DESIGN DATA SHEET
DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND

DDS 430-3
1 March 1986

SHIPBOARD FIRE DETECTION SYSTEM

CONTENTS

430-3-a References

Shipboard Fire Detection System Selection and Installation Guidance, NAVSSES Project A-1623-2, 8 July 1981.

Military Specification for a Shipboard Fire Detection System (SFDS), 20 June 1981.

430-3-b Introduction

This Design Data Sheet (DDS) describes the criteria applicable for system design of a fire detection system utilizing Shipboard Fire Detection System (SFDS) components to provide an efficient and reliable fire detection capability. This DDS also gives the approach necessary to select the type, quantity and location of detectors in protected compartments and the type and location of alarm switchboards to display alarm conditions. Specific compartments to be provided with the fire detection coverage will vary with ship class and funding available.

430-3-c Definitions

Class A Fires - Fires involving combustible solids such as wood, cloth or paper.

Class B Fires - Fires involving flammable liquids or gases.

Class C Fires - Fires involving energized electrical or electronic equipment or conductors.

Smouldering Stage of Fire - Stage of fire in which there are invisible products of combustion and visible smoke present, but little or no heat at the overhead and no visible flame.

Flaming Stage of Fire - Stage of fire in which invisible products of combustion and open flames are present. Visible smoke may or may not be present depending on the efficiency of the fire. Detectable heat at the overhead will become present as the fire progresses.

430-3-d General Requirements

1. System Description

The SFDS is a general purpose fire and smoke detection system for use on U.S. Navy ships. The system consists of the following units:

(a) alarm switchboards

(b) ionization smoke detectors

(c) photoelectric smoke detectors

(d) flame detectors

(e) fixed temperature heat detectors (105, 125, 150 and 175°F)

(f) rate of temperature rise heat detectors

(g) electrical socket bases

(h) end-of-line devices

The alarm switchboard supervises the detection circuits and provides visual and audible alarms indicating the status and location of fire or system trouble conditions.

The alarm switchboard interfaces the detectors by means of specific voltage levels to determine normal, alarm, and supervisory failure conditions. Either type 3SWAU or type 3SWU cable can be used to interface the alarm switchboard with the detectors. Light-weight cable (3XSW) or low-smoke cable (LS3SWU) may be substituted as required by the ship class. The length of the cable for any single circuit must not exceed one thousand feet.

Each compartment protected by detectors must occupy an individual switchboard zone module unless the number of detectors required in the compartment exceeds the current supplying capability of the zone module. Multi-level compartments must have an individual zone module for each level to aid fire parties in locating the fire.

The number of detectors for any single circuit is limited by the current supplying capability of the zone module (eight hundred milliamperes) which supervises that circuit. The current draw of the detectors varies from type to type, thus the maximum number of detectors which can be installed per circuit varies with the mix of detectors desired to be installed on that circuit. In the following example the current draw specified per detector is a maximum figure that would occur with the detector in an alarm condition.

For example:

8 ionization @ 30 mA per detector	= 240 mA
8 photoelectric @ 35 mA per detector	= 280 mA
1 flame @ 80 mA per detector	= 80 mA
5 rate of temperature rise @ 30 mA per detector	= 150 mA
10 fixed temperature @ 5 mA per detector	= 50 mA
	800 mA

This combination of detectors would be acceptable for installation on one circuit.

Ionization smoke detectors and photoelectric smoke detectors have adjustable sensitivity settings that can be set such that the detectors will detect fires but not false alarm from normal environmental conditions. The ionization detectors should be installed with the sensitivity set at 2% per foot obscuration for gray smoke, unless otherwise specified in Table II. If false alarms occur the sensitivity can be decreased by setting the sensitivity to 3% per foot obscuration for gray smoke. The photoelectric smoke detectors should be installed with the sensitivity set at 1% per foot obscuration for gray smoke.

All SFDS detectors have a nameplate located externally on the case on which must be etched the switchboard and zone circuit to which the detector is connected. All SFDS detectors have horizontal and vertical mounting capability. Detectors are connected into the circuit by means of electrical socket bases. Initially the electrical socket bases will accept all types of detectors, but after the bases are installed aboard ship they can be keyed to accept one particular type of detector. There are five selectable keying rings, one each for the ionization smoke detector, photoelectric smoke detector, flame detector, rate of temperature rise heat detector and fixed temperature heat detector (all temperature values). Each detector circuit is supervised such that removal of the detector from its socket or any break (open) in the ship's detector cabling will cause a supervisory failure alarm.

An end-of-line device must be installed in the most electrically remote electrical socket base of each circuit.

The SFDS will interface with other components such as remote alarms and manually-operated lever switches to provide capabilities for crew members to notify damage control watchstanders of a fire or notify watchstanders at OOD stations remote from the SFDS alarm switchboard.

Electrical and physical characteristics for SFDS components are given in Table I.

