### Ozone

#### The use of propellants other than liquid hydrogen and liquid oxygen to fuel rocket launches is unjust.

#### That solves ozone because solid fuel rockets are the ones that burn the ozone layer

"We know that alumina does deplete ozone just from rocket launches themselves because a lot of **solid-fuel rockets** use, or have, alumina as a byproduct," Boley said. "That creates these little temporary holes in the stratospheric ozone layer. That's one of the biggest concerns about compositional changes to the atmosphere that spaceflight can cause."

#### Liquid hydrogen/oxygen are safe

Mortillaro 21 [Nicole Mortillaro, CBC News Senior Reporter, editor of the Journal of the Royal Astronomical Society of Canada, author of several books. "Rocket launches could be affecting our ozone layer, say experts." CBC, 4-22-2021, accessed 1-22-2022, https://www.cbc.ca/news/science/rocket-launches-environment-1.5995252] HWIC

There are different types of rocket propellants. Some, like liquid oxygen and liquid hydrogen, produce mainly water vapour and have little environmental impact. These were used in past shuttle launches and even in the Apollo-era Saturn V vehicles.

Then there are those that produce alumina particles in the stratosphere, such as those in solid rocket boosters, which were also used in past shuttle launches, and are still being used today by some launch companies.

Finally, there are those that deposit black soot in the stratosphere, such as kerosene used in SpaceX's Falcon 9 and Russia's Soyuz rockets.

It's the alumina and black soot that is most concerning to experts.

### ASATs

#### The use of Anti-satellite weapons is unjust.

#### The inclusion of remotely controllable thrusters on satellites is unjust.

#### Solves escalation – internal link isolated in Falco and Akoto ev is "new satellites bad bc hackers can drive them into the other satellites" but that can't happen if the satellite can't be steered remotely and only makes automatic course adjustments.

**The United States federal government unilaterally increasing funding for private sector space-situational awareness technology and integrating Battle Management Command, Control, and Communications, tactical intelligence, and intelligence, surveillance, and reconnaissance systems is just.**

**Solves collisions, assures allies, and avoids key sharing key secrets**

**Hitchens and Johnson-Freese 16** (Theresa Hitchens and Joan Johnson-Freese. Johnson-Freese is a professor of national security affairs at the Naval War College in Newport, Rhode Island. Theresa Hitchens is a Senior Research Scholar at the University of Maryland’s Center for International and Security Studies at Maryland (CISSM), and former Director of the United Nations Institute for Disarmament Research (UNIDIR). “Toward a New National Security Space Strategy Time for a Strategic Rebalancing,” Atlantic Council Strategy Papers, No. 5, 2016, <https://www.atlanticcouncil.org/images/publications/AC_StrategyPapers_No5_Space_WEB1.pdf>, WC)

Improved SSA is a foundational capability for any US space strategy in any and all circumstances, given the rapid changes in the space environment. The national space security community has recognized this repeatedly, although funding has arguably not been commensurate with the rhetoric. Attempts are now being made to rectify the funding situation because of the Russia/China threat scare. According to the Government Accountability Office (GAO), the Obama administration is planning to spend about $6 billion between 2015 and 2020 to beef up SSA capabilities—largely within the Pentagon, but also at contributing agencies NOAA and NASA.50 Calculating exact spending on SSA activities, however, is not possible due to the way the Defense Department tracks (or, rather, does not track) related spending. According to the GAO report:

• Compiling a budget for all SSA-related efforts is a challenge because many assets that support the SSA mission do not have it as their primary mission.

• DOD is not required to and does not track the budgets specific to its SSA efforts for multiple-mission systems, and it does not estimate what percentage would be allocated to SSA.

• For example, some portion of the ballistic missile defense sensors budget, which averages about $538 million per fiscal year over the next few years, supports SSA, but DOD does not track the efforts of multi-mission sensors in a manner that would provide such data.

• SSA-related efforts performed using intelligence community sensor systems are also not included in the core SSA budget because those efforts and their budgets are classified.51

SSA is also an area ripe for possible leveraging of commercial and foreign capabilities, both to **provide resilience** and to **complicate an adversary’s calculations regarding an attack**—one of the stated goals of the Obama administration’s NSP. However, that potential has yet to be fully exploited, and greater emphasis should be put on doing so.

