

FUEL CONSUMPTION MONITORING PROGRAM

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G2. ACRONYMS AND ABBREVIATIONS

| ABBR. | DESCRIPTION |
|--------------|---|
| 737 NG | 737 New Generation |
| ACARS | Aircraft Communications Addressing and Reporting System |
| AD | Aerodrome |
| ADF | Additional Fuel |
| AIMS | Airline Information Management System |
| AIP | Aeronautical Information Publication |
| AirFase | Software for post flight data analysis |
| ALF | Destination alternate fuel |
| AOC data | Data exported by EFA for Skybreathe containing flight schedule, crew composition, journey log and ACARS data |
| API | Application Programming Interface |
| APM | Aircraft Performance Monitoring |
| AUP | Airspace Use Plan |
| CGF | Contingency fuel |
| DB | Database |
| DCS | Departure Control System |
| DFDAU | Digital Flight Data Acquisition Unit |
| DISCR | Discretionary fuel |
| DSIRF | Digital Standard Interface Record Format |
| DY | Daily |
| EFA | Extranet Flight Application |
| ETN | Enroute Tracking Number |
| EXT | Extra fuel |
| FAP | Part of AirFase, It reconstructs flights and compares actual data with recommended values to identify abnormal events and calculate operational trends. |
| FDR | Flight Data Recorder |
| FDS | Flight Dispatch Support |
| FF | Fuel Factor |
| FMC | Flight Management Computer |
| FMS | Flight Management System |
| FOB | Fuel On Board |
| FRF | Final reserve fuel |
| FTP | File Transfer Protocol |
| GSM | Global System for Mobile communication |
| INOP | Inoperative |
| LSAP | Loadable Software Airplane Part(s) |
| MFC | MyFuelCoach |
| MFT | Managed File Transfer |
| NOP | Network Operations Portal |
| NOTAM | Notice To Airmen |
| OFF | Operational Flight Plan |
| OM-A | Operations Manual Part A |

FUEL CONSUMPTION MONITORING PROGRAM
GENERAL

| ABBR. | DESCRIPTION |
|--------------|--|
| OOOI | Out Off On In messages |
| OPS Group | Operations Group containing important news about aerodromes and airspaces |
| PCMCIA | Personal Computer Memory Card International Association (memory card standard) |
| PF | Performance Factor |
| PLN | Planned |
| RSF | Reserve fuel |
| SCR | Stable Cruise Report |
| SFTP | Secure File Transfer Protocol |
| SID | Standard Instrument Departure procedure |
| STAR | Standard Instrument Arrival procedure |
| TAS | True Airspeed |
| TNKRNG | Tankering |
| TPF | Trip fuel |
| TXF | Taxi fuel |
| WPS | Word per second |
| WQAR | Wireless Quick Access Recorder |
| ZFW | Zero Fuel Weight |

Chapter 1 INTRODUCTION

This document is a summary of the whole process of aircraft consumption evaluation as well as mitigation of potential hazards, that could arise from situations different than planned in OFP. The manual reflects the requirements described in CAT.OP.MPA.181 point (a) (4), AMC6 CAT.OP.MPA.181 and GM1 CAT.OP.MPA.181.

According to CAT.OP.MPA.180 company has decided to implement basic fuel scheme with variations. Every company decision to alter planned fuel consumption figures is based on specific data such as statistical evaluation, operational experience, anticipated delays, or aircraft specific fuel consumption data from Airplane Performance Monitoring all of which is described in this document.

First step of the process is focused onto categorization and identification of problematic citypairs or destination aerodromes. After the identification, the analysis is made for citypairs or destinations that might require some mitigating actions.

The mitigations might have many forms such as different SIDs or STARs planned, different wind, flight level or routing planned in OFP etc. One of the mitigating measures is a fuel component “Extra fuel” that may be added mostly because of the process described in chapter [5 Analysis and Mitigations](#).

Note: The EASA regulation introduces a new term fuel/energy to support innovation and allow for the smooth integration of new technologies into the air operations domain. This document keeps using term fuel because it operates aircraft using conventional hydrocarbon-based fuel and so this term is not restrictive in its operation as stated in point (4) of commission implementing regulation (EU) 2021/1296 and GM29 Annex I Definitions.

If no statistics is available, no extra fuel will be added by default. It will be added in case of anticipated delays available from public source of information such as NOTAM, AIP, AUP, NOP, OPS Group. This information will be monitored by navigation department or FDS Back Office.

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Chapter 2 DATA COLLECTION

This chapter describes Data Collection processes set in the company to acquire relevant and current data for Fuel Consumption Monitoring on any citypair, airport, and aircraft specific data. Performance and fuel consumption specific on any citypair, airport or airplane may be evaluated specifically if needed through either **SkyBreathe Analytics** or **Airplane Performance Monitoring (APM)** carried out by performance engineers.

2.1 SKYBREATHE

The main platform for fuel monitoring is cloud-based application SkyBreathe by OpenAirlines. It collects most of the data mentioned in this chapter. The primary reason for creating such platform was fuel efficiency, but it is adequate tool to accommodate all needs for the whole fuel consumption monitoring program. The application works in real time with all data that it receives.

There are several data sets for each flight, which are stored and collected – see table below:

Table 2-1 *Data set description*

| Data | Type |
|---------------------------|---------|
| OFP | Planned |
| Flight Schedule | |
| Journey Log | Actual |
| Operating crew | |
| ACARS | |
| Loadsheets / Load Message | |
| QAR/WQAR | |

2.1.1 OFP Data

For statistical evaluation of OFP (Planned) data such as planned weights, fuel figures, ATC route etc., OFP data from last 7 days are downloaded automatically every day from PPS API service into SkyBreathe application in a structured form (xml format), so that SkyBreathe can read, assign to the corresponding flight and statistically evaluate the data. The structure, and the legend of the data can be found in Confluence – FDS Internal Space under Open Airlines page.

OFP xml data are not directly accessible through EFA. Either EFA support or SkyBreathe support must be contacted to acquire the data from PPS API.

2.1.2 AOC Data

AOC Data (for SkyBreathe) are automatically exported every day by EFA to OpenAirlines' FTP. AOC data are a compilation of data from following sources:

1. Journey Log data
2. ACARS Data (e.g., OOOI messages)
3. AIMS Data (flight schedule, crew composition)

AOC Data may be manually downloaded from EFA -> DB Transport -> Export for OpenAirlines. If a correction of the data is necessary it must be corrected in EFA or AIMS (as applicable) and then a new upload to OpenAirlines must be manually prompted to be updated in SkyBreathe – the change will be visible after the next midnight as well.

2.1.3 Loadsheet Data

Loadsheet Data (for SkyBreathe) are automatically exported by EFA to OpenAirlines' FTP. AOC data are a compilation of data from following sources:

1. Loadheets
2. Load Messages

Due to variety of loadsheet sources (various DCS, formats, manual loadsheets) loadsheet data are typically very sparse due to requirement to be machine readable.

Loadsheet Data may be manually downloaded from EFA -> DB Transport -> Export for OpenAirlines and manually input into SkyBreathe FTP in the same way as AOC data, if required.

2.1.4 Actual Flight Data

Quick Access Recorder data (herein after QAR) provide wide opportunity to get actual flight data from Digital Flight Data Acquisition Unit (herein after DFDAU, sometimes rather incorrectly referred to as FDR for Flight Data Recorder).

Further details regarding QAR data security and flow is described in Safety Management Manual G-MN-05.

2.1.4.1 QAR - Boeing 737 NG Models

Boeing 737 NG fleet data gathering works through PCMCIA cards, which need to be physically changed, downloaded, and formatted on regular basis, preferably during daily checks of aircraft.

There are 2 main types of PCMCIA Cards:

- Teledyne
- Honeywell

Above types of cards are not interchangeable. Further there are 2 main data frames:

1. **737-7 512WPS** –, Teledyne DFDAU
2. **737-3B and 737-3C - 256 WPS** Teledyne/Honeywell DFDAU

Types of data frames per aircraft and data structures are described in Confluence, FDS Internal Space, Open Airlines page. Data frames are specified per tail in SkyBreathe FTP server; therefore, it is essential to keep the aircraft specific dataframes properly formatted. For example, OK-TVR uses Teledyne DFDAU at 512 WPS; common issue for lack of data is that Skybreathe receives data for OK-TVR in 256 WPS format. In that case SkyBreathe is unable to decode the data.

PCMCIA cards and PCMCIA card readers are managed by Safety department despite cards are usually manipulated by maintenance engineers. In case new cards or readers are needed IT department is responsible for ordering new hardware.

2.1.4.1.1 PCMCIA Cards Downloads Process

Downloading period for PCMCIA cards is usually during line maintenance as follows:

- Main stations every DY check,
- other stations 2x week,
- all stations each Weekly check (10 days).

Cards shall be processed within 24Hrs after card replacement using preferably **ACMSFORMAT** software.

After a card is processed by ACMSFORMAT software (takes up to 10min based on card size), data are then:

- zipped and immediately sent to SFTP, and
- stored for 30 days on local PC in a format of ZIP files for retention.

There is a running script at SFTP to process data and after confirmation of receipt data are immediately:

- unzipped at \\berlin-new\fimroot\ for AirFASE processing (Safety Dept. Purposes),
- sent to SKYBREATHE SFTP - for SkyBreathe processing,
- data are stored 90 days at SFTP server for retention then deleted.

The path to the SkyBreathe SFTP together with access credentials is to be found in Confluence application, FDS Internal Space, Open Airlines page. Access credentials may be used for manual data upload.

