Attachment 18

AIR TRAFFIC CONTROL TOWER (ATCT) SITING CRITERIA

A18.1. General Information. Locating and siting an ATCT is a complex procedure that involves many operational and technical requirements. The tower cab must be correctly oriented. The area to be controlled must be visible from the cab. The air traffic controller must have proper depth perception of the area under surveillance, and there can be no electronic interference with equipment in the cab nor with navigational equipment on the ground. For these considerations and other operational and technical aspects of selecting a site, consult Air Force Flight Standards Agency, Engineering and Systems Integration Branch (HQ AFFSA/XRE), 1535 Command Drive, Suite D309, Andrews AFB, MD 20762-7002 and 38 Engineering Installation Wing (38 EIG/EICG), 3580 D AVE, Bldg 201W, Tinker AFB, OK 73145-9155, in the early stages of planning. A site survey will be conducted to determine the best siting for the proposed ATCT. For accurate planning and design considerations, the site survey should be conducted within five years of the projected ATCT construction completion date. More specific architectural, structural, mechanical, and electrical systems design requirements may be found in the Air Traffic Control Tower Design Guide published by the Design Group Division at Headquarters, Air Force Center for Environmental Excellence (HQ AFCEE/DCD), 8004 Arnold Drive, Brooks AFB TX 78235-5361.

A18.2. Siting Criteria. ATCT siting and height determination require sound engineering principles and close coordination with the host base. Siting project engineers should consider factors that relate to the economics of each candidate site, such as accessibility to utilities, subsoil and ground water conditions, expansion possibilities, as well as selecting a site requiring a tower of the minimum height necessary to meet the specific requirements. The following specific guidelines should be followed:

A18.2.1. The air traffic controllers operating this facility should have a clear, unobstructed, and direct view to all operating positions of the airport traffic area; to the approach end of the primary instrument runway; and all other active runways, taxiways, parking aprons, test pads, and similar areas. The tower should be located close to runway midpoints and equidistant from other airfield areas to the greatest extent possible.

A18.2.2. The site must provide sufficient area to accommodate the initial building and any planned expansions, including vehicle parking, fuel storage tanks, and exterior transformers.

A18.2.3. Siting of the ATCT must meet explosives separation distance criteria in AFMAN 91-201.

A18.2.4. As a minimum, the site must conform to ground system and obstruction clearance criteria for Category II Instrument Landing Operations (see Federal Aviation Administration Handbook (FAAH) 7110.65, Air Traffic Control, and AFMAN 11-230).

A18.2.5. The ATCT must be sited where it will not detract from the performance of existing or planned electronic air navigational facilities (terminal very high frequency omnirange (TVOR), air-port surveillance radar (ASR), and tactical air navigation (TACAN)). There are no criteria that establish minimum distances from electronic air navigational facilities. However, the facilities most likely to be affected are the TVOR, TACAN, and ASR. The ATCT should be no closer than 300 m (1,000 feet) from these three facilities. Other electronic air navigation facilities (precision approach radar, ILS) are not as likely to be affected because their usage is more directed along the runway's major axis. However, care should be taken in siting the ATCT so it does not conflict with proper operation of these facilities.

A18.2.6. Sufficient depth perception of all surface areas to be controlled must be provided. This is the ability to differentiate the number and type of grouped aircraft and ground vehicles and to observe their movement and position relative to the airfield surface areas. Proper depth perception is provided when

the controller's line-of-sight is perpendicular or oblique to the line established by aircraft and ground vehicle movement, and where the line-of-sight intersects the airfield surface at a vertical angle of 35 minutes or more. Required eye level elevation is determined using the following formula:

$E_e = E_{as} + D \tan (35 \text{ min} + G_s)$

Where:

E_e = Eye-level elevation (1.5 m (5') above control cab floor).

E_{as} = Average elevation for section of airfield traffic surface in question.

D = Distance from proposed tower site to section of airfield traffic surface in question.

G_s = Angular slope of airfield traffic surface measured from horizontal and in direction of proposed tower site (negative value if slope is downward towards the tower, positive value if slope is upward towards the tower).

A18.2.7. Siting should conform to airfield and airspace criteria in Chapter 3. Deviations should only be considered when they are absolutely necessary. Any deviations require a waiver.

