

SINGAPORE CIVIL DEFENCE FORCE

PUBLIC WARNING SYSTEM



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Technology Department**



SCOPE



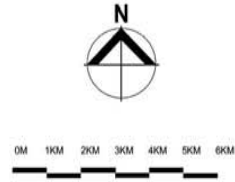
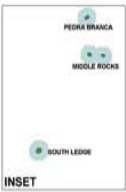
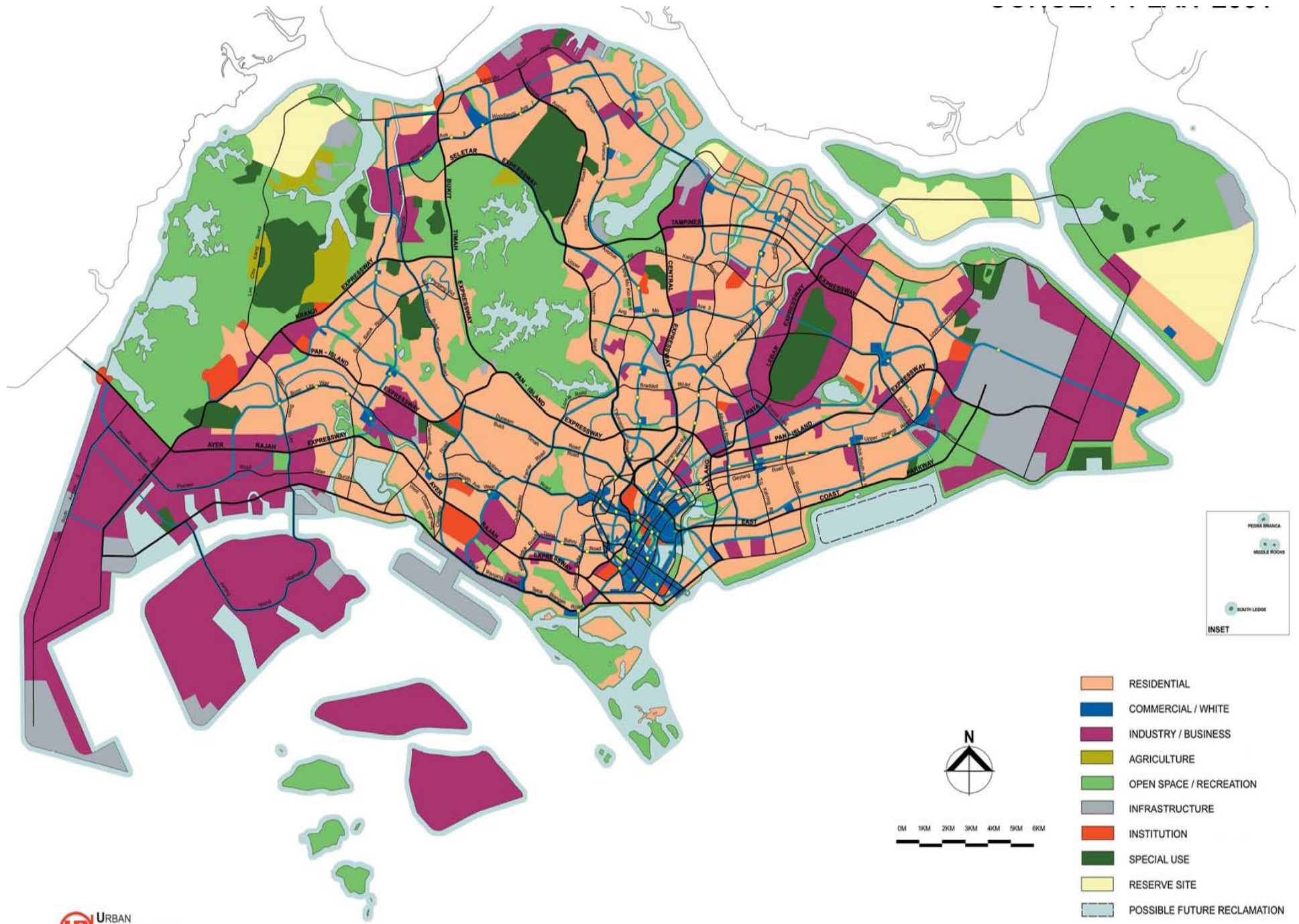
- REPUBLIC OF SINGAPORE
- SINGAPORE CIVIL DEFENCE FORCE
- CD EARLY WARNING CONCEPT
- MILESTONES
- SYSTEM CAPABILITIES
- TYPES OF SIGNALS
- TYPES OF SIRENS
- PUBLIC EDUCATION & AWARENESS
- FUTURE PLANS FOR SINGAPORE'S WARNING & ALERT SYSTEM
- CONCLUSION



REPUBLIC OF SINGAPORE



- Island City-State, located at the southern tip of the Malay Peninsula with a population of 4.86 million (2008)
- Land area of 710.2 km² (19% - Residential, 19% - Commercial & Industries, 20% - Recreation & Community, 22% - Infrastructure & 20 % - Other use)
- Highly developed market-based economy, depending heavily on exports and refining imported goods (especially in manufacturing)
- Has one of the busiest ports and airports in the world
- Is the world's fourth largest foreign exchange trading centre



- RESIDENTIAL
- COMMERCIAL / WHITE
- INDUSTRY / BUSINESS
- AGRICULTURE
- OPEN SPACE / RECREATION
- INFRASTRUCTURE
- INSTITUTION
- SPECIAL USE
- RESERVE SITE
- POSSIBLE FUTURE RECLAMATION
- ROAD
- RAIL

REPUBLIC OF SINGAPORE



- **Natural threats**
 - Tremors
 - Haze
 - Community spread of infectious diseases
- **Other threats**
 - Major fires
 - Structural collapse
 - Air crash incidents (outside airport)
 - Terrorist attacks
 - Hazmat incidents
 - Public safety & security threats