On June 1, 2015, US Strategic Command (STRATCOM) initiated a six-month pilot program to research how to integrate commercial operators (and their SSA data) into the JSpOC, called the Commercial Integration Cell. The initial effort involves six operators: Intelsat, SES Government Solutions, Inmarsat, Eutelsat, DigitalGlobe, and Iridium Communications. The goal is to assess whether JSpOC operations can be enhanced via integration of industry capabilities and insights, and, if so, how.52 The pilot program comes after years of lobbying by industry, including through SDA, for closer cooperation and collaboration between commercial operators and the US military on space-object data tracking. One major hurdle has been that the computer systems and models used by JSpOC are antiquated, and incompatible with more up-to-date industry practices. While updates are planned, given the **lack of adequate budget resources**, this situation is not likely to be rectified anytime soon. This misalignment between **ways and means** should be addressed as soon as possible by the incoming administration.

Another question is the extent to which US allies will be allowed access to the improved SSA data, including the interference warnings and collision analysis it will provide.53 The issue with allies is not just technical, but also, and primarily, political. The uncertainty in the private sector about JSpOC-industry collaboration and data sharing is underscored by AGI’s COMSpOC. AGI is seeking to tap into the expanded (and unfilled by JSpOC) need for such data in the commercial marketplace, both in the United States and abroad.54

Lieutenant General John W. Raymond, Commander of the Joint Functional Component Command for Space, told the House Armed Services Strategic Forces Subcommittee on March 25, 2015, that STRATCOM is working on a new “**tiered SSA Sharing Strategy**.” Raymond stated: “The tenets of this strategy are to share more information in a timelier manner with the broadest range of partners. We aim to promote an interactive, exchange-based relationship with satellite 35 owners and operators where all parties gain. This open exchange of information also supports U.S. and allied efforts to **detect, identify, and attribute actions in space that are contrary to responsible use** and the long-term sustainability of the space environment.” He further noted that, as of March 2015, there were forty-six SSA-sharing agreements in place with forty-six commercial firms, eight nations, and two intergovernmental organizations, with ten more in the works.55 (The number of such SSA agreements, as of March 2016, is now at sixty-three.)56

The word “**tiered**” in Raymond’s statement **is central**, as part of the issue for the Defense Department is figuring out what data to share with whom, at what level of specificity and accuracy. There has traditionally been reluctance about “giving away the store,” particularly because many allies more closely integrate their civilian and military space operations, with less of a focus on **protecting national security secrets**. It is hard to underestimate the challenges— for example, simply regarding security clearances for access to US data. Further, some nations are leery of relying too closely on information provided by the US military. For this very reason, the European Union (EU) in 2009 launched an effort to pursue independent SSA capabilities— an effort that has proceeded in fits and starts, due to internal EU concerns about the sharing of both information and funding. As of early 2015, the nascent program is being funded by fourteen participating EU states, focusing largely on figuring out how to better coordinate European activities, but also looking at how to improve capabilities.57According to the European Space Agency (ESA): “To date, Europe’s access to information on what is happening in space has been largely dependent on non-European sources. In recent years, for example, data to trigger alerts on potential collisions between European satellites and debris objects have only come through the good will of other spacefaring nations. For this and other reasons, Europe needs an autonomous SSA capability.”58 It remains unclear how the EU SSA system, once established, will interact with that of the United States. This should be a major focus of future US space diplomacy and cooperation, to ensure that the systems are compatible and accessible—in part, to provide mission assurance.

The United States signaled its desire to forge the closest partnership on SSA sharing with Australia, Canada, and the United Kingdom, via a Memorandum of Understanding on Combined Space Operations, signed in September 2014.59 The details of the MoU, however, are vague.60 It should be noted that all three countries have assets that could contribute to US efforts, and would not simply benefit from a one-way absorption of US data.