A18.2.8. Siting should provide an acceptable orientation of the tower cab. The preferred tower cab orientation in relation to the runway is obtained when the long axis of the equipment console is parallel to the primary runway. The reason for this orientation is to allow controllers to face the runway and the ATCT instrument panel without frequently turning their heads to observe events on the runway. Preferred direction should be north (or alternatively, east, south, or west, in that order of preference) when sited in the Northern Hemisphere. Also, locations that place the runway approach in line with the rising or setting sun should be avoided.

A18.2.9. Siting should be such that visibility is not impaired by external lights such as floodlights on the ramp, rotating beacons, reflective surfaces, and similar sources.

A18.2.10. Siting should consider local weather phenomena to keep visibility restriction due to fog or ground haze to a minimum.

A18.2.11. Siting should be in an area relatively free of jet exhaust fumes and other visibility impairments such as industrial smoke, dust, and fire training areas.

A18.2.12. The tower should be sited in an area where exterior noise sources are minimized. For noise level determination, site selection project engineers should enlist the assistance of a host base civil engineer and a bioenvironmental engineer. They should also make use of the Air Force *Bioenvironmental Noise Data Handbook* (AMRL-TR-7550) and noise level data available in the Base Comprehensive Plan. Special efforts should be made to separate the ATCT from aircraft engine test cells, engine run-up area, aircraft parking areas, and other sources of noise.

A18.2.13. Efforts should be made to site the ATCT so that access can be gained without crossing areas of aircraft operations.

A18.2.14. Siting should be coordinated as much as possible with the Base Comprehensive Plan. Particular attention should be given to future construction (including additions or extensions) of buildings, runways, taxiways, and aprons to preclude obstructing controller visibility at a future date.

A18.2.15. The ATCT should be sited so it is free of interference from or interference with existing communications-electronics meteorology or non- communications-electronics meteorology facilities. If an acceptable location is not otherwise obtainable, consider relocating these facilities.

Figure A18.1. Runway Profile and New Control Tower.

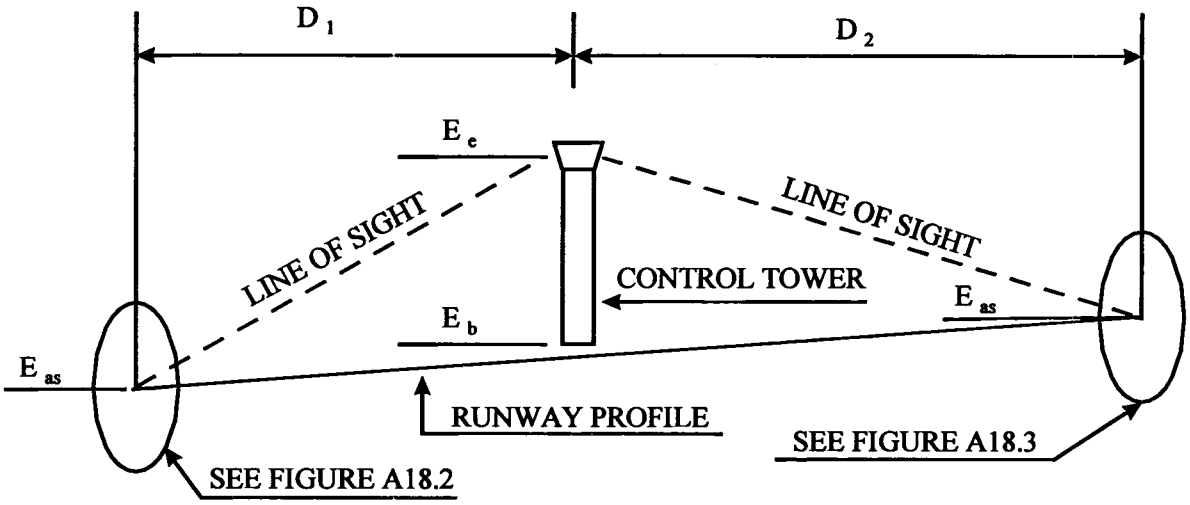
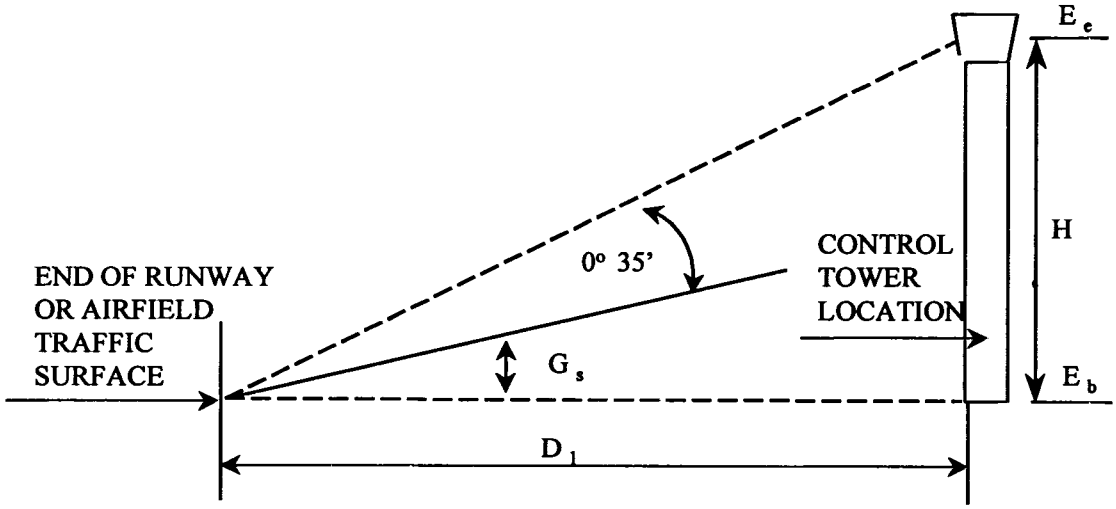