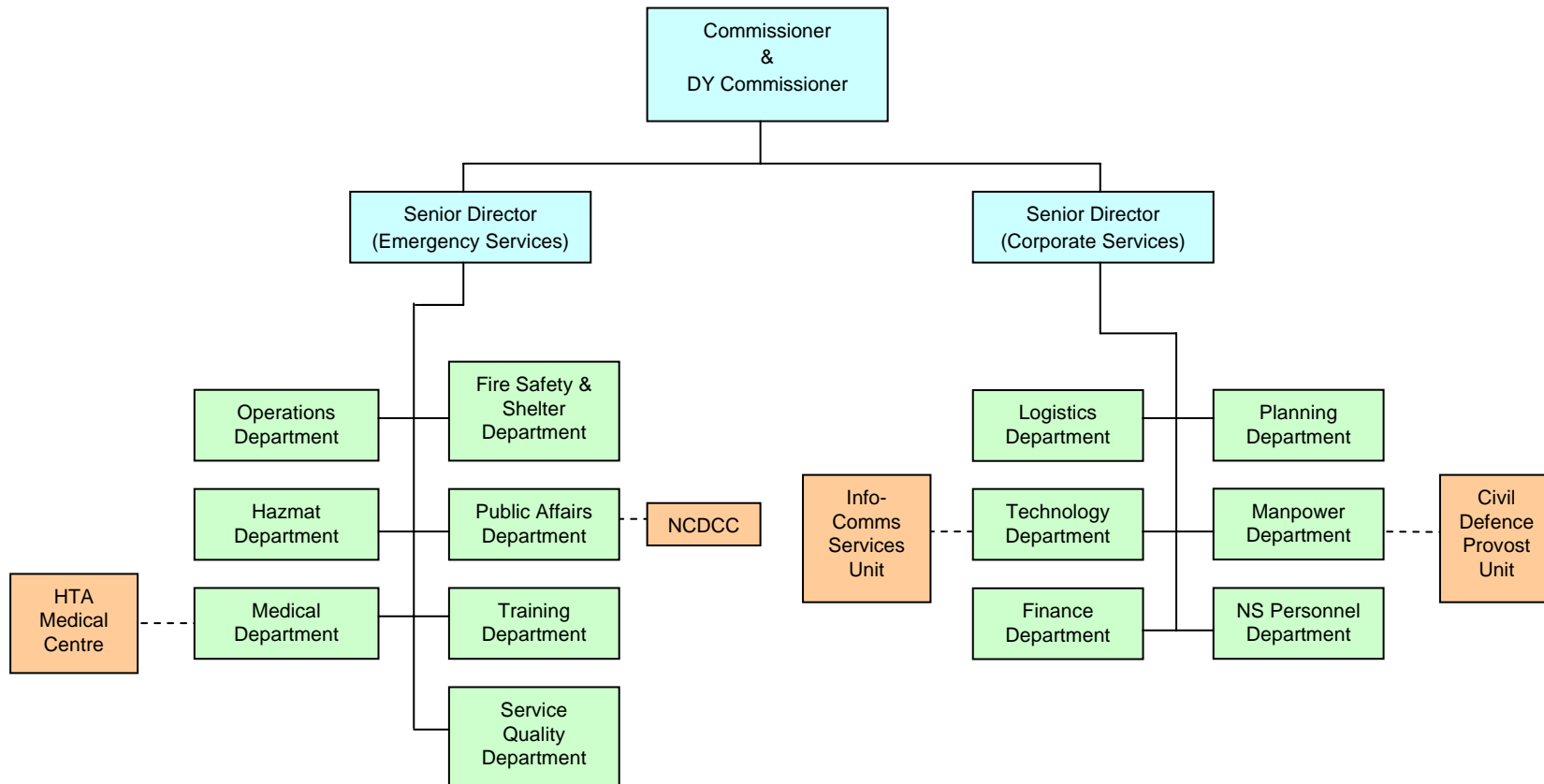
SINGAPORE CIVIL DEFENCE FORCE



- National Authority for fire-fighting, rescue and emergency ambulance services in Singapore
- Mission
 - **TO PROTECT AND SAVE LIVES AND PROPERTY FOR A SAFE AND SECURE SINGAPORE**
- SCDF plays a fundamental role in warning and directing our population of impending threats



