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Space Resources, the Enabler of the Earth-Moon Ecosphere (5)

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## TOP 5 LESSONS FOR SPACE FROM THE SHALE REVOLUTION

**Abstract**

Since the early 2000s, the US oil and gas industry experienced a major change. Innovation drove a transition to smaller, more entrepreneurial companies guiding the market. Investment grew at a breakneck pace, and activity levels skyrocketed. The intervening two decades saw the Shale Revolution change the technological, economic, geopolitical, reputational, and regulatory landscape of the industry. If that sounds familiar, it should. In this paper, we will introduce key concepts of the Shale Revolution, including the scientific basis for the massive shift. We will then explore the parallels with space today and how those parallels provide lessons learned for space. We will explore technological innovation, economics, geopolitics, communications, and regulatory developments as our Top 5 parallels from which we might glean lessons. The technology for a moon mission was successfully applied decades before the technology to drill and complete long horizontal wells, despite orders of magnitude higher investment in the drilling of wells over those same decades. We will explore the scientific and engineering innovations that drove the Shale Revolution, and how the momentum of the Revolution created an environment for iterative innovation and adoption of new technologies. After a century of drilling, shale-play development reduced the proportion of wells that find no resource to less than 1% from about 40%. This introduced a perception that a money machine had been created. The resulting waves of investment spurred supply while hiding free market forces. Regardless of economics, the sheer volumes that were produced shifted global power. The United States produced enough resource to meet its own demand, even if it couldn't refine it all, and OPEC could no longer fully manipulate commodity prices. Investment in export capacity, however, was slow to develop, dulling the full impact. As increased activity levels drew attention, an anti-fracking movement developed, and the industry did little to respond. As Superbowl ads sow the seeds of an anti-launch movement, we will discuss perception and reality of vilified industries. Scrutiny related to the encroachment of residential development into existing oil and gas fields led to increased regulation at both existing and new levels of government. Alongside helpful and necessary regulation, redundancy and irrelevance emerged, driving up costs, slowing timelines, and providing regulatory competitive advantage. Space can benefit from a good look at this recent history of another industry, anticipating the emergence of similar patterns and formulating strategies to address them.