The space information in a General geographic volume of the National Atlas of Russia

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The space images serve an independent source of the information about territory of Russia, and also source, essentially adding the cartographical information. The space photoimages are included in first General geographic volume of the National atlas of Russia in section "Geographical regions and seas of Russia". The pages of the given section with the space images are submitted by space images, address maps and summaries to images. The preparing of images to the edition comes true on computer publishing complexes.

The basic purpose of including space images in a General geographic volume of the National atlas of Russia is a maintenance of a high scientific and technological level of the contents of the National atlas of Russia as a whole and the volume in particular at the expense of granting to the readers of the atlas original, different from the cartographical, high quality information on place. The space images serve an independent source of the information about territory of Russia, and also source, essentially adding the cartographical information.

The space photoimages in General geographic volume of the National atlas of Russia give idea about physical-geographical peculiarities and modern shape of various regions of our country; their economic assimilation; character of a lay-out of large cities and natural peculiarities of their vicinities. Space photoimages give the information on place, essentially distinguished from cartographical: they show at a moment of shooting natural shape of place, constructed on the objective laws of an optical generalizing, while the maps display place in conditional signs on the basis of subjective generalizing and with use occuring at different times unvisual information (for example, state and administrative borders et cetera). A combination of the cartographical and space images of place will allow to the reader to make more complete idea about territory.

The space photoimages of an earth surface have ceased to be a rarity in present time. They all are located more often in large cartographical products: the complex world, national and regional atlases, and also some thematic (branch) atlases and series of maps. In the last years in our country several large cartographical products ("Atlas of snow-ice resources of the World", atlas "Resources and Environment World atlas", electronic atlas "Our Earth" and other), where space pictures are widely submitted, were developed. For this purpose large preliminary work on development and realization of the concept for space-born maintenance of named cartographical products was spent.

The Russian space vehicles regularly make photographic shooting of various regions for the globe and Russia. To the present time extensive fund space images of a various kind is generated, methods of processing of the space information are developed, significant experience of the space information application is saved at study of natural resources as well as social and economic objects. At the same time there are not enough generalizing products, reflecting modern level of space shooting in Russia, principles and methodical approaches for use of materials of shootings from space at an atlas mapping. The inclusion of the high level space information in the National atlas of Russia will illustrate opportunities of its usage at creation of the new information documents, that reflect a modern condition of natural and socioeconomic objects, ecological condition of environment, extent of anthropogenious influence on natural conditions.

The necessity of the space photoinformation using for the National atlas of Russia as a whole and for General geographic (first) volume of the Atlas, in particular, is well-founded in the developed in 1995 Concepts of the National atlas of Russia, Initial requirements for General geographic volume of the National atlas of Russia and also in the Offers on use of the space information in General geographic volume of the National atlas of Russia. The need of use of the space information in the Atlas is caused also by the requirements of maintenance of high quality, reliability, up-to-dateness and design separate volumes of the Atlas and National atlas of Russia as a whole.

Use of the space photoinformation at creation of the National atlas of Russia comes true on several directions. Space images are used for topographical and general geographical decoding of area objects and for updating topographical (general geographic) basis; as a source of the special contents of thematic maps, independent source of the information about a nature and economic assimilation of various territories of Russia or source, essentially adding the information, received by other methods; as an illustration to real image-picture of various regions for our country.

The basic problems, solved at designing and creating of space pages for General geographic volume of the National atlas of Russia, are:
– definition of the space photoinformation forms of use at mapping and study of natural and socioeconomic objects for creation general geographic and thematic maps of a volume;
– definition of the requirements to the space photoinformation, used as sources for drawing up general geographic thematic maps and as independent materials and illustrations of a volume;
– development of common matters in the space photoinformation technique of use for drawing up the maps, that are in volume,
– development of methods of mounting subdivisions and pages with the space photoimages as independent materials and illustrations, their coordinating with maps, texts and other materials of a volume;
– development of the document, that determinates the operating procedure with the space information at creation General geographic volume of the National atlas of Russia.

