

**SYSTEMS WOVEN BY TWO FLUX-SUBSYSTEMS: ONE OF THEM IS PLANETARY. CONCISE ATLAS OF THE SOLAR SYSTEM (12): SPACE SCIENCE AND TECHNOLOGY.** Sz. Bérczi<sup>1</sup>, B. Boldoghy<sup>2</sup>, V. Cech<sup>1</sup>, A. Fabriczy<sup>1</sup>, H. Hargitai<sup>1</sup>, S. Hegyi<sup>3</sup>, A. Horváth<sup>4</sup>, Gy. Hudoba<sup>5</sup>, J. Kummert<sup>2</sup>, I. Nehéz<sup>6</sup>, I. Schiller<sup>1</sup>, B. Takács<sup>1</sup>, T. Varga<sup>7</sup>, T. Weidinger<sup>8</sup>.

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**Introduction:** To increase student’s appreciation for research in planetary science we developed the Concise Atlas Series of the Solar System. The booklets in the series help students in stepping from university coursework to individual (and collective) research [1-7]. This transition is the most critical one from student life to investigator’s work.

Our new 12<sup>th</sup> issue deals with the technology aspects of space and planetary science. The main chapters are

1. Atmospheric and hydrologic circulation in the Earth
2. A section of the water flux system on Earth surface.
3. Material fluxes in production technology.
4. One town, multiple production technologies: their interactions with the natural flux streams:

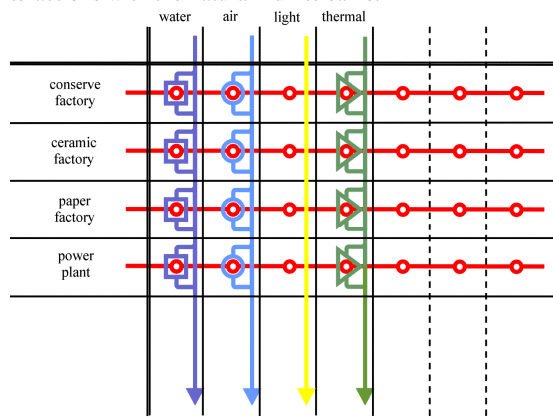


Fig.1 Technologies Consum Streaming

Fig. 1. Matrix woven by two subsystem fluxes: by the environmental one versus the production by technology one.

This matrix description is in equivalent style as for the Hunveyor-matrix, where the fluxes of a planetary surface are interacting with the flux of measuring and data analysis in instrumentation of the space probe.

5. Physical description of transport processes in physics: the Onsager matrix.
6. Circulations in the human body and their interaction with environmental containers and fluxes.
7. Living places (houses): Transportations organized in industrial level to maintain the habitability for great number of residents. Special environments with special supplies.
8. The Mars Analog Simulation Basis of the Mars Society at the Utah Desert Station. The whole system of the basis.

9. Humans settling in the space. The International Space Station system. The spacesuit system.

10. Lunar basis construction. Principles.

11. Martian basis construction. Principles.

12. Summary: Déjà vu, - some aeons ago. Cells coming out from the sea. Humans coming out of the atmosphere.

Planetary surface FLUX	FLUX OF GASES, WIND	SOIL, SURFACE DUST	LIGHT COLOR	THERMAL EFFECTS	ELECTRIC CHARGING	MAGNETIC EFFECTS
Hunveyor structure						
SKELETON	Great wind pressure	Settling dust on the outer surfaces	Sunlight can scatter and reflect on	Thermal insulation in special directions	Charging of the skeleton Ion-cloud effects	Magnetic dust settling on the surface
SENSORS+ ELECTRONICS	Measuring wind elicity, composition of gases	Filtering dust from the atmosphere	Refl. Spectroscopy, surface textures (fabrics) imaging	Thermometer, extension stamps,	Electrostatic effects Lunar levitating cloud measurements	Collection of magnetic grains by magnets
ENERGY-SUPPLY		Dust may decrease the power	Solar panel	Mirror can focus energy on some exp		
MOVING SUBSYSTEMS		Defending the moving subsist. from dust				

Fig. 2. Hunveyor matrix, comparison for the town with 4 factories. Both form a complex system for the technologies and fluxes. Studying them parallel we need using the technology-environment matrix. This matrix in principle similar to that of measurements of a space probe, where Hunveyor is in interaction with planetary environmental fluxes (crossing the measuring processes as some fluxes in technologies).

