香港 國際機場 | HONG KONG INTERNATIONAL AIRPORT

Accreditation of ISO 55001 / PAS 55 for AGL System in Hong Kong International Airport

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Airport Authority Hong Kong

8 Jul 2015

Contents

- Hong Kong International Airport (HKIA)
- Airfield Ground Lighting (AGL) System
- Asset Management System
- Certification of ISO 55001 and PAS 55
- HKIA future development

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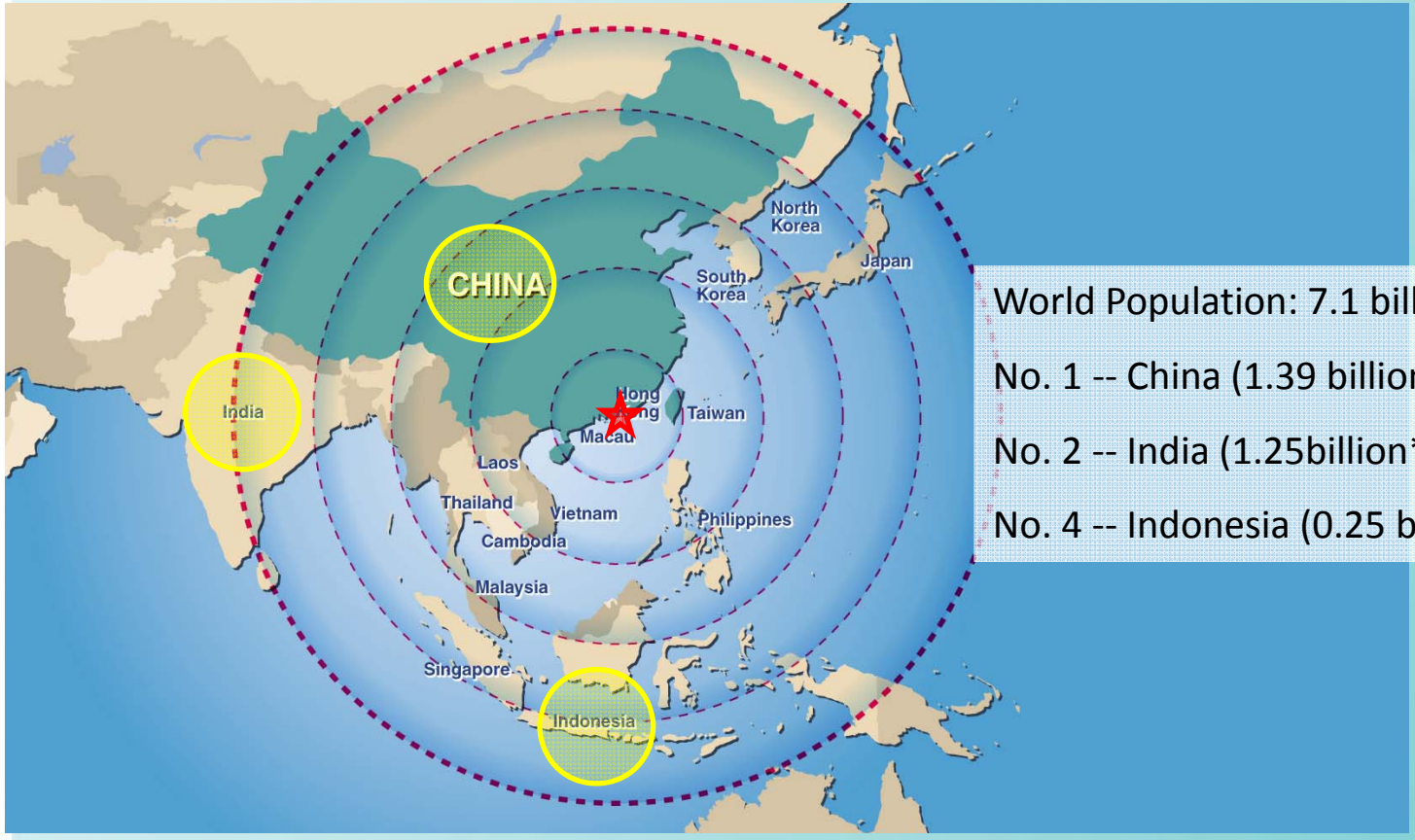
Hong Kong International Airport (HKIA)

Open since	:	**6 July 1998**
Total site area	:	**1,255 hectares**
No. of runways	:	**Two** 3,800m (L) x 60m (W) each
Total terminal area	:	**750,000 sq m** (including T1, T2, North Satellite Concourse and SkyPier)
Total no. of aircraft stands	:	**173** Passenger stands: 86 Cargo stands: 43 Long term & maintenance stands: 44

Reaching Half of the World's Population

… within <u>five</u> hours of flying time



World Population: 7.1 billion

No. 1 -- China (1.39 billion*)

No. 2 -- India (1.25billion*)

No. 4 -- Indonesia (0.25 billion*)

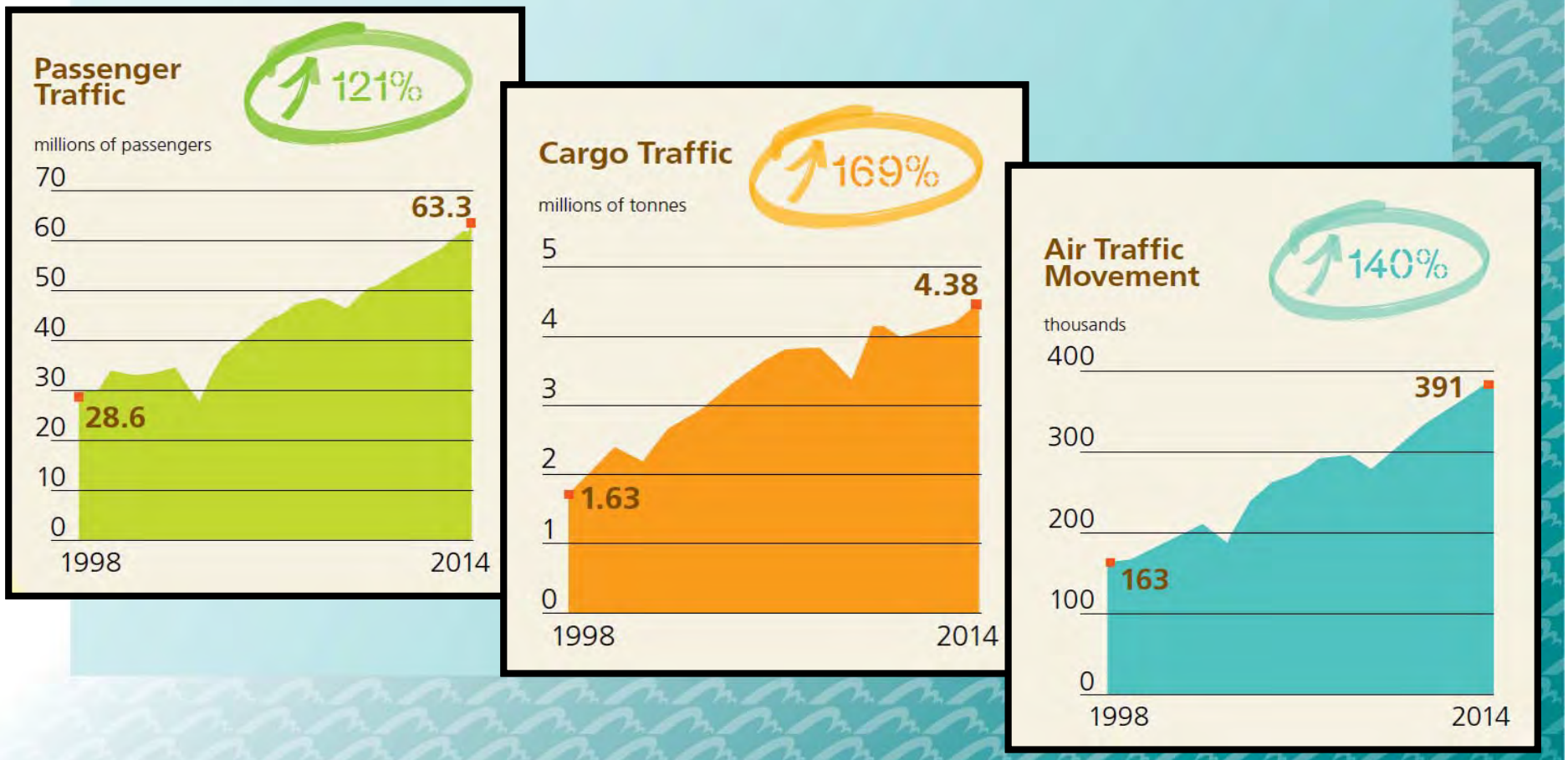
*Source： United Nations 2013 data
No. 3 – USA (0.32 billion)

Connecting Hong Kong with the World

- More than 100 airlines serving approximately 180 destinations worldwide (including 47 mainland cities); about 1,100 flight movements daily

Solid & Robust Traffic Growth

- In 2014, HKIA handled 63.3 million passengers, 4.38 million tonnes of cargo and 391,000 flight movements.



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South & North Runway in HKIA

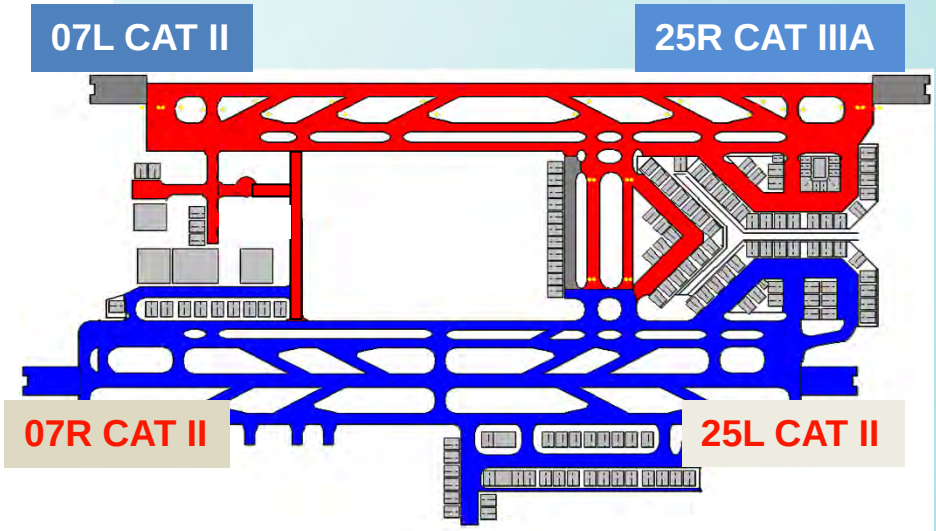
Airfield Ground Lighting (AGL) System

AGL System Major Assets

- Electrical Power Supply Equipment including 11kV and 380V Switchboards, HV/LV transformers, LV Generators and UPS
- Airfield lighting including AGL light fittings, lighting power cables and Constant Current Regulators (CCRs)
- Control and Monitoring System comprises PLCs, workstations and Dedicated Networks (DN)

Airfield Ground Lighting (AGL)

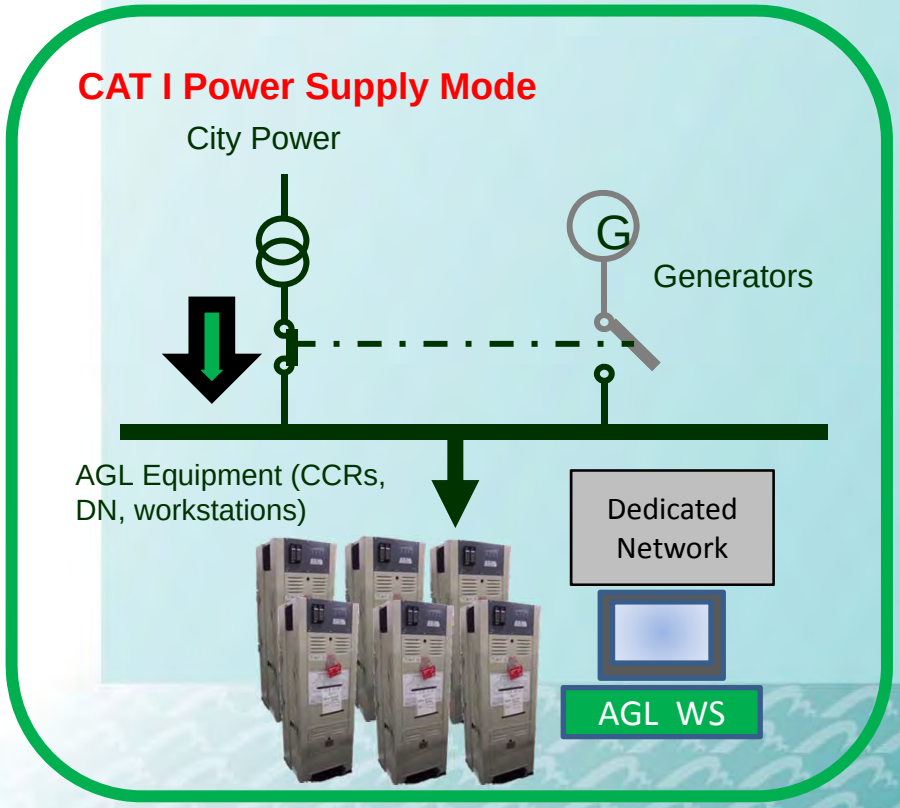
North Runway
- 184 circuits, supply from 110 nos. of CCRs
- Operation Mode: CATI, II, IIIA

