

**International Forum on Airport Emergency and Risk Management**  
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**THE BOEING COMPANY**

The Boeing Company is a worldwide manufacturer of commercial jet transport aircraft, military combat aircraft, satellites, defense systems and wide range of airline service related products. Boeing has operations in 16 of the United States and in X different countries worldwide. It is comprised of 8 separate divisions, two of which are involved in manufacturing and assembly of commercial aircraft, military aircraft and satellites. Currently, The Boeing Company employs nearly 150,000 people.

The two manufacturing and assembly divisions are Boeing Commercial Aircraft and Integrated Defense Systems.

Final assembly operations involving commercial aircraft are conducted in the Seattle area in Washington State and in Long Beach California. Final assembly operations for military aircraft and satellites are performed in St. Louis, Missouri, and Long Beach and El Segundo, California. Final assembly of rotorcraft occurs in Mesa, Arizona and Philadelphia, Pennsylvania.

**Commercial Aircraft**

The commercial transport aircraft products produced by Boeing include a family of aircraft beginning with the 717, the smallest jet transport, and ending with the 747, which is currently the largest commercial jet transport available. Commercial jet transports are separated into two general categories, single and twin aisles.

Single aisle aircraft include the 717, 737 and 757. The 717 incorporates the use of two fuselage mounted engines and is a 100 seat aircraft. Final assembly of the 717 takes place at the Boeing plant in Long Beach, Calif.

The 737 itself is a family of aircraft which include the 737-600, -700, -800 and 900 models. The 737 incorporates the use of two wing mounted engines and can seat anywhere from 110 to 189 people depending on type and configuration. Final assembly of the 737 takes place at the Boeing plant in Renton, Washington. Also available in the 737 platform, is the Boeing Business Jet.

The final single aisle aircraft is the 757 which incorporates the use of two wing mounted engines and can seat from 200 to 280 people. Final assembly of the 757 takes place at the Boeing plant in Renton, Washington. The 1,050th and final 757 will be delivered to its airline customer in April 2005.

Twin aisle aircraft include the 747, 767 and 777. The 767 and the 777 incorporate the use of two wing mounted engines. The 767 can seat from 318 to 375 passengers, while the 777 can seat between 300 and 550 passengers. Final assembly of the 767 and 777 occurs at the Boeing plant in Everett, Washington.

The Boeing Flagship, the 747, incorporates the use of 4 wing mounted engines and can seat up to 524 people. Final assembly of the 747 is also conducted at the Boeing plant in Everett, Washington.

The 7E7, the newest commercial jet transport in the Boeing family will be an all composite aircraft. Final assembly of the 7E7 will also take place at the Everett, Washington plant which is scheduled to begin in 2006.

### **Integrated Defense Systems**

The Integrated Defense Systems division of the Boeing Company focuses on military applications and includes a wide range of products. These products include jet fighter, bomber, surveillance and transport aircraft, missiles, helicopters, satellites and launch vehicles.

Boeing manufactures and assembles the F-15 and F/A-18 jet fighters at its plant in St. Louis Missouri. It provides continued support to the United States Air Force for the B-52 and B-1 bombers. Airborne Warning and Control System aircraft include the venerable E-3 which is a modified Boeing 707 and the newer version 767 platform. The primary jet transports included in the Integrated Defense Systems product line include the C-17 Globemaster, which is assembled at the Boeing plant in Long Beach, California. Post production support for the KC-135 and KC-10 air refueling tankers continues as well as the newest air refueling tanker employing the use of a 767 airframe. Boeing missile products include the Harpoon ship to ship missile and the Standoff Land Attack Missile – Extended Range (SLAM-ER). Helicopters, including the AH-64D Apache and the V-22 Osprey are manufactured and assembled at Boeing's Mesa, Arizona and Philadelphia, Pennsylvania plants respectively. Boeing is the largest manufacturer of satellite systems which include a wide variety of communication and weather satellites. Boeing Satellite Systems manufactures and assembles all satellite products at the Boeing plant in El Segundo, California. The launch vehicles, the Delta II, Delta III and Delta IV rockets, are manufactured and assembled at the Boeing plant in Decatur, Alabama.

## Boeing Manufacturing Sites

### Everett, Washington

The site's main assembly building, which the Guinness Book of World Records acknowledges as the largest building in the world by volume, has grown over the years to enclose 472 million cubic feet of space (13.3 million cubic meters). Its footprint covers 98.3 acres (39.8 hectares). The original factory was completed in 1969. From its original size, it was expanded by more than 45 percent in 1980 to house the 767 assembly line, and another 50-percent enlargement was added in 1993 for 777 assembly operations. The site has grown as well to a total of 1,025 acres (415 hectares), including 215 acres (86 hectares) of paved yards and parking, and 282 acres (113 hectares) of building area.

Each day, parts and subassemblies come to the plant from all over the globe. More than a thousand suppliers ship components by truck, rail, air and ship from throughout the world and all 50 states.

Inside the factory, overhead bridge cranes cruise 90 feet (27 meters) above the floor on 31 miles (50 kilometers) of crane rail network, supported by the roof trusses of the factory building. Along with a fleet of more than 100 forklifts, 18 cranes, each capable of lifting 34 tons, carry 747 and 767 parts through the factory. Eight additional 40-ton cranes are used for 777 manufacturing operations.



With six million parts in the 747 and more than three million each on the 767 and the 777, the systems used to order, track and distribute the correct part to the correct assembly point at the right time is no less complex

The Everett factory can accommodate two 777 production lines, and one each 747 and 767 production lines. Production rates vary with market activity, but have been as high as seven per month for the 747 and 777, and five per month for the 767.

As the production line moves, the airframe gets closer to the doors through which the finished jetliner will roll out. Four of the six hangar doors are 87 feet high (26.5 meters) and 300 feet wide (91 meters) and two are 87 feet high (26.5 meters) and 350 feet wide (107 meters).

In addition to the factory and warehouses, the site contains nine office buildings and one 500,000 square foot (46,451 square meters) building that supplies

interior paneling and stowage bins for all Boeing jetliners. Finished airplanes may receive the distinctive markings of the purchasing airline in any of the three paint hangars.

The factory areas and final assembly areas at the Everett location are protected by standard wet pipe type automatic sprinkler systems. These systems are designed to provide a 0.16 gpm/sq. ft. (6.5L/min/sq. meters) density over the most remote 5000 sq. ft. (465.51 sq. meters). The sprinklers are 165°F (74.4°C) rated and cover a maximum of 120 sq. ft. (11.14 sq. meters) per sprinkler. This protection scheme is allowable, since the aircraft within these buildings have not as yet been loaded with fuel. Once the interiors have been loaded into the aircraft fuselage, these interiors are equipped with a VESDA (Very Early Smoke Detection Apparatus). Although this is not fixed suppression for the aircraft, it does provide prompt indication of a fire condition. Once this signal is transmitted and received, the Boeing Fire Department is dispatched to the scene, they are able to respond to this area in 2 to 2-1/2 minutes.

The paint hangars, of which there are three, are protected in accordance with NFPA 409 for a Group 1 hangar. Two are equipped with AFFF while the third is in a straight water deluge arrangement. The sprinkler system at the roof level of one of the paint hangars is in a deluge arrangement employing the use of 3% AFFF. The second, also employing a 3% AFFF concentration is in a closed sprinkler preaction type arrangement. These systems cover a maximum of 15,000 sq. ft. (1394 sq. meters) and are designed to deliver a 0.16 gpm/sq. ft. (6.5 L/min/sq. meters) density over the entire hangar floor for the deluge system and 0.16 gpm/sq. ft. (6.5L/min/sq. meters) density over the most remote 30,000 sq. ft. (2787 sq. meters). Due to the type and size of the aircraft that are painted in these hangars, under-wing protection is also used. Two of these hangars are equipped with oscillating monitor nozzles designed to deliver a AFFF in a 3% concentration over the paint hangar floor area. The third is arranged to deliver water without AFFF. All of the electrical equipment inside the paint hangar is suitable for Class 1 Division I locations, including the stacker crane apparatus that provides access to the aircraft for the painters. Detection for the deluge system at the roof level is through line detection. Boeing uses the Alison Control 9090 series Continuous Linear Thermal Sensor type coaxial detection system.

