

NEW EQUIPMENT FOR COMPOSING MATERIALS
OF MULTISPECTRAL SPACE AND AERIAL
PHOTOGRAPHIC SURVEYS

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Multispectral photography is widely used in remote sensing of the Earth performed for the purpose of studying the natural resources and monitoring the environment in the USSR.

Photography is accomplished from aeroplanes, space vehicles, manned orbital stations, and unmanned space vehicles, series "Cosmos".

Such surveying is performed with the use of special cameras and camera systems in the visible and near IR spectrum ranges.

As it is known, multispectral photography consists in simultaneous recording of the image of one and the same area of the terrain or one and the same object in two or more frequency ranges of electromagnetic spectrum.

Information so obtained discriminates the characteristics of objects under study that makes it possible, further on, to insure conditions for feasible automation of interpretation of objects phenomena, and processes during processing and, first of all, composing of images and to better reliability

and efficiency of work.

One of the multispectral camera systems used includes cameras, with focal length being 200 mm and film gate equal to 180x180 mm. Images are taken in the wave ranges of 500 to 600, 600 to 700, and 700 to 900 mm.

The aim of ground processing of multispectral space photos is conversion of this information so that it becomes convenient for various users who are specialists in different fields of science and production.

Composition of color images on the basis of multispectral photography is very efficient method of such conversion.

For the recent years, the Soviet specialists have developed many new devices and systems for optical composition of wide-format multispectral images.

These devices make it possible to solve practically all the problems arising from scientific and practical utilization of multispectral space and aerial photos. Creation of such devices put the USSR instrument making to the forefront of this field.

Elaboration of image composing equipment has been accomplished by a modular method aimed at creation of the most simple, reliable, cheap, small-sized and highly efficient devices to insure high-quality production and to encompass, in various combinations - any technological versions of processing multispectral photos.

Devices employed in the said system depend on contact-copying or projection method of composing images and envisage individual or shared utilization for interpretation of photos, and are intended for mass-productions at a large enterprise or for production of small lots or separate samples of false-color images.

Basic constructional solutions of the equipment developed are protected by inventor's certificates.

The system for composing multispectral images includes:
contact printing and image composing set "Contact-1";
multispectral image composing projector CPM-1;
multispectral image composing projector CPM-2 for shared use;
image composing unit PC-4.

1. Contact Printing and Image Composing Set

"Contact-1"

The "Contact-1" set is intended for making composite color image by means of contact printing from initial spectral negatives or positives, composite color photomosaics from copies of spectral photomosaics on transparent base, precision high-resolution false-color and black-and-white copies of initial images on a transparent base and for contact printing and measurement of optical density of images. The number of spectral negatives is not limited.

The "Contact-1" set includes:

image contact composing and printing unit (КСП);

image optical density meter (ИОН);

photo scanning, alignment, and punching unit (ПСП);

vacuum pan;

programmable microcalculator "Electronica-53-34".

The КСП unit is intended for contact-making of composite color images and for black-and-white, color, and false-color printing format to format and format to roll.

The unit is designed for using initial negatives, up to 530x610 mm, and operates at manual and semiautomatic control.

Photographic materials are held in place by means of the vacuum pan.

The unit insures resolution of 120 line/mm for black-and-white materials. Decrease of resolution for copies made by the unit is not over 12% relative to initial negatives. The level of illumination of the working field is 300 lx, with illumination irregularity being not over 10%.

The ИОН meter serves to measure optical densities of spectral black-and-white negatives (positives) on identical portions by means of an opacity meter. The dimensions of negatives are up to 530x610 mm.

The ПСП unit is intended for visual interpretation of multispectral negatives (positives) by means of the so called sight check. The unit is also used for visual alignment by contours and for punching aligning holes on a technological (working) field and color photographic materials.

The dimensions of images are up to 530x610 mm. Illumination of the working field is 1,000 lx. Resetting the unit from one format to the other takes not over 10 min.

The "Contact-1" set occupies 6 sq.m.

2. Multispectral Image Composing Projector CPM-1

The CPM-1 projector is intended for mass production by projection of composite color images, up to 30x30 cm, at 1.7X magnification and for visual interpretation of wide-format multispectral images and for their recording by means of photography.

The projector includes four projection channels, with the format of initial photos up to 190x230 mm, the format of a projected image up to 180x180 mm, and the dimensions of a looking-through screen being 320x320 mm.

Each projection channel is fitted with six light filters and provides magnification equal to 1.68X to 1.72X, with illumination at the center of the screen being 2,500 lx. Photographic recording of a composite image can be made either on formatted or rolled material.

3. Multispectral Image Composing

Projector CPM-2 for Shared Use

The CPM-2 projector is a shared apparatus and is intended for composing multispectral wide-format images and for interpretation of this image by a group of specialists.

This projector is the most efficient for complex interpretation of images.

The CPM-2 projector can also be used for training the students of high and special schools and for training and training for new profession the specialists.

The projector includes for projection channels fitted with six color and six neutral filters and provides for automatic focussing of images on the screen. The dimensions of initial photos are 190x230 mm.

Each channel provides for 10X and 18X magnification. A field of an image measuring 180x180 mm is projected at a screen measuring 4 sq.m. at 10X magnification and a field of 90x90 mm at 18X magnification.

4. Image Composing Unit PC-4

The PC-4 unit is of a projector type and is intended for composing wide-format multispectral images by parts at simultaneous 5X magnification.

The unit can be used both for mass production of composite color images and individual interpretation and photographic recording of particular composite images.

Besides, the PC-4 unit makes it possible to obtain composite color photomosaics from preliminary rectified black-and-white wide-format spectral (false-color) positives.

The unit includes a photographic recording attachment, three cassettes, two cases, MJB-2 microscope, photosensor, voltmeter, and SPTA kit.

The PC-4 unit comprises four projection channels fitted with three light filters each. The dimensions of initial images are up to 190x190 mm, with the size of a projected portion being 100x100 mm and the size of a looking-through screen, 500x500 mm.

Maximum illumination of the screen is 1,000 lx. Photographic recording is accomplished on color rolled or formatted film or paper, 530x30,000 mm and 520x520 mm, respectively.

Multispectral image composing equipment, types "Contact-1"; CPM-1, CPM-2 and PC-4 make it possible to use initial wide-format materials of multispectral photographic surveys to obtain composite color photographic products with the less loss of initial quality of images used and to resort to different types of composing.

This equipment makes it possible to accomplish photometric correction of irregularities in distribution of image tone on spectral positives caused by irregular illumination of the focal plane of a camera, state of atmosphere, etc. Correction is carried out with the use of masks made by means of image input/output units (for instance, the Φ EAF system manufactured by VEB "Carl Zeiss") and a computer (for instance, type CM14.20.06).

Composite color images and photographic products so obtained provide for clearness of color tones and distinct differences of objects all over the area of the image under interpretation.

The Soviet specialists have also developed and put into practical use, the techniques for composing multispectral images with the use of one-channel projectors made in the USSR and rectification instruments, type "Rectimat-C" made by VEB "Carl Zeiss", GDR.

The equipment, types "Contact-1", СПМ-1, СПМ-2, and ПС-4 can be bought via the Foreign Trade Association "Sojuzkarta".