2.1.4.2 WQAR - Boeing 737 MAX Models

Boeing 737 MAX fleet data gathering works through WQAR (wireless QAR using 2048 WPS). QAR data are sent from DFDAU and zipped by airplane system and saved on ONS (Onboard Network System) after each flight shortly after second engine power off.

If GSM connection is available on the station after the second engine power off, task is finished in approximately 10 minutes after the power off.

Data are sent to Boeing LSAP library (Loadable Software Airplane Part(s)), where data is kept for 270 days. There is Boeing's Managed File Transfer (MFT) service running at LSAP, which is scheduled to copy these WQAR files from LSAP every 8 minutes. Data are stored there for 90 days for retention.

MFT server with MFT client – there is a running script, which downloads and compresses (.zip file) WQAR data from Boeing MFT server every 30 minutes to <\\berlin-new\OperationalData\737MAX>.

There is a running service on Berlin server to further process the data in following two ways once received:

1. unzip the data and send to \\berlin-new\firmroot\ for **AirFASE** processing,
2. send zipped data to SkyBreathe SFTP: /data/FDRRAW/received for processing.

Data sent to SkyBreathe are available after midnight the next day if the non-corrupted file has been decoded properly.

2.1.4.2.1 WQAR INOP Procedure

In case when WQAR is not available, QAR data may be acquired in the similar fashion as for 737 NGs through PCMCIA cards.

2.1.4.3 FDR Data Monitoring

SkyBreathe is set to weekly and automatically send a list of “FDR Coverage Percent” report, which is a query that lists a percentage of past flights, which have successfully paired with its “FDR” (actually W/QAR) data during the previous week. In order to have statistically sound data for fuel statistic, following FDR Percentage targets are set:

Table 2-2 SkyBreathe FDR Coverage Target values.

| Fleet | FDR Percentage Target |
|----------------|------------------------------|
| Boeing 737 NG | 85% |
| Boeing 737 MAX | 95% |

It may happen that FDR Target values are not met typically due to lack of flights (e.g. 2 flights per week with one not having FDR data would result in 50% coverage). However, typical aircraft utilization should meet above target values. If it does not, FDS shall investigate, if the missing data may be salvaged through Safety Department (for data flow problems) or OpenAirlines Support (for corrupted PCMCIA contents) and make immediate corrective action to upload the missing data.

2.2 STABLE CRUISE REPORTS FOR APM

The Safety Department manages data in AirFASE, where data are decoded (using the Teledyne FAP) to the proper format for further data processing. The data are in parallel with this decoding and are filtered by the pre-set Stability Criteria parameters to get Stable Cruise Reports (herein after SCR). Safety Department then provides FDS with SCRs for the whole 737 NG Fleet via email at least on the monthly basis. 737 NGs' DFDAUs are set to record one SCR compliant to stability criteria (see chapter per each flight at maximum and further SCRs are recorded within first 30 minutes after reaching an initial cruise level.

Data acquired from Safety Department from 737 NGs must be converted through SC2APM4 software first to get reports into DSIRF compatible file, which can be read by Boeing software PET (Performance Engineers' Tool).

Boeing 737 MAX aeroplanes transmit SCRs via ACARS in real time directly in DSIRF compatible format. SCR messages are then further distributed via email to FDS for storage and evaluation purposes. Boeing 737 MAX's DFDAU search stability criteria every 30 minutes from the last successful stability record or change of flight parameters (such as flight level change). Therefore, more records may be available from one flight on MAX.

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Chapter 3 AIRCRAFT PERFORMANCE MONITORING

Aircraft specific fuel consumption is continuously monitored through below described APM procedure. The APM ensures timely control of tail specific fuel consumption and is a key tool to monitor engine and airframe efficiency.

The main goal of APM is an accurate investigation of aircraft specific Fuel Factor, which is a coefficient in percent (%) describing how much different the actual aircraft consumption is from the book performance. For example, Fuel Factor (+)4.8 means the aircraft consumes 4.8% more fuel than expected based on manufacture's performance data. Note the lowest possible Fuel Factor for 737 airplanes is 0.0(%).

3.1 FUEL FACTOR EVALUATION

The APM works by evaluating SCR reports as described in the previous chapter against manufacturer's book performance. SCR stability criteria is a set of physical aerometric parameters. All these parameters must stay inside the tolerances for **3 minutes** to pass the filter. Also, all climbing and descending data are filtered out. It is allowed to get just one record per flight of 737 NG models, The criteria are part of the FAB code adjustable by flight data monitoring department. The decision about the setting of tolerances is made by FDS.

Table 3-1 *The Stability Criteria parameters*

| Parameter | Tolerance +/- |
|------------------|----------------------|
| MACH | 0.004 |
| AIRSPEED | 1,5 kts |
| PRESS ALTITUDE | 80 ft |
| GROUND SPEED | 2 kts |
| AMBIENT TEMP | 0,5 °C |
| ROLL ANGLE | 2° |
| POWER SETTING | 0,4 %N1 |
| HEADING | 2° |
| WIND SPEED | 2 kts |
| WIND DIRECTION | 2° |

FDS runs the DSIRF format data through PET/APM software (Boeing software dedicated for the performance factors – fuel factor and drag factor analysis) after the end of each month or more often, if required. The analysis in APM is done using SCR data not older than three months prior the evaluation date based for each tail number. The result of this analysis is calculated and recorded in PF_Overview.xls file available at G:\Ground Operations Division\FDS\APM - Performance factor – this file is backed up each month and the folder is restricted to be accessed by FDS Department only. The resulting factors are evaluated case by case basis depending on the number of data and a scatter of values. Mostly a negative value of tail specific average Fuel Mileage figure is used as a Fuel Factor (FF) for flight planning program. In worse cases following Boeing recommended formula may be used for the Fuel Factor:

Figure 3-1 Fuel factor formula

$$\Delta \text{ FF}\% = \left\{ \frac{1}{\left(\frac{\Delta \text{ FM}\%}{100} + 1 \right) \left(\frac{\Delta \text{ Thrust Req'd}\%}{100} + 1 \right)} - 1 \right\} * 100$$

However, the Thrust Required is assumed to be 0, which is the recommended assumption by Boeing. Fuel Factor evaluation is recommended to be consulted with fuel bias figures in SkyBreathe Analytics – see **Chapter 3.5**.

3.2 FUEL FACTOR DISTRIBUTION

After performance monitoring for the fleet or required aircraft is evaluated, FDS publishes a bulletin “Fleet Performance Chart” with the overview of all tail numbers and corresponding fuel factors with explicitly listed changes from the previous version.

The bulletin is then distributed by EFA to all relevant persons (EFA user groups) including the technical department which is obliged to insert the respective values in the FMS of each aircraft. Email notification about the release of the new revision of the bulletin is also sent by the bulletin administrator to relevant departments. FDS then assures the insertion of the revised Fuel Factor values in the Flight planning system on the day of the bulletin effectivity.

3.3 FUEL FACTOR CHANGE FMC

Once the new revision of Fleet Performance Chart is issued, Maintenance Planning Department is required to plan to carry out of task as described in Scheduled Workcard (K-34-0975) for every aircraft with Fuel Factor change as soon as possible to meet the effectivity of the bulletin. FDS then checks the workcard accomplishment in the OASES system.

It may happen that there is a discrepancy in the FMC and OFP Fuel Factor due to lagging maintenance opportunities. However, normally the changes are not critical and Fuel Factor changes within tolerance $\pm 0,5$ is typically not noticeable either by crews or FMC predictions. If Fuel Factor for any aircraft is not changed within the week of the bulletin effectivity, immediate notice is sent to the engineering and maintenance planning department to schedule the workcard. Furthermore, if there is a Fuel Factor change higher than $\pm 0,5$, additional alerting email is sent to the Engineering and Maintenance Planning Department and immediate action to change the Fuel Factor is desired.

The Fuel Factor change itself is carried out by trained and fully qualified (EASA Part 145, B2) aircraft engineers, who then confirm the Fuel Factor change by signing the workcard. The engineer performing the Fuel Factor change is assisted by other engineer, who visually crosschecks the inserted value, so that it matches the bulletin value for the respective aircraft and the risk human error, which would result in typo mistake during insertion is mitigated. After the Duplicate inspection, the card is signed by both engineers.

CAUTION:

ONLY FUEL FACTORS ARE NORMALLY CHANGED BY THIS PROCEDURE.

**DRAG FACTORS MUST NOT BE CHANGED BASED ON APM BUT ELABORATE FDR
AND PET ANALYSIS IS REQUIRED.**

3.4 APM ADDITIONAL ASSUMPTIONS

If an aircraft did not perform a flight with usable data for the longer period, the last usable values will be used for flight planning system and FMS setting. For the new aircraft from manufacturer FF will be set to 1%, for the newly introduced aircraft after another operator FF will be set on 5%.

FDS should solve any increase of FF of more than 2% within the last three months with the technical pilot and technical department to try to identify the reason of degradation. The FF higher than 6% should be also solved to be improved.

If there is both engines replacement in 5-day timeframe and the airplane had lower FF than the one the pair of engines comes from, default FF of 5% or the other airframe's coefficient shall be set depending on what is greater. If leased engines are used, default coefficient of 5% shall be used and after 14 days data are evaluated and changed, if necessary. This procedure is not applied, if the engines are installed after a shop visit.