The fire protection water supply for the Everett facility is provided from five 2,500 gpm (9463.53 lpm) at 125 psi (8.62 bar) diesel engine driven fire pumps. This is supplemented at a second pump house which houses three additional fire pumps, a 2000 gpm (7570.82 lpm) at 60 psi (4.14 bar), and 1500 gpm (5678.12 lpm) at 60 psi (4.14 bar) electric motor driven pumps plus a (5678.12 lpm) at 60 psi (4.14 bar) diesel engine driven fire pump. All taking suction from a 16 inch (406.4 mm) main fed from the Everett public water supply. The south pump supply is from a 1 million gallon (3,785,412 liters) above grade reservoir.

Once the aircraft are painted, they are moved out to the flight line where they are delivered to the customer.

## **Renton, Washington**

Throughout the years, the Airplane Programs' site in Renton, Wash., has been home to many of commercial aviation's most renowned airplanes, including the 707, 727 and 737. Today, employees at Renton, a 280-acre (113.31 hectares) site encompassing 6.4 million square feet (594,600 square meters) of building space, produce the Boeing Next-Generation 737 model, as the 757 model was recently retired from the Boeing aircraft family.

Forty percent of the world's commercial jetliner fleet was produced at Renton. When completed, the 737/757 final assembly building was the world's largest building by volume - a record later surpassed by the final assembly building for the Boeing 747, 767 and 777 in Everett.

The ground floor of the final assembly building for the Boeing 737 and 757 covers 760,000 square feet (70,600 square meters). Activities at other main buildings at the Renton site include sub-assembly, wing-line production and a paint hangar.

Renton Airport, located west of the main site, is used by Boeing to perform pre-flight tests on all 737s and 757s before they make their initial test flight. After the flight, the 737s land at Boeing Field in Seattle and the 757s at Paine Field near Everett, where final preparations are made before they are delivered to customers.

The factory areas and final assembly areas at the Renton location are protected by standard wet pipe type automatic sprinkler systems. These systems are designed to provide a 0.16 gpm/sq. ft. (6.5L/min/sq. meters) density over the most remote 5000 sq. ft. (465.51 sq. meters). The sprinklers are 212°F (100°C) rated and cover a maximum of 120 sq. ft. (11.15 sq. meters) per sprinkler. This protection scheme is allowable, since the aircraft within these buildings have not as yet been loaded with fuel. Once the interiors have been loaded into the aircraft fuselage, these interiors are equipped with a VESDA (Very Early Smoke Detection Apparatus). Although this is not protection for the aircraft, it does provide prompt indication of a fire condition. Once this signal is transmitted and received, the Boeing Fire Department is dispatched to the scene

The paint hangars, of which there are two, one is protected by standard wet pipe type automatic sprinkler systems. These systems are designed to provide a 0.16 gpm/sq. ft. (6.5L/min/sq. meters) density over the most remote 5000 sq. ft. (465.51 sq. meters). The sprinklers are 212°F (100°C) rated and cover a maximum of 120 sq. ft. (11.15 sq. meters) per sprinkler. The other hangar is protected by deluge sprinkler systems. These systems cover a maximum of

15,000 sq. ft. (1393.55 sq. meters) and are designed to deliver a 0.16 gpm/sq. ft. (6.5L/min/sq. meters) density over the entire hangar floor. This protection scheme is allowable, since the aircraft within these buildings have not as yet been loaded with fuel. Due to the type and size of the aircraft that are painted in these hangars, under-wing protection is not provided. All of the electrical equipment inside the paint hangar is suitable for Class 1 Division I locations, including the stacker crane apparatus that provides access to the aircraft for the painters.

Once the aircraft are painted, they are moved out to the flight line and then taken to Boeing Field in Seattle where they are delivered to the customer.

The main fire protection water supply for the Renton facility is provided from two 60 inch (1524 mm) fire mains at 205 psi (14.13 bars) each, regulated down to 125 psi (8.62 bar). There are also multiple cross ties from the local public water supply.

### **North Boeing Field, Seattle, Washington**

The aircraft modification and delivery hangar at the North Boeing Field location covers 220,310 sq. ft. (20,467.47 sq. meters) is protected by deluge sprinkler systems. These systems cover a maximum of 15,000 sq. ft. (1393.55 sq. meters) and are designed to deliver a 0.16 gpm/sq. ft. (6.5 L/min/sq. meters) density over the entire hangar floor. The policy for taking previously fueled aircraft into this building is to de-fuel, mop and purge the fuel cells prior entering the building.

