Aircraft Fuelling

"Don't take chances"

Static electricity is a phenomenon that occurs whenever two objects or substances come in contact with each other and then are separated. The separation action causes an electric charge to build between the two objects. The charge remains in a "static" condition, unless and until there is an avenue for discharge. The discharge usually occurs rapidly and is seen as a spark between objects. If the static does not discharge rapidly, it will slowly dissipate over time, but this is dependent on several factors and may not be predictable. The static charge will not build up, however, if the two objects are connected by a bonding wire that keeps them at the same electric potential.

When this initial separation occurs, an electric charge can also build up between either of those two objects and others that are in the area. This secondary charge, which may be at a different level than the primary charge, remains until there is an avenue to equalize the difference. If any of these objects comes close enough to another, those two will discharge and a spark will occur. However, other static charges that have built up might not be equalized and may still exist. Again, it is important to know that a static charge will not build up between any two objects that are electrically bonded to each other even though charges have developed between surrounding objects. Composite aircraft are more likely to develop and sustain a static charge because of the low conductivity of the fibreglass structure.

Natural Static Conditions
One of the most frequent natural static conditions occurs during rain. The action of water droplets separating from clouds and from each other as they fall causes an

electric charge to develop between the clouds and the droplets. The droplets carry this charge to the earth's surface which then has a different electric potential from the cloud. Either the cloud or the ground can be either positive (+) or negative (-). The electric charge on the surface is usually equalized across the ground by the layer of water that is left as the droplets spread out over the rocks, buildings, vehicles, etc. However, the electrical difference between the cloud and the surface is not equalized. Also, as the cloud moves along, driven by the wind, this charge moves with it, even after the rain has stopped. Any objects on the ground, such a building, fuel tanks, and vehicles, are affected and develop that same electrical difference with the cloud as it passed overhead. In addition, other objects that are not electrically bonded to the ground and other clouds may develop a different charge level than already exits. Even if the main charge between the ground and cloud discharge through lightening, these secondary charges may remain in the "static" condition. It is this part of the phenomenon that is a hazard around aircraft that are being fuelled.

Bonding

In general terms, aircraft and fuel trucks, storage tanks, fuel drums, or gas cans are not normally connected unless actual fuelling is being performed. Static charges can exist between any of them at any time. If there is or has been a rain, thunder, or lightening storm, it is likely that static charges have built up and need to be dissipated. This is particularly likely with aircraft since they are usually separated from the ground and from fuel, tanks, drums, or cans by the rubber tires. This charge will not be dissipated, unless one of these objects is brought close enough to the aircraft for the electrical difference to discharge. If this discharge occurs rapidly when a fuel nozzle is being brought close to an aircraft's fuel tank opening, the spark can, and likely will, ignite the fuel vapours. If the vapours are in a high enough concentration, an explosion will occur.

To avoid this situation, fuel trucks, fuel drums, or gas cans should be electrically connected to the aircraft before being brought close to begin fuelling. The proper way is by using a bonding or grounding wire. This will put them at the same electrical potential and a static charge, if it was present, will no longer exist. In fact, to ensure proper bonding, we should follow this sequence. The truck, tank, or can, should be electrically bonded to the ground first. Then the aircraft should be electrically bonded to the ground. And the last step is to bond the truck, tank, or can, to the aircraft before the hose and nozzle are brought to the aircraft. Any static charges that were present will be discharged through the bonding wires, and these wires will prevent additional charges from building during the fuelling process. Remember that fuel being poured into a fuel tank will develop static charges just like the rain, if electrical bonding is not present.

Plastic fuel containers, unless specifically designed to have anti static properties, should **not** be used to transport or move fuel around airfields for the purpose of fuelling aircraft, as the sloshing of fuel can allow electrostatic charge to build up. Plastic filler funnels or pipes should **never** be used to guide fuel into aircraft tanks. The use of chamois as a filter is extremely hazardous.

AIC 39/98 (Loading of aviation fuel) and CAA CAP74 (Aircraft fuelling) contain considerable advice on the subject.