3.5 SKYBREATHE ANALYTICS

Although SkyBreathe application is mainly used for advanced fuel statistics, its capabilities in terms of APM are quite limited. Nevertheless, there is an Engineering Dashboard, where APM Dashboard is set at least 2 APM charts:

(1) Fuel Bias

The Measure shows how much fuel is used compared to OFP planned fuel. The results of this measure should be investigated per tail by using Filters. Results of this measure need to consider informative and those for historical records of Fuel bias trending, since the value may be distorted by diversions, non-standard flights, ZFW errors etc. The median monthly value should be between 0.99 and 1.02. It is advised to move resulting Fuel Factor from APM accordingly with the value scatter and trends, while investigating the Fuel Bias values and trends. Value lower than 0.99 means the aircraft has lower actual consumption than planned.

(2) FOB indicator

This Measure shows the difference between Fuel Used and Fuel On Board – this measure uses the two methods to evaluate the accuracy of Fuel Tank Quantity indicators. The results are consistent fleet-wise with Tail specific medians around 130-150kgs on 737 NGs and around 0kgs for 737 MAX.

3.6 SKYBREATHE APM

To be developed...

Chapter 4 SKYBREATHE MONITORING

SkyBreathe is one the key tool for determining the Extra Fuel values for each airport or citypair and it can also be used partially for APM (see chapter ...). This chapter describes key features, which are commonly used for statistical evaluation of fuel components. SkyBreathe administration is made by FDS department. It contains following tasks:

- Dashboard and queries administration
- Citypair categorization and analysis
- Proposing mitigating actions

4.1 ACCESS TO SKYBREATHE

In order to have full access to SkyBreathe the user must have login, which can be obtained from FDS department. After gaining full access the user may create Custom Measures, Queries and Dashboards. The platform is accessible to unregistered users as well after opening link that registered user has created. The link enables unregistered user only to view certain dashboards, without the right to edit it. This can be used if other users/departments would be needed during the process. Mobile version of the software is provided to pilots in form of iPad application (**see chapter 4.2**).

4.2 MY FUEL COACH

The version of SkyBreathe for mobile devices is called MyFuelCoach, it is created specifically for pilots. The tutorial for the application is available after first login or can be accessed anytime via Settings -> Show tutorial. The application has 5 tabs that provide different information:

1. **Journal** where pilots have general overview how much fuel he has saved
2. **Flights** where each flight is analysed with regards to fuel efficiency
3. **Benchmark** comparing pilot's potentials to save fuel to company average
4. **Dashboards**, that are created by FDS specifically for pilots
5. **Briefing** that gives pilot basic information about airport he/she is about to fly to/from

Briefing is most important part of the application. Pilots can view statistics based on 3 parameters: citypair, aircraft type, period. Those statistics are divided into 4 categories: **Fuel planning, Departure, Arrival and Best practices**. Best practices are used for fuel efficiency, so only first three tabs are relevant for purpose of this document. Examples can be seen on Figures below.

Figure 4-1 MFC Fuel planning

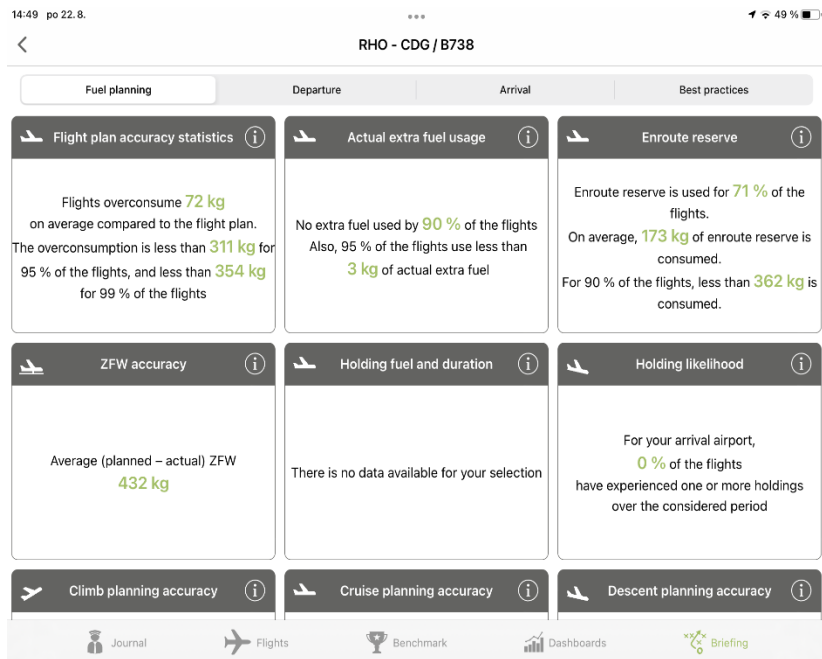


Figure 4-2 MFC Departure

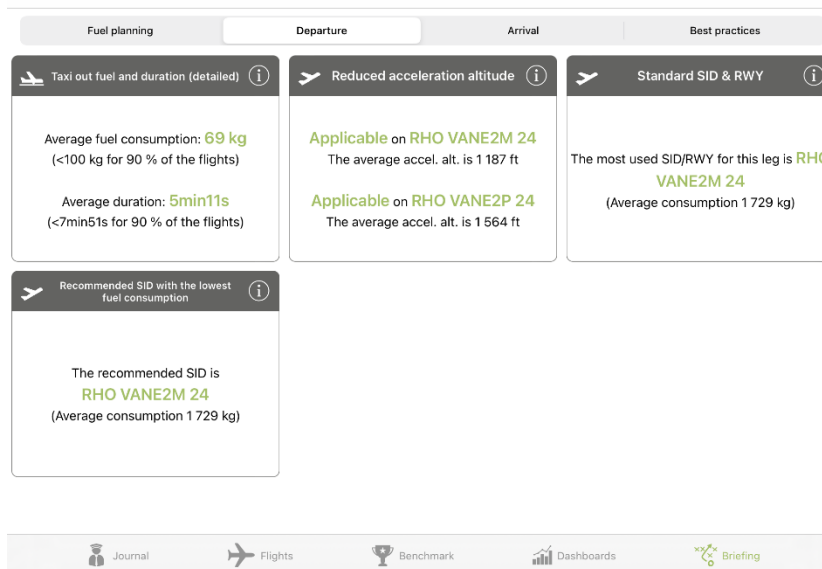
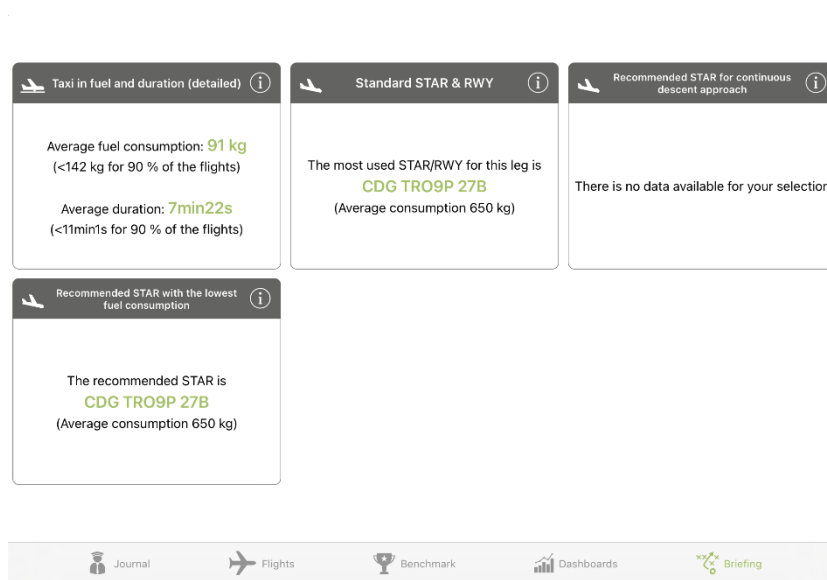


Figure 4-3 MFC Arrival



4.3 SKYBREATHE FUNCTIONS

SkyBreathe platform can have various functions thanks to variety of data that the platform is using. After login registered users can see main screen with “Best Practices.” Those are default queries created by Open Airlines displaying remaining potential how can the company and pilots save fuel. Similar version of the main screen is displayed to pilots after opening the mobile application, but they see only their own flights.

The main information for periodic evaluation will be found in custom dashboards, that were created specifically for needs of this program.

4.4 CITYPAIR CATEGORIZATION

In order to effectively identify problematic flights, the statistics is based on evaluation of different “citypairs” Citypair is combination of specific departure and a specific arrival airport. Data collected from the opposite directions are evaluated as different citypair. This means, for example, that all data from flights departing from PRG arriving to BRQ would be evaluated and compared together, but flights departing from BRQ arriving to PRG would be considered as different citypair.

Processing data according to citypairs allows to search for conditions, that persist on certain routes or airports and adversely affect the fuel consumption. Those conditions may be for example earlier descent than planned, bad enroute weather that leads to change of routing or frequent holding. This kind of evaluation searches for conditions that are independent of certain aircraft or aircraft type but rather those that affect all aircraft.

For the purpose of such monitoring new custom dimensionless number was created. It is called ETN (Enroute fuel Tracking Number) and compares planned trip fuel with actual. In order to

take into account potential flights where holding fuel was added, the holding fuel is added to the planned trip fuel as it is one of the mitigations for problematic flights. The ETN is counted as below.

$$ETN = \frac{(Planned\ trip\ fuel + Extra\ fuel) - Actual\ trip\ fuel}{Planned\ trip\ fuel}$$

There are 3 important ETN intervals describing different situations:

- **Negative** value of ETN means that more trip fuel than expected was used. For example, value -0.05 means that total of 1.05 trip fuel was used on the actual leg
- **0** value means that on the flight exactly the same amount of trip fuel was used as in OFP. The closer ETN gets to 0 the more accurate flight planning was made
- **Positive-** in case of positive ETN, less trip fuel, than planned was used. In this case the flight planning is on the “safe side”, but if the number would be too high, other problems could occur, i.e., required holding above destination in order to reduce weight and not exceed Maximum Landing Weight.

