25.03.2021

# RunwaySense

# Welcome Guide

# Table of Contents

# 1 Revision Table

| Version | Modifications | Date |
|---|---|---|
| Rev 1.0 | Initial revision | 12.03.2021 |

# 2 Introduction

Dear Customer,

Thank you for contributing to RunwaySense, the collaborative Navblue service to enhance runway condition awareness.

The aim of this document is to provide you the key information to benefit of this service.

# 3 Using aircraft as a sensor

## 3.1 Why should the aircraft be used as a sensor?

Aeroplane deceleration results from several forces: aerodynamic drag forces, generated by the airframe and in particular the ground spoilers, reverse thrust (if available) and wheel braking.

In general, a braking action report should characterize the availability (or lack thereof) of wheel braking. The difficulty for a pilot is in differentiating in real time, which portion of the total deceleration is coming from the wheel-brakes. This difficulty is compounded by the typical use of autobrakes on contaminated runways. As the autobrake commands an overall airplane deceleration rate, the pilot is able to detect a lack of wheel-braking when the target deceleration is not achieved, however it is still difficult to differentiate how much each component is contributing to the deceleration.

Once the aircraft decelerates to lower speeds (generally below 60kt), pilots often use manual braking and at these speeds the aerodynamic drag and reverse thrust forces are negligible. It is often in this zone where pilots are able to more easily “feel” the runway by using the brake pedals to understand the braking action.

Given these complexities, making an accurate report can be a difficult task for a pilot, and braking report quality can become subject to differences of subjectivity between different pilots. To resolve this and provide objective and consistent braking action reports, Airbus has developed technology which uses aircraft data measured during the ground run to identify the available braking action.

## 3.2 Principle

The BACF records a number of parameters throughout the landing phase. The analysis is performed on data starting from a few seconds after nose gear touchdown to exclude load transients and allow the wheels to spin up. Data below 30kts ground speed is excluded as the anti-skid system disconnects at that speed.

For the data in between, the system isolates the portion of the deceleration that can be attributed to the wheel brakes by feeding the recorded information into a technical aircraft model. A friction limit is encountered whenever the Braking System Control Unit (BSCU) has to reduce brake torque to avoid a wheel spindown. Up to three recording periods exceeding a hundred meters for which the system estimates that the wheel braking was friction limited are retained for the braking action analysis. The classification of the braking action in one of the RCAM categories (e.g. POOR or MEDIUM) is done by comparing the real braked distance to a theoretical distance for ideal surface conditions for each braking action. The system displays the appropriate RCAM category for each runway zone and the overall average for the stop.

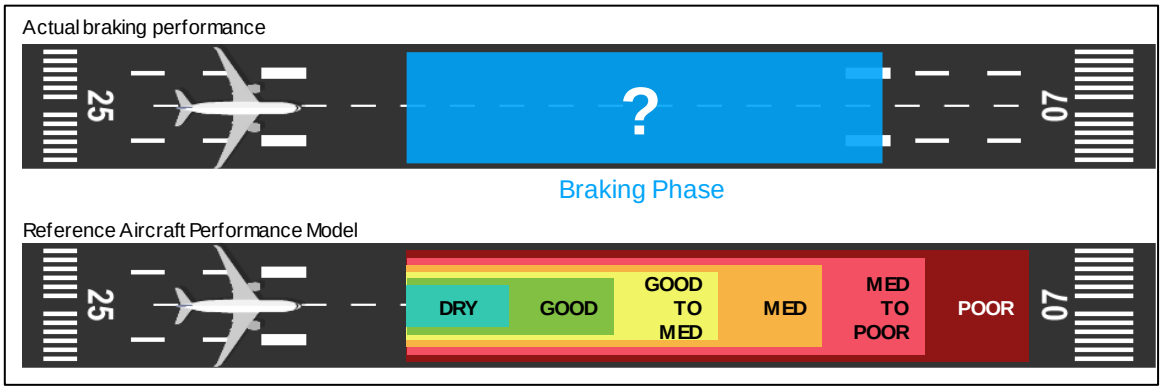



*Figure 1: Comparison of actual braking performance to models of wheel-braking performance*

Additionally, using GPS data available from the aircraft navigation systems, it is possible to identify which section of the runway the aircraft is on when a runway state is identified. The function can identify several states at different points on the runway.