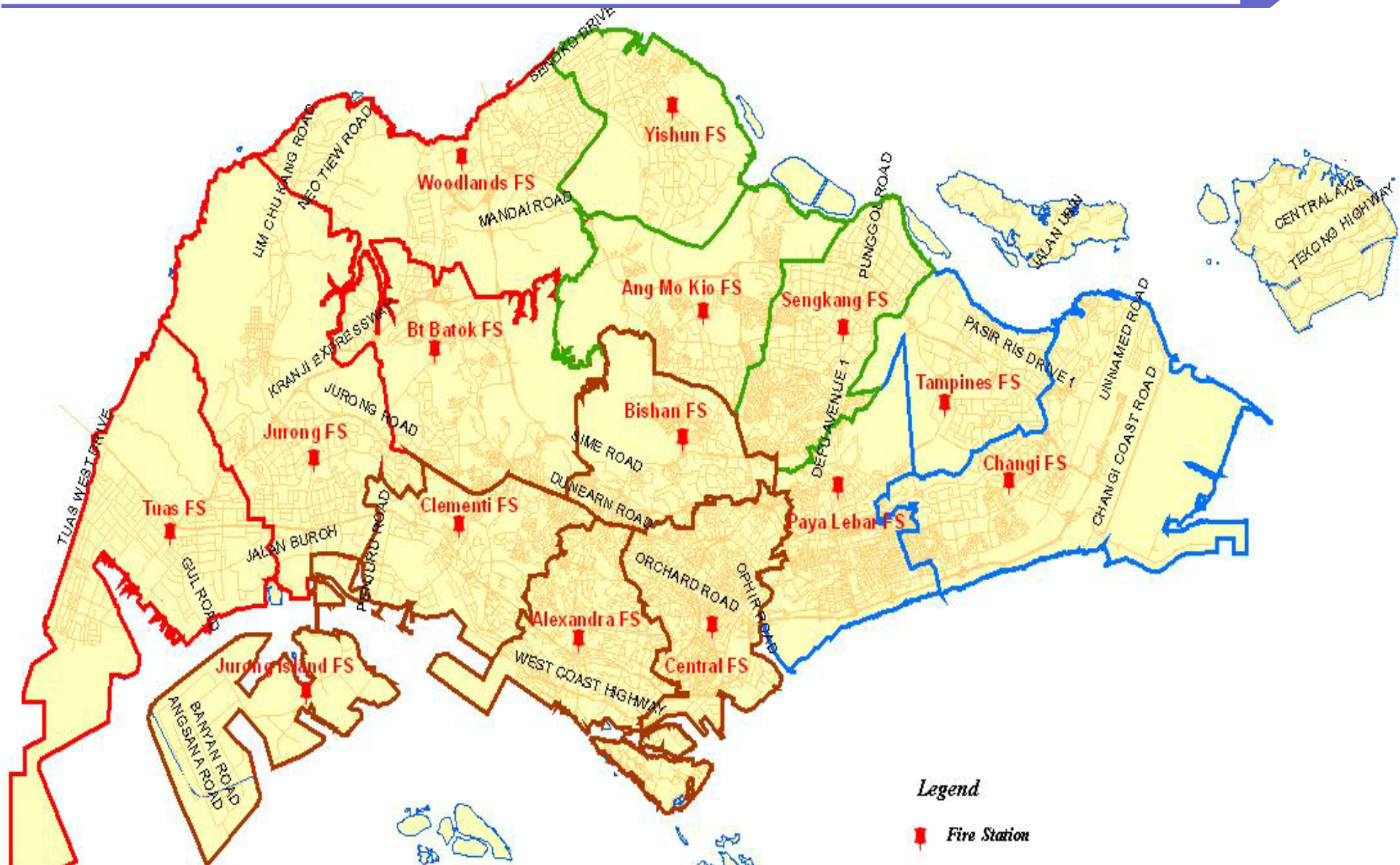
HQ SCDF Organisation Chart



SCDF Territorial Divisions



SCDF Fire Stations



CD EARLY WARNING CONCEPT



- “CD Early Warning Concept” conceived in 1985
- SCDF to be responsible to warn the population of impending threats through a ***nation wide siren system*** which will be centrally operated and capable of sending out different signals
- To complement the CD Shelter Programme



MILESTONES



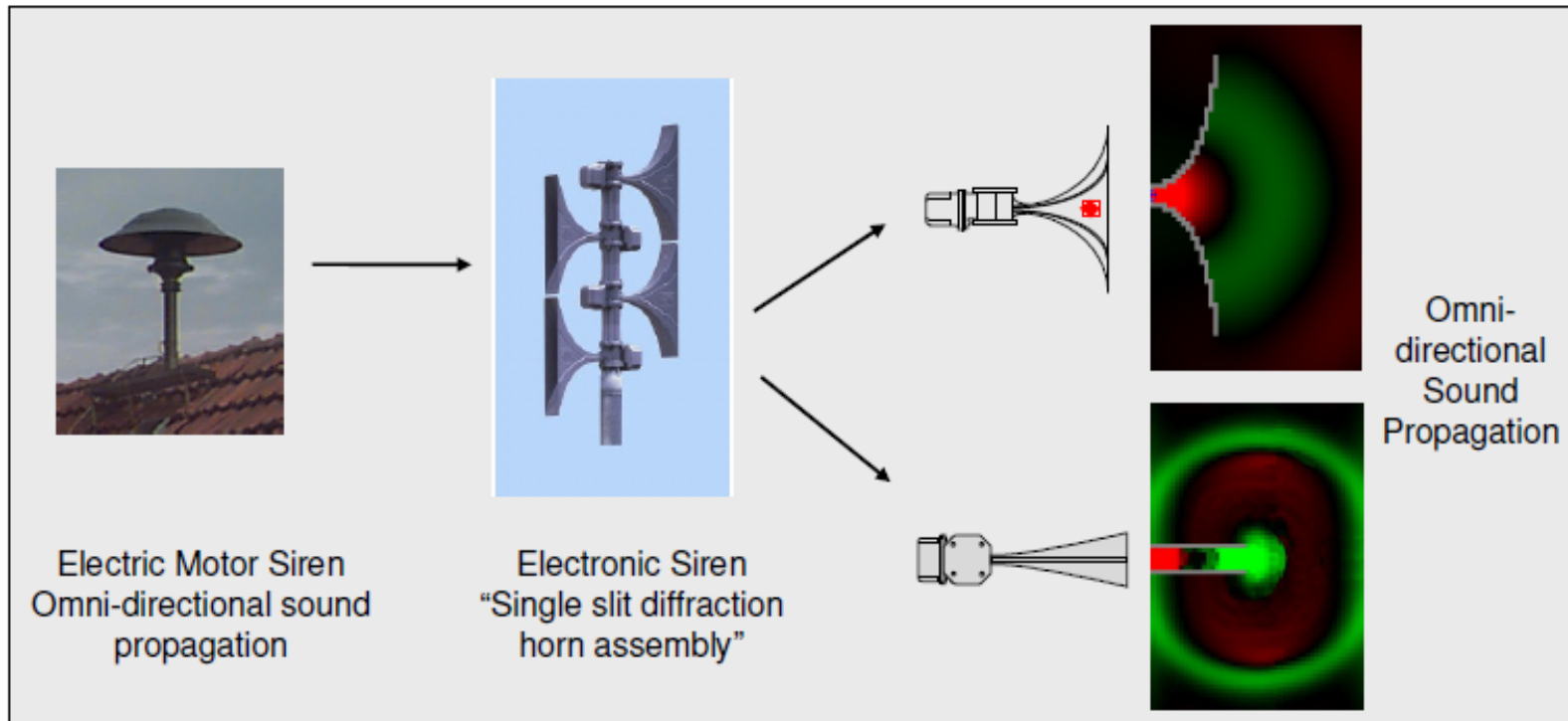
- Budget approved for PWS implementation in 1987
- Contract was awarded on 15 Jan 1991
- System was commissioned on 29 Sep 1992 with the first island-wide sounding exercise
- 1st in Asia to deploy the Electronic Siren system
 - Independent of mains power supply
 - Ability to release different alert tones / public address
 - Variety of communication link interfaces
- The system hardware, software and operating platform went through an upgrading in 2002



Electric Motor vs. Electronic Siren



Obsolete Electric Motor Sirens generate upon rotation omni-directional sound propagation. HÖRMANN's in-house development created the **single slit diffraction horn** to maintain omni-directional sound propagation with fixed installed horn assemblies for Electronic Sirens.



