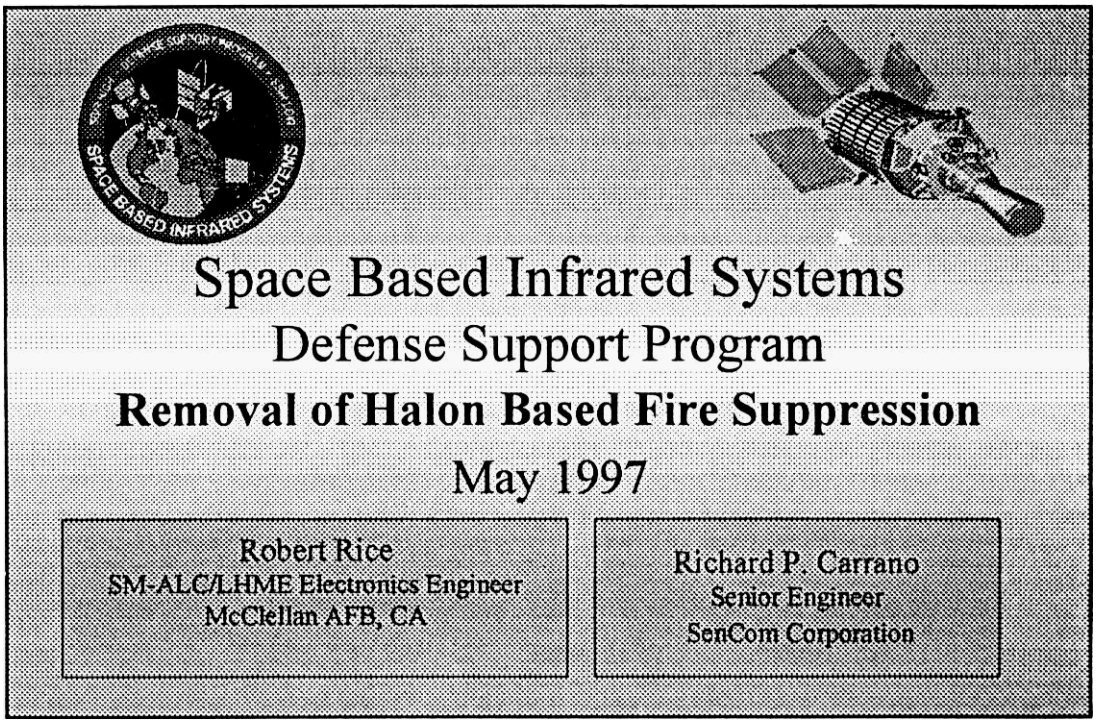
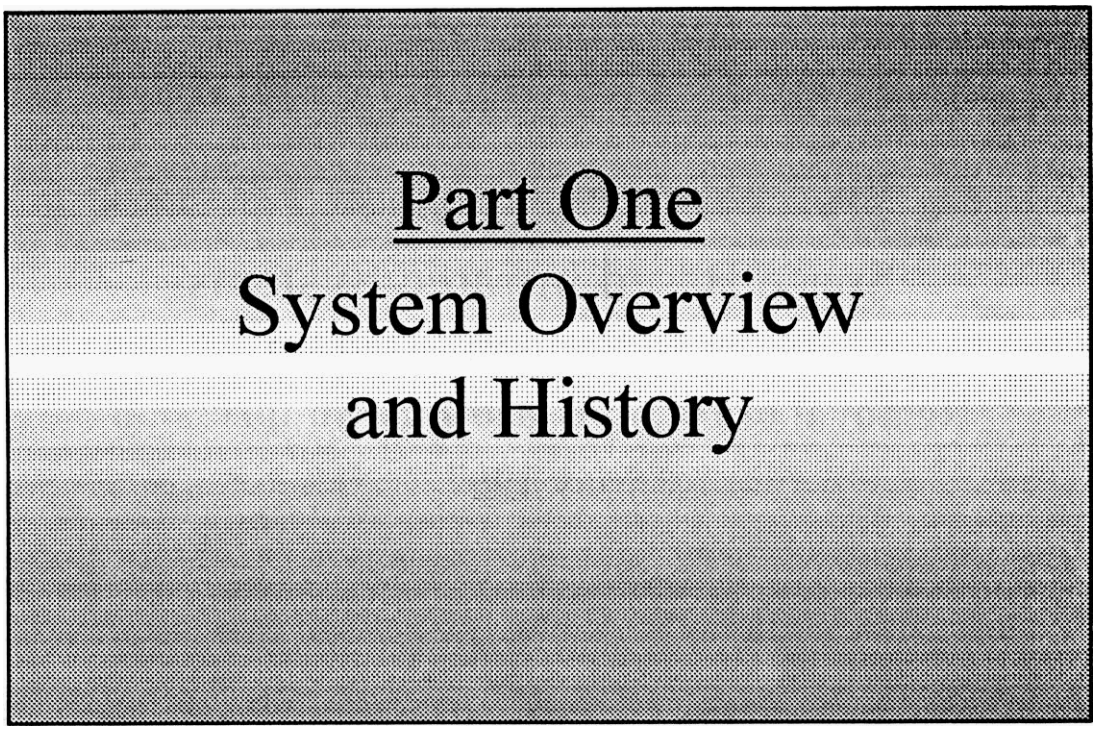