The basic requirements to the space information, represented in General geographic volume, are:
– high contrast and high quality of the images, predominance of colour pictures;
– cloudness not more than 10–20 % of the image area;
– summer period of shooting.

At development of the General geographic volume of the National atlas of Russia content about 300 pictures, received from domestic space vehicles, were looked through. Almost seventy images of different scales were selected among them for including in General geographic volume.

The prevailling majority of spacephotoimages of the given volume is received from automatic space apparatus (ASA) of second and third generations “Resource-F1” (camera KFA-1000), “Resource-F2” (camera MK-4), “Resource-F3” (camera KFA-3000). Space images of 1:3 000 000 scale, received from domestic operating space apparatus: hydrometeorological (“Meteor-30” – scanning device MSU-S), naturalresource (“Resource-O1” – MSU-SK, MSU-SK2), oceangraphic (“Ocean-O1” – MSU-S; “Ocean-O3” – MSU-S2), were included for display of some large regions of Russia in General geographic volume of the National atlas of Russia.

ASA “Resource-F1”, that provides a reception of multizone and spectrumzone information from height of 240 kms. There are six shooting systems on it: a star camera; threecamera multizone complex KATE-200 with a size of frame 18×18 cm; two longfocuse wideformat photocameras KFA-1000 with a size of frame 30×30 cm. Threecamera multizone complex KATE-200 provides reception from height of 240 kms of the multizone videoinformation with the spatial resolution 25−30 м at a strip of capture width of 215 kms. Original scale of the photoimages, received by photosystem KFA-1000, is about 1:200 000 – 1:270 000. The ground resolution is 5 m. A strip of capture – about 60 kms. The area, displayed on one frame, is about 6500 square kilometers. The high resolution of this information enables of great enlargement, thus the pictures quality does not much vary.

ASA “Resource-F2” are equipped by the star camera and multizone cameras MK-4. The photosystem MK-4 has four spectral channels, that allow to carry out synchronous multizone and spectrumzone Earth shooting of high geometric and photometric characteristics. A frame format is 18×18 cm. Opportunities ASA “Resource-F2” allow repeatedly to change height of a working orbit from 180 up to 355 km with the purpose of realization different scale shootings of various resolution. Original scale of the received images – from 1:550 000 up to 1:1 500 000 in a strip of shooting from 120 up to 270 км. At scale of shooting about 1:800 000 the ground resolution runs up to 5–10 m.

ASA “Resource-F3” is equipped by two cameras KFA-3000, allowing to receive the images by a format 30×30 см with the spatial resolution 2-3 м in scale 1:90 000 – 1:140 000 and strip of shooting of 55–84 kms (width of a strip for two frame).

In a volume the global survey information of the small spatial resolution received with a space vehicle “Meteor”, is used as well as the information of the middle and high resolution arriving from nature-resource sattelites “Resource-O1” (space vehicles №2 and №3 have been functioning since 1988 till present time) and “Ocean-O1”. Pictures of such scale in General geographic volume of the National atlas of Russia the following territories are covered by: the whole peninsula Kamchatka; Middle and

Down Povolzh`e; south of Russia (Black and Caspian sea, Large Caucasus, Stavropol`e); north-east of a European part of Russia, Northern Ural, firth of Ob river; Barabinskaya lowland, Kulundinskaya plain, Priobskoye plateau.

At a choice of the space information for inclusion in General geographic volume of the National atlas of Russia the preference was given to spectrazone images. Spectrazone space pictures, received by shooting on a two-layer colour spectrazone film in bands 570–680 nm and 680–810 nm, display territory of research in conditional colours. The colour scale of spectrazone shooting photoprints, received through three filters, is approached to natural. Contrast mosaic of colour scale of these images, inherent to various types of a landscape, natural and anthropogenious objects, elements of an infrastructure, infringements of environment, allows to differentiate these objects with greater reliability, than on black-and-white space pictures. Borders of objects on these pictures are precise and sharp.