Advantages of Electronic Siren



- Operation by inbuilt maintenance free battery blocks of respective capacity
- Independent from mains power supply in emergency conditions
- Battery supply for 1 month standby operation and multiple activations
- Single phase mains power supply, lowest power consumption
- Configurable for omni-directional or directional sound propagation
- Alarm tones and patterns can be individually programmed
- Storage and activation of digital text messages
- Capability of live PA announcements
- Inbuilt self test routines for detailed technical status information
- Interfaces for a variety of communication links (radio, line, GSM, TCP/IP)
- Local and remote activation and monitoring
- Modular construction, cost efficient, requiring minimum maintenance



SYSTEM CAPABILITIES



- Public Warning coverage
 - 284 sirens located @ populated areas
- Control Centre and Siren communication
 - Leased line as main communications
 - VHF radio as backup communications
- Control Centre redundancy capabilities
 - Main and backup control & activation centres



SYSTEM CAPABILITIES



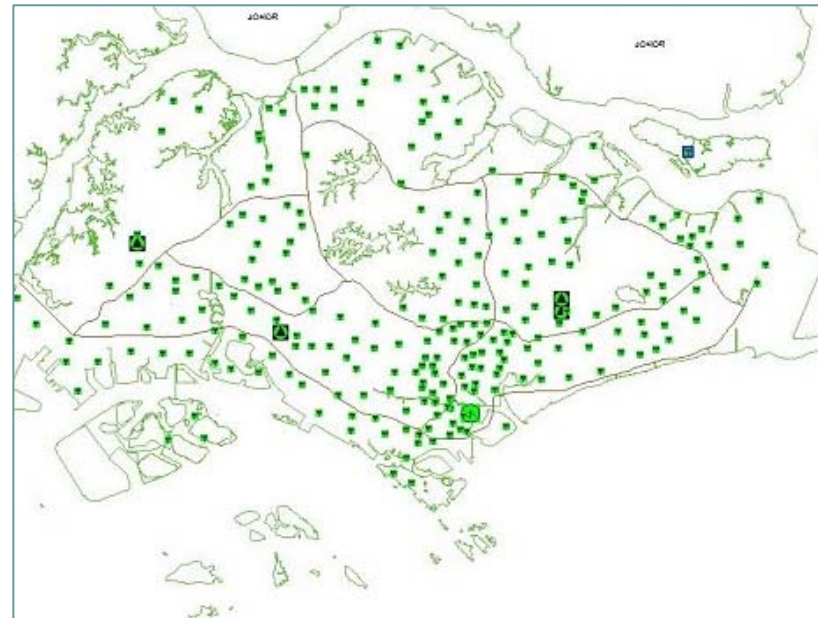
- Graphical User Interface
 - User friendly display & operation
- Real-time status update of sirens
 - Up to date status of sirens (operational, faulty or shutdown)
- Integrated diagnostic program
 - Remote troubleshooting of faulty sirens via software (door forced open, battery state, power supply, amplifier / driver status, line / radio status)



SYSTEM CAPABILITIES



- “2 key” process for siren activation
 - Software selection of siren activation
 - Hardware confirmation of activation of selected sirens
- Ability to perform island-wide, geographical & localised sounding of sirens
- Island-wide sounding of sirens
 - < 5 seconds upon activation



SYSTEM CAPABILITIES



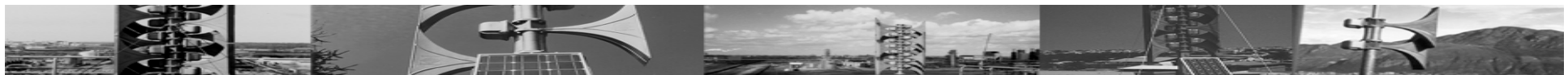
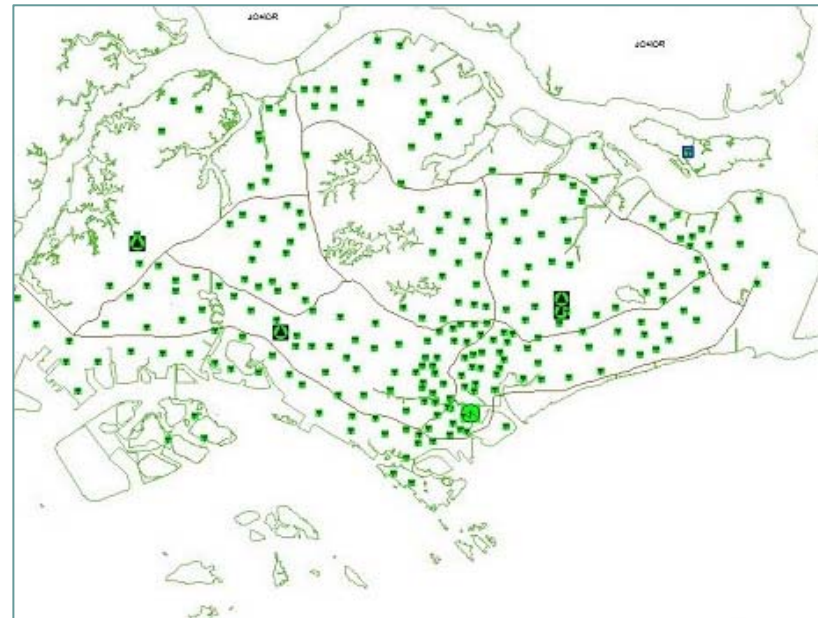
- Ability to release
 - different alert tones
 - live public address and
 - pre-recorded messages
- Generation of status reports
 - Total sirens
 - Operation sirens
 - Shutdown sirens
 - Faulty Sirens



