



Fire Protection Engineering  
Mechanical/Electrical/Plumbing  
Engineering  
Code Consulting



# Aviation



### **FSC, Inc.**

#### **Corporate Headquarters:**

3100 South 24th Street, Suite E  
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Tel: (913) 722-3473  
Fax: (913) 722-3484

#### **Subsidiaries:**

##### **FSC MEP Engineers, LLC**

8511 Hillcrest Road, Suite 100  
Kansas City, MO 64138 U.S.A.

##### **FSC Bredson, Inc.**

8511 Hillcrest Road, Suite 100  
Kansas City, MO 64138 U.S.A.

##### **FSC Engineers, Pvt. Ltd.**

221 Bisarya Complex  
Bhopal - 462011 M.P. India

##### **FSC Consulting Services, Pvt. Ltd.**

221 Bisarya Complex  
Bhopal - 462011 M.P. India

Web: [www.fsc-inc.com](http://www.fsc-inc.com)

FSC provides professional engineering services to the Aviation and Aerospace Manufacturing Industry.

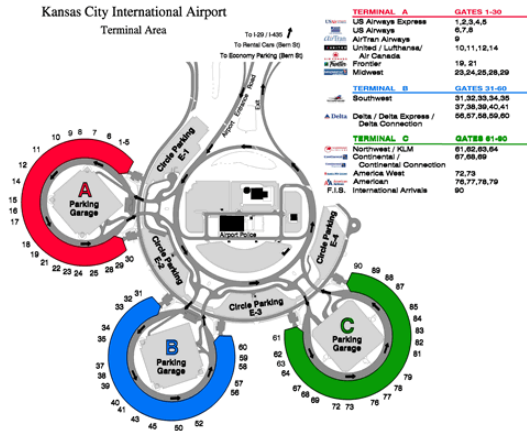
FSC has extensive experience in providing Fire Protection & Mechanical / Electrical engineering services to Airports, in particular designing and construction administration for the \$184 million renovation of the Kansas City International Airport.

Our Aviation portfolio also includes providing design of Fire Protection systems for Aircraft buildings and Hangars for:

- Boeing Corporation—Wichita, KS
- Bombardier Learjet—Wichita, KS
- Cessna Aircraft Company
- Raytheon Corporation
- Hawker Beechcraft Corporation
- Spirit Aero Systems
- Air Force Bases—Whiteman, McConnell, Richards Gebaur, and Tinker



Kansas City International Airport  
Terminal Area



### Kansas City International Airport (1998 - 2006) Kansas City, MO

MEP and FP services for the \$184 million renovation of the Kansas City International Airport, in particular the passenger terminals, baggage areas, Federal inspection services facility, parking and bus facility and parking garages.

Our design and construction administration services for the three horseshoe configured terminals totaling approximately 340,720 sq. ft. included:

- Terminal Design
- Baggage Make-Up / Outbound Baggage/ Baggage Claim Areas Design
- Security Systems Design
- Mechanical Systems Design
- Electrical Systems Design
- Plumbing Systems Design
- Fire Alarm Systems Design
- Fire Protection Systems Design included sprinkler coverage for both levels, special deluge type sprinkler system for the upper level for glass protection.
- Familiar with FAA and TSA Regulations, Guidelines and Requirements.

MEFP Construction Cost: \$45 million

### Joplin Regional Airport (2005 - 2008) Joplin, MO

MEP engineering services for the design of a new 25,000 sq ft. Airport Terminal Building including ticket counters, terminal gates and baggage claim area, in particular:

- System/energy analysis
- Mechanical, Electrical, Plumbing and Communication systems design.
- Security design, including cameras, TVs, etc. to comply with latest TSA Standards.

Total Construction Cost: \$15 million



### Wichita Mid-Continent Airport (2004 - Present) Wichita, KS

- **Airport Improvements** - MEFP services for the renovation of the mail public corridors to the gates and upgrade of the public toilets to ADA, new air handling units with new and improved air distribution, relocation of existing utilities, and upgrade of controls. MEFP Construction Cost:\$450,000
- Fire Protection study to explore options of renovating existing terminal or build a new terminal.
- Fire Protection and Code Consulting services for a new 257,200 sq. ft. terminal, as recommended by the study. Total Construction Cost: \$147.5 million

### Hangar 600 - Salina Airport Authority (2008) Salina, KS

Fire Protection engineering and consulting services for the design-build of a new 69,000 sq. ft. hangar and office complex. The 40,000 sq. ft. hangar was protected with:

- Closed head wet pipe system at roof.
- (13) high expansion AFFF foam generators.
- 600 gallon foam bladder tank.
- 2500 GPM at 100 PSI fire booster pump supplied by City water.

