

INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY AND  
REMOTE SENSING (ISPRS)

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M E M B E R R E P O R T  
OF THE SCIENTIFIC AND TECHNICAL UNION FOR  
GEODESY AND LAND MANAGEMENT, BULGARIA

Having made its first steps only 30 years following the country's liberation from 5 centuries of Ottoman domination, photogrammetry in Bulgaria has been making a steady headway to reach its present state, meeting the needs of its national economy as well as being a match to modern trends in science and technology.

The very first photogrammetric surveys in Bulgaria were recorded in 1907-1908 and were plotted by Eduard von Orel using a stereo-authograph of his own make. During the 1912 Balkan War aerial photographs were taken for military reconnaissance, while during World War I (1914-1918) terrestrial photographs were taken for military purposes and for designing a railway line as well. Later on, in 1920 and 1921 terrestrial photographs were taken also, while the first panoramic aerial photographs were recorded in 1926.

A rather noteworthy attempt of adopting terrestrial photogrammetry in Bulgaria was made in 1928 near Sofia, the capital. The newly designed Wild phototheodolite was used to make a survey of an area of nearly 2.5 sq.km, which was later mapped at the 1:10 000 scale at the Wild factory by means of the also newly developed A-2 authograph. In 1930 preparation began for the use of terrestrial photogrammetry in drawing the 1:25 000 scale map of the country. The same year three Wild phototheodolites, an A-2 authograph, a Wild aerial photographic camera and a Hegershoff-Heide rectifier were imported, so that the use of terrestrial photogrammetry for the mountainous regions began simultaneously with the aerial photography of the country's plain regions. Later on, stereophotogrammetric instruments were secured and aerial stereophotogrammetry has been in use almost exclusively ever since 1940. Its application in large-scale mapping and for non-topographic purposes attained its peak in the post-World War II period, marked by major socialist reforms aiming at the restoration and intensive development of Bulgarian economy.

Nowadays over 20 institutes, enterprises and offices in Bulgaria are developing and using photogrammetry in various fields of human endeavours both in this country and abroad. Presently we have at our disposal laboratories equipped with all the necessary modern photogrammetric instruments and systems.

Training in photogrammetry is the concern mainly of the Geodesy Department of the Higher Institute of Architecture and Construction as well as of other two technical universities and five technical colleges in the country. Research is carried out by the Research Institute of Geodesy and Photogrammetry at the General Administration for Geodesy, Cartography and Cadastre, as well as by the respective departments of the technical universities. The first manual of photogrammetry of 1930 has long been replaced by textbooks, nu-

merous instructions, courses and technologies, while the number of theoretical and applied publications on photogrammetry in yearbooks and reviews, including publications in periodicals abroad, will soon reach 1000.

Bulgarian photogrammetrists are organized in their Photogrammetry and Remote Sensing scientific and technical section with the Scientific and Technical Union for Geodesy and Land Management, being a member of ISPRS.

The territory of Bulgaria is covered periodically by aerial photographs for various purposes at scales ranging from 1:30 000 to 1:3 000. The instruments used are mainly wide-angle (15/23 cm) and normal-angle (30/23 cm) aerial cameras of Zeiss-Jena (GDR), Zeiss-Oberkochen (FRG) and Wild (Switzerland), mounted on AN-30 and AN-14 Antonov (USSR) aircraft. For the purpose are used films and slides of Agfa-Gevaert (FRG), Kodak (USA), ORWO (GDR) and ASMA (USSR). Photolaboratory equipment used is Zeiss-Jena, Zeiss-Oberkochen and Pentacon (GDR). Aerial photographs at scales 1:30 000 to 1:100 000 are used in prospecting for natural resources and environment protection. Multizonal photographs are being taken by means of the MKF-6 multi-spectral camera of Zeiss-Jena, used for devising test-areas for interpretation of space photographs and their comprehensive use for national economy purposes.

Principal photogrammetric activity in Bulgaria comprises making and revising topographic maps, maps of populated areas and such for the specific requirements of surveys and design of various projects and equipment, including orthophoto plans to serve as basis for cadastre.