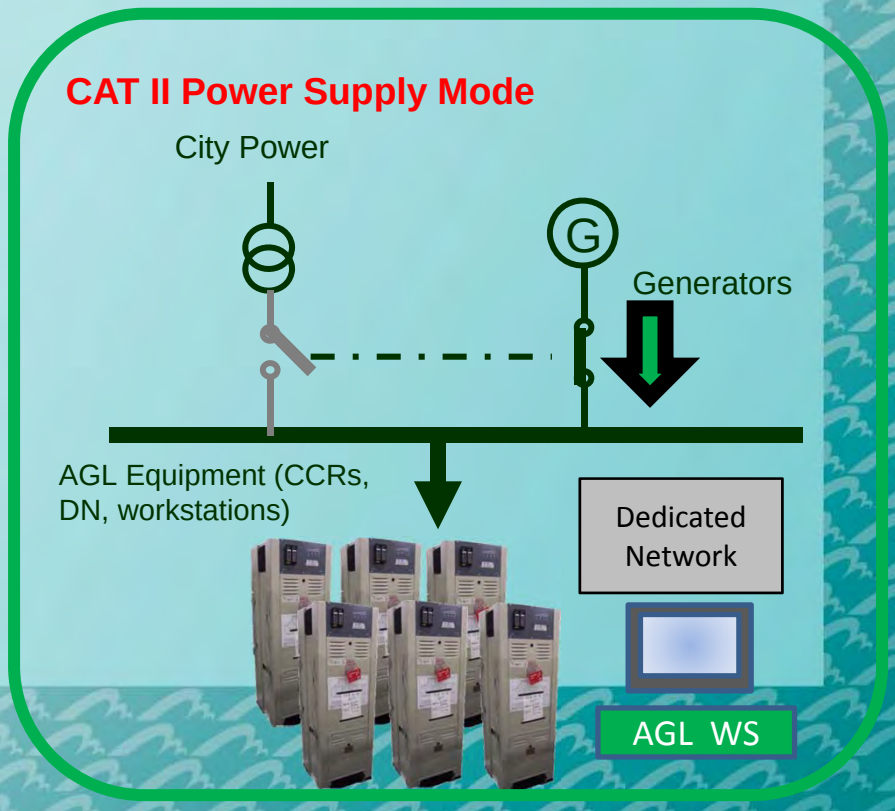


South Runway
- 143 circuits, supply from 80 nos. of CCRs
- Operation Mode: CATI, II

Power Supply System at LV side

Operation Mode	Primary Power	Secondary Power
Day	City Power	Generators
CAT I	City Power	Generators
CAT II / III	Generators	City Power

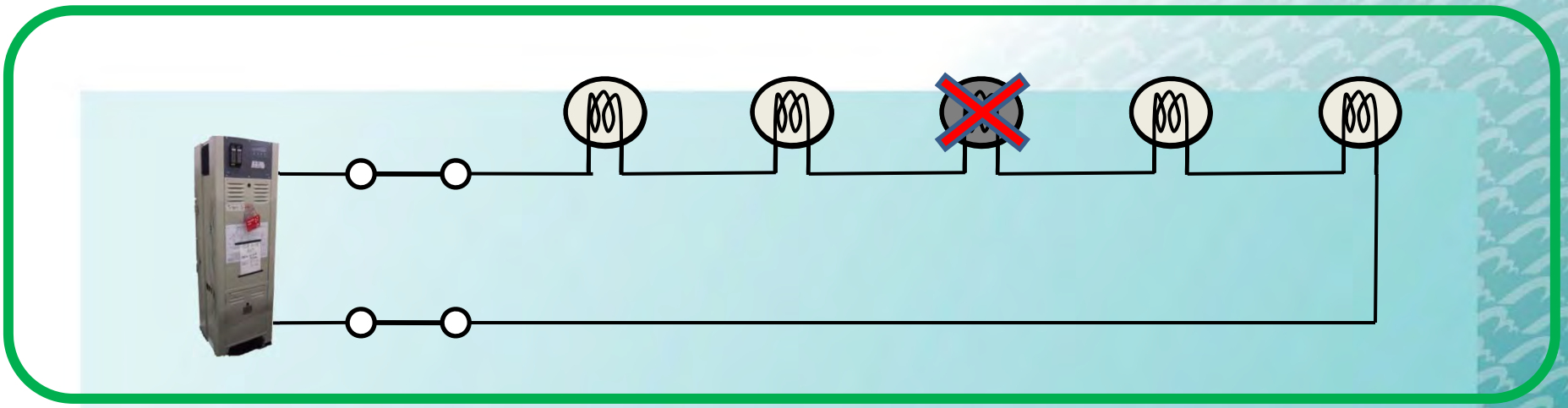


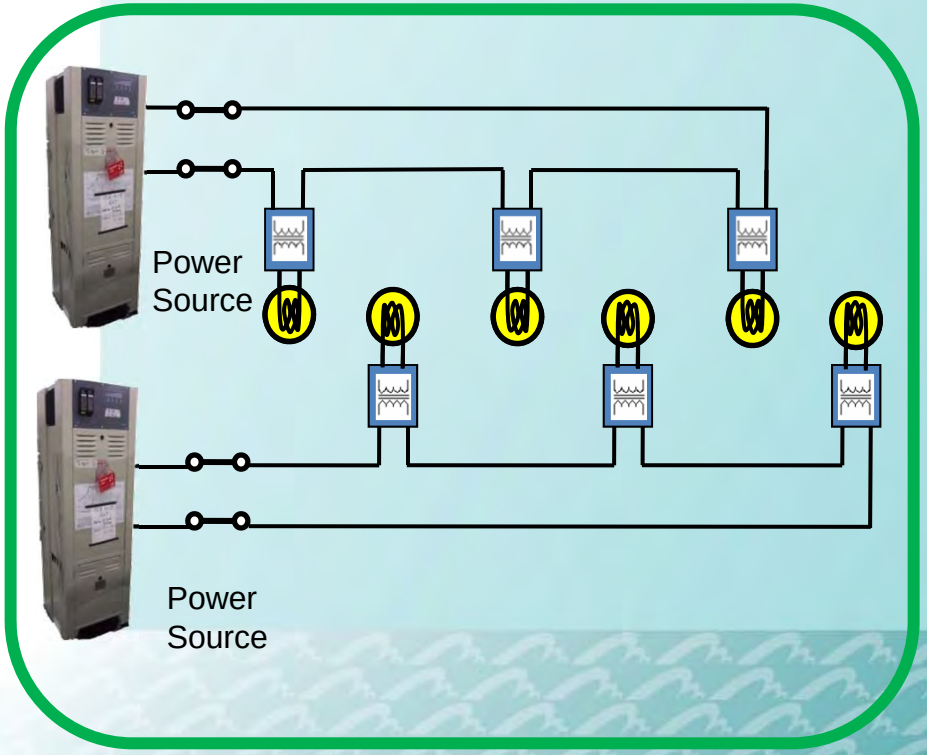


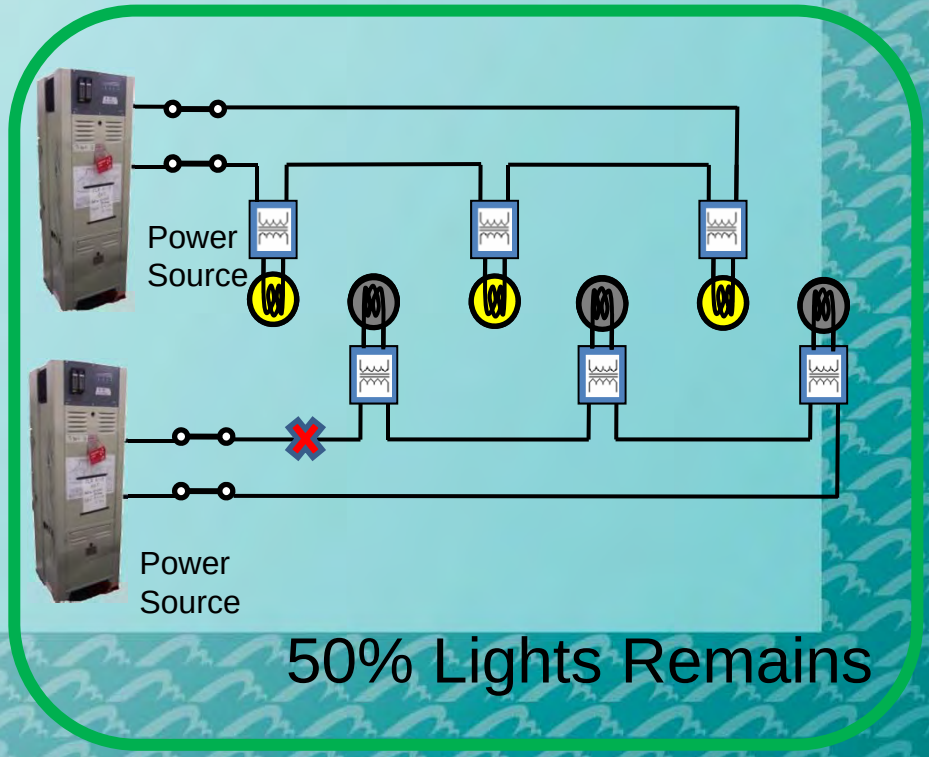
Secondary Power Supply's Switch Over Time
As per ICAO Requirement

Precision Approach (Cat. No.)	AGL type	Max. Switch-over Time (sec)
I	Approach lighting system Runway edge Runway threshold Runway end Essential taxiway Obstacle	15
II	Approach lighting system Runway edge Runway threshold Runway end Runway centre line Runway touchdown zone Stop bars at taxi-holding position Essential taxiway including stop bars Obstacle	1 15 1 1 1 1 1 15 15
III	(same as category II except all stop bars : 1 second)	

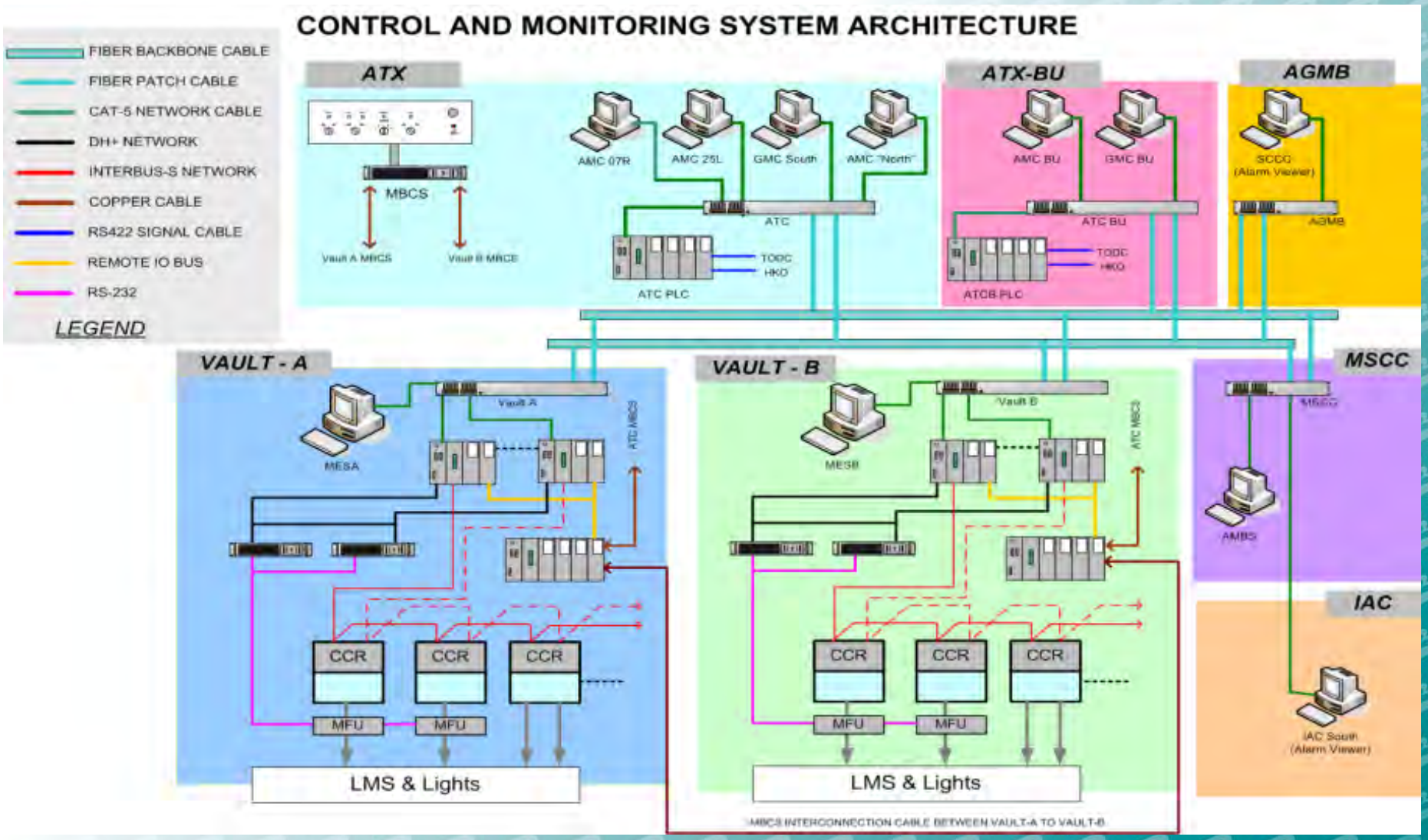
Interleave Series Circuits







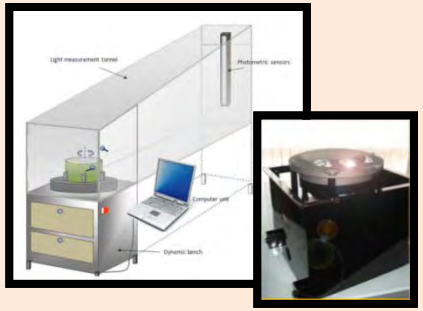
AGL Control and Monitoring System (CMS)



AGL Maintenance Works

AGL workshop

Checking & Refurbishment
- Checking for physical condition
- Cleaning the surface of prisms



Light Measurement Tunnel
- Monitoring the Performance
- According to ICAO specification
- After refurbishment or maintenance
- Before reinstalling the light on site