Fire Protection services included:

- Preparation of design narrative.
- Perform water supply analysis and establish pump sizes.
- Present various options.
- Preparation of shop drawings and hydraulic calculations.
- Coordinate approval with all stalk holders.

Total Construction Cost: \$6.1 million



### Boeing Company, Military Aircraft & Missile Systems Wichita, KS

#### New Hangar, Central Plant and Dock (2004)

Fire Protection engineering design services:

- Hangar roof was equipped with a closed head wet pipe system; monitors with deluge AFFF foam system operating were used under the wings.
- The central plant and dock area were equipped with a wet pipe system.

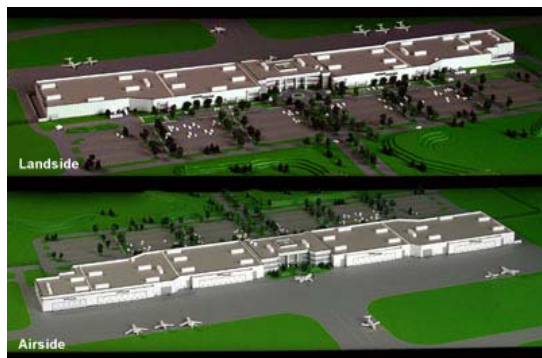
**Boeing North Hangar (2004)**  
**Wichita, KS**

Fire Protection engineering design and consulting services included:

- Converted existing open heads deluge system to a closed head wet pipe system.
- Added wet system protection under mechanical platform

**Cessna Aircraft Company**  
**Wichita, KS**

**Cessna C10 Citation Service Center (2004)**



Fire protection engineering design and consulting services for the **Design Build** of a new 240,000 sq. ft. C10 hangar included:

- Twenty two (22) Closed Head Foam-water Wet systems at Roof
- Six (6) Wet Pipe Sprinkler systems for Offices and supporting facilities
- 4,400 Sprinkler Heads
- Two (2) under floor Water Storage Reservoirs
- Two (2) 700 HP Vertical Turbine Fire Pumps rated 4,500 gpm at 135 psi each
- Two (2) Foam Concentrate Storage Bladder Tanks - 3,000 gallons each

FSC services included:

- Preparation of Design Narrative
- Perform Water Supply Analysis and Establish Pump and Tank sizes
- Preparation of Hydraulic Calculations and system Installation Drawings
- Coordinate Approval with all Stake Holders

**Cessna C6 Service Center (2008)**  
**Wichita, KS**

Fire protection engineering and consulting services for the **Design Build** of a new 75,000 sq. ft. hangar included:

- Four (4) Closed Head Foam-water Wet systems at Roof
- One (1) Wet Pipe Sprinkler system for Offices
- 1,150 Sprinkler Heads
- Sprinkler protection for Structural Steel Columns

FSC Services included:

- Preparation of Design Narrative
- Perform Water Supply Analysis
- Preparation of Hydraulic Calculations and system Installation Drawings
- Coordinate Approval with all Stake Holders.

**Bombardier/Learjet**  
**Wichita, KS**

Fire Protection design services for manufacturer of business jets for civilian and military use.

**Raytheon Aircraft Corporation**  
**Wichita, KS**

- Provided contract design documents for fire protection services for an experimental flight hangar that included piping layout for wet and deluge system, foam equipment, riser assembly, protection arrangement for radio and instrument laboratory, etc.



- Building 86 Test Facility Hangar
- Japat Hangar
- Master Plan for Entire Campus
- Building 46
- Building 81
- Building 43 and Sanding Room
- Anechoic Chamber

**Hawker Beechcraft Corporation (2008)**  
**Little Rock, AR**

Fire Protection engineering and consulting services for the Design Build of a new 51,000 sq. ft. B600 hangar, and 21,000 sq. ft. material storage facility, and offices. The hangar was protected with :

- Three (3) Closed Head Foam-water Wet systems at Roof
- One (1) Wet Pipe Sprinkler system for Offices
- 800 Sprinkler Heads
- Two (2) Foam Concentrate Storage Bladder Tanks - 700 gallons each

FSC services included:

- Preparation of Design Narrative
- Perform Water Supply Analysis
- Preparation of Hydraulic Calculations and System Installation Drawings
- Coordinate Approval with all Stake Holders.

