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to the crew and passengers. Just preceding the onset of a lightning stroke to an aircraft, pilots have reported observing a streamer or corona discharges build up on the nose, propellers or other extremity of the craft. The network of the streamer accompanies that of the aircraft and depends on the passage of a lightning stroke nearby or through the aircraft. Corona discharges or sharply curved surfaces of aircraft have also been observed during flight between masses of clouds already charged with electrical charges of opposite sign (positive and negative). Subsequent charging of the aircraft by lightning and other effects during flight through some or other precipitation particles intensifies the corona discharges. These are of the same nature as St. Elmo's Fire.

St. Elmo's Fire has been observed numerous times on the mastsheads of ships and generally occurs with them during passage beneath the barometrical or other meteorological conditions where intense electrical potential gradients exist.

(a) Effect on Surrounding Atmosphere

1. Clouds

Lightning of any kind can occur in clouds only if the dielectric properties of the air are broken down when the sparking potential gradient is reached. In clear air this amounts to about 30,000 volts per cm. at sea level and about 21,000 volts per cm. at 10,000 ft. altitude. In clouds, or in the presence of precipitation particles the sparking potential gradient is less, depending on the size of the particles. For example, in the presence of raindrops  $1/8$  inch in diameter it is about 10,000 volts/cm.

As shown by Debye<sup>2</sup>, droplets of water suspended in an electrical field sufficiently intense to induce breakdown will display sparklike-discharge phenomena and will

1. Barriam, J. F., "Lightning Discharge to Aircraft and Associated Meteorological Conditions," E.A.C.A. Technical Note 2001, (1960).
2. Debye, H. G., Proc. Roy. Soc. London, Ser. A, vol. 153, pp. 545-560, (1931).

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