LORADS III transition

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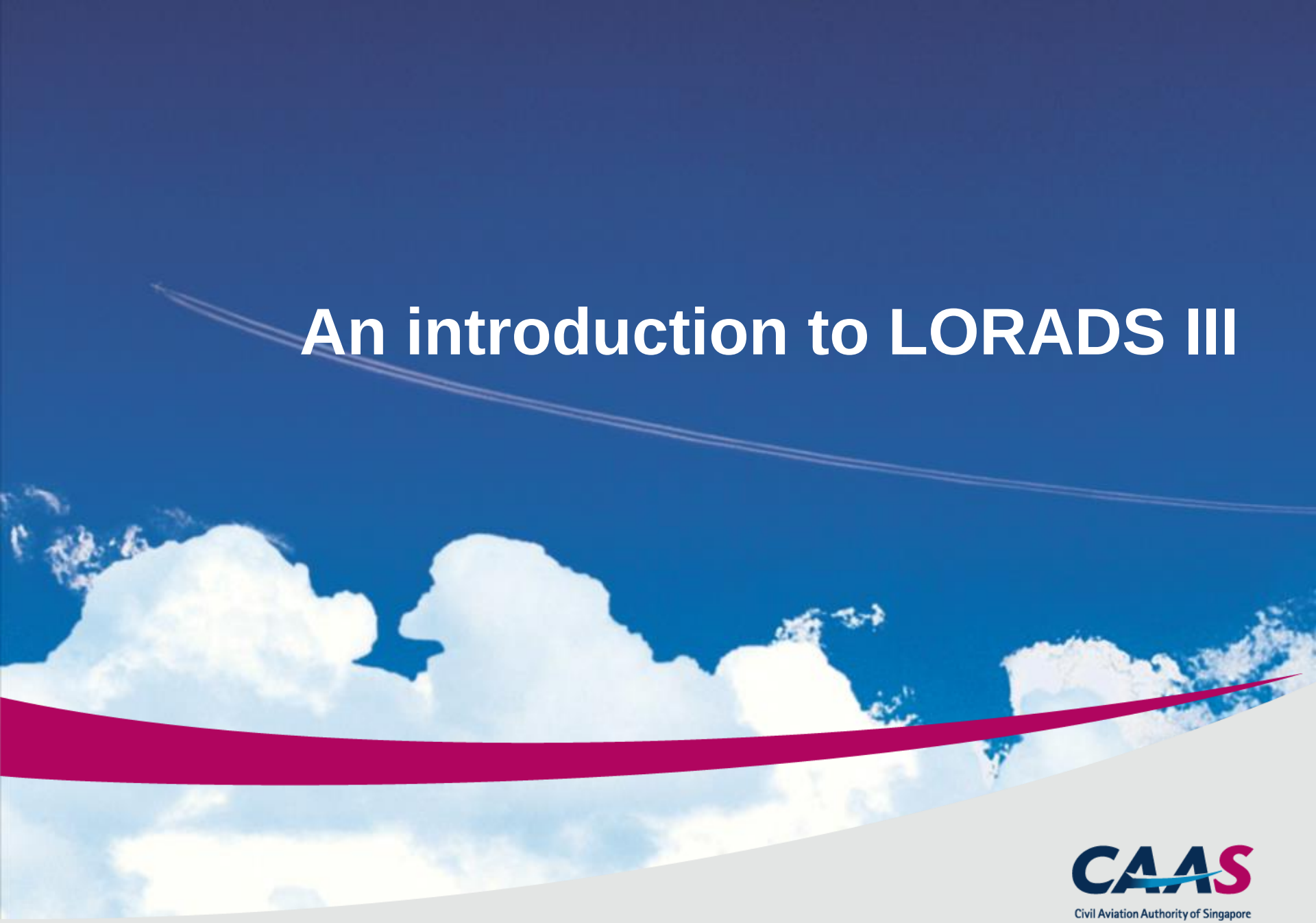
Scope of presentation

- A brief introduction to LORADS III
  - Key components
  - LIII workstation
  - LIII features - Java HMI, new features, redundancy

- LORADS III Operational Transition
  - Training
  - Operational readiness
  - Shadow operations
  - Cut-over plan and contingencies
  - LORADS III Regulatory approval
  - Lessons learnt

An introduction to LORADS III



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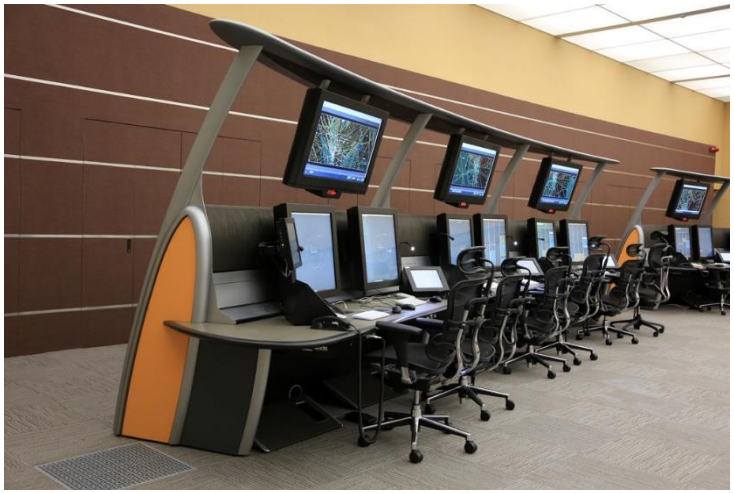
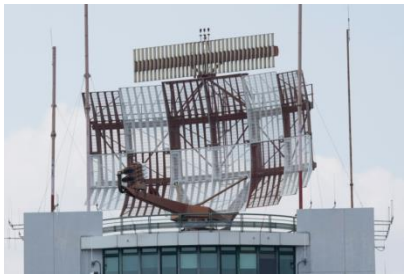
LORADS III ATC System

- Customized state-of-the-art system
- Basic system commissioned in Feb 2013 and operational with effect from 16 Oct 2013
- System planned for management of air traffic to 2025; Air traffic in the Singapore FIR projected to be double that of 2010 by then
- Platform and tools for controllers to work smarter, faster and with greater safety

