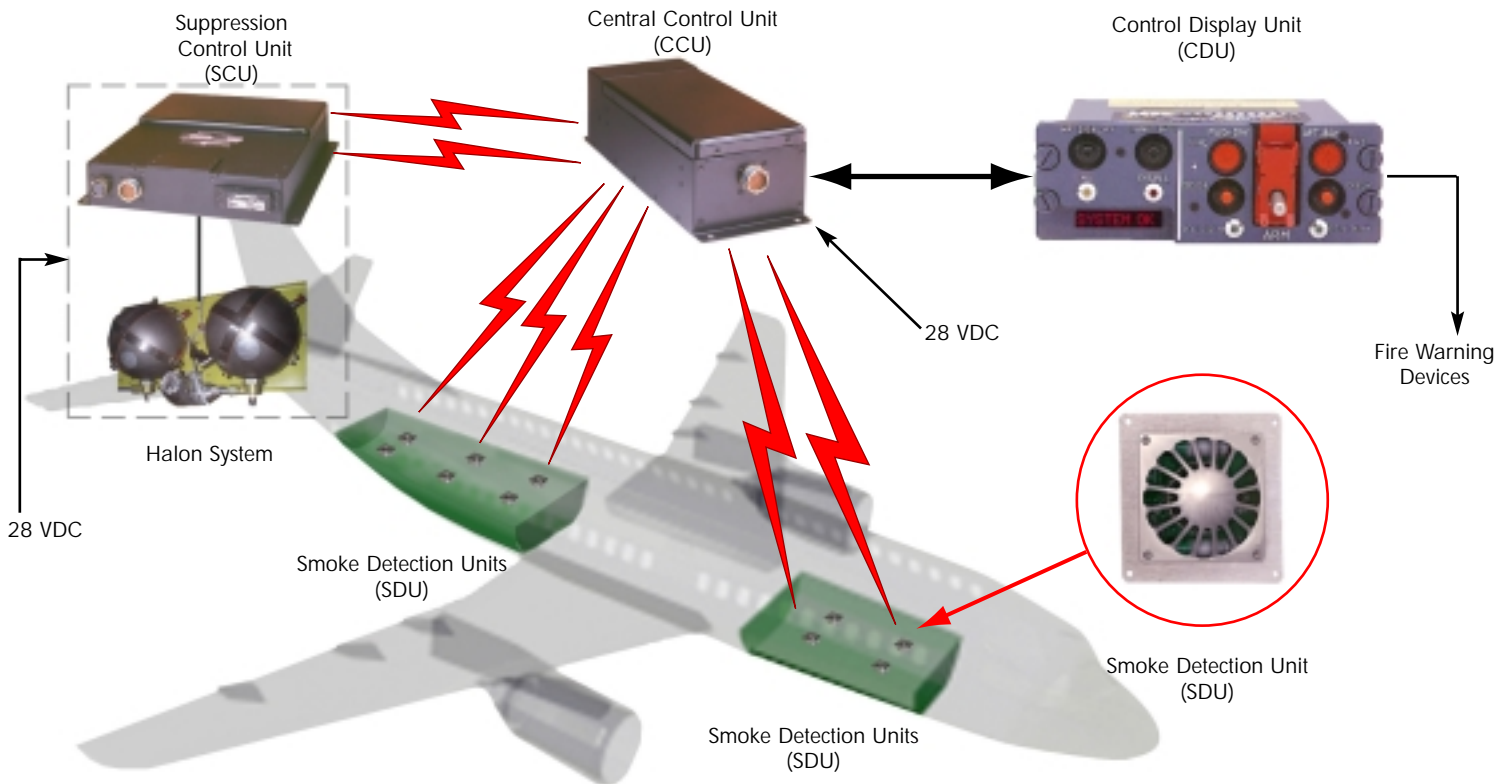# securaplane®
TECHNOLOGIES

ST3000

Wireless Smoke Detection and Fire Suppression System

Direct Sequence Spread Spectrum

RF Technology comes to aviation:

- Reduced installation time
- Lower overall cost
- Less installed weight

Suppression
Control Unit
(SCU)

Central Control Unit
(CCU)

Control Display Unit
(CDU)

28 VDC

Fire Warning
Devices

Halon System

28 VDC

Smoke Detection Units
(SDU)

Smoke Detection Unit
(SDU)

Smoke Detection Units
(SDU)

Securaplane® introduces Wireless Spread Spectrum RF Technology to the aviation industry.

