

## **Taking and Trading in Space: Accounting for Asteroid Mining Prerequisites**

Nels Weber  
nelsweber@gmail.com

### **Humanity is ready to launch into space, and commerce will take us there**

A new economy is beginning to blossom in outer space. Humanity stands on a precipice and all we need is the drive to jump off and fly. And a few key concepts and companies are ready to pilot us into the future. It has been nearly six decades since the first manmade satellite orbited the Earth. In the intervening years there have been myriad strategies, and attempts to harness outer space's potential. Now, after all these preparations and plans, we are ready to vault into the future. This flight will be launched by commercial entities and fueled by economic incentives and appetites.

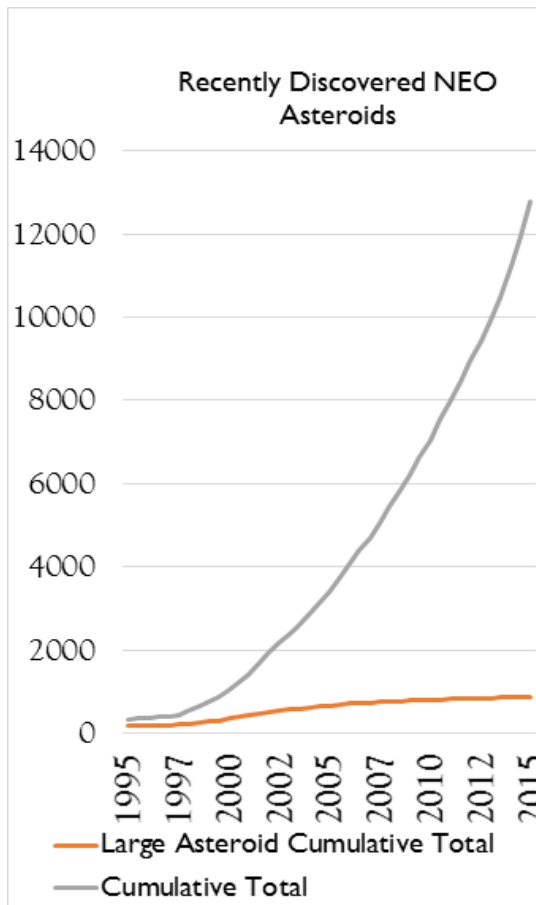
To expand mankind's horizons beyond Earth we must collectively commit to the proposition that there is great benefit floating above us. We are a species enamored with wealth. So it is only expedient to rely on the acquisition of riches to provide us with the motive to create our future as a spacefaring species. Humanity's aptitude and appetite for trade will galvanize our extraterrestrial aspirations and make them a reality. In the last few decades we have increasingly displayed the drive to become a space-born species. Our cultures dream en masse of space in ever more popular media forms. Children are taken by its allure. Businessmen, as well as elder statesmen, are tantalized by its possibilities.

Governments and private companies alike are becoming practiced in the techniques necessary to accomplish the goal of expansion beyond our planet. We received the tacit mandate to explore and expand into these new realms when the planet's governments gifted their money and effort. The endeavor to harness space's assets will affect all mankind's future, so this is only just.

This undertaking to master space becomes more coordinated and legitimate every day. Last month Congress passed, and the President signed, the Commercial Space Launch Competitiveness Act. Legislation that paves the groundwork for huge strides in humanities conquest of space. This law will encourage new commercial efficiencies and technologies in the space arena. Significantly, the law grants property rights to those who utilize space resources. A statute designed to incentivize the acquisition of needed resources from within the extra-planetary environment. This will be advantageous as the price of launching resources into orbit greatly prohibits utilizing space's potential. Launch costs are exorbitant and the risks are high. Often this makes the Return On Investment (ROI) too low to warrant the expense of attempting an extra-planetary venture. With this Bill Congress sought to lessen future costs and risks. However, Congress might have seen beyond these mundane primary goals, and sought to grant the grip crucial to mankind bootstrapping itself off the planet. Which is the promise implicit in mining resources from nearby celestial bodies.

But mining is not the Commercial Space Launch Competitiveness Act’s principal purpose. The Act is directly designed to drive down the costs outlaid in rocketing mass to orbit. To reach this goal the legislation takes two approaches, to decrease the price of boosting mass to orbit, and avoid these costs by increasing resource availability in Near Earth Orbit (NEO). These coordinated legal and commercial inducements will act as a flywheel. As the flywheel cranks every successive effort and advancement will increase the ease and ability with which we will create a space-based infrastructure.

**Resources are abundant in nearby asteroids.**



The burgeoning space economy offers us many lucrative prospects. Beautiful vistas of resources and techniques will redefine and redress many issues we currently face on Earth. The new economy will bring new technologies to market while it simultaneously opens vast new avenues for scientific inquiry. A multitude of unknown benefits lie beyond every horizon we will encounter in space.

None though, are as immediate or foreseeable as obtaining raw materials, chemical resources, and ores from NEO asteroids. Currently a cadre of global astronomers labor to discover, chart, explore, and characterize NEO asteroids. The project’s progress is shown in the inset graph. The graph’s data was provided by [NASA/JPL](#).