According to ETN flights on different citypairs are automatically divided into following categories

Safe deviation (ETN ≥ -0.03)

Safe deviation category includes all flights that have used less than 1.03 planned trip fuel. This means that even if those flights would be planned with 3% contingency fuel and no extra fuel would be taken, it would be enough to complete the flight without burning any other reserve fuel.

Minor deviation (-0.05 ≥ ETN > -0.03)

All flights contained in minor deviation category have used less than 1.05 planned trip fuel. This means that there would be sufficient fuel, unless you planned them with smaller reserves than 5% contingency. Although this can seem like a problem, there is no safety issue, because all flights with lower reserves are planned with appropriate enroute alternates. The main reason for this category is that in case the number of flights in minor and major deviation category for particular citypair exceeds **50%**, there is reason to evaluate them and consider not planning flights between those airports with lower reserves than 5% contingency fuel.

Major deviation (-0.05 > ETN)

All flights within major deviation category have used more than 1.05 of the planned trip fuel. This means that even if 5% contingency fuel was planned, it would not be sufficient and unless there was some extra fuel, other reserves would have to be used.

4.5 MONITORING PROCESS

The evaluation and categorization in SkyBreathe software is automatic and works in real time. FDS Department shall review and analyse displayed data using custom dashboards in intervals described in this document. It is mandatory to analyse major deviation citypairs and those where minor + major deviations exceed 50% of all flights.

Figure 4-1 Monitoring dashboard example

City pair categories

ETN all deviations

ALL DEVIATIONS - ETN

Search: Entries: 10

| Scheduled leg IATA | Number of flights [CNT] | ETN count major deviation [CNT] | ETN count minor deviation [CNT] | ETN count safe deviation [CNT] | ETN no data available [CNT] |
|--------------------|-------------------------|---------------------------------|---------------------------------|--------------------------------|-----------------------------|
| PRG-AYT | 178 | 9 | 16 | 135 | 18 |
| BUD-AYT | 32 | 4 | 2 | 25 | 1 |
| OSR-AYT | 23 | 3 | 1 | 18 | 1 |
| WAW-SKG | 9 | 3 | 1 | 5 | 0 |
| BTS-AYT | 20 | 2 | 2 | 15 | 1 |
| DJE-PRG | 57 | 2 | 2 | 46 | 7 |
| TLV-BUS | 46 | 2 | 1 | 40 | 3 |
| AYT-WRO | 19 | 2 | 2 | 13 | 2 |
| PRG-BJV | 21 | 2 | 6 | 12 | 1 |
| KTW-AYT | 27 | 2 | 1 | 22 | 2 |

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ETN Major

MAJOR DEVIATIONS

Search: Entries: 10

| Actual leg IATA | ETN [AVG] | ETN count major deviation [CNT] | Alternate reserve consumed [AVG] | Final reserve consumed [AVG] | Equivalent time fuel at landing all [AVG] |
|-----------------|-----------|---------------------------------|----------------------------------|------------------------------|---|
| PRG-AYT | -0.07 | 9 | 0 | 0 | 121.78 |
| BUD-AYT | -0.07 | 4 | 0 | 0 | 88.07 |
| OSR-AYT | -0.07 | 3 | 0 | 0 | 158.59 |
| WAW-SKG | -0.06 | 3 | 0 | 0 | 116.72 |
| AYT-WRO | -0.07 | 2 | 0 | 0 | 217.79 |
| BTS-AYT | -0.08 | 2 | 0 | 0 | 83.14 |
| DJE-PRG | -0.08 | 2 | 0 | 0 | 72.51 |
| KTW-AYT | -0.06 | 2 | 0 | 0 | 88.31 |
| PRG-BJV | -0.08 | 2 | 0 | 0 | 221.55 |
| PRG-ZTH | -0.11 | 2 | 0 | 0 | 209.46 |

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4.5.1 SkyBreathe Dashboards

To access distribution of flights, user must open dashboard specifically created for this case. This dashboard can be found in category Fuel Consumption Monitoring Program. The access is through the sequence: Dashboards > Fuel Consumption Monitoring Program > Citypair categories – ETN.

After opening dashboard, four tables are shown. The first table combines all the categories together with information about how many flights were made in selected period. (Figure 4-1) To view percentage of respective categories the user shall use citypair analysis dashboard as described in [Chapter 5](#).

Other tables provide information about number of flights in specific categories with other quick information, that could be useful for primary inspection, such as if any reserves were consumed or equivalent time at landing.

Figure 4-2 Access to dashboards

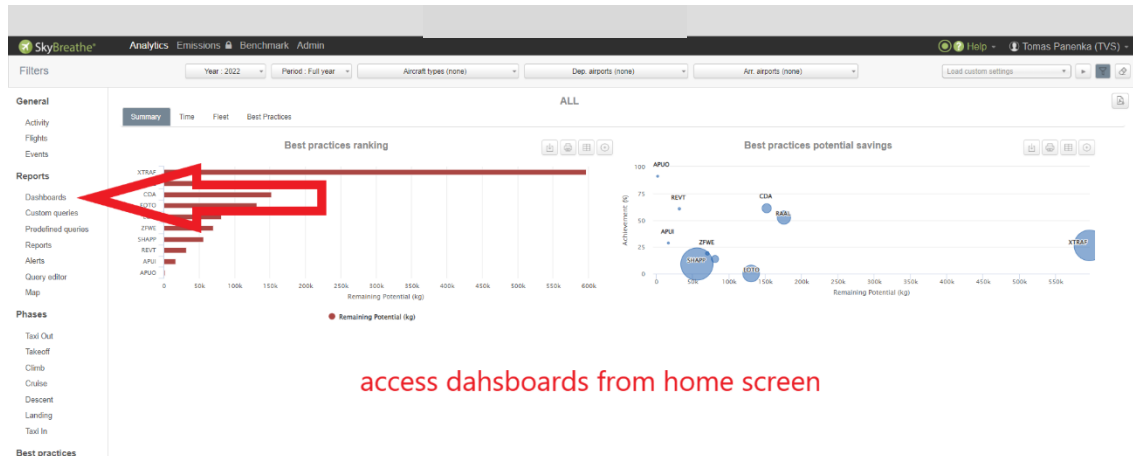
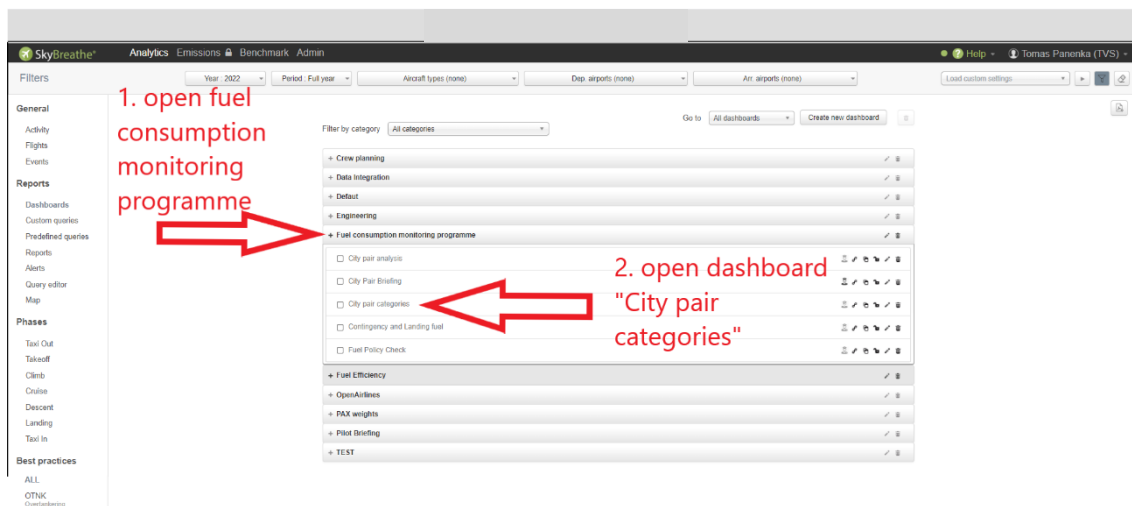


Figure 4-3 Selecting the dashboard



4.5.2 SkyBreathe Data Parameters

Due to variety of operated airports, some data might not be relevant for the statistics due to lack of rotations made on the specific citypair. For this reason, all dashboards for deviation categories are by default set to display only citypairs when two or more flights in the analysed period fall into respective category.

In order to have sufficient amount of data, the analysis is made once a month and all flights from the previous month are considered. Due to delay in process of the data collection on B737NG described in [Chapter 2](#), all flights from the previous month are analyzed on 10th of the following month. For this purpose, the user has to set filters to only count data from past month as described on the images below. FDS will also receive email notification about major deviations as soon as data are available. Flights in this category shall be reviewed as soon as possible and conclusions shall be added to the monthly analysis report (Chapter 5.3).

