EGHD Expert Group on the Human Dimension of the Single European Sky

December 2017
Issue 2

Position Paper

The Human Dimension in Remote Tower Operations

1. Overview

This position paper reviews the human dimension associated with Remote Tower Operations (RTO) to identify principles and recommendations for the European Commission (EC) to ensure the human dimension is appropriately considered in future deployments.

Application of these recommendations should facilitate a constructive approach towards RTO in all operating environments. This in turn safeguards human performance levels which has a positive impact on performance of RTO.

This paper is supported by three annexes containing information on:

- Remote tower concept description (Annex 1)
- Remote tower implementation status (Annex 2)
- RTO regulatory and standardisation activities (Annex 3)

2. Context

Remote Towers are being used by ANSPs to provide aerodrome air traffic services (ATS) . They may help them meet the needs of their customers or business models. There are examples of Remote Towers in operation to provide aerodrome ATS within Europe, and Internationally, as evidenced in Annex 2.

There is no doubt that the introduction of Remote Tower concepts may change the way the human operates; induces changes to working methods, the organisation, the perception of the environment, and the information presentation. Understanding the potential impacts, both positive and negative, on the human is required e.g. level of workload, fatigue and situational awareness.

The human dimension has been considered as part of the development and transition activities of current RTO deployments, but it is now important to ensure that the human dimension is considered in a consistent and effective manner across all operational environments. This is critical because implementations of Remote Towers are focussed in specific operating environments, and reliant on specific technical solutions from a limited number of manufacturers. What is acceptable for one operating environment may be unsuitable for another, and the solutions therefore need to be adapted accordingly.

In addition, the flexibility of Remote Tower technology means the operational concepts continue to evolve in a wide variety of operating environments. The current implementations may not represent a finished solution or account for evolving concepts.

The enhancement of conventional tower operations with remote tower technology should explicitly be considered in the development of remote tower concepts. For example, tracking facilities could detect objects (including drones) interfering with approach and IR cameras could improve low visibility procedures.

3. Principles for RTO Deployment

The following human dimension principles have been identified as fundamental to the success of remote tower implementations. These principles are already largely addressed through published Regulation and Acceptable Means of Compliance (AMCs), Service Providers processes and Manufacturers technology designs. These principles are documented here to highlight them as good practice.

Note that recommendations have been identified in the next section in addition to the principles directly below. The recommendations are defined where specific issues have been identified that require further analysis to ensure the impact on the human is appropriately managed.

The EGHD has identified the following principles:

1. Remote tower operations must be approved by the regulator and regarded as a change to the functional system in its operational environment according to EU regulations.
2. The licencing of ATS operational staff should be based on standard practice and regulatory oversight; subject to any changes required to support remote tower operations.
3. Operational suitability of technical solutions, procedures and training should be assured through human performance assessments.
4. ATS operational staff should be provided with efficient and safe contingency procedures, training and means to handle operations in non-nominal and emergency conditions.
5. Clear lines of responsibilities should be defined for the relay and interpretation of data.
6. Availability and integrity of the data displayed should be in line with existing standards for CNS equipment.
7. Operational experience of remote tower implementations should be drawn on collectively to improve industry wide knowledge.
8. Technical (ATSEP) and operational staff should be appropriately involved in verifying system, procedures and training suitability at all points of the development and implementation process.
9. Equipage should be validated as having a positive effect on operations, whilst ensuring a satisfactory minimum for safe and effective operations.

4. Specific recommendations

This section highlights nine key human dimension topics that require specific attention to ensure they are managed appropriately in the deployment of remote tower operations.

4.1. Legal baseline for Remote Towers in Europe

The ICAO provisions (including PANS ATM) have been transposed into the European Legal Framework[1] by EASA. Within this framework, EASA has developed Guidance Material (ED Decision 2015/14/R) on the implementation of the RTO concept for single mode of operation. These are now being updated to include more advance applications of RTS such as multiple mode of operation.

The provision of ATS from Remote Towers raises concerns relating to cross-border operations. Clear agreements relating to staff responsibilities and liabilities should be put in place between relevant states. There are potential benefits of EU provisions to ensure consistency in the way these agreements are defined and put in place.

