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# Setting Values for TDWR/LLWAS 3 Integration Parameters

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16. Abstract

In 1993 the FAA will begin deploying the Terminal Doppler Weather Radar (TDWR) at selected airports in the United States. Forty-five TDWRs will be collocated with LLWAS 3 systems, and the FAA has decided that all TDWRs collocated with LLWAS 3 systems must be integrated with LLWAS 3 prior to commissioning. The algorithm chosen to perform this integration must be supplied with a set of site-specific parameters. This report gives guidance on how to set the values of these integration parameters.

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# ABSTRACT

In 1993 the FAA will begin deploying the Terminal Doppler Weather Radar (TDWR) at selected airports in the United States. Forty–five TDWR's will be collocated with LLWAS 3 systems, and the FAA has decided that all TDWR's collocated with LLWAS 3 systems must be integrated with LLWAS 3 prior to commissioning. The algorithm chosen to perform this integration must be supplied with a set of site–specific parameters. This report gives guidance on how to set the values of these integration parameters.

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# 1. INTRODUCTION

In 1993 the FAA will begin deploying the Terminal Doppler Weather Radar (TDWR) at selected airports in the United States. Forty–five TDWR's will be collocated with LLWAS 3 systems, and the FAA has decided that all TDWR's collocated with LLWAS 3 systems must be integrated with LLWAS 3 prior to commissioning. The algorithm chosen to perform this integration takes as input a stream of TDWR alerts, a stream of LLWAS alerts, and a set of integration parameters. It then combines the information from pairs of contemporaneous TDWR and LLWAS alerts to produce a single integrated runway alert. The integration parameters are a key element in this process since they govern exactly how the information from the input alerts are combined to form the integrated alerts. This report gives guidance on how to set these integration parameters. It is assumed that the reader is already familiar with how the TDWR/LLWAS Integration algorithm works as detailed in the algorithm's specification[1].

The parameters described here are of two types: those that may have a separate value for each runway and system (TDWR or LLWAS) and those with a single value. The parameters set for each runway and system follow. The names after these parameters are the names for these parameters in the integration algorithm specification:

LLWAS coverages (*llwas_coverage*)

TDWR coverages (*tdwr_coverage*)

LLWAS screening thresholds (*llwas_thresh1, llwas_thresh2, llwas_thresh3, llwas_thresh4, llwas_thresh5, llwas_thresh6*)

TDWR screening thresholds (*tdwr_thresh1, tdwr_thresh2, tdwr_thresh3, tdwr_thresh4, tdwr_thresh5, tdwr_thresh6*)

LLWAS loss factors (*llwas_mb_factor*)

TDWR loss factors (*tdwr_mb_factor*)

LLWAS gain factors (*llwas_gf_factor*)

TDWR gain factors (*tdwr_gf_factor*)

The parameters with a single value are:

Maximum wind shear alert value (*max_wsa*)

Minimum microburst alert value (*min_mba*)

Loss increment (*loss_increment*)

Loss–gain buffer (*loss_gain_buffer*)

Each of these parameters is discussed below. The integration algorithm specification requires alert values to be expressed in meters per second, but for convenience knots are sometimes used in the discussion below. In this report conversions between knots and meters per second are done using a factor of one meter per second to 1.943844 knots.

# 2. LLWAS AND TDWR COVERAGES

The initial step in integrating alerts from the TDWR and LLWAS systems is to screen the alerts to reduce false alerts and overwarning. In this process weak alerts (as defined by the integration parameters) are reduced or dropped if there is no confirmational evidence from the other system. However, confirmational screening only makes sense if the alert occurred within the detection region covered by the other system. For example, a TDWR alert in the three mile box of a runway should not be screened if LLWAS coverage on that runway only extends to the two mile box. The same may also be said for using TDWR to screen LLWAS. But the TDWR detection region usually subsumes the entire airport, so the following discussion concentrates on determining LLWAS coverages.