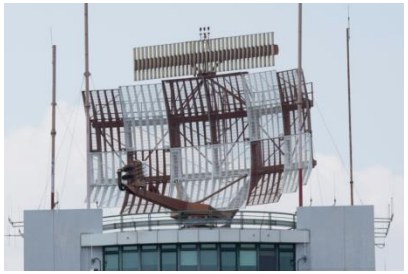
Key Components of LORADS III



Air Traffic Management System



Mode-S
Approach Radar

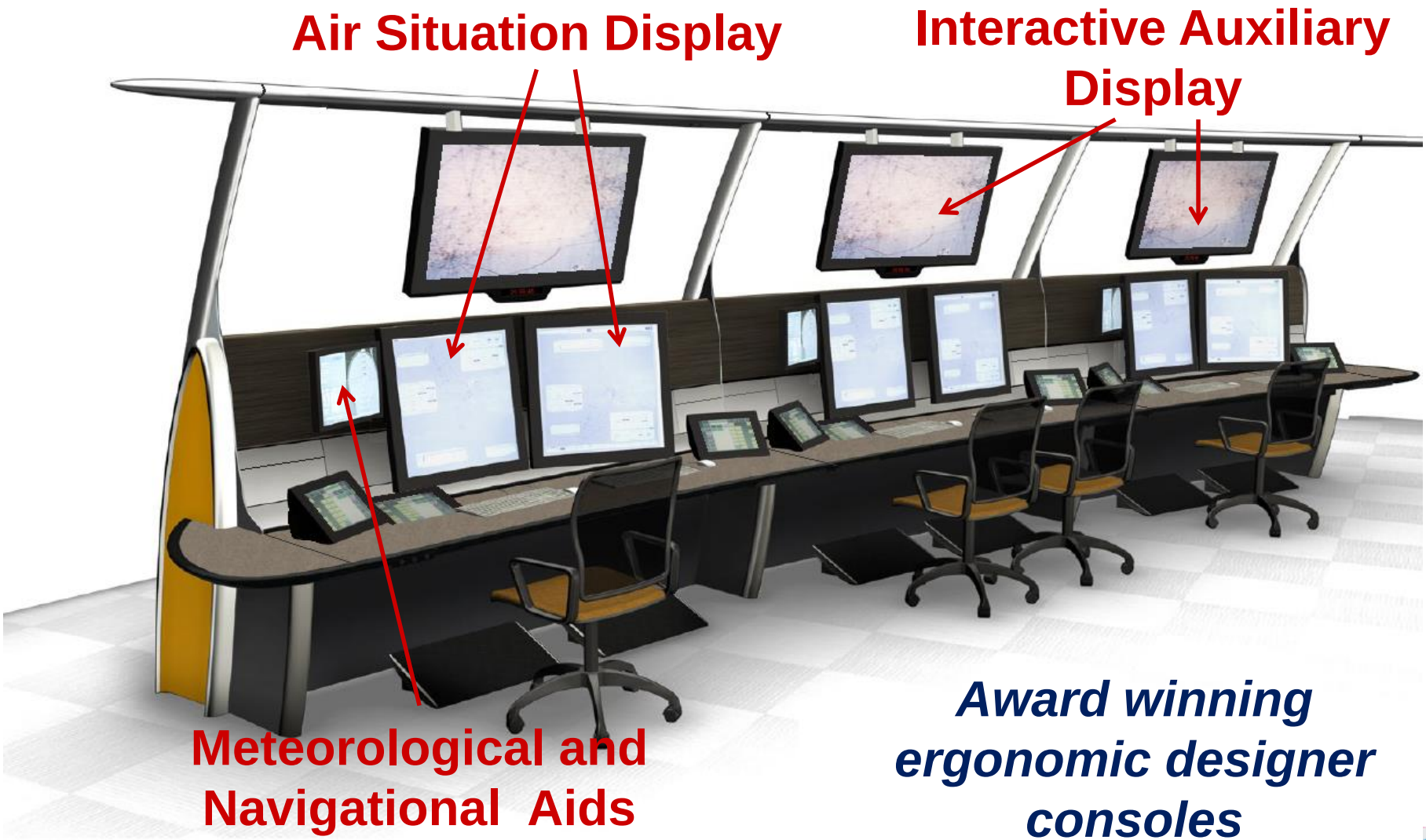


Mode-S
Long Range Radar

Integrated Voice
Communications System

LORADS III
building

Enhanced ATC Workstations



Award winning ergonomic designer consoles

Multiple LORADS III Sites

- Multiple sites
  - SATCC - Area and Approach Control Centres

  - Changi Tower and Back-up Tower Cabins
  - Various sites at Changi Airport, (including airside operations, MET, others)