Availability

Maintainability

Reliability

Reliable AGL System in HKIA

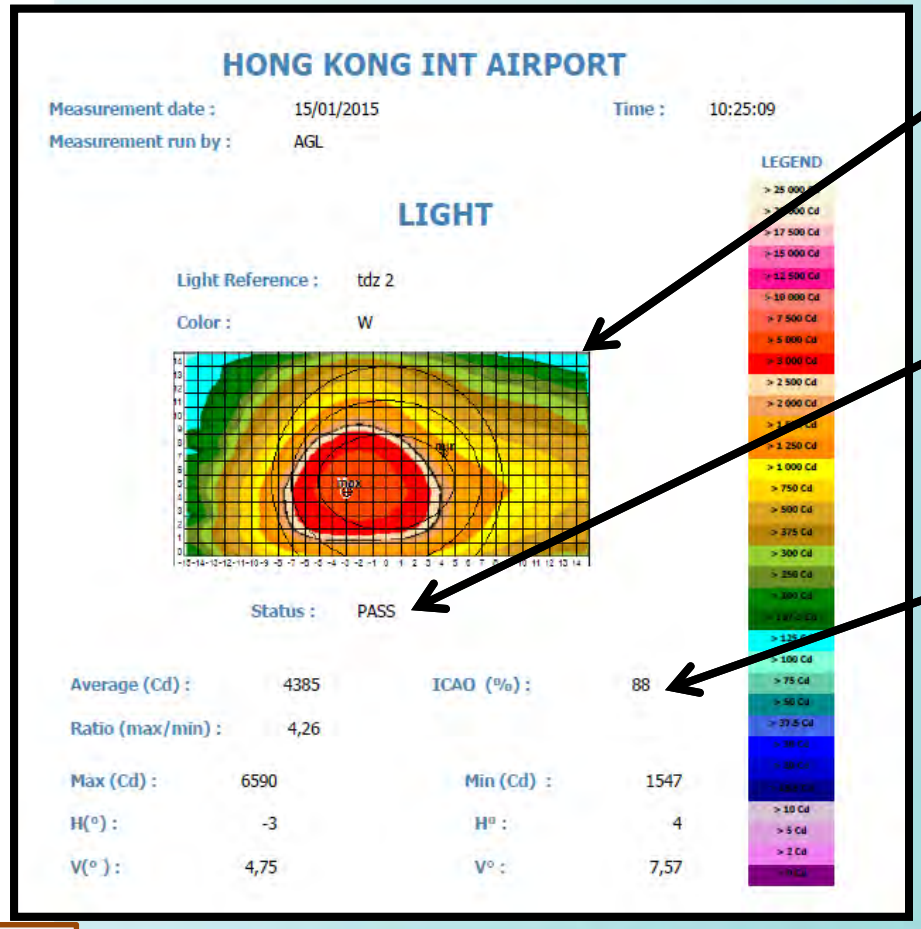
Runway

Preventive Maintenance
- Replacement of bulbs
- General Checking

Photometric measurement
- At intervals of two months
- Providing statistical data for analysis

Report for Photometric Measurement

Light Measurement Tunnel



ISO candela diagram
- High resolution
- Analyzing and comparing the performance of the light beam

Status
Pass / Fail

ICAO (%)
The compliance percentage according to the ICAO specification

Position of the light beam
Vertical and Horizontal angel

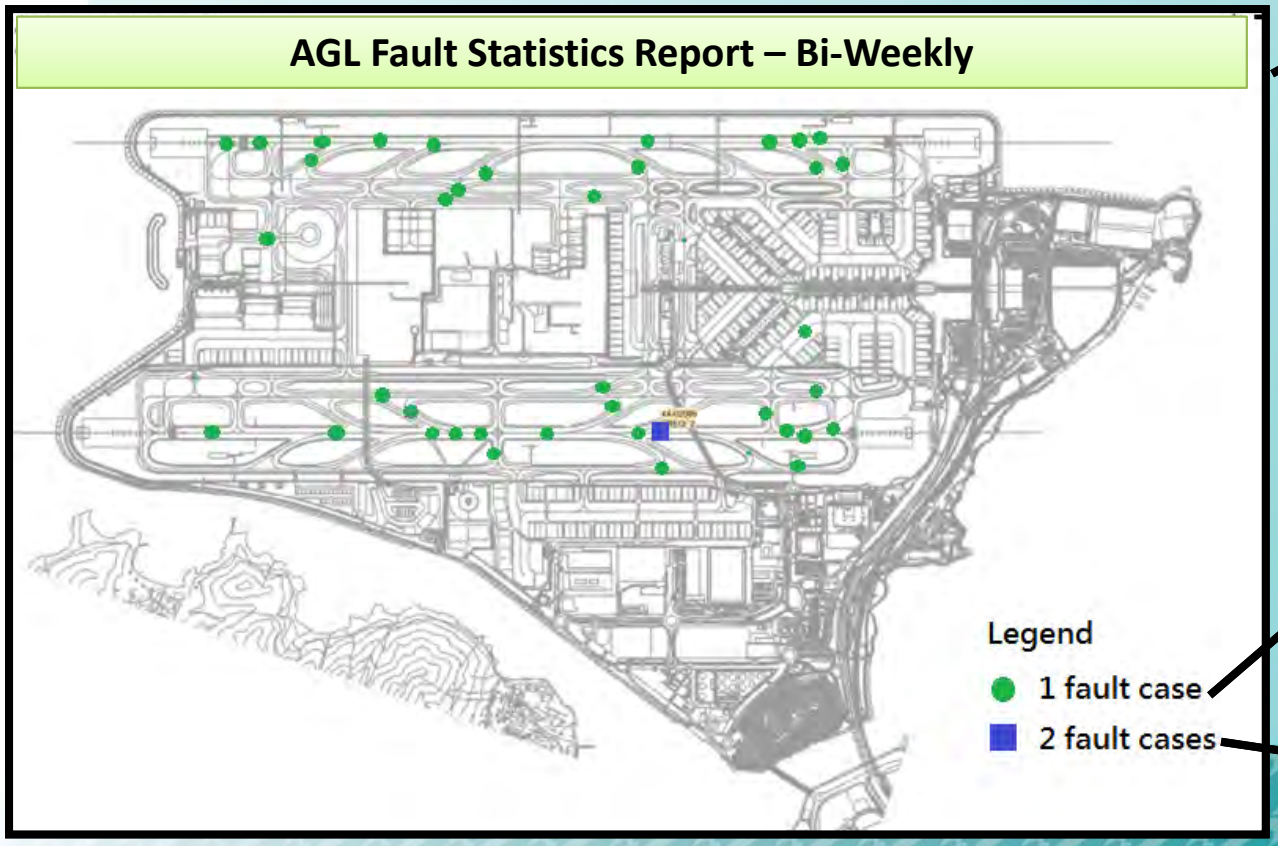
Supplemental Information
AGL Luminescence Requirement

Geographic Information System (GIS)

Providing statistical data for analysis

- Facilitate planning of Bulk Replacement
- Paying attention to frequent cases

Extraction of Maintenance history of each AGL



Follow-up actions

- Replacement of bulbs
- Drawing attention to the situation

Risk Management

Risk Matrix

Frequency		Consequence				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

Risk Register

Risk Identification					Risk Analysis					Risk Treatment		
Item No.	Physical Failure Risk	What can happen? Risk event (failure mode)	Possible Effect (impact)	Existing Control	Likelihood (1-5)	Consequence (A-E)	Risk Rating	Risk Tolerability (H/M/L)	Effectiveness of the existing control (Y/N)	Risk Treatment Plan	Residual Risk Rating	Residual Risk Tolerability
1	Low carbon emission requirement that creates a stress to use LED airfield lights	New failure mode	Undermine the performance level	Trial run	3	B	3B	M	Y	-	-	-
2	Unauthorized access to AGL vaults	Improper action caused damage of equipment or power interruption	Suspension of services	1. Report to FRT for any faulty doorlocks identified 2. Temporary measures to secure the entrance of the vault before replacement of the doorlocks	4	C	4C	M	Y	-	-	-

Risk Identification					Risk Analysis					Risk Treatment		
Item No.	Operational Risk	What can happen? Risk event (failure mode)	Possible Effect (impact)	Existing Control	Likelihood (1-5)	Consequence (A-E)	Risk Rating	Risk Tolerability (H/M/L)	Effectiveness of the existing control (Y/N)	Risk Treatment Plan	Residual Risk Rating	Residual Risk Tolerability
1	Technical staff competence development and evaluation	Downgrade the service performance	Longer system recovery time, higher maintenance cost	Training	4	D	4D	M	Y	-	-	-
2	Retention of professional and experience staff	Lower efficiency in performing maintenance & repair work	Undermine the serviceability level	Promotion & Bonus, training	4	D	4D	M	Y	-	-	-
3	Frequent change maintenance window	Scheduled maintenance affected	Undermine the maintenance quality	1. Advance notice of change provided 2. At least 2 nos. of maintenance window per week for each runway	4	D	4D	M	N	Treatment Plan (A)	3D	M
4	Short maintenance duration	Scheduled maintenance affected and increase failure rate	Undermine the maintenance quality	Arose stakeholder's awareness of impact to maintenance work	4	B	4B	H	N		4B	H
5	Some taxiways and taxi lanes are difficult to close for maintenance	Schedule maintenance affected and increase failure rate	Undermine the maintenance quality	Arose stakeholder's awareness of impact to maintenance work	5	C	5C	H	N		5C	H
6	Inconsistent understanding of failure analysis approach	Incorrect task priority assignment	Unpredictable equipment breakdown	1. Briefing, 2. Progress meeting	3	B	3B	M	Y	-	-	-
7	Failure to report the identified asset risk	1. Unable to prevent incident from happening 2. Unable to timely restore system upon failure	Undermine the serviceability level	1. Monthly report 2. Maintenance checklist 3. Progress meeting	4	B	4B	H	N	Treatment Plan (B)	4D	M
8	Communication about the asset risk between different stakeholders	Maintenance issues and concerns cannot reach different stakeholders	Scheduled maintenance affected and increase failure rate	Regular progress meeting with different stakeholders	4	C	4C	M	Y	-	-	-

High-speed imaging for AGL inspection (Trial Assessment)

Assessment Objectives

1. Using high-speed imaging for AGL inspection at day & night as trial
2. Identification of system design variables
3. Characterization of image quality for automatic optical inspection (AOI)
4. Consolidation of proposed system design for onward development and deployment

Major Results

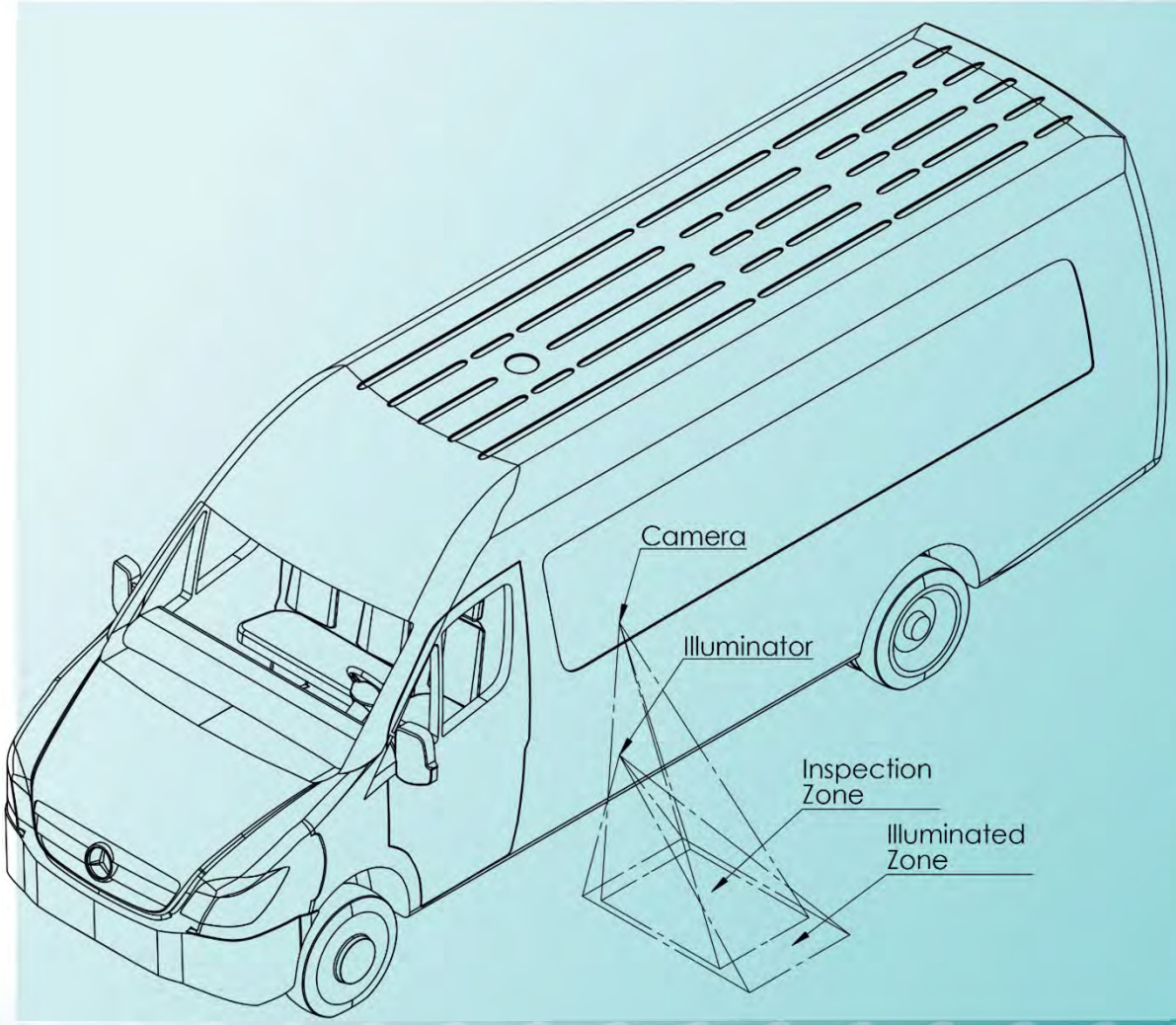
1. Tested high speed imaging of AGL on moving platform at 30 to 80 kmph