Also, it is not only US allies who require better SSA in order to operate satellites safely and securely. More than seventy countries operate satellites, with 1,381 operating satellites in orbit at the end of 2015.61 Many of these operators lack sufficient SSA. In the July 2013 report adopted by the UN General Assembly in October 2013, the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities cited the need for improved global access to space data, both for safety purposes and for building trust. The report stated that, beyond a lack of space capacity, “the inability of many States to acquire significant space-based information” is a factor “contributing to the lack of confidence.”62 Russia has proposed to the COPUOS Scientific and Technical Subcommittee that the UN Office of Outer Space Affairs consider the development of an international, open database of on-orbit objects (both operational satellites and debris) to fill this gap.63 The United States and its allies have rejected the Russian proposal, largely for budgetary reasons, but the United States has been internally mulling over a possible proposition to create an informal international group to discuss the challenges to sharing SSA data and how to overcome them. This would be a promising first step, and a testimony to continued leadership in SSA by the United States, consistent with a national space strategy aimed at reducing risks. Inevitably, some form of open-access space-object database is going to be required, simply to ensure on-orbit safety—particularly in LEO, as the number of so-called Cubesats (very small satellites) rises 37 dramatically. **The United States should take the lead** on developing a workable space-traffic management regime underpinned by SSA.

**The U.S. is winning the military space race now, but quickly developing Chinese and Russian tech threatens primacy—a strong Space Force is key to stopping this constant threat**

**Roglin 11/30/21**

(Josh Roglin, George Washington University, BA in International Affairs; “A shadow war in space is heating up fast”, Nov. 30, 2021, https://www.washingtonpost.com/opinions/2021/11/30/space-race-china-david-thompson/)//HW-CC

When Russia blows up a satellite in space with a missile (as it did this month), or when China tests a new hypersonic missile (as it did last month), the ongoing arms race in space leaps into the news. But in between these “Sputnik”-like moments, outside the public’s view, the United States and its adversaries are battling in space every day. While Washington officials and experts warn of the risks of an arms race in space, the United States’ adversaries are constantly conducting operations against U.S. satellites that skirt the line between intelligence operations and acts of war. The pace of conflict is intensifying, according to a top Space Force general, who told me that China could overtake the United States to become the number one power in space by the end of the decade. “The threats are really growing and expanding every single day. And it’s really an evolution of activity that’s been happening for a long time,” Gen. David Thompson, the Space Force’s first vice chief of space operations, told me in an interview on the sidelines of the recent Halifax International Security Forum. “We’re really at a point now where there’s a whole host of ways that our space systems can be threatened.” Right now, Space Force is dealing with what Thompson calls “reversible attacks” on U.S. government satellites (meaning attacks that don’t permanently damage the satellites) “every single day.” Both China and Russia are regularly attacking U.S. satellites with non-kinetic means, including lasers, radio frequency jammers and cyber attacks, he said. Thompson repeatedly declined to comment on whether China or Russia has attacked a U.S. military satellite in a way that did permanent or significant damage, telling me that would be classified if it had happened. The Chinese military is quickly deploying ground-based systems for doing battle in space, such as lasers that can damage nosy U.S. intelligence community satellites, which could be considered an act of war. “The Chinese are actually well ahead [of Russia],” Thompson said. “They're fielding operational systems at an incredible rate.” Both the Russians and the Chinese are working on satellites that can attack other satellites, he said. For some time now there have been reports that China was developing a satellite that could claw another satellite or grab one with a robotic arm or a grappling hook. The Chinese government has several reasons to want to disable U.S. satellites, which have been useful in revealing concentration camps built to intern Uyghur Muslims and new Chinese nuclear missile silo fields. “We are still the best in the world, clearly in terms of capability. They're catching up quickly,” he said. “We should be concerned by the end of this decade if we don't adapt.”

#### Starlink is specifically key to modernize and secure navigation

[Mark Harris, award-winning freelance journalist originally from the U.K. but now based in Seattle. He was a Knight Science Journalism Fellow at MIT in 2013. "SpaceX’s Starlink satellites could make US Army navigation hard to jam." MIT Technology Review, 9-28-2020, accessed 1-22-2022, https://www.technologyreview.com/2020/09/28/1008972/us-army-spacex-musk-starlink-satellites-gps-unjammable-navigation/] HWIC

SpaceX has already launched more than 700 Starlink satellites, with thousands more due to come online in the years ahead. Their prime mission is to provide high-speed internet virtually worldwide, extending it to many remote locations that have lacked reliable service to date.

Now, research funded by the US Army has concluded that the growing mega-constellation could have a secondary purpose: doubling as a low-cost, highly accurate, and almost unjammable alternative to GPS. The new method would use existing Starlink satellites in low Earth orbit (LEO) to provide near-global navigation services.