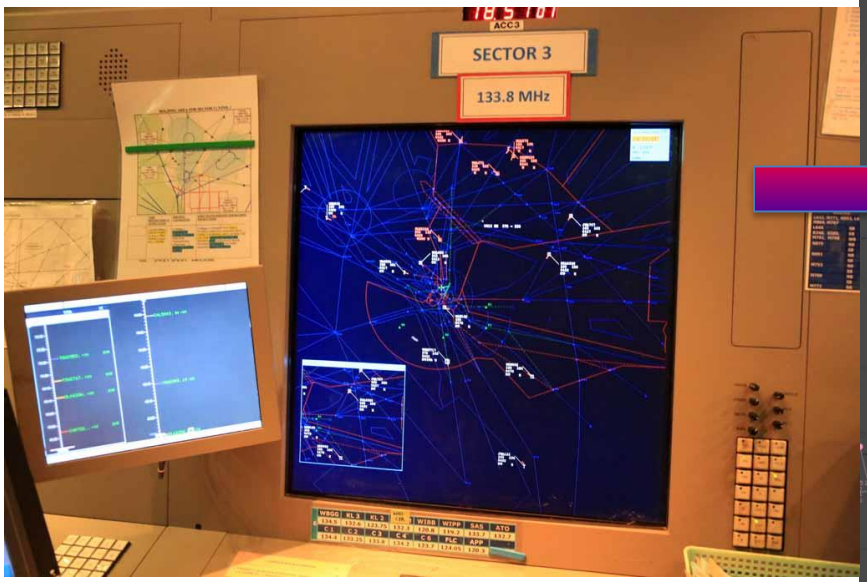
SATCC
Area Control Centre

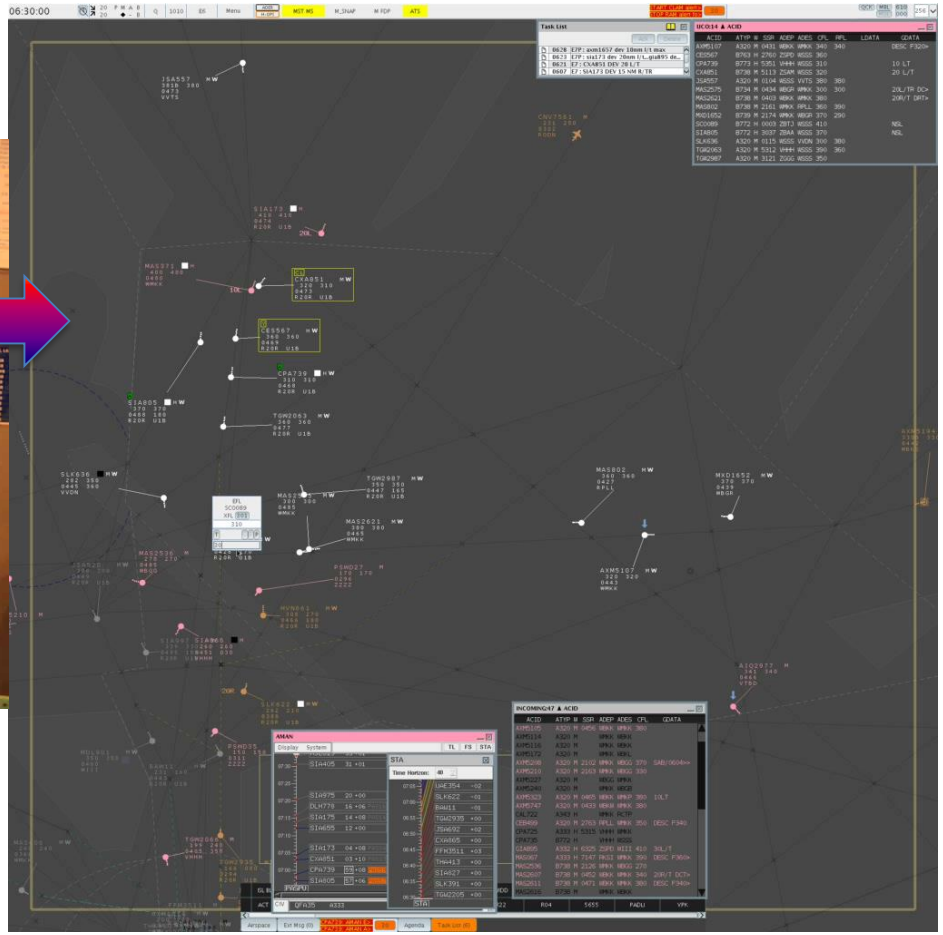
Java HMI

- The JHMI is the centrepiece of the system
- Highly configurable software reduces controller's workload through new ways of viewing, organising and interacting with flight information
- Intuitive and user-friendly Java-based HMI makes it easier for our controllers to complete their tasks.
- Smart menus and highly configurable windows allow information to be presented in a single screen, giving controllers more time to manage flights efficiently
- 4-D trajectory computations helps controllers to make quick decisions, with information to optimize the flight profiles of flights and keeping interventions to a minimum with reduced vectors and level restrictions.

Java-based
Human Machine Interface

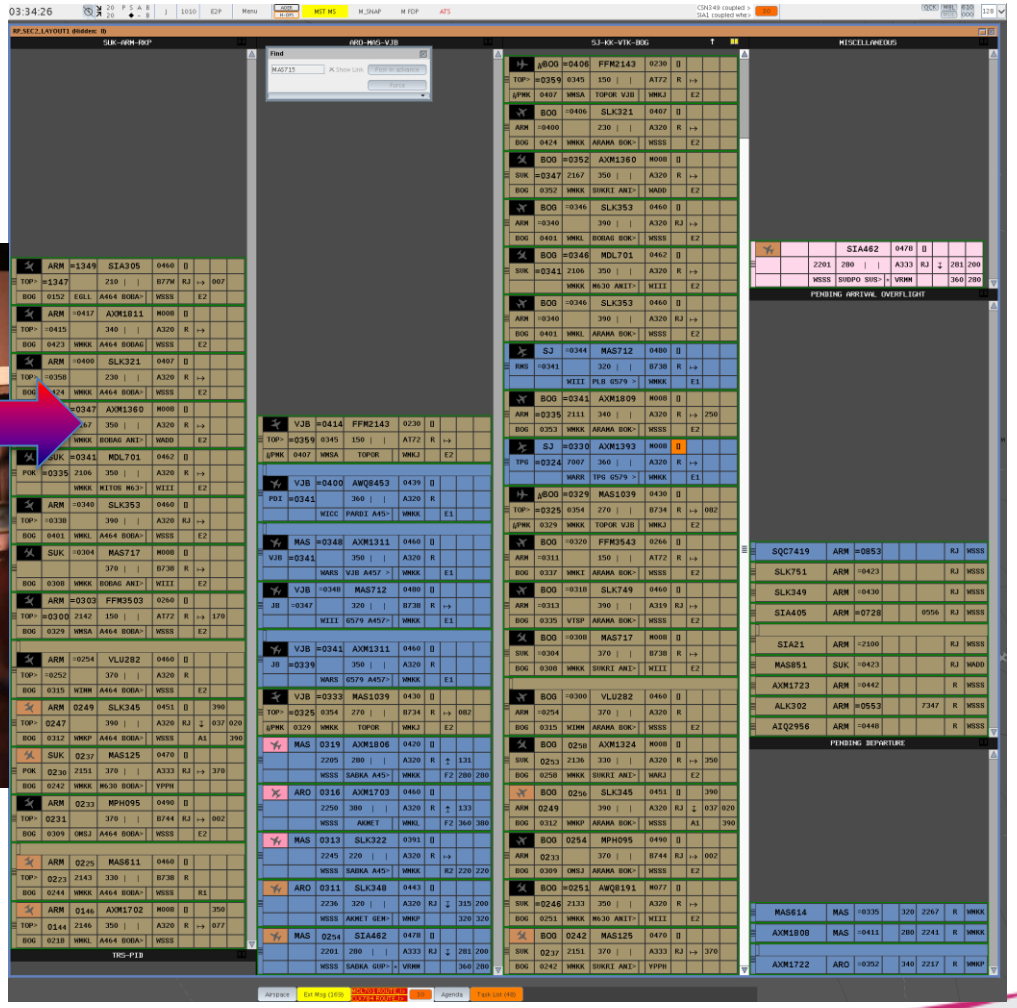
OLD





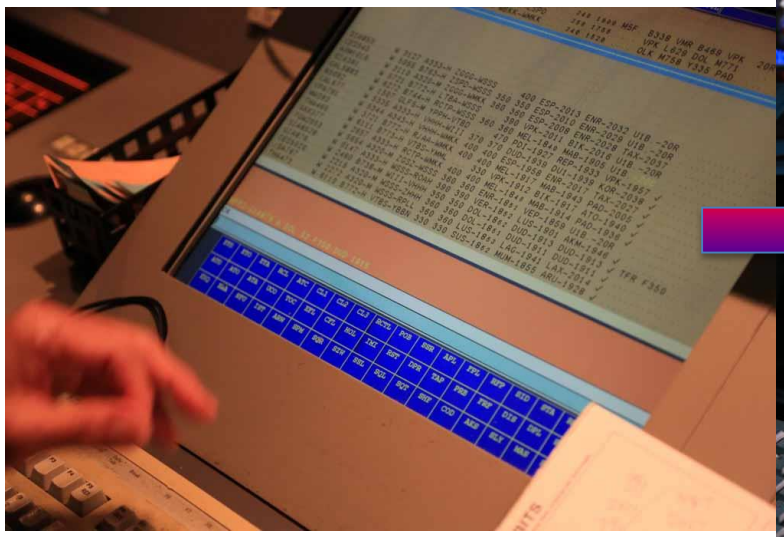
Paperless Environment

OLD



Touch Screen Displays

OLD



LORADS III Features

- ATC automation features
  - Silent coordination for both internal and inter-centre tasks e.g. AIDC with HCM ACC
  - Tasks are performed on objects of interest e.g. labels, maps
  - Better management of flight information
- Enhanced decision-making tools
  - Integrated Arrival Manager
- Many safety nets
  - Flight plan conflict probe
  - Short term conflict alert
  - Vertical and lateral adherence monitoring
  - New alerts such as Holding Adherence Monitoring

LORADS III Redundancy

- Multiple levels of redundancy to ensure uninterrupted ATC services
- Built-in redundancies, multiple networks, duplicated servers
- Bypass processing for key servers e.g. FDP, SNAP
- Immediate Back-up (IBU) on hot standby
  - Provides controllers with immediate Air Picture at press of a button should the main system fail or position display processer fail
  - 2 modes: HMI-IBU (standalone) or SYS-IBU (system wide upgrade with external links)
- Other Back-up modes
- Separate power sources, (including uninterruptable power supply (UPS) and generators)

