ECA Position Paper

Remote Tower Services

Remote Tower Services (RTS) is a new concept where the air traffic service at an airport is performed remotely, i.e. somewhere else than in the local control tower. Over the coming decade, this concept is likely to develop further, to gain maturity, and to gradually spread within the industry. This paper outlines the European pilots' perspective and position on RTS. ECA accepts the development of RTS that meet an equivalent level of safety or increase the safety of flight operations subject to a number of conditions, which are explained below.

CONCEPT

The concept of Remote Tower Services (RTS), also referred to as Remote and Virtual Tower, is being studied in the context of the Single European Sky Air Traffic Management Research Programme (SESAR) in Europe, as well as in other countries such as the United States ("Blended Airspace" in NextGen) and Australia, while it is already operational to a certain service level in countries such as Japan.

ICAO is assessing the concept with regard to the need to update ICAO regulations and it is included in ASBU module B1-81. Work on new/updated provisions is expected to start not before 2016 and might take place in the ATMOPS panel, pending agreement by the Air Navigation Commission.

Modes of Operation

For many years, visual observation of traffic in the pattern and on ground from a local air traffic control tower was the single means of observing and separating traffic at airports worldwide. With the appearance of radar and new surveillance systems for airborne and ground movements, as well as an ever-increasing size of airports, camera and ground-surveillance systems have been installed in accordance with ICAO DOC 4444. Nevertheless, ICAO procedures still regard visual observation has the method of choice whenever possible.

As the concept of Remote Tower Services was being researched, it became clear that it would differ fundamentally from traditional modes of tower operation. Cameras and sensors could be placed anywhere on the field, and not just in one location, and air traffic controllers would be presented a virtual picture of reality, enhanced by a number of gadgets. While some manufacturers favour a rather real presentation of the outside world, others would present only infrared images to controllers. Therefore a distinction has to be made between Remote Tower Services displaying a real-life picture that is possibly enhanced by some gadgets and Virtual Towers that partially or completely display an artificial picture.

In the concept as outlined by SESAR, radar coverage and radar separation are vital. This means that new separation methods might be necessary. Airspace design might have to be reviewed to take the necessity of transponder carriage into account. Also, there is neither provision on charting requirements nor flight procedures for RTS.

As the current ICAO provisions are clearly out-dated in regard to RTS, there is an urgent need for globally accepted SARPS, common definitions and procedures.

Common standards and recommended practices, definitions and procedures shall be developed covering flight procedures, separation standards and minimum requirements of systems and sensors among others.

The RTS concept can be applied to airports of all sizes and kinds of locations. While initially meant for remotely located airports (e.g. in Scandinavia or the Australian Outback), plans are now under way to use it for medium-sized airports alike and as contingency measure for major airports or for apron control only. The concept splits up into three sections:

- **Single Remote Tower**
  - One air traffic controller is responsible for operations at one airport at a time. Yet, he/she might hold multiple ratings to control different airports, one after the other.
- **Multiple Remote Tower**
  - One air traffic controller is responsible for operations at more than one airport at the same time. This requires multiple ratings for each controller and careful staffing schedules. This concept is completely new compared to current operations.
- **Contingency Tower**
  - A contingency facility to be used when an airport tower is unserviceable for a short period of time (e.g. fire, technical failure). Remote Tower operation will then assure at least a basic level of service.

Remote Towers can be operated from a **Remote Tower Centre (RTC)** that can be located anywhere, but is usually planned to be at a reasonable distance from all the airports to be controlled in order to reduce latency of signals and increase technical reliability.

Benefits

While the conventional concept of operating an ATC tower is proven to be safe in current day-to-day operations, the deployment of RTS does have potential safety benefits.

Smaller airfields currently only receiving Aerodrome Flight Information Service (AFIS) might be upgraded to fully controlled airfields. Other airports facing cutbacks due to low number of flight movements might still be able to provide ATS services, even if only for a limited time per day. The same is true for areas where destroyed infrastructure (e.g. after a fire) or an unstable safety situation (e.g. war zones) requires the quick set-up and operation of a control facility.

