Twenty Seventh Meeting of the Communications/Navigation and Surveillance Sub-group (CNS SG/27) of APANPIRG

WP/17 - ACHIEVING HIGH RESILIENCE IN SUSTAINING OPERATIONS OF CRITICAL AERONAUTICAL INFRASTRUCTURE

Presented by Hong Kong, China

Critical Aeronautical Infrastructure (CAI)

Critical Aeronautical Infrastructure (CAI) *needs uninterrupted operations for sustaining round-the-clock provision of air navigation services for flight safety purpose.*

Failure of CAI may lead to major disruption or even airspace closure . . .

15 JUN 2022 | 02:03 AM UTC

Switzerland: Authorities close airspace nationwide due to technical issue at air traffic control the morning of June 15

Air traffic control 'failure' hits UK airports

By Barry Neild, Tamara Hardingham-Gill, Catherine Nicholls and Ben Brown, CNN
Updated 11:41 AM EDT, Mon August 28, 2023

Travel > News Travel

AIRSPACE CHAOS Probe into Air Traffic Control system failure launched after Irish airspace was forced to close

The Irish Airport Authority have launched a probe into the failure as flights from Cork, Shannon and Knock were cancelled and delayed as Irish airspace closed last night

John Hand
Published: 10:06, 3 Oct 2018

TRANSPO / US & WORLD / AVIATION

The EU's air traffic control system failed, and up to 15,000 flights may be grounded

Photo by Sean Gallup/Getty Images

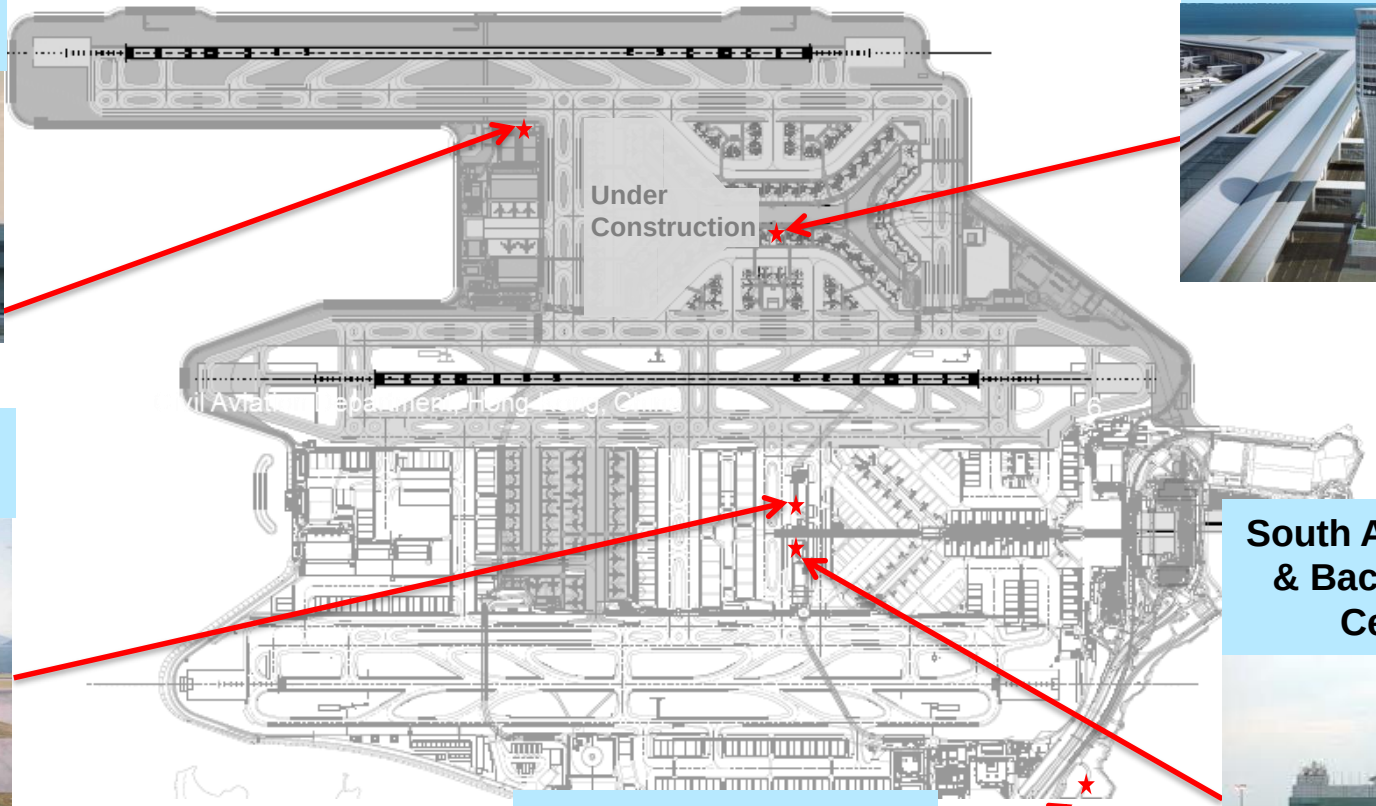
/ Eurocontrol's flight management system failed, affecting as many as 15,000 flights