The paint hangars, of which there are two, are protected in accordance with NFPA 409 for a Group 1 hangar. The sprinkler systems at the roof level are in a deluge arrangement employing the use of 3% AFFF. These systems cover a maximum of 15,000 sq. ft. (1393.55 sq. meters) and are designed to deliver a 0.16 gpm/sq. ft. (6.5 L/min/sq. meters) density over the entire hangar floor. Under-wing protection is provided for only one the hangars, which was designed for large aircraft. This hangar is equipped with oscillating monitor nozzles designed to deliver a AFFF in a 3% concentration over the paint hangar floor area. All of the electrical equipment inside the paint hangars is suitable for Class 1 Division I locations, including the stacker crane apparatus that provides access to the aircraft for the painters.

The fire protection water supply for North Boeing Field site is provided from two 300,000 gallon (1,135,624 liters) water storage tanks via one 2,000 gpm (7570.82 lpm) at 100 psi (6.89 bar) and one 1000 gpm (3785.41 lpm) 100 psi (6.89 bar) diesel engine driven fire pumps and two 2000 gpm (757.82 lpm) 100 psi (6.89 bar) electric driven fire pumps. Additionally, there are multiple cross-ties from local public water supplies.

## Wichita, Kansas

The Boeing, Wichita site is comprised of 280 separate buildings and covers in excess of 12 million square feet (1,114,836 square meters). The main manufacturing building, Plant 2, covers 3.2 million sq. ft. (297,290 sq. meters) and has an 80 ft. (23.38) ceiling height. Construction of this building began in 1941 for the production of the Boeing B-29 Superfortress. It was later used for the final assembly of the B-47 and B-52. In the mid to late 1990's two additions were constructed which brought the building to its current size.

Currently, Wichita produces part of every commercial jetliner except the 717, including 75 percent of the airframe for the Next-Generation 737-600/ -700/ -800/ -900 and Boeing Business Jet models, Wichita joins the forward and aft fuselage assemblies into one unit prior to shipment by rail to its sister division in Renton, Washington.

Boeing Wichita was selected as a supplier partner for the 7E7 program, with responsibility for the design and production of the aircraft's cab section.

Wichita also designs and builds engine nacelles and nose sections for the 747, 757, 767 and 777 jetliners. Employment at the Wichita site is approximately 12,000 people.

Automatic sprinkler protection is generally provided throughout all of the buildings at this facility. The systems installed during the original building construction were laid out on an ordinary hazard pipe schedule using ½ in. (12.7 mm) orifice 165°F (74.4°C) rated sprinklers covering a maximum of 120 sq. feet (11.14 sq. meters) per sprinkler. The more recently install sprinkler systems were hydraulically designed to provide a minimum of a 0.17 gpm/sq. ft. (6.5 L/min/sq. meters) over a 3000 sq. ft. (278.7 sq. meter) area using ½ in. (12.7 mm) orifice 165°F (74.4°C) sprinklers covering a maximum of 120 sq. feet (11.14 sq. meters) per sprinkler.

In addition to the manufacturing operations, there are three paint facilities. Two of these were originally constructed as paint facilities for finished aircraft, and are now used to paint the sub-assemblies manufactured here. The wet type automatic sprinkler systems in these paint areas are capable of providing a 0.30 gpm/sq. ft. (12.2 L/min/sq. meter) density over a 5000 sq. ft. (465.51 sq. meter) area using ½ in. (12.7 mm) orifice, 165oF (74.4oC) rated sprinklers. The third paint facility was constructed in 1990 and it is protected by a wet pipe automatic sprinkler system capable of delivering a 0.36 gpm/sq. ft. (14.4 L/min/sq. meter) density over the most remote 3000 sq. ft. (278.7 sq. meters).

There are three main flight operations hangars at this facility. Two of these were constructed in the 1950's and the third in 1985. The original sprinkler design incorporated the used of open sprinkler deluge systems designed to

deliver a 0.16 gpm/sq. ft. (6.5 L/min/sq. meter) density over the hangar area. The largest hangar covers 332,000 sq. ft. (30,844 sq. meters), the second largest covers 223,000 sq. ft. (20,717 sq. meters) and the third covers 107,300 sq. ft. (9,968.5 sq. meters). Due to the age, condition and history of accidental discharges, Boeing has undertaken a project to replace each of these deluge systems with a wet pipe automatic sprinkler system designed in accordance with NFPA 409 for unfueled aircraft; that being a 0.17 gpm/sq. ft. (6.9 L/min/sq. meter) density over the most remote 5000 sq. ft. (465.51 sq. meters).

