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(54) Title: METHOD FOR CONTROLLING A DISPLAY MODE IN A COMBAT AIRCRAFT

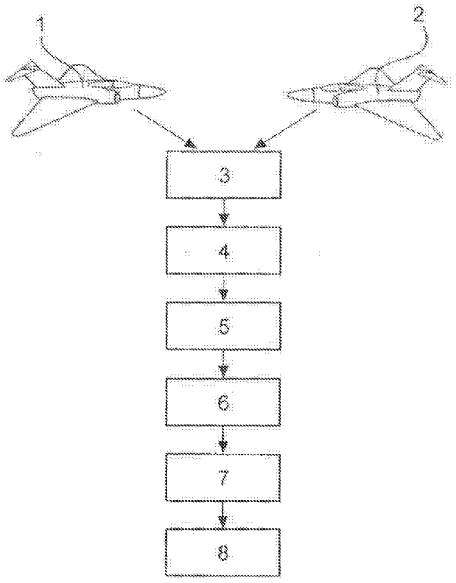

Fig. 1

(57) Abstract: The invention relates to a method for controlling a display mode in a combat aircraft (1) comprising the steps of: a) determining (3) sensor capacity of an enemy combat aircraft (2), b) forming (4) a detection area based on the determined sensor capacity from the previous step a), c) determining (5) the position of the combat aircraft (1) relative to the detection area, and d) controlling (6) the display mode based on the determined difference in position from the previous step c), wherein the determined difference in position is adapted for indicating whether the combat aircraft (1) is inside or outside the detection area. In this way, the pilot gets a quick overview and can make an efficient decision with regard to choosing the tactics in a combat situation.

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METHOD FOR CONTROLLING A DISPLAY MODE IN A COMBAT AIRCRAFT

Field of the invention

The invention relates to a method for controlling a display mode in a combat aircraft.

Background of the invention

Document US 6,567,014 B1 describes an aircraft head up display system that displays a basic mode, an en route mode, or an approach/landing mode. When the aircraft attitude changes to predefined unusual attitude conditions, the display changes to an unusual attitude mode to indicate the unusual attitude condition. The display in the unusual attitude mode removes non-essential symbols and displays the aircraft air speed, altitude and attitude.

Highly developed functions for human machine interface, HMI for short, and decision support as support functions for the pilot environment in combat aircraft already exist. All solutions are based on and adapted for high tempo in flight and combat situations where HMI and decision support together describe the current position and display tools and solutions to the pilot. Existing solutions are based on the aircraft itself and its available resources and tools. Sensors, such as radar, are typically operated by the pilot as a tool for close-range scanning or for scanning objects for identification and continued pursuit. Decision support supports the multiple use of sensors by merging objects

detected by several different sensors and coordinating and correlating these objects in a situation picture. This is usually done via networks in further steps to create a common situation picture between several aircraft within an aircraft group.

When complexity increases because more tools and sensors are supplied, the possibilities available to the pilot to control his tools and/or sensors in time are limited and made difficult. In time-critical situations, for instance in air combat, the pilot risks becoming the underdog. Another limitation is the fact that each tool and/or sensor has its own characteristics and peculiarities. Each sensor and/or tool therefore requires its own interface and control functions which the pilot needs to be able to understand and use correctly.

Summary of the invention

It is the object of the invention to provide a possibility for controlling a display mode such that the pilot gets a quick overview.

This object is achieved by the subject matter of independent claim 1. Preferred embodiments are defined in the sub claims.

According to an aspect of the invention, this object is achieved by a method for controlling a display mode in a combat aircraft comprising the steps of: a) determining sensor capacity of an enemy combat aircraft, b) forming a detection area based on the determined sensor capacity from the previous step a), c) determining the position of the combat aircraft relative to the detection area, and d) controlling the display

mode based on the determined difference in position from the previous step c), wherein the determined difference in position is adapted for indicating whether the combat aircraft is inside or outside the detection area.

According to a preferred embodiment of the invention, the method comprises the step of recording sensor capacity and detection area, wherein the recorded data is adapted for generating a situation picture. The method preferably comprises the step of displaying the recorded data corresponding to displaying a plurality of situation pictures.