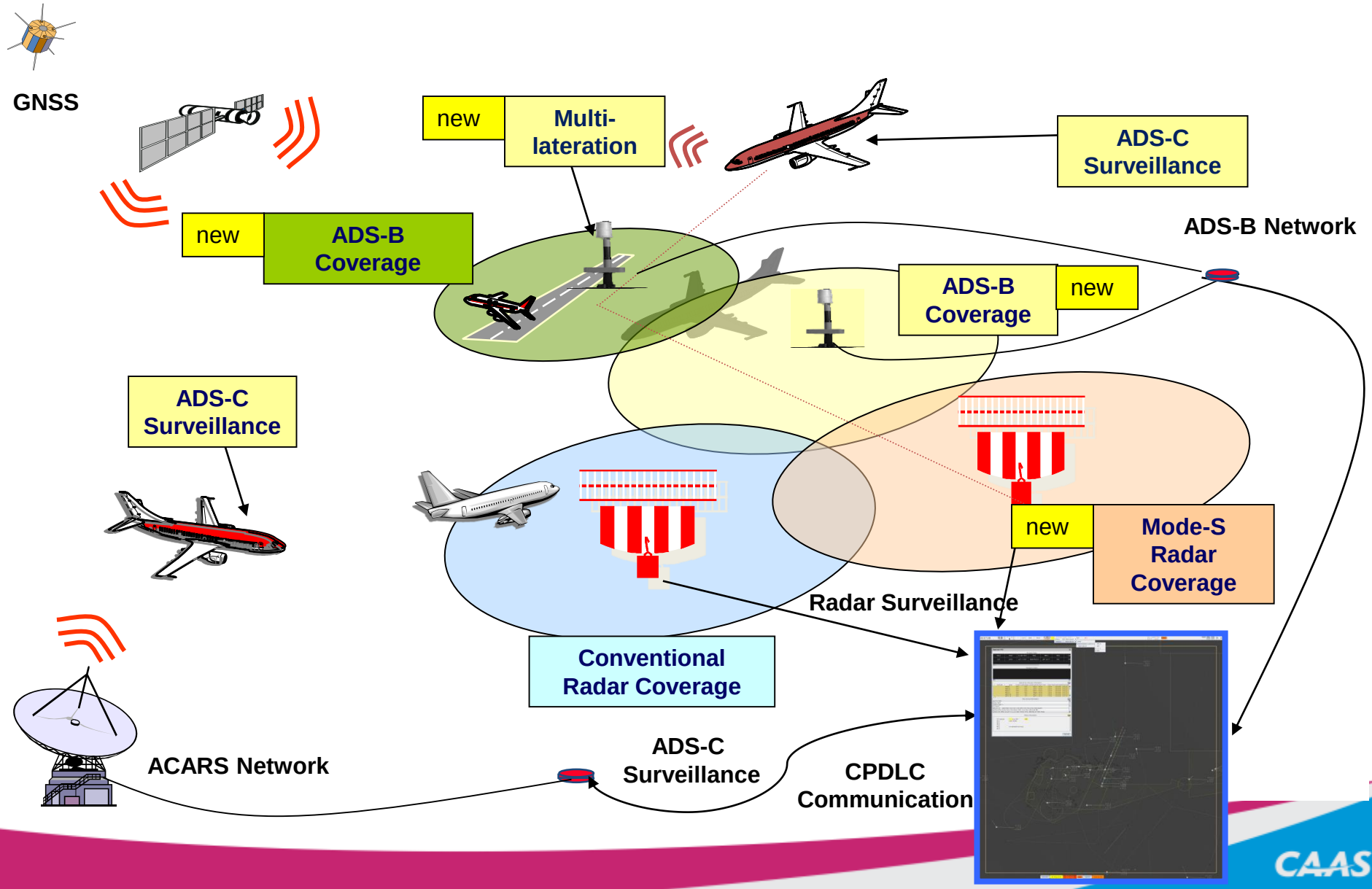
Improved Surveillance Processing Capabilities

- New generation trackers for harnessing multiple surveillance sources, including Mode-S radars and ADS-B

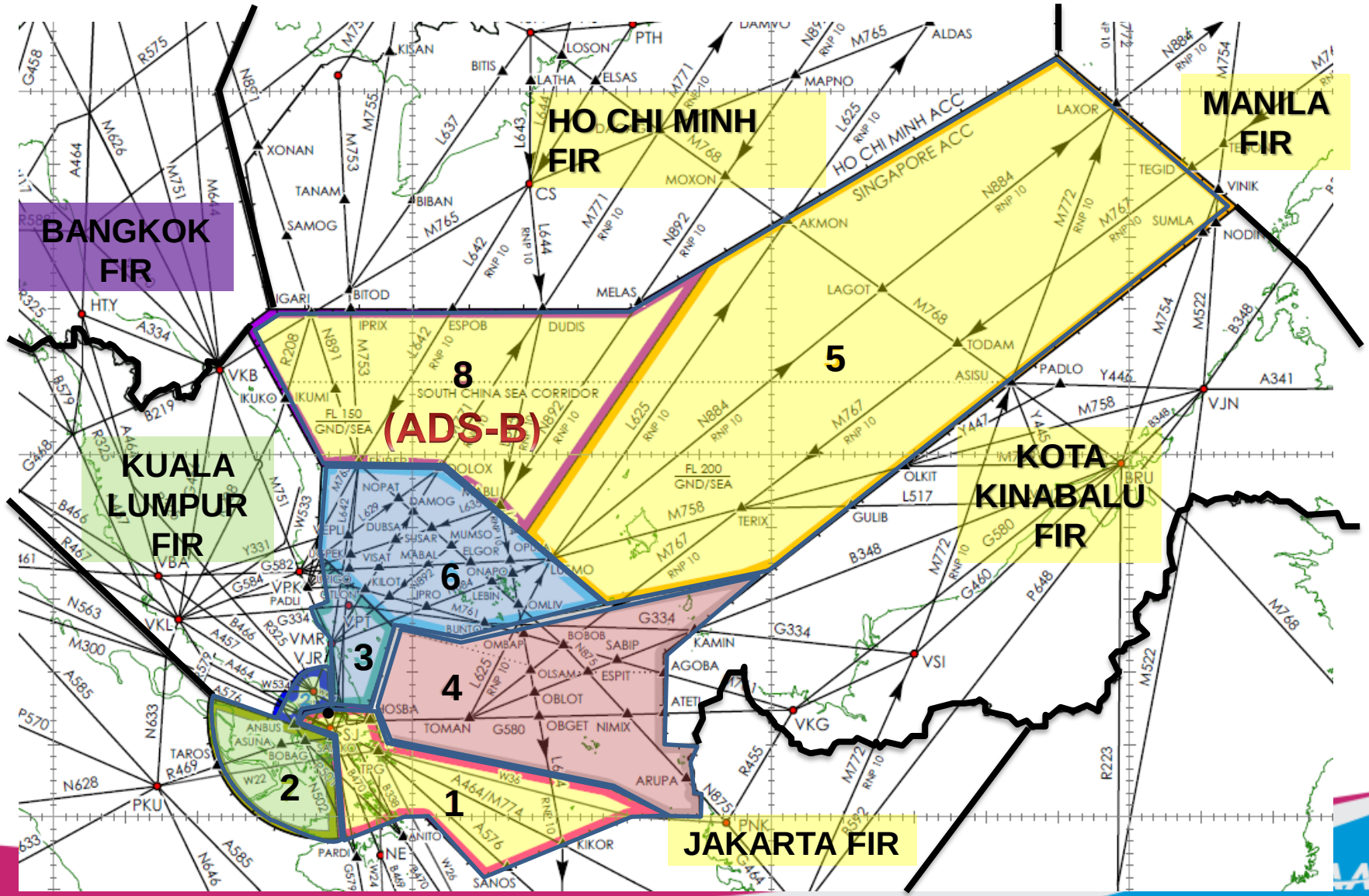
- Multiple Sensor Tracking System allows fusion of surveillance data from all sensors into integrated air situation display

