OASISAIRBRIDGE

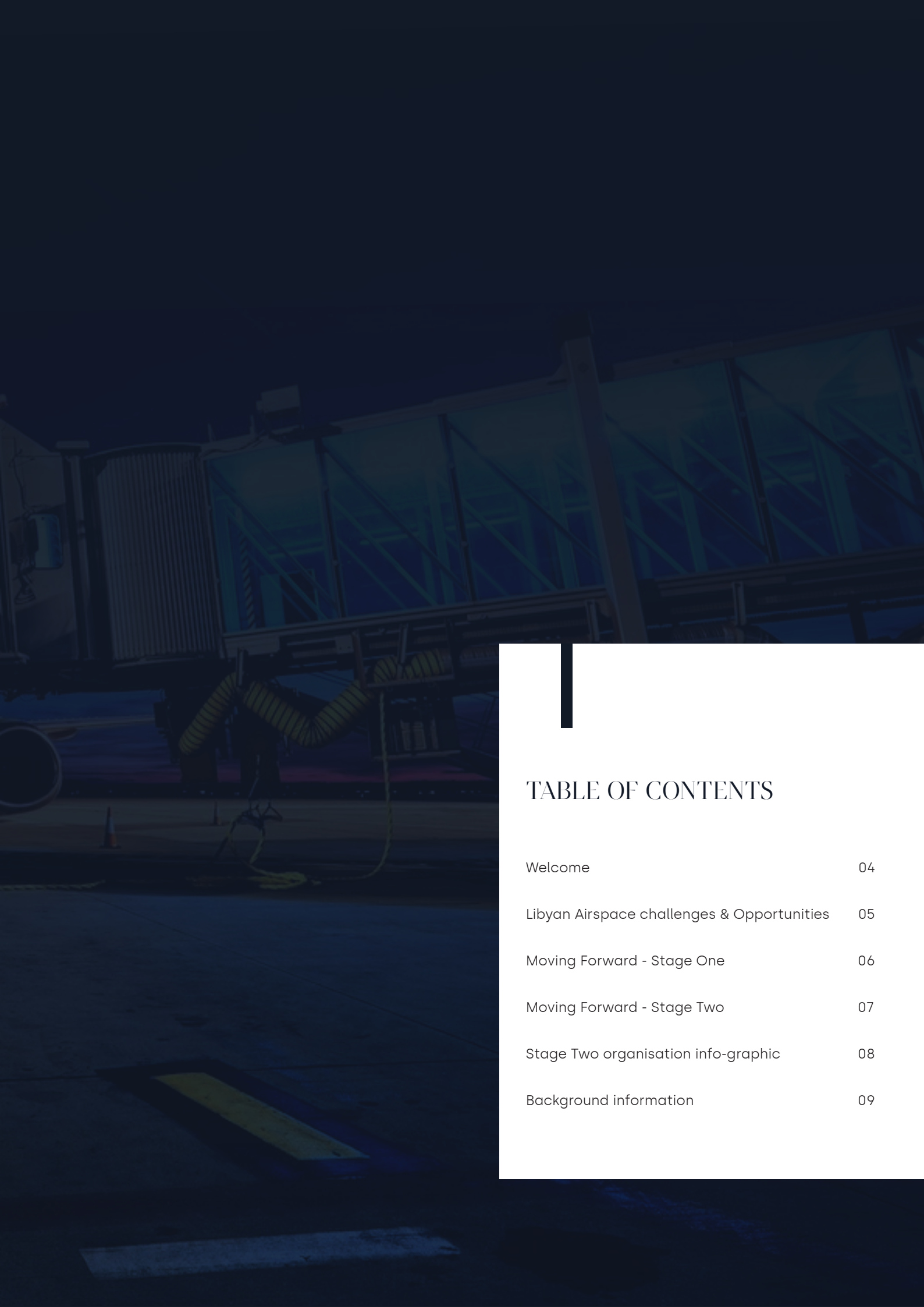
# Libyan National Airspace Study

Safely returning leading international airlines to countries emerging from conflict and enhancing developing countries aviation capability using the latest in Air Traffic Management technology

2021

*In the depth of winter, I finally learned that within me there lay an invincible summer.*

Albert Camus



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## CEO Message

# WELCOME

When NATS withdrew from Libya during 2015 I was asked by a member of the United Kingdom Foreign and Commonwealth Office if I could pen a brief report into what I thought would be required to return aviation to Libya.

