

Alcohol in Space: An Update

By Chris Carberry

Abstract

Non-traditional companies have joined the space industry in increasing numbers over the past decade. Alcohol producers are among the more intriguing new players hoping to stake their ground in space. Since the publication of *Alcohol in Space* in 2019, several new alcohol-related space projects have been launched and other existing projects advanced. These projects include aging a full case of Bordeaux wine in space, the upcoming launch of a microgravity champagne bottle, and new plans to produce and age significant quantities of alcoholic beverages away from Earth. These projects may benefit alcohol brands and products. However, the value of these investments goes far beyond the alcohol industry. Alcohol producers may see potential benefits for their brands and products by using the space environment, but they could also play an important role in the development of commercial space and the establishment of a permanent human presence in space. Their use of microgravity in space could contribute to critical technologies, capabilities, and processes, such as agriculture, fluid dynamics, human health and metabolism, distillation, and many other areas. The alcohol industry represents an important microcosm of the expanding diversity of the space exploration and development sector.

Keywords: Alcohol, space, wine, microgravity, product aging, distillation.

Background

Alcoholic beverages have been consumed in space by astronauts and cosmonauts for decades, but since most national space agencies officially prohibit these drinks, no formal research has been conducted to determine how humans metabolize alcohol in a microgravity environment. We currently only have anecdotal stories of how fermented drinks have impacted humans physiologically, and what role booze has played in the lives of astronauts/cosmonauts in space over the past sixty years.

This self-imposed ignorance will almost certainly come to an end in the next decade. As the era of commercial space blooms, public acknowledgement of alcoholic beverages in space is inevitable. Companies like Axiom, SpaceX, Blue Origin, Virgin Galactic, and others are launching ordinary people into space at an increasing rate. With this unprecedented expansion beyond Earth's atmosphere, the market for staples of ordinary life and culture here on Earth—such as alcohol—will also expand. Thus, alcohol will emerge from the spacefaring shadows. This public acknowledgement is essential—even for those who oppose the consumption of fermented and distilled beverages. Otherwise, this public taboo could hinder what could be an important aspect of human health in space.

This concern is not a product of science fiction or a problem that is many decades away. Beverage companies around the world are discovering the potential of this new market. Some are already using the space environment (or planning to) to benefit their products—and to enable future consumption of those products in space. As described in the 2019 book *Alcohol in Space* (by the author of this article),¹ the Scottish whisky company Ardbeg and the Japanese whiskey producer Suntory conducted separate aging experiments aboard the International Space Station (ISS). Even the American beermaking behemoth Anheuser-Busch entered the space-booze race, sending several barley experiments to the ISS, hoping to advance the day when it will produce beer in space or even on the surface of Mars.

Since then, numerous other space-related alcohol projects have emerged. Soon after the publication of *Alcohol in Space*, the wine industry joined this new potential industry. Twelve bottles of Petrus Bordeaux (2000 vintage) were launched to the ISS in November 2019 to observe whether wine ages differently in the space environment than it does on Earth. The WISE (Vitis Vinum in Spatium Experimentia) mission was a partnership between such entities as Space Cargo Unlimited, the University of Bordeaux's Wine Institute, and Nanoracks

The wine resided on the ISS for a total of 438 days, traveling more than 186 million miles. Upon its return to Earth in 2021, a blind taste test took place to determine whether the space-flown wine had evolved differently than the bottles that had remained on Earth. According to Space Cargo Unlimited co-founder Nicolas Gaume, the space-flown wine tasted "absolutely different" than the wine that had remained on the Earth's surface.² During a presentation at a meeting of the American Society for Gravitational and Space Research in 2022, the WISE team reported that its experiment "clearly supports an influence of oxygen on the aging of wine in relation to some components on [the] ISS. [This] kind of proof is only possible in Space with its microgravity environment. The changes in the wine we discovered are unique and cannot [be] identically recreated on Earth." Jane Anson of *The Decanter* concurred that the space-flown wine was distinct, explaining that it seemed to have opened up more and that "the tannins had softened, the side of more floral aromatics came out."³ This result could have significant implications for the future of the alcohol industry. Using the space environment could lead to unique products that can only be created outside the gravitational pull of Earth. While cost and

¹ Chris Carberry, *Alcohol in Space: Past, Present and Future* (Jefferson NC: McFarland & Company, 2019).

