Project: ***New types of actuators specific to space applications. Acronym ACTOSPACE***

Ctr. 88/29.11.2013 Financed by State Budget - Space Technology and Advanced Research - STAR, Contracting Authority Romanian Space Agency (ROSA), Period 2013-2015

Coordinator: INCDIE ICPE-CA, **Partner 1:** STRAERO SA, **Partner 2**: Smart Mechanics SRL

The main objectives of the project were the design and the manufacturing of two micro motors: one magnetostrictive linear micro motor and one piezoelectric rotating micro motor. According with planed activities of the project Straero was responsible for following activities:

Stage 1	Stage 2
1. Design of magnetostrictive linear micro motor;	1. Design of the piezoelectric rotating micro motor;
2. Functional model of the electric drive testing : magnetostrictive linear micro motor - specific electronic driver;	2. Functional model of the electric drive testing : piezoelectric rotating micro motor - specific electronic driver;
3. Experimentation and utility demonstration report for the electronic driver for magnetostrictive linear micro motor - for aerospace applications;	3. Experimentation and utility demonstration report for the electronic driver for piezoelectric rotating micro motor - for aerospace applications;
4. Protection of industrial property rights, patenting of the electric drive: magnetostrictive linear micro motor with specific electronic driver	4. Protection of industrial property rights, patenting of the electric drive: piezoelectric rotating micro motor with specific electronic driver
Magnetostrictive linear micro motor	Piezoelectric rotating micro motor
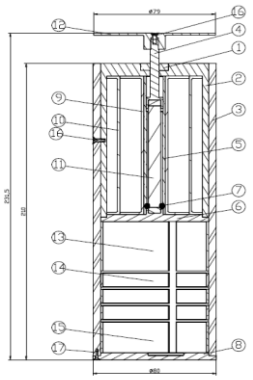	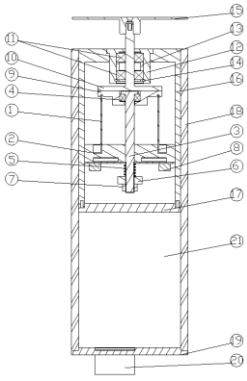
Fig. 1 Magnetostrictive linear micro motor (section)	*Fig. 2 Piezoelectric rotating micro motor (section)*

Experimental testing of the magnetostrictive linear micro motor was accomplished true fixing the micro motor in the Instron 3367K4453 (fig. 3) traction machine's gauges by introducing an overload on the superior gauge through an elastic element for avoiding deterioration of the micro motor. Overload force was 8÷10N, for all loading test made. The main purpose of the testing was: measurement of the load developed by micro motor and evaluation of the thermal level reached by it in the functional time with the measured load. Testing method consist in generation and measurement of the developed load

by the magnetostrictive linear micro motor. The magnetostrictive micro motor was charged from an variable cc source (0 - 32 Vcc). There was taken into consideration 6 loading cases according to electric power supply of the micro motor. Overload charged was introduced by Instron traction machine with elect mechanic driving. Measurement of the developed load by magnetostrictive micro motor was through 50 kgf dose and with conditioning and amplification signal system of the Spider 8 device. Data acquisition and signal preparing were developed by specific soft Catman 5.0 through a PC.

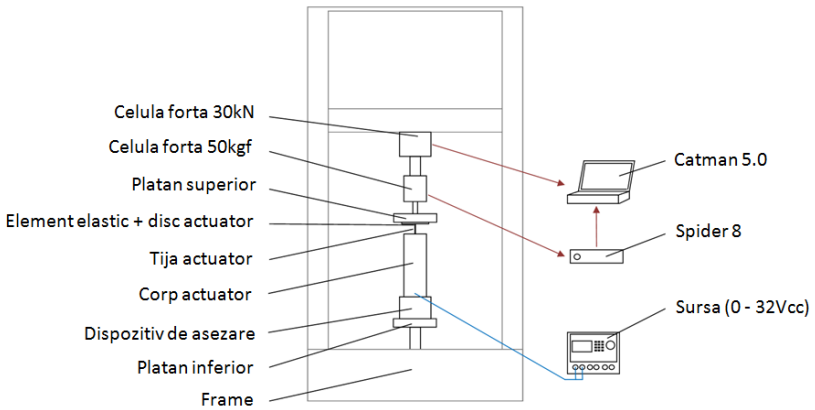

Fig. 3 Testing device scheme

After the experimental stage, processing the data acquisitioned and interpreting resulted the values of the load tensions developed by the actuator (Table 1).