By Nick Statt
Apr 4, 2018, 2:45 AM GMT+8 | 0 Comments

ATC Centres & Towers at the HKIA

Interim ATC Tower

North ATC Tower



New ATC Tower (under construction)

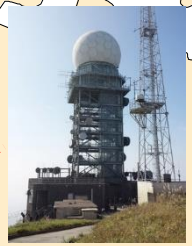
South ATC Tower & Backup ATC Centre

Main ATC Centre

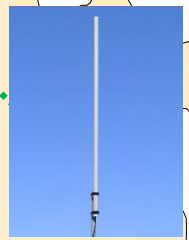
Off-airport CNS Stations in Hong Kong

Lung Kwu Chau

Tai Mo Shan



Shek Uk Shan



Beacon Hill

Sha Chau

HKIA

Siu Mo To

North Lantau

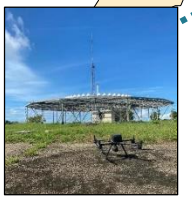
Victoria Peak

Mount Butler

Mount Parker

Tung Lung Chau

Cheung Chau

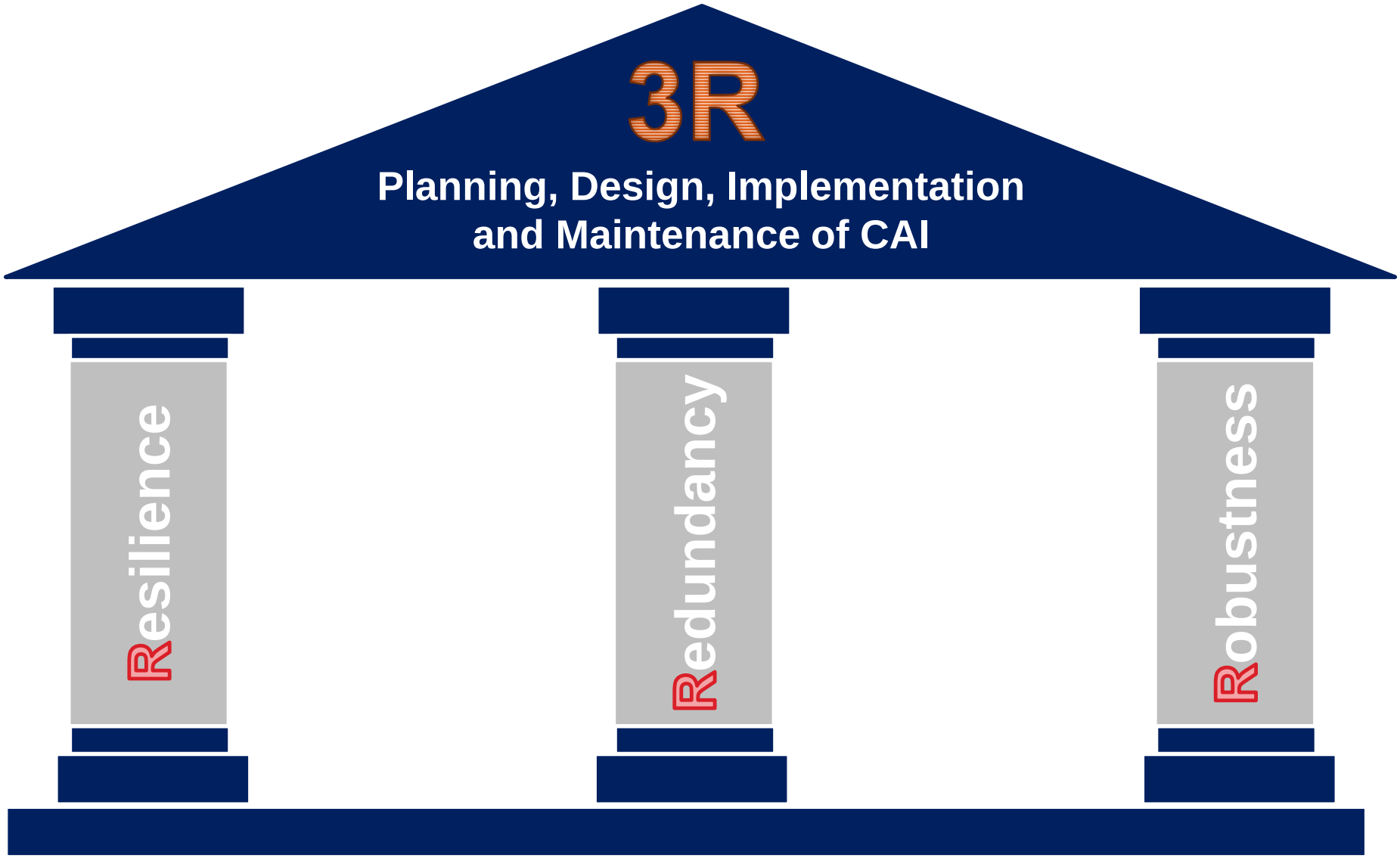


Cape D'Aguilar

Legend

- Comms
- Navaids
- Surveillance

The “3R”


3R
Planning, Design, Implementation
and Maintenance of CAI
Resilience
Redundancy
Robustness

ATC System Architecture & Design

Operating in parallel providing immediate backup to each other when one fails

Main System

Fallback System

Identical Systems

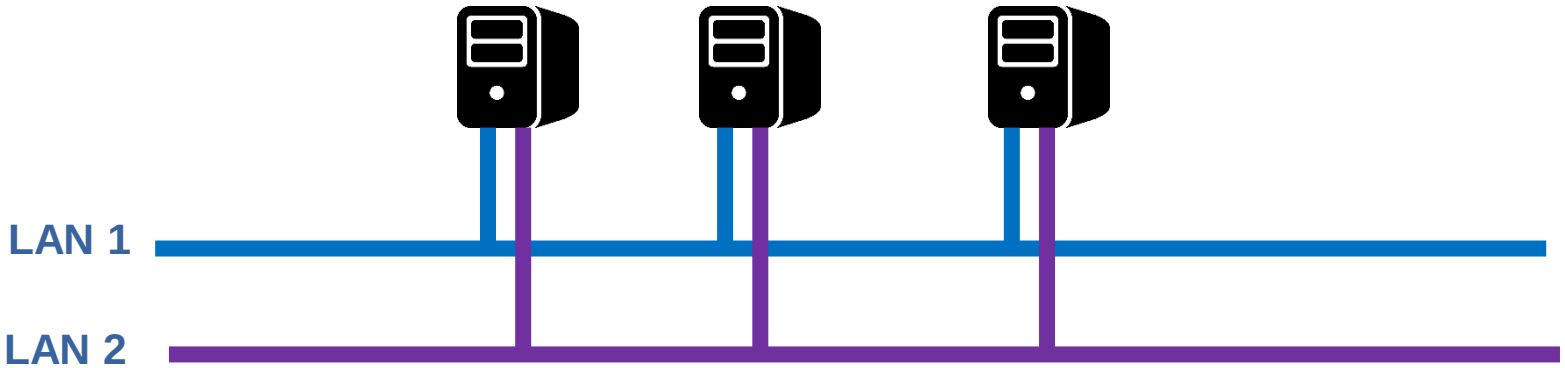
Additional Layer of Protection in line with IGD developed by ICAO ATM Automation System Task Force

