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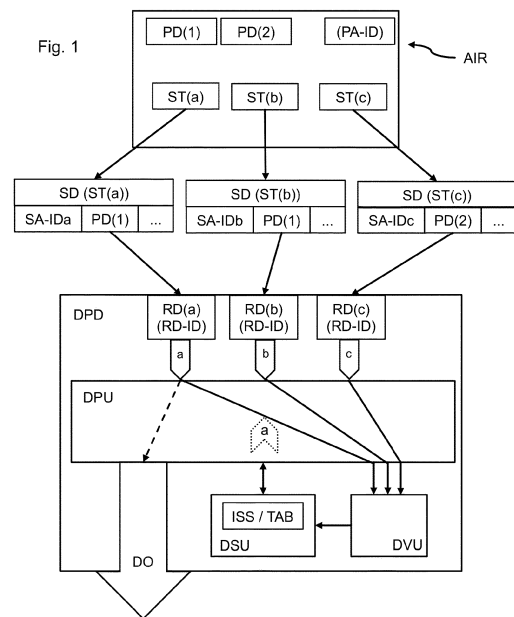
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METHOD AND SYSTEM FOR REPEATEDLY PROVIDING AIR TRAFFIC POSITION DATA
- (57) A method and a system for repeatedly providing air traffic position data of multiple surveilled aircraft (AIR) travelling in a surveillance region are described, wherein surveillance data (SD) of at least one of said multiple surveilled aircraft (AIR) are provided over time using at least two different surveillance technologies (ST), said surveillance data (SD) containing at least position data (PD) of said aircraft (AIR) and a surveillance technology specific aircraft identifier (SA-ID) of said aircraft (AIR). It is provided that for different surveilled aircraft (AIR), repeatedly surveillance data (SD) are received over time by multiple receiving devices (RD) and a receiving device identifier (RD-ID) is assigned to the surveillance data (SD); a physical aircraft identifier (PA-ID) is assigned to the received surveillance data (SD) in accordance with the surveillance technology specific aircraft identifier (SA-ID); for each of the physical aircraft identifiers (PA-ID), one of the surveillance technologies (ST) is selected with a pre-configured input source selector (ISS) and the air traffic position data (PD) of surveillance data (SD) received from the selected surveillance technology (ST) is outputted; the input source selector (ISS) is re-configuring based on all surveillance data (SD) received, wherein re-configuring comprises assessing the surveillance data (SD). (Fig. 1)
- Fig. 1


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Description

[0001] The invention relates to a method and a system for repeatedly providing air traffic position data of multiple surveilled aircraft travelling in a surveillance region.

[0002] Such technologies are used inter alia for Air Traffic Control (ATC) or Air Traffic Management (ATM) appliances. Further, such technologies are used for Unmanned Aerial Traffic Management (UMT) appliances. The invention relates to all tracking and monitoring surveillance techniques and provides a possibility to include all those technologies in one system for all types of aircraft, providing air traffic position data for each aircraft with high accuracy and quasi real time.

[0003] Typically, the position data from various data sources, such as different surveillance systems, is being processed, merged and unified to feed data into an air traffic situation display (commonly speaking "radar-display") for ATC or ATM. According to the prior art, this is achieved by multi-sensor data fusion (MSDF). Multi-sensor data fusion (MSDF) is defined as the process of integrating information from multiple sources to produce the most specific and comprehensive unified data about an entity, activity or event. As a technology, MSDF is the integration and application of many traditional disciplines and new areas of engineering including communication and decision theory, uncertainty management, estimation theory, digital signal processing, computer science and artificial intelligence.

[0004] In G. GIRIJA et. Al., "Tracking filter and multi-sensor data fusion", Sadhana, Vol. 25, Part 2, April 2000, pp. 159-167, India, is described. Multi-sensor data fusion (MSDF) is defined as the process of integrating information from multiple sources to produce the most specific and comprehensive unified data about an entity, activity or event.

[0005] However, there are certain drawbacks. One aspect is that the processing of the original surveillance data is based on a complex technology and thus time consuming. Further, it is the aim of multi sensor data fusion to estimate a most probable position. However, due to the complex processing, there is a notable delay so that the position as a result of MSDF is no real time position.

[0006] Further, due to the relation between the different sensor technology when estimating a position using all available sensor data, it is difficult to include new sensor data in the system.

[0007] Accordingly, there is a need to provide high precision position data of surveilled aircraft faster, quasi in real time, while it shall be avoided to provide incorrect position data due to the use of bad (or at least not the best) position data.

[0008] This problem is solved with the proposed method of claim 1 and the proposed system of claim 9.

[0009] According to the invention, surveillance data SD of at least one of said multiple surveilled aircraft AIR are provided over time using at least two different surveil-

lance technologies ST or different devices related to the different positioning and/or transmission technologies. This means that redundant air traffic location data (in the sense of surveillance data) are provided. Said surveillance data SD contain at least air traffic position data PD of said aircraft AIR and a surveillance technology specific aircraft identifier SA-ID of said aircraft AIR. A surveillance technology specific aircraft identifier allows to distinguish the surveillance data SD from one aircraft AIR in the surveillance region from the surveillance data SD from another aircraft AIR in the surveillance region, if both surveillance data are from the same surveillance technology ST. However, for different surveillance technologies ST, different surveillance technology specific aircraft identifier SA-ID may be used, with the effect that the position data PD received for different aircraft AIR by different surveillance technologies ST cannot be directly compared.

[0010] The proposed method comprises at least the following steps:

(1) For different surveilled aircraft AIR, repeatedly receiving said surveillance data SD overtime by multiple receiving devices RD and assigning a receiving device identifier RD-ID to the surveillance data SD. The receiving device identifier RD-ID may also be indicative of the surveillance technology ST used. The receiving device identifier RD-ID may indicate the one of the multiple receiving devices RD that has received the respective surveillance data SD. One unique receiving device identifier RD-ID may be indicative for each one of the different surveillance technologies ST using one of possibly more transmission or communication channels.

(2) Assigning a physical aircraft identifier PA-ID to the received surveillance data SD in accordance with the surveillance technology specific aircraft identifier SA-ID. This may, for example, be achieved by forming trajectories from the position data contained in surveillance data SD over the time for each of the surveillance technology specific aircraft identifier SA-ID of said aircraft and comparing the trajectories for the different surveillance technology specific aircraft identifiers SA-ID. As trajectories for physical different aircraft differ in their temporal course and trajectories for the physical identical aircraft correspond to each other in their temporal course, the different surveillance technology specific aircraft identifiers SA-ID in the surveillance data SD of the identical physical aircraft can be assigned to the one physical aircraft identifier PA-ID. The before described way of assigning physical aircraft identifier PA-ID can be performed by analyzing the received data only. Another exemplary way may be the use of MSDF-data available. It is to be noted, however, that these possibilities are to be understood as an examples only allowing to determine a physical aircraft identifier PA-

ID as an indicator for one physical aircraft having different surveillance technologies just be the data received. The skilled person may use other solutions known or derivable from his technical knowledge. It is in particular to be noted that the physical aircraft identifier PA-ID does not need to be known in the aircraft itself or used somewhere else to describe the physical aircraft AIR. Alternatively, the physical aircraft identifier PA-ID can also be known and used from a previously provided SA-ID table for a specific aircraft listing the surveillance technology specific aircraft identifier SA-ID of surveillance technologies (ST) installed in or for said aircraft AIR.

(3) For each of the physical aircraft identifiers PA-ID, selecting with a pre-configured input source selector ISS one of the surveillance technologies ST and outputting the air traffic position data PD of surveillance data SD received from the selected surveillance technology ST, these surveillance data SD also being denoted as "selected surveillance data SD" in the following. This step allows a quasi real time handling of the surveillance data SD in the sense that one input source (for example identified by the assigned receiving device identifier RD-ID) is selected based on pre-configured decision and only the position data PD received via this selected input is forwarded to the data output for outputting the position data PD to following applications. No further evaluation or processing of the surveillance data is performed in line with the invention allowing thus to provide position data PD in real time.

(4) Re-configuring the input source selector ISS based on all surveillance data SD. The step of re-configuring comprises assessing the surveillance data SD using at least one of the following:

(a) Assessing quality of data in the data transmission to each of the receiving devices RD. This may include an input delay measured in time.

(b) Assessing a comparison of the position data for one physical aircraft AIR received, e.g. based on different sensor data such as different GNSS data or GNSS-data and radar data. This allows randomly erroneous position data from one sensor to be discarded if a set of position data is outside a tolerance area around the position data of several other sensors.

(c) Assessing the quality of the sensor technology used for determining the position data. This may be related, e.g., to the precision of the sensor used based on detector technology or physical constraints of the method used. Further it is possible to assess changing environmental conditions detected and reported by the sensor itself and/or use information on the distance to the

senor and time of transmission.

(d) Using pre-assigned priorities related to different receiving devices RD and/or surveillance technologies ST. This may be based on a general assessment in case all data received are of good quality. Then, the best data may be selected to pre-assigned priorities to the different data inputs, i.e. the data receivable by the system. This assessment may also be used as an initial preselection.