The LLWAS coverage parameters indicate, for each runway at an airport, the mile box most distant from the runway that has sufficient LLWAS coverage that LLWAS may be used to screen TDWR alerts. If a TDWR alert occurs in a mile box more distant than the LLWAS coverage value for that runway, then it is considered to have occurred outside of LLWAS coverage. The coverage values are computed using the edge elements of the LLWAS network as defined in the LLWAS Airport Configuration File (ACF). The coverages are computed in generating the LLWAS ACF for each runway by the following steps:

1. Find all of the edges associated with a runway,
2. Compute the middle sixty percent of each associated edge,
3. Find the perpendicular projection of each middle sixty percent on the runway (This projection is given a minimum length of one kilometer.),
4. Compute the maximum distance of each projection from the arrival end of the concrete runway,
5. Convert the distance to nautical miles, and
6. Add one to the distance obtained and truncate the result to an integer.

The values obtained by this process are mile boxes that are taken to be the maximum extent of LLWAS coverage for each edge for that runway. Combining these values provides the extent of LLWAS coverage for that runway. The LLWAS coverage values are read from the operational LLWAS ACF in the following way:

1. Find the arrival edge location table. It is the first table in the ACF and is located at the beginning of the file. The table is headed by a line beginning with a number whose value is the total number of edges and is followed by a string of the form

   "# OF EDGES, ARR_EDGE_LOC"

   The line after this lists the arrival runway names as headings for the columns of the table.

2. For each arrival runway, read down its column and find the largest value. The largest value is the coverage value for that runway

3. Each arrival runway has a corresponding departure runway that shares its airspace. However, departure runways only extend to two nautical miles from the end of a runway. So the coverage for the associated departure runway is taken as:

departure coverage = minimum{2, associated arrival runway coverage}

It should be noted that changes in the LLWAS Airport Configuration File must be reflected in the Integration Coverage Parameters.

The last column in tables 1. and 2. below show the LLWAS coverages derived using this method for the runways at Stapleton International Airport in Denver, CO and Orlando International Airport in Orlando, FL.

At this point one may ask how well the coverages derived by this method represent the ability of LLWAS to detect microbursts within the coverage region. To test this, simulation experiments were run on the LLWAS networks of Denver and Orlando using three model microbursts with different size–loss combinations. The smallest microburst used had a radius of one kilometer to the point of maximum outflow, and had a loss of 30 knots. This is a very small event just at the microburst loss level and is a difficult case for LLWAS to detect. Two additional cases were also run, both being larger and easier to detect. The second microburst used also had a 30 knot loss, but was larger, having a 1.25 kilometer radius. The final microburst used had a loss of 35 knots and a radius of 1.5 kilometers. This case represents a microburst of roughly median size, and so its simulation results are more indicative of LLWAS's response to the most frequently encountered events. The simulation was conducted by taking each microburst in turn and placing it at the far end of each runway corridor, completely outside LLWAS detection coverage. The microburst was then moved down the runway center line at successive quarter kilometer increments until the system issued a microburst alert (loss at least 30 knots). From this information it was possible to compute the distance from the end of the runway to the position at which an arrival aircraft would encounter the region of peak outflow from the microburst. The middle three columns of each table show values for these first encounter distances for each runway and microburst type. The second column of the table shows additional values in parentheses. These are the maximum distance down the runway that any alert, including those below the microburst level, occurred. These values are included in the table for those cases where this distance is significantly greater than that for the microburst alert. It shows that although coverage for microbursts is weak in these cases, general loss coverage is good.

**Table 1.**
**Denver – Distance (nm) from Runway End to First Encounter of Peak Outflow on Arrival**

| | Microburst Radius, Microburst Loss | | | |
|---|---|---|---|---|
| **Runway** | **1Km, 30 knots** | **1.25Km, 30 knots** | **1.5Km, 35 knots** | **ACF** |
| 35RA | 0.7 (2.4) | 2.8 | 3.3 | 3 |
| 17LA | 1.6 (2.2) | 2.3 | 2.5 | 2 |
| 35LA | –0.1 (1.5) | 1.8 | 2.5 | 2 |
| 17RA | 2.5 (3.0) | 3.2 | 3.5 | 3 |
| 08RA | 1.2 | 1.4 | 1.6 | 1 |
| 26LA | 2.7 | 2.9 | 3.0 | 2 |
| 08LA | 1.1 | 1.3 | 1.5 | 1 |
| 26RA | 2.8 | 3.0 | 3.2 | 3 |