Recommendation 1	*The EC should develop provisions to ensure consistency in the way cross-border operational agreements are defined and put in place.*

4.2. A roadmap for regulation and standardisation activities

The EGHD supports the initiatives that facilitate industry-wide standardisation and development of remote tower operations, as presented in Annex 3.

However, it is not clear that there is any synchronisation between all the individual activities and the EGHD requests that these activities are designed to achieve a common outcome.

Recommendation 2	*The EC should ensure there is a clear and well-defined roadmap for RTO regulation and standardisation activities which should be well communicated to stakeholders*

4.3. Sharing good practice

The EGHD notes that remote tower operational knowledge to-date has been largely gained through development and implementation experience within individual ANSPs. This has led to a limited supply of freely available information for other implementers.

The EGHD advocates mechanisms to share experience developed locally to build industry-wide knowledge in areas such as safety and human factors. For example, understanding the impact on the appropriateness of the display system that may cover less than the 360-degree world view on displays. However, the group acknowledges the challenges of setting up such collaborative initiatives due to increasing competition between both ANSPs and manufacturers.

[1] The European Legal Framework is primarily defined by CIR (EU) No 1035/2011, CIR (EU) No 923/2012 and CIR (EU) No 139/2014. This list is not exhaustive.

Subsequent developments in remote towers accommodating more complex operating environments should progress incrementally, based on previous experience gained through other implementations.

Recommendation 3	*European Commission should promote the development of collaborative working groups (regulators, SESAR JU, ANSPS, manufactures, airspace users, military and professional staff organisations) to create and share good practice relating to remote tower operations and specifically the human dimension*

4.4. Licencing and endorsement

The need for a specific remote tower unit or rating endorsement in CIR 340/2015 (ATCO Licence regulation) should be studied. The EGHD recommends that two scenarios are analysed:

Specific remote tower rating endorsement: The use of RTO may require a specific rating endorsement; this would be an endorsement attached to an Aerodrome Control Visual (ADV) or Aerodrome Control Instrument (ADI) rating and not linked to unit endorsement. This view considers that remote towers are a technical means to providing a service. The analysis should consider the opposite case and experience regarding the change: what would be required for an ATCO working in a remote tower centre and who move to a conventional tower with no previous experience?

Remote tower unit endorsement: If a service can be provided both from a remote tower and a conventional tower (switching from one to the other depending on time or any other criteria) then the remote tower and the conventional tower would be two different units requiring two different unit endorsements. 'RTO' can be mentioned in the unit endorsement name to differentiate it from the conventional tower unit endorsement, but it should not refer to a specific kind of unit endorsement (in case of only and permanent remote TWR there is no need to specify 'RTO' in the unit endorsement). The possibility of temporary unit endorsement should be evaluated.

In any case, training plans and competence assurance plan should meet new EU/EASA regulations and be approved by the relevant NSA.

In addition, EGHD recommends that lessons learned for licencing and endorsement for multiple aerodromes should be studied.

Licencing arrangements for more than one aerodrome*:* Licencing arrangements for more than one aerodrome needs to be addressed. EGHD recommend that the current approach of one unit endorsement for each aerodrome is maintained.

Recommendation 4	*Assess CIR 2015/340 to ensure that operators have appropriate competencies and training. Licencing and endorsement should be adapted to remote tower context based as far as possible on current working practices.*

Note: In implementing this recommendation ensure a dedicated working group including end users evaluate existing regulations for training, licensing and endorsement. Specific RTO needs and the associated competences required should be identified in order to operate safely with remote tower operations.

4.5. *Operational context*

The operational context is a key factor to be considered in the definition of the requirements related to remote tower operations. The operational context is closely linked to the notions of complexity and density that characterise the airport types and connected airspace. If definitions on airport types are used or required to determine the conditions of operations in remote towers, then they should reflect the actual impact of these characteristics on the operators (level of workload).

In this way, complexity and density of an airport are related to many factors such as traffic density, airport complexity, airspace complexity, traffic complexity, number of simultaneous movements, changing ratio of IFR/VFR traffic, airport infrastructure, etc. Seasonal factors like weather also play a part in understanding local complexities.