According to a preferred embodiment of the invention, the step of determining sensor capacity of the enemy combat aircraft is performed by detecting or by assuming the sensor capacity of the enemy combat aircraft. The detection of sensor capacity of the enemy combat aircraft is preferably done when the enemy combat aircraft is in proximity to the combat aircraft.

According to a preferred embodiment of the invention, the display mode is selected based on a predetermined condition comprising the determined change in position relative to a predefined zone. The predefined zone preferably corresponds to a geographic zone adapted for defining the detection limit of the enemy combat aircraft of to a geographic zone adapted for defining a shoot-down limit of the enemy combat aircraft, respectively, wherein the geographic zone is adapted for decision support of the combat aircraft in a combat situation with the enemy combat aircraft. Detecting is preferably performed by a sensor, such as radar, a database and/or a link.

According to a preferred embodiment of the invention, controlling the display mode is performed in a continuous fashion such that the display is continuously switched between different modes when a probabilistic value is exceeded,

wherein the probalistic value is determined by at least one of a predefined detection criterion, a predefined identification criterion and a predefined behaviour criterion of the enemy combat aircraft. Such a predefined criterion preferably comprises a predefined altitude limit, a predefined speed limit and/or a combat tactical criterion, such as at least one sensor parameter and/or a weapon limit.

The terms "in a continuous fashion" and "continuously switched" refer to the switching of the display mode and mean that switching of the display mode is done continuously in time and/or in frequency. This is preferably done in a way such that a user cannot perceive a discrete change on the screen of the display. This preferably corresponds to the fact that a change of the display mode is done such that the display screen shows the change of the display mode without punctuation or without interruption, i.e. the user cannot perceive the change of display mode by a discrete fluctuation on the display screen itself.

According to a preferred embodiment of the invention, the enemy combat aircraft corresponds to at least one of a ground station, an unmanned aerial vehicle and a helicopter.

It is an idea of the invention that the step of controlling, i.e. step d), is adapted for decision support when preferably handled three dimensionally, i.e. the calculations in the previous steps referring to the determination of different parameters, such as sensor capacity and position, are

performed in three dimensions. However, a two dimensional display for the pilot is typically sufficient for decision support.

It is an idea of the invention that the aircraft adapts its HMI to the pilot based on the assessed combat situation. Preferably, the adaptation is achieved by two modes: Firstly, the pilot's own aircraft is assessed not to have been detected. This situation picture is recorded on the basis of a zone perspective with different zones indicated on the basis of the overall enemy situation. Secondly, the pilot´s own aircraft is assessed to have been detected. The situation picture assumes a duel mode in which every enemy aircraft is recorded from a duel perspective. In this way, a good overview of combat in an early stage is provided by means of an overall perspective based on zone areas. In more intensive combat, where survival is assesses as critical, the perspective shifts to a duel situation with a duel against every defined enemy aircraft. It is a further idea of the invention to adapt to different situations. Preferably it is switched between a zone mode and a duel mode, wherein the duel mode is on top priority. If the pilot is inside the detection area it is switched to a duel mode and a duel with every opponent is established. If the pilot is outside of the detection area it is switched to a zone mode such that the pilot gets an overview over the complete situation. In the duel mode, there are restricted volumes of interest, i.e. the object is of interest. In the zone mode, there are areas of interest. Hence, it is an idea of the situation to provide a situation-adapted method in order to be almost always aware of the current situation.

Brief description of the drawings

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

In the drawings:

Fig. 1 illustrates the steps of a method for controlling a display mode in a combat aircraft according to a preferred embodiment of the inventions; and

Fig. 2 shows an HMI display mode controlled in a combat situation with zone mode or duel mode according to another preferred embodiment of the invention.

Detailed description of embodiments

Fig. 1 shows the steps of a method for controlling a display mode in a combat aircraft according to a preferred embodiment of the invention. Firstly, sensor capacity of an enemy combat aircraft 2 is determined 3. Secondly, a detection area based on the determined sensor capacity from the previous step is formed 4. Thirdly, the position of the combat aircraft 1 relative to the detection area is determined 5, and, finally, the display mode is controlled 6 based on the determined difference in position from the previous step. The determined difference in position is adapted for indicating whether the combat aircraft is inside or outside the detection area. In further steps, it is possible to record 7 sensor capacity and detection are and to display 8 the recorded data.

