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Final Report
NASA
Cost Reimbursable

This is to report on the use of the funds provided by NASA to support the "Third International Symposium on Environmental Hydraulics with a Special Theme on Urban Fluid Dynamics." An Abstract Book and a CD containing all of the full papers is included with this report.

1. Symposium Summary

The "Third International Symposium on Environmental Hydraulics with a Special Theme in Urban Fluid Dynamics" was held on the campus of Arizona State University in Tempe, Arizona, USA, from 5-8 December 2001. The Symposium proved to be a forum for the discussion of a wide range of applied and basic research being conducted in the general areas of water and air resources, with the latter focusing on air quality in urban areas associated with complex terrain. This aspect of the Symposium was highlighted by twelve invited papers given by distinguished international scientists and roughly three hundred contributed manuscripts. Owing primarily to the current international situation, roughly 20% of the authors canceled their plans to attend the Symposium; while this was unfortunate, the Symposium went ahead with the enthusiastic participation of more than 250 scientists from forty nations.

The invited lectures were outstanding. While the numbers and content of these are too extensive to summarize here, some selected highlights are noted. Dr. Soroosh Sorooshian, University of Arizona, Tucson, gave the opening lecture in which he addressed some of the recent international initiatives aimed to better understand elements of the water and energy cycles. He noted the importance of using such tools as remote sensing to develop more sophisticated and reliable prediction models. Dr. Robert Bornstein, San Jose State University, presented a brief history of the various techniques employed to simulate the effects of urban areas on the atmospheric boundary layer, relating these to urban effects on weather and air pollution issues.

Dr. Olcay Unver, President of Turkey's Regional Development Administration's South Eastern Anatolia Project (GAP), one of the largest water development projects in the world, discussed the "lessons learned" during the management of that project. Dr. Unver pointed to the need of changing from a purely engineering approach for such projects to one that recognizes that environmental, social, economic and cultural effects of the development also must be addressed. Since the Symposium, the Turkish Government, in the process of assessing different possibilities to contribute to the reconstruction of Afghanistan, accepted GAP's proposed

reintegration plan which included eight projects among which were regional and community planning, agricultural development, sanitation and water systems and health care. We applaud Dr. Unver and his colleagues on their broad vision related to environmental projects.

A second, and overarching theme, of the Symposium was the issue of the use of the results of basic research, and the participation in the conduct of that research, by scientists and policy makers from developing countries. This aspect of the Symposium was highlighted by the keynote address, "The Role of Intergovernmental Organizations in Water and Atmospheric Research," given by Godwin O.P. Obasi, Secretary General of the World Meteorological Organization (WMO).

Dr. Obasi considered the topics of water resources, natural disasters and climate change in his address. An assessment of some of the research needs in each was advanced and included the following:

> Water resources: More extensive research is needed on (i) affordable water purification systems, (ii) desalinization of sea water, (iii) water use strategies, (iv) shared basin management, (v) intensified monitoring, (vi) flood control management and (vi) innovative building designs.
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> Natural disasters: Research is needed on the enhanced application of science and technology to (i) improved, timely and useful prediction, (ii) early warning about impending hydrological, weather and climate hazards and (iii) to the integration of these into an overall disaster plan.
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> Climate change: Further research is needed on (i) the thresholds at which strong discontinuous responses to climate change would be triggered, (ii) the understanding of the dynamic responses of ecosystems to multiple stresses and (iii) the evaluation of the effectiveness and costs of adaptation options.

The general theme of providing better support for developing nations was continued at a panel discussion held during the last session of the Symposium. Dr. Obasi served as the Panel moderator, with Dr. D. James Baker, former Administrator of the U.S. National Oceanic and Atmospheric Administration, NOAA, setting the stage for the discussion by giving a paper, "Improving Global Management of Air and Water Resources through Research and Technology." The remaining panel members were Javier Aparicio, Mexican Institute of Water Technology, Lord Julian Hunt, University College London, and Abu Saleh Khan, Surface Water Modeling Center, Bangladesh. Among the conclusions of

the discussion were the need to develop easier access to data by the developing countries and the need to increase the emphasis on education.