**Table 2.**
**Orlando – Distance (nm) from Runway End to First Encounter of Peak Outflow on Arrival**

| | Microburst Radius, Microburst Loss | | | |
|---|---|---|---|---|
| **Runway** | **1Km, 30 knots** | **1.25Km, 30 knots** | **1.5Km, 35 knots** | **ACF** |
| 35A | 2.1 | 2.5 | 2.7 | 2 |
| 17A | 0.8 | 2.2 | 3.3 | 3 |
| 36A | 2.1 | 2.4 | 3.0 | 2 |
| 18A | –0.7 | 2.2 | 2.6 | 2 |

In the case of the small microburst, LLWAS's coverage behavior was erratic. Its loss is just at the microburst level and its size is such that it may fall between LLWAS sensors. In some cases coverage is good, as in Denver for the runways 08RA, 08LA, and 26LA. In other cases the coverage is poor, as in Denver for the runways 35RA, and 35LA. However, as the microbursts move from this marginal case to more typical cases, the coverage performance markedly improves. In general, comparing the ACF value with the coverage distance values indicates that the ACF provides a good, if slightly conservative estimate of LLWAS coverage.

The TDWR coverage parameters serve the same purpose for screening LLWAS alerts that the LLWAS coverage parameters do for TDWR. However, setting these parameters is much simpler. The area covered by TDWR is so great that it is assumes it covers the entire airport. Therefore, the TDWR coverage parameters are set to three nautical miles.

| *tdwr_coverage* = 3 nautical miles for all runways |
|---|

# 3. LLWAS AND TDWR SCREENING THRESHOLDS

The TDWR and LLWAS threshold values are used during alert screening to determine whether an alert issued by one of the systems is weak– –in which case it requires confirmation– –and whether the alert given by the other system is strong enough to confirm the weak alert. The screening process may drop, downgrade, or pass a weak alert depending on its type and whether or not it is confirmed by the other system. Different factors come into play when setting the thresholds for each system. The purpose of screening is to reduce false alerts and overwarning. Both systems have a high probability of detection for microbursts, and so integration imposes the constraint that weak microburst alerts are reduced to wind shear alerts if the other system is reporting no loss. TDWR's probability of false alert for microbursts depends on its viewing angle relative to the runway of interest. We refer to runways whose direction is less than 45 degrees to the radar beam, as measured at runway center, as parallel–beam runways. Runways whose direction is greater than or equal to 45 degrees, as measured at runway center, are referred to as cross–beam runways. Experience has shown that for runways roughly parallel to the radar beam, TDWR has almost no false alerts for microbursts. So only weak microburst alerts are subject to this constraint if the runway is parallel beam. All LLWAS weak microburst alerts are subject to this constraint since LLWAS's probability of false alert for microbursts is not runway specific.

Screening is also used to reduce false wind shear with loss alerts. Both systems produce false wind shear alerts, but since the probability of detection for wind shears is not as high as the probability of detection for microbursts, only very weak alerts are subject to this process. Again, there is a viewing angle dependency on probability of false alert from TDWR.

Since LLWAS does a much better job of detecting wind shears with gain, screening is used to remove all TDWR gain alerts that occur within LLWAS coverage. This should be rethought if the TDWR gust front algorithm is substantially improved.

Each system has six screening thresholds:

1. Weak Gain Level (*thresh1*). Any gain between zero and this threshold requires confirmation of the other system.
2. Gain Confirmation Level (*thresh2*). A weak gain is confirmed if the other system issues a loss above this level.
3. Weak Loss Level (*thresh3*). Any loss between zero and this threshold requires confirmation of the other system.
4. Loss Confirmation Level (*thresh4*). A weak loss is confirmed if the other system issues a loss above this level.
5. Weak Microburst Level (*thresh5*). Any loss between the minimum microburst value (see below) and this threshold requires confirmation of the other system
6. Microburst Confirmation Level (*thresh6*). A weak microburst is confirmed if the other system issues a loss above this level.

Settings for these parameters for TDWR and LLWAS were obtained from a performance evaluation of the TDWR, LLWAS, and integration systems at Orlando conducted during the summer of 1991[2]. Alert data from these systems were compared with dual–Doppler data for 10 selected days, and performance measures for each system were computed. Based on the results of this analysis the recommended values for the LLWAS and TDWR thresholds are given in tables 3 and 4.

