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Irisation in a missile contrail at 40 km

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On the evening of 21 December 1967, a Minuteman missile was launched from Vandenberg Air Force Base, leaving a sunlit contrail which was clearly visible in Huntington Beach, Calif., 150 miles to the southeast. When first noticed at 1720 PST, the trail had the appearance shown in the cover photograph. From the lower portions came long, white fallstreaks, much like cirrus uncinus. These streaks were not evident from regions of the contrail higher than the sharp bend, near the left edge of the photograph.

Near the bend, the contrail exhibited brilliant irisation, similar to that seen in thin cirrocumulus within 10° of the Sun. The usual greens and pinks were most evident, in bands parallel to the contrail direction, as typical for tropospheric clouds (World Meteorological Organization, 1956). The upper portion of the bend was orange, and the outer edge a bright blue. A number of color pictures were taken between 1720 and 1730, and the relative positions of the irisation bands remained essentially constant, indicating that the

sizes of the transparent droplets causing the colors were not rapidly changing.

The Sun set on the colored area at 1740, when the trail was 10° above the horizon. From these data, the height of the colors may be calculated to be 40 km. A typical temperature at this altitude for the January stratosphere at 30°N latitude is 252K (Environmental Science Services Administration, 1966). Thus it is possible for supercooled water droplets to exist at this height if suitable freezing nuclei are not present. But the long life of the colors indicates that the droplets did not rapidly evaporate. If the droplets were water, this implies a stratosphere nearly saturated with respect to liquid water. This would not be a typical condition, and it would therefore be interesting to know how often such contrails change into artificial nacreous clouds.

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