[0011] As a result of the assessing of the surveillance data SD and/or the surveillance technology ST, a rating value RV is assigned to the surveillance data SD based on the assessing of the surveillance data SD. This rating value RV is preferably used for selecting one from the surveillance data SD for outputting the air traffic position data PD, and in particular used by the input source selector ISS.

[0012] Assessing the data may occur synchronously upon receipt of each surveillance data SD, for example using a batch technology and/or comparing actual surveillance data SD with surveillance data previously received. Assessing the data may also occur asynchronously, meaning that the surveillance data are collected for a surveillance period, and then a comparison of the different surveillance data SD received during the surveillance period are compared with each other. Also, a combination of synchronous and asynchronous assessment is possible.

[0013] According to an important aspect of the invention, the step of selecting the surveillance data and outputting the position data PD is performed independently of the step of re-configuring. In particular, outputting the position data PD may be formed before the step of re-configuring is completed or even before it is actually started. This is possible by using the pre-configured input source selector ISS. "Pre-configured" means accordingly, that it was configured in a previous surveillance period based on all surveillance data SD received during said previous surveillance period SP and can be used for selecting and outputting the position data without processing any received surveillance data SD. This enables a (quasi-)real-time data stream of the position data for monitoring purposes, such as a proposed use for time and safety critical applications like Air Traffic Control (ATC) or Air Traffic Management (ATM), with an elective selection of the available best quality data with an up-to-date section tool (input source selector ISS) based on assessment of the latest detected surveillance data, as a re-configuration of the input source selector ISS is also performed by processing and assessing all surveillance data of the actual surveillance period. The re-configured input source selector ISS is thus available for a selection of the input of surveillance data SD in the future.

[0014] In case that no surveillance data SD have been received previously, the pre-configured input source selector may be configured using pre-assigned priorities

related to different receiving devices RD and/or surveillance technologies ST, as this is irrespective of real data quality. However, according to the invention, any other initial pre-configuration can be used. The initial pre-configuration is only used for the first surveillance data from one aircraft, as the input source selector is re-configured after receiving surveillance data SD.

[0015] It is to be emphasized that system und method can also work with aircraft providing only one surveillance technology. In this case, the position data PD of each of the received surveillance data SD is outputted. As there is, in such case, no selection possible between different surveillance technologies ST, the input source selector ISS is simply selecting the one available surveillance technology ST. However, system und method according to the invention are adapted to cope also with aircraft having multiple surveillance technologies ST.

[0016] According to a preferred embodiment, one individual input source selector ISS may be provided for each surveilled physical aircraft, as the selection of the input may depend on surveillance devices used on this aircraft AIR. Further, the transmission of the surveillance data SD from the aircraft AIR to the receiving devices RD may depend on the aircraft position. However, in line with the invention there may be provided alternatively or additionally other input source selectors ISS, e.g. according to the type of aircraft (manned aircrafts, unmanned aircraft systems (UAS) or other types or subtypes), subregions of the surveillance region.

[0017] In one embodiment of the proposed method, the step of re-configuration is performed after the step of selection of output is completed. However, according to a preferred embodiment the step of selecting the surveillance data SD and outputting of the position data PD of the selected surveillance data SD (step 3) and the step of re-configuring the input source selector ISS (step 4) are processed in parallel. This allows for a faster update of the input source selector ISS.

[0018] In a preferred embodiment, selecting one of the surveillance technologies ST with a pre-configured input source selector ISS comprises accessing a selection table TAB having data sets of an indication of the surveillance technology ST used (such as for example the receiving device identifier RD-ID), the surveillance technology specific aircraft identifier SA-ID of said aircraft, the physical aircraft identifier PA-ID and a rating value RV. The best rating value RV is unique. This ensures that the best surveillance technology ST can be selected as input source (active source) for the surveillance data SD to output the respective position data. All non-best rating values may be identical just indicating a non-active source. In an alternative embodiment, for each combination of the indication of the surveillance technology ST used and the physical aircraft identifier PA-ID, a unique rating value RV may be provided enabling a clear ranking of all surveillance technologies ST for one aircraft AIR. In any case, the best data for one physical aircraft identifier PA-ID can be selected. Accordingly, for one physical

aircraft AIR in question, the indication of the surveillance technology ST used with the best rating value RV is identified. The best rating value RV may be, e.g., the highest or lowest value. Then, the surveillance data SD associated with said identified indication of the surveillance technology ST are selected. The rating value RV may be a combination of different (sub) rating values, such as a listing value LV indicating pre-assigned priorities related to different receiving devices RD and/or surveillance technologies ST irrespective of actual data transmission (static rating value) and a rating value RV(SD) related to the actual received surveillance SD data assessing, e.g. the conditions of transmission, comparison of position data (PD) and/or quality of sensor data (dynamic rating value).

[0019] Thus, according to the invention, the rating value RV is not limited to one numerical, alphanumeric or otherwise defined value. It may also be a combination of multiple single values, each of which indicating one aspect or a combination of aspects of the rating, such as assigned priorities to different receiving devices RD and/or surveillance technologies ST, assessed quality of data transmission, assessed comparison of position data and/or assessed quality of sensor technology used for example. Some examples for that are explained with respect to the drawings.

[0020] In case that the surveillance data SD received may not be usable, rating value RV may be a null-value. This null-value is not considered to be one of the unique rating values, as it indicates that these data are not selectable.

[0021] In another embodiment, the receiving devices RD may be configured to add a time stamp to the surveillance data SD indicating the time of receipt of the surveillance data SD in the receiving device RD.

[0022] This may be used for a basic input specific timing check. Further, this may be used for assessing the delay time during the data transmission of the surveillance data SD when assessing quality of the received data, for example if the surveillance data SD and/or position data PD contain a sending and/or collection date. This is the case for example the case for GNSS-data (Global Navigation Satellite System) or network related transmission technology, such mobile data networks like LTE or others.

[0023] According to an embodiment of the invention, assessing quality of data in the data transmission to each of the receiving devices (RD) comprises at least one of the following:

- Assessing delay time during data transmission. For example, the actual delay time may be compared to a regular transmission time for the specific transmission technology.
- Assessing quality indicators contained in the received surveillance data. Generally, these may be data indicating the integrity of the data itself, e.g. check sums of data packets or the like, or data indi-

cating the integrity of the physical communication channel, e.g. packet loss rates, transmission field strengths, stability of frequency bands or the like.

- Assessing failure messages of the communication system.

[0024] Generally, the delay time or other specific quality indicators may be assigned with a specific value or value range, dependent on a specific surveillance technology. If the actual input data do not meet this value or value range, they can be flagged as currently degraded, wherein the degrading may be expressed by a numeric, alphanumeric or other suited value depending on the difference between an actual value of a quality indicator contained in the data and a predefined limit or limit range.

[0025] According to a further aspect to the invention, the proposed method may further comprise determining (by for example measuring) the position data PD of the surveilled aircraft using sensor devices of a specific surveillance technologies ST. The position data (PD) in the surveilled aircraft may be based and/or transmitted on at least two the surveillance technologies listed below:

- Automatic Dependent Surveillance Broadcast (ADS-B) using at least one of the following transmission technologies, each of which being in combination with ADS-B a different surveillance technology ST:
 - ADS-B Antenna for radio transmission in the 1000 MHz region
 - Multilateration-Antennas (MLAT) for radio transmission in the 1000 MHz region
 - Secondary Surveillance Radar (SSR) in the 1000 MHz region
- (Flight Alarm) FLARM using radio transmission
- Network Remote ID (NRID) using an IT network server connection based on mobile phone radio
- Satellite Communication (SatCom) using an IT network server connection
- Multi Sensor Data Fusion (MSDF) from multiple surveillance technologies
- Direct or Broadcast Remote ID (DRID) using WIFI and/or Bluetooth)

[0026] ADS-B is a surveillance technology and form of electronic conspicuity in which an aircraft determines its position via satellite navigation or other sensors and periodically broadcasts it, enabling it to be tracked. For transmission suited transponders are used provided in the aircraft. ADS-B Antennas are used for receiving a radio communication with the position data contained in the radio transmission modulated data stream. Multilateration-Antennas (MLAT) are used for position detection / measurement of the times of arrival (TOA) of energy wave traveling from the aircraft to different receiving points synchronized in time. By relating the different re-

ceiving times to the different receiving position, the point of origin (position) is determined by multilateration methods. Secondary Surveillance Radar is a radar system for aircraft equipped with a radar transponder that replies to each interrogation radar signal by transmitting at least encoded identity code and height data. From the time of travel and angle of the radar signal, the position can be determined in a Radar Network (RadNet) System combining multiple SSR radar stations.

[0027] FLARM obtains its position and altitude readings from an aircraft internal GNSS and a barometric sensor and then broadcasts this together with forecast data about the future 3D flight track using a low range transponder, usually in the 868 MHz ISM/SRD frequency band.

[0028] NRI transmits position data of an aircraft internal GNSS using normal IT network technology based on mobile phone radio connections, using LTE for example. This is usually a very fast communication channel.