In some cases it is supposed to use high quality black-and-white pictures with the precise contrast image. Black-and-white pictures are submitted mainly on islands of Russian Arctic and northern regions of Russia. But at preparation for the edition and at presence of the multizone space images computer processing on creation of the synthesized images will be spent.

The space photoimages are included in first General geographic volume of the National atlas of Russia in section "Geographical regions and seas of Russia" by three blocks at the end of regional subsections: European part of Russia, Asian part of Russia, Russian Arctic. It allows to emphasize an independent role of space images in the volume and moreover it is effective from technological positions. The pages with space pictures are included in general numbering of pages of a volume. The name to the picture is given due to a major geographical object, displayed on image, the same time, the specified object can occupy only part of the picture or is represented on it not completely. When the image of territory is almost the same on a map and a picture, the picture should get the name of a map.

The schemes of picture arrangement are located on sheets with subtitul pages and are combined with the schemes of an arrangement for the given region map sheets. An arrangement of space pictures for regions inside of Russia (European part of Russia, the Asian part of Russia and Russian Arctic) is submitted on three pages of the atlas. Here a help and explanatory material to space images of the subsections as a whole is given.

The pages of the given section with the space images are submitted by space images, address maps, summaries to images.

The space photoimages for General geographic volume of the National atlas of Russia according to the general concept of the National atlas of Russia and a concept of its airspace maintenance should give representation about physical-geographical peculiarities of separate regions of our country, large orographical units, basins of the large rivers, some elements of a soil-vegetative cover, modern view of various regions of Russia, their unique and characteristic landscapes, character of a lay-out of capital and large cities, natural peculiarities of district, in which cities are located.

In the majority of cases the space pictures submitted in General geographic volume of the National atlas of Russia are larger (in comparison with general geographic maps of the given section) scale. Such scale causes display on pictures of a part of territory, shown on general geographic map of the given region. At space maintenance of the General geographic volume for National atlas of Russia there are used both contact and enlarged prints space pictures. For example, in an illustration of a lay-out of large cities, detailed characteristics of territory and objects in large scale the contact and enlarged space images, received by the apparatus KFA-1000, are used. At the illustration of physical-geographical conditions of large area territories the space images, received by apparatus MK-4 and KATE-200 (contact and enlarged prints), are used. For more evident display of landscapes, occupying still more large territories, photoschemes (installations of several pictures), characterized large field of view are used.

As qualitatively a new kind of the information about shape of an earth surface space pictures have a number of valuable properties for general geographic mapping. First of all it is possibility to view of significant territories and in connection with this opportunity for study of large natural complexes as of a unit; an identical level of the information about large territories at lumpsum shooting; objective optical generalization; speed reception of the space information; regular repeatability of shooting on the same territory, reflecting dynamics in change of the environment; an opportunity to study of removed territories, inaccessible for research by other means; high quality of the photoimage.

The summaries accompany all space photoimages and are located on the same page, where the picture is. There are the help technical items of information about the space image (kind of space shooting, photocamera, original scale of shooting, scale of the image in the volume, year and season of shooting) and brief description of territory, displayed on the shoot, in these summaries. The summaries to the space images illustrate an opportunity of reception of the useful information from these images for the purposes of general geographic mapping and decision either one or another scientific and practical problems.

The address map (fragment of a 1:2 500 000 or 1:1 000 000, 1:7 500 000 general geographic map) gives geographical "binding" of objects (mountains, hollows, mountain ridges, rivers, lakes, cities and etc.) that are seen on the space image, and shows their names. It is located on one page with space image, summary to it and ground photo.

In some cases, for the best allocation of natural objects that are characterized on the picture, use of contrast artificial colours (for example, water objects are shown by blue colour) is admitted. Simultaneously with colourcorrection fine mechanical defects of the photoimages are eliminated.