Modern RTS concepts include a number of tracking features. Aircraft position can be followed easily with a label attached next to the tracked target on the controller's out-the-window screen, giving information on the call sign, altitude, and distance among others. Ground staff and vehicles can be tracked, as well as birds and other animals or human intruders. Runway incursions can be automatically detected.

Whilst increasing the alertness of the controller, care has to be taken as not to overload the controller with too much information, leading to a situation where controllers develop a certain alarm-fatigue due to constant inputs. Task coordination needs to be carefully assessed, as controllers will probably spend more time "head-down", concentrating on managing the systems (e.g. electronic flight strips) instead of actually watching movements.
The opposite may also be true at airports with very few movements, when performance of controllers and stimulation levels increase due to optimal workload distribution (Yerkes-Dodson law).

The increased possibilities of presenting multiple data inputs are likely to lead to enhanced visual reproduction, especially during twilight and night, as well as bad weather. The use of infrared cameras allows for weather assessment and target detection even during complete darkness.

The idea of a remote contingency tower providing at least some level of service or the same service at a decreased movement rate is safety-wise beneficial compared to having to close an airport completely.

Having multiple controllers present in the same RTC might also lead to better coordination between ATS units.

AREAS OF CONCERN

Contingency measures at conventional towers include the use of handheld transmitters or light-guns, as well as signal rockets. Should the tower building become unusable, contingency operations could easily continue from a nearby location with the above-mentioned means, at least at small and medium-sized airports. This is different for RTS, where no controller is located at the airport itself. While data transmissions can be backed-up by a second system or other measures, the impact of hardware failures might be fatal for operations. Cases have been reported, where bugs sat on the camera blocking the view. The outage of a camera or a display at the controller working position (CWP) covering essential parts of the airport area or traffic circuit are likely to happen at some stage.

Adequate contingency procedures in case of hardware malfunctions (e.g. camera, controller working positions) and system downgrades shall be in place.

Cyber-security has become an increasing source of concern within the aviation community and remote tower operations have the potential to increase the vulnerabilities of the system given the very nature of the concept. Precautionary measures and contingency procedures shall be established to prevent an attack, and to minimise its consequences. ANSPs and aircraft operators shall establish a mandatory reporting system for cyber-related occurrences, and cyber security shall become an essential part of their security management system.

All aircraft systems, on-ground systems/networks and data transfers between aircraft and ground shall be protected from hacking, data manipulation and viruses.

Traffic separation, especially for VFR flights is usually based on visual observation in conventional towers. Displays at RTS CWPs do not allow for visual evaluation of airborne aircraft positions. This is why the usage or radar data appears to be essential for RTS operation. This in turn might necessitate the need for transponder carriage by aircraft intending to use that airport. It has to be evaluated how far adjustments to current airspace design and specifications are necessary, e.g. mandating the use of transponders for all aircraft. General aviation aircraft are likely to be affected by revised rules.

From a pilot's point of view there should be no changes to current operations. Yet, it might be necessary to revise communication procedures and charting requirements. Especially in a Multiple RTS environment, the re-transmit function that allows users to listen to radiotelephony on multiple frequencies might be a feature to ensure safe operations. Mentioning the airport's name in clearance (e.g. cleared to land runway 20 Dresden) might be another option of avoiding misunderstandings.

Communication procedures and regulations for airspace design around RTS airports (e.g. transponder mandatory zones) shall be evaluated and changed where necessary.

Coordination between airspace users and ANSPs will have to be increased to accommodate all aircraft movements, be they planned or unplanned. As in today's ATC environment, staff shortages may happen. While this is usually a problem in the en-route part of flights today, availability of tower controllers might be the limiting factor in RTS operations, with not enough staff available to cater for all flights. Unexpected flights such as VFR traffic or flights that have to land due to emergencies or diversions might push the remotely controlled tower even further beyond capacity. While slot allocations or per-prior-request-only operations might counteract such problems, there is a clear shift of responsibility for safety from ANSPs to pilots and operators. It is not acceptable that unavailability of tower controllers leads to hazardous situations.

Holding patterns, diversions or hazardous situations due to ATC staff shortages shall be avoided.

It is air traffic controllers who nowadays often do weather assessment and the evaluation of the runway surfaces status. In case of RTS operations these would have to be performed by dedicated staff or adequate systems and sensors. It is also questionable how far weather assessment can be done by RTS controllers when being presented with a compressed or limited view of the airport. The quality of reports must not be lower than in today's environment.

Ensure that real-time weather data and runway surface status is accurately assessed and transmitted to pilots.

The concept of RTS fundamentally changes the working environment of tower controllers and different procedures and techniques have to be used. This is especially true for Multiple Tower operations. While research has shown that the concept can generally work, not all implications on daily operations are yet fully understood. It would be advisable to first evaluate experience of prolonged live Single RTS, before establishing Multiple RTS. There are currently no long-time studies on how human performance is affected in Remote Tower operations and current results indicate that there are certain limitations for humans with regards to working in an RTS environment.

Nowadays only few air traffic controllers hold ratings for more than one tower and it is highly unlikely that these would be exercised in a single shift. In Multiple RTS controllers might be required to work at airports with completely different or very similar layouts and weather patterns. Both can lead to a fragmented situational awareness, causing misunderstandings, mix-ups and other working errors, thus having the potential to significantly decrease the safety of operations. Competency of controllers to evaluate the situation at a specific airport might also decrease with increased workload and numerous distractions. Studies have shown that head-down time increases in a Multiple RTS environment. Other factors like usage of a common frequency or aligning procedures and airport markings have not been studied yet.

ECA does not support the implementation of Multiple RTS, until sufficient experience with Single RTS has been gained and until human factors and technical implications have been thoroughly researched and are adequately mitigated to ensure safe ATC operations.

The technology of RTS will afford providers the ability to offer RTS across state borders. This will open opportunities for providers to seek a different regulatory environment to that of the state where the aerodrome is based. In a competitive market, this risks to open the door to ‘regulatory forum shopping’ where providers may seek a forum with more lenient and commercially expedient regulatory (including social and taxation) regimes. This could leave some RTS providers with less oversight and regulation than others, distort the market between RTS and normal on-site staffed aerodromes, and expose ATS staff to the risk of casualised employment relationships with the attendant possible degradation in safety culture.

ECA does not support the implementation of cross-border RTS service, until a legal EU framework is in place to effectively prevent regulatory forum shopping and market distortion.

EUROPEAN COCKPIT ASSOCIATION POSITION

Taking into consideration all relevant factors towards the establishment and operation of Remote Tower Services (RTS), the European Cockpit Association's position to RTS is:

- **ECA accepts the development of RTS that meet an equivalent level of safety or increase the safety of flight operations subject to a number of conditions:**
    - **Common standards and recommended practices, definitions and procedures are developed covering flight procedures, separation standards and minimum requirements of systems and sensors among others.**
    - **Risks in regards to RTS are being studied and solved. These including the following aspects (in no particular order):**
        - Adequate contingency procedures in case of hardware malfunctions (e.g. cameras, controller working positions) and system downgrades shall be in place;
        - All aircraft systems, on-ground systems/networks and data transfers between aircraft and ground shall be protected from hacking, data manipulation and viruses.
        - Communication procedures and regulations for airspace design around RTS airports (e.g. transponder mandatory zones) shall be evaluated and changed where necessary;
        - Avoiding holding patterns, diversions or hazardous situations due to ATC staff shortages;
        - Ensuring that real-time weather data and runway surface status is accurately assessed and transmitted to pilots;
- **ECA does not support the implementation of Multiple RTS until sufficient experience with Single RTS has been gained and until human factors and technical implications have been thoroughly researched and are adequately mitigated to ensure safe ATC operations.**
- **ECA does not support the implementation of cross-border RTS service, until a legal EU framework is in place to effectively prevent regulatory forum shopping and market distortion.**

APPENDIX 1 – Current ICAO provisions relating to RTS

ICAO is assessing the concept with regard to the need to update ICAO provisions, and it is included in ASBU module B1-81.

The following recommendations are found in a working paper from ANC 2012 presented by the European Union and its Member States, by the other Members States of the European Civil Aviation Conference and by EUROCONTROL:

b) Request ICAO to urgently initiate the necessary actions to update ICAO provisions to
provide for:
1) Requirements for the use of sensors, and display technologies to replace visual observation of traffic in the provision of Air Traffic Control and Flight Information Services;
2) Additional requirements for surveillance and ground/ground communications systems
to adapt to the above;
3) New operational procedures, where relevant, both at the remote ATC facility and on the
airborne side; and
4) New requirements for ATCO/pilot training and eventually licencing if necessary.

ICAO ANNEX 2 Rules of the Air, Tenth Edition

3.6 Air traffic control services

3.6.5 Communications

3.6.5.1
An aircraft operated as a controlled flight shall maintain continuous air-ground voice communication watch on the appropriate communication channel of, and establish two-way communication as necessary with, the appropriate air traffic control unit, except as may be prescribed by the appropriate ATS authority in respect of aircraft forming part of aerodrome traffic at a controlled aerodrome.

Note 1.— SELCAL or similar automatic signalling devices satisfy the requirement to maintain an air-ground voice communication watch.
Note 2.— The requirement for an aircraft to maintain an air-ground voice communication watch remains in effect after CPDLC has been established.

3.6.5.2 Communication failure
If a communication failure precludes compliance with 3.6.5.1, the aircraft shall comply with the voice communication failure procedures of Annex 10, Volume II, and with such of the following procedures as are appropriate. The aircraft shall attempt to establish communications with the appropriate air traffic control unit using all other available means. In addition, the aircraft, when forming part of the aerodrome traffic at a controlled aerodrome, shall keep a watch for such instructions as may be issued by visual signals.

Visual signals for aerodrome traffic may be found in Annex 2, Appendix 1, 4.1

ICAO DOC 4444 PANS-ATM, Edition 15

7.1 FUNCTIONS OF AERODROME CONTROL TOWERS

7.1.1.1

Aerodrome control towers shall issue information and clearances to aircraft under their control to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of preventing collision(s) between:

a) aircraft flying within the designated area of responsibility of the control tower, including the aerodrome traffic circuits;
b) aircraft operating on the manoeuvring area;
c) aircraft landing and taking off;
d) aircraft and vehicles operating on the manoeuvring area;
e) aircraft on the manoeuvring area and obstructions on that area.

7.1.1.2

Aerodrome controllers shall maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome as well as vehicles and personnel on the manoeuvring area. Watch shall be maintained by visual observation, augmented in low visibility conditions by an ATS surveillance system when available. Traffic shall be controlled in accordance with the procedures set forth herein and all applicable traffic rules specified by the appropriate ATS authority. If there are other aerodromes within a control zone, traffic at all aerodromes within such a zone shall be coordinated so that traffic circuits do not conflict.

7.1.1.4

Where parallel or near-parallel runways are used for simultaneous operations, individual aerodrome controllers should be responsible for operations on each of the runways.

7.3 INITIAL CALL TO AERODROME CONTROL TOWER

For aircraft being provided with aerodrome control service, the initial call shall contain:

a) designation of the station being called;
b) call sign and, for aircraft in the heavy wake turbulence category, the word “Heavy”;
c) position; and
d) additional elements, as required by the appropriate ATS authority.

Note.— See also Chapter 4, 4.11.3.1, for aircraft in the air, making the first call to the aerodrome tower.

8.6.9 Information regarding adverse weather

8.6.9.1

Information that an aircraft appears likely to penetrate an area of adverse weather should be issued in sufficient time to permit the pilot to decide on an appropriate course of action, including that of requesting advice on how best to circumnavigate the adverse weather area, if so desired.

8.10 USE OF ATS SURVEILLANCE SYSTEMS IN THE AERODROME CONTROL

SERVICE

8.10.1 Functions

8.10.1.1

When authorized by and subject to conditions prescribed by the appropriate ATS authority, ATS surveillance systems may be used in the provision of aerodrome control service to perform the following functions:

a) flight path monitoring of aircraft on final approach;

b) flight path monitoring of other aircraft in the vicinity of the aerodrome;

c) establishing separation specified in 8.7.3 between succeeding departing aircraft; and

d) providing navigation assistance to VFR flights.

8.10.1.2

Special VFR flights shall not be vectored unless special circumstances, such as emergencies, dictate otherwise.