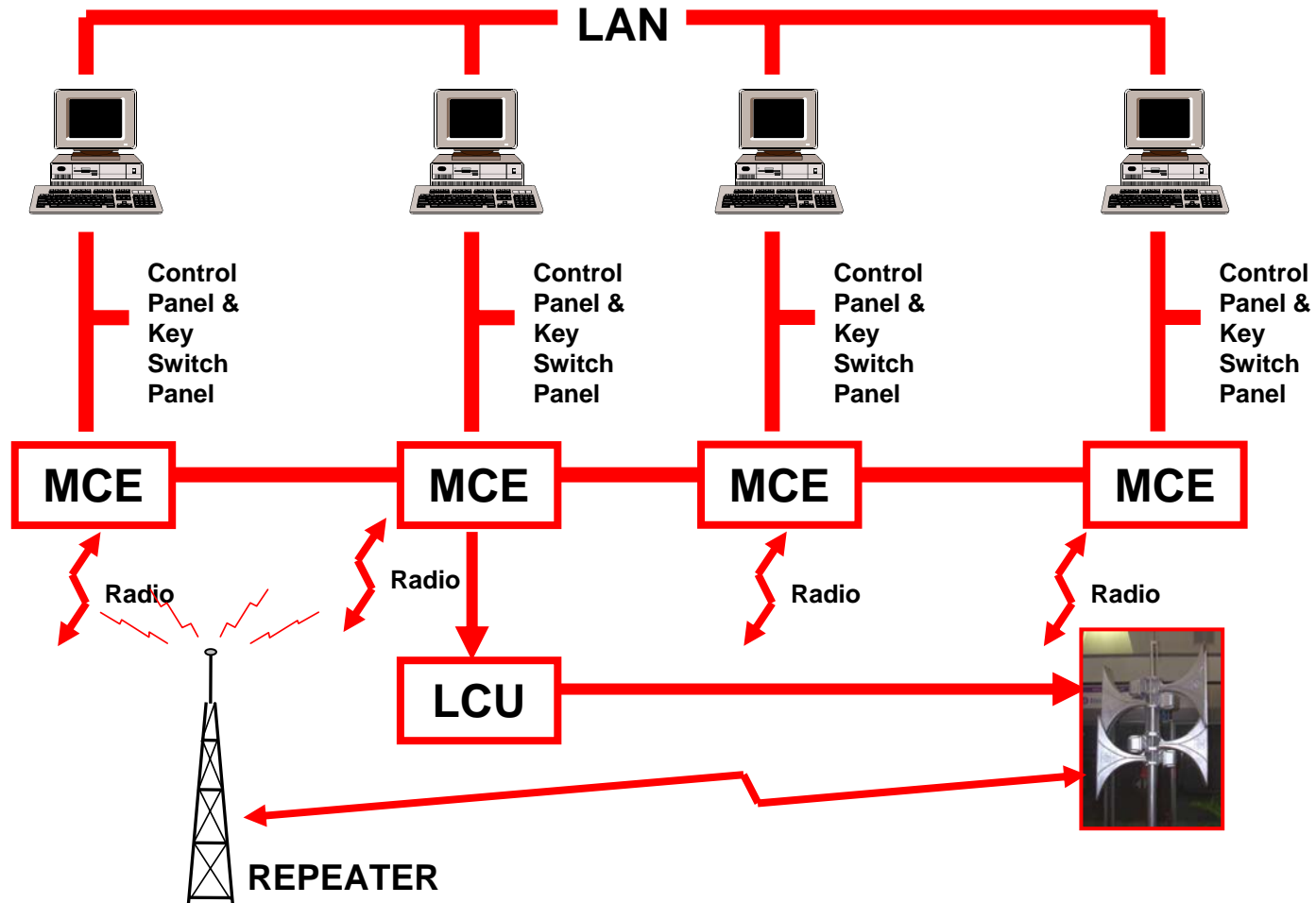
SYSTEM CAPABILITIES



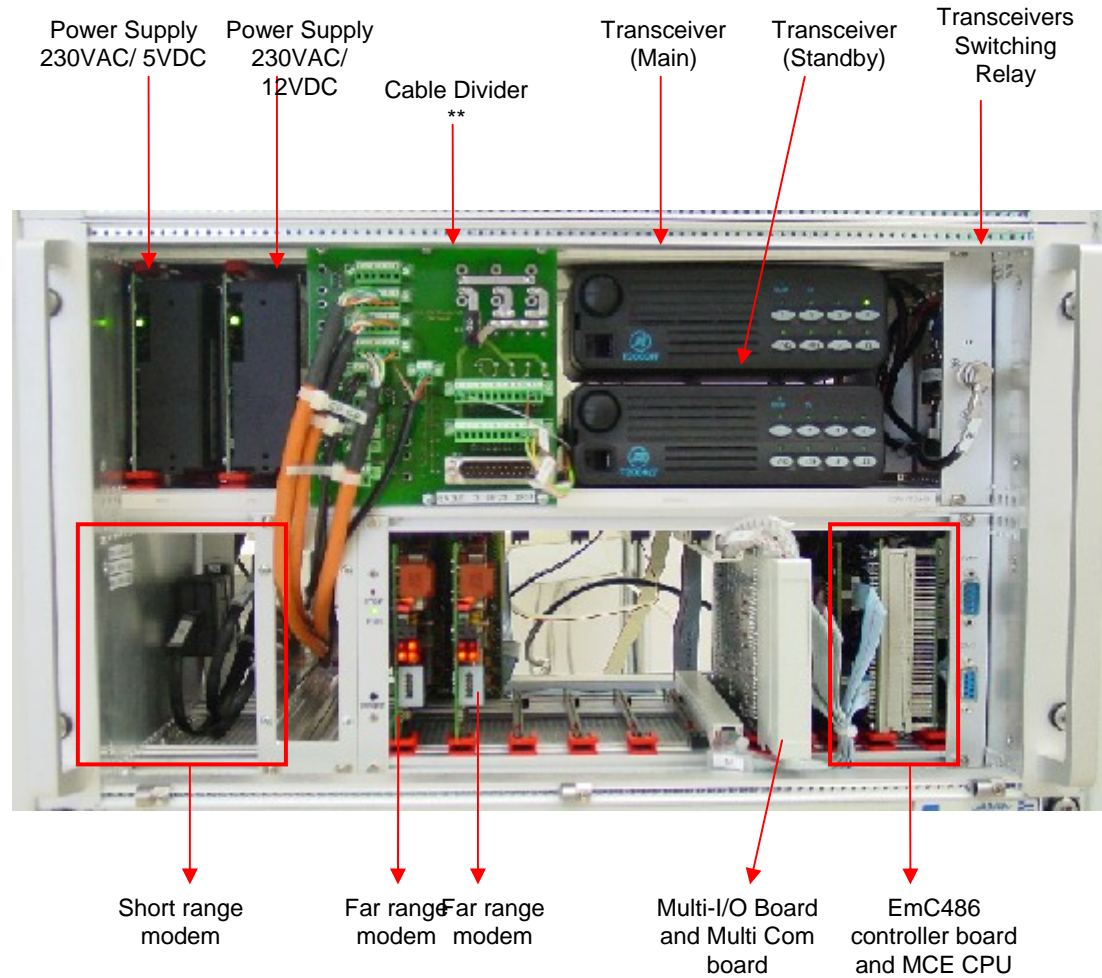
- Portable siren deployment
 - to enhance coverage
- Digital Audio Broadcast
 - Broadcast of emergency messages to DAB radios
- Emergency over-riding of radio broadcast
 - Subject to approval of broadcast authority