The topographic map at the 1:25 000 scale is being revised on the basis of aerial photographs at scales ranging from 1:25 000 to 1:30 000, and the large-scale topographic maps of the country (1:5 000 and 1:10 000) - on aerial photographs at scales of 1:12 000 and 1:30 000. Making and updating maps of populated areas at 1:1 000 and 1:500 scales are made by aerial photographs at scales of 1:6 000 and 1:8 000. Orthophoto plans at the scale of usually 1:10 000, based on 1:30 000 scale aerial photographs, serve as basis for the Unified Cadastre of Bulgaria. Maps and plans at scales of 1:500 to 1:10 000 are being made to meet the special needs of surveying and designing of various projects and equipment (mining and geological surveys, roads, railways, bridges, tunnels and other engineering structures, industrial areas, etc.).

Photogrammetric measurements of terrain profiles used in automated designing of motorways and photogrammetric inventoring of existing road network should be noted as well. Photomosaics at different scales for the needs of townplanning are also made. Geographic and small-scale topographic maps are being revised on the basis of space photographs processed by means of analog and analytical stereophotogrammetric methods, rectification and orthophotocopy.

Alongside the other methods of photogrammetric densification of the geodetic network, an extensive application has gained the analytical block aerotriangulation. Photographic co-ordinates are measur-

ed by the Zeiss-Jena Stecometer stereocomparator and recorded on magnetic tape by means of the Bulgarian-made ISOT 9115 E/ES 9004 recording system, linked to it. Zeiss-Jena Transmark and Wild PUG-4 devices are used for marking and transferring image points onto slides. Computation is effected by means of IBM-370 or United System (ES) computers of the Comecon countries, using Bulgarian or adapted programs.

Stereo-restitution is performed mainly by analog plotters of the Zeiss-Jena Stereometrograph type, orthophotostereography - by Zeiss-Jena Topokart-Orthophot and Topomat systems, while rectification is made by SEG-I (Zeiss-Jena), SEG-V (Zeiss-Oberkochen) and E-4 Wild rectifiers.

Bulgarian-made devices forming a system for acquisition and processing of graphic information are: ISOT 9115E for analog-digital data transformation, ES9004 and ES9003 (inbuilt minicomputer) devices for data recording on magnetic tape, ISOT 230 alpha-numerical printer, ISOT 210 minicomputer and an automatic plotter. The modules of this system are used in various combinations for recording photogrammetric measurements, digitalization of existing maps of populated areas and cadastre orthophotomaps, and for devising digital terrain models. Technologies for making and updating of maps of populated areas as well as for setting up cadastral data bank have been developed on the basis of the above system.

Terrestrial photogrammetry rendered measuring processes in certain fields far more efficient, such as in coke output; mining; civil, transport and water engineering; architecture; archeology; machinebuilding; medicine; forestry; crime detection, etc. For the purposes of architecture one makes plans and photoplans of street areas, facades of buildings, monuments and interior design elements (iconostases, profiles and vaults of churches, fragments, bas-reliefs, murals, etc.) at scales from 1:100 to 1:1 000. Terrestrial photogrammetry is applied in industry to calculate volumes of bulk materials. For the needs of hydrotechnical construction it is used for digitalization of contours and for subsequent area estimation to determine changes in water volumes of dams. Measurements for estimation of areas and volumes in open-pit mining are being made as well. Application of terrestrial photogrammetry is based mainly on the use of UMK versatile camera, PHOTHEO phototheodolite and SMK stereometric camera, while mapping is assisted by the use of Topokart and Stereoauthograph, all products of Zeiss-Jena.

In conclusion, it should be noted that a brief account like this could hardly be conducive to an adequate appreciation of the scope of development achieved by photogrammetry in Bulgaria in the course of the last 75 years. Its particularly intensive and wide upsurge took place in the last 4 decades. The future of photogrammetry in Bulgaria is in setting up fully automated photogrammetric systems for acquisition and processing of data from outer space, air and earth alike.

