

AD-A075 140 ARMY FACILITIES ENGINEERING SUPPORT AGENCY FORT BELV--ETC F/G 13/1

CEILING FANS FOR ENERGY CONSERVATION.(U)

MAY 79 6 T STORY

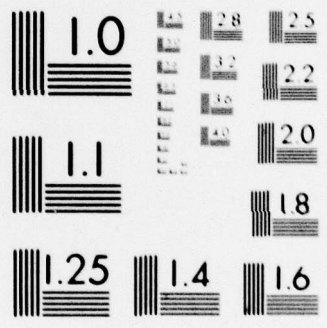
UNCLASSIFIED USAFESA-TS-2069

NL

| OF |
AD
A075140



END
DATE
FILMED
11-79
DDC



MICROCOPY RESOLUTION TEST CHART
 NATIONAL BUREAU OF STANDARDS 1963-A

12

FESA-TS-2069

LEVEL II

AD A075140

CEILING FANS FOR ENERGY CONSERVATION

GEORGE T. STORY

15 May 1979

Final Report

DDC FILE COPY

Prepared for
US Army Facilities Engineering Support Agency
Technology Support Division
Fort Belvoir, VA 22060

DDC
RECEIVED
OCT 17 1979
A

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

79 10 16 024

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ES-TS-2069	2. GOVT ACCESSION NO. (14) USA	3. RECIPIENT'S CATALOG NUMBER FESA-TS-2069
4. TITLE (and Subtitle) 6 Ceiling Fans for Energy Conservation.		5. TYPE OF REPORT & PERIOD COVERED 9 Final report
7. AUTHOR(s) 10 George T. Story		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Facilities Engineering Support Agency Technology Support Division		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 12 14
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		11. REPORT DATE 16 May 1979
		13. NUMBER OF PAGES
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release, distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Energy, Conservation, Ceiling Fans, Thermal Stratification		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) → Considerations for the use of ceiling fans to conserve energy are given. A sample calculation of energy savings is included. ←		

CEILING FANS FOR ENERGY CONSERVATION

Ceiling fans can provide energy savings in high ceilinged buildings where warm air accumulates and causes excess heat loss through the upper parts of the building envelope. It is not possible to predict with certainty when and to what extent this phenomena will occur. In general though, thermal stratification of the air in buildings can occur in high ceilinged structures (over 15') where the heating system is not combined with an air distribution system to promote vertical mixing of the air. It is prevalent in warehouses and maintenance shops where unit heaters are located at the ceiling level and discharge to the side rather than down. It also appears where radiators are used to heat high ceilinged structures.

In order to predict the savings from the destratification of a particular structure, it is necessary to measure the floor to ceiling temperature distribution during a heating period. When this is known, an assumption can be made to describe the thermal profile after installation of fans and a savings estimate can be made from standard heat transfer calculations. The following example will serve as a guide to making these calculations:

Assume a maintenance shop 250' by 150' with a 25' ceiling. The temperature distribution is measured as follows:

Floor level - 69°F

5' - 72°F

10' - 79°F

15' - 86°F

20' - 87°F

25' - 87°F

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DDC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist.	Avail and/or special
A	

It can be seen that the area above the worker level is being unnecessarily heated. Assume that through the use of ceiling fans, this heat can be redistributed downward and that the temperature distribution could be altered to be:

Floor level - 69°F
 5' - 72°F
 10' - 73°F
 15' - 75°F
 20' - 75°F
 25' - 76°F

These are typical examples of before and after fan temperature distributions. Now, the difference in heat transfer through the upper parts of the structure can be calculated.