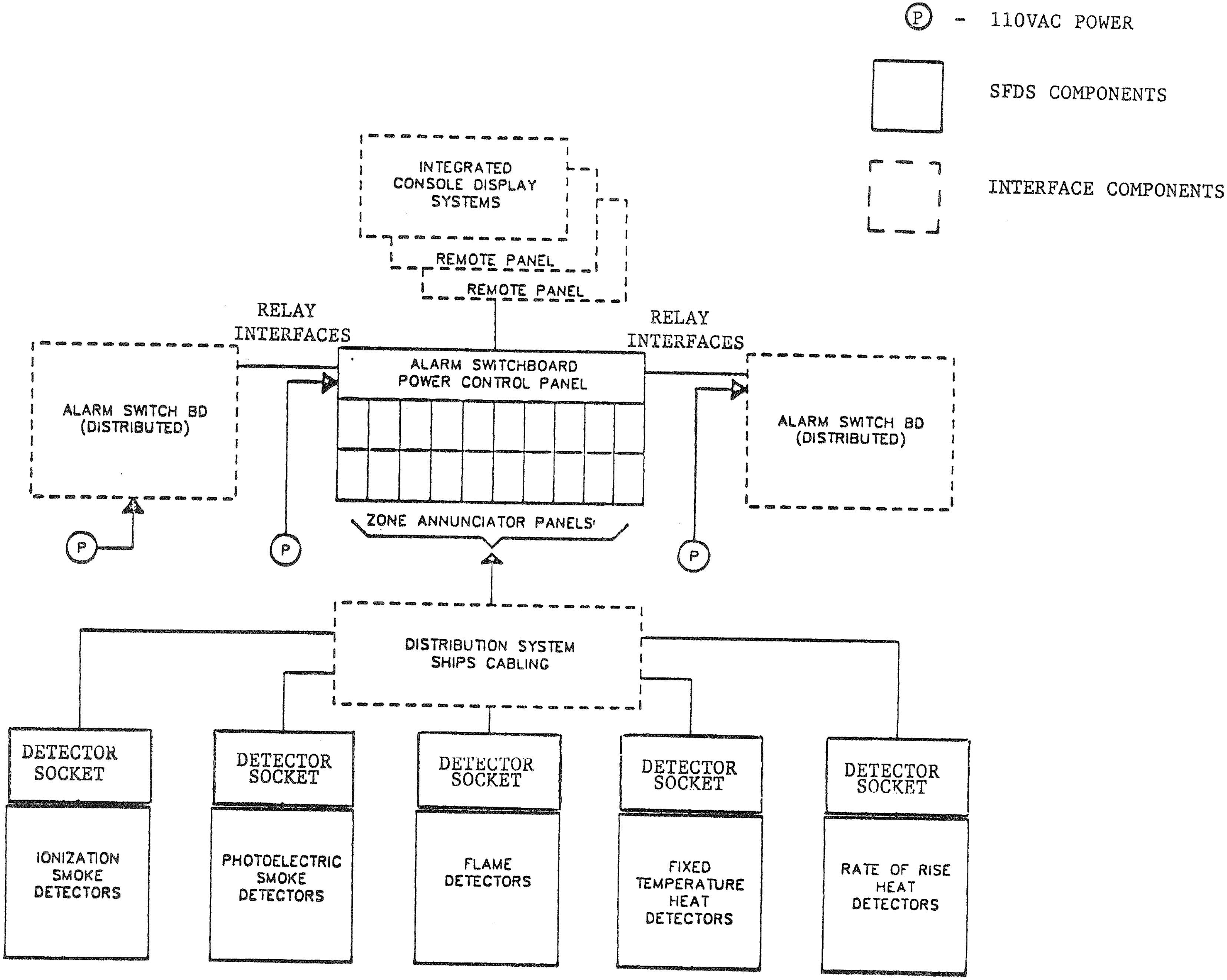

Figure 1 Shipboard Fire Detection System

TABLE I

ELECTRICAL CHARACTERISTICS FOR INSTALLED EQUIPMENT						
NOMENCLATURE	VOLTS	PHASE	FREQ (HZ)	TYPE	MAX AMPS	REMARKS
POWER CONTROL PANEL	115	1	60	I	5	POWER CONTROL PANEL FUSED FOR 5 AMPERE INPUT CURRENT
ZONE ANNUNCIATION PANEL	NOT APPLICABLE					POWER SUPPLIED BY POWER CONTROL PANEL
ZONE MODULE	NOT APPLICABLE					POWER SUPPLIED BY POWER CONTROL PANEL

PHYSICAL CHARACTERISTICS FOR INSTALLED EQUIPMENT										
	WEIGHT	SIZE (INCHES)			CLEARANCE (INCHES)					
NOMENCLATURE	(LBS)	H	W	D	T	F	R	B	LH	RH
POWER CONTROL PANEL	50	12	24	11	4	36	BHD MTD	0	6	12
ZONE ANNUNCIATION PANEL	20	4	24	11	0	36	BHD MTD	12	6	12
ZONE MODULE		CONTAINED IN ZONE ANNUNCIATION PANEL								

TABLE I

ELECTRICAL CHARACTERISTICS FOR INSTALLED EQUIPMENT						
NOMENCLATURE	VOLTS	PHASE	FREQ (HZ)	TYPE	MAX AMPS	REMARKS
IONIZATION SMOKE DETECTOR	24	DC	DC		.030	
PHOTOELECTRIC SMOKE DETECTOR	24	DC	DC		.035	
FLAME DETECTOR	24	DC	DC		.080	
RATE OF TEMPERATURE RISE HEAT DETECTOR	24	DC	DC		.030	

PHYSICAL CHARACTERISTICS FOR INSTALLED EQUIPMENT										
NOMENCLATURE	WEIGHT (LBS)	SIZE (INCHES)			CLEARANCE (INCHES)					
		H	W	D	T	F	R	B	LH	RH
IONIZATION SMOKE DETECTOR	6	10.5	6	6	No clearances have been specified for detectors.					
PHOTOELECTRIC SMOKE DETECTOR	6	11.25	6	6	No clearances have been specified for detectors.					
FLAME DETECTOR	8	16	9	9	No clearances have been specified for detectors.					
RATE OF TEMPERATURE RISE HEAT DETECTOR	7	10	6	6	No clearances have been specified for detectors.					

DETECTOR PHYSICAL DIMENSIONS INCLUDE ELECTRICAL SOCKET BASE

TABLE I

ELECTRICAL CHARACTERISTICS FOR INSTALLED EQUIPMENT						
NOMENCLATURE	VOLTS	PHASE	FREQ (HZ)	TYPE	MAX AMPS	REMARKS
FIXED TEMPERATURE HEAT DETECTOR	24	DC	DC		.005	

PHYSICAL CHARACTERISTICS FOR INSTALLED EQUIPMENT											
NOMENCLATURE	WEIGHT (LBS)	SIZE (INCHES)			CLEARANCE (INCHES)						
		H	W	D	T	F	R	B	LH	RH	
FIXED TEMPERATURE HEAT DETECTOR	6	11.75	6	6	No clearances have been specified for detectors.						

DETECTOR PHYSICAL DIMENSIONS INCLUDE ELECTRICAL SOCKET BASE

2. DDS Usage

To use this DDS for fire detection system design, use the following sentences using the DDS sections specified.

(a) Use Section 430-3-e to prioritize the SFDS installation for compartments.

(b) Use Table II and Section 430-3-f to select detectors to be installed in a compartment.