In a non-peer-reviewed paper, Todd Humphreys and Peter Iannucci of the Radionavigation Laboratory at the University of Texas at Austin claim to have devised a system that uses the same satellites, piggybacking on traditional GPS signals, to deliver location precision up to 10 times as good as GPS, in a system much less prone to interference.

Weak signals

The Global Positioning System consists of a constellation of around 30 satellites orbiting 20,000 kilometers above Earth. Each satellite continuously broadcasts a radio signal containing its position and the exact time from a very precise atomic clock on board. Receivers on the ground can then compare how long signals from multiple satellites take to arrive and calculate their position, typically to within a few meters.

The problem with GPS is that those signals are extremely weak by the time they reach Earth, and are easily overwhelmed by either accidental interference or electronic warfare. In China, mysterious GPS attacks have successfully “spoofed” ships in fake locations, while GPS signals are regularly jammed in the eastern Mediterranean.

The US military relies heavily on GPS. Last year, the US Army Futures Command, a new unit dedicated to modernizing its forces, visited Humphreys’s lab to talk about a startup called Coherent Navigation he had cofounded in 2008. Coherent, which aimed to use signals from Iridium satellites as a rough alternative to GPS, was acquired by Apple in 2015.

“They told me the Army has a relationship with SpaceX [it signed an agreement to test Starlink to move data across military networks in May] and would I be interested in talking to SpaceX about using their Starlink satellites the same way that I used these old Iridium satellites?” Humphreys says. “That got us an audience with people at SpaceX, who liked it, and the Army gave us a year to look into the problem.” Futures Command also provided several million dollars in funding.

The concept of using LEO satellites for navigation isn't new. In fact, some of the first US spacecraft launched in the 1960s were Transit satellites orbiting at 1,100 kilometers, providing location information for Navy ships and submarines. The advantage of an LEO constellation is that the signals can be a thousand times stronger than GPS. The disadvantage is that each satellite can serve only a small area beneath it, so that reliable global coverage requires hundreds or even thousands of satellites.

Upgrade and enhance

Building a whole new network of LEO satellites with ultra-accurate clocks would be an expensive undertaking. Bay Area startup Xona Space Systems plans to do just that, aiming to launch a constellation of at least 300 Pulsar satellites over the next six years.

Humphreys and Iannucci’s idea is different: they would use a simple software upgrade to modify Starlink’s satellites so their communications abilities and existing GPS signals could provide position and navigation services .

They claim their new system can even, counterintuitively, deliver better accuracy for most users than the GPS technology it relies upon. That is because the GPS receiver on each Starlink satellite uses algorithms that are rarely found in consumer products, to pinpoint its location within just a few centimeters. These technologies exploit physical properties of the GPS radio signal, and its encoding, to improve the accuracy of location calculations. Essentially, the Starlink satellites can do the heavy computational lifting for their users below.

The Starlink satellites are also essentially internet routers in space, capable of achieving 100 megabits per second. GPS satellites, on the other hand, communicate at fewer than 100 bits per second

“There are so few bits per second available for GPS transmissions that they can’t afford to include fresh, highly accurate data about where the satellites actually are,” says Iannucci. “If you have a million times more opportunity to send information down from your satellite, the data can be much closer to the truth.”

The new system, which Humphreys calls fused LEO navigation, will use instant orbit and clock calculations to locate users to within 70 centimeters, he estimates. Most GPS systems in smartphones, watches, and cars, for comparison, are only accurate to a few meters.

But the key advantage for the Pentagon is that fused LEO navigation should be significantly more difficult to jam or spoof. Not only are its signals much stronger at ground level, but the antennas for its microwave frequencies are about 10 times more directional than GPS antennas. That means it should be easier to pick up the true satellite signals rather than those from a jammer. “At least that’s the hope,” says Humphreys.

**Space dominance is key to global peace – nuclear and conventional deterrence is collapsing, which will provoke civilization-ending revisionist aggression from Russia and China**

Dr. Robert **Zubrin 19**, Masters in Aeronautics and Astronautics and Ph.D. in Nuclear Engineering from the University of Washington, President of Pioneer Energy, Founder and President of the Mars Society, Senior Fellow with the Center for Security Policy, The Case for Space: How the Revolution in Spaceflight Opens Up a Future of Limitless Possibility, p. Google Books

The **U**nited **S**tates needs a new national security policy. For the first time in more than 60 years, we face the real possibility of a **large-scale conventional war**, and we are **woefully unprepared**.