[0029] SatCom transmits position data of an aircraft internal GNSS using Satellite Communication, which is usually a slow communication channel.

[0030] External MSDF-data may also be used and assessed as surveillance data SD from a surveillance technology ST.

[0031] Position data, such as aircraft internal GNSS may also be transferred via Direct or Broadcast Remote ID connections (DRID) using wireless LAN networks (WIFI) and/or Bluetooth technologies.

[0032] The invention also relates to a system for repeatedly providing air traffic position data of multiple surveilled aircraft AIR travelling in a surveillance region, wherein surveillance data SD of at least one of said multiple surveilled aircraft AIR are provided over time using at least two different surveillance technologies ST, said surveillance data SD containing at least position data PD of said aircraft AIR and a surveillance technology specific aircraft identifier SA-ID of said aircraft AIR. The system has a data processing device DPD comprising multiple receiving devices RD, at least one data output device OD, a data processing unit DPU, a data selection unit DSU and a data validation unit DVU. The data processing device DPD, or at least one processor of the data processing device DPD is adapted to perform the method as described before or parts thereof, combining all or a selection of the described features in a reasonable manner. As a preferred example, the method may be implemented according to any of the claims 1 to 8.

[0033] There may be at least one processor of the data processing device DPD adapted to perform all the method steps of the receiving devices RD, the data output device OD, the data processing unit DPU, the data selection unit DSU and/or the data validation unit. All these devices may be implemented as interfaces and/or logical units having at least one processor of the data processing device DPD. However, each or some of the interfaces and/or units may be stand-alone entities having own processor devices adapted to perform the steps of the

method related to the respective entity. Preferably, all processors are connected for a data exchange. In case the system also comprises sensor devices of a specific surveillance technologies ST for collection position data PD of the surveilled aircraft, the at least one processor of the data processing device DPD may also be adapted to control the sensor devices and the surveillance technologies ST, for example by a separate bidirectional communication or a bidirectional communication channel included in the surveillance technologies ST.

[0034] Such possibilities are included in the wording of a "data processing device DPD" being adapted to perform the method according to any of the claims 1 to 9"

[0035] A receiving device RD may be an interface of the processing device for connecting to external detector devices, said external detector devices being adapted for receiving communication data sent from surveillance devices according to one of the surveillances technologies ST, said communication data comprising the surveillance data SD. In another embodiment, the external detector devices by be comprised in the receiving devices RD. This means that the receiving devices RD also directly receive the communication data provided by the surveillance technologies ST.

[0036] Accordingly, the multiple receiving devices RD may be adapted for repeatedly receiving said surveillance data SD over time for different surveilled aircraft, wherein said surveillance data SD of each of all different surveillance technologies ST is receivable by at least one of the multiple receiving devices RD. This ensures that all surveillance data SD provided by the different surveillance technologies ST can be received and processed with the proposed system.

[0037] The data output device OD for outputting air traffic position data may be an interface for providing such air traffic position data PD to other appliances, as mentioned before.

[0038] The data processing unit DPU is connected to each of the multiple receiving devices RD for data input of all surveillance data SD received by the receiving devices RD to said data processing unit DPU and is connected to the data output DO for outputting the position data PD contained in the surveillance data SD as air traffic position data PD. The data selection unit DSU may contain the pre-configured input source selector ISS for selecting one the surveillance technologies ST to identify the air traffic position data PD to be outputted. The outputted air traffic position data PD are the position data in the surveillance data SD received from the selected surveillance technology ST. This outputting of the position data PD can be realized real time or quasi real time.

[0039] The data validation unit DVU may be adapted for re-configuring the input source selector ISS, thus ensuring a timely adjustment of the input source selector ISS in case of changes in the surveillance data SD for one physical aircraft, in particular changes in availability and/or quality of the said data.

[0040] Preferably, the data selection unit DSU is con-

nected to the data processing unit DPU and the data validation unit DVU for data exchange. Further, the data validation unit DVU may be connected to the data processing unit DPU, the data validation unit DVU being adapted for receiving the surveillance data SD from the data processing unit DPU. It may be advantageous that the data validation unit DVU is adapted for parallel processing of the surveillance data SD for re-configuration of the input source selector ISS. Parallel processing means that the data validation unit DVU can process the surveillance data SD for assessing, including validity checks and input rating during the re-configuration of the input source selector ISS irrespective of a processing in the data processing unit DPU, which is adapted for output of the selected data, i.e. the position data PD from the selected surveillance technology ST.

[0041] The data selection unit DSU may be realized as a data storage for storing a selection table TAB comprising data accessible by the data processing DPU unit and the data validation unit DVU. These data preferably include at least the receiving device identifier RD-ID (or any other indicator of the surveillance technology ST used for the related surveillance data SD), the surveillance technology specific aircraft identifier SA-ID of said aircraft, the physical aircraft identifier PA-ID, and the rating value RV (as one single value or a combination of multiple single values).

[0042] An advantage of the receiving device identifier RD-ID as indicator of the surveillance technology ST used for the related surveillance data SD is that the system is free to create such indicator and does not depend on possible ID-data-fields include in the surveillance data SD itself. However, receiving device identifier RD-ID may be identical to an ID-data-field in the surveillance data SD itself indicating the surveillance technology SD used.

[0043] Further, the system may comprise sensor devices of a specific surveillance technologies ST for collection position data PD of the surveilled aircraft and transmitting said surveillance data SD to said receiving devices RD. The sensor devices may be controlled by data processing device DPD.

[0044] Further advantages, features and potential applications of the invention also result from the following description of embodiment examples and the drawing. In this context, all features described and/or illustrated together or in any combination meaningful for a skilled person belong to the subject matter of the invention, also independently of their grouping in described or illustrated embodiment examples or in the claims.

Fig. 1 shows a schematic combined system and process diagram of one embodiment of the invention;

Fig. 2 shows a selection table of an input source selector for the embodiment of Fig. 1;

Fig. 3 shows a schematic flow diagram of some meth-

od steps performed according to an embodiment of the method according to the invention;

Fig. 4 shows a schematic combined system and process diagram of another embodiment of the invention;

Fig. 5 shows a selection table of an input source selector for the embodiment of Fig. 4;

Fig. 6 shows a schematic system and process diagram of a data value unit for re-configuration according to the embodiment of Fig. 4; and

Fig. 7 shows a selection table of an input source selector for the embodiment of Fig. 4 after a re-configuration.

[0045] In Fig. 1 is describing one exemplary embodiment of the invention shown in an abstract manner. Aspects of the proposed method and system for repeatedly providing air traffic position data of multiple surveilled aircraft travelling in a surveillance region will be evident from the following description.

[0046] On the top of the diagram an surveilled aircraft AIR is shown having two sensor devices (not shown) of specific surveillance technologies ST for collecting position data and PD(2) of the aircraft AIR. The position data PD(1) is related to a surveillance technologies ST(a) and ST(b), and the position data PD(2) is related to a surveillance technology ST(c).

[0047] For example, position data PD(1) are collected from a global navigation satellite system (GNSS) and position data PD(2) are collected from a radar system, such as Secondary Surveillance Radar (SSR) system. It is emphasized that the position data PD need not to be known in the aircraft AIR or sensor devices for acquiring the position data PD are located in the aircraft AIR. Also, the physical aircraft identifier PA-ID need not to be known in the aircraft AIR. The fact that these data are arranged in the figures in boxes in the area of the aircraft AIR is only to express that these data correlate with the physical aircraft AIR. For example, radar position data are determined in the radar antenna system on the ground and not available in the aircraft AIR.

[0048] The surveillance technologies ST(a) is based on Network Remote ID (NRID) using an IT network server connection based on mobile phone radio to transmit the surveillance data SD(ST(a)). The surveillance technologies ST(b) is based on Automatic Dependent Surveillance Broadcast (ADS-B) using an ADS-B Antenna for radio transmission in the 1000 MHz region to transmit the surveillance data SD(ST(b)). The surveillance technologies ST(b) is using transponder using transmission frequencies in the 1000 MHz region as well to transmit the Surveillance data SD(ST(c)).

[0049] All these technologies provide a surveillance technology specific (meaning "unique") aircraft identifier

SA-IDa, SA-IDb, SA-IDc of said aircraft and the respective position data PD(1), PD(2) in the data format of the surveillance data SD, besides possibly other data fields, as exemplary shown for the surveillance data SD(ST(a)), SD(ST(b)), SD(ST(c)). The SA-IDs are, however, unique only within the same surveillance technology ST, and not globally across all existing data formats for the different surveillance technologies ST.

[0050] In this example, only one surveilled aircraft AIR is shown travelling in the surveillance region covered by the proposed system. Typically, there is more than one physical aircraft AIR in the surveillance region, the positions of these physical aircraft are surveilled by different surveillance technologies ST, and the surveillance data SD of these physical aircraft are provided over the time.

[0051] All of these surveillance data SD are received by receiving devices RD of the system, wherein at least one receiving devices RD is provided for each surveillance technology ST. In the example shown, the receiving devices RD are shown as interfaces for data input a, b, c integrated into a data processing device DPD of the system.