- Many options of displaying tracks
  - MST from all sensors
  - MST from each sensor type e.g. radar, ADS-B
  - Tracks from back-up tracker system (automatic)

Communications and Surveillance



Singapore Area Control Sectors



Enhancements completed in Phase II

- Departure clearances via data link (DCL)
- Medium Term Conflict Alert
- Surveillance Traffic Indicator
- Enhanced Mode S features
- Controller workload monitoring
- Feeder Fix Management
- HMI enhancements e.g. Static pages, highlights
- Seletar Tower pages
- APL to FPL conversion
- Others….

Transition to LORADS III

CAAS
Civil Aviation Authority of Singapore

Scope

1. LORADS III Operation Transition Task Force
2. Controllers (ATCO) and ATC Support Officers (ATCSO) Training
3. Operational Readiness Survey
4. Shadow Operations
5. Criteria and Decision for Cut-Over
6. Regulatory Approval for Cut-over
7. Cut-over Contingency Plans

(1) Operational Transition Task Force

- To ensure a smooth transition to LORADS III, an Operational Transition Task Force was established with the following **objectives:**

➢ Develop an Operational Transition Plan

➢ Oversee the Operational Transition period

➢ Decide on a cut-over date

- Some of the main **problems anticipated** were:

➢ Manpower requirements

➢ LORADS III system stability

➢ Operational readiness of ATCOs and ATCSOs

(1) Operational Transition Task Force

- Regular meetings were held to discuss progress and make critical decisions. Some **key considerations** were:

  - System software status and stability
  - Manpower deployment
  - Training of ATCOs and ATCSOs
  - Safety case assessment and other cyber security assessment
  - ATCO and ATCSO Operational readiness
  - Engineering and Maintenance team readiness

(2) Training plan for ATCOs

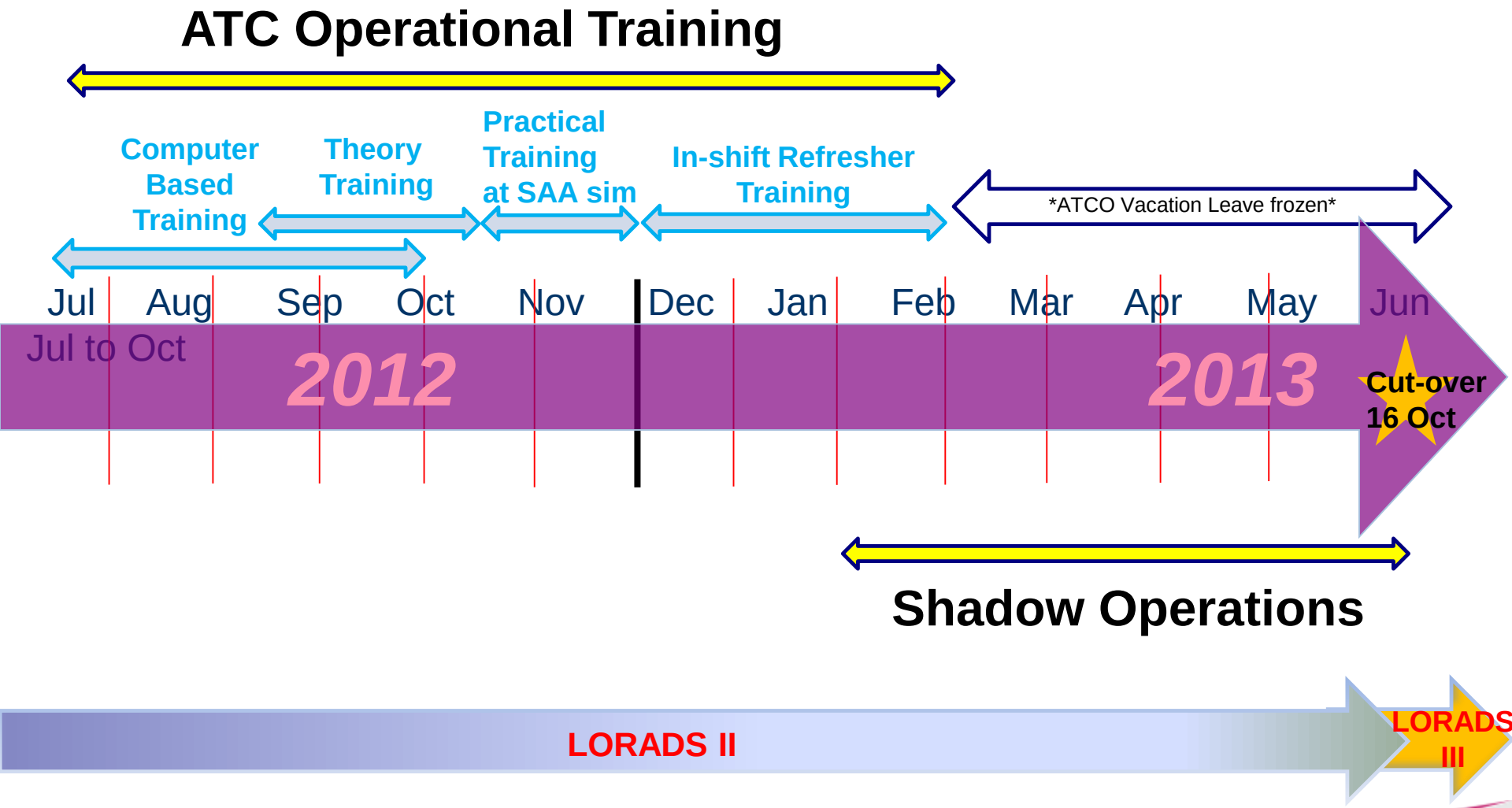
Training syllabus

- Computer Based Training (CBT)
- Formal Theory
- Formal Practical Simulator training at SAA
- Hands-on practical training at operations room
- Shadow operations

(2) LORADS III Training Plan for ATCOs

S/N	Type of training	Start	End	Training hours per controller
1	CBT Starter kit	Jul 2012	Aug 2012	20 hours
2	LORADS III Theory – Day 1	27 Sep 2012	14 Nov 2012	8 hours
3	LORADS III Theory – Day 2	~	~	8 hours
4	LORADS III Theory – Day 3	~	~	8 hours
5	LORADS III Practical – Day 1	15 Nov 2012	21 Dec 2012	8 hours
6	LORADS III Practical – Day 2	~	~	8 hours
7	Jan 2013 IS LIII refresher training	Jan 2013 8 x IS training days		8 hours
8	Feb 2013 IS LIII refresher training	Feb 2013 8 x IS training days		8 hours
9	Mar 2013 IS LIII refresher training	Mar 2013 8 x IS training days		8 hours
11	Shadowing – Workflow training	Apr 2013 8 x IS training days		8 hours
12	Shadowing – Workflow training	May 2013 8 x IS training days		8 hours
13	Full shadow	Jun - Oct 2013		Approximately 100 hours
Total training hours per ATCO				Approximately 200 hours ***Minimum 160 hours***

