VEHICLE PART RELIABILITY DETERMINATION SYSTEM AND METHOD

FIELD OF THE DISCLOSURE

Embodiments of the present disclosure generally relate to systems and methods for determining reliability of various parts of a vehicle, such as an aircraft.

BACKGROUND OF THE DISCLOSURE

Vehicles are used to transport individuals between locations. For example, commercial aircraft are used to transport passengers between various locations. A typical aircraft includes thousands, if not millions, of component parts. For example, each system, sub-system, structure, and the like of an aircraft may be formed from thousands of component parts.

As can be appreciated, aircraft operators and passengers value flights that are on time. Maintenance operations pose a potential delay for aircraft. For example, if it is determined that a particular part of an aircraft needs to be replaced between flights, a maintenance crew replaces the part. However, such maintenance procedures may cause the ensuing departure time to be delayed while the old part is replaced with a new part.

SUMMARY OF THE DISCLOSURE

A need exists for a system and method of assessing reliability of parts of a vehicle, such as an aircraft. Further, a need exists for a system and method of determining a remaining life of parts of an aircraft. Also, a need exists for a system and method of determining times to replace parts of an aircraft in order to avoid flight delays that may otherwise occur due to maintenance operations between flights.

With those needs in mind, certain embodiments of the present disclosure provide a part reliability determination system that is configured to determine a reliability of at least one part of a vehicle. The part reliability determination system includes a part life distribution control unit configured to determine a part life distribution related to the at least one part, wherein the part life distribution related to the at least one part is based on historical part data for prior parts of the same type as the at least one part that have been previously used with respect to the vehicle and at least one other vehicle. The system also includes a part life prediction control unit configured to determine a remaining life of the at least one part based on current life data of the at least one part in relation to the part life distribution related to the at least one part. A vehicle usage database is configured to store vehicle usage data regarding actual use of the vehicle, and the part life prediction control unit is configured to determine the remaining life in relation to the vehicle usage data.

Certain embodiments of the present disclosure provide a part reliability determination system that is configured to determine a reliability of at least one part of a vehicle. The part reliability determination system includes a part life distribution control unit configured to determine a part life distribution related to the at least one part, wherein the part life distribution related to the at least one part is based on historical part data for prior parts of the same type as the at least one part that have been previously used with respect to the vehicle and at least one other vehicle. The system also includes a part life prediction control unit configured to determine a remaining life of the at least one part based on current life data of the at least one part in relation to the part life distribution related to the at least one part. The current life data includes one or both of time since installation or cycles since installation.

The system may include a parts database in communication with the part life prediction control unit. The current life data of the part(s) may be stored in the parts database. Historical part data regarding the part(s) may be stored in the parts database.

~~In at least one embodiment, a vehicle usage database stores vehicle usage data regarding actual use of the vehicle. The part life prediction control unit determines the remaining life in relation to the vehicle usage data.~~

~~The current life data may include one or both of time since installation or cycles since installation.~~

In at least one embodiment, the part life prediction control unit determines the remaining life based, at least in part, on a prior replacement time of at least one prior part. The part life distribution control unit may build a chain of part installation times and part removal times. The part life distribution unit may use the chain to determine how long the part(s) has been used, and/or the remaining life of the part(s).

The part life prediction control unit may analyze vehicle configuration data to determine the presence and number of the part(s).

In at least one embodiment, the part life prediction control unit determines a time since installation or a cycles since installation for the part(s) based, at least in part, on a part number or serial number of the part(s).

In at least one embodiment, the part life prediction control unit determines the remaining life of the part(s) through a determination of one or both of a time the since the part(s) was installed or cycles since the part(s) was installed in relation to one or more mathematical models.

Certain embodiments of the present disclosure provide a part reliability determination method that is configured to determine a reliability of at least one part of a vehicle. The part reliability determination method includes using a part life distribution control unit to determine a part life distribution related to the at least one part, wherein using the part life distribution control unit comprises basing the part life distribution related to the at least one part on historical part data for prior parts of a same type as the at least one part that have been previously used with respect to the vehicle and at least one other vehicle. The method also includes determining, by a part life prediction control unit, a remaining life of the part(s) based on current life data of the part(s) in relation to a part life distribution related to the part(s), and storing vehicle usage data regarding actual use of the vehicle. The determining includes determining the remaining life of the at least one part in relation to the to the vehicle usage data.