**Hawker Beechcraft Corporation (2008)**  
**Little Rock, AR**

FSC was hired as an expert witness to investigate and determine the reason(s) for accidental tripping of Foam-water Oscillating Nozzles. An existing 62,000 sq. ft. hangar was protected with:

- Four (4) Closed Head Foam-water Wet systems at Roof
- Three (3) Deluge Foam-water Oscillating Nozzles
- One (1) Foam-water Hand Hose system
- One (1) Wet Pipe Sprinkler system for Offices
- Central Foam Concentrate Storage Bladder Tank for the Campus

FSC services included:

- Field investigation, collection of facts and interviewing all involved in the design and installation of the systems
- Consultation with manufacturers and installing contractor for fact finding
- Preparation of initial report of the findings
- Making corrections to existing systems to prevent future false system activation
- Preparation of Final Report

### **Hawker Beechcraft Corporation (2008)**

#### **Wichita, KS**

Fire Protection engineering services for the 52,000 sq. ft. B89 storage facility addition equipped with a wet sprinkler system.

### **New Century AirCenter**

#### **Olathe, KS**

Fire protection engineering and consulting services required to upgrade the fire protection system for the existing 54,000 sq. ft. hangar included:

- Analysis of existing, Closed head Wet Pipe system at Roof
- Analysis of existing Water Supply and with a New Fire Pump
- Design and Preparation of new High Expansion Foam Generators at Roof level
- One (1) Foam Concentrate Storage Bladder Tank, 700 gallons

### **Spirit Aero Systems**

#### **Wichita, KS**

#### **South Hangar Deluge System Replacement (2007)**

Fire protection engineering and consulting services required for the existing 136,000 sq. ft. hangar included:

- Abandoning four (4) existing Deluge Foam-water systems
- Design and preparation of New Closed Head Wet Pipe systems
- Design and preparation of Wet Pipe system for protection under Large Steel Truss system
- 1,400 Sprinkler heads were used
- Two (2) Foam Concentrate Storage Bladder Tanks - 700 gallons each

FSC services included:

- Preparation of Design Narrative
- Perform Water Supply Analysis
- Preparation of Hydraulic Calculations and System Installation Drawings
- Coordinate Approval with all Stakeholders

### **McConnell Air Force Base (1996 - 2010)**

#### **Wichita, KS**

#### **KC-135 Operations/Training Facility (1997)**

Fire Protection design and layout of fire pump, preparation of hydraulic calculations, site investigation.  
Total Construction Cost: \$400,000 FP Cost: \$110,000

#### **MWR Community Center (1996)**

Developed design criteria, analyzed codes for compliance, prepared contract documents and hydraulic calculations.  
Total Construction Cost: \$13.9 million FP Cost: \$470,000

#### **Street Lighting (2008)**

Electrical power and road lighting design calculations for a new road.

Electrical Construction Cost: \$200,000

#### **POL and Refueler Buildings (2004)**



### **Forbes Field Air National Guard Training Facility**

#### **Topeka, KS**

Fire protection design services for a Kansas Air National Guard Training Facility for the US Army Corps of Engineers - Kansas City District.

### **Whiteman Air Force Base**

#### **Knob Noster, MO**

#### **B2 Support Facility Package 83 (1998)**

Fire Protection design and consulting services (ADAL Fire protection systems) for two dock hangars each 20,500 sq. ft. separated by a 4,000 sq. ft. support facility.

FSC services included:

- Existing floor in hangar areas were removed for installation of new under floor Inverted Deluge Systems in Hangars A and C for under wing protection.
- Each hangar was provided with under floor piping for concealer "pop-up" type IDS foam nozzles for under wing protection. Piping system consists of fiberglass reinforced pipe (FRP) with bell & spigot joints using epoxy adhesive. Under this design, two IDS systems were provided for each hangar.
- Existing overhead AFFF deluge systems at roof were recalculated to balance new under floor AFFF Inverted Deluge Systems.
- Two (2) AFFF concentrate pumps are used to supply existing AFFF foam to in-line proportioners in existing AFFF foam deluge systems for the roof.
- 3000 gallon AFFF tank was designed for the roof systems.
- Two (2) 500 gallons hydro-pneumatic diaphragm tanks.  
FP Cost (estimated): \$783,000  
Fire Protection design services.