The Symposium brought to light a number of reoccurring issues. One is the seemingly large gap between many of the basic research projects being conducted and some of the enormous problems (e.g., water availability) that are being faced and require solution by potential users of that research. The world community, especially the developing countries, faces a wealth of difficult problems in the management of its precious air and water resources. It is hoped that the attendees at this 3rd Symposium will have an increased sensitivity to some of these critical research issues.

Secretary General Obasi's keynote address (free) and the Symposium Abstract book and CD ROM containing the Symposium manuscripts ($70) can be obtained by writing to Don L. Boyer, Department of Mechanical and Aerospace Engineering, Arizona State University, Tempe, AZ 85287-6106 or by e-mail to don.boyer@asu.edu.

2. Use of the NASA Funds

The NASA funds were used to provide travel support to qualified scientists and engineers from developing countries; included are registration fees, housing, and airfare, as appropriate. The attached Table delineates the names of those supported, their affiliation, their topic area and the funds provided. The support of NASA is truly appreciated.

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#	NAME	AFFILIATION	PAPER	SUPPORT
1	Banihabib, Mohammad	Soil Conservation & Watershed Management Research Center, Iran	Numerical Simulation of Sedimentation in Detention Dams During a High Concentrated Flow	$ 1,274
2	Baruah, Pranab	University of Tsukuba, Japan	Incipient Oscillations of a Falling Water Sheet and their Instability Mechanisms	$ 1,000
3	Chacheskin, Yuli	Institute for Problems of Mechanics, Moscow, Russia	1. Internal waves, periodic boundary layers and internal boundary currents in a continuously stratified fluid 2. Upstream Disturbances, Attached Internal Waves and Vortex Structures past a 2D Body in a Continuously Stratified Liquid	$ 361*
4	Genikhovich, Eugene	Main Geophysical Observatory, St. Petersburg, Russia	Characteristic Features of the Urban Field of Concentrations: An Experimental and Theoretical Study	$ 1,280
5	Kirillin, Georgiy	Institute for Water Ecology and Inland Fisheries, Berlin, Germany	On Self-Similarity of the Pycnocline	$ 700
6	Klenov, Valeri	State Institute of Applied Ecology, Moscow, Russia	Elaboration and Verification for Debris Flow 2D Simulation	$ 1,360
7	Korchagin, Nikolay	Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia	1. Integral Model of Formation of Anomalous Waters Near Hydrothermal Springs 2. Model for the Evolution of Hydrothermal Sources in Regions of Ocean Spreading	$ 1,000
8	Mironov, Dmitrii	Deutscher Wetterdienst, Offenbach am Main, Germany	Penetrative Convection Driven by the Radiation Heating: A Study of Spring Convection in Ice-Covered Lakes	$ 1,000
9	Morozov, Eugene	Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow	Internal Tides in the Strait of Gibraltar	$ 1,000
10	Pavlyukova, Elena	Moscow, Russia	Direct Numerical Simulation of 2D-3D Transitional Viscous Fluid Flows around the Bluff Bodies	$ 1,750
11	Ramonel, Carlos	Universidad Nacional del Litoral, Santa Fe, Argentina	Metamorphosis Processes (1992-2000) of the Quinto River,	$ 1,400
12	Ravlic, Nenad	Civil Engineering Institute of Croatia, Croatia	Impact of Bottom Topography on Split Outfall Discharge Zone Hydrodynamics	$ 1,000
13	Sun, Jing-Mei	Hong Kong University of Science and Technology	Co-Removal of Hexavalent Chromium with Copper in Wastewater Purification	$ 300
14	Tsvetova, Elena	Institute of Computational Mathematics and Mathematical Geophysics SD RAS, Novosi-birsk, Russia	A Numerical Study of Mass and Heat Exchange in a Small Artificial Lake with Complex Topography	$ 1,575
TOTAL				$ 15,000

*Partial support; ISEH provided $ 489 for a total of $850.