

Consideration of 95% Performance Metrics

January 2002

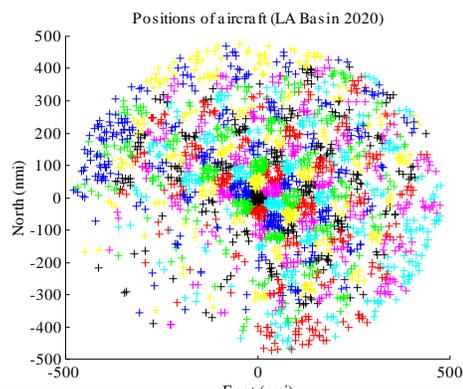


7900 Wisconsin Avenue, Suite 201
Bethesda, Maryland 20814
+1-301-652-5306
adsi@adsi-m4.com



LA Basin traffic snapshot

- Thousands of aircraft
- Millions of aircraft pairs
- Performance varies with:
 - geographic location
 - local aircraft density
 - altitude of both aircraft
 - receiver sensitivity
 - transmitter power (for a given target)
 - antenna gain variations
 - other factors



What do we mean by “nominal performance”?
How should statistics be evaluated? Performance validated?



Types of 95% metrics*

January 2002

- For the **worst-case user or worst-case observing location**, 95% update interval = X sec
 - For LAX, the worst-case location is ground zero. There are more than 100 aircraft within 20 nmi. What will the pilot see if the display is set to a 40 nmi scale or a 100 nmi scale? Is this metric meaningful?
- Considering all pairs of users in a given range bin, the **95% percentile receiver** perceives a 95% update interval = X sec
 - For LAX, this will be a user roughly 20 nmi from ground zero. Still an extreme case.
- **Averaging over all pairs of users in a given range bin**, 95% update interval = X sec
 - Population average still emphasizes results at “ground zero” since many users are in the center
 - Is this more operationally meaningful than the worst-case approach? For which applications?
- Averaging over all pairs of users in a given range bin, **for whom acquisition has been successfully achieved**, 95% update interval = X sec
 - This may serve to capture the reality that not all aircraft at moderate to long range will be under track
 - The problem is that a simulation may not know which targets would have been “acquired”
- **Averaging over all pairs of users in a given range bin, and excluding the 5% worst-performing pairs**, 95% update interval = X sec
 - Similar to above, but avoids philosophical difficulty of predicting acquisition performance. Relatively easy to implement in a simulation. May offer an operationally meaningful and precise metric of performance.

*We may assume that target pairs beyond geometric line-of-sight are automatically excluded from the statistics

ads@ads-m4.com
Performance metrics

3



Types of 95% metrics (cont)*

January 2002

- For a user in the **average location**, averaging over all targets in a given range bin, 95% update interval = X sec
 - Spatial average de-emphasizes results in center of the scenario. An alternative to the population averages described on the previous chart.
 - This spatial average can be tailored for acquisition considerations as well. For example, in each spatial patch (e.g., a hexagonal tile) do the following:
 - gather performance data for all the receivers in the patch;
 - consider all receiver/target pairs that satisfy a given range criterion (a range bin);
 - discard the 5% worst-performing pairs (i.e., to give due consideration for targets not under track);
 - evaluate the 95% confidence update interval for the remaining pairs;
 - finally, average the results over all the spatial patches (uniform weight for each tile regardless of aircraft count).

Discussion:

The current MASPS requirement (95%) is ambiguous. It fails to give proper guidance to evaluate whether any given system meets requirements. The precise meaning should be defined.

*We may assume that target pairs beyond geometric line-of-sight are automatically excluded from the statistics

ads@ads-m4.com
Performance metrics

4



Suggested text 1

January 2002

Current text:

For all of the scenarios included in Table 3-4, the state vector shall (RX.XX) be acquired with a 95% confidence by the range specified for the scenario.

Suggested text:

For each of the scenarios included in Table 3-4(a), the state vectors received from at least 95% of the observable user population (radio line-of-sight) shall (RX.XX) be acquired by the range specified for the scenario. The update period following initial state vector acquisition, evaluated over the spatial extent of the operational domain, shall (RX.XX) satisfy the probability and timing requirements in Table 3-4(a).*

*The set of user pairs considered, for which update rate requirements are evaluated, refers to those pairs for which initial data acquisition and reporting (track acquisition) has been achieved. It is recognized that persistent variable factors (e.g., low transmit power, antenna nulls) may cause a small percentage of user pairs to fail initial acquisition at the indicated range. The expectation over spatial domain, rather than population, is intended to avoid excessive weighting of scenario-wide performance evaluations by localized domains of high traffic density.



Suggested text 2

January 2002

Current text:

For each of the scenarios included in Table 3-4, the state vector shall (RX.XX) be acquired with a 95% confidence by the range specified for the scenario.

Suggested text:

For each of the scenarios included in Table 3-4(a), the state vectors received from at least 95% of the observable user population (radio line-of-sight) shall (RX.XX) be acquired by the range specified for the scenario, and for all such acquired tracks the update rate shall satisfy the time and probability requirements in Table 3-4(a). It is recognized that persistent variable factors such as dips in antenna gain may cause a small percentage of user pairs to fail to be in-track.