PWS Network Diagram



Management Control Equipment



Line Control Unit



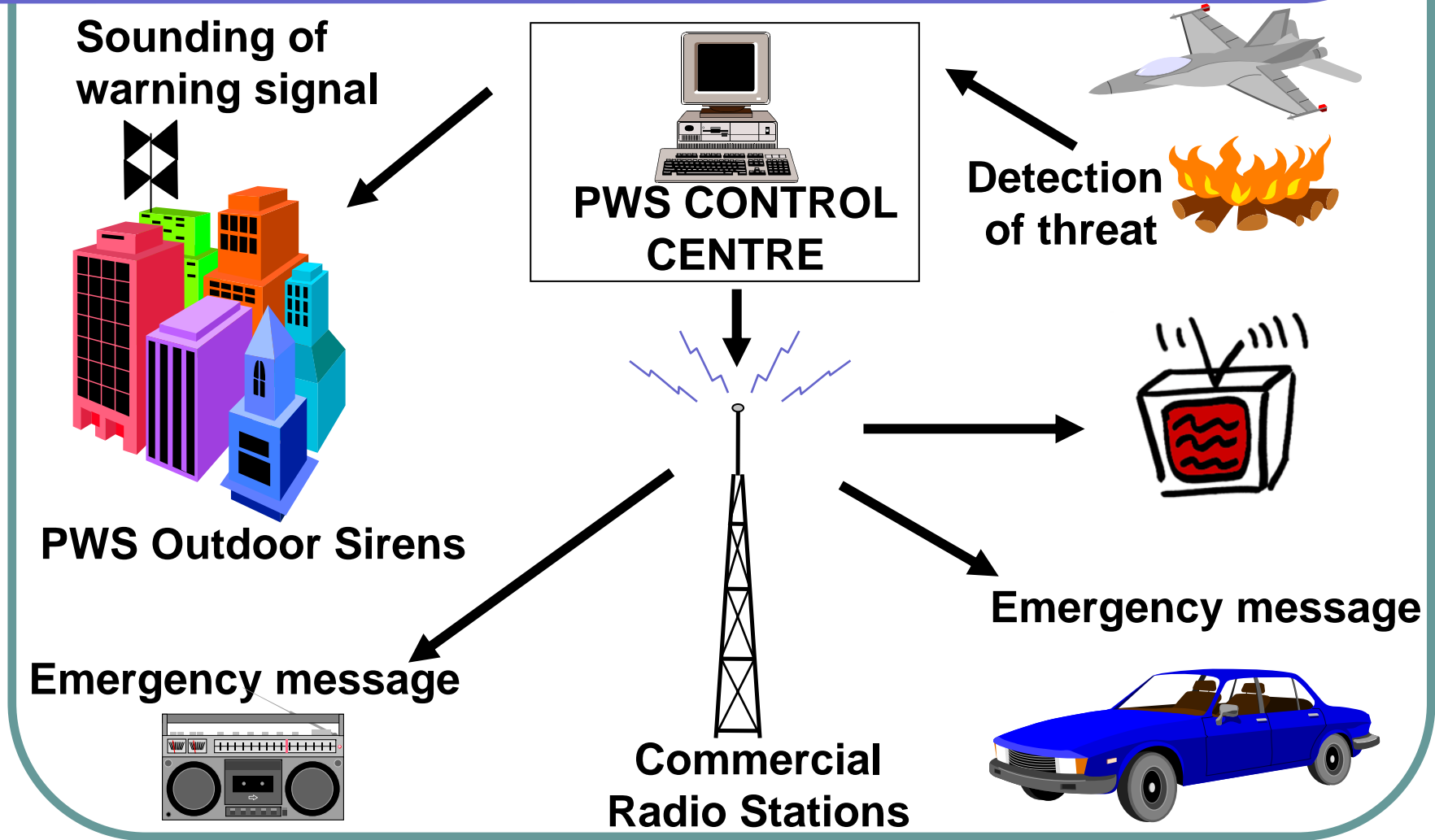
LCU (Front view- open)



LCU (inside cabinet)



Use Of TV & Radio For PWS



TYPES OF SIGNALS




- Alarm
- All Clear
- Important Message
- Chime



Alarm




- This signal is to inform the population to seek protection in shelter/cover
- Length : 1 minute
- Tone : Wailing Blast 



All Clear




- This signal is to inform the population that they may leave shelter/cover
- Length : 1 minute
- Tone : Continuous Blast 



Important Message




- This signal is to inform the population to monitor radio broadcast for emergency messages
- Length : 1 minute
- Tone : Pulsating Blast 



Chime



- This is used for sounding tests and through its regular sounding, increase public awareness of PWS
- Length : 20 seconds
- Tone : Melody 



TYPES OF SIRENS

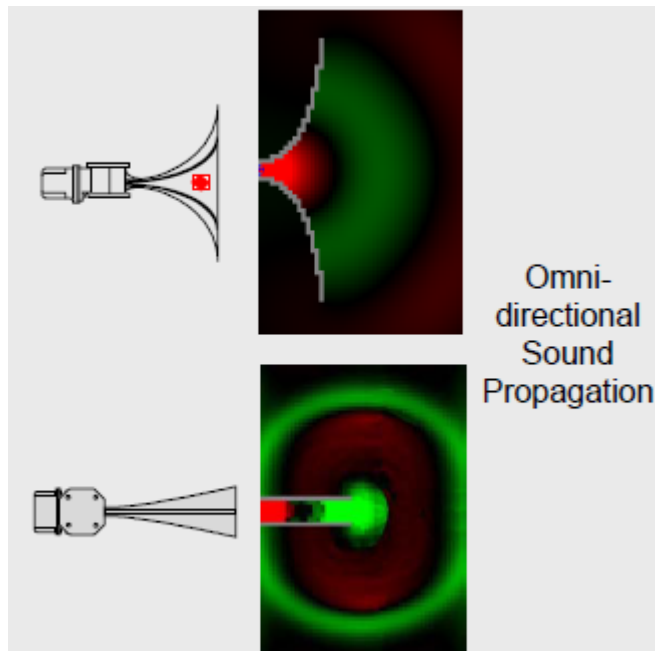


- ECN 600
- ECN 1200
- ECN 2400

*All sirens have 360° (degree) omni-directional sound propagation



Siren Horn Design



- The 360° (degree) omni-directional sound propagation pattern is created upon diffraction of sound on the slit of the siren horn.
- To assure a 360° (degree) sound propagation pattern for the siren head installations in the field, the siren head will be split in 2 channels, which is assembled in 180° (degree) opposite direction.