(3) Operational Transition and Shadow Plan



(3) LORADS III Transition and Shadow Plan

S/No	Date	Timings	Shadow mode	Remarks
1	Mar 2013	Office hours only	LII main, LIII shadow	Shadow manning: SAT controllers / Planner ATCOs
2	Apr -May 2013	Morning shift 08:00 to 16:30 afternoon shift 16:30 to 23:30	LII main, LIII shadow	Shadow manning: 4 shift controllers supplemented with SAT controllers and Planner ATCOs
3	Jun 2013 till cut-over day*	Morning shift 08:00 to 16:30 afternoon shift 16:30 to 23:30	LII main, LIII full shadow	Shadow manning: 16 shift controllers supplemented with SAT controllers and Planner ATCOs
4	Cut-over day*	Date and time to be decided by Ops Transition Task Force	LIII main, LII full shadow	Full Manning for LORADS III plus full shadow manning at LORADS II for two weeks following cut-over.
5	Post-cutover with manning of LII	LIII-full shift system	LIII main, LII skeletal shadow	Skeletal shadowing at LORADS II for up to 3 months. The Operational Transition Task Force will make a decision to reduce the shadowing period at LORADS II.
6	Post-cutover without manning of LII	N.A.	LIII main, no shadow operations	LORADS II kept warm (powered with no manning)

(4) Operational Readiness Survey

- An operational readiness survey was developed in-house with advice from contracted Human Factors experts

- The survey would provide a form of feedback and indication of the confidence/competence level of ATCOs and ATCSOs

(4) Operational Readiness Survey

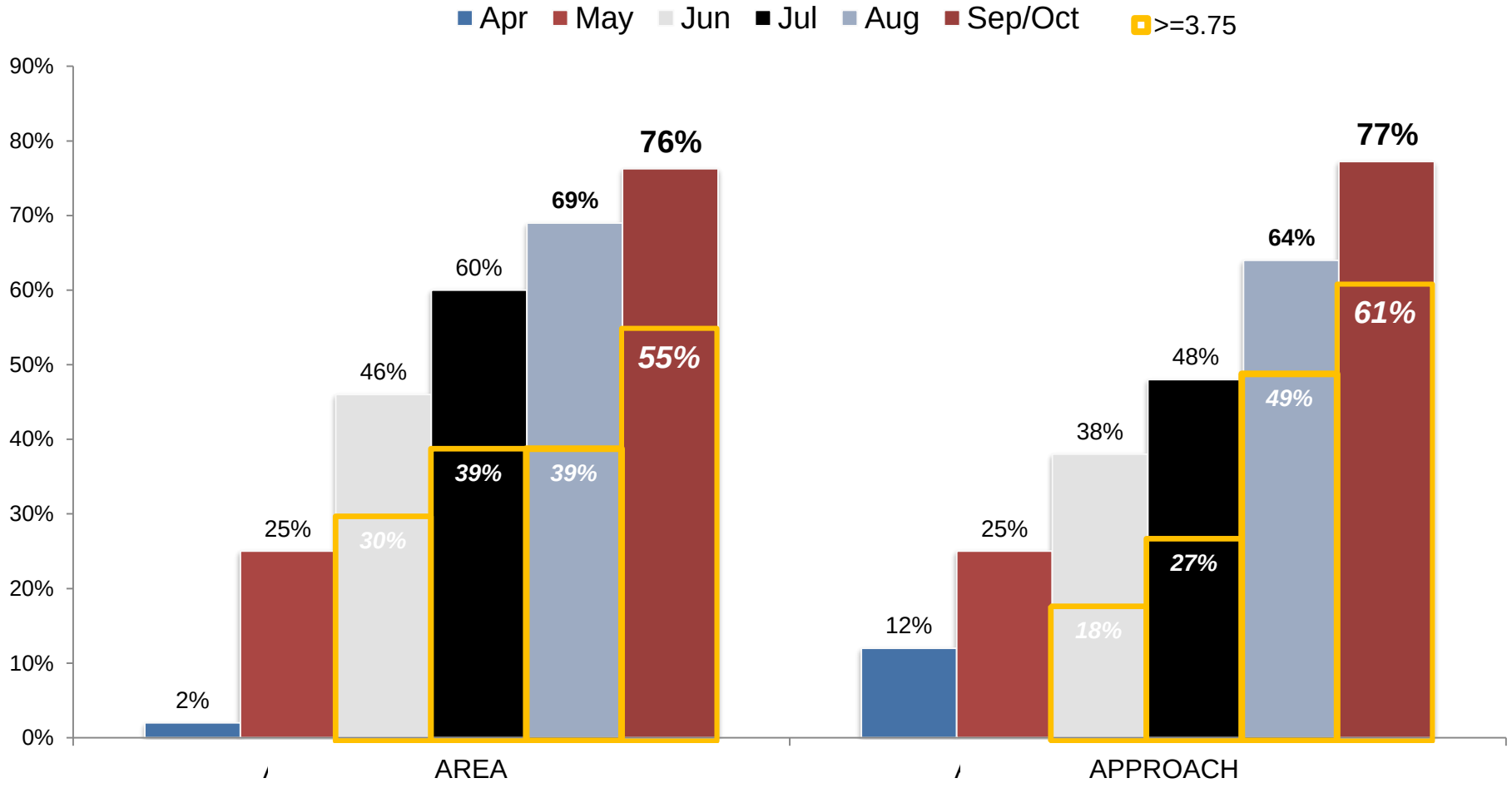
Structure of survey

The ATCO Operational Readiness Survey comprises of 3 sections.

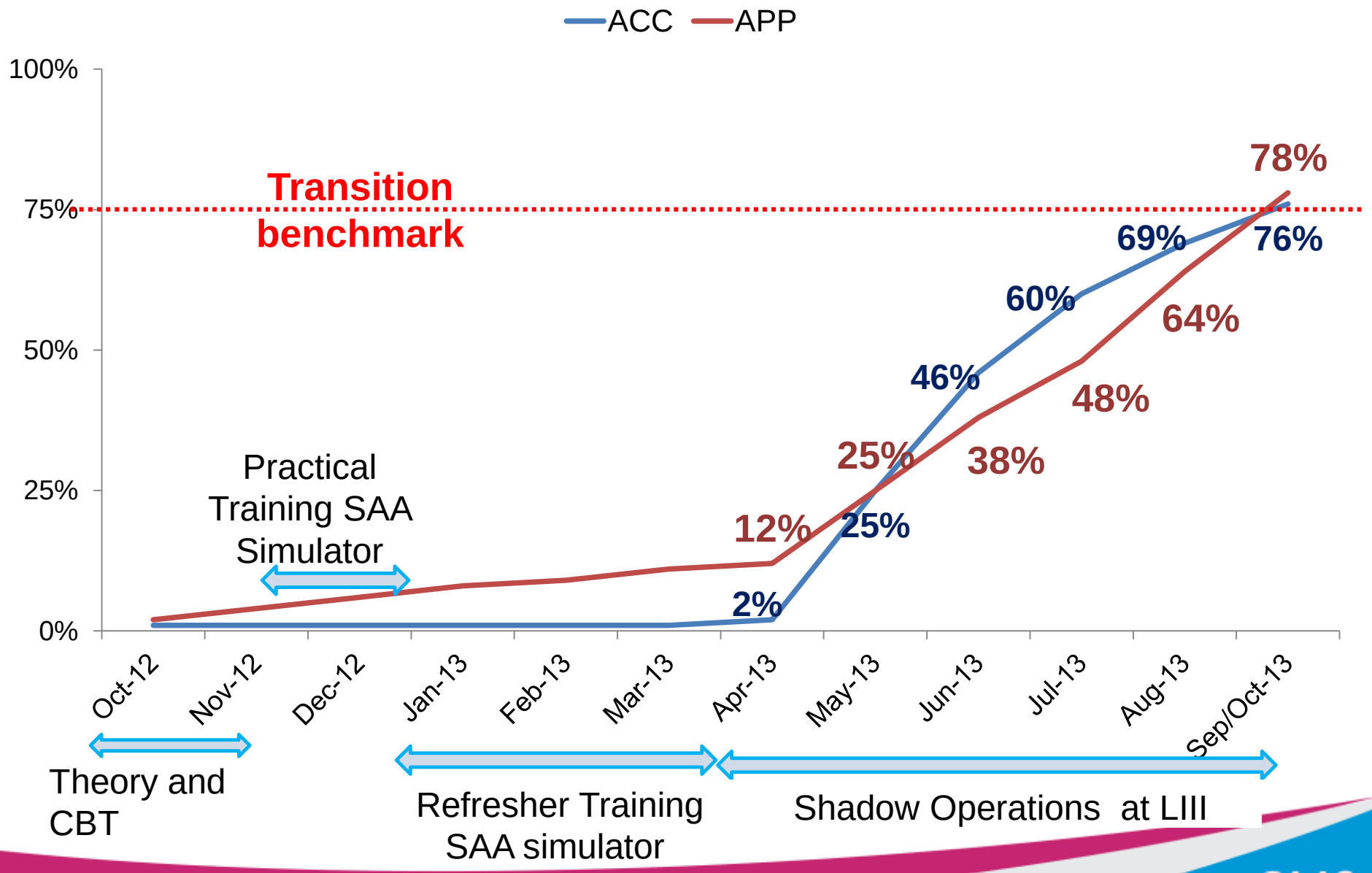
- The **first section** covers the six competencies based on ATC functional tasks that are used to assess ATCO on-the-job training, e.g. coordination, control judgement, equipment handling
- The **second section** seeks to solicit the respondent's self grading to serve as a balance against the six competencies.

  Qn. How would you rate your current competency level on LORADS 3 mode of operation?
- The **third section** is the feedback portion where respondents are given the opportunity to share and comment on the experiences during shadow operations at LORADS III

Percentage of ATCOs above Operation Readiness Benchmark (3.50)



Progress of ATCO operational readiness



(5) Criteria and Decision for Cut-Over

The cut-over date of **16 Oct 2013** to LORADS III was decided based on the following criteria:

- All technical testing has been successfully completed
- All ATCOs, ATCSOs and technical staff training have been completed
- ATC and maintenance operational staff were ready and confident to use new system
- Contingency plans were in place
- Completion of safety case
- Sufficient manpower to implement cut-over and back-up plans

(5) Criteria and Decision for Cut-Over

- Decision points for Cut-Over
  - Achieved the desired ATCO's competence/confidence levels
  - Must-have LIII system functionalities/corrections completed
  - Acceptance of Safety Case Assessment
- Cut-over successfully effected on 16 October 13
- Shadow operations in LII (originally planned for 3 months) was scaled down once ascertained that LORADS III is stable and functioning well.
  - LORADS II kept in warm readiness
  - LORADS II was de-comissioned on 1 April 2014

(6) Cut-Over Contingency Plans

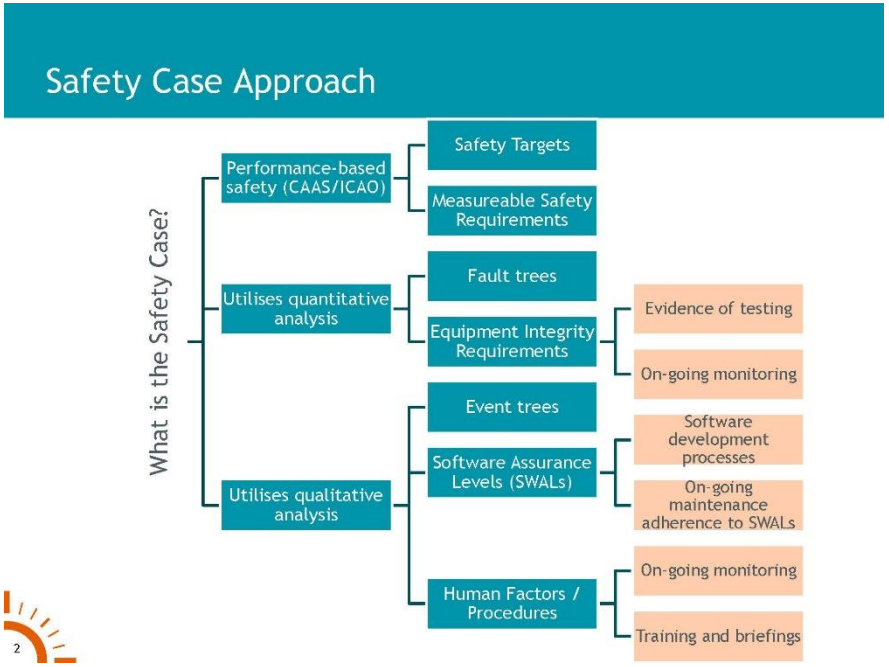
Date	Mode of ops	1st Layer Back-up	2nd Layer Back-up
16 Oct 2013	LIII main, LII full shadow	LIII IBU, if major failure revert to SATCC LII*	SATCC LORADS II if LORADS III IBU fails
Oct to Dec 2013	LIII main, LII skeletal shadow	LIII IBU, if major failure revert to SATCC LII*	SATCC LORADS II if SATCC LORADS III IBU fails
Jan 2014 to Mar 2014	LIII main, LII in warm standby but no shadow	LIII IBU	Operate from either SATCC LORADS III ACC or APP centres
1 Apr 2014 onwards	LIII only (LII decommisioned)	LIII IBU	Full LORADS III Contingency plans activated. Operate from either SATCC LORADS III ACC or APP centres .

