

CH-47 CHINOOK HELICOPTERS: PREVENTING CHAFING DAMAGE ON STRUCTURES WITH DURABLE SEALING AND SURFACE PROTECTION TAPES

Situation

Operators of CH-47 Chinook helicopters at the Royal Netherlands Air Force (RNLAf) sought a solution to prevent chafing damage caused by the abrasion of floor and access panels against airframe structures during flight operation.

Challenge

Corrosion and mechanical forces such as continuous vibration can severely damage aircraft structures over time. Consequently, RNLAf operators discovered chafing damage on floor structural beams (Figure 1). The paint was worn away to expose bare metal, setting the conditions for continued wear and corrosion and ultimately requiring repair or replacement of the helicopter structure. They also discovered similar chafing on engine cowlings and various access panels throughout the aircraft (Figures 2–5).

Solution

Gore engineers worked closely with the RNLAf to install GORE® SKYFLEX® Aerospace Tapes, 110 and 700 Series to the panels and structure of a CH-47 helicopter. The structure was cleaned prior to installation, and Gore's 700 Series tape was applied to the floor beams (Figure 6). Gore's 110 Series tape was also applied to floor panel mating surfaces along the panel perimeter. In addition, they installed the 700 Series tape on the engine mounts and cowlings at key panel contact surfaces to protect chafing caused by vibration, as well as panels and mounting surfaces.



"In this application, Gore's tapes provided a protective barrier by reducing friction and preventing damage to the underlying helicopter structure."

– Ross Livingston, Gore Product Specialist

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Next, they conducted thorough flight testing through normal operational use, and results showed that Gore's ePTFE (expanded polytetrafluoroethylene) tapes effectively sealed and protected the underlying helicopter structure. Figure 7 shows that Gore's 110 Series installed on floor panels remained serviceable after 400 flight hours.



Figure 1: Chafing damage to the floor structure.

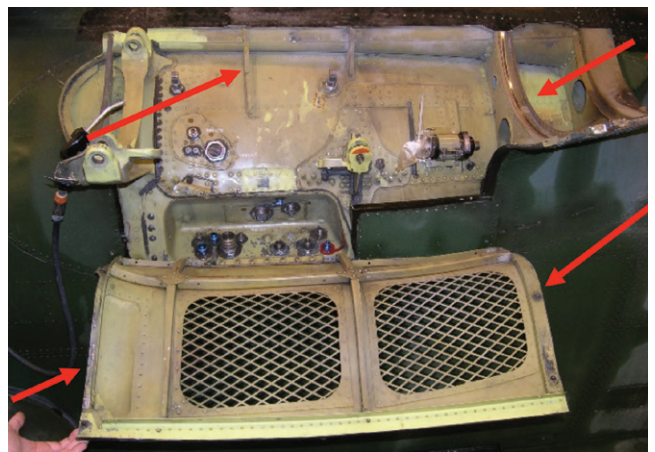


Figure 2: Chafing damage on engine mount fairing and access door.

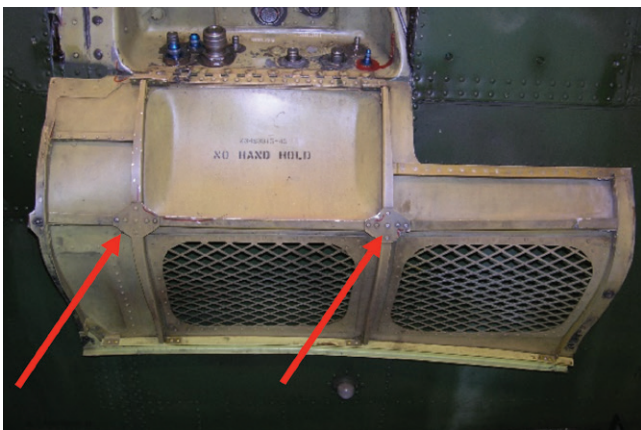


Figure 3: Chafing damage to engine fairing access door.



Figure 4: Chafing damage to engine inlet D-ring cowl at mating surface.



Figure 5: Chafing damage to access panel mating surfaces on fuselage sponson.

