Airport Emergency Conferencing System

Ringdown Firebar Conferencing Server

An XOP Networks White Paper

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Executive Summary

When an emergency occurs, an airport's communication infrastructure plays a critical role in ensuring coordination with both the first responders and additional agencies that need to take supporting actions. Crash phone systems are an integral part of an airport's communication infrastructure.

Traditionally, a Crash phone is implemented using a standalone system that relies on copper-based Loop Start lines connecting Red analog crash phones to the main conference server. As more airports embrace IP technology (Ethernet/Fiber), the Crash phone function also can benefit from availability of these networks.

XOP is at the forefront of providing crash phone solutions that help airports transition from legacy Analog/TDM based systems to modern systems that fully exploit the Internet/VoIP technology.

XOP's Airport Emergency Conferencing solution, also called 'Ringdown Firebar Conferencing Server' (RFCS) helps Airports transition from Analog/Copper based to VoIP/VLAN/Fiber based Crashphone system. This solution has the additional advantage of being highly scalable, reliable and having built-in redundancy that results in very high availability.

The key features of the RFCS based solution are:

- Integrated Crash Alert and Crash Phone capability
- Traditional Analog and VoIP based Crash phones can co-exist on the same network
- Multiple phones and Push Buttons can be designated as the trigger points
- Activation of alarms such ~~as~~ bells, sirens and strobe lights can be initiated from a Push Button
- Third-party integrated devices available that can trigger automatic opening of gates at an ARFF centre
- FXO/T1/PRI for connectivity through any local PBX to the external world (secondary phones, e.g., cell phones)
- Built-in recording feature that can be used during post emergency analysis.
- Configurable on-demand and scheduled conferences. These can be used for drills and routine checking of the communication infrastructure.
- Flexible architecture – allows redesign (Adds, Moves and Changes) of the emergency network as the needs of the airport change.

1 Introduction

Airports, during their operations may come across situations that endanger life and property, both in the air, and on the ground. The nature of these emergencies may include (but is not limited to) aircraft emergencies, natural disasters, terrorist acts, hazardous material related threats, and public health emergencies.

Thus, airports need to have an Airport Emergency Plan (AEP) with the objective of minimizing losses that may occur from various emergencies. The AEP defines the entities involved, their roles and responsibilities and the processes to be followed during the emergency.

Communication infrastructure plays an important role in ensuring coordination between various entities involved in alerting an emergency situation, the first responders and the additional agencies that need to take up supporting actions and activities.

The entities/agencies typically involved are, the Air Traffic Control unit (ATC), Airport Rescue and Fire-Fighting services (ARFF), airport operations control, medical and ambulance services, aircraft owners/operators, airport tenants, security services, and police. There are also many off-site entities, such as local fire departments, police, health service providers (such as hospitals, ambulance services, etc.) and military etc.

In case of emergencies, normally the ATC tower is the initiator, and the ARRF is the first point of contact. Traditionally a *Red Crash Phone* is used to initiate a dial-out *conference* as soon as the initiating trigger phone goes off-hook. Upon off-hook, all intended recipients are placed into the emergency conference. The *Crash Phone System* is designed to allow more than one initiator to trigger the conference.

In addition to the emergency conference, some airports also use an Alerting function. Typically, a Push Button is installed in ATC, which when depressed allows various sirens, bells and strobe lights to be initiated at various entities involved in the operation of the airport.

The XOP Ringdown Firebar Conference Server (RFCS) supports both - Emergency Conferencing and Crash Alert functions. The system can be configured to support either one or both of these functions.

2 Technology Considerations

Communication technology has advanced considerably in providing more reliable and efficient solutions. The legacy Crash phone emergency conferencing solutions that use copper wire and analog mixers have many draw backs. The key issues are:

- The system has performance problems during rains or high humidity, resulting in degradation in the quality of communication.
- Sometimes analog copper cables can become unreliable due to rodents etc.
- Adds, Moves and Changes to the Crash phone network are not easy.
- Availability of spare parts for discontinued Crashphone systems (e.g., Tellabs 291/292) and routine maintenance is expensive.