Definitions relating to airport density and complexity should be reviewed to ensure that remote tower concepts are reflected appropriately. It is recognised that these definitions should be used as a guide only and not remove the need for a local assessment of the RTO implementation. However, appropriate complexity and density definitions will provide one important means to ensure that impact on operators is duly considered based on the operating environment.

Recommendation 5	*EC to encourage the definition of a standard terminology for complexity and density levels as a characteristic of an airport in order to reflect different operational environment.*

4.6. Single-mode and multiple-mode operations

The RTO concept has two main modes of operating; single-mode or multiple-mode (refer to Annex 1 for definition). Maturity of Single-mode operations is developing as evidenced by live operations in low density operations. Multiple-mode operations are less mature and require close considerations recognising that ANSPs are actively trying to gain certification. Identifying lessons learnt on single tower operations should drive the conditions of multiple mode tower services implementation.

Recommendation 6	*European Commission should ensure the development of single-mode operations standardisation and appropriate research and development activities to assess the human performance aspects*

There are two different methods that can be considered to deliver ATS:

- Sequentially: this way of operating might be defined for multiple mode but also for single mode as numerous modules may be placed in a single RTC therefore consolidating many 'towers' into a single location. This way of operating supposes a pre-defined organisation with timeframes for ATS delivery to a given airport. This has the potential to optimise rostering at a strategic level, or for tactical switching between aerodromes considering traffic patterns. The group understands sequentially as an operator being in charge of one aerodrome only at a time. This means controllers are not interrupted by switching from one airport to another and, therefore, this way of operating may reduce impacts related to high workload and confusion.
- Simultaneously: this way of operating might be defined only for multiple mode because ATS can be delivered to more than one airport at a time concurrently. Professional staff associations do not support simultaneous operations performed by a single operator as it induces changes to operator's workload and situational awareness. Therefore, the conditions under which simultaneous operations are envisaged should be further investigated.

Controllers can currently operate different sectors in the same shift in the en-route and terminal environment by having multiple validations. Within a tower, a controller can also have two validations for both ground movement and runway control. Remote towers are a further adaptation of this. At Heathrow (since 2009), the provision of a contingency tower is via a remote tower in a separate location away from the airfield and controllers. Controllers must maintain a validation to be able to use this contingency tower at any time should the main tower be incapacitated, albeit with a reduced capacity.

Sequential operations are considered feasible if an appropriate work organisation can be defined to handle these operations. The conditions which would allow an operator to handle more than one aerodrome (e.g. the time frame for switching from one aerodrome to another) should be defined and verified.

The conditions under which simultaneous operations are envisaged should be further investigated to understand the impact on human performance.

Recommendation 7	*European Commission should ensure the development of sequential and simultaneous operations standardisation, and appropriate research and development activities to assess the human performance aspects*

4.7. Information assurance

ATS Operational staff and technical personnel (ATSEPs) require the provision of reliable data to have confidence in the information they are presented and their ability to detect errors or deviations (i.e. quality, correctness and availability of data and consequential responsibilities/accountabilities). A set of minimum quality requirements for presentation and design is required to allow operators' awareness on data integrity and availability for safe and efficient service. These requirements include establishing agreements with information providers ensuring integrity of data from source to end-user.

Recommendation 8	*EC should ensure that regulation clarifies how to prevent, protect, and handle consequences of situations where the operator bases his/her decision on wrong data.*

4.8. Impact on Airspace Users

The feasibility of any required aircraft operator equipage should be investigated and operational consequences assessed. An area of concern is losing the destination airport and one or more alternative airports at the same moment in case of a system failure at a RTC serving multiple aerodromes. ECA currently do not support simultaneous RTO operations unless redundancy functionalities and regulation are in place to cover the hazard of a failure at a RTC, that has the possibility to close multiple airports simultaneously. Regulation and procedures must also be in place for all modes of operation to secure normal operations at aerodromes to remain operationally unaffected by an airborne emergency at one aerodrome when multiple aerodromes are served by a common RTC.

For areas with multiple aerodromes with RTO the redundancy capability and procedures must be clearly communicated to the airspace users. This in order to create confidence in RTO and to avoid uncertainty in decision-making processes, for example during flight planning phase, and option generation during malfunctions and emergencies. It will also serve the purpose of minimising additional stress on crews in the event of a malfunction or emergency either on ground or airborne in areas with multiple aerodromes with RTO.