Figure A18.2. Minimum Eye-Level Determination.



Given: E_{as} = 30.5 m (100') MSL E_b = 32.3 m (106') MSL

D_1 = 1,828.8 m (6,000')

G_s = +2 min

Find E_e:

E_e = 30.5 m (100') + H

= 30.5 m (100') + (1,828.8 m (6,000') x tan (35 min + 2 min))

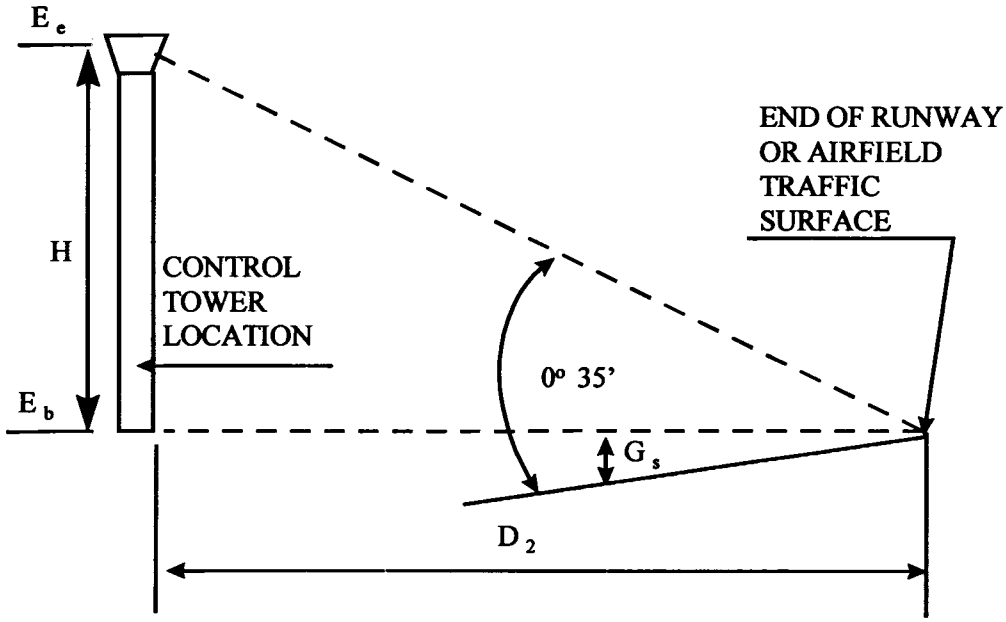
= 30.5 m (100') + (1,828.8 m (6,000') x 0.01076)

= 30.5 m (100') + 19.7 m (64.6')

= 50.2 m (164.6') MSL

Required Eye Level Height = E_e - E_b = 50.2 m (164.6') - 32.3 m (106.0') = 17.9 m (58.6')

Figure A18.3. Minimum Eye Level Measurement.