2. Confirmed that image quality under this condition can be processed for automatic AGL inspection

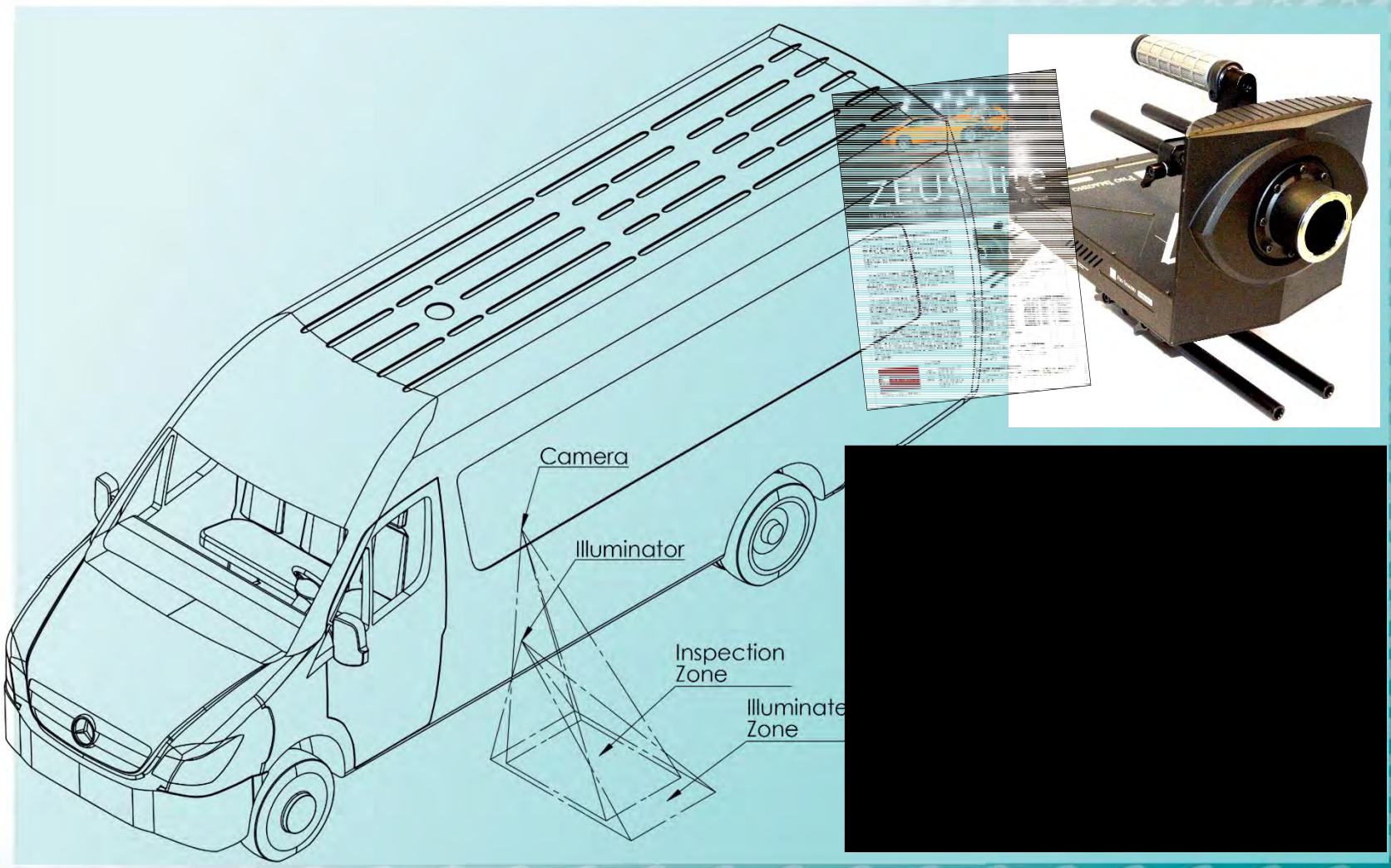
3. Inspection was confirmed to cover :
   i. AGL integrity (i.e. any missing of light)
   ii. Bolt presence (on ring and light)
   iii. Bolt looseness (i.e. orientation of stroke marking)
   iv. Crack presence (i.e. epoxy on outer ring)

4. Tested in both day & night conditions

Data Collection Setup



Data Collection Setup



AGL Inspection System – High Speed Camera

High Speed Imaging Products
ZEUS and ZEUS lite

- 8,000 fps @ VGA resolution
- 2,000 fps @ 1.3 MP resolution

Application:

- High throughout inspection
- Material science study
- Collision and impact study
- Ballistic experiment
- Structural analysis

Thermographic Imaging Products
HELISO 384 and HELIOS 80

- 60 fps @ 384 x 288 resolution, 50mK
- 8.6 fps @ 80 x 60 resolution, 50mK

Applications:

- Tunnel monitor
- Long range wildfire detection
- Border control
- Public hygiene control
- Pedestrian detection
- Radiator design and analysis
- Material science

AGL Inspection System – High Speed Camera

Imaging Combo for Aerial Survey
Cameras and processing & sensing unit for wide spectral imaging (LWIR, NIR, VIS)
Application:

- Wide area yield control & monitoring
- Water stress study
- Soil status monitoring
- Photosynthesis analysis
- Multi-purpose geodetic surveying

8K Ultra HD Imaging Product

- 10,000 x 7,000 resolution @ 3fps
- 8/10/12-bit pixel depth
- Living streaming capable

Application:

- PCB inspection
- Bank note quality check
- Commercial photography
- Ultra wide FOV microscopic imaging
- Biometric security

AGL Inspection System – Assessment

High-speed Imaging (At night time)

Observer

AGL Inspection System – Assessment

High-speed Imaging (At night time)

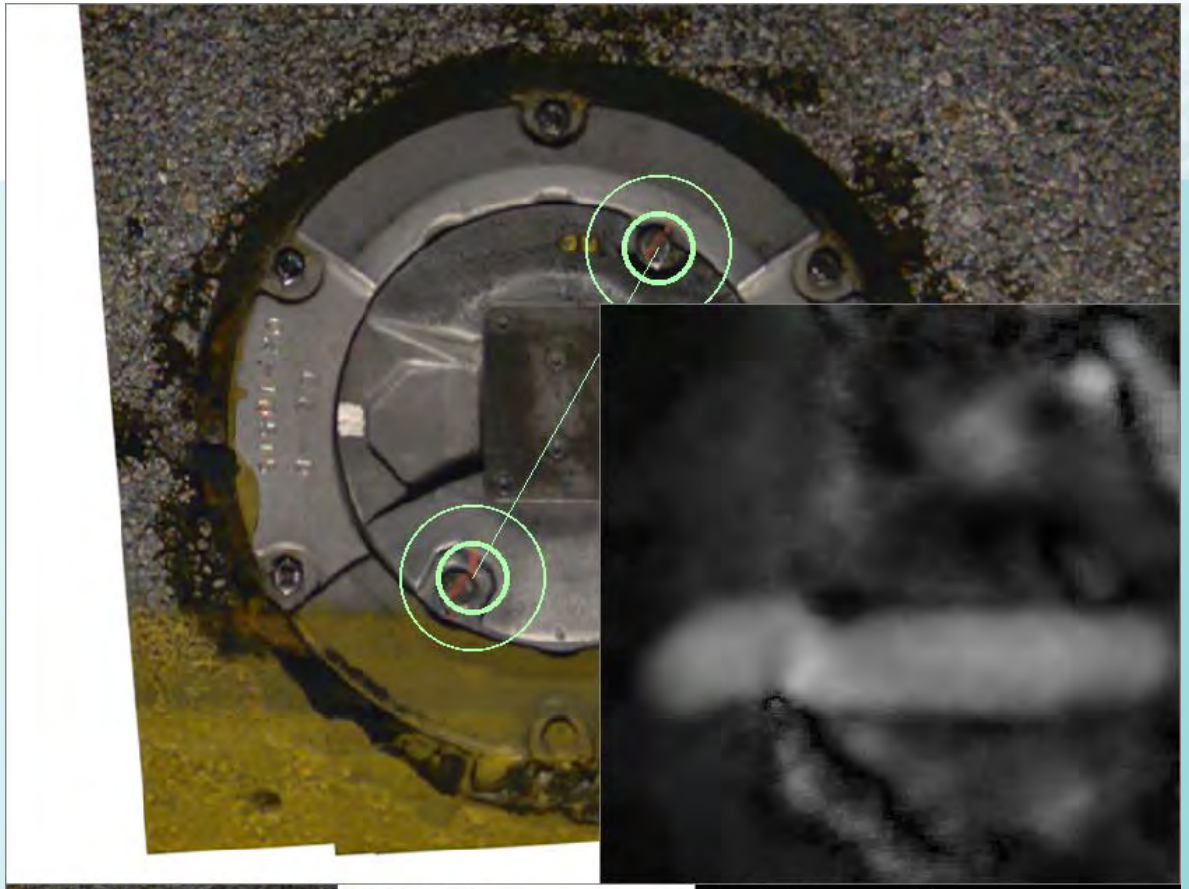
AGL Inspection System – Assessment

High-speed Imaging (At day time)

AGL Inspection System – Assessment

High-speed Imaging (At day time)

An Excerpt of the Processing Results – AGL 1



Transform: OK

Ring: OK
Light: OK
Bolts on ring: OK
Bolts on light: OK
Mark found.
Bolt heading(1/2): OK
Mark found.
Bolt heading(2/2): OK

Overview of Processing Pipeline

- GNSS Annotation
- Geometric Component Extraction
- Homography Transformation
- SVM Classification
- Model Feature Characterization

An Excerpt of the Processing Results – AGL 2

Transform: OK

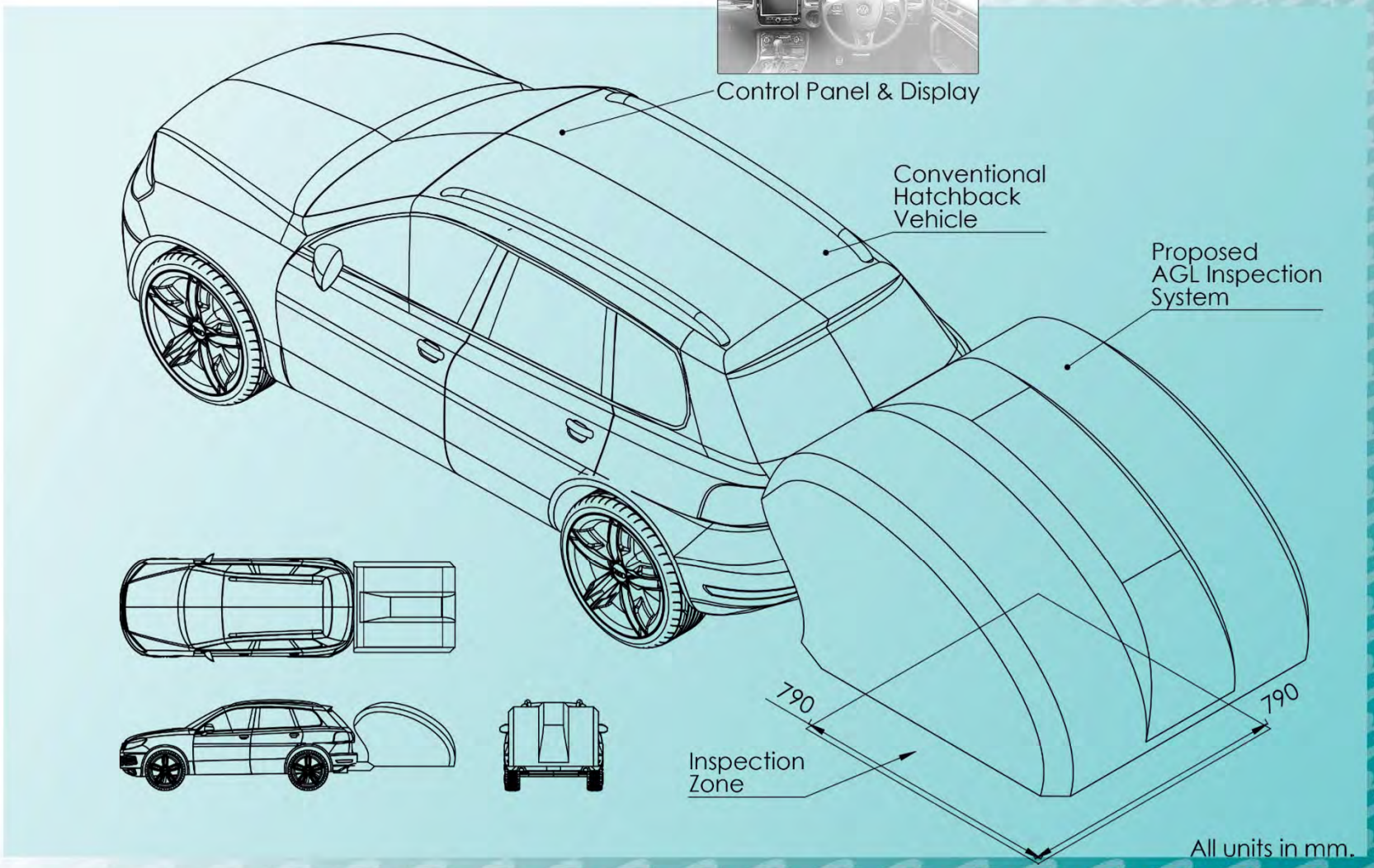
Ring: OK
Light: OK
Bolts on ring: OK
Bolts on light: OK
Mark not found.
Possible crack(1)
Possible crack(2)
Possible crack(3)

Overview of Processing Pipeline

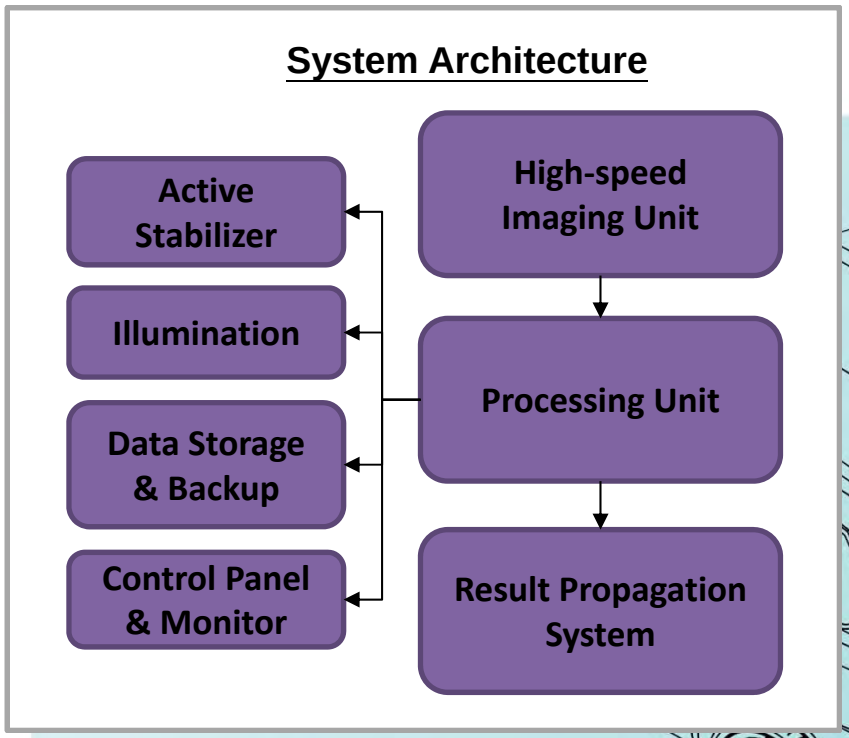
- GNSS Annotation
- Geometric Component Extraction
- Homography Transformation
- SVM Classification
- Model Feature Characterization

