AC NO: 120-31

DATE: 12/15/76

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: OPERATIONAL AND AIRWORTHINESS APPROVAL OF AIRBORNE OMEGA RADIO NAVIGATION SYSTEMS AS A MEANS OF UPDATING SELF-CONTAINED NAVIGATION SYSTEMS

1. PURPOSE. This advisory circular sets forth an acceptable means, but not the only means, of compliance with the referenced sections of the Federal Aviation Regulations (FAR) for operations outside the United States under FAR Part 121 using OMEGA radio navigation systems to update self-contained systems such as Doppler or Inertial. This circular also sets forth an acceptable means, but not the only means, for obtaining airworthiness approval of airborne OMEGA navigation systems for use in updating self-contained navigation systems.

2. REFERENCES. Federal Aviation Regulations 121.103, 121.121, 121.355, 121.389, 121.405, 121.411, 121.413, 121.415, 121.433; 21.111; 25.1301, 25.1309.

3. INFORMATION.

   a. OMEGA is a radio navigation system which uses very low frequency signals from a worldwide network of eight transmitters. A number of signal processing schemes are used by different manufacturers to provide position and other navigation information to the pilot. When OMEGA systems meet the requirements described below, they may be used to update self-contained navigation systems for operations in oceanic areas or in remote land areas.

   b. This advisory circular is divided into two sections. The first section (paragraphs 4 through 20) deals with operational approval under FAR 121, and the second section (paragraphs 21 through 40) deals with airworthiness approval under FAR 25 (transport category aircraft). In cases where compliance with a particular subparagraph must be examined by both FAA operations personnel and FAA engineering personnel, those subparagraphs are included in both Sections 1 and 2 for completeness.

c. Guidance concerning the use of OMEGA as the sole means of navigation will be issued as additional OMEGA operating experience is gained. In addition, guidance concerning use of OMEGA as a replacement system in cockpit/LORAN-A operations will be issued at the appropriate time.

SECTION 1. OPERATIONAL APPROVAL

4. GENERAL.

a. The basic requirements under FAR Part 121 for en route navigational facilities are contained in 121.103 and 121.121, which require that "nonvisual ground aids" be available along the route for navigating aircraft within the degree of accuracy required. These nonvisual ground aids are considered to include long-range radio navigation systems such as OMEGA. Airborne navigation equipment requirements are contained in FAR 121.355 and 121.389.

b. Applicants desiring operational approval for use of OMEGA systems in accordance with Section 1 of this circular should contact the Air Carrier District Office or International Field Office charged with the administration of their operating certificate 30 days prior to the start of evaluation flights.

5. REQUEST FOR OPERATIONAL APPROVAL. The request should contain the following information:

a. Evidence of a determination by the FAA that the candidate system will not adversely affect other required systems aboard the aircraft.

b. A summary of flight experience using the system which shows a history of adequate accuracy and service reliability.

c. Training program curricula for crewmembers for initial approval under FAR 121.405, and for maintenance personnel.

d. A maintenance program for compliance with subpart L of FAR Part 121, including the stationing of spare parts and test equipment, and updating of maintenance manuals.

e. A description of the system installation.

f. Proposed revisions to the Operations Manual describing all normal and abnormal system operating procedures, blunder protection procedures including cross-checking of data insertion, detailed methods for continuing the navigation function with partial or complete OMEGA system failure, and methods for determining which

system is the most accurate in the event of a large divergence between them. For the purpose of this advisory circular, a large divergence is one which exceeds separation criteria requirements.

g. Proposed revisions to the Minimum Equipment List (MEL) concerning OMEGA, with appropriate justification.

h. A list of operations to be conducted using the system, containing an analysis of each with respect to signal reception for ground synchronization and en route operation, track length, signal absorption by the Greenland icecap, procedures for operating in areas of magnetic compass unreliability (if applicable), availability of other en route aids, and adequacy of gateway and terminal radio facilities to support the system. For the purpose of this advisory circular, a gateway is a specific navigation fix where the use of the long-range system commences or terminates.

i. Availability of adequate NOTAM service for the transmitters needed to support the operation.

6. EQUIPMENT AND EQUIPMENT INSTALLATION.

a. OMEGA navigation systems should be installed in accordance with applicable airworthiness requirements.

b. System controls and data display should be visible to, and conveniently accessible to, each pilot while seated at his duty station.

c. The equipment should provide, by adequate visual or aural signals, warning of system failure, malfunctions, accuracy degradation alert (ambiguity light), lack of synchronization, and operation without adequate signals.

d. The airborne system should be protected against power interruptions or abnormalities as specified in the airworthiness approval criteria, and system performance should not be adversely affected by power interruptions encountered during normal operations.

e. If evaluation flights are made in operations on which a long-range navigation system is required, a navigation system already approved under Part 121 will be used as the primary means of navigation. Approval may be obtained for temporary cockpit arrangements involving installation of the candidate system provided sufficient flights with the system installation in its final form are observed.

f. Aircraft using OMEGA systems which are subject to lane ambiguity should have a means for meeting ATC separation standards during any period of lane uncertainty and for reacquiring the proper lane when normal system operation is resumed. Thus, an adequate means of dead reckoning within the overall navigation system onboard the aircraft is required.

g. A preflight test capability should be provided to inform the flightcrew of system status.

h. An automated display of the aircraft's present position in suitable coordinates should be provided.

i. If the navigational capability depends upon the magnetic compass, operations in areas of magnetic compass unreliability will require special consideration.

j. The receiver antenna design and installation should provide adequate immunity from the effects of precipitation static and other noise or disturbances.

k. System operation should not be adversely affected by aircraft maneuvering or changes in attitude encountered in normal operations.

l. System controls should be arranged to provide adequate protection against inadvertent system turnoff.