Given: E_{as} = 33.5 m (110') MSL E_b = 32.3 m (106.0') MSL

D_2 = 1,828.8 m (6,000')

G_s = - 2 min

Find E_e:

E_e = 33.5 m (110') + H

= 33.5 m (110') + (1,828.8 m (6,000') x tan (35 min - 2 min))

= 33.5 m (110') + (1,828.8 m (6,000') x 0.0096)

= 33.5 m (110') + 17.6 m (57.6')

= 51.1 m (167.6') MSL

Required Eye Level Height = E_e - E_b = 51.1 m (167.6') - 32.3 m (106.0') = 18.8m (61.6')

CONCLUSIONS:

a. 18.8 m (61.6') height is larger and therefore controls.

b. Eye height to cab ceiling is 2.1 m (7'), therefore overall height is (2.1 m (7') +18.8 m (61.6') = 20.9 m (68.6')).

c. In this case minimum tower height of 20.4 m (67') will not satisfy requirements (see figure A18.4). Therefore, in order to meet the minimum 35-minute depth perception requirement, an additional floor must be added to increase the overall height of the proposed control tower.

A18.3. Minimum Required Floor Levels. The ATCT height is established by the required number of floor levels or by the 35-minute depth perception requirement, whichever is greater. As a rule, all towers have the following floors, starting with the ground floor (see figure A2-4):

A18.3.1. Chief Controller Office, 3 m (10').

A18.3.2. Training or crew briefing room, 3 m (10').

A18.3.3. Lower electronics equipment room, 3 m (10').

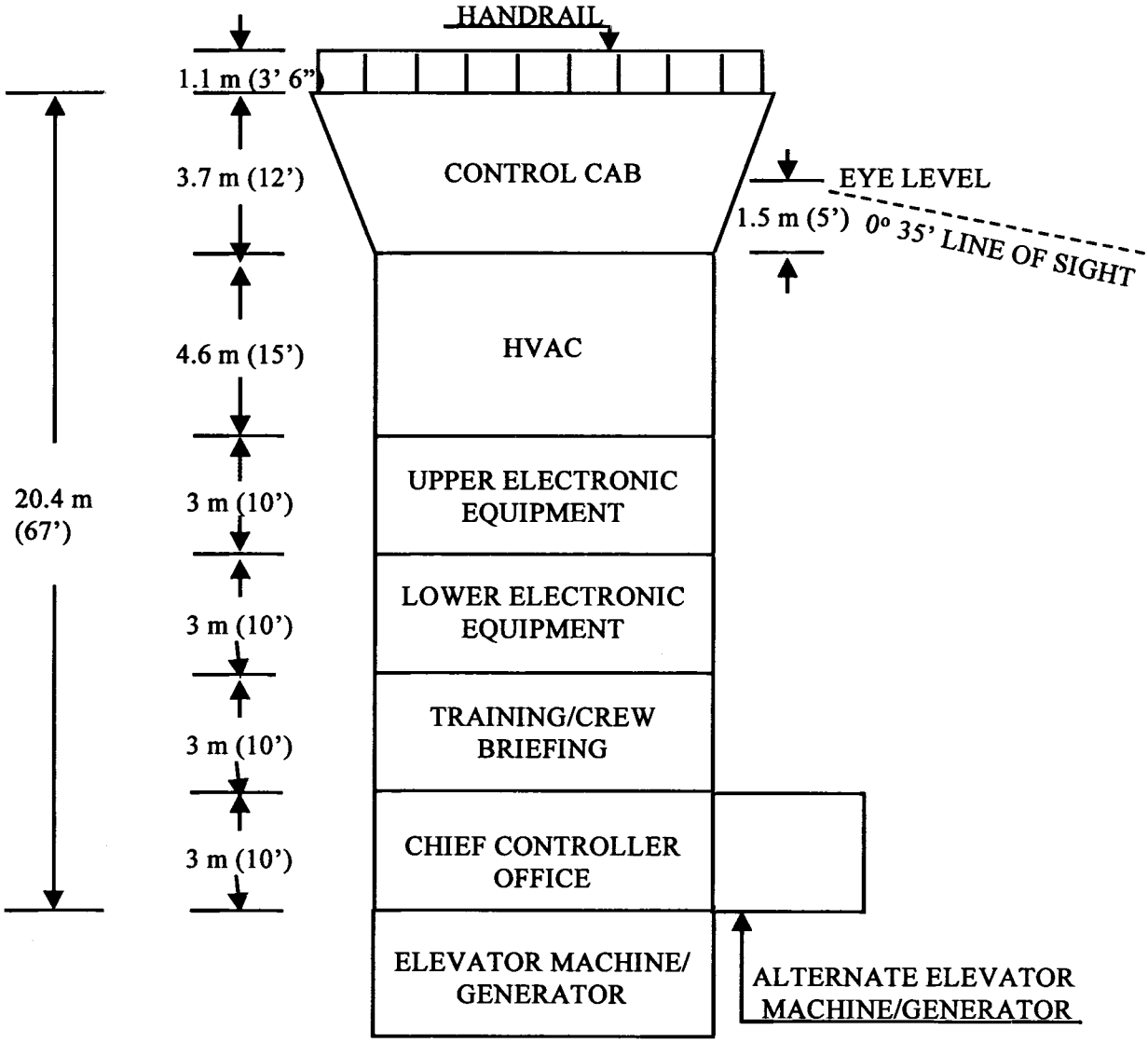
A18.3.4. Upper electronics equipment room, 3 m (10').

