International Civil Aviation Organization

THE TWELFTH MEETING OF ASIA/PACIFIC ROBEX WORKING GROUP (ROBEX WG/12)

ICAO Regional Sub-Office, Beijing, China

17 ï 19 March 2014

Calculations of Performance Indicators

1. Compliance Index

The ROBEX Compliance index can be calculated from:

$$V_{bul\ compliance} = \frac{No\ of\ reports\ received\ for\ a\ bulletin}{No\ of\ reports\ required\ for\ the\ bulletin}$$

The Compliance Index is to assess the level of compliance to the ROBEX scheme. The determination of the compliance index is performed as follows:

- Å Total number of reports received for ROBEX bulletin during the monitoring period**, include reports in the retard bulletins**.
- Å Weed out **correction and amendment bulletins**, as these are re-transmitted messages, **can be disregarded**.

Explanations:

No. of reports received for a bulletin is the number of reports that are not ñNIL.ò In other words, do not count the reports that are ñNIL.ò In addition, do not count reports that are correction and amendment in nature. However, the assessment should include the delayed reports in the retard bulletins.

No. of reports required for a bulletin is the number of reports that each RODB should expect to receive within each particular bulletin.

Procedure:

1. For each day, run through the aerodromes within each bulletin. Count the numbers of reports that do not contain optional elements and are not ñNIL.ò Alternatively count the number of reports that contain ñOptional RRX
2. For each day, calculate the required number of reports for each bulletin by adding the number of required reports for each aerodrome listed in each bulletin.
3. For each day, calculate the compliance index by taking the ratio of the No. of reports received for a bulletin (calculated in 1.) and the No. of reports required for a bulletin (calculated in 2.).

4. To calculate monthly compliance index, add up the compliance index (calculated in 3.) of all the days in a month and divide by the number of days in month.
   e.g. 288/288 + 240/288 + 288/288 + ... + 288/288 => (31 elements for 31 days)
5. Alternatively, to calculate monthly compliance index, add up the No. of reports received for a bulletin (calculated in 1.) for all the days in a month and divide by the No. of reports required for a bulletin (calculated in 2.) in that month.

Example I:
Bulletin SAIN33 includes 6 aerodromes: VECC, VEPT, VGEG, VGHS, VNKT, and VQPR.
For each aerodrome, the No. of reports required for a bulletin equals 2*24 = 48 reports.
If only on the 2nd of March, RODB does not receive reports from one aerodrome.
Calculate the compliance index for Bulleting SAIN33 in March.?
Answer:
No. of reports received for a bulletin
= (6 aerodromes*48 reports*30 days) + (6 aerodromes*48 reports*1 day)
= 8,640 + 240
= 8,880
No. of reports required for a bulletin
= (6 aerodromes*48 reports*31 days) = 8,928

March compliance index = 8,880/8,928 = 0.9946

2. Availability Index

The availability index measures the current coverage of the OPMET distribution against the ROBEX exchange requirements. The determination of the availability index is performed on a daily basis from the data captured during the monitoring period. If at least one non-NIL report is received from the aerodrome during the 24-hour period, that aerodrome is considered to have been available. The daily availability index of a particular bulletin can be calculated as:

$$V_{bul\ availability} = \frac{\text{No of aerodromes for which one or more non-NIL data type are received}}{\text{No of aerodromes required in the bulletins}}$$

<u>NIL data type</u> is defined as data element that reports that there are no observations (SA) or forecast (FT).

<u>Non-NIL data type</u> is defined as data element that is not ñNILò i.e. not (METAR VTBD 270200Z NIL=)

No of aerodromes for which one or more non-NIL data type are received is the number of aerodromes which receives one or more Non-NIL data type within a period of one day or 24 hours.

No of aerodromes required in the bulletins is the total number of aerodromes listed in the bulletin from which RODB should receive data from.

For example, the Bulletin SAIN33,
SAIN33 VECC 012350
METAR VECC 012350Z 16004KT 2500 HZ SCT018 BKN100 28/26 Q0996 NOSIG=
METAR VEPT 012350Z NIL=
METAR VGEG 012350Z 14007KT 6000 SCT015 BKN100 27/26 Q0998 NOSIG=
METAR VGHS 012350Z 17005KT 4000 HZ BKN010 OVC100 28/25 Q0997 TEMPO RA=
METAR VNKT 012350Z NIL=
METAR VQPR 012350Z NIL=

The No. of aerodromes required in the bulletin SASD31 for that particular day is 6 aerodromes.