SDUs

CDU

CCU

Securaplane technologies now offers the air transport industry an elegant, cost effective solution to current requirements for smoke detection and fire suppression control systems.
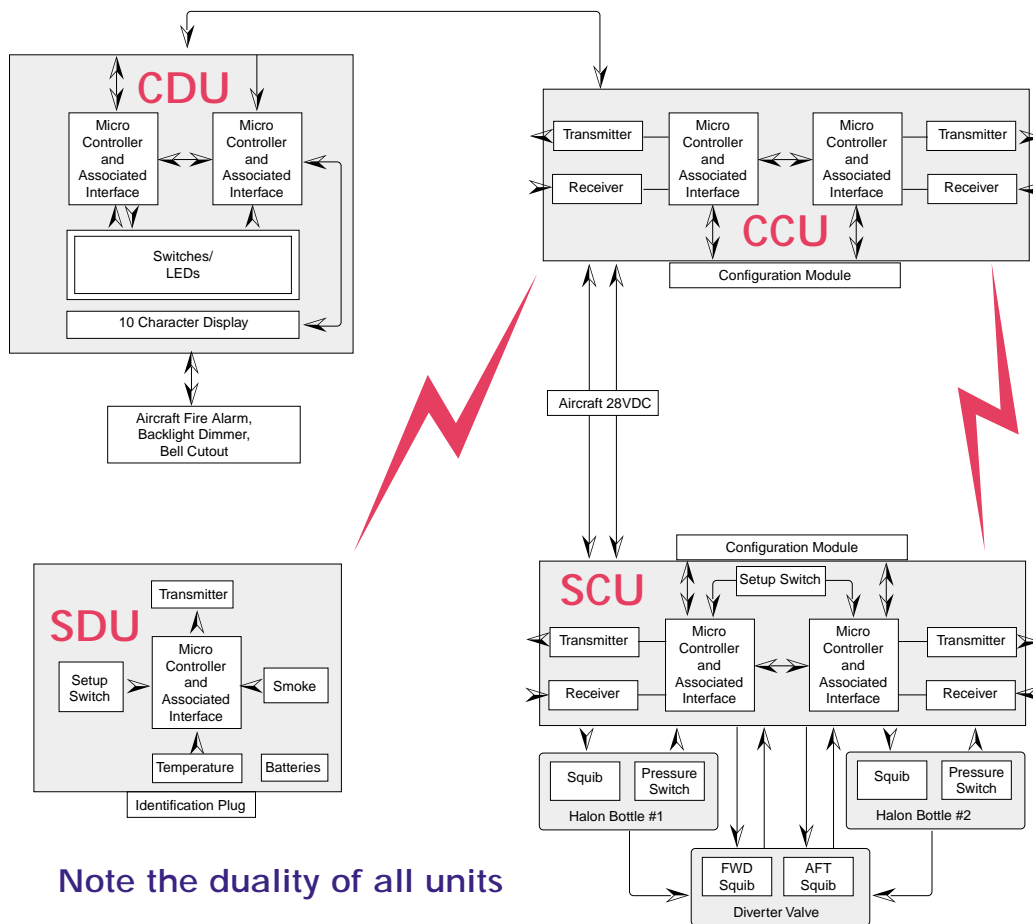
Reduced Installation Time

The paradigm of having to install a smoke detection and fire suppression system during a heavy maintenance cycle is broken! Airlines concerned that their "D" checks are at capacity for adding additional modifications have a **choice** of **doubling** their opportunity to install the mandated smoke system compared to a wired system. The Securaplane® ST3000 wireless system can be installed during an overnight "C" check or other **short** inspection interval. Just ask any of the many airlines that have selected the revolutionary ST3000.

Airlines and other installers have calculated anywhere from 40 to 60 percent fewer installation manhours for the Securaplane® system versus a wired system. And more importantly, it allows becoming compliant by 1 March 2001. One airline states that it will turn an airplane in one day vs. three days for a wired system. Another airline has calculated just over 100 man-hours **savings per airplane**.