#### **B2 Support Facility Package 84 (1999)**

Fire Protection design and consulting services (ADAL Fire protection systems) for two dock hangars each 20,500 sq. ft. separated by a 9,000 sq. ft. support facility. The support facility includes mechanical rooms, electrical room, rest rooms, offices, and corridor.

FSC services included:

- Extension of fire mains
- Two (2) Inverted deluge systems for Docks A & C
- Four (4) Overhead deluge systems for Docks A & C
- Two (2) Wet type fire sprinkler systems for mechanical room
- Foam pumps and AFFF foam tank
- Fire protection and alarm system  
Total Construction Cost: \$14 million  
FP Cost (estimated): \$ 1million

### **Fort Riley - Air Support Operations Squadron (ASOS)**

#### **Fort Riley, KS**

#### **Building 727 (2008)**

Fire protection design services for the 31,200 sq. ft. officer vehicle maintenance repair facility. Design included a wet pipe fire sprinkler system including hydraulic calculations and detailed design to prepare contractor shop drawings.

FP Construction Cost : \$84,000



Fire Protection Engineering  
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# Aircraft Hangars



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Web: [www.fsc-inc.com](http://www.fsc-inc.com)

FSC has extensive experience in providing Fire Protection engineering services for Aircraft Hangars. Our portfolio includes Aircraft Hangars and associated facilities for:

- Cessna Aircraft Company
- Boeing Corporation
- Spirit Aero Systems
- Hawker Beechcraft
- Salina Airport Authority
- Whiteman Air Force Base (USACE)
- McConnell Air Force Base (USACE)
- Tinker Air Force Base (USACE)

The systems designed for the above facilities included all and /or some of the following features:

- Foam-water Closed Head Wet systems
- Foam-water Open Head Deluge systems
- Low level Low-Expansion Foam Oscillating Nozzles
- High-Expansion Foam Generators
- Foam-water Hand Hose systems
- Low level (under wing) Protection
- Water Storage Reservoir
- Foam Concentrate Storage (Bladder Tank)
- Foam Concentrate Pump
- Fire Pump
- Detection and Actuation systems
- Paint Hangar

## Salina Airport Authority (2008)

### Salina, KS

#### Hangar 600

Fire Protection engineering and consulting services for the design-build of a new 69,000 sq. ft. hangar and office complex. The 40,000 sq. ft. hangar was protected with:

- Closed head wet pipe system at roof.
- (13) high expansion AFFF foam generators.
- 600 gallon foam bladder tank.
- 2500 GPM at 100 PSI fire booster pump supplied by City water.

Fire Protection services included:

- Preparation of design narrative.
- Perform water supply analysis and establish pump sizes.
- Present various options.
- Preparation of shop drawings and hydraulic calculations.
- Coordinate approval with all stake holders.

Total Construction Cost: \$6.1 million

## Spirit Aero Systems

### Wichita, KS

#### South Hangar Deluge System Replacement (2007)

Fire protection engineering and consulting services required for the existing 136,000 sq. ft. hangar included:

- Abandoning four (4) existing Deluge Foam-water systems
- Design and preparation of New Closed Head Wet Pipe systems
- Design and preparation of Wet Pipe system for protection under Large Steel Truss system
- 1,400 Sprinkler heads were used
- Two (2) Foam Concentrate Storage Bladder Tanks - 700 gallons each

FSC services included:

- Preparation of Design Narrative
- Perform Water Supply Analysis
- Preparation of Hydraulic Calculations and System Installation Drawings
- Coordinate Approval with all Stake Holders

## New Century AirCenter

### Olathe, KS

#### Hangar Upgrade (2004)

Fire protection engineering and consulting services required to upgrade the fire protection system for the existing 54,000 sq. ft. hangar included:

- Analysis of existing, Closed head Wet Pipe system at Roof
- Analysis of existing Water Supply and with a New Fire Pump
- Design and Preparation of new High Expansion Foam Generators at Roof level
- One (1) Foam Concentrate Storage Bladder Tank, 700 gallons

## Boeing Company, Military Aircraft & Missile Systems

### Wichita, KS



#### Boeing New Hangar, Central Plant and Dock (2004)

Fire Protection engineering design services:

- Hangar roof was equipped with a closed head wet pipe system; monitors with deluge AFFF foam system operating were used under the wings.
- The central plant and dock area were equipped with a wet pipe system.

