POSSIBILITIES AFTER GOVERNMENTAL SPACE RESEARCH LIKE MICRO AND NANO SPACE PROBES - THE HUNGARIAN PULI SPACE. VIZI, Pál Gábor[1], [1]RMKI KFKI. H-1121 BUDAPEST, Konkoly Th. 29-33. vizip@rmki.kfki.hu

Introduction: We can sense nowadays a big change in space activity – governmental operation is decreasing and as a consequence private inventions are increasing. There is a big question. Is it important for a small country to try her possibilities? Is it a reachable goal to make and operate new generation of devices like cube sats and micro probes?

Let us make some considerations and scrutinize newly generated possibilities and challenges arising all around the world to use for lunar and planetary research.

Hungarian Puli Space team has been founded for trying local possibilities for small countries. [1] The first goal will be only education and outreach, but can we reach the Moon? [2]

Discussion: Puli Space is an attempt of a small country to reach the goal of GLXP. The group is a private initiative in collaboration of scientific research places, including universities and research institutes.

The aim is to demonstrate abilities of the team by landing a self-made probe on the Moon by 2014 and thus complete the Google Lunar X PRIZE challenge. Puli Moon probe - according to plan - will ascend to orbit with the help of a commercially available rocket and journey on its own to land on the lunar surface, explore the nearby area and send high quality imagery and video recordings of its surroundings and itself back to Earth. The project requires the setting up of a functional mission design, researching the necessary components, building a functional module and finally managing its mission to space.

Based on the GLXP experience, independently of result, they intend to become a player in the growing space industry.

Puli Space also considers it a top priority to promote scientific thinking and to encourage students in choosing a career in sciences.

The 'Minimal Plan': A part of my research is the "Minimal Plan", which is the smallest, lightest and cheapest solution to reach the goal.

The most expensive part of the project must be minimized which is to overcome the Earth's gravity and to reach the orbit. The lightest is the cheapest because of smaller energy demand. In addition when we are light enough, there are possibilities to obtain a secondary payload space, e.g. through internet on another scientific or commercial rocket. Application forms can be found to reach available secondary payload possibilities. In this case the orbital price is around one percent – Masat-1 [3] will achieve its orbit similarly like other cube satellites.

If we can make a secondary payload space, maybe that would be interesting for third party investors. They will be able to buy parts of mission for different purposes like business, research or simply to build a monument in memory of her or himself.

The 'Modular Minimal Plan': The "Minimal Plan" must be modular and easily expanded. In other words, if a project can collect more money or resources, then new parts must be merging into the original design to achieve the extended goal.

First of all, the minimal design is the smallest, lightest and cheapest solution to reach the goal, but must be expandable.

Evolution of plan can grow in two directions e.g. expanding or multiplying or both together.

Let us see some examples for minimal design. To move on the surface of the Moon there is a completely new idea named SunChariot rover, a ball surface with lots of empty sausages which look like a hedgehog or jumping puli dog, a spiny ball. The ball is the best wheel which can not be overturned. The ball is a closed unit. If this SunChariot lands on the Moon at dawn, then one surface is in shadow and sausages are shriveled flaccid at near absolute zero degree; other side heated by Sun and here are sausages inflating the ball. The final result is a rotation to the shadow direction. This is a minimal design but expandable, because inside there is spare place where we can install solar cells, motor and, if necessary, accumulators also. The condition of expanding is the power of rocket to orbit. If we do not have enough power to lift up our payload from earth, then the lightest solution must be applied. But if we have enough power, then rover skill can be improved by adding solar cells, motor and accumulator.

In keywords from minimal to expanded some skills are SunChariot or center of gravity moving motor or torque motor; one camera or more 3D cameras; competition to receiving our signals (together with amateurs) or own space communication system. The minimal launch plan is to obtain a secondary payload. Expanded plan for launch is to collect others to start together. Maximized plan is to make a big enterprise to send a complete probe fleet. Probes are for different purposes, as e.g. climate and weather observation, disaster pre-

vention and protection. With this idea, the plan is modular from 'minimal plan' to 'expandable one'.

I do not want to elaborate in detail the well-known disciplines about reaching the Moon, like orbits, because they are well documented. I just would like to speak very shortly about a smooth landing facility with a combined orbit modifier and landing braking rocket and airbags because they are similar to the landing of Mars rovers.

Simulation: All of our designs are planned to test in virtual software simulations. Most simulation can be achieved by commercial off-the-shelf software and some are usable free of charge. (Linux, Open Systems, Open (Oxygen) Office, Open Office, Google Sketchup: 3D static, Sketchy Physics, Orbiter the free spaceship simulator, Celestia astronomical simulator; CAD/CAM programs, and educational software) Microsoft operating systems and office programs for Hungarian universities, students and research institutes are available for free according to agreement between Microsoft and Hungarian Government for learning, educating and researching purposes.

Supports from Universities: A At the Faculty of Science, Eötvös Loránd University (ELTE TTK), based on NASA 1966-1968 Surveyor-program, a Hungarian UNiversity surVEYOR [4] practicing space probe model program has been founded. They started a teaching program based on original Surveyor concept [5] which has a simple, clear structure, easy programmable instruments as a good sample to build experimental practice space probes for students.

The program does not only develop experimental practice with instruments and robotics but makes the education of enthusiastic planetary geology students possible where they can study a simulated planetary terrain.

It also helps keep up enthusiasm, constructive activity of students in natural sciences, as well as helps select new constructional units and measurements and form international university community working together on planetary science.

If you do not have enough money to build one, why do you not build two or more: Several useful purposes are available to make use of the benefits of modern micro and nano probes nowadays. Environmental protection, disaster prevention, climate monitoring, pest and crop estimation for beneficial commodity exchange appearance. Investors can get out extra profit when invent in time.

An environmental disaster is important to be timely presented to the community of earth scientists and engineers especially to geodesists, structural engineers and field geologists. Prompt information dissemination is also needed to make them aware of the factors which led to the disaster and make them assess the status of all reservoirs worldwide. We highlight the risks and most importantly present a unique space based tool that may help in disaster prevention. Until now micro probes were only rarely used for disaster prevention but it will change in the future if we can supply a solution with a national fleet of micro probes. The result is: there are enough incoming from benefits described above to make Lunar and planetary probes also.

Who can make these micro or nano space probes? Currently operating research institutes, universities and private technology centers like intentionally founded firms, limited companies, foundations, corporations and consortiums can make these micro or nano space probes. Enthusiastic students and researchers, engineers, managers, investors etc. all together can make efforts to aim the chosen goal. Students can make scientific papers, student research works, independent labs, MSc theses and PhD research. Lawyers are connected to project to supply the legal background. Media specialists make the necessary PR and marketing mission. Several private persons and firms supported the team.

Several private groups and firms around the world Space industry firms and private competitor groups have organized itself. Private rockets in USA, Danish private rocket and a lot GLXP groups and they target is the Moon..

Conclusion:

In this article I showed the topic and I briefly described the results. I presented the “minimal plan” and its modularity. Results of brainstorming and new ideas are increasing. We can recognize: small private groups all around the world are capable to make powerful and successful space devices. The recently started space activity and industry is the inescapable trend of the future and benefits are available for lunar and planetary activities.

References:

[1] Pulispace.com http://pulispace.com/
[2] Puli Goes To The Moon Concept Video http://www.youtube.com/watch?v=jfKK6o7BXkk
[3] Masat-1 cubesat program http://cubesat.bme.hu/?lang=en
[4] Surveyor program http://hu.wikipedia.org/wiki/Surveyor-program
[5] http://en.wikipedia.org/wiki/Surveyor_Program