The Large Format Camera on Shuttle Mission 41-G

As long ago as 1965 a working group within NASA prepared a "Proposal for an Integrated Group of Photographic Experiments for Manned Earth Orbital Missions (Apollo Application Flights)." This proposal contained a recommendation for a large format terrain mapping camera of 30-cm focal length, and a pair of stellar cameras to be used for attitude determination. The Apollo Application Flights never materialized, because the Apollo hardware was converted to the Skylab program.

In 1967-68 the National Research Council, at the request of NASA, conducted a summer study on "Useful Applications of Earth Oriented Satellites." The Geodesy-Cartography Panel of that study documented the capability of such a camera system to establish supplemental control and provide information content for mapping at scales as large as 1:50,000. Ten years later, in October 1977, NASA headquarters provided funding to the Johnson Space Center for design and construction of the camera system. Separate contracts were awarded to Itek Optical Systems Division of Litton Industries for the mapping camera—now identified as the Large Format Camera (LFC)—and the stellar cameras—identified as the Attitude Reference System (ARS). The LFC was delivered in December 1980 and the ARS in May 1983. The two systems were integrated on the Modular Payload Equipment Support System (MPESS) which is designed for mounting in the cargo bay of the Space Shuttle. Project Engineer for the system was Mr. Bernard H. Mollberg at Johnson Space Center, to whose dedication the cartographic community owes the existence of this exceptional instrument.

The parameters of the camera system are as follows:

Large Format Camera

Lens

Focal length 30.5 cm, aperture *f*/6.0
Resolution 80 line pairs/mm AWAR
Maximum distortion less than 20 μm
Interchangeable haze and minus blue filters
Rotary capping and chopping shutter
Automatic exposure control, 1/250 to 1/30 sec.

Magazine

Format 23 × 46 cm, long dimension in direction of flight
12 illuminated fiducials
Back illuminated 5 × 5 cm reseau
Forward overlap 10, 60, or 80 percent
Adjustable forward motion compensation
Film capacity 2400 frames
Automatic data recording

Attitude Reference System

Two lenses directed 45° fore and aft
Focal length 150 mm, aperture *f*/2.8
Format, 2 frames 60 × 60 mm on single 70 mm film web
Focal plane reseau 5 × 5 mm
Exposure 25 msec synchronized with LFC exposure

Both camera systems are controlled from the Payload Operations Control Center (POCC) at Johnson Space Center, and camera housekeeping data—temperature, motor operation, film advance, frames remaining, etc.—are transmitted and displayed at the POCC.

On 5 October 1984, nearly 20 years after it was conceived, the LFC/ARS was finally carried into space on Shuttle Mission STS-41G. Requests for coverage had been received for 368 sites located on all continents except Antarctica. The orbit inclination was 57° and the Shuttle operated at nominal altitudes of 352, 272, and 225 km. A total of 2160 frames were exposed—1520 on Kodak 3412 and 3414 panchromatic black/white, 320 on SO-242 natural color, and 320 on SO-131 color infrared films. Sixty percent of the frames have less than 0.36 cloud cover. Optically, mechanically, and electrically, the camera operated without flaw, and many exceptional scenes were acquired.

The foldout is a contact size print from frame 0664 acquired at 12:56 p.m. EST on 7 October 1984 from an altitude of 237 km. The area covered is 178 × 356 km and the photo scale is 1:778,000. The scene includes Cape Cod, Martha's Vineyard and Nantucket Islands, the cities of New Bedford, Providence, Boston, Worcester, and extends northwest into New Hampshire and Vermont. The city of Boston is outlined by a 15-mm square. This area is enlarged 15.6× to 1:50,000 scale and reproduced on the cover. Clearly evident are Logan Airport, primary and secondary street patterns, major buildings and bridges, and shipping and small craft in the harbor. The photography is expected to be adequate to support 1:50,000-scale planimetric and topographic mapping with a minimum of ground control.

The original film has been transferred to

USGS EROS Data Center
Sioux Falls, SD 57198

Qualified investigators can obtain indexes, film and paper prints, and 2× and 4× enlargements from that source.