WHAT IS CLAIMED IS:

1. A part reliability determination system that is configured to determine a reliability of at least one part of a vehicle, the part reliability determination system comprising:

a part life distribution control unit configured to determine a part life distribution related to the at least one part, wherein the part life distribution related to the at least one part is based on historical part data for prior parts of the same type as the at least one part that have been previously used with respect to the vehicle and at least one other vehicle; ~~and~~

a part life prediction control unit configured to determine a remaining life of the at least one part based on current life data of the at least one part in relation to the part life distribution related to the at least one part; and

a vehicle usage database configured to store vehicle usage data regarding actual use of the vehicle, wherein the part life prediction control unit is configured to determine the remaining life in relation to the vehicle usage data.

2. A part reliability determination system that is configured to determine a reliability of at least one part of a vehicle, the part reliability determination system comprising:

a part life distribution control unit configured to determine a part life distribution related to the at least one part, wherein the part life distribution related to the at least one part is based on historical part data for prior parts of the same type as the at least one part that have been previously used with respect to the vehicle and at least one other vehicle; and

a part life prediction control unit configured to determine a remaining life of the at least one part based on current life data of the at least one part in relation to the part life distribution related to the at least one part,

wherein the current life data includes one or both of time since installation or cycles since installation.

~~2~~3. The system of claim 1 or 2, further comprising a parts database in communication with the part life prediction control unit, wherein the current life data of the at least one part is stored in the parts database, and wherein the historical part data is stored in the parts database.

~~3. The system of claim 1 or 2, further comprising a vehicle usage database configured to store vehicle usage data regarding actual use of the vehicle, wherein the part life prediction control unit is configured to determine the remaining life in relation to the vehicle usage data.~~

~~4. The system of any one of claims 1-3, wherein the current life data includes one or both of time since installation or cycles since installation.~~

~~5~~4. The system of any one of claims 1-~~4~~3, wherein the part life prediction control unit is configured to determine the remaining life based, at least in part, on a prior replacement time of at least one prior part.

~~6~~5. The system of any one of claims 1-~~5~~4, wherein the part life distribution control unit is configured to build a chain of part installation times and part removal times, and wherein the part life distribution control unit is configured to use the chain to determine the remaining life of the at least one part.

~~7~~6. The system of any one of claims 1-~~6~~5, wherein the part life prediction control unit is configured to analyze vehicle configuration data to determine presence and number of the at least one part.

~~8~~7. The system of any one of claims 1-~~7~~6, wherein the part life prediction control unit is configured to determine a time since installation or a cycles since installation for the at least one part based, at least in part, on a part number or serial number of the at least one part.

~~9~~8. The system of any one of claims 1-~~8~~7, wherein the part life prediction control unit is configured to determine the remaining life of the at least one part through a determination of one or both of a time the since the at least one part was installed or cycles since the at least one part was installed in relation to one or more mathematical models.

~~10~~9. A part reliability determination method that is configured to determine a reliability of at least one part of a vehicle, the part reliability determination method comprising:

using a part life distribution control unit to determine a part life distribution related to the at least one part, wherein using the part life distribution control unit comprises basing the part life distribution related to the at least one part on historical part data for prior parts of a same type as the at least one part that have been previously used with respect to the vehicle and at least one other vehicle; ~~and~~

determining, by a part life prediction control unit, a remaining life of the at least one part based on current life data of the at least one part in relation to the part life distribution related to the at least one part; and

storing vehicle usage data regarding actual use of the vehicle,

wherein the determining comprises determining the remaining life of the at least one part in relation to the to the vehicle usage data.

~~11~~10. The method of any one of claim ~~10~~9, further comprising:

communicatively coupling a parts database with the part life prediction control unit;

storing the current life data of the at least one part in the parts database; and

storing the historical part data in the parts database.

~~12. The method of claim 10 or 11, further comprising storing vehicle usage data regarding actual use of the vehicle, and wherein the determining comprises determining the remaining life of the at least one part in relation to the to the vehicle usage data.~~

~~13~~11. The method of any one of ~~claims 10-12~~claim 9 or 10, wherein the determining comprises determining the remaining life based, at least in part, on a prior replacement time of at least one prior part.