# Table of Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TABLE OF CONTENT</strong></td>
<td>3</td>
</tr>
<tr>
<td>1. FOREWORD</td>
<td>5</td>
</tr>
<tr>
<td>2. INTRODUCTION</td>
<td>6</td>
</tr>
<tr>
<td>2.1. BACKGROUND INFORMATION</td>
<td>6</td>
</tr>
<tr>
<td>2.2. HISTORY</td>
<td>7</td>
</tr>
<tr>
<td>2.2.1. ORIGINAL REGULATIONS</td>
<td>7</td>
</tr>
<tr>
<td>2.2.2. RELIABILITY OF FIRST GENERATION OF JET ENGINES</td>
<td>10</td>
</tr>
<tr>
<td>2.2.3. HIGH-BYPASS ENGINES, AND WIDE-BODY TWIN AIRCRAFT</td>
<td>10</td>
</tr>
<tr>
<td>2.2.4. INITIAL 120-MINUTE ETOPS OPERATIONS</td>
<td>11</td>
</tr>
<tr>
<td>2.2.5. MODIFICATION OF EXISTING AIRCRAFT</td>
<td>13</td>
</tr>
<tr>
<td>2.2.6. EVOLUTIONS OF THE REGULATIONS</td>
<td>13</td>
</tr>
<tr>
<td>2.2.7. DEVELOPMENT OF MODERN ETOPS AIRCRAFT</td>
<td>14</td>
</tr>
<tr>
<td>3. ETOPS REGULATIONS</td>
<td>15</td>
</tr>
<tr>
<td>3.1. OBJECTIVES AND CONCEPT</td>
<td>15</td>
</tr>
<tr>
<td>3.1.1. OBJECTIVES</td>
<td>15</td>
</tr>
<tr>
<td>3.1.2. CONCEPT</td>
<td>17</td>
</tr>
<tr>
<td>3.1.3. ETOPS SIGNIFICANT SYSTEMS</td>
<td>17</td>
</tr>
<tr>
<td>3.2. ETOPS TYPE DESIGN &amp; RELIABILITY APPROVAL</td>
<td>18</td>
</tr>
<tr>
<td>3.2.1. APPLICABILITY</td>
<td>18</td>
</tr>
<tr>
<td>3.2.2. PROCESS</td>
<td>19</td>
</tr>
<tr>
<td>3.2.3. DESIGN REQUIREMENTS</td>
<td>20</td>
</tr>
<tr>
<td>3.2.3.1. Human Factors and Safety Analyses</td>
<td>20</td>
</tr>
<tr>
<td>3.2.3.2. Air Conditioning (ATA 21)</td>
<td>20</td>
</tr>
<tr>
<td>3.2.3.3. Communications (ATA 23)</td>
<td>20</td>
</tr>
<tr>
<td>3.2.3.4. Electrical Generation (ATA 24)</td>
<td>20</td>
</tr>
<tr>
<td>3.2.3.5. Fire Protection (ATA 26)</td>
<td>21</td>
</tr>
<tr>
<td>3.2.3.6. Fuel (ATA 28)</td>
<td>22</td>
</tr>
<tr>
<td>3.2.3.7. Hydraulic (ATA 29)</td>
<td>24</td>
</tr>
<tr>
<td>3.2.3.8. Ice and Rain Protection (ATA 30)</td>
<td>28</td>
</tr>
<tr>
<td>3.2.3.9. Pneumatic (ATA 36)</td>
<td>28</td>
</tr>
<tr>
<td>3.2.3.10. Auxiliary Power Unit (APU) (ATA 49)</td>
<td>28</td>
</tr>
<tr>
<td>3.2.3.11. Power Plant (ATA 70)</td>
<td>29</td>
</tr>
<tr>
<td>3.2.4. CERTIFICATION RESULTS</td>
<td>29</td>
</tr>
<tr>
<td>3.3. ETOPS OPERATIONAL APPROVAL</td>
<td>29</td>
</tr>
<tr>
<td>3.3.1. APPLICABILITY</td>
<td>29</td>
</tr>
<tr>
<td>3.3.2. PROCESS</td>
<td>30</td>
</tr>
<tr>
<td>3.3.3. THE IN-SERVICE PLAN</td>
<td>31</td>
</tr>
<tr>
<td>3.3.4. THE ACCELERATED PLAN</td>
<td>32</td>
</tr>
<tr>
<td>3.3.5. APPROVAL</td>
<td>33</td>
</tr>
</tbody>
</table>
### 4 ETOPS RELIABILITY TRACKING BOARD

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 INTRODUCTION</td>
<td>35</td>
</tr>
<tr>
<td>4.2 MONITORED ITEMS</td>
<td>35</td>
</tr>
<tr>
<td>4.2.1 ENGINES</td>
<td>35</td>
</tr>
<tr>
<td>4.2.2 ETOPS SIGNIFICANT SYSTEMS</td>
<td>36</td>
</tr>
<tr>
<td>4.2.3 TROUBLESHOOTING PROCEDURES</td>
<td>36</td>
</tr>
<tr>
<td>4.3 OUTCOME</td>
<td>36</td>
</tr>
</tbody>
</table>

### 5 ETOPS DOCUMENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 CONFIGURATION, MAINTENANCE AND PROCEDURES DOCUMENT</td>
<td>37</td>
</tr>
<tr>
<td>5.1.1 INTRODUCTION</td>
<td>37</td>
</tr>
<tr>
<td>5.1.2 CMP COMPONENTS</td>
<td>39</td>
</tr>
<tr>
<td>5.1.3 CMP CREATION, AND REVISION PROCESS</td>
<td>45</td>
</tr>
<tr>
<td>5.1.4 CMP PUBLICATION</td>
<td>45</td>
</tr>
<tr>
<td>5.2 OTHER ETOPS DOCUMENTS</td>
<td>45</td>
</tr>
<tr>
<td>5.2.1 ETOPS SIGNIFICANT SYSTEMS LIST</td>
<td>45</td>
</tr>
<tr>
<td>5.2.2 PARTS LIST</td>
<td>47</td>
</tr>
<tr>
<td>5.2.3 ETOPS COMPLIANCE DOCUMENT</td>
<td>47</td>
</tr>
</tbody>
</table>

### 6 ETOPS AND AIRBUS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 MILESTONES</td>
<td>48</td>
</tr>
<tr>
<td>6.2 CERTIFICATION STATUS</td>
<td>48</td>
</tr>
<tr>
<td>6.2.1 A300 AND A310 FAMILY AIRCRAFT</td>
<td>49</td>
</tr>
<tr>
<td>6.2.2 A318, A319, A320 AND A321 FAMILY AIRCRAFT</td>
<td>50</td>
</tr>
<tr>
<td>6.2.3 A330 AIRCRAFT</td>
<td>51</td>
</tr>
<tr>
<td>6.3 HOW CAN AIRBUS ASSIST YOU?</td>
<td>51</td>
</tr>
<tr>
<td>6.3.1 TRAINING COURSES</td>
<td>52</td>
</tr>
<tr>
<td>6.3.2 CONSULTING SERVICES</td>
<td>52</td>
</tr>
<tr>
<td>6.3.3 TECHNICAL QUESTIONS</td>
<td>52</td>
</tr>
<tr>
<td>6.4 AIRBUS ETOPS ORGANIZATION</td>
<td>53</td>
</tr>
<tr>
<td>6.5 ETOPS TECHNICAL DOCUMENTATION ON AIRBUSWORLD</td>
<td>53</td>
</tr>
</tbody>
</table>
1 FOREWORD

This “Getting to Grips with ETOPS” is divided into three volumes:

- Volume I: Certification and Approval, this very volume. Its main objective is to provide recommendations that satisfy the Extended Twin OPerationS (ETOPS) operational, and reliability requirements, in order for an airline to obtain the necessary approvals from the presiding National Airworthiness Authorities.

- Volume II: The Flight Operations View. This volume expands on the specificities of ETOPS flight operations, and describes the preparation, dispatch, and execution of an ETOPS flight. Volume I provides an introduction to these specificities.

- Volume III: The Maintenance View. This last volume expands on the maintenance aspects associated with ETOPS. Volume I provides an introduction to these specificities.

The purpose of this publication is to provide Operators with the Airbus interpretation of the applicable ETOPS regulations, and of the associated guidelines, and recommendations.

If any deviation appears between the information provided in this brochure and that published in the applicable reference documents (Configuration, Maintenance, and Procedures (CMP), Aircraft Flight Manual (AFM), and Master Minimum Equipment List (MMEL)), the information provided in CMP, AFM, and MMEL shall prevail at all times, unless otherwise stated by Airbus ETOPS/EDTO group, and an agreement is obtained from the local regulatory authorities.

All recommendations comply with the current regulatory requirements, and are intended to assist the Operators in maximizing the safety, and cost effectiveness of their ETOPS operations.

All brochure holders and users are encouraged to forward their questions and suggestions to the AIRBUS contacts of the “6.3 HOW CAN AIRBUS ASSIST YOU?” section.
2 INTRODUCTION

2.1 BACKGROUND INFORMATION

ETOPS is an acronym that was created by the International Civil Aviation Organization (ICAO). It was first used to describe the operation of a twin-engine aircraft over a route that contains a point beyond a defined threshold from an adequate airport.

- This threshold is defined by the Operator’s National Airworthiness Authorities (NAA), and is usually set to one hour (60 min) flying time, at the approved one-engine inoperative cruise speed. A maximum diversion time is also introduced: It defines an area of operation, along the intended route.
- An adequate airport is an airport, expected to be available, where the landing performance requirements at the forecasted landing weight can be met. The airport also has the necessary facilities and services like air traffic services, lighting, communications, meteorological services, navigation aids, rescue and fire-fighting services, and at least one appropriate instrument approach procedure usable by the aircraft.
ETOPS regulations are applicable to routes over not only water, but also remote land, and areas like Siberia or Africa at night. Modern twin-jet aircraft are much more capable and reliable than aircraft from previous generations. Their development has required the rewriting of some of the rules governing the aviation world to take into account these new capabilities. The civil aviation regulatory authorities have responded favorably to these technological and safety advances, and have worked with the industry to create new sets of rules. The purpose of ETOPS is very clear: It is to provide a very high level of safety while facilitating the use of twin-jet aircraft on routes that were previously restricted to three and four-engine aircraft.

To operate an aircraft under ETOPS regulations, an airline must comply with all of the following requirements:

- The aircraft model is approved for ETOPS by the NAA of the manufacturer, and this approval has been validated by the NAA of the airline
- The aircraft used on that route are configured, maintained, and operated as per ETOPS requirements
- The NAA of the airline has granted it an ETOPS operational approval.

ETOPS regulations and requirements are detailed in the following chapters.

### 2.2 HISTORY

Ever since aviation was born, Humans have tried to fly further and further away from their departure points. The hundreds of yards of the Wright brothers have evolved, with time, into thousands of nautical miles.