AGL Inspection System – Assessment

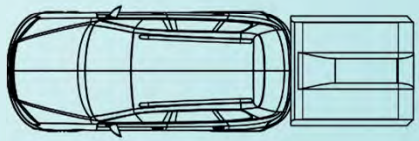
AGL Inspection System

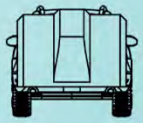


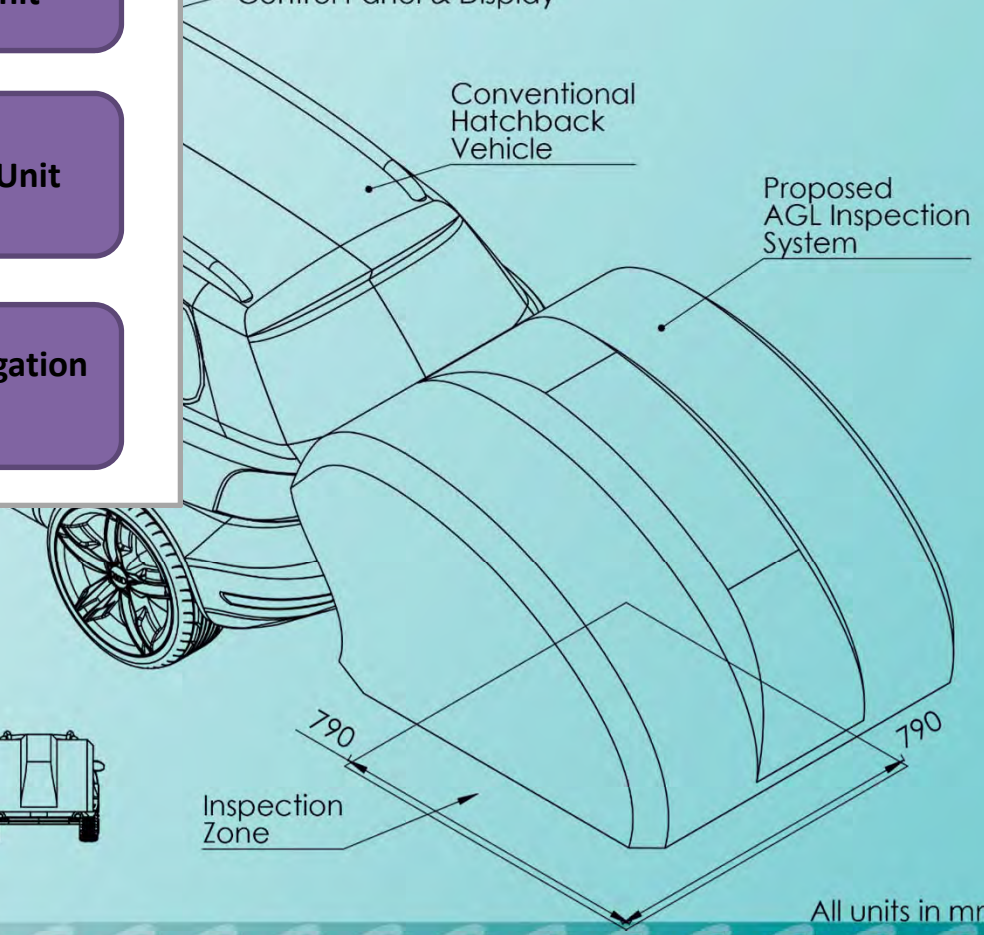
Proposed AGL Inspection System



Control Panel & Display







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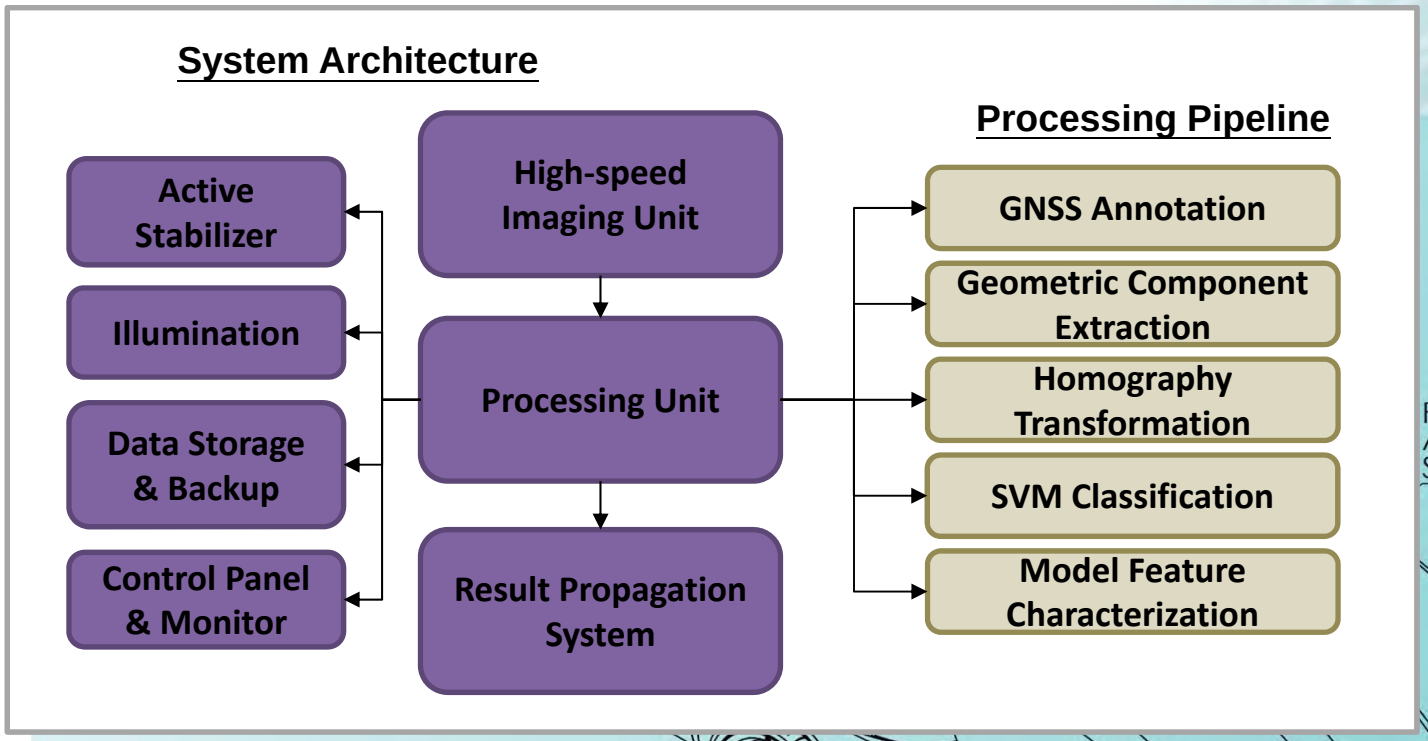

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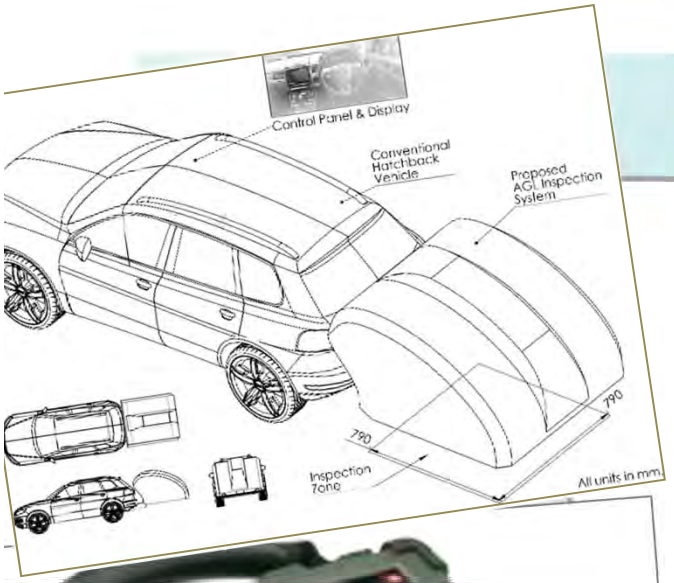

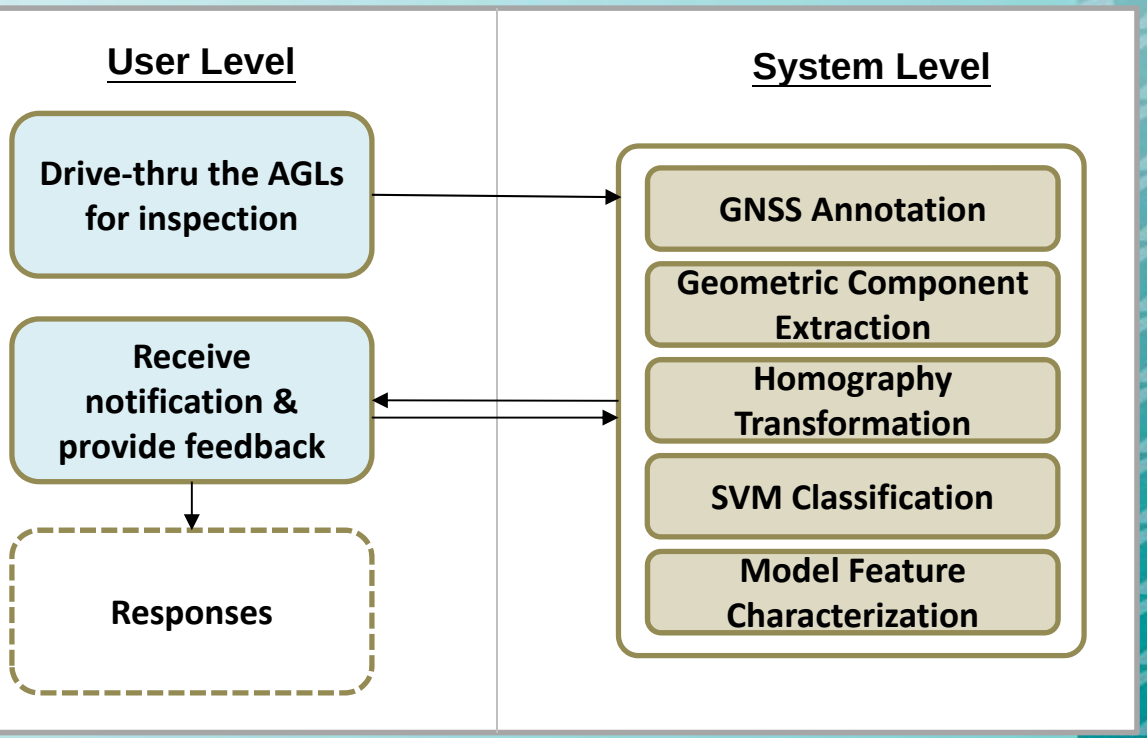

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Asset Management System (AMS)

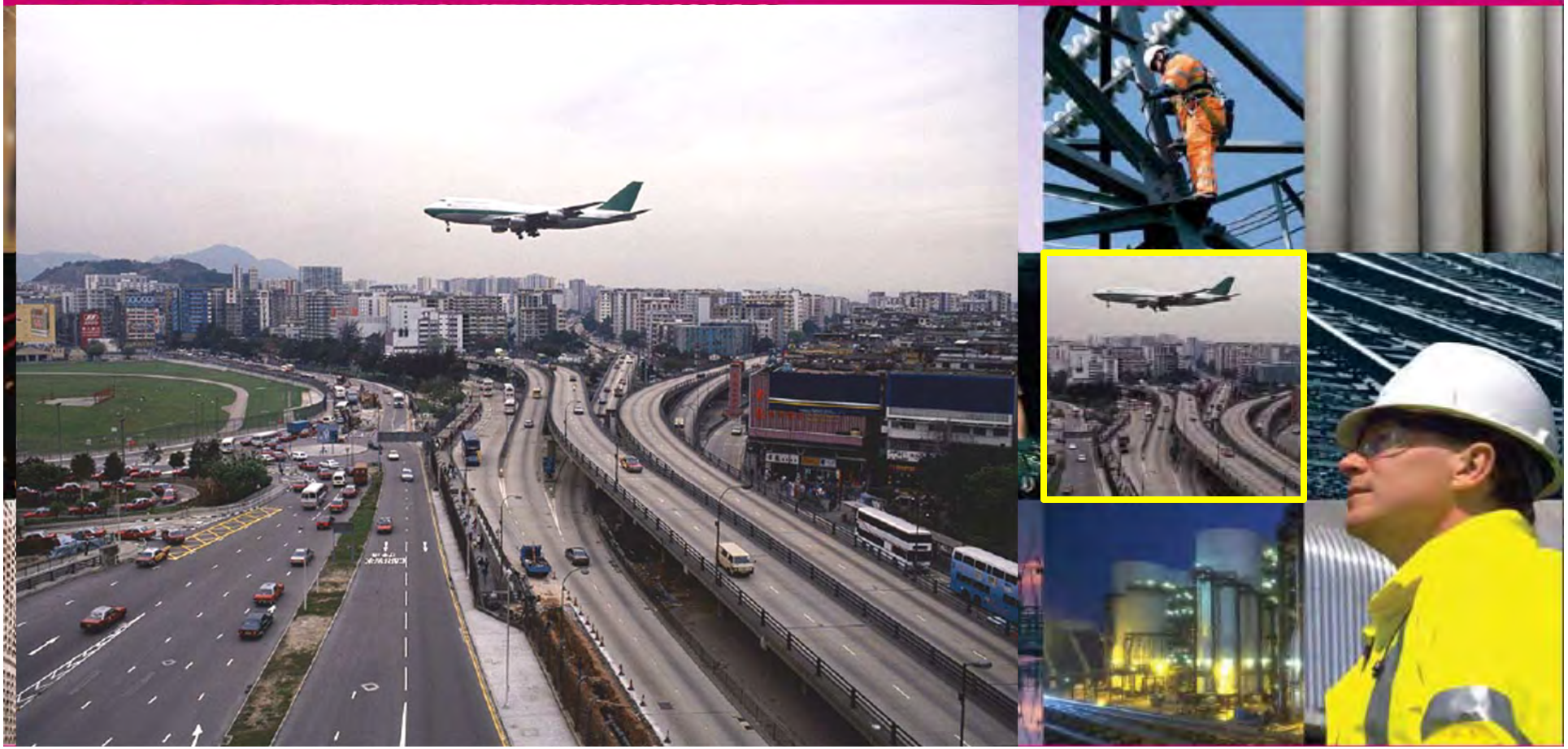
- The AMS was established to provide a systematic, holistic and cost-effective framework for management of AGL in HKIA since December 2013
- The development of AMS was based on PAS 55-1 : 2008, Asset Management, Part 1, T.S. Management Manual and System Management Plan etc.