SCU

System Architecture

CDU

Micro Controller and Associated Interface	Micro Controller and Associated Interface

Switches/ LEDs

10 Character Display

Aircraft Fire Alarm, Backlight Dimmer, Bell Cutout

CCU

Transmitter | Micro Controller and Associated Interface | Micro Controller and Associated Interface | Transmitter

Receiver | | | Receiver

Configuration Module

Aircraft 28VDC

SDU

Transmitter

Setup Switch | Micro Controller and Associated Interface | Smoke

Temperature | Batteries

Identification Plug

SCU

Configuration Module

Setup Switch

Transmitter | Micro Controller and Associated Interface | Micro Controller and Associated Interface | Transmitter

Receiver | | | Receiver

Squib	Pressure Switch		Squib	Pressure Switch

Halon Bottle #1 | Halon Bottle #2

FWD Squib | AFT Squib

Diverter Valve

The System can lose a channel or one SDUs per cargo bay and still meet MEL dispatch requirements.

If two SDUs are failed in one bay, the system can still dispatch, provided no cargo is loaded in the affected bay.

CDU = Control Display Unit
CCU = Central Control Unit
SCU = Suppression Control Unit
SDU = Smoke Detection Unit

Note the duality of all units

Dual Channel Redundancy = Dispatchability

Spread Spectrum RF Transmission and DO-160C

Spread Spectrum consists of rapidly transmitting data over not just one but many frequencies. The Securaplane® system uses 126 individual frequencies. By "spreading" the data over a broad "spectrum" or bandwidth, the apparent power per individual frequency is tiny, yet the cumulative signal strength is quite powerful, providing tremendous "throughput". Yet this signal operates below DO-160C, commercial aviation's regulatory document. On an oscilloscope, a spread spectrum transmissions resemble (and operate inside) allowable ambient noise. Coding is used so that only a receiver matching the code sequence will receive the signal. Aircraft parked next to each other will not interfere with each others' operation.

Narrow Band Signal
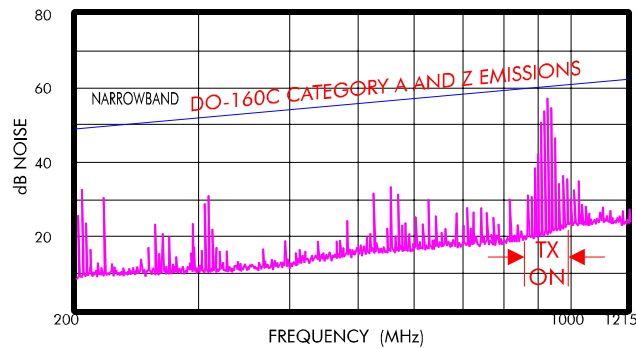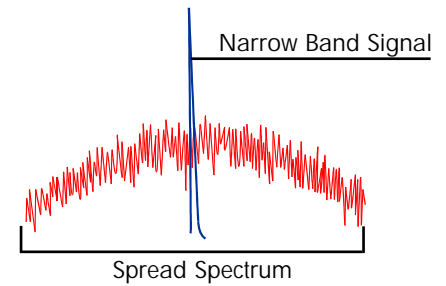
Spread Spectrum

Spread Spectrum advantages include:

- Low probability of interference with other systems.
- Sharing the same frequency band with other users.
- Low probability of interference from other aircraft systems.
- Reduction of multi-path signals.

Spread Spectrum is a mature technology which has been used since 1944 by the military for secure communication, missile guidance and other critical applications where signal integrity is essential.

(Chart: dB NOISE vs FREQUENCY (MHz), 200 to 1215; NARROWBAND, DO-160C CATEGORY A AND Z EMISSIONS, TX ON)

The Fascinating Origin of Spread Spectrum RF Technology

Hedy Lamarr and George Antheil.

Below: Their patent.

On August 11, 1942, MGM movie star Hedy Lamarr and musician George Antheil were awarded US Patent Number 2,292,387 for their "Secret Communications System".

Lamarr had told Antheil about her idea for a Secret Communications System that could guide torpedoes to their target without being intercepted by the enemy, by sending messages between transmitter and receiver over multiple radio frequencies in a random pattern. The message would move so quickly across the radio waves that anyone tuning in to a particular frequency would only hear a blip, and would be unable to intercept the message.