[0052] Providing one receiving devices RD for each surveillance technology ST may not necessarily mean that there is one physical receiver for each surveillance technology ST. If more surveillance technologies ST use an identical transmission channel, one common physical receiver may be used for physically receiving the data in transmission. Further, one surveillance technology ST may be collected or received by different receiving devices RD, using for example different transmission channels.

[0053] Logically, however, one receiving device RD is assigned to one surveillance technology ST. Thus, the system can distinguish the different surveillance technologies ST by the different receiving devices RD receiving the respective surveillance data SD as data input. In other words, different data inputs a, b, c, into the data processing device are DPD are (at least) logically assigned to different receiving devices RD and thus indicative of the specific surveillance technology ST and/or transmission channels used.

[0054] In order to assign the surveillance technology ST used to the surveillance data, a receiving device identifier RD-ID is assigned to the surveillance data SD. This may be performed in the receiving device RD or a data processing unit DPU of the data processing device DPD.

[0055] In a further processing step, a physical aircraft identifier PA-ID is assigned to the received surveillance data SD in accordance with the surveillance technology specific aircraft identifier SA-ID. To this aim, a mapping may be stored in the data processing device DPD, for example in a data selection unit DSU, said mapping containing the surveillance technology specific aircraft identifier SA-ID and a physical aircraft identifier PA-ID only related to the physical aircraft AIR. As result, the incoming surveillance data SD can be allocated to a certain physical aircraft AIR without any need for further investigation,

such as 3D-positioning-correlation of contained position data PD, just by making use of the surveillance technology specific aircraft identifier SA-ID in the input surveillance data SD and the physical aircraft identifier PA-ID contained in the stored mapping.

[0056] For each physical aircraft AIR, one of surveillance technologies ST (or the related surveillance data SD) is selected, and the air traffic position data PD of said selected surveillance data SD / surveillance technology ST is outputted to the data output DO. In Fig. 1, the input a is selected, i.e. the surveillance data SD(ST(a)) received by the receiving device RD_a with the position data PD(1). This is indicated by the dashed line connecting input a with the data output DO.

[0057] The process of selecting is performed using a pre-configured input source selector ISS, which is stored in the data selection unit DSU. The input source selector ISS provides a rating for each data set of the surveillance technology specific aircraft identifier SA-ID and physical aircraft identifier PA-ID as further data the receiving device identifier RD-ID: RD(a), RD(b), RD(c) (correlated with the surveillance technology ST(c), ST(c), ST(c) used or the input a, b, c, respectively) and a rating value RV. The best rating value RV indicates the surveillance data SD to be selected for outputting the position data PD from the surveillance data SD as the air traffic position data PD.

[0058] The rating value RV and the receiving device identifier RD-ID may additionally be stored in the mapping, leading to a stored section table TAB of the input data selector ISS with data information related to the surveillance technology specific aircraft identifier SA-ID, the physical aircraft identifier PA-ID, receiving device identifier RD-ID and the rating value RV.

[0059] For the example of Fig. 1, a possible selection table TAB is shown in Fig. 2, with a selection for the aircraft AIR with the PA-ID = "1 abd-cdef-1234" and the best rating value RV = 1. Accordingly, the input source selector ISS will according to Fig. 2 select the surveillance data SD received by the receiving device RD = "RD(a)" corresponding to input "a" and the surveillance technology "SA-IDa", as shown in Fig. 1.

[0060] As this selection table TAB is predefined, the selection of one from the surveillance data SD correlated with one of the surveillance technologies ST can occur immediately upon receipt of the surveillance data SD, without any further processing and/or assessing of the surveillance data SD to be performed. Due to the rating value RV stored in the input source selector ISS, the actually best input data of the position data PD can be selected and used for the output of the position data PD to following appliances.

[0061] In contrast to the prior art, no fusion of the data (multi sensor data fusion MSDF) is performed according to the invention, but a selection of the best and most trustful data source is applied. This leads to faster and more precise position data because the selection of the data does not involve time consuming data processing,

and the best available data are chosen in contrast to sensor data fusion where the best available sensor data may be blurred with worse data by estimating the most probable position.

[0062] According to the invention, another solution is found for minimizing the risk of choosing not the best position data from the plurality of position data provided by the multiple surveillance systems.

[0063] Parallel to or after selecting and outputting the best available position data PD based on the pre-configured input source selector ISS, a re-configuration of the input source selector ISS is performed based on all received surveillance data SD. During re-configuration, all incoming surveillance data SD are processed and validated by assessing the incoming data. As a result of the validation / assessment, the rating values RV of the input source selector ISS are adjusted (amended or confirmed) for each of the received surveillance data SD to ensure the best data source (surveillance data SD) is selected by selecting one of the surveillance technologies ST and outputting the best available position data PD contained in the surveillance data SD related to the selected surveillance technology ST.

[0064] The re-configuration can be accomplished in a data validation module DVU. As shown in Fig. 1, all surveillance data SD(ST(a)), SD(ST(b)), SD(ST(c)) received by the receiving devices RD(a), RD(b), RD(c) are transmitted by the data processing unit DPU to the data validation unit DVU for parallel processing of the data. In a first step of re-configuration, assessing and validating of the data is performed. This may comprise at least one of the following criteria or assessing steps:

1. Assessing quality of data in the data transmission to each of the receiving devices RD in the surveillance data SD.

Input types, i.e. surveillance data from a specific surveillance technology ST, can be assigned with quality indicators with a specific value of a value range. If the data does not meet this quality indicator, it can be flagged as "currently degraded" for the rating value RV meaning that these data shall not be used. The rating value RV may be a null-value.

Example: A value to assess may be the input delay due to transmission measured in time [s]: if the delay value is too high, the input is marked as "currently degraded". For a Network Remote ID transmitted via LTE and Internet, a delay limit could be set to "xxx ms".

2. Assessing a comparison of position data PD.

For example, position data PD contained in the different surveillance data SD for the same aircraft AIR can be compared. Comparison of position data PD received via different surveillance technologies ST is utmost effective if the position data is measured from independent sensor devices. Example: Position data PD from a surveillance technology ST "Net-

work Remote ID (NRID)" and from a surveillance technology ST "ADS-B" most likely originate from independent GNSS sensor devices. Matching GNSS positions (position data PD) can increase the rating value RV, not matching positions can lower the rating value RV. If, to the contrary, different surveillance technologies ST use the same GNSS sensor device, comparing these data would not result in a gain in information as the source of the data is the same. This may also be considered for assessment and assigning a rating value.

3. Assessing the quality of the sensor technology used for determining the position data PD.

If quality indicators are contained within the surveillance data related to the precision of the position data PD, they may be part of the validation and assessment.

Example: A quality indicators may be the dilution of precision for GNSS: if a precision value provided by the aircraft via the surveillance technology ST this implies that the data source is not precise enough. The data quality rating value may be adapted.

4. Pre-assigned priorities related to different receiving devices (RD) and/or surveillance technologies (ST).

Surveillance data SD can be assigned with an additional weight (rating value RV) to ensure a natural prioritization of inputs due to precision and time delay in providing the position data.

Example: ADS-B data has a very high update frequency, and as a result should be preferred instead of ATC Secondary Surveillance Radar with a lower update frequency as long as the quality of the data is equally good. This is explained more in detail in a further embodiment of the invention according to Figures 4 to 7. This additional weight may be determined once and not amended during re-configuration.

[0065] Accordingly, the pre-assigned priorities (criterion / step 4) are static values, in particular based on an assessment of one surveillance technology ST in relation other service technologies ST. The other assessment steps 1 to 3 are dynamic values, as these are based on the actual received data.

[0066] As a result of the assessing and validating the surveillance data SD, the rating values RV for the surveillance data in the selection table TAB of the input source selector ISS stored in the data selection unit DSU is updated by the data validation unit DVU. In case of a change in the rating, the rating value RV in the selection table TAB may lead to a change of the surveillance technology ST and the output of position data PD from surveillance data SD related to the new selected surveillance technology. This ensures that the actual best data are selected as position data PD, while using all received surveillance data for the re-configuration of the input

source selector ISS. The re-configured input source selector ISS is used as pre-configured input source selector ISS for all surveillance data (SD) received thereafter, until a new re-configuration is performed.

[0067] In the example of Fig. 1, the pre-configured input source selector ISS selects input "a" (as indicated in the dotted arrow) with the received surveillance data SD(ST(a)) by the receiving device RD_a for the output of the related position data PD. After a change of the rating values RV in the input source selector ISS, the input "c" may be selected, with the surveillance data SD(ST(c)) received by the receiving device RD_c (which is not shown in Fig. 1).

[0068] Fig. 3 show a schematic flow diagram of some method steps performed according to an embodiment of the method according to the invention. Surveillance data SD of one of the surveillance technologies ST are received from an aircraft AIR in a receiving device RD related to the surveillance technology ST, said receiving device RD being an input interface to the data processing unit DPU. The proposed method is performed in two independent processing branches, preferably in parallel.

