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7 February 1950JOINT COMMUNICATIONS-ELECTRONICS COMMITTEE

WARNING AND TARGET INFORMATION PANEL  
COUNTERMEASURES PANEL  
COMMUNICATIONS EQUIPMENT PANEL  
FREQUENCY ALLOCATION PANEL

JOINT MILITARY CHARACTERISTICS  
FOR AN INTEGRATED AIR NAVIGATION AND  
TRAFFIC CONTROL SYSTEM WITHIN THE CONTROL ZONE

Note by the Secretaries

The enclosure, (J/AN 19/4) a report approved by the Joint Aids to Navigation Panel is forwarded for coordination to the members of the Joint Warning and Target Information Panel, Joint Countermeasures Panel, Joint Communications Equipment Panel and the Joint Frequency Allocation Panel.

W. H. BIRCH

Secretary, Joint  
Countermeasures Panel  
Secretary, Communications  
Equipment Panel

W. R. JOY

Secretary, Warning and Target  
Information Panel  
Secretary, Frequency Allocation  
Panel

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~~RESTRICTED~~ENCLOSUREJOINT MILITARY CHARACTERISTICS  
FOR AN INTEGRATED AIR NAVIGATION AND  
TRAFFIC CONTROL SYSTEM WITHIN THE CONTROL ZONEReport by the Joint Aids to Navigation PanelTHE PROBLEM

1. To adopt joint military requirements and characteristics for an integrated system of air navigation, traffic control, approach and landing within the control zone.

FACTS BEARING ON THE PROBLEM

2. Military air operations require an expeditious solution to the problem of operation of tactical and transport aircraft under all conditions of visibility. At the present time no joint military characteristics exist for a system that will solve this problem.

3. The system must be designed to accommodate all types of military aircraft, including those whose space limitations will not permit the installation of equipment equal to the present allowance. In view of limiting space, weight, and aerodynamic factors, the airborne equipment must impose minimum detriment to aircraft performance, the primary burden being placed upon the surface installations.

4. The system must meet military security requirements in order that the equipment will be of maximum service to friendly aircraft and of minimum service to an enemy. The susceptibility to enemy countermeasures must be held to a minimum.

5. The general requirements for navigation, communications and traffic control apply alike to operations of aircraft carriers and air bases, and it is essential that techniques and procedures be coordinated for the maximum standardization.

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6. The Air Navigation Development Board (ANDB) is presently proceeding with the development of a "common system" of navigational aids designed to meet civil and non-tactical military aviation requirements for traffic control and air navigation. It appears that the original concept of the "common system" will not fulfill certain military requirements.

#### DISCUSSION

7. Discussion and assumptions are contained in Appendix "D".

#### CONCLUSIONS

8. Military aircraft will be required to operate under all conditions of weather. An integrated system of navigation, traffic control, approach, and landing aids must be developed and made operational before all-weather air operation can become an actuality. Such a system is not now available.

9. Any "common system" adopted by the United States should accommodate military operations, however, the availability of a satisfactory military system should not be delayed pending the integration and development of a fully satisfactory "common system".

10. Because the requirement for all-weather flight is vital to all types of military operations, the priority of this development should be determined by the Joint Chiefs of Staff as appropriate to the mission concerned.

#### RECOMMENDATIONS

11. That the joint military characteristics as contained in Appendix "A" be approved.

12. That the approved military characteristics and supporting staff study be transmitted to the Chairman, Research and Development Board for appropriate research and development action, to the Services for information and guidance and the Chairman, Air Navigation Development Board for information.

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13. That the development and evaluation of the necessary elements of this system be prosecuted with the same priority as other essential requirements of air defense and anti-submarine warfare.

COORDINATION

14. Coordination with the Joint Warning and Target Information Panel, the Countermeasures Panel, the Communications Equipment Panel and the Frequency Allocation Panel is deemed necessary.