Our program takes over a great arc from streams in the natural environments till the confined streams with containers in the space station. Along this study great number of comparisons of various systems help studying the main steps to be solved in a space technology project. This way not only simple production technologies become clearer but their connections and interrelations, too.

One of the most complex parts of the transport effects are shown both with physical and technological aspects. Generally the main transport processes are known (Table 1.),

Table. 1.

The main law	Flux (extensive) quantity	Intensive quantity	Conductivity
Fourier	Inner energy	Temperature	Thermal Conductivity
Ohm	Electric charge	Elektric potential	Electric Conductivity
Fick	Mass	Density	Diffusional coeff.
Hagen-Poiseuille	Volume	Pressure	Volume Conductivity
Darcy	Volume	Pressure	Seepage-coeff.
Newton	Impulse	Velocity	Viscosity coeff.

However, physics studies joint transport processes in the so called Onsager matrix (Table. 2.) There the cross effect transports (out of the spur of the matrix) are important in the complex systems with several fluxes running parallel (right).

**Summary:** Earlier booklets in the series exhibited mainly the automatic technologies used by space probes on planetary surfaces. In the new booklet the presence of the human body plays the main role with its requested circulation and supplying systems.

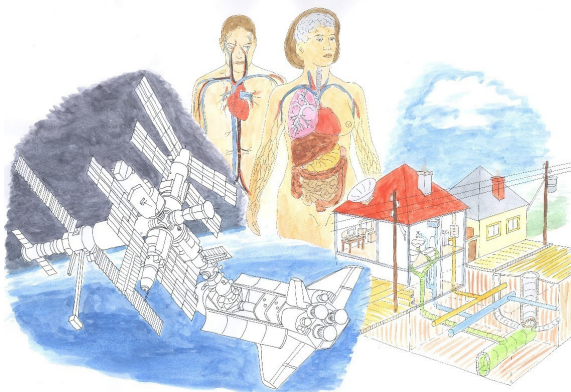


Fig. 3. The back cover of the booklet symbolizes the steps in overviewing the systems: human body (circulations), house (circulations, connections to transport systems), and space station (circulations and containers).

**References:** [1] Bérczi, et al (2003): 34th LPSC, #1305; [2] Mörtl, et al. (2004): 35th LPSC, #1214; [3] Mészáros, et al. (2005): 36th LPSC, #1177; [4] Bérczi, et al. (2006): 36th COSPAR Scientific Assembly. 2006, Beijing, CDROM, #679. [5] Hudoba, et al. (2006): 37th LPSC, #1114; [6] Mörtl, et al (2006): 37th LPSC, #1618; [7] Hegyi, et al. (2007): 38th LPSC, #1204;

Stream of extensive quantities	$dV/dt$	$dE_p/dt$	$dn_x/dt$	$dQ/dt$
Strain of intensive v quantities				
mechanical $p_1-p_2$	MECHANICAL WORK D'ARCY-POISEUILLE	COMPRESSION EXPANSION	FILTRATION	PIEZO-ELECTRICITY
thermal $T_1-T_2$	EXTENSION, ARCHIMIDES	THERMOENERGY TRANSPORT, NEWTON CONDUCTION LAW	THERMO-DIFFUSION SORRET EFFECT	THERMO-ELECTRICITY, SEEBECK EFFECT
chemical potential d. $n_1-n_2$		DUFOUR EFFECT	DIFFUSION FICK'S LAW	ELECTRO-CHEMICAL EFFECT
electric potential difference $Q_1-Q_2$	ELECTRIC MECHANICAL WORK	PELTIER EFFECT	ELECTRO-CHEMICAL EFFECT	ELECTRIC FLUX OHM'S LAW

Table. 2.

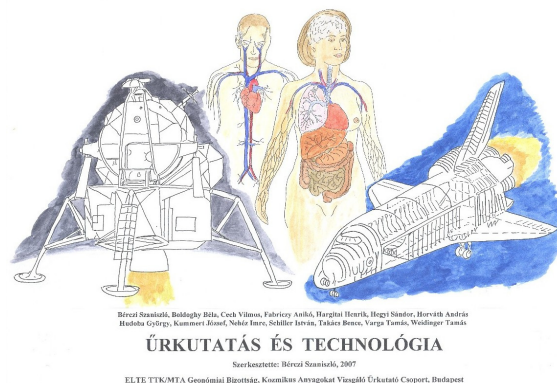


Fig. 4. The front cover of the booklet symbolizes the steps from human body to the outerspace basis systems. The preliminary version of the topics was: Human body – living house – space station. We celebrate the 40 years of first lunar landing, by this booklet, too.