—*Frederick J. Doyle*


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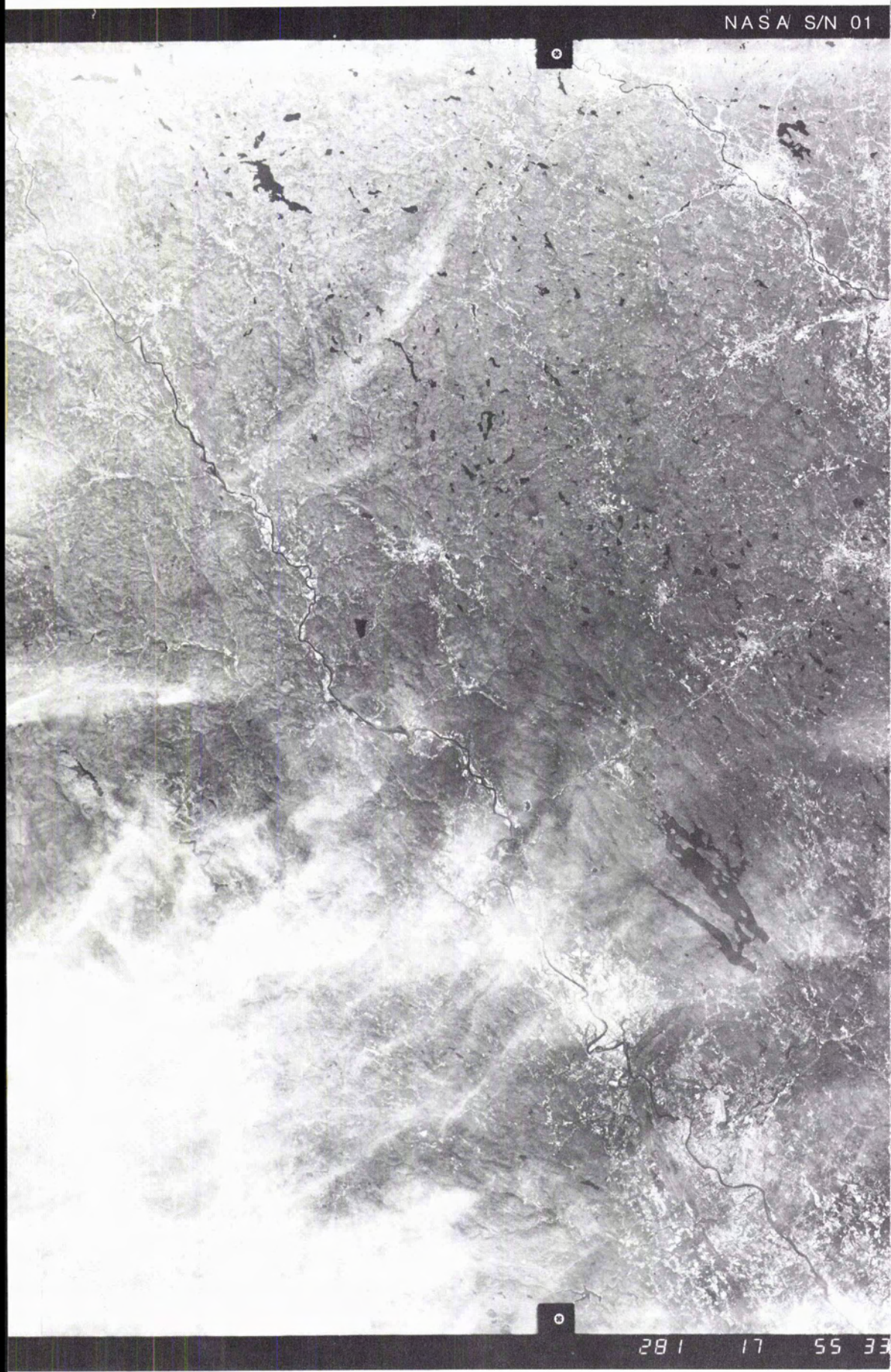
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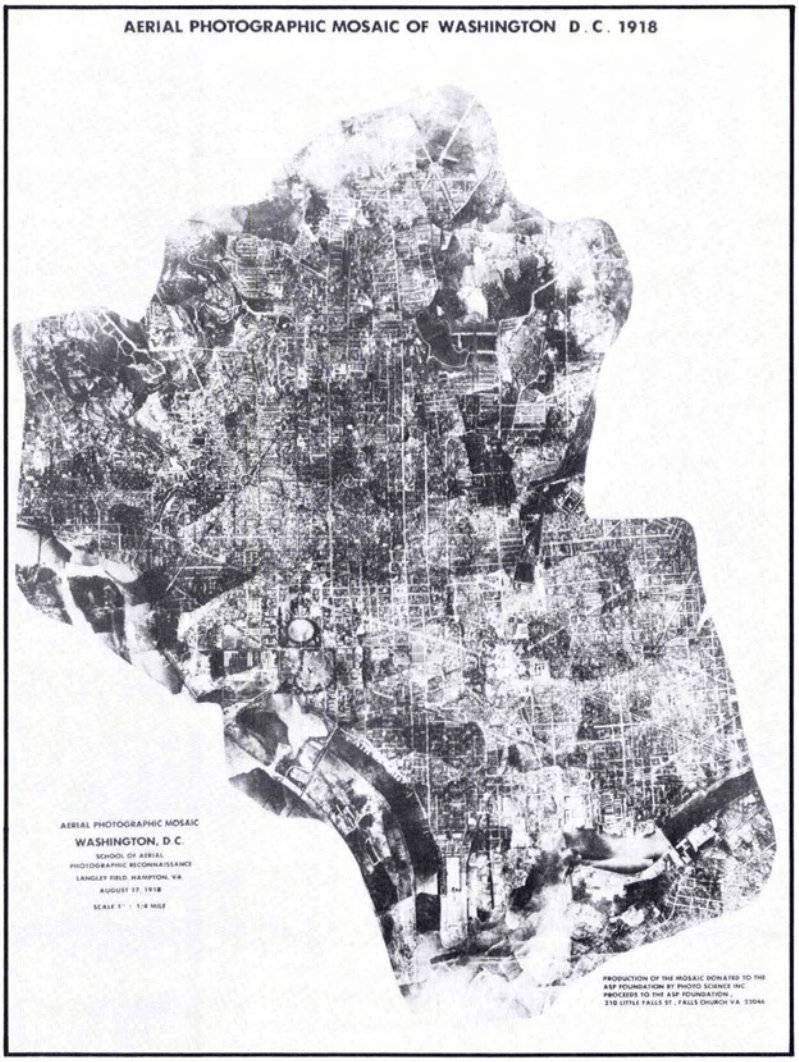