(c) Use the applicable detector environmental restriction Sections (430-3-h-2, 430-3-i-2, 430-3-j-2, 430-3-k-2, 430-3-l-2) to ensure the detectors to be installed are compatible with the compartment environment.

(d) Use Section 430-3-f to select a substitute detector if required.

(e) Use the applicable detector location Sections (430-3-h-3, 430-3-i-3, 430-3-j-3, 430-3-k-3, 430-3-l-3) to ascertain where the detectors must be installed.

(f)Use the applicable detector quantity Sections (430-3-h-4, 430-3-i-4, 430-3-j-4, 430-3-k-4, 430-3-l-4) to ascertain the quantity of detectors required.

(g) Use Section 430-3-g-4 to ascertain where the alarm switchboard must be installed.

430-3-e Areas of Coverage

1. If the extent of the SFDS installation is restricted due to funding limitations or other causes, priorities have been established in paragraphs two through five.

2. Compartments having critical functions which are unattended/unmanned for any significant time, whether in port or underway, should have top priority. Compartments storing critical weaponry and magazines or storage areas where large scale cook-off is possible should be included in this priority ranking. Compartments which contain sleeping personnel without a fire watch should also be included.

3. Unmanned/unattended, non-critical compartments, which border the top priority compartments, and from which an undetected fire could easily involve or inflict damage on the top priority compartments, should be second in priority.

4. Unattended/unmanned compartments which are not critical, etc., and are distant from the top priority compartments, but in which an undetected fire would grow rapidly enough to overwhelm available fire parties, should be third in priority. The premise here is that the inability to control the fire could eventually cause the ship or its vital functions to be lost.

5. Usually manned compartments not included in Priorities 1, 2, and 3 are fourth in priority. Fire detection equipment may alert personnel of fire before detection by personnel in the compartment and it will ensure that a timely alarm is sounded.

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
AMMUNITION AND WEAPONS COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
ARMORY	X	X			X					
ASSEMBLY ROOM	X	X			X					
HANDLING ROOM	X	X			X					
MAGAZINE	X	X	X		X					FLAME DETECTORS INSTALLED IN MISSILE MAGAZINES.
STOREROOM	X	X	X		X					USE FLAME DETECTOR ALSO IF STOREROOM HAS HIGH OVERHEAD.
LFORM SPACE	X	X			X					
READY ROOM	X	X			X					
CHECK OUT AREA	X	X			X					

Table II shows detector recommendations for general compartment types, Environmental restrictions of detectors must be considered for detector selection.

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
COMMAND AND CONTROL COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
BRIDGE	X	X								
BRIEFING ROOM		X		X						
CIC	X	X								
COMMAND CENTER	X	X								
COMMUNICATIONS CENTER	X	X								
INTELLIGENCE CENTER	X	X								
RADIO ROOM	X	X								
PRIMARY FLIGHT CONTROL	X	X								
BALLAST/DEBALLAST CONTROL	X	X								

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
DENTAL AND MEDICAL COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
OPERATING ROOM		X		X						
PHARMACY		X		X						
TREATMENT ROOM		X		X						
WARD	X	X								IONIZATION DETECTOR SET TO MINIMUM SENSITIVITY. (i.e. 3% PER FOOT OBSCURATION FOR GRAY SMOKE)
CASUALTY COLLECTION STATION		X		X						
SCRUB ROOM		X		X						

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
ELECTRICAL AND ELECTRONIC COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
COMPUTER CENTER	X	X								DETECTORS MAY REQUIRE SPECIAL HOUSING OR SPECIAL LOCATION TECHNIQUES IF SPACE HAS HIGH AIR VELOCITIES.
EQUIPMENT ROOM	X	X								
GENERATOR ROOM	X	X								
SWITCHBOARD ROOM	X	X								
DEGAUSSING ROOM	X	X								
ECM ROOM	X	X								

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
FLAMMABLE LIQUID STORAGE COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
CARGO STOREROOM		X		X						USE PHOTOELECTRIC AND FLAME DETECTOR FOR HIGH OVERHEAD COMPARTMENT.
FLAMMABLE LIQUID STOREROOM		X		X						USE PHOTOELECTRIC AND FLAME DETECTOR FOR HIGH OVERHEAD COMPARTMENT.
PAINT MIXING AND ISSUE ROOM		X		X						USE PHOTOELECTRIC AND FLAME DETECTOR FOR HIGH OVERHEAD COMPARTMENT.
COMPRESSED GAS STOWAGE		X		X						USE PHOTOELECTRIC AND FLAME DETECTOR FOR HIGH OVERHEAD COMPARTMENT.

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
INTERNAL FUELING COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
INTERNAL FUELING STATIONS			X							

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
LABORATORY COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
BACTERIOLOGICAL LABORATORY		X		X						
GEOMAGNETIC LABORATORY	X	X								
OIL AND WATER TEST LABORATORY		X		X						
PHOTO LABORATORY		X		X						
ELECTRONICS RECORDING LABORATORY	X	X								

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
STORAGE COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
LARGE STORAGE AREA WITH HIGH OVERHEAD		X	X							
LARGE STORAGE AREA WITH LOW OVERHEAD		X		X						
HANGAR BAY		X	X							IN LOW OVERHEAD PORTIONS OF HANGER AREAS USE PHOTOELECTRIC AND RATE OF RISE DETECTORS.
WELL DECK			X							

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
LIFE SUPPORT COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
BAKERY		X		X						
BARBER SHOP	X	X								
GALLEY		X		X						
HOBBY SHOP		X		X						
LAUNDRY	X	X								
MESSROOM		X		X						
PANTRY		X		X						
SCULLERY		X		X						

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
LIVING AND OFFICE COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
BERTHING AREA	X	X								IONIZATION DETECTORS SET TO MINIMUM SENSITIVITY. (i.e. 3% PER FOOT OBSCURATION FOR GRAY SMOKE)
OFFICE		X		X						
STATEROOM/SEA CABIN	X	X								IONIZATION DETECTORS SET TO MINIMUM SENSITIVITY. (i.e. 3% PER FOOT OBSCURATION FOR GRAY SMOKE)
LIBRARY	X	X								IONIZATION DETECTORS SET TO MINIMUM SENSITIVITY. (i.e. 3% PER FOOT OBSCURATION FOR GRAY SMOKE)
BRIG	X	X								IONIZATION DETECTORS SET TO MINIMUM SENSITIVITY. (i.e. 3% PER FOOT OBSCURATION FOR GRAY SMOKE)
RECREATION ROOM/ WARDROOM		X		X						
TRAINING ROOM	X	X								IONIZATION DETECTORS SET TO MINIMUM SENSITIVITY. (i.e. 3% PER FOOT OBSCURATION FOR GRAY SMOKE)
LOUNGE		X		X						