² CBC Radio, "As it Happens: How Does Wine Taste After a Year in Space? 'Wonderful,' Says the Man Who Sent It There," March 24, 2021, www.cbc.ca/radio/asithappens/as-it-happens-the-wednesday-edition-1.5962007/how-does-wine-taste-after-a-year-in-space-wonderful-says-the-man-who-sent-it-there-1.5962009.

³ Lucy Shaw, "Space-Aged Petrus Tastes 'More Floral' Than Earth-Aged Equivalent," *The Drinks Business*, March 25, 2021, www.thedrinksbusiness.com/2021/03/space-aged-petrus-tastes-more-floral-than-earth-aged-equivalent.

logistics will play a significant role in determining the practicality of such efforts, this could mark the beginning of one of the biggest innovations in the production of alcoholic beverages in centuries.

However, aging wine in space was not the only justification for this experiment. According to Gaume, "What I can say is that gravity and the absence of gravity are still poorly known phenomena, and this knowledge is always useful, especially in the current time of climate change. The fact that we chose wine is no coincidence because the vine is one of the first plants to feel and suffer the effects of climate change." Perhaps these types of experiments can also help us to understand and adapt to climate change better as we grow vital crops.

The space-flown bottles of Petrus would also have the distinction of being among the few bottles of wine to have flown in space (the first bottle of wine flew in space in 1985; A half bottle of 1975 Château Lynch-Bages flew on the Space Shuttle with French astronaut Patrick Baudry). One of the remaining bottles of space-aged Petrus was sold by Christie's auction house for an estimated \$1 million, thus becoming a proof of concept for future high-end products that are manufactured or modified utilizing the space environment.

The potential high-end market for space-flown (or even space-produced beverages) has caught the imagination of some American producers. In January 2023, Mystic Farm & Distillery of North Carolina announced its entry into the luxury space-alcohol market, hoping to be the first company to send American bourbon into space. Unlike the Ardbeg and Suntory experiments, Mystic plans to age its product in full-size whiskey barrels. By doing so, it will gain a more realistic understanding of how whiskey *really* ages in microgravity. Full-size barrels will also ensure it has a sufficient volume of this rare product to sell to wealthy individuals around the world. If all goes as planned, the initial experiment will produce 1,000 bottles of Mystic Galactic whiskey. In addition to several potential investors, Mystic plans to raise funds by offering individuals shares for \$75,000 each. For this investment, they will receive a 50ml sample of the space-flown whiskey, a 750ml (non-space-flown) bottle contained in a custom-made flight case, a piece of the whiskey barrel that that flew in space, and invitations to "ultra-luxury events." To assure potential investors that their investment will not be wasted on a failed effort, Mystic will return all the \$75,000 investments if the project never gets off the ground.⁴

For Mystic Farm & Distillery co-founder Jonathan Blitz, this project is not entirely driven by potential profit. Blitz has been inspired by space exploration since he was a child. He recalled that "As a high schooler in the 1980s, we were constantly told that space manufacturing would be the new frontier and that we would soon have all manner of biologics and materials manufactured in space. We were inspired to create a distinctive

⁴ Kirk Miller, "This Is the First Bourbon Aged in Space," Inside Hook, January 23, 2023, www.insidehook.com/daily-brief/booze/mystic-galactic-space-bourbon.

ultra-luxury bourbon, but the opportunity to create the first viable commercial product made in space really lit our fire.”⁵

This is not just a publicity stunt to sell the product. Mystic sees space as a potentially new and unique environment to barrel age its whiskey. Blitz noted that “The aging conditions of barreled spirits have long been known to have a substantial effect on the character and quality of the finished product.”⁶ For example, Mystic produces bourbons that are aged in the Piedmont region of North Carolina, benefiting from rapid temperature cycling and hot summers. This environment helps to produce a unique bourbon, but there are many potential aging environments that can also create distinctive beverages. According to Blitz, “Some companies have aged their spirits on ships, and a recent discovery of 150-year-old barrels of whiskey at the bottom of Lake Michigan has raised the prospect of deep-water-aged whiskey.”⁷

Blitz firmly believes that space alcohol will eventually be big business, and that Mystic is well positioned to lead a new market forward. “We believe that we are blazing a trail that others will undoubtedly follow,” observed Blitz. “The necessary price point and operational risks will likely leave the field open to smaller companies like ours for some time. We do expect the cost of launch and re-entry to continue falling, and that means more attainable price points for consumers.”⁸

