Russian and Japanese Aerospace Literature

During 1996 the *AIAA Journal* will carry selected abstracts on leading research topics from Russian aerospace literature and, as space permits, from similar Japanese literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features Atmospheric Propagation from Russia and Aluminum Alloys from Japan.

Support for assembling and publishing the selected abstracts has been provided by the Innovative Science and Technology Directorate of the Strategic Defense Initiative Organization (SDIO), with the sponsorship and technical management of the abstract service by the Office of Naval Research (ONR) under ONR Grant N00014-93-I-1074.

Abstracts in this listing have been taken from the monthly abstract journal *International Aerospace Abstracts* (IAA), published by the American Institute of Aeronautics and Astronautics (AIAA). Additional materials can be obtained through searching the Aerospace Database—available online via DIALOG or NASA RECON.

Paper copies and microfiche of the original documents cited are available from Aeroplus Dispatch, 1722 Gilbreth Road, Burlingame, CA 94010 (800) 662-2376. Use the "A" number to identify material you want. Please be advised that most of the original documents are in the original language. Direct questions concerning this abstract section of the *AIAA Journal* to Norma Brennan at AIAA Headquarters.

Russian Aerospace Literature
This month: *Atmospheric Propagation*

A95-34662   Atmospheric transparency variation spectra (Spektry variatsij prozrachnosti atmosfery). B. D. BELAN, G. O. ZADDE, and A. I. KUSKOV (RAN, Inst. Optiki Atmosfery; Tomskij Gosudarstvennyj Univ., Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, No. 4, 1995, pp. 619–624. In Russian. 7 Refs. Documents available from Aeroplus Dispatch.

The temporal variations of the spectral transparency of the atmosphere and its components are investigated by using spectral analysis. Some hidden periodicities are identified which are commensurate with variations of atmosphere parameters at the synoptic scale. The results suggest that the attenuating properties of air can be predicted synoptically for time periods of 3–20 days.

A95-34136   A numerical model of an adaptive optical system. I—Propagation of laser beams in the atmosphere. II—Wavefront transducers and actuators. III—Software implementation of the model (Chislennaya model' adaptivnoj opticheskoj sistemy. I—Rasprostranenie lazernykh puchkov v atmosfere. II—Datchiki volnovogo fronta I ispolnitel'nye ehlementy. III—Programmnaya realizatsiya modeli). V. P. LUKIN, F. Y. KANEV, P. A. KONYAEV, and B. V. FORTES (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, No. 3, 1995, pp. 409–434. In Russian. 28 Refs. Documents available from Aeroplus Dispatch.

Computational algorithms and a computer code are described which make it possible to model the propagation of high-power laser beams in the atmosphere and to evaluate the efficiency of using various adaptive optics components, such as Hartmann wavefront sensors and flexible and segmented mirrors. Sewing algorithms are presented for a discontinuous phase surface, and models are proposed for some actuators, including modal and zonal correctors, a segmented mirror, and two models (static and dynamic) for a flexible mirror. A set of application software based on the numerical models of adaptive optics is described. Particular attention is given to the graphic interface of the application programs which makes the software user-friendly.

A95-29783   Characteristics of the use of adaptive optical systems in the atmosphere (Osobennosti ispol'zovaniya adaptivnykh opticheskikh sistem v atmosfere). V. P. LUKIN (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, Nos. 1, 2, 1995, pp. 280–290. In Russian. 34 Refs. Documents available from Aeroplus Dispatch.

Results of recent studies concerned with the development and applications of adaptive optical systems are summarized. A classification of state-of-the-art optoelectronic systems is proposed, and the place of adaptive systems within this classification is defined. Some highlights in the evaluation of adaptive systems are discussed, including the development of a new numerical model and structural analysis of the most promising optoelectronic algorithms and systems using adaptive correction.

A95-29782   Second-generation autodyne lidar (Avtodinnye lidary vtorogo pokoleniya). E. P. GORDOV (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, Nos. 1, 2, 1995, pp. 265–279. In Russian. 38 Refs. Documents available from Aeroplus Dispatch.

The fundamental principles of the laser reception of echo signals are examined, and autodyne lidar systems are described which employ this method of weak optical signal reception in atmospheric sounding. Some recently proposed modifications for the autodyne lidar are examined. These include parametric lidar in which the modulation of the probing beam is used to expand the range of optical and dynamic characteristics of the atmospheric path and of the remote reflector that can be extracted from the received echo signal. Another example is hybrid lidar in which the advantages of the traditional continuous-wave autodyne lidar are combined with those of the pulsed lidar.

