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**Safety Management System  
in  
Air Traffic Services**

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# Content

- Air Traffic Services
- Safety Management System –Why?
- SMS Implementation in ATS by HK CAD
- Conclusion

# Air Traffic Services

## Aims

- Prevent collisions
- Orderly and expeditious flow
- Advice & information for safe and efficient conduct of flights
- Search and Rescue



## Air Traffic Services

- Air Traffic Control Service (ATC)
- Flight Information Service
- Alerting Service

provided by

*Air Traffic Management Division*

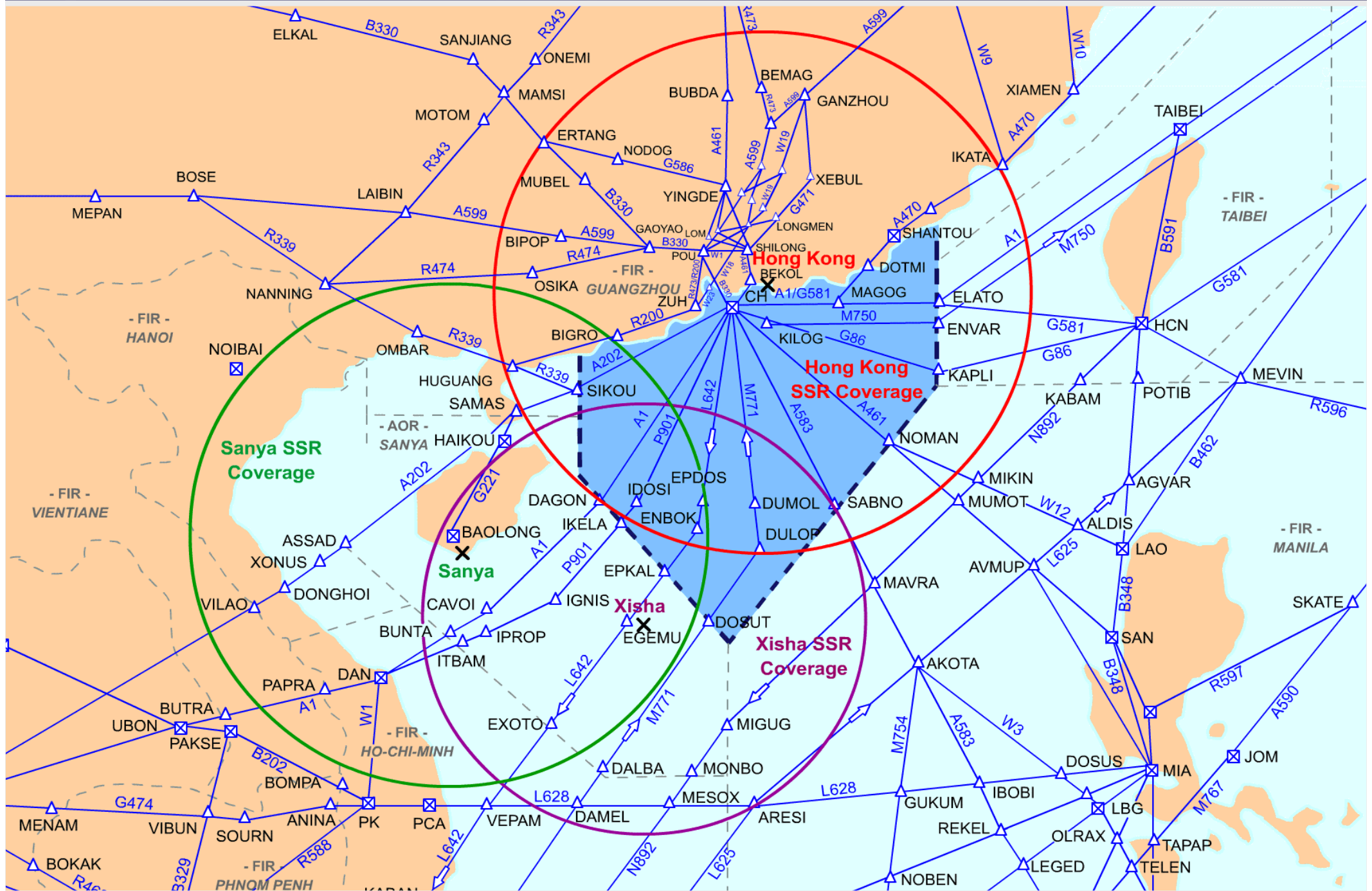
*Civil Aviation Department*

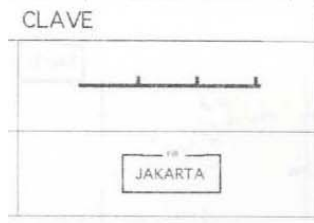
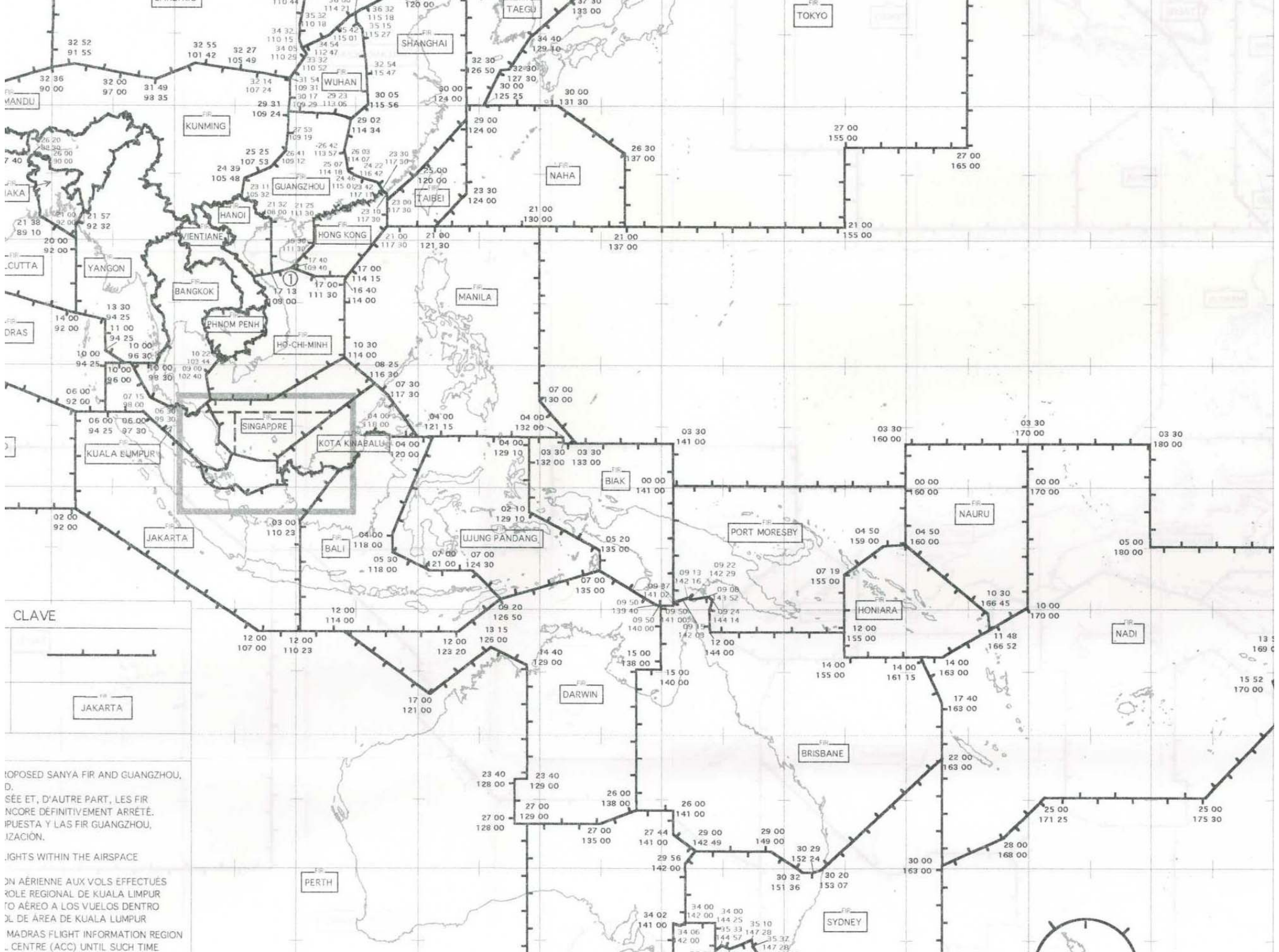


**Aerodrome Control Tower**



# Air Traffic Control Centre





PROPOSTO SANYA FIR AND GUANGZHOU, D. SÉE ET, D'AUTRE PART, LES FIR NCORE DÉFINITIVEMENT ARRÊTÉ. IPUESTA Y LAS FIR GUANGZHOU, IZACION.

