AIRBORNE, BOUND ROOF STRUCTURES FOR MARTIAN APPLICATION, FOR THE PROTECTION OF LIVING SPACES SUITABLE FOR HUMAN BEINGS, OR SETTING UP INDUSTRIAL ACTIVITIES. ***I. Nehéz*[1], *T. Varga*[2], *I. Darányi*[2], *I. Szilágyi*[2], *Sz. Bérczi*[3],** Nehéz Balloon Project, H-8500 Pápa, Korona u. 16., Hungary (nehezimre@kabelszat2002.hu), [2]VTPatent Agency, H-1111 Budapest, Bertalan L. u. 20., Hungary (info@vtpatent.hu), [3]Eötvös University, Budapest, Pázmány Péter sétány 1/a, Hungary.(berczi szani@ludens.elte.hu)

Summary: Shading, protecting airborne, bound roof surfaces of big size are made in Martian environment, to give protection from cosmic and UV radiation, dust or other effects with the application of Nil-Diffusion (ND) technology in such a way, that no separate supporting or stiffening structures have to be used. These are suitable for the protection of the living spaces suitable for human beings, or setting up industrial activities.

Background of the problem to be solved: In the Martian surface environment the UV radiation of the Sun and the cosmic radiation are of hazardous extent. The atmosphere can protect to a lesser extent only. It is also important the effect of the dust and the wind. For the future planning human and industrial activity it is necessary setting up closed, semi-closed spaces for dust protection and arranging technical, human demands, shaping environment.

In the traditional realisations it is necessary to set up a supporting structure in case of an area of great covered surface, but in case of a small area as well. In case of applications in distant planetary destinations the mass and dimensions to be transported are quite limited, it excludes the application, delivery and feasibility of rigid supportive structures and roof structures of otherwise appropriate strength.

The supportive structures can be set up on the site by blown hose structures of over pressure with pneumatic stiffening, blown with the gas compound of the local atmosphere, or the solution would be the application of a gas lighter than the gas of the local atmosphere, but it is limited by the gas-enclosing capacity of the foil applied. In connection the realisation the theoretical problem of diffusion due to the partial pressure and pressure gradient resulting in the loss of lift gas and becoming heavy - so the roof structure descends.

The main issues of the application of airborne roof structures: It justified to build a roof structure lighter than atmosphere, without inner support in case of application either on Earth or on other planet surface: -in case of big covered surfaces, big size roof structures, - when there are big surface objects on the covered area, - in such cases, when the supportive or stiffening structures would be of too big size (more than 100 m), - transport to the site, setting up would be too difficult or impossible. Taking into consideration outside conditions, these conditions justify Martian application to a great extent.

The essence of our proposal: The Nil-Diffusion (ND) technology makes possible the realisation of the lifting bodies of an airborne, bound roof surfaces of big size are made in Martian environment for long life. It is not necessary to make the whole roof structure this way, it is sufficient to make it for a part only.

One of the possible ways of realisation - making use of the possibilities offered by Martian atmosphere - that lifting units filled with lift gas, preferably with hidrogen or helium are used for ensuring the lifting, keeping of the roof.

The stiffness and mechanical structural stability of the roof structure are ensured by ribs of pneumatical stiffening, resp. with an inner structure, which ensures the structural stiffening, mechanical stability of the roof structure. These pneumatical ribs can be filled with the gas of the local atmosphere, which do not have up-driving effect, the weight of the roof consists of the weight of their own material and the gas part of over-pressure.

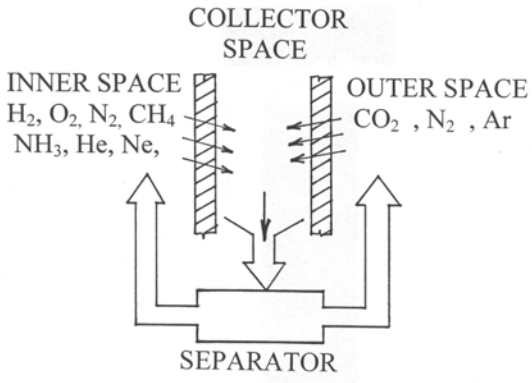

Fig. 1: The pricniple of the Nil-Diffusion covering of the lifting bodies utilized in the Martian atmosphere

The theory of Nil-Diffusion technology: In the Nil-Diffusion (ND) covering with active isolation **i**nstead of one layer, two or more layers are applied in the covering, and between the layers there is at least one collector space. The task of the collector space is to separate the material layers of the covering and it is applied as a collector. The gases penetrating through the material layers of the inner and outer layers from any direction are removed and after selection they are sent back to their source space. The separation can take place with various well-known methods depending on the different gas compositions.