8.10.1.3

Caution shall be exercised when vectoring VFR flights so as to ensure that the aircraft concerned does not inadvertently enter instrument meteorological conditions.

8.10.1.4

In prescribing conditions and procedures for the use of ATS surveillance systems in the provision of aerodrome control service, the appropriate ATS authority shall ensure that the availability and use of an ATS surveillance system will not be detrimental to visual observation of aerodrome traffic.
Note.— Control of aerodrome traffic is in the main based on visual observation of the manoeuvring area and the vicinity of the aerodrome by the aerodrome controller.

8.10.2 Use of ATS surveillance systems for surface movement control

8.10.2.2.1

SMR should be used to augment visual observation of traffic on the manoeuvring area and to provide surveillance of traffic on those parts of the manoeuvring area which cannot be observed visually.

8.10.2.3 IDENTIFICATION OF AIRCRAFT

Where an ATS surveillance system is used, aircraft may be identified by one or more of the following procedures:

a) by correlating a particular position indication with:

   i) an aircraft position visually observed by the controller;

   ii) an aircraft position reported by the pilot; or

   iii) an identified position indication displayed on a situation display;

b) by transfer of identification when authorized by the appropriate ATS authority; and
c) by automated identification procedures when authorized by the appropriate ATS authority.

8.11 USE OF ATS SURVEILLANCE SYSTEMS IN THE FLIGHT INFORMATION SERVICE

Note.— The use of an ATS surveillance system in the provision of flight information service does not relieve the pilot-in-command of an aircraft of any responsibilities, including the final decision regarding any suggested alteration of the flight plan.

ICAO DOC 7030 PANS-ATM, Edition 15

EUR 6-5.6 Advanced surface movement guidance and control systems (A-SMGCS)

6.5.6.2 A-SMGCS functions

6.5.6.2.1

When authorised by and subject to conditions prescribed by the appropriate ATS authority, the information provided on an A-SMGCS display may be used for the purpose of:

a) determining the location of aircraft on the movement area and vehicles on the manoeuvring area;
Note.— Where visual observation by the aerodrome controller is not possible, or whenever deemed beneficial by the aerodrome controller, the information provided by A-SMGCS may be used to replace visual observation.
b) monitoring aircraft and vehicles on the manoeuvring area for compliance with clearances and instructions;
c) determining that a runway is clear of traffic or assisting in the assessment that a runway will be clear of traffic prior to a landing or take-off;
d) providing information on essential local traffic on or near the manoeuvring area;
e) providing directional taxi information to aircraft when requested by the pilot or deemed necessary by the controller. Such information should not be issued in the form of specific heading instructions (except in special circumstances, e.g. emergencies); and
f) providing assistance and advice to emergency vehicles.

APPENDIX 2 – Current IFALPA policy on Remote Tower

7.1. X Remote Aerodrome Control

(Note: There is no current ICAO text available on this subject)

Aerodrome Control requires the establishment of controlled airspace (Control Zone) of adequate classification – Class C for air transport operations (IFALPA Annex 11 Policy – para 2.6.2 refers);

Changes to operational procedures should be implemented only if appropriate Safety Assessments as required by ICAO Annex 11 para 2.27 and ICAO Doc 4444 PANS-ATM para 2.6.1. have been carried out successfully, addressing, in particular, but being not limited to

- Effects of loss of human redundancy, in particular related to visual observation of the manoeuvring area,
- Recognition of and reaction to possible accidents, and
- Definition of the need for appropriate tools to mitigate some of these risks, for example A-SMGCS and / or surface radar.

An acceptable system to support the operation of an Aerodrome Control Service from a location remote from the aerodrome requires that all of the services normally provided by a local tower controller be made available by other means.