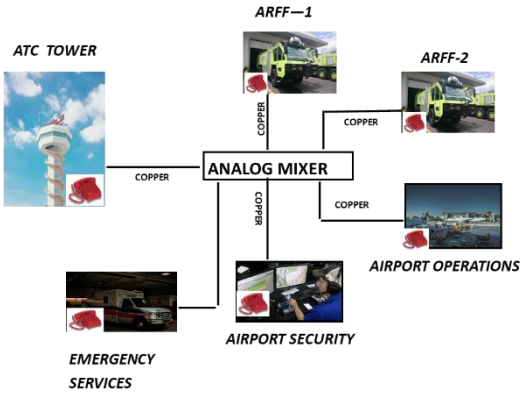


Figure 1: Legacy Crash Phone Alerting System

In addition to the crash phone network, other network elements are needed to meet the additional communication needs, e.g., audio/ visual alarms, pager systems, communication with outside agencies etc.

Most of the airports have deployed, or are deploying optical fiber/Ethernet based Local Area Networks for their voice and data needs. This network can be leveraged to build modern IP based Crash Phone and Crash Alert systems. This approach has many advantages over the legacy systems.

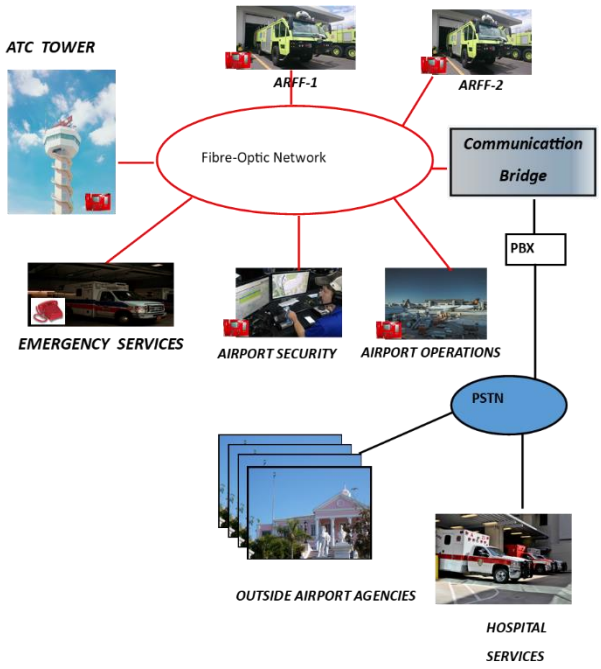


Figure 2: VoIP based Crash Phone with Fiber-Optic Network

These advantages are:

- An integrated approach to the communication needs, thereby reducing the total cost of ownership.
- IP-based Crash Phones can be deployed along with traditional analog Red Phones.
- Additional flexibility, allowing redesign of the network, making Adds, Moves and Changes a much simpler and less expensive exercise.
- Interface through a local PBX which allows secondary phones (e.g., cell phones) to be used.

3 Ringdown Firebar Conferencing Server (RFCS)

3.1 Product Overview

The RFCS provides is a robust, reliable and scalable solution that supports *all* types of telephone devices. The system contains modular gateways and application processing modules. The gateways supply rock-solid, proven compatibility with all physical telephony media types. The product supports FXS/FXO/T1/PRI devices, as well as SIP/H323 trunks . Consequently, the product supports the legacy Loop-Start lines and allows the airport to migrate to both a hybrid (analog and IP) or to an all-IP solution.

The following is a list of network interfaces that are supported by the RFCS:

- FXS 2-wire analog lines for connecting to Analog Red-Phones, Paging Systems, and 911 dispatch consoles. It comes in 4, 8 or 16 circuits per module and up to 12,000 Ft of 24awg copper pair.
- FXO 2-wire analog for connection to another system (i.e., Secondary Crash Phone, Legacy PBX). It comes in 4, 8 or 16 circuits per module.
- FXS Loop Extender Module, can extend the loop to 30,000 ft. It comes in 4 circuits per module
- T1/PRI: Industry Standard trunk interface for connection to local TDM PBXs/ Public Switched Telephone Network (PSTN). This comes in 4 trunks (up to 92 DS0 ports) per module.
- VoIP/SIP Industry Standard interface for connection to ~~the~~ modern IP-Based PBX & VoIP Carriers. Proven compatibility with all major suppliers, i.e., Avaya, Cisco, Nortel, Huawei, Mitel etc. Can support up to 96 Speech Channels.

The system contains an integrated remote management system for monitoring the health of its hardware components.

The RFCS allows *multiple* conferences to be set up that can be proactively configured to be used for specific emergency situations (North runway emergency, South runway emergency etc.).

The figure below shows a typical configuration of the RFCS server.

