

A Breakthrough in High-Altitude Photographs from Jet Aircraft

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AS PHOTOGRAMMETRIC INSTRUMENTS become more sophisticated and consequently capable of resolving and analyzing smaller "bits" of information, the requirement to reach ever higher altitudes becomes more pressing. The arrival of jet aircraft was a gigantic step in this direction and the air forces of the major countries of the world were quick to put them to use in gathering and recording many kinds of information. Unfortunately, the cost of the early jets, when added to the high cost of installing sensing equipment in their pressurized cabins, made them uneconomical for use by private enterprise.

The development of the small business jets and some typical Yankee ingenuity by Mark Hurd Aerial Surveys personnel has now solved this dilemma.

Drawing on 15 years of high-altitude flying experience in B-17's and P-38's, the Hurd company designed and constructed a *door* for jet aircraft which will accept sensing equipment requiring a downward-viewing window or opening up to 12 by 14 inches in size. The picture on the cover of this issue was exposed with a Wild RC-8 camera installed in this door. It was taken from a Lear Jet at 44,000 feet using Eastman double X film. The RC-8 camera was chosen because of its excellent geometry and resolving power and its compatibility with all stereo plotting equipment.

A unique feature of this installation is its *quick change* aspect. The Hurd door, containing cameras or other sensing equipment, can be installed on the aircraft in an hour, or removed and the original door reinstalled in the same or less time.

Utilizing the circular fuselage of the Lear Jet, the Hurd company installed a platform on the lower half of the door. This platform partially replaces the skin of the door and projects through the former skin line. In this platform they installed a 12 by 14-inch optically flat glass over which they mounted a Wild RC-8 camera. A Mark Hurd tracker was installed behind the glass for measuring end-

lap and drift and for use in precise navigation. The new configuration was sealed to hold pressure, and faired over to prevent drag or buffeting. The optical glass was installed for photographic use but can be replaced with other sensing equipment requiring contact with the external environment.

The engineering design and construction of the camera door has been approved by the Federal Aviation Administration. Engineering flight tests were performed by an FAA pilot and there was no discernible difference in the flight characteristics of the aircraft with the camera door installed. Consequently a Supplemental Type Certificate with no restrictions has been issued by FAA. The Hurd company has applied for patents on the camera door in many countries of the world and expect them to be granted in the near future.

Photographic flights using the RC-8 camera with 9×9-inch format have been flown over Phoenix, Arizona and Minneapolis-St. Paul, Minnesota. Continuous strips were flown between Los Angeles and San Francisco and between Santa Barbara and San Francisco, California, at altitudes of 48,000 feet. Kodak Double X film, type 2405, was used on the Phoenix strip. Plus X, type 2401, film was used on the Los Angeles to San Francisco strip and on the Minneapolis-St. Paul flight. Ektachrome MS Aerographic film, type SO-151, was used on the flight between Santa Barbara and San Francisco. A shutter speed of 1/500 second was used on all flights.

Preliminary plotter tests of the negatives taken over the Phoenix test area indicate an excellent *C-factor*, but more tests must be made under varying conditions before this can be established with a high degree of certainty. However, there is little doubt about the excellent negative resolution. Enlargements have been made to eight diameters which resolve ground detail invisible to the naked eye on the negative. High-contrast detail, such as white lines as narrow as one foot in width on airport runways, appear on the enlargements.

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More Discussion of "Down to Earth"

Dear Editor:

I have just finished reading, "Discussion of Down to Earth," by Charles J. Robinove, in the March 1968 issue of PHOTOGRAMMETRIC ENGINEERING. It is amazing how two people can read an article and get such widely divergent reactions from it. My reaction is quite different from that of Mr. Robinove.

Mr. Robinove ends his well written article by saying,

"... our Society cannot remain viable by rigidly restricting itself to only one phase of photographic use and by broadly condemning on slim ground the vision of its own members who seek to extend their scientific and engineering pursuits. . . . Let us wisely and conscientiously broaden our horizons rather than resting in our laurels."

I fail to see where Mr. Gruner advocated any restriction to "one phase of photographic use," or condemned the vision of members "who seek to extend their scientific and engineering pursuits." Furthermore, to imply that Mr. Gruner is against broadening our horizons in favor of "resting in our laurels," is a most unfortunate remark.

Suppose we back up a bit. It was the enthusiasm of Mr. Gruner, and 11 other visionaries, that got our Society started in 1934. He spent the next several years as a veritable missionary selling photogrammetry to the U.S. Government. And he has never ceased to work at broadening its horizons. The presentation, in 1963, of our Society's highest honor, the Photogrammetric Award, gave testimony to his, "Long record of very valuable accomplishments and contributions to the Science of Photogrammetry by a Charter Member of ASP."

In his paper, "Down to Earth," Mr. Gruner asked a number of sober, pertinent questions—questions that deserve serious reflection and objective answers. His main argument is that we have many, "down-to-earth" problems yet to solve, and, he wonders if enough attention is being given to them. After all, the theme of the Los Angeles meeting was "Time of Appraisal." A mark of maturity, certainly of a profession, should be the ability of self-appraisal.

Mr. Gruner is not condemning the untiring efforts of dedicated scientists like Mr. Robinove, who, as a Research Hydrologist, has found space photography to be a new and useful tool. In his paper, on page 1109, center of first column, Mr. Gruner praises, "... the astounding progress in the sector of information acquisition, in data extraction and analytical treatment of these data." Also, on page 1110, bottom of first column, he gives unstinting praise of the "fabulous development of electronic devices. . . ." He praises other areas as well.

I consider Mr. Gruner's paper one of the most straightforward and courageous this Society has had. I interpreted it to mean that the governing question should be, not "can it be done?", but, rather, "should it be done?" I too dread the day when some overly zealous group of hucksters will offer the Department of Health, Education and Welfare, a completely automated system of human procreation requiring no active human intervention. They will prove with overpowering logic that it *can* be done. I trust someone like Mr. Gruner will be around then to ask, "should it be done?"

—Joseph B. Theis

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At the negative scale of 1:94,000, the computed width of these lines is .0032 mm. on the negative.

The Hurd company, in conjunction with the University of Minnesota, has also developed a multiple camera mounting which readily installs in the jet door and which will accommodate four or five 70 mm. Hasselblad cameras. This unit will be used extensively

during the coming season for research in identifying the varied signatures of ground objects or bits under a wide range of film-filter-environment combinations. This *quad pod* or *quint pod*, as it is known in the Hurd organization, will also quickly mount in propeller-driven photographic aircraft for accomplishing low-altitude photography.