*Figure 2: Localisation of Runway conditions*

A few seconds after the aircraft speed has decreased below 30kts, details about the runway state become available to the pilot on a dedicated MCDU page. If the pilot felt that the runway was slippery, or in a different condition to that communicated by Air Traffic Services (ATS), this information can be accessed by the pilot and radioed to ATS at an appropriate moment.


*Figure 3:BACF MCDU page*

The BACF function is part of the ATSU and can thus be accessed via the ATSU datalink pages. The interface is shortly described in the FCOM DSC-46-10-40-30. This section provides additional explanations of the displayed information.

The **Rollout Distance** is the distance from main gear touchdown to the point at which the ground speed has dropped to 30kt, speed below which the function does not analyse the braking action. It is given for information only but may help to assess the proportion of the friction limited part of the stop.

The **average** computed braking action consider the cumulative distance of all the friction limited sections of the landing roll. This overall distance is compared with the braking distance required for the various braking action categories of the RCAM.

The data calculated by BACF is also routed automatically by ACARS message to NAVBLUE.

## 3.3 Aircraft Performance Model

BACF is based on Airbus aircraft performance model. These models have been adjusted to represent the aircraft, without additional margin which could be used for certification. The objective is to be representative of operational conditions.

The end result of BACF will be conservative. i.e, if the runway condition is close to Medium and just worse than medium on some portion, the result of the identification will be Medium to poor.

## 3.4 ACARS Messages

### 3.4.1 Types of Messages

Two types of braking action identification are performed with BACF:

**Friction limited cases***: The deceleration is high enough to detect a slippery area.*

The braking action is measured during the landing roll when the function detects that the braking force is friction limited.

The system isolates the portion of the deceleration that can be attributed to the wheel brakes by feeding the recorded information into a technical aircraft model. A friction limit is encountered whenever the Braking System Control Unit (BSCU) has to reduce brake torque to avoid a wheel spindown.

**Non friction limited cases:** *The deceleration is lower than the maximum capability offered by the runway.*

In addition to these Friction limited cases that occur only when the friction is limited, there is an additional logic in the system that will provide information in case the deceleration and the braking order are high enough to conclude that the runway condition code is X or better. In that case, BACF will emit messages stating that the braking action is “xxx or better”.

If the runway condition is worse than Medium to Poor, no braking action is reported.

Based on actual operating fleet equipped with BACF, **30% of landing provide a message**, 5% of these messages are friction limited cases.

### 3.4.2 ACARS Message Content

The BACF generates the following data which is contained within the ACARS message:

- Message type (error or normal).
- Flight Number (from FMS).
- Destination airport (from FMS).
- Aircraft and Engine Type.
- Time message was sent.
- Error Code (if applicable).
- GPS position(s) (to identify landing runway and geo-localize the braking action zones along the runway axis).
- Ground speed(s) at start and end of each braking action zone(s).
- Overall average braking action computed.
- Braking action computed for each zone (up to 3 separate identification zones if applicable).

All data is included within one ACARS block. The message length is maximum 208 bytes; only 35 bytes if error message.

# 4 BACF Installation

## 4.1 BACF versions

There are 2 versions of BACF:

- **BACF V3 certified in June 2019**
- **BACF V4 certified in March 2020**

BACF V4 offers the same capabilities as BACF V3, with more aircraft version compatible.