For **NMEFU** Presentation on Thursday **8** May **97** in ABQ:

The individual who worked with me to prepare this paper is Mr. Rob Rice of McClellan Air Force Base in Sacramento, CA, an Electronics Engineer formerly assigned to the Defense Support Program

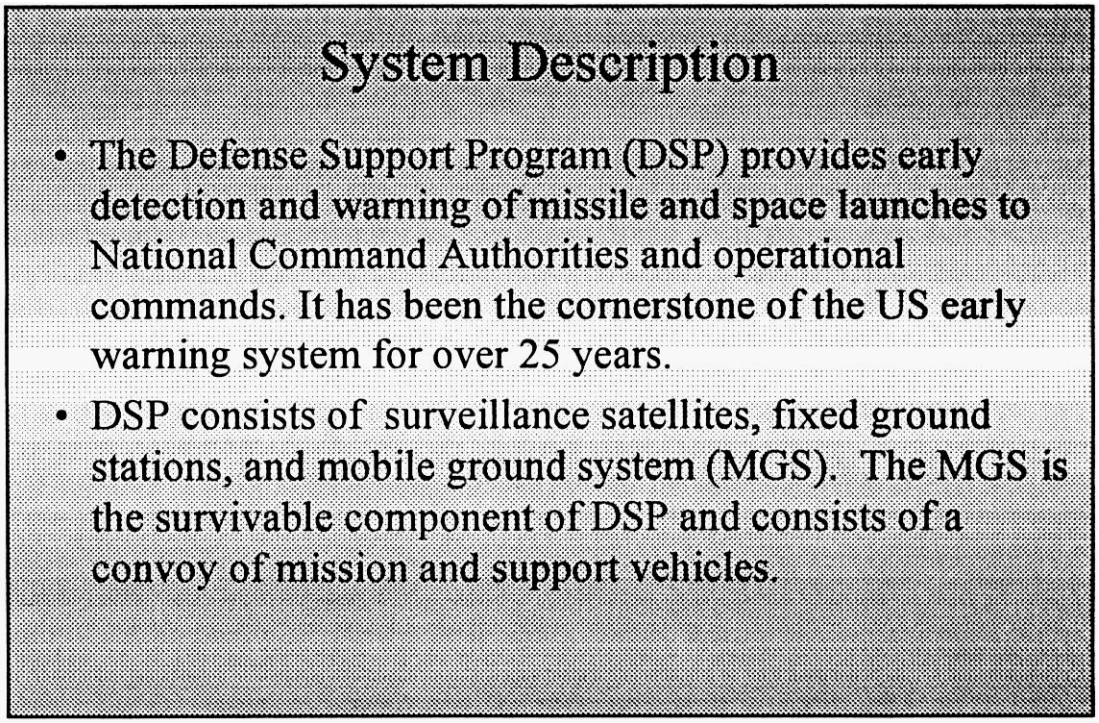
For JDEP Presentation on Wednesday 21 May **1997** in **SD:**

This paper was prepared **as** a joint effort with **Mr.** Rob Rice of McClellan AFB in Sacramento, CA, an Electronics Engineer formerly assigned to the Defense Support Program. We will be presenting this paper as a tag-team effort today