RIGHTS WITHIN THE AIRSPACE

EN AÉRIENNE AUX VOLS EFFECTUÉS  
 ROLE REGIONAL DE KUALA LIMPUR  
 TO AÉRO A LOS VUELOS DENTRO  
 AL DE ÁREA DE KUALA LUMPUR  
 MADRAS FLIGHT INFORMATION REGION  
 CENTRE (ACC) UNTIL SUCH TIME





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# Safety Management System - Why?

## International Civil Aviation Organization

### ICAO SARP's Requirements

#### States *Regulators*

- *Safety Programme*
- *Acceptable Level of Safety*

#### Service Providers

*ATS Provider*

*Aircraft Operators*

*Maintenance Organizations* *Aerodrome Operators*

- *Safety Management System*



# Safety Management System - Why?

Harmonization of safety standards  
in using new technologies

Satellite

Datalink

Automated Systems, etc



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# CNS/ATM

Communication

Navigation

Surveillance

Air Traffic Management



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# Safety Management System - Why?

## Is Flying Safe ?



## 2003 Aircraft Accidents

Hull Loss/Substantial Damage 91

Fatal

27

2015 ?



# Scope of SMS in ATS

- ALARP
- Hazards within ATS

## Implementation work started in 2001

- define safety policy and principles
- safety management course for senior ATCO
- induction presentations to all ATC staff on

### *Safety and Quality Management*

- identify **Owners of Safety Management Procedures** (*viz Documents*)
- establishment of a **Quality Assurance post**
  - *coordinate SMS activities*
- develop **Safety Management Procedures**

# ATMD

## Safety Management Policy Manual

- **Issued in April 2002**

Approved by Assistant Director-General of Civil Aviation (ATM)  
Owned by Chief ATCO (Safety, Quality and Development)

- ***Safety Policy***
- ***Safety Objectives***
- ***Accountabilities & Responsibilities***
- ***Safety Management Procedures***



# ATMD Safety Policy

- Minimizing Risks ALARP –  
***Safety has First Priority***
- Clear lines of Accountability & Responsibility  
***Everyone is responsible for safety***
- Promoting Safety Culture through Training  
***Continuous Improvement***
- Ensuring safety policy implementation and  
***Compliance to SARPS and procedures***
- Ensuring externally supplied products and services meet ATMD S&Q requirements

# Safety Objectives

- **Goal**

*Maintain the highest level of safety as far as reasonably practicable when providing air traffic services*

- **Means**

*Maintain a safety system and culture that encourages safety improvement and effective communication about safety issues*

- **Equipment & System**

*Define, introduce, maintain and operate equipment and systems in a controlled, standardized and safe manner according to relevant ICAO Standards and Recommended Practices, Divisional safety cases, operating procedures, and instructions.*



- **Involvement & Training**
- **Safety Assessment**
- **Investigations Documentation**
- **Supervision**
- **Safety & Quality Audits**
- **Accountabilities & Responsibilities**
- **Regular Reviews**



## **ATMD**

# **Safety Management Procedures**

- **Safety Control Procedures**
- **Safety Assurance Procedures**
- **Safety Promotion Procedures**

# **Safety Control Procedures**

- **Safety Level Monitoring**
- **Training, Licensing, Examination  
and Competency**
- **Document & Record Control**
- **Human Factors**
- **Emergency & Crisis Management**
- **Safety-Related Technical Systems**



# **Safety Assurance Procedures**

- **Risk Assessment & Management**
- **Safety Assessment**
- **Internal Auditing**
- **Incident Investigation**



# **Safety Promotion Procedures**

- **Safety-Related Information**
- **Staff Safety Suggestion**
- **Lessons Learnt**



# **Publication of Procedures**

**- Manuals, Handbooks, etc**



# **Safety Control Publications**

- **“Acceptable Level of Safety”**
- **Human Factors Training Programme**
- **Emergency & Contingency Procedures Manual**
- **Document and Record Control procedure**
- **Recruitment Manual**
- **Training Unit Operations Manual**
- **Personnel Licensing Handbook**
- **Quick Reference Material Handbook**
- **Aeronautical Information Service Quality Manual**
- **Operational Instruction**



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# **Safety Assurance Publications**

- **Safety Assessment Guidance Manual**
- **Auditor Handbook**

# **Safety Promotion Publications**

- **ATMD Staff Suggestion Scheme**
- **Safety Information**
- **Lessons Learnt**
- **Occurrence Report Database**



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# **CAD's Safety Regulatory Oversight**

**Air Traffic Management Standards Office  
(ATMSO)**

**established in March 2003**

# ATMSO's Tasks

- **Establish the ATM services safety regulatory framework based on statutory requirements**
  - AN(HK)O & ICAO SARPs
  - consultation with concerned parties
- **Oversight of ATS SMS development**
- **Administer the ATC Licensing System – ATC competency assurance**

- Define ATM Services Safety Regulatory Objectives, Requirements and Standards  
**Document CAD670**
- Review/Amend Air Navigation (HK) Order
- Conduct ATM services safety oversight -  
**monitoring, assessments, audits, inspections**
- Participate in ATC accident/incident investigations

# Acceptable Level of Safety (ALOS) and Safety Monitoring of ATS Operations

- Establishment of ALOS and Safety Objectives
  - ICAO Annex 11 requirements
- There is no such thing as absolute safety  
Acceptable level of safety = Acceptable level of risk
- Level of risk is the product of :  
Probability of occurrence (P) x Severity of consequence (S)

# Risk Classification Scheme ATC Operations

Probability of Occurrence  
per flight

Severity Category

Qualitative	Quantitative	Collision	AIRPROX	OD	TI
Frequent	$P_s > 10^{-3}$	A	A	A	B
Probable	$10^{-3} > P_s > 10^{-4}$	A	A	B	C
Occasional	$10^{-4} > P_s > 10^{-5}$	A	A	C	D
Remote	$10^{-5} > P_s > 10^{-6}$	A	B	D	D
Improbable	$10^{-6} > P_s > 10^{-7}$	A	C	D	D
Extremely Improbable	$P_s < 10^{-7}$	B	D	D	D

## Acceptability Indicators

A = Unacceptable

B = Undesirable, may exceptionally be acceptable but only with the endorsement of ADG(ATM) and ADG(FS)

C = Acceptable upon review, with the endorsement of ADG(ATM)

D = Acceptable



# Categories of Risk Level

- Unacceptable
- The In-Betweens (ALARP)
  - consideration needs to be given to the various tradeoffs between risks and benefits
- Acceptable

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**ALARP – As Low As Reasonably Practicable**



# Application of Acceptable Level of Safety (ALOS)

Examples of ATS aspects where ALOS is applicable

- A maximum probability of loss of separation
- A maximum probability of runway incursion
- A maximum number of valid short-term conflict alerts (STCA) per hour per ATC sector

