CLAIMS

1. A method for detecting landing quality of an aircraft, comprising:

determining whether a vertical speed rate is greater than a first preset value or a vertical acceleration is greater than a second preset value when the aircraft lands;

collecting landing data;

generating a landing message based on the collected landing data in response if the vertical speed rate is greater than the first preset value or the vertical acceleration is greater than the second preset value when the aircraft lands;

storing or transmitting the landing message; and

determining the landing quality of the aircraft based on the landing data in the landing message.

2. A method according to claim 1, further comprising:

determining whether the vertical acceleration is greater than the second preset value when the aircraft lands in response if the vertical speed rate is not greater than the first preset value when the aircraft lands.

3. A method according to claim 1, wherein, the first preset value is set so that the landing message is generated at every landing.

4. A method according to claim 1, wherein, both of the first preset and the second preset values are set so that the landing message is generated every time the aircraft lands relatively hard.

5. A method according to claim 1, wherein, the ACMS or AHM is used to collect the landing data and generated the landing message.

6. A method according to claim 1, wherein, the landing data includes:

radio altitude RALT, vertical speed rate RALR, pitch angle PTCH, pitch speed rate PTCR, roll angle ROLL, roll speed rate ROLR, and yaw speed rate YAW at a time of 1 second before a touchdown.

7. A method according to claim 1, wherein, the landing data includes:

radio altitude RALT, vertical speed rate RALR, pitch angle PTCH, pitch speed rate PTCR, roll angle ROLL, roll speed rate ROLR, and yaw speed rate YAW at a time of a touchdown.

8. A method according to claim 1, wherein, the landing data includes:

maximum values and minimum values of vertical load VRTA, longitudinal load LONA and lateral load LATA during a period from 1 second before a touchdown to the touchdown.

9. A method according to claim 1, wherein, the landing data includes:

maximum values and minimum values of vertical load VRTA, longitudinal load LONA and lateral load LATA during a period from 1 second before a touchdown to 3 seconds after the touchdown.

10. A method according to claim 1, further comprising:

determining whether hard or heavy landing occurs through determining whether the value of the vertical speed rate or the vertical acceleration when landing is greater than their respective limit values.

11. A method according to claim 10, wherein, the limit values of the vertical speed rate or the vertical acceleration are first values where a landing weight of the aircraft is less than or equal to a maximum landing weight;

the limit values of the vertical speed rate or the vertical acceleration is second values where the landing weight of the aircraft is greater than the maximum landing weight;

the first values are greater than the second values.

12. A method according to claim 1, further comprising:

determining whether the aircraft touches down.

13. A method according to claim 12, further comprising: starting a first trigger configured for monitoring whether the aircraft touches down when a slat release is more than 5°and a flight altitude is less than 10000 feet.

14. A method according to claim 13, further comprising:

starting a second trigger in response to the touchdown of the aircraft, the second trigger is configured to determine whether the vertical speed rate at a time of the touchdown and in a period from 0.5 second before the touchdown to the touchdown is greater than the first preset value or the vertical acceleration at a time of the touchdown and in a period from 0.5 second before the touchdown to the touchdown is greater than the second preset value.

15. A method according to claim 14, further comprising:

starting a third trigger, which is configured to determine whether the vertical speed rate in a period from the touchdown to 0.5 second after the touchdown is greater than the first preset value or the vertical acceleration in a period from the touchdown to 0.5 second after the touchdown is greater than the second preset value.

16. A method according to claim 13, further comprising:

starting a fourth trigger in response to the touchdown of the aircraft, the forth trigger is configured for recording the following data:

values of the RALT, RALR, PTCH, PTCR, ROLL, ROLR and YAW at a time of 1 second before a landing time; and

values of the RALT, RALR, PTCH, PTCR, ROLL, ROLR and YAW at a time of the landing

time.

17. A method according to claim 13, further comprising:

starting a fifth trigger in response to the touchdown of the aircraft, the fifth trigger is configured to record maximum values and minimum values of the VRTA, LONA LATA and RALR during a period from 1 second before the landing time to 3 seconds after the landing time.

18. A method according to claim 13, further comprising:

determining whether the aircraft touches down again and whether the vertical acceleration exceeds the second preset value during the second touchdown;

recording the following data in response if the vertical acceleration exceeds the second preset value during the second touchdown

values of the RALT, RALR, PTCH, PTCR, ROLL, ROLR and YAW at a time of 1 second before the second touchdown,

values of the RALT, RALR, PTCH, PTCR, ROLL, ROLR and YAW at a time of the second touchdown,

maximum values and minimum values of VRTA, LONA, LATA and RALR in a period from 1 second before the second touchdown to 3 seconds after the second touchdown.