The existence and anatomy of NEO asteroids implicitly promises marvels. We will open up new potentials not only in orbit but we will alleviate needs here on Earth. This is the true promise offered to us, succor to ailing humanities wants and needs.

*Asteroid Mining 101* by Dr. John S. Lewis is the recently published bible on the concepts and possibilities entangled in asteroid mining. It lists the estimated total mass in the NEO asteroid cloud as  $1.2 \times 10^{17}$  kg. (1.2 billion Metric megatons.) This astronomically large number contains a stupefying quantity of usable resources. Some of which are listed in the enclosed table of quantities and values.

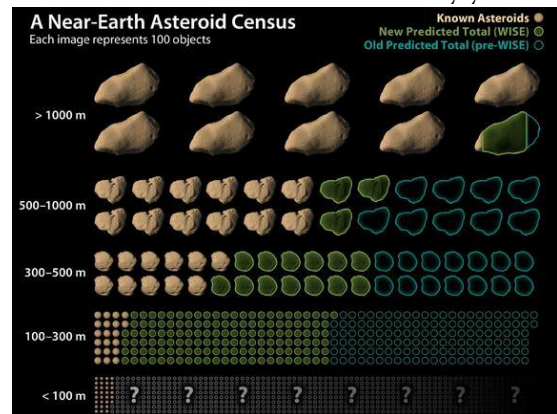
Ore:	Amount:	Worth:
<b>Iron</b>	$3.7 \times 10^{16}$ kg	$\$1.1 \times 10^{16}$
<b>Nickle</b>	$2.5 \times 10^9$ kg	$\$7.0 \times 10^{16}$
<b>Cobalt</b>	$2.0 \times 10^8$ kg	$\$7.0 \times 10^{16}$
<b>PGMs*</b>	$1.8 \times 10^6$ kg	$\$7.0 \times 10^{16}$
*Platinum Group Metals		

To clarify an important point, the value assigned to these ores are divisible by tens of quadrillions of dollars. This is the epitome of hyperbole as commodity prices do not function in such a straightforward manner. It follows then that these numbers are essentially meritless. However, they do convey the magnitude of available wealth just outside our current reach. Even a small margin of error would result in vast differences while summing the value represented in these ores. However, the riches presented cannot be too far off in practical valuation. As we will not acquire these valuables nor move them to market all at once. In all probability, the majority of ores refined in space will stay in space.

Ores will find far greater utility and fetch a better price in space’s marketplace. In being utilized in space the ore’s value will be amplified. As when it is kept in space the cost in transportation to Earth markets will be foregone. Ore will also fetch a better price in the extra-planetary market. As the price of competitive and comparative material from Earth will include the cost to get it into orbit. A process that will inflate the trade value of the commodity in question. This will allow a space concern to increase their prices to below the Earth-based competition but above the commodities market price on Earth’s surface. Additionally, if too much asteroid derived ore is introduced into Earths commodity market it will increase the supply, decrease the scarcity, and therefore decrease the price. For these reasons the space economy will create and trade in its own commodity market.

What will happen in this space-based marketplace is merely conjecture. However, the figures and values are based on is backed by diligent and meticulous efforts. This process is outlined in *Asteroid Mining 101*. It teaches that the methods of deduction used in to determine the composition of distant celestial bodies is based on cross-disciplinary research going back decades. Through experimentation and the careful application of the scientific process we slowly acquired the ability to assess asteroid anatomy at distances in the millions of miles. This ability derives mainly from meteorite samples distributed across the globe’s research institutions. These meteorites are meticulously analyzed and categorized. More are found and scrutinized every year.

This has created a vast data set magnified by global telescope networks tasked with isolating nearby asteroids’ reflected spectra. This spectra enlightens us on the asteroid’s compositional framework. The library of meteorite samples are then referenced to extrapolate the finer tendencies in chemical makeup. These two tools, when mathematically extrapolated, allow us to quantify the orbital dynamics and qualify the chemical composition of an asteroid, or even a whole field such as the NEO asteroids. This process has allowed the volume of known celestial bodies to grow every year.



NEO Census of Asteroids within 5 million miles.  
Graphic [Provided](#) by NASA/JPL

We currently search the skies for asteroids driven by curiosity and credible fear. However, one satellite searches for more lucrative reasons. An Arkyd 100 class satellite designed, build and orbited by [Planetary Resources](#) currently maps the heavens as it quests for a likely location to start a mining venture. An undertaking that reveals a seldom considered truth: as more asteroids are discovered we also expose usable resources. As the previous graph showed, the growth in the quantity of NEO asteroids identified in the previous two decades is substantial. According the JPL we have gone from 333 charted asteroids in 1995 to 12,770 in June of 2015.

Space brings new hopes, technologies, and prospects to mankind. Recently commerce has quietly conquered the first major roadblock in accessing orbit. The cost to get a kilogram of mass into orbit on [SpaceX's Falcon Heavy will soon fall below \\$1000](#). A price that beats SpaceX's major competition, ULA, by more than 13 times. A feat attributable not only to SpaceX's prowess, but a success linked to the commercial forces that drive and hone SpaceX's processes and decisions. Change in this one key economic ratio, price per kg to orbit, will create a new world in space. Market forces will alter and refine this ratio and its implications. Examination into the forces that motivate this process are warranted.

### **Space exploitation and exploration as *Systems of Survival***

Before we advance in our examination in regards to humanities' future in space. A necessity arises to contextualize the interactions that have guided us to our current place in space. The dynamic times we are in call for reevaluating both past and present circumstances. Resource exploration and exploitation is a fundament in mankind's history. These ultra-modern possibilities in outer space are just another way to prospect for wealth. The dawning space age is only a new phase in the historic quest for riches. These actions are ancient and elemental, so assessing their methods and mores will require a holistic approach. This approach should be adept in assessing past, current and future space exploits. It should also act as an appraising tool able to delve into the psychic processes which create the actions we see in the space industry.

A comprehensive tool fitted to these requirements is the schema Jane Jacobs puts forth in her 1992 book *Systems of Survival* (SoS). In SoS Jacobs boils down all human action, particularly resource exploration and exploitation, into two moral syndromes. These moral syndromes are Guardian and Commercial, and each explains humanities relationship to space adroitly.

*Systems of Survival* explicates The Guardian Moral Syndrome as having arisen from pre-historic "taking" patterns. These patterns Jacobs clusters into fifteen characteristic traits that build the ethical framework of what we recognize today as governmental and institutional establishments. Jacobs defines these traits as a Syndrome using syndrome's classical Greek definition: "things that go together." Jacobs delineated these traits while she surveyed history. In this survey she recognized and categorized characteristic human behaviors in "taking." Which is the operation, protection, and governance of territory and resources. Jacobs asserts that the other main economic and moral method mankind works with is "trading." Qualified by Jacob's as The Commercial Moral Syndrome: a collection of traits that coalesce when an entity is concerned with

“exchange by voluntary agreement.” These two Syndromes are not mutually exclusive. Which has vast implications for man’s future and past in space and on Earth.

Jacobs affirms two main implications for beings with blended Syndromes. One is Systematic Moral Corruption, and the other is Moral Flexibility. Jacobs explains Systematic Moral Corruption as “Any significant breach of a syndrome’s integrity —usually by adopting an inappropriate function— (that) causes some normal virtues to convert automatically to vices, and still others to bend and break for necessary expedience.” Moral Flexibility is the ability to switch between the Syndromes as needed. Sometimes applying two divergent traits to determine the ethical response for the faced situation. Although this sounds commendable, a worthy argument can be made that the larger problems in the past, present, and possibly the future of mankind’s journey to space stem from Moral Flexibility being misapplied as Systematic Moral Corruption.

### **The Commercial Syndrome is better suited to the dynamic space environment.**

A new day dawns in space’s marketplace. We have seen that new ordinances are being passed and new entities have placed their wares out for show. Commercial interests are now ready to move beyond being merely contractors for large government and inter-governmental agencies. These corporations will decide their own paths and actions. Freedom and self-reliance will renew vigor and efficiency. In the next few decades far more will be done than in the previous six. Progress made possible by laws such as the Commercial Space Launch Competitiveness Act and the Space Act of 2010. Breakthroughs will be implemented by companies such as: SpaceX, Bigelow Aerospace, Planetary Resources, Tethered Unlimited, Spaceflight Industries, Blue Origins, Boeing, Sierra Nevada, Orbital Dynamics, and others yet to be born. These corporations will do as companies are wont to do, compete and collaborate to extract valuable resources and bring them to market.

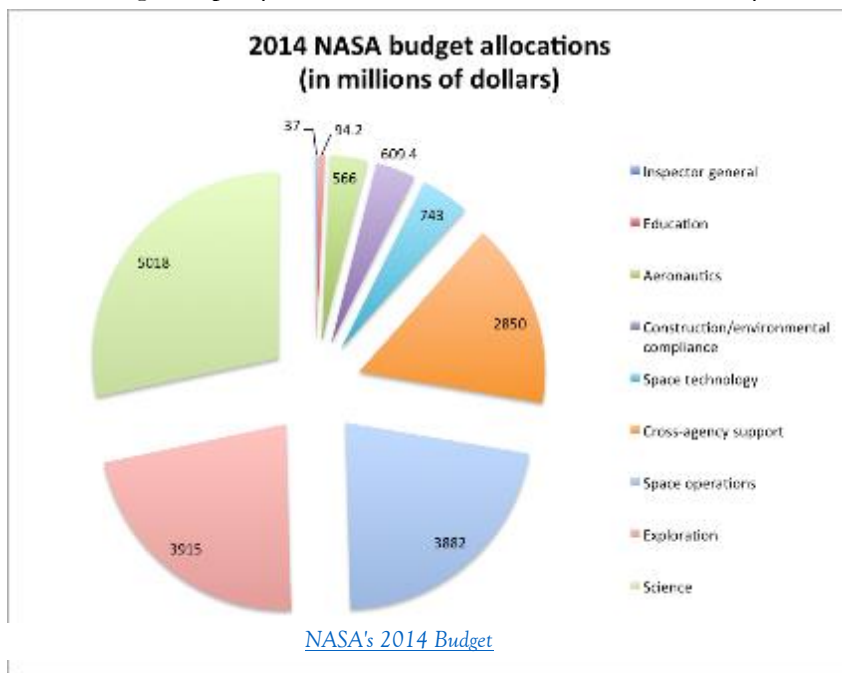
NASA cannot compete or collaborate with the same efficiency nor aptitude. NASA is fundamentally a governmental agency, and it meets trouble when it attempts to act beyond that role. Space is an environment requiring constant adaptation and innovation. Its unforgiving nature necessitates brutal honesty and humility. You must enter space not only because you want to go there, but because you know that **you** will gain from it. Guardian natures are fundamentally at odds with all these characteristics. For these reasons and more outer space will be best used by ethically Commercial ventures. These harsh realities have forced NASA and similar agencies to adopt many Commercial characteristics. And when they cannot abide to act in a Commercial manner, they contract these actions out to those who can.

### **NASA is corrupted when forced to use Commercial ethics in its Guardian duties**

There is danger in selectively choosing a Commercial Syndrome characteristic to use when your nature impels a Guardian ethic. These situations lead to Systematic Moral Corruption. Which is rooted in using a contrary Syndrome’s ethics to decide on an action while lacking the support of the rest of the traits in the Syndrome. These traits “go together” to back each other up

and inform the ethics of the action at hand. NASA has morally corrupted itself many times. Often it acts in a Commercial manner while being motivated by Guardian intentions.

This happens when it projects its budgets. NASA receives annually updated budgets from Congress yet has multi-year projects that are sometime decades in length. NASA is expected by Congress to make budgetary projections using Commercial Syndrome traits. Such as “Be thrifty,” “Be efficient,” “Compete,” and “Respect Contracts.” However, when the budget is determined and the money is passed onto them NASA operates in full Guardian mode. Wherein they make sure to use the full budget no matter what. Budget overruns are common if not expected. At this point NASA also becomes very proprietary. In this way NASA falls back on the core Guardian traits of “Shun trading” and “Be exclusive.” This is shown in the way they award contracts not to the lowest bidder but based on how much business NASA has had with the contractor in the past. NASA also enforces complicated application and license requirements. Many of these require the contracting company to take on Guardian traits and “Be loyal.”



“Deceive for the sake of the task” plays a major part in the processes used to project annual budgets. NASA will know a budget is not going to be met but will deceive both themselves and Congress in an attempt to preserve their power base. This is a strong tradition in modern NASA and a key Guardian trait is to “Adhere to tradition.” Juggling Syndromes for governmental largesse mostly goes away with private for profit corporations

who choose to operate in the commercial sector. Reliance on government funds will still be a part of gaining access to space. But the mechanism will be driven by competition, if the Commercial Space Launch Competitiveness Act is any indicator.

This Act will help NASA become more firmly footed in the Guardian Syndrome and private companies will grow to take over its aspects that require the syndrome of Commercial Morals. This will be a change beneficial to all mankind and will contribute greatly to the next steps we as a species will make into space.

Below are a small sample of the both the Guardian and Commercial characteristics NASA possesses and displays. These show the versatility space’s environs necessitates and encourages. NASA has struggled to operate while employing these divergent traits.

## NASA's Guardian Syndrome

### ❖ Shun Trading

- *"I propose the taboo originated as a different type of military safe-guard. Defense against treachery... Trading secrets to the enemy is fundamentally like any trading." SoS*
  - Section 20135 in [The Space Act of 2010](#) decrees all patents are held in the name of the Administrator.
  - These intellectual properties are not traded, but rather licensed by NASA.

### ❖ Exert prowess

- *"It means having power and using it effectively." SoS*

- NASA was created to effectively use and display technological power and prowess. To fight the education and technology gap faced when Sputnik (and particularly Sputnik 2) went up.

### ❖ Be obedient and disciplined

- The scientific rigor prerequisite in NASA's endeavors require discipline. To speak nothing of the tenacity needed for spaceflight.

### ❖ Respect hierarchy

- *"It is the chief principle of organization for guardians... chains of command extending in formal, unbroken order" SoS*

- Starting with the Administrator and the Deputy Administrator, then cascading down through the ranks, [NASA has always been a clearly designed, designated and delineated hierarchy.](#)

### ❖ Adhere to tradition

- NASA has traditions that are both whimsical ([beans](#)) and deadly serious ([launch checklists.](#))

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## NASA's Commercial Syndrome

### ❖ Shun force

- NASA was founded strictly to be a non-military institution. Designed both by Congress ([LBJ](#)) and the Executive Branch ([Eisenhower](#)) to be non-violent.

### ❖ Come to voluntary agreements

- The [1958 Space Act](#) Section 205 outlines NASA's interaction with international space agencies and promotes agreements with them.
- The [Space Act of 2010](#) Section 20102 "(c) Commercial Use of Space.-Congress declares that the general welfare of the United States requires that the Administration seek and encourage, to the maximum extent possible, the fullest commercial use of space."

### ❖ Be honest

- *"Be honest... gives substance to voluntary agreement... by definition, dishonesty it kept down to the supportable level wherever commerce remains viable." SoS*

- Honesty is codified into [NASA's Ethics Rules](#) and in by [Executive Branch Mandate](#),

### ❖ Collaborate easily with strangers and aliens

- The [1958 Space Act](#) Section 205 gives rights no other agency had at the time to interact with foreign entities and governments.
- In [The Space Act of 2010](#) "Sec. 20115. International Cooperation: The Administration... may engage in a program of international cooperation in work done pursuant to this chapter, and in the peaceful application of the results thereof, pursuant to agreements made by the President with the advice and consent of the Senate."

## Through legislation NASA is impelled to become more Commercial.

Even this minor charting of NASA's Syndromes makes clear that although NASA is a government agency in the Guardian sphere, it expresses many Commercial attributes. Nor do the two Syndromes corrupt automatically. Often they exhibit Moral Flexibility. A change in framework can result in traits from each Syndrome. Demonstrated by the laws that have created NASA.

<b>Legislation:</b>	<b>Affects Commercial:</b>	<b>Affects Governmental:</b>
<b>Instituting NASA:</b> <a href="#"><u>The Space Act of 1958</u></a> ~July 29, 1958~	<ul style="list-style-type: none"> <li>• Moved space activities from the military into a civilian arena.</li> <li>• Utilized commercial contractors, exposing private workers to space technologies.</li> <li>• Created modern manufacturing facilities and technologies for commerce.</li> </ul>	<ul style="list-style-type: none"> <li>• Sold big government action as a requirement to harnessing the dreams of the future.</li> <li>• Modified patent law so civilian and contractor inventions benefit the government.</li> <li>• Created powerful ties between the government and industry.</li> </ul>
<b>Endowing Commercial Space:</b> <a href="#"><u>The Commercial Space Launch Act</u></a> ~October 30, 1984~	<ul style="list-style-type: none"> <li>• Dictated NASAs need for innovative commercially developed equipment.</li> <li>• Allowed the private sector to create satellites, launch vehicles, and other space technology.</li> <li>• Encouraged and permitted private launch, services, &amp; sites.</li> </ul>	<ul style="list-style-type: none"> <li>• Moved launch authority to the DoT.</li> <li>• Allowed commercial spaceflight while keeping the government firmly in control.</li> <li>• Enables government to utilize competitive pricing models in space technologies</li> </ul>
<b>Refining Space:</b> <a href="#"><u>The 2005 NASA Authorization Act</u></a> ~December 30, 2005~	<ul style="list-style-type: none"> <li>• Directed NASA to support university research.</li> <li>• Designated the ISS as a research tool for those outside of NASA, including commercial ventures</li> <li>• Commissioned NASA to work closely with the private sector.</li> </ul>	<ul style="list-style-type: none"> <li>• Revitalized national vision of NASA as a supplier of large scale dreams and endeavors.</li> <li>• Directed NASA to increase collaborations with other government institutions, increasing governmental scope.</li> </ul>
<b>Revitalizing Space:</b> <a href="#"><u>The 2010 NASA Authorization Act</u></a> ~October 11, 2010~	<ul style="list-style-type: none"> <li>• Expanded Commercial Crew Development Program.</li> <li>• Increased investment in the Experimental Program to Stimulate Competitive Research</li> </ul>	<ul style="list-style-type: none"> <li>• Resolved to examine alternative management strategies.</li> <li>• Increased capabilities and infrastructure with SLS.</li> </ul>
<b>Privatizing Space:</b> <a href="#"><u>The Commercial Space Launch Competitiveness Act</u></a> ~November 25, 2015~	<ul style="list-style-type: none"> <li>• Unifies codes governing private space usage, increasing ease of entry into commercial space markets.</li> <li>• Creates property rights for space resources. Encouraging the commodification of space activities.</li> </ul>	<ul style="list-style-type: none"> <li>• Expands government incursion into space activities by delegating power to the GAO.</li> <li>• Reiterates government's ultimate power in space matters.</li> <li>• Gives DOD ultimate authority in space traffic management.</li> </ul>



## **Aptitude depends on the realm you act in and the Syndrome you operate with.**

NASA's major contributions to the world have been in scientific explorations and endeavors. Both benefit from Guardian Syndrome traits. NASA behaves with all the Guardian traits but the most gainful ones are: "Exert prowess," "Be obedient and disciplined," "Dispense Largesse," and "Show fortitude." Prowess and fortitude are rife in NASA's most visible members, the astronauts. However, the vast majority of NASA workers are contractors who work in support roles where obedience to mission guidelines and scientific rigor and discipline are key. NASA also benefits mankind greatly through its largesse as shown by its NASA Spinoff programs. With this program's help every US citizen gets back [14\\$ for every 1\\$](#) invested in NASA's greater mission.

But the Spinoff program is another fashion in which NASA operates in the commercial world. Applying Jane Jacobs' Commercial Syndrome to this we can say NASA "Compete(s)." However, NASA derives no profits from the Spinoff program. Rather it falls back on the Guardian trait, "Dispense largesse." So it acts in the commercial market, but ineffectively. Monetary benefits are derived from the process, but not by NASA. It just bolsters its reputation. Falling back on yet another Guardian trait "Treasure honor."

Sometimes these conflicts are forced. Such as when Congress mandated NASA to use prizes and competitions to drive innovation. Here again, NASA fell back on Guardian principles while acting in a commercial realm. Rumors abound about these prizes being rigged, and awarded to a select few that have gained favor with NASA. An example of NASA "Be(ing) exclusive." This is also an example of the Guardian Syndrome's "Deceive for the sake of the task." Faultily awarding prizes is not the only example where NASA uses this deceptive trait in ways that are inopportune. Once, it was even deadly.

"Deceiving for the sake of the task" was at work in the Challenger Disaster. Entrenched bureaucrats followed Guardian instincts and went against what the reality the situation should have dictated to them. The mission controllers deceived themselves and their subordinates that a launch was a worthy risk in the face of the shame in aborting the mission. Instead the NASA commanders chose to "Treasure honor" and to "Be fatalistic." And those who knew that it was wrong fell in line to "Be obedient and disciplined" and "Respect hierarchy."

If a commercial agency was faced with these circumstances it would have listened to its instinct to, "Be thrifty" and "Be honest." A profit driven corporation would not have risked the shuttle, the astronauts' lives, or the hundreds of millions in investments. The possible effect on ROI would have been too high. A commercial institution would not have been swayed to lie about the situational reality for the Guardian traits: "Adhere to tradition," and "Show fortitude." These Guardian traits do not work well with the space's harsh realities.

Their commercial counterparts work much better. The specialists and engineers at a hypothetical private space corporation aware of the fault in an untested cold weather launch would have "Dissent(ed) for the sake of the task" and stopped the mission. Or they might have used the Commercial attitudes "Be open to inventiveness and novelty" and "Use initiative and enterprise" to fix the problem before it blew up into a catastrophe.

As we move into a new commercial future in space we can look forward to new possibilities based on the implications behind the Commercial Syndrome. Not only will things be more “efficient”, “honest”, “industrious”, “inventive and novel”, space will be filled with “initiative and enterprise” which will encourage “Collaborat(ing) easily with strangers and aliens.” A behavioral syndrome that will encourage all mankind interested in a future in space to “Invest for productive purposes” in an “optimistic” fashion. This bright future is just the ramifications of the full Commercial Syndrome implemented in space. A Syndrome which has been attempted to manifest fully in the past, but has been stunted by the Guardian Syndrome. Government has its place, but it should be in providing infrastructure, rules and laws. Not expanding into new markets. This begs the question, do we need a Guardian Syndrome in space at all? With modern technology harnessing the near infinite resources available you can hypothesize an entirely commercial system.

### **Can The Commercial Syndrome operate on its own in space?**

To rephrase the previous question, could asteroid mining exist wholly in the commercial realm without Guardian sway? Surely if the mined material were to come back to Earth; Guardian interaction is a necessity. As every habitable portion of Earth has a governing Guardian body. To get the resources to a buyer on Earth, Guardian agencies will have to be in play. Taxes will have to be paid and regulating bodies will have to be appeased. This appeasement works with governments’ traits “Be exclusive” and “Treasure honor.” Guardians have exclusive sway over laws and if you avoid them you offend their honor and role. However, asteroid mining is not predicted to only interact with Earth. Its greatest benefit will derive from providing material, particularly mass-dense, substances to facilities and concerns already in space.

So, in extra-planetary jurisdictions, would these asteroid miners need to interact with Guardian beings? To reach an asteroid, the first few vehicles will be produced on Earth by Earth-based companies under Guardian institutions’ purview. Therefore yes, asteroid mining companies would be under Guardian sway initially. But once we have the resources in orbit to build the refinement apparatus and the vessel to get the robots or humans miners to the asteroid... what about then? Once they’ve intercepted an asteroid, landed on it, started to process its regolith, where are the Guardian institutions? It can be argued that even in this advanced instance of the space economy, these miners, who could be beholden to no government body, will voluntarily act in a Guardian fashion. For just as the Commercial Syndrome is well adapted to space, the Guardian Syndrome is well adapted to supporting and bolstering the commercial apparatus.

After all a core Guardian trait is to “Adhere to tradition” and the extraction, conversion, and acquisition of ore is a tradition as old as farming. The methods that we will use to mine space resources will be iterative innovations based on a technological practice dating back thousands of years. Early mines were run by governments, and it would not be surprising if some of the first asteroid mines were government supported as well. All mining, and asteroid mining is no different, is “taking” territory. This is the root of Guardian actions and ethics. These hypothetical miners at the forefront of progress and technology will be essentially “Adhering to

tradition” and are certainly “Exert(ing) prowess” and by necessity “Be(ing) obedient and disciplined.” I am confident that once the apparatus and methods of asteroid mining are established it will have a Moral Flexibility like NASA. Just one skewed towards the Commercial Syndrome. As the Commercial Syndrome ethics will motivate them to undertake the endeavor in the first place; and in it they will find their greatest strengths, as it suits space in a superior manner.

### **Space-based enterprise requires large support frameworks.**

But a venture to extract resources from asteroids cannot, will not be as simple as I have outlined. There will be a larger apparatus at work. There will be support staff for the vessels and technologies: the designers, mechanics, and engineers of all sorts. There will be the support staff for the humans who operate the mission. The incredible logistics required in any complex cosmic enterprise will necessitate its own organization. A cadre of individuals will be obligatory to enter into such any such endeavor. There will even be the accountants. Yes, importantly, there will be accountants who make sure the mission is profitable. For whether the ore ends up traded in space or shipped to Earth, accountants will balance the books and verify the venture’s feasibility.

Accountants will also be there to mediate the balance between the ethics of the Guardian and Commercial Syndromes involved in the undertaking. Accountants act as arbitrators to make sure neither Syndrome gains inappropriate power. Accountants negotiate the balance between Guardian fealty to taxes, tradition, and law with unrepentant Commercial drives for profits and progress for its own sake. Accountants facilitate Moral Flexibility. Progress will be facilitated by accountants. Advanced accounting methods will be used to increase the efficiencies of space based factories. Accounting standards will be used to plot out the value chains of lunar and asteroid mining concerns. The ROI of Lunar vs Martian colonies will be tabulated and used to help the decision of which venture is more likely to succeed.

### **Accounting uses The Guardian Syndrome to provide commerce a stable schema.**

We exist in a world governed and sustained by fiscal concerns. This makes accounting vitally significant. In essence, Accounting is a Guardian tradition that facilitates Commercial Syndrome action. Accounting acts as a vocabulary that provides a method of mediation within Guardian institutions and between different Commercial agents. Accountants track, assess, and broadcast the fiscal health of an institution who has contracted them. All these actions, roles and responsibilities are tertiary to accounting’s primary role: facilitating taxation. Accounting is primarily a bridge between Commercial and Guardian, and so it is a profession of Moral Flexibility. Most accountants work within the Commercial realm but with Guardian ethics.

Accounting is a profession that works internally in organizational entities of all varieties. For the sake of brevity and the topic of our explorations we will focus on accountants working in the Commercial sphere. When accountants work in commerce, they bring the strength and stability of the Guardian Syndrome’s worldview to the management, discovery, and recording of a

company's fiscal activities and health. Accounting draws upon the array of Guardian Syndrome characteristics to coordinate its rights, reactions, and responsibilities. Accountants are internal workers and, although they facilitate trade, at their core they "Shun trading." Accountants also "Exert prowess" and are required to "Be obedient..." to the law, practices and ethics of the field which requires them to be "...disciplined." There are many strong "traditions" in Accounting to "Adhere to." Many of these traditions revolve around a culture that encourages accountants to "Be ostentatious" and "Make rich use of leisure." These extravagances do not contribute to accountants facilitating the structure of Commercial ventures but they do indicate Moral Flexibility.

Accountants assuredly are core functionaries in the commercial realm. As they perform key activities in commerce. These functions must be tracked and reported to both corporate ownership and Guardian oversight bodies, as taxes must be paid. These responsibilities buttress accountants' Guardian drive to "Treasure honor" and protect the company's reputation as well as their own. Accountants also "Show fortitude." In difficult times they are often called upon to report financials that are not what their managing executives would prefer. If an accountant lies in their reports, or is pressured into manipulating the facts and figures their job holds sacrosanct, this is a sign of Systematic Moral Corruption. In these instances they are perjuring their Commercial instincts to "Be honest," "Be optimistic" and most importantly to "Dissent for the sake of the task." Instead they are misusing the Guardian ethics of "Respect hierarchy" by kowtowing to authority. They are misapplying "Be loyal" by showing loyalty to the people in charge instead of the profession's ethical standards.

### **Accounting Will Be Fundamental to the New Space Economy**

The application and practice of Accounting in space is a natural extension of the coming space economy. Accounting is known as the language of business and for business to be transacted fluently in any setting good accounting practices must be upheld. In this new extraterrestrial marketplace, if trade is to be carried out successfully, there must be accurate records kept. There also must be a way to prove profitability or loss and a method to set good prices. Asteroid mining deals in commodities. So its prices will be set by the market. But other space-based enterprises will need good managerial economics and market research based price determination. Both these methods are best processed by and substantiated by accountants. Financial records will be key to establishing order in the possible chaos of this new business frontier, and records must be setup and implemented from the start.