A95-29781   Development of lidar methods of atmospheric aerosol sounding (Razvitie lidarnykh metodov zondirovaniya aehrozol'noj atmosfery). G. G. MATVIENKO (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, Nos. 1, 2, 1995, pp. 242–264. In Russian. 35 Refs. Documents available from Aeroplus Dispatch.

Single-frequency methods of the lidar sounding of atmospheric aerosols are analyzed. Data are presented on the spatial-temporal variability of natural aerosols in the boundary atmospheric layer and its relation to turbulence. The possibilities afforded by ground-based and airborne lidar in mapping aerosols and determining the intensity of local pollution sources are demonstrated. Noncoherent methods for the sounding of horizontal wind profiles are described. Results of the laser sounding of cloud fields obtained by means of orbital quantum ranging instruments in 1982–1983 are discussed in relation to the problem of aerosol sounding from space.

A95-29775   Theory of linear systems in disperse medium optics (Teoriya linejnykh sistem v optike dispersnykh sred). V. V. BELOV (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, Nos. 1, 2, 1995, pp. 116–130. In Russian. 47 Refs. Documents available from Aeroplus Dispatch.

Results of comprehensive experimental and theoretical studies concerned with problems of optical signal propagation through dispersive media are reviewed. The studies, carried out at the Institute of Atmospheric Optics, Russian Academy of Sciences, have consistently applied the theory of linear systems to the analysis of optical signal propagation through dispersive and absorbing media. Algorithms for the mathematical modeling of the transmission properties of optical signal channels in dispersive media have been developed and validated.

A95-29774   Nonlinear propagation of laser emission in the atmosphere (Nelinejnoe rasprostranenie lazernogo izlucheniya v atmosfere). A. A. ZEMLYANOV (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, Nos. 1, 2, 1995, pp. 89–115. In Russian. 91 Refs. Documents available from Aeroplus Dispatch.

Results of recent research concerned with the problem of nonlinear propagation of laser emission in the atmosphere are summarized, with particular reference to the work carried out at the Institute of Atmospheric Optics, Russian Academy of Sciences. The discussion covers nonlinear optical effects, propagation of high-intensity radiation in turbid media, and thermal blooming effects. Attention is given to laser evaporation of droplets, optical breakdown of aerosols, and stimulated Raman scattering in transparent droplets.

A95-29771   Advances in atmospheric optics and monitoring of the physical state of the atmosphere (Uspekhi atmosfernoj optiki i monitoring fizicheskogo sostoyaniya atmosfery). M. V. KABANOV (Konstruktorsko-Tekhnologicheskij Inst. 'Optika', Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, Nos. 1, 2, 1995, pp. 31–49. In Russian. 33 Refs. Documents available from Aeroplus Dispatch.

A retrospective review of fundamental and applied research in the field of atmospheric optics is presented, with attention given to studies concerned with the spectral transparency of the atmosphere, principles of optical radiation and image transfer in scattering media, and optical refraction in the Earth atmosphere. Advances in the optical experiment methodology and technology are discussed with particular reference to combined climatological/ecological monitoring. Results of the processing of homogeneous series of observations of the climatological/ecological parameters of the atmosphere are presented.

A95-29770   Spectral line periphery problem in atmospheric optics (Problema periferii kontura spektral'nykh linij v atmosfernoj optike). S. D. TVOROGOV (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 8, Nos. 1, 2, 1995, pp. 18–30. In Russian. 40 Refs. Documents available from Aeroplus Dispatch.

The spectral line periphery problem in atmospheric optics is examined, and previously proposed solutions are briefly reviewed with particular reference to studies by Zuev (1966), Tvorogov (1988), and Nesmelov et al. (1977, 1986, 1988). The possibilities afforded by the line wing theory for practically important applications in atmospheric optics are discussed. Some illustrative examples are presented.

A95-22158   Color temperature and pseudoemission properties of the atmospheric dust. V. P. GALILEJSKIJ, A. M. MOROZOV, and V. K. OSHLAKOV (Russian Academy of Sciences, Inst. of Atmospheric Optics, Tomsk, Russia), *Optics in atmospheric propagation and random phenomena; Proceedings*, Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2312), 1994, pp. 65–71. 8 Refs. Documents available from Aeroplus Dispatch.

