



ICAO

**INTERNATIONAL CIVIL AVIATION ORGANIZATION**

**WESTERN AND CENTRAL AFRICA OFFICE**

**Twenty-Third Meeting on the Improvement of Air Traffic Services over the South Atlantic  
(SAT/23)**

**Durban, South Africa, 6-8 June 2018**

---

---

**Agenda Item 2: Air traffic management (ATM)**

**2.3 Flight Level Occupancy in the EUR-SAM Corridor (2017)**

*(Presented by SATMA)*

<b>SUMMARY</b>
This working paper presents to SAT States detailed information about the flight level occupancy in the EUR-SAM Corridor on August 2017.
<b>REFERENCE(S):</b>  Report of the SAT22 meeting.
<b>Related ICAO Strategic Objective(s):</b> The working paper relates to the Air Navigation Capacity and Efficiency Strategic Objective of ICAO.

## 1. INTRODUCTION

The importance of SATMA collection and treatment of statistical data of air traffic movements along the EUR-SAM Corridor during last years, has been strongly highlighted in previous SAT meetings as a relevant data to take preventive actions, in line with the evolution of these figures. Nevertheless, several issues were detected during last SATs related to the statistical data presented:

- Provided figures do not represent whole EUR/SAM Corridor since data is based exclusively on traffic that fly over Canarias FIR;
- Regarding EUR/SAM Corridor Traffic Statistics Program, one of five programmes established by SAT 22 ATM WG, it was required to include information about Flight Level occupancy.

The objective of this working paper is to cover both, the mentioned detected issues and SATMA monitoring performed in the EUR-SAM Corridor.

Once presented in SAT/23 meeting, this statistical data of the EUR-SAM Corridor will be available on SATMA web page: [www.satmasat.com](http://www.satmasat.com).

## 2. BACKGROUND

In accordance with the SAT19/01 conclusion, SATMA was assigned to gather the necessary traffic data for airspace planning, safety assessments and statistics in the EUR/SAM Corridor. In order to achieve this objective, Brazil, Cape Verde, Spain and Senegal should collect Air Traffic Movement data from their ATM Systems in a period of six months in accordance with the pre-established format agreed with each member.

Up to date, all SAT members have provided annually this information to perform the safety analysis. Afterward, a preliminary analysis of the global figures per ACCs is conducted to determine the representative month. This month is selected in accordance to the most relevant figures of traffic and its data consistency per FIR. August 2017 was selected to obtain the traffic for the safety assessment in 2017 and key source to perform the present assessment.

## 3. HYPOTHESIS, ASSUMPTIONS AND CONSIDERATIONS

Even though global figures and conclusions should be obtained directly from the data provided by each ANPS with an easy and simple process, the data provided are not coherent among ANSP. For instance, there are flight plans that are not registered by all involved ANPS's, the operational information shows differences in terms of time, flight levels or coordination points, and even flight plans of the same day reported by the same ANSP with the same times but different trajectories.

Therefore, and in order to increase the consistency of this operational data, several hypothesis and assumptions have been considered:

- The original information supplied by each ANSP was treated as partial to obtain its operational indicators. However, this data was considered globally to complete the lacking of some flights in FIR reported by the rest of adjacent ones.

- A total of 30.000 position reports have been provided. Additional information has been extrapolated from this original data until 71.000 positions reports. Likewise, coordinates reports have been associated with the closer waypoint possible.
- Whereas flight plan information had only an initial and final point, the flight plan has been extrapolated to the closer route. For instance, if the initial flight plan was TENPA SAMAR, the final flight plan would be TENPA USOTI APASO VIDRI GDV SAMAR.
- Although the provided data of traffic outside of the EUR-SAM corridor were not relevant for the safety and statistical assessments, in this assessment, all data has been processed similarly.

Finally, it is necessary to explain some terms in order to understand the figures presented in this working paper:

- It is considered “EUR/SAM traffic” the traffic which has flown at least a leg of the following AWYs in SBAO/GOOO/GVSC FIRs: UN741, UN866, UN873 and UN857.
- It is considered “EUR/SAM Area” the area where the information has been reported to SATMA. Next figure depicts what it is considered the EUR/SAM Area.

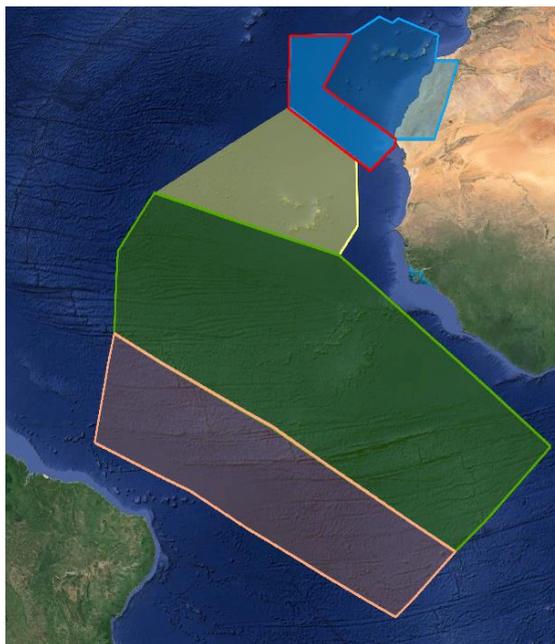


Figure 1. EUR/SAM Area

- The information related to dates, months, and times is obtained from the first waypoint where the flight is referred. The criteria and information used to perform this study, both global and per FIR, are the same.