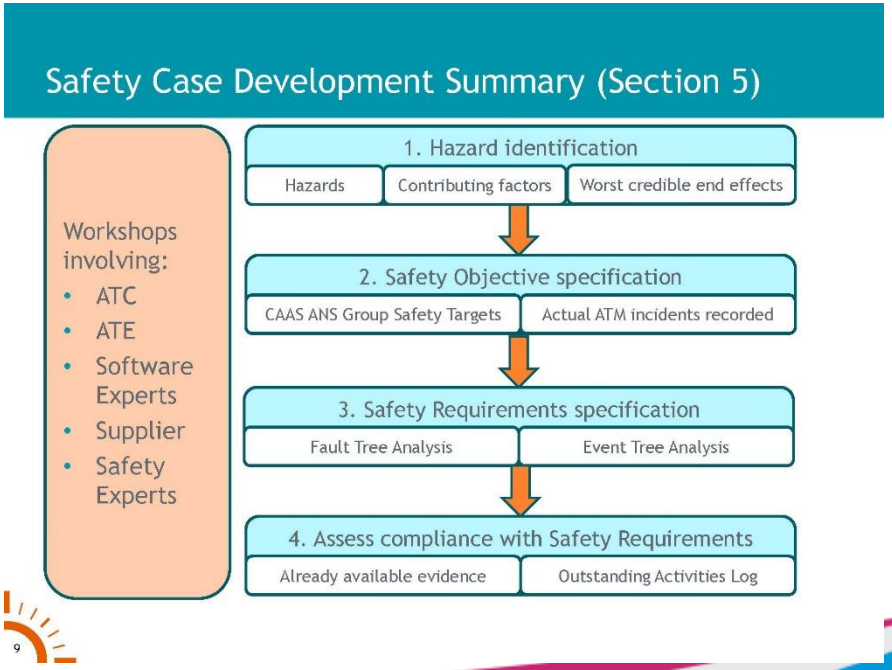
(7) LIII Regulatory Approval

- Regulator's Requirement for Introducing new Safety Critical Systems:-
  - A Safety Case must be performed when commissioning a critical system.
  - What is a "Safety Case":
    - ✓ A structure and comprehensive analysis and documentation of the ***safety objectives***, ***safety risk assessment*** and ***risk management*** of a system.
    - ✓ Starting from the definition of the operational requirement to the commissioning and commencement of operation of the system.
    - ✓ Involves the identification of all the hazards associated with the system that provides the operational service, risk assessment of the hazards and the establishment of the necessary controls to ensure that risks are managed.

LIII Regulatory Approval

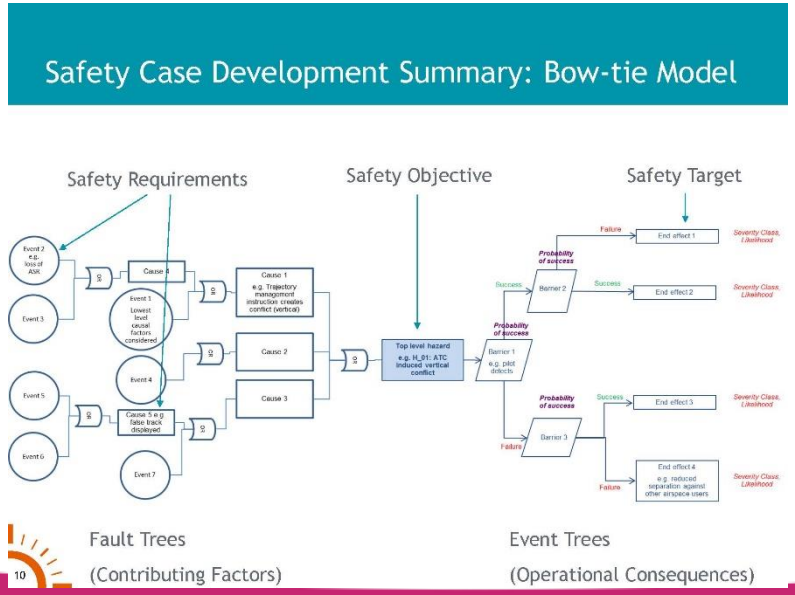
- LORADS III ATC System Safety Case:
  - Holistic review of transition from LORADS II to LORADS III
  - Covered new ATC system requirements, the readiness of human (i.e. ATCO, ATCSO and technical staff) as well as new procedures.

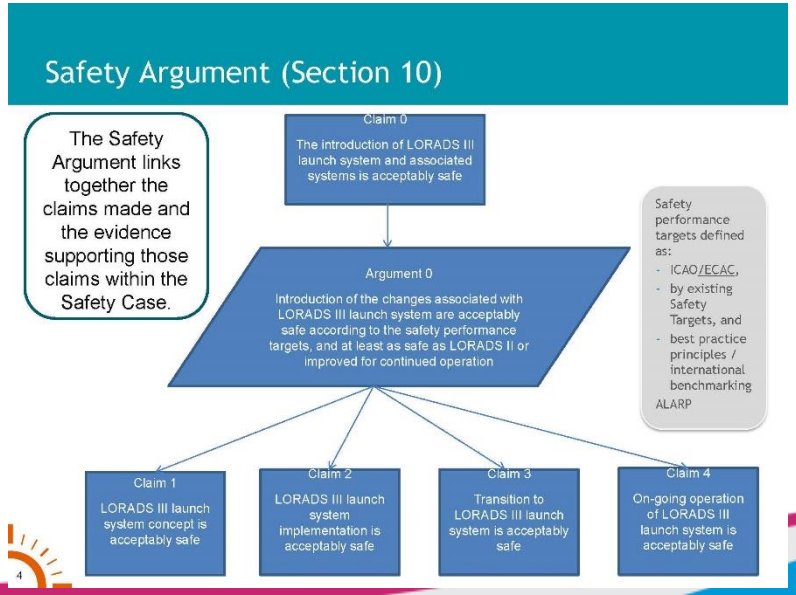




LIII Regulatory Approval

- Engaged External Safety Consultant, **Helios**, to prepare the Safety Case Report with CAAS stakeholders
- Adopted a Bowtie risk analysis method:
  - Identifying the associated hazards
  - Assessing the risks involved
  - Establishing the necessary controls to manage the risks





LIII Regulatory Approval

LORADS III Safety Case Report submitted to the Regulator for acceptance before commencement of operations

AA/CNS/G1

14 October 2013

D(ATE) 22/10/13

ACCEPTANCE OF LORADS III SAFETY CASE

I refer to the LORADS III Safety Case submitted by ATE Division on 6 June 2013, which we have conditionally accepted on 5 July 2013 pending completion of all Outstanding Activities Log (OAL).

2 Further to the conditional acceptance of the safety case, we have received the status of completion and supporting evidence of the OAL on 14 October. Based on the supporting evidence submitted, 50 of the 51 OAL have been completed. The alternate means of compliance proposed for the outstanding item, which is to use Thales engineers to standby at SATCC to respond to any software contingencies until ST Electronics software engineers are ready, is acceptable.

3 In view of the above, AAR hereby accepts the LORADS III safety case with effect from 14 October 2013.

ALAN FOO
D(SPL)/D(AAR)

Lessons Learnt

Civil Aviation Authority of Singapore

LIII – some lessons learnt

- Operational Requirements
  - Risks of new development (as compared to off-the-self)
    - ✓ Needs much closer monitoring of development
    - ✓ More resources for project monitoring
    - ✓ Ensure sufficient resources to keep up with documentation changes
- Manpower
  - Training
    - ✓ Supplement with CBT
    - ✓ Ensuring currency of training
  - Transition
    - ✓ Manpower
      - ✓ Leave curtailment
    - ✓ Determination of essential functionalities for cut-over
    - ✓ Develop methods to determine transition readiness
    - ✓ Regulatory approval

Thank you

Civil Aviation Authority of Singapore