Lamarr and Antheil knew they had something that could help win the war. They sent their invention to the recently established National Inventors Council, and Antheil claimed that Charles Kettering himself, director of the Council and research director at General Motors, encouraged them to patent it. The two inventors worked with an MIT electrical engineer to iron out some technical kinks, and submitted their patent proposal in 1941. Rather than develop the patent commercially, they gave it away to the government for the war effort.
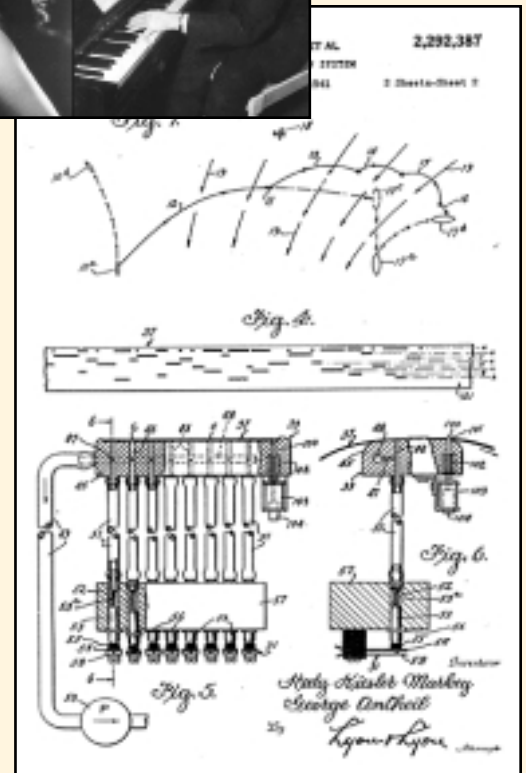
Initially, spread spectrum remained a military data communications technology.

In the mid-1980s, the US military declassified spread-spectrum technology, and the commercial sector began to develop it for consumer use.

Control Display Unit (2 Bay)

–Designed by pilots, for pilots.–

Press to test all CDU lamps and LEDs.

Illuminates when fire is detected.

Press to turn on alphanumeric display and step through any detected faults

Illuminates when the system detects a fault, or service is required.

Press to release fire suppressant.

Arms fire suppression system.

Alphanumeric display of system status. Indicates "FIRE" in the event of a fire.

Blinks when bottle is discharged, steady when bottle is empty.

Illuminates if system is not dispatchable.
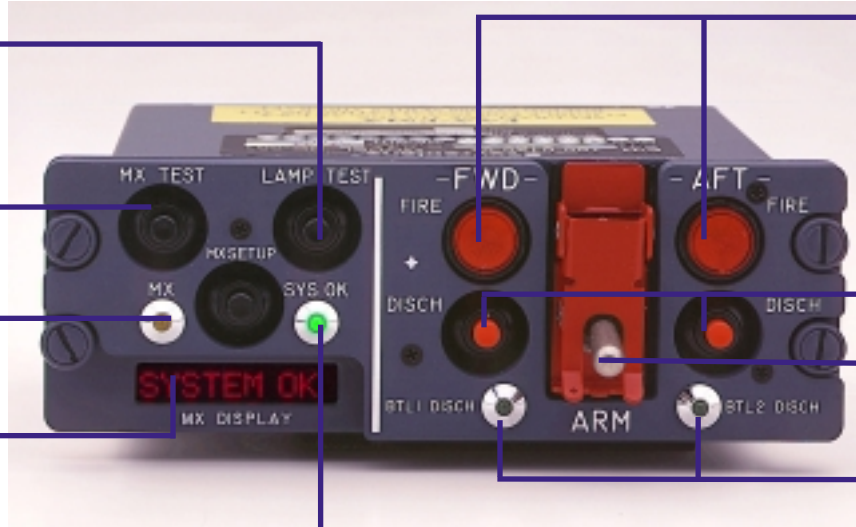
Selective Fire Suppression and Complete System Monitoring

The CDU is the control point for the entire system. The 10 digit scrolling LED reports not only when and where a fire has been detected, but also reports on system integrity, component status, and is used by maintenance to install new or replacement components.