### 4.1.1 BACF V3

There are 4 service bulletins, associated to 2 media.

| | | |
|---|---|---|
| SB 46-1146 | A320CEO family – FANS B | LA2T0P20040N0C1 |
| SB 46-1147 | A320NEO family – FANS B | LA2T0P20040N0C1 |
| SB 46-1148 | A320CEO family – FANS A/Pre-FANS | LA2T0P20040M0C1 |
| SB 46-1152 | A320NEO family – FANS A/Pre-FANS | LA2T0P20040M0C1 |

A new version of this Service Bulletin is available since January 2021

**A320 SOFTWARE / HARDWARE Pre-Requisites for BACF V3**

- ATSU Software standard:
    - Pre-FANS minimum CSB7.2, or
    - FANSA+ minimum CSB7.4, or
    - FANSB+ minimum CSB6
- ATSU hardware standard:
    - C40 / C50 / C70 (Pre-FANS only), or
    - A10 (Pre-FANS, FANSA+ or FANS B+ only)
- FWC standard: minimum H2-F6
- SDAC standard: minimum H2-E2[(1)]
- DMC standard:
    - EIS1: minimum V60, or
    - EIS2: minimum S5

(1) there is a limitation of SDAC H2-E2 is used. BACF will not be able to detect in pedal braking mode, only Autobrake MED.

### 4.1.2 BACF V4

There are 2 service bulletins, associated to 1 media

| | | |
|---|---|---|
| SB 46-1170 | A320CEO family | LA2T0P20040S0C1 |
| SB 46-1171 | A320NEO family | LA2T0P20040S0C1 |

**A320 SOFTWARE / HARDWARE Pre-Requisites for BACF V4**

- ATSU software standard:
  - Pre-FANS minimum CSB7.2, or
  - FANS A+ minimum CSB7.2, or
  - FANS B+ minimum CSB6.5, or
  - FANS C minimum CSB 9.2.3
- ATSU hardware standard:
  - C40 / C50 / C70 (Pre-FANS, FANS A+[(1)]), or
  - A10 (Pre-FANS, FANS A+, FANS B+ or FANS C)
- FWC standard: minimum H2-F6
- SDAC standard: minimum H2-E2[(2)]
- DMC standard:
  - EIS1: minimum V60, or
  - EIS2: minimum S5

(1) If ATC ARINC 623 software (FIN 23TXSW1) is not installed
(2) There is a limitation of SDAC H2-E2 is used. BACF will not be able to detect in pedal braking mode, only Autobrake MED.

### 4.1.3 Media delivery

After signature of the agreement, NAVBLUE send you the media to install BACF. The shipping number will be provided.

## 4.2 Re-direction of ACARS Messages

ACARS messages related to BACF are identify with SMI “RSA”. The message length is maximum 208 bytes; only 35 bytes if error message.

Simply contact your ACARS service provider and ask them to route a copy to Navblue (Type-B address = **YKFRSCR**)

# 5 RunwaySense Web Platform

## 5.1 How to connect?

RunwaySense URL is https://runwaysense.navblue.cloud/

To connect, you need a personal account.

Please to contact the Navblue customer team to ask for credential (see 6 Customer Portal)

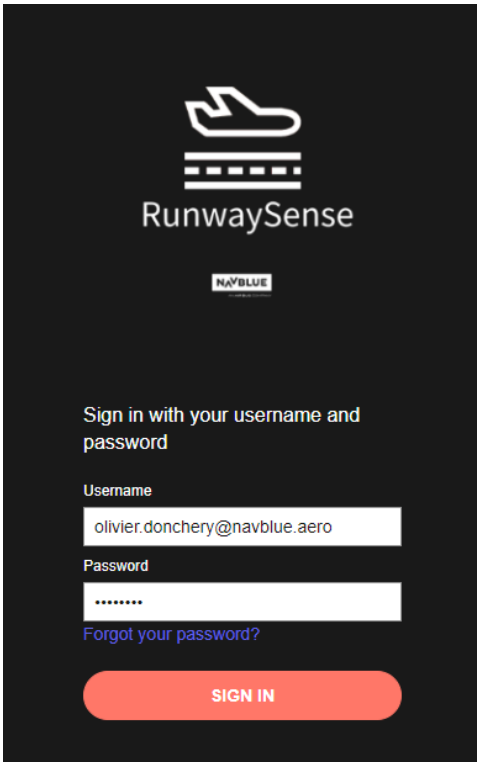



*Figure 4: RunwaySense login form*

## 5.2 How to consult daily messages?

### 5.2.1 Airline view

As an airline, you can consult a summary of message received by your fleet during the last 24 hours.