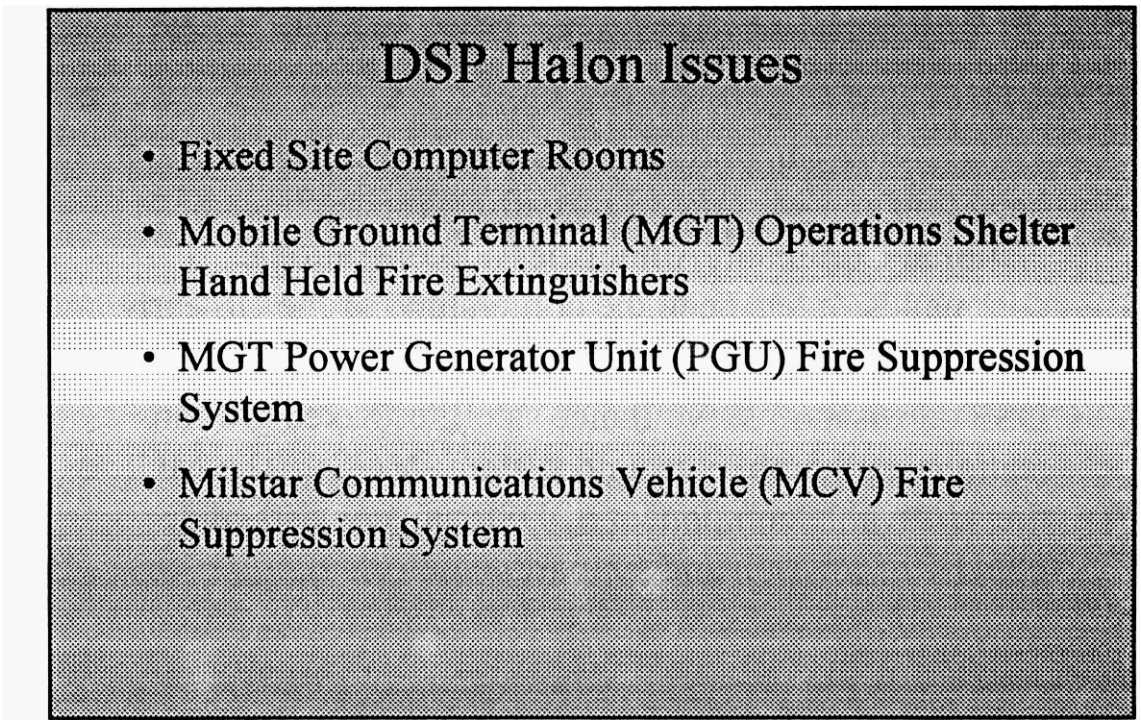
This presentation will be general in nature mainly because it deals with operational classified military satellite systems and the censures would not allow further disclosure.

Unlike most of the other research oriented papers presented at this conference, I will not be including test results for the agents discussed. rather, I will concentrate on the aspects of retrofitting replacement agents into an existing design.



DSP was originally a classified demonstration system **in** the 1970s. The DSP name was later declassified and can now be uttered without violating any security provisions.

Essentially, the system provides space based warning of missile launches.



This is a **summary** of subjects which have been addressed in McClellan AFB's Pollution Prevention efforts.

Some of these projects are now completed, some are still outstanding. Each issue was dealt with in a slightly different manner.

Fixed Site Computer Rooms

- The DSP fixed site computer rooms relied on a 50 LB. Halon 1301 fire suppression system for protection. Air Force Space Command (AFSPC) civil engineering mandated removal of all Halon 1301 systems and replacement with conventional sprinkler systems.
- The risks to critical computer systems were presented to AFSPC by SM-ALC. Two alternatives were also presented:
  - FM-200 total flooding system
  - Advanced sensor technology
- AFSPC choose to accept increased risks and proceed with sprinkler system installation in fixed site facilities.

The 50 lb. Halon charge was oversized.

Some of the computer equipment protected was specially designed over 25 years ago and is irreplaceable since in many cases the manufacturers are longer producing them or the supplier is no longer in business as a result of defense industry consolidation.

An Australian fixed site was the first to receive a bid on FM-200 conversion. This caused AFSPC to require Halon 1301 replacement with conventional water sprinklers.

In the next 5 years the DSP Program will be replaced by a new acronym called SBIRS- Space Based InfraRed System

MGT Operations Shelter Hand-Helds

- Halon 1202 hand-held fire extinguishers were installed in the MGT operations shelters.
- Fire danger expected to be localized to a single equipment rack.
- Users requested that the Halon extinguishers be replaced with CO_2 extinguishers.
- Using the successful integration of CO_2 fire extinguishers into F-16 cockpits by Ogden ALC as a precedent, SM-ALC approved replacement.

Dry Chemical Fire Extinguishers were not considered to be a viable option because extended downtime for residual agent cleanup was unacceptable, even if no equipment damage occurred.

MGT PGU Fire Suppression System

- The MGT uses a 10 LB. Halon 1301 fire suppression system for fire protection in the power generator unit (PGU) compartment. The PGU consists of primary and back-up diesel generators and power distribution electronics.
- The PGU is critical for MGT mission operation. When a failure occurs in one of the generators, the PGU it is expected to be back on line using the back-up generator in a mater of minutes.

Again, Dry Chemical Fire Extinguishers were unacceptable for the same reason.

The 10 Ib. Halon charge was also overdesigned for the space protected, which has a 120 ft^3 floodable volume.

MGT PGU Fire Suppression System (Cont'd)

- Several alternatives have been researched and presented to AFSPC;
  - The use of a dry chemical replacement was flatly rejected by AFSPC due to mission requirements.
  - Inert gas or CO_2 is not feasible due to size and weight constraints.
  - Reliance on hand-held fire extinguishers alone has also been rejected due to mission requirements.
  - SM-ALC has been unable to obtain USAF approval for use of "next generation" alternatives such as FM-200, CEA-410, etc.
  - SM-ALC will continue to use to waiver process to support the PGU Halon 1301 system.