Smoke sensors send test signals to the CCU in 30 second intervals. These signals are processed and sent to the CDU. Should any sensor fail to report, or indicate low battery condition, the CDU will notify the operator.

When the CCU had determined that a fire condition exists, the alphanumeric LED indicates in english which bay is affected. A large red LED will also indicate which bay is signalling a fire. The pilot actuates the guarded arm switch, then depresses the discharge (DISCH) button for the affected bay. If the pilot depresses the incorrect button, the computer will sense the error and prevent actuation.

The SCU makes wireless confirmation to the CCU that the squib has fired, and the CDU flashes confirmation. The system can be operated manually at any time by the pilot.

Control Display Units for Different Applications

CDU for 3 Bays
(DC-10, MD-80 etc.)

CDU for Business Jets
Passenger Cabin
and Class "B" compartments
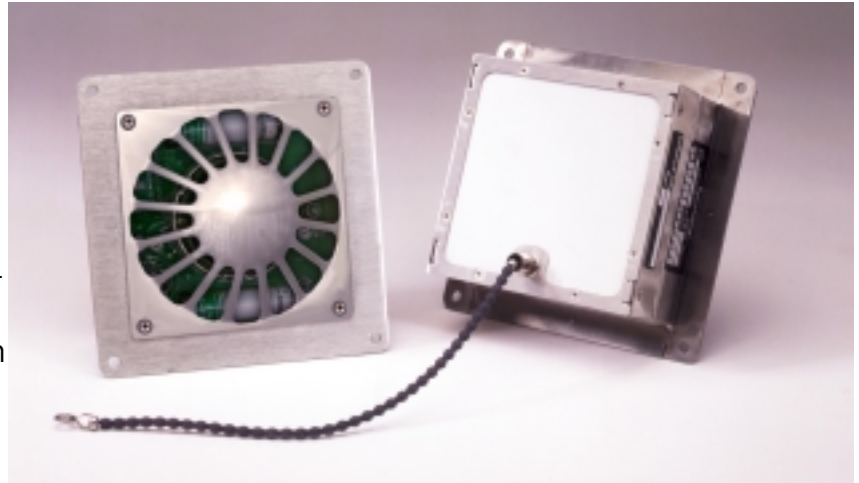
CDU Cargo Aircraft
(No Suppression)

