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### 1NC-Education DA

#### A human mission to Mars is key to inspiring a new generation of scientists and engineers

Ehlmann et al 05—Bethan Ehlmann [California Institute of Technology | CIT · Division of Geological and Planetary Sciences]; Humans to Mars: A feasibility and cost-benefit analysis; May 2005 Acta Astronautica 56(9-12):851-8; 10.1016/j.actaastro.2005.01.010. (AG DebateDrills)

Educating and inspiring America’s youth has long been a priority of NASA. Hence, we investigate the likely effects of a human mission to Mars on education in the United States. The Bureau of Labor predicts a 20% employment increase in engineering and a 15% increase in the physical sciences in the next 10 years, but as the Hart–Rudman Commission report states simply, the “US need for the highest quality human capital in science, mathematics, and engineering is not being met” [10]. In physics and advanced mathematics, American seniors score significantly below the international average on tests. While this is usually attributed to problems within the schools themselves, a general disinterest in math and science also contributes to American high school students’ poor performance. The trend continues at the undergraduate level. Comparing degrees granted between 1975 and 1999, the United States has a poor percentage increase compared to other nations. This decline is also reflected in the downward trend of the US relative to other nations in science and engineering degrees granted per capita to 24-year-olds [10]. At the graduate level, it is apparent that the number of doctoral degrees in natural sciences and engineering attained in Europe and Asia has increased rapidly compared to that of the United States. In 1975, the US granted approximately13,000 science and engineering doctoral degrees compared to Europe’s 7,000 and Asia’ 4500. In 1999, the US granted approximately18,000 science and engineering Ph.D.s while Europe granted 23,000 and Asia 19,000 [10]. Additionally, within US universities, 25% of graduate students in the sciences and nearly 40% of the graduate students in engineering, mathematics, and computer science are foreign born [10]. Based on this data, we see that decreasing production of scientists and engineers is not a global trend, but an area of particular concern for policy-makers in the United States. Some argue that money put into the space program could be better spent by putting it directly into the educational system to encourage students in the sciences and engineering. This is an unfortunate misconception. The United States is already one of the top spenders per student in the world [10]. Although more funding could always be useful to the American educational system, it does not promise the sustained effort needed to increase the number of Americans pursuing advanced degrees in science or engineering. The government cannot simply buy more computers, fund more scholarships, and lower teacher-to-student ratios enough to convince an 18-year-old freshman to invest at least 8 years in the pursuit of a science and engineering advanced degree. Students need something to inspire their efforts. The idea of space exploration significantly influencing youth is not without precedent. During the Apollo era of the 1960s, there was a dramatic increase in the number of American students pursuing advanced degrees in science, math, and engineering shortly after President Kennedy’s initiation of the Apollo program (Fig. 1). Furthermore, after the Apollo program was dismantled and NASA’s funding cut, the number of students going into these fields decreased with a down-ward trend of NASA’s budget. The figure is only a correlation; numerous other significant historical events, including the Vietnam War, also occurred at this time. However, anecdotal accounts of science and engineering professionals entering their disciplines inspired by the Apollo program “To the Moon” goal indicate how NASA can inspire a generation. Indeed, “To inspire the next generation of human explorers” [11] is the most compelling reason for the US policy-makers to support a human mission to Mars. The United States counts on advanced technology for economic stability and national security, which in turn depends on the ability of American universities to supply the science and engineering workforce. As the technological demands of the American lifestyle steadily increase, inspiration of the next generation of scientists and engineers becomes critical. A human mission to Mars has the unique ability to invigorate future scientists and engineers and create a program that operates in tandem with existing educational programs, adding an inspirational vision to supplement the efforts of teachers.

#### Scientific and engineering education key to preventing Climate Change – providing students facts, skills, and motivation to take action.