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
MACHINERY COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
AUXILIARY MACHINERY ROOM	X	X	X							
MAIN MACHINERY ROOM	X	X	X							
PUMP ROOM	X	X	X							
UPTAKE SPACE								X		SURVEY OF UPTAKE SPACES MUST BE MADE DURING NORMAL OPERATING CONDITIONS TO INSURE THAT DETECTORS ARE NOT LOCATED IN NORMALLY HOT SPOTS SO AS TO MINIMIZE FALSE ALARMS. DETECTORS SHOULD NOT BE LOCATED NEXT TO UPTAKES.

TABLE II

REQUIRED DETECTORS FOR COMPARTMENT TYPES										
SHOP AND REPAIR COMPARTMENTS	IONIZATION	PHOTOELECTRIC	FLAME	RATE OF RISE	FT 105	FT 125	FT 150	FT 175		REMARKS
ORDNANCE SHOP		X		X						
ELECTRICAL/ ELECTRONIC SHOP		X		X						
MACHINERY SHOP		X		X						
BATTERY SHOP		X		X						
INSTRUMENT SHOP		X		X						
METAL WORKING SHOP		X		X						
CARPENTER/ CANVAS/ PLASTIC SHOP		X		X						

430-3-f Detector Selection Rationale

Use both ionization and photoelectric smoke detectors in all spaces selected for protection except where environmental restrictions preclude the use of ionization smoke detectors. Where environmental restrictions preclude the use of ionization smoke detectors, use photoelectric smoke detectors and some substitute detector.

Where ionization smoke detectors cannot be used because of environmental restrictions, rate of rise heat detectors must be substituted if the space has a low overhead (sixteen feet or less). Flame detectors must be substituted if the space has a high overhead (greater than sixteen feet). In a multi-level compartment, each level that is constituted by a solid overhead or solid gratings must be treated as a low or high overhead space, whichever is applicable.

Fixed temperature heat detectors are installed in magazines to sense that the space is being overheated (possibly by a fire in an adjacent space).

Augment smoke detectors with flame detectors in spaces where response to small flaming fires is necessary, i.e., where these fires could rapidly develop into large fires or explosions.

For compartments that are ventilated at deck level, e.g. - A/C Machinery Rooms, Refrigeration Machinery Rooms, O_2 N_2 Stowage Rooms, Operating Rooms, Flammable Liquid Storerooms, Gasoline Spaces, etc., the detectors recommended in

Table II for that type compartment shall be used. Flame detectors shall also be installed whether specified by Table II for that compartment or not. In such spaces, smoke/heat can be exhausted by deck level ventilation before it activates the smoke/heat detectors.

The referenced report, "Shipboard Fire Detection System Selection and Installation Guidance," NAVSSES Project A-1623-2, 8 July 1981, contains very detailed discussions of the detector selection rationale used to produce the detector recommendations in Table II of DDS 430-3. In the event of any conflict between DDS 430-3 and that report, DDS 430-3 governs (e.g., do not cross zone as stated on page 33 of the reference report, do not use collector plates as stated on page 29 of the referenced report).

430-3-g Alarm Switchboard

1. Description

The alarm switchboard consists of one Power Control Panel and from one to ten zone annunciation panels. Each zone annunciation panel is capable of containing ten zone modules. Each zone module supervises one detector circuit. This gives the capability of supervising one hundred detector circuits per power control panel. Expansion of the system beyond ten zone annunciation panels (one hundred detector circuits) requires an additional power control panel.

The power control panel contains the system power supplies, battery, fuses, controls,visual/audible indicators and summary alarm annunciation. The power control panel houses indicator lights for power on, battery low, battery on, ground fault (+), ground fault (-), supervisory failure and alarm. The power control panel contains an internal battery to maintain system power for a minimum of thirty minutes in the event of ship's power interruption.

Zone modules have three modes of operation, Normal, Test and Cutout. These modes are selectable by a three position rotary switch. Each zone module has three LED indicators, a red alarm indicator, a yellow supervisory failure indicator and a yellow cutout indicator.

The alarm switchboard provides the capability for external remoting of alarm status (discrete alarm signals and contact closures) as follows:

(a) The power control panel energizes six fused 115 VAC discrete alarm signals whenever an alarm signal (summary) is present. The power control panel also provides one dry relay contact for each of the power control panel indicator lights which closes whenever that indicator light (alarm, supervisory failure, battery low, battery on, ground fault (+), ground fault (-) or power on) is energized.

(b) Each zone module provides four dry relay contacts for external remoting of zone module status. One relay contact closes when a fire alarm is indicated, one closes when a supervisory failure is indicated,

one closes when the zone module is put in cutout and one closes when the test mode is selected. (These are in addition to the signals being sent to and displayed on the power control panel).

All relay contacts provided for remoting of switchboard or zone module status are electrically isolated, normally open and capable of switching a resistive load of one-half ampere at twenty eight volts DC.

2. Capability

(a) The SFDS alarm switchboard provides controls and audible and visual indicators required for system operation and alarm annunciation.

3. Environmental Restrictions

(a) None.

4. Location

(a) The alarm switchboard must be located in a compartment which is manned twenty four hours per day, at sea and in port, perferably in Damage Control Central or Central Control Station. This space must have the capability to rapidly respond to a fire either with local personnel or via communications to other personnel throughout the ship.

5. Quantity

(a) Alarm switchboard quantities will vary with the number of detector circuits and the number of areas where annunciation is required.

(b) One zone module will be required for each detector circuit.

430-3-h Ionization Smoke Detector

1. Capability

(a) Responds well to flaming fires whether or not visible smoke is present.

(b) Good overall response to many fire scenarios.

(c) Detects visible smoke particles. (Discrete sensitivity levels of one, two and three percent per foot obscuration for gray smoke, and a maximum of three, five and seven percent per foot obscuration for black smoke, respectively).

2. Environmental Restrictions

(a) Detectors cannot be used in compartments where presence of submicron size particles is high, such as diesel engine rooms, areas where internal combustion engines are used, areas where volatile liquids are stored, food cooking areas, weld shops, foundries and trash burning rooms.

(b) Detectors cannot be used in compartments where air circulation is such that combustion products are ventilated to the outside before providing a sensible fire signature for the detectors.

3. Location

(a) Detectors shall not be placed in high velocity air currents. Consequently, detectors shall not be placed in line with heating, air conditioning, ventilation (HVAC) discharge, exhaust registers, or any source of high velocity air. High velocity air is defined as air with a velocity over 150 feet per minute. Normal air flow in compartments ranges from 50 to 150 feet per minute away from the influence of HVAC discharge and exhaust.

(b) Ionization and Photoelectric Smoke Detectors shall be installed at all levels (excluding the bilge) constituted by solid overheads or solid grating in multi-level compartments, (e.g., DD-963 enginerooms). In compartments with high overheads, i.e., overheads higher than sixteen feet, which have levels constituted by open grating, the detectors should be installed at the overhead and at the grating level nearest halfway between the overhead and the deck. When a level is constituted by a combination of solid and open grating, the detectors shall be installed under the solid grating where available. In high overhead compartments, detectors shall be installed under significant partial levels constituted by solid grating (e.g., CG-26 class missile magazines). Detectors must not be installed where they interfere with normal compartment operation or vehicular traffic. For example, intermediate level detectors would not be installed in the center of hangar bays or in places in magazines which would interfere with magazine operation.

(c) Detectors in high overhead (greater than sixteen feet above the lowest level grating) magazines and multi-level machinery spaces must be located both on the overhead and at intermediate levels because combustion products may be removed by the ventilation before detectors on the overhead sense the combustion products.

(d) Certain Class A fire like smouldering wood, smouldering cotton sheets, etc. produce products of combustion which stratify and migrate very slowly to the overhead. In high overhead spaces, smoke can get fairly dense at the lower levels before any smoke reaches the overhead. This necessitates the placement of smoke detectors not only on the overhead, but at intermediate levels, in spaces like magazines which it is imperative to sense the fire before the flaming stage.

(e) Smoke detectors should also be placed at intermediate levels in high overhead spaces where personnel are sleeping. Smoke concentrations can reach harmful levels where the personnel are before detectors on the overhead alarm.

(f) In compartments with overheads or platforms having beams eight inches or deeper or which are hot relative to lower levels in the space, detectors must be located on the faces of twelve inch beams or at an equivalent distance below the overhead. The eight inch beams form pockets which could delay combustion products from reaching the detector. Overheads which are hot relative to lower levels of the compartment can form a thermal cushion which could delay combustion products from reaching the detector.

(g) In compartments with overheads or platforms having beams less than eight inches deep and which remain cool, detectors must be located

directly on overheads or platforms. These areas are most likely the place combustion products will gather and be detected. No thermal cushion should be present on these overheads or platforms.

(h) Beams deeper than twelve inches must be considered as bulkheads when installing detectors. A detector must be installed to provide coverage for each overhead compartment formed by beams deeper than twelve inches, that are greater than four feet from each other.

(i) In compartments with beams twelve inches deep or less, detector mounting depth will follow guidelines in paragraphs (f) or (g), as applicable.

(j) Figures 2, 3, and 4 illustrate smoke detector installations in compartments with varying beam configurations.

(k) When ionization and photoelectric detectors are employed in the same space, they should not be installed at the same locations. The ionization detector chain should cover the entire space and so should the photoelectric detector chain. The area coverage of detectors within each individual chain should not exceed four hundred square feet (20 foot spacing). The area coverage provided collectively by both chains should not exceed the two hundred and fifty square foot general requirement.

(l) Figure 2 shows the location of both ionization and photoelectric detectors on an overhead with deep beams. Altogether there are fifteen detectors required to cover the overhead compartments formed by the fourteen and eighteen inch beams. The example displays eight ionization detectors in a chain where the coverage is approximately three hundred square feet per detector. The photoelectric detector

chain consists of seven detectors each covering approximately three hundred and forty square feet. Collectively, the fifteen detectors each cover an area of approximately one hundred and sixty square feet. Therefore, all the area coverage requirements are met by the example.

Detector spacing distance requirements are also met by the example. Considered collectively the detectors are within sixteen feet of each other. Detectors within an individual chain are within twenty feet of each other. Note that detectors are located at the approximate centers of the compartments which they protect and are on the faces of the twelve inch beams. It should also be noted that if this overhead were in a space where only one type of smoke detector could be employed, e.g. a diesel engineroom, than fifteen detectors of that type would still be required.

(m) Figure 3 show a smooth overhead of the same size as in Figure 2. The total number of detectors required on this overhead is reduced to twelve. If two types of smoke detectors are deployed, there would be six of each type. Area coverage for each individual chain of six detectors would be four hundred square feet. Collectively, the twelve detectors protect two hundred square feet each. Note that the detector locations are spaced to place detectors no closer than eight feet from the bulkheads. This technique provides for obtaining the best area coverage from all detectors.

(n) Figure 4 illustrates an overhead which is partially open and partially beamed. There are sixteen smoke detectors required to cover this overhead. If two types of detectors are used then there would be eight of each type installed as shown. Again, the installation meets

the area and distance requirements for the individual chains and for the detectors considered collectively. Note that the long compartments are served by two detectors. Note also that detectors are either centered in compartments or located at a distance from large beams or bulkheads. This technique maximizes their are coverage potential.

(o) In Figure 3 and 4, detectors not on twelve inch beam faces would be installed at an equivalent depth. In Figure 4, if the narrow compartments were four feet wide instead of six feet wide, then the longitudinal eighteen inch beams would have been considered no obstruction.

(p) Figure 2, 3 and 4 illustrate how two smoke detector types can be deployed in a way which provides a space with superior protection to that obtained by deployment of the same number of detectors of a single type. In the examples shown, the overhead is not only covered by the number of detectors types required but also has overall coverage by two detector types. Two types of smoke detectors provide a better response potential than one type of smoke detector.

4. Quantity

(a) One detector is required for every two hundred and fifty square feet of coverage. The spacing between smoke detectors should therefore not exceed 16 feet. Where practical, detectors near bulkheads should be located eight feet from the bulkheads to obtain maximum area coverage potential. These spacing requirements apply to overhead locations and intermediate level locations.

(b) When ionization and photoelectric detectors are employed in the same space, they should not be installed at the same locations. The ionization detector chain should cover the entire space and so should the photoelectric detector chain. The area coverage of detectors within each individual chain should not exceed four hundred square feet (20 foot spacing). The area coverage provided collectively by both chains should not exceed the two hundred and fifty square foot general requirement.

430-3-i Photoelectric Smoke Detector

1. Capability

(a) Detects visible smoke particles. (Discrete sensitivity levels of one and two percent per foot obscuration for gray smoke,and a maximum of six and ten percent per foot obscuration for black smoke, respectively).

(b) Detects certain smouldering fires in advance of flaming while ionization smoke detector detects after flaming during the same fires.

(c) Can be used in certain shipboard environments which would cause ionization smoke detector to alarm.

2. Environmental Restrictions

(a) Detectors cannot be used in compartments where air circulation is such that combustion products are ventilated to the outside before providing a sensible fire signature for the detectors.

3. Location

(a) Photoelectric smoke detector location criteria are the same as ionization smoke detector criteria. See paragraph 430-3-h-3.

4. Quantity

(a) Photoelectric smoke detector quantity criteria are the same as ionization smoke detector criteria. See paragraph 430-3-h-4.

430-3-j Flame Detector

1. Capability

(a) A solid angle field of view of ninety degrees.

(b) Detection of fires in the flaming stage. (one square foot diesel fuel fire at forty feet, dead ahead; thirty feet at extreme limit of field of view).

(c) Provides most rapid response to flaming fires.

(d) Provides response to small flaming fires in ventilated spaces with a high overhead.

2. Environmental Restrictions

(a) Detectors should not be installed in compartments where welding occurs on a frequent basis. Welding can cause spurious alarms from these detectors.

3. Location

(a) Detectors should be located in positions which maximize their area coverage. For example, detectors should be located both on the overhead and on vertical bulkheads in a typical space. When placed on bulkheads in large multi-level spaces, extensive area coverage can be obtained by placing detectors opposite each other, one at one level and one at another level. Space coverage should be efficient relative to the number of detectors used. Flame detectors should not be used to cover small obscure areas of the space.

4. Quantity

(a) Quantities of flame detectors will vary with the area covered and the view obstructions present within a compartment.

430-3-k Fixed Temperature Heat Detector

1. Capability

(a) Detects ambient temperatures greater than detector alarm setting. (Detectors are available with alarm temperatures of one hundred and five, one hundred and twenty five, one hundred and fifty and one hundred and seventy fives degrees Fahrenheit).

(b) Only detector which can detect an overheat condition in the compartment in which it is installed which is being caused by a fire in an adjacent compartment.

2. Environmental Restrictions

(a) Detectors must not be installed in compartments where ambient temperatures normally exceed the alarm setting of the detector.

3. Location

(a) Fixed temperature heat detector location criteria are the same as ionization smoke detector criteria except fixed temperature heat detectors shall not be installed at levels constituted by open grating or partial solid grating which cannot trap heat. They are to be used at intermediate levels constituted by vast solid grating which acts as a true overhead.

(b) Detectors shall not be placed in air currents which will prevent the detectors from properly monitoring the space being protected. Consequently they shall not be placed in line with heating, air conditioning, or ventilation discharge registers or in air from magazine gravity cooling coils, etc.

(c) Detectors must be insulated with melamine blocks from surfaces which can prevent them from accurately monitoring the air temperature of the compartment they are protecting, e.g., overheads or bulkheads that are subject to varying temperatures due to sunlight or other factors. These varying temperatures could cause a detector to reach its alarm point.

4. Quantity

(a) One detector is required for every two hundred and fifty square feet area of coverage. The spacing between detectors should therefore not exceed 16 feet. Where practical, detectors near bulkheads should be located eight feet from the bulkheads to obtain maximum area coverage potential. These spacing requirements apply to overhead locations and intermediate level locations.

430-3-1 Rate of Temperature Rise Heat Detector

1. Capability

(a) Detects ambient temperature rises at or above fifteen degrees Fahrenheit per minute.

(b) Sensitive to rapid changes in temperature without risk of false alarms from overheating.

(c) Responds to flaming fires in spaces with a low overhead.

2. Environmental Restrictions

(a) Rate-of-Temperature Rise Heat Detectors should be installed only in spaces with a low overhead or at intermediate levels constituted by solid grating where heat buildup from fires can cause a significant rate of temperature rise.

3. Location

(a) Rate of temperature rise heat detector location criteria are the same as ionization smoke detector criteria except as noted in (c) below.

(b) Detectors must not be installed in areas where rapid changes in temperature occur on a routine basis such as close to ovens and foundries. Such locations could cause false alarms.

(c) Detectors used in conjunction with photoelectric smoke detectors must be installed in the same locations as the photoelectric smoke detectors.

(d) Detectors must be insulated with melamine blocks from surfaces which can prevent them from accurately monitoring the air temperature of the compartment they are protecting, e.g.,overheads or bulkheads that are subject to varying temperatures due to sunlight could cause a detector to reach its alarm point.

(e) Rate of Temperature Rise Heat Detectors shall not be placed in air currents which will prevent the detectors from properly monitoring the space being protected. Consequently they shall not be placed in line with heating, air conditioning, or ventilation discharge registers or in air from magazine gravity cooling coils, etc.

4. Quantity

(a) One detector is required for every two hundred and fifty square feet area of coverage. The spacing between detectors should therefore not exceed 16 feet. Where practical, detectors near bulkheads should be located eight feet from the bulkheads to obtain maximum area potential. These spacing requirements apply to overhead locations and intermediate level locations.

430-3-m Electrical Socket Base

1. Capability

(a) Provides a mounting base and electrical connection into the SFDS for detectors.

2. Restrictions

(a) Electrical socket bases will power one detector.

3. Location

(a) Location of the electrical socket bases will be determined by the location necessary for the detector it serves.

4. Quantity

(a) One electrical socket base and appropriate keying ring will be required for each detector to be installed.

430-3-n End-of-Line Device

1. Capability

(a) End-of-line devices provide a path for the supervisory currents in SFDS detector circuits.

2. Environmental Restrictions

(a) None.

3. Location

(a) One end-of-line device will be installed in the most electrically remote electrical socket base in a detector circuit.

4. Quantity

(a) One end-of-line device will be required for each detector circuit.

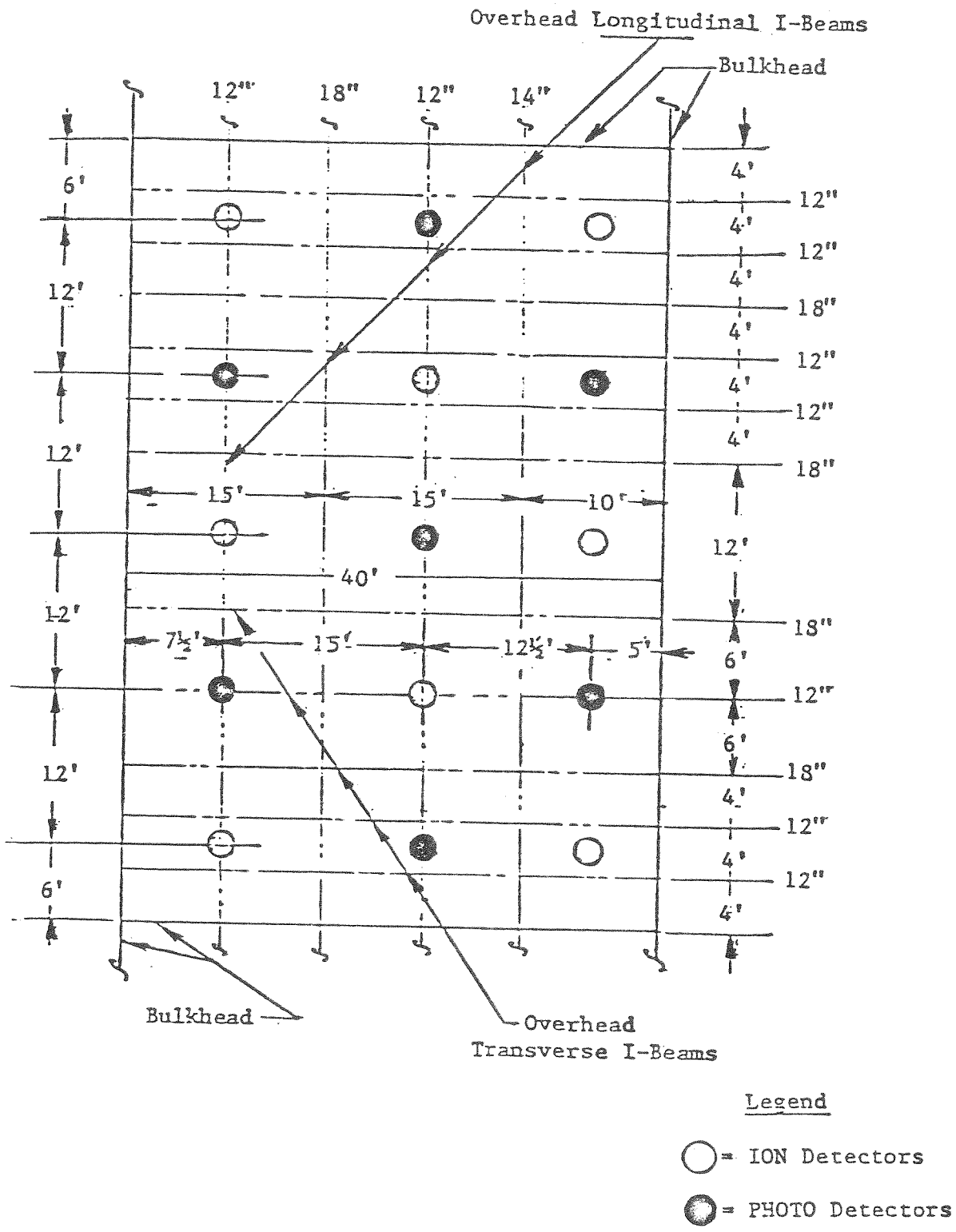

Figure 2: Smoke Detector Locations on an Overhead with Large Beams

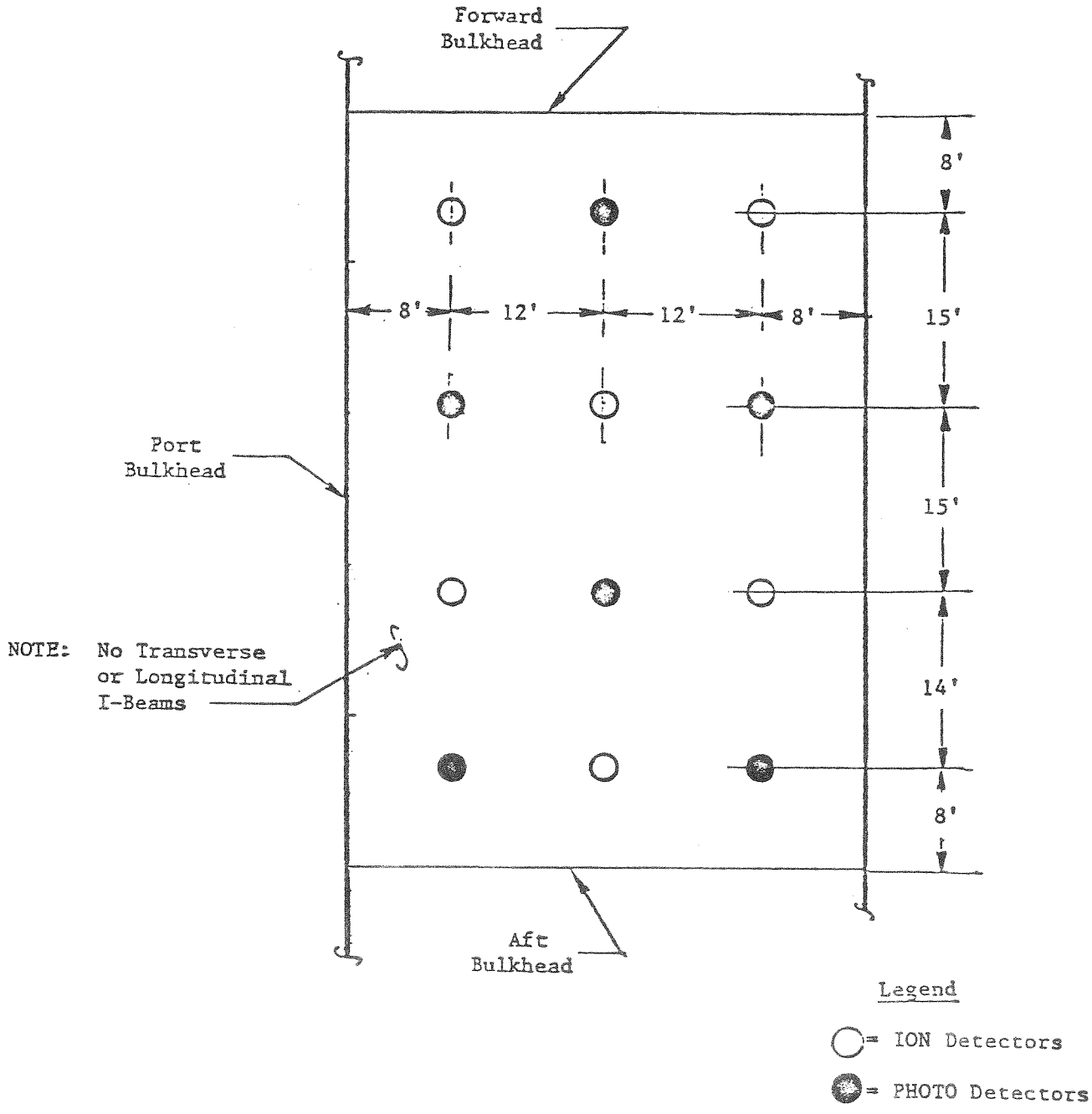

Figure 3: Smoke Detector Locations on a Smooth Overhead

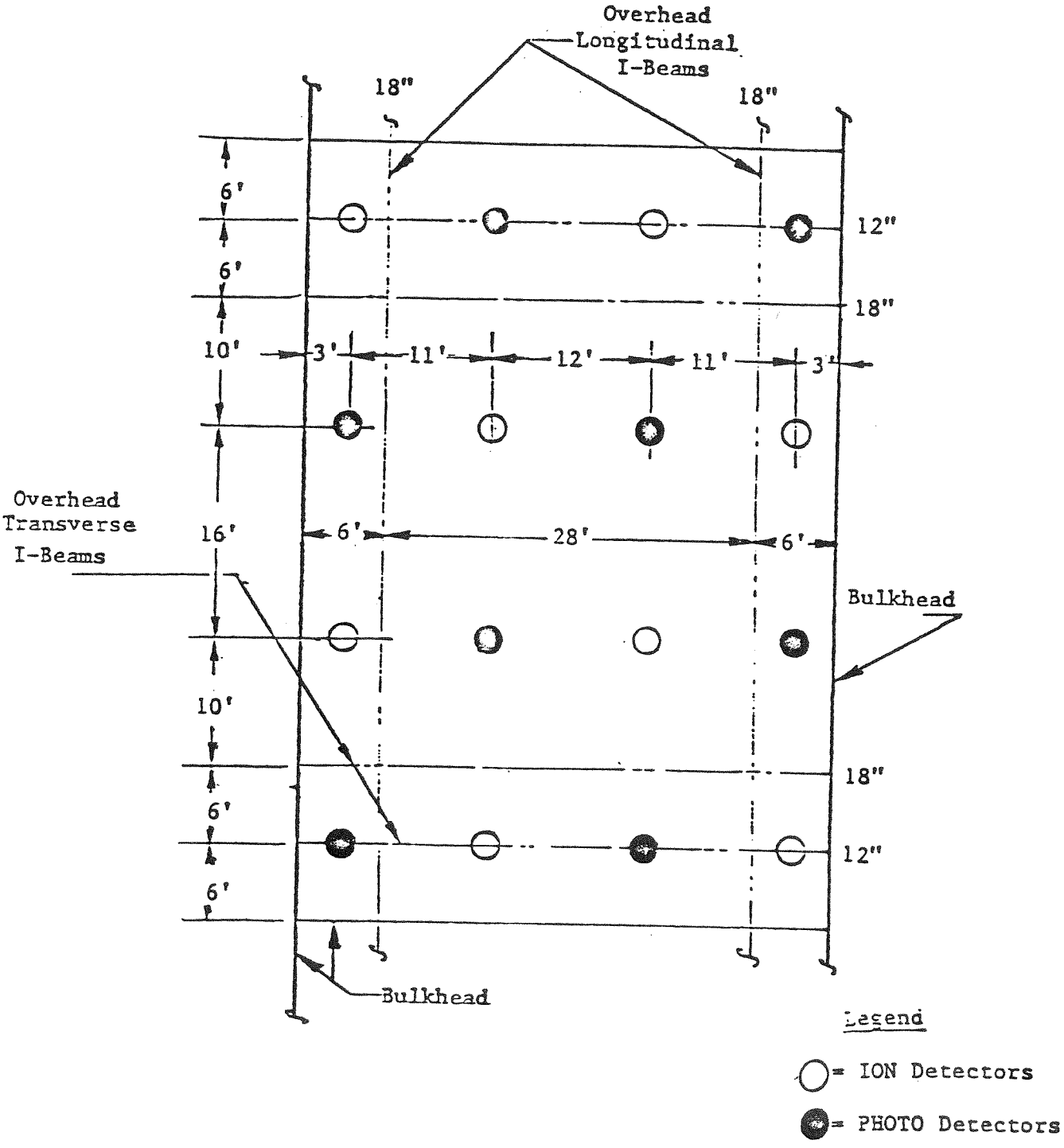

Figure 4: Smoke Detector Locations on an Overhead with Large Beams and Open Areas