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~~RESTRICTED~~APPENDIX "A"JOINT MILITARY CHARACTERISTICS  
FOR AN INTEGRATED AIR NAVIGATION AND  
TRAFFIC CONTROL SYSTEM WITHIN THE CONTROL ZONEI - GENERAL INFORMATION1. Objective.

a. To provide a means for the continuous safe and efficient movement of air traffic within the control zone under all conditions of visibility. The basic system of aids shall provide communication, navigation and traffic control.

b. The following operational requirements must be satisfied to accomplish the stated objective:

(1) The system shall, insofar as practicable, deny service or countermeasures to the enemy, and not be subject to interference, either natural or "man made".

(2) The system shall be adaptable, insofar as is practicable, to both carrier and land base operation.

(3) The system shall provide for the safe, orderly and expeditious flow of air traffic throughout the controlled zone, and shall be such that it is possible for the aircraft to be navigated, without visual reference to the ground, over all portions of the route including take-off and landing.

(4) The system shall provide a landing rate of at least two aircraft per runway per minute.

(5) Be readily integrated with the air defense requirements.

(6) The system shall provide for the immediate exchange of pertinent navigation and control intelligence throughout the controlled zone.

(7) The system shall provide complete automatic traffic control, with provision for either automatic or manual flight. The ground portion of the system shall be capable of manual operation when required.

(8) Provide a minimum simultaneous control capacity of 50 airplanes, and a desired capacity of 300 airplanes.

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(9) The ground portion of the system at a particular installation must be capable of operational control from a single location.

(10) Configuration of the ground components will be adapted to fixed, portable, shipboard or air transportable versions as required.

(11) The system shall provide to the pilot continuous indication of distance and azimuth from a selected geographical point in the controlled zone.

(12) The system shall permit use of any operationally desirable track within the control zone.

(13) The system shall operate to an altitude of at least 50,000 feet, and must have a radial coverage of 100 miles at line of sight.

(14) The system shall be capable of operation in all parts of the world.

## 2. Proposed Service Employment.

### a. Installations will be utilized at the following:

(1) Air bases, with applicable portions appropriately sited within the control zone.

(2) Aircraft carriers or tenders, with applicable portions in supporting vessels.

(3) The airborne portion of the system shall be capable of installation in all types of military aircraft.

### b. Internal location of equipment:

(1) Adequately protected space for control operations in a designated control center.

(2) Equipment and antenna locations as required for satisfactory performance.

(3) Airborne components available for pilot control and display.

## 3. The system shall provide for the following functions:

### a. Primary functions.

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(1) Automatic identification, tracking, sequencing, spacing and direction of flight paths for all aircraft within the controlled zone.

(2) The system shall be capable of providing a continuous and expeditious track control from any desired point in the control zone to the completion of landing roll.

(3) The system shall provide a means of enabling aircraft to proceed expeditiously to their parking area or to the take-off runway under conditions of low visibility.

(4) Automatically controlling the flight path of departing aircraft through the departure area.

(5) Automatic control of missed approaches.

(6) The system shall provide surveillance of the approach path to insure safety, and shall provide precise approach path guidance to aircraft without full equipment.

(7) The system shall provide for the immediate exchange of intelligence throughout the controlled zone.

(8) The system shall provide to the pilot continuous indication of distance and azimuth from a selected geographical point in the controlled zone.

b. Secondary functions.

(1) Be readily integrated with the air defense requirements.

(2) The system shall be capable of extension by installing additional surface units and interconnecting communication channels.

(3) Maximum security as regards obtaining of intelligence from the system by the enemy, or enemy countermeasures.

(4) Maximum employment of installations and equipments previously provided for tactical purposes.