Figure 4-4 Opening filter settings

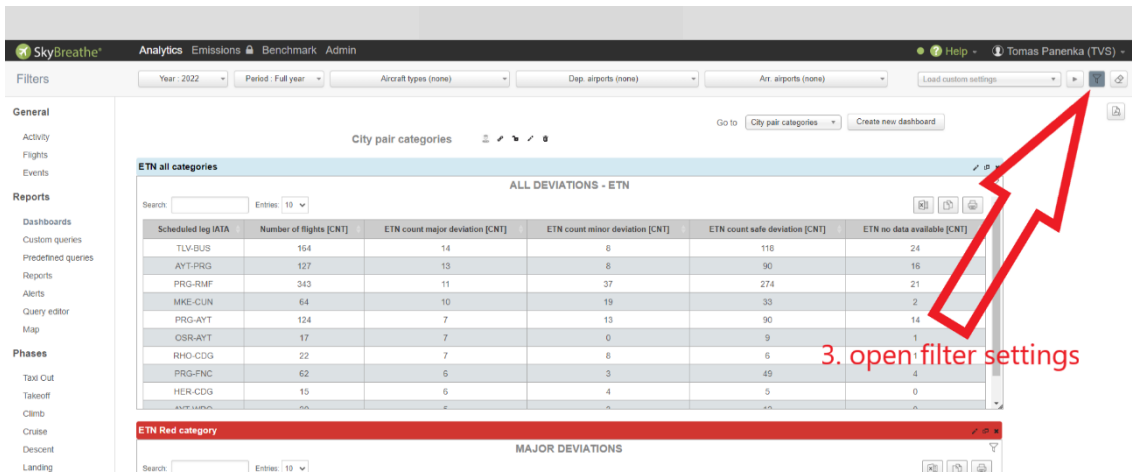
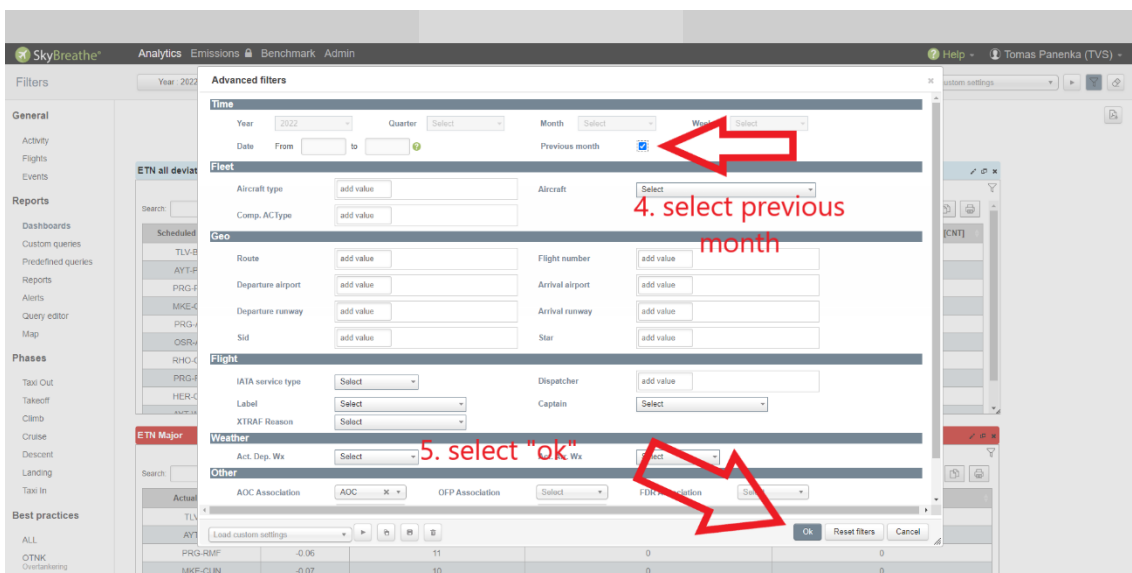


Figure 4-5 Adjusting the filter settings for citypair monitoring



4.5.3 Review

After setting correct filters FDS members can review all categories by the following rules.

- **Safe Deviation** category does not present any level of overburn risk there is no need to analyze flights that fall into it.
- **Minor Deviation** category may cause low level of potential overburn and therefore will be analyzed if the percentage of Major + Minor deviation flights exceed 50% of all flights.
- **Major Deviations** must be analyzed. The risk of overburn in this category is the high and therefore each citypair that falls here must be processed by FDS Department or any other competent person. The analyzing process is described in [Chapter 5](#).

4.5.4 Regular Reports

FDS will automatically receive two emails with a notification to review past month data together with Excel tables containing all relevant (2 and more flights in category) **Major deviation** citypairs and all **Minor deviations**. The email will be sent **each month on the 10th**.

4.5.5 Extra Fuel Monitoring

In the dashboard the fourth category is visible which is called Extra Fuel monitoring. This table will show all flights for which Extra Fuel was added. The category will display the flights in the three categories as if no holding fuel was added. Therefore, if any citypair appears in safe deviation category or minor deviation category even without the extra fuel, part of or whole Extra Fuel may be removed in future flights. This may be done only after sufficient number of flights indicate less or no Extra Fuel is needed.

4.5.5.1 Statistical Contingency Fuel

Statistics of likely consumed contingency fuel takes into considerations last 2 years of operation and all citypairs with more than 10 flights. Flight planning software and FDR must be available. Diverted flights are excluded from these statistics. The statistics compared the real fuel burn with the planned fuel burn and provides 90% and 95% statistical values for a particular city-pair and aircraft model. Zero value means that the taxi fuel +trip fuel + contingency fuel was burnt on the flight. Negative value means the citypair mostly uses less fuel than planned. Positive value possibly indicate an Extra Fuel may be needed.

SkyBreathe measure is called “Statistical extra fuel for fuel planning REAL vs PLN [kg]” and it is not to be confused with the measures for ETN evaluation. Statistical Contingence Fuel is only the informative value, whereas Extra Fuel added based on Major ETN deviation is a compulsory component of Minimum Fuel.

The Statistical Contingency Fuel is uploaded as it comes from SkyBreathe report (slight format change needs to be done) directly to PPS server (file fuelstat.csv)

4.5.6 Destination statistics

Sometimes the categorization might indicate that the reasons of overburn are dependent only on destination aerodrome rather than citypair. For this reason, the dashboard for citypair categorization contains destination statistics. It does not categorize or rank the destinations and is only meant as source of additional information in case the analysing person suspects that the overburn is due to the conditions prevailing at the specific destination.

The query contains following data:

- Number of flights arriving in selected period
- Percentage of flights that flew planned STAR
- Descent ground distance difference (actual – planned)
- Descent duration difference (actual – planned)
- Number of cruise steps during descent
- Descent fuel difference (actual – planned)

- Descent fuel difference in % (actual / planned)

Figure 4-5 Destination statistics

| rival airport IATA | Number of flights [CNT] | Planned STAR flown [AVG] | Descent ground distance diff [AVG] | descent duration diff [AVG] | CRUISE step descent count [AVG] | Descent fuel difference [AVG] | Descent fuel absolute difference percentage [AVG] |
|--------------------|-------------------------|--------------------------|------------------------------------|-----------------------------|---------------------------------|-------------------------------|---|
| ETM | 1 | 100% | 119.38 | 21 | N/A | 746 | 236.79 |
| LUX | 1 | 0% | 50.16 | 7 | 1 | 690 | 205.22 |
| DWC | 17 | 23.53% | 84.47 | 15 | N/A | 487 | 186.79 |
| DXB | 140 | 32.86% | 64.62 | 14 | 1 | 470 | 182.47 |
| RKT | 44 | 79.55% | 71.68 | 12 | 1 | 448 | 164.22 |
| MRS | 8 | 25% | 91.81 | 13 | 1.5 | 504 | 161.26 |
| JED | 9 | 22.22% | 101.7 | 13 | N/A | 530 | 161.16 |
| VCE | 5 | 40% | 91.8 | 12 | 2 | 522 | 152.69 |
| FRA | 15 | 26.67% | 75.6 | 12 | N/A | 438 | 150.39 |
| PUJ | 64 | 14.06% | 77.3 | 11 | 1.73 | 441 | 144.85 |

4.5.7 Taxi Fuel Monitoring

The taxi time statistics for Boeing fleet is automatically run in the SkyBreathe application every month (at the start of the month) – FDS is notified about the updated values via email. Results are then compared to existing values, merged, and uploaded to the PPS server (file taxi.csv).

Taxi time statistics takes into considerations last 2 years of operation and all aerodromes with more than 20 flights. The 90% statistical value is then uploaded in PPS. Data from Flight planning software and flight data recorder must be available. Diverted flights are excluded from these statistics.

The exact name of the measure is “Monthly Report on Taxi Out and In time statistic for PPS”

4.6 PAX BAG WEIGHT EVALUATION

Statistical passenger and bag (PAX BAG) weight is preferably used in order to estimate ZFW for flight planning purposes that correspond to the type of operation. This is used for accurate ZFW predictions for flight planning purposes based mainly on variations of weights of checked luggage and PAX composition (M/F/CH). Note the cargo and mail weights are always considered as actual listed weights and are NOT considered in PAX BAG weight statistics. The PAX BAG weight are evaluated in SkyBreathe application using custom query called “PAX BAG weight for EFA”. For the weight determination data from past years for the mentioned period will be used in this query. The query then sorts flights according to:

- **Operator** to detect different ACMI project
- **Service type** to find out if it was charter flight or regular flight

In order to have sufficient amount of data only **regular flights with at least 1 rotation per week** and **charter flights with at least 2 rotations per week** are taken into account. After downloading the data from SkyBreathe they are processed in Excel.

During PAX BAG statistic evaluation FDS has discovered that the weights change periodically throughout the year. For this reason, three intervals were determined in which the PAX BAG weight is evaluated (February – May, June – August, September – January).