In detail, these requirements include but are not limited to:

• detection of passive and active targets anywhere within the aerodrome boundary
• detection of foreign objects of defined minimum properties anywhere on the movement area
• detection of ground targets of defined minimum properties to a specified distance beyond the threshold(s)
• detection of airborne targets of defined minimum properties to a specified distance beyond the aerodrome boundary
• imminent runway intrusion detection and alerting for passive and active targets
• imminent collision detection and alerting for passive and active targets
• real-time weather observation and reporting at least as timely, accurate and comprehensive as a human controller
• real-time runway surface condition observation and reporting at least as timely, accurate and comprehensive as a human controller

APPENDIX 3 – Current IFATCA policy on Remote Tower

VISUAL OBSERVATION & NEW AERODROME CONTROL TOWER CONCEPTS

IFATCA policy is:

Visual observation in ATM is defined as: Observation through direct eyesight of objects situated within the line of sight of the observer possibly enhanced by binoculars.

Resolution B10 – WP85 – Kathmandu 2012

An Aerodrome Control Tower is a unit established to provide air traffic control service to aerodrome traffic. The tower cab shall be constructed as to provide aerodrome controllers the capability to maintain a continuous watch on all flight operations on and in the vicinity of the aerodrome as well as vehicles and personnel on the manoeuvring area. Watch shall be maintained by visual observation, augmented by radar or other approved surveillance systems when available.

Before any Aerodrome Control Service Concept can be endorsed by IFATCA, the following requirements shall be met:

The controller shall be provided with at least the same level of surveillance as currently provided by visual observation;
The introduction of Aerodrome Control Service Concepts shall be subject to a full safety analysis and relevant safety levels shall be met;
Contingency procedures shall be in place;
Controllers shall be involved in the development of Aerodrome Control Service Concepts.

WP 87 – Istanbul 2007

Policy concluded at 53th IFATCA Annual Conference 2014 to be included in the IFATCA Technical and Professional Manual:

ATCOs shall not be expected to provide a Remote and Virtual tower service for more than one aerodrome simultaneously.

Separation standards and procedures for Remote and Virtual Towers shall be developed or adapted and implemented based on a robust safety case and the demonstrated capabilities of the system.

Standards, procedures and guidance for Remote and Virtual Towers are required.

This includes an action item:

It is recommended that:

The Executive Board urge ICAO to develop standards, procedures and guidance for Remote and Virtual Towers.

APPENDIX 4 – Detailed list of possible benefits and areas of concern

Benefits

Increased safety

- Ability to provide higher service levels to airports, where it is currently impractical or not cost-effective to have a staffed tower (e.g. previously non-controlled or AFIS-only airport now under full ATS control or visual observation.
- Ability to continue to provides ATS services instead of having to cut down on service levels due to cost or staff issues
- Temporary installation of a tower for short- or medium-term usage
- Modern equipment could help controllers to better judge a situation and provide more accurate data (e.g. moving marker on screen with the aircraft itself not being visible, radar label showing aircraft altitude and distance)
- Possibility to track aircraft in the vicinity of an airfield or on the ground
- Possibility to track ground vehicles, objects or intruders and automatically detect runway incursions
- Possible enhancement of visual reproduction during low-light, night and bad weather, especially in conjunction with infra-red cameras
- Availability of extra staff to control a tower during normal ops or emergencies
- Contingency Tower operation in case of emergencies at original tower, allowing continuous operation of an airport (although with lower capacity)
- In Multiple RTS fewer phases of very low workload at smaller airports might lead to better performance and stimulation levels of controllers (see Yerkes-Dodson law)
- Integration of several ATS stations in one facility could lead to better coordination between them

Reduced cost

- Staffing costs could be decreased by making better use of work schedules, productivity and not having to locate staff to remote locations
- More efficient use of infrastructure (no tower buildings, one centralised facility, universal controller work stations...)

Modern Technology

- Integration in other ATM networks/systems (e.g. European SWIM project)
- Standardised controller working position (CWP)

Areas of Concern

Regulations

- No definitions of what a Remote Tower is and no standards and recommended practices for operation of RTS (e.g. PANS-ATM and Annex 10). This also includes the review of separation standards.