Halon **1301** Waiver Process Is **Still** Pending.

USAF currently uses two 10 lb. Halon 1301 bottle per year in accidental expenditures and leakage losses.

MCV Fire Suppression System

- The Milstar Communications Vehicle (MCV) is being added to the MGS convoy to permit transmission of DSP data over the Milstar satellite system. The MCV is based on Milstar Mobile Constellation Control Station (MMCCS) vehicles produced by Lockheed-Martin.
- The MCV and MMCCS vehicles were originally equipped with Halon 1301 fire suppression systems.
- MILSATCOM program office at Space and Missile Center in Los Angeles approved replacement of Halon 1301 system with an FM-200 fire suppression system.

The important point here is that Halon 1301 was replaced with FM-200 while the MCV was still in the Acquisition Phase. This was the reason why a Halon-based fire extinguishing agent could not be fielded at the time.

The conversion approval was made at a different command prior to turnover of the system to the users.

Summary

- Milstar & DSP Operated by Different Offices.
- At the time of Milstar deployment, Halon was not an option. FM-200 testing was still underway but showed promise as least objectionable candidate.
- Since preliminary test results showed no adverse effects, FM-200 approved for Milstar conversion.
- Since then, USAF has developed reservations about FM-200. DSP remains a Halon system.
- Now two different systems, destined to be combined, are in service, resulting in higher logistics and maintenance support costs.

MILSTAR conversion to FM-200 was approved by Space & Missile Center (SMC)

DSP Fixed and Mobile Site Decisions were made by Air Force Space Command (AFSPC)

DSP Fixed Sites Use A Conventional Water Sprinkler System (which is not wholeheartedly received throughout the user community)

Part Two
Design Features

Performance Attributes

Definitions

- Lowest Observed Adverse Effect Level (LOAEL)
  - The lowest dose of a chemical which produces statistically or biologically significant increases in frequency or severity of adverse effects.
- No Observed Adverse Effect Level (NOAEL)
  - The highest concentration at which no adverse toxicological or physiological effect has been observed. Effetcs may be produced at this dose, but are not considered adverse.

Performance Attributes

No Observed Adverse Effect and Lowest Observed Adverse Effect Level Comparisons

Trade Name	Desig-nation	Min Des Conc	NOAEL (% VV)	LOAEL (% VV)	ODP	Atm Life (Yrs)
Halon 1301	CF_3Br	5	5.0	7.5	10	65
FM-200	HFC-227ea	7	9	10.5	0	36.5
FE-13	HFC-23	16	50	>50	0	264
NAF-S-III	HCFC Blend A	11.9	10	>10	.036	12

Ref.: UNEP HTOC Tech Note 1

FE-13 was eliminated from the running due to its atmospheric life

NAF-S-III was eliminated due to its design concentration

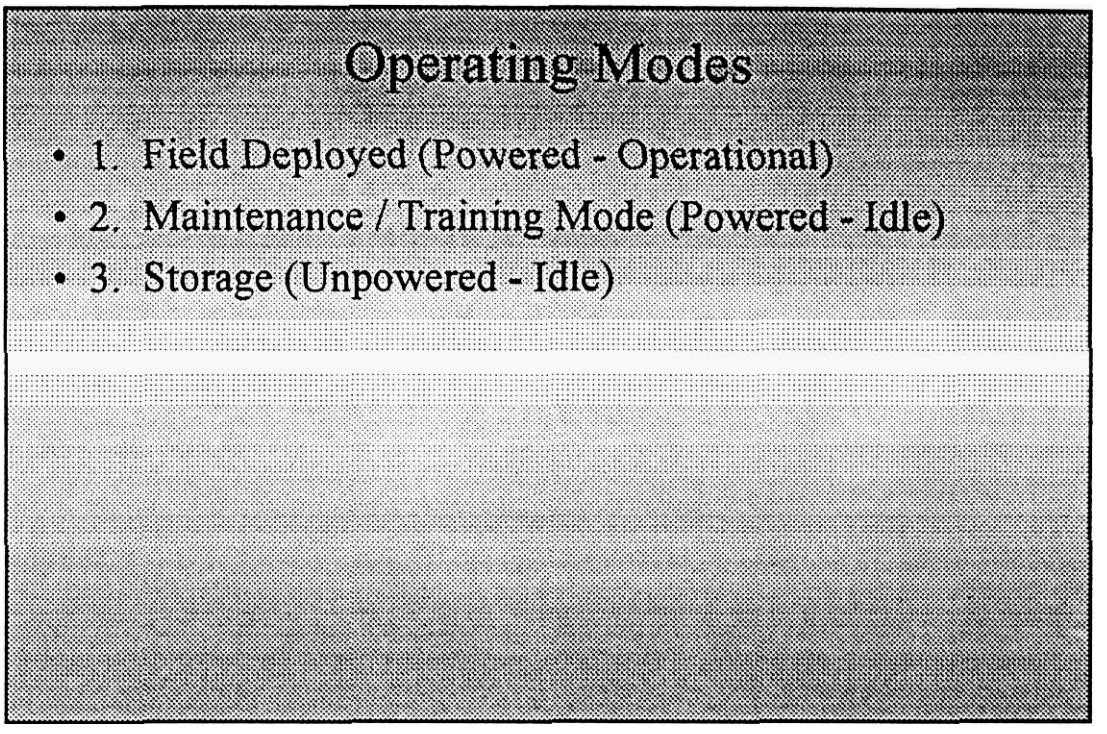
Other agents were also considered but eliminated for various performance related reasons