There is an extensive history in the evolution of the rules that led to ETOPS operations. These operations are not as recent as one would think: The first one took place in 1919 when two Britons, Captain J. ALCOCK, and Lieutenant A. W. BROWN, crossed the Atlantic, eastward, in a twin-engine Vickers Vimy, eventually “landing” in an Irish peat bog after a sixteen-hour flight.

**2.2.1 Original Regulations**

But we had to wait until 1936 to see Pan Am operate the first transoceanic passenger flight, across the Pacific Ocean, with a Martin M130. At the same time, the U.S. Civil Aviation Administration (CAA), ancestor to the Federal Aviation Administration (FAA), created the requirements that are still incorporated in the current section 121.161 of the Federal Aviation Regulation (FAR).
Notice how large these aircraft were: They were so huge that no runways existed at the time to accommodate them, hence the need for seaplanes. But these behemoths would barely survive WWII, and disappear soon after…

The Laté 631 was one of the last survivors. She had a wingspan of approximately 57 m, was powered by 6 Wright R2600 (1 500 hp each), had an average Takeoff Weight (TOW) of 71 T, and a range of 3 750 nm for a maximum of 46 passengers, and a crew of 5.

The seaplanes were replaced by slightly smaller, but more capable aircraft (Both in terms of range, and payload), like the Douglas DC-4.

The initial "60-minute rule" was established in 1953. This rule applied to all types of aircraft, regardless of their number of engines: All operations were restricted to an en-route area-of-operation that was within 100 nm of an adequate airport. In those days, for many aircraft, 100 nm roughly corresponded to a 60-minute flying time with one engine inoperative. The rule focused on the poor reliability of the piston engines that were available at the time. Its purpose was to limit the required flying time to reach an alternate airport, and hence reduce the risk of a catastrophe by lowering, to an acceptable level, the probability that all engines would fail. In other words, the low reliability level of piston engines required that aircraft remain within 60 minutes of an adequate airport to ensure that, if one engine failed at any point along the route, the aircraft could land before the remaining engine failed. But the rule was flexible: It authorized operations beyond these 60 minutes, if a special approval was granted by the administrator. This special approval was based on the Operator’s experience, the type of terrain, the type of operations, and the performance of the aircraft to be used. There was no regulatory upper limit to this special approval. This rule was also applied to three-engine aircraft, until 1964.

Also in 1953, the ICAO Standing Committee on aircraft performance reviewed piston-engine reliability data. The following chart, extracted from the committee report, provides the probability of failure for piston engines vs. power at a constant engine speed of 1 000 rpm:
Failure Probability vs. Engine Horsepower at 1 000 rpm (1953)

The chart indicates that the probability of failure increased with power: For an aircraft that required 6 000 horsepower to complete a mission, a twin-engine aircraft had an engine failure probability of 13.68 (2 x 6.84), while a four-engine aircraft had a failure probability of 8.12 (4 x 2.03).

Following this reliability review, the ICAO published a recommendation stating that a 90-minute diversion time, at all engine operating speed, was acceptable for all aircraft. The more flexible ICAO recommendation was selected by many non-US regulatory authorities, and many non-US airlines started to operate their twin-engine aircraft under this rule. However, at that time, four-engine aircraft were the queens of the sky, and twin-engine aircraft were mostly relegated to short, and medium range operations.
Therefore, for commercial operations, the twin-engine aircraft remained limited to the above-mentioned 60-minute threshold. This era was also the beginning of the end of the big radials: In the 1950s the first jet-powered commercial aircraft, like the de Havilland Comet, started gracing the skies.

2.2.2 Reliability of First Generation of Jet Engines

The introduction of jet engines, like the JT8D, into civil aircraft significantly enhanced the reliability and safety of propulsion systems. This enhancement enabled manufacturers to develop twin-engine jet aircraft that were bigger, and faster than four-engine piston aircraft.

2.2.3 High-bypass Engines, and Wide-body Twin Aircraft

By the early 1980s, great advances had been made in the aircraft operational environment, design reliability, and integrity. These advances were based on the highly satisfactory experience of the first generation of jet engines, and the knowledge gained from the operational introduction of the Pratt & Whitney JT9D, the General Electric CF6, and the Rolls-Royce RB211 large high-bypass engines.
Getting to Grips with ETOPS: Certification and Approval

Introduction

twin-jet aircraft, usable on routes up to 90-minute maximum diversion time, e.g. across the Caribbean Sea or the Indian Ocean.

In addition, in these nearly 40 years, jet operations have demonstrated that, contrary to piston engines, the failure probability of a jet engine is neither affected by the thrust nor by the size of the engine. The failure rates of some of the large high-bypass engines are similar to the JT8D failure rate, and are nearly ten times better than piston engines. Therefore, now, the probability of an engine failure is higher on a quad-jet than on a twin-jet.

![Failure Rate per 1000 hours vs. Jet-Engine Thrust](image)

2.2.4 Initial 120-minute ETOPS Operations

The greatest initial interest in 120-minute rules ETOPS operations was over the North Atlantic (NAT). The highly competitive nature of NAT operations made the use of wide-body twin-jets very attractive. However, under the 60-minute rule, operations required indirect routings (Usually referred to as random routes), and the use of en-route alternate airports that have limited airport services, and facilities, and are subject to frequent weather limitations. NAT operations under a 120-minute rule would enable Operators to use the minimum cost routings (Organized Tracks System), and enable the use of alternates that are properly equipped to support a diverting aircraft.

All of this slowly led the Authorities and the industry to realize that technical advances in airframe, avionics, and propulsion had created the need, and the opportunity, to define a new type of operation. All twin-jets could then be designed with performance, and safety enhancements that allowed them to safely fly sectors that were historically restricted to three and four-engine aircraft. The advent of the A300-600, A310, 757, and 767, as well as a new generation of high-bypass engines provided twin-jets with the efficiency, safety, and range/payload capabilities, that made the old 60-minute rule restriction inappropriate.
Although a limited number of extended diversion-time operations had been conducted as permitted by the old ICAO 90-minute guidelines, ETOPS, as it is today, began in the early 1980s:

The ICAO set an ETOPS Study Group that had the following objectives:

- To examine the feasibility of extended-range operations with these new twin-jets
- To define the special criteria that Operators and Manufacturers should apply to ensure that these operations were conducted with a very high level of safety.

The ICAO Study Group recommended that a new ICAO rule be established to recognize the capabilities of these new aircraft, and the limitations of the older ones. The end result was an amendment to ICAO Annex 6, that, unless the aircraft could meet special ETOPS safety criteria, recommended that all turbine-powered aircraft be restricted to 60-minute flying time, at one-engine-inoperative speed, from an adequate airport.

At the same time, the FAA also began the initial work that resulted, in 1985, in Advisory Circular (AC) 120-42. This AC established the criteria for approval of a deviation, in accordance with FAR 121.161, to increase the ETOPS area of operation to 120-minute flying time, at one-engine-inoperative speed, under standard conditions, and in still air.

Several other civil aviation regulatory authorities also published ETOPS criteria including the Civil Aviation Administration (CAA) - UK, Direction Générale de l’Aviation Civile (DGAC) - France, Transport Canada, Department of Transport (DOT) - Australia, and CAA - New Zealand, during the same time period. Many other countries relied on the guidance provided in the ETOPS amendments to ICAO Annex 6.
2.2.5 Modification of Existing Aircraft

Although there were several aircraft that could comply with ETOPS performance requirements, and that had the range/payload capabilities to make ETOPS operations economically feasible, there were no aircraft capable of meeting the aircraft system, and propulsion system requirements at the time that the ETOPS rules were being developed. Therefore, the first ETOPS aircraft were modified versions of aircraft originally intended for non-ETOPS operations. These modifications were necessary to enhance the reliability of propulsion systems, and to enhance the redundancy, and performance of electrical, hydraulic, and avionics systems. As a matter of fact, an additional electrical generator was added to most of these aircraft to provide four independent sources of alternative electrical power, to ensure that all critical systems be continuously supplied with electrical power without a time limitation. On Airbus aircraft, this additional generator is hydraulically driven.

2.2.6 Evolutions of the Regulations

In 1988, the success of 120-minute ETOPS operations led the authorities, and the industry to consider the possibility of 180-minute ETOPS operations. Operators were very interested in the implementation of 180-minute ETOPS, because it meant that almost all existing routes in the world could be serviced by twin-jets, in particular routes across the Pacific Ocean. In addition to the major design enhancements incorporated in ETOPS aircraft, enhancements in high-bypass engine reliability made 180-minute operations possible.

The FAA published AC 120-42 "A" on December 30, 1988, that provided the criteria for 75-minute, 120-minute, and 180-minute operations. On January 18, 1989, the FAA approved the first 180-minute ETOPS operation. Since then, ETOPS operations have continuously increased on the North Atlantic routes where, actually, more twin-jets are flying than tris or quads, as well as on most long range routes across, and between the five continents.

In 1993, the European Joint Airworthiness Authorities (JAA) developed their own criteria, Information Letter (IL) 20/Advisory Material Joint (AMJ) 120-42, that combined the best points from the individual European rules, and from the FAA criteria.
In 2007, the FAA published a new ExTended OPerationS (ETOPS) regulation, based on the previous ETOPS, but also applicable to tris, and quads. The Civil Aviation Safety Authority (CASA) from Australia then published a new regulation named Extended Diversion Time Operations (EDTO), also applicable to tris, and quads. The ICAO followed soon after, and created a special operations task force to make new recommendations, also taking into account tris, and quads.

In 2010, based on the latest evolutions of the industry and the demonstrated safety of 180-minute ETOPS, the European Aviation Safety Agency (EASA), that replaced the JAA, published a new set of criteria, the Acceptable Means of Compliance (AMC) 20-6 Rev 2. This AMC provides the criteria that Operators and Manufacturers should apply to get approvals for diversion times exceeding 180 minutes (Also known as “Beyond 180 min”). AMC 20-6 Rev 2 is applicable only to twin-jets, and is still applicable at the time this brochure is published.

These new ETOPS rules also clarify, and provide more formal definitions of exemptions like the increase of the maximum diversion time to 207 min for NOrthern PACific (NOPAC) operations.

2.2.7 Development of Modern ETOPS Aircraft

The success of ETOPS operations, the safety benefits associated with the ETOPS-led designs, and the large economic benefits provided to ETOPS Operators have had a powerful effect on the design of all modern twin-jets. Thanks to ETOPS operations, it is now economically feasible to build very large twin-jets. These new aircraft, like the Airbus A330 and the Airbus A350XWB, have even better safety features, and higher operating performances than comparable tris, and quads. In addition, these new aircraft have a better range than previous generations and can operate on Polar routes and routes in some remote areas of the southern hemisphere. In fact, these new aircraft have been the driving force behind the new “Beyond 180 min” rule.

The Airbus A350XWB, the latest generation
3.1 OBJECTIVES AND CONCEPT

3.1.1 Objectives

The main objectives of the initial ETOPS rules, back in 1985, were:

- “Ensure an overall level of operational safety consistent with that of modern three-, and four-engine aircraft”

The design of an ETOPS twin-jet must ensure that the operation of the said twin-jet is, at least, as safe as a tri- or a quad-jet used on the same route. Let us use the engines as an example.