Feasibility study: One of the several realizations of Martian application of long life airborne, bound roof structures is, when the roof structure is simply anchored and the elements of the roof structure are stretched in two directons on the sides, made only of foil or they are partly filled with the local gas, e.g. they are ribbed because of mechanical stability. This gives inertia to the roof. These ribs filled with local gas run crosswise or lengthwise or in a central direction. So e.g. using a lifting body in the middle, anchored sidewise circularly we get a hemisphere arched structure, like a circus tent, e.g. dome.

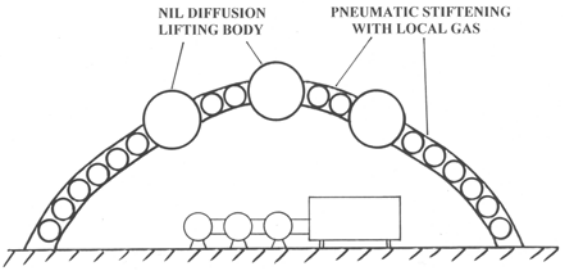

Fig. 2: Realisation of the airborne, bound dome roof on the planar Martian surface

Possible forms of realization: Dome, with one or more sphere-like lifting body with stiffening hose-ribs running radially or sidewise from the lifting body.

Elliptical or lengthwise formation, with one or more lengthwise cylinder-like lifting bodies in the middle with stiffening hose-ribs running sidewise. These are hose-ribs stiffened pneumatically.

The envelope of the roof consisting of several cylindrical or sphere-like elements, certain parts of which are lifting bodies working on ND principle (cylindrical or spherical, or other shape) and the roof between them is filled with units of cylindrical or spherical shape filled with local gas. This way lifting of the roof structure is ensured by the lifting bodies working on ND principle filled with lifting gas, while the material of the roof structure envelope or other parts in given case is only the cylindrical hose-module, hose-body providing stiffening.

Possible applications: Basically two main methods of application should be distinguished:

- tent-like roof set up due to any reason on a flat Martian surface, it can be dome or arched structure like.
- a roof joining the surface objects or closing the hollows in the Martian surface. It can be dome, arched structure like or flat. The flat roof one is advantageous from the point of view of surface winds, as it is less exposed to aerodynamical effects, even the wind blowing above it can ensure a lifting effect. At the same time the wind does not disturb the micro climate below the surface.

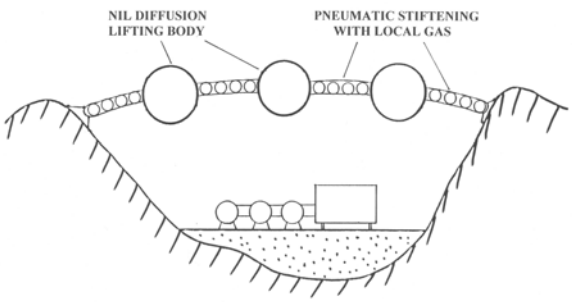

Fig. 3: Realisation of the airborne, bound plain roof in a Martian valley

Additional issues of application, realization: Material of the foil used for gas enclosure of small mass, high gas-sealing capacity, high mechanical strength, flexible plastic foil with great light-reflecting capacity, preferably with UV and cosmic radiation resistance. Multi-layer foil is used for enclosing spaces based on nil-diffusion of the roof structure with layers and finish conforming with the application of ND technology. In case of gas spaces of atmospherical filling, of pneumatic stretch of over-pressure only simple, one-layer foil with proper gas-sealing property should be used, prefereably the foil developed by NASA for stratospheric balloons on Earth, used in one or more layers. For the use of ND technology one or more equipment for separating and cleaning gas is necessary as separate units. Realization, installation, functioning of these can take place in conformity with the application of ND technology.

Advantages: It is possible to create airborne roof structures in the Martian environment in such a way, that they keep their lifting capacity on the long term as well. In carbon dioxide atmosphere inner spaces filled with hydrogen do not lose their lifting capacity. ND technology prevents penetration of gas from the outer atmosphere into the lifting space, ensuring that the lifting space does not get heavy. Specifically small mass has to be transported, enormous spaces are isolated by them, without inner support, these spaces can be air-conditioned, or can be filled with any of the gases. The meteorite protection can be solved if the roof is made of several parts. Security is greater, because in case one of them is damaged, not the whole roof collapses.

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