

bipropellant thrusters. The primary difference between these two types of thrusters is that monopropellant thrusters utilize a single liquid fuel source (typically hydrazine), whereas bipropellant thrusters operate using a combination of both a liquid fuel (typically monomethylhydrazine) and an oxidizer. Monopropellant thrusters are well-suited for pulsed operations of short duration, making them ideal for attitude control and station-keeping. As such, monopropellant thrusters typically produce less than a pound to about 5 pounds of thrust (although for particular applications, some monopropellant thrusters are designed to produce as much as 140 pounds of thrust).

A bipropellant in-space propulsion system typically consists of separate attitude control and apogee thrusters. As with other apogee thrusters, bipropellant apogee thrusters generally produce thrust that ranges between 90 to 140 pounds of force. Bipropellant attitude control thrusters provide thrusts comparable to monopropellant thrusters, which are usually 5 pounds of force or less. Bipropellant in-space propulsion systems are more fuel efficient, as well as more expensive, than monopropellant propulsion systems.

Dual mode apogee thrusters are specialized bipropellant apogee thrusters that operate using hydrazine, the same fuel used by monopropellant thrusters, in combination with an oxidizer. A dual mode propulsion system affords spacecraft manufacturers the option of using monopropellant thrusters and a bipropellant apogee thruster on a single spacecraft without having to use two separate fuel systems. As a result, a spacecraft can attain the benefit of using highly reliable and accurate monopropellant thrusters for attitude control while at the same time utilizing bipropellant apogee thrusters. Dual mode apogee thrusters are more fuel efficient, as well as more expensive, than traditional bipropellant apogee thrusters.

The determination by customers of the appropriate type of propulsion thruster to put on a satellite or spacecraft is based on the satellite's or spacecraft's mission and encompasses a variety of factors. Those factors can include the nature of the mission, the length of the mission, the orbit(s) in which the spacecraft will operate, the mass and volume of the spacecraft itself, the launch vehicle it will be placed on, other equipment that will be on the spacecraft, and the price of the thrusters. An engineering decision is made, based on all of these factors, as

to which type of propulsion thruster(s) is best suited for a particular satellite or spacecraft. Although the price of an in-space propulsion thruster is a factor that customers take into consideration when selecting an in-space propulsion thruster, it is rarely the most important factor. For these reasons, customers for one type of in-space propulsion thruster—monopropellant, bipropellant apogee, dual mode apogee, or bipropellant attitude control—would not be likely to switch to any of the other types of thrusters for use on a particular satellite or spacecraft, if the price of the first type of thruster were to increase by five to ten percent.

The relevant geographic market for each in-space propulsion market is the United States. Although there are a handful of foreign suppliers of in-space propulsion thrusters, they are not effective competitors in the U.S. in-space propulsion markets. The principal reason for this is that U.S. export regulations, in particular the International Traffic in Arms Regulations, make it very burdensome and time consuming for U.S. commercial, civil and defense customers to procure foreign thrusters, making foreign suppliers an unattractive option. In addition, on many U.S. Department of Defense as well as other U.S. governmental spacecraft programs, foreign-supplied thrusters are not an option at all due to national security issues. Accordingly, for the vast majority of in-space propulsion applications, only U.S. manufacturers are effective competitors.

The U.S. markets for the research, development, manufacture and sale of monopropellant, bipropellant apogee, and dual mode apogee thrusters are all highly concentrated. Aerojet and ARC are the only viable suppliers of these thrusters to commercial, civil and defense customers in the United States for most programs. Even for customers where other suppliers (such as foreign manufacturers) are potential options, Aerojet and ARC are each other's closest competitors and the other suppliers are substantially less attractive options. Prior to the acquisition, Aerojet and ARC frequently competed against each other for U.S. monopropellant, bipropellant apogee, and dual mode apogee thruster business, and this competition benefitted customers of these products. By eliminating competition between the only two viable competitors for most customers and by far the two best options for other customers in these highly concentrated markets, the proposed acquisition would create a virtual monopoly in each of these markets. As a result, the

combined firm would be able to exercise market power unilaterally. It is thus likely that as a result of the acquisition purchasers of monopropellant, bipropellant apogee and dual mode apogee thrusters would be forced to pay higher prices and that innovation, service levels, and product quality in these markets would decrease.

The U.S. market for the research, development, manufacture and sale of bipropellant attitude control thrusters is also highly concentrated. In fact, ARC is the only firm with recent sales of bipropellant attitude control thrusters to U.S. customers. For many customers, including the vast majority of U.S. governmental customers, ARC essentially has a monopoly position in the bipropellant attitude control thruster market. Although Aerojet does not currently produce bipropellant attitude control thrusters, it has substantial existing expertise and technology in this area, has produced these thrusters in the recent past, and is a likely potential entrant into the market. Aerojet's acquisition of the ARC in-space liquid propulsion business eliminates the most likely potential competitor in this market and for many customers, including the vast majority of U.S. governmental customers, leaves the market with a single supplier for the foreseeable future.

There are significant impediments to new entry into each in-space propulsion market. A new entrant into any one of these markets would need to undertake the difficult, expensive and time-consuming process of researching and developing a viable in-space propulsion thruster, acquiring the necessary production and testing assets, obtaining the appropriate environmental permits, and developing the expertise needed to successfully design, manufacture, and market these products. Finally, a new entrant would need to establish what is commonly referred to as "heritage" for each new thruster, which is a successful track record of use in space. It would take a new entrant over two years to accomplish these steps and achieve a significant market impact. Additionally, new entry into the in-space propulsion market is unlikely to occur because the sunk costs and economies of scale necessary to enter the market and effectively produce in-space propulsion thrusters are extremely high relative to the limited sales opportunities available to new entrants.

IV. The Consent Agreement

The Consent Agreement effectively remedies the acquisition's anticompetitive effects by requiring GenCorp to divest ARC's in-space liquid