PUBLICLY AVAILABLE SPECIFICATION

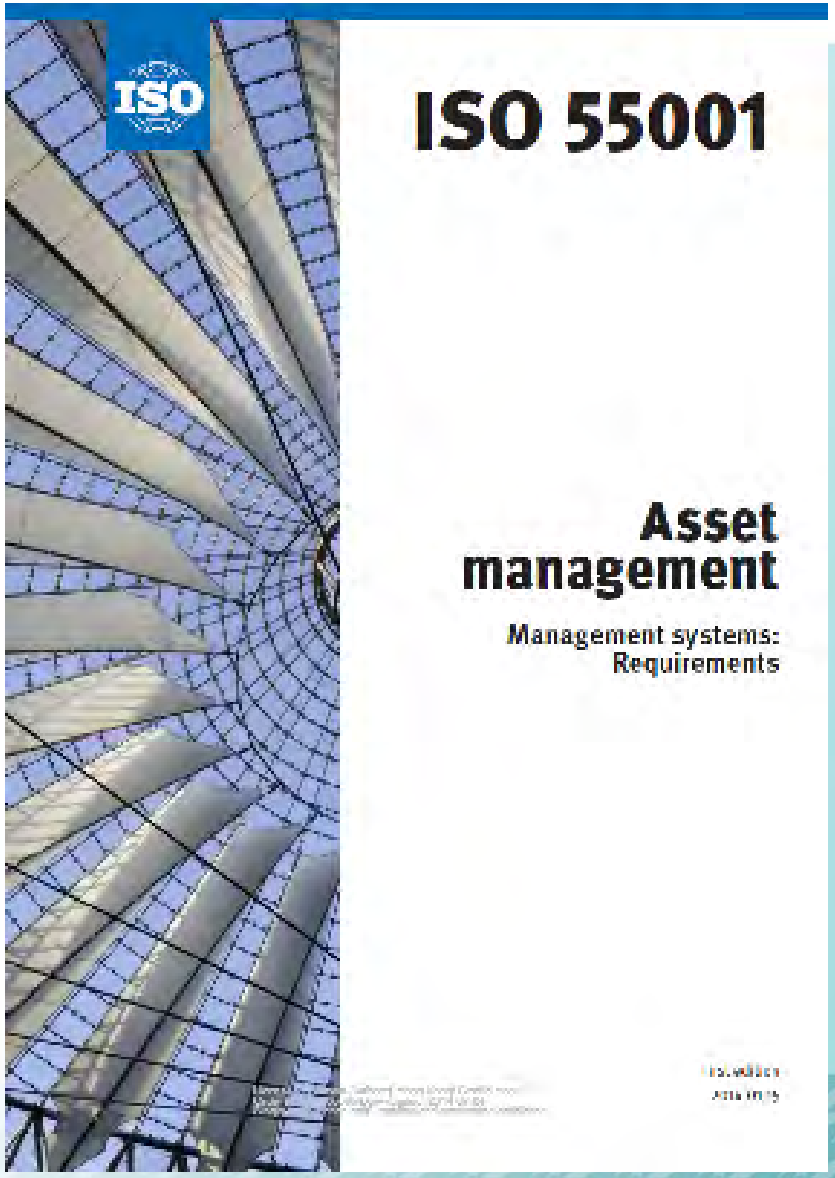
The Institute of Asset Management

PAS 55-1:2008

Asset Management

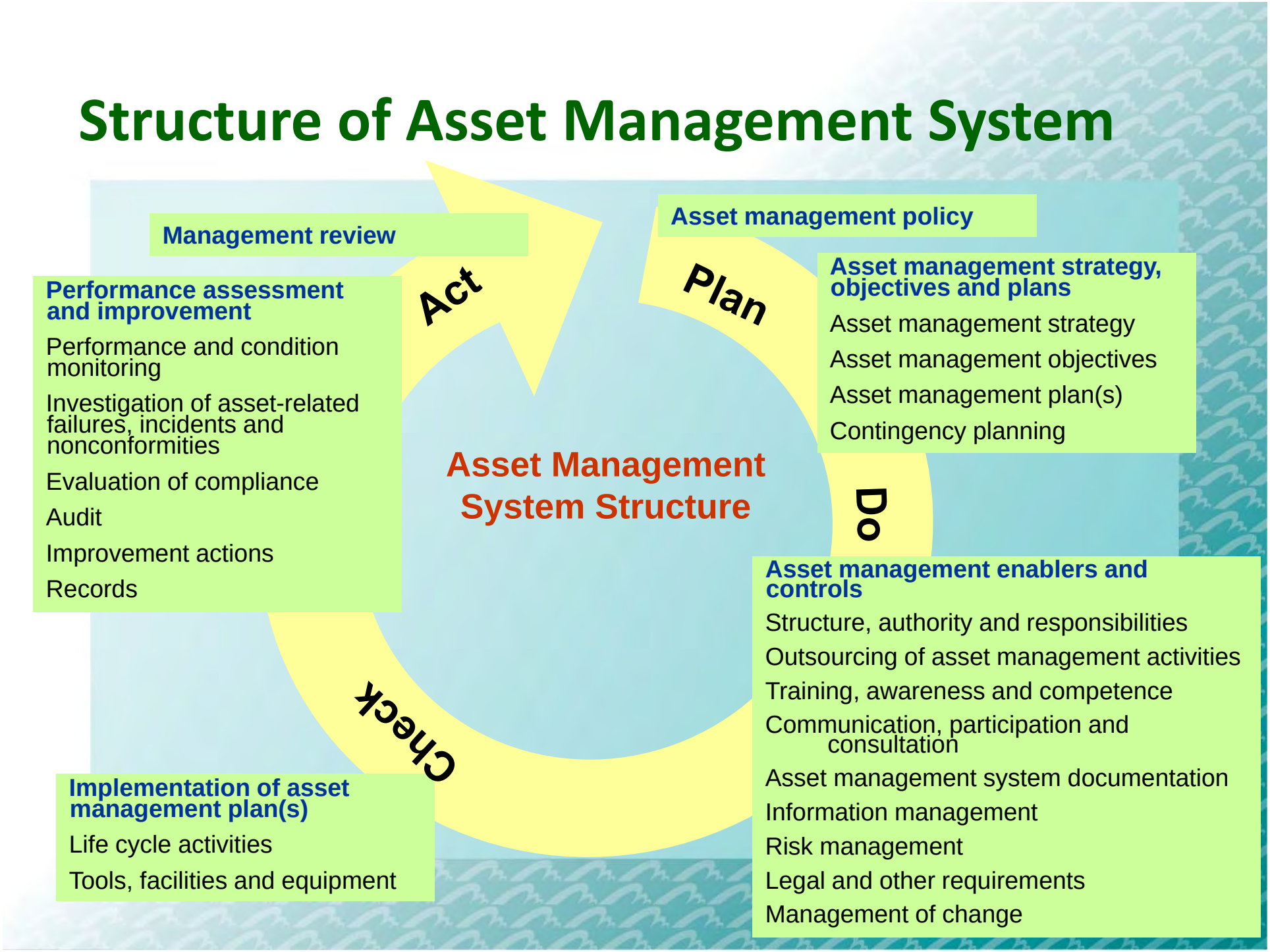


Asset Management System (AMS)



- In 2014, the AMS was revised to align to the international standard of ISO 55001:2014, Asset Management – Management Systems: Requirements.

Structure of Asset Management System



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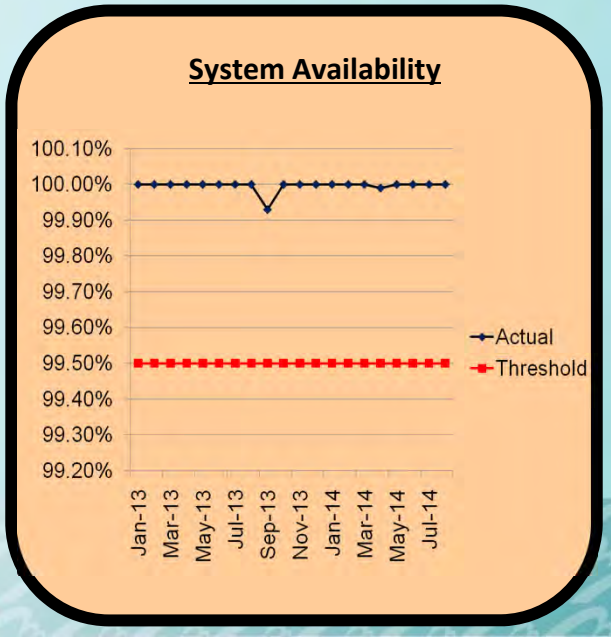
Asset Management Objectives

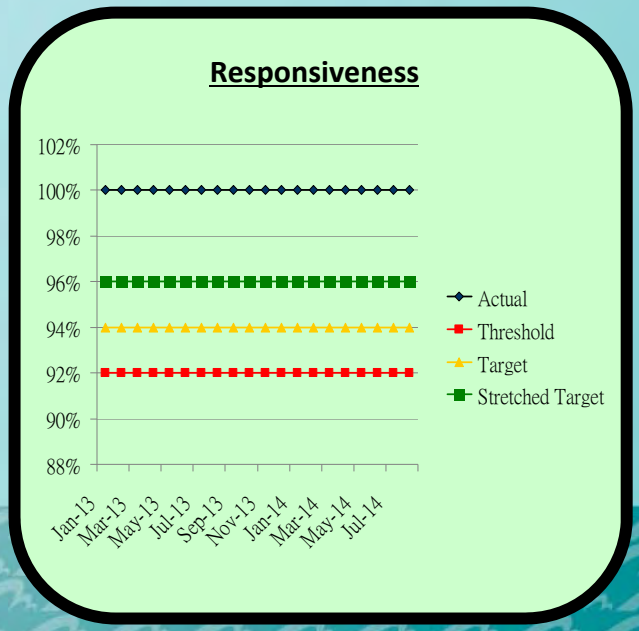
1. Aim to achieve the below Key Performance Indicators (KPI) :

Description	Key Performance Indicator
System Availability *	>99.5%
Emergency Response in 10 minutes	>94%

*** System availability = (Total Required Operating Time – Total Downtime)**

Total Required Operating Time





Asset Management Objectives

2. **Ensure a reliable, robust and safe AGL system**
3. **Maintain Availability for each component of critical AGL spare part to 100%**
4. **Achieve average AGL staff training not less than 4.5 days/staff/year**

Asset Management Strategy

The asset management strategy was established to achieve the defined objectives. The strategy is to :

a. **implement Reliability Centered Maintenance (RCM) and Condition Based Maintenance processes on assets**

b. **Maintain relevant and reliable maintenance data and records of all assets**

c. **Conduct periodic risk-based system review to identify single point failure and area of improvement to maintain system reliability**

Asset Management Strategy

d. Identify critical spare parts to determine the minimum ordering and re-ordering levels

e. Utilize information system (e.g. AAMS or GIS) on records of maintenance works planning

f. Maintain timely and effective fault response

g. Communicate with relevant stakeholders including Civil Aviation Department (CAD), International Civil Aviation Organization (ICAO), International Federation of Airline Pilot's Association, etc.

Asset Management Strategy

g. Integration of Safety Management Plan

h. Upgrade the core infrastructure of AGL System to extend the system life so as to cope with the air traffic movements

i. Provide appropriate training to staffs

j. Review technology trend in the market to improve system performance

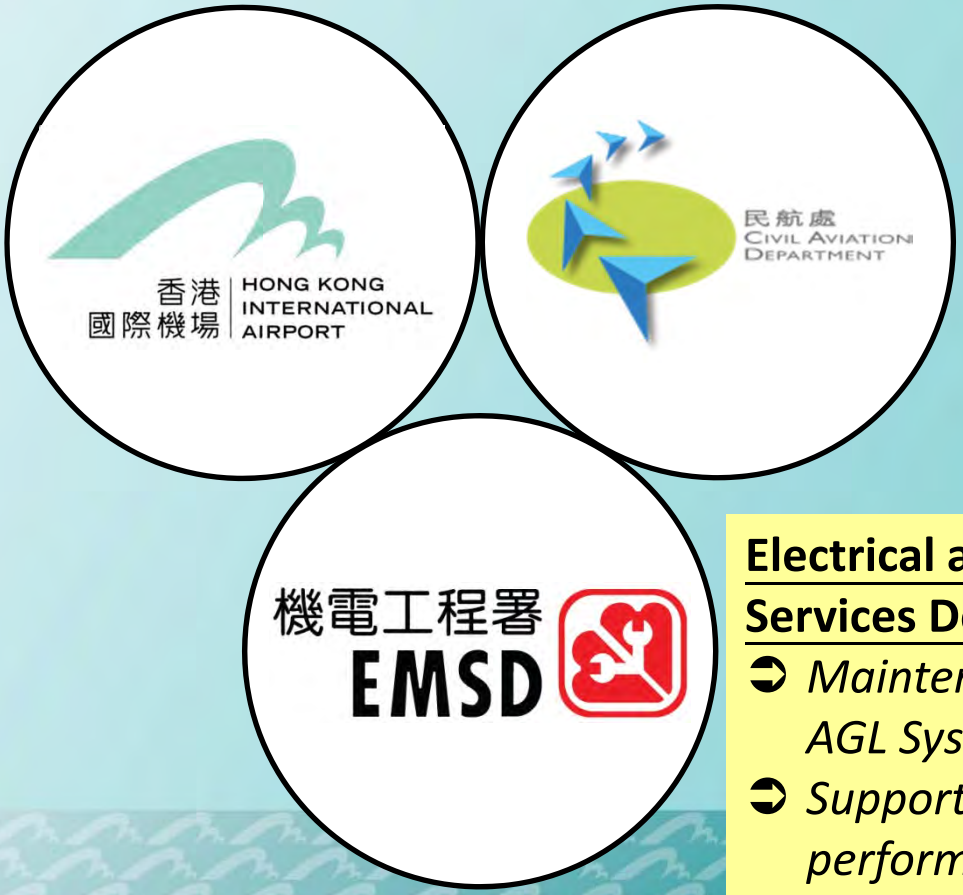
Main Stakeholders

Airport Authority H.K.