[0069] In the first processing branch, the data processing unit DPU assigns a physical aircraft identifier PA-ID to the received surveillance data SD, the receiving device identifier RD-ID being already assigned to the received surveillance data SD, and selects for each of the physical aircraft identifiers PA-ID one of the surveillance technologies ST used for this aircraft. In this first step, the data processing unit DPU accesses the data selection unit DSU with a table TAB relating the surveillance technology specific aircraft identifier SA-ID to a physical aircraft identifier PA-ID and the input source selector ISS for selecting a surveillance technology ST for this aircraft. This may be performed by a rating value RV in the table TAB associated with the physical aircraft identifier PA-ID and the receiving device identifier RD-ID as indicator of the surveillance technology ST.

[0070] In a second step (SEL?) it is checked if the actually received surveillance data SD are related to the selected surveillance technology ST. If this is true, the position data PD of the actual surveillance SD data are outputted via the output device OD as an interface to other appliances. If this is not true, processing in this processing branch terminates (TRM).

[0071] In the second processing branch, all surveillance data SD received are processed in the data validation unit DVU for a re-configuration of the table TAB / input source selector ISS stored in the data selection unit DSU. The re-configuration may comprise both, validation and assessing of the surveillance data and/or checking and amending the relation between RD-ID and PA-ID. Both aspects are described in more detail in the other embodiments of the invention. As a result, the table TAB / input source selector ISS are updated (UPDT) for use with the coming surveillance data received. It is emphasized that the data selection unit DSU is preferably one single unit despite being shown twice in the flow diagram

of Fig. 3 to clarify that the processes in the first and second branch are not correlated.

[0072] According to an embodiment, the relation between RD-ID and PA-ID and the rating values RV of the input source selector ISS may be stored in one and the same or different tables TAB.

[0073] Fig. 4 shows a more specific embodiment of the invention. The structure, function and steps correspond to the embodiment of Fig. 1 and the flow diagram of Fig. 3. The description of Figures 1 and 3 related to the basic functions and elements is therefore valid also for Fig. 4 and will not be repeated here.

[0074] In the example of Fig. 4, a physical aircraft identifier PA-ID and a plurality of sensor positions and/or devices are related with the surveilled aircraft AIR, each providing position data PD(x), with $x = 1$ to 3 for three detector devices. The position data PD are provided using different surveillance technologies ST being ADS-B, FLARM, NRID and SatCom wherein the ADS-B technology is used with ADS-B antennas, with MLAT-Antennas and with radar technology SSR transponders, each being considered a separate source of surveillance technology ST. The different technologies have been explained before. Surveillance technologies ST NRID and SatCom are transferred via data communication networks to server devices.

[0075] The receiving devices RD used are different antennas, transponder or servers, respectively, for surveillance technologies ST being ADS-B, MLAT, SSR, FLARM, NRID, SatCom, which are also used as receiving device identifiers RD-ID indicative of the surveillance technology ST used. These multiple receiving devices RD are connected to the data processing device DPD via data interfaces a, b, c, d, e, f for inputting the surveillance data SD (containing, inter alia, as data field the surveillance technology specific aircraft identifier SA-ID and the related position data P(x)) to the data processing unit DPU.

[0076] Further, as an optional feature, surveillance data SD may be available from a fusion device FD for a multi sensor data fusion MSDF as described above, resulting also in (estimated) position data PD of the aircraft AIR. These sensor data may be considered as position data PD of another surveillance technology ST denoted as MSDF received by a receiving device RD with the receiving device identifier RD-ID "MSDF" and inputted via a data interface g to the data processing unit DPU or data processing device, respectively.

[0077] The data processing unit DPU thus processes seven different surveillance technologies ST identified by a unique receiving device identifier RA-ID and assigned with the surveillance technology specific aircraft identifier SA-ID. This is evident from Fig. 5 showing a selection table TAB if the input source selector ISS at a certain time. Surveillance data SD of all surveillance technologies ST have received for a first surveilled aircraft AIR with the physical aircraft identifier PA-ID = "PAC-1". Further, surveillance data SD have also been received

for a second surveilled aircraft AIR with the physical aircraft identifier PA-ID = "PAC-2" for the surveillance technology ST = "ADS-B". It is emphasized that the table TAB shown in Fig. 2 is a simplified exemplary view of a table TAB. In particular, the shown table TAB may be an extract of a real table with much more surveilled aircraft in the surveillance region.

[0078] It is assumed that the physical aircraft identifiers PA-ID are already known, and all received data have been classified as valid data, indicated by a rating value $RV(SD) = 1$. This rating value $RV(SD)$ is a dynamic rating value, as it depends on the receipt of surveillance data SD and their assessment. As long as no surveillance data SD have been received from a physical aircraft AIR, this dynamic rating value $RV(SD)$ may be null. After receipt of surveillance data SD from one surveillance technology ST, the assigned rating value $RV(SD)$ may be stored for a certain (e.g. predefined) time period. If no surveillance data SD from this surveillance technology ST and aircraft AIR have been received for a time span longer than this time period, the rating value $RV(SD)$ may be reset to null.

[0079] These data are for illustration purposes only. In particular, the table TAB and the rating system may be more refined and sophisticated in practice. For example, a self-learning or self-correcting table TAB may be achieved.

[0080] In this context, for example, assessing a comparison of position data PD during re-configuration may be used to check the relation of the surveillance technology specific aircraft identifier SA-ID and the physical aircraft identifier PA-ID. This relation may be adapted if, for example, two position values PD related to the identical physical aircraft identifier PA-ID move simultaneously and independently of one another. Then, these surveillance data SD relate to different aircraft AIR and have to be assigned to different physical aircraft identifier PA-IDs.

[0081] As pre-assigned priorities related to different receiving devices RD and/or surveillance technologies ST, the selection table TAB shows as an additional list value LV for rating which defines a fixed input priority in case that the assessment of the received surveillance data SD indicates that all data have been received within a defined quality range and are rated as valid data (as the case in Fig. 5). Then, the surveillance data SD with the (in this example) smallest rating value LV will be chosen.

[0082] Thus, a combined rating value RV is composed of the two independent (sub) values LV and $RV(SD)$ as discussed before.

[0083] For the present example of Fig. 5, the NRID denoted data stream (receiving device identifier RD-ID), which is usually the fastest data to be received, has the best rating value RV. These data will be selected by the input source selector ISS to be forwarded as position data PD to the output device OD.

[0084] Further, all surveillance data SD received via the data interfaces a to g (input channels) are forwarded to the data validation unit DVU for assessing and validat-

ing of the data, as in general described also for the example according to Fig. 1. In the following, an example for possible steps assessing and validating the surveillance data SD for the specific surveillance technologies ST are described referring to Fig. 6. The method steps described are explanatory only and may be combined with other features of the invention in any useful manner, as the skilled person will understand. The method steps described may also be adapted to other surveillance technologies and/or arranged in a different order, where appropriate.

[0085] The step of re-configuring the input source selector ISS, as realized according to the example of Fig. 6, comprises up the six method steps S1 to S6 of processing and/or assessing for the surveillance data SD received from different surveillance technologies ST, or receiving devices RD, as indicated. Receiving devices RD, such as antennas, transponder or servers, may add a high precision time stamp indicating the time of receiving of the surveillance data in the receiving device RD.

[0086] The first step S1 may be a surveillance technology ST and/or input specific basic timing check, making use of added time stamp in the receiving device RD or inherent data of the related surveillance technology and/or communication channel. This timing check may in particular be directed to the time of delay between collecting the position data PD and/or surveillance data SD according to the surveillance technology ST and their receipt in the system. A normal delay time range may be checked against an actual delay time determined in step S1. A too long delay time may be assessed, leading to a degrading of the data. The surveillance technologies ST, where step S1 may be performed according to the present example, are evident from Fig. 6.

[0087] In a second step S2, format specific quality indicators may be checked and/or processed. For the ADS-B surveillance technology ST using ADS-B antennas in the communication channel, an analysis of the accuracy, integrity and uncertainty indicators may be performed (a2). The position data PD are GNSS data contained in the surveillance data. For ADS-B surveillance technology ST using MLAT antennas, MLAT processing is performed to calculate a position for assigning positing data PD (b2). As the Network Remote ID (NRID) surveillance technology ST is no broadcasting technology, the aircraft sets up a network connection via LTE to the receiving device RD, which is usually a server, and transmits the data directly to this server. Such NRID data may be processed such that - after adding a high precision time stamp through the receiving server (e1) - accuracy, integrity and uncertainty indicators included in the data message are analyzed and assessed (e2). Detection of failures or unwanted accuracies may lead to degrading of the data.

[0088] In a third step S3, a surveillance technology specific position validations are performed. For the ADS-B surveillance technology ST it is clear that the position data of the receiving devices with the receiving device identifiers RD-ID and MLAT shall related to the identical

position, despite using different position sensors (GNSS data in the data message and multilateration of the received data message). Accordingly, a multi sensor data comparison or validation may be performed limited to these sensor data for a surveillance technology specific position validation (ab3). Similar applies to SSR radar data processed in a Radar Network (RadNet) receiving broadcasted radar response at different locations (c3). For NRID data, cell ID validation may be performed assessing a match between a LTE cell of the data source to the geographical position data PD in the data itself. Detection of failures, unwanted or intentional inaccuracies may lead to degrading of the data.