Click on the Airline [ICAO Code] on the menu on Top Right of the page

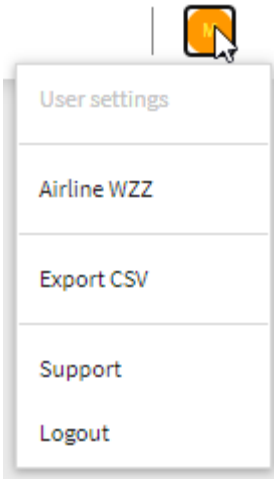



*Figure 5: Access to all the messages from an airline fleet*

My landings

| Flight number | Aircraft Type | Landing Time | Airport | Runway | Average Condition |
|---|---|---|---|---|---|
| SKU3703 | A320 | Today, 0043Z | SCEL | 17L/35R | Good or better |
| SKU323 | A320 | Today, 0013Z | SCEL | 17L/35R | Good to medium or better |
| SKU247 | A320 | Thu 2021-03-11, 2247Z | SCEL | 17L/35R | Good or better |
| SKU434 | A320 | Thu 2021-03-11, 2232Z | SCEL | 17R/35L | Good to medium or better |
| SKU402 | A320 | Thu 2021-03-11, 2049Z | SCEL | 17R/35L | Good to medium or better |
| SKU204 | A320 | Thu 2021-03-11, 1915Z | SCEL | 17R/35L | Good to medium or better |
| SKU122 | A320 | Thu 2021-03-11, 1658Z | SCEL | 17R/35L | Good to medium or |

*Figure 6: Summary of messages received by a fleet during the last 24 hours*

### 5.2.2 Airport view

As an airline, you can consult the airport page.

1. On the top Left of the main page, enter the airport ICAO code

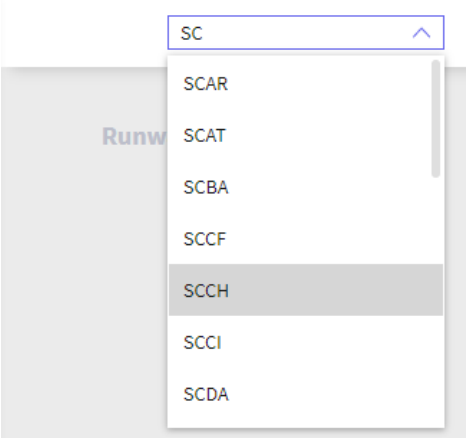



*Figure 7: Airport selection*

2. Each time a message is received by Navblue, this message is displayed. All messages for all runways of the airport are collected in this page. Click on the tile to display the runway page, or on the runway identification available in menu bar on the left

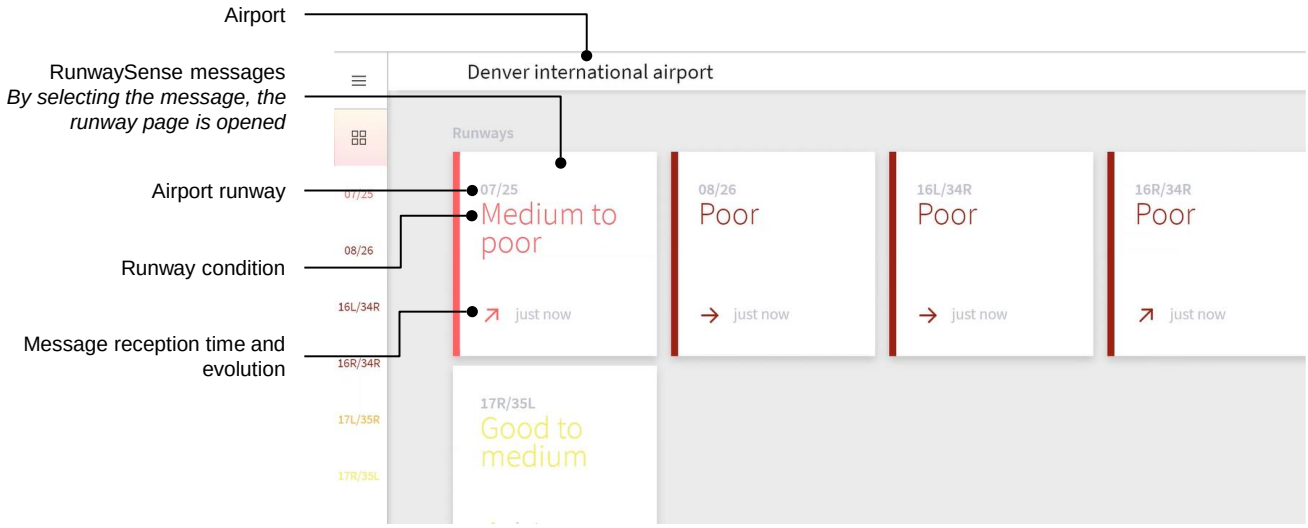



*Figure 8: RunwaySense airport dashboard page*

3. On the airport page, all the message related to the selected runway are available. Identification zones are displayed.

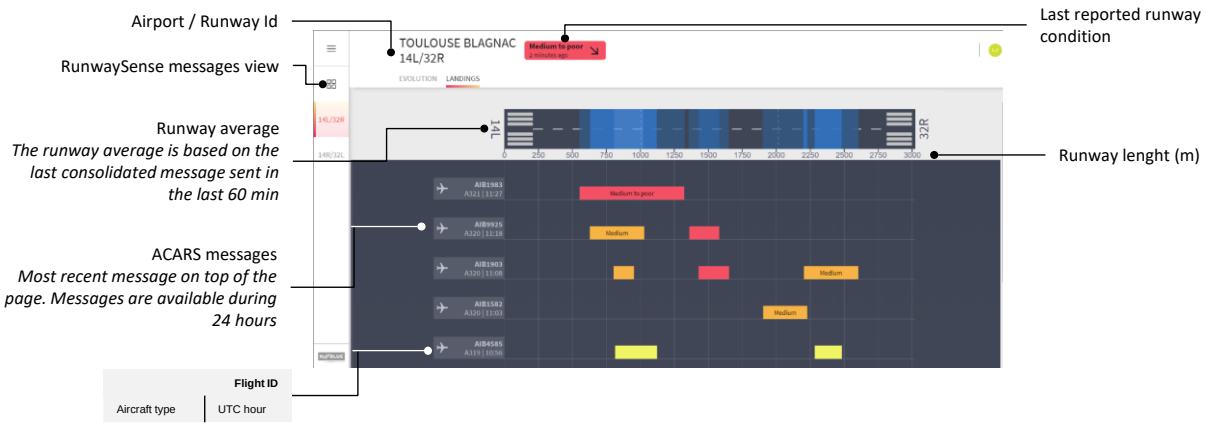



*Figure 9: RunwaySense runway page*

4. Braking actions are consistent with the Global Reporting Format.

   Two types of messages are displayed:

   - Braking friction limited cases
   - Non Braking friction limited cases

| Runway condition | Friction limited case | Non friction limited case |
|---|---|---|
| DRY | | |
| GOOD | | |
| GOOD TO MEDIUM | | |
| MEDIUM | | *Not displayed* |
| MEDIUM TO POOR | | *Not displayed* |
| POOR | | *Not displayed* |
| NIL | | *Not displayed* |

*Figure 10: Braking Action messages legend*

## 5.3 How to consult history of data?

You can have access up to 2 years of history of messages.