Contingency System

Provided by another supplier independent from Main/Fallback systems

Redundant LAN

Core common services, e.g. Surveillance Data Processing Servers and Flight Data Processing Servers

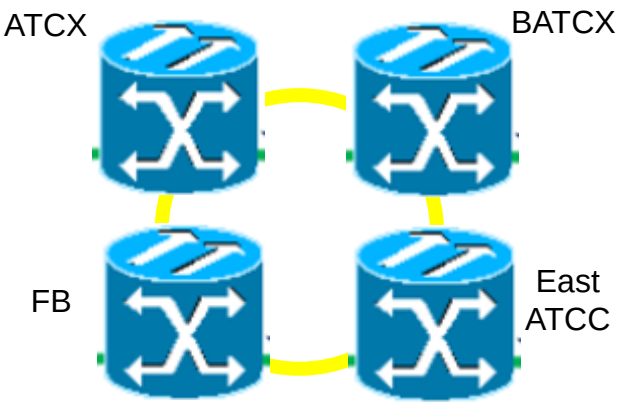


System logs collection and handling of recording and playback

Location & Route Diversity

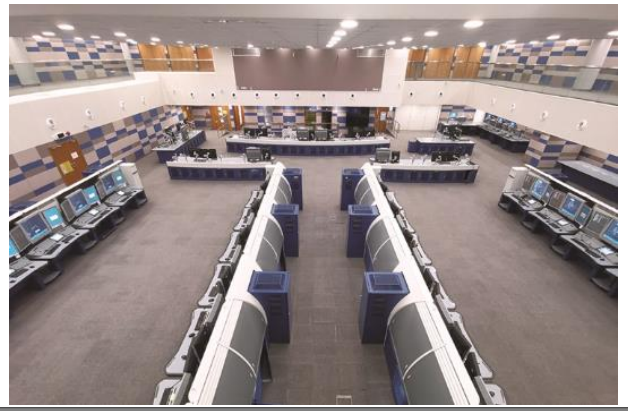
- Multiple ATC centres/towers with identical systems provisions
- Fibre optics communication cables are installed in a ring configuration
- Regular activation drills of backup facilities are conducted to ensure readiness and familiarization by personnel involved