A18.3.5. Heating, ventilating, air conditioning room, 4.6 m (15').

A18.3.6. Tower cab, 3.7 m (12') to roofline.

NOTE: If more height is required to obtain the 35-minute depth perception requirement, add additional open intermediate floors with 3 m (10') story height.

Figure A18.4. Minimum Tower Floors.



A18.4. Siting Procedures. A representative from Air Force Flight Standards Agency, Engineering and Systems Integration Branch (AFFSA/XRE), usually serves as project siting engineer for tower siting and a representative from the Engineering Installation Wing (EIW/EICG) usually serves as project engineer for support equipment installation. The project siting engineer, in determining the site recommendation, should fix the ATCT siting and height to the cab floor with assistance from and concurrence of Base Communications (Plans and Programs), Base Airfield Operations Flight (Control Tower and Airfield Management), and Base Civil Engineering offices. The project engineer for support equipment installation

will establish internal ancillary equipment requirements based on an assessment of operational needs. Suggested procedures for selecting an ATCT site are in A18.4.1 and A18.4.2 below:

A18.4.1. Office Study by Siting Engineers.

A18.4.1.1. Using elements of the most up-to-date Base Comprehensive Plan, make tentative site selections. Using elements of the Base Comprehensive Plan and the 35-minute depth perception requirements, determine the approximate tower height for each tentative site selected.

A18.4.1.2. Analyze more than one tentative site if appropriate.

A18.4.2. Field Study by Siting Engineers:

A18.4.2.1. Conduct field review of the office-selected tentative sites plus other sites that merit consideration based on discussions with base organizations and the on-location surveys. Consider both siting requirements and siting considerations previously discussed.

A18.4.2.2. Consider in the survey of each site the availability and cost of access roads, utility extensions, and communications cable relocations. The Base Civil Engineer should make the cost estimates. Also, the Base Civil Engineer should evaluate each site to determine the adequacy of ground conditions for structural support of the tower, drainage characteristics, and availability of utilities.

A18.4.2.3. Use profile drawings and shadow maps to determine areas of visibility restrictions due to other structures.

A18.4.2.4. If available and practical, obtain panoramic pictures taken at the proposed tower cab eye level at each tentative site. Photographs should be in color to allow precise interpretation of the surfaces and objects viewed, and should be oriented to true north and for the complete 360-degree horizontal plane around the site. Suggested methods of taking pictures are from a helicopter, cherry picker, or crane boom.