Dyster 13--Adam Dyster is a National Organizer for @serauk, Labour's Environment Campaign,Climate Home, 2013 (“Education is the key to addressing climate change, September 7, 2013, http://www.climatechangenews.com/2013/07/09/comment-education-is-the-key-to-addressing-climate-change/,Accessed 6-26-2017, AIN)

Education is vitally important for several, key reasons. It can deliver the scientific facts about the biggest issue facing young people, something that is being felt by millions worldwide. It equips youth with the skills to help combat climate change, and be part of a green recovering, and positive future. It also encourages young people to be involved as global citizens, and involves and engages them in an issue that’s impacts will be felt most keenly by those now going through the education system. We have a responsibility to educate, not only bound by international convention, but by moral and ethical duties. Schools must educate young people about the world around them, so that they are informed with facts and key issues. Education should keep up to date with science and academic thought. Just as the facts and science of stem cell research or alcohol abuse are taught, because of their relevance and strong scientific foundations, so should climate change and sustainability – indeed, even more so, given the magnitude and impact of environmental issues. Facts not fiction Such education must be about facts and science, not treated as the political football as it so often is. Such politicisation mires the issue, and means that the urgency and relevancy of climate change education is often lost amidst political point scoring. This should, as with other relevant science-based issues, be an area of consensus, not party political manoeuvring. Beyond establishing the facts of the issue, education can have be a great force for good, preparing young people to face, and indeed improve, the world after education has long been completed. How can we expect creative solutions and innovation to combat climate and sustainability issues if we don’t educate the next generation about them? The UK campaign against the removal of climate change from the Geography curriculum is itself proof of the power of education. Esha Marwaha, at 15-years-old, was able to write so eloquently on the dangers of removing climate change that her petition gained over 30,000 signatures in a matter of weeks. Yet without education, would we get another Esha, or another generation of activists, or even another generation who care about climate change. Without education, those who want or who’re able to combat climate change will surely be in the minority. New jobs This is especially relevant with the need for innovation and sustainable development. Currently the green economy is nascent, its burgeoning growth providing employment and a viable alternative to resource hungry industries and economic models. But positive growth needs new generations who both understand the need for alternative development and have the passion and desire to act. Education has a key role in showing young people that not only do they have wider responsibilities, but also that they are entitled to involvement in decisions. Climate change and sustainability are issues that cut across generations, and the decisions that are made today will have impact not upon the generation that makes them, but generations to come.1 Education can help give young people the tools to take part in these decisions, allowing them to enter into the debate. UN agreements Finally, there is a legal obligation for many countries to educate about climate change. Under Article 6 of the UN’s Framework Convention on Climate Change, signatories are obliged to: ‘Promote and facilitate …the development and implementation of educational and public awareness programmes on climate change and its effects’. This article is clear and direct, and must not be ignored. However in many respects this legal obligation is a lesser consideration when compared to the moral obligation each generation has to educate the next about climate change. Education is the most powerful tool and can engage young people in the debate, prepare them for working with the green economy, and give the definitive science and facts about the biggest issue facing young people. To quote H.G. Wells: “Human history becomes more and more a race between education and catastrophe.”

#### The impact is extinction—only quickly finding solutions prevents us from reaching tipping points

Sears 21-- Sears, Nathan Alexander. "Great Powers, Polarity, and Existential Threats to Humanity: An Analysis of the Dis-tribution of the Forces of Total Destruction in International Security." (2021).