Test	1	2	3	4	5	6
F_{min} [N]	-5,433	-25,053	-102,326	-117,418	-108,061	-105,646
F_{max} [N]	69,123	70,934	121,04	107,759	55,842	61,577
V [V]	18	22	26	28	31	31
F_{p-p} [N]	74,556	95,987	223,366	225,177	163,903	167,223

Table 1: The values of the load vs. tension

The maximum load developed by the actuator was 225.17 N accomplished on 4 test stage, with a charging tension of 28Vcc. Frequency of the excitation load through power specter method analysis of the acquisitioned signal is presented in table 2:

Caz	1	2	3	4	5	6
V [V]	18	22	26	28	31	32
f[Hz]	111,5	11,5	111,5	111,6	111,6	111,8

Table 2: Load frequency measured depending on tension

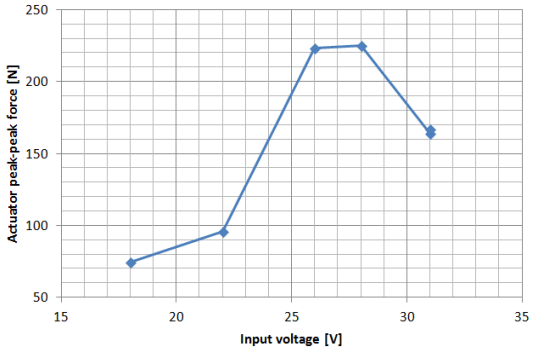

Fig. 4 Graphic of the load variation with charging tension of the micro motor

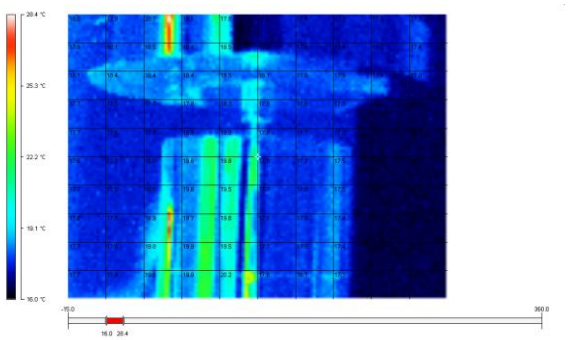

Fig.5 Recorded temperatures during electric load functioning of the magnetstrictive micro motor

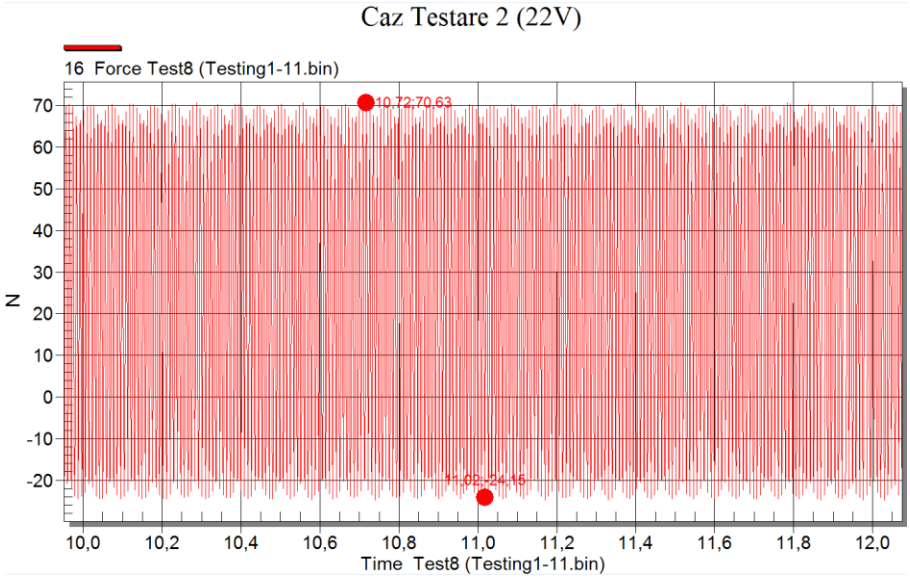

Fig.6 Results of testing stage 2 (22V)

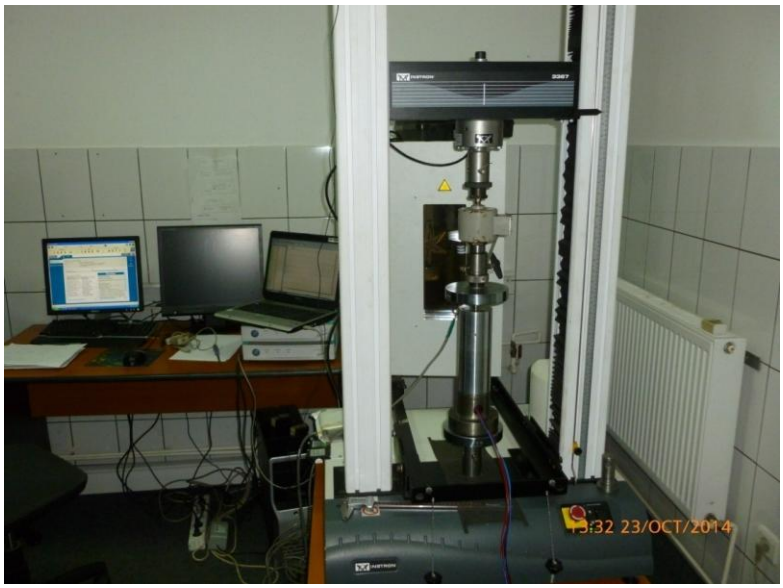

Fig. 7 Magnetostrictive liniar micro motor testing

Fig. 8 Magnetostrictive liniar micro motor testing