Aircraft engines do not only produce thrust. They are also a source for the electrical, hydraulic, and pneumatic systems of the aircraft. Here are two aircraft designed without any ETOPS constraints:

In normal operations, with all engines operating, the available electrical power is:

- 100% (for both)

With one engine inoperative, the available electrical power is:

- 50% (for one)
- 75% (for the other)
In order to comply with ETOPS requirements, the twin-jets are equipped with an additional electrical generator to cope with the possible loss of an engine. This additional generator can be the generator of the APU:

![Diagram of an aircraft with one engine inoperative]

With one engine inoperative
the available electrical power is:

- 100%
- 75%

But ETOPS does not cover only the electrical system: Other aircraft systems are designed to comply with ETOPS requirements. They are:
- The FIRE system (ATA 26)
- The FUEL system (ATA 28)
- The HYDRAULIC system (ATA 29)
- The ANTI-ICE system (ATA 30)
- The PNEUMATIC system (ATA 36), etc.

In addition, ETOPS-capable aircraft have more reliable, and/or redundant systems:
- The engines, and the APU are continuously monitored by maintenance teams, in order to assess their reliability
- The fire system does not cover only the engines or the APU: The cargo holds also have a dedicated fire protection that can control a fire for the entire duration of the diversion, plus an additional 15 minutes
- These reliabilities and redundancies minimize the crew workload, even in the case of a failure.

However, these redundancies have one drawback: The consequence of a simultaneous maintenance error on parallel systems can affect safety.

![Diagram of an aircraft with dual maintenance performed on two identical engine-mounted systems]

With dual maintenance performed on two identical engine-mounted systems,
the potentially affected systems are:

- Two out of two
- Two out of four

• “Ensure safe operations on routes distant from diversion airports”

ETOPS do not address only the design of aircraft systems. These regulations also take the following operational considerations into account:
- The flight crew must always know the weather conditions at each alternate airport along the route
- There must be sufficient fuel onboard, at departure, to reach an alternate airport, even if the worst scenario unfolds.
3.1.2 Concept

These objectives are still in force today. In order to satisfy them, the ETOPS concept, implemented nearly 30 years ago, has not changed. It can be summarized by the following words: **Preclude**, and **protect** the diversion.

- **Preclude**
  
  In order to ensure the highest level of safety for operations, diversions have to be precluded, as much as possible. To preclude diversions, aircraft manufacturers and Operators must apply both of the following:
  
  o **First**, the manufacturer must design a reliable aircraft. As already mentioned, the design includes not only the airframe, but also the engines, and aircraft systems. This reliable aircraft design must minimize the occurrence of failures. This is demonstrated by the manufacturer, with the ETOPS Type Design & Reliability Approval (Certification) of the aircraft.
  
  o **Second**, the Operator must maintain this high level of reliability via the following actions:
    
    ▪ The implementation of specific maintenance precautions, and of conservative practices, like avoiding simultaneous maintenance actions on parallel systems
    
    ▪ The demonstration of its readiness to operate under ETOPS regulations. These actions are necessary to grant the ETOPS Operational Approval to the Operator.

- **Protect**
  
  If a diversion cannot be avoided, it must be performed in the safest way possible. This is also achieved in two steps:
  
  o **First**, the manufacturer must implement the systems and functions required to ensure a safe diversion and a safe landing. The manufacturer must ensure a high level of performance for these systems, in both normal and degraded modes of operation, and demonstrate this performance to obtain the ETOPS Type Design & Reliability Approval (Certification) of the aircraft.
  
  o **Second**, the Operator must be able to cope with adverse operating conditions, by having operational plans in place, to protect the passengers and crew. The Operator must demonstrate this ability, in order to obtain the ETOPS Operational Approval.

Both ETOPS Type Design & Reliability, and ETOPS Operational approvals are necessary to operate under ETOPS regulations.

3.1.3 ETOPS Significant Systems

For ETOPS, some aircraft systems are very important, in order to preclude and protect the diversion. They are called ETOPS significant systems. ETOPS regulations define significant systems, as follows:

- Systems for which a failure may affect the safety of an ETOPS flight (Preclude)
- Systems that must be operative to ensure a safe flight and a safe landing, in the case of a diversion (Protect).

In fact, the same wording “ETOPS significant systems” is used to cover three different cases:

- Systems that require precautions to avoid multiple maintenance errors
- Systems that require a specific reliability monitoring for ETOPS
- Systems for which a failure must be reported to the Authorities, for safety reasons.
The Airbus approach is to take into account these three different types of systems:

- **Maintenance significant systems**, are systems for which it is necessary to apply specific precautions to avoid multiple human errors (e.g. on these systems, the same mechanics should not perform a maintenance task on two channels at the same time, unless a dual verification is performed). This list of maintenance significant system is also taken into account in the frame of ETOPS Service Check or verification program definition.

- **ETOPS significant systems**, are systems that require an ETOPS reliability monitoring (Monitoring of the failure rate trend).

- **ETOPS report items**, are the occurrences related to ETOPS significant systems, for which the Authorities want a periodic reporting and analysis (Event-oriented reporting of in-service ETOPS occurrences).

ETOPS significant systems are further categorized into two groups, called Group 1, and Group 2. These groups were introduced both in the new EASA and FAA ETOPS regulations, in association with the “ETOPS significant system” list.

- **Group 1**: The identification of ETOPS Group 1 systems is related to the assessment of the consequence of an engine failure. Therefore, Group 1 systems are typically specific to twin-engine aircraft compared to four-engine aircraft.

- **Group 2**: Group 2 systems are usually common to two, three, and four-engine aircraft. They are not concerned by the additional requirements related to reliability demonstration, because it is considered that the basic type certification exercise adequately covers the need. Nevertheless, the consequence of the failure of a Group 2 system would still require to be addressed in the frame of the reliability (And maturity) demonstration for ETOPS, and any required corrective action could be mandated further to an assessment of the impact of the concerned system failure on the safety of the flight.

Note: Due to the fact that additional requirements apply to Group 1 systems, this classification is only necessary for the aircraft manufacturer when conducting the ETOPS reliability demonstrations for an Early ETOPS approval (See 3.2.2 - ETOPS TYPE DESIGN, AND RELIABILITY APPROVAL - Process, here-below). The objective of these demonstrations is to validate the reliability of the aircraft at entry into service, in accordance with the early ETOPS certification process. These reliability demonstrations are required only for ETOPS Group 1 systems.

### 3.2 ETOPS TYPE DESIGN & RELIABILITY APPROVAL

#### 3.2.1 Applicability

The ETOPS Type Design & Reliability approval is the ETOPS certification of the aircraft. The aircraft manufacturer is responsible for obtaining it. The Primary Certifying Authority of the manufacturer is in charge of the issuance of this certification, i.e. the EASA for Airbus. This authority can be seconded by other validating authorities, for example, the FAA.

But what ETOPS rules must aircraft manufacturers apply?

Aircraft manufacturers must apply the ETOPS rules that are valid at the time of application for certification. For example:

- For aircraft certified by the EASA, and with applications submitted before 2011 (e.g. A320, A330 180 min ETOPS, etc.), aircraft manufacturers should apply AMC 20-6 Rev 1. From then on, AMC 20-6 Rev 2 is applicable.

  Note: The A350 could have also been certified against AMC 20-6 Rev 1, but, as a “Beyond 180 min” maximum diversion time was targeted, AMC 20-6 Rev 2 was selected instead.

- For aircraft certified by the FAA before 2007 (e.g. A320, A310, B737, B767, etc.), aircraft manufacturers should apply AC120-42A. From February, 15, 2007, AC120-42A has been replaced by the FAA PART 21, 25, and 33 certification rules.

- ICAO Airworthiness manual 9760, and ICAO Standard And Recommended Practices (SARPs) Annex 8 include additional guidelines.
In addition, ETOPS certifications granted before the publication of newer ETOPS operational criteria remain valid. This is further detailed in the regulations themselves. For example, EASA AMC 20-6 Rev 2, in chapter 1 - section 1, states:

ETOPS type design approvals and operational approvals obtained before the issue of this revision remain valid. Extension of existing ETOPS type design approvals or operational approvals beyond 180 min should be issued in accordance with this revision.

Note: Once granted, the ETOPS Type Design & Reliability Approval can be revoked: An ETOPS Reliability Tracking Board (ETOPS RTB) performs a continuous monitoring of the reliabilities of aircraft systems, APU and engines. If the reliabilities do not reach the Airworthiness Authorities expectations, the maximum diversion time can be reduced, or the ETOPS certification revoked. (Refer to chapter 4: ETOPS RELIABILITY TRACKING BOARD.)

Aircraft manufacturers must obtain the ETOPS Type Design & Reliability Approval before Operators can apply for the ETOPS Operational Approval.

### 3.2.2 Process

The manufacturer must demonstrate the compliance of the candidate aircraft with all the design provisions, and reliability objectives of the applicable ETOPS rules.

- **Design:** The certifying Airworthiness Authorities conduct a design review of the aircraft, based on the certification documents provided by the aircraft manufacturer. They publish the result of their investigation in a document called Design Compliance Findings.

- **Reliability:** The ETOPS RTB is initiated during the flight tests of the candidate aircraft. Its members come from the authorities and from the aircraft, and engine manufacturers. The purpose of the ETOPS RTB is to review the service data of the aircraft, and amend the ETOPS requirements of the aircraft, if necessary. The ETOPS RTB continues after the certification of the aircraft is obtained.

An aircraft manufacturer can obtain the ETOPS certification in one of the following two ways:

- **Via an in-service approval,** that requires some engine-operation experience on the candidate aircraft:
  - For the EASA: Up to 100 000 engine hours
  - For the FAA: Up to 250 000 engine hours.

- **Via an early ETOPS approval:**
  - It enables the aircraft manufacturer to obtain an ETOPS certification with very little or no previous experience
  - It is a process-based approach, that requires extensive maturity, and reliability demonstrations with the candidate aircraft, for example:
    - **Ground tests:** Engines, and APU endurance bench tests (3 000 cycles)
    - **Specific flight tests,** with the following scenarios:
      - Maximum duration flights
      - Maximum duration flights with One Engine Inoperative (OEI), with simulated diversion scenarios
      - Flights performed in degraded system configurations (e.g. single electrical generator, single engine bleed, etc.)
      - Operations and reliability demonstrations.
    - **Lessons learned analysis:** The manufacturer demonstrates that the new aircraft design takes into account previous program Airworthiness Directives (ADs)
    - **Technical Transfer Analysis:** The new aircraft design must take advantage of technology transfers and experience gained from previous programs, etc.
      - This process involves a close monitoring, by the Authorities, of the reliability demonstrations.
The next chapter describes the above-mentioned design requirements and explains the EASA and FAA differences.

### 3.2.3 Design Requirements

#### 3.2.3.1 Human Factors and Safety Analyses

The manufacturer must demonstrate that the crew workload is minimized under failure conditions, for the maximum diversion time/distance. Since the flight crew workload may increase during a diversion, an assessment is made to ensure that the safety of the flight does not require more than average piloting skills or crew coordination.