Design Parameters Considered

- 1. Operating Conditions (Ambient Temp., Press. Range)
- 2. Monitoring System / Agent Discharge
- 3. Plumbing
- 4. Design Concentration
- 5. Agent Coverage / Effectiveness

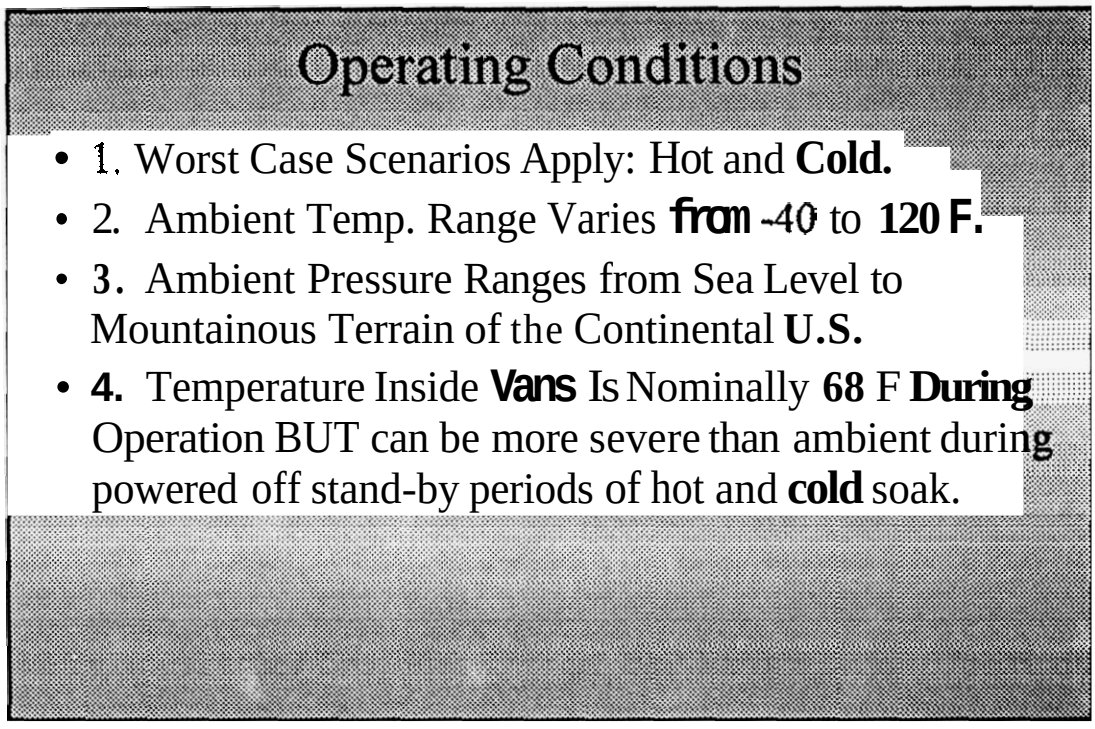
Operating Conditions - Debate still exists over specifying the exact ambient temperature range. -40 F/C is the best estimate used at this point

Note that -40 F/C is the system operating requirements and that surrounding ambient temperatures outside the vehicle can be lower in some operating environments



PGU Generator Sets can also be operated when the system is on the road being transported without the equipment being operational - although this isn't always practiced, it must be considered for fire risk analysis

The reason for this capability is to allow rapid delpoyment upon arrival at the site by minimizing required warm up time before the system becomes operational