Fig. 2 shows an HMI display mode controlled in a combat situation with zone mode or duel mode according to another preferred embodiment of the invention. HMI operates either

zone-oriented or duel-oriented dependent on the assessed position. Zone position applies generally and it is not until the detection are is entered that the pilot´s own aircraft is assumed to have been detected by the enemy aircraft. Any detection can be either analyzed by the decision support or set manually by the pilot. It is then shifted to a duel mode and HMI then operates with one duel for every enemy aircraft instead of with several duels combined. When the combat situation resumes its original character, HMI returns to zone position. This takes place either by manual switching or automatically by means of decision support.

In this way a good overview at an early stage facilitates planning an initiative-taking with low risk to one´s own aircraft. When the risk increases because one´s own aircraft is detected, the perspective switches to a duel situation with a threat object, such as an enemy combat aircraft or a ground station arranged near or on a surface-to-air missile site. In the duel situation every threat can be prioritized and handled on the basis of the risk it presents in the relevant time perspective.

While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative of exemplary and not restrictive and it is not intended to limit the invention to the disclosed embodiments. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used advantageously.

Claims

1. A method for controlling a display mode in a combat aircraft (1) comprising the steps of:

a) determining (3) sensor capacity of an enemy combat aircraft (2),

b) forming (4) a detection area based on the determined sensor capacity from the previous step a),

c) determining (5) the position if the combat aircraft (1) relative to the detection area, and

d) controlling (6) the display mode based on the determined difference in position from the previous step c), where in the determined difference in position is adapted for indicating whether the combat aircraft (1) is inside or outside the detection area.

2. The method according to claim 1, comprising the step of recording (7) sensor capacity and detection are, wherein the recorded data is adapted for generating a situation picture.

3. The method according to claim 2, comprising the step of displaying (8) the recorded data corresponding to displaying a plurality of situation pictures.

4. The method according to one of the preceding claims, wherein the step of determining (3) sensor capacity of the enemy combat aircraft (2) is performed by detecting or by assuming the sensor capacity of the enemy combat aircraft (2).

5. The method according to one of the preceding claims, wherein the display mode is selected based on a predetermined condition comprising the determined change in position

relative to a predefined zone.

6. The method according to claim 5, wherein the predefined zone corresponds to a geographic zone adapted for defining the detection limit of the enemy combat aircraft (2) or to a geographic zone adapted for defining a shoot-down limit of the enemy combat aircraft (2), respectively, wherein the geographic zone is adapted for decision support of the combat aircraft (1) in a combat situation with the enemy combat aircraft (2).

7. The method according to one of claims 4 to 6, wherein detecting is performed by a sensor, such as a radar, a database and/or a link.

8. The method according to one of the preceding claims, wherein controlling (6) the display mode is performed in a continuous fashion such that the display is continuously switched between different modes when a probabilistic value is exceeded, wherein the probalistic value is determined by at least one of a predefined detection criterion, a predefined identification criterion and a predefined behaviour criterion of the enemy combat aircraft (2).

9. The method according to one of the preceding claims, wherein the enemy combat aircraft (2) corresponds to at least one of a ground station, an unmanned aerial vehicle and a helicopter.

