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Author: Mr. Dmitry Osadchenko

Central Research Institute for Machine Building (JSC TSNIIMASH), Russian Federation,
tsniimash1312@gmail.com

Dr. Oleg Saprykin

TSNIIMASH, Russian Federation, oleg.sapr@gmail.com

Dr. Anatoly Golovko

Central Research Institute for Machine Building (JSC TSNIIMASH), Russian Federation,
anatoly.golovko@mail.ru

Ms. Alla Botvinko

TSNIIMASH, Russian Federation, abotvinko@tsniimash.ru

Mr. Nikolay Feklunin

Central Research Institute for Machine Building (JSC TSNIIMASH), Russian Federation,
tsniimash1312@gmail.com

Dr. Vjacheslav Zherdev

Central Research Institute for Machine Building (JSC TSNIIMASH), Russian Federation,
VMZherdev53@gmail.com

Mrs. Elena Baksheeva

TSNIIMASH, Russian Federation, bel.pocht@yandex.ru

Ms. Nataliya Biryukova

Central Research Institute for Machine Building (JSC TSNIIMASH), Russian Federation,
biryukovans@tsniimash.ru

INTERNATIONAL SPACE EXPERIMENT "STUDY ON APPLICABILITY OF TO FUTURE SYSTEMS FOR PRECISION PROXIMITY WITH UNCOOPERATIVE SPACE OBJECTS INCLUDING AUTOMATIC MAINTENANCE ACTIVITIES"

Abstract

International Space Experiment (SE) will be conducted on two Russian cargo spacecraft named "Progress". To complete the SE mission it will be necessary: 2 flight-ready assemblages of rendezvous systems, a small target-spacecraft with its launcher-container.

The space experiment will be conducted in two phases:

-the first phase of the SE will be carried out with employment of "Progress" and rendezvous system during "Progress" standard rendezvous with the ISS;

-the second phase will be performed during autonomous flight of the "Progress" after its mission completion and undocking from the ISS in the course of repeated approaches to the target-spacecraft.

In the given report there is SE configuration and methods, in the course of which the following goals are to be achieved:

-capability test of a scanning laser distance measuring instrument employment for the cargo spacecraft rendezvous with the ISS;

-operability evaluation of three-dimensional modeling to control spacecraft rendezvous with the station;

- effectiveness test of the scanning laser distance measuring instrument within the control loop of the spacecraft rendezvous with an uncooperative space object;
- development and testing of algorithms for automatic rendezvous with uncooperative space objects, validation of software dedicated to automatic rendezvous of an active vehicle with an uncooperative spacecraft;
- development of a technologic target-spacecraft simulating an uncooperative space object that is used for real environment testing of maintenance technologies;
- implementation of the "Progress" rendezvous with the target-spacecraft;
- opportunity analysis of use of experience (technology) gained for a new generation of manned space systems, including maintenance dedicated vehicles.

In the SE a laser rendezvous system is one of the scientific hardware proposed to use, with the following functions presented:

- object detection;
- determination of distance to the object;
- definition of orientation and velocity (state vector) of the object;
- formation of the imaginary object ("cloud of points");
- development of a three-dimensional oriented model of the rendezvous object based on the available library of images.

In the report there is also practical relevance of the international SE for near and far space exploration described.