The roof on the shop is 1" of wood with 2" of insulation with bitumen roofing on top. We calculate the heat transmission coefficient of the roof as follows: (see ASHRAE handbooks)

<u>LAYER</u>	<u>R VALUE</u>	<u>FT² HR °F</u> <u>BTU</u>
Inside Air	0.61	
Wood	0.93	
Insulation	5.56	
Bitumen	0.33	
Outside Air	<u>0.17</u>	
Total	7.60	
Roof U value = 1/R = 0.13	<u>BTU</u>	<u>FT² HR °F</u>

The walls of the structure are 8" concrete block

<u>LAYER</u>	<u>R VALUE</u>	$\frac{F^2 \text{ HR } ^\circ F}{\text{BTU}}$
Inside Air Layer	0.68	
8" Block	1.72	
Outside Air Layer	<u>0.17</u>	
	2.57	

$$\text{Wall U Value} = \frac{1}{2.57} = 0.39 \frac{\text{BTU}}{\text{FT}^2 \text{ HR } ^\circ F}$$

There is a row of windows around the shop. They are 6' tall and reach from the 14' level to the 20' level (no storms).

The effective U value of single pane windows (metal sash, 80% glass) is

$$1.00 \frac{\text{BTU}}{\text{HR FT}^2 ^\circ F}$$

Air infiltration through the windows is calculated as follows:

Assume an outside windspeed (winter) of 10 mph. Theoretical pressure drop across the windows is given by:

$$P_v = 0.000482 v_w^2$$

where

$$P_v = \text{velocity head, inches of H}_2\text{O}$$

$$v_w = \text{wind velocity, mph}$$

so

$$P_v = .048 \text{ inches of H}_2\text{O}$$

Effective pressure differences requires a factor of 0.64 to account for build up of pressure inside a building, so:

$$P = 0.64 (.048) = 0.031 \text{ inches of H}_2\text{O}$$

Infiltration can be determined from the following functions¹ for these given types of windows:

- (1) Loose fit w/o weather strip
- (2a) Average fit w/o weather strip
- (2b) Loose fit with weather strip
- (3) Average fit with weather strip

Infiltration Functions:

(1) $I = 40 + 370 P$

(2) $I = 14 + 132.5 P$

(3) $I = 7 + 70 P$

where I = Cubic Feet per Hour (CFH) per foot of crack

The value is then reduced by half to account for exiting air.

So in this example (assuming average fit)

$P = .031$

$I = 14 + 132.5 (.031)$ CFH per foot of crack

$I = 18 \frac{\text{CFH}}{\text{Ft of crack}}$

The windows are 1 sq ft panes so we have 10,400 ft of crack or

$I = 187,200$ CFH

The amount is divided in half to account for exiting air so:

$I = 93,600$ CFH

¹Retrofitting Existing Housing for Energy Conservation:
An Economic Analysis - US Department of Commerce and Federal
Energy Administration, Dec 1974

We are now in a position to calculate the difference in heat loss for the two different temperature distributions.

The temperature difference across the roof has been reduced by 11°F so the difference in heat transfer through the roof is:

$$\begin{aligned} Q &= UA \Delta T = 0.13 \times 150 \times 250 \times 11 \\ &= 53,625 \text{ BTU/HR} \end{aligned}$$

For the section of wall from 10' to 14' (we will ignore the area below this for conservatism) we have reduced the temperature by about 8°F, so,

$$\begin{aligned} Q &= UA \Delta T = (0.39) (3200 \text{ ft sq}) (8) \\ &= 9,984 \text{ BTU/HR} \end{aligned}$$

For the windows (14' to 20') an 11°F drop, so

$$Q = UA \Delta T = (1.00) (4800) (11) = 52,800 \text{ BTU/HR}$$

For the wall section above the windows:

$$\begin{aligned} Q &= UA \Delta T = (0.29) (4000) (11) \\ &= 17,160 \text{ BTU/HR} \end{aligned}$$

The difference in heat loss from air infiltration is calculated as follows:

$$\begin{aligned} Q &= 0.018 \frac{\text{BTU}}{\text{HR-CFH}} \times \text{CFM} \times \Delta T \\ &= (0.018) \times (93,600 \text{ CFH}) \times (11) \\ &= 18,533 \text{ BTU/HR} \end{aligned}$$

So our total change in heat loss due to the operation of the fans will be:

$$= 152,102 \text{ BTU/HR}$$

The annual BTU savings can now be found by multiplying this figure by the number of heating hours per year (assume 2000 for this example).