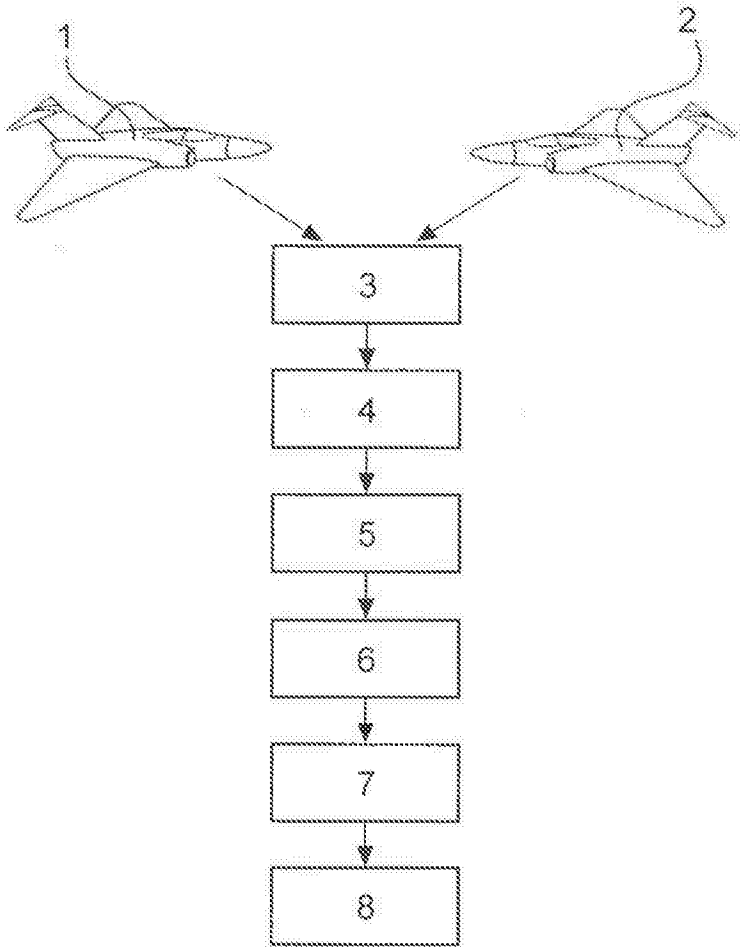
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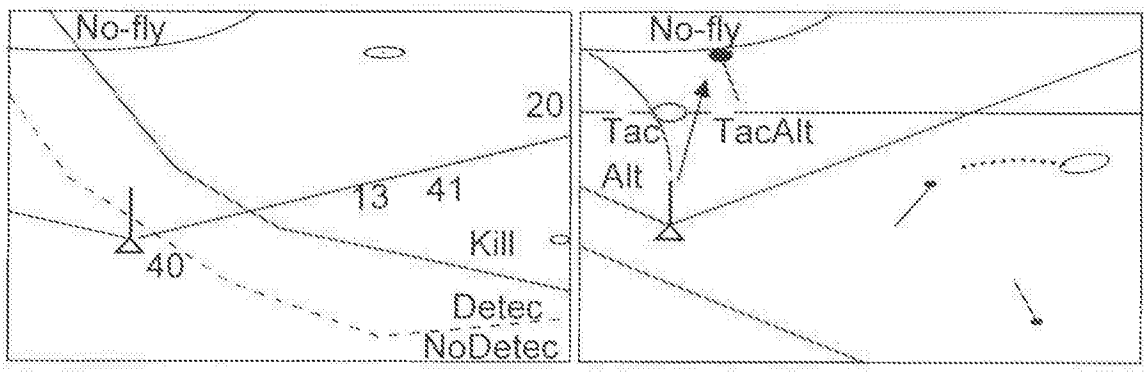
Fig. 1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13
41
Kill
40
Detec
NoDetec
No-fly
Tac
Alt
TacAlt

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2017/050508

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G01C, G02B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2722821 A2 (BOEING CO), 23 April 2014 (2014-04-23); paragraphs [0021]-[0025], [0028]-[0030]; figure 2b --	1-9
A	WO 2013122521 A1 (SAAB AB ET AL), 22 August 2013 (2013-08-22); page 5, line 6 - page 5, line 20; page 6, line 24 - page 8, line 1; figure 2; claims 1-4,10-11 --	1-9
A	US 20040044445 A1 (BURDON DAVID), 4 March 2004 (2004-03-04); paragraph [0032]; figure 1; claims 1,4 --	1-9
A	WO 9519545 A1 (HONEYWELL INC), 20 July 1995 (1995-07-20); abstract; figure 1; claims 1-3 --	1-9

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
03-08-2017	03-08-2017

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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 02090890 A1 (SAAB AB ET AL), 14 November 2002 (2002-11-14); abstract -- --------	1-9

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