Ring Topology

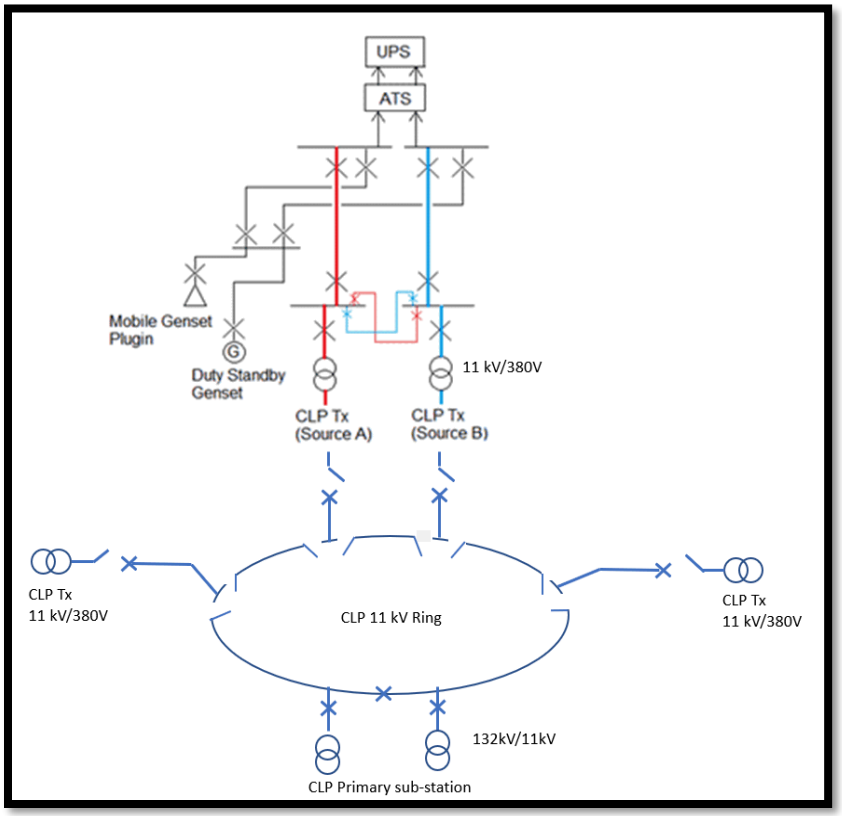


Main ATC Centre

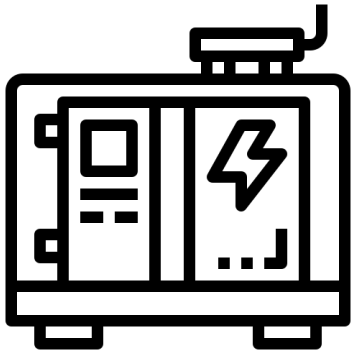
Backup ATC Centre



City Mains & Genset



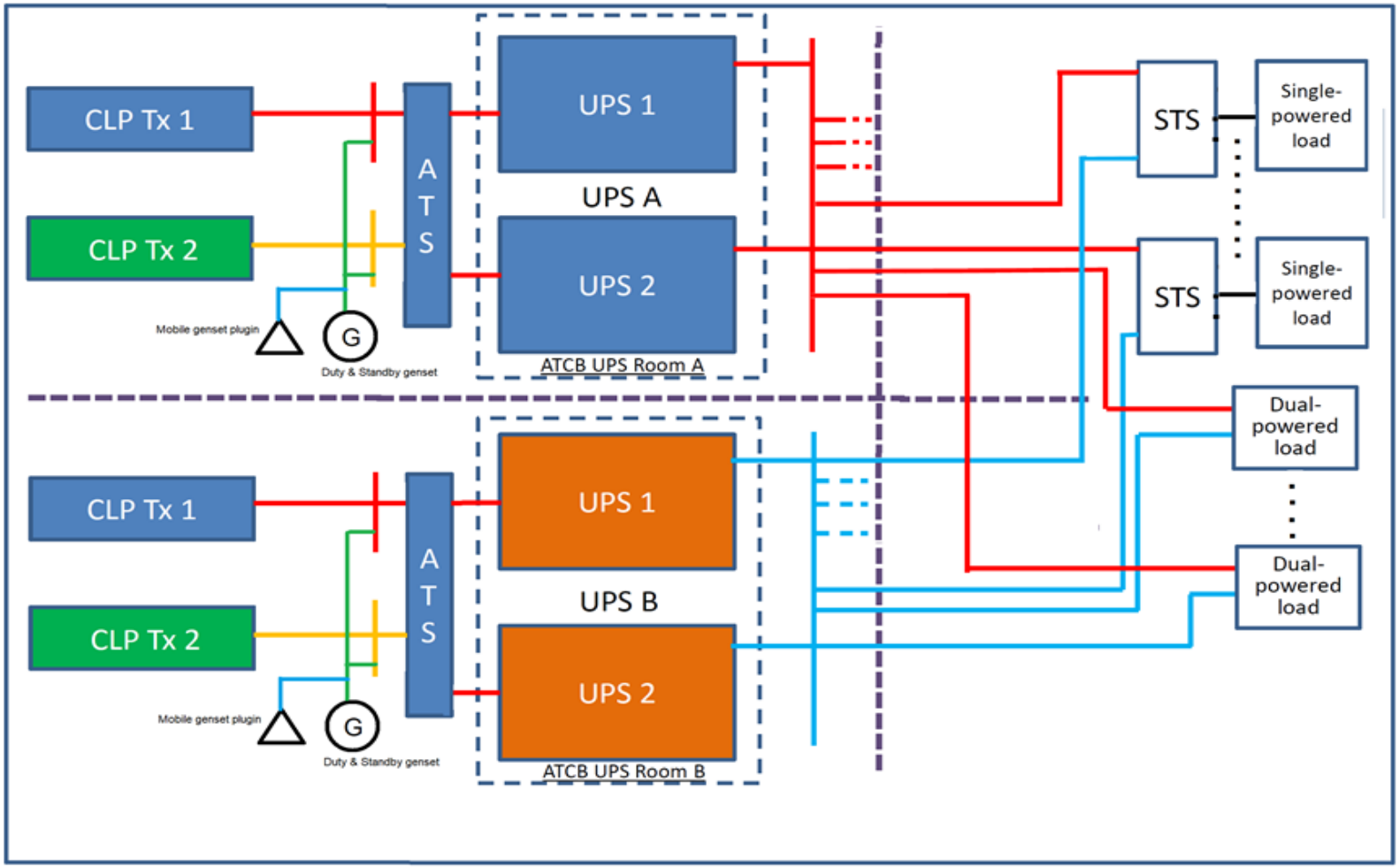
Dual feeds with duty/backup transformers in a ring topology