### 5.3.1 How to download messages?

1. To download these messages, click on the top right of the page.

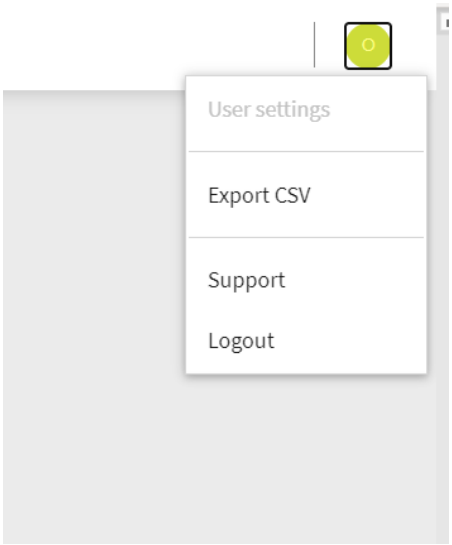



*Figure 11: Export CSV*

2. Select the airport and the period

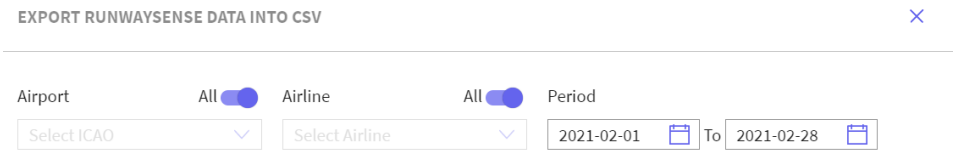



*Figure 12: Export CSV - Airport and period selection*

3. The file is downloaded on your computer

### 5.3.2 What is the content of csv files?

The information provided are:

- ID: the unique report identification
- Aircraft: Type of aircraft
- airportICAO: Represents the airport's ICAO code in 4 characters
- flightNumber is the landing report's associated flight number
- globalIdentificationType: define the type of identification:

  Type 1: Average Braking Action (friction limited)

  Type 2: Average Braking Action and local worse detected"

  Type 3: At Least Braking Action (not friction limited)

- identificationZones is a list of detection zones with the following information
  - zone number
  - the TALPA value of the zone rounded to the lowest integer
  - the start and end in meters of the zone in the detected landing direction

- the landingDirection indicates on which side of the runway the aircraft lands
- runwayCode represents the runway's identification
- State is the average identified Braking Action of the runway

  0: 'NIL',

  1: 'Poor',

  2: 'Medium to poor',

  3: 'Medium',

  4: 'Good to medium',

  5: 'Good',

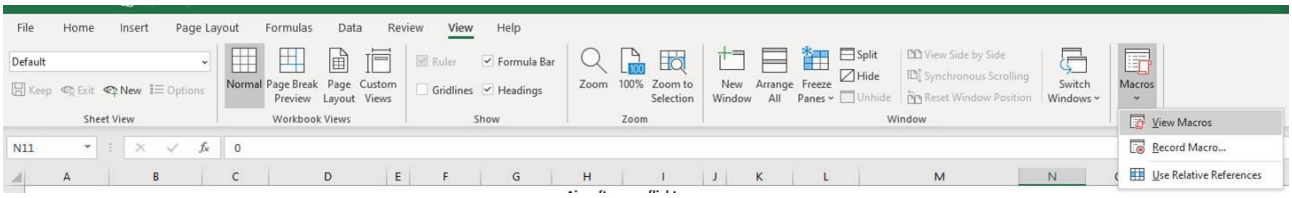
  6: 'Dry'

- the time is a timestamp in seconds
- runwayBearing in degrees from 0 to 360°, represents the runway's orientation
- the runwayThreshold is a long/lat position of the runway Threshold
- runwayLength represents the runway's length (in meter)
- aircraftRegistration is the aircraft registration of the aircraft reporting