The preparing of images to the edition comes true on computer publishing complexes. Positives are scanned and exposed to colourcorrecting. The colourcorrecting is made at certain participation of the author or editor of section of a volume. Thus the colours are selected in the majority of cases as it is possible closer to natural. Then colourseparating is made and afterwards four colourseparated positives are set on a film (polygraphic triad + black). Colourseparated positives are used for printing of colourful tests and edition.

The experience, received from the work under space maintenance of the first volume for National atlas of Russia, should find wide application at creation of the subsequent volumes of the Atlas, other cartographical products, and also in the scientific, educational and industrial purposes.

The preparation of pages with the space images to edition is carried on the basis of computer technology, uniform for the Atlas as a whole. The specificity of the space images has demanded including of some changes into this technology in comparison with the map edition preparation one.

The separate work with the constituents of atlas page – space images, address maps, and text materials (summaries to snapshots, headers, page numbers, subscripts of scale) is provided at starting stage of operation according to this technology.

The space images. The choice of space snapshots from funds of State research center "Priroda" and of the NITS IPR (Scientific and research center of natural resources study) was realized on the base of developed concept of volume space support, providing rather uniform covering of territory of Russia by space snapshots, representation of all natural zones and their economic developing. About 300 photographs were scanned and then at first their black-and-white imprints and after that the color (spectrazone (multispectral) and synthesized) ones were analyzed for definition of their aptitude for putting in the Atlas. 83 snapshots of different scales from them were selected for inclusion in General geographic volume. The color and black-and-white dublicate positives or dublicate negatives were produced from originals of these snapshots for further operation. The dublicate positives or dublicate negatives are scanned on the Linotype-Hell company barrel scanner TANGO with a resolution not less than 300 dpi and are color corrected to approach the color transfer to natural one as near as possible. The image treatment is performed on Apple Macintosh computers with Linocolor 4.2 and Adobe PhotoShop 5.0 programs. The image of initial color dublicate positives has a blue-lilac range of color. It was managed to achieve the acceptable result with the help of correction curves of blue, green and red color channels and selective correction of groups of colors. The retouch and color change of separate parts is performed after general color correction of each image. For example, the color of water surfaces, which is, as a rule, black on initial materials, is substituted on cyan or blue. The black-and-white snapshots are rendered if it is possible. The polyzonal black-and-white images are synthesized. The color correction of the space images is performed at obligatory collaboration of the text summary writer or editor of volume subsection. The colors are selected in most cases as close to natural ones as possible. The use of contrast artificial colors is enabled in some cases for the best accentuation on snapshots of natural and man-caused objects. The small mechanical defects of the photo-images are eliminated simultaneously with the color correction.

Address maps. The address maps of pages with the space images are composed to prevent doubling of operations on the base of the corresponding general geographic maps of the first volume in scales 1:2 500 000, 1:1 000 000 or 1:7 500 000 according to designed computer technology of compiling of the general geographic volume of the National atlas of Russia. Scale of an address map is selected according to scale of the space image. It was supposed, that the creation of address maps would be performed at once after a vectoring of main maps, that is practically in parallel: the files with records of the drawn up maps will be passed for compiling on their base of address maps. But because many errors were found after a vectoring and first editing of maps it was necessary to refuse from it.

The fragments of maps with 8×8 or 10×10 cm sizes (but other map sizes are permissible) are "cut out" for territory, imaged on a space snapshot, and its nearest neighborhoods, from files with the general geographic maps recordings. If there are no ready files, the fragment of basic map is scanned and the necessary square is selected according to address map sizes. Its vectoring is performed with simultaneous conducting of map-making operations. The obtained address maps are turned about so that a