Multiple gensets in “N+1” configuration

Quick hook-up to large-capacity mobile genset

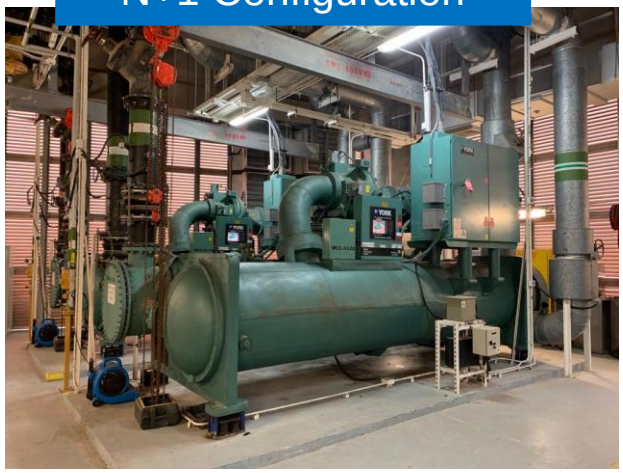
Uninterruptible Power Supply (UPS)



UPSes can continuously support hours of uninterrupted operation of safety-critical ATC equipment, thus ATC service.

Air Conditioning

N+1 Configuration

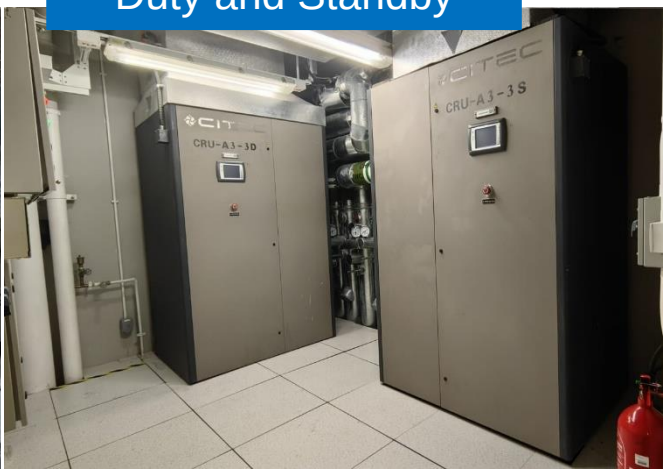


Water-cooled Chiller System (WCC)

Backup ACC activates in case WCC fails

Air-cooled Chiller System (ACC)

Duty and Standby



CRAC Unit

All safety-critical ATC servers/workstations and operational personnel are continuously and separately cooled by conditioned air to ensure their reliability and performance

Comprehensive Maintenance

Comprehensive Maintenance

- Periodic drills
- System switchovers
- Routine, corrective and proactive maintenance
- Training
- Contingency plans

Sustaining uninterrupted operations of CAI

Action by the Meeting

The meeting is invited to:

a) note the experience of Hong Kong China in the planning, design, implementation and maintenance of Critical Aeronautical Infrastructure (CAI) in achieving high resilience in supporting its round-the-clock operations for flight safety purpose;

b) encourage CAAs/ANSPs to share their relevant experience;

c) consolidate the experience into a guidance document for future reference; and

d) discuss any relevant matter as appropriate.

Thank you


• Safe • Orderly • Efficient
• Airworthy • Teamwork
Committed to a Safe, Efficient and Sustainable Air Transport System