

BALANCING AMERICA'S TRADE DEFICIT—A POSSIBILITY: MINE THE ASTEROIDS

We have a realistic, practical, and lucrative opportunity to get a return on those tens of billions of tax-payer dollars invested in landing astronauts on the moon and later landing robotic craft on Mars. And seizing that opportunity could also leverage and accelerate implementation of the technologies developed by [private U.S. corporations](#)^{6,9} for the purpose of commercializing Space.

Wealthy entrepreneurs and private corporations could establish a [commercial consortium](#) to fund the first phase of a highly lucrative Near Earth Object (NEO) asteroid mining operation. NEOs were recognized as potentially lucrative [sources of raw materials](#) over 20 years ago, but we lacked the propulsion technology needed to quickly traverse great distances within the Solar System. Now, with proven ability to live in Earth orbit and the likely successful test of the [VASIMR engine](#) before 2015, it will soon be possible to mine NEO asteroids, ferry the ore to Earth orbit, process it in Space, and then shuttle finished materials to Earth.

Consider this paper as a conceptual framework and ideas that could lead to developing an asteroid mining operation. This paper is dynamic, as new ideas or refinements are frequently added. It can be found on-line at: <http://tinyurl.com/3flo2t9>

INVEST IN ESTABLISHING A NEW ECONOMY BASED ON EXISTING SPACE TECHNOLOGY

America has the means to reduce the trade deficit, eliminate the deficit, reduce the debt, and, in the process, create a new Space-based economy and millions of new jobs on Earth. Not in the blink of an eye, of course, but gradually over the same ten-year period during which those pseudo-deficit-obsessed do-nothing right-wing Republicans aspire to cut spending by \$2 Trillion.

We have the means to create an entirely new multi-trillion dollar Green economy, bigger than the Automotive Industry, the Oil Industry, and the Computer Industry combined.

Why not repurpose or focus existing Space technology and the soon-to-be-proven VASIMR engine to mine the asteroids? It's estimated that *just one* large asteroid, Amun, could produce a variety of minerals valued in the trillions of dollars, after the cost of infrastructure construction, mining, processing and ferrying back to earth.

Sound far-fetched? Not really. Advanced robotic craft, capable of landing on Mars and analyzing mineral samples, could be repurposed to identify very large mineral-rich asteroids. With the likely to be successful [VASIMR engine](#)¹, human miners could travel to pre-identified target asteroids relatively quickly and even live in space colonies within the Asteroid Belt built from materials mined from these asteroids and powered by safe and plentiful Thorium molten-salt—MSR--nuclear reactors—Thorium can be mined from an asteroid or from Earth's moon. Mined minerals, possibly even partially processed using solar furnaces, could be hurled, using magnetic mass-accelerators, from several asteroids being mined to VASIMR powered barges that ferry the ore at high-speed to moon orbit. Complete refining could be done at a permanent processing plant in moon orbit, powered by cheap continuously available solar energy--both electrical and thermal. Finished processed material could be ferried to earth using a next-generation space shuttle.

And about that trade deficit... steel—it's needed ubiquitously worldwide for everything from cars to spoons and from high-rise construction to ball-bearings. Lithium-Ion batteries--needed for cell phones, notebooks,

and electric vehicles; and several other rare earth elements (REEs)—in short supply, needed to manufacture flat-screen TVs and LED's (the next revolution in lighting).

America, once dominating the steel industry, now imports much of its steel. And about 97% of those rare earth elements, essential for manufacturing iPads, hybrid cars, LED Christmas lights, and much more, come from mines in China, not mines in the U.S. We have to import them to manufacture many of the high-tech products Americans enjoy. And just look at all the [high-tech products](#)² that are dependent on REEs.

All these elements, in addition to gold and silver, are abundant in asteroids. Why not mine the asteroids, refine the ore in Space, use them in U.S. based industry, and export them, too? Moreover, America would cease to be dependent on China for materials critical to another major facet of America's economy. There are other benefits to mining the asteroids, too: environmental pollution from mining these metals would be reduced—or certainly not increased by mining these resources from new mines in the United States; and the substantial electrical power needed to mine and process ores would not add to the already heavily burdened U.S. power grid.

Once the VASIMR engine is successfully tested in Earth orbit, is there any critical-path technology not already developed and tested that's needed to achieve this goal? From food and water—hydroponics and aquaculture to supply miners with fresh food, packaged prepared meals with long-term shelf life, and fuel cells to synthesize water—to electrical energy generation from safe MSRs, to specialized zero-gravity tools, telemetry, space shuttle technology, and lots more, too numerous to list—is there *anything* that could prevent NASA from establishing this new Space-based mining economy?

Yes. The dysfunctional U.S. Congress would stop it cold, because it requires investment funds framed myopically by the right-wing Republicans as “spending”. But, but working together through a consortium, American private industry could create this lucrative new economy.

By realizing this goal in increments, it's probably possible to use seed capital that could be raised by working with America's millionaire and billionaire entrepreneurs, highly profitable corporations, and venture capital firms to establish and fund a consortium focused solely on investing in developing Space-based mining.

The first increment would require a relatively small amount of seed capital (compared to the cost of establishing sustainable mining operations in the Asteroid Belt). How much? That's an amount that needs to be estimated. However, in 2011 dollars, the *entire* Apollo program, from R&D through implementation and execution of multiple landings, cost around \$250B; the International Space Station is estimated to cost, over a *thirty year period*, less than \$150B; and SpaceX's “[Falcon 9 launch vehicle](#)”⁷ was developed from a blank sheet to first launch in four and half years for just over \$300 million”.

How would the first increment ore-processing plant generate revenues? Feasibility studies would be required to determine the least funding required to establish the most cost-effective and profitable prototype Space mining operation. Assuming operational VASIMR-powered Space-barges to transport ore at high speed, possibilities that could be assessed include these two prototype systems: 1) mining near earth asteroids (NEOs), such as [Trojan](#)³ or [Potentially Hazardous](#)⁴ asteroids, and constructing a second space station in Earth orbit to process the ore and to provide living accommodations for miners, 2) build a prototype ore processing plant in synchronous moon orbit, mine ore from the moon, and catapult the ore to the orbiting processing plant using magnetic mass-accelerators powered by a Thorium-based MSR.

In either case, the refined metals would then be shipped to Earth via a second generation [space shuttle](#)⁸ and sold by the consortium—revenues for a presumably healthy ROI and for funding larger-scale mining operations in the Asteroid Belt or of Trojan asteroids in the Mars or Jupiter orbital paths.

Is it feasible for a private sector consortium to pool hundreds of billions in seed funds? If so, is it feasible to establish a moon- or Earth-orbiting ore processing plant and Space mining prototype in less than 5 years? Is it then feasible to be mining a potentially high-profit asteroid in the Asteroid Belt within five years later? It's a ponderable possibility, isn't it? And if feasible, it would result in significant benefits:

- A major new U.S. economy, along with millions of new jobs.
- Major new mineral resources,
- U.S. independence from foreign mining operations and supply,
- Balance the U.S. trade deficit, eliminate the national deficit and debt with 10-15 years.
- No pollution from mining,
- No demand from the terrestrial power grid for mining and processing ores,
- A potential for generating trillions in revenues per large asteroid, and
- Possibly, as a side-effect, mining and then eliminating asteroids that could impact Earth

The number of people required—support services, electronics, robotics, telemetry, computer software, communications, food sciences, hydroponics, mining, engineering, pilots, shelter construction, clothing, tools, shuttle craft, and much, much more—could create millions of new jobs, possibly within 10 years.

References

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