#### Boeing North Hangar (2004)

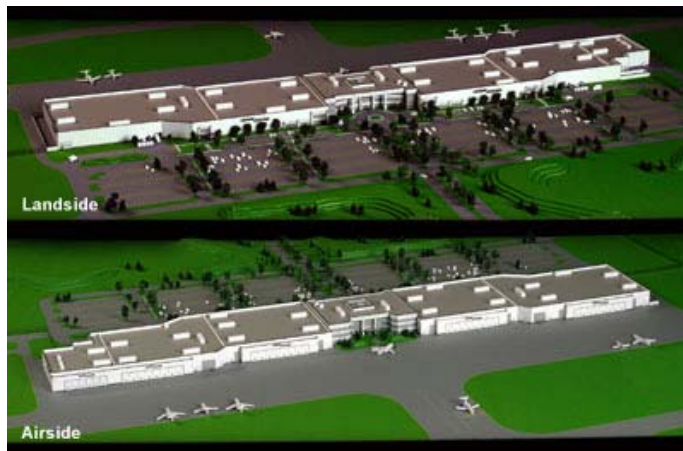
Fire Protection engineering design and consulting services included:

- Converted existing open heads deluge system to a closed head wet pipe system.
- Added wet system protection under mechanical platform

## Cessna Aircraft Company

### Wichita, KS

#### Cessna C10 Citation Service Center (2004)



Fire protection engineering design and consulting services for the **Design Build** of a new 240,000 sq. ft. C10 hangar included:

- Twenty two (22) Closed Head Foam-water Wet systems at Roof
- Six (6) Wet Pipe Sprinkler systems for Offices and supporting facilities
- 4,400 Sprinkler Heads
- Two (2) under floor Water Storage Reservoirs
- Two (2) 700 HP Vertical Turbine Fire Pumps rated 4,500 gpm at 135 psi each
- Two (2) Foam Concentrate Storage Bladder Tanks - 3,000 gallons each

FSC services included:

- Preparation of Design Narrative
- Perform Water Supply Analysis and Establish Pump and Tank sizes
- Preparation of Hydraulic Calculations and system Installation Drawings
- Coordinate Approval with all Stake Holders

#### **Cessna C6 Service Center (2008) Wichita, KS**

Fire protection engineering and consulting services for the **Design Build** of a new 75,000 sq. ft. hangar included:

- Four (4) Closed Head Foam-water Wet systems at Roof
- One (1) Wet Pipe Sprinkler system for Offices
- 1,150 Sprinkler Heads
- Sprinkler protection for Structural Steel Columns

FSC Services included:

- Preparation of Design Narrative
- Perform Water Supply Analysis
- Preparation of Hydraulic Calculations and system Installation Drawings
- Coordinate Approval with all Stake Holders

#### **Raytheon Aircraft Corporation Wichita, KS**

- Provided contract design documents for fire protection services for an experimental flight hangar that included piping layout for wet and deluge system, foam equipment, riser assembly, protection arrangement for radio, instrument laboratory, and support areas.



- Building 86 Test Facility Hangar
- Japat Hangar
- Master Plan for Entire Campus
- Building 46
- Building 81
- Building 43 and Sanding Room
- Anechoic Chamber

#### **Hawker Beechcraft Corporation (2008) Little Rock, AR New B600 Hangar**

Fire Protection engineering and consulting services for the Design Build of a new 51,000 sq. ft. hangar, and 21,000 sq. ft. material storage facility, and offices. The hangar was protected with :

- Three (3) Closed Head Foam-water Wet systems at Roof
- One (1) Wet Pipe Sprinkler system for Offices
- 800 Sprinkler Heads
- Two (2) Foam Concentrate Storage Bladder Tanks - 700 gallons each

FSC services included:

- Preparation of Design Narrative
- Perform Water Supply Analysis
- Preparation of Hydraulic Calculations and System Installation Drawings
- Coordinate Approval with all Stake Holders.

#### **Hawker Beechcraft Corporation (2008) Little Rock, AR**

##### **B300 Hangar - Expert Witness/ Fire Suppression Redesign**

FSC was hired as an expert witness to investigate and determine the reason(s) for accidental tripping of Foam-water Oscillating Nozzles. An existing 62,000 sq. ft. hangar was protected with:

- Four (4) Closed Head Foam-water Wet systems at Roof
- Three (3) Deluge Foam-water Oscillating Nozzles
- One (1) Foam-water Hand Hose system
- One (1) Wet Pipe Sprinkler system for Offices
- Central Foam Concentrate Storage Bladder Tank for the Campus

FSC services included:

- Field investigation, collection of facts and interviewing all involved in the design and installation of the systems
- Consultation with manufacturers and installing contractor for fact finding
- Preparation of initial report of the findings
- Making corrections to existing systems to prevent future false system activation
- Preparation of Final Report

#### **Hawker Beechcraft Corporation (2008) Wichita, KS**

Fire Protection engineering services for the 52,000 sq. ft. B89 storage facility addition equipped with a wet sprinkler system.

