CLAIMS

What is claimed is:

1. Method for eliminating false Mode S SSR or 3A code tracks on radar display created by a radar extractor of a radar as a consequence of false replies, i.e. replies reflections against reflectors, a reflector being natural or artificial object different from an aircraft target, the replies being signals representing a target, the radar comprising the radar extractor and a radar tracker, the method comprising ~~being characterised by the execution of~~ the following steps:

A. Creating a raw video map, that is extended to the area covered by the radar and is subdivided into cells of predefinable dimensions, each cell delimiting a portion of the area wherein a aircraft target can be present, to each cell being associated a probability of presence of false replies in such a cell;

B. For a situation corresponding to a scan by the radar:

B0. Identifying replies clusters, i.e. two or more replies sets closer to each other in azimuth and range than corresponding predefined threshold values;

B1. Associating to each cell of the raw video map a power level received by the radar in the corresponding area portion;

B2. Extracting the plots, i.e. replies cluster average points determined in case a replies set has a number of replies greater than a pre-defined threshold, by the radar extractor;

B3. Sending the extracted plots to the radar tracker along with said probability of presence of false replies in the cells to which they respectively belong;

B4. Calculating, by means of the radar tracker, the tracks relevant to the plots, updating the already existing tracks on the radar display and initiating new tracks

using one or more track initiation thresholds chosen on the basis of said probability of presence of false replies calculated in step B3;

C. With respect to the all tracks of step B4, determining, by means of the radar tracker, false tracks and ~~relevant~~ initial points of the false tracks;

D. On the basis of the initial points of the false tracks determined in step C, calculating the probability of presence of said false replies in the cells corresponding to said initial points and updating the raw video map of step A;

E. Repeating steps B-D.

2. Method according to claim 1, ~~characterised in that~~ wherein in step B4 a track initiation threshold is used, which is a pre-defined number of correlating consecutive plots, said track initiation threshold being an increasing function of said probability of presence of false replies calculated in step B3.

3. Method according to claim 1 or 2, ~~characterised in that~~ wherein the power level associated to each cell in step B1 is determined by the intensity of the reply signal(s) within the the cell, said probability of presence for the cell being calculated over multiple radar scans as:

$$E\{P^{i}_{RX} * N_{scan\ with\ reflection} / P_{MAX} * N_{scan\ TOT}\}$$

wherein:

- $N_{scan\ with\ reflection}$ is the number of radar scans for which false tracks have been determined in the cell in step C;

- $N_{scan\ TOT}$ is the number of multiple radar scans;

- P^{i}_{RX} indicates the power of the signal received from the i-th reply falling in the cell, with i=1,...k where k is the total number of replies in the cell and depends on the geographical extension of the same cell;.

- P_{MAX} indicates the highest power receivable from the cell;

And wherein E{} indicates an average operation executed on the replies in the cell.

4. Method according to any one of the preceding claim, ~~characterised in that~~ wherein said probability of presence in each cell is calculated as a percentage of the current average power stored in the cell P_r^n:

$$P_{ft} = b\, P_r^n$$

wherein b is a configurable parameter.

5. Method according to any one of the preceding claims, ~~characterised in that~~ wherein in B1, for each cell, the power level received in the current scan P_r is averaged with a power level P_r^{n-1} already associated to the cell, and an averaged value P_r^n is currently associated to the cell, according to the following:

$$\text{If } P_r \geq P_r^{n-1}, \text{ then } P_r^n = P_r$$

$$\text{Else } P_r^n = \alpha\, P_r + (1-\alpha)\, P_r^{n-1}$$

Wherein α is a real number weight, equal for all cells, parametrising a "memory" of cell average power that affects the one or more track initiation thresholds in step B4, the value α being suitable to be pre-set to meet changing detection situations such as traffic density and environment changing speed, and, once a track has been identified

as false in step C, α value will be set to a different value $\alpha_r < \alpha$ to increase algorithm memory of the false track.

6. Method according to any one of the preceding claims, ~~characterised in that~~ wherein in step C the radar tracker determines false tracks on the basis of one or more pre-defined criteria, a false track being determined when a track:

- has an unsteady trajectory defined by a variance of the range and/or azimuth speed larger than a pre-defined threshold;
- is chosen out of two tracks having the same Mode S address and manoeuvering at the same time, wherein manouvering condition is estimated according to the innovation energy criterium of the Kalman filtering, by calculating the range distance between the two tracks and using following choice criteria:
  - if said range distance is larger than a pre-defined range distance threshold, particularly radar range accuracy, the track with the largest range distance is chosen;
  - otherwise the track is chosen that is the first track terminated in time;
- The false track is the one of two tracks having the same mode S address, for which the roll call interrogations do not succeed;
- Is chosen by an operator who manually inputs information in the radar tracker about which one of the tracks are false tracks.

7. Method according to any one of the preceding claims, ~~characterised in that~~ wherein during step D, the radar tracker communicates the initial points of the false tracks individuated in step C to the radar extractor, which carries out the calculation of probability of presence.

8. Method according to any one of the preceding claims, ~~characterised in that,~~ wherein during step A, when the system ADS-B is at disposal, in case an ADS-B plot is present which

is correlating in position with a SSR plot, all the remaining plots will be marked as reflections and the relevant cells of the raw video map will be marked with probability 100%.

9. A computer program product comprising a computer usable medium having control logic stored therein for causing a computer to execute steps A-E of the method for eliminating false Mode S SSR or 3A code tracks on radar display created by a radar extractor as a consequence of the false replies, according to the method of claim 1.

10. Tangible memory medium readable by a computer, having a program memorized on it, ~~characterised in that~~ wherein the program is the computer program according to claim 9.

11. System for eliminating false Mode S SSR or 3A code tracks on a radar display created by a radar extractor as a consequence of false replies, the system ~~being characterised in that it~~ comprisinges means to execute the method according to claim 1, the system comprising:

- a radar extractor, including electronic means configured to perform steps A, B0-B3, D;
- a radar tracker, including electronic means configured to perform steps B4, C.