Thus, the assumption here is that a Hothouse Earth climate could pose an existential threat to the habitability of the planet for humanity (Steffen et al. 2018., 5). At what point could climate change cross the threshold of an existential threat to humankind? The complexity of Earth’s natural systems makes it extremely difficult to give a precise figure (Rockstrom et al. 2009; ). However, much of the concern about climate change is over the danger of crossing “tipping points,” whereby positive feedback loops in Earth’s climate system could lead to potentially irreversible and self-reinforcing “runaway” climate change. For example, the melting of Arctic “permafrost” could produce additional warming, as glacial retreat reduces the refractory effect of the ice and releases huge quantities of methane currently trapped beneath it. A recent study suggests that a “planetary threshold” could exist at global average temperature of 2°C above preindustrial levels (Steffen et al. 2018; also IPCC 2018). Therefore, the analysis here takes the 2°C rise in global average temperatures as representing the lower-boundary of an existential threat to humanity, with higher temperatures increasing the risk of runaway climate change leading to a Hothouse Earth. The Paris Agreement on Climate Change set the goal of limiting the increase in global average temperatures to “well below” 2°C and to pursue efforts to limit the increase to 1.5°C. If the Paris Agreement goals are met, then nations would likely keep climate change below the threshold of an existential threat to humanity. According to Climate Action Tracker (2020), however, current policies of states are expected to produce global average temperatures of 2.9°C above preindustrial levels by 2100 (range between +2.1 and +3.9°C), while if states succeed in meeting their pledges and targets, global average temperatures are still projected to increase by 2.6°C (range between +2.1 and +3.3°C). Thus, while the Paris Agreements sets a goal that would reduce the exis 6 - tential risk of climate change, the actual policies of states could easily cross the threshold that would constitute an existential threat to humanity (CAT 2020). How do the CO2 emissions of the leading states affect the existential risk of climate change? One way to measure this would be to compare the leading states’ CO2 emissions against the global “carbon budget”—or the amount of CO2 emissions over a period of time that would keep global average temperature below the existential threshold of +2.0°C above preindustrial levels (IPCC 2018). If any of the leading state’s CO2 emissions—existing or projected—are equal to the global carbon budget, then this would constitute an absolute existential threat capability. None of the leading states appear to possess such an absolute existential threat capability. For example, the benchmark of total global annual CO2 equivalent emissions for a +2.0°C “compatible pathway” are 46 billion tonnes (bt) in 2025 and 38bt in 2030 (CAT 2020). China’s CO2 emissions are by far the largest amongst the leading states, which amounted to 10.17bt in 2019 and are expected to climb to somewhere below 15bt in the period between 2025 and 2030. China’s emissions are therefore far below the global carbon budget. Similarly, one 2019 study by the International Energy Agency estimated a remaining global carbon budget of 880 billion tonnes for having a 66% change of remaining well below 2.0°C (or 1.8°C) (Dalman 2020). Assuming China’s CO2 emissions were to remain on average at their current levels of approximately 10bt per year over the next 40 years until reaching China’s goal of “carbon neutrality” by 2060, China’s total emissions would still account for less than half of the global carbon budget. It is therefore highly unlikely that any 7 one of the leading states meets the threshold of CO2 emissions that would constitute an absolute existential threat capability, since no single state realistically accounts for the entire global carbon budget.

### 1NC – Space Col DA

#### Private sector innovation in the commercial space industry is high now.

**Smith 18** [Matthew Smith, 6-11-2018, "Commercialized Space and You," Science in the News, https://sitn.hms.harvard.edu/flash/2018/commercialized-space-and-you/]//DDPT

Step aside, NASA. The 20th century model of space exploration is running out of fuel, and private companies are now leading the race for human expansion across the galaxy. Elon Musk, Richard Branson, and Jeff Bezos are three of the billionaires leading this extraterrestrial adventure with their respective companies, SpaceX, Virgin Galactic, and Blue Origin. Bezos, the founder of Amazon and currently the wealthiest person in the world, has a vision of sending autonomous rovers to the Moon and helping to eventually create a Moon Village. He has explained that collaborations with the National Aeronautics and Space Administration (NASA) and other government agencies are encouraged and appreciated, but are no longer essential to achieve his goal. [Musk](https://www.geekwire.com/2018/jeff-bezos-blue-origin-space-venture-go-moon-settlements/), who co-founded Tesla, has already launched nine rockets within the first five months of 2018, one of which was the most powerful private spacecraft [ever sent into orbit](http://sitn.hms.harvard.edu/flash/2018/spacex-launches-falcon-heavy-rocket-successfully/). Looking forward, SpaceX aims to complete its first manned mission to Mars in 2024, almost a decade earlier than NASA’s projections. Even the current US president is encouraging this shift to private companies driving [innovation in space](https://www.washingtonpost.com/news/the-switch/wp/2018/02/11/the-trump-administration-wants-to-turn-the-international-space-station-into-a-commercially-run-venture/?noredirect=on&utm_term=.d2c1eccab4ca). With almost [$1 billion](https://www.forbes.com/sites/alexknapp/2018/04/10/nearly-1-billion-was-invested-in-space-startups-in-1q2018-new-report-says/#5fdd019b285c) invested in space-focused startups in the first quarter of 2018, the commercialized space industry shows no sign of slowing down.