Flight test campaigns are then performed to validate this acceptable flight crew workload, and the adequacy of the flight crew procedures (Normal, abnormal, and emergency procedures). The following are examples of flight test scenarios, that combine flights with one engine inoperative, and system failure simulations:

- Diversion in electrical emergency configuration
- Emergency descent to, and diversion at, Flight Level (FL) 100 or to the Minimum Safety Altitude (MSA)
- Failure of the autopilot and autothrust, etc.

Safety analyses (Functional Hazard Analyses (FHAs) and System Safety Analyses (SSAs) are reviewed to define the maximum permissible diversion time. The corresponding time limitation of the Most Time Limited System (MTLS), other than the Cargo Fire Suppression System, is then published in the Flight Manual.

The following rule provides the relationship between the maximum permissible diversion time, and the time limitation of the MTLS:

\[
\text{MTLS time limitation} \geq \text{ETOPS diversion time} + 15 \text{ min}
\]

#### 3.2.3.2 Air Conditioning (ATA 21)

The manufacturer must demonstrate that an appropriate cockpit and cabin environment is preserved in the case of combined propulsion and electrical system failures, that are not shown to be extremely improbable (e.g. in electrical emergency configuration).

The manufacturer must also demonstrate that an excessive temperature in the avionics compartment is extremely improbable.

On Airbus twin-engine aircraft, cabin pressurization and equipment cooling are ensured by either of the following systems:

- A single engine air-bleed system, or
- The APU air-bleed system, up to 22,000 ft.

#### 3.2.3.3 Communications (ATA 23)

The manufacturer must demonstrate that an appropriate communication system is installed:

- One voice-based communication system is required for all ETOPS operations
- For the FAA: A SATCOM Voice is required for “Beyond 180 min” ETOPS operations
- In areas where SATCOM is not available (i.e. polar regions), or does not support voice communication, a backup voice system is required (HF).

#### 3.2.3.4 Electrical Generation (ATA 24)

The manufacturer must demonstrate that the electrical generation system complies with the following design requirements:

- An ETOPS aircraft must be equipped with at least three reliable independent generators
- In the case of an engine failure, the remaining electrical power must be sufficient to ensure a safe flight and a safe landing, i.e. each generator must be capable of supplying
sufficient electrical power, in order to ensure the safety of the flight and landing, even under adverse operating conditions

- In the case of “Beyond 180 min” ETOPS operations:
  - For the EASA: A fourth generator is required, unless the aircraft manufacturer can demonstrate that the loss of the three independent sources is extremely improbable
  - For the FAA: A fourth generator is required to power one cross-feed valve, and one fuel boost pump in each tank.

On Airbus twin-engine aircraft, the electrical generation is ensured by:

- On A300/A310, A318/A319/A320/A321, and A330 family aircraft:
  - Two engine-driven Integrated Drive Generators (IDGs)
  - One APU-driven generator (APU GEN)
  - One hydraulically-driven Constant Speed Motor/Generator (CSM/G) (Also called Emer Gen or St, and-by Gen) supplied by the main hydraulic circuit (Green or blue depending on the aircraft family)

- On the A350:
  - Four engine-driven Variable Frequency Generators (VFGs) (That represent the three independent electrical sources)
  - One APU GEN.
  - The four generators are independent versus any single cause event (local fire, mechanical damage, uncontained engine failure, etc.) In addition, thanks to the four independent sources:
    - There is no need to start the APU in ETOPS area,
    - The dispatch with the APU inoperative may be permitted (MMEL).

### 3.2.3.5 Fire Protection (ATA 26)

The manufacturer must demonstrate that the aircraft has an appropriate cargo fire suppression system (Both in terms of capability & reliability):

- The cargo fire protection system must cover the maximum approved diversion time with an additional 15 minutes for holding, and/or approach, and landing: e.g. the necessary minimum protection times for 120-minute ETOPS, and 180-minute ETOPS are, respectively, 135 minutes, and 195 minutes.
- These protection times are demonstrated by flight tests. They are considered as a time limitation, and inserted in the AFM, FCOM, and ETOPS CMP Document.

On Airbus twin-engine aircraft, the capability of the cargo fire protection system depends on the aircraft families:

- On the A330, the cargo hold is protected for up to 260 minutes. This is appropriate for ETOPS 180 min, and for “Beyond 180 min” ETOPS operations (However limited to a 245-minute diversion time)

- On A320 family aircraft, two options are available for the cargo fire suppression system: 135-minute, and 195-minute protection times. These are appropriate for, respectively, ETOPS 120-minute, and 180-minute operations.

However, for all Airbus aircraft, the reliability of the fire protection system is such that, even in electrical emergency configuration (Aircraft electrically powered by the CSM/G only):

- The fire detection and extinguishing capabilities are still ensured for the engines and the APU
- The smoke detection, ventilation control, and heating control are still available for the cargo holds
- The smoke detection is still operational for the avionics compartment.
3.2.3.6 Fuel (ATA 28)

The manufacturer must demonstrate that the fuel system complies with the following design requirements:

- In the case of one engine inoperative, the fuel cross-feed to the remaining operating engine must be protected against additional single malfunctions:
  - On the A320, the fuel cross-feed valve is designed so that a test before departure is sufficient to satisfy this requirement,
  - On the A330, the fuel cross-feed is available via the normal cross-feed gallery or, in the case of a failure, via the refueling gallery.
• The effect of turbulences, and negative load factors on engine operation must be evaluated if:
  o The fuel boost-pumps are not powered (e.g. limitation in CSM/G configuration), or
  o The loss of all fuel boost-pumps is not classified as “extremely improbable”.
A320 family aircraft are the only Airbus twin-engine aircraft for which a loss of all fuel boost-pumps is not classified as “extremely improbable”. Flight tests were performed in order to demonstrate the gravity feeding capabilities of the A320 family aircraft.

In addition, for “Beyond 180 min” ETOPS operations, the FAA requires that:

• An alert appears to inform the flight crew when the available fuel quantity to the engines goes below the required fuel quantity to fly to the destination. The alert must be triggered when there is sufficient remaining fuel to safely complete a diversion. It must also account for abnormal fuel management or transfer between tanks, and possible loss of fuel.

On the Airbus twins that are qualified for “Beyond 180 min” ETOPS operations, the following alerts satisfy the above-mentioned FAA requirements:

  o A “FUEL FU/FOB DISCREPANCY” ECAM alert. This alert is triggered if there is a difference between the initial Fuel On-Board (FOB) and the sum of the current FOB, and Fuel Used (FU). It indicates a possible fuel leak.
  o An FMS low fuel alert. This alert is triggered when the Estimated Fuel On-Board (EFOB) at destination (DEST EFOB) is strictly below the minimum fuel required to reach the destination (MIN DEST FOB).

By default, MIN DEST FOB is equal to the sum of the alternate (ALTN) and FINAL fuel quantities (MIN DEST FOB = ALTN + FINAL).

A normal A330 FUEL PRED page that displays the MIN DEST FOB
An abnormal A330 FUEL PRED page that displays the EFOB at destination < MIN DEST FOB

The EXTRA fuel quantity is equal to the difference between the DEST EFOB, and MIN DEST FOB fuel quantities (EXTRA = DEST EFOB - MIN DEST FOB). Therefore, the alarm is triggered when the EXTRA fuel quantity is negative.

Note: When the alarm is triggered, the remaining fuel quantity is sufficient to complete a diversion.

3.2.3.7 Hydraulic (ATA 29)

The manufacturer must demonstrate that, in the case of an engine failure, the remaining hydraulic power is sufficient to safely fly and land the aircraft.

The following are two examples of hydraulic system architectures, found on Airbus twin-engine aircraft, that comply with the above-mentioned requirements:
On the A330:

The aircraft is equipped with three independent hydraulic circuits: The GREEN, BLUE and YELLOW circuits. In normal operations, each engine pressurizes two circuits:

- Engine 1 pressurizes the GREEN and BLUE circuits
- Engine 2 pressurizes the GREEN and YELLOW circuits
If one engine fails, only one circuit is lost: e.g. in the case of Engine 1, the BLUE circuit is lost. The following diagram indicates what are the systems affected by the loss of the BLUE hydraulic circuit.

Due to the fact that all critical items have a minimum of two hydraulic power sources, only a few items are lost:

- Flight control system: Only one pair of spoilers (2 and 3) is lost on each wing. All other flight controls have multiple power sources.
- Brake system: The alternate braking and the parking brake are lost.
- Engines: Engine 1 thrust reverser is lost (Only for Rolls Royce and Pratt & Whitney engines).

This means that the failure of one engine does not cause any loss of critical items.
On the A350:

The aircraft is equipped with two independent hydraulic circuits: The GREEN, and YELLOW circuits. In normal operations, each engine pressurizes both circuits. If one engine fails, no circuit is lost, as each circuit is pressurized by two Engine-Driven Pumps (EDPs), one per engine.
3.2.3.8 Ice and Rain Protection (ATA 30)
The manufacturer must demonstrate that the ice and rain protection system complies with the following design requirements:

- The aircraft must be able to safely perform a diversion in icing conditions, including the landing.
- In addition, if the aircraft is in electrical emergency configuration (i.e. supplied only by the CSM/G), the following functions must remain available:
  - The engine air-intake anti-ice
  - The wing anti-ice
  - At least one alpha-probe anti-ice
  - At least one pitot-probe anti-ice.

Notes: 1) The EASA, and the FAA state that a weather radar is necessary, if icing conditions can be encountered. This weather radar is not required to be available if the aircraft is powered by its CSM/G.
2) The effects of ice accretion on unprotected surfaces must be accounted for (Fuel, performances, etc.)

3.2.3.9 Pneumatic (ATA 36)
The pneumatic system supplies:

- The air conditioning, and pressurization system (ATA 21)
- The pressurization of the hydraulic reservoirs (ATA 29)
- The wing anti-ice function (ATA 30)
- The engine start function (ATA 70).

Note: Engine-nacelle anti-ice & wing leading-edge ventilation are separately supplied (Respectively from the engine High Pressure Compressor (HPC), and from a wing NACA ram-air inlet).

The manufacturer must demonstrate that the pneumatic system complies with the following design requirement.

If the aircraft is in electrical emergency configuration, during a diversion with one engine inoperative, the bleed system must remain operative:

- The cross-bleed valve, and one Bleed Monitoring Computer (BMC) are kept powered
- All detectors (pressure, temperature, overheat, leak, etc.) and valve positions are maintained
- The pneumatic valve closure behavior remains unchanged.

Note: Parts of this requirement are derived from ATA 21, and ATA 30 requirements. For additional information, please refer to the above-mentioned ATA chapters.