There are over 500 sprinkler systems at this facility and over 1400 control valves. The underground fire protection mains are in a looped and gridded arrangement and total in excess of 25 miles (40.2 km) in length. They are arranged to provide an ordinary hazard level of protection for this predominantly metal/electronic working facility. The water supply for the Wichita site is provided from two separate pumping facilities. The main pump facility contains six 2500 gpm (9463.53 lpm) diesel engine driven vertical turbine pumps and one 1500 gpm (5678.12 lpm) electric motor driven horizontal split case centrifugal pump. These pumps take suction from a 750,000 gallon (2,839,059 liter) below grade concrete reservoir. The second pumping facility houses two 2500 gpm (9463.53 lpm) diesel engine driven vertical turbine pumps taking also taking suction from a a 750,000 gallon (2,839,059 liter) below grade concrete reservoir.

### **St. Louis, Missouri**

The St. Louis site covers 9.7 million square feet (901,160 sq. meters), this was the original site of the McDonnell Aircraft Company which was formed in 1939. It started off building parts for other aircraft companies and evolved into the premier manufacturer of jet fighter aircraft, including the F101 Voodoo, F4 Phantom, F15 Eagle and the currently produced F/A18 Super Hornet. The McDonnell Aircraft Company merged with The Douglas aircraft Company which was predominantly involved in the manufacture of commercial transports in 1967. In 1997 The McDonnell Douglas Company merged with the Boeing Company to form the largest aerospace company in the world. This site now encompasses 112 Buildings and is the headquarters of the Integrated Defense Systems Division.

Employment at the St. Louis location is approximately 13,000 people.

Due to the age of many of the buildings at this site the automatic sprinkler systems protecting the factory and final assembly areas are generally laid out on an ordinary hazard pipe schedule using ½ in. (12.7 mm) orifice 165°F (74.4°C) rated sprinklers covering a maximum of 120 sq. feet (11.14 sq. meters) per sprinkler. The more recently install sprinkler systems were hydraulically designed to provide a minimum of a 0.17 gpm/sq. ft. (6.5 L/min/sq. meters) over a 5000 sq. ft. (465.51 sq. meter) area using ½ in. (12.7 mm) orifice 165°F

(74.4°C) sprinklers covering a maximum of 120 sq. feet (11.14 sq. meters) per sprinkler.

The fire protection water supply for the factory and final assembly buildings is provided through connections to the St. Louis County public water supply system, fed by 12 inch (304.8 mm) and 30 inch (762 mm) water mains.

The single Aircraft Hangar that houses and services fueled aircraft is protected in accordance with NFPA 409 (2001 edition) for a Group I Hangar. The sprinkler system at the roof level is a closed-sprinkler wet pipe automatic sprinkler system designed to provide a 0.17 gpm/sq. ft. (6.9 L/min/sq. meter) density over the most remote 15000 sq. ft. (1393.55 sq. meter) area. The sprinklers are of the quick response type and have a temperature rating of 175°F (79.4°C). The fire protection system at floor level is a low-level low expansion foam system consisting of oscillating foam monitors. These monitor systems are designed to deliver a minimum application rate of 0.10 gpm/sq. ft. (4.1 L/min/sq. meter) of 3% AFFF MIL Spec concentrate to achieve coverage of the entire hangar floor within 3 minutes of actuation.

The four aircraft paint hangars are protected in accordance with NFPA 409 for a Group II Hangar. The fire protection system at the roof level of each paint hangar is a closed-sprinkler, foam-water sprinkler system designed to deliver a density of 0.16 gpm/sq. ft. (6.5 L/min/sq. meter) of 3% AR-AFFF concentrate over the entire 8,500 sq. ft. (789.7 sq. meters) area of the paint hangar. The sprinklers are 175°F (79.4°C) rated and cover a maximum of 100 sq. ft. per sprinkler. All electrical equipment and devices inside the paint hangar is suitable for Class 1, Division 1 locations.

The two aircraft fuel calibration hangars are protected in accordance with NFPA 409 for a Group II Hangar. The fire protection system at the roof level of each fuel cal hangar is a closed-head foam-water sprinkler system designed to deliver a density of 0.16 gpm/sq. ft. (6.5 L/min/sq. meters) of 3% AFFF MIL Spec concentrate over the entire 5,300 sq. ft. (492.4sq. meters) hangar area. The sprinklers are 175°F (79.4°C) rated and cover a maximum of 100 sq. ft. (9.3 sq. meter) per sprinkler. All electrical equipment and devices inside the fuel cal hangar is suitable for Class 1, Division 1 locations.