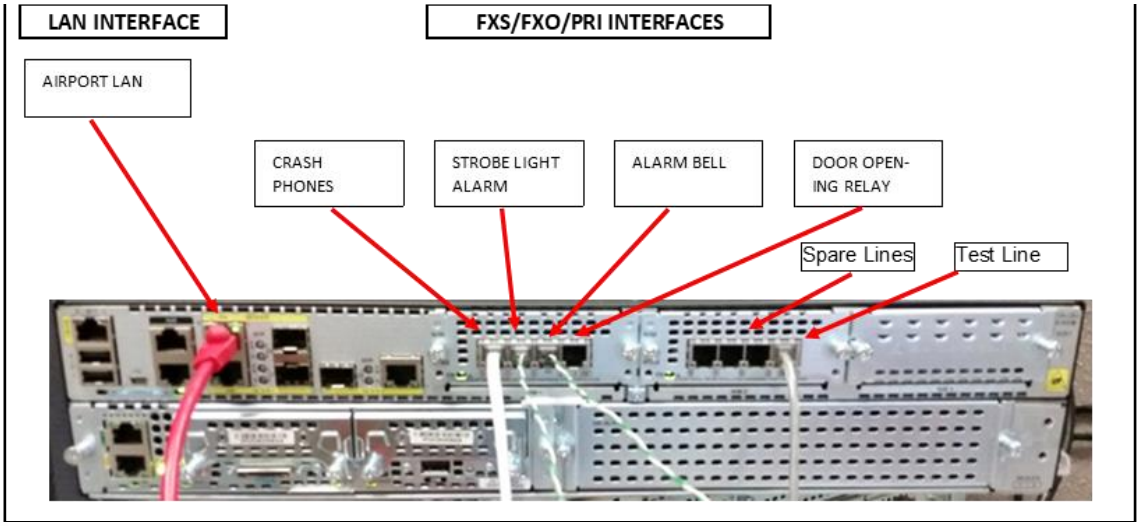


Figure 3: RFCS - Router Based Hardware

3.2 Network Topology

The Figure below shows a typical RFCS that serves both Emergency Conferencing and Crash Alert functions.

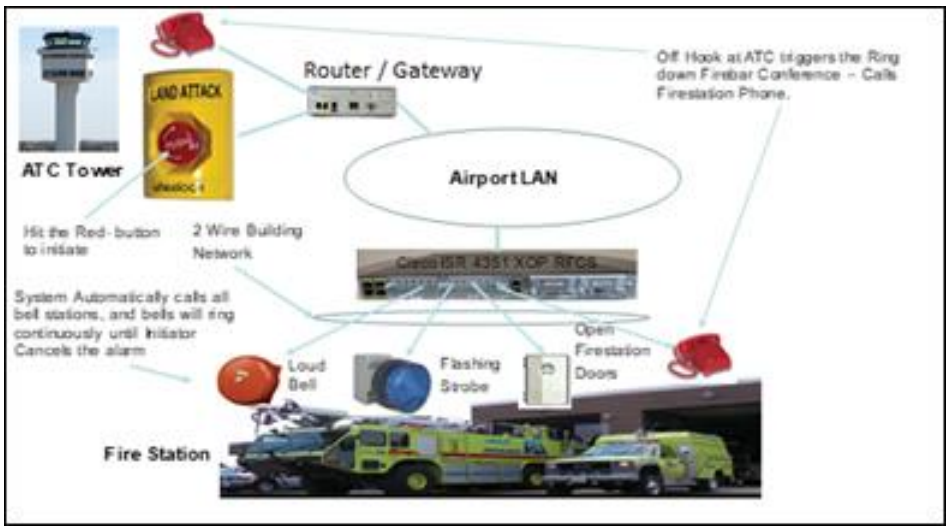
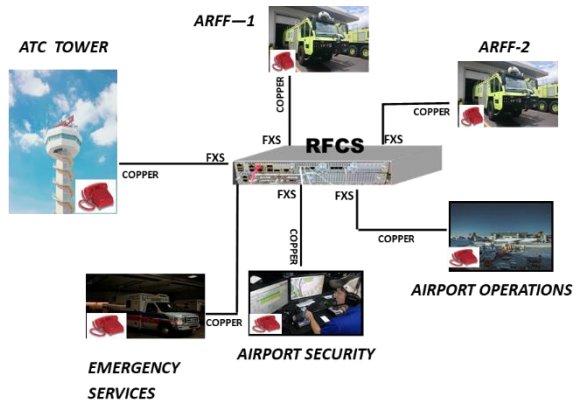


Figure 4: Multiple Devices Connected to RFCS

Note: The RFCS may be deployed in a variety of topologies, ~~as~~ suitable for the airport's communication network.