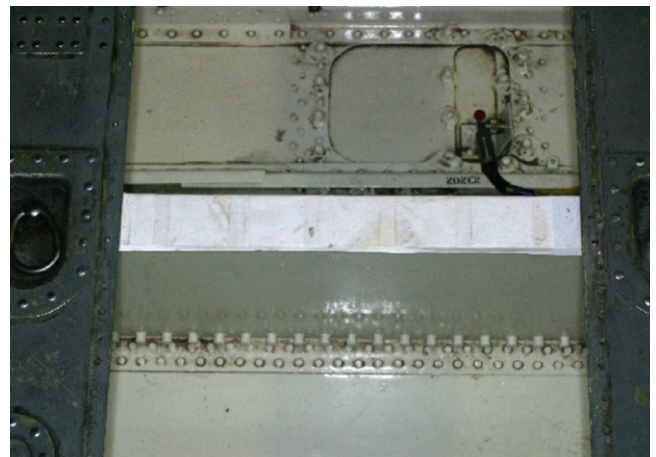


Figure 6: GORE® SKYFLEX® Aerospace Tapes, 700 Series installed on floor beam.



Figure 7: GORE® SKYFLEX® Aerospace Tapes, 110 Series installed on floor panels.

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Similarly, results showed that Gore's 700 Series installed on an engine mount structure, although discolored, remained intact and functional (Figure 8). The 700 Series installed on engine access door and cowling contact areas also remained intact and effective after 400 flight hours (Figures 9 and 10).



Figure 8: GORE® SKYFLEX® Aerospace Tapes, 700 Series installed on engine mount structure.



Figure 9: GORE® SKYFLEX® Aerospace Tapes, 700 Series installed on engine access door.

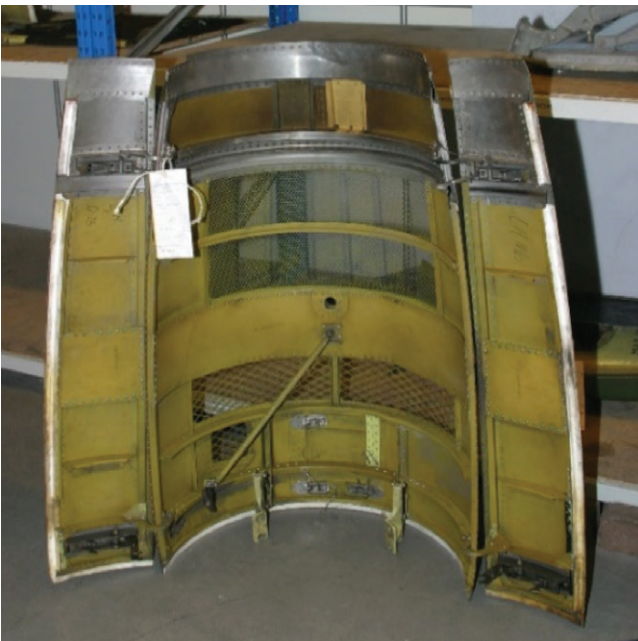


Figure 10: GORE® SKYFLEX® Aerospace Tapes, 700 Series installed on engine cowling contact areas.

Figure 11 shows that the 700 Series installed on an engine inlet D-ring cowling and contact areas effectively absorbed friction and wear from panel contact. Furthermore, results showed that the 700 Series installed on the upper engine inlet screen assembly was still serviceable after preventing cowling wear (Figure 12).