## 4. DISCUSSION

### 4.1 AIR TRAFFIC STATISTICS IN THE EUR/SAM AREA – CANARIAS FIR

Next table shows the number of flights belonging to EUR/SAM or random/transversal traffic (Canarias FIR). The total number of flights registered in the EUR/SAM area of Canarias FIR has been **2.422** flights. Most of them are considered traffics belonging to EUR/SAM Corridor (92.5 % of total).

	Canarias FIR	
	AUGUST 2017	%
EUR/SAM	2242	92.6%
TRANSVERSAL	26	1.1%
RANDOM	154	6.4%
<b>TOTAL</b>	<b>2422</b>	

**Table 1.** Global Figures of Flights – EUR/SAM Area – Canarias FIR

The following table shows, for the most significant airlines in terms of registered figures, the number of flights and percentage referred to the total number of registered flights in the EUR/SAM Area – Canarias FIR during the studied period.

TRAFFIC PER AIRLINE IN CANARIAS FIR			
AIRLINE	FLIGHTS	% TOTAL	% EURSAM
TAP	586	24.2%	23.9%
IBE	211	8.7%	7.9%
AEA	168	6.9%	5.9%
TOM	126	5.2%	5.2%
TAM	122	5.0%	5.0%
AFR	104	4.3%	3.8%
DLH	82	3.4%	3.3%
TCV	72	3.0%	3.0%
AZU	61	2.5%	2.5%
KLM	58	2.4%	2.3%
TUI	54	2.2%	2.2%
RAM	54	2.2%	2.2%

**Table 2.** Global Figures per airline – Canarias FIR

On the other hand, considering the foreseen evolution of EUR/SAM Corridor, several additional analyses have been accomplished for each FIR:

- **Flight level distribution- Canarias FIR**

Flight level FL350 was the most required one. Likewise, the 20% of traffic in Canarias FIR was cleared to FL340 or below.

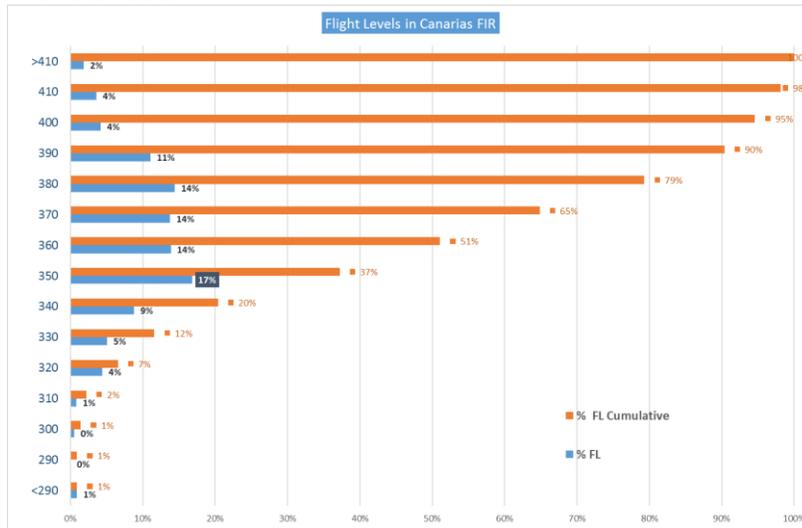


Figure 2. Distribution the Flight Levels in EUR/SAM Corridor – Canarias FIR

Note that to prepare this assessment only FL in the border of FIR was considered.

- **Traffic load- Canarias FIR**

Next chart shows a summary of traffic load registered in Canarias FIR where bars represent the number of aircraft that entered in the FIR per hour. The orange curve represents the maximum number of aircrafts that entered in the FIR per hour. The peak periods of traffic are 00-02 and 13-14 UTC. Likewise the peak hour was 01 with 16 flights.