4. General

a. In an All Weather Operation it is considered necessary that air operations, both combat and transport, be conducted with

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a maximum degree of safety and efficiency under all conditions of visibility. A prerequisite to safe and efficient all weather operation is the highest degree of instrument flight proficiency and judgment on the part of the pilot. Nevertheless, in order to handle large numbers of aircraft and to permit them to land expeditiously under conditions of low visibility and ceiling, automatic features are considered necessary.

b. The operational employment of combat aircraft, particularly in the initial phase of any future war, may require the execution of combat missions to the maximum tactical radius of the aircraft concerned. This means that aircraft returning to base will not have an appreciable amount of reserve fuel. Landings must be accomplished as expeditiously as the acceptance rate of the runway or runways will permit, regardless of visibility. In order to do this, precise timing is necessary to establish desired landing intervals not only on the final approach path, but extending into the control area as far as necessary.

c. The most hazardous and difficult flight conditions are encountered in the control zone including the approach and landing. The combination of poor weather conditions and high traffic density multiplies these difficulties and hazards. No satisfactory solution has been found to the problem of short distance navigation, traffic control, and landing during all weather and high traffic density conditions.

##### 5. Availability Date.

a. A present and continuing need exists for this system, and until steps are taken to provide such a system the capability of air operations is reduced intolerably during periods of low visibility. It is not expected that the system will be developed in one step to its complete form, since operational experience and developments in associated fields will permit periodic improvement in accuracy, minimum visibility, traffic handling capacity and landing interval. To specify a date for the complete system is unrealistic, therefore, research and development of existing equip-

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ment should be continuous until flight operations can be conducted without regard to weather conditions.

## II - OPERATIONAL CHARACTERISTICS

1. Frequency coverage.
  - a. As required.
  - b. Channel requirements as necessary.
2. Emission as required.
3. Range as required.
4. Spatial coverage as required.
5. Minimum susceptibility to interference compatible with functional performance standards.
6. Individual plane identification as required.
7. Stability as required.
8. Resolution and discrimination as required.
9. Accuracy and fidelity as required.
10. Emolcy, insofar as feasible, the equipment installed in the aircraft as required by its mission. Supplementary functions shall be accomplished by surface installed equipment to the maximum extent practicable.

## III - PHYSICAL CHARACTERISTICS

1. Any detriment to aircraft performance, caused by installation of the systems components, shall be held to a minimum. Configuration of the ground components will be adapted to fixed, portable, shipboard or air transportable versions as required.
2. Arrangement and coordination of component units as required.
3. Provision to operate with currently effective communication system.
4. Power supply as required.
5. Maximum practicable standardization.
6. Construction characteristics as appropriate to purpose of individual component and operating location.
7. Arrangement of equipment as required for most efficient operation.

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8. Compact, portable pre-flight ground test units shall be provided for testing and aligning all airborne system components.
9. Stabilization as required.
10. Standard destruction requirements will apply.
11. Maximum use of miniaturization techniques for airborne equipment.

#### IV . EQUIPMENT OPERATION AND MAINTENANCE CHARACTERISTICS

1. Operating time for surface installations continuous except for routine maintenance periods. Airborne operating time for duration of flight.
2. Adjustments to be the minimum compatible with satisfactory operation.
3. Control features as required.
4. Data transmission as required.
5. The system shall incorporate fail safe provisions.
6. All airborne equipments shall be provided with appropriate indicators to alert the pilot in the event of malfunction of the system.
7. Optimum warm-up time to full operation.
8. Minimum number and skill of personnel compatible with satisfactory functioning.
9. The component equipments will be designed so as to permit ease of maintenance in the field, i.e., built in test equipment, quick change, rugged and interchangeable components. Emergency maintenance procedures (required during operations) shall be capable of being accomplished by substitution of components with power-on insofar as standard engineering safety, design, and construction practices will permit.

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~~RESTRICTED~~APPENDIX "B"

MEMORANDUM FOR THE CHAIRMAN, RESEARCH AND DEVELOPMENT BOARD

Subject: Joint Military Characteristics for an Integrated Air Navigation and Traffic Control System within the Control Zone.

Enclosure: Copy of Subject Report.