#### Private space appropriation is uniquely key to ensuring ongoing innovation towards space exploration and colonization.

**Cheng 20** [Dean Cheng, 09-16-2020, "Outer Space and Private Property," Heritage Foundation, https://www.heritage.org/space-policy/commentary/outer-space-and-private-property]//DDPT

Fully 53 years after the Outer Space Treaty, however, this has begun to change. The success of SpaceX, Blue Origin, Virgin Galactic, and other private companies has led to what has been termed Space 2.0.

The Obama administration’s decision to rely on commercial space-launch services to resupply the International Space Station opened the door to expanding private enterprise’s role in space.

The innovation exhibited in the various Falcon launches, including the ability to reuse the booster rockets, has seen a significant drop in the cost of placing payloads into orbit. As a result, a real opportunity exists for companies to begin thinking about how to use space not simply to improve terrestrial operations, but to make money from space and its physical resources.

The uncertainty associated with private property rights, however, has had a constraining effect on the ability to exploit space more extensively. Companies are unlikely to be willing to risk capital and assets if they are not sure that they will be able to profit from their investments.

#### The private sector is the key internal link to space exploration and colonization.

**Sharma 9/7** [Maanas Sharma, 9-7-2021, "The Space Review: The privatized frontier: the ethical implications and role of private companies in space exploration," The Space Review, https://www.thespacereview.com/article/4238/1]//DDPT

In recent years, private companies have taken on a larger role in the space exploration system. With lower costs and faster production times, they have displaced some functions of government space agencies. Though many have levied criticism against privatized space exploration, it also allows room for more altruistic actions by government space agencies and the benefits from increased space exploration as a whole. Thus, we should encourage this development, as the process is net ethical in the end. Especially if performed in conjunction with adequate government action on the topic, private space exploration can overcome possible shortcomings in its risky and capitalistic nature and ensure a positive contribution to the general public on Earth.

The implications of commercial space exploration have been thrust into the limelight with the successes and failures of billionaire Elon Musk’s company SpaceX. While private companies are not new to space exploration, their prominence in American space exploration efforts has increased rapidly in recent years, fueled by technological innovations, reductions in cost, and readily available funding from government and private sources.[1] In May 2020, SpaceX brought American astronauts to space from American soil for the first time in almost 10 years.[2] Recognizing the greatly reduced costs of space exploration in private companies, NASA’s budget has shifted to significantly relying on private companies.[3] However, private space companies are unique from government space agencies in the way they experience unique sets of market pressures that influence their decision-making process. Hence, the expansion of private control in the space sector turns into a multifaceted contestation of its ethicality.

The most obvious ethical concern is the loss of human life. Critics contend that companies must answer to their shareholders and justify their profits. This contributes to a larger overall psyche that prioritizes cost and speed above all else, resulting in significantly increased risks.[4] However, the possible increase in mishaps is largely overstated. Companies recognize the need for safety aboard their expeditions themselves.[5] After all, the potential backlash from a mishap could destroy the company’s reputation and significantly harm their prospects. According to Dr. Nayef Al-Rodhan, Head of the Geneva Centre for Security Policy’s Geopolitics and Global Futures Programme, “because there were no alternatives to government space programs, accidents were seen to some degree as par for the course… By comparison, private companies actually have a far more difficult set of issues to face in the case of a mishap. In a worst case scenario, a private company could make an easy scapegoat.” [6]

Another large ethical concern is the prominence capitalism may have in the future of private space exploration and the impacts thereof. The growth of private space companies in recent years has been closely intertwined with capitalism. Companies have largely focused on the most profitable projects, such as space travel and the business of space.[7] Many companies are funded by individual billionaires, such as dearMoon, SpaceX’s upcoming mission to the Moon.[8] Congress has also passed multiple acts for the purpose of reducing regulations on private space companies and securing private access to space. From this, many immediately jump to the conclusion that capitalism in space will recreate the same conditions in outer space that plague Earth today, especially with the increasing push to create a “space-for-space” economy, such as space tourism and new technologies to mine the Moon and asteroids. Critics, such as Jordan Pearson of VICE, believe that promises of “virtually unlimited resources” are only for the rich, and will perpetuate the growing wealth inequality that plagues the world today.[9]