$$\frac{\text{MBTU Savings}}{\text{YR}} = \frac{152,102 \times 2000}{10^6} \times 300 \frac{\text{MBTU}}{\text{YR}}$$

If the building is heated by oil at \$.50/gal, and the furnace is 75% efficient, the cost per MBTU is:

$$\frac{\$}{\text{MBTU}} = \frac{.5}{(.75) (.1387)} = \$4.80$$

So the yearly dollar savings due to reduce fuel consumption is:

$$\text{Annual savings} = 300 \times 4.80 = \$1,440.00$$

A typical 52" fan will destratify about 2500 ft² of area in a building with a 25' ceiling. Thus, our example building would require 15 fans. Typical power consumption of a fan is 250 watts so 15 fans would use 3.75 kw. For a 2000 hr. heating season, this means a consumption of 7500 KWH. At \$.04/KWH, this yields an annual cost of \$300. Thus, the net annual savings are:

$$\$1,440 - \$300 = \$1,140$$

The installed cost of fans is typically \$150 per fan. So for this example, the total cost is \$2,250.

This yields a simple payback time of

$$\frac{\$2,250}{\$1,130/\text{HR}} = 1.97 \text{ years}$$

It can be seen from this example that a rapid payback can be achieved by the application of fans where severe thermal stratification exists.

There are several points that should be considered when placing fans. They should not be located over an area where personnel are working permanently as the drafts can be troublesome. If the fans will be near such an area, it is advisable to equip them with a speed control that can be accessed from the floor level. These are usually available from the fan manufacturer. If heat producing equipment is present, it is beneficial to locate a fan directly over it to help recycle that heat.

There are other devices available to control thermal stratification. One of these is a small fan mounted in a 6" to 12" duct which directs the air to the floor level. Research at the National Bureau of Standards has indicated that these are not as effective as ordinary ceiling fans.

They may however, be more architecturally acceptable in offices, churches, or other more finished buildings. Inclosed fans (appearing similar to unit heaters) are also available. These may be useful for safety purposes if personnel are frequently in the ceiling area. These units are more expensive and therefore have longer payback periods.

The standard type of fans are also available in decorator designs with choices of colors, patterns and fan-light combinations. These are also more costly, however, they may be acceptable in some applications where utility type fans are not.

HQDA (DALO-TSE-F)
WASH DC 20314

HQDA (DAEN-ASI-L) (2)
WASH DC 20314

HQDA (DAEN-MPO-B)
WASH DC 20314

HQDA (DAEN-MPR-A)
WASH DC 20314

HQDA (DAEN-MPO-U)
WASH DC 20314

HQDA (DAEN-MPZ-A)
WASH DC 20314

HQDA (DAEN-MPZ-E)
WASH DC 20314

HQDA (DAEN-MPZ-G)
WASH DC 20314

HQDA (DAEN-RDM)
WASH DC 20314

HQDA (DAEN-RDL)
WASH DC 20314

US Military Academy
ATTN: Dept of Mechanics
West Point, NY 10996

US Military Academy
ATTN: Library
West Point, NY 10996

Director, USA-WES
ATTN: Library
P.O. Box 631
Vicksburg, MS 39181

Commander, TRADOC
Office of the Engineer
ATTN: ATEN
Ft. Monroe, VA 23651

Commander, TRADOC
Office of the Engineer
ATTN: ATEN-FE-U
Ft Monroe, VA 23651

AF Civil Engr Center/XRL
Tyndall AFB, FL 32401

Naval Facilities Engr Command
ATTN: Code 04
200 Stovall St.
Alexandria, VA 22332

Defense Documentation Center
ATTN: TCA (12)
Cameron Station
Alexandria, VA 22314

Commander and Director
USA Cold Regions Research Engineering
Laboratory
Hanover, NH 03755

FORSCOM
ATTN: AFEN
Ft McPherson, GA 30330

FORSCOM
ATTN: AFEN-FE
Ft McPherson, GA 30330

Officer-in-Charge
Civil Engineering Laboratory
Naval Construction Battalion Center
ATTN: Library (Code L08A)
Port Hueneme, CA 93043