There is an expectation that on-board systems will not be affected by remote tower operations, and the group suggests ensuring that the solutions remain independent of aircraft equipage.

Recommendation 9	*EC should investigate remote tower equipage in order to determine the potential impact of this new technology on both air and ground operations.*

5. Summary

The EGHD asks the European Commission to note the nine human dimension principles identified as fundamental to the introduction of remote tower implementations, and the nine recommendations on topics that require specific attention to ensure they are managed appropriately in the deployment of remote tower operations. The EGHD notes the rapid evolution of the RTO concept, and will critically follow developments of this topic.

5.1. Recommendations

Recommendation 1	*The EC should develop provisions to ensure consistency in the way cross-border operational agreements are defined and put in place.*
Recommendation 2	*The EC should ensure there is a clear and well-defined roadmap for RTO regulation and standardisation activities which should be well communicated to stakeholders*
Recommendation 3	*European Commission should promote the development of collaborative working groups (regulators, SESAR JU, ANSPS, manufactures, airspace users, military and professional staff organisations) to create and share good practice relating to remote tower operations and specifically the human dimension*
Recommendation 4	*Assess CIR 2015/340 to ensure that operators have appropriate competencies and training. Licencing and endorsement should be adapted to remote tower context based as far as possible on current working practices.*
Recommendation 5	*EC to encourage the definition of a standard terminology for complexity and density levels as a characteristic of an airport in order to reflect different operational environment.*
Recommendation 6	*European Commission should ensure the development of single-mode operations standardisation and appropriate research and development activities to assess the human performance aspects*
Recommendation 7	*European Commission should ensure the development of sequential and simultaneous operations standardisation, and appropriate research and development activities to assess the human performance aspects*
Recommendation 8	*EC should ensure that regulation clarifies how to prevent, protect, and handle consequences of situations where the operator bases his/her decision on wrong data.*
Recommendation 9	*EC should investigate remote tower equipage in order to determine the potential impact of this new technology on both air and ground operations.*

Annex 1. Remote tower conceptual description

A remote tower enables location independent provision of aerdodrome ATS including Aerodrome Flight Information Service (AFIS) and/or Air Traffic Control (ATC) as an alternative to a conventional AFIS position or a Visual Control Tower (VCT). Conventional services are located on-site at an airport and provide visual observation in situ. Visual observation in Air Traffic Management (ATM) is the direct observation[2] of objects situated within the line of sight of the observer, enhanced by binoculars. Watch is maintained by visual observation and complemented by radar or other approved surveillance systems when available. When talking about the notion of an aerodrome control tower, it is recognised that the tower cab is constructed to allow aerodrome controllers 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. A VCT is conventionally located on-site at an airport. To date, remote tower deployment has been based around sensor technology located at the local aerodrome (such as high resolution cameras, masts and microphones) and connected to a Remote Tower Centre (RTC) which displays the sensory information to the Air Traffic Control Officer (ATCO) or Aerodrome Flight Information Services Officer (AFISO). Air Traffic Safety Electronics Personnel (ATSEP) at both ends should be appropriately involved in verifying the integrity, availability and accuracy of the information that will be supplied to the control units.

As well as displaying traditional sensory information to the operator to support situational awareness of the aerodrome, research and development activities are undertaken to enhance or augment reproduction to provide additional safety nets and tools for the controller. Examples to date include infra-red imaging, target tracking and runway incursion warnings.

Remote tower technology is a change for the way operators deliver ATS, and several new operational concepts have arisen in response to specific local needs. ANSPs are currently developing the following applications throughout the world:

- *Single mode of operation*, in which a single airport is operated by operators in a remote tower module. Even if numerous modules may be placed in a single RTC (therefore consolidating many 'towers' into a single location), ATS will *not* be delivered to more than one airport at a time concurrently.

- *Multiple mode of operation,* in which operators deliver ATS to more than one airport at a time concurrently. This concept is being trialled for low density operations to allow these airports to operate based on demand rather than fixed operational hours.