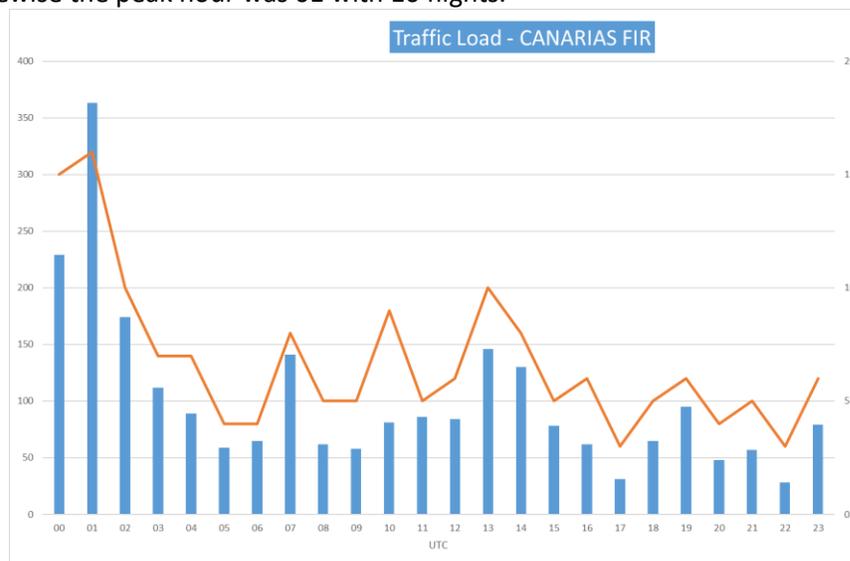


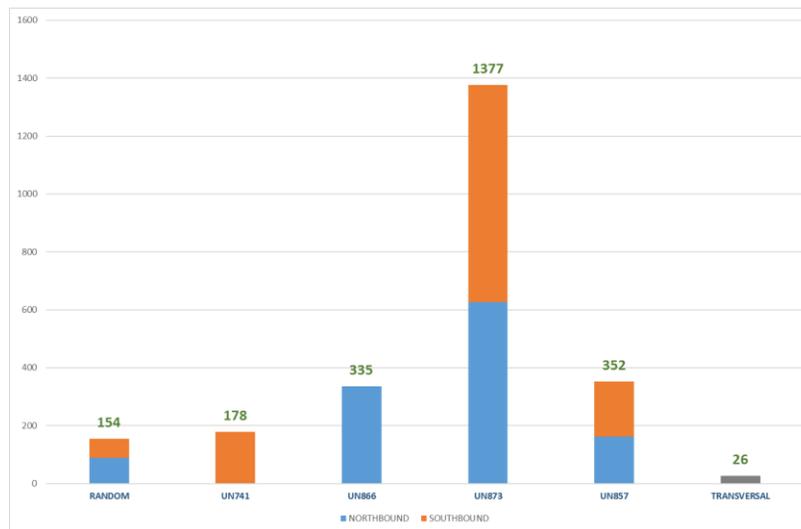
Figure 3. Traffic load in EUR/SAM Corridor – Canarias FIR

- **Traffic distribution per ATS Route– Canarias FIR:**

The following figures and tables try to sum up the operational data provided to SATMA. In Canarias FIR the main flow is via IPERA (UN873), afterwards this traffic planned other ATS routes depending on their origin/destination. UN741 and UN866 have also relevant figures but less than the first one due to their unidirectional characteristic. Note that UN857 figures have already overcome UN741 and UN866, even though it is a bidirectional route. Finally, it is remarkable that Canarias FIR registered several “random routes” which are based on published DCT.

TRAFFIC	RANDOM	UN741	UN866	UN873	UN857	TRANSVERSAL
NORTHBOUND	89	0	335	627	161	26
SOUTHBOUND	65	178	0	750	191	
TOTAL	154	178	335	1377	352	26

**Table 3.** Distribution per ATS Route – Canarias FIR



**Figure 4.** Distribution per ATS Route – Canarias FIR

- **Main Flows - Canarias FIR**

TRAFFIC FLOWS	FLIGHTS	%
SAMAR IPERA	626	25.8%
IPERA SAMAR	316	13.0%
IPERA VASTO	247	10.2%
TENPA KONBA	190	7.8%
NELSO EDUMO	160	6.6%
TERTO IPERA	103	4.3%
TERTO GUNET	90	3.7%
GUNET SOLNA	64	2.6%
TENPA BIMBO	62	2.6%
TENPA VASTO	53	2.2%
SAMAR GUNET	50	2.1%
SOLNA GUNET	49	2.0%

**Table 4.** TRAFFIC FLOWS – Canarias FIR

## 4.2 AIR TRAFFIC STATISTICS IN THE EUR/SAM AREA – SAL OCEANIC FIR

Next table shows the number of flights belonging to EUR/SAM or random/transversal traffic (Sal Oceanic FIR). The total number of flights registered in the EUR/SAM area of Sal Oceanic FIR has been **4.021** flights. The number of flights belonging to EUR/SAM corridor is similar to Canarias FIR. However, the random traffic registered a significant figure to be taking into account by the SAT group.

	SAL OCEANIC FIR	
	AUGUST 2017	%
EUR/SAM	2350	58.4%
TRANSVERSAL	461	11.5%
RANDOM	1210	30.1%
<b>TOTAL</b>	<b>4021</b>	

**Table 5.** Global Figures of Flights – EUR/SAM Area – Sal Oceanic FIR

The following table shows, for the most significant airlines in terms of registered figures, the number of flights and percentage referred to the total number of registered flights in the EUR/SAM Area – Sal Oceanic FIR during the studied period.