At the time, Aireon and Remote Digital Towers were not options available to me, but I explored the technology available at the time and drafted a report which set out what airspace was, how it worked and how important it was to acquire aviation capability to fit in with the design of the airspace.

I also looked at the key Libyan stakeholders, of which there are many. The aim of the report was to achieve two things; firstly, a report which explained what airspace management and roadmap is and secondly, to highlight the danger of not understanding the importance of knowing what training is required by when and why acquiring goods and services should be centered around the airspace design.

Libya seemed, at the time, to be placing training programs, procuring equipment, services and building infrastructure ahead of designing an Airspace Roadmap and Masterplan and it was beginning to look like a lot of the equipment and training wouldn't be fit for purpose.

Now that we have companies like Aireon and other new technology, Libya has the opportunity to have the latest in airspace design which will require the latest training. It may be that less infrastructure and equipment is required as a result.

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# Libyan Airspace Challenges and opportunities

Libyan airspace is currently controlled from an air traffic operations centre on Malta, and occasionally from a control centre in Tripoli, due to the original systems within Tripoli having been damaged. Airspace management is provided at an operational minimum standard which does not meet the required standard practices and regulations required under the International Civil Aviation Organisation (ICAO) International Standards. In addition, aircraft are not managed using radar data, which is a more efficient and safer method, due to the complete lack of functioning equipment within Libya.

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> European air carriers are currently not permitted to fly into Libya due to the lack of airspace management.

Prior to take off, an aircraft informs the Maltese Centre Air Traffic Controllers that they intend to fly in Libyan airspace, including details of their destination airport and what time they expect to land. The receiving airport, in Libya, is then informed of the aircraft details and approximate landing time. This basic level of information is made available to other airspace users such that with current low volumes of air traffic they are able to adequately separate themselves from each other.

European air carriers are currently not permitted to fly into Libya due to the lack of airspace management and the un-regulated state of the airports. This decision is governed by International regulations established by ICAO and also the UK and European regulators. It will be important for Libyan airports to quickly move to certified ICAO standards in order to ensure that domestic airlines operating in Libya can fly in to EU airports without restrictions.

Mitiga and Misrata airports are relatively intact but are located in built up areas and therefore the commercial airlines have an increased risk of rocket attack so the European airlines refuse to fly there (and can't get insurance to do so); this is why Tripoli and Benghazi are the favoured airports, being in relative open country. Both Tripoli and Benghazi Airport require rebuilding. Libya has only ever required limited civilian, cargo and military airspace needs for the past few decades and therefore Air Traffic Management (ATM) has lacked proper investment for a substantial period of time. The facilities which were in place to meet those limited needs have either been destroyed in conflict or are no longer fit for purpose.

The systems procured in the past seem to have been procured randomly, are not fully integrated into the infrastructure and not considered as part of the wider airspace needs.

# Moving Forward
## *Stage One*

Through placing a temporary modern deployable active and/or passive surveillance system container (shipping container) in Tripoli (or anywhere in Libya – even on top of a building/ hotel - provided there is connection to power and data over a telephone line), will enable a quick and temporary safety and operational improvement to enable the most basic form of area air traffic control for a limited number of aircraft to operate in area airspace.

If the modern deployable system is placed at an airfield it is easier to upgrade to a radar-based system, (once the airfield radar is installed). Having a radar at the airfield provides the airfield air traffic controllers the ability to see the aircraft on a display as they approach the airfield. This is a much safer and more efficient approach when the volume of aircraft increases. Additionally a temporary deployable Air Traffic Control tower, placed at a suitable airport or airports, will enable a limited amount of aircraft to land and take off at that airport. Following the deployment of temporary systems, basic procedures which enable aircraft to move from the upper airspace into the lower airspace and vice versa will need to be written. Procedures and flight plans need to be written for handing aircraft over from area control to tower control. As importantly, procedures and flight plans need to be agreed between different airspace areas for handing over aircraft from one area to another. These procedures are called Local Operating Agreements and are normally published in the MATS Part 1 (Manual of Air Traffic Services) and need to be agreed and in place between different area control. Libya's airspace neighbours would be Tunisia, Malta, Egypt, etc. All procedures are designed depending upon the skill, capability, workload, operating charts, flight plans and systems which have been put in place or are planned to be put in place.