- Definitions of requirements for different service levels.
- ICAO currently regards visual observation as main mean for providing separation, only augmented by surveillance equipment in low visibility conditions – is RTS visual observation?
- Standardisation with other ATM system/networks (e.g. SWIM) is needed.
- A safety assessment according ICAO Annex 11 para 2.27 and ICAO Doc 4444 PANS-ATM para 2.6.1 should be carried out (see IFALPA policy).
- When parallel or near-parallel runways are used for simultaneous operations, each runway should be controlled by an individual controller → Multiple RTS with parallel or near-parallel runways opposes to that
- Phraseology needs to be developed/regulated, e.g. mentioning the airport name with a clearance. In how far should pilots be informed that they are flying to a remotely controlled airfield? Communication failures (back-up, addressed to inbound aircraft)
- Information on weather should be issued in sufficient time to allow for a flight path deviation. There is a risk that this requirement cannot be fulfilled in set-ups with a limited/compressed view only. Weather radar or the presence of meteorologist could mitigate this risk.
- The appropriate ATS authority shall ensure that the availability and use of an ATS surveillance system (radar, e-strip tool) will not be detrimental to visual observation of aerodrome traffic.
- Surface Movement Radar (SMR) should only augment visual observation of the manoeuvring area, but may provide surveillance of traffic on those parts of the manoeuvring area which cannot be observed visually → is that a justification for the sole use of RTS?
- Airspace around airports might have to be changed (e.g. TMZ), potentially posing limitations for General Aviation users

INFRASTRUCTURE/EQUIPMENT/CWP

- In case of system malfunctions or system downgrades, as well as emergency situations inside the RTC there is a danger that numerous airports become unserviceable immediately with no possible back up (such as ALDIS signal lamps and handheld transceivers).
- Due to the arrangement of cameras and screens, the view presented to controllers is often distorted and compressed - it should be as undistorted as possible.
- Runway thresholds might be difficult to see due to image presentation. These are highly sensitive area (e.g. runway incursions, short landings, overrun) and shall be clearly visible
- 360° view should be available. This is especially the case when no meteorologist is at the field and weather assessment is done by the ATCO or when aircraft without transponder fly in the vicinity of the field (also take into account failures of transponder or ground-based tracking installations).
- Binocular replacement shall be available
- Light-gun or signal rockets shall be available at the airfield
- Birds in the vicinity or near the runway need to be detected by surveillance equipment, as visual observation is mostly impossible. Difficulties exist in differentiating between birds, ground vehicles and other targets.
- The use of satellite data transmission should be avoided in higher latitudes due to influence of space weather on equipment and signals.

- The re-Transmit function could be used to allow pilots to listen to multiple airports at the same time, however it is not clear how that will affect performance and safety.

PROCEDURES/HUMAN PERFORMANCE

- Loss of three-dimensional visual perception due to two-dimensional presentation, leads to inability of separating traffic in the circuit visually.
- Holding patterns because of staff shortages are likely at some stage, most likely also on short notice. Operational risk is shifted towards the operator and pilots! This is especially critical in times in which airlines try to reduce fuel and demand pilots to take as little extra fuel as possible.
- Define the amount of traffic/movements one controller can handle simultaneously at one or multiple aerodromes.
- High stress levels need to be avoided so that ATCOs will not be overwhelmed by the amount of work as this might lead to confusion, misunderstandings and errors. Careful staffing and back-up options must be available.
- Transition to a computer workstation means certain limitations in human performance that need to be taken into account when staffing the stations (e.g. limited time of working hours in a row, increased workload, working environment), similar to ATC Centres nowadays.
- Risk of “alarm”-fatigue” due to nuisance and false alerts, leading to less frequent and slower alarm response by ATCOs.
- With around 75-80% of aircraft accidents being related to human error, Multiple RTS is especially prone to error. Due to a fragmented situational awareness compared to the mental picture when working at one airport only and the potential for significant differences in factors such as weather between the aerodromes, Multiple RTS operation may negatively affect the controllers’ performance and lead to safety hazards.
- In Multiple RTS ATCOs should be expected to perform ATS services only. Other services, such as determining weather conditions or coordination with ground operations should be done by a meteorologist at the field or supervisor.
- Currently there is no definition of maximum number of ratings that can be held by a single controller. There is no experience with multiple ratings exercised at different airports simultaneously. CWPs and procedures at different airports will likely have to be aligned in order to reduce the likelihood of misunderstandings and working errors.
- Ground-staff will still be required at the airfield to maintain equipment or perform weather observation and must be readily available

Table of contents

* * *