# Comments on "An Inexpensive Rocket Technique for Obtaining Low Level Wind Profiles"

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Rocket-laid smoke trails have been used for some time for the determination of wind profiles both near the surface (Tolefson and Henry, 1961; Cooke, 1962) and in the upper atmosphere, (Aufm Kampe, Smith and Brown, 1962). The introduction of a recoverable rocket using $CO_2$ as propellant by Gill, Bierly and Kerawalla ("An inexpensive rocket technique for obtaining low level wind profiles," *J. Appl. Meteor.*, August 1963) undoubtedly makes the technique much more attractive for low-level application. However, its use in the course of a study of drifting snow, carried out by the Meteorology Department, University of Melbourne, for the U. S. Weather Bureau at Byrd station, Antarctica, has shown up two major shortcomings which must be eliminated in order to give the technique its full potential value. We feel that a brief discussion of these may be helpful for anyone inclined to use the technique.

By way of background it should be stated that our experience is based on the results of 12 rockets, donated by the Australian Weapons Research Establishment. The firings were carried out by R. Dingle with the help of Byrd personnel and that of M. Mellor and other members of the U. S. Army Cold Regions Research and Engineering Laboratory. The conditions of the high Antarctic plateau made this an arduous undertaking and it is highly creditable that 8 very good photographic records were obtained. The first difficulty arose already at this stage, viz. lack of contrast between the smoke trail and its background in many weather situations of interest. The solution evidently consists of using colored smoke, and might be provided by a device known as the Buoyant Orange Smoke Signal (BOSS) manufactured by Bristol Rocket Apparatus Ltd., England. This device produces a bright orange smoke which promises to be visible on color film against almost any background.

The second difficulty is more subtle and has been evaded in previous low-level studies at the expense of considerable errors. These arise from the assumption that all parts of the smoke trail have the same distance from a camera, even though, e.g., with a 60 ft $sec^{-1}$ wind parallel to the optical axis of one of the cameras the basic distance of 2000 ft used by Gill, Bierly and Kerawalla would change by almost 30% in the 10 seconds between successive photos. Yet without assuming a constant trail distance from each camera it is in general impossible to arrive at common points on the two trail photos taken at right angles to one another.

The solution to this problem was suggested to us by Mr. S. G. Bervoets of the Department of Surveying, University of Melbourne, but we find that it has been discovered previously for the case of high-level flow by Aufm Kampe, Smith and Brown (1962). It consists of mounting the two cameras parallel to one another at each end of a relatively short (approx. 100 m) and pre-

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cisely measured base line located with preference *upwind* of the rocket. The smoke trail photos will then represent stereo pairs which can be evaluated with almost unlimited accuracy in a modern stereo plotter. Not only does this arrangement eliminate all ambiguity in the identification of points on the trail, but it also simplifies the synchronization of the photos and ensures that the trail remains in the camera view fields for the maximum period of time.

## REFERENCES

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