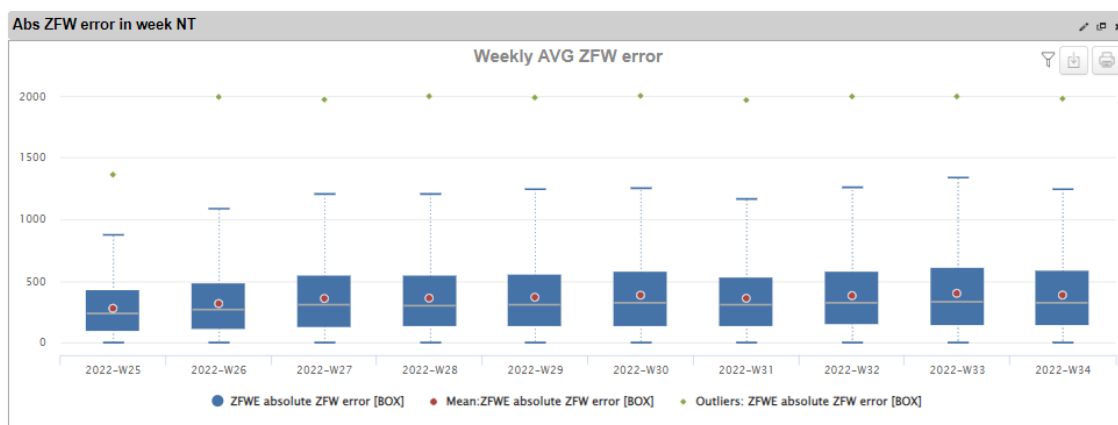
If **ACMI out project** is operated, that has been operated all data from the past operation may be considered without sorting into mentioned periods.

If new ACMI or new charter request is operated, it is calculated according to EFA – WBC application. In case of special flight (sportsmen, army) the weight of passenger and luggage shall be specified in the request and the calculation is based on this information.

4.6.1 ZFW accuracy monitoring

In order to ensure that the PAX BAG weight is accurate query “Weekly AVG ZFW error” is used. It is for monitoring the planned and actual ZFW in week intervals. The query is used for all flights from which data are available.

Figure 4-6 Weekly AVG ZFW error query



The blue box represents error interval of 25% - 75%, where the mean error can be mostly visible. The blue lines represent maximum value of error. Green dots are outliers when special conditions probably prevailed so those are mostly not considered.

Chapter 5 ANALYSIS AND MITIGATION

After identification of any major deviation or more than 50% of minor deviation the flights must be analyzed. FDS or other involved department members shall investigate reasons and conditions that contributed to higher fuel consumption. The means of investigation are described in this chapter.

5.1 SKYBREATHE TABLES

The main source of information should be SkyBreathe dashboard specifically created to facilitate the investigation. It contains several queries separated according to different reasons that might cause higher consumption. The person that will analyze a specific citypair shall review the queries and try to define the problem and describe the reason to Confluence as described in Chapter 5.3.

5.1.1 Dashboard access and setting

To access dashboard for fuel monitoring, follow the sequence Dashboards > Fuel Consumption Monitoring Program > Citypair analysis similar way as described in [Chapter 4.5.1](#). After accessing the dashboard, it is necessary to adjust the setting for the analyzed citypair. To do so, the departure and the arrival airport must be selected, and period set to the previous month as described on below images.

After selecting proper filter settings, dashboards are set for the analysis. In the dashboard user can find several queries, but these all share same principles. The main principle is that if planned and actual values are compared; **it is always calculated as the actual value minus the planned value**, so user can get better orientation in the table. All queries are sorted as well so they display the most critical flights first.

Figure 5-1 Opening filter settings

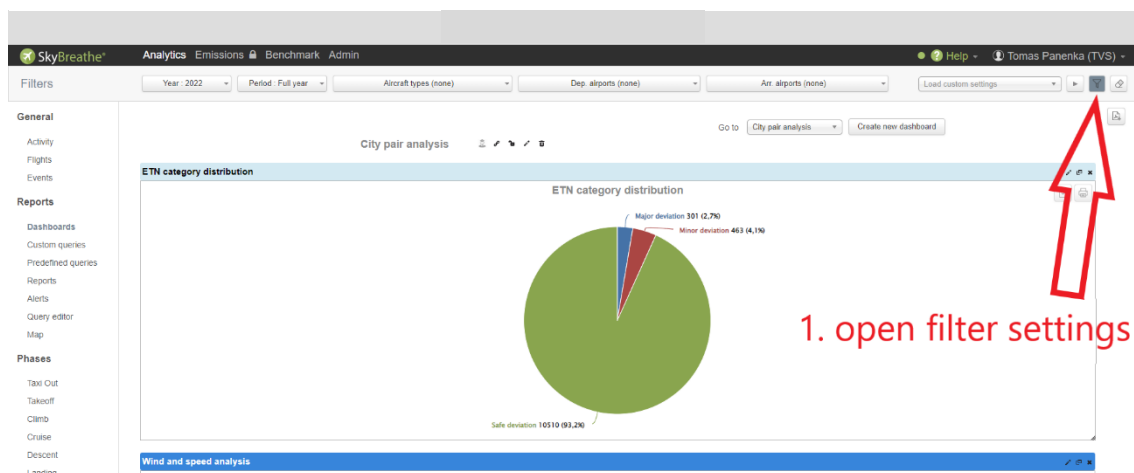


Figure 5-2 Adjusting the filter settings for citypair analysis

Advanced filters

2. select previous month

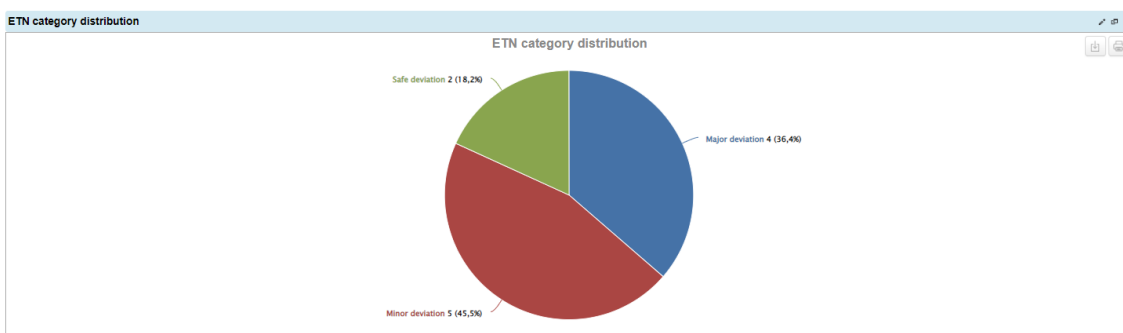
3. enter departure and arrival airports

4. select "Ok"

5.1.2 Dashboard analysis

The first displayed query is called ETN category distribution which displays percentage of each category in all flights from the filter. The percentage gives better information about how often the major deviation occurs. It can also be used for the minor deviations to determine whether the sum of the minor and the major deviation has exceeded 50% of all flights.

Figure 5-3 ETN category distribution



Second query shows equivalent time at landing, it is fuel at landing calculated as time in the air. The measure called "Equivalent time fuel at landing" is excluding the alternate and final reserve fuel. Measure "Equivalent time fuel at landing all" is counting with total mass of fuel on board at landing.

Figure 5-4 *Landing equivalent time query*

| Actual leg IATA | Scheduled departure date | ETN [AVG] | ETN category [SUM] | Equivalent time fuel at landing [AVG] | Equivalent time fuel at landing all [AVG] |
|-----------------|--------------------------|-----------|--------------------|---------------------------------------|---|
| RHO-CDG | 2022-05-29 17:25:00 | -0.11 | Major deviation | -6.38 | 61.32 |
| RHO-CDG | 2022-05-29 17:35:00 | -0.08 | Major deviation | 10.43 | 76.03 |
| RHO-CDG | 2022-05-01 17:25:00 | -0.04 | Minor deviation | 16.98 | 76.9 |
| RHO-CDG | 2022-05-01 16:55:00 | -0.04 | Minor deviation | 20.27 | 80.05 |
| RHO-CDG | 2022-05-01 17:35:00 | -0.03 | Minor deviation | 23.98 | 83.68 |
| RHO-CDG | 2022-05-22 17:25:00 | -0.06 | Major deviation | 21.65 | 86.59 |
| RHO-CDG | 2022-05-22 17:35:00 | -0.03 | Minor deviation | N/A | 89.79 |
| RHO-CDG | 2022-05-08 17:35:00 | -0.02 | Safe deviation | 18.48 | 90.13 |
| RHO-CDG | 2022-05-08 17:25:00 | -0.04 | Minor deviation | 18.91 | 90.51 |
| RHO-CDG | 2022-05-15 17:35:00 | -0.03 | Safe deviation | N/A | 101.69 |

Next query is wind and speed analysis; it is meant to compare wind, ground distance, trip time and trip fuel differences. Comparing those values can reveal the negative conditions such as:

- **Longer ground distance** mostly cause due to high traffic, weather conditions or other issues such as longer SID/STAR.
- **Longer air distance** can be caused by same reasons as ground distance with addition of higher headwind component, which is also displayed in the query
- **Faster cruise speed than planed** can be recognized by comparing trip time with ground distance (i.e., if ground distance and wind remains the same but the trip time decreases it is probable that the flight was made with higher TAS and therefore higher fuel consumption). This can also be recognised in individual flight analysis as described in Chapter 5.2