[0089] To be able to correlate the independent data sources, such as ADS-B, FLARM, NRID and Satcom, a lookup of the IDs contained in the messages is performed in the predefined ID mapping table in step S4, as indicated in the selection tables TAB of Figs. 5 and 7.

[0090] As a result of this method step S4, the independent messages can be mapped to the same aircraft AIR as source, thus having the same physical aircraft identifier PA-ID. If one of the surveillance data SD cannot be assigned to a physical aircraft identifier PA-ID, these data may be degraded and not used as position data for the output device OD.

[0091] In method step S5, a position validation is performed. The position data between the different data sources from the same aircraft (due to the mapping process) can be compared to validate the quality of the position. This may be accomplished using multi sensor data fusion (MSDF) and/or other methods. In step S5, also an update of the relation between the surveillance technology specific aircraft identifier SA-ID and the physical aircraft identifier PA-ID, if the relation is found not to be correct.

[0092] Based on the before described assessment results, rating values RV for each of the surveillance data are determined (including confirming or amending). This serves as input rating for each data stream as basis for the invention, which also may be described as Multi-Sensor Best Data Selection (MSBDS). Accordingly, in method step S6, the rating value RV is written or updated in the selection table TAB, stored as input source selector ISS in the data selection unit DSU.

[0093] A (simplified) example of the selection of one of the surveillance data SD with the input source selector ISS is described with respect to Fig. 5 and Fig. 7 showing selection tables TAB in the course of time.

[0094] For the physical aircraft AIR with the physical aircraft identifier PA-ID in a previous surveillance period, surveillance data by all receiving devices RD with the identifiers ADS-B, MLAT, SSR, FLARM, NRID, SatCom, MDSF have been validly received. The pre-configured input source selector ISS indicates this status by (sub) rating values RV(SD) = 1 of the overall rating value RV. This is the result of a previous re-configuration as shown in and described with respect to Fig. 6. In this case due to the input priority (reflected in the list value LV of the

rating value RV) the NRID data stream is the one with the highest overall priority (best rating value RV) and selected for use and for outputting the position data of the respective surveillance data SD. All other data streams are used for continuous validation and rating during the re-configuration step for the input source selector ISS.

[0095] In the course of time, as a first event, a delay on the LTE network connection occurs. The NRID timestamp get out of the prescribed boundaries and data quality reduces. As a result, the NRID input rating is reduced from $RV(SD) = 1$ to $RV(SD) = 0$. As the ADS-B input is not affected by these changes, it becomes the best rated input and the data stream used is switched to ADS-B as a source in the coming re-configuration process.

[0096] As a second event, a problem in the frequency band of ADS-B, MLAT and SSR occurs. Immediately, ADS-B, SSR and MLAT operating in this frequency range become degraded in a re-configuration process. The input rating of these specific inputs are degraded.

[0097] The result of the first and second event are reflected in the input source selector ISS of Fig. 7. As FLARM is operating on 868 MHz, it is available with all quality indicators in the boundaries and becomes the best rated input and the data stream used is switched to FLARM as a source.

[0098] If, as a third event, the delay on the LTE network connection reduces, the NRID timestamps return to the prescribed boundaries again and data quality increases. As a result, the NRID input rating increases as well in a following reconfiguration process. After this change, NRID becomes the best rated input and the data stream used is re-switched to NRID as the active source.

[0099] Important advantages of the method and system according to the invention are that input rating calculation in the re-configuration process is independent of the real time signal chain. The validation can take place in parallel to the selection of the best data stream. Real positions are passed to the output to following systems. There is no need to calculate and estimate positions with certain probabilities as in the multi sensor data fusion. As there is a fixed link in the mapping table between the surveillance technology data source (e.g. ADS-B Transponder) and the aircraft it is physically mounted on, the risk of duplicate tracks due to errors in the data of one input is reduced.

Claims

1. Method for repeatedly providing air traffic position data of multiple surveilled aircraft (AIR) travelling in a surveillance region, wherein surveillance data (SD) of at least one of said multiple surveilled aircraft (AIR) are provided over time using at least two different surveillance technologies (ST), said surveillance data (SD) containing at least position data (PD) of said aircraft (AIR) and a surveillance technology specific aircraft identifier (SA-ID) of said aircraft (AIR), where-

in said method comprises

- (1) for different surveilled aircraft (AIR), repeatedly receiving said surveillance data (SD) over time by multiple receiving devices (RD) and assigning a receiving device identifier (RD-ID) to the surveillance data (SD);
- (2) assigning a physical aircraft identifier (PA-ID) to the received surveillance data (SD) in accordance with the surveillance technology specific aircraft identifier (SA-ID);
- (3) for each of the physical aircraft identifiers (PA-ID), selecting with a pre-configured input source selector (ISS) one of the surveillance technologies (ST) and outputting the air traffic position data (PD) of surveillance data (SD) received from the selected surveillance technology (ST);
- (4) re-configuring the input source selector (ISS) based on all surveillance data (SD) received, wherein re-configuring comprises assessing the surveillance data (SD) using at least one of the following:

- (a) assessing quality of data in the data transmission to each of the receiving devices (RD);
- (b) assessing a comparison of position data (PD);
- (c) assessing the quality of the sensor technology used for determining the position data (PD);
- (d) pre-assigned priorities related to different receiving devices (RD) and/or surveillance technologies (ST);

and assigning a rating value (RV) to the surveillance data (SD) based on the assessing of the surveillance data (SD).

2. Method according to claim 1, wherein one individual input source selector (ISS) is provided for each surveilled aircraft (AIR).
3. Method according to claim 1 or 2, wherein the step of selecting the surveillance technology (ST) and outputting of the position data (PD) of the surveillance data (SD) received from the selected surveillance technology (ST) and the step of re-configuring the input source selector (ISS) are processed in parallel.
4. Method according to any of the preceding claims, wherein selecting one of the surveillance technologies (ST) with said pre-configured input source selector (ISS) comprises

accessing a selection table (TAB) having data

- sets of an indication of the surveillance technology (ST) used, the surveillance technology specific aircraft identifier (SA-ID) of said aircraft, the physical aircraft identifier (PA-ID) and the rating value (RV), wherein at least the best rating value (RV) is unique;
 identifying the indication of the surveillance technology (ST) used with the best rating value (RV).
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5. Method according to any of the preceding claims, wherein the receiving devices (RD) add a time stamp to the surveillance data (SD) indicating the time of receipt of the surveillance data (SD) in the receiving device (RD).
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6. Method according to any of the preceding claims, wherein assessing quality of data in the data transmission to each of the receiving devices (RD) comprises at least one of the following:
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- assessing delay time during data transmission;
 - assessing quality indicators contained in the received surveillance data SD;
 - assessing failure messages of the communication system.
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7. Method according to any of the preceding claims, wherein said method further comprises determining the position data (PD) of the surveilled aircraft using sensor devices of a specific surveillance technologies (ST).
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8. Method according to the any of the preceding claims, wherein the position data (PD) of the surveilled aircraft are based on and/or transmitted by at least one of the surveillance technologies (ST):
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- Automatic Dependent Surveillance Broadcast (ADS-B) using at least one of the following transmission technologies, each of which being in combination with ADS-B a different surveillance technology ST, such as ADS-B Antennas for radio transmission, Multilateration-Antennas (MLAT) for radio transmission and/or Secondary Surveillance Radar (SSR);
 - Flight Alarm (FLARM) using radio transmission;
 - Network Remote ID (NRID) using an IT network server connection based on mobile phone radio;
 - Satellite Communication (SatCom) using an IT network server connection;
 - Multi Sensor Data Fusion (MSDF) from multiple surveillance technologies
 - Direct or Broadcast Remote ID (DRID) using wireless LAN networks and/or Bluetooth
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9. System for repeatedly providing air traffic position
- data of multiple surveilled aircraft (AIR) travelling in a surveillance region, wherein surveillance data (SD) of at least one of said multiple surveilled aircraft (AIR) are provided over time using at least two different surveillance technologies (ST), said surveillance data (SD) containing at least position data (PD) of said aircraft (AIR) and a surveillance technology specific aircraft identifier (SA-ID) of said aircraft (AIR), said system having a data processing device (DPD) comprising
- multiple receiving devices (RD) adapted for repeatedly receiving said surveillance data (SD) over time for different surveilled aircraft, wherein said surveillance data (SD) of each of all different surveillance technologies (ST) is receivable by at least one of the multiple receiving devices (RD);
- a data output device (OD) for outputting air traffic position data (PD);
- a data processing unit (DPU) connected to each of the multiple receiving devices (RD) for data input of all surveillance data (SD) received by the receiving devices (RD) to said data processing unit (DPU) and connected to the data output (DO) for outputting the position data (PD) contained in the surveillance data (SD);
- a data selection unit (DSU) with a pre-configured input source selector (ISS) for selecting one the surveillance technologies (ST);
- a data validation unit (DVU) for re-configuring the input source selector (ISS);
- said data processing device (DPD) being adapted to perform the method according to any of the claims 1 to 8.
10. System according to claim 9, wherein the data selection unit (DSU) is connected to the data processing unit (DPU) and the data validation unit (DVU).
11. System according to claim 9 or 10, wherein the data selection unit (DSU) is a data storage for storing a selection table (TAB) comprising data, such data being accessible by the data processing unit (DPU) and the data validation unit (DVU).
12. System according to any of the claims 9 to 11, wherein the data validation unit (DVU) is connected to the data processing unit (DPU) and adapted for receiving the surveillance data (SD) from the data processing unit (DPU).
13. System according to any of the claims 9 to 12, wherein data validation unit (DVU) is adapted for parallel processing of the surveillance data (SD) for re-configuration of the input source selector (ISS).