Procedure:

1. For each day or the period of 24 hours, obtain the No. of aerodromes required in the bulletin.
2. For each day or the period of 24 hours, run through the aerodromes within each bulletin. Count the numbers reports received from each aerodrome that contain NON-NILL data type. If the number exceeds zero, then that aerodrome receives one point, else zero point. Add up the points of each aerodrome to obtain the No of aerodromes for which one or more non-NIL data type are received.
3. For each day, calculate the availability index by taking the ratio of the No of aerodromes for which one or more non-NIL data type are received (calculated in 2.) and the No. of aerodromes required in the bulletin (calculated in 1.)
4. To calculate monthly availability index, add up the daily availability index (calculated in 3.) of all the days in a month and divide by the number of days in month.
   e.g. 6/6 + 6/6 + 6/6 + 5/6 + 4/6 + 6/6 + ... + 2/6 => (31 elements for 31 days)
5. Alternatively, to calculate monthly availability index, add up the No of aerodromes for which one or more non-NIL data type are received (calculated in 2.) for all the days in a month and divide by the No. of aerodromes required in the bulletin (calculated in 1.) in that month.

Example II: Bulletin SAIN33 continued from example I.
Calculate the availability index for Bulleting SAIN33 in March.?

Answer:
No. of aerodromes required in the bulletin
= 6 aerodromes *31 days
= 186

No of aerodromes for which one or more non-NIL data type are received
= (6 aerodromes*30 days) + (5 aerodromes*1 day)
= 180 + 5
= 185

March availability index = 185/186 = 0.9946

3. Regularity Index

(iii) Regularity Index

The regularity index measures the consistency in the number of reports provided by an aerodrome. The computation of Regularity Index assumes that the number of report follows a normal distribution and attempts to ascertain the distribution characteristics (mean and standard deviation) from a set of data. These characteristics are used to determine if subsequent number of reports from an aerodrome is "regular".

Denoting mean and standard deviation by μ and σ, a threshold report numbers (τ) can be established as:

$$\tau = \mu - \sigma$$

The threshold is a reporting characteristic of an aerodrome. If the subsequent daily number of reports meets or exceeds the threshold, it is considered "regular". The daily regularity index for a bulletin can be expressed as:

$$V_{bul\ regularity} = \frac{\textit{No of aerodromes for which the number of reports equals or exceeds the threshold}}{\textit{No of aerodromes required in the bulletin}}$$

The threshold is the number of reports provided by the aerodrome which is considered ñregular.ò This number is defined by calculating the statistics (mean and standard deviation) of the number of reports provided by the aerodrome within a time frame e.g a period of 6 months, 1 year, or 5 years.
No of aerodromes which the number of reports exceeds the threshold is the number of aerodromes which provides more than τ reports within a period of one day or 24 hours.
No of aerodromes required in the bulletins is the total number of aerodromes listed in the bulletin from which RODB should receive data from.

Procedure:

1. Calculate the threshold of each aerodrome within RODBôs responsibility by collecting the number of reports each aerodrome receives within the given time frame.
2. For each aerodrome, find the mean (average) and standard deviation (deviation from the mean).
   For example, for a time frame of five days (for simplicity),
   VECC provides daily 10, 7, 10, 8, and 9 reports respectively.
   Mean = (10+7+10+8+9)/5 = 8.8
   Standard deviation =sqrt [(10-8.8)^2+(7-8.8)^2+(10-8.8)^2+(8-8.8)^2+(9-8.8)^2] / 4
   = 1.304
3. Calculate the threshold by subtracting the standard deviation from the mean.

From the above example, the threshold τ = 8.8-1.304 = 7.45 reports.

4. For each day or the period of 24 hours, run through the aerodromes within each bulletin. Count the numbers reports received from each. If the number exceeds τ, then that aerodrome receives one point, else zero point. Add up the points of each aerodrome to obtain the No of aerodromes which the number of reports exceeds the threshold.
5. For each day or the period of 24 hours, obtain the No. of aerodromes required in the bulletin.
6. For each day, calculate the reglarity index by taking the ratio of the No of aerodromes which the number of reports exceeds the threshold (calculated in 4.) and the No. of aerodromes required in the bulletin (calculated in 5.)
7. To calculate monthly regularity index, add up the daily availability index (calculated in 3.) of all the days in a month and divide by the number of days in month.
   e.g. 6/6 + 6/6 + 6/6 + 5/6 + 4/6 + 6/6 + ... + 2/6 => (31 elements for 31 days)
8. Alternatively, to calculate monthly availability index, add up the No of aerodromes which the number of reports exceeds the threshold (calculated in 4.) for all the days in a month and divide by the No. of aerodromes required in the bulletin (calculated in 5.) in that month.

Example III: Bulletin SAIN33 continued from example I.

aerodrome	Threshold
VECC	10 reports
VEPT	10 reports
VGEG	10 reports
VGHS	10 reports
VNKT	10 reports
VQPR	10 reports

If on the 2nd and 15th of March, RODB does not receive reports from VQPR and on 15th of March, RODB does not receive reports from VGEG. On any other days, all the aerodromes provided more than 10 reports. Calculate the regularity index for Bulleting SAIN33 in March.

Answer:

No. of aerodromes required in the bulletin = 6 aerodromes *31 days = 186

No of aerodromes which the number of reports exceeds the threshold

= (6 aerodromes*29 days) + (5 aerodromes*2 days)

= 174 + 10 = 184

March regularity index = 184/186 = 0.9892

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