Commander and Director
USA Construction Engineering
Research Laboratory
P.O. Box 4005
Champaign, IL 61820

Commanding General, 3d USA
ATTN: Engineer
Ft. McPherson, GA 30330

Commanding General, 5th USA
ATTN: Engineer
Ft Sam Houston, TX 78234

AFCE Center
Tyndall AFB, FL 32403

Naval Facilities Engineering Cmd
Energy Programs Branch, Code 1113C
Hoffmann Bldg. 2, Mr. J. Hughes
Stovall Street
Alexandria, VA 22332

Commander, DARCOM
Director, Installation
and Services
5001 Eisenhower Ave.
Alexandria, VA 22333

Commander, DARCOM
ATTN: Chief, Engineering Div.
5001 Eisenhower Ave
Alexandria, VA 22333

Air Force Weapons Lab/AFWL/DE
Chief, Civil Engineering
Research Division
Kirtland AFB, NM 87117

Strategic Air Command
ATTN: DSC/CE (DEEE)
Offutt AFB, NE 68112

Headquarters USAF
Directorate of Civil Engineering
AF/PREES
Bolling AFB, Washington, DC 20333

Strategic Air Command
Engineering
ATTN: Ed Morgan
Offutt AFB, NE 68113

USAF Institute of Technology
AFTT/DED
Wright Patterson AFB, OH 45433

Air Force Weapons Lab
Technical Library (DOUL)
Kirtland AFB, FL 87117

Chief, Naval Facilities
Engineer Command
ATTN: Chief Engineer
Department of the Navy
Washington, DC 20350

Commander
Naval Facilities Engineering Cnd
200 Stovall St
Alexandria, VA 22332

Commander
Naval Facilities Engr Cnd
Western Division
Box 727
San Bruno, CA 94066

Civil Engineering Center
ATTN: Moreell Library
Port Hueneme, CA 93043

Commandant of the Marine Corps
HQ, US Marine Corps
Washington, DC 20380

National Bureau of Standards (4)
Materials & Composites Section
Center for Building Technology
Washington, DC 20234

Assistant Chief of Engineer
Rm 1E 668, Pentagon
Washington, DC 20310

The Army Library (ANRAL-R)
ATTN: Army Studies Section
Room 1A 518, The Pentagon
Washington, DC 20310

Commander-in-Chief
USA, Europe
ATTN: AEAEN
APO New York, NY 09403

Commander
USA Foreign Science and
Technology Center
220 8th St. N.E.
Charlottesville, VA 22901

Commander
USA Science & Technology
Information Team, Europe
APO New York, NY 09710

Commander
USA Science & Technology
Center - Far East Office
APO San Francisco, CA 96328

Commanding General
USA Engineer Command, Europe
APO New York, NY 09403

Deputy Chief of Staff
for Logistics
US Army, The Pentagon
Washington, DC 20310

Commander, TRADOC
Office of the Engineer
ATTN: Chief, Facilities
Engineering Division
Ft Monroe, VA 23651

Commanding General
USA Forces Command
Office of the Engineer
(AFEN-FES)
Ft McPherson, GA 30330

Commanding General
USA Forces Command
ATTN: Chief, Facilities
Engineering Division
Ft McPherson, GA 30330