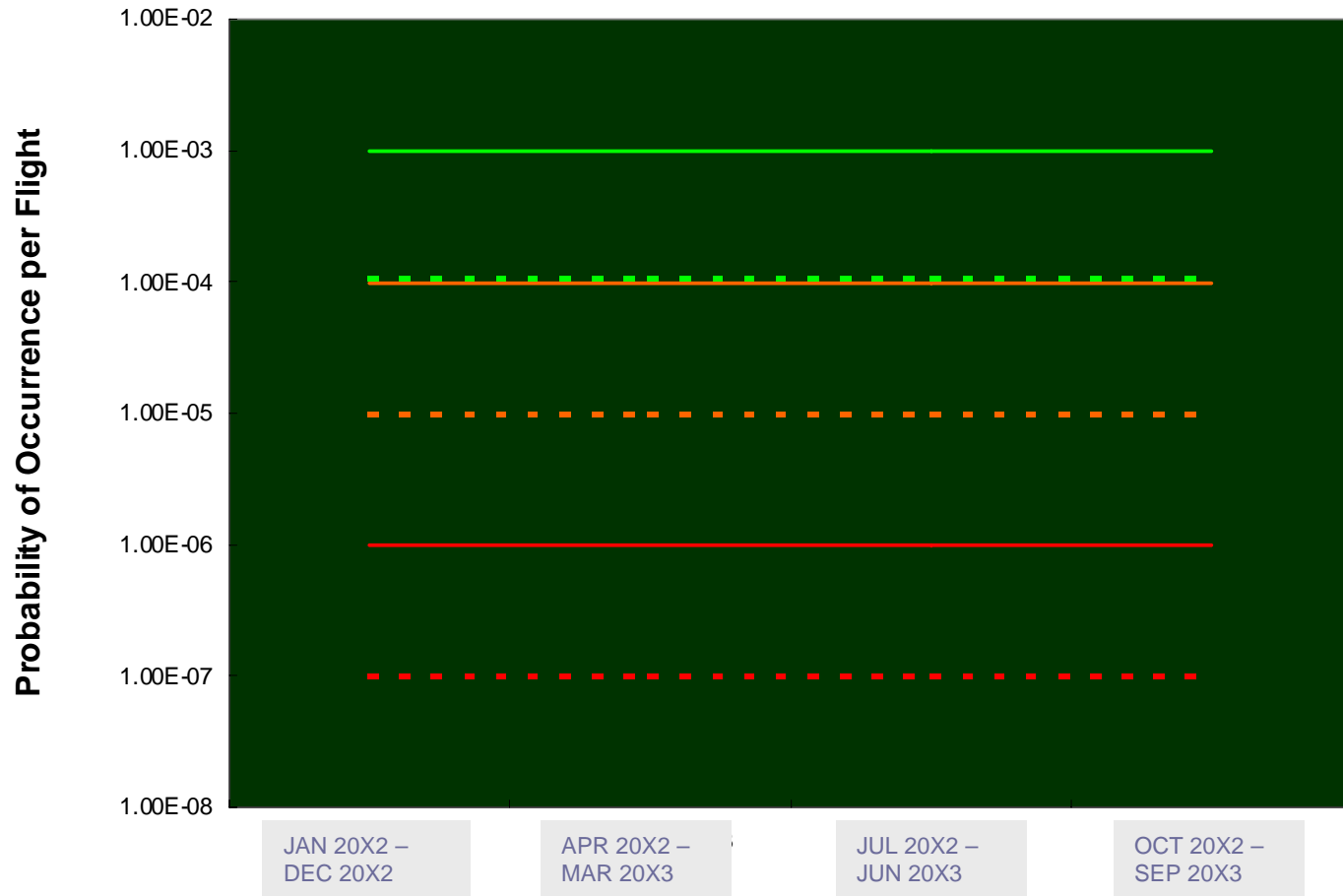


# ATS ALOS Classification Scheme

## ATS ALOS Classification



ATMD  
SEP 2004



- - - ALOS for AIRPORX with endorsement of ADG(ATM), upon review

— ALOS for AIRPORX subject to special endorsement by both ADG(ATM) & ADG(FS)

- - - ALOS for OD with endorsement of ADG(ATM), upon review

— ALOS for OD subject to special endorsement by both ADG(ATM) & ADG(FS)

- - - ALOS for TI with endorsement of ADG(ATM), upon review

— ALOS for TI subject to special endorsement by both ADG(ATM) & ADG(FS)



More specific safety targets ( ALOS ) can be set, using the matrix

- Level bust
- Unauthorized track deviation
- Wrong transfer level
- Failure of ATC radar display
- Failure of ATC communication system



