

SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (6)

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DEVELOPMENT OF HIGHLY DURABLE PULSED PLASMA THRUSTER FOR ACTIVE FLARE
SATELLITE CONSTELLATION

Abstract

Well-polished surfaces of satellites like solar panels and antennas occasionally reflect sunlight directly toward the Earth and cause “satellite flare”, which can be observed from the ground. The typical example of this kind of flare is known as “Iridium Flare” caused by Iridium communication satellite constellation. Although these flares are unintentional phenomena, causing satellite flares intentionally anywhere at any time may be useful for entertainment and advertising purposes. Therefore, the concept of “active flare satellite constellation” is proposed here.

An active flare satellite is the medium-sized satellite and is equipped with a reflective mirror as well as a pulsed plasma thruster (PPT). The mirror can be steered by an actuator so that observers on the ground can enjoy the flares for a long period of time. The flares can be colored by a color filter attached to the mirror. Also, a liquid crystal panel can add blinking effects to the flares. By operating multiple active flare satellites as a constellation, simple geometric patterns and alphabets can be expressed and this, so called “space bulletin board” may be utilized in many ways such as attractions in theme parks, advertising and optical communication.

With the aim of forming the active flare satellite constellation and maintaining it against disturbances such as air resistance and J2 gravity effect, pulsed plasma thruster is adopted for its capability to control the thrust digitally and minutely. The main topic of this study is to devise a new type of pulsed plasma thruster which is highly durable enough to operate the constellation and provide flare services consequently. Several types of configurations and supplying methods of teflon propellant as well as thruster structures are experimentally tested in this study in order to realize continuous supply of the propellant and therefore a long period of operation.