- *Owner of AGL System*
- *Responsible for maintaining the system operation*

Civil Aviation Department

- *Regulator and Controller of AGL System*



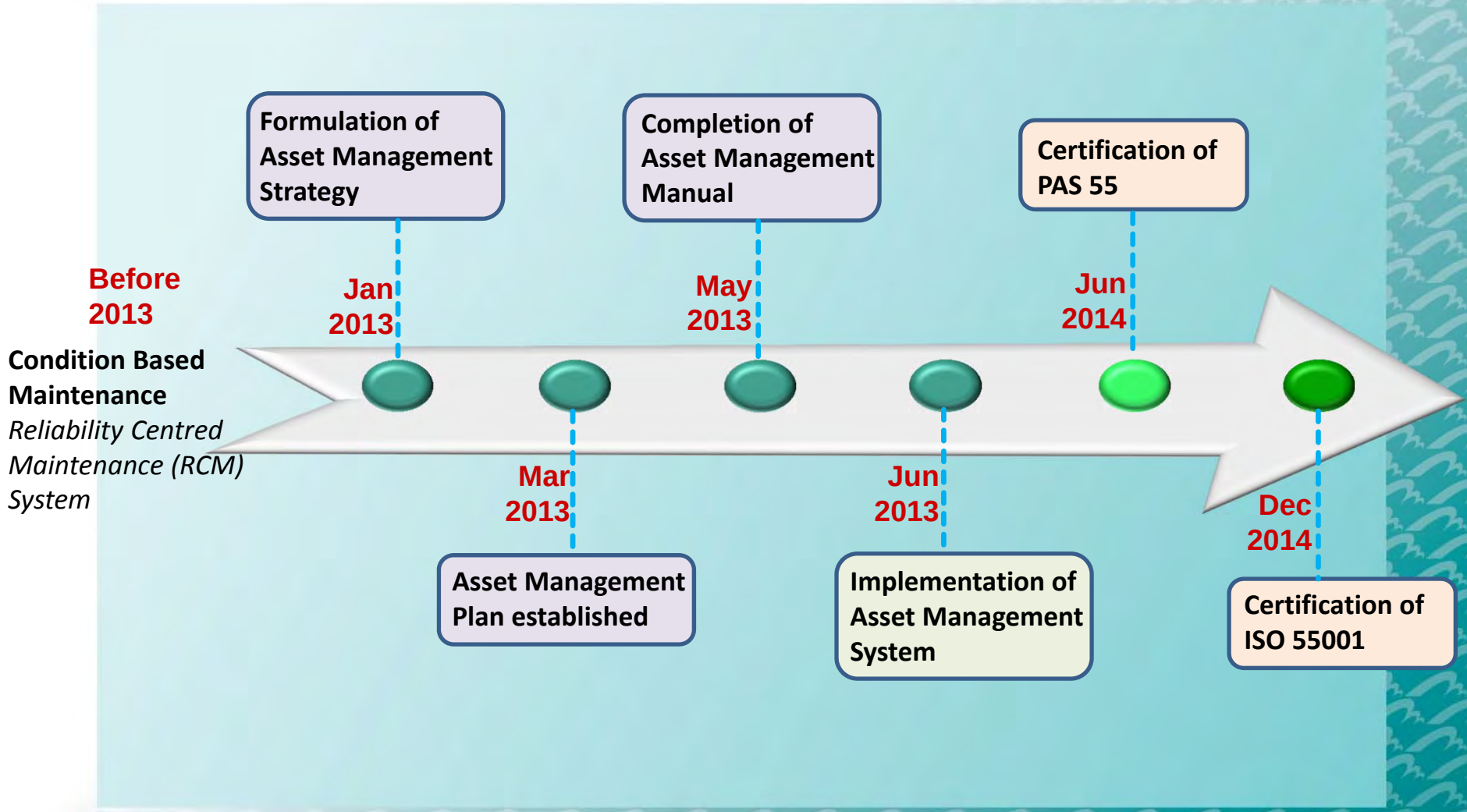
Electrical and Mechanical Services Department

- *Maintenance Contractor of AGL System*
- *Support Airport Authority to perform maintenance works*

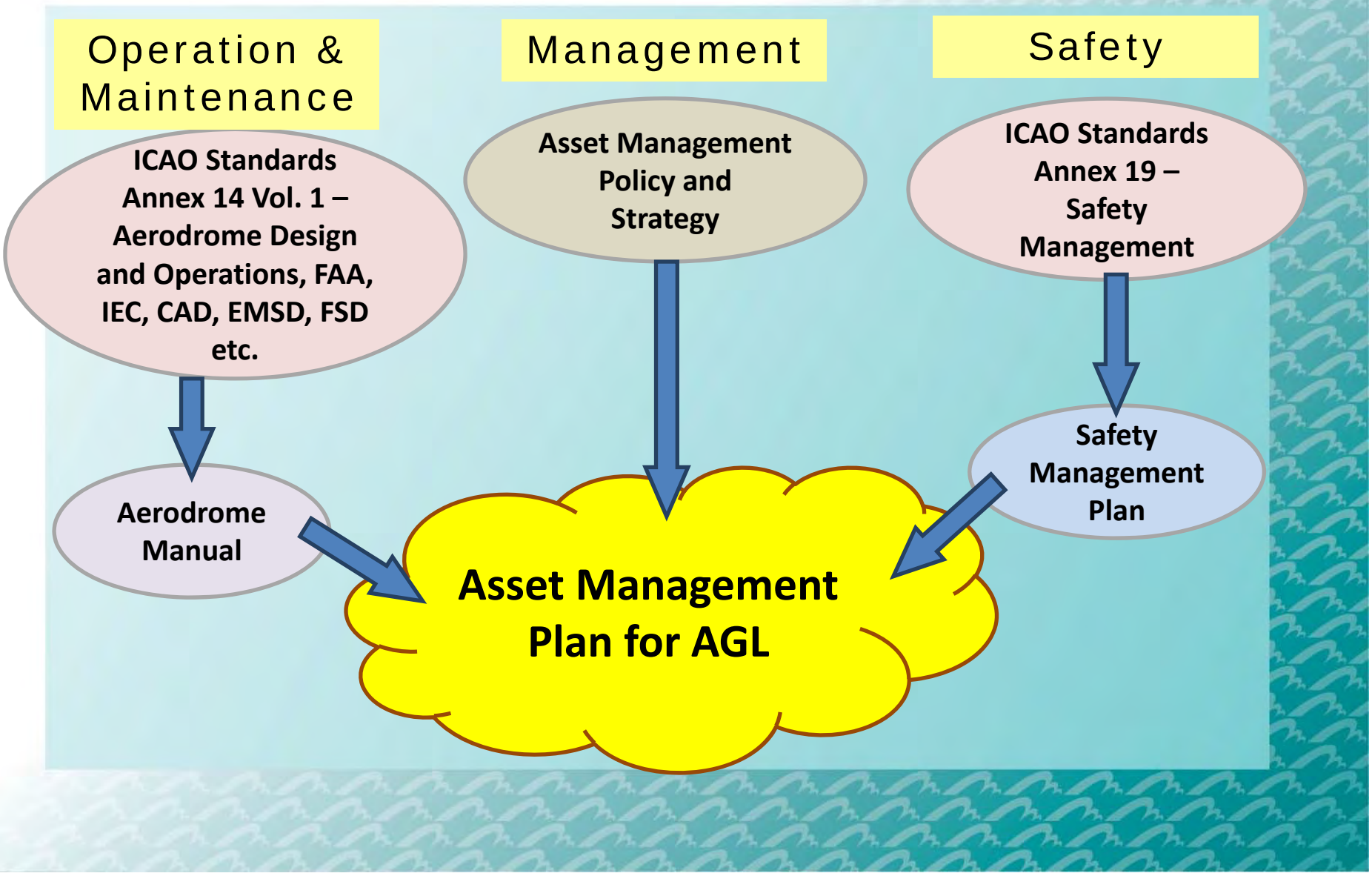
Hong Kong Quality Assurance Agency (HKQAA)

Established in 1989 as a non-profit-distribution organization by the Hong Kong Government. Hong Kong Quality Assurance Agency (HKQAA) helps industry and commerce in the development of quality, environmental, safety, hygiene and social management systems.

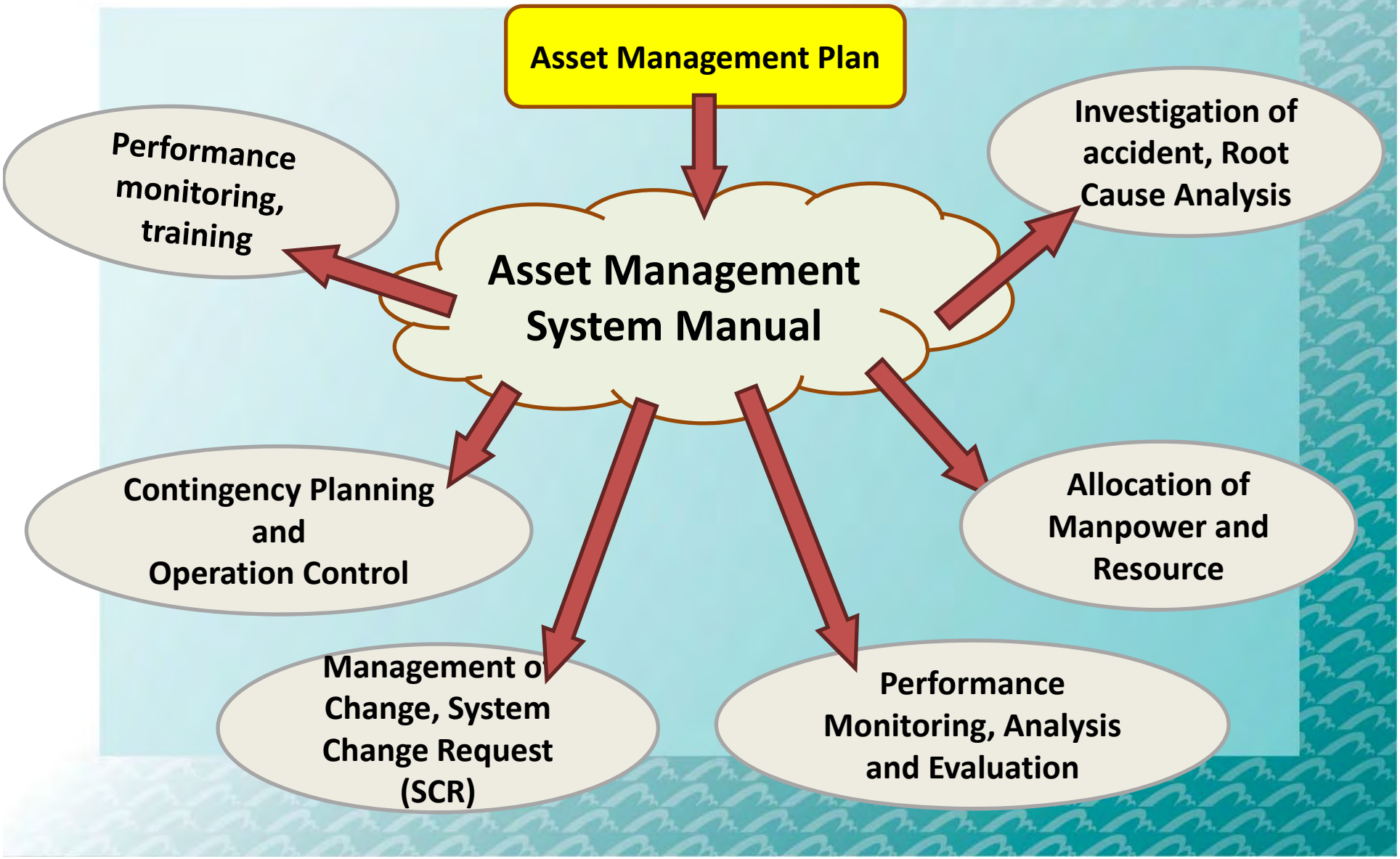
Roadmap for Accreditation of PAS 55 and ISO 55001



Asset Management Plan



Asset Management System Manual



Hong Kong Safety Management

The ICAO Annex 19 – Safety Management stipulates the requirements for States / Administrations to establish a State Safety Programmes (SSP) in order to achieve an acceptable level of safety performance in civil aviation.

Hong Kong Safety Management

In line with the basic principles of safety management, the ultimate objectives of SSP is the continues improvement of aviation safety. The 4 components and 11 elements in the Hong Kong Safety Programme are based on ICAO's framework as the below table.