#### **McConnell Air Force Base (1996 - 2010) Wichita, KS**

- **KC-135 Operations/Training Facility (1997)**  
Fire Protection design and layout of fire pump, preparation of hydraulic calculations, site investigation.  
Total Construction Cost: \$400,000 FP Cost: \$110,000
- **MWR Community Center (1996)**  
Developed design criteria, analyzed codes for compliance, prepared contract documents and hydraulic calculations.  
Total Construction Cost: \$13.9 million FP Cost: \$470,000
- **POL and Refueler Buildings (2004)**  
Fire Protection design services.



- **B2-LO Facility Restoration (1998) (1999)**  
Fire Protection design and consulting services included:  
(Support Facility Package 83 and 84) - **ADAL Fire protection systems for two dock hangars** each 20,500 sq. ft. separated by a 4,000 sq. ft. support facility.
- **Building 1166 Aircraft Hangar (2004)**  
FP services for Fire Protection Services, Inc.  
Design 01/21/04
- **Building No. 1176 Aircraft Hangar (2004)**  
FP services for Fire Protection Services, Inc.  
Corrosion Protection  
Design 01/21/04

## **Whiteman Air Force Base**

### **Knob Noster, MO**

#### **B2 Support Facility Package 83 (1998)**

Fire Protection design and consulting services (ADAL Fire protection systems) for two dock hangars each 20,500 sq. ft. separated by a 4,000 sq. ft. support facility.

FSC services included:

- Existing floor in hangar areas were removed for installation of new under floor Inverted Deluge Systems in Hangars A and C for under wing protection.
- Each hangar was provided with under floor piping for concealer “pop-up” type IDS foam nozzles for under wing protection. Piping system consists of fiberglass reinforced pipe (FRP) with bell & spigot joints using epoxy adhesive. Under this design, two IDS systems were provided for each hangar.

Existing overhead AFFF deluge systems at roof were recalculated to balance new under floor AFFF Inverted Deluge Systems.

- Two (2) AFFF concentrate pumps are used to supply existing AFFF foam to in-line proportioners in existing AFFF foam deluge systems for the roof.
- 3000 gallon AFFF tank was designed for the roof systems.
  - Two (2) 500 gallons hydro-pneumatic diaphragm tanks.

FP Cost (estimated): \$783,000

## **Whiteman Air Force Base**

### **Knob Noster, MO**

#### **B2 Support Facility Package 84 (1999)**

Fire Protection design and consulting services (ADAL Fire protection systems) for two dock hangars each 20,500 sq. ft. separated by a 9,000 sq. ft. support facility. The support facility includes mechanical rooms, electrical room, rest rooms, offices, and corridor.

FSC services included:

- Extension of fire mains
- Two (2) Inverted deluge systems for Docks A & C
- Four (4) Overhead deluge systems for Docks A & C
- Two (2) Wet type fire sprinkler systems for mechanical room
- Foam pumps and AFFF foam tank
- Fire protection and alarm system

Total Construction Cost: \$14 million

FP Cost (estimated): \$ 1million

## **Tinker Air Force Base**

### **Oklahoma City, OK**

#### **Hangar Fire Protection Building 240 (1999)**

Upgrade existing aircraft bay to an aircraft fuel cell hangar for B1B, B52, KC135R and AWACS aircraft. Performed code analysis based on Engineering Technical Letter and NFPA standards, CADD generated bid drawings, computerized hydraulic calculation and specifications. Analyzed existing water supply and offered recommendations for improvement. Provided construction support and review of shop drawings.

Total Construction Cost: \$3,660,000 FP Cost: \$1,098,000



## **Fort Riley - Air Support Operations Squadron (ASOS)**

### **Fort Riley, KS**

#### **Hangar Building 727 (2008)**

Fire protection design services for the 31,200 sq. ft. officer vehicle maintenance repair facility. Design included a wet pipe fire sprinkler system including hydraulic calculations and detailed design to prepare contractor shop drawings

FP Construction Cost : \$84,000