A18.4.2.5. Consider the environmental impact of each site. The Environmental Impact Analysis Process (EIAP) is accomplished through the base civil engineer.

A18.5. Site Recommendations. On completing the field study, siting participants should evaluate each alternative location and should recommend a site. The project siting engineer should then compile all siting data, comparisons, and determinations (including the siting recommendation) in a Statement of Intent (SOI). If practical, the SOI should be signed by all participating personnel, the base communications officer, the Base Civil Engineer, and the base commander. If practical, the SOI must be completed and signed by appropriate personnel before completing the field study. The SOI should include the following:

A18.5.1. Siting recommendation—location, orientation, and height.

A18.5.2. Data comparisons and determinations made during field study.

A18.5.3. Reasons for deviations, if any, from siting requirements.

A18.5.4. Panoramic pictures, if available.

A18.5.5. Economic evaluations, if applicable.

A18.5.6. Major construction requirements to support communications-electronic (C-E) equipment, if applicable.

A18.5.7. Other special considerations.

A18.6. SOI Distribution. The SOI should be distributed to all signatories for programming the support construction and the CE installation. Copies should be retained by the appropriate Base Civil Engineer, Communications, and Airfield Operations Flight offices. Copies should be sent to the MAJCOM and AFFSA/XR. After agreement to a siting recommendation, the host base submits the siting plan to the appropriate MAJCOM for approval. A sample of SOI is shown on the following pages.

A18.7. Sample Statement Of Intent (SOI)

A18.7.1. This is a Statement of Intent (SOI) between HQ AFFSA/XR and (enter appropriate Wing) as it pertains to the (enter date) Site Survey for the proposed new air traffic control tower at (enter appropriate base).

A18.7.2. The purpose of this SOI is to reserve the area required for this project, to note the major allied support requirements needed for later installation of the project equipment, and to serve as a source document for Project Book preparation.

A18.7.3. This survey considers (enter appropriate number) possible control tower locations:

A18.7.3.1. Site No. 1: (Verbally describe location).

A18.7.3.2. Site No. 2: (Verbally describe location).

A18.7.3.3. Site No. 3: (Verbally describe location).

A18.7.4. Site Numbers. (insert appropriate numbers) were rejected for the following reasons:

A18.7.4.1. Site No. _____: (Insert reasons for rejection).

A18.7.4.2. Site No. _____: (Insert reasons for rejection).

A18.7.5. Based on the results of this survey, it is recommended that Site Number _____ be selected for the new control tower. The following rationale supports this recommendation: (Insert rationale.)

A18.7.6. The control tower will be designed using the _____ AFB control tower as a guide. The height of the control tower will be (insert height in meters (feet)). See attached sketch. This height is necessary to provide adequate visibility for taxiways/ runways and to provide the minimum angle of 35 minutes for depth perception to the farthest aircraft traffic surface on the airdrome.

A18.7.7. Allied Support Requirements:

A18.7.7.1. Utilities. Electrical power shall be 120/208, (Insert appropriate number) Hz, plus or minus 10 percent, three-phase, four wire.

A18.7.7.2. Environmental Requirements: Environmental control is required in the control cab and the two electronic equipment rooms in order to sustain effective and continuous electronic equipment operation. The operational limits and the amount of heat dissipated by the equipment are as follows:

Room Heat Dissipated Temp/Humidity

Tower Cab _____BTU _____/_____

Upper Equipment Room _____BTU _____/_____

Lower Equipment Room _____BTU _____/_____

A18.7.7.3. Field Lighting Panel: A field lighting panel, connected to the night lighting vault, will be required for this new structure.

A18.7.7.4. Communications: All existing communication lines/circuitry for NAVAID monitors and radio transmitters/receivers now terminated in the existing control tower shall be provided to the new control tower.

A18.7.7.5. Underground Duct: The existing base duct system must be extended to the proposed control tower site for the field lighting cables, primary power cables, control cables, telephone cables, and meteorological cables.

A18.7.8. After the control tower project has become a firm MCP item, programming action should be initiated by the base Communications Squadron to relocate the electronic equipment from the old control tower.

A18.7.9. Points of contact concerning the survey are _____, HQ AFFSA/XRE, DSN 858-3986 , and _____, 38 EIG/EICG, DSN 884-2888.