3.2.3.10 Auxiliary Power Unit (APU) (ATA 49)
The manufacturer must demonstrate that the APU complies with the following design requirements:

- The APU installation must comply with normal certification requirements.
- The APU must comply with additional ETOPS requirements related to its intended function (e.g. the third electrical generator):
  - The APU must demonstrate an in-flight start capability of at least 95 %, up to the maximum operating altitude (For aircraft that do not normally require APU operation in ETOPS sectors)
  - The APU must be sufficiently reliable for ETOPS operations: It must demonstrate a maximum failure rate of 10 E-3 per APU operating hour (Equal to a Mean Time Between Failure (MTBF) of minimum 1 000 hr)
  - The manufacturer must demonstrate the compliance with the above-mentioned requirements, via an Early ETOPS demonstration (in the case of ETOPS at EIS), and in-service experience.
### 3.2.3.11 Power Plant (ATA 70)

There are no specific ETOPS design requirements related to the power plant, however, the manufacturer must ensure all of the following:

- ETOPS engines must be equipped with an oil tank filler cap.
- An engine failure, contained or not, must not adversely affect the remaining systems or equipment: i.e. In the case of single engine operations, the system redundancies must be adequate.
- The engines must comply with ETOPS reliability objectives, i.e. the In-Flight Shut-Down (IFSD) target rates. The compliance with these reliability objectives must be demonstrated via:
  - In-service experience, or
  - An Early ETOPS exercise in the case of ETOPS at EIS.

**Notes:**
1) The IFSD target rates depend on the maximum authorized diversion time:
   - 0.05/1,000 engine hours for ETOPS 120 min
   - 0.02/1,000 engine hours for ETOPS 180 min
   - 0.01/1,000 engine hours for “Beyond 180 min” ETOPS.
2) The IFSD target rates are computed, based on world-fleet data, on a 12-month rolling average.

Reviews of the propulsion-system data and of in-service experience should be conducted:

- By the certification team, before the first ETOPS Type Design & Reliability approval (Initial certification of the aircraft), and
- By the dedicated ETOPS RTB, on a continuing basis thereafter. (Refer to chapter 4: ETOPS RELIABILITY TRACKING BOARD.)

### 3.2.4 Certification Results

In order to assess the ETOPS capability of the aircraft, the Regulatory Authority analyses the IFSD rate of the propulsion system, and other in-service events (both in-flight, and on the ground), related to the engine, its associated equipment and other aircraft systems.

The maximum authorized ETOPS diversion time for the candidate aircraft model/engine combination is then granted, based on the Airworthiness Authorities’ engineering judgment, that quantifies the proposed reliability solution, and the predicted reliability level.

### 3.3 ETOPS OPERATIONAL APPROVAL

#### 3.3.1 Applicability

The Operator is responsible for obtaining the ETOPS Operational Approval, that is granted by the Operator's local NAA. The ETOPS criteria of this local NAA may be different from the EASA or FAA ones. In order to obtain the ETOPS Operational Approval, the Operator has to demonstrate its compliance with these requirements. This impacts the entire Operator's organization (i.e. flight operations, and maintenance).

But what ETOPS requirements should Operators apply?

Operators should apply the ETOPS requirements that are valid at the time of application for approval, i.e. as of September 2014:

- For EU-OPS Operators (EASA): AMC 20-6 Rev 2, Chapter III “OPERATIONAL APPROVAL CONSIDERATIONS”
- For FAR 121 Operators (FAA): AC 120-42B, Chapters 4 & 5
- For CAA Operators: CAP 513
- For DGAC Operators: CTC 20
- For TC Operators: TP6327, etc.
However, contrary to the ETOPS Type Design & Reliability Approval, the Operator must take into account, and apply, any update of the original regulation that may appear after the approval is granted.

Here, again, this approval is subject to a continuous review by the local authority. This ensures that the Operator achieves and maintains the desired quality levels.

### 3.3.2 Process

In order to obtain an ETOPS Operational Approval, the Operator must demonstrate that it correctly manages the required ETOPS processes, i.e. in the fields of flight operations, and maintenance.

The Operator must prepare the various documents required for the approval:

- The desired Maximum Diversion Time (MDT) that cannot be greater than the certified maximum authorized ETOPS diversion time of the aircraft model/engine combination
- For the flight operations, an ETOPS manual that contains:
  - The necessary ETOPS procedures
  - The intended ETOPS area of operation, including the selected ETOPS routes
  - The selectable alternate airports
  - The recovery plans, if necessary
  - The flight planning specificities, like:
    - The effects of some aircraft system failures on the available flight-time (The Time Limited Systems (TLS))
    - A weather study on the intended routes, and selectable alternate airports, etc.
  - The in-flight procedures, also included in the operating manuals, and related to the following subjects:
    - Communications,
    - Flight monitoring,
    - Decision-making process, to help the flight crew in the case of a diversion, etc.
- For the maintenance:
  - An ETOPS manual that contains:
    - All ETOPS maintenance procedures
    - The ETOPS maintenance plan, and the associated software
    - The ETOPS tasks identification.
  - A monitoring program, that takes into account the oil consumptions of the engines and of the APU, the recording of the in-flight start capabilities of the APU, and the associated software
  - A reliability monitoring program, and the associated software
  - An occurrence reporting program, also with the associated software.

The following key personnel from the Operator must be nominated, trained, and be able to acquire ETOPS experience:

- The ETOPS coordinator
- The check airmen
- The flight crews
- The cabin attendants, if a recovery plan exists
- The dispatchers
- The line maintenance crews.

This full training program must also be documented, and presented to the NAA.

Note that all documents subject to legal approval are signed and stamped by the NAA.
There are two methods to obtain the ETOPS Operational Approval: The in-service plan, and the accelerated plan. The Operator selects one plan or the other, depending on its experience and on the existing time constraints.

### 3.3.3 The In-Service Plan

This method was previously known as the “Conventional ETOPS”. In order to obtain the ETOPS Operational Approval via this method, the Operator must have one to two years of in-service experience with the specific aircraft model/engine combination. The in-service experience limits the desired MDT, as follows:

- One year of non-ETOPS experience for up to 120 min approval
- One year of 120 min experience for up to 180/240 min approval
- Two years of 240 min experience for “Beyond 240 min” approval.

The ETOPS in-service approval

The Operator must send an ETOPS application letter to its local NAA at least 3 months before the planned date for the beginning of ETOPS operations. This letter shall include the following Operator's ETOPS objectives:

- The intended routes
- The corresponding area of operations
- The desired Maximum Diversion Time
- The applicable fleet
- The planned date for the beginning of ETOPS operations, etc.

The judgment criteria to obtain the approval are simply based on the Operator's in-service experience with the candidate aircraft model/engine combination. There are no special strategies to prepare: An action plan will be needed only in case of non-compliance with one of the NAA criteria.
3.3.4 The Accelerated Plan

If the Operator does not have the required necessary experience for the in-service plan, the Operator can compensate for this lack of experience by applying compensating factors. This method is called the accelerated plan.

The compensating factors are the basis of accelerated plan. The following are examples of compensating factors:

- A previous experience with other airframe or engines of a similar technology
- A previous ETOPS experience (e.g. another ETOPS program in the same company)
- A specific ETOPS training
- The recruitment or the temporary secondment of already ETOPS-experienced personnel, and their associated phasing-out plan
- The simulations of ETOPS operations, that should include the following:
  - Simulation of the flight preparation (ETOPS dispatch)
  - Simulation of the in-flight procedures, including the flight follow-up, provided:
    - The flights used for the simulation are of a sufficient duration,
    - The aircraft is from the same family (Or from the same cockpit technology) as the ETOPS candidate aircraft, e.g. use of an A340 flight to simulate an A330 ETOPS one.
  - Simulation of the maintenance dispatch:
    - By application of the ETOPS service checks
    - By checking the aircraft configuration against an ETOPS MEL.
- A combination of the above-mentioned compensating factors, etc.

The required amount of compensating factors depends on:

- The ETOPS objectives
- The organization, i.e. the current one vs. an ETOPS one
- The experience acquired on:
  - ETOPS operations
  - Long range operations
  - The route(s) to be flown
  - The technology of the candidate aircraft model/engine combination.

Note: The experience on ETOPS is transferable from any real or simulated ETOPS program, even from another Operator (e.g. a partner with actual ETOPS experience).
Examples of compensating factors:

- In order to achieve 120-minute ETOPS at EIS, the Operator, with no prior experience, must demonstrate its knowledge in:

- In order to achieve 180-minute ETOPS at EIS, the Operator will have to perform additional simulations, on top of what is needed for 120-minute ETOPS, to compensate for the lack of required ETOPS experience for the in-service approval.

The Operator must send the ETOPS application letter to its NAA at least 6 months before the planned date for the beginning of ETOPS operations. The accelerated plan requires a defined strategy, because the Operator and its NAA must communicate, in order to specify the compensating factors, and adapt the approval plan to the Operator's experience. The judgment criteria to obtain the approval are based on facts, and engineering data provided by the Operator. They are used to determine the ETOPS capability of the candidate aircraft model/engine combination for the Operator.

3.3.5 Approval

The NAA creates an assessment team, in order to evaluate the Operator's capability, for one approval plan or the other. This team has inspectors and pilot-inspectors. These team members are experts in the following fields:

- Flight Operations
- Maintenance
- Engineering
- Quality.
The assessment team will review the data, and documents, called the ETOPS Operational Compliance Documents, provided by the Operator. They contain:

- The required ETOPS manuals
- The experience records of both the maintenance and flight operations
- The implemented training programs
- The ETOPS simulation reports (If applicable)
- The self-audit reports (If applicable)
- The ETOPS proving-flight report (If applicable).

Based on the ETOPS Operational Compliance Documents and an audit report provided by the assessment team, the NAA determines if the Operator complies with the ETOPS operational requirements.
4 ETOPS RELIABILITY TRACKING BOARD

4.1 INTRODUCTION

As already mentioned, a reliability review process is initiated during the ETOPS Type Design & Reliability Approval of the aircraft. This process carefully monitors the flight, and system tests of the candidate aircraft. The manufacturer must demonstrate that various systems of the aircraft, like the engines or the APU, are at, or above, a required level of reliability. In addition, after they obtain the ETOPS Type Design & Reliability approval, the manufacturer must continuously maintain the reliability level of the certified aircraft, via ETOPS Continued Airworthiness.

The purpose of ETOPS Continued Airworthiness is to monitor the in-service experience that the aircraft type has acquired since its ETOPS certification, to determine the reliability of the aircraft systems, APU and engines. The collected data is analyzed by the manufacturer, and the NAA during ETOPS Reliability Tracking Board (RTB) meetings.

How often are these meetings held? The answer is based on the maturity of the aircraft type:

- For new aircraft types, the RTB meetings are held regularly, usually every 6 months
- For mature aircraft types (i.e. when the NAA states that the reliability indicators are stable, and that sufficient experience has been accumulated), RTB meetings are organized, on average, every two years. At the time of writing, the A300, and A310 family, the A320 family, and the A330 are considered as mature aircraft types. For these aircraft, the RTB meetings are now held only when required (e.g. when a specific reliability issue occurs, when a complex certification is faced, etc.), however, reliability reports are produced on a regular basis.