TRAFFIC PER AIRLINE IN SAL OCEANIC FIR			
AIRLINE	FLIGHTS	% TOTAL	% EURSAM
TAP	817	20.3%	14.3%
IBE	298	7.4%	4.8%
TAM	294	7.3%	3.0%
AFR	266	6.6%	2.3%
AEA	192	4.8%	3.5%
BAW	157	3.9%	0.8%
DLH	140	3.5%	2.0%
KLM	139	3.5%	1.3%
TCV	136	3.4%	2.0%
SAA	124	3.1%	0.0%
TOM	124	3.1%	3.1%
DAL	115	2.9%	0.0%

**Table 6.** Global Figures per airline – Sal Oceanic FIR

On the other hand, considering the foreseen evolution of EUR/SAM Corridor, several additional analyses have been accomplished for each FIR:

- **Flight level distribution – Sal Oceanic FIR**

Flight level FL350 and FL370 were the most required one. Likewise, the 27% of traffic in SAL Oceanic FIR was cleared to FL340 or below.

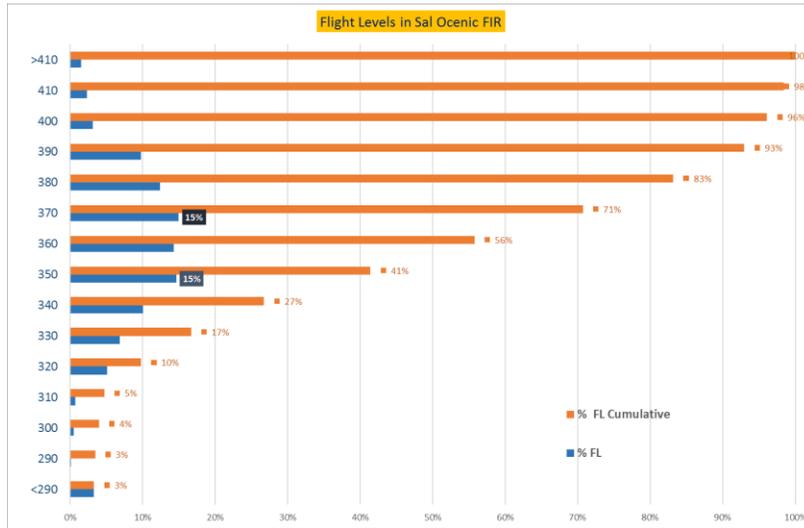


Figure 5. Distribution the Flight Levels in EUR/SAM Corridor – Sal Oceanic FIR

Note that to prepare this assessment only FL in the border of FIR was considered.

- **Traffic load – Sal Oceanic FIR**

Next chart shows a summary of traffic load registered in Sal Oceanic FIR where bars represent the number of aircraft that entered in the FIR per hour. The orange curve represents the maximum number of aircrafts that entered in the FIR per hour. The peak periods of traffic are 23-03 and 13-14 UTC. Likewise the peak hour was 01 with 20 flights.

