes are within the operational service Volume of these NAVAIDs.
- The operation is conducted at or above the IFR minimum altitude published or approved for that route by the ICAO contracting state having jurisdiction over that airspace.
- The required airborne, ground-based and/or space-based navigational facilities are available and operational to enable navigation to the degree of accuracy required for the control of air traffic.

**B. Area Navigation Systems.** Appropriate area navigation systems can be used to conduct IFR Class I navigation. Any area navigation system used for IFR flight must provide present position information and navigation guidance to maintain the assigned track and arrive at the designated waypoints. Area navigation may be based on the following:

- VOR and DME-source-referenced

- LORAN-C, GNSS earth-referenced in accordance with WGS84 or equivalent
- Self-contained in the aircraft (INS, IRS).

1) IFR Class I navigation can be conducted with IFR-approved area navigation systems suitable for the area of operations. Area navigation systems must be evaluated to ensure that the system and the operator are capable of navigating to the degree of accuracy required for control of air traffic within the proposed area of operation

2) In U.S. Class A airspace (18,000 feet mean sea level (MSL) to Flight Level (FL) 600), IFR Class I navigation can be conducted with suitable area navigation systems that are not approved for IFR flight in areas where domestic ATS procedures are applied. In the U.S. Class A airspace, additional safety is provided by ATC radar. This independent surveillance method and the procedures specified for this type of operation provides an equivalent level of safety and permits safe separation of aircraft. RNAV operations can be authorized provided the following conditions are met:

- The flightcrew is properly trained for the equipment and special procedures to be used.
- Each flight operation is authorized by the appropriate ATC facility.
- The entire portion of the intended route of flight using the area navigation system will be in the U.S. Class A airspace and under positive radar control.
- Contingency procedures are established so that the flight can immediately return to and use airways facilities at any point in the flight.
- The airborne navigational equipment (VOR, DME, ADF) required to navigate in Class A airspace is installed and operational.

**4-57 IFR CLASS I NAVIGATION APPROVALS.** General direction and guidance of air navigation approvals are in section 2. Specific direction and guidance for approving IFR Class I navigation is discussed in the following subparagraphs.

**A. Degree of Accuracy Required.** Inspectors must determine that the navigational equipment and the operational procedures/techniques used permit reliable IFR Class I navigation to the degree of accuracy required for the control of air traffic. The degree of accuracy required for any IFR Class I navigation operation must provide for the following criteria:

- Meets regulatory requirements for IFR airways navigation
- Meets the standard practices in this order
- Meets the requirements of part B of the OpSpecs
- Provides accepted, safe operating practices
- Permits the safe separation of aircraft
- Ensures obstacle avoidance along the route of flight
- Ensures adequate protection for persons and property on the ground
- Permits reliable navigation to the intended destination and any necessary alternate or diversionary airports

**B. Airworthiness of Navigational Equipment.** Inspectors must determine that required navigational equipment is certified for IFR flight and installed in accordance with approved data. The operator must provide written evidence of the airworthiness approval for the required equipment. The operator must also provide written evidence that shows that any RNAV system used for IFR Class I navigation meets the performance criteria for the proposed area of operation. If, for example, the proposed area of operation includes areas of magnetic unreliability (AMU), the navigation equipment must be approved for IFR operations in that environment.

**C. Other Factors.** Inspectors must determine that the operator's manuals, training programs, minimum equipment lists (MELs), and company policies and practices adequately address the proposed IFR Class I navigation operation and the equipment to be used considering the following factors:

- Terrain characteristics
- The operator's experience with other aircraft and navigation systems in the area of proposed operation
- The operator's experience with the same aircraft and navigation in similar areas of operation
- The need to adequately protect persons or property on the ground
- Operations in special areas of operation, including AMU
- Use of special means of navigation
- Use of special navigation techniques

**D. Approval.** IFR Class I navigation approvals are granted by issuance of or amendments to OpSpecs. The areas of operation authorized must be specified in part B, paragraph B050 of OpSpecs (see Volume 3, Chapter 18.)

NOTE: The inspector will not, under any circumstances, issue OpSpecs approving IFR Class I navigation operations until all requirements are met (including the principal avionics inspector's (PAI) approval of the operator's programs, if required) and the operator is capable of commencing safe operation.

**RESERVED.** Paragraphs 4-58 through 4-75.