STAR TOPOLOGY

The RFCS can be used as a replacement for a legacy analog Crash Phone system.



Here, the RFCS is connected to *Crash Phones* using the 2 wire FXS interface (i.e., copper wire loops). The connected devices (phones, alerting equipment etc.) can be up to 12000 feet away without the loop extender or up to 30000 feet away using the loop extenders. For airports that are planning to move to advanced network technology, this can be the first step in their transition.

Figure 5: STAR Topology - FXS Interface

HYBRID STAR-BUS TOPOLOGY

As Airports introduce new technology, they can gradually introduce high speed Ethernet LAN into their Crash Phone operation. The RFCS is connected to legacy phones using an FXS interface and is also connected to LAN using the Ethernet interface available on the server. This allows both technologies to be used on the same server in a hybrid fashion. The locations that are on the LAN can have VoIP based Crash Phones. The end users still see a "logical" single conference whenever an emergency conference or crash alert is initiated.

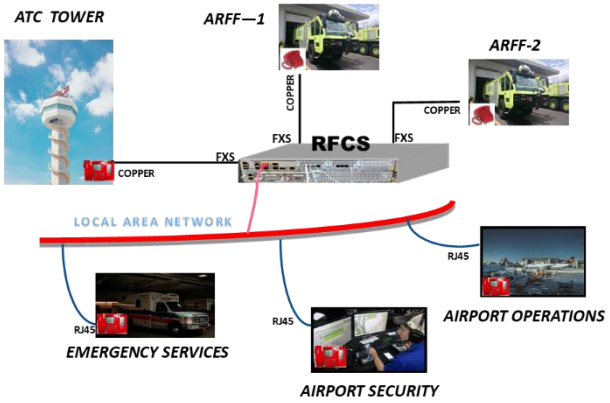


Figure 6: HYBRID TOPOLOGY - FXS & ETHERNET LAN

RING TOPOLOGY

An airport that is installing new communication infrastructure is likely to use **Fiber-optics** technology. A fiber-optic ring provides the backbone of the network to which all other devices are connected. An Ethernet-based VLAN is implemented on top of the fiber cabling.

The diagram below shows the RFCS system with a redundant hot-standby secondary server connected to the network. The various locations/first responders have VoIP based Crash phones are connected to the ring.

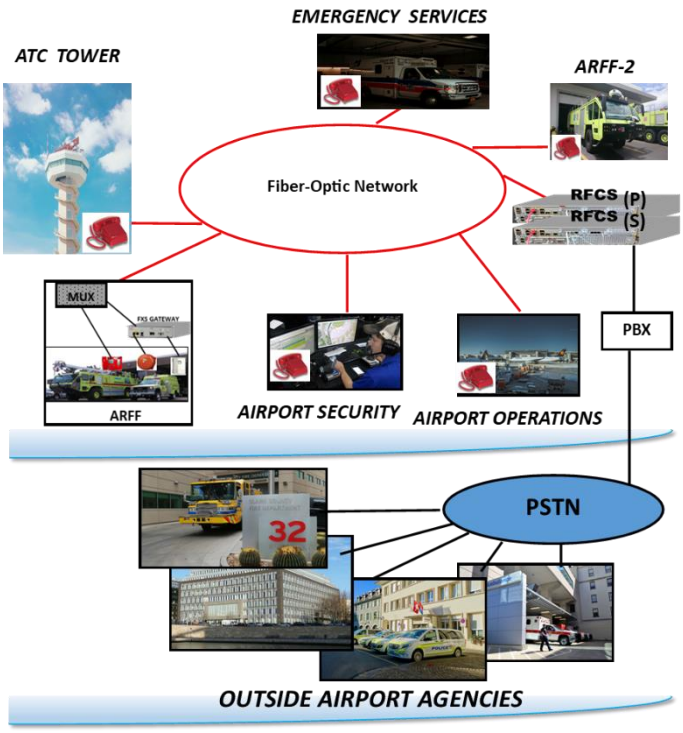


Figure 7: RING TOPOLOGY

The diagram also depicts an ARFF station that has multiple devices, including a VoIP phone, an alarm bell that rings when alert notification event occurs, and a door-open relay that is automatically triggered at alert notification. These devices have FXS interfaces and are connected through a gateway to an Ethernet Switch/MUX that is in turn connected to the fiber-optic ring. *(The additional communication devices required for the connectivity are not shown for all the stations.)*

Since the RFCS has FXS/FXO interfaces, the FXO interface is used to connect to a PBX, allowing connectivity with other agencies, including secondary responders using the PSTN.