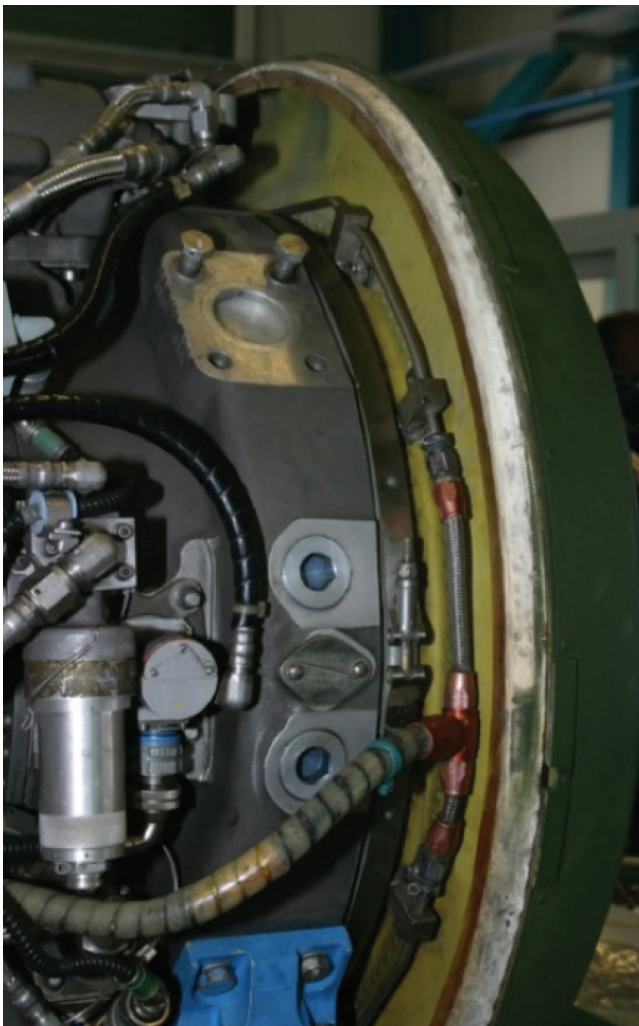


Figure 11: GORE® SKYFLEX® Aerospace Tapes, 700 Series installed on engine inlet D-ring cowling.

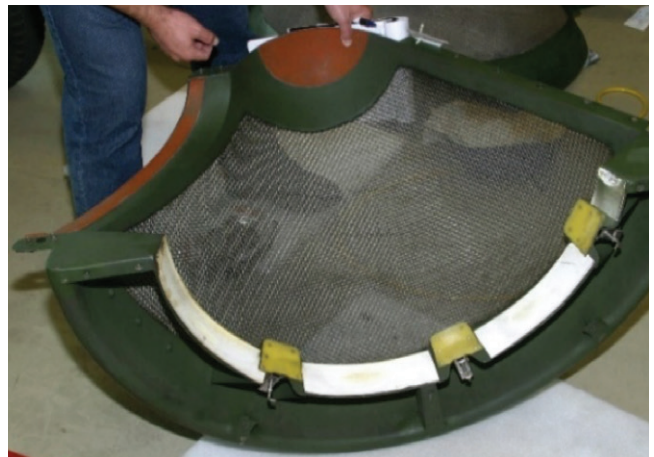


Figure 12: GORE® SKYFLEX® Aerospace Tapes, 700 Series installed on upper engine inlet screen assembly.



Gore's 700 Series installed on the CH-47 remained intact and functional providing durable protection against chafing.

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In addition, test results showed that Gore's 700 Series installed on access panels and panel mating surfaces of the helicopter provided durable protection against chafing. The 700 Series installed on the aft pylon canted deck cover (Figure 13), and transmission access panel (Figure 14) prevented chafing and remained functional after 400 flight hours.

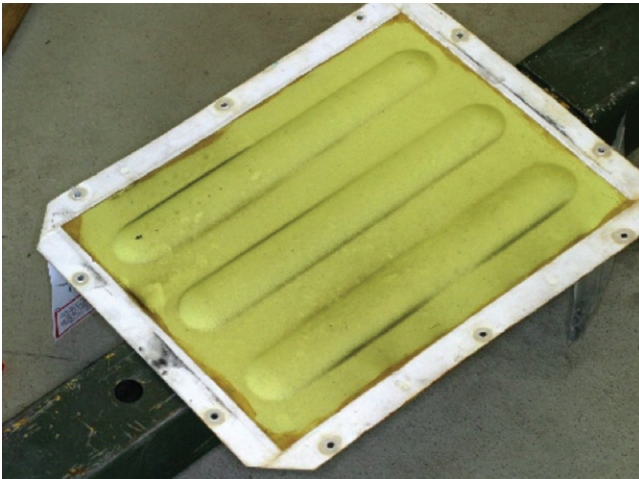


Figure 13: GORE® SKYFLEX® Aerospace Tapes, 700 Series installed on aft pylon canted deck cover.