ECN 600



- 109 db(A)
- 4 horns & drivers
- 2 amplifiers
- 320m (city), 470m (high-rise), 500m (low-rise)





Siren Type	ECN 600
Sound Pressure Level	109 dB (A) / 30 m
Fundamental Frequency	415/425 Hz
Siren Sound	Customer Specification
Alert Signals	Customer Specification
Number of Alert Signals	Up to 10
Number of Horns and Drivers	4
Weight of Single Horn	9 kg
Head Dimension (w x d x h) in mm	Single Column 136 x 834 x 1600
Material of Horns	Gk-AISi12Mg wa
Colour of Horns	Natural Aluminium
Humidity	0-100%
Number of Amplifiers	2
Mains Power Supply	230 V or 110 V + /-10%
Battery Voltage	24 V
Max. Charging Current	4 A
"Standby" Time	Up to 1 month
Number of Alarms available within 48 h without Mains Power Supply	Up to 20
Cabinet Dimensions (w x d x h) in mm	600 x 350 x 760
Cabinet Colour	RAL 7035
Control Cabinet ambient Temperature Range	-25 °C... +65 °C
Cabinet Material	St 1203, 1,5 mm thick
<i>Specifications are subject to change without notice!</i>	

ECN 1200



- 115 db(A)
- 8 horns & drivers
- 4 amplifiers
- 420m (city), 640m (high-rise), 700m (low-rise)



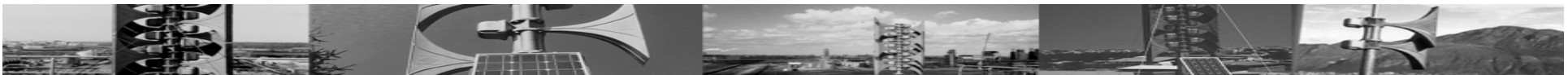


Siren Type	ECN 1200
Sound Pressure Level	115 dB (A) / 30 m
Fundamental Frequency	415/425 Hz
Siren Sound	Customer Specification
Alert Signals	Customer Specification
Number of Alert Signals	Up to 10
Number of Horns and Drivers	8
Weight of Single Horn	9 kg
Head Dimension (w x d x h) in mm	Double Column 300 x 850 x 1605
Material of Horns	Gk-AISi12Mg wa
Colour of Horns	Natural Aluminium
Humidity	0-100%
Number of Amplifiers	4
Mains Power Supply	230 V or 110 V + /-10%
Battery Voltage	24 V
Max. Charging Current	4 A
"Standby" Time	Up to 1 month
Number of Alarms available within 48 h without Mains Power Supply	Up to 20
Cabinet Dimensions (w x d x h) in mm	600 x 350 x 760
Cabinet Colour	RAL 7035
Control Cabinet Ambient Temperature Range	-25 °C... +65 °C
Cabinet Material	St 1203, 1,5 mm thick
<i>Specifications are subject to change without notice!</i>	

ECN 2400



- 121 db(A)
- 16 horns & drivers
- 8 amplifiers
- 540m (city), 830m (high-rise), 1050m (low-rise)





Siren Type	ECN 2400
Sound Pressure Level	121 dB (A) / 30 m
Fundamental Frequency	415/425 Hz
Siren Sound	Customer Specification
Alert Signals	Customer Specification
Number of Alert Signals	Up to 10
Number of Horns and Drivers	16
Weight of Single Horn	9 kg
Head Dimension (w x d x h) in mm	Double Column 300 x 850 x 2900
Material of Horns	Gk-AISi12Mg wa
Colour of Horns	Natural Aluminium
Humidity	0-100%
Number of Amplifiers	8
Mains Power Supply	230 V or 110 V + /-10%
Battery Voltage	24 V
Max. Charging Current	4 A
"Standby" Time	Up to 1 month
Number of Alarms available within 48 h without Mains Power Supply	Up to 20
Cabinet Dimensions (w x d x h) in mm	600 x 420 x 1300
Cabinet Colour	RAL 7035
Control Cabinet Ambient Temperature Range	-25 °C... +65 °C
Cabinet Material	St 1203, 1,5 mm thick
<i>Specifications are subject to change without notice!</i>	

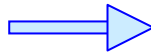
Pole Siren with Solar Panel



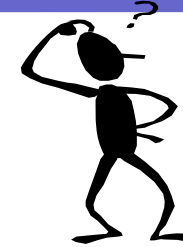
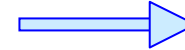
Deliberate Activation Process



Incident

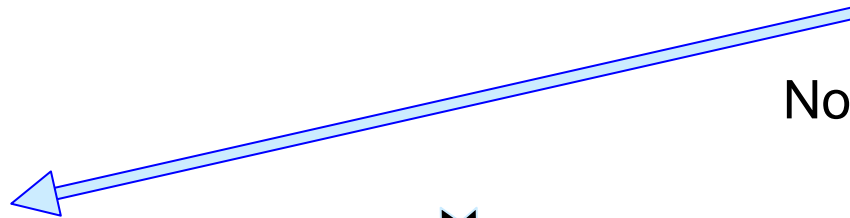


Decision Making Process

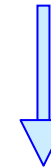


Activate PWS?