1918 AERIAL PHOTOGRAPHIC MOSAIC OF WASHINGTON, D.C. 20″ × 26″, black and white. Commemorating 50 years of photogrammetry in the United States, this poster is the latest in the series of posters distributed by the ASP Foundation. This is the earliest known aerial mosaic still in existence. Dated August 17, 1918, by School of Aerial Photographic Reconnaissance, Langley Field, Hampton, VA. Proceeds to the nonprofit ASP Foundation.

Price: $10. Postage $3 domestic

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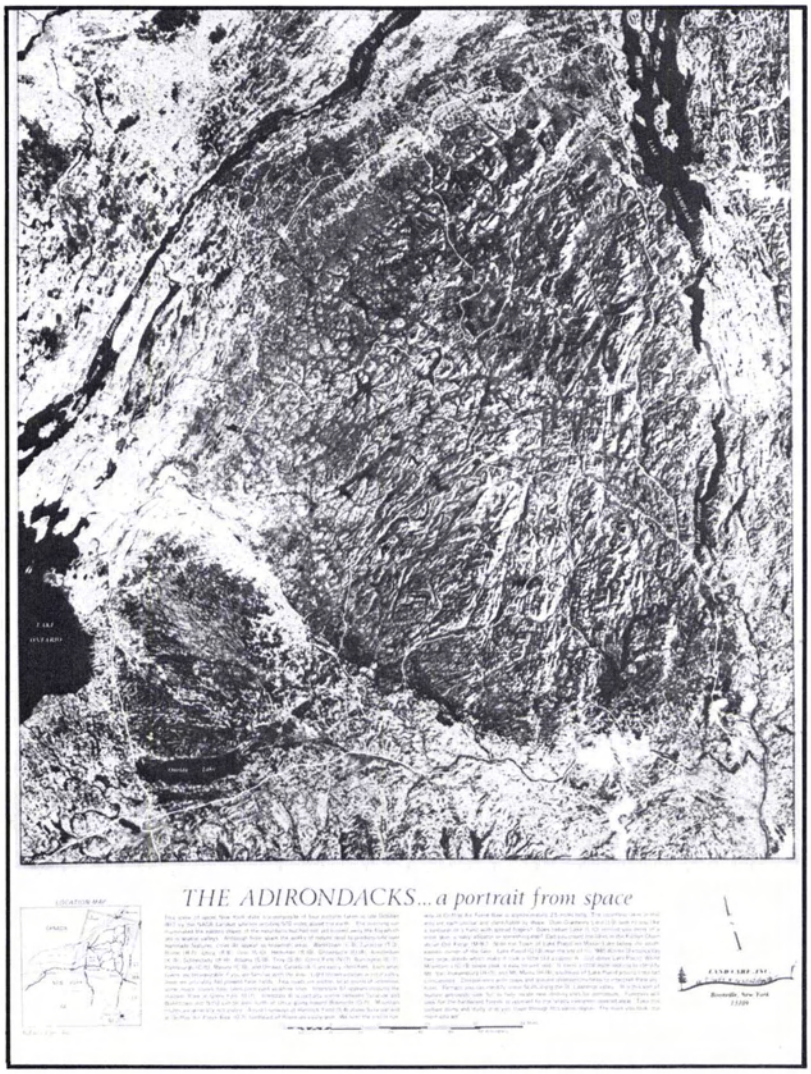