1 *Passive surveillance*

2 *Airfield Radar System*

3 *Deployable Air Traffic Control*

4 *Operating Agreements*

# Moving Forward *Stage Two*

As Libya will have an immediate increase in aircraft movements due to its need to produce oil to generate wealth the number of flights entering and departing Libya to satisfy the oil industry will place a heavy burden on the limited number of air traffic controllers and the temporary systems and limited procedures in place. As Libya requires the return of commerce and industry into Libya, mainly from Europe, the increase in air traffic could be quite substantial and if the correct systems are not in place with the required regulatory approvals being granted, revised and re- granted as the demand increases, the airspace will become saturated, in-efficient, unsafe, unable to handle the demand and as a result could be closed. Libya is unique in that it relies heavily on imports - Cargo aircraft require different procedures and processes to passenger aircraft and military aircraft.

An Airspace Masterplan will have to be drafted. Typically, an Airspace Masterplan is written for a twenty year forward looking period. The Masterplan is written every five years for the future twenty year period and is amended depending on the future projected demands upon all air travel.

The Airspace Masterplan would start with a Concept of Operations (CONOPS), this would lead into an Operational Requirement (OR) followed by a Airspace Design Phase (ADP). From here the SIDS and STARS are developed. Once developed the airspace design will require simulated testing, to check its validity. Given the provision of information an initial airspace design would take approximately six months to complete but this would be a basic design which will need further work, almost immediately, ahead of the need to increase capacity to control and manage aircraft entering the airspace.

Once the Airspace design has been completed the infrastructure, training, safety measures – all of the needs required to implement the design, need to be procured and put in place for the airspace to become operational. The time this would take depends on the complexity of the airspace needs, the airspace capacity required and the ability for the various stakeholders to meet the required procurement plan which would have to be developed alongside the Airspace Masterplan. Initially, the Airspace design would be limited in the amount of aircraft it can handle, and then increase the volume within time, however, irrespective of the amount of flights into, out of and across Libya, some procedures, systems and infrastructure will need to be put in place. (Emergency services, Procedures, avoidance areas etc).

Likely military needs over the next twenty years require consideration when designing airspace and formulating the Airspace Masterplan. Rotary aircraft and military aircraft (as well as light aircraft) must be considered at the outset of any airspace design otherwise airspace can be closed if a rotary aircraft were to fly where passenger and cargo aircraft operate. Should a military airspace proposal not be forthcoming from the Libyans then a military operating methodology can be proposed. This avoids having to redesign and possibly suspend the civilian airspace to enable military aircraft to fly.

# Organisations Required to Help input into the Airspace Master Plan


*An indicative selection of interested parties from the wide ranging stakeholders involved in the global air transport system.*

# Background Information

## Airspace Categories

**Upper airspace**. Where aircraft remain at altitude and fly over a managed airspace area (region) without landing or taking off, this is sometimes referred to as FIR (Flight Information Region) .

**Lower airspace**, also known as the CTA / TMA / CTR (Control Area, Terminal Area, Control Zone), where aircraft fly when approaching or departing airports (or for aircraft which have a low flight ceiling (such as rotary wing)).

**Area Control.** Typically National or regional airspace which is controlled from a national facility such as Swanwick facility in the UK.

**Airport airspace control**, which typically exists within a 10-15 mile radius of the airport and is controlled by the approach control and airport tower control facilities.

## Airspace Capacity

To determine the allowable capacity of airspace the airspace designer has to consider, for example: the geographical architecture of the various airports, the capability of the systems which the air traffic controllers use, the skill and number of available air traffic controllers, the capability of the ground based communication systems which must be compatible with the aircraft systems, back up and redundancy systems, area emergency services capability, ATM written procedures (for passenger aircraft and cargo aircraft), avoidance areas, flight plans, agreements with neighbouring countries to receive and release aircraft, rotary wing needs and military needs.

Additionally, consideration must also be given to airport capacity for the airports located within the airspace - as aircraft wake vortex, airport emergency service capability, aircraft taxiway plans, aircraft parking, meteorological information, passenger handling throughput, customs procedures for aircraft and passengers, runway lighting, automated landing procedures, runway inspections and more all contribute to the flow of aircraft in the airspace and therefore the capacity which the airspace can handle.