Figure 5-5 *Wind and speed analysis query*

| Actual leg IATA | Actual departure date | ETN [AVG] | ETN category [SUM] | Actual wind difference [AVG] | Ground distance difference [AVG] | Trip time difference [AVG] | Trip fuel difference [AVG] |
|-----------------|-----------------------|-----------|--------------------|------------------------------|----------------------------------|----------------------------|----------------------------|
| RHO-CDG | 2022-05-29 17:45:00 | -0.11 | Major deviation | -7.16 | 39.69 | 3 | -997.3 |
| RHO-CDG | 2022-05-29 17:50:00 | -0.08 | Major deviation | -6.11 | 51.34 | 8 | -761.95 |
| RHO-CDG | 2022-05-15 18:57:00 | -0.07 | Major deviation | -2.11 | -2.85 | -7 | -657.24 |
| RHO-CDG | 2022-05-22 17:38:00 | -0.06 | Major deviation | -1.06 | 2.33 | -2 | -596.1 |
| RHO-CDG | 2022-05-01 17:33:00 | -0.04 | Minor deviation | -3.04 | -8.67 | -3 | -403.61 |
| RHO-CDG | 2022-05-01 17:09:00 | -0.04 | Minor deviation | -2.71 | -0.68 | 1 | -379.4 |
| RHO-CDG | 2022-05-08 17:36:00 | -0.04 | Minor deviation | 1.31 | -8.02 | -3 | -318.31 |
| RHO-CDG | 2022-05-01 17:42:00 | -0.03 | Minor deviation | -4.26 | -9.26 | -2 | -311.79 |
| RHO-CDG | 2022-05-22 17:43:00 | -0.03 | Minor deviation | -0.44 | -25.87 | -5 | -290.18 |
| RHO-CDG | 2022-05-15 18:51:00 | -0.03 | Safe deviation | -1.45 | 17.96 | -3 | -228.92 |
| RHO-CDG | 2022-05-08 17:45:00 | -0.02 | Safe deviation | -2.5 | -4.91 | -3 | -209.4 |
| RHO-CDG | 2022-05-08 11:52:00 | N/A | 0 | N/A | N/A | -5 | N/A |

Other conditions that may have adversely affected the fuel consumptions are displayed in the third query. It is focused on the vertical profile of the flight and the phases as climb and descent.

The most common reasons of the higher fuel consumption that may be revealed by this query are:

- **Climb restrictions** (speed, altitude) that cause the higher climb fuel
- **Different cruise altitude/FL than the planned** to cause the higher trip fuel
- **Early or late descent** that causes the differences in the descent fuel

Figure 5-6 Vertical profile query

| Actual leg IATA | Actual departure date | ETN [AVG] | ETN category [SUM] | Average actual to planned altitudes difference [AVG] | Trip fuel diff [AVG] | Climb fuel diff [AVG] | Descent fuel difference [AVG] |
|-----------------|-----------------------|-----------|--------------------|--|----------------------|-----------------------|-------------------------------|
| RHO-CDG | 2022-05-29 17:45:00 | -0.11 | Major deviation | 1 | 997.3 | -130 | 724 |
| RHO-CDG | 2022-05-29 17:50:00 | -0.08 | Major deviation | 1277 | 761.95 | -119 | 654 |
| RHO-CDG | 2022-05-15 18:57:00 | -0.07 | Major deviation | 1 | 657.24 | -186 | 388 |
| RHO-CDG | 2022-05-22 17:38:00 | -0.06 | Major deviation | 2 | 596.1 | -109 | 605 |
| RHO-CDG | 2022-05-01 17:33:00 | -0.04 | Minor deviation | 1 | 403.61 | -288 | 654 |
| RHO-CDG | 2022-05-01 17:09:00 | -0.04 | Minor deviation | -11 | 379.4 | -260 | 705 |
| RHO-CDG | 2022-05-08 17:36:00 | -0.04 | Minor deviation | -800 | 318.31 | -108 | 397 |
| RHO-CDG | 2022-05-01 17:42:00 | -0.03 | Minor deviation | 2 | 311.79 | -272 | 602 |
| RHO-CDG | 2022-05-22 17:43:00 | -0.03 | Minor deviation | 1691 | 290.18 | -112 | 617 |
| RHO-CDG | 2022-05-15 18:51:00 | -0.03 | Safe deviation | 1017 | 228.92 | -360 | 350 |

Holdings on the route are another reason that might cause overburn . They can be simply identified in the “Holding Analysis” query. The user can see the number of holdings that were made as well as the total fuel burnt during the holding.

Figure 5-7 Holding analysis query

| Scheduled leg IATA | Actual departure date | ETN [AVG] | ETN category [SUM] | Holdings fuel burn [AVG] | Holdings count [AVG] |
|--------------------|-----------------------|-----------|--------------------|--------------------------|----------------------|
| RHO-CDG | 2022-05-29 17:45:00 | -0.11 | Major deviation | N/A | 0 |
| RHO-CDG | 2022-05-29 17:50:00 | -0.08 | Major deviation | N/A | 0 |
| RHO-CDG | 2022-05-15 18:57:00 | -0.07 | Major deviation | N/A | 0 |
| RHO-CDG | 2022-05-22 17:38:00 | -0.06 | Major deviation | N/A | 0 |
| RHO-CDG | 2022-05-01 17:33:00 | -0.04 | Minor deviation | N/A | 0 |
| RHO-CDG | 2022-05-01 17:09:00 | -0.04 | Minor deviation | N/A | 0 |
| RHO-CDG | 2022-05-08 17:36:00 | -0.04 | Minor deviation | N/A | 0 |
| RHO-CDG | 2022-05-01 17:42:00 | -0.03 | Minor deviation | N/A | 0 |
| RHO-CDG | 2022-05-22 17:43:00 | -0.03 | Minor deviation | N/A | 0 |
| RHO-CDG | 2022-05-15 18:51:00 | -0.03 | Safe deviation | N/A | 0 |

5.1.3 ZFW Error

Other two queries from the dashboard display graph and table with Zero Fuel Weight error which is difference between Actual ZFW and Planned ZFW. It can also have contribution to higher fuel consumption, because planned ZFW is statistical and if the plane is heavier than expected it will consume more fuel. The person that analyses the dashboard might find relation between ZFW error and higher consumption that could indicate that ZFW error is one of the reasons of overburn.

Figure 5-8 ZFW error graph

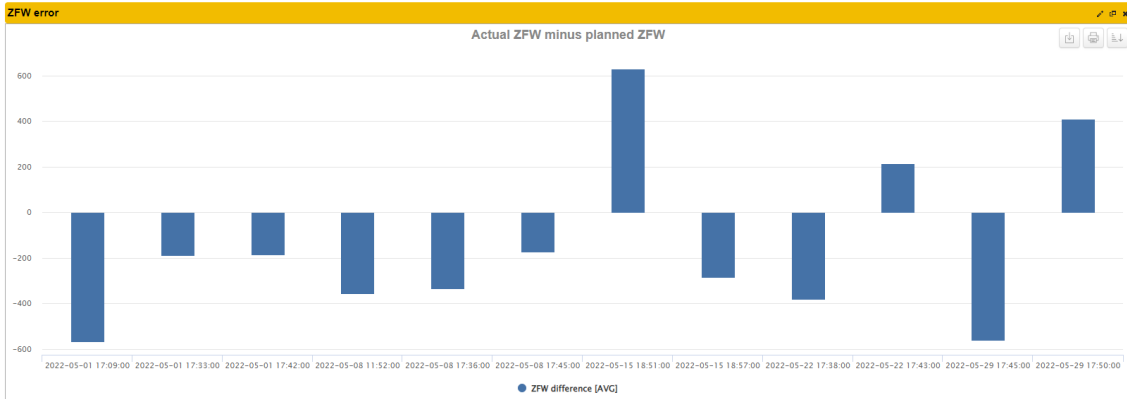


Figure 5-9 ZFW error table

| Scheduled leg IATA | Actual departure date | ETN [AVG] | ETN category [SUM] | ZFW difference [AVG] |
|--------------------|-----------------------|-----------|--------------------|----------------------|
| RHO-CDG | 2022-05-29 17:45:00 | -0.11 | Major deviation | -562 |
| RHO-CDG | 2022-05-29 17:50:00 | -0.08 | Major deviation | 411 |
| RHO-CDG | 2022-05-15 18:57:00 | -0.07 | Major deviation | -286 |
| RHO-CDG | 2022-05-22 17:38:00 | -0.06 | Major deviation | -380 |
| RHO-CDG | 2022-05-01 17:33:00 | -0.04 | Minor deviation | -190 |
| RHO-CDG | 2022-05-01 17:09:00 | -0.04 | Minor deviation | -566 |
| RHO-CDG | 2022-05-08 17:36:00 | -0.04 | Minor deviation | -335 |
| RHO-CDG | 2022-05-01 17:42:00 | -0.03 | Minor deviation | -186 |
| RHO-CDG | 2022-05-22 17:43:00 | -0.03 | Minor deviation | 214 |
| RHO-CDG | 2022-05-15 18:51:00 | -0.03 | Safe deviation | 629 |

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5.2 INDIVIDUAL FLIGHT ANALYSIS

In case the user wants to analyse specific flight rather than group of flights on the citypair, individual flight analysis can be used. It provides the most detailed data such as fuel comparison by phases of flights, routing, or vertical profile. It can be access from main screen by clicking on the “Flights” function. After that the user shall use filters and find the specific flight that he/she wants to analyse.

FUEL CONSUMPTION MONITORING PROGRAM ANALYSIS AND MITIGATION

After accessing the specific flight, multiple tabs can be seen. First one is called **Flight information** and contains basic fuel information such as fuel at departure, take off, landing and arrival. Next tab **Best Practices** is primarily meant as guidance how to save fuel, but also can show where the reason of overburn is, mainly in the **“Remaining potential”** graph. This graph shows conditions that contributed to higher fuel consumption and should be considered. In **Detail by phases** tab the flight data are divided into phases and basic information displayed i.e., duration, fuel consumption, distance, etc.

