A WAY TO UNDERSTAND STREWNFIELDS - TESTING MODEL CALCULATIONS BY ARTIFICIAL METEOROIDS EXPERIMENT.

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Introduction: As a cooperation of a research institute and high school and undergraduate university students, an artificial meteoroid dark flight experiment is in progress by us. The spherical test-meteorites have internal miniaturized telemetry electronics, and they are communicating with a host unit housed onboard of a high-altitude balloon's gondola, as well as a receiver on the ground. They are thrown out at about 32-35 km, and after free fall we should find them. Comparing the real touchdown coordinates with the purely theoretically calculated results could tell us how good we simulate the dark flights, and thus, how good we can simulate strewn fields.

In case of probable meteorite falls the precise calculations of the 'dark flight' of those particles, which survived the dramatic luminous part of the atmospheric travel, will be very important for the recovery efforts. There are lots of uncertainties in the initial input parameters, as well as in the free flight calculations. Thus, it is desirable to have artificial tests of at least some aspects of this problem. 'Intelligent artificial meteors' experiment (IAMET) can test our dark flight code.

Creating artificial meteors based on "Info-Droplets": Serving artificial meteors for our dark-flight tests, some of us ('SOPROBOTICS' team) have applied the earlier 'info-droplet' concept, which was a basic part of their previous space-related project. This consists a miniaturized telemetry panel and radio transmitter forming an autonomous intelligent unit. For creating "intelligent" artificial meteoroids, which can report theirs spatial position continuously during their 'dark flight' – they put this 'info-droplet' electronics inside a non-metallic (3D-printed) spheroid body. Unfortunately, the minimum size is defined by the sizes of electronic panels and the peripheries (battery, GPS sensor, radio antenna, etc.), and thus, it has D=10 cm diameter. It is larger than most of the bodies collected during a typical meteorite fall (see e.g. Kosice case), but still realistic one. We can adjust the average density of this artificial meteoroid body either by varying the material of the ball, or putting some lead inlets in some empty parts of the sphere. Presently we did the latter, and thus, our first few IAMET's are having an average density of 3,4 g/cm^3, like a typical stony meteorite. The inner structure can be seen on Figure 1. For more details about the electronics, see [1].

The well-known diameter and density of our spheres together with the broadcasted starting coordinates and velocity components give accurate initial parameters for the air drag calculations.

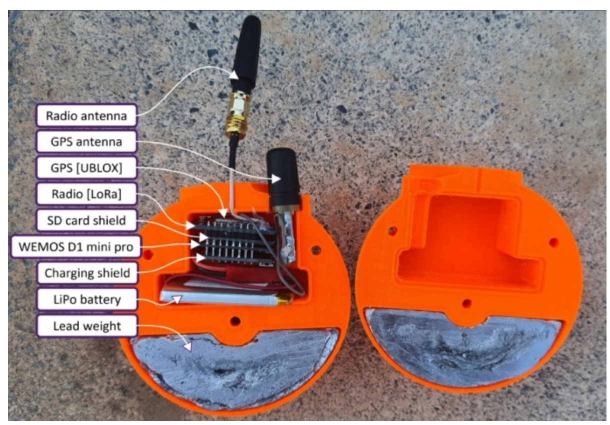

Figure 1: *Our intelligent artificial meteoroid (AIMET) – inner structure with explanations*.

Telemetry and the protocol of IAMET's flight experiment: Each IAMET measures its temporary GPS position along all the flight upwards to the higher atmosphere, inside a balloon gondola - and after throwing out from the gondola, downward, during the freeflight, transmitting data to the ground-based receiver as well as to the co-falling gondola host unit. After touchdown, the recovery team collects all the IAMET's and recognize the founding positions. On the other hand, another 'calculating' person will know only the initial coordinates, size, density and velocities of each unit at the starting time of freeflight, and the wind parameters (as usually, from ECMWF database). The output of his 'dark flight' calculation will be the 'theoretical' touchdown positions which will then be compared and evaluated regarding the real ones. The experience will hopefully give many information about our codes, and about the eligibility of the parameters used in our calculations.

The very first in-flight and crash tests: Since we don't want to use the electronics only one time - the IAMET structure has been tested for mechanical stress during a typical touchdown. The test ball has been thrown from the top of a high building - see photo on Figure 2 below.

Figure 2. *The first 'artificial meteorite' body after the touch-down, thrown from the top of a high building. The inside electronics did not damage, remained reusable. This was our need.*

The in-flight operational tests (tests of the derivation and storage of the temporary coordinates, radio communication, etc.) were done on 23 July, 2022, just inside a balloon gondola, flying up to 35 km height. After some further developments of the IAMET balls and the electronics, the first free-fall tests will be done in near future.

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References: [1] Á. Lang, M. Bejó, B. Hargitai, Á. Sztojka, and B. Molnár, 2022, Proc. of Europlanet Science Congress 2022 conference.