Commanding General, 1st USA
ATTN: Engineer
Ft George G. Meade, MD 20755

Commander
USA Support Command, Hawaii
Fort Shafter, HI 96858

Commander
Eighth US Army
APO San Francisco 96301

Commander
US Army Facility Engineer
Activity - Korea
APO San Francisco 96301

Commander
US Army, Japan
APO San Francisco, CA 96343

Facility Engineer
Fort Belvoir
Fort Belvoir, VA 22060

Facility Engineer
Fort Benning
Fort Benning, GA 31905

Facility Engineer
Fort Bliss
Fort Bliss, TX 79916

Facility Engineer
Carlisle Barracks
Carlisle Barracks, PA 17013

Facility Engineer
Fort Chaffee
Fort Chaffee, AR 72902

Facility Engineer
Fort Dix
Fort Dix, NJ 08640

Facility Engineer
Fort Eustis
Fort Eustis, VA 23604

Facility Engineer
Fort Gordon
Fort Gordon, GA 30905

Facility Engineer
Fort Hamilton
Fort Hamilton, NY 11252

Facility Engineer
Fort A P Hill
Bowling Green, VA 22427

Facility Engineer
Fort Jackson
Fort Jackson, SC 29207

Facility Engineer
Fort Knox
Fort Knox, KY 40121

Facility Engineer
Fort Lee
Fort Lee, VA 23801

Facility Engineer
Fort McClellan
Fort McClellan, AL 36201

Facility Engineer
Fort Monroe
Fort Monroe, VA 23651

Facility Engineer
Presidio of Monterey
Presidio of Monterey, CA 93940

Facility Engineer
Fort Pickett
Blackstone, VA 23824

Facility Engineer
Fort Rucker
Fort Rucker, AL 36362

Facility Engineer
Fort Sill
Fort Sill, OK 73503

Facility Engineer
Fort Story
Fort Story, VA 23459

Facility Engineer
Kansas Army Ammunition Plant
Independence, MO 64056

Facility Engineer
Lone Star Army Ammunition Plant
Texarkana, TX 75501

Facility Engineer
Picatinny Arsenal
Dover, NJ 07801

Facility Engineer
Louisiana Army Ammunition Plant
Fort MacArthur, CA 90731

Facility Engineer
Milan Army Ammunition Plant
Warren, MI 48089

Facility Engineer
Pine Bluff Arsenal
Pine Bluff, AR 71601

Facility Engineer
Radford Army Ammunition Plant
Radford, VA 24141

Facility Engineer
Rock Island Arsenal
Rock Island, IL 61201

Facility Engineer
Rocky Mountain Arsenal
Denver, CO 80340

Facility Engineer
Scranton Army Ammunition Plant
156 Cedar Avenue
Scranton, PA 18503

Facility Engineer
Tobyhanna Army Depot
Tobyhanna, PA 18466

Facility Engineer
Tooele Army Depot
Tooele, UT 84074

Facility Engineer
Arlington Hall Station
400 Arlington Blvd
Arlington, VA 22212

Facility Engineer
Cameron Station, Bldg 17
5010 Duke Street
Alexandria, VA 22314

Facility Engineer
Sunny Point Military Ocean Terminal
Southport, NC 28461

Facility Engineer
US Military Academy
West Point Reservation
West Point, NY 10996

Facility Engineer
Fort Ritchie
Fort Ritchie, MD 21719

Facility Engineer
Army Materials & Mechanics
Research Center
Watertown, MA 02172

Facility Engineer
Ballistics Missile Advanced
Technology Center
P.O. Box 1500
Huntsville, AL 35807

Facility Engineer
Fort Wainwright
172d Infantry Brigade
Fort Wainwright, AK 99703

Facility Engineer
Fort Greely
172d Infantry Brigade
Fort Richardson, AK 99505

Facility Engineer
Tarheel Army Missile Plant
204 Granham-Horsdal Rd
Burlington, NC 27215

Facility Engineer
Harry Diamond Laboratories
2800 Powder Mill Rd
Adelphi, MD 20783