4.2 MONITORED ITEMS

4.2.1 Engines

- In order to maintain the ETOPS type certification of an aircraft model/engine combination, the manufacturer must demonstrate that the IFSD rate of the world-wide fleet (ETOPS, and non-ETOPS aircraft) remains below a given threshold. The threshold depends on the granted Maximum Diversion Time:
  - 0.05 IFSD rate per 1 000 engine hours for 120 min operations
  - 0.02 IFSD rate per 1 000 engine hours for 180 min operations
  - 0.01 IFSD rate per 1 000 engine hours for “Beyond 180 min” operations.

Note: The threshold is also used for the initial ETOPS certification of the aircraft model/engine combination.
The ETOPS regulations state that the Operators have to report their In-Flight Shut Down (IFSD) rate on a regular basis. If this IFSD rate exceeds another defined threshold, the NAA launch a technical review of the situation. This review may ultimately cause the suspension of the Operator’s ETOPS approval. This threshold also depends on the Maximum Diversion Time granted:

- 0.05 IFSD rate per 1 000 engine hours for 120 min operations
- 0.03 IFSD rate per 1 000 engine hours for 180 min operations
- 0.02 IFSD rate per 1 000 engine hours for “Beyond 180 min” operations.

Note: If the fleet is too small to be statistically significant (i.e. less than 15 aircraft), the IFSD rate is only used as a trending mechanism. This rate cannot be used as the only reason to suspend ETOPS operations. The ETOPS operations are reviewed on an individual event basis.

4.2.2 ETOPS Significant Systems

A specific monitoring process tracks the Mean Time Between Unscheduled Removal (MTBUR), and the Mean Time Between Failure (MTBF) of the components identified as ETOPS significant. The purpose of this tracking is to be able to compare, and to monitor the MTBUR, and MTBF trends of an individual aircraft component in order to validate:

- That the troubleshooting is being performed correctly
- The health of the component in the airline vs. the health in the world fleet.

This ensures that the established maintenance program is valid.

4.2.3 Troubleshooting Procedures

Troubleshooting is validated by demonstrating that the MTBUR rate and the MTBF rate do not differ by more than a factor 2 or 3. If this factor is exceeded, then troubleshooting procedures should be reassessed and corrective actions initiated. ETOPS operations may be questioned if a significant problem within the overall troubleshooting of the aircraft is found. However, in most cases, the Airworthiness Authorities will ensure that the corrective action is taken, and is effective before suspending an ETOPS ticket.

Notes: 1) The MTBUR/MTBF of the ETOPS significant systems are calculated taking into account both ETOPS, and NON-ETOPS flights hours.
2) The IFSD rates are calculated by engine-type for all flights (ETOPS, and NON-ETOPS).

4.3 OUTCOME

Following an RTB meeting, the ETOPS Configuration, Maintenance, and Procedures (CMP) document may be revised:

- To include new aircraft models or aircraft modifications that affect ETOPS operations
- To mandate corrective actions
- To update existing corrective actions, etc.

Similar activities are led with the FAA (e.g. in the frame of the FAA ETOPS certification exercises).
5 ETOPS DOCUMENTS

5.1 CONFIGURATION, MAINTENANCE AND PROCEDURES DOCUMENT

5.1.1 Introduction

The ETOPS approval is associated with the publication of an ETOPS Configuration, Maintenance and Procedures (CMP) document. This CMP is certified by the Airworthiness Authorities (EASA/FAA). For extended range operations, and in accordance with the applicable operational rules, the CMP defines the following:

- The configuration of the airframe, engines and APU (Lists of Modifications and Service Bulletins)
- The specific maintenance requirements
- The specific procedures
- The dispatch limitations.

Note: CMP data is also included in the following documentation:
- The MMEL (ETOPS dispatch restrictions)
- The AFM
- The FCOM (ETOPS procedures, single engine speed, ETOPS fuel scenario, etc.)
- The MPD (Specific check intervals for ETOPS)
- The IPC (P/N not approved for ETOPS).

The CMP is customized in accordance with the Operator’s fleet.

To be compliant with ETOPS requirements, an aircraft must be configured, maintained and operated in accordance with the corresponding CMP.
The following describes the main difference between an EASA CMP and an FAA CMP:

- For the FAA, the original version of the CMP is frozen. Any subsequent revision required by the reliability monitoring process is addressed via the publication of Airworthiness Directives (ADs).
- For the EASA, the original version of the CMP is not frozen. CMP revisions can be initiated each time there is a safety problem or if an evolution is necessary, due to technical evolutions of the aircraft, modifications of rules or of document references, etc. This implies that the EASA CMP is always up-to-date. Remember that the ETOPS approval is not granted forever: it is submitted to a continuous monitoring of the in-service reliability by the Airworthiness Authorities. This reliability monitoring may result in changes to the ETOPS standards of the airframe, and/or engines (Service Bulletins, maintenance actions or operational procedures mandated to restore the reliability).

This Getting to Grips brochure focuses on the EASA CMP.
5.1.2 CMP Components

The CMP has the following parts:

- The Approval Page

The approval by the NAA is indicated by the stamp or reference of approval placed on the corresponding page.

---

**Example of an Approval Page (A330 CMP)**

- The Lists of Approved Models (Airframe, engines and APU combinations)

The CMP is applicable to a set of referenced aircraft, engines, and APUs. In this document there are two chapters named “APPROVED AIRCRAFT MODEL/ENGINE COMBINATIONS” and “APPROVED AIRCRAFT MODEL/APU COMBINATIONS”, that include the approved engines and APUs.
Example of a List of Approved Aircraft Model/Engine Combinations (A330 CMP)

- **Summary of CMP Reference Revision**

  The Summary of CMP Reference Revision is the entire list of revision subjects that affect the items from the envelope CMP document. This list is not customized, i.e. it may contain items not included in a specific customized CMP document. The purpose of this list is to provide a record of all revision subjects, regardless of the applicability of these revision subjects to a specific customized CMP document.

  For example, the Summary of CMP Reference Revision Table of a customized CMP produced for an Operator of a specific aircraft model/engine combination may also list the revised item numbers related to other aircraft model/engine combinations.
### Summary of CMP Reference Revision

<table>
<thead>
<tr>
<th>Revision Number</th>
<th>Approval Date</th>
<th>Revision Subject</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25/SEP/1994</td>
<td>BASIC ETOPS STANDARDS FOR A330 SERIES AIRCRAFT. CONTAINS THE CONCLUSIONS FROM THE ORIGINAL ETOPS TYPE DESIGN AND RELIABILITY ASSESSMENT.</td>
<td>21-1-0000-001 rev 1, 24-1-0000-002 rev 1, 28-1-0000-001 rev 1, 28-1-0000-002 rev 1, 28-1-0000-003 rev 1, 28-1-0000-004 rev 1, 28-1-0000-005 rev 1, 28-1-0000-006 rev 1, 28-1-0000-007 rev 1, 28-1-0000-008 rev 1, 28-1-0000-009 rev 1, 28-1-0000-010 rev 1, 31-1-0000-001 rev 1, 31-1-0000-002 rev 1, 31-1-0000-003 rev 1, 31-1-0000-004 rev 1</td>
</tr>
<tr>
<td>10</td>
<td>04/AUG/1995</td>
<td>BASIC ETOPS STANDARDS FOR A330 SERIES AIRCRAFT. CONTAINS THE CONCLUSIONS FROM THE ORIGINAL ETOPS TYPE DESIGN AND RELIABILITY ASSESSMENT.</td>
<td>21-1-0000-001 rev 1, 24-1-0000-002 rev 1, 28-1-0000-001 rev 1, 28-1-0000-002 rev 1, 28-1-0000-003 rev 1, 28-1-0000-004 rev 1, 28-1-0000-005 rev 1, 28-1-0000-006 rev 1, 28-1-0000-007 rev 1, 28-1-0000-008 rev 1, 28-1-0000-009 rev 1, 28-1-0000-010 rev 1, 31-1-0000-001 rev 1, 31-1-0000-002 rev 1, 31-1-0000-003 rev 1, 31-1-0000-004 rev 1</td>
</tr>
<tr>
<td>11</td>
<td>04/AUG/1995</td>
<td>INTRODUCTION OF MPD REFERENCES IN MAINTENANCE ITEMS AND HARMONIZATION WITH THE MPD TEXT AS NECESSARY. OTHER WORDING IMPROVEMENTS FOR CLARITY.</td>
<td>24-1-0000-001 rev 5, 24-1-0000-002 rev 5, 24-1-0000-003 rev 5, 24-1-0000-004 rev 5</td>
</tr>
<tr>
<td>12</td>
<td>04/AUG/1995</td>
<td>ITEMS WITH EXPIRED COMPLIANCE DATES RECLASSIFIED AS PRIORITY ITEMS (NOTE: CORRESPONDING INTERIM SOLUTIONS IF ANY, ARE DELETED).</td>
<td>28-1-0000-009 rev 5, 30-1-0000-002 rev 5</td>
</tr>
</tbody>
</table>

### Example of a Summary Of CMP Reference Revision (A330 envelope CMP)

The list of items included in a specific customized CMP document is provided in the Table of Content of this customized CMP document.
Getting to Grips with ETOPS: The ETOPS Documents

Certification and Approval

- The list of items contained in the CMP

**Examples of items (A330 CMP)**

Each item, or ETOPS requirement, is specified with the following form:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Number</th>
<th>Revision number</th>
<th>Area of Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversion Time Range</td>
<td>Compliance Schedule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item Description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solution(s)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The form has the following fields:

- **Standard**
  
The ETOPS CMP document contains four standards of items:
  
  - Configuration
  - Maintenance
  - Procedure
  - Dispatch.

  Operators may develop alternate configuration items, and/or procedures, in compliance with applicable rules. These alternate configurations, and/or operational equivalents shall be approved in compliance with applicable rules, and are not included in the CMP. Incorporation of the provisions in this document or approved equivalents shall follow a schedule agreed with the authority.

- **Number**
  
  This field identifies the item number. It uses the following format: aa-b-ccdd-xxxx, where:
  
  - “aa” is the ATA chapter (e.g. 21, 24, 26, etc.)
  - “b” is one of the following standards:
    - 1 for Configuration items
    - 2 for Maintenance items
    - 3 for Procedures items
    - 4 for Dispatch items.
  
  *Note: Only configuration items are listed in the ETOPS Compliance Document (ECD) – refer to section 5.2.3.*

  - “cc” is the engine manufacturer code, for items related to the engines and APU
    
  *Note: For items related to other aircraft systems, this code is set to 00.*

  - “dd” is the engine family code, for items related to the engines and APU
    
  *Note: For items related to other aircraft systems, this code is set to 00.*

  - “xxxx” is the item number, automatically attributed by the software used to generate the ETOPS CMP document and the ECD.

  An item number in yellow indicates that the item has been revised since the previous applicable CMP publication.

- **Area of operation**
  
  If required, this field identifies the items applicable only to specific type of ETOPS related operations. NORMAL, in this field, means that the item is applicable to any type of ETOPS.

- **Diversion time range**
  
  This field identifies the ETOPS diversion time for that the item is required. The following table provides the available possibilities:

<table>
<thead>
<tr>
<th>Diversion Time Range</th>
<th>Applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td>From 60 min to 120 min</td>
<td>Operations up to 120 min diversion time</td>
</tr>
<tr>
<td>From 60 min to 180 min</td>
<td>Operations up to 180 min diversion time</td>
</tr>
<tr>
<td>Greater than 60 min</td>
<td>All ETOPS operations, up to the maximum certified diversion time (Or distance) of the aircraft</td>
</tr>
<tr>
<td>Greater than 180 min</td>
<td>Operations “Beyond 180 min” diversion time only</td>
</tr>
</tbody>
</table>
A specific item can have different applicabilities, depending on the available diversion time range.

- Compliance schedule
  The compliance schedule defines the applicability of the items as follows:
  - For a Configuration item: This field contains the schedule for embodiment of the item, and its priority status:
    - Priority: The configuration items marked as Priority in the CMP must be embodied before the beginning of ETOPS operations
    - No later than DD/MMM/YYYY: The corresponding item must be embodied before the indicated date (DD/MMM/YYYY). Exceeding this limit is subject to a prior approval by their authority. Operators that apply for ETOPS approval, after the specified time limits for embodiment of items have expired, should incorporate the items, before they start ETOPS operations, unless otherwise approved by their authority.
    - No Priority: The corresponding item is recommended for ETOPS, but not mandatory.
  - For a Maintenance item: This field contains either the related maintenance task interval (e.g. At each A-Check, 18 months, 800 Flight Cycles, 2 000 FH, etc.), or the end date for compliance in case of a onetime maintenance (e.g. 12/SEPT/2017). If a maintenance task interval in the CMP is more restrictive than the interval required in the MRB report, the CMP interval overrules the one from the MRB report. If the MRB task interval is more frequent than required by the CMP, the MRB task interval remains valid until the Operator justifies the escalation. In this case, the CMP interval is considered as an upper limit to this escalation. Maintenance tasks that become obsolete due to an authorized configuration change are not applicable. Maintenance check intervals specified in the CMP document may be escalated in accordance with practices approved by the Operator's maintenance authority, except where a “Not to exceed” value is quoted. An escalation of a “Not to exceed” value can only be approved by the appropriate type certification authority.
  - For a Procedure item: This field indicates the applicability of the procedure depending on the diversion time range. When “See text below” is indicated for a specific diversion time range, the related Flight Crew procedure must be applied as required.
  - For a Dispatch item: This field indicates the applicability of the dispatch item depending on the diversion time range. When “See text below” is indicated for a specific diversion time range, the related ETOPS dispatch criteria must be applied as required.

As already mentioned in the paragraph dedicated to the diversion time range field, some items may feature several diversion time ranges with different applicabilities, depending on the diversion time. In this case, the diversion time range, and the corresponding compliance schedule are listed on the same line.

- Cross reference
  This field defines a link between this item, and other items that may appear in the CMP document.

Typical cross references may be:
  - Item Y cancels the need for item X: The item X is not needed, and it shall not be performed if item Y has been applied.
Item Y not needed if item X is done: Item Y is not applicable if item X has been applied.

- Solution
  This field contains several solutions: Solution 1, Solution 2,... Solution N. Compliance with any of these solutions ensures compliance with the item. A Solution is a logical combination of document references like: Aircraft Modifications (MODs), Service Bulletins (SBs), Vendor SBs (VSBs), Aircraft Maintenance Manual (AMM) references, Maintenance Planning Document (MPD) references, Flight Crew Operating Manual (FCOM) references, Airworthiness Directive (AD) references, etc.

5.1.3 CMP Creation, and Revision Process

- Creation
  The CMP is created during the initial ETOPS certification of the aircraft model/engine combination, and is based on the following:
  - Reviews, and revisions of the SSAs
  - Reviews of the System Description Notes (SDNs)
  - Reliability reviews: In-service experience of the aircraft type accumulated since the aircraft type certification, if any
  - Technical Transfer Analyses (Experience with other Airbus aircraft types)
  - Certification tests: Bench tests (e.g. 3 000 engine cycles test), and flight tests.

- Revisions
  Revisions of this document become effective, in accordance with national procedures, at the date specified by the EASA, and replace previous revisions. Standard revisions are published, based on the conclusions of the ETOPS RTB, in charge of the analysis of in-service experience. Temporary revisions are published to address minor evolutions and requests from the Operators.
  "Airworthiness Directives", published by the EASA, are always fully applicable. If there are differences between the CMP and an EASA "Airworthiness Directive", the "Airworthiness Directive" prevails.

5.1.4 CMP Publication

When a revision is published, the Operators are informed by their Airbus representatives, who have received the corresponding documents (The customized ETOPS CMP document, its information letter, and the ETOPS Parts list).
In addition, the most recent revision of the CMP document, in its envelope format, is available on the AirbusWorld website, with the associated information letter and parts list. Given the frequency of a CMP revision issuance, it is suggested that the Operator visit the website once or twice a year, to check, and confirm that they have the most recent applicable revision at any moment. They can also contact the Airbus ETOPS department to ask any questions related to the CMP document.
The CMP is usually available for publication approximately two months after its approval by the NAA.

5.2 OTHER ETOPS DOCUMENTS

5.2.1 ETOPS Significant Systems List

Airbus provides customers with a list of systems/functions that are considered as ETOPS significant. This list is defined by engineering judgment based on results from SSAs or design requirements.
This ETOPS Significant System List is an Airbus recommendation: It is designed to help the ETOPS Operators to create their own ETOPS Significant Systems list. For example, an Operator may add other equipment that are deemed important for its ETOPS operations (Either it is for safety, or for economical reasons). Conversely, an Operator may find the list too conservative for some ATA chapters: In accordance with its own experience and internal policies, this Operator can decide to slightly alleviate the content of the Airbus proposed list of ETOPS Significant Systems.

<table>
<thead>
<tr>
<th>ATA Chapter</th>
<th>System</th>
<th>Description</th>
<th>Risk</th>
<th>Action Required</th>
<th>Certification Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - Job Plan</td>
<td>22 - Job Plan</td>
<td>Electrical System</td>
<td>Low</td>
<td>Add to Job Plan</td>
<td>Certification Data</td>
</tr>
<tr>
<td>20 - Job Plan</td>
<td>22 - Job Plan</td>
<td>Electrical System</td>
<td>Low</td>
<td>Add to Job Plan</td>
<td>Certification Data</td>
</tr>
<tr>
<td>20 - Job Plan</td>
<td>22 - Job Plan</td>
<td>Electrical System</td>
<td>Low</td>
<td>Add to Job Plan</td>
<td>Certification Data</td>
</tr>
<tr>
<td>20 - Job Plan</td>
<td>22 - Job Plan</td>
<td>Electrical System</td>
<td>Low</td>
<td>Add to Job Plan</td>
<td>Certification Data</td>
</tr>
<tr>
<td>20 - Job Plan</td>
<td>22 - Job Plan</td>
<td>Electrical System</td>
<td>Low</td>
<td>Add to Job Plan</td>
<td>Certification Data</td>
</tr>
</tbody>
</table>

**Example of an ETOPS Significant Systems List (A330)**
5.2.2 Parts List

The CMP document defines the ETOPS configuration in terms of Modification, and/or Service bulletin references. It does not address the corresponding Part Numbers (P/Ns). In order to assist the Operator in the identification of these P/Ns, Airbus developed the Parts List. The P/Ns included in this document are:

- The P/Ns that are not approved for ETOPS (i.e. P/Ns not to be installed on ETOPS aircraft), or,
- The P/Ns that define the minimum required standard for an appropriate ETOPS configuration.

The ETOPS Parts List is based on the most recent revision of the ETOPS CMP document. But, contrary to the ETOPS CMP document, the ETOPS Parts List is not customized: It is valid for all models and the associated configurations of a specific aircraft family, and all existing CMP revisions (At the time of publication of the Parts List). Therefore, some items in the Parts List may not be applicable to a specific Operator. In case of doubt, the CMP should always be used as the reference regarding the required ETOPS configuration.

The Parts List is not an approved document, and should only be considered as a tool to assist the Operator in the identification of the P/Ns that are not approved for ETOPS.

5.2.3 ETOPS Compliance Document

An ETOPS Compliance Document (ECD) is published for the initial delivery of all Airbus ETOPS aircraft. This document provides a status of compliance of the aircraft design definition, versus the applicable configuration requirements as stated in the corresponding ETOPS CMP Document. It clarifies the areas of compliance and non-compliance by listing both of the following:

- The items that have been incorporated
- The items that will have to be retrofitted.

Note: At delivery, the conformity status of an individual aircraft versus the design definition is provided in the aircraft Inspection Report, and in the APU, and engines logbooks.
6 ETOPS AND AIRBUS

6.1 MILESTONES

Airbus started working on extended range operations in the mid-seventies with several airlines. These companies operated A300B2s, and B4s, under the 90-minute ICAO rule, over the North Atlantic, the Bay of Bengal, and the Indian Ocean.

The first “real” Airbus ETOPS operations started in June 1985: Singapore Airlines started operating the A310-200 in Asia. In April 1986, PanAm was the first Airbus customer to inaugurate transatlantic revenue service with A310-200, and A310-300 aircraft. In less than five years, more than 20 Operators joined the two pioneers in Airbus ETOPS operations.

In March 1990, the A310-324 (PW4000 engines) was the first FADEC engine powered aircraft to receive ETOPS approval by the FAA. At the same time, the A300B4-605R was the first Airbus aircraft to get ETOPS approval for 180 minutes diversion time.

By the end of 1991, all A310, and A300-600 were approved for 180 minutes diversion time by the French DGAC.

In September 1991, the A320 was the first fly-by-wire aircraft to be approved for ETOPS operations with 120 minutes diversion time.

In April 1994, the A330-301 (CF6-80E1A2 engines) obtained the ETOPS Type Design Approval from the JAA with 120-minute diversion time. This was the first new aircraft to receive early ETOPS approval worldwide. In May 1994, Aer Lingus was the first Operator to inaugurate ETOPS operations over the North Atlantic with this aircraft.

At the same time, the A300-600, equipped with CF6-80C2A5F engines (featuring FADEC), obtained the ETOPS Type Design Approval (180-minute diversion time) from the JAA at entry into service.

In 1996, the A330 obtained the ETOPS 180-minute Type Design Approval. At the same time, the A319, and A321 joined the A320 with their ETOPS 120-minute approvals.

In 2009, the A330 became the first Airbus to be certified for “Beyond 180 min” ETOPS, that approximately corresponds to 240 minutes.

In 2014, the A350XWB became the first Airbus to be certified for “Beyond 180 min” ETOPS at EIS, that approximately corresponds to 370 minutes.

6.2 CERTIFICATION STATUS
Most Airbus twin-engine aircraft are currently approved for ETOPS. The following tables provide the Maximum Diversion Time (MDT) for each certified aircraft model/engine combination, for both the EASA and FAA. In these tables, 180 means that the combination is certified for up to 180-min diversion time, and >180 means that the combination is certified for “Beyond 180 min” diversion time.