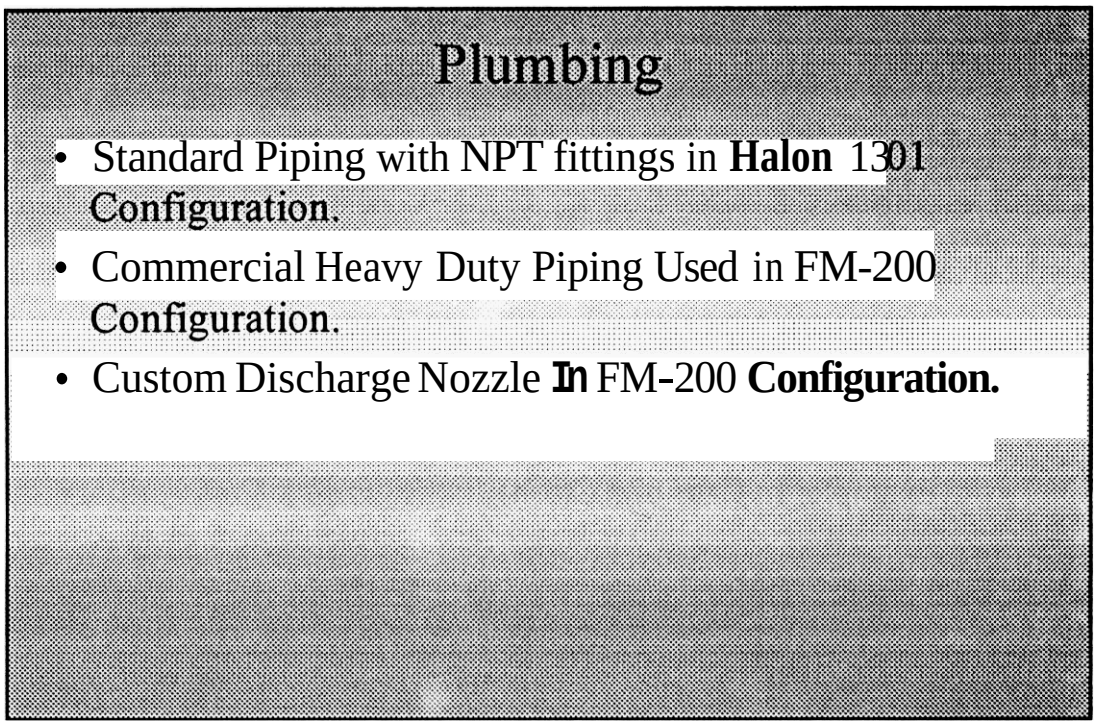


Again, the Operating Design Temperature For The System is -40 F/C

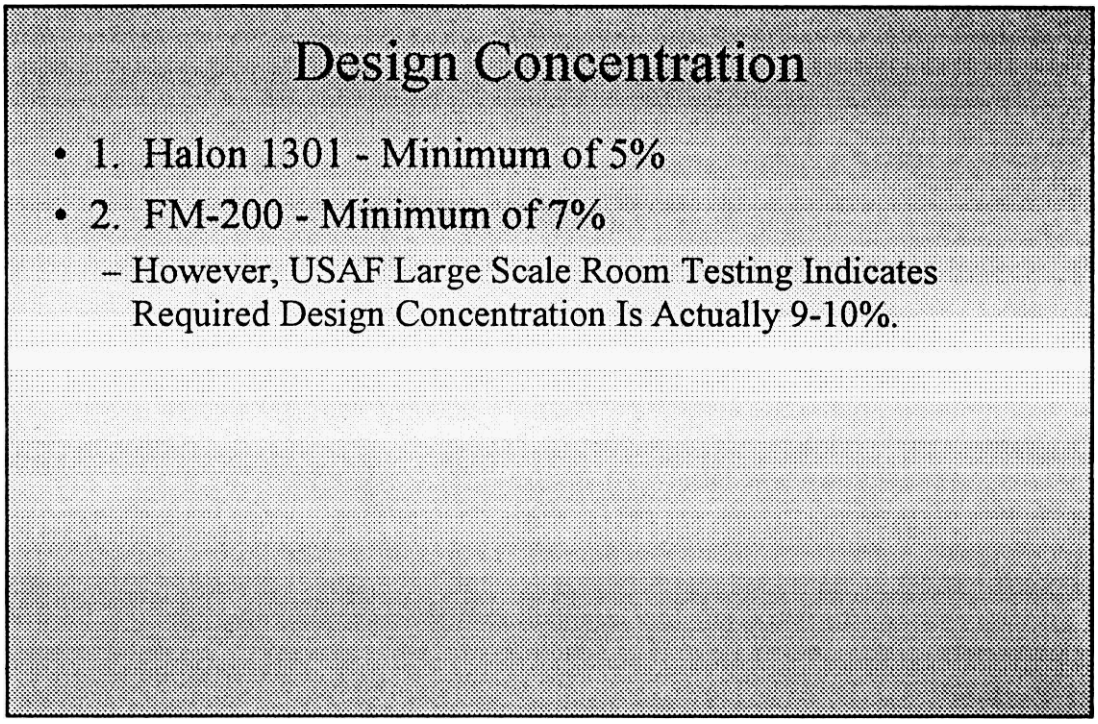
Monitoring System / Agent Discharge

- 1. Continuous Monitoring By Rated Compensated Heat Detectors.
- 2. Control Panel Alarms Activated By Heat Detectors.
- 3. Operators Manually Discharge Agent.
- 4. Tipping Switch Automatically Discharges Agent If Power Generator Trailer Is Overturned
  - (Example: In Case of a Crash)