Eastern and Central Europe is now **so weakly defended** as to **virtually invite invasion**. The **U**nited **S**tates is not about to go to nuclear war to defend any foreign country. So **deterrence is dead**, and, with the German army cut from 12 divisions to three, the British gone from the continent, and American forces down to a 30,000-troop **tankless remnant**, the only serious and committed ground force that stands between Russia and the Rhine is the Polish army. **It’s not enough**. Meanwhile, in **Asia**, the powerful growth of the Chinese economy promises that nation eventual overwhelming numerical force superiority in the region.

How can we **restore the balance**, creating a **sufficiently powerful** conventional force to **deter aggression**? It won’t be by matching potential adversaries tank for tank, division for division, replacement for replacement. Rather, the **U**nited **S**tates must seek to **totally outgun** them by obtaining a **radical technological advantage**. This can be done by achieving **space supremacy**.

To grasp the importance of space power, some historical perspective is required. Wars are fought for control of territory. Yet for thousands of years, victory on land has frequently been determined by dominance at sea. In the 20th century, victory on both land and sea almost invariably went to the power that controlled the air. In the **21st century**, victory on land, sea or in the air will go to the power that controls **space**.

The **critical military importance** of space has been **obscured** by the fact that in the period since the **U**nited **S**tates has had space assets, all of our wars have been fought against **minor powers** that we could have defeated without them. Desert Storm has been called the first space war, because the allied forces made extensive use of GPS navigation satellites. However, if they had no such technology at their disposal, the end result would have been just the same. This has given some the impression that space forces are just a frill to real military power — a useful and convenient frill perhaps, but a frill nevertheless.

But consider how history might have changed had the Axis of World War II possessed reconnaissance satellites — merely one of many of today’s space-based assets — without the Allies having a matching capability. In that case, the Battle of the Atlantic would have gone to the U-boats, as they would have had infallible intelligence on the location of every convoy. Cut off from oil and other supplies, Britain would have fallen. On the Eastern front, every Soviet tank concentration would have been spotted in advance and wiped out by German air power, as would any surviving British ships or tanks in the Mediterranean and North Africa. In the Pacific, the battle of Midway would have gone very much the other way, as the Japanese would not have wasted their first deadly airstrike on the unsinkable island, but sunk the American carriers instead. With these gone, the remaining cruisers and destroyers in Adm. Frank Jack Fletcher’s fleet would have lacked air cover, and every one of them would have been hunted down and sunk by unopposed and omniscient Japanese air power. With the same certain fate awaiting any American ships that dared venture forth from the West Coast, Hawaii, Australia and New Zealand would then have fallen, and eventually China and India as well. With a monopoly of just one element of space power, the Axis would have won the war.

But modern space power involves far more than just **recon**naissance satellites. The use of space-based **GPS** can endow munitions with 100 times greater accuracy, while space-based **communications** provide an unmatched capability of **c**ommand and **c**ontrol of forces. Knock out the enemy’s reconnaissance satellites and he is effectively blind. Knock out his comsats and he is deaf. Knock out his navsats and he loses his aim. In any serious future conventional conflict, even between opponents as mismatched as Japan was against the United States — or Poland (with 1,000 tanks) is currently against Russia (with 12,000) — it is space power that will **prove decisive**.

Not only Europe, but **the defense of the entire free world hangs upon this** matter. For the past 70 years, U.S. Navy carrier task forces have controlled the world’s oceans, first making and then keeping the Pax Americana, which has done so much to secure and advance the human condition over the postwar period. But should there ever be another major conflict, an adversary possessing the ability to locate and target those carriers from space would be able to **wipe them out** with the **push of a button**. For this reason, it is **imperative** that the **U**nited **S**tates possess space capabilities that are **so robust** as to not only assure our own ability to operate in and through space, but also be able to **comprehensively deny it** to others.

*Space superiority* means having better space assets than an opponent. Space supremacy means being able to assert a **complete monopoly** of such capabilities. The latter is what we must have. If the United States can gain space supremacy, then the capability of any American ally can be multiplied by orders of magnitude, and with the support of the similarly multiplied striking power of our own land- and sea-based air and missile forces be made **so formidable** as to render any conventional attack **unthinkable**. On the other hand, should we **fail** to do so, we will remain **so vulnerable** as to increasingly **invite aggression** by ever-more-**emboldened** revanchist powers.

For this reason, both **Russia** and **China** have been developing and actively testing antisatellite (ASAT) systems. Up till now, the systems they have been testing have been ground launched, designed to orbit a few times and then collide with and destroy targets below one thousand kilometers altitude. This is sufficient to take out our reconnaissance satellites but not our GPS and communications satellites, which fly at twenty thousand and thirty-six thousand kilometers respectively. However, the means to reach these are straightforward, and, given their critical importance to us, there is every reason to believe that such development is well underway.11

The Obama administration sought to **dissuade** adversaries from developing ASATs by **setting a good example** and **not working on them ourselves**. This approach has **failed**. As a consequence, many defense policy makers are now advocating that we move aggressively to develop ASATs of our own. While more hardheaded than the previous policy, such an approach remains entirely inadequate to the situation.

The United States armed forces are far more dependent upon space assets than any potential opponent. Were both sides in a conflict able to destroy the space assets of the other, we would be the overwhelming loser by the exchange.

## Case

### Collisions

#### Launches and debris are inevitable – space tourism and state programs

Impey 21 [Chris Impey, professor and deputy head of the department of astronomy at the University of Arizona. His astronomy research focuses on observational cosmology—using telescopes and other instruments to study the large-scale structure and evolution of the universe. He also does research on education and science literacy. "2021: More space launches than any year in history since Sputnik." The Hill, 12-29-2021, accessed 1-22-2022, https://thehill.com/opinion/technology/587630-2021-more-space-launches-than-any-year-in-history-since-sputnik?rl=1] HWIC

The pace of space exploration was frenetic in 2021, with major developments in space policy, and 2022 promises to be just as exciting. Let’s pause and look back on the space milestones of this year:

Moguls in space

It’s an indelible image of science fiction made real. Actor William Shatner, who played Captain Kirk in the original Star Trek TV series, choking up as he described his flight with Blue Origin, after he became the oldest person to reach space at 90 years old. “I hope I never recover from this,” he said.

This year saw three billionaires bolt from the starting blocks in a new commercial space race. First to go up was Sir Richard Branson in July, in the second suborbital flight of his SpaceShipTwo craft. He beat Amazon and Blue Origin founder Jeff Bezos by just nine days, but Bezos can claim bragging rights because his New Shepard craft flew above the Karman line, which is the official demarcation of outer space.

The third billionaire in this elite club is Elon Musk. The Tesla and SpaceX CEO also had a banner year, sending eight astronauts and a ton of supplies to the International Space Station for NASA, and his Inspiration4 mission was the first orbital spaceflight with only private citizens aboard. In a signpost for the future, Musk’s Starship, part of his plan to colonize Mars, stuck its first landing.

A fourth billionaire, Japanese fashion mogul Yusaku Maezawa — who doesn’t have his own rocket company — paid his way to the Space Station on a Russian Soyuz spacecraft.

For one brief moment in December, there were a record 19 people weightless in space, eight of them private citizens. The six tourist spaceflights in 2021 were also a record, and part of a resurgence in activity in space. There were 134 successful orbital missions, with China edging out the United States for the most by any country.

That’s more launches in 2021 than in any year in the history of the space program since Sputnik!

The new Wild West

If all this activity has a downside, it’s the fact that near-Earth orbits are getting crowded, a situation that will only get worse.

People looked anxiously to the sky in May, when a 10-story chunk of China’s biggest rocket plunged to Earth. It landed harmlessly in the Indian Ocean, but there will be many more uncontrolled reentries as China builds its space station. A more ominous event occurred in November, when Russia destroyed one of its own orbiting satellites. This created a vast cloud of fast-moving debris which forced astronauts in the International Space Station to take shelter in their escape spacecraft.

Space junk is a growing problem. There are 23,000 pieces of debris larger than a softball orbiting the Earth. But space junk moves so fast that any of the 100 million pieces larger than a millimeter could damage a spacecraft. In addition to launching 12 people into Earth orbit, SpaceX launched 800 small satellites in 2021. Musk’s eventual goal is 42,000 Starlink satellites to deliver wireless internet to remote parts of the world. These mega-constellations of satellites being launched by SpaceX and other companies will clutter low-Earth orbit. And they’re also bright, shiny objects that will adversely affect ground-based astronomy.