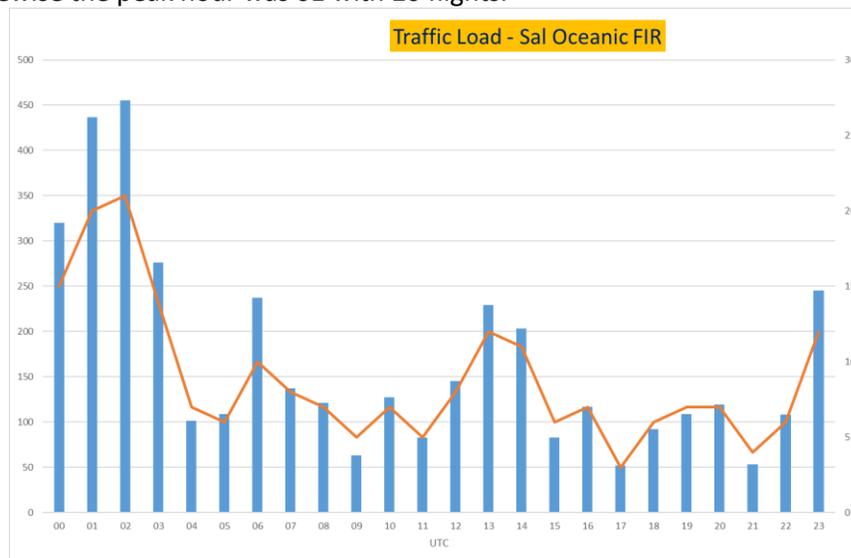


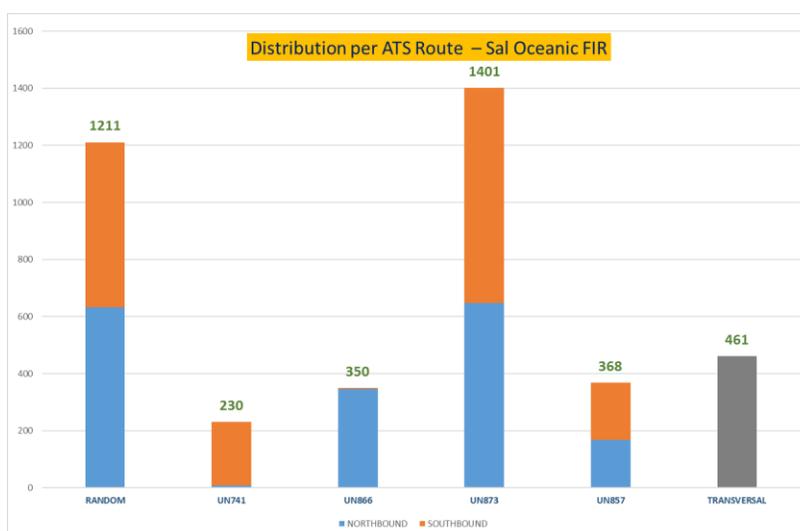
Figure 6. Traffic load in EUR/SAM Corridor – Sal Oceanic FIR

- **Traffic distribution per ATS Route– Sal Oceanic FIR:**

The following figures and tables try to sum up the operational data provided to SATMA. In Sal Oceanic FIR the main flow is via IPERA (UN873). In addition, it is remarkable that Sal Oceanic FIR registered a relevant traffic by random route.

TRAFFIC	RANDOM	UN741	UN866	UN873	UN857	TRANSVERSAL
NORTHBOUND	632	7	346	648	168	461
SOUTHBOUND	579	223	4	753	200	
TOTAL	1211	230	350	1401	368	461

**Table 7.** Distribution per ATS Route – Sal Oceanic FIR



**Figure 7.** Distribution per ATS Route – Sal Oceanic FIR

- **Main Flows – Sal Oceanic FIR**

TRAFFIC FLOWS	FLIGHTS	%
IPERA POMAT	395	11.1%
AMDOL TENPA	309	8.7%
POMAT IPERA	297	8.3%
BIKOM ULTEM	286	8.0%
ULTEM XUVIT	220	6.2%
GARPO ERNEK	174	4.9%
CVS IPERA	168	4.7%
ULTEM BIKOM	143	4.0%
IPERA CVS	138	3.9%
EDUMO KENOX	134	3.8%
ERNEK GARPO	115	3.2%
GUNET BOTNO	100	2.8%

**Table 8.** TRAFFIC FLOWS – Sal Oceanic FIR

### 4.3 AIR TRAFFIC STATISTICS IN THE EUR/SAM AREA – DAKAR OCEANIC FIR

Next table shows the number of flights belonging to EUR/SAM or random/transversal traffic (Dakar Oceanic FIR). The total number of flights registered in the EUR/SAM area of Dakar Oceanic FIR has been **3.458** flights. The random traffic registered a significant figure, similar to Sal Oceanic FIR, to be taking into account by the SAT group.

	DAKAR OCEANIC FIR	
	AUGUST 2017	%
EUR/SAM	1965	56.8%
TRANSVERSAL	38	1.1%
RANDOM	1455	42.1%
<b>TOTAL</b>	<b>3458</b>	

**Table 9.** Global Figures of Flights – EUR/SAM Area – Dakar Oceanic FIR

The following table shows, for the most significant airlines in terms of registered figures, the number of flights and percentage referred to the total number of registered flights in the EUR/SAM Area – Dakar Oceanic FIR during the studied period.

TRAFFIC PER AIRLINE IN DAKAR OCEANIC FIR			
AIRLINE	FLIGHTS	% TOTAL	% EURSAM
TAP	653	18.9%	14.4%
TAM	374	10.8%	5.3%
IBE	337	9.7%	6.2%
AFR	291	8.4%	5.1%
AEA	211	6.1%	4.5%
AZA	203	5.9%	0.8%
DLH	173	5.0%	2.4%
BAW	161	4.7%	2.6%
KLM	146	4.2%	2.7%
ARG	121	3.5%	0.8%
LAN	76	2.2%	0.1%
AZU	65	1.9%	1.9%

**Table 10.** Global Figures per airline – Dakar Oceanic FIR

On the other hand, considering the foreseen evolution of EUR/SAM Corridor, several additional analyses have been accomplished for each FIR:

- **Flight level distribution – Dakar Oceanic FIR**

Flight level FL370 was the most required one. Likewise, the 25% of traffic in Dakar Oceanic FIR was cleared to FL340 or below.