Hong Kong Safety Programme Framework

1. State Safety Policy and Objectives
1.1 Hong Kong safety legislative framework
1.2 Hong Kong safety responsibilities and accountabilities
1.3 Accident and incident investigation
1.4 Enforcement policy
2. State Safety Risk Management
2.1 Safety requirements for the service provider's SMS
2.2 Agreement of the service provider's safety performance
3. State Safety Assurance
3.1 Safety oversight
3.2 Safety data collection, analysis and exchange
3.3 Safety-data-driven targeting of oversight on areas of greater concern or need
4. State Safety Promotion
4.1 Internal and external training, communication and dissemination of safety information

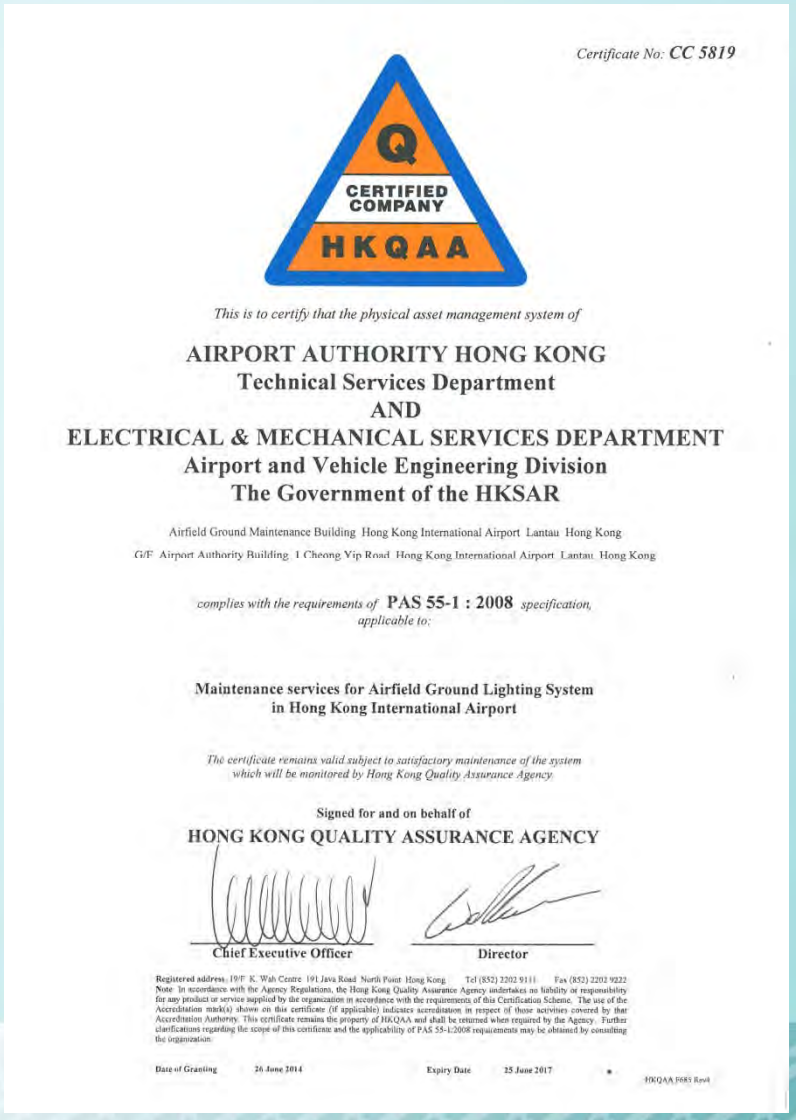
Performance Evaluation

- Proactive Monitoring
- Reactive Monitoring
- Evaluation of Compliance
- Internal Audit
- Improvement Action
- Preventive Action
- Management Review
- Management of Change

ISO 55001 / PAS 55 Certification

HKIA is the first international airport to achieve the certification of ISO 55001 and PAS 55 for maintenance services on AGL system within Asia and Pacific region in 2014.

Accreditation of ISO 55001 and PAS 55-1



Certificate No: CC 5819

CERTIFIED COMPANY
HKQAA

This is to certify that the physical asset management system of

AIRPORT AUTHORITY HONG KONG
Technical Services Department
AND
ELECTRICAL & MECHANICAL SERVICES DEPARTMENT
Airport and Vehicle Engineering Division
The Government of the HKSAR

Airfield Ground Maintenance Building Hong Kong International Airport Lantau Hong Kong
G/F Airport Authority Building 1 Cheong Yip Road Hong Kong International Airport Lantau Hong Kong

complies with the requirements of **PAS 55-1 : 2008** *specification, applicable to:*

Maintenance services for Airfield Ground Lighting System in Hong Kong International Airport

The certificate remains valid subject to satisfactory maintenance of the system which will be monitored by Hong Kong Quality Assurance Agency.

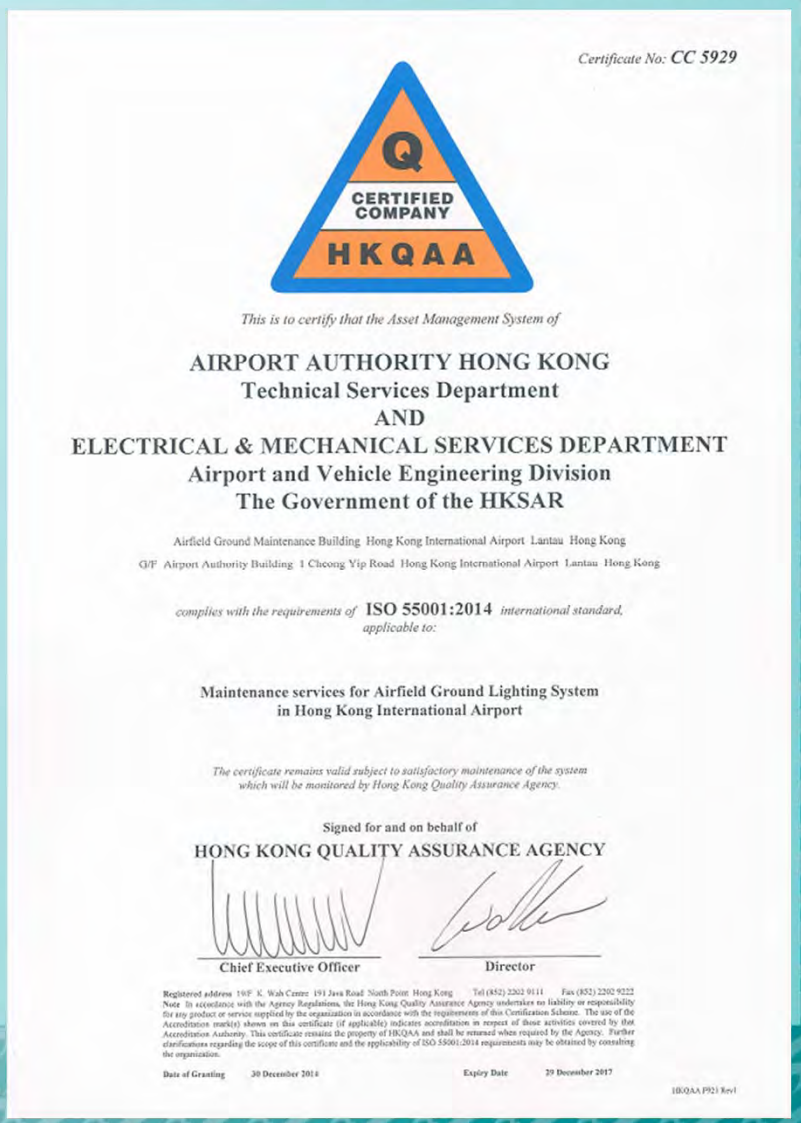
Signed for and on behalf of
HONG KONG QUALITY ASSURANCE AGENCY

Chief Executive Officer | Director

Registered address 19/F K. Wah Centre 191 Java Road North Point Hong Kong Tel (852) 2202 9111 Fax (852) 2202 9222
Note: In accordance with the Agency Regulations, the Hong Kong Quality Assurance Agency undertakes no liability or responsibility for any product or service supplied by the organization in accordance with the requirements of this Certification Scheme. The use of the Accreditation mark(s) shown on this certificate (if applicable) indicates accreditation in respect of those activities covered by that Accreditation Authority. This certificate remains the property of HKQAA and shall be returned when required by the Agency. Further clarifications regarding the scope of this certificate and the applicability of PAS 55-1:2008 requirements may be obtained by consulting the organization.

Date of Granting 26 June 2014 Expiry Date 25 June 2017

HKQAA P685 Rev4



Certificate No: CC 5929

CERTIFIED COMPANY
HKQAA

This is to certify that the Asset Management System of

AIRPORT AUTHORITY HONG KONG
Technical Services Department
AND
ELECTRICAL & MECHANICAL SERVICES DEPARTMENT
Airport and Vehicle Engineering Division
The Government of the HKSAR

Airfield Ground Maintenance Building Hong Kong International Airport Lantau Hong Kong
G/F Airport Authority Building 1 Cheong Yip Road Hong Kong International Airport Lantau Hong Kong

complies with the requirements of **ISO 55001:2014** *international standard, applicable to:*

Maintenance services for Airfield Ground Lighting System in Hong Kong International Airport

The certificate remains valid subject to satisfactory maintenance of the system which will be monitored by Hong Kong Quality Assurance Agency.

Signed for and on behalf of
HONG KONG QUALITY ASSURANCE AGENCY

Chief Executive Officer | Director

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Date of Granting 30 December 2014 Expiry Date 29 December 2017

HKQAA P923 Rev1

Contents

- Hong Kong International Airport (HKIA)
- Airfield Ground Lighting (AGL) System
- Asset Management System
- Certification of ISO 55001 and PAS 55
- **HKIA future development**

Medium-Term Plan: Midfield Development and West Apron Expansion

West Apron Expansion

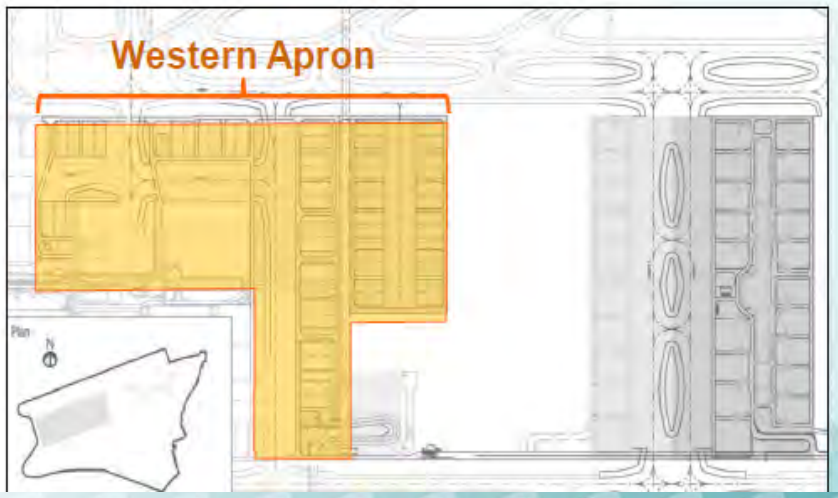
HK$2.5 bn project

- 28 new parking stands
- A cross-runway tunnel linking the west apron and the cargo area
- Fully operational in early 2015

Midfield Development

HK$10 bn project

- A concourse with 105,000 m² of floor area
- 20 aircraft parking stands
- Extension of APM from T1
- A cross-field taxiway
- To be completed by end 2015



3RS Project of HKIA

New Passenger Concourse with 57 parking positions

Extended APM system

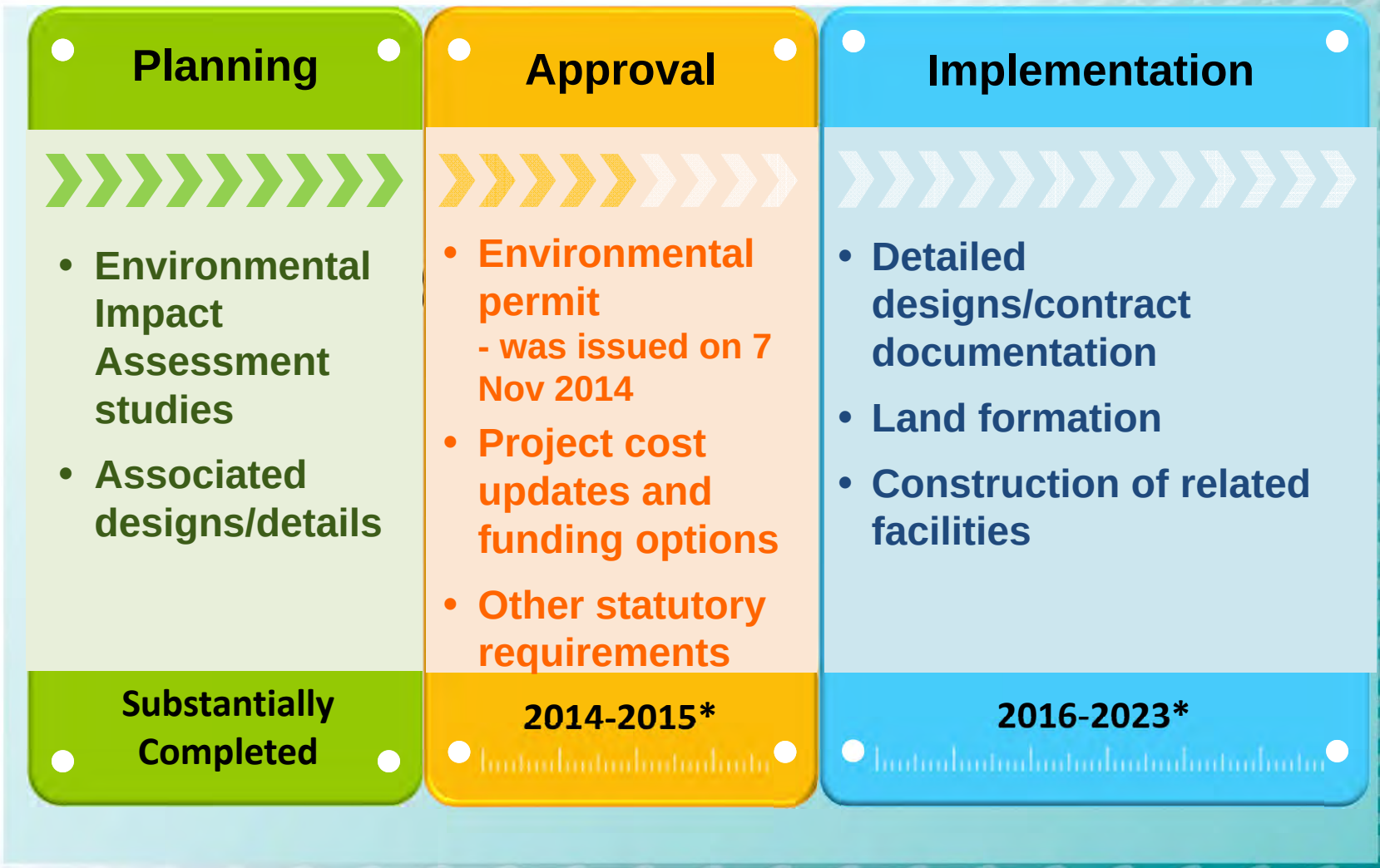
New Baggage Handling System

Expansion of T2

圖例：

- Reclamation Footprint
- Runway
- Taxiway
- Third Runway Concourse
- Terminal 2 Expansion
- Automated People Mover
- Baggage Handling System

Target to Commission 3RS in 2023



*Indicative timeline that is subject to change

3RS Project of HKIA

- Environmental friendly feature
  - courtyard situated at the centre of the concourse
  - advanced air-conditioning & lighting systems
  - power generated by solar energy

END