Advanced Smoke/Temperature Detector

Securaplane's® Smoke/Temperature Sensors (SDU's) detect the presence of smoke and heat. Bay temperature is used along with "smoke" detection to determine if a fire condition exists. Normally the system requires two sensors to detect smoke before an alarm is issued. However, an alarm is issued if a single sensor detects smoke **and** temperature exceeding 150° F.
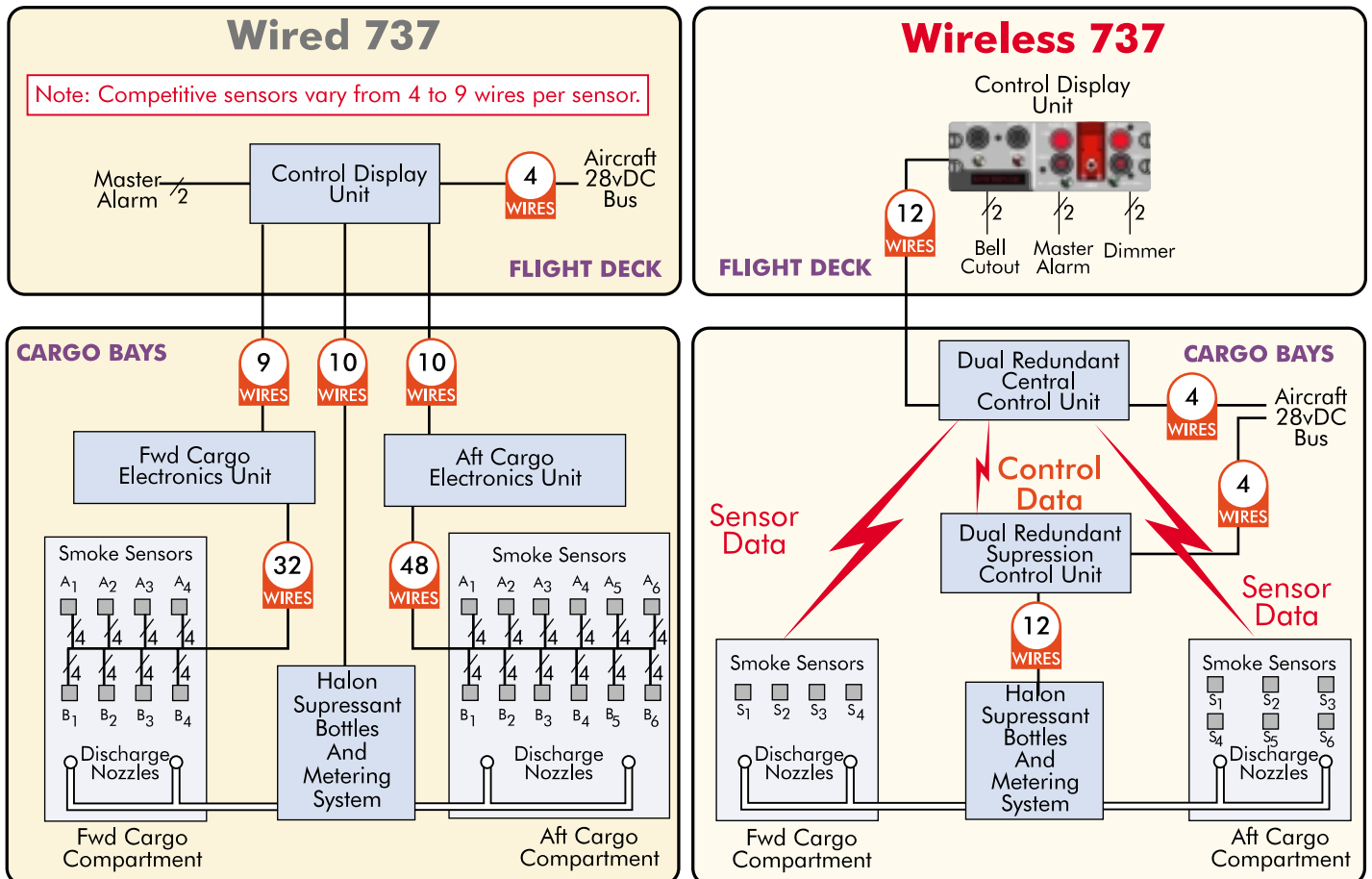
Each SDU has a cargo bay identification plug and and a unique identification number. This code identifies the SDU to the CCU, and the identification plug shows which cargo bay it is located in. The identification plug is a quick disconnect type connector which is attached to the aircraft airframe by a steel lanyard. Replacing and installing a new sensor is as easy as disconnecting the plug, removing the sensor, and replacing it with another. Sensors are interchangeable.

