APPENDIX B: Different Experiment Configurations for the Metal Drill Shaving Abrasion Test.

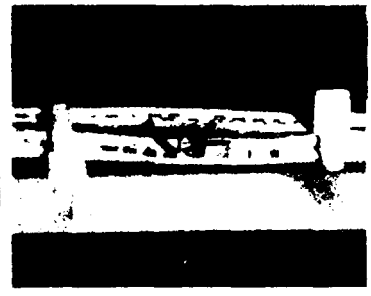
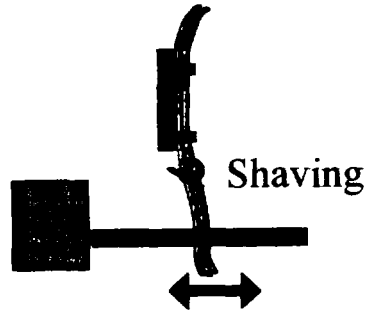
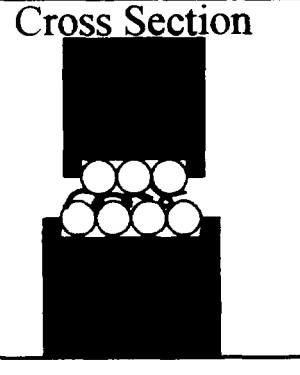
There were several different configurations of metal drill shaving abrasion test experimented with before the apparatuses described in the main text were decided upon. They caused varying degrees of damage to the insulation. Some of the configurations were objected to because it was thought that they did not to represent a realistic situation that could occur on an aircraft. A short description of these configurations is given in Table 7.

The cross sectional size and shape of the metal shavings have a large effect on the results of a given configuration. The most obvious reason for this is the mechanical strength of the shaving. Often a thin shaving would simply break apart and fall out of the test bundle. Also important is the shape of the shaving and how that effects the interaction of the shaving with the individual wires of the bundles.

The size of the shaving also affects the current carrying capacity of the shaving. If a shaving has a relatively large cross section will be able to support a larger current without evaporating and thus opening up the circuit. However, if the cross section is too large the circuit breakers will trip before enough heat is generated to initiate an arc.

The ability to control the size and shape of the shaving is more of an art than a science at this point. All of the shaving used in this project were produced using a 3/16" drill bit. The type of material is important with the grade 5 steel tending to produce longer, stronger shaving as compared to the aluminum 7075. A shaving with a larger cross section can be produced by drilling a pilot hole before drilling the hole the produces the shaving.

Table 7. Description of alternate abrasion configurations

Description	Results	Comments	Illustration
Two Bundles that are aligned much like the longitudinal abrader describe in the main text but in this case the metal shavings are glued to one of the bundles with a epoxy.	This test results in damage to the insulation with relatively thin shavings. Flash events can occur.	The gluing of the shaving may mimic the adhesion of the shaving to bundle by anti-corrosion fluid found in the field . However, the introduction of a foreign agent such as epoxy is undesirable .	
In this test a shaving is placed between the wires in a bundle. One end of the bundle is fix while the other is moved back and forth perpendicular to the axis of the wire bundle.	While there is some relative motion of the wires to the shaving it is small and does not produce much damage. There were no flashing events during these tests.	This test is appealing because one can visualize this situation to be found on an aircraft.	
The test is a longitudinal type abrasion test with two pieces square bar stock with a shallow channel acting as wire holders. The lip of the channel hold the wire in place with shaving placed between the two rows.	The amount of damage to the wires depends on how much force is holding the two wire holders together. A flash event occurred when a spring loaded clamp is used.	The wire holder supports the wire much like a large bundle would. However the wire holder and clamps used are not found on aircraft which makes the setup undesirable .	
In this test two row of wire are wrapped around a 3" mandrel with shaving trapped between. The top row is squeezed into then loosened from the bottom row by the oscillating bar.	The squeezing did cause damage to the insulation and in one case caused a small flash.	Again the wire holder and clamps used are not found on aircraft which makes the setup undesirable .	Side view: