# \*\*\*CP Solvency\*\*\*

## Nuclear Propulsion – 1NC

### Text: The United States Federal Government should create NucRocCorp and Space Charter Authority.

### That solves

**BEHRHORST AND DEWAR ‘10** (Bruce, is a staff writer for nuclearspace and has assisted in the formation of the NPO Nuclear Space Technology Institute, AND\*\*\* Dr. James Dewar Worked exclusively on nuclear policy issues in the Atomic Energy Commission and its successor agencies, the Energy Research and Development Administration and the Department of Energy, PhD from Kansas State University. He held a Q clearance, with Sigma access, as well as many intelligence clearances, November 17, “BREAK THE TABOO, INVEST IN A REAL SPACE PROGRAM”, http://www.nuclearspace.com/nucrocketbook\_dewarview.html, MinR)

Well, I came up with a private sector-government corporation that I call, 'NucRocCorp' in which the government provides the HEU (Highly Enriched Uranium) land and facilities as a contribution in kind while the private sector and citizen taxpayers provide the money to make it happen. NucRocCorp will be profit driven and you can read the argument, I think it would be highly profitable. So now, I said, 'How can I bring in Szilard's world peace idea?' Here I came up with a way for **citizens around the world to participate and profit**. I call it the "Space Charter Authority" that would grant charters to private sector entities to build "For-profit Space Stations" in LEO. National governments would not do it nor would the UN, at least that's my argument. These space stations have to be funded by the private sector and must be free to make business decisions without having to go to the government every year for funding or approvals. In the private sector time-is-money and that will be true in space as well as on earth.

## Solvency: Nuclear Propulsion

### Government fails at nuclear propulsion. Free market solves

**BEHRHORST AND DEWAR ‘10** (Bruce, is a staff writer for nuclearspace and has assisted in the formation of the NPO Nuclear Space Technology Institute, AND\*\*\* Dr. James Dewar Worked exclusively on nuclear policy issues in the Atomic Energy Commission and its successor agencies, the Energy Research and Development Administration and the Department of Energy, PhD from Kansas State University. He held a Q clearance, with Sigma access, as well as many intelligence clearances, November 17, “BREAK THE TABOO, INVEST IN A REAL SPACE PROGRAM”, http://www.nuclearspace.com/nucrocketbook\_dewarview.html, MinR)

Bruce: In your estimation what would it take to completely change the American effort in Space? Dewar: The short answer is to break the taboo against using nuclear rockets to reach and return from LEO. That changes the economics of the space program drastically, to where $100 per pound would become the norm, but where the figure would likely be reduced even further as newer nuclear engines are introduced. That alone changes its very nature as now private citizens and private money can do things they want in space whereas sticking with chemical propulsion means mainly a government space program probably forever. The longer answer is that this country and other countries that share in its fundamental values must enter into a debate and dialogue over using nuclear rockets to reach and return from LEO. This opens up space for the average citizen whereby he or she not only can have personal access but also can profit from its enormous potential. The consequences can be that profound and I articulate them in my second book. However, I offer them only in the sense of putting a marker on the table, to use a bureaucratic phrase, to provoke discussion and dialog. So in sum, I propose to enter into debate and dialogue on breaking the taboo and on the new institutions that will be required to manage and direct this effort. In other words, breaking the taboo means a private sector space program will become much larger than a government-run one. Some people consider the normal lifecycle of a large corporation to follow the following: They are born well meaning by technical people. They flourish under sales and marketing. This attracts the finance parasites who reduce the company to feebleness. Then lawyers take over and you have the government bailouts (too big to fail) and leveraged buyouts by interests who are well connected to government much like the environmental services are in now. Case in point, Gore backer car company gets a 529 million U.S. government loan and all the nouveau-criminal ways to kill companies, without ever forcing them to go bankrupt. I would think that NucrocCorp or the Fraternal Space Regime (Space Charter Authority) you reference would never permit this so-called 'lifecycle' for large corporations, because you would in effect spread risk around to other companies and governments not to mention the added responsibility in providing the financing for life sustaining support for whole settlements and space colonies. Bruce: Could my assessment of NucrocCorp or the Fraternal Space Regime seem plausible? Dewar: When I began my book I had no idea where I was going to end up. I was working my way through the logic of the argument of breaking the taboo. That's really the truth. So when I developed entities such as NucRocCorp it was to overcome hurdles or barriers. With NucRocCorp, it was to overcome the political problem of NASA giving a sweetheart contract to one or two companies, such as was done with Westinghouse and Aerojet General in the 1960's, to develop a nuclear rocket engine. If it takes payloads to space for $100 per pound that would privilege them while putting the others out of business. That is an untenable position. So I came up with the NucRocCorp concept to allow all rocket firms to participate either on engine development or on actual missions or both. Then I looked at the funding. **The government cannot do it; it's broke.** So I came up with this NucRocCorp concept whereby the government provides things as a contribution in kind, such as the uranium HEU fuel, while the private sector provides the men, money and material to make it happen. Then I looked at the enormous stimulus the Rover/NERVA had on the economy, where some companies are now making billions off its innovations, but I note the taxpayers who funded it in the first place got little or nothing from their tax dollars. So I wanted to find a way to let them profit personally, to get a return on their tax dollars, if they so desire. The upshot of this is the NucRocCorp, but view it only as a marker laid on the table to provoke discussion and dialogue. I think it could lead to a Fraternal Space Regime, as all technologies have political, social and other consequences, but that depends on the leaders who take up the argument. I hope members of Nuclear Space read the book and begin a debate and dialogue. I hope my book sparks new ideas and thoughts. On The Space Show interview in September 2009 with David Livingston you didn't seem too interested by the review of the U.S. Human Space Flight Plans Committee (aka, The Augustine Committee after its chairman Norm Augustine) released it's report on Human Space Flight (HSF). You characterize the current support as a waste of time and urged space policy fans to instead focus on your book, "The Nuclear Rocket" to get a glimpse of what a revitalized international space program would look like with nuclear power as the mainstay for investment of the 3 billion dollars for HSF in a NASA budget for advancement. Some see the HSF effort as unconvincing rationale in fact many house committee members appeared to conclude there's no technical reason to mission with Constellation and it was simply the reason to spend more money on HSF. Apart from the influence Americans obtain with working with the technical international community the single overriding issue for most people is the propagation of human beings in the solar system. Especially in light of the recent global collapse of the banking system and the worst economic downturn since the Great Depression. Plagued with soaring deficits of several trillions of dollars what can people possibly find as productive and prosperous in attempts at establishing a lunar human base? According to examples you point to in nuclear rocket engine development in your book-it's quite a lot. Bruce: What in your estimation is the most dire message you would send to government (NASA), industry and the public in general on how to revive technological prosperity and human advancement ? Or are we just too late and NASA and the space program needs to collapse and start over with new technological people and thinking? Dewar: I do believe the space program is in dire straits, as it has pushed chemical rocket propulsion as far as it can go. Even with the Ares vehicles we will be seeing just marginal improvements over the Saturn V. It's back to the past, particularly with the J2X, a marginally improved J2. The chemical rocket space program is stuck with solid rockets having specific impulses around 330 seconds and liquids, namely LOX/LH2, at 450. As I say in my book, all that has been done for the last fifty years is to gold plate the nail; the real need is for a bigger hammer. And that bigger hammer is Nuclear Propulsion. But it also needs to break the taboo against using nuclear rockets to reach LEO and if it does, the economics of reaching LEO becomes a sliding scale. It might start at $1000 per pound for a first generation solid core, but steadily drop as more advanced systems are introduced. So when a fourth, fifth, sixth generation systems are introduced, it might be $100 per pound or even less. Here I must point out even the humble solid core nuclear rocket, starting at 825 seconds of specific impulse, can improve drastically. To hammer that point home in my book, I base my analysis on the specifications I expect in a fourth generation solid core and that is 1000 seconds. Does it stop there? No. I have an appendix that sketches some of the things that can come in even later generation systems. Moreover, at one point early in Rover/NERVA's history, some were speculating the solid core could reach 1600 seconds of specific impulse. That seems like a pipe dream now, but I was talking to a knowledgeable expert several months ago on this very point and he guessed maybe 1700 or 1800 seconds. That seems preposterous now, but as you start research and development, you find things you never dreamed of, so maybe this guess might prove realistic. I hope, I need not point out to Nuclearspace.com that each increase in specific impulse (Isp) means a corresponding increase in thrusting power and speed and that changes the economics of moving payloads into and around space. But that's just one aspect of the "tricks" one can use to upgrade even the humble solid core. I think what my friend was thinking about when he said, 1700-1800 seconds was somehow getting the hydrogen molecule to disassociate into two atoms, and if you know the rocket equations state the velocity of the gas in the nozzle chamber is proportionate to the square root of its temperature over its molecular weight. If hydrogen atoms come out the nozzle, that means the molecular weight is one, not two. That's a tremendous improvement. Now, do I want the space program to collapse and begin over again? No, not at all. All my book seeks to do is look at the consequences of breaking the taboo against using nuclear rockets to reach LEO. So it's a book to provoke discussion and dialogue within the space community and public on a subject that has not been studied, with the exception of Bob Bussard's two ASPEN concepts, since 1960. Can you launch a nuclear rocket and return it to earth safely? I think the answer is definitely Yes, and it will be safer than a chemical rocket. Those are bold words, but I include an appendix that takes a look at the various steps in the launch sequence to see if there are any show-stoppers. I don't see any. But I would welcome a dialogue with Nuclearspace.com members here. Read the book, hear the arguments, agree, disagree, propose, amend or whatever, but get off chemical propulsion if you want to have a real space program. It's done it's job, but now is the time for a rocket system for the 21st century. As a precondition of eligibility in the Fraternal Space Regime. You advise congress to break its taboo on the use of the nuclear rocket and institute the Democratization of Space Act. You oppose it being open to all nations, as is the case with the UN. You require only democratic governments that adhere to the rule of law, have free elections, preserve human rights, live peaceably in the community of nations and keep in full compliance with international obligations need apply. Bruce: How would you manage peace and equal economic opportunity with some of the nations that have less than stellar human rights record or demonstrated military interventionist policy? You mention countries with dictators like Libya, Cuba and North Korea, Somalia as unstable. Authoritarian countries like China and Vietnam would be ineligible. Countries like Rwanda and Sudan would be ineligible countries with deplorable practices toward women like in southeastern Asia would be ineligible. What about countries that soft pedal military intervention in the internal affairs of other nations feel it necessary to spread a particular brand of democracy like the United States or Russia? Countries like North Korea, Iran, India, Israel and Pakistan who have not ratified NPT often refuse to sign or acknowledge the existence of their domestic nuclear weapons. When evidence clearly exhibits they posses nuclear weapons and the delivery systems it requires. How fair and even handed will membership to the Fraternal Space Regime be in these cases? Dewar: This question tracks part of the title to my book: Making Our Planet Green, Peaceful and Prosperous. Obviously, the question is about the Peace part. To talk about this I must go to the source, the origin of this idea, and that lies with Leo Szilard in 1932 who said (paraphrased), 'Nuclear rockets would bring peace to earth.' Many today may not know who Szilard was, but back then he was probably second to Albert Einstein in terms of his importance. If not second, at least in the top ten of the brightest, smartest people of the first half of the twentieth century. On the face of it, this claim seems ludicrous, yet Szilard had a habit of being quite prophetic and quite right. In 1934 he foretold the industrial uses of atomic energy, something quite routine today. In 1939 he wrote the letter that Einstein signed that led to the atomic bomb effort in WWII. In other words, he foresaw the bomb. So he has a pretty good track record. His comment appears to have motivated other very bright people such as Stan Ulam, the co-inventor of the H-bomb. It also may have influenced Freeman Dyson. These are very intelligent people and for them to say something like this means, to my way of thinking, that they have an insight that most do not. Yet for some reason none have developed their idea in any way to say how it could be done. That's what I've done in my book, to show how nuclear rockets might bring about world peace. It's "a" vision of how it might happen and here I stress the indefinite article "a." It is not "the" vision, and I hope it provokes debate and dialogue and gets the space community off its "mission-itis," the ever-prevalent belief a mission must exist before a nuclear rocket can be developed. This is simply a carry-over from the ultra expensive chemically propelled space program. So, what I argue for in my book is starting with a small engine first and use it to develop the infrastructures needed to effectively use it. And since I project the costs of reaching LEO would be $100 per pound by the time of a fourth generation system, I see that this in effect democratizes the space program, opening it up to the common man. So, I said, 'How can this happen?' and I came up with the concept of a one-time "free launch" whereby NASA would launch payloads free of charge to anyone who wanted to build it at his or her expense. I expect a fourth generation nuclear rocket could launch a payload to LEO of 17,000 pounds and so, each person might be given 500 pounds of payload. That's 34 private citizens who could have a payload launched, but it could be more or could be less, that's for debate to decide. As it is now, only government scientists or well-endowed companies can launch payloads into space. NASA did have a highly popular program called "Hitchhiker" in which 200 pound canisters would be taken aboard the space shuttle filled with experiments from students or private citizens. But that was cancelled. Imagine what the interest would be like for a "free launch" program by the private sector. I hold it would **really stimulate interest in space**. Now, when you build a small engine you are learning how to build really big ones. Let me get technical for a moment. In Rover/NERVA, the typical core size was 35 inches wide by 52 inches long, with a very large reactor, the Phoebus 2A, at 55x52 inches and a very small engine, the Pewee, at 20x52 inches. Each of these had different power levels, the super large one at 5000MW, the small one at 500MW and the others at 1000-1500MW. So you have many design choices as you scale up from a small engine, perhaps in 5 inch increments: 25, 30, 35, 40, 45, 50 and 55 inch core diameters. These many design choices mean you could launch increasingly larger payloads to LEO. Perhaps a decade or so after the program was restarted you might have super heavy lifters taking 500 tons or more to LEO per launch. That might seem absurd now, but bear in mind Rocketdyne did a study in 1968 that said, by taking a first generation NERVA I engine and using it as the third stage of the Saturn V you could double the lift capability to LEO, from 250,000 pounds for the all-chemical Saturn V to 500,000 pounds. So now, in principle, we could have a super heavy lifting capability. How could we use it effectively? Here it didn't take me long to figure out that this could mean the **birth of a competitive, private sector space station industry** doing all sorts of things in space, from manufacturing to tourism and hotels. Obviously, that is not something government should be involved in, as this implies making a profit and, I submit, a very healthy profit. So now I started to think how could I structure this to allow the average citizen to participate in and profit from such endeavors?

### It’s profitable for private sector

**DEWAR ‘10** (James, A., September, “A Technical and Economic Introduction to Nuclear Rockets”, Dr. James Dewar Worked exclusively on nuclear policy issues in the Atomic Energy Commission and its successor agencies, the Energy Research and Development Administration and the Department of Energy, PhD from Kansas State University. He held a Q clearance, with Sigma access, as well as many intelligence clearances, http://www.nuclearspace.com/A\_Technical\_Note\_on\_Nuclear\_Rockets-1.doc, MinR)

The above centered on cost per pound to LEO, but now we must consider profitability. How much money can be made? It’s fairly obvious that $100/pound to LEO promises to be a very profitable enterprise, even if I’ve excluded the other costs that must be figured into any venture such as plant and equipment, salaries, insurance, health and retirement programs and so forth. But there is another factor, another way to make money and it might be as profitable or even more profitable than building and operating fleets of nuclear rockets. And it is absolutely, positively different from chemical rocket engines, which offer no such possibility. None! Zero! Zilch! Nada! I speak of technologies that a private corporation such as NucRocCorp would license, sell, or spin-off for a profit. This was not possible in Rover/NERVA because government money was used so the technologies had to be public domain. So the taxpayer got nothing, but individuals or corporations in the know got quite a bit. Here are two examples. I’ve already mentioned graphites and carbon composites and to this we can add heat pipes. Both originated in Rover/NERVA and now are multi-bullion dollar industries. For more information here, read chapter 16 of To the End of the Solar System. In a renewed nuclear rocket program, there will be, I believe, many profitable spin-offs but not as free-bees, but for some type of remuneration to NucRocCorp and its stockholders. While many possibilities would exist, I can see already two. **Both appear to be quite profitable**. First, the program will be creating a broad and fundamental assault on high temperature materials that will, in turn, be very marketable and profitable in other industries. Higher temperature materials promise much higher efficiencies, among other things, so you are likely to see market pull here as these other industries see they must incorporate these materials in their products or face loss of market share.

## Solvency: Lunar/Space Colonization

### Colonization inevitable: It’s not a question of if, but who

**KEMP ‘6** (Curran R, freelance geologist working on a Masters in Economic Geology, December 19, “All Colonization Should Be Private”, http://mises.org/daily/2421, MinR)

 Easterbrook is right about the waste of funds for such an endeavor, but some of his logic misses the point. Any money spent by the government for the colonization of the moon, or space, is a misallocation of funds. Colonization of the moon needs to be done by private investors, and Locke's principle needs to be applied: the first to mix labor with material becomes the owner of such materials. NASA can have no such claim, and a government moon base will not lead to the industrial development of the moon, Mars, or anywhere else in the solar system. What leads to development of such places is an entrepreneur who sees such areas are not being served in the market, and invests and develops such places to bring them to the market. This needs to be the first principle when looking at new areas of human development, but I want to explain why I think that Easterbrook is wrong to assume that Antarctica will not be settled. Throughout the course of human migration in the last 10,000 years, new areas were explored, exploited, and developed. The reasons for this can be numerous: population pressure, following resources (food, fuel, shelter, and material), or just plain curiosity. The easiest areas and resources are used first, and over time, more complex methods and areas are exploited. In the 21st century, man is now to the point where the Antarctic, the oceans, and space are the new frontiers for humans to explore, exploit, and develop. Humans have been using the oceans since the beginning of exploration. We are now at the point of developing settlements in the ocean, outside of national boundaries. This will take courage, cunning, and the spirit of colonization. Current laws in the UN charter make it difficult for such development to take place, since the charter states that the oceans should be used for the betterment of all of mankind, whereas the actual expenditures will be born by individuals. Similar to the UN Law of the Sea is the Antarctic Treaty, which prohibits permanent colonization of the Antarctic continent. The 1991 mining treaty prohibits exploration and mining in Antarctica for the next 50 years. The Antarctic treaty is a convention that has kept development out. Antarctic resources have been speculated for over a hundred years, but so far, most of the resources found have proven to be subeconomic. The economic model is based upon current prices, distances to market, and current technology. If the technology changes, then it becomes economic. Of the known deposits, copper and molybdenum exist in the Antarctic peninsula, large titanium and apatite mineralization in Dufek Massif, coal and iron ore in the Prince Charles mountains, and uranium in the Southern Victoria range. This does not include the possible oil and gas deposits in the Weddell and Rose Seas, and all the fresh water tied up in glacial ice. Technology now makes it possible to live in inhospitable places. Humans have been living and working in the Antarctic for the past 100 years, but most have just been visitors. It is now possible for people to go to Antarctica and colonize a new frontier. People have always used the resources that have been on hand, and it will be no different than in the Antarctic. Up to now, resources have been mostly and almost wholly brought from outside of the continent. In the early days of exploration in Antarctica, explorers like Amundsen and Scott used the local resources to feed themselves. They hunted seals and penguins and used the ice for temporary shelter and water. Modern scientist (explorers) live in environments separated from the Antarctic, and are more like temporary visitors. They treat the continent as a preserve that can't be disturbed. Antarctica is not a park; the continent is as big as the United States and Mexico combined. Tectonic history indicates potential vast reserves of mineral resources that can be used to physically advance mankind. "There's minerals there, there's gold, there's iron ore, there's coal." These were the May 1st comments by the Australian National Party members Barnaby Joyce on his recent trip to the Antarctic. This Australian politician is right in assuming that if his country does not develop these resources, then other countries will, and they will ignore Australia's Territorial claim as being nothing more than a piece of paper. Claims mean nothing unless actual physical occupation occurs. It is time for Antarctica to be brought into the 21st century, and properly developed for the place that it is. Modern underground mining techniques can turn vast subterranean frozen areas of the continent into livable space for the use of housing, manufacturing, retail, and agriculture. These developments can take place alongside the mining of valuable resources. In the beginning, most of the material mined will be shipped to the world market. This indicates that only the highest valued materials will be mined first. But, over time, as more underground space is made, more sophisticated local markets will develop, and subeconomic resources will become economic and used within the local market. All of this can take place if certain rules are observed: laissez faire and laissez passer; let the market develop organically. Who knows what resources lie underneath the Antarctic landscape? But the other factor that might cause development is one that Easterbrook did not bring up, and that is the need for freedom. Robert Zubrin, of the Mars society, was once asked why people will go to Mars. Freedom, he answered, is the one reason that humans will go to Mars. It is also the reason that Antarctica will be colonized. The cost of freedom can only be measured internally by the individual, just like the value theory of price in the market. It cannot be planned by any central governing board. Both the Law of the Sea and the Antarctic Treaty need to be ignored as relics of the socialist past. Antarctica, the oceans, and **space will all eventually be settled. It is just a matter of when, by whom, and for what reasons**.

## Solvency: Waste Disposal

### Their evidence is biased: NASA conducted studies to support the Shuttle. Free market key to solve

**URBAN ‘8** (Michael, Founder and CEO of the SCC consulting practice, providing Management Process Reengineering (MPR) workshops for experienced executives around the world, June 2 7, “Nuclear Waste Disposal Analysis”, http://michaelurban3.com/nuclear-waste-disposal/, MinR)

After extensive investigation, NEZO has determined that most studies of the extraterrestrial disposal mode were flawed for two specific reasons. The results of these flawed studies have misled the nuclear power industry into false conclusions regarding their disposal options. In addition, government regulatory strategies have been based upon the same erroneous conclusions regarding the available options. To help clear up these misunderstandings, the following issues were addressed: Why were the prior studies flawed? What facts are accurate? What are the relative risks? Can the risks be mitigated to a practical level? What is the most effective disposal option overall? The Issues In our investigation, we found that the studies most commonly cited by members of the nuclear power industry are seriously flawed for one of two reasons: The analysts who conducted the studies were not knowledgeable experts regarding the aerospace industry, the related technologies, costs, or safety factors. In the cases where the analysts were knowledgeable experts, they had individual or political agendas that seriously biased their evaluation. In the case of the NASA studies that took place after deployment of the Space Shuttle, the analysts **had one main objective – to justify the use of the Space Shuttle for any and all launch activities**. The studies they conducted only evaluated the use of the Shuttle as the exclusive means for launching nuclear waste. The only thing these studies proved is that the Space Shuttle is a poor choice for an extraterrestrial nuclear waste disposal vehicle. It’s well known within the commercial space industry that the Shuttle is one of the most complex and expensive launch vehicle technologies available. Other more economical means of space launch were not included in the most recent NASA studies. This caused extraterrestrial disposal to appear as if it were a high risk option due to the poor economic factors. This resulted in an inaccurate evaluation based on incomplete and biased data. Before the Space Shuttle existed, NASA conducted a study of nuclear waste disposal options. Their analysis was part of a more general evaluation entitled the Commercial Space Transportation Study (CSTS). That particular study was not biased by the political motivation to use the Space Shuttle, because the Shuttle didn’t exist yet. The conclusion of the NASA CSTS analysis was that the costs and technology to launch nuclear waste into space WAS FEASIBLE and could be pursued as a commercial venture. In a European study conducted by Nirex, they included the Arianespace launch system in their evaluation. The cost structure turned out to be very similar to the Space Shuttle, and therefore didn’t include an example of cost effective operations. In addition, since it wasn’t a “man-rated” rocket, the prediction for potential flight accidents was relatively high and created the erroneous appearance of unacceptable risk. Many stakeholders both inside and outside of the nuclear power industry consider extraterrestrial waste disposal to be the most desirable option of all, except for two well known concerns: The risk of releasing radioactive material into the environment in the event of a launch failure. Operational costs might be too high to make it economically viable. Our analysis has determined that both of these issues could be easily remedied through a collaboration between the nuclear power industry and the private space industry. If successful, such a venture would result in development of the most popular and effective option for waste disposal. Prior studies have all utilized historic flight statistics for conventional rockets to predict the potential risks for the release of radioactive material. In those studies, the focus on existing rocket designs introduced a major flaw into their analysis. Rockets have historically been designed primarily to achieve the highest performance, often at the cost of safety. If they were designed with payload safety as the top priority, it would result in a completely different vehicle design. The use of such a vehicle would mitigate the first and most important concern the general public has regarding rocket launches carrying nuclear waste. Those same studies utilized existing cost data on conventional rockets to evaluate the potential economic models. They didn’t include an evaluation of newer designs developed with “cost” as one of their top priorities. The emerging private space industry has recently shown it can achieve significant cost reductions compared to historic levels that exist in government launch operations. Some projections indicate they can potentially reduce costs by a factor of 10 to 100 times below historical models. The **economic risk factors have therefore already been addressed** to some extent by the private space industry through its efforts to satisfy the “space tourism” market.. There is great potential for the private industry to develop even more cost effective operations as the experience base grows. The lessons learned in the **private space sector could easily be carried over and applied to the extraterrestrial disposal of nuclear waste**. The current $.001/kw-hr paid by US nuclear plant operators for disposal purposes may be sufficient to provide the revenue necessary to match the costs of a privately operated extraterrestrial disposal operation. The US DOE has already stated the real costs may eventually be more like $.003/kw-hr in the end. At that level of funding, an extraterrestrial option for nuclear waste disposal could easily be operated at a profit. Another factor causing the biased conclusions in prior studies is that many of **them have been conducted by governmental** (or quasi-governmental) **organizations**. Since sovereign States have absolute control over their territorial “land”, so politicians tend to view “repository storage” as their preferred option. That option provides full political control over the nuclear fuel cycle so long as it’s maintained within their sovereign territory. This political motivation has often been a driving force behind previous industry studies, whether intentional or not. Therefore, politicians seem to consistently prefer the various “burial” options. One example that clearly demonstrates this issue is the Yucca Mountain repository project in the US. The US government has passed laws making it illegal to consider other disposal options, and so all government funding is directed to development of the burial mode. Even with those laws in place, the project has been unsuccessful in achieving its goals due to public and political opposition. This is most likely because the general public seems to have an innate aversion to most burial modes (not in my backyard). The Solution The extra-terrestrial disposal of nuclear waste has constantly proven to be the preferred option by the public, government, and industry – if the launch failure and cost issues could be overcome. Based on our research, the risk of launch accidents could be mitigated by developing a “purpose built” rocket, designed exclusively to launch nuclear waste. The primary characteristic of such a rocket would be a 100% launch abort capability. This means the payload could be recovered at any time during the ascent phase of the flight profile. The rocket itself wouldn’t necessarily survive the abort, but the radioactive payload would be safely returned to a predetermined recovery point. The issue of cost can also be resolved by developing a “purpose built” rocket. Most existing rocket designs are optimized for performance, not cost. The private aerospace industry is currently making significant advances in this area. The knowledge base for this new approach to more cost effective rocket design is rapidly evolving. The private space industry is guiding the way to safe, cost effective, commercial space launch operations. So far, the nuclear power industry has been unable to fully resolve the waste disposal issue. Any proposed solution always seems to be objectionable to at least one group of stakeholders. Previous efforts, driven primarily by political agendas, have led to a single solution mentality around the world. Global nuclear power demand is projected to grow significantly over the coming years. This may be an excellent time for the nuclear power industry to develop a new alternative for waste disposal. A joint venture between the private space industry and the private nuclear power industry could result in development of a **revolutionary new disposal option**. It would provide a practical alternative to the politically sensitive burial modes, and NEZO has determined that it may be the best method for safe, secure, and permanent disposal of nuclear waste.

### Withdrawing government involvement in waste disposal allows the free market to solve

**NASA ‘97** (March 11, “Commercial Space Transportation Study”, http://www.hq.nasa.gov/webaccess/CommSpaceTrans/SpaceCommTransSec35/CommSpacTransSec35.htm, MinR)

In fact, the issue of public acceptance is arguably the most important driver in the development of a commercial space disposal venture. Any economic benefit of space disposal is moot **if regulation and protest prevent operations**. The effort that will be required in convincing people of the safety of this concept cannot be overstated. 3.5.5.3.3 Market Assessment There is a tremendous stockpile of high-level nuclear waste in this country left over from 50 years of bomb‑building and 35 years of nuclear power generation. With the ending of the Cold War there is additional plutonium to dispose of in the safest way possible. In addition, the rest of the world, especially the former Soviet Union, has an abundance of high-level waste. Worldwide high-level waste will approach 100,000 metric tons by the year 2000 based on nuclear power generation data. Some of that waste is currently being processed (glassified) for above-ground storage (e.g., in France), but most will be sitting in temporary storage tanks in the year 2000. Buried sites like Yucca Mountain offer long-term storage at moderate cost, but it is very difficult to prove no leakage over geological times because our database is not sufficient. This point is used by environmentalists to raise local opposition to proposed permanent depositories. As a result, the agreement defining the Yucca Mountain site states that after 50 years of operation the overall performance will be reviewed and a majority vote of Congress can close the facility and have all the waste removed. The agreement also states the second disposal site will be on the U.S. East Coast. That will be a very difficult sell. An alternative to space disposal is transmutation of the long half-life radioactives to short-lived radioactives that decay away in 20 to 30 years While physically possible, this may be technically and economically unfeasible. This approach is discussed in depth in Section 3.5.5.6. Hence, our assessment is that the market for permanent disposal of high-level nuclear waste is huge, easily enough to justify major investments in infrastructure, and that space disposal provides a very valid alternative to ground disposal. 3.5.5.3.4 Market Infrastructure The principal infrastructure required in addition to the space transportation system is a ground-processing facility to load the shipping canisters. We are planning only simple mechanical and chemical separation, but the Federal moratorium on processing has prevented any processing of spent fuel rods for the last 20 years. That moratorium is supposed to have been withdrawn, but if not, it will have to be rescinded before launch operations can begin. As will be discussed later, nuclear waste is best "aged" for about 10 years prior to processing to reduce the thermal loads from radioactive decay. Ground depositories such as Yucca Mountain would serve as excellent sites to temporarily store spent fuel prior to processing and launch. 3.5.5.4 Prospective Users The U.S. customers for this service are the U.S. Government (in particular the Department of Energy) and the utility companies. It is possible that disposal of hazardous wastes could someday be an international concern and be controlled by the United Nations, but that is pure speculation at this time. CSTS members held discussions with DOE, with informal exchanges conducted with members of Electrical Power Research Institute (EPRI), a number of West Coast utilities, and Greenpeace. 3.5.5.5 CSTS Needs and Attributes Nuclear waste canisters do not care when or how they get to the LEO transfer station. They can fly on regularly scheduled launches that are undersubscribed or they can fly on dedicated launches that fill in holes in the launch schedule. They are small and dense, so they are easy to integrate. However, they are going to be radioactive and thermally active. How radioactive and how much heat is radiated was determined by quantifying various sample waste products. This data show the thermal radiation of concentrated nuclear waste 2 years after removal from the reactor to be about 180 kw/ton. After 10 years heat production has dropped by roughly an order of magnitude, and it decays very slowly after that. Hence, we recommend the spent fuel rods be aged for 10 years at a temporary repository prior to processing and packaging in the GPHS canisters. The canisters are designed to withstand the thermal flux from 238PuO2, which is 0.4 kwth/gm, or twice the worst flux expected from the concentrated spent fuel waste. On the other hand, the spent fuel waste radiates a large fraction of its energy as gamma particles unlike 238PuO2, which is an alpha emitter. This further reduces the thermal load on the canisters but causes problems with ground handling and sharing a payload bay with live animals. The extent of the problem with gamma radiation will depend on the age and specific mix of nuclear waste and has not been fully quantified at this time. 3.5.5.5.1 Transportation System Characteristics Two scenarios for placing the waste canisters of the lunar surface were examined: a reusable spacecraft that travels round-trip from LEO to the surface of the Moon, and a partially reusable spacecraft that positions a dumb solid rocket lander on a precise lunar intercept trajectory and then returns to LEO. The first LEO-to-lunar transportation scenario involves a space-based reusable spacecraft. In this scenario, nuclear waste is brought to LEO as secondary- or low-priority payload on a LEO launch vehicle. The waste is accumulated at a LEO node and transferred to the lunar transfer vehicle (LTV). The LTV takes its cargo to the Moon, expending its translunar injection tanks and lunar descent tanks. The LTV returns to the LEO node where it picks up its cargo and full tanks for its next mission. A mission timeline and Delta-Vs are given in figure 3.5.5.5-1. The mission time from LEO to LEO is 187 hours, or almost 8 days. Adding 1 day at LEO for refueling and loading gives a total mission time of 9 days. [TABLE HERE] The second LEO-to-lunar transportation scenario involves a space-based reusable propulsion module (Fig. 3.5.5.5-2). In this scenario, nuclear waste is brought to LEO attached to small solid-rocket landers. Full tanksets are also launched to orbit, and the assembled vehicle delivers the landers to a lunar impact trajectory and expends its translunar injection tankset . The propulsion module returns to the LEO node where it picks up its cargo and full tanks for its next mission. The mission time from LEO to LEO is 170 hours or about 7 days. Adding 1 day at LEO for refueling and loading gives a total mission time of 8 days. [FIGURE HERE] 3.5.5.5.2 Transportation System Capabilities It is obvious that the transportation system, perceived as the weak link in the disposal concept, will need to pay special attention to the safe delivery of its cargo. As scheduling the launches with certainty is not as important a capability as for other CSTS markets, the operator has some flexibility in launching when it is most prudent, Ideally, the launch system must be at least as safe and reliable as terrestrial delivery systems, such as rail transport. This level of reliability is arguably still for in the future, even if a commercial system embodied redundancy, health monitoring, engine-out, and so forth, in its design. It is more likely that the payload can be encapsulated in a way that ensures that zero waste is released, even in worst case launch vehicle failure. There is a precedent for this in the launching of thermoisotope generators on interplanetary probes. In fact, for this baseline analysis, our concept for shielding is to use the already-space-qualified general purpose heat source (GPHS) containers. Each GPHS container holds 32.8 lbm of 238Pu fuel and 27.1 lbm of shielding, giving a 0.83 shield-to-fuel ratio. The container has a 3D graphite aeroshell designed to withstand reentry and an impact of 165 ft/s. In order to size the transport system to the Moon, the following assumptions are made: [TABLE HERE] With a payload to the moon of 91,000,000 kg, either vehicle must make several thousand trips (Fig. 3.5.5.5-3). For this reason, preprocessing of the waste at the launch site is very attractive. If three vehicles are used on a 9-day cycle, 100 missions can be accomplished in 300 days, leaving 65 days a year for maintenance and repair. Given a lifetime of 10 years for the spacecraft, only 12 transfer vehicles need to be built for the large round-trip lander, compared to 50 for the small one-way lander. [TABLE HERE] With preprocessing at the launch site, the number of missions and costs fall roughly by a factor of 30. This allows waste disposal over a reasonable time period using LEO delivery masses of interests to other users (Fig. 3.5.5.5-4). [TABLE HERE] 3.5.5.5.3 Ground Handling Disposing of hazardous waste in space isolates it from our biosphere, removing the threat to future generations. However, to be economically practical we need to eliminate most of the nonhazardous material from the waste and only pay to launch the truly hazardous material. To accomplish, this we propose to move the spent fuel rods to the launch site and then (1) cut open the spent fuel rods, separate the fuel from the cladding, compress the cladding and bury it in low-level waste repositories, (2) chemically separate the uranium oxides from the spent fuel and recycle them as reactor fuel, and (3) put the remaining material into GPHS canisters designed for space launch and launch them promptly to a transfer station in LEO. By not separating isotopes, we believe we can keep the ground processing cheap (less than $100/lb), relatively free from public/political controversy, and environmentally safe. Figure 3.5.5.5-5 presents preliminary cost estimates for ground processing from a DOE Environmental Impact Statement on Management of Commercially Generated Radioactive Waste, October 1980. [TABLE HERE] To quantify the type and mass of the remaining material after the two-step processing discussed above, we will provide an example based on a series of ORIGEN computer runs provided by Sandia National Laboratory (ref. 4). This example includes the ORIGEN2.1 output for Sequoyah Unit 2, with the model based on a reactor power of 3411 MWth for 2 years. The fuel loading assumed was 88,563 kg of Uranium @ 2.535 enrichment. The basis point was 1.5 years after removal. After 1.5 years in cooling pool, the rods have 83.09 metric tons of actinides, 5.4 tons of fission products, and 30.3 tons of activation products. Removal of the cladding and unreacted uranium oxide reduces this to 2.74 tons of material to be loaded into GPHS containers and launched. With a typical GPHS ratio of container mass to fuel of 0.83, we estimate a total mass for this example of 5.01 metric tons. If we assume the Sequoyah Unit 2 produced 1100 MWe of power at a 65% online factor, this would equate to 12.53X109 kW/h of electricity over the 2 years. At the $0.001-kW/h millage, if we were to operate with just the money set aside, we must dispose of 5.01 tons of loaded containers for $12.53 million, or $2500/kg delivered to the Moon. Note that the current DOE disposal plan will require the equivalent of three times this cost. This example is thought to be representative of spent nuclear reactor fuel, but many more cases are necessary to quantify possible separation scenarios and disposal of the many types of nuclear waste. 3.5.5.5.4 User/Space Transportation Interfaces a. Autonomous access to pad, mechanical only interface. b. Cryogenic propellant transfer to payload bay. c. Thermal heat rejection capability of up to 10 kW. 3.5.5.5.5 Improvements Over Current a. Reliability such that vehicle loss rate ≤1/1000. b. Launch costs less than $600/lb. 3.5.5.6 Business Opportunities The majority of nuclear waste is in the form of spent fuel rods, and they current belong to the electric utility companies. The government, in the form of the DOE, has committed to accept legal liability and responsiblity for this waste in 1998 and begin storing it in a semipermanent depository in 2010. That effort is not on schedule and becomes less likely all the time. Hence, **there is a valid business opportunity to offer an alternative permanent solution that is cost competitive and more salable to Congress and the environmental movement**. According to the cost assessments shown below space disposal has a lower life cycle cost than ground disposal and **could be available** in the same timeframe with moderate investments in new hardware (other than a new launch system). Hence, there is a legitimate opportunity **to negotiate an** **anchor tenant** **agreement** with either the electric utility companies or the DOE to permanently dispose of the U.S. and overseas nuclear waste. Right now space disposal is the moderate technical risk option but there is a higher risk major competitor, as discussed below. The major competitor for removing nuclear waste from the biosphere (other than ground storage, which does not remove the waste, but only stores it) is nuclear transmutation. The Grumman Corporation and Los Alamos National Energy Lab are looking at the feasibility of accelerated transmutation of waste using a high-energy particle beam system. Conceptually, such a system would be capable of transforming the atomic nuclei of the waste into other radioactive elements with a shorter half-life. The device to be used in the accelerator transmutation of waste (ATW) is a product of past Strategic Defense Initiative Organization (SDIO) research into directed-energy weapons and would use a derivative of the neutral particle-beam-based Continuous Waste Deuterium Demonstration (CWDD) program. The concept involves scaling up a charged particle accelerator beam until it produces a very dense and energetic beam of protons. These protons are then directed onto a lead or tungsten target. The protons interact with the target and produce highly energetic neutrons. Beyond the target a heavy-water or graphite "blanket" slows down the neutrons into an energy range such that they can interact with the nuclei of radioactive materials loaded into a target zone, and changes them into less-radioactive or inert materials. Meanwhile a continuous slipstream processor collects and separates the processed materials from the unprocessed materials in a continuous flow separation system. Using this system, the ATW process is projected to result in very low-level, short-lived waste products, and short-lived species byproducts. The goal of this program is to get everything of significant activity to a 30-year half-life. The status of the program is currently at conceptual stage. The ATW program currently is looking for at $30 to 50 million in government funding from the DOE for a conceptual study of an accelerator to produce a neutron beam that would be used to irradiate samples of nuclear waste. After this conceptual study, then a demonstration and test program is expected before this can be committed to for reprocessing of nuclear fuel or waste. There is an industry working group of Grumman, Westinghouse Electric, TRW Space & Defense, Lockheed Missiles & Space, Rockwell, Thomson, General Atomics, Litton Electron Devices, BDM Engineering Services, and Babcock & Wilcox, which is working to understand this technology. It was hoped that this project would receive TRP (Technology Reinvestment Program) funding for defense conversion work, but at this time no funding has been received. This information was provided by Grumman senior program engineer Timothy Myers and Anthony Favale, Grumman's deputy director of energy systems. CSTS Comment - There are technical, political, and financial issues to be resolved with this system. The technical issues involved in this concept involve the beam system and the slipstream processor. The charged particle beam will have to achieve orders of magnitude of greater beam flux than current systems and orders of magnitude greater beam duration of operating time. (The current beam is a pulsed beam, and for effective transmutation the beam must be continuous.) The slipstream processor itself will be a technical challenge. The processor must work continuously separating out the transmuted materials from the nontransmuted products. This will involve continuous flow chemistry and separation, working with highly radioactive and rather nasty chemical substances, while the beam is running. And the separation system may have to separate between substances with different isotopes, but almost identical chemistry. The political barrier is that there is currently an executive order prohibiting reprocessing of nuclear waste. This executive order was put into force primarily to recognize issues with waste reprocessing and the separation of controlled substances such as plutonium from existing nuclear waste stocks, including spent nuclear fuel. To demonstrate the slipstream processor needed to demonstrate the continuous flow reprocessing, this executive order will have to be changed. (It should be noted that the space disposal of nuclear waste will also have this problem, although the levels and complexity of the reprocessing are much simpler in the space disposal option.) The final barrier for this system is cost. The final cost of developing a transmutation system for nuclear waste is unknown, but estimates for the cost of adding such a system to handle the disposal of commercial nuclear electric power wastes project the addition of costs to the generation costs of nuclear power, increasing the average price of electricity from 3% to 10% This represents a recurring cost from $5 billion per year to $17.5 billion per year. This compares to a cost of $1.2 billion per year for space disposal at $600/lb. The time scale for this project potentially places it in the same time period as a new launch system. The current expectation is that an ATW system would require a conceptual study, then a demonstration system (including the nuclear chemistry demonstration, the continuous flow/separation system, and the beam power and duration scaleup), and then commitment to an operational system. From the market contract, the time to proceed to the first unit of an operational system ranges from 8 to 15 years, depending upon funding and the results of each stage of the program. The time scale to the operation of a small-scale fully operational demonstration system may be as little as 8 years, with the longer time period assuming 2 years for the conceptual study, 8 years in development of the demonstration system, and another 5 years to put the first operational unit into operation. 3.5.5.6.1 Cost Sensitivities First-order cost estimates for the lunar transfer hardware were made using cost estimating relationships (CER) provided by General Dynamics (Fig. 3.5.5.6-1). The complexity factor is taken to be less for the expendable spacecraft than the reusable spacecraft. The costs of the expendable tanks are estimated separately for the reusable spacecraft because they will need to be replaced each flight. For units after the first, the cost is estimated using a learning curve. The cost is estimated for both cases using the dry mass of the vehicle. [TABLE HERE] This cost estimate does not include the ground processing facility that would need to be developed, nor the LEO node where the space-based propulsion/avionics module is stored. In this estimate, we will assume $2 billion for developing the necessary ground and LEO facilities. The expendable lander option can be accomplished with payload sizes of interest to many users, and has a large DDT&E savings and lower life cycle costs relative to the reusable lander (Figs. 3.5.5.6-2 and -3). However, it does require more years to complete disposal. If no ground processing is done then the entire 51,000 metric tons of waste must be loaded into GPHS containers and the total cost estimates including launch to LEO are $210 billion for the round trip to the surface system and $149 billion for the reusable TLI stage with expendable lander. This assumes a launch cost of $100/lb to LEO, which is the lower limit used in the CSTS discussions. Obviously, hauling the entire undifferentiated nuclear waste package to the Moon is not economically feasible. If the nuclear waste is treated with the simple mechanical and chemical separation described above, and only 3% of the remaining material containing the most hazardous portion of the fuel rods is shipped to space, then the total cost of disposal falls to $35.8 billion for the round-trip system and $27.8 billion for the expendable lander system. This is at a launch cost of $500/lb ($1100/kg), so if the fuel can be partially processed at the launch site, space disposal presents an economically attractive alternative.

## Solvency: Debris

### Free market key: opportunities

**LAUNCHSPACE ‘9** (May 18, “An Entrepreneur's Dream - Space Debris”, http://www.spacemart.com/reports/An\_Entrepreneur\_Dream\_Space\_Debris\_999.html, MinR)

Entrepreneurs can smell an opportunity to make money. Some have a sixth sense and others have to work at it. But, all have something in common; they want to turn an idea into a profit. Many potential opportunities are connected to a negative event. Such events often create an imperative to correct a situation. Today, we are on the threshold of an event that may prove to be devastating to the future of the world's access and use of space. That event is the growing cancer of space debris. Every operational satellite is already at risk of a catastrophic collision with debris, and that risk is growing. The growth of debris poses an increasing threat to navigation, communications, defense and scientific spacecraft that must be stopped and reversed. Time is running out! Experts estimate that a chain reaction of debris collisions with each other and with operating satellites will lead to a thick spherical shell of debris engulfing near-Earth space and preventing satellites from operating in low and high orbits. No one knows when this will happen, but estimates range from a decade to 20 years. It could happen sooner; we just don't know. Nevertheless, we do know that, left alone, the debris menace will overwhelm our ability to deal with it. In fact, in some ways, it has already overwhelmed our capabilities. This is bad news for the world space community. But, it could be good news for some entrepreneurs because the mitigation and remediation of space debris is a growth industry that is in its infancy. Now may be the time for those swashbuckling, IPO wheeling, wide-eyed raisers-of-money to come out of the dot-bomb shadows and start to create new companies that sell debris cleanup services to the international space community. There is little doubt that space must be cleaned up and the cost will be astronomical. This may be that moment in history when the first billionaire is created by developing a plan to save space for generations to come. How can anyone make money eliminating space debris? There are several possible innovative ideas out there. For example, borrowing an idea from the Obama Administration, all spacefaring nations might collect a "debris footprint" tax on every new satellite. Each satellite owner might be required to pay an amount equal to a large fraction of the original cost of the satellite, plus launch costs. Typically, in today's world, this may amount to tens of millions of dollars, because the cost of removing the satellite and its debris will surely cost at least several mission dollars. Imagine collecting an average tax of $25 million per satellite. There are typically 125 satellites launched each year. Thus, over $3 billion per annum would be collected, or something over $30 billion per decade. Presumably, these taxes would be used to pay for clean up services. Surely there is a cleaver entrepreneur out there who can figure a way to leverage technology, excess space assets and financial management into a lean and mean debris collection machine. Of course, the governments of the world could simply decide to pay the existing aerospace contractor community to clean up space. But experience tells us that the right entrepreneur can do it cheaper, better and faster. So, where are you, Mr. Entrepreneur?

### Companies are already interested

**RETROSPACE ‘10** (July, “Executive Summary”, http://www.spacetech.tudelft.nl/fileadmin/Faculteit/LR/Opleidingen/SpaceTech/Central\_Case\_Project/doc/ST12-DID4-V1-003\_-\_\_-\_executive\_summary.pdf, MinR)

As activity in space increases, so does the debris. The potential market is considerable. RetroSpace estimates the market for debris removal market is worth more than $200 million per year. The market for large objects is not only significant, but also stable. Based on conservative estimates for future launches into LEO, and the optimistic assumption that 95% of these will be successful in implementing some form of the suggested debris mitigation recommendations, **there is still a sustainable market** for RetroSpace services well into the future. The figure above illustrates that RetroSpace debris removal will stabilize the current situation, maintain that stabilization in the face of increasing activity, and then act to improve the situation into the future. The RetroSpace system offers the following products and services: • Debris Removal of uncontrolled and intact debris: The primary revenue stream for RetroSpace is the debris removal service. RetroSpace will remove large objects from the most congested orbits on behalf of the SDRF. This will begin in LEO, but it is envisioned that the RetroSat platform could be used in the future for GEO applications to serve commercial clients. • Direct sales of the RetroSat platform and it’s unique capabilities: RetroSpace is cognizant of the fact that not all actors in space will want their assets inspected closely and manipulated by a third party. For that debris which is not addressable by RetroSpace, the company intends to sell and license the full RetroSat platform to friendly entities. • “Space Tug” services to functional satellites: As a logical extension of removal, RetroSpace can also offer “Space Tug” services. RetroSat is able to mate with a client spacecraft and provide the thrust necessary for altitude adjustments or inclination changes. One possible application is mission recovery of satellites that are stranded in the wrong orbit through a launcher error. • Damage Inspection services to orbiting satellites: RetroSat is endowed with an advanced vision system for surveying debris during proximity operations. In the same way that it surveys debris to determine spin rates and potential grapple points, RetroSat is able to inspect client satellites remotely to assist in failure investigations. In the cluttered LEO orbits, the public sector has an intense interest in debris removal, and securing future access to space. Many of the satellites in LEO are owned by governments and public organizations. Extensive surveys and customer interviews conducted by RetroSpace have made it clear that commercial entities are not willing to pay for debris removal themselves. Thus, **the public sector is the targeted customer at LEO**. Additionally, space-faring nations have an obligation to resolve the LEO debris problem to clean up space for greater public good. A relative distribution of “debris owners” can be seen in the following table: Future business expansion will cover extended services beyond space debris removal. In contrast to LEO, commercial operators are interested in debris removal at GEO as that is where the high revenue commercial satellites reside. Nonoperational satellites blocking valuable GEO slots are excellent candidates for the RetroSpace “space tug” service which can tug these dead satellites to a GEO graveyard orbit.

## A2: No Profit Motive

### Pharma and biotech disproves

**MACAULEY ‘00** (Molly K., Senior Fellow Resources for the Future, July 18, “Prepared Statement delivered July 18, 2000 to the U.S. House of Representatives, Subcommittee on Space and Aeronautics, Committee on Science”, www.rff.org/RFF/Documents/RFF-CTst-00-macauley-July18.pdf, MinR)

The first point I'd like to make is that although commercial development of many space technologies requires very large investments, the projects are well within the capacity of the private capital market. Some highlights from a recent article in the business section of The Washington Post (11 June 2000) illustrate how these private markets work. The article refers to the biotechnology industry, but it could refer just as well to space businesses: “It carries unique risks.” “There’s a sense that this industry really matters…. It’s developing products that can fundamentally impact our well-being.” “The majority of these companies have small capitalizations.” “Investors in this industry require not only time for research and knowledge, but also extraordinary patience – 10 to 15 years’ worth of patience – and a willingness to buy a bunch of companies that offset the ones that fail.” “The companies that have produced great earnings started their research 10 or 15 or 20 years ago.” “It can take a decade just to bring a product from concept to testing. Many don’t make it that far through the regulatory process. During this period, the company is not generating cash. It’s consuming cash, and therefore its financial health is generally not improving. It’s either staying the same or getting worse.”1 These comments characterize the challenges in commercializing new technology: ♦Long lead times for project development ♦Long payback periods ♦Large uncertainty or risk However, despite these highly uncertain and distant returns, capital flows into pharmaceutical and biotechnology firms. It allows them to invest several billions annually in R&D on new drugs and other products and services. A point that I will return to is also noted in these comments as the rationale for undertaking such investment—“the sense that this industry really matters... It’s developing products that can fundamentally impact our well-being.” These challenges—long lead times, distant payback, and uncertainty and risk—characterize not only biotechnology, but also a host of other business, including space commercialization. Much is also in the news about the capitalization of another frontier industry, that of the “dot.coms.” Jeff Taylor, the CEO of monster.com, recently shared the following “New Math” at a breakfast meeting of technology experts. Table 1 below illustrates the capital that is flowing into this sector. The column headed “Market Cap” shows money going into the sector; the column headed “1999 Earnings” shows revenues and losses. \*\*\*[table here]\*\*\* The point of these examples is that the private sector is **clearly demonstrating its ability and willingness** to finance a broad range of technology development, and, importantly, the negative returns in the far right column illustrate that these opportunities, like space commercialization activities, are not at all “sure bets.” Many dot.coms, as well as biotechnology companies, although well capitalized, are earning negative revenues. By the way, many are also forecasting continued poor earnings for years to come. In other words, like space businesses, they have long payback periods, long lead times for project development, and high uncertainty or risk. Yet the investment community is willing to finance them. Some observers point out that many new businesses do not involve very large, up-front construction costs as might be required for space business. Yet the capital market also finances projects with large fixed costs, such as the construction of baseload electric generating units, chemical processing plants, oil refineries, and liquefied natural gas supertankers. And in the case of space, investors have funded the capital costs for manufacture, launch, and operation of communications satellites, and development costs for receivers, hardware, and software for using the Global Positioning Satellite System (GPS). Taken together, this evidence strongly rejects the failure of capital markets as a rationale for government intervention in the commercialization of space. Although commercial development of many space technologies may require multi-million dollar investments, the projects are well within the capacity of the private capital market.

## A2: Tax Exemption Hurt Econ

### Turn: new data proves it helps

**WINGO ‘7** (Dennis, CEO of the Huntsville, Alabama-based Skycorp Inc, Spring, “Zero G, Zero Tax”, http://www.nss.org/adastra/volume19/wingo.html, MinR)

 First introduced in 2000. Provided for 20-year tax holiday for new space products and services. To attempt to maintain revenue neutrality, existing profitable industries were excluded; thus the definition of eligible products and services excluded "any telecommunications service, any service provided by a weather or other Earth observation satellite and any service of transporting property to or from outer space." Reintroduced in 2001. Exclusions changed to "any telecommunications service provided from Earth orbit, any service provided by a weather or other Earth observation satellite, and any other service provided on or before the date of the enactment of this section of transporting property to or from outer space." The 2005 version incorporates some tax-credit concepts from the former Calvert-Ortiz tax bill (i.e., Invest in Space Now Act). Can be seen as merger of two bills. The ZGZT legislation has had many sponsors and actually almost passed in the House of Representatives in 2001. The bill failed because the congressional budget office examined the tax consequences of the bill at $10 billion over its 20-year life. This was not examined for its positive aspects. Today there is zero revenue by any company that would be covered under the ZGZT legislation. In order to cost the government $10 billion, the companies have to make a profit of $28.57 billion over that time period (assuming the standard 35% corporate tax rate). If we use a conservative 10% profit margin for these companies, this implies that the aggregate revenue over the 20-year period is $285.7 billion! Let's take this a little further. It is typical for companies in the high-tech engineering world to have a cost of labor of 30-50% of revenue. This means that the salaries for all of the people who work for the ZGZT-enabled companies are between $86 billion and $143 billion. Most of these folks have mid- to high-paying jobs, meaning that we can take a conservative 18% of their salaries for federal taxes and 15.3% for social security and Medicare taxes. This brings a total tax revenue into the federal treasury as follows: [table here] What the table above clearly shows is that even using very conservative numbers for salaries as a percentage of revenue and taxes as a percentage of salaries, the net gain to the federal treasury is between $18 billion and $37 billion over the life of the bill. This is pretty good for an industry that did not exist before the passage (potential) of the bill. This is called dynamic scoring in congressional legal terms, something that Congress did not do when they considered the ZGZT bill previously. It is this type of argument that has to be made for Congress to really understand how this bill enables space commerce. What about the investor? The investment community well understands the effect of tax policy on the growth of industry. The tax holiday on the Internet was one of the crucial factors enabling its growth from a few hundred academic computers in the 1980s to the global force that it is today. This is also the potential for space. We as space advocates know the value of opening the solar system for economic development. We have not done a good job over the years in communicating this vision. We have an opportunity with ZGZT and similar legislation to let dollars speak for us with the result that Buck Rogers takes on a whole new meaning!

# \*\*\*Innovation DA\*\*\*

## Uniqueness – 2NC Supplement

### Private market solves. Government fails

**HUDGINS ‘9** (Edward, is director of advocacy for The Atlas Society. He is an expect on the regulation of space. Formerly director of regulatory studies for the Cato Institute and editor of its Regulation magazine, July 17, “When We Walked on the Moon”, http://www.atlassociety.org/when-we-walked-moon, MinR)

But in the decades since the landing, NASA has become bloated, bureaucratic, and mired in the mud of the parochial political concerns of politicians. This is the fate of all government agencies, no matter the quality of the individuals working for them. Consider the example of NASA’s current principal project. The space station was originally proposed in the mid-1980s with a price tag of about $8 billion and a projected completion date in the early 1990s. Instead, with redesigns and even downsizing, it will not be completed until 2010, at a cost of well over $100 billion. Perhaps the goal was as much to keep money flowing to contractors as it was to build a space station. Most scientists see little value in the station compared to other possible uses for that money. And, incredibly, NASA is now planning to de-orbit the station and let it burn up in the atmosphere in 2016, only five years after completion. Just the kind of astronomical waste you’d expect from government! Enterprise in Orbit NASA has failed, as it was bound to, to commercialize access to space—that is, to bring down the costs and improve the quality in the way the private sector has done for cars, air travel, televisions, personal computers, and cell phones. But **private entrepreneurs have been able to overcome many barriers placed in their way by governments**, and in recent years have begun to provide access to space in the same ways that innovators in the past have provided so many other goods and services. In 2004, Burt Rutan won the private $10 million Ansari X Prize by building a craft that could travel into space with a crew capacity of three, twice in a two-week period. He’s now working with airline and railroad entrepreneur Richard Branson to provide sub-orbital flights to the public at a price that will allow many people to venture outside of our atmosphere. Elon Musk, through his company SpaceX, has designed and built private rockets from the ground up and recently launched a satellite. Robert Bigelow, through his company Bigelow Aerospace, has launched a one-third-size version of an innovative space station and plans to launch a full-sized model soon for a fraction of the cost of NASA’s orbiting white elephant. Such entrepreneurs are creating the infrastructure that will make us a space-faring civilization and should provide the paths back to the Moon and onto Mars.

## Link – 2NC Supplement

### Kills innovation: 3 warrants

**HUDGINS ‘7** (Ed, August, “Individualism in Orbit: Morality for the High Frontier”, http://www.atlassociety.org/tni/individualism-orbit-morality-high-frontier, MinR)

One reason why space is not yet part of humanity’s domain can be found in economics. Basically, the federal government has dominated space-related activities for half a century. Governments can achieve certain limited, defined, short-term goals—for example, building the atomic bomb or sending humans to the moon—though usually at very high costs to the taxpayer. But they simply can’t commercialize goods and services—that is, bring costs down and quality up, and make them available to everyone. Often, **governments get in the way of private entrepreneurs**. Entrepreneurs are the only ones who can commercialize anything—cars, televisions, airline flights, personal computers, iPods, the Internet, you name it. After the Apollo moon landings, NASA went from exploration to freight hauling. The space shuttle was a transport vehicle that was supposed to bring down the costs of putting payloads and people up into orbit, perhaps with as many as fifty flights per year. Instead, the shuttle averaged a half-dozen liftoffs annually from the Kennedy Space Center, and the actual costs of access to orbit shot up like a rocket. As the government prepared the shuttle for its first flight in April 1981, not only did it ban government payloads from private rockets (in order to give the business to NASA), but its regulatory regime added to the costs and risks of independent, private rockets, keeping them off of the market. In the mid-1980s, NASA devised yet another major project: a space station that was supposed to house a permanent crew of twelve, cost $8 billion, and arrive in orbit by the early 1990s. As costs rose, NASA went through one redesign after another, reduced the permanent crew capacity to three, and brought in international partners. A 1995 Government Accountability Office report put the total cost of building and running the station for a decade at nearly $50 billion. The real total cost of the station could be as much as $100 billion by the time it’s completed in 2010. Why have these government space programs failed? The problem isn’t talent. Most NASA workers are highly skilled and excited about the goals they seek to achieve. The principal problem lies in the very nature of government institutions like NASA. First, NASA operations are, to a great extent, determined by politics. For example, various NASA centers and projects continue, in large part, because of support by elected officials from the congressional districts and states that benefit directly from their local presence. Second, because NASA is a government agency using taxpayer dollars, it must secure annual approval for its budget, and its projects are subject to oversight by Congress, the Government Accountability Office, Inspectors General, and others. Like other government agencies, **NASA answers not to market demand and conditions but to politicians**, whose primary incentives are to respond to political pressures and otherwise cover their butts. Third, because NASA uses taxpayer dollars, the incentives to be economical, frugal, and innovative are reduced. Failure often means more taxpayer dollars and bailouts—witness the history of the shuttle and station. By contrast, private owners who put their own money at risk have a **stronger incentive to be true innovators and to manage resources wisely**. For example, non-toxic liquid hydrogen and oxygen used as fuel to put the shuttle into orbit are contained in a 150-foot-tall external tank on which the shuttle orbiter rests. After launch, just as the shuttle is approaching orbit, it jettisons this tank, which falls into the ocean. Private owners would certainly have bent over backwards not to see tens of millions of dollars of equipment destroyed with each flight. They would have followed up on one of the many plans—for example, those offered by the Space Island Group—to place those tanks into orbit where they could have been retro-fitted as orbiting laboratories, hotels, or honeymoon suites. If those tanks had been placed in orbit with every shuttle flight, there would be over thirty acres of interior space, more than the floor space of the Pentagon, waiting to be homesteaded.

# \*\*\*Coercion\*\*\*

## Coerion/Innovation DA Link – 2NC

### Tag at your liberty to apply to the proper DA

**BOYACK ‘8** (Connor, is a web developer, political economist, and social media consultant, He serves as State Coordinator for the Tenth Amendment Center in Utah, May 27th, “NASA, Legalized Theft, and a Waste of Money”, http://www.connorboyack.com/blog/nasa-legalized-theft-and-a-waste-of-money, MinR)

Since its inception, so-called leaders in government have been quite fond of this un-Constitutional agency. NASA’s $17 billion annual budget is a **taxpayer black hole of astronomical proportions**, providing scientists with the resulting bounty of legalized theft. Max Raskin eloquently portrayed the NASA problem thusly: Is there really anything incredible about giving billions of dollars to a bunch of rocket scientists and telling them to have fun? It doesn’t take the aforementioned rocket scientist to know that **people behave differently** when they aren’t spending their own money. **They will take unnecessary risks, pay themselves greater salaries, and have no way of verifying whether what they are doing is cost-effective**. Private entrepreneurs who actually have to work for their money and convince others of the worthiness of their endeavors are much more honorable. They do not rely on the the coercive arm of government and do not force others to subsidize their mistakes. And it is this system of private enterprise that the government discourages most. When the government taxes income, **it taxes success**. When the government prevents competition, it prevents progress. When the government regulates, **it discourages innovation**. The billions of dollars that get funneled into the black hole that is NASA are siphoned off from the productive private sector. However interesting one finds space travel, one must recognize that forcing other people to pay for one’s interests and hobbies is wrong. Raskin notes here the economic malfeasance taking place at the bidding of federal officials. Any intervention by central planners (namely, government officials) to alter the economy stifles progress and rewards those who are politically favored by the current establishment. Incompetence is thus allowed and rewarded, and the drive for innovation at the heart of all entrepreneurial endeavors becomes extinct. But ethical issues aside, is NASA a waste of money? Certainly there are positive results from NASA’s taxpayer-funded ventures. We have learned a great deal about the universe, and have been presented with many (hopefully not Photoshopped!) photos of celestial bodies. But despite the apparent rewards, it is impossible to ignore the heavy burden imposed upon citizens of this country. I can think of plenty of better ways to spend $17 billion this year, can’t you? The argument always made in favor of any policy or department created by our elected leaders is just that—we’ve elected these people through the democratic process, so if we don’t like what they’re doing, we’re free to vote them out of office. This concept, though, is intellectually and Constitutionally hollow; **we do not have a democracy, nor are our leaders entitled to pass whatever laws they choose**. Though the vast majority ignore and abuse it, our elected leaders have sworn an oath to uphold the Constitution, which gives our federal branches of government enumerated (specific and limited) powers. This means that even if every single official in Congress was in favor of NASA, it is still illegal (since the Constitution is the supreme law of the land, as we all learned in school) to allow the federal government to have anything to do with it. Spare me all the platitudes of exploring God’s creations, learning more about ourselves and our planet’s history, and propelling humanity into the future. Any defense of a government-run space agency holds no water unless authority for such an initiative can be demonstrated. Instead, common sense and history both teach us that private enterprise will always succeed far better than any government-created enterprise, and at far less of an expense. Is the knowledge we’ve gained about our neighboring galaxies really worth $17 billion annually? Perhaps. Is it worth taking $17 billion in taxes from U.S. citizens each year by force? **Absolutely not**.

## Coercion Turns Case – 2NC

### Vote neg to solve the case in a less coercive manner

**HUDGINS ‘7** (Ed, August, “Individualism in Orbit: Morality for the High Frontier”, http://www.atlassociety.org/tni/individualism-orbit-morality-high-frontier, MinR)

Today, we live “in the future”—the future that for decades had been depicted in science fiction, pursued by scientists and engineers, and hoped for by optimistic individuals everywhere. This future, as imagined in the past, had three outstanding features. Human beings would be flourishing in a peaceful, prosperous world based on advances in science and technology; they would be engaging in heroic pursuits; and they would be creating a space-faring civilization. On July 20, 1969, when Neil Armstrong and Buzz Aldrin became the first humans to walk on the moon, it took an act of imagination not to envision such a future. Yet, sadly, the real future—the world we live in today—is different from that positive vision. To be sure, science and technology have advanced, making us more prosperous and bettering our lives. Advances in medical technology keep us alive and improve our quality of life. A single personal computer, available to anyone today for a few hundred dollars, is more powerful than the roomful of multi-million-dollar mainframes that guided humans to the moon. Endless information flows freely on the Internet. Cell phones, like Star Trek communicators, keep us in touch anytime, anywhere. And we have every sort of consumer electronic and entertainment device. Furthermore, the Western, industrialized countries, and especially the United States, continue to prosper, and many emerging, formerly impoverished countries are joining the ranks of the enriched. But in the industrialized West, we also see signs of cultural breakdown. Many cities in America and Europe are corrupt havens of crime, more Blade Runner dystopian than Star Trek progressive. Schools with far more money than they ever had in the past are graduating the illiterates of the future. Many adults don’t know the difference between science and scientology, astronomy and astrology. The threat of Islamofascism shows that hundreds of millions of individuals remain mired in primitive superstition, tribalism, and a lust for repression, violence, and murder. And, of course, we are not yet a space-faring civilization. Humans have a tiny, three-person outpost in orbit, but not the huge, orbiting Hilton hotels depicted in the 1968 movie 2001: A Space Odyssey. We still don’t have permanent stations at gravitationally stable Lagrange points in space or settlements on the moon, Mars, or Ganymede. We have no nuclear-powered rockets ready to carry humans to the nearest stars at near the speed of light. Ultimately, the reasons why we’re not a space-faring civilization are many of the same reasons for the problems here on Earth. **The main reason is one of values**. We do not yet have values that are up to the task of guiding and motivating the development of space. We have a mixed and confused morality—and a culture that is based on and that reinforces that morality. For those who long to reach for the stars and establish a viable culture, a new philosophy is essential. Even for those satisfied with the challenges and joys of this planet, the success of future societies off this Earth could provide a paradigm for resolving the problems that space pioneers will leave behind. To fuel their launch to the stars, what they will need is a philosophy of rational individualism.

## A2: Non-U

### Our argument is linear—every increase in coercive power decreases human dignity.

**ROTHBARD ‘70** [Murray, academic vice president of the Ludwig von Mises Institute and distinguished professor at UNLV, **Freedom, Inequality, Primitivism and the Division of Labor, http://www.mises.org/fipandol/fipsec1.asp]**

Individual human beings are not born or fashioned with fully formed knowledge, values, goals, or personalities; they must each form their own values and goals, develop their personalities, and learn about themselves and the world around them. Every man must have freedom, must have the scope to form, test, and act upon his own choices, for any sort of development of his own personality to take place. He must, in short, be free in order that he may be fully human. In a sense, even the most frozen and totalitarian civilizations and societies have allowed at least a modicum of scope for individual choice and development. Even the most monolithic of despotisms have had to allow at least a bit of "space" for freedom of choice, if only within the interstices of societal rules. The freer the society, of course, the less has been the interference with individual actions, and the greater the scope for the development of each individual. The freer the society, then, the greater will be the variety and the diversity among men, for the more fully developed will be every man's uniquely individual personality. On the other hand, the more despotic the society, the more restrictions on the freedom of the individual, the more uniformity there will be among men and the less the diversity, and the less developed will be the unique personality of each and every man. In a profound sense, then, a despotic society prevents its members from being fully human.

## A2: Util

### Extinction is justified to protect liberty

**SHUE ‘89** – Professor of Ethics and Public Life at Princeton University (Henry, Nuclear Deterrence and Moral Restraint, p. 64-5)

The issue raises interesting problems about obligations among generations. What obligations do we owe to future generations whose very existence will be affected by our risks? A crude utilitarian calculation would suggest that since the pleasures of future generations may last infi­nitely (or until the sun burns out), no risk that we take to assure certain values for our generation can compare with almost infinite value in the future. Thus we have no right to take such risks. In effect, such an approach would establish a dictatorship of future generations over the present one. The only permissible role for our genera­tion would be biological procreation. If we care about other values in addition to survival, this crude utilitarian approach produces intolerable consequences for the current generation. Moreover, utility is too crude a concept to support such a calculation. We have little idea of what utility will mean to generations very distant from ours. We think we know something about our children, and perhaps our grandchil­dren, but what will people value 8,000 years from now? If we do not know, then there is the ironic prospect that something we deny ourselves now for the sake of a future generation may be of little value to them. A more defensible approach to the issue of justice among generations is the principle of equal access. Each generation should have roughly equal access to important values. We must admit that we shall not be certain of the detailed prefer­ences of increasingly distant generations, but we can as­sume that they will wish equal chances of survival. On the other hand, there is no reason to assume that they would want survival as a sole value any more than the current generation does. On the contrary, if they would wish equal access to other values that give meaning to life, we could infer that they might wish us to take some risks of species extinction in order to provide them equal access to those values. If we have benefited from "life, liberty and the pursuit of happiness," why should we as­sume that the next generation would want only life?

### Util fails to protect moral rights – it silences rights claims when not grounded in law.

**BYRNES ’99** (Erin Byrnes, JD U Arizona, 1999, “Therapeutic Jurisprudence: Unmasking White Privelege to Expose the Fallacy of White Innocense,” 41 Ariz. L. Rev. 535)

Utilitarianism conceives of rights as being cognizable only when they are legally recognized. 236 To the utilitarian, there is no such thing as a moral right because it is not socially recognized. 237 The utilitarian rejection of moral rights can be fatal to affirmative action. Rights in utilitarian rhetoric are synonymous with the idea of a valid claim to act. 238 Put differently, one can be said to hold a valid claim when, and only when, that claim is grounded in a legally or socially recognized right. This normative theory of rights further posits that the exercise of rights is not dependent upon a duty incumbent upon others to acknowledge or respect that right. 239 This is clearly problematic when applied to calls for affirmative action. Instead of conceiving of rights as corresponding with a duty, the utilitarian thinks of rights in terms of "immunity rights," which have a corresponding concept of a "disability." 240 This too is a foreboding concept because affirmative action programs often involve affirmative guarantees, versus a simple right to be free from discrimination. An example of an immunity right is the right to free speech. The right to free speech exists independently of an obligation upon others not to interfere with an individual's right to exercise free speech. 241 The corresponding disability operates upon Congress. The disability prohibits Congress from enacting certain laws abridging the individual's right to free speech, but does not extend so far as to require the passage of legislation which would affirmatively protect or guarantee the immunity right. 242 The immunity right, then, is one that merely involves a freedom from outside interference, a sort of negative right, as opposed to being a right that is affirmatively protected through the imposition of an obligation upon others to honor the right. The distinction made between moral and legal rights, encompassing the distinction between a disability and a duty, is central to the utilitarian argument. Utilitarianism squarely rejects the recognition of moral rights because moral rights must be understood in terms of a corresponding beneficial obligation. 243 A moral conception of rights dictates that a right is held by an individual "if and only if one is supposed to benefit from another person's compliance with a coercive...rule." 244 Utilitarianism must necessarily reject a conception of rights grounded in morality because the utilitarian doctrine is diametrically opposed to the notion that rights correspond with duties. [\*563] Furthermore, utilitarianism renounces moral rights precisely because they exist independent of social recognition or enforcement. 245 Moral rights "are independent of particular circumstances and do not depend on any special conditions," 246 like legal affirmation. Thus, moral rights cannot be accepted by the utilitarian because they lack the normative grounding fundamental to utilitarian theory. Utilitarians, therefore, assume that there is a clear delineation between moral rights and the pursuit for overall human welfare, the central tenet of utilitarian doctrine.

### Util makes no sense in the context of rights

**MACHAN ‘95** (Tibor, Professor of philosophy, Auburn University, PRIVATE RIGHTS AND PUBLIC ILLUSIONS, 1995, p. 129)

The essential point to note at this juncture is how the idea of the worth and rights of the individual simply cannot find a place in the standard utilitarian cost-benefit analysis favored by many economists. Benefits, according to this approach, are to be measured by what people prefer (or would prefer, if properly informed), while costs are reducible to what people would prefer to do without or avoid if they were properly informed. The kind of value (or worth) **individuals have,** however**, is not just one benefit competing among other benefits**...Consider the case where some people are injured or harmed by others. "Since the costs of injury are borne by its victims," Kelman contends, "while its benefits are escaped by its perpetrators, simple cost-benefit calculations may be less important than more abstract conceptions of justice, fairness, and human dignity. Developing this theme more fully, Kelman writes as follows: We would not condone a rape even if it could be demonstrated that the rapist derived enormous pleasure from his actions, while the victim suffered in only small ways. Behind the conception of "rights" is the notion that some concept of justice, fairness or human dignity demands that individuals ought to be able to perform certain acts, despite the harm of others, and ought to be protected against certain acts, despite the loss this causes to the would-be perpetrator. Thus we undertake no cost-benefit analysis of the effects of freedom of speech or trial by jury before allowing them to continue.

# \*\*\*AFF\*\*\*

## AFF – A2: Innovation DA

### Doesn’t turn case: Government key to solve their impacts

**TUDOREANU ‘11** (Mike, UMass/Amherst pursuing his Ph.D, in economics, March 24, “Why we need NASA”, http://dailycollegian.com/2011/03/24/why-we-need-nasa/, MinR)

So there is absolutely no excuse for attacking NASA on spending grounds. But there are some preachers of unrestrained capitalism who attack it on ideological grounds, simply because it is a government agency. They believe that private enterprise can take us into space, and point to such recent developments as the first private sub-orbital flight (in 2004) and the growth of space tourism. I really don’t see what’s so exciting about the fact that private companies finally managed, in 2004, to do what the government had been doing since the early 1960s. On the other hand, space tourism is making money; that is true. **But it relies on government-created and government-funded technology.** The first space tourist was taken into Earth orbit in 2001 by a Soyuz spacecraft. It’s not exactly a ringing endorsement of the free market when your business has to rely on Soviet technology, is it? And in any case, **tourism is never going to help us push the boundaries of a new frontier**. The whole point of exploration (in space or anywhere else) is that you have to go off into the unknown and put your life on the line. That’s not what tourists are after. America was not discovered by people looking for a dream holiday. The fact is that private companies, market forces and the profit motive cannot take us beyond the confines of Earth. Exploration in general, throughout human history, **was always supported first and foremost by governments**. Christopher Columbus was funded by the Spanish state. The great Chinese explorer Zheng He was sponsored by the Ming government when he sailed across the Indian Ocean. There are good reasons why it was always this way. Private companies will only agree to do something if they can expect to make a profit from it. But how can you know if discovering a new land is profitable before you’ve actually discovered it? You don’t know what the new land might hold – sometimes you don’t even know if the new land exists. It’s not like gambling on the stock market, where you can calculate risk projections and expected returns. Private companies (especially banks) are perfectly willing to gamble, as long as they know the odds. But the thing about exploration is that you don’t know the odds. You just have to leap into the unknown, and history shows that the first voyage to a new land tends to **be extremely unprofitable**. After the new land has been discovered and charted, then there may be profit opportunities and private business might join in. But not before. Space exploration is likely to be even more unprofitable than sailing across the oceans of Earth, for two reasons. **First, it requires huge upfront investments** (building a spaceship is far more expensive than building a boat), and it’s difficult to imagine any way that a private space company could recover those costs. Second, there are no people to trade with – or steal from – at the other end of the voyage. We will have to build everything ourselves once we get there. We may find mineral resources, but the same minerals could also be found on Earth.

### Government focus creates much more wealth

**VERNIKOS ‘8** (Joan, a member of the Space Studies Board of the National Academy and former director of NASA’s Life Sciences Division, [article written by Stephen J. Dubner, author of “Freakonomics”], January 11, “Is Space Exploration Worth the Cost? A Freakonomics Quorum”, http://www.freakonomics.com/2008/01/11/is-space-exploration-worth-the-cost-a-freakonomics-quorum/, MinR)

At what cost? Is there a price to inspiration and creativity? Economic, scientific and technological returns of space exploration have far exceeded the investment. Globally, 43 countries now have their own observing or communication satellites in Earth orbit. Observing Earth has provided G.P.S., meteorological forecasts, predictions and management of hurricanes and other natural disasters, and global monitoring of the environment, as well as surveillance and intelligence. Satellite communications have changed life and business practices with computer operations, cell phones, global banking, and TV. Studying humans living in the microgravity of space has expanded our understanding of osteoporosis and balance disorders, and has led to new treatments. Wealth-generating medical devices and instrumentation such as digital mammography and outpatient breast biopsy procedures and the application of telemedicine to emergency care are but a few of the social and economic benefits of manned exploration that we take for granted. Space exploration is not a drain on the economy; it **generates infinitely more than wealth than it spends**. Royalties on NASA patents and licenses currently go directly to the U.S. Treasury, not back to NASA. I firmly believe that the Life Sciences Research Program would be self-supporting if permitted to receive the return on its investment. NASA has done so much with so little that it has generally been assumed to have had a huge budget. In fact, the 2007 NASA budget of $16.3 billion is a minute fraction of the $13 trillion total G.D.P. “What’s the hurry?” is a legitimate question. As the late Senator William Proxmire said many years ago, “Mars isn’t going anywhere.” Why should we commit hard-pressed budgets for space exploration when there will always be competing interests? However, as Mercury, Gemini and Apollo did 50 years ago, our future scientific and technological leadership depends on exciting creativity in the younger generations. **Nothing does this better** than manned space exploration. There is now a national urgency to direct the creative interests of our youth towards careers in science and engineering. We need to keep the flame of manned space exploration alive as China, Russia, India, and other countries forge ahead with substantial investments that challenge U.S. leadership in space.

### Government spending solves innovation

**COWING ‘8** (Keith Cowing, founder and editor of NASAWatch.com and former NASA space biologist, [article written by Stephen J. Dubner, author of “Freakonomics”], January 11, “Is Space Exploration Worth the Cost? A Freakonomics Quorum”, http://www.freakonomics.com/2008/01/11/is-space-exploration-worth-the-cost-a-freakonomics-quorum/, MinR)

 Right now, all of America’s human space flight programs cost around $7 billion a year. That’s pennies per person per day. In 2006, according to the USDA, Americans spent more than $154 billion on alcohol. We spend around $10 billion a month in Iraq. And so on. Are these things more important than human spaceflight because we spend more money on them? Is space exploration less important? Money alone is not a way to gauge the worthiness of the cost of exploring space. NASA is fond of promoting all of the spinoffs that are generated from its exploits, such as microelectronics. But are we exploring space to explore space, or are we doing all of this to make better consumer electronics? I once heard the late Carl Sagan respond to this question by saying, “you don’t need to go to Mars to cure cancer.” If you learn how to do that as a side benefit, well, that’s great, but there are probably more cost effective ways to get all of these spinoffs without leaving Earth. To be certain, tax dollars spent on space projects **result in jobs — a large proportion of which are high paying, high tech positions**. But many other government programs do that as well — some more efficiently. Still, for those who would moan that this money could be “better spent back on Earth,” I would simply say that all of this money is spent on Earth — it creates jobs and provides business to companies, just as any other government program does. You have to spend all of NASA’s money “on Earth.” There is no way to spend it in space — at least, not yet. Where am I going with this? Asking if space exploration — with humans or robots or both — is worth the effort is like questioning the value of Columbus’s voyages to the New World in the late 1490s. The promise at the time was obvious to some, but not to others. Is manned space exploration worth the cost? If we Americans do not think so, then why is it that nations such as China and India — nations with far greater social welfare issues to address with their limited budgets — are speeding up their space exploration programs? What is it about human space exploration that they see? Could it be what we once saw, and have now forgotten?

### Government spending key to growth

**LIVINGSTON ‘8** (David M. Livingston, host of The Space Show, a talk radio show focusing on increasing space commerce and developing space tourism, [article written by Stephen J. Dubner, author of “Freakonomics”], January 11, “Is Space Exploration Worth the Cost? A Freakonomics Quorum”, http://www.freakonomics.com/2008/01/11/is-space-exploration-worth-the-cost-a-freakonomics-quorum/, MinR)

 I hear this question a lot. So a few years ago, I decided to see what really happened to a public dollar spent on a good space program, compared to spending it on an entitlement program or a revenue generating infrastructure program. I used the school breakfast program for the test entitlement program. I chose Hoover Dam for the revenue generating infrastructure program. The space program I chose was the manned program to the moon consisting of the Mercury, Gemini, and Apollo programs. Let me briefly summarize what I discovered. All programs, if properly managed, **can produce benefits** in excess to the original invested dollar. There is no guarantee that a program will be properly managed, and this includes a space program. “Properly managed” implies many things, but I don’t think space is any more or less likely to be well managed than anything else the government does. A mismanaged space program wastes money, talent, and time, just like any other faulty program. As for what happened to the dollar invested in the respective programs, the school breakfast program was successful, in that it increased the number of kids who received breakfast. However, when funding for this program or this type of program stops, as soon as the last of the funds goes through the pipeline, the program is over. It has no life past government funding. I was unable to find an inspirational or motivational quality for the program leading to downstream business, economic, or science advancements. One could make the case that kids who benefited from the program went on through school to accomplish great things, and I don’t doubt that — I simply could not document it in my research. The Hoover Dam was very interesting. This project paid off its bond cost early, was a major contributor to the U.S. victory in World War II, and has been a huge economic factor for development in the Western part of the country. However, the Hoover Dam requires overhead and maintenance investment on a continual basis. It needs repairs, updates, modernization, and security, and it employs a labor force. Were we to stop investing in the Hoover Dam, over time it would lose its effectiveness and cease to be the value to our nation that it is now. Its value to us depends on our willingness to maintain, protect, and update it as necessary. The Hoover Dam and Lake Mead have given birth to thousands of private businesses, economic growth for the region, and much more. However, as with the entitlement program above, I could not find an inspirational or motivational aspect to the Hoover Dam. What I discovered about our manned lunar program was different. When I did this study, it was 34 years after the last dime had been spent on Apollo, the last of the manned moon programs. Thirty-four years later, when I asked guests on The Space Show, students, and people in space-related fields what inspired or motivated them to start a space business or pursue their science education, over 80 percent said they were inspired and motivated **because of our having gone to the moon**. Businesses were started and are now meeting payrolls, paying taxes, and sustaining economic growth because the founder was inspired by the early days of the manned space program, often decades after the program ended! This type of inspiration and motivation seems unique to the manned space program and, of late, to some of our robotic space missions. I found the same to be true when I asked the same question to Space Show guests from outside the U.S.

## AFF – A2: Coercion – Util Turn

Their moral decision-making is evil
ISSAC 02—Professor of Political Science at Indiana-Bloomington, Director of the Center for the Study of Democracy and Public Life, PhD from Yale (Jeffery C., Dissent Magazine, Vol. 49, Iss. 2, “Ends, Means, and Politics,” p. Proquest)

As a result, the most important political questions are simply not asked. It is assumed that U.S. military intervention is an act of "aggression," but no consideration is given to the aggression to which intervention is a response. The status quo ante in Afghanistan is not, as peace activists would have it, peace, but rather terrorist violence abetted by a regime--the Taliban--that rose to power through brutality and repression. This requires us to ask a question that most "peace" activists would prefer not to ask: What should be done to respond to the violence of a Saddam Hussein, or a Milosevic, or a Taliban regime? What means are likely to stop violence and bring criminals to justice? Calls for diplomacy and international law are well intended and important; they implicate a decent and civilized ethic of global order. But they are also vague and empty, because they are not accompanied by any account of how diplomacy or international law can work effectively to address the problem at hand. The campus left offers no such account. To do so would require it to contemplate tragic choices in which moral goodness is of limited utility. Here what matters is not purity of intention but the intelligent exercise of power. Power is not a dirty word or an unfortunate feature of the world. It is the core of politics. Power is the ability to effect outcomes in the world. Politics, in large part, involves contests over the distribution and use of power. To accomplish anything in the political world, one must attend to the means that are necessary to bring it about. And to develop such means is to develop, and to exercise, power. To say this is not to say that power is beyond morality. It is to say that power is not reducible to morality. As writers such as Niccolo Machiavelli, Max Weber, Reinhold Niebuhr, and Hannah Arendt have taught, an unyielding concern with moral goodness undercuts political responsibility. The concern may be morally laudable, reflecting a kind of personal integrity, but it suffers from three fatal flaws: (1) It fails to see that the purity of one's intention does not ensure the achievement of what one intends. Abjuring violence or refusing to make common cause with morally compromised parties may seem like the right thing; but if such tactics entail impotence, then it is hard to view them as serving any moral good beyond the clean conscience of their supporters; (2) it fails to see that in a world of real violence and injustice, moral purity is not simply a form of powerlessness; it is often a form of complicity in injustice. This is why, from the standpoint of politics--as opposed to religion--pacifism is always a potentially immoral stand. In categorically repudiating violence, it refuses in principle to oppose certain violent injustices with any effect; and (3) it fails to see that politics is as much about unintended consequences as it is about intentions; it is the effects of action, rather than the motives of action, that is most significant. Just as the alignment with "good" may engender impotence, it is often the pursuit of "good" that generates evil. This is the lesson of communism in the twentieth century: it is not enough that one's goals be sincere or idealistic; it is equally important, always, to ask about the effects of pursuing these goals and to judge these effects in pragmatic and historically contextualized ways. Moral absolutism inhibits this judgment. It alienates those who are not true believers. It promotes arrogance. And it undermines political effectiveness.

### Utilitarianism upholds self-ownership and thus liberty.

**BAILEY ’97** (James Bailey, lecturer Politics at Princeton, 1997, Utilitarianism, Institutions, and Justice, Oxford University Press, p. 160)

I have also tried to show that attempts to subvert utilitarianism through appeals to formal properties about theories of justice—such as finality and publicity—do not work either. The finality of utilitarianism is unlikely to be in jeopardy in a world in which people cannot suffer horrible acts as patients or alienating acts as agents. The rules protecting self-ownership, which are necessary to prevent exploitation, also forbid the horrible acts and allow individuals the liberty to do much of what they see as with their lives. The question of utilitarianism's subversion in its finality by grossly, unfair distributive arrangements is answered by a set of institutions in which no deep suffering is allowed and a generous provision is made for educational opportunities for all.

### Policy must be viewed through a consequentialist framework- slipping into the libertarian mindset only recreates the root cause of the affirmative harms

**FRIEDMAN ’97** (Jefferey Friedman, PoliSci Bernard U, 1997, "What's Wrong with Libertarianism," Critical Review, Volume: 3, pp. 458-459)

On the one hand, the reclamation of the Enlightenment legacy can lead in far more directions than the political—science path I have suggested. It is surely important to launch anthropological, economic, historical, sociological, and psychological investigations of the preconditions of human happiness. And post-libertarian cultural historians and critics are uniquely positioned to analyze the unstated assumptions that take the place of the requisite knowledge in determining democratic attitudes. A prime candidate would seem to be the overwhelming focus on intentions as markers for the desirability of a policy. **If a policy is well intended, this is usually taken to be a decisive consideration in its favor**. This heuristic might explain the moralism that observers since Tocqueville have noticed afflicts democratic cultures. To date, this phenomenon is relatively unexplored. Analogous opportunities for insightful postlibertarian research can be found across the spectrum of political behavior. What is nationalism, for example, if not a device that helps an ignorant public navigate the murky waters of politics by applying a simple “us-versus-them” test to any proposed policy? Pursuit of these possibilities, however, must be accompanied by awareness of the degeneration of postwar skepticism into libertarian ideology. If the post-libertarian social scientist yields to the hope of re-establishing through consequentialist research the antigovernment politics that has until now been sustained by libertarian ideology; she will only recreate the conditions that have served to retard serious empirical inquiry. It is fashionable to call for political engagement by scholars and to deny the possibility that one can easily isolate one’s work from one’s political sympathies. But difficulty is no excuse for failing to try. Libertarians have even less of an excuse than most, since, having for so long accused the intellectual mainstream of bias and insulation from refutation, they should understand better than anyone the importance of subverting one’s own natural intellectual complacency with the constant reminder that one might be wrong. The only remedy for the sloppiness that has plagued libertarian scholarship is to become one’s own harshest critic. This means thinking deeply and skeptically about one’s politics and its premises and, if one has libertarian sympathies, directing one’s scholarship not at vindicating them, but at finding out if they are mistaken.

## AFF – A2: Coercion

### Justifies the cost: heg. Psychic prestige link turns coercion.

**CONNELL ‘8** (Kathleen M. Connell, a principal of The Connell Whittaker Group, a founding team member of NASA’s Astrobiology Program, and former policy director of the Aerospace States Association, [article written by Stephen J. Dubner, author of “Freakonomics”], January 11, “Is Space Exploration Worth the Cost? A Freakonomics Quorum”, http://www.freakonomics.com/2008/01/11/is-space-exploration-worth-the-cost-a-freakonomics-quorum/, MinR)

 The value of public sector human space exploration is generally perceived as worth the cost when exploration outcomes address one or more national imperatives of the era. For example, in the twentieth century, the Soviet Union’s launch of Sputnik required a bold technological retort by the U.S. Apollo put boots on the moon, winning the first space race. The resulting **foreign policy boost and psychic prestige** for the U.S. more that [than] justified the cost for the Cold War generation. Unquestionably, manned exploration of that era also created unintended economic consequences and benefits, such as the spinoff of miniaturization that led to computers and cell phones. Apollo also created new NASA centers in the South, acting as an unanticipated economic development anchor for those regions, both then and now. In the twenty-first century, what would happen if U.S. manned space programs were managed based upon the contemporary demands of the planet and the American taxpayer? NASA could be rewarded to explore, but with terrestrial returns as a priority. Space exploration crews could conduct global warming research on the International Space Station National Laboratory, while other crews from the public or private sector could rapidly assemble solar energy satellites for clean energy provision to Earth. Lunar settlements could be established to develop new energy sources from rare compounds that are in abundance on the moon. Getting to Mars, to develop a terrestrial lifeboat and to better understand the fate of planets, suddenly takes on new meaning and relevance. I have to come the conclusion, after over 20 years in the space industry, that addressing global challenges with space solutions that benefit humanity and American constituents is **the key to justifying the cost** of manned space exploration. I believe we are about to find out, all over again, if civil manned space capability and policy can adapt and rise to meet new imperatives.

### Can’t calculate space policy with taxes

**LOGSDON ‘8** John M. Logsdon, director of the Space Policy Institute and acting director of the Center for International Science and Technology Policy at George Washington University’s Elliott School of International Affairs, [article written by Stephen J. Dubner, author of “Freakonomics”], January 11, “Is Space Exploration Worth the Cost? A Freakonomics Quorum”, http://www.freakonomics.com/2008/01/11/is-space-exploration-worth-the-cost-a-freakonomics-quorum/, MinR)

 The high costs of sending humans into orbit and beyond are measured in dollars, rubles, or yuan. The benefits of human spaceflight are not so easily calculated, since they include both tangible and intangible payoffs. So answering the question, “Do the benefits outweigh the costs?” is not straightforward. If the payoffs are limited to scientific discovery, the position taken by many critics of human spaceflight is “no.” With both current and, especially, future robotic capabilities, the added value of human presence to missions aimed primarily at new understanding of the moon, Mars, near-Earth asteroids, and other celestial destinations most likely does not justify the added costs and risks involved. However, Steve Squyres, the principal investigator for the Mars Exploration Rovers, has frequently said that he wished that spirit and opportunity were working in partnership with humans on the surface of Mars; that combination, he argues, would greatly increase the scientific payoffs of the mission. To me, the primary justifications for sending people into space require that they travel beyond low Earth orbit. For the next few decades, the **major payoffs** from humans traveling to the moon and Mars **are intangible**, and linked to both national pride and national power. Space exploration remains an effort that can be led by only a few countries, and I believe that it should be part of what the United States does in its desire to be seen by both its citizens and the global public as a leader, one to be admired for its continued willingness to invest in pushing the frontiers of human activity.

## AFF – A2: Coercion/Innovation DA – No Link

### No link: drop in the ocean

**TUDOREANU ‘11** (Mike, UMass/Amherst pursuing his Ph.D, in economics, March 24, “Why we need NASA”, http://dailycollegian.com/2011/03/24/why-we-need-nasa/, MinR)

First of all, **the money spent on NASA is a drop in the ocean compared to total government spending.** For instance the NASA budget for 2011 stands at around $18.7 billion. By comparison, the wars in Iraq and Afghanistan are costing us $159.3 billion in 2011, the total Pentagon budget this year is $548.9 billion, President Barack Obama’s tax cut extension will cost $200-500 billion and the bailout of the banks cost $700 billion. In other words, NASA can take us to the final frontier for a fraction of the cost of the Bush tax cuts, or the same amount of money it takes to occupy a few mountains and bomb a few villages in the Afghan countryside. I’d call that a bargain. Even in the 1960s, when the space program received about twice as much funding as today (adjusted for inflation), President Kennedy pointed out that NASA’s budget was smaller than the amount of money Americans spent on cigarettes every year.