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Corresponding author: DELETOMBE Eric
e-mail of corresponding author: eric.deletombe@onera.fr
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Title

Wear and heat of aircraft materials in case of emergency landing situations

Authors

T. Devo[1,2], A. Beaurain[2], S. Penaherrera [1,2], E. Deletombe [1], Y. Desplanques [3], P. Dufrénoy [4],*

** Corresponding author*
[1] ONERA, 59045 Lille, France, eric.deletombe@onera.fr
[2] LaMcube,59650 Villeneuve d'Ascq
[3] Centrale Lille, 59650 Villeneuve d'Ascq
[4] Université-de-Lille, 59650 Villeneuve d'Ascq

Abstract

During aircraft wheels-up emergency landings, wear and heat phenomena occurring due to the friction between aircraft parts and the runway might endanger the passengers' safety when fuel tanks are concerned, which must then be protected. The study and characterization of thermal and mechanical phenomena involved in case of such extreme loading conditions are required if one wants to better understand the physics behind, then later design efficient protections. In the absence of full scale return of experience, the first step towards the development of improved solutions (in terms of efficiency/mass penalty criterion) consists in performing laboratory tests, assuming a proper scale reduction strategy is defined, which is not a trivial issue. A preliminary PhD work [Devo, 2021] was then performed in the frame of a French DGAC funded research project (PHYSAFE) : the proposed presentation first briefly recalls the followed approach in this first step research, describes the test protocol which basically relied on the use of a LaMcube existing high energy braking tribometer/pin-on-disc testing machine with specific limitations (circular track, vertical disk, concrete pin on aluminum disk tests) at this stage of research, then nevertheless concludes with interesting results and perspectives. The second part of the talk presents key evolutions of the experimental protocol and testing conditions, which were proposed to get - if not fully - at least more representative and instructive laboratory tests. This second part is subdivided into two streams of research : on the one hand, the existing experimental tribometer is still used (S. Penaherrera's PhD work, in progress), but with a different set of first bodies (materials in contact), and a different strategy/scaling rule to define the loading case (based on inverse analysis using simple 1D thermal modeling). On the other hand, a prototype new test mean is specified and designed to overcome the previously described limitations of the existing braking tribometer (helical track, horizontal disk, aircraft material pin on rock disk tests), with the emphasis being placed in the presentation on how main technical locks (tribological system dynamics) were removed. The presentation will be illustrated by a set of results and comparisons obtained with the different test means, for different sets of materials.

Key words: Emergency landings, Wear & Heat, Aircraft's structural materials, Friction tests, Tribological Systems

References

Tovignon Devo, *Study and characterization of wear and heat phenomena for aircraft's structural materials during wheels-up emergency landings*, PhD thesis, Centrale Lille, November 17, 2021.