7. TRAINING PROGRAMS.

a. Initial training programs should include the following:

(1) Instruction regarding responsibilities of flight crewmembers, dispatchers, and maintenance personnel.

(2) For pilots, instruction in the following:

(a) A description of the equipment and manner of installation, theory of operation, and system capabilities and limitations.

(b) Normal operating procedures including preflight procedures and testing, data insertion and cross-checking, en route procedures including periodic cross-checking of system position display against aircraft position.

(c) Updating procedures, if applicable.

(d) Operations in areas of magnetic compass unreliability, if applicable.

(e) Abnormal and emergency procedures, including airborne resynchronization, if applicable.

b. Procedures for operating the new navigation system should be incorporated into the recurrent training program for flight crewmembers.

c. The training and qualification program should include an in-flight qualification check based on the training program or an equivalent check in a simulator or approved training device, certified by a qualified check airman. Accomplishment of such training during evaluation flights is acceptable. Sufficient flightcrews considered fully qualified by the applicant will be observed by the FAA to determine the overall effectiveness of the training and qualification programs.

8. ACCURACY AND RELIABILITY. The applicant should show:

a. That an adequate in-flight service reliability rate, stated in terms of in-flight mean time between failures (MTBF), is in existence, with no significant unresolved problems remaining.

b. That the OMEGA navigation system will be used to update the self-contained system to meet accuracy requirements stipulated for long-range navigation systems in FAR Part 121. Systems which become exceedingly inaccurate without displaying a warning indication will be included in the accuracy accounting. Systems which display a failure warning and are subsequently shutdown or disregarded will be included in the accounting of failed systems in paragraph 8a.

NOTE: Applicants should note that ICAO is promulgating a Minimum Navigation Performance Specification (MNPS) which contains accuracy requirements which will require compliance by all operators in a designated portion of North Atlantic airspace, referred to as "the MNPS airspace," commencing December 29, 1977. In general, the Specification will require that systems demonstrate a capability for keeping aircraft within 12.6 NM of course, 95% of the time. Aircraft which depend on navigation systems that cannot meet this requirement may be excluded from the airspace, which is delineated as follows:

"that volume of airspace between FL275 and FL400, extending between latitude 27°N and latitude 67°N, bounded in the East by the eastern boundaries of the Santa Maria Oceanic, Shanwick Oceanic, and Reykjavik FIRs, and in the West by longitude 60°W within the New York Oceanic FIR, and the western boundary of the Gander Oceanic and the Reykjavik FIRs."

Approval under ICAO MNPS may be granted after demonstration of compliance with the above accuracy requirement (when it is finalized). However, it should also be noted that navigation system performance in the MNPS airspace will be monitored, especially with regard to large deviations. Under this monitoring, operators using navigation systems which permit deviations of 30 NM or more for a total of 1 hour in each 2,000 flight-hours, or deviations of between 50 NM and 70 NM (approximately along the adjoining track in 60 NM separation) for a total of 1 hour in each 8,000 flight-hours in the system, will be required to take corrective action or be excluded from the airspace.

Since these ICAO requirements have not been finalized at this writing, applicants and the FAA approving office should determine their status at the time of application.

9. EVALUATION PROGRAM.

a. When OMEGA navigation systems are to be used to replace another radio navigation system for updating a self-contained system such as doppler, only those aspects involving the new system and its interface with the primary system need to be evaluated concerning requirements described in Section 1 of this circular; however, overall system accuracy and reliability should be demonstrated.

b. Approval by evaluation should be requested as part of the application for operational approval of the use of OMEGA to update the self-contained navigation system.

c. The applicant should provide data from sufficient flights which show that he is able to use OMEGA to update self-contained navigation systems in routine operations so that the requirements of FAR Part 121 are met.

d. In addition to the other considerations listed in this circular, the Administrator will determine whether operation of the system imposes an unacceptable cockpit workload on the flightcrew. This aspect should receive careful scrutiny when positional and flight progress readouts from the updating system are presented in a form different from those provided by the primary system.

10. OPERATIONS SPECIFICATIONS.

a. After the evaluation is completed, FAA approval is indicated by issuance of operations specifications, or amendment thereto, authorizing the use of OMEGA to update the self-contained navigation system. Approval is limited to those operations or areas where compliance with FAR Part 121 requirements was demonstrated.

b. The operations specifications will contain applicable limitations or special requirements needed for particular routes or areas, and where necessary, a list of a sufficient number of OMEGA ground transmitters required to be in operation to provide the necessary amount of redundancy.

c. When navigation system installations using OMEGA for updating meet the requirements of Section 1 of this circular and also meet the ICAO MNPS accuracy requirement for operations in the North Atlantic (when it is finalized), the operations specifications will be so endorsed, and further evaluation with regard to this particular requirement will not be necessary.

11.-20. RESERVED.

SECTION 2. AIRWORTHINESS APPROVAL

21.-40. RESERVED for airworthiness approval criteria which will be issued at a later date.

J. A. Ferrarese

J. A. FERRARESE
Acting Director, Flight Standards Service

GPO 911-952