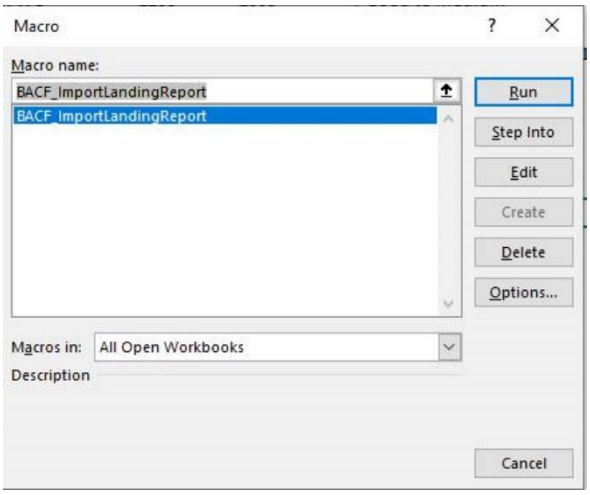
### 5.3.3 Excel tool to read *csv file

An Excel macro to import *csv files into Excel is available.

1. Open *RunwaySense_data-Customer_Version.xlsm* file available for download here
2. Select View > Macros > View Macros




3. Run BACF_ImportLandingReport

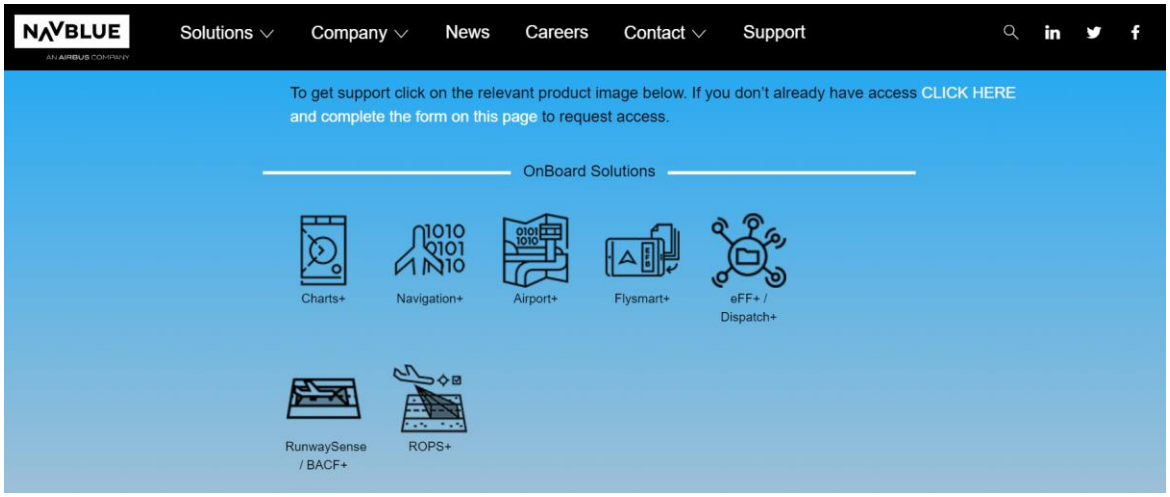



4. Select the *csv file

# 6 Customer Portal

NAVBLUE provides support for RunwaySense services to our customer, available 24/7.

Via https://www.navblue.aero/support/




Each product / service has a dedicated portal (see screenshot above) from where the Customer can:

- Perform a free text search of a product / service knowledge base.
- Raise a new support ticket.
- Check on the status of existing tickets.
- View the knowledge base and navigate through categories of articles based upon the product / service.
- Participate in community forums (where applicable for that product / service).

Support requests shall be documented and submitted by the Customer through the NAVBLUE Customer Support Portal for the product/service named above, at:

https://www.navblue.aero/support/

If a new user, Customer may request a Support Portal User Account at:

https://www.navblue.aero/new-user-request-form-for-customer-support-portal/

Should Customer experience any problems connecting to the NAVBLUE Customer Support Portal, support is available by phone +1-613-704-0358.

A brief video (9 minute) is available as an introduction to navigating and support ticketing in the NAVBLUE Customer Support Portal. It can be viewed via:

https://navblueacademy.support.navblue.aero/support/solutions/articles/35000137701-introduction-to-navblue-support-portal

NAVBLUE

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