19. A method for detecting landing quality of an aircraft, comprising:

determining whether the aircraft touches down;

collecting landing data in response to the touchdown of the aircraft;

determining whether a hop occurs during landing;

collecting secondary landing data when the aircraft touches down again in response if the hop occurs during landing;

generating a landing message according to the collected landing data and the secondary landing data;

storing or transmitting the landing message; and

determining the landing quality of the aircraft based on the landing data and the secondary

landing data of the landing message.

20. A method according to claim 19, further comprising:

determining whether the vertical speed or vertical acceleration at a time of touchdown exceeds the first preset value or the second preset value;

determining whether the vertical acceleration when the aircraft touches down again is greater than a second preset value;

generating a long landing message in response if the vertical speed or vertical acceleration exceeds the first preset value or the second preset value and if the vertical acceleration when the aircraft touches down again is greater than a second preset value.

21. A method according to claim 20, further comprising:

recording the second preset value, maximum value and trigger code in response if the vertical acceleration when the aircraft touches down again is greater than a second preset value.

22. A method according to claim 19, wherein, ACMS or AHM is used to collect the landing data and generate the landing messages.

23. A method according to claim 19, wherein, the landing data includes:

radio altitude RALT, vertical speed rate RALR, pitch angle PTCH, pitch speed rate PTCR, roll angle ROLL, roll speed rate ROLR, and yaw speed rate YAW at a time of 1 second before a touchdown.

24. A method according to claim 19, wherein, the landing data includes:

radio altitude RALT, vertical speed rate RALR, pitch angle PTCH, pitch speed rate PTCR, roll angle ROLL, roll speed rate ROLR, and yaw speed rate YAW at a time of a touchdown.

25. A method according to claim 19, wherein, the landing data include:

maximum values and minimum values of vertical load VRTA, longitudinal load LONA and lateral load LATA during a period from 1 second before a touchdown to 3 seconds after the touchdown.

26. A method according to claim 19, wherein, the secondary landing data includes:

radio altitude RALT, vertical speed rate RALR, pitch angle PTCH, pitch speed rate PTCR, roll angle ROLL, roll speed rate ROLR, and yaw speed rate YAW at a time of 1 second before the second touchdown.

27. A method according to claim 19, wherein, the secondary landing data includes:

radio altitude RALT, vertical speed rate RALR, pitch angle PTCH, pitch speed rate PTCR, roll angle ROLL, roll speed rate ROLR, and yaw speed rate YAW at a time of the second touchdown.

28. A method according to claim 19, wherein, the secondary landing data includes:

maximum values and minimum values of vertical load VRTA, longitudinal load LONA and lateral load LATA during a period from 1 second before the second touchdown to 3 seconds after the second touchdown.

29. A method according to claim 19, wherein, the step of determining whether a hop occurs during landing comprising:

determining whether two main landing gears have been compressed and kept compressed enough long and then the left and right main landing gears are in extension state again.

30. A method according to claim 19, wherein, the step of determining whether a hop occurs during landing further comprising:

determining whether a period is less than 10 seconds in which the left and the right main

landing gears are in extension state again.

31. A method according to claim 19, further comprising:

when a slat release is greater than 5°and a flight altitude is less than 10000 feet, starting a first trigger configured for monitoring whether the main landing gears have been compressed and kept compressed for a period enough long.

32. A method according to claim 31, wherein, the period enough long is 0.5 second.

33. A method according to claim 32, further comprising:

starting a second trigger and a third trigger by the first trigger, wherein the second trigger and the third trigger are configured to detect whether the left and right landing gears are in a extension state again and keep in the extension state for more than 1 second.

34. A method according to claim 33, further comprising:

starting a fourth trigger and a fifth trigger respectively by the second trigger and the third trigger, wherein, the fourth trigger and the fifth trigger are configured to detect whether a period, in which the left and right landing gears are in the extension state, is less than 10 seconds and thereafter the left and right landing gears are in the compressed state again.

35. A method according to claim 34, further comprising:

starting a sixth trigger and a seventh trigger respectively by the fourth trigger and the fifth trigger, wherein, the sixth trigger and the seventh trigger are configured to collect the landing data in a period from 1 second before the aircraft touches down again and 3 seconds after the landing.

36. A method according to claim 35, further comprising:

when the slat release is greater than 5°and the flight altitude is less than 10000 feet, starting a touchdown trigger, which is configured to determine whether the aircraft touches down,.

37. A method according to claim 36, further comprising:

starting an eighth trigger by the touchdown trigger, which is configured to determine whether a long message or a short message should be generated.

38. A method according to claim 19, further comprising:

determining whether the hard or heavy landing occurs through determining whether the value of the vertical speed rate or the vertical acceleration when landing is greater than respective limit values.

