

(Amended by 121-13  
10/14/69)

# Federal Aviation Agency



AC NO: 121-11 CH 1  
CERTIFICATION AND  
OPERATIONS: AIR  
CARRIERS AND COMMERCIAL  
OPERATORS OF LARGE  
AIRCRAFT

EFFECTIVE :  
1/10/68

## CHANGE

**SUBJECT :** CH 1 TO ADVISORY CIRCULAR 121-11  
**SUBJ:** APPROVAL OF INERTIAL NAVIGATION SYSTEMS (INS)

- PURPOSE.** This advisory circular change transmits a page change to the subject advisory circular. This change provides a change in the wording of Note 2 on Page 1 of Attachment 1 of the advisory circular.
- EXPLANATION OF CHANGE.** The wording of Note 2 on Page 1 of Attachment 1, Sample Operations Specifications - En Route Procedures, is changed to clarify its meaning.

### PAGE CONTROL CHART

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*Edward C. Hudson*  
Director  
Flight Standards Service

# Federal Aviation Agency



*(Amended by 12-13  
10/14/69)*

<b>AC NO :</b> AC 121-11 <b>CERTIFICATION AND OPERATIONS:</b> AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT
<b>EFFECTIVE :</b>  3/23/67

**SUBJECT :** APPROVAL OF INERTIAL NAVIGATION SYSTEMS (INS)

1. **PURPOSE.** This Advisory Circular states an acceptable means, not the only means, of compliance with the referenced sections of the FAR as they apply to persons operating under Part 121 who desire approval of inertial navigation systems as the sole means of navigation in their operations.
2. **REFERENCES.** Federal Aviation Regulations 121.355, 121.389, 121.411, 121.412, 121.413, 121.415, 121.417, 121.418 and Advisory Circular No. 25-4.
3. **CANCELLATION.** Advisory Circular 120-3.
4. **INFORMATION.** An inertial navigation system is a self-contained navigation system which provides aircraft position and other significant navigation information in response to signals resulting from inertial effects on components entirely within the self-contained system. Under the provisions of FAR sections 121.355 and 121.389, cockpit navigation over international routes and in areas previously requiring a navigator may be approved using inertial navigation systems.
5. **GENERAL.** The operator desiring approval for use of inertial navigational systems should contact the local Air Carrier District Office (ACDO) or International Field Office (IFO) as appropriate for advice in preparation of an initial written request for FAA evaluation of its proposal. The necessary information is outlined in paragraph 6 of this circular. Thirty days should be allowed for review and processing of the initial request. Subsequent to approval of the initial request, the operator may submit an application for approval of operations specifications and en route flight procedures, using the guidelines established in item 7 of this circular.
6. **INITIAL REQUEST FOR EVALUATION.** The initial request for evaluation of an operator proposal for use of inertial navigation systems should contain the following information:

- a. Experience. Prior to presenting its initial request, an operator should have accumulated sufficient experience with the equipment to establish a history of accuracy and reliability of the inertial navigation system it proposes to use. The applicant may cite previous or related operational experience in the approval of the system being installed. The applicant may also cite operational experience obtained during type certification of the aircraft. The Agency may adjust its evaluation and approval so as to avoid unnecessary duplication of effort. A comprehensive summary of this experience should be provided to show competency in the operation and maintenance of the equipment and feasibility of the proposed operation.
- b. Training Program. The operator should outline the training program he plans to set up to comply with sections 121.411, 121.412, 121.413, 121.415, 121.417 and 121.418. Under these rules, the training program is acceptable if -
- (1) It encompasses all phases of the operation and the responsibilities of flight crewmembers, dispatchers and maintenance personnel.
  - (2) Its technical content, for pilots, covers -
    - (a) Theory and procedures, limitations, detection of malfunctions, preflight and inflight testing, cross-checking methods, etc., relating to the operation; and
    - (b) The use of computers, an explanation of all systems, a review of navigation, and flight planning.
  - (3) Its recurrent training program includes INS training and line checks using INS navigation.
  - (4) Each pilot assigned as an operating crewmember completes as many trips over a route or area (either in actual operation or, in part, in an approved simulator) under the supervision of a check airman, as may be necessary to -
    - (a) Ensure his qualification in the system; and
    - (b) Enable certification of his proficiency in the system, as required by section 121.413.
- c. Maintenance Program. The applicant should provide an outline of the training to be given maintenance personnel in the new equipment, proposed intervals for inspection and overhaul, test and inspection procedures, and the stationing of spare parts and test equipment.

d. Equipment Installation.