Facility Engineer
Fort Missoula
Missoula, MT 59801

Facility Engineer
New Cumberland Army Depot
New Cumberland, PA 17070

Facility Engineer
Oakland Army Base
Oakland, CA 94626

Facility Engineer
Vint Hill Farms Station
Warrentown, VA 22186

Facility Engineer
Twin Cities Army Ammunition Plant
New Brighton, MN 55112

Facility Engineer
Volunteer Army Ammunition Plant
Chattanooga, TN 37401

Facility Engineer
Watervliet Arsenal
Watervliet, NY 12189

Facility Engineer
St Louis Area Support Center
Granite City, IL 62040

Facility Engineer
Fort Mornmouth
Fort Mornmouth, NJ 07703

Facility Engineer
Redstone Arsenal
Redstone Arsenal, AL 35809

Facility Engineer
Detroit Arsenal
Warren, MI 48033

Facility Engineer
Aberdeen Proving Ground
Aberdeen Proving Ground, MD 21005

Facility Engineer
Jefferson Proving Ground
Madison, IN 47250

Facility Engineer
Dugway Proving Ground
Dugway, UT 84022

Facility Engineer
Fort McCoy
Sparta, WI 54656

Facility Engineer
White Sands Missile Range
White Sands Missile Range, NM 88002

Facility Engineer
Yuma Proving Ground
Yuma, AZ 85364

Facility Engineer
Natick Research & Dev Ctr
Kansas St.
Natick, MA 01760

Facility Engineer
Fort Bragg
Fort Bragg, NC 28307

Facility Engineer
Fort Campbell
Fort Campbell, KY 42223

Facility Engineer
Fort Carson
Fort Carson, CO 80913

Facility Engineer
Fort Drum
Watertown, NY 13601

Facility Engineer
Fort Hood
Fort Hood, TX 76544

Facility Engineer
Fort Indiantown Gap
Annville, PA 17003

Facility Engineer
Fort Lewis
Fort Lewis, WA 98433

Facility Engineer
Fort MacArthur
Fort MacArthur, CA 90731

Facility Engineer
Fort McPherson
Fort McPherson, GA 30330

Facility Engineer
Fort George G. Meade
Fort George G. Meade, MD 20755

Facility Engineer
Fort Polk
Fort Polk, LA 71459

Facility Engineer
Fort Riley
Fort Riley, KS 66442

Facility Engineer
Fort Stewart
Fort Stewart, GA 31312

Facility Engineer
Indiana Army Ammunition Plant
Charlestown, IN 47111

Facility Engineer
Joliet Army Ammunition Plant
Joliet, IL 60436

Facility Engineer
Anniston Army Depot
Anniston, AL 36201

Facility Engineer
Corpus Christi Army Depot
Corpus Christi, TX 78419

Facility Engineer
Red River Army Depot
Texarkana, TX 75501

Facility Engineer
Sacramento Army Depot
Sacramento, CA 95813

Facility Engineer
Sharpe Army Depot
Lathrop, CA 95330

Facility Engineer
Seneca Army Depot
Romulus, NY 14541

Facility Engineer
Fort Ord
Fort Ord, CA 93941

Facility Engineer
Presidio of San Francisco
Presidio of San Francisco, CA 94129

Facility Engineer
Fort Sheridan
Fort Sheridan, IL 60037

Facility Engineer
Holston Army Ammunition Plant
Kingsport, TN 37662

Facility Engineer
Baltimore Output
Baltimore, MD 21222

Facility Engineer
Bayonne Military Ocean Terminal
Bayonne, NJ 07002

Facility Engineer
Bay Area Military Ocean Terminal
Oakland, CA. 94626

Facility Engineer
Gulf Output
New Orleans, LA 70146

Facility Engineer
Fort Huachuca
Fort Huachuca, AZ 86513

Facility Engineer
Letterkenny Army Depot
Chambersburg, PA 17201

Facility Engineer
Michigan Army Missile Plant
Warren, MI 48089

COL E.C. Lussier
Fitzsimons Army Med Center
ATTN: HSF-DFE
Denver, CO 80240

US Army Engr Dist, New York
ATTN: NANEN-E
26 Federal Plaza
New York, NY 10007

USA Engr Dist, Baltimore
ATTN: Chief, Engr Div
P.O. Box 1715
Baltimore, MD 21203

USA Engr Dist, Charleston
ATTN: Chief, Engr Div
P.O. Box 919
Charleston, SC 29402

USA Engr Dist, Detroit
P.O. Box 1027
Detroit, MI 48231

USA Engr Dist, Kansas City
ATTN: Chief, Engr Div
700 Federal Office Bldg
601 E. 12th St
Kansas City, MO 64106

USA Engr Dist, Omaha
ATTN: Chief, Engr Div
7410 USOP and Courthouse
215 N. 17th St
Omaha, NE 68102