## M I T G L I E D S B E R I C H T

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WISSENSCHAFTLICH-TECHNISCHEN VERBANDES FÜR GEODÄSIE UND  
LANDEINRICHTUNG IN BULGARIEN

/Zusammenfassung/

Gegenwärtig findet die Photogrammetrie in Bulgarien im Rahmen von mehr als 20 Instituten, Betrieben und Dienststellen, und zwar in verschiedenen Sphären der menschlichen Tätigkeit, darunter auch weit über die Grenzen des Landes hinaus, weitgehend Einsatz. Das Land verfügt über modern ausgestattete Photolabors wie auch über die erforderliche Art und Zahl von Photokameras, Sonderflugzeugen und photogrammetrischen Geräten und Systemen. Das Territorium Bulgariens wird regelmässig mit Luftbildaufnahmen unterschiedlicher Bestimmung im Masstab 1:30 000 bis 1:3000 bedeckt. Zum wichtigsten Wirkungsbereich der Photogrammetrie gehören vor allem die Herstellung und Erneuerung von Karten im Masstab 1:25 000 bis 1:5000, einschliesslich der grossmasstäblichen topographischen Karte Bulgariens (1:5000, 1:10 000), Karten der Ortschaften (1:1000, 1:500), grossmasstäblichen Karten zwecks Erforschung und Projektierung unterschiedlicher Objekte und Anlagen wie auch die Schaffung von Orthophotoplänen (1:5000, 1:10 000) als Grundlage des Einheitlichen Katasters der VR Bulgariens. Für nichttopographische Zwecke findet die terrestrische Photogrammetrie weitgehend Verwendung.

Parallel zur intensiven Entwicklung der Produktion werden auch wissenschaftliche Untersuchungen, die vorwiegend angewandten Charakter haben, durchgeführt. Besonderes Augenmerk gilt den automatisierten Systemen für Datenverarbeitung, der Aerotriangulation, Ortholichtbildentzerrung, den Fernerkundungsverfahren und der den Zwecken der Architektur dienenden Photogrammetrie.

Gegenwärtig sind drei technische Hochschulen und fünf technische Fachschulen im Lande mit der Ausbildung von Spezialisten in der Fachrichtung Photogrammetrie betraut. Herausgegeben wurden Lehrbücher, Richtlinien, Instruktionen und Technologien, und die Gesamtzahl der theoretischen und der auf die Praxis bezogenen Publikationen auf dem Gebiet der Photogrammetrie, die in den Jahrbüchern und Zeitschriften - darunter auch im Ausland - erschienen sind, wird bald 1000 erreichen.

Die bulgarischen Photogrameter sind in der wissenschaftlich-technischen Sektion "Photogrammetrie und Fernerkundung der Erde" bei dem Wissenschaftlich-technischen Verband für Geodäsie und Landeinrichtung vereint, über den sie der Internationalen Gesellschaft für Photogrammetrie und Fernerkundung angehören.

## R A P P O R T

de

L'UNION SCIENTIFIQUE ET TECHNIQUE DE GEODESIE ET  
D'AMENAGEMENT EN BULGARIE

/Résumé/

Plus de 20 instituts, entreprises et services bulgares font usage de la photogrammétrie dans divers secteurs de l'activité humaine, y compris à l'étranger. A présent nous disposons de laboratoires très modernes et équipés et de caméras photo et d'avions spéciaux de même que de nombreux appareils et instruments photogrammetriques contemporains. Le territoire bulgare est périodiquement couvert de levés aériens à l'échelle de 1:30 000 et 1:3 000 à des usages divers. L'activité photogrammétrique essentielle consiste à établir et à rénover les cartes, échelle 1:25 000 jusqu'à 1:500, y compris la carte topographique à grande échelle, 1:5 000, 1:10 000, les cartes des localités 1:1 000, 1:500, les cartes à grande échelle pour l'étude et la réalisation de différents ouvrages et équipements l'établissement de carte orthophotographique 1:5 000, 1:10 000 à l'usage du cadastre de la R P de Bulgarie. On utilise couramment la photogrammétrie terrestre à des fins non topographiques.

Parallèlement au volume important de la production, des recherches scientifiques pour être appliquées dans la pratique. On accorde une attention toute particulière aux systèmes automatisés de traitement de données, l'aérotriangulation, l'orthophototransformation, les méthodes de télédétection et la photogrammétrie architecturale.

La photogrammétrie est enseignée dans trois universités techniques et cinq écoles techniques. Il existe de nombreux manuels, des instructions, des tableaux, des technologies et les publications théoriques et d'ordre pratique dans les annals et les revues spécialisées atteindront bientôt le chiffre 1000.

Les activités des photogramètres bulgares sont régies par la section "Photogrammétrie et télédétection" près l'Union scientifique et technique de géodésie et d'aménagement, qui est membre de l'ISPRS.