The Tipping Switch Feature which shuts **down** the generators Is designed primarily to prevent auto crash fires

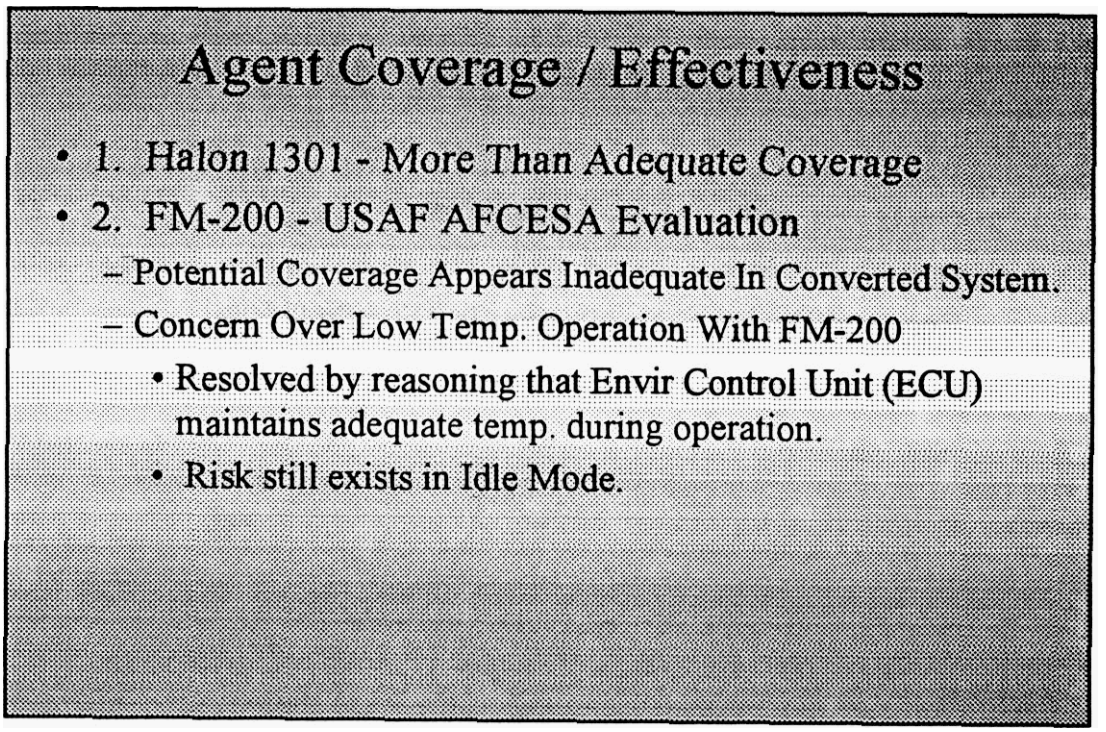


Halon 1301 used in DSP does not require a discharge nozzle since the overdesign provides adequate coverage