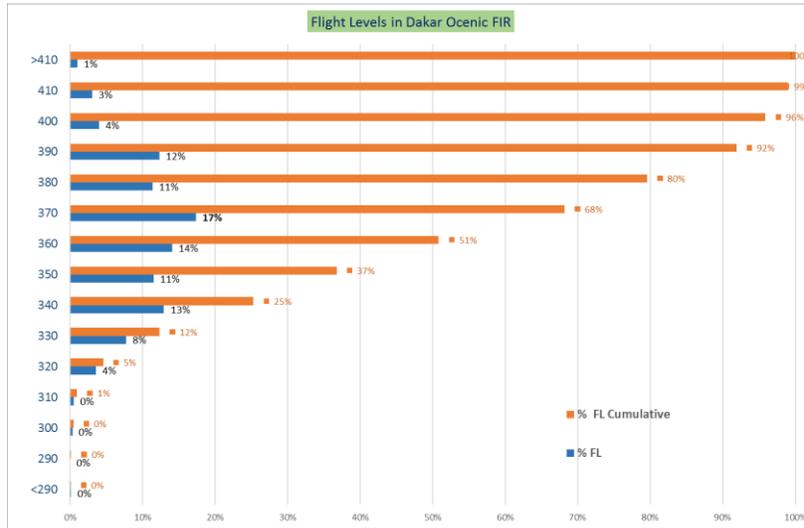


Figure 8. Distribution the Flight Levels in EUR/SAM Corridor – Dakar Oceanic FIR

Note that to prepare this assessment only FL in the border of FIR was considered.

- **Traffic load – Dakar Oceanic FIR:**

Next chart shows a summary of traffic load registered in Dakar Oceanic FIR where bars represent the number of aircraft that entered in the FIR per hour. The orange curve represents the maximum number of aircrafts that entered in the FIR per hour. The peak periods of traffic are 01-03 and 22-23 UTC. Likewise the peak hour was 02 with 22 flights.

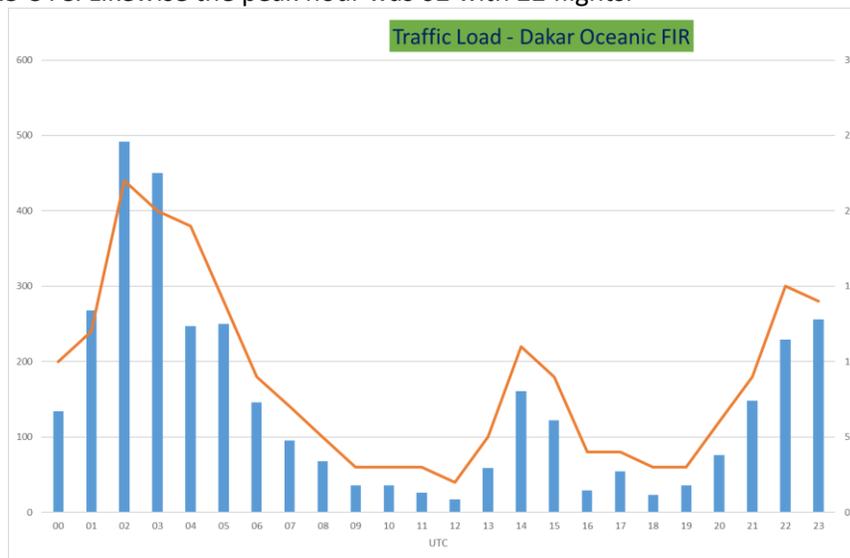


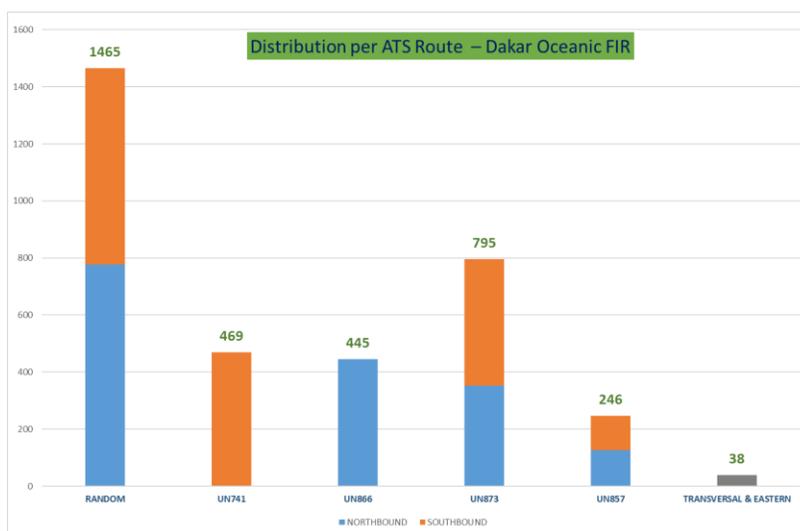
Figure 9. Traffic load in EUR/SAM Corridor – Dakar Oceanic FIR

- **Traffic distribution per ATS Route – Dakar Oceanic FIR:**

The following figures and tables try to sum up the operational data provided to SATMA. In Dakar Oceanic FIR the main flow is random route.