**Table 3.**
**Recommended TDWR Threshold Settings**
**(meters per second)**

| Runway Type | *Thresh1* | *Thresh2* | *Thresh3* | *Thresh4* | *Thresh5* | *Thresh6* |
|---|---|---|---|---|---|---|
| **Parallel** | 51.44 | 51.44 | –9.00 | 0.0 | 0.0 | 0.0 |
| **Cross** | 51.44 | 51.44 | –10.29 | 0.0 | –16.72 | 0.0 |

**Table 4.**
**Recommended LLWAS Threshold Settings**
**(meters per second)**

| Runway Type | *Thresh1* | *Thresh2* | *Thresh3* | *Thresh4* | *Thresh5* | *Thresh6* |
|---|---|---|---|---|---|---|
| All | 0.0 | 0.0 | –9.00 | 0.0 | –16.72 | 0.0 |

The values in the TDWR table show that any gain from zero to 100 knots is considered weak and requires LLWAS to issue a 100 knot gain to confirm the TDWR alert. Since neither system can issue alerts that large, these parameter settings effectively screen all TDWR gains inside LLWAS coverage. This is appropriate since analysis showed that TDWR detects gains poorly. The weak wind shear level for TDWR is set at –17.5 knots on parallel–beam runways and –20 knots on cross–beam runways. Since alerts are rounded to the nearest five knots, a setting of –17.5 knots effectively screens only 15 knot alerts. The higher value on cross–beam runways takes into account TDWR's degraded performance on these kinds of runways. The confirmation level is set to zero, so any LLWAS loss will confirm the weak TDWR loss. For parallel–beam runways, the weak microburst level is set to zero so that no microbursts are screened. Again, the cross–beam runway threshold is set higher, at –32.5 knots. This effectively screens only 30 knot alerts. The confirmation level is zero so any LLWAS loss will confirm a weak TDWR microburst.

The values in the LLWAS table show that all gains are treated as strong and are passed through screening. The weak wind shear level is set at –17.5 knots and confirmed by any TDWR loss. The weak microburst level is set at –32.5 knots and confirmed by any TDWR loss.

# 4. LLWAS AND TDWR LOSS AND GAIN FACTORS

After screening, the alerts are joined using logic to reduce false microburst alerts and over-warning. The alert joining reduces the runway alert towards the average of the TDWR and LLWAS alert values, but will not drop below some fraction of the LLWAS alert or below some fraction of the TDWR alert. These fractions are the loss and gain factors. This process prevents the average from dropping the value of the alert estimate too far.

As with the thresholds above, settings for these parameters for both TDWR and LLWAS were obtained from a performance evaluation of the TDWR, LLWAS, and integration systems at Orlando conducted during the summer of 1991[2]. Based on the results of that analysis, the following are the recommended setting for the LLWAS and TDWR loss factors and for the LLWAS and TDWR gain factors:

| |
|---|
| *llwas_mb_factor* and *tdwr_mb_factor* = 0.8 for all runways |

| |
|---|
| *llwas_gf_factor* and *tdwr_gf_factor* = 1.0 for all runways |

# 5. MAXIMUM WIND SHEAR ALERT VALUE AND MINIMUM MICROBURST ALERT VALUE

The maximum wind shear alert value (*max_wsa*) is the largest loss value that is at the wind shear alert level. This parameter is used by integration as the value to which weak microburst alerts from one system are reduced when they are not confirmed by the other system. In the past, the largest loss at the wind shear alert level has been set at −25 knots (−12.86 meters per second). Note that the value of this parameter is negative.

The minimum microburst alert value (*min_mba*) is the smallest magnitude of loss that is at the microburst level. This parameter is used by integration for both screening and arbitration to determine if a given loss alert is a microburst alert. In the past, the smallest loss at the microburst level has been set at 30 knots (15.43 meters per second). Note that this value is positive.

| |
|---|
| *max_wsa* = −12.86 meters per second |

| |
|---|
| *min_mba* = 15.43 meters per second |

## 6. LOSS INCREMENT VALUE AND LOSS-GAIN BUFFER VALUE

These two parameters are used by integration when arbitrating between two alerts in the case when one system issues a loss alert below the microburst level and the other issues a gain alert. The loss increment value (*loss_increment*) specifies how much the gain must exceed the loss in order for it to win over the loss in arbitration. The loss increment is set to a value of 10 knots (5.14 meters per second) to match the arbitration logic in LLWAS 3.

The loss–gain buffer (*loss_gain_buffer*) is also used when arbitrating between a loss alert and a gain alert when the loss is below the microburst level. If the last integrated alert issued was a loss, then the value of the loss–gain buffer is added to the sum of the current loss alert and the loss increment in arbitration. This increases the apparent loss and so causes arbitration to require a larger gain in order for the gain to win in arbitration. If the last integrated alert issued was a gain, then the value of the loss–gain buffer is subtracted, making it easier for the gain to win in arbitration. This operation is used to reduce flickering of the issued alerts between loss alerts and gain alerts. Experience has shown that a loss–gain buffer value of five knots (2.57 meters per second) reduces flicker in the issued alerts.

| *loss_increment* = 5.14 meters per second |
|---|

| *loss_gain_buffer* = 2.57 meters per second |
|---|

# REFERENCES

[1] Cole, R.E. "Terminal Doppler Weather Radar/Low–Level Wind Shear Alert System Integration Algorithm Specification, Version 1.1," Lexington, MA, MIT Lincoln Laboratory, ATC–187, Gov. Accession No. DOT/FAA/NR–92/3, 24 February 1992.

[2] Cole, R.E. and R.F. Todd, "A Comparative Performance Study of TDWR/LLWAS 3 Integration Algorithms For Wind Shear Detection," Lexington, MA, MIT Lincoln Laboratory, publication pending.

# APPENDICES

Appendix 1 shows a sample layout for an Integration Parameter File for Orlando, FL. Files of this form were used during the 1991 performance evaluation of integration, and they were also used during the 1992 operational test in Orlando, FL. Appendix 2 shows a sample LLWAS Airport Configuration File for Orlando, FL.

# APPENDIX 1.
# SAMPLE INTEGRATION PARAMETER FILE FOR ORLANDO INTERNATIONAL AIRPORT

```
Number of operational runways
        12
Runway names
        35A                         / rwy 0
        17A                         / rwy 1
        36RA                        / rwy 2
        36LA                        / rwy 3
        18LA                        / rwy 4
        18RA                        / rwy 5
        17D                         / rwy 6
        35D                         / rwy 7
        18LD                        / rwy 8
        18RD                        / rwy 9
        36RD                        / rwy 10
        36LD                        / rwy 11
LLWAS coverage
        2                           / rwy 0
        3                           / rwy 1
        2                           / rwy 2
        2                           / rwy 3
        2                           / rwy 4
        2                           / rwy 5
        2                           / rwy 6
        2                           / rwy 7
        2                           / rwy 8
        2                           / rwy 9
        2                           / rwy 10
        2                           / rwy 11
LLWAS threshold
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 0
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 1
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 2
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 3
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 4
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 5
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 6
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 7
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 8
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 9
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 10
        0.0  0.0  -9.00  0.0  -16.72  0.0   / rwy 11
```

```
TDWR coverage
        3                       / rwy 0
        3                       / rwy 1
        3                       / rwy 2
        3                       / rwy 3
        3                       / rwy 4
        3                       / rwy 5
        3                       / rwy 6
        3                       / rwy 7
        3                       / rwy 8
        3                       / rwy 9
        3                       / rwy 10
        3                       / rwy 11
TDWR thresholds
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 0
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 1
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 2
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 3
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 4
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 5
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 6
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 7
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 8
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 9
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 10
        51.44  51.44  -9.00  0.0  0.0  0.0        / rwy 11
LLWAS and TDWR loss factor
        0.8  0.8          / rwy 0
        0.8  0.8          / rwy 1
        0.8  0.8          / rwy 2
        0.8  0.8          / rwy 3
        0.8  0.8          / rwy 4
        0.8  0.8          / rwy 5
        0.8  0.8          / rwy 6
        0.8  0.8          / rwy 7
        0.8  0.8          / rwy 8
        0.8  0.8          / rwy 9
        0.8  0.8          / rwy 10
        0.8  0.8          / rwy 11
LLWAS and TDWR gain factors
        1.0  1.0          / rwy 0
        1.0  1.0          / rwy 1
        1.0  1.0          / rwy 2
        1.0  1.0          / rwy 3
        1.0  1.0          / rwy 4
        1.0  1.0          / rwy 5
        1.0  1.0          / rwy 6
        1.0  1.0          / rwy 7
        1.0  1.0          / rwy 8
```

```
        1.0  1.0           / rwy 9
        1.0  1.0           / rwy 10
        1.0  1.0           / rwy 11
Max windshear alert value
        -12.86
Min microburst alert value
         15.43
Loss gain buffer value
          2.57
Loss increment value
          5.14
```

