ORDER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

7032.5

2/28/84

SUBJ: AIRPORT SURFACE DETECTION EQUIPMENT (ASDE-3) AIR TRAFFIC SERVICE OPERATIONAL REQUIREMENTS

1. PURPOSE. This order establishes the Air Traffic Service operational requirements for the ASDE-3.

2. DISTRIBUTION. This order is distributed to the branch level in the Air Traffic, Program Engineering and Maintenance, and Systems Engineering Services, Technical Center, regional Air Traffic Divisions and to the Aeronautical Center, air route traffic control centers, military liaison officers and Level IV and V terminals.

3. APPLICATION. This order applies to all Air Traffic Service personnel and is for the guidance of all other organizational units.

4. MISSION NEED. The primary need for an ASDE is to obtain positive surveillance and assist in expediting aircraft flow during restricted visibility conditions. The following are examples of the use of ASDE by controllers on a continuing basis during periods of restricted visibility:

a. Ascertain that departing aircraft have taxied into position for takeoff on the proper runway of two close parallel runways when arriving aircraft are on final approach for landing on the adjacent runway.

b. Ascertain that taxiing aircraft are not inadvertently entering an active runway during restricted visibility conditions when the pilot may not be able to see adequately to determine that he is holding short of a runway.

c. Assist the ground controller in preventing collision situations, and providing an orderly movement of aircraft and ground vehicles on the airport surface when visibility restrictions prevent the controller, pilots, or vehicle operators from seeing other ground traffic on the airport.

d. Determine that runways are not occupied by other aircraft, ground vehicles, or other obstructions prior to issuing takeoff/landing clearance to departing/landing aircraft.

e. The ASDE is, to some extent, used at night to determine positions of aircraft where the distance to the end of the runway and the flat viewing angle from the tower cab do not allow the controller to visually determine relative positions of aircraft awaiting takeoff.

5. PROBLEM DEFINITION. The ASDE-2 now used at several major airports has been operational for the past 20 years. Being a vacuum tube design, it has had a maintenance problem with tube failures, resulting in a mean time between failures

Distribution: A-W(AT,PM,ES)-3; A-X(AT)-3; A-Y-1; A-Z-3; A-FAT-1-7(STD); A-FAT-2,8 (Level IV and V only)

Initiated By: AAT-150

rate of approximately 200 hours. In addition, the radar is nearly useless in heavy rain due to backscatter from rain droplets, resulting in a whiteout and absorption of signals at its emitted frequency by the rain.

6. SYSTEM DESCRIPTION. The ASDE-3 will be a high resolution ground mapping radar that shall provide the local and ground controllers in the control tower a clear, accurate, and bright presentation of airport runways, taxiways, and aprons, and of any stationary or moving aircraft or vehicles on these surfaces under all weather conditions.

7. OPERATIONAL REQUIREMENTS.

a. Performance.

(1) The system must provide coverage for all existing movement areas (runways, taxiways, instrument landing system critical holding areas, etc.) and airport master plan approved additions for the following airports:

(a) Denver, CO
(b) Dallas/Ft. Worth, TX
(c) Los Angeles, CA
(d) Atlanta, GA
(e) Chicago (O'Hare), IL
(f) Boston, MA
(g) New York (JFK), NY
(h) San Francisco, CA
(i) Miami, FL
(j) Cleveland, OH
(k) Washington (National), VA
(l) Pittsburgh, PA
(m) St. Louis, MO
(n) Philadelphia, PA
(o) Memphis, TN
(p) New York (LaGuardia), NY
(q) Houston, TX
(r) Minneapolis, MN
(s) Detroit, MI
(t) Tampa, FL
(u) Seattle, WA
(v) Baltimore, MD
(w) Newark, NJ
(x) Portland, OR
(y) New Orleans, LA
(z) Kansas City, MO
(aa) Washington (Dulles), VA
(bb) Andrews AFB, MD

Note: This requirement may be satisfied by multiple sensors capable of presenting all information (and/or any part) on a common display.

(2) The area of nonreturn around the sensor shall not have a radius of greater than 500 feet.

(3) The system shall be capable of detecting aircraft (whose radar cross section (RCS) is 3 m^2 (estimated RCS of a small single engine aircraft)) up to a height of 200 feet above ground level.

(4) The system shall be capable of detecting and displaying all aircraft/service vehicles/etc., within the sensor's designated coverage.

(5) The system shall be capable of detecting high speed (165 knots) aircraft.

(6) The actual position of a 3 m^2 RCS target on the ground shall be within 20 feet of the displayed target position.

(7) The system must be capable of distinguishing two aircraft having 3 m^2 RCS each, when separated by 40 feet in range or 80 feet in azimuth. The system must also be capable of resolving two aircraft and/or vehicles, regardless of size, when separated by 80 feet.

	Size	Vehicle Length
(a)	Small aircraft (Cessna 150 or vehicle)	Up to 50 feet
(b)	Medium aircraft (B-727/DC-9)	90 to 160 feet
(c)	Large aircraft (B-747/DC-8)	180 feet and above

(8) The slant range error shall not exceed 50 feet.