These modes need to be studied with respect to the way ATS will be delivered by operators:

- *Sequentially:* this way of operating might be defined for *multiple* mode but also for *single* mode as numerous modules may be placed in a single RTC therefore consolidating many 'towers' into a single location. This way of operating supposes a pre-defined organisation with timeframes for ATS delivery to a given airport. This has the potential to optimise rostering at a strategic level, or for tactical switching between aerodromes considering traffic patterns. The group understands *sequentially* as an operator being in charge of one aerodrome only at a time. This means controllers are not interrupted by switching from one airport to another and, therefore, this way of operating may reduce impacts related to high workload and confusion.

- *Simultaneously:* this way of operating might be defined only for *multiple* mode because ATS can be delivered to more than one airport at a time concurrently.

[2] ICAO State Letter AN 7/63.1.1-17/23 introduces 'visual surveillance system' as a possibility to maintain visual observation [15].

Sequential and simultaneous operations assume that controllers have the adequate rating, ratings endorsements and unit endorsements for more than one airport.

Remote tower operations may also relate to the following applications:

- *Contingency centres*, a lower-cost alternative to traditional contingency solutions such as a secondary tower or a non-visual control room. Contingency centres can be developed in case of downtime for conventionally served airports to ensure continuity of service.

- *Combining existing towers,* at (very) large new and existing airports where more than one tower is required to cover the many and often far afield runways. An RTC could be the preferred option to allow all tower controllers to operate from a same location.

These definitions are proposals and their inclusion in this paper aims to provide a framework for EGHD discussions. They are currently discussed in RMT.0624 but not officially approved by EASA. Definitions will need to be harmonised with relevant stakeholders as EASA or EUROCAE.

In addition, emerging and future concepts include:

- *Mobile ATS on demand,* provided by sensors and displays which are considerably easier to move than concrete towers, enabling the remote towers concept to be used for mobile structures such as oil rigs and military bases as well as moving RTCs to accommodate airport developments.

- *Outside own area and cross border tower services,* which might provide ATS from anywhere. Potentially, with several ANSPs having opened their tower services to competition, tower services could be outsourced to neighbouring countries in future (including RTO).

- *Remote tower services, which might provide ATS from anywhere.* This enables provision of service at remote airports increasing flexibility of service. The sequential mode would enable provision of service on demand 24 hours a day for several airports with little traffic but critical availability issues (e.g. ambulance flights).

- *Enhancement of current operations*, where, rather than procuring a full remote tower, aspects of the RTC could be used in conjunction with current towers to enhance capabilities. For example, tracking facilities could detect objects (including drones) interfering with approach and IR cameras could improve low visibility procedures.

- *Extended operational hours and locations,* to provide more flexible ATS even on airport with irregular and infrequent traffic. Consequences for the human on rosters.

Annex 2. Remote tower implementation status

The first remote concept was developed in Japan in the 1970s where over 20 towers have been operated remotely. Following new technological possibilities, Sweden developed a concept to increase the economic viability of airports in isolated and remote locations. The concept of single mode operations is proven. There is operational experience at very low-density airports. For example, LFV gained approval for their remote tower Centre in Sundsvall, Sweden, in 2015 to provide services to the remote location of Örnsköldsvik Airport 150km away. Operations began in Sundsvall-Timrå Airport from November 2016. Further, LFV is running a project with the objective to gain operational approval for multiple operations in 2018.

Various remote tower concepts – from isolated and remote locations to medium-sized airports – are being developed and adopted in several locations with a variety of intentions. Table 1 notes the current remote tower implementations at the time of writing.