meridian driving approximately through center of an address map, is placed upright. The meridians are signed on northern framework; parallels – on a western one for odd pages of the Atlas, on eastern one – for even pages; address map scale, corresponding to general geographic map scale, is pointed on a southern framework. The created address map is framed for its best perception as independent cartographic material. The mask is "put on" from exterior of a framework to confine the "tails" of elements, which could not be cut precisely by framework. The boundaries of territory shown on a space snapshot are pointed on address map. The inhabited locality titles, which have found beyond the scope of a map, are transferred inside of it; and, on the contrary, if the inhabited locality letter-punch is beyond the scope of an address map, the title of the inhabited locality is removed. The same operation is carried out with titles of the rivers, lakes, water storages etc. The titles of physical and geographical objects (plains, lowlands, eminencies etc.); of the subjects of Russian Federation; frontier states, which have appeared in score of a map, put on an address map. The size of fonts for large objects in this case could be a little smaller then the sizes of identical titles on the general geographic maps. Many inscriptions for best location of object geographic titles and their good readability (the grid of coordinates is discontinued at the black color inscriptions) are shifted, taking into account their location relative to other objects and geographic grid too. Then the presence of all inscriptions of elements of a general geographic map contents is checked up.

The regularity of strata succession is checked up: all inscriptions should be higher than all remaining strata, the hydrographic information should "lie" above relief strata, the inhabited locality letter-punches – above railroads, highways, rivers etc.). The obligatory testing of each stratum on overprint is carried on (overprint regime should be switched off) during the address map preparation for record on diskette to guarantee of print high quality. The operation with address maps is carried on in FreeHand software package on the IBM-compatible computers. The files with address maps should be converted in the format *.eps* to transfer them to Macintosh system.

The summaries. The summaries for the space images are prepared by the specialists-geographers, which are well known with the given region and possess sufficient information base for given territory. The authoring texts of the summaries are exposed to scientific and literary redaction for unification of their structure and correspondence to the bulk of a place, marked out for them on page. The final determination of summary contents and its editing are carried out after the first stage of computer page make-up, when the precise boundaries of the space images and bulk of summaries are determined. The text of the summaries is typed on personal computers in the program Word 7.0/97/2000 for Windows 95/98/ME. The text of the summaries is written in RTF-format for transfer to make-up.

Page make-up. The atlas page make-up is performed by montage of files of all component parts of page (raster space images, vector address maps and text summaries) on Apple Macintosh publishing computers with software package QuarkXPress 4.1 after these files are prepared. The make-up is performed taking into account the general requirements to composition and design of the atlas as a whole and particular requirements to pages with the space images. The general requirements are determined the format of pages, position of the folio and page headers on them, types and points of fonts, sizes of a back edge. There are particular requirements for pages with the space images such as the placing of the space images just barely enough to the page edge, combination on one page of the space images, address maps and text summaries, availability of a color background for the fields under the summaries, folio and page headers. There are some difficulties in this case:

1) the space snapshots have a wide scatter in color, differ in color range from address maps, therefore it is very difficult to select for all pages a uniform background satisfied to design requirements;
2) it is impossible to determine at once sizes of the space image and address map, bulk and contents of the summary. These parameters are determined during page montage. The space images are placed in the location marked out for them on page of the atlas according to dummy copy. The scale of snapshot and territorial coverage of the image are changed in this case. The page header and folio are inserted into the space image.

Therefore make-up is performed in two stages: preliminary and final. The precise boundaries of the space image, sizes of an address map and summaries are determined as a result of preliminary make-up. The precise boundaries of the space image are carried on address map, the bulk and contents of the summaries are determined from the black-and-white printed sample and they are finally edited. After that the final make-up of page is performed, according to results of it the color printed sample is made.

The color separation and output of four color-separated positives (polygraphic triad + black one) are performed to a film by the control editorial staff after the revision of the printed sample of made-up page. The color-separated positives are used for printing of colorful samples and circulation. The colorful samples, printed from them, approved finally by editorial board.

The developed technology has permitted to achieve of high polygraphic quality of the images with conservation of natural color transfer.