TRAFFIC	RANDOM	UN741	UN866	UN873	UN857	TRANSVERSAL & EASTERN
NORTHBOUND	778		445	353	126	38
SOUTHBOUND	687	469		442	120	
TOTAL	1465	469	445	795	246	38

**Table 11.** Distribution per ATS Route – Dakar Oceanic FIR



**Figure 10.** Distribution per ATS Route – Dakar Oceanic FIR

- **Main Flows – Dakar Oceanic FIR**

TRAFFIC FLOWS	FLIGHTS	%
POMAT TASIL	418	12.2%
DEKON AMDOL	410	12.0%
TASIL POMAT	352	10.3%
KODOS TAROT	334	9.8%
TAROT KODOS	327	9.6%
XUVIT NANIK	255	7.5%
MOVGA BIKOM	204	6.0%
KENOX NANIK	170	5.0%
ERETU BOTNO	121	3.5%
BOTNO ERETU	119	3.5%
GOGSO GARPO	119	3.5%
BIKOM MOVGA	110	3.2%

**Table 12.** TRAFFIC FLOWS – Dakar Oceanic FIR

#### 4.4 AIR TRAFFIC STATISTICS IN THE EUR/SAM AREA – ATLANTICO FIR

Next table shows the number of flights belonging to EUR/SAM or random/transversal traffic (Atlantico FIR). The total number of flights registered in the EUR/SAM area of Atlantico FIR has been **3.387** flights. Eastern –Western flows are based on ATS Routes, that afterwards entry/exit in random areas Dakar Oceanic FIR.

	ATLANTICO FIR	
	AUGUST 2017	%
EUR/SAM	1856	54.8%
TRANSVERSAL	42	1.2%
EASTERN-WESTERN	1373	40.5%
RANDOM	116	3.4%
<b>TOTAL</b>	<b>3387</b>	

**Table 13.** Global Figures of Flights – EUR/SAM Area – Atlantico FIR

The following table shows, for the most significant airlines in terms of registered figures, the number of flights and percentage referred to the total number of registered flights in the EUR/SAM Area – Atlantico FIR during the studied period.

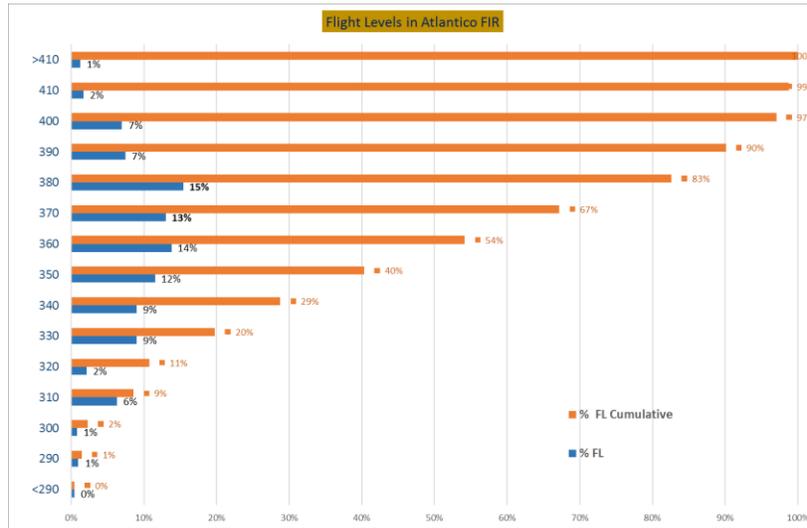
TRAFFIC PER AIRLINE IN DAKAR OCEANIC FIR			
AIRLINE	FLIGHTS	% TOTAL	% EURSAM
TAP	653	18.9%	14.4%
TAM	374	10.8%	5.3%
IBE	337	9.7%	6.2%
AFR	291	8.4%	5.1%
AEA	211	6.1%	4.5%
AZA	203	5.9%	0.8%
DLH	173	5.0%	2.4%
BAW	161	4.7%	2.6%
KLM	146	4.2%	2.7%
ARG	121	3.5%	0.8%
LAN	76	2.2%	0.1%
AZU	65	1.9%	1.9%

**Table 14.** Global Figures per airline – Atlantico FIR

On the other hand, considering the foreseen evolution of EUR/SAM Corridor, several additional analyses have been accomplished for each FIR:

- **Flight level distribution – Atlantico FIR**

Flight level FL380 was the most required one. Likewise, the 29% of traffic in Atlantico FIR was cleared to FL340 or below.