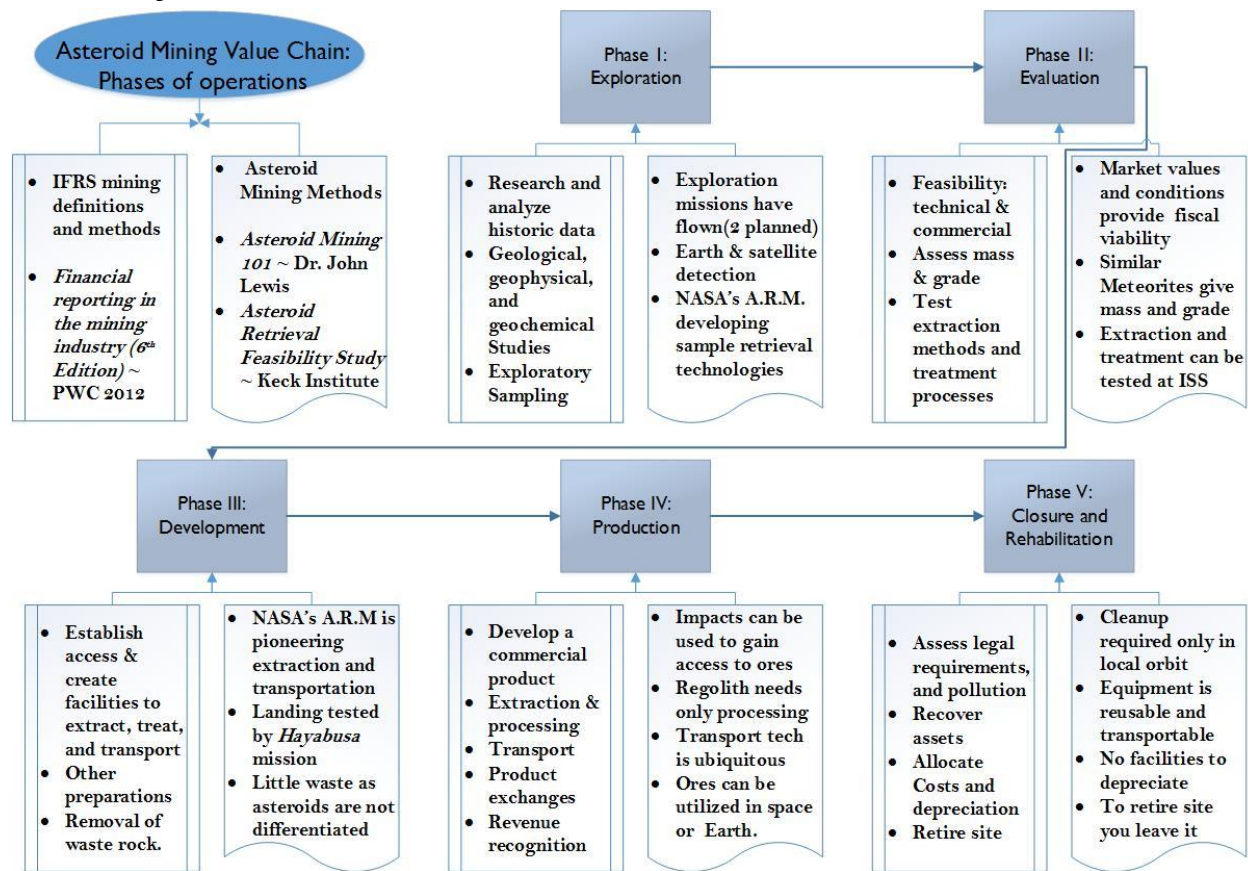
Moreover, accountancy has within its power the ability to make things more efficient. Efficiency will be needed as a space company's supply and value chain management will be all important. As the supply chain in orbit will be exorbitantly complex. Accounting is also the tool wherein costs will be tabulated. Computation of cost benefit analysis and extrapolation of ROI will inform any space company due to the large investitures made, particularly in startup costs.

Without tabulating the financials and proving a concept is viable you could doom a venture; and then the efforts of hundreds or thousands of hopeful people could be for naught.

The next space race will be a commercial process; and commerce has an end goal, and the road leading to that goal is paved in paper. Accountants will be the checks and balances to the heedless rush of those who want progress for its own sake. Accountants will be the emergency brake and the steering wheel on the enthusiasm of those wanting to rush headlong into an unknown future. Such a heedless charge in space's harsh, remorseless backdrop could be deadly. Accountants will also moderate the Guardian tendency towards conservatism which could be just as deadly to the realization of spaces potential.

### The IFRS Mining Value Chain reapplied to extracting asteroid based ores

Accounting standards and practices go back hundreds of years and are constantly being refined and rarified. Future and present space companies will benefit greatly from these preexisting models. Models that can be easily applied to the praxes operant in space's new dimension. As an example and exercise in this the following flow chart is presented. In it the most modern accounting standards pertaining to mining are presented and then correlated to prospective methods and technologies to accomplish these standards. Current progress towards meeting these models are provided as well.



**Space presents man with great possibilities, accounting will facilitate these.**

The modern age is an exciting time. We will soon unleash the greatest economic drives known to man into our greatest mystery. Space will be the vital environment needed to forge and temper mankind's evolving nature. The possibilities are as vast as space itself.

We will conquer space under the aegis of business methods and mentalities, the Commercial Syndrome. These advances in winning a toe-hold in the vastness of space will be supported by profit motivation, competitive and comparative advantages. The companies that will be the organizational inhabitants orbiting Earth will get there by implementing modern innovation-centric business structures. Space will be appropriated through advances in intellectual and material technologies and via progress in business processes such as psychology and science-based human resources. It will also be founded on and using modern Accounting practices. As accounting has the Moral Flexibility to bridge mans' two methods of exploiting resources: taking and trading.

**Nels Weber** is an Accounting Student at The University of Washington:Bothell. He has an extensive background in using philosophical methods to analyze various phenomena. He intends to work in the commercial space sector.