The enclosure was approved for joint use on \_\_\_\_\_ by the Joint Communications-Electronics Committee, and is forwarded to the Committee on Navigation, Research and Development Board, for appropriate research and development action.

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~~RESTRICTED~~APPENDIX "C"

MEMORANDUM FOR THE SERVICES AND THE CHAIRMAN, AIR NAVIGATION  
DEVELOPMENT BOARD.

Subject: Joint Military Characteristics for an Integrated Air  
Navigation and Traffic Control System within the  
Control Zone

Enclosure: Copy of Subject Report.

1. The enclosure was approved for joint use \_\_\_\_\_  
by the Joint Communications-Electronics Committee, and is forwarded  
to the Services for information and guidance and to the Chairman,  
Air Navigation Development Board for information.

2. A copy of the enclosure is being forwarded to the Committee  
on Navigation, Research and Development Board, for appropriate re-  
search and development action.

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~~RESTRICTED~~APPENDIX "D"JOINT MILITARY CHARACTERISTICS  
FOR AN INTEGRATED AIR NAVIGATION AND  
TRAFFIC CONTROL SYSTEM WITHIN THE CONTROL ZONEDiscussion

1. An air traffic control system must satisfy two primary operational functions:
  - a. Maintenance of safe separation between aircraft.
  - b. Expeditious progress of aircraft operating in the system.
2. Tactical military air operations, including training flights, consist basically of off-airways flights. These flights will have random times of arrival and directions of approach to the control zone. A system adequate to meet all military requirements must accommodate such flights as well as scheduled point-to-point flights. The system must be capable of handling aircraft arriving both singly and in formation.
3. An immediate requirement for such a system is demonstrated both in the conduct of the Berlin Air Lift and in the conduct of tactical training operations.
4. The execution of combat missions will require operation at the maximum performance of the aircraft concerned, with the result that returning aircraft will require the most expeditious handling within the control zone.
5. The system should provide sufficient and appropriate data to permit automatic as well as manual control of all aircraft. Manual instrument landing is a necessary alternate to monitored automatic landing.

DEFINITION

5. The definition for "control zone" in Civil Air Regulation, Part 60.74 is as follows: "An air space of defined dimensions designated by the Administrator extending upward from the surface to include one or more airports and within which rules additional to those governing flight in control areas apply for the protection of air traffic".

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7. The above definition is assumed to apply. The control zone may be of any varying size and shape which can be circumscribed by a circle of radius not in excess of 100 miles. The number and relative location of landing areas will vary among control zones, with each landing area equipped to accomplish separate initial and final approach control.

8. Security assumptions are as follows:

a. An enemy will be able to intercept and take useful bearings on signals in all parts of the frequency spectrum, either from aircraft or surface installations. The use of VHF and UHF will restrict the radius within which the enemy can obtain intelligence from the system's operation, and within which the enemy may be expected to intercept and D/F all types of signals.

b. The enemy will be capable of emitting interfering signals effective to a degree which will depend upon the distance from the receiving installation concerned, and upon the relative magnitude of useful and jamming signals.

c. The location of fixed radiating elements of the system cannot be kept from the enemy for an extensive operating period, but the use of VHF and higher frequencies will require a more extensive reconnaissance on the part of the enemy.

d. Dependence on airborne emissions will yield useful information to a properly equipped enemy, thereby endangering the security of our own aircraft, and should be kept to a minimum.

9. The presently proposed civil air traffic control system may not meet all security requirements, and may not accommodate all types of tactical aircraft at the required interval.

10. Areas immediately downwind and upwind of each active landing strip will be reserved for final approach, pull-up, and departure.

11. Aircraft pulling up from a missed approach will require a new approach with a minimum of delay, and will follow a designated procedure to arrive at a point for respacing in the approach pattern.

12. Weather information within the approach control area will be

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provided to the pilots.

13. Many military aircraft will be equipped with airborne radar, IFF, and radio altimeters.

14. A suitable beacon will be necessary for radar assist and identification. such beacon will be available to supplement other navigational aids.

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