(1) This information should show that the planned INS equipment installation meets the appropriate criteria set forth in AC 25-4 (or meets other acceptable criteria). Dual inertial navigation systems (including navigational computers and reference units) are acceptable under FAR 121.355.

(2) This information should also show that:

(a) Cockpit arrangement will afford easy viewing and manipulation of necessary controls consistent with priority of existing equipment.

(b) Adequate lighting, suitable charts for plotting, necessary forms and related equipment will be provided in the cockpit.

e. Operations Manual. Revisions to the operations manual should be provided outlining all procedures and emphasizing the methods for preflight and inflight test and step-by-step operation of the INS. Detailed procedures for continuing the navigation function with partial or complete equipment failure and methods for determining which system is most accurate should be included.

f. Minimum Equipment List (MEL). The operator's minimum equipment list will depend on individual circumstances, but main units of navigational equipment should be operative at takeoff and so indicated in the operator's approved MEL over routes requiring use of the INS. Any exceptions should be as specifically itemized in the remarks column of the minimum equipment list for the aircraft concerned. FAA Master MELs need not be revised for this purpose.

g. Routes or Areas. A proposal for the use of self-contained navigation over land mass areas should include specific routes such as Frobisher to Churchill to Edmonton. Oceanic navigational areas may be proposed, such as North Atlantic, South Atlantic, North Pacific and South Pacific, etc. Charts, logs, flight plan forms, and other equipment to be used by the pilot in navigating his aircraft should be provided. The use of INS into airports at latitudes above 70 degrees should be covered by procedures for high latitude platform realignment. Precise coordinates accurate to within one minute should be established for a designated geographic fixed position on each airport to be used for the establishment of alignment and insertion of present position data in the aircraft's INS prior to takeoff.

- h. Demonstration of Operational Ability. The operator should provide a schedule of flights that shows his ability to use INS cockpit navigation in his operations, instead of a navigator or a previously approved specialized means of navigation. During these flights, the pilots should navigate the aircraft using INS and their navigational duties should not encroach significantly on their other required duties. The pilots should be relieved of any workload associated with any previously approved specialized means of navigation. This may be done by adding a navigator or other flight crewmember to the crew, as appropriate. The additional flight crewmember should track the flight independent of INS, and give the information obtained to the pilot-in-command. The pilot-in-command decides if changes in course are necessary to remain within allowable navigational limits. INS should not be used in Part 121 operations until the Agency approves amended operations specifications (see paragraph 7.a).
- i. Equipment Accuracy and Reliability.
- (1) INS units should be maintained within the accuracy tolerances specified by the operator's maintenance manual. A failure or malfunction within the system should not result in loss of the aircraft's required navigational capability.
  - (2) Evaluation flights should be observed by appropriate Agency personnel to determine reliability and feasibility of the system on a proposed route or oceanic area. Inertial navigation training of flight crewmembers is acceptable during evaluation flights.
- j. Agency evaluation should ensure:
- (1) Satisfactory installation of equipment.
  - (2) Accuracy of the system.
  - (3) Dependability of the system.
  - (4) Feasibility in broad geographic areas while flying in various directions.
  - (5) Adequacy of training program (operations and maintenance).
  - (6) Adequacy of operational procedures (operations and maintenance).
  - (7) Adequacy of charts, forms, hardware, etc.
  - (8) Adequacy of flight crew qualification and acceptability of cockpit workload.
  - (9) Adequacy of proposed MEL.