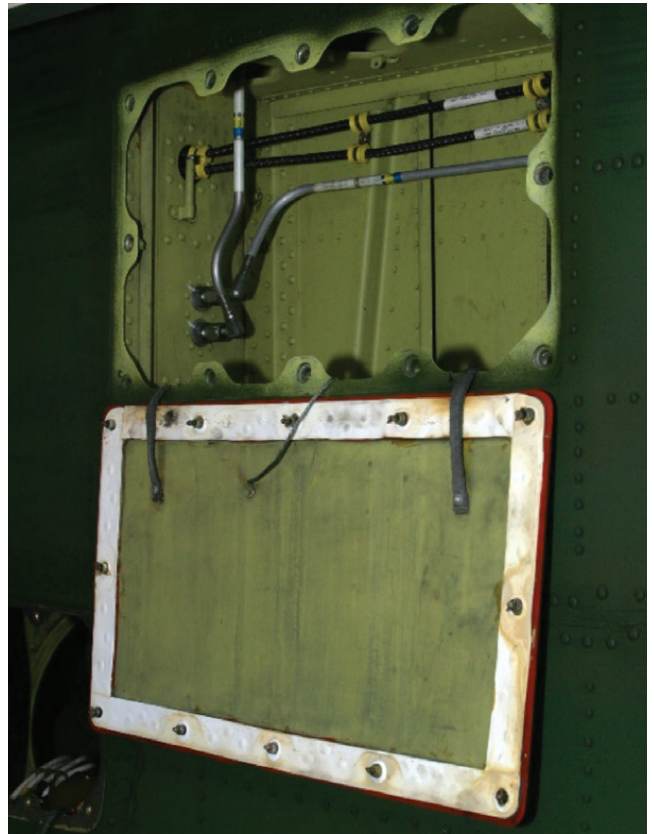


Figure 14: GORE® SKYFLEX® Aerospace Tapes, 700 Series installed on aft pylon transmission access panel.

Likewise, results showed that the 700 Series successfully protected sponson access panel mating surfaces against chafing with no damage to the panels (Figure 15). Finally, Figure 16 shows that the 700 Series installed to the mounting surface for the forward transmission drip pan remained intact after rigorous flight testing with no damage to the panels or structure.



Figure 15: GORE® SKYFLEX® Aerospace Tapes, 700 Series applied to sponson access panel mating surfaces.



Figure 16: GORE® SKYFLEX® Aerospace Tapes, 700 Series applied to mounting surface for forward transmission drip pan.

Conclusion

Ultimately, GORE® SKYFLEX® Aerospace Tapes provided a durable, low-friction barrier that absorbed the effects of repeated vibration, thus reducing chafing damage between the panels and structure. Thorough testing proved how effectively Gore's tapes provided a sacrificial protective barrier by reducing friction and protecting the underlying helicopter structure from damage. While damage to the structure is inevitable in some places, the effects can be minimized with durable tapes that can endure mechanical forces over a longer period. Protection can be restored by replacing only the damaged tape areas, leaving the undamaged tape in place, which provides a more cost-effective option than structural repair or replacement.

GORE® SKYFLEX® Aerospace Tapes eliminated the need for the RNLA to repair or replace the CH-47 Chinook structure – reducing labor, downtime and lifecycle costs. As a result, the RNLA installed Gore's tapes to other comparable structures throughout the helicopter and achieved similar results during operational use.

Proven Performance with Diverse Portfolio

Proven by more than 20 years of successful applications, GORE® SKYFLEX® Aerospace Materials solve many sealing and surface protection challenges in civil and military aircraft. They are available in a variety of form-in-place (FIP) tapes and die-cut gaskets in various sizes. Gore's tapes and gaskets provide design engineers, manufacturers, and operators with many benefits that simplify aircraft assembly, and increase availability and throughput, including:

- reliable and predictable surface protection, sealing and gap filling with highly-conformable materials
- durable protection against mechanical forces, extreme temperatures, aggressive fluids, and other environmental hazards
- supports design goals for manufacturing with dry materials
- easier and faster installation from single-component, non-curing materials
- less replacement and re-work of seals by maintaining performance over multiple open/close cycles for reduced life-cycle costs
- low environmental impact and improved safety with non-hazardous materials
- no operator certification or special handling of materials required



GORE® SKYFLEX® Aerospace Tapes, 700 Series

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