4 Conferencing and Alerting

The RFCS supports **multifunction notification** as described in FAA Advisory Circular (AC No: 150/5220-7D, dated: April 14, 2008). This is achieved through the conferencing and alerting features of the RFCS which allows simultaneous alerts to be sent to:

- ARFF service (should receive alarm first and respond while remainder of list is being notified).
- ATCT, FSS, or other control point.
- Airport police/security.
- Airport management (Operations and Maintenance).
- Military units (at joint-use airports).
- Other authorities on or off the airport as required by the Airport Emergency Plan (AEP).

4.1 Multi-modal Notification Capability

The RFCS supports both dial-out emergency conferences and emergency alerting functions. The third-party modules (e.g., Valcom Paging Gateway, Viking Push Button gateway) appear as a SIP extension to the core RFCS software. This allows another degree of freedom, since the RFCS is able to trigger a crash phone emergency conference when a push-button is pressed. A crash alert (sirens, strobe lights etc.) can also be launched by going off-hook on the emergency crash phone.

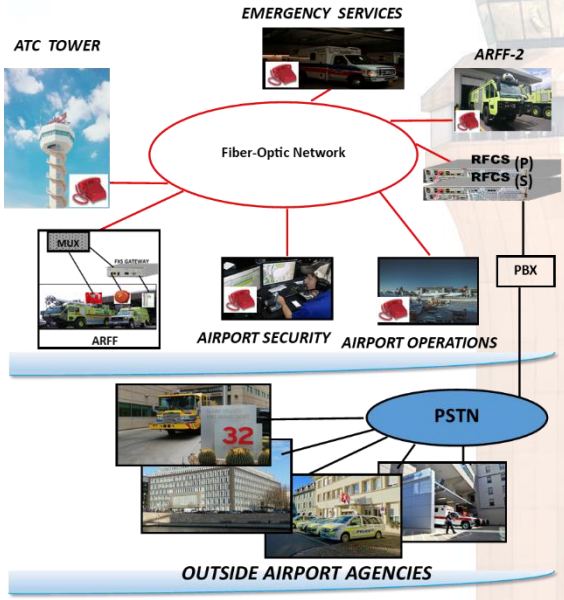
4.2 Conference Monitoring and Management

The system can be controlled through an easy-to-use browser-based portal using a PC directly connected to the server or through a PC on the local network. The interface allows:

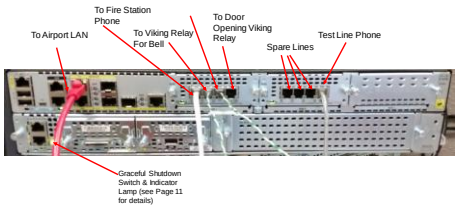
- Administrative Control
  The system allows configuration of various initiator accounts and allows designation of devices which trigger the associated conferences.
  The system also allows display and control of an on-going conference via the built-in real-time status portal. This real-time monitoring tool shows participants as they join or leave a conference. This also allows the network administrators to proactively test the crash phone network and eliminate network issues.
- Conference Set-up
  The conference set-up feature allows one to define conference, the participants (users), and the triggering mechanisms for the conference. The conferences can also be scheduled so that periodic testing can take place at defined frequency.
- Recording
  The system supports recording conferences. These recordings can be subsequently retrieved using the RFCS web portal, or distributed through e-mails. The recordings can be archived offsite periodically in order to release disk space on the server.
- Reports
  Various usage reports are available that can be used for off-line analysis.

5 Product Summary

RFCS deployment in Network



RFCS Interfaces



RFCS Supporting Devices

Features

- Standalone Crashnet Ring-down Firebar equipment
- Scalable from 8 ports to 96 ports
- Supports direct analog lines and VoIP/SIP Ports
- FXS Interface for direct connectivity to Field Phones (RED emergency Phones)
- FXO Interface for direct connectivity to PSTN/On-site PBX
- Digital Master Control Phone(s) for viewing individual line status (on-hook, off-hook, ringing etc.)
- Web Portal for provisioning and administration
- Support for 12,000 feet loops (standard)
- Support for Long Loop lengths, 30,000 feet via external loop extenders (optional)
- Scheduled (Daily, Weekly etc.) recurring dial-outs for routine automated Crashnet testing
- Multiple designated trigger phones
- Multiple hysteresis controls for preventing un-intentional triggers
- Web Portal for viewing and controlling on going Crashnet conferences
- Built-in recording capability
- Hardened for outside plant deployment
- Dual Redundant Power Supplies
- Solid State hard Drive.