The two aircraft Hush Houses or aircraft engine test hangars are protected in accordance with NFPA 409 for a Group II Hangar. The fire protection at the roof level of each Hush House is a deluge foam-water system designed to deliver a density of 0.16 gpm/sq. ft. (6.5 L/min/sq. meters) of 3% AFFF MIL Spec concentrate over the entire 4500 sq. ft. (418 sq. meter) area of the hangar. Each of these hangars is equipped with two fixed under-wing nozzles designed to direct the foam solution beneath the wings and entire length of the fuselage. The under-wing protection employs 3% AFFF MIL Spec concentrate at a 0.10 gpm/sq. ft. (4.1 L/min/sq. meter) density.

The fire protection water supply for the Flight Ramp facilities is provided from four 5,000 gpm (18,927 lpm) 140 psi (9.65 bar) and one 2,500 gpm (9463.53 lpm) 135 psi (9.3 bar) diesel engine driven fire pumps. The four 5,000 gpm (18,927 lpm) fire pumps take suction from two 300,000 gallon above grade (1,135,624 liter) water storage tanks and the 2,500 gpm (9463.53 lpm) fire pump takes suction from a 250,000 gallon (946,352 liter) above grade water storage tank. The water storage tanks are filled from a 12 inch (304.8 mm) connection to the St. Louis County public water supply.

## **Long Beach, California**

The Long Beach, California facility is split into two separate and distinctive facilities. One facility manufactures and assembles the Boeing 717 commercial jet transport, while the other facility manufactures and assembles the C-17 Globemaster military airlift aircraft.

The commercial site produces the 717 twinjet and supporting in-service airplanes. Opened by the Douglas Aircraft Company in 1941, the Long Beach site in California became part of Boeing as a result of the merger of Boeing and McDonnell Douglas in 1997. The Long Beach site assembles the Boeing 717-200, a 100-passenger twinjet. During its 60-plus-year history, the facility has produced more than 15,000 airplanes, including the famed DC-3/C-47, DC-8, DC-9, DC-10, MD-80, MD-90 and MD-11 passenger planes, as well as such military airplanes as the B-17 (in cooperation with Boeing), the A-20, A-26, C-74, C-124, A-4D, C-133 along with early and the current model of the C-17.

The Long Beach site covers 2 million square feet (18,586 sq. meters) which includes Buildings 50, 52, 54, 55, 58, 59 and a number of temporary structures. Building 54, the main assembly building and offices for program management and other functions covers 1.1 million square feet (102,193 sq. meters). It is comprised of 5 bays; Bay 1 is 186 ft (56.7 meters) by 780 ft (237.7 meters) with a 50 ft (15.24 meter) useable height; Bays 2 and 3 are 202 feet (61.57 meter) by 780 (237.7 meter) feet with a 70 ft. (21.34 meter) useable height; and Bays 4 and 5 are 202 feet (61.57 meter) by 780 feet (237.7 meter) with an 80 ft. (23.38 meter) useable height. The hangar doors span more than 2000 linear feet (609.6 meters), including the largest hangar leaf door ever erected, 102 ft. (31.1 meters) by 80 ft. (23.38 meters) and weighing 56 tons (50,802.35 kg) each, of which there are 8 on the building.

Employment at the Long Beach location is approximately 7,300 people.

The factory areas and final assembly areas at the Long Beach facility are protected by standard wet pipe type automatic sprinkler systems. These systems are designed to provide an ordinary hazard level of protection for this generally metal-working occupancy. The density at the roof level in these areas

is generally a 0.16 to 0.17 gpm/sq. ft. (6.5 to 6.9 L/min/sq. meters) density over the most remote 3000 sq. ft. (278.7 sq. meters). The sprinklers are 165°F (74°C) rated and cover a maximum of 120 sq. ft. (11.14 sq. meters) per sprinkler