However, others contend that just because private space exploration has some capitalist elements, it is by no means an embodiment of unrestricted capitalism. A healthy balance of restricted capitalism—for example, private space companies working through contracts with government agencies or independently under monitoring and regulation by national and international agreements—will avoid the pitfalls that capitalist colonialism faced down here on Earth. Even those who are generally against excessive government regulation should see the benefits of them in space. Lacking any consensus on definitions and rights in space will create undue competition between corporations as well as governments that will harm everyone rather than helping anyone. To create a conducive environment for new space-for-space exploration, one without confrontation but with protection for corporate astronauts, infrastructure, and other interests, governments must create key policies such as a framework for property rights on asteroids, the Moon, and Mars.[7,10]

Another key matter to note is restricted capitalism in space “could also be our salvation.”[11] Private space exploration could reap increased access to resources and other benefits that can be used to solve the very problems on Earth that critics of capitalism identify. Since governments offset some of their projects to private companies, government agencies can focus on altruistic projects that otherwise would not fit in the budget before and do not have the immediate commercial use that private companies look for. Scott Hubbard, an adjunct professor of aeronautics and astronautics at Stanford University, discusses how “this strategy allows the space agency to continue ‘exploring the fringe where there really is no business case’” but still has important impacts on people down on Earth.[12]

Indeed, this idea is a particularly powerful one when considering the ideal future of private companies in space exploration. Though there is no one set way governments will interact with companies, the consensus is that they must radically reimagine their main purpose as the role of private space exploration continues to grow. As governments utilize services from private space companies, “[i]nstead of being bogged down by the routine application of old research, NASA can prioritize their limited budget to work more on research of other unknowns and development of new long-term space travel technologies.”[13] According to the Council on Foreign Relations, such technologies have far-reaching benefits on Earth as well. Past developments obviously include communications satellites, by themselves a massive benefit to society, but also “refinements in artificial hearts; improved mammograms; and laser eye surgery… thermoelectric coolers for microchips; high-temperature lubricants; and a means for mass-producing carbon nanotubes, a material with significant engineering potential; [and h]ousehold products.”[2] Agencies like NASA are the only actors able to pursue the next game-changing missions, “where the profit motive is not as evident and where the barriers to entry are still too high for the private sector to really make a compelling business case.”[8] These technologies have revolutionized millions, if not billions, of lives, demonstrating the remarkable benefits of space exploration. It follows then that it is net ethical to prioritize these benefits.

This report concludes that the private sector, indeed, has a prominent role to play in the future of space exploration. Further, though private space exploration does bring the potential of increased danger and the colonization of space, these concerns can be effectively mitigated. Namely, strong government frameworks—particularly international ones—will minimize possible sources of ethical violations and ensure an optimal private sector role in space. This also allows government agencies to complete significantly more difficult, innovative projects which have transformative benefits for life on Earth.

Collins 10

7.2. High return in safety from extra-terrestrial settlement

Investment in low-cost orbital access and other space infrastructure will facilitate the establishment of settlements on the Moon, Mars, asteroids and in man[/woman]-made space structures. In the first phase, development of new regulatory infrastructure in various Earth orbits, including property/usufruct rights, real estate, mortgage financing and insurance, traffic management, pilotage, policing and other services will enable the population living in Earth orbits to grow very large. Such activities aimed at making near-Earth space habitable are the logical extension of humans’ historical spread over the surface of the Earth. As trade spreads through near-Earth space, settlements are likely to follow, of which the inhabitants will add to the wealth of different cultures which humans have created in the many different environments in which they live.