(9) The map lines shall be within 12 feet of the radar received position of the actual edge of the runways, taxiways, etc.

(10) The system shall provide an update rate of once per second.

(11) There shall be no evidence of second-time-around or other spurious returns on the presentation.

(12) The system shall be useable (within the limits stated in this order) during all weather conditions.

(13) The capability shall exist for slaving an additional display from each of the independent displays for system expansion (two local controls and/or two ground controls) without any loss in presentation quality.

(14) Eliminate, to the extent possible, the effects of shadowing on the movement areas. Note: Due to the inherent nature of radar, we recognize shadowing cannot be totally eliminated.

b. Reliability/Availability. The operational availability of the ASDE radar system shall be at least 0.995. This figure shall be calculated using all downtime, including scheduled maintenance. The ASDE system is considered to have failed when ATC can no longer provide full service through data obtained from the ASDE. This includes loss or degradation of performance outside the limits stated in this order, regardless of the location of the sensor, weather conditions, or whether on main or standby power.

c. Display.

(1) Independent displays at each local and ground control position shall be provided.

(2) The quality of the presentation shall be constant throughout the display area, clear of clutter, flicker free, and of uniform brightness.

(3) The presentation shall be well defined and blooming eliminated.

(4) The presentation shall provide sufficient contrast and brightness under all ambient light conditions and must be free of reflection and glare.

(5) The display presentation shall be rectangular with a diagonal of no less than 14 inches.

(6) The system shall provide the capability to write alphanumerics anywhere on the display.

(7) Each display shall have an associated QWERTY keyboard (standard typewriter keyboard) with a ten key numeric board and have back lit keys with variable intensity.

(8) Each display key-pack unit shall have an alphanumeric gain and character size controls.

(9) All operator controls (range scale, map selection, etc.) will be key-pack menu driven, with the exception of focus, contrast, and brightness.

(10) There shall be a data entry device (cursor) to locate selected menu items (e.g., alphanumerics, off-center, etc.).

(11) All operator controls and key-pack units shall be immediately accessible to the user.

(12) Each display shall have the capability of independent split-screen presentations with independent range scales, and shall have the same presentation quality as when the split-screen capability is not in use.

(13) Each display shall have independent reverse video capability, operator controlled and shall not affect the quality of the presentation.

(14) Full variable range and range offset shall be provided.

(15) After changing the range, offset, etc., the display shall recover its presentation quality within 1 second.

(16) A variable target trail history of up to 16 scans shall be provided with separate operator controls. Runway areas shall have a greater target history capability than taxiway/apron areas.

d. Environmental.

(1) Equipment associated with the ASDE shall not create an obstruction to visibility or movement within the tower cab.

(2) The operation of the sensor shall result in no vibration and the noise level must be nondistractive and shall not exceed the limits specified in paragraph 3.3.1.7 of FAA-G-2100C (FAA standards for tolerable noise levels).

(3) The display background color shall be the most pleasing and optimum for use of controlling airport surface traffic.

(4) The display shall be designed in such a manner that will eliminate all black hole effects.

(5) The contractor shall allow participation by the operational requirements team in the design development of the human-machine interface.

e. Data processing.

(1) This system shall not be designed in a way that would preclude the capability of accommodating data block association.

(2) The video mapper shall be completely programmable with software flexibility to allow for modification in a realistic time frame by local maintenance personnel. The map shall be able to outline all movement areas and any other areas deemed appropriate by local air traffic facility management (e.g., ILS critical signal protection clear areas). The mapping shall be of such definition so as to not detract from any target presentation, be of consistent width and, when appropriate, appear as straight lines (i.e., runways, etc.).

(3) The split-screen system shall have the capability of accommodating independent maps. The number of maps will be determined by local operational requirements (e.g., runway configurations, number of displays, etc.). The maximum number of maps, one of which shall be a crash grid, shall be established prior to completion of the specification.

(4) The system shall have the capability of suppression and total blanking of designated areas in accordance with stored information. Two programmable independent levels of suppression shall be simultaneously available.

(a) Suppression - allows control of video in designated areas by programming.

(b) Blanking - eliminates all video in designated areas.

(5) The system shall have the capability, from the console, of receiving all video in designated suppressed and blanked areas for the purpose of locating aircraft and vehicles off movement areas.

(6) All data shall be retained when on or going to standby power (or going back to commercial power).

f. Testing. The Air Traffic Service shall conduct an operational acceptance test on the first production system delivered to a facility. The operational acceptance test will employ controller personnel and will include a series of tests involving different sized and shaped aircraft and vehicles. Some of the areas the tests will concentrate on will be surveillance accuracy, target resolution, coverage, target detection performance, display characteristics, data processing functions, presentation quality, and system performance during at least moderate rain.

g. Training. Upon delivery, operator manuals shall be provided to each facility for the purpose of training air traffic personnel in operator interface.

R. J. Van Vuren
Associate Administrator
for Air Traffic