The paint hangar utilized in the manufacturing of the C-17 was recently retrofitted with a new protection scheme to allow the introduction of fully fueled aircraft. This new scheme incorporated the use of a wet pipe automatic sprinkler system at the roof level designed to provide a 0.17 gpm/sq. ft. (6.9 L/min/sq. meters) over the most remote 15,000 sq. feet (1393.55 sq. meters) utilizing quick response sprinklers with 175°F (79.4°C) temperature ratings. The supplemental fire protection system includes the use of 3% AFFF delivered through oscillating monitor nozzles designed to deliver the AFFF at a 0.10 gpm/sq. ft. (4.1 L/min/sq. meter) density over the entire hangar floor area. This particular paint hangar utilizes a down draft configuration for the removal of vapors. The ducts below the floor are protected by an open sprinkler deluge system. Both the deluge system protecting the underfloor ducts and the oscillating monitor nozzles are actuated through the use of UV-IR (ultraviolet-infrared) optical type detectors.

The paint hangar utilized for the manufacturing of the 717 aircraft is not arranged for the introduction of fueled aircraft. It is protected by a standard wet pipe type automatic sprinkler system designed to deliver a 0.30 gpm/sq. ft. (12.2 L/min/sq. meter) density over the most remote 5000 sq. ft. (465.51 sq. meters) using ½ in. (12.7 mm) orifice, 286°F (141°C) rated sprinklers covering a maximum of 100 sq. ft. per sprinkler.

## **Mesa, Arizona**

The Mesa, Arizona facility was constructed in the mid eighties as part of Hughes Helicopter. It is home to the AH-64D Apache Longbow, Integrated Defense Systems Electrical Products Strategic Manufacturing Center, and more. It encompasses 25 Buildings totaling 1,872,000 square feet (173,914 square meters).

Approximately 700,000 square feet (65,032 square meters) is occupied by factory and hangar spaces. Employment at the Mesa site is in excess of 5000 people.

The factory areas and final assembly areas at the Mesa facility are protected by standard wet pipe type automatic sprinkler systems. These systems are designed to provide an ordinary hazard level of protection for this generally metal-working occupancy. The density at the roof level in these areas is generally a 0.16 to 0.17 gpm/sq. ft. (6.5 to 6.9 L/min/sq. meters) density over the most remote 3000 sq. ft. (278.7 sq. meters). The sprinklers are 165°F

(74°C) rated and cover a maximum of 120 sq. ft. (11.14 sq. meters) per sprinkler

The water supply for the Mesa site is provide by three fire pumps including one 1500 gpm pump and two 2000 gpm pumps.

## **El Segundo, California**

The El Segundo site is the home to Boeing Satellite Systems, a wholly owned subsidiary of the Boeing Company. The main building was built in the forties, and was occupied by several different manufacturing companies before Hughes Satellites purchased it. Hughes started building satellites at this facility in 1961, and launched the first one in 1963.

The main manufacturing building S25 has grown with the addition of nine other buildings that have all become part of the main building. Six of the nine building additions incorporate the use of a high bay, 85 feet (25.9 meters) to facilitate satellite manufacturing and movement. Presently, Building S25 covers 798,896 square feet (74,220 square meters).

The El Segundo site has a total of 42 buildings covering a total of 3.1 million square feet (288,000 square meters). There are approximately 6,500 employees at this site. In addition to the manufacturing operations, personnel at this site occupy five high-rise office buildings.

Automatic sprinkler protection is provided throughout all of the buildings at this facility. They are arranged to provide an ordinary hazard level of protection for this predominantly metal/electronic working facility. These systems can provide a minimum of a 0.16 gpm/sq. ft. (6.5 L/min/sq. meters) over a 3000 sq. ft. (278.7 sq. meters) area using ½ in. (12.7 mm) orifice sprinklers covering a maximum of 120 sq. feet (11.15 sq. meters) per sprinkler.

The satellite manufacturing and testing process requires the use of several anechoic chambers. There are eleven such chambers at this facility. Nine of them are protected by pre-action type sprinkler systems; the remaining two are protected by in an open sprinkler deluge arrangement.

The water supply for the manufacturing portion of the site is provided by two, 2000 gpm pumps taking suction from a 300,000 gallon (1,135,624 liter) above grade reservoir. A 1,500 gpm (5678.12 lpm) booster pump taking suction from the public water supply provides the water supply for the high-rise buildings.

Boeing, as a company, takes the fire protection of their people and facilities very seriously. They employ full time fire departments at their major sites and 5 Fire Protection Engineers to ensure their assets are protected from fire risks.

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