Success of such extra-terrestrial settlements will have the additional benefit of reducing the danger of human extinction due to planet-wide or cosmic accidents [27]. These horrors include both man-made disasters such as nuclear war, plagues or growing pollution, and natural disasters such as super-volcanoes or asteroid impact. It is hard to think of any objective that is more important than preserving peace. Weapons developed in recent decades are so destructive, and have such horrific, long-term side-effects that their use should be discouraged as strongly as possible by the international community. Hence, reducing the incentive to use these weapons by rapidly developing the ability to use space-based resources on a large scale is surely equally important [11] and [16]. The achievement of this depends on low space travel costs which, at the present time, appear to be achievable only through the development of a vigorous space tourism industry.

# Case

## 1

#### European commission isn’t an ext link- it just says the ozone necessary but not that we destroy it completely

#### No Link- very little of ozone depletion is caused by rockets

#### Uq overwhelms the link- the ozone is closing in the squo according to their UN 19 card, no reason that doesn’t continue to happen even if a few rockets get launched

#### No brink- no reason that private appropriation causes this- their ev just says rockets cause this

## 2

#### Giacomin based on Satalites, which aren’t appropriation and doesn’t mean it applies to resources from asteroids

#### Global ineq nonuq- you don’t lock it in at all

#### Resources in space aren’t limited like satalite space- functionally dev countries have access

## 3

#### REMS don’t run out for 900 years

Britannica https://www.britannica.com/science/rare-earth-element/Abundance-occurrence-and-reserves

As of 2017, known world reserves of rare-earth minerals amounted to some 120 million metric tons of contained REO. China has the largest fraction (37 percent), followed by [Brazil](https://www.britannica.com/place/Brazil) and Vietnam (18 percent each), Russia (15 percent), and the remaining countries (12 percent). With reserves this large, the world would not run out of rare earths for more than 900 years if demand for the minerals would remain at 2017 levels. Historically, however, demand for rare earths has risen at a rate of about 10 percent per year. If demand continued to grow at this rate and no [recycling](https://www.britannica.com/science/recycling) of produced rare earths were undertaken, known world reserves likely would be exhausted sometime after the mid-21st century.

#### Turn- Space mining solves resource shortages, specifically REMs

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Coping with the Scale and Complexity Problem The land area of the entire world is 148.94 million sq. km (or 57.506 million sq. miles), and its water area is 361.132 million sq. km (or 139.434 million sq. miles). About half of that land area is truly viable for year- round habitation when one eliminates most parts of Antarctica, the Arctic north, Siberia, the most dangerous mountain ranges and the most arid desert regions. Rising sea levels will further decrease available land areas. When one divides about 75 million sq. km by 10 billion people (or about 133 people people/sq. km) it becomes clear that rising global population and shrinking land areas and exhaustion of many types of natural resources—especially potable water— will be a growing problem.7 Figure 2.2 shows the volume of water in the world in comparison to the total volume of Earth. This graphic helps us to realize just how small the amount of potable water that is truly accessible today in comparison to a rising global population actually is. Figure 2.2 underscores the issue of just how difficult it will be to continue to provide key resources especially to major urban centers as global population continues to grow. And this is not just a question of sustaining human needs for water and natural resources. It is also a matter of sustaining endangered species of flora and fauna. The United Nations had done an analysis that shows the loss of species since 1800 and projections for the future show a very disturbing trend.8 The graphs in Fig. 2.3 that come from the U. S. Geological Survey seem to show a relationship between the rapid growth of the global human population in recent times and the increasing rate of extinction on species. The future availability of petroleum products and water is most often mentioned in studies of future resource scarcity, but broader studies have shown that the world by the mid twenty-first century will have many shortages. The following results from a detailed Global Nonrenewal Natural Resources (NNR) study came up with the following results, as shown in Fig. 2.1. 9 Although these results might vary somewhat from year to year based on economic downturns or upturns, the overall trend toward increasing shortages is clear. The upward mobility of the populations in China, India, Indonesia, and other newly industrialized companies suggest that up to three times more consumer demand for products and energy will be present by the middle of the twenty-first century. Only recycling and new energy sources can meet the great bulk of this burgeoning demand. Meeting the demand for natural resources has been identified as a problem by many that have researched this problem. The projections of shortages in the future are presented in Fig. 2.4 and in even greater detail in Fig. 2.5 are certainly of concern. As Chris Clugston’s detailed analysis of this subject has concluded: “