THE ADIRONDACKS . . . A PORTRAIT FROM SPACE. Scene of upper New York state in full color. An 18″ × 20″ composite of four pictures taken in late October 1977 by the NASA Landsat satellite orbiting 570 miles above the earth.

Price: $4. Postage $3 domestic

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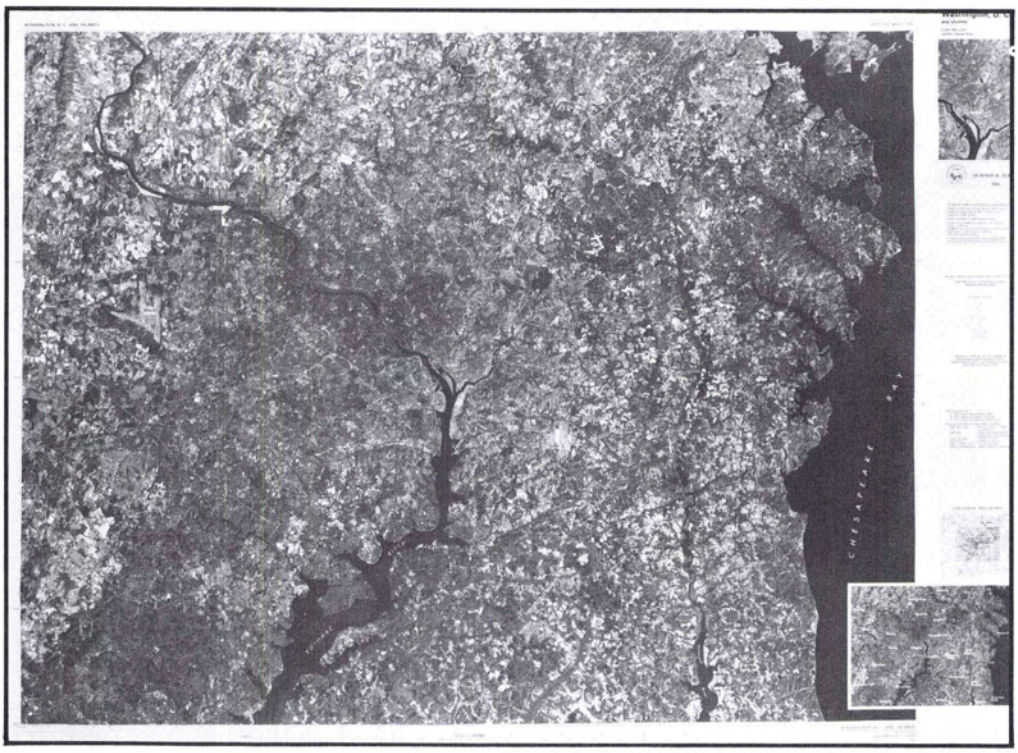
A SATELLITE VIEW OF THE CHESAPEAKE BAY. 20″ × 25″, color. Comes with factsheet describing Landsat, multi-spectral scanner imaging system, spectral bands. Can identify government/military areas such as the Aberdeen Proving Ground, national wildlife refuges, lakes and reservoirs, as well as cemeteries, airports and bridges.

Price: $5. Postage $3 domestic



WASHINGTON D.C. AND VICINITY, SATELLITE IMAGE MAP. Experimental edition, 1982, by USGS. 32½″ × 43″. Image recorded by Thematic Mapper on NASA Landsat-4 on November 2, 1982 at 10:14 a.m., E.S.T. Includes color key and location diagram.

Price: $5. Postage $3 domestic