14. System according to any of the claims 9 to 13, wherein the system comprises sensor devices of specific surveillance technologies (ST) for collecting position data (PD) of the surveilled aircraft and transmitting said surveillance data (SD) to said receiving devices (RD). 5

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Fig. 1

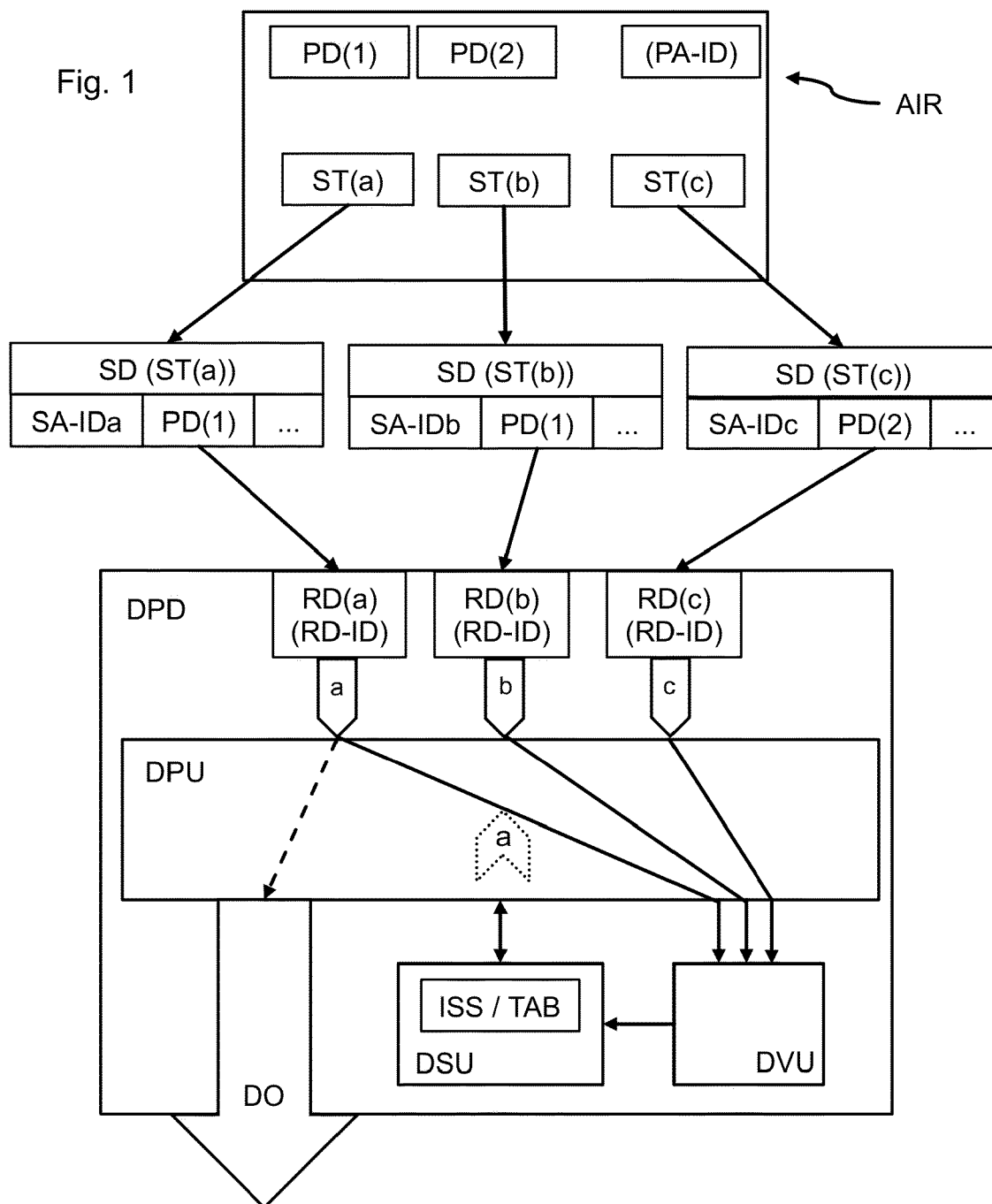


Fig. 2

SA-ID	PA-ID	RD-ID	RV
SA-IDa	1abd-cdef-1234	RD(a)	1
SA-IDb	1abd-cdef-1234	RD(b)	3
SA-IDc	1abd-cdef-1234	RD(c)	2