Each sensor is powered by two 5-year Lithium Thionyl Chloride batteries. Each unit signals the status of the batteries to the CCU every 30 seconds.
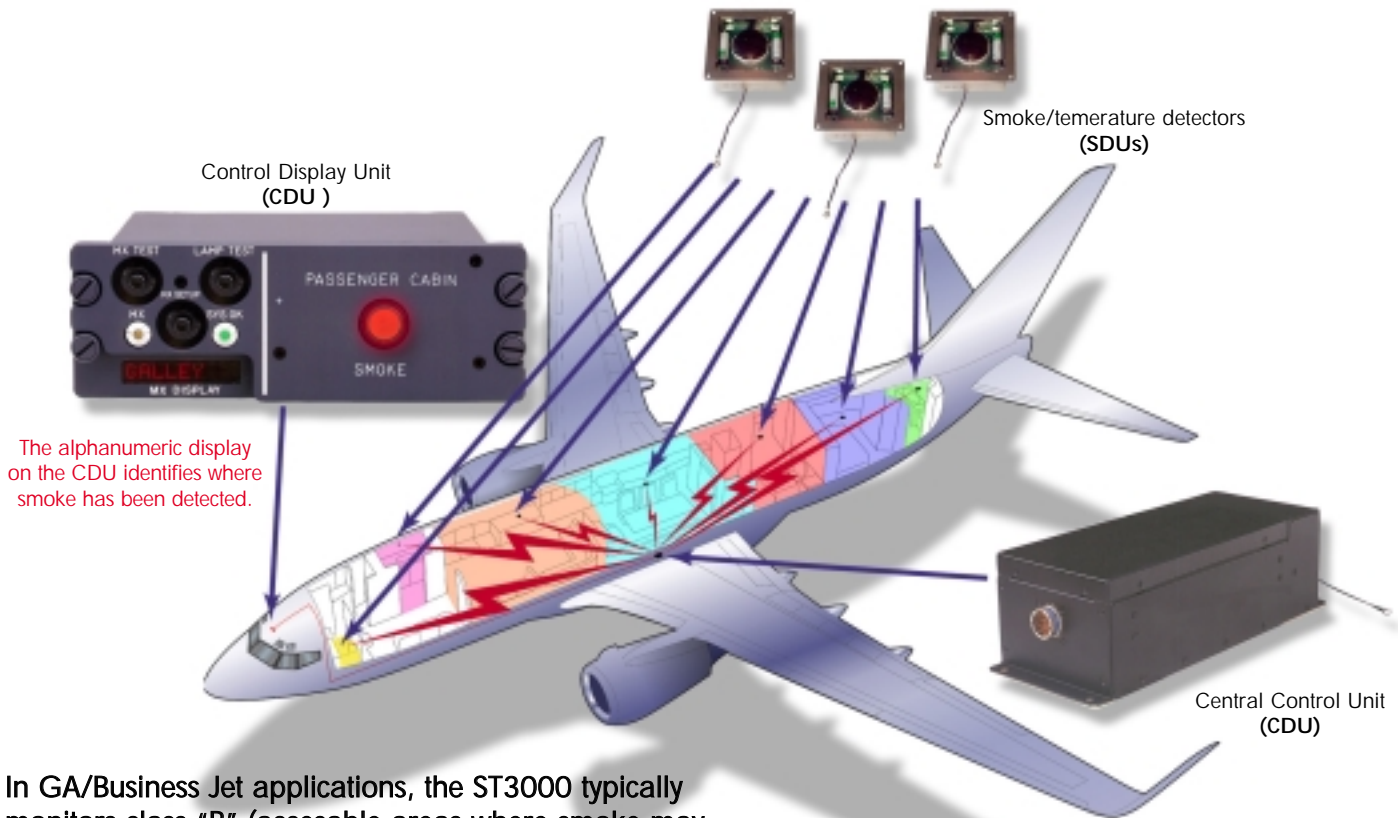
At the heart of each patented SDU is a proven infra-red smoke detector, manufactured in the U.S. by a firm which demands over-engineering for maximum false alarm immunity. Every IR sensor is 100% tested with real smoke at three levels of obscuration. They are virtually immune to rapid condensation.

Wired vs Wireless Block Diagrams

Business Jets

Smoke/temerature detectors
(SDUs)

Control Display Unit
(CDU)

The alphanumeric display
on the CDU identifies where
smoke has been detected.

Central Control Unit
(CDU)

In GA/Business Jet applications, the ST3000 typically monitors class "B" (accesable areas where smoke may not be noticed) and passenger cabin areas. Though smoke detection is not always required in the cabin, passengers might not be awake to observe the first signs of a fire.

Quick installation and ease of maintenance are important aspects of a wireless smoke sensor system.

Yet beyond this, the expensively appointed interiors of today's business jets require a consideration of the effect that installing a smoke sensor system will have.

Removing paneling, and running wires from as many as seven different locations throughout the length of the aircraft would require extensive dismantling of the interior. A dual loop wiring harness also limits the locations that sensors can be placed.

A wireless system allows flexibility in choosing discrete locations for sensor placement as well as limiting the amount of interior panels which would need to be disturbed, thus providing for the least impact to the interior furnishings.

A wireless system greatly reduces the wear and tear on the aircraft interior, whether it be during installation, or during maintenance of the system, thus protecting an important investment.

For retrofit applications, the minimum impact of installing a wireless system should be an important consideration.