Monitoring by trained safety and standard officers

and

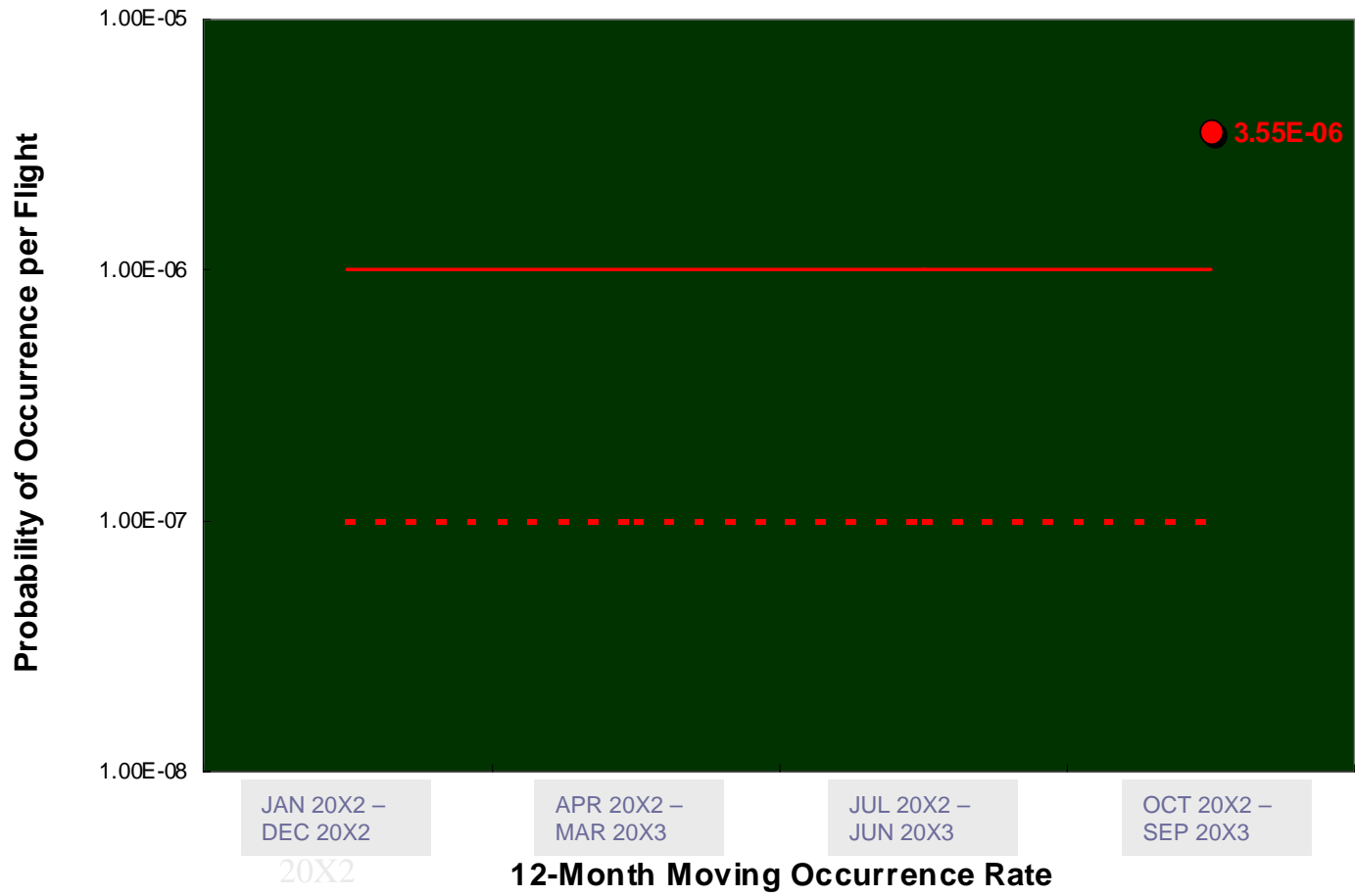
Use of mathematical models

can go hand-in-hand



# What if risk data exceeds ALOS?

## Loss of Separation (AIRPROX) Risk in Area Control



- - - ALOS for AIRPORX with endorsement of ADG(ATM), upon review  
— ALOS for AIRPORX subject to special endorsement by both ADG(ATM) & ADG(FS)  
● AIRPROX Occurrence Rate (Hypothetical Data)

**AIRPROX** - An occurrence when both horizontal and vertical separations between aircraft are less than 50% of the required standards.



## Action to be considered

- Large scale retraining
- Airspace re-structuring
- Introduction of more rigid procedures
- More system redundancy
- Additional traffic flow control measures
- Review & Adjust the ALOS





# Conclusion

- Commitment
- Proactive Safety Culture
- User Friendly
- Consultation with Users
- Training in SMS
- Just Culture
- Regulatory Oversight
- Development Training



*民航處* **Civil Aviation Department, Hong Kong, China**

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***Thank You***