Table 1: Current remote tower operations

ANSP	Concept	Developments
LFV	Isolated and remote locations Medium-sized airports	Having delivered over 6,000 hours of operation since approval in April 2015, the remote tower facility in Sundsvall is being expanded to include more airports, currently three airports are connected, and a further centre is planned to be developed at Stockholm Arlanda to support operations to 5 further airports, two in south, three in north.
Avinor	Isolated and remote locations	With the initiation of their €40m remote tower program in 2015 to provide services to 15 airports, sensors are currently being installed at 5 airports to begin test operations from their Remote facility in Bodø in early 2017.
DSNA	Isolated and remote locations	The airport at St Pierre has an onsite facility to both provide services to the local aerodrome and to provide remote services to nearby Miquelon to improve service continuity, with less than 6,000 inhabitants and severe weather challenges.
NavCanada	Isolated and remote locations	Proof of concept trial at Fredrington airport 300km from Halifax, to enhance information available.
DFS	Medium-sized airports	Investigating remote services at Saarbrücken (30,000 movements), Dresden and Erfurt, supported by single facility at Leipzig with the aim of improving controller efficiency through multiple licencing.
Leesburg airport	Medium-sized airport Upgrading ATC Services	US commercial airport, one of 5,000 non-towered airports in US despite 100,000 movements, undergoing trials alongside the FAA to upgrade airport operations to an ATC airport which allows heavier/more frequent movements.
IAA	(SESAR) Isolated and remote locations	Cork and Shannon control centre in Dublin to reduce costs by shadowing ATC services at night at Shannon and Cork from an RTC located at Dublin Airport in a multiple mode configuration [12]. Trials were successfully completed in December 2016 and a phased deployment is now being considered.
ENAV	(SESAR) Medium Airports	Remote Airport Concept of Operation (RACOON) project [13] is testing multiple mode operations at Milan Linate airport from Milan Malpensa, conducting shadow mode operations in quiet periods.

Hungarocontrol	(SESAR) Medium-sized airport upgrading ATC service	Enhanced operations at Budapest, where the two runways extend over 6km, enhanced visual tools and contingency services will improve safety and continuity of operations [14].
LVNL Netherlands	(SESAR) Isolated and remote locations	Remote facility trials at Schiphol airport controlling Groningen Airport with Maastricht Aachen as a mirror airport through SESAR trials. Exercise terminated.
PANSA	Medium-sized airports	Ongoing procurement for an 'rTWR system' to be implemented for Lublin airport and service provided from 'rTWR Centre' located in Rzeszów.

Annex 3. RTO development, regulatory and standardisation activities

SESAR JU carries out development and validation activities in support of RTO. These activities are supporting the standardisation and regulation work. SESAR JU has published several documents, including an Operational Services and Environment Description (OSED) [7], a Safety Assessment [8] and Human Performance Report [9] for single mode, and a Safety Assessment [10] and Validation Report on multiple mode. Several validation activities have taken place through SESAR, firstly under SESAR 1 WP 6.9.3, and work is now developing under PJ05 of SESAR 2020.

The table below summarises the key bodies involved in regulation and standardisation and their current initiatives:

Organisation	Summary of activity
Eurocae	EUROCAE Working Group 100 is responsible for developing European standards for Remote and Virtual Towers. Its first task was to develop Minimum Aviation System Performance Standards (MASPS) for the visual optical sensors element of a remote tower, the final version of which was published in September 2016 as ED-240. The next task for the Working Group will be to extend its analysis to develop standards for remote tower optical sensor tracking facilities.
ICAO	Based on recommendations from ITF (International Transport Workers´ Federation), the ICAO Air Traffic Management Operations Panel (ATMOPSP) reviewed the ICAO provisions in Annex 11 and PANS-ATM (Doc 4444) with a view to examine the provisions in order to identify shortcomings, if any, and develop new provisions as necessary to accommodate remotely provided aerodrome ATS. Their proposal to amend PANS-ATM is included in ICAO State Letter AN 7/63.1.1-17/23 [17]. The update has been approved by the Air Navigation Commission (ANC) and is planned to enter into force in November 2018.
European Commission	Regulation and guidance material exists on several topics related to the human dimension, including: • Annex I to Decision 2015/010/R1 'AMC and GM to Part ATCO' Amendment 1 [2]. This deals with remote towers related training elaborated by EASA; • Guidance material related to IR 2015/340 ATCO.D.060 [3]; EASA issued Requirements on Air Traffic Controller licensing regarding remote tower operations [9], an amendment to Acceptable Means of Compliance and Guidance Material of Commission Regulation (EU) 2015/340, in 2015 which focusses on the establishment of high-level guidance on training and qualification of ATCOs.
EASA	• Phase 1 of EASA's Technical Requirements for remote tower operations (RMT .0624[4]) focussed on single mode operations, resulting in an NPA (2015-04 Technical and operational requirements) **Error! Reference source not found.** and Guidance Material on the implementation **Error! Reference source not found.** within the current regulatory framework. The guidance material has a key focus on Human Performance (HP) assessment in the frame of safety assessment. • Phase 2 of RMT.0624 was launched in 2016, to expand into 'multiple and more complex mode of operations', and will reference industry standards as produced by EUROCAE WG-100 (ED-240). Further to RMG meetings, a new public consultation or NPA is scheduled to be published in 2017.