OPERATIONS SPECIFICATIONS - EN ROUTE FLIGHT PROCEDURES

Form Approved  
Budget Bureau No. 04-R083.1

ROUTE OR ROUTE SEGMENT	VIA	OPERATION AUTHORIZED				TYPE OF AIRCRAFT AUTHORIZED			SPECIAL REQUIREMENTS					
		DAY		NIGHT		DC-8			MOCA	MEA	MAA	OTHER	TYPE NAVIGATION <sup>1</sup>	
		VFR	IFR	VFR	IFR									
Approved routes and oceanic areas will be listed here. Example:  Frobisher to Churchill to Edmonton  or  North Atlantic Ocean	Direct	NA	X	NA	X	B-707								Inertial
	All routes over North Atlantic between Eastern and Western Gateways	NA	X	NA	X									
						Notes: Cockpit (INS) navigation authorized with the following equipment operating satisfactorily at dispatch: 1. Dual INS and Computer Systems (Items of equipment that may be inoperative will be included in the operators approved MEL and shown on this operations specification below) 2. Pilots will be qualified in accordance with approved training programs. If pilots are not qualified, specialized navigation will be required. 3. Operation of overwater portion of transatlantic flight is authorized up to and including 42,000 feet.								
EFFECTIVE DATE	NAME OF AIR CARRIER					<sup>1</sup> Where a navigator or special cockpit navigation and equipment is required, so specify; ie Navigator, Cockpit (Doppler - Loran), (Inertial).								
	XYZ Airlines, Inc.													

k. Agency observations:

- (1) Air carrier operations inspectors will observe sufficient qualification checks given to the first flight crews qualified during an initial evaluation program to ensure valid appraisal of the items listed under paragraph 6.j. Normally this will involve observation of at least 30 percent of the checks given during the initial evaluation program, however, in a potentially large operation involving numerous aircraft and flight crews the number of round trips observed need not exceed 75 where the evaluation proceeds satisfactorily. In a small operation involving only a few aircraft and flight crews, more than 30 percent of the checks may need to be observed to properly evaluate the overall program. Subsequent evaluations over additional routes or oceanic areas may require observation of a lesser number of trips.
- (2) Inspectors observe enough checks after operational approval to ensure that the operator maintains the overall quality of his program.

7. REQUEST FOR APPROVAL.

- a. The operator may forward a request for approval of its proposal following FAA observation of a representative number of satisfactory pilot qualification checks and resolution of all items arising during the initial evaluation program. Final FAA approval is indicated by approval of amended operations specifications defining the new operations and will be limited to those routes or oceanic areas over which the adequacy of the equipment and cockpit navigation has been demonstrated.
- b. Proposed operations specifications authorizing cockpit navigation over routes predicated on INS should contain the following:
  - (1) Specific route or oceanic area of operation.
  - (2) Requirement that pilots must be qualified in the navigational system.
  - (3) Specific items of INS equipment that may be inoperative for dispatch.

8. COORDINATION WITH WASHINGTON OFFICE, FS-1.

- a. The appropriate ACDO or IFO advises the Director, Flight Standards Service:
  - (1) When an application for evaluation is received.
  - (2) When any problem areas exist.
  - (3) Concerning the status of the program as it progresses.
- b. Before approving the use of INS over any route or oceanic area ACDO or IFO coordinates its recommendations with the Director, Flight Standards Service.

  
Acting Director  
Flight Standards Service



OPERATIONS SPECIFICATIONS - EN ROUTE FLIGHT PROCEDURES

Form Approved  
Budget Bureau No. 04-ROB3.1

ROUTE OR ROUTE SEGMENT	VIA	OPERATION AUTHORIZED				TYPE OF AIRCRAFT AUTHORIZED			SPECIAL REQUIREMENTS				
		DAY		NIGHT		DC-8	B-707	etc.	MOCA	MEA	MAA	OTHER	TYPE NAVIGATION <sup>1</sup>
		VFR	IFR	VFR	IFR								
Approved routes and oceanic areas will be listed here. Example:  Frobisher to Churchill to Edmonton  or  North Atlantic Ocean*	Direct          All routes over North Atlantic between Eastern and Western Gateways	NA          NA	X          X	NA          NA	X          X								Inertial
Notes: Cockpit (INS) navigation authorized with the following equipment operating satisfactorily at dispatch: 1. Dual INS and Computer Systems (Items of equipment that may be inoperative will be included in the operators approved MEL and shown on this operations specification below). 2. Both pilots will be Inertial qualified in accordance with approved training programs, except that when navigation is being performed under the supervision of an approved Inertial-qualified check pilot, the pilots performing such supervised navigation need only have satisfactorily completed the approved Inertial ground school curriculum. 3. Operation of overwater portion of transatlantic flight is authorized up to and including 42,000 feet.													*
EFFECTIVE DATE	NAME OF AIR CARRIER					<sup>1</sup> Where a navigator or special cockpit navigation and equipment is required, so specify: ie Navigator, Cockpit (Doppler - Loran), (Inertial).							
	XYZ AIRLINES, INC.												

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