USA Engr Dist, Fort Worth
ATTN: Chief, SWFED-D
P.O. Box 17300
Fort Worth, TX 76102

USA Engr Dist, Sacramento
ATTN: Chief, SPKED-D
650 Capitol Mall
Sacramento, CA 95814

USA Engr Dist, Far East
ATTN: Chief, Engr Div
APO San Francisco, CA 96301

USA Engr Dist, Japan
APO San Francisco, CA 96343

USA Engr Div, Europe
European Div, Corps of Engineers
APO New York, NY 09757

USA Engr Div, North Atlantic
ATTN: Chief, NADEN-T
90 Church St
New York, NY 10007

USA Engr Div, South Atlantic
ATTN: Chief, SAEN-TE
510 Title Bldg
30 Pryor St, SW
Atlanta, GA 30303

USA Engr Dist, Mobile
ATTN: Chief, SAMEN-C
P.O. Box 2288
Mobile, AL 36601

USA Engr Dist, Louisville
ATTN: Chief, Engr Div
P.O. Box 59
Louisville, KY 40201

USA Engr Div, Norfolk
ATTN: Chief, NAOEN-D
803 Front Street
Norfolk, VA 23510

USA Engr Div, Missouri River
ATTN: Chief, Engr Div
P.O. Box 103 Downtown Station
Omaha, NE 68101

USA Engr Div, South Pacific
ATTN: Chief, SPDED-TG
630 Sansome St, Rm 1216
San Francisco, CA 94111

USA Engr Div, Huntsville
ATTN: Chief, HNDED-ME
P.O. Box 1600 West Station
Huntsville, AL 35807

USA Engr Div, Ohio River
ATTN: Chief, Engr Div
P.O. Box 1159
Cincinnati, Ohio 45201

USA Engr Div, North Central
ATTN: Chief, Engr Div
536 S. Clark St.
Chicago, IL 60605

USA Engr Div, Southwestern
ATTN: Chief, SWDED-TM
Main Tower Bldg, 1200 Main St
Dallas, TX 75202

USA Engr Dist, Savannah
ATTN: Chief, SASAS-L
P.O. Box 889
Savannah, GA 31402

Commander
US Army Facilities Engineering
Support Agency
Support Detachment II
Fort Gillem, GA 30050

Commander
US Army Facilities Engineering
Support Agency
ATTN: MAJ Brisbane
Support Detachment III
P.O. Box 6550
Fort Bliss, Texas 70015

NCOIC
US Army Facilities Engineering
Support Agency
Support Detachment III
ATTN: FESA-III-SI
P.O. Box 3031
Fort Sill, Oklahoma 73503

NCOIC
US Army Facilities Engineering
Support Agency
Support Detachment III
ATTN: FESA-III-PR
P.O. Box 29704
Presidio of San Francisco, CA 94129

NCOIC
US Army Facilities Engineering
Support Agency
ATTN: FESA-III-CA
Post Locator
Fort Carson, Colorado 80913

Commander/CPT Ryan
US Army Facilities Engineering
Support Agency
Support Detachment IV
P.O. Box 300
Fort Monmouth, New Jersey 07703

NCOIC
US Army Facilities Engineering
Support Agency
ATTN: FESA-IV-MU
P.O. Box 300
Fort Monmouth, New Jersey 07703

NCOIC
US Army Facilities Engineering
Support Agency
Support Detachment IV
ATTN: FESA-IV-ST
Stewart Army Subpost
Newburgh, New York 12250

NCOIC
US Army Facilities Engineering
Support Agency
Support Detachment II
ATTN: FESA-II-JA
Fort Jackson, South Carolina 29207

NCOIC
US Army Facilities Engineering
Support Agency
Support Detachment II
P.O. Box 2207
Fort Benning, Georgia 31905

NCOIC
US Army Facilities Engineering
Support Agency
Support Detachment II
ATTN: FESA-II-KN
Fort Knox, Kentucky 40121

US Army Facilities Engineering
Support Agency
FE Support Detachment I
APO New York 09081