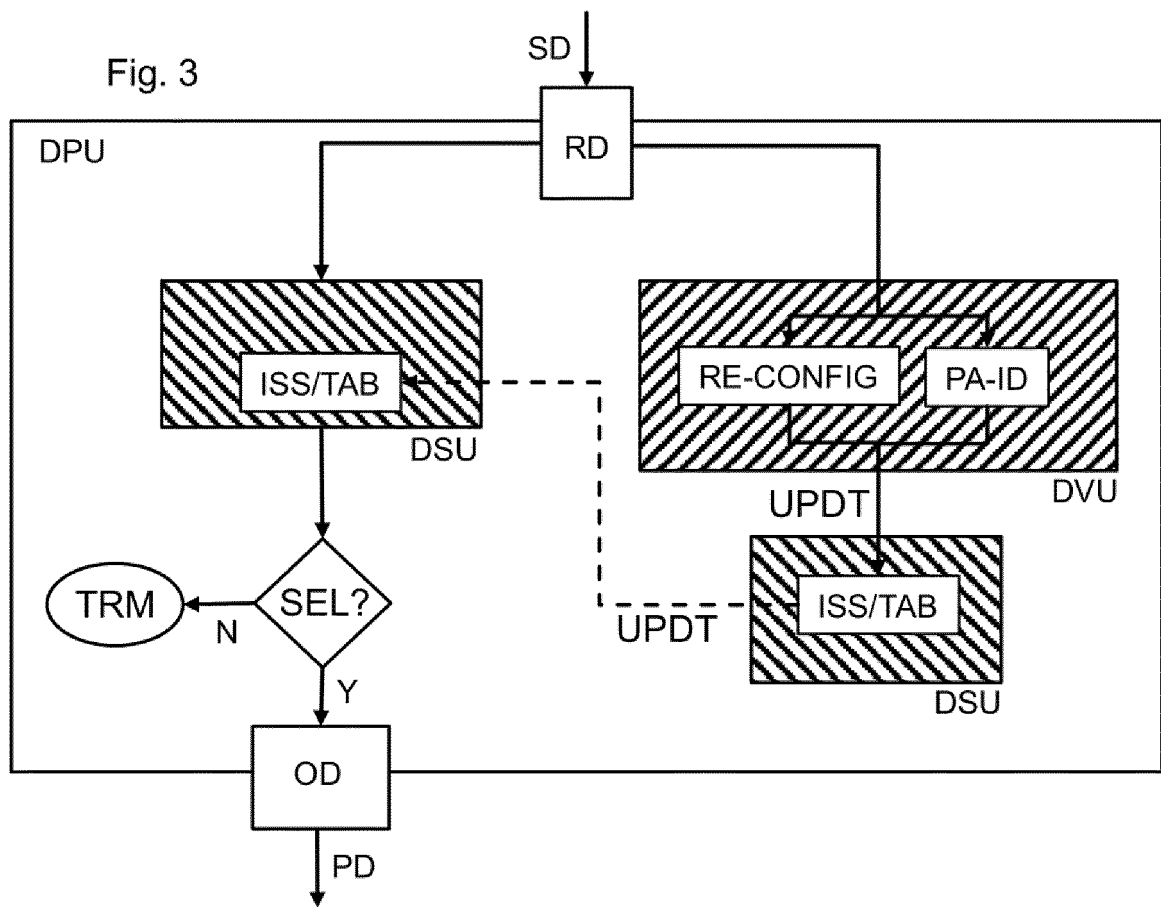


Fig. 4

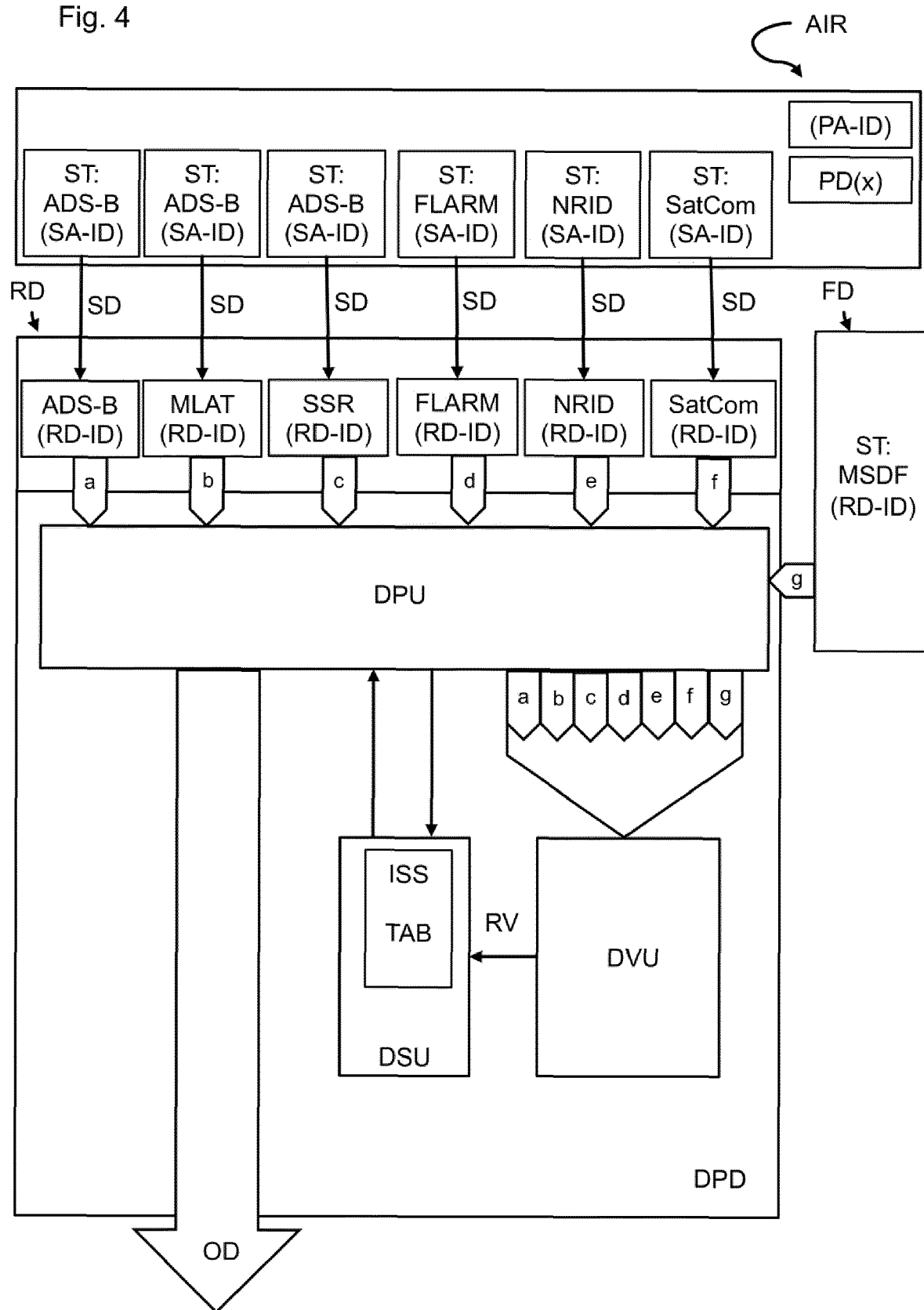


Fig. 6

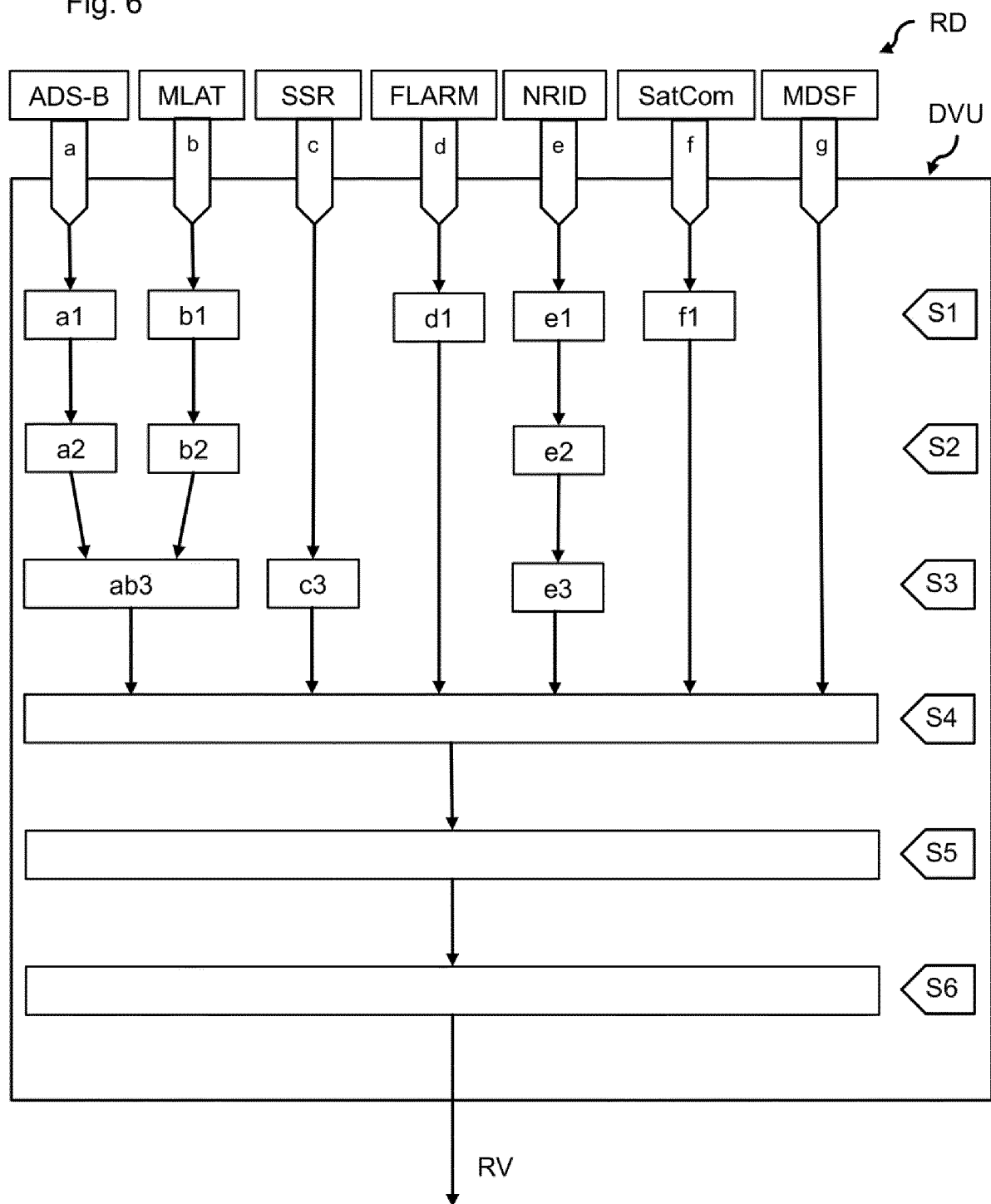


Fig. 5

SA-ID	PA-ID	RD-ID	RV	
			LV	RV(SD)
SA-IDb	PAC-1	NRID	1	1
SA-IDa	PAC-1	ADS-B	2	1
SA-IDc	PAC-1	SSR	3	1
SA-IDd	PAC-1	FLARM	4	1
SA-IDf	PAC-1	MLAT	5	1
SA-IDe	PAC-1	SATCOM	6	1
SA-IDg	PAC-1	MSDF	7	1
SA-IDa	PAC-2	ADS-B	2	1

Fig. 7

SA-ID	PA-ID	RD-ID	RV	
			LV	RV(SD)
SA-IDb	PAC-1	NRID	1	0
SA-IDa	PAC-1	ADS-B	2	0
SA-IDc	PAC-1	SSR	3	0
SA-IDd	PAC-1	FLARM	4	1
SA-IDf	PAC-1	MLAT	5	0
SA-IDe	PAC-1	SATCOM	6	1
SA-IDg	PAC-1	MSDF	7	1
SA-IDa	PAC-2	ADS-B	2	1



EUROPEAN SEARCH REPORT

Application Number

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	Anonymous: "POWERFLARM FUSION USER AND MAINTENANCE MANUAL", / 10 May 2021 (2021-05-10), XP093042913, Retrieved from the Internet: URL: https://flarm.com/wp-content/uploads/man/FTD-078-PowerFLARM-Fusion-User-and-Maintenance-Manual.pdf [retrieved on 2023-04-28] * Section 6.2.1 * * Section 1 * * Section 6.5 * -----	1-14	INV. G08G5/00 G01S5/00
X	US 9 310 477 B1 (SAMPIGETHAYA RADHAKRISHNA G [US]) 12 April 2016 (2016-04-12) * abstract; figure 1 * * column 3, line 25 - column 5, line 36 * -----	1-14	TECHNICAL FIELDS SEARCHED (IPC) G08G G01S
The present search report has been drawn up for all claims			
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