

28th SYMPOSIUM ON SPACE POLICY, REGULATIONS AND ECONOMICS (E3)  
International Space Exploration Policies and Programmes (2)

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PREDICTING THE TRAJECTORIES OF CIVIL SPACE PROGRAMS

**Abstract**

In the past fifteen years, civil spending in space has increased rapidly as countries expand their existing space programs and new countries have begun to participate in space activities. Understanding countries' trajectories can help predict which countries might develop indigenous technology and new applications. However, this is challenging for a number of reasons. First, there is significant diversity in the interests, budgets, and level of technological development of participating countries. Second, countries involved in space are increasingly interconnected through partnerships, collaborations, and international fora. Furthermore, a country can purchase capability from turn-key solution providers. In this paper, we present an analysis of civil space programs and find predictors of future developments for countries with emerging space programs.

We find that the decision to first develop a satellite in geostationary orbit (GEO) or low-Earth orbit (LEO) is a strong predictor of whether a government will operate a satellite with a foreign partner. Furthermore, the decision to collaborate with a foreign partner for the first satellite is a strong predictor of whether future satellites will also involve a foreign partner. There are nearly equal numbers of countries that use French, Russian, or Chinese partners, and there does not appear to be any bias towards language, date of launch, or region that influences the choice of partner.

In addition to understanding the likelihood of partnering with a foreign partner, we are interested in how these partnerships influence whether a country will develop independent satellite design, manufacturing, and operation capabilities. Using case studies of countries that have partnered with Surrey Satellite Technology Ltd. for satellites, we propose that countries that have developed or are developing an indigenous technology base (even one that is not space-focused) are likely to use SSTL to rapidly advance and develop technological independence in space. Countries without long-term investments in a strong technological workforce base are much less likely to gain independence from similar partnerships. This analysis provides insight into how emerging space nations develop and identifies countries that may experience fast growth in the near future.