A mathematical model of the angular distribution of the sky spectral brightness is used to calculate Tc and epsilon of the solar radiation brightness field scattered in the atmosphere. Estimates of the sky-zenith color temperature made on the basis of photometric observations under conditions of cloudless day sky are presented. Specific values of color temperature obtained on the basis of observations of spectral zenith brightness of a clear and turbid atmosphere and cloud propagation. It is suggested that the color temperatures of zenith with and without cloudiness differ significantly (by about a factor of 5). The evident differences in the character of color-characteristic distributions in cloudy and cloudless areas of the sky can help solve different fundamental and applied problems of atmospheric optics.

A95-22155   Computer system for estimation of atmospheric effects on propagation of optical radiation. E. B. BELYAEV, A. I. ISAKOVA, Y. D. KOPYTIN, and V. V. NOSOV (Russian Academy of Sciences, Inst. of Atmospheric Optics, Tomsk, Russia), *Optics in atmospheric propagation and random phenomena; Proceedings of the Conference*, Rome, Italy, Sept. 1994 (A95-22151 05-74), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2312), 1994, pp. 33–43. 16 Refs. Documents available from Aeroplus Dispatch.

A computer system for predicting and taking into account the effect of the totality of linear optical phenomena in the real atmosphere on the accuracy and energy characteristics of optoelectronic systems and devices is presented. The computer system for estimation of the atmospheric effect on the propagation of optical radiation is a set of application programs relying on engineering techniques and summarizing the results of fundamental scientific studies in atmospheric optics. The system can provide versatile services. The system makes it possible to present promptly the results as tables, diagrams, and graphs. It can be used as a training program for students. The computer system consists of two packages of programs for IBM PC/AT. (Author)

A95-22108   A study of the dynamics of optically dense winter hazes using the inversion of the measured values of the spectral transparency of the atmosphere (Issledovanie dinamiki razvitiya opticheski plotnykh zimnikh dymok metodom obrashcheniya izmerenij spektral'noj prozrachnosti atmosfery). E. V. MAKIENKO, Y. A. PKHALAGOV, R. F. RAKHIMOV, V. N. UZHEGOV, and N. N. SHCHELKANOV (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 7, Nos. 11, 12, 1994, pp. 1504–1507. In Russian. 3 Refs. Documents available from Aeroplus Dispatch.

A study is made of the transformations of the particle size spectra of the submicron and coarse aerosol fractions in the process of the formation and evolution of optically dense winter hazes. Results are obtained by solving the inverse problem using experimental data on the spectral dependences of the aerosol attenuation coefficient in the wavelength region 0.44–3.9 μ. It is found that, for stable high (above 95%) values of relative humidity, the time variability of the absolute air humidity correlates with the dynamics of the principal integral microstructural characteristics of the cumulative aerosol fraction.

A95-22104   Effect of spatial variations of the relaxation matrix on the transmissivity of a molecular atmosphere (Vliyanie prostranstvennykh variatsij matritsy relaksatsii na propuskanie molekulyarnoj atmosfery).

Y. V. KISTENEV (Tomskij Gosudarstvennyj Univ., Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 7, Nos. 11, 12, 1994, pp. 1478–1481. In Russian. 5 Refs. Documents available from Aeroplus Dispatch.

The transmissivity of resonant media is analyzed for the case where the medium relaxation matrix, which determines the width and the central frequency of the absorption line, varies along the propagation path. Conditions are determined under which spatial variations of the relaxation matrix lead to the dependence of the medium transmissivity on the direction of propagation, such as in the case of propagation direction reversal. The practical implications of this effect are briefly discussed.

A95-22101   Efficient methods for calculating the optical properties of gas media (Ehffektivnye metody rescheta opticheskikh svojstv gazoobraznykh sred). B. A. FOMIN, A. N. TROTSENKO, and S. V. ROMANOV (Rossijskij Nauchnyj Tsentr 'Kurchatovskij Inst.', Moscow, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 7, Nos. 11, 12, 1994, pp. 1457–1462. In Russian. Documents available from Aeroplus Dispatch.