Figure 5-10 Opening individual flight analysis

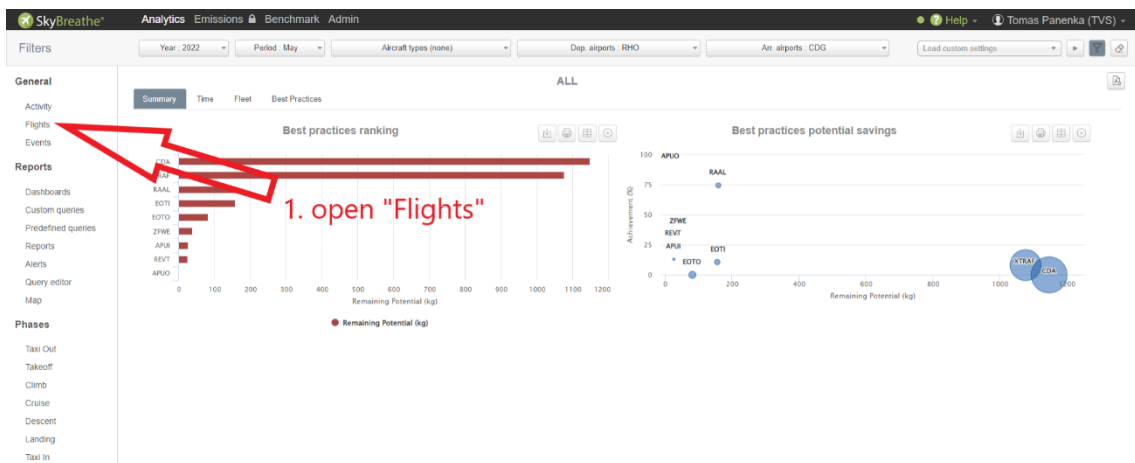
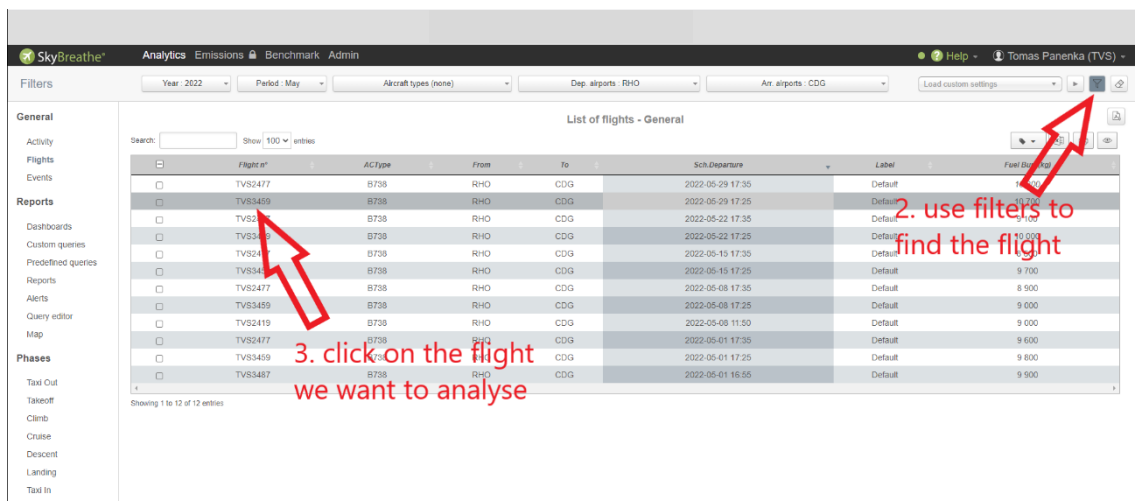


Figure 5-11 Selecting the flight

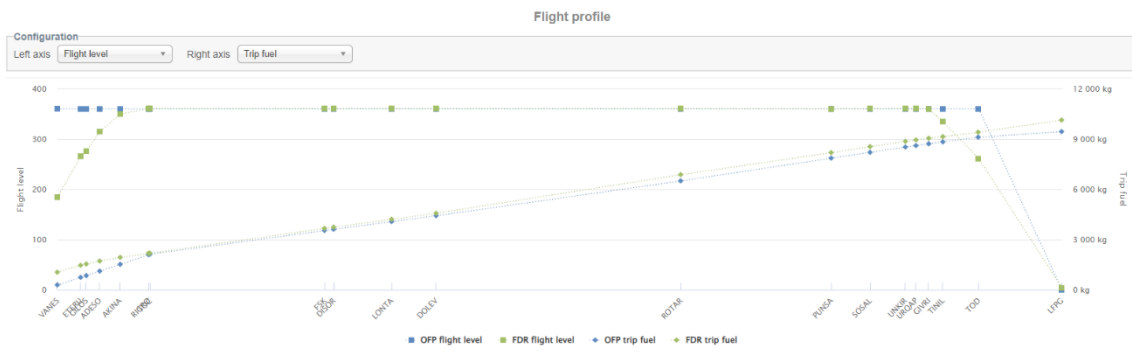


The most important tab for purpose of fuel consumption monitoring program is called **OFF – FDR comparison**. In this tab we can see differences between flight plan and FDR (W/QAR) data. The first graph compares ZFW, Fuel on board and fuel overburn/saved fuel according to the flight phases. The second graph can be set to compare different values, but by default is set to display planned and actual flight level with planned and actual trip fuel. The comparison is very useful in case there is non-standard flight level. Typical situation can be seen on image below where the crew had to commence early descend which was the main contributing factor to the overburn.

CAUTION: INDIVIDUAL FLIGHT ANALYSIS IS ONLY APPLICABLE IN CASE OF AVAILABLE QAR DATA

User can compare different parameters such as **flight level, true airspeed, groundspeed, wind direction and speed or fuel burnt / remaining** throughout the whole flight or from waypoint to waypoint. This tab can also be used to find out about shortcuts.

Figure 5-10 *Flight profile comparison*



Last from the tab is trajectory where map with horizontal and vertical profile can be found. Last two tabs **Turnaround** and **Crew** are mostly unimportant for the analysis.

5.3 MONTHLY ANALYSIS

After evaluating all major deviation citypairs and appropriate minor deviations the user shall fill out the **Monthly Citypair Fuel Analysis Report**. This report can be found on the Confluence website. Confluence is internal website with access only for users authorised by administrator. The interface allows creating multiple spaces. FDS has its own internal space where monthly reports can be found.

After accessing the FDS space, the user can open the Monthly Fuel reports site. For each month sub-site will be created using a template. The template contains header that consists of date, analysed month, and number of citypairs in major and minor deviation category, list of the citypairs follows.

FUEL CONSUMPTION MONITORING PROGRAM ANALYSIS AND MITIGATION

Second part of the template is **Citypair Analysis checklist** which must be filled in for each analysed citypair. It contains table with possible conditions that might have caused overburn. The analysing person shall evaluate whether all those causes contributed to higher consumption, possibly add other cause that came up from the analysis. The summary is then written to the header with mitigating actions and holding fuel if required.

If addition of holding fuel is required, it is done by FDS. The required amount is inserted into PPS (PPS, Data - > Data Editor -> FUEL RULES) software with certain parameters citypair, departure AD, arrival AD, date, time of day, aircraft tail number). After that the PPS will automatically add this value as EXTRA FUEL to each fuel calculation defined by the parameters.

Crew can find out the reason of extra fuel in EFA flight notice where it shall be inserted by FDS department after Monthly Citypair Fuel Analysis is done or in case new major deviation citypair has been analysed.

OCC and navigation department have access to Monthly Citypair Fuel Analysis reports through Confluence.

Figure 5-11 *Monthly Citypair Fuel Analysis Report header*

Monthly Citypair Fuel Analysis Report

| | |
|--|--|
| DATE | |
| ANALYSED MONTH | |
| NUMBER OF MAJOR DEVIATION CITYPAIRS | |
| NUMBER OF MINOR + MAJOR DEVIATION CITYPAIRS WITH MORE THAN 50% OCCURENCE | |

Analyzed Citypairs

Major Deviations

| | Actual Leg IATA | ETN (AVG) | ETN count major deviation | Alternate Reserve Consumed [KG] | Final Reserve consumed [KG] |
|---|-----------------|-----------|---------------------------|---------------------------------|-----------------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

Minor deviations

| | Actual Leg IATA | ETN (AVG) | ETN count minor deviations | ETN count minor plus major deviation | Number of flights |
|---|-----------------|-----------|----------------------------|--------------------------------------|-------------------|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

Figure 5-12 Citypair Analysis checklist

Citypair Analysis checklist

| | | | |
|----------------------------|--|---------------------------|--|
| Analysed citypair | | Deviation category | |
| Reasons of overburn | | | |
| Mitigating actions | | | |
| Added extra fuel | | Analyzed by | |

| Potential Cause | Relevant reason? | | Number of Occurences | Description | Mitigation |
|--|------------------------------|-----------------------------|----------------------|-------------|------------|
| Longer ground distance | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Stronger headwind/weaker tailwind than planned | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Temperature difference | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Faster cruise speed than planned | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Climb restrictions | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Different cruise altitue / FL | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Descent restrictions | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Holding | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| GW error | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Ramp fuel difference | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Aircraft performance degradation | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| MEL/CDL items | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Diversion | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Technical problem | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |
| Other:_____ | <input type="checkbox"/> Yes | <input type="checkbox"/> No | | | |