39. A method according to claim 38, wherein, the limit values of the vertical speed rate or the vertical acceleration are first values where a landing weight of the aircraft is less than a maximum landing weight;

the limit values of the vertical speed rate or the vertical acceleration is second values where the landing weight of the aircraft is greater than the maximum landing weight; and

the first values are greater than the second values.

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CLAIMS

1. A method for detecting landing quality of an aircraft, comprising:
determining whether a vertical speed rate is greater than a first preset value when the aircraft lands by an aircraft data system;
determining whether a vertical acceleration is greater than a second preset value when the aircraft lands in response if the vertical speed rate is not greater than the first preset value when the aircraft lands by the aircraft data system;
collecting landing data by the aircraft data system;
generating a landing message based on the collected landing data in response if the vertical speed rate is greater than the first preset value or the vertical acceleration is greater than the second preset value when the aircraft lands by the aircraft data system;
storing or transmitting the landing message by the aircraft data system; and
determining the landing quality of the aircraft based on the landing data in the landing message by the aircraft data system.

2. A method according to claim 1, wherein the aircraft data system comprises ACMS or AHM to collect the landing data and generate the landing message.

3. A method according to claim 1, wherein the landing data includes: radio altitude RALT, vertical speed rate RALR, pitch angle PTCH, pitch speed rate PTCR, roll angle ROLL, roll speed rate ROLR, and yaw speed rate YAW at a time of 1 second before a touchdown.

4. A method according to claim 1, wherein the landing data includes: radio altitude RALT, vertical speed rate RALR, pitch angle PTCH, pitch speed rate PTCR, roll angle ROLL, roll speed rate ROLR, and yaw speed rate YAW at a time of a touchdown.

5. A method according to claim 1, wherein the landing data includes: maximum values and minimum values of vertical load VRTA, longitudinal load LONA and lateral load LATA during a period from 1 second before a touchdown to the touchdown.

6. A method according to claim 1, wherein the landing data includes: maximum values and minimum values of vertical load VRTA, longitudinal load LONA and lateral load LATA during a period from 1 second before a touchdown to 3 seconds after the touchdown.

7. A method according to claim 1, further comprising:
determining whether hard or heavy landing occurs through determining whether the value of the vertical speed rate or the vertical acceleration when landing is greater than their respective limit values.

8. A method according to claim 7, wherein the limit values of the vertical speed rate or the vertical acceleration are first values where a landing weight of the aircraft is less than or equal to a maximum landing weight;
the limit values of the vertical speed rate or the vertical acceleration are second values where the landing weight of the aircraft is greater than the maximum landing weight; and
the first values are greater than the second values.

9. A method according to claim 1, further comprising:
determining whether the aircraft touches down.

10. A method according to claim 9, further comprising:
starting a first trigger configured for monitoring whether the aircraft touches down when a slat release is more than 5° and a flight altitude is less than 10000 feet.

11. A method according to claim 10, further comprising:
starting a second trigger in response to the touchdown of the aircraft, wherein the second trigger is configured to determine whether the vertical speed rate at a time of the touchdown and in a period from 0.5 second before the touchdown to the touchdown is greater than the first preset value or the vertical acceleration at a time of the touchdown and in a period from 0.5 second before the touchdown to the touchdown is greater than the second preset value.

12. A method according to claim 11, further comprising:
starting a third trigger, which is configured to determine whether the vertical speed rate in a period from the touchdown to 0.5 second after the touchdown is greater than the first preset value or the vertical acceleration in a period from the touchdown to 0.5 second after the touchdown is greater than the second preset value.

13. A method according to claim 10, further comprising:
starting a fourth trigger in response to the touchdown of the aircraft, wherein the fourth trigger is configured for recording the following data:
values of the RALT, RALR, PTCH, PTCR, ROLL, ROLR and YAW at a time of 1 second before a landing time; and
values of the RALT, RALR, PTCH, PTCR, ROLL, ROLR and YAW at a time of the landing time.

14. A method according to claim 10, further comprising:
starting a fifth trigger in response to the touchdown of the aircraft, wherein the fifth trigger is configured to record maximum values and minimum values of the VRTA, LONA LATA and RALR during a period from 1 second before the landing time to 3 seconds after the landing time.

15. A method according to claim 10, further comprising:

determining whether the aircraft touches down again and whether the vertical acceleration exceeds the second preset value during the second touchdown;

recording the following data in response if the vertical acceleration exceeds the second preset value during the second touchdown

values of the RALT, RALR, PTCH, PTCR, ROLL, ROLR and YAW at a time of 1 second before the second touchdown,

values of the RALT, RALR, PTCH, PTCR, ROLL, ROLR and YAW at a time of the second touchdown,

maximum values and minimum values of VRTA, LONA, LATA and RALR in a period from 1 second before the second touchdown to 3 seconds after the second touchdown.