### 6.2.1 A300 and A310 Family Aircraft

<table>
<thead>
<tr>
<th>Model</th>
<th>Basic</th>
<th>Intermix</th>
<th>MDT EASA</th>
<th>MDT FAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A300-600 PW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A300B4-620</td>
<td>JT9D-7R4 H1</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A300C4-620</td>
<td>JT9D-7R4 H1</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A300B4-622</td>
<td>PW4158</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A300B4-622R</td>
<td>PW4158</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A300F4-622R</td>
<td>PW4158</td>
<td>-</td>
<td>180  180</td>
<td>-</td>
</tr>
<tr>
<td>A300-600 GE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A300B4-601</td>
<td>CF6-80C2A1</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A300B4-603</td>
<td>CF6-80C2A3</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A300B4-605R</td>
<td>CF6-80C2A5</td>
<td>-</td>
<td>180  180</td>
<td>-</td>
</tr>
<tr>
<td>A300B4-605R</td>
<td>CF6-80C2A5F</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A300C4-605R/F</td>
<td>CF6-80C2A5</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A300F4-605R</td>
<td>CF6-80C2A5F</td>
<td>-</td>
<td>180  180</td>
<td>-</td>
</tr>
<tr>
<td>A300F4-608ST</td>
<td>CF6-80C2A8</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A310-221</td>
<td>JT9D-7R4 D1</td>
<td>JT9D-7R4 E1 500 JT9D-7R4 E1 600</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A310-222</td>
<td>JT9D-7R4 E1 500</td>
<td>JT9D-7R4 D1 JT9D-7R4 E1 600</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A310-222/VAR100</td>
<td>JT9D-7R4 E1 500</td>
<td>JT9D-7R4 D1 JT9D-7R4 E1 600</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A310-322</td>
<td>JT9D-7R4 E1 500</td>
<td>JT9D-7R4 D1 JT9D-7R4 E1 600</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A310-324</td>
<td>PW4152</td>
<td>-</td>
<td>180</td>
<td>120</td>
</tr>
<tr>
<td>A310-325</td>
<td>PW4156A</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A310-203</td>
<td>CF6-80A3</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A310-203C</td>
<td>CF6-80A3</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A310-204/VAR100</td>
<td>CF6-80C2A2</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A310-304</td>
<td>CF6-80C2A4</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A310-308</td>
<td>CF6-80C2A8</td>
<td>CF6-80C2A4</td>
<td>180</td>
<td>-</td>
</tr>
</tbody>
</table>
### 6.2.2 A318, A319, A320 and A321 Family Aircraft

<table>
<thead>
<tr>
<th>Model</th>
<th>Basic</th>
<th>Intermix</th>
<th>MDT EASA</th>
<th>MDT FAA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A318 CFM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A318-111</td>
<td>CFM56-5B8</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A318-112</td>
<td>CFM56-5B9</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td><strong>A318 PW</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A318-121</td>
<td>PW6122A</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A318-122</td>
<td>PW6124A</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td><strong>A319 CFM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A319-111</td>
<td>CFM56-5B5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A319-112</td>
<td>CFM56-5B6</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A319-113</td>
<td>CFM56-5A4</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A319-114</td>
<td>CFM56-5A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A319-115</td>
<td>CFM56-5B7</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td><strong>A319 IAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A319-131</td>
<td>V2522-A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A319-132</td>
<td>V2524-A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A319-133</td>
<td>V2527M-A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td><strong>A320 CFM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A320-111</td>
<td>CFM56-5A1</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A320-211</td>
<td>CFM56-5A1</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A320-212</td>
<td>CFM56-5A3</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A320-214</td>
<td>CFM56-5B4</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A320-215</td>
<td>CFM56-5B5</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A320-216</td>
<td>CFM56-5B6</td>
<td>-</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td><strong>A320 IAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A320-231</td>
<td>V2500-A1</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A320-232</td>
<td>V2527-A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A320-233</td>
<td>V2527E-A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td><strong>A321 CFM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A321-111</td>
<td>CFM56-5B1</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A321-112</td>
<td>CFM56-5B2</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A321-211</td>
<td>CFM56-5B3</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A321-212</td>
<td>CFM56-5B1</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A321-213</td>
<td>CFM56-5B2</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td><strong>A321 IAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A321-131</td>
<td>V2530-A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A321-231</td>
<td>V2533-A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>A321-232</td>
<td>V2530-A5</td>
<td>-</td>
<td>180</td>
<td>180</td>
</tr>
</tbody>
</table>

**Notes:**
1) There are two ETOPS options on A318/A319/A320/A321 aircraft: 120-min, and 180-min ETOPS capabilities.
2) A318, A319, A320, and A321 aircraft are delivered in compliance with the 120-min or 180-min ETOPS configuration standards, as applicable at time of delivery, only if the related option is selected by the Operator.
### 6.2.3 A330 Aircraft

<table>
<thead>
<tr>
<th>Model</th>
<th>Basic</th>
<th>Intermix</th>
<th>MDT EASA</th>
<th>MDT FAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A330-201</td>
<td>CF6-80E1A2</td>
<td></td>
<td>&lt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-202</td>
<td>CF6-80E1A4</td>
<td>CF6-80E1A4/B</td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-203</td>
<td>CF6-80E1A3</td>
<td></td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-301</td>
<td>CF6-80E1A2</td>
<td></td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-302</td>
<td>CF6-80E1A4</td>
<td>CF6-80E1A4/B</td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-303</td>
<td>CF6-80E1A3</td>
<td></td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-223</td>
<td>PW4168A (–1D incl)</td>
<td>PW4168A (–1D incl)</td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-223F</td>
<td>PW4170</td>
<td>PW4168A-1D</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A330-321</td>
<td>PW4164</td>
<td>PW4164-1D</td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-322</td>
<td>PW4168</td>
<td>PW4168-1D</td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-323</td>
<td>PW4168A (–1D incl)</td>
<td>PW4168A (–1D incl)</td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-243</td>
<td>Trent 772B-60</td>
<td>Trent 772C-60</td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-243F</td>
<td>Trent 772B-60</td>
<td>Trent 772C-60</td>
<td>180</td>
<td>-</td>
</tr>
<tr>
<td>A330-341</td>
<td>Trent 768-60</td>
<td></td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-342</td>
<td>Trent 772-60</td>
<td></td>
<td>&gt;180</td>
<td>180</td>
</tr>
<tr>
<td>A330-343</td>
<td>Trent 772B-60</td>
<td>Trent 772C-60</td>
<td>&gt;180</td>
<td>180</td>
</tr>
</tbody>
</table>

**Notes:**
1) All A330 aircraft are delivered in compliance with the 180-min ETOPS configuration standards (Basic aircraft specification, as applicable at the time of delivery)
2) "Beyond 180 min" ETOPS capability is available as an option

### 6.3 HOW CAN AIRBUS ASSIST YOU?

Airbus has created a number of services, in order to assist its customers. These services range from the usual training courses to consulting services. The following section describes some examples of these services. Please contact your Airbus representative for additional information about these services.
6.3.1 Training Courses

Airbus has developed a complete family of courses related to ETOPS:

- **Dispatcher courses**, for all Airbus twins. The main objectives are to:
  - Familiarize the trainees to the use of the Airbus operational documents like the Aircraft Flight Manual (AFM), the Flight Crew Operating Manual (FCOM), the Master Minimum Equipment List (MMEL) and the Aircraft Characteristics for Airport Planning (ACAP)
  - Describe some of the Airbus Performance programs like the Computerized Flight Planning and the Runway Analysis programs
  - Study the aircraft systems at a description level
  - Provide a specific training for airlines that operate in ETOPS conditions.

- **ETOPS flight crew courses**, for all Airbus twins. These courses are designed to train the flight crew for the specificities of ETOPS requirements and rules, dispatch criteria, and the operational guidelines to effectively operate in the ETOPS environment.

- **ETOPS maintenance courses**. These courses raise the maintenance personnel’s awareness of all technical requirements and procedures necessary to operate and dispatch an aircraft under ETOPS regulations.

- ...

6.3.2 Consulting Services

Airbus can help its customers obtain an ETOPS Operational Agreement and maintain it, with the following consulting services:

- **ETOPS assistance program**. The Airbus ETOPS assistance program is designed to help airlines create a viable ETOPS program. The program includes:
  - A general introduction to ETOPS (ETOPS Briefing)
  - One or two visits from Airbus ETOPS experts. They advise the Operator on ETOPS regulations and policy matters, and how to adjust to them
  - The access to a set of “ready-to-customize” ETOPS documents
  - The assessment of the Operator’s schedule
  - The assessment of the Operator’s organization and available means
  - The proposal of an approval program by the National Airworthiness Authority based on these reviews.

- **Study of specific routes**: Airbus can determine the constraints and procedures associated with specific ETOPS routes to be flown, and specific to each aircraft model.

- **ETOPS compliance status update**: For each new ETOPS aircraft delivery, Airbus provides the Operator with an ETOPS Compliance Document (Refer to 5.2.3: ETOPS COMPLIANCE DOCUMENT). When the aircraft is delivered to a second-hand Operator, this document may need to be updated to reflect the configuration requirements of the applicable ETOPS CMP document at the current valid revision, and the actual configuration (technical status) of the aircraft. The amount of work required to perform this ETOPS compliance status update depends on:
  - The availability of an ETOPS Compliance status at initial delivery
  - The new country of registration,
  - The availability and the quality of the technical records (SB/Mod status, etc.)

6.3.3 Technical Questions

For any additional information or technical questions related to Airbus ETOPS, please, send an e-mail to:

etops-edto.support@airbus.com
6.4 AIRBUS ETOPS ORGANIZATION

Airbus has created a dedicated ETOPS department. This department is responsible for:

- Acting as a source of expertise on all ETOPS matters, and advising, and/or providing Operators or Authorities with training courses on ETOPS regulations, organization, procedures, technical, flight operations and maintenance aspects
- Managing the ETOPS Type Design assessment process under the applicable rules (e.g. EASA, FAA, etc.)
- Managing the ETOPS continued reliability assessment process
- Preparing the ETOPS Manuals for approval, validation, and publication (ETOPS CMP document, ETOPS Compliance document, ETOPS Parts List, etc.)
- Preparing or validating Airbus communication, and training material on ETOPS
- Preparing, and implementing assistance programs for ETOPS (Candidate) Operators to obtain or restore their operational approval
- Acting on behalf of Airbus (or European industries) in ETOPS rulemaking processes of all countries or international organizations (Particularly with the EASA, FAA and ICAO).

6.5 ETOPS TECHNICAL DOCUMENTATION ON AIRBUSWORLD

Information and ETOPS technical documents (Envelope CMPs, Parts Lists, etc.) are available on AirbusWorld, via the following path:

“Maintenance & Engineering Community”

→ “Prepare Maintenance Program”

→ “Consult Airbus Maintenance Requirements”

→ “Consult ETOPS/LROPS Requirements”