The smoke/temperature sensors install unobtrusively in ceiling or wall panels.
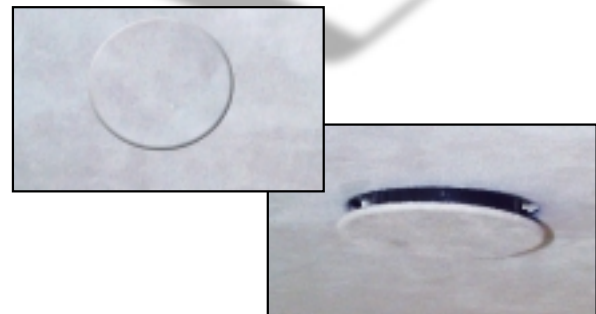
System Components and Specifications

Dual Central Control Unit (CCU)

The CCU houses the Spread Spectrum Receiver that receives status from the smoke, temperature sensor and receives status from the SCU and controls halon discharge through the SCU.

The CCU also contains the detection logic which calculates the probability of a fire.

Power: 28VDC @ 120ma max.

Size: 4″ x 9″ x 3″

Weight: 2.93 lb

Check-In Interval: 30 seconds

Memory: Non-volatile + Configuration Module

Suppressant Control Unit (SCU)

The Dual SCU houses the Spread Spectrum Transmitter and Receiver and Microcontroller that communicates with the CCU.

The SCU transmits bottle pressure, squib continuity, and battery energy level information to the CCU.

The SCU receives the Halon discharge command from the CCU and fires the appropriate squibs.

Contents: Spread Spectrum Transmitter/Receiver +Microcontroller

Power: 28VDC @120mA

Weight: 3.69 lb

Check-In Interval: 30 seconds

Memory: Non-volatile + Configuration Module

Smoke Detector Unit (SDU)

These units use both temperature and smoke detection to reduce false alarms.

The identification plug provides each Sensor with its cargo bay location. Each sensor has a unique code. This code identifies the compartment of each sensor to the Dual Central Control Unit.

The Identification Plug is housed in a quick disconnect type plug which is attached to the aircraft airframe by a steel lanyard.

Power: 2 3V Lithium Thionyl Chloride cells:

Size: 5.5″ x 5.5″ x 2.25″

Weight: 1.88 lb

Check-in Interval: 30 seconds

Control Display Unit (CDU)

Control Display Units (CDU) include automatic monitoring and fault isolation. The digital display lights for maintenance functions, and back-up fire indication.
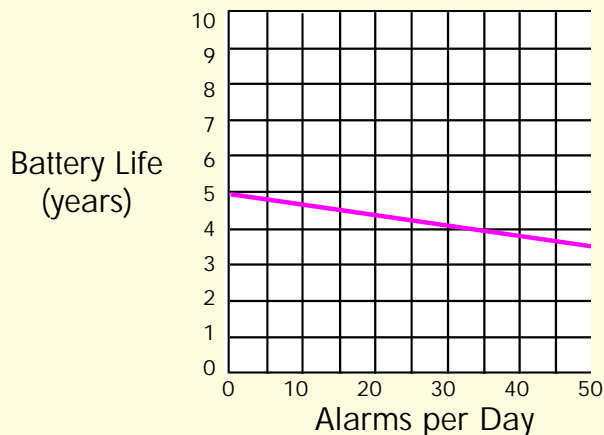
Units have been designed for a wide variety of aircraft types with varying numbers of cargo bays and sensor placements. CDU's for (3) cargo bays are available.

Power: 28VDC @ 120ma max.

Size: 5.75″ x 5″ x 2″

Weight: 1.01 lb

Battery Life for a Securaplane® Smoke Detector

Battery Life (years) vs Alarms per Day

NOTE: The smoke detector sends a battery level and RF test every 30 seconds.

Battery Type:
Lithium Thionyl
Chloride — primary

Meets:
MIL-B4946/(ER)
U/L - 1642
MIL - STD - 810C
MIL - STD - 202F

Disposal
Same as for Ni-Cad Cells
$2.00/lb. min.
BDT quote 12/97

With more than 10 years of avionics experience that includes the pioneering application of spread spectrum radio frequency (RF) technology to aviation systems, Securaplane® Technologies is committed to an innovative approach. We do not do "me-too" products, preferring to instead take a fresh look at a difficult product requirement, redefining the paradigm rather than redesigning an existing solution.

Securaplane® has built a strong customer base with business jet manufacturers, major airlines, and air freight carriers with a diverse offering of products, including emergency batteries, main battery chargers, and the world's most popular electronic aircraft security systems.

Securaplane's® new facility in Tucson, Arizona.