No



Yes



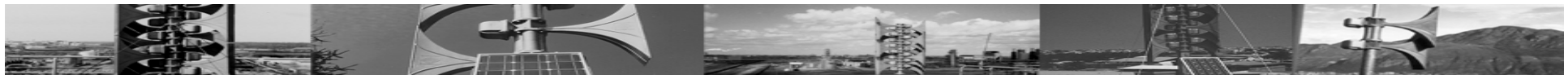
Monitoring of Situation



Activation of PWS



Co-ordination with Related Agencies



PUBLIC EDUCATION & AWARENESS



- **Media**
 - **Radio**
 - **Television**
 - **Newspapers**
 - **Posters**
 - **CD Emergency Handbook**
 - **SCDF Internet Website**
 - **Road shows**
- **SCDF Heritage Gallery**
- **SCDF Hotline**

Aug 9, 8.22pm: The Pledge Moment

ORGANISERS of the National Day Parade are urging Singaporeans to take 30 seconds off to recite the Pledge, reflect on its meaning and reaffirm their commitment to the nation, on its 44th birthday. To mark The Pledge Moment, the Singapore Civil Defence Force will sound the chime through its islandwide public warning system at 8.22pm on Aug 9.

media platforms and star power to get Singaporeans to say the Pledge with one voice. From today, there will be television and radio trailers, print and online ads on the event. Radio deejays will also talk about The Pledge Moment and the National Day Parade on their shows.

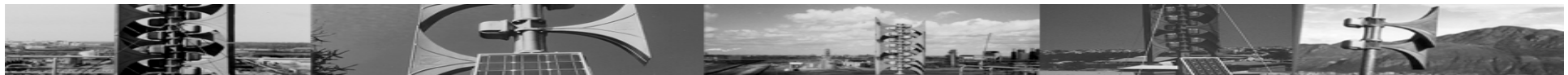
For the first time during National Day, MediaCorp's 12 radio stations



Island-wide Soundings



- 15 island-wide soundings a year
 - Total Defence Day (Important Message Signal)
 - 15 February @ 1205 hrs
 - National Day (Chime Signal)
 - 9 August @ 2022 hrs
 - Civil Defence Day (Important Message Signal)
 - 15 September @ 1205 hrs
 - Monthly Chime Signal Test
 - Every 1st of the month @ 1200 hrs



Total Defence Day



- Total Defence Day is celebrated annually on February 15 in Singapore
- Public education is conducted to remind Singaporeans on the importance of Total Defence.
- At 1205 hours, the Singapore Civil Defence Force (SCDF) will sound the Important Message Signal through the island-wide Public Warning System (PWS) sirens.
- Simultaneously at 1205 hours, local radio stations will sound the important message signal and explain to the listeners on the appropriate measures to be taken for the three different types of PWS signals.



Total Defence Concept



- Total Defence concept was introduced in 1984
- Adapted from the experiences of countries like Switzerland and Sweden
- We needed to draw on the different strengths and abilities of our community to augment our defence capability
- Total Defence has five aspects
 - Military Defence
 - Civil Defence
 - Economic Defence
 - Social Defence and
 - Psychological Defence



Civil Defence Day



- Civil Defence Day is held annually on 15 September
- For CD personnel to pledge and reaffirm their commitment to SCDF and also the Life-Saving cause
- At 1205 hours, the Singapore Civil Defence Force (SCDF) will sound the Important Message Signal through the island-wide Public Warning System (PWS) sirens.
- Simultaneously at 1205 hours, 10 local radio stations will sound the important message signal and explain to the listeners on the appropriate measures to be taken for the three different types of PWS signals.



Key Challenges Faced



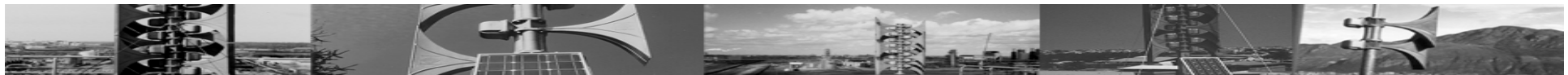
- Getting approval from building owners for installation of PWS sirens
- Managing public expectations of the PWS
- Educating the public with regards to the various PWS signals



FUTURE PLANS FOR SINGAPORE'S WARNING & ALERT SYSTEM



- Upgrade our current outdoor warning siren system
- To broadcast 1 message over multiple mediums
- Disseminate message to general public or focused groups
- Leverage on the following technology (not limited to):
 - Cell broadcast
 - Radio Data System (RDS)
 - SMS/MMS
 - Internet websites
 - Emails
- Setup of emergency public announcement broadcast centre



Cell Broadcast



- Cell broadcast is a technology that allows a text message to be defined and distributed to all mobile phones that are connected to the base transceiver stations (also known as cells) in a GSM network.
- Cell broadcast is a location based service. Where SMS is a service of individual messages, cell broadcast is capable of broadcasting one single message to reach concurrently all mobile handsets, equipped with the cell broadcast function, within the geographical vicinity of the cell.
- The advantage of this approach is that it leverages on the prevalent ownership of mobile phones in Singapore to receive the warnings/alerts without the need for the public or focus groups to own a dedicated portable receiver.



Radio Data System



- The RDS has been the standard in Europe since 1990s for sending small amounts of digital information using conventional FM radio broadcast.
- The technology could be harnessed to send out public warning signals and text or even as a signal to trigger the operation of a device.
- Dedicated decoders could be connected to the Public Address (PA) System of a premise to broadcast the warning signals.



Digital Audio Broadcast



- The DAB is a commercial radio broadcast. The DAB standard was designed in the 1980s and the technology was used mainly in Europe and Canada.
- The DAB was designed for robust digital audio and multimedia data broadcasting.
- Proponents claimed that the DAB offered several technological advantages over analogue FM radio through interference free reception and high quality sound.



CONCLUSION



- Outdoor warning is currently the fundamental provision to warn our population
- We are constantly reviewing and upgrading our outdoor warning system coverage
- We are now embarking on an integrated warning & activation system project



THE END



ありがとう

Thank you!



NEA – Environment Monitoring



- An important part of the National Environment Agency's (NEA's) approach to safeguarding Singapore's environment is the monitoring of environmental conditions.
- Monitoring of air quality takes place at stations around Singapore, and plays an important role in keeping the population up to date on haze conditions.
- NEA monitors both drinking water and coastal and inland waters in Singapore. Inland waters include reservoirs and rivers. NEA provides guidelines for drinking water and recreational waters.
- NEA's Met Services department monitors weather conditions in Singapore, including atmospheric and seismic conditions.
- In addition to maintaining long-term weather records, Met Services also provides information on current and forecast conditions.