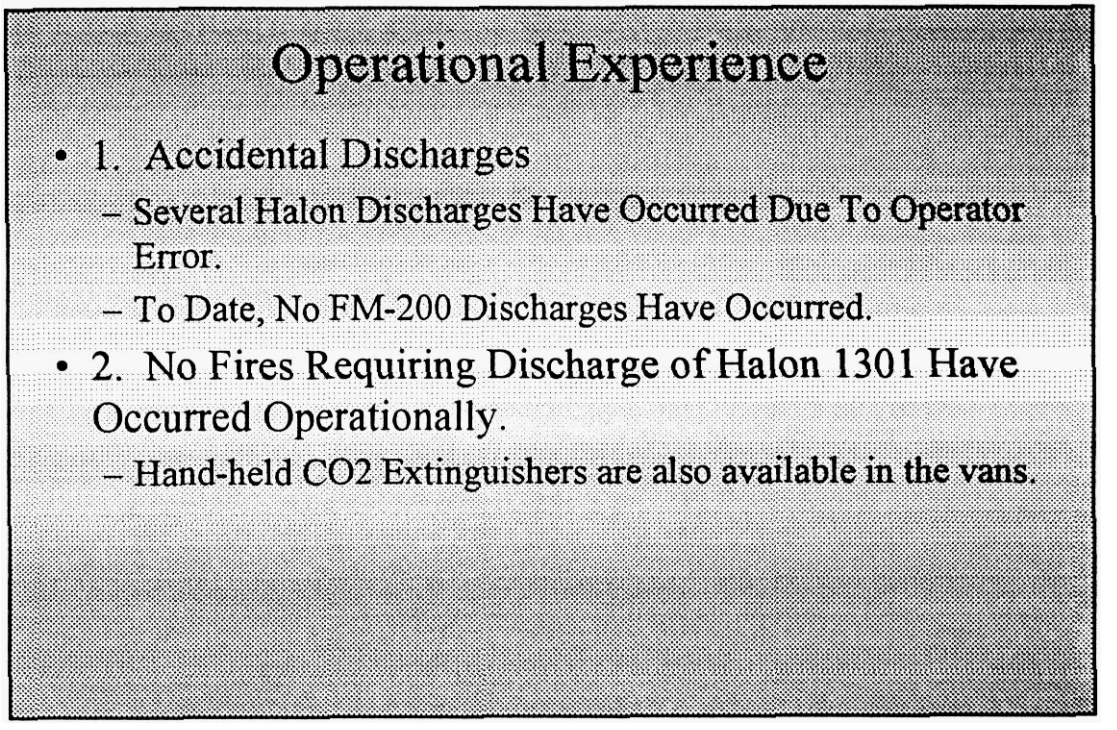


This is the crux of the issue with FM-200.

To get the desired effectiveness, USAF Large Scale Room Testing at Tyndall AFB, FL required FM-200 concentrations of 9-10% which is ABOVE the NOAEL and approaches the LOAEL (an unaccepatble situation)

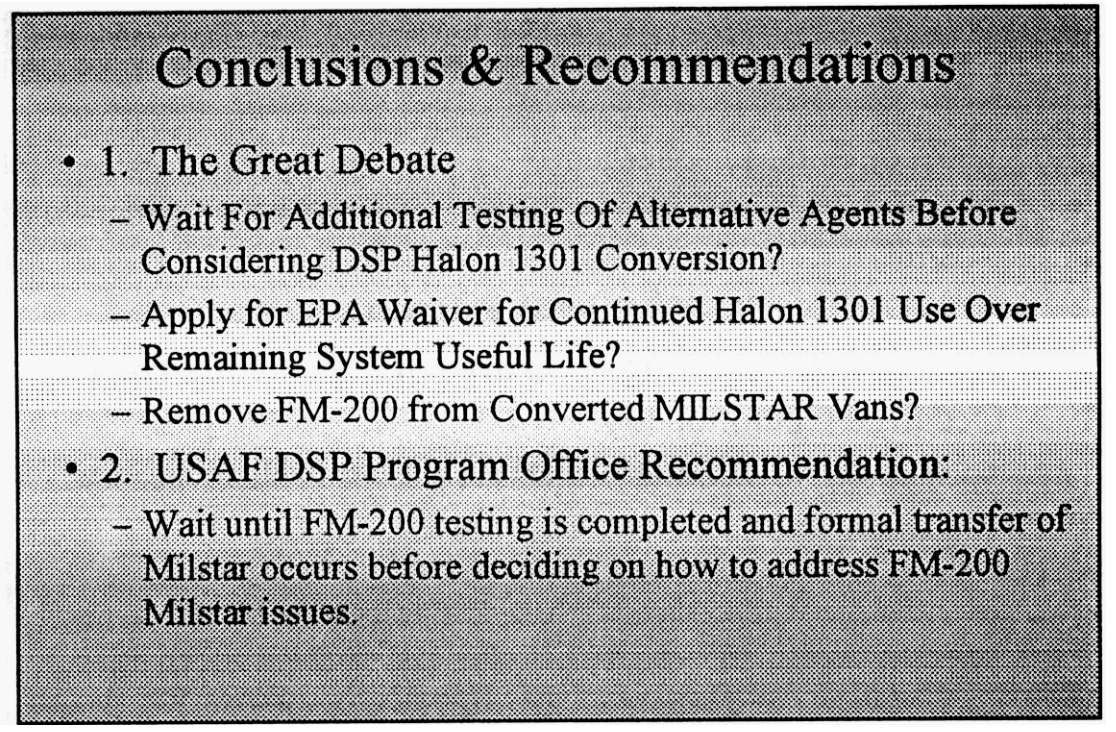


One of the biggest drawbacks of FM-200 is the ability to flow the agent at a temperature below **32** F



Operator errors have caused most of the accidental Halon 1301 discharges to date

FM-200 system control panels were discontinued. UL Interim Approval expired and manufacturer decided to replace design instead of seeking to renew UL listing.



At this time, we are still awaiting a USAF decision on resolving the Milstar FM-200 shortfalls reported by AFCESA

DSP Mobiles will be around for another 15 years - **As long as** there are DSP satellites flying.

USAF Civil Engineering Support Agency has recommended installing ultra-sensitive heat detectors to identify problems before they actually require fire suppression to allow intervention by simply powering down the system.