Combining the capability of all the ATM systems, infrastructure and skilled individuals determines what the allowable airspace capacity is. Flight charts and plans, CAA regulatory approvals, ICAO approvals, and redundancy systems have to be designed and maintained. Tripoli airport, as an example, is the largest airport in Libya, geographically located in the West of Libya. Tripoli operates a single runway airport and is not located near other international or national airports. (Gatwick is located near Heathrow). Single runway operation airports have restrictions. Tripoli doesn't have refuelling or maintenance facilities therefore aircraft can't sit in a holding pattern for too long waiting to land if the runway is blocked and they don't have an alternative for the aircraft to land at. Therefore the nature of the Tripoli Airport places restrictions on the number of aircraft operating in the lower airspace (CTA/ CTR) In designing developing and maintaining Libyan airspace, to meet the immediate and medium term needs of the country, many factors will have to be considered and a number of different Libyan organisations will have to be involved. Most of these organisations either don't exist or those that do, don't have any funding.

## Air Traffic Controllers

An efficient, highly trained airspace/ air traffic controller can handle between 15 - 20 aircraft at any one time, using the latest modern equipment, operating from a modern contained facility. Using Radar based technology enables the controller to see the aircraft - the placement of Radars around the country at certain points provides better visibility for the air traffic controllers and helps aircraft keep away from declared avoidance areas (such as oil refineries,

military establishments, other airports and areas with are deemed restricted by the CAA or the airlines - high security risk areas).

The less chance of a breach into an avoidance area, the less the insurance premiums for the Airlines. Libya has few airspace controllers, most are elderly. It takes unto two years to train an airspace controller. Prior to training airspace controllers the systems they will need to operate have to be selected and put in place. Navigating the aircraft around the sky, including the airlines ability to book flight plans, depends on the provision of up to date charts detailing avoidance areas, agreed radio frequencies ( the availability of ground based radio stations for effective communication) as well as appropriate and correct flight procedures. The systems which are used to aid the Air traffic controller must be compatible with the systems on the aircraft. The airspace systems need to be put in place first and the airlines need to procure aircraft with compatible systems or transfer existing aircraft from routes which already have the correct systems installed. Aircraft flying routes from one regional area airspace must be fitted with the correct systems to enable them to fly into another airspace. (overflights from Europe may be utilise different equipment to flights arriving into Libya from Tunisia).

## Aircraft and ATM systems

The systems used by the aircraft and the airspace can change over time. This change in systems will be dependent upon the navigation performance requirements. GNSS and EGNOS are basic systems, controlled by Satellites. Airspace coverage may require VOR (VHF omni directional ranging systems) in order for ground based systems navigation infrastructure and is used for both aircraft navigation and for the airspace controller to accurately track aircraft. Some aircraft and airspace utilise RNAV (1) and others utilise RNAV(5). Some modern aircraft are factory fitted with the latest technology which means they do not require any back-up systems, however, these aircraft are expensive and airlines will be reluctant to introduce new latest technology aircraft into a new airspace where demand is not yet proven. Fitting the latest technology systems into the airspace would be a later part of an Airspace Masterplan, depending on the expected capacity from overflights and arrivals and departures, as well as the number of operational airports and avoidance areas. It would be too costly and time consuming to put the latest systems on the ground in the early stages of the airspace design, particularly in Libya where the airport architecture (number and location of the various airports) is still being considered.

## Airports and Airspace

Airspace design must take into account the location of and requirements of the airports residing within the airspace area. Tripoli, Benghazi, Sirte and all of the oilfield airports need to work well within the area airspace together, as part of a single design, with the required flight plans and avoidance areas. As more of Libya's 147 airfields come on line the airspace management will become more complex and therefore the initial design and interoperability between the stakeholders needs to be as seamless as possible, including the provision of budgets to pay for the procurement of goods and services to meet the Airspace design needs, as well as the required training.

To return European Air Carriers to, from and over Libya there needs to be a re-establishment of international air services to international regulatory standards:

1. Safety assessment of airports, equipment and airspace.
2. Creation of Airspace Master Plan and associated Concept of Operations.
3. Certification or new airports, systems and airspace with international regulators.
4. Co-ordination and tenders for the supply of these services.
5. Implementation of billing and collection services for airspace overflights.

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