Annex 4. References

[1] ICAO, ETF (2016), *ICAO Assembly 39th Session Working Paper, A Safe, Holistic and Considered Framework for the Further Introduction of Remote Towers*
http://www.icao.int/Meetings/a39/Documents/WP/wp_263_en.pdf

[2] EASA, *Annex I to Decision 2015/010/R 'AMC and GM to Part ATCO' Amendment 1*
https://www.easa.europa.eu/system/files/dfu/AMC%20%26%20GM%20to%20Part%20ATCO%20-%20Amdt%201%20(Annex%20I%20to%20ED%20Decision%202015-015-R).pdf

[3] EASA (2015), *Air Traffic Controllers' Licensing and Certification*
https://www.easa.europa.eu/system/files/dfu/Easy%20Access%202%20ATCO.pdf

[4] EASA (2014), *Terms of Reference for Technical requirements for remote tower operations RMT.0624*
https://www.easa.europa.eu/system/files/dfu/ToR%20RMT.0624%20Issue%201.pdf

[5] SESAR Joint Undertaking (2014), *D02/D04 OSED for Remote Provision of ATS to Aerodromes, including Functional Specification*
http://www.sesarju.eu/sites/default/files/solutions/4_Single_Remote_Tower_OSED.pdf?issuusl=ignore

[6] SESAR Joint Undertaking (2014), *OFA06.03.01 Remote Tower – Safety Assessment Report for Single Remote Tower*
http://www.sesarju.eu/sites/default/files/solutions/3b_Single_Remote_Tower_Safety_Assessment_Report.pdf?issuusl=ignore

[7] SESAR Joint Undertaking (2013), *PP 6.9.3 HP Assessment Report*
http://www.sesarju.eu/sites/default/files/solutions/3a_Single_Remote_Tower_Human_Performance_Assessment.pdf?issuusl=ignore

[8] SESAR Joint Undertaking (2015), *OFA06.03.01 Remote Tower – Safety Assessment Report for Multiple Remote Tower*
http://www.sesarju.eu/sites/default/files/solutions/4_Remote_Tower_two_low_density_airports_SAR.pdf?issuusl=ignore

[9] EASA (2015), *ED Decision 2015/015/R Requirements on Air Traffic Controller licensing regarding remote tower operations*
https://www.easa.europa.eu/document-library/agency-decisions/ed-decision-2015015r

[10] KONGSBERG, *Avinor and KONGSBERG enters into agreement on the world's largest investment for remote towers*
https://kongsberg.com/en/kog/news/2015/august/avinor%20and%20kongsberg%20enters%20into%20agreement/

[11] Deutsche Flugsicherung, *DFS selects remote tower technology from Frequentis*
https://www.dfs.de/dfs_homepage/en/Press/Press%20releases/2015/03.06.2015.-%20DFS%20selects%20remote%20tower%20technology%20from%20Frequentis/

[12] IAA (2016), *The IAA Trials Ireland's First Remote Air Traffic Control Management System*
https://www.iaa.ie/news/2016/06/30/the-iaa-trials-ireland-s-first-remote-air-traffic-control-management-system

[13] European Commission, *Remote Airport Concept of OperatioN (RACOON)*
http://www.sesarju.eu/newsroom/all-news/sesar-racoon-project-simulates-remote-tower-services-multiple-airportsports

[14]HungaroControl, *Remote Tower: a new approach for mid-size airports* http://en.hungarocontrol.hu/knowledge-center/remote-tower

[15]ICAO (2017), *Proposals for the amendment of Annex 10, Volume II relating to pronunciation of numbers and PANS-ATM (Doc 4444) relating to remote ATS and ATM procedures* https://transportstyrelsen.se/globalassets/global/regler/remisser/luftfart/annex-10-vol-ii-och-pans-atm-proposal-17_23.pdf