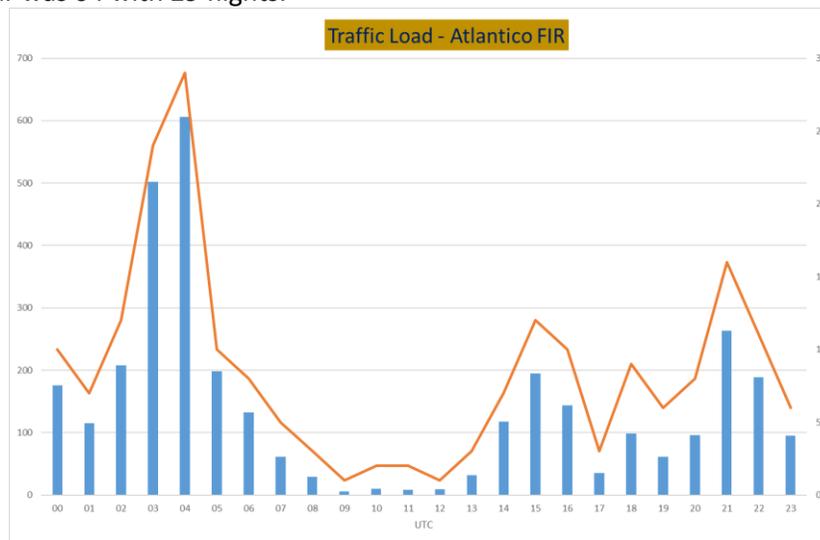


**Figure 11.** Distribution the Flight Levels in EUR/SAM Corridor – Atlantico FIR

Note that to prepare this assessment only FL in the border of FIR was considered.

- **Traffic load – Atlantico FIR:**

Next chart shows a summary of traffic load registered in Atlantico FIR where bars represent the number of aircraft that entered in the FIR per hour. The orange curve represents the maximum number of aircrafts that entered in the FIR per hour. The peak period of traffic is 03-04. Likewise the peak hour was 04 with 29 flights.



**Figure 12.** Traffic load in EUR/SAM Corridor – Atlantico FIR

- **Traffic distribution per ATS Route – Atlantico FIR:**

The following figures and tables try to sum up the operational data provided to SATMA. In Atlantico FIR the main flow is via IPERA (UN873). Note that western –eastern flow cover a huge area with several ATS routes.

TRAFFIC	EASTERN-WESTERN	UN741	UN866	UN873	UN857	TRANSVERSAL	RANDOM
NORTHBOUND	694		362	371	117	42	67
SOUTHBOUND	679	456		451	99		49
TOTAL	1373	456	362	822	216	42	116

Table 15. Distribution per ATS Route – Atlantico FIR

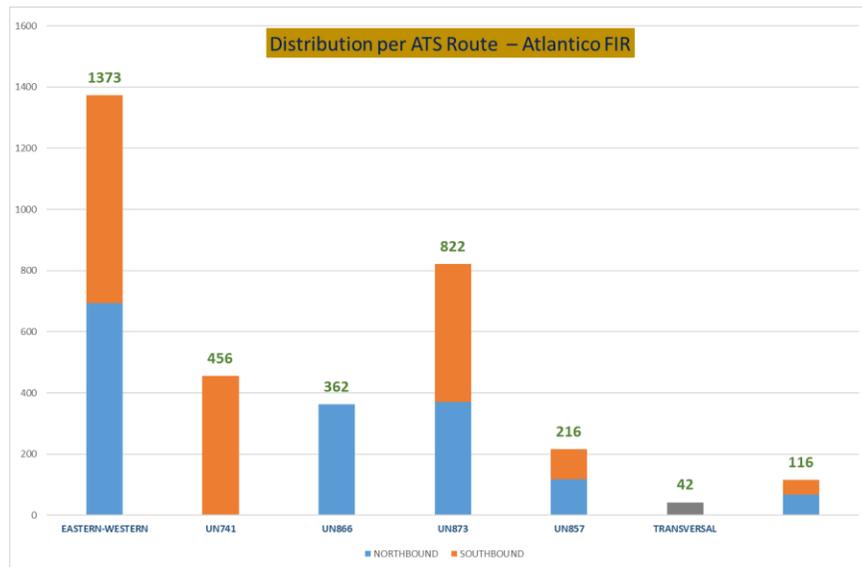


Figure 13. Distribution per ATS Route – Atlantico FIR

- **Main Flows – Atlantico FIR**

TRAFFIC FLOWS	FLIGHTS	%
NANIK JOBER	450	13.5%
TASIL VUNOK	445	13.4%
VUNOK TASIL	370	11.1%
MAGNO DEKON	361	10.8%
BUTAP CALVO	280	8.4%
DAKAP MOVGA	277	8.3%
CALVO BUTAP	219	6.6%
BUTAP VURBI	115	3.5%
ERETU UTRAM	95	2.9%
UTRAM ERETU	83	2.5%
MOVGA ESLEL	73	2.2%
MOVGA DAKAP	68	2.0%

Table 16. TRAFFIC FLOWS – Atlantico FIR

## **5. ACTION BY THE MEETING**

The SAT/23 Meeting is invited:

- To analyse and discuss the conclusions of this WP.
- To determine if others air traffic statistics studies are needed to assess the evolution of the traffic in the EUR-SAM corridor.
- To determine, if needed, the reduction of the scope and/or the exclusion the traffic out of EUR/SAM Corridor.