Methods for increasing the efficiency of numerical methods employed in atmospheric optics problems are reviewed. In particular, attention is given to the line-by-line (LBL) calculation of the parameters of selective gas absorption of optical emission and its scattering by spherical particles as well as LBL methods for solving equations of long-wave and short-wave radiation transfer in the atmosphere. Numerical procedures for increasing the efficiency of these methods are presented, as are the corresponding algorithms. The efficiency of the improved methods is estimated.

A95-20579   Spectroradiometer based on Wedge Interference Filters (SWIF) for applications in atmospheric optics. O. B. VASILYEV (St. Petersburg State Univ., Russia; Univ. Nacional Autonoma de Mexico, Coyoacan) and R. M. WELCH (South Dakota School of Mines and Technology, Rapid City; Univ. Nacional Autonoma de Mexico, Coyoacan), *Optical spectroscopic techniques and instrumentation for atmospheric and space research; Proceedings of the Conference*, San Diego, CA, July 1994 (A95-20526 04-35), Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 2266), 1994, pp. 578–587. 2 Refs. Documents available from Aeroplus Dispatch.

The SWIF Spectroradiometer was designed and built utilizing Wedge Interference Filters and a CCD-matrix as sensors for use in ground-based and airborne optical sensing of the atmosphere and the surface in the spectral range of 0.35–1.15 μ. To perform absolute calibration of this instrument, a series of observations of direct solar radiation were made at Mauna Loa Observatory (MLO) in Hawaii in May–June 1993. The present paper is devoted to the description of the SWIF instrument and its absolute field calibration. (Author)

A95-16496   Estimating the possibility of using data collected by a network of actinometric stations for determining the atmosphere transparency during space surveys (Otsenka vozmozhnosti ispol'zovaniya dannykh, poluchaemykh set'yu aktinometricheskikh stantsij, dlya opredeleniya prozrachnosti atmosfery vo vremya kosmicheskoj s'emki). L. M. MATIYASEVICH (Gosudarstvennyj Nauchno-Issledovatel'skij I Proizvodstvennyj Tsentr 'Priroda', Moscow, Russia), *Issledovanie Zemli iz Kosmosa* (ISSN 0205-9614), No. 6, 1994, pp. 68–75. In Russian. 6 Refs. Documents available from Aeroplus Dispatch.

Statistical data on the time and space distribution of atmosphere transparency are considered. The possibility of determining the atmosphere transparency during space survey by using data provided by actinometric stations is demonstrated. (Author)

A95-16491   A method for determining the optical parameters of the atmosphere and surface albedo from multi-angle convergent observations (Metod opredeleniya opticheskogo sostoyaniya atmosfery i al'bedo poverkhnosti po dannym mnogouglovoj konvergentnoj s"emki). A. I. LYAPUSTIN (Rostovskij Gosudarstvennyj Univ., Rostov-on-Don, Russia), *Issledovanie Zemli iz Kosmosa* (ISSN 0205-9614), No. 6, 1994, pp. 17–25. In Russian. 14 Refs. Documents available from Aeroplus Dispatch.

A procedure for the optical remote sensing of the Earth-atmosphere system from space using measurements of upward radiance at different view angles is presented. The role of viewing geometry is discussed and investigated in numerical simulations. Sensitivity studies show that the error of determination of atmospheric optical thickness and surface albedo for the Lambertian type of surface does not exceed 10% and 0.01, respectively. (Author)

A95-16023   Sensing cloudiness by a orbital laser range finder (Zondirovanie oblachnosti orbital'nym lazernym dal'nomerom). G. P. KOKHANENKO, G. G. MATVIENKO, V. S. SHAMANAEV, Y. N. GRACHEV, and I. V. ZNAMENSKIJ (RAN, Inst. Optiki Atmosfery, Tomsk, Russia), *Optika Atmosfery i Okeana* (ISSN 0869-5695), Vol. 7, No. 7, 1994, pp. 967–975. In Russian. 10 Refs. Documents available from Aeroplus Dispatch.

The feasibility of using orbital lidars for sensing cloudiness is examined by interpreting signals obtained with a geodesic laser range finders. A method is described for deriving the optical characteristics of cloudiness from measurements of the duration of signal echo at several altitude levels. The results of the analysis of cloud returns by the range finder demonstrate the feasibility of obtaining reliable information by means of space lidars. The requirements for the instruments' technical parameters are discussed. (Author)