# APPENDIX 2.
# SAMPLE FIRST PAGE OF LLWAS AIRPORT CONFIGURATION FILE FOR ORLANDO INTERNATIONAL AIRPORT

```
        2  id_parm

MCO  AIRPORT NAME

        6  number of directional runways

       50 # OF EDGES,  ARR_EDGE_LOC
```

| | 17A | 35A | 18LA | 18RA | 36RA | 36LA |
|---|---|---|---|---|---|---|
| 1 | 1 | -99 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | -99 | -99 | -99 | -99 |
| 3 | -99 | 1 | -99 | -99 | -99 | -99 |
| 4 | -99 | 1 | -99 | -99 | 1 | 1 |
| 5 | -99 | -99 | -99 | -99 | 1 | 1 |
| 6 | -99 | -99 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | -99 | -99 | -99 | -99 |
| 9 | 0 | 0 | -99 | -99 | 1 | 1 |
| 10 | -99 | -99 | 0 | 0 | 0 | 0 |
| 11 | 2 | -99 | 1 | 1 | -99 | -99 |
| 12 | 1 | -99 | -99 | -99 | -99 | -99 |
| 13 | -99 | -99 | 0 | 0 | 0 | 0 |
| 14 | 1 | -99 | 0 | 0 | 0 | 0 |
| 15 | 2 | -99 | -99 | -99 | -99 | -99 |
| 16 | -99 | -99 | 0 | 0 | 0 | 0 |
| 17 | -99 | -99 | 1 | 1 | -99 | -99 |
| 18 | -99 | -99 | 1 | 1 | -99 | -99 |
| 19 | 2 | -99 | 1 | 1 | -99 | -99 |
| 20 | 3 | -99 | -99 | -99 | -99 | -99 |
| 21 | -99 | -99 | 2 | 2 | -99 | -99 |
| 22 | 0 | 0 | -99 | -99 | -99 | -99 |
| 23 | 1 | -99 | -99 | -99 | -99 | -99 |
| 24 | 1 | -99 | -99 | -99 | -99 | -99 |
| 25 | 0 | 0 | -99 | -99 | -99 | -99 |
| 26 | 0 | 0 | -99 | -99 | -99 | -99 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | -99 | 2 | -99 | -99 | -99 | -99 |
| 29 | -99 | 1 | -99 | -99 | -99 | -99 |
| 30 | -99 | 1 | -99 | -99 | -99 | -99 |
| 31 | -99 | -99 | -99 | -99 | 2 | 2 |
| 32 | -99 | 1 | -99 | -99 | -99 | -99 |
| 33 | -99 | 2 | -99 | -99 | 2 | 2 |
| 34 | -99 | -99 | 0 | 0 | 0 | 0 |
| 35 | -99 | 1 | -99 | -99 | 1 | 1 |
| 36 | -99 | -99 | -99 | -99 | 2 | 2 |
| 37 | -99 | -99 | -99 | -99 | 1 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 38 | -99 | -99 | 0 | 0 | 0 | 0 |
| 39 | -99 | -99 | 0 | 0 | 0 | 0 |
| 40 | -99 | -99 | 1 | 1 | -99 | -99 |
| 41 | 1 | -99 | -99 | -99 | -99 | -99 |
| 42 | 0 | 0 | -99 | -99 | -99 | -99 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0 |
| 44 | -99 | -99 | 0 | 0 | 0 | 0 |
| 45 | -99 | -99 | 1 | 1 | -99 | -99 |
| 46 | 2 | -99 | 1 | 1 | -99 | -99 |
| 47 | -99 | 1 | -99 | -99 | -99 | -99 |
| 48 | 0 | 0 | -99 | -99 | 1 | 1 |
| 49 | -99 | -99 | -99 | -99 | 1 | 1 |
| 50 | -99 | -99 | 0 | 0 | 0 | 0 |

<Rest of Airport Configuration File removed..>