Not to be outdone, another American space-booze project called Moonshine Distillery has set the ambitious goal of producing moonshine on the surface of the Moon. According to co-founder Adam Anderson, the concept also grew from his passion for space exploration. “At first, I just thought it was a lot of fun. But as I began to understand what it took to build a manufacturing platform that can act as an orbital distillery as the first step, on our way to building an actual facility on the moon to make moonshine, I really became super obsessed about the importance of space and its role in humanity’s future.”⁹

Like Mystic Galactic, Anderson also sees a major opportunity for luxury products that can help to fund new industries in space. He compared his proposed product to other rare/luxury items on Earth, particularly ones that have an interesting backstory. “When people buy collectible luxury products such as rare whiskies and spirits, they are doing it because of emotion,” stated Anderson. “The story matters, at least, if not more than the quality of the product. For space manufacturing to work you have to produce a product that generates enough revenue and profit to justify [doing it] again. Luxury items are one of the categories that check all the boxes for profitable early-stage manufacturing.”¹⁰ As

⁵ Interview with Jonathan Blitz.

⁶ Interview with Jonathan Blitz.

⁷ Interview with Jonathan Blitz.

⁸ Interview with Jonathan Blitz.

⁹ Interview with Adam Anderson.

¹⁰ Interview with Adam Anderson.

with most burgeoning space-related entrepreneurs of the last decade, Anderson is extremely ambitious: "In ten years I plan on being on the Moon, sipping some of our Moonshine," but these ambitions do not end with sipping moonshine on the Moon. "Along the way, we will have built small, reusable manufacturing platforms, we will perfect space-to-space supply chains, and we will fund the infrastructure necessary to produce positive and sustainable change for the planet."¹¹

In the end, however, it is about quality of life; truly living in space. Anderson recalls a conversation with one of the people attempting to build space hotels, whom he asked, "Do you mean to tell me that somebody is going to pay you \$40 million to spend a week in the space station and you are not going to be open to space whiskey?" The (paraphrased) answer was, "Hell no!"¹²

Indeed, quality of life is the central goal of renowned champagne producer Maison Mumm (as described in *Alcohol in Space*). As commercial space activities expand, Mumm envisions that guests on space hotels and other future facilities will drink their champagne, toasting to their extraordinary adventures in space. The company has developed a special bottle and microgravity champagne glass suitable for use in microgravity to enhance the conviviality of its orbital drinking experience. According to the Mumm website, "In order to comply with the dual space-AOC Champagne specifications, Mumm Cordon Rouge Stellar had to meet a complex set of constraints (e.g. gaseous liquid in the absence of gravity, pressure contained in the bottle, food compatibility, material specifications, size, ergonomics, and intuitive use)."¹³

The newest model of its bottle is now scheduled to fly with the Axiom Space Ax-3 mission, which is due to launch with SpaceX in January 2024. This will be their first step to enable "Mumm Cordon Rouge Stellar to participate in the pursuit of space exploration. Space travelers will be able to enjoy a product that comes from Earth's soil as well as the savoir-faire of humankind, a symbol of our culture. Champagne allows us to recreate an emblematic ritual of celebration and conviviality that brings us together."¹⁴

It remains to be seen, however, whether Mumm and other producers of carbonated beverages (such as beer) will be able to overcome a significant challenge that is unique to those types of beverages in microgravity. The carbon dioxide gas within these drinks behaves differently in a microgravity environment than it does in the 1g environment of Earth. In microgravity, the CO₂ in a carbonated drink does not rise to the surface of the beverage and disperse into the atmosphere as it does on the Earth's surface. It collects in a ball in the center of the drink and expands. A similar phenomenon occurs in the human stomach. As a result, when astronauts have consumed carbonated beverages in space,

¹¹ Interview with Adam Anderson.

¹² Interview with Adam Anderson.

¹³ G. H. Mumm, "Mumm Cordon Rouge Stellar," 2023, www.mumm.com/en-ww/news/mumm-cordon-rouge-stellar/.

¹⁴ Mumm, "Mumm Cordon Rouge Stellar."

they have reported stomach cramps and wet burps. Producers of carbonated beverages must solve this problem if they hope to serve their beverages in space.

Unlike Maison Mumm or Anheuser-Busch, the carbonation challenge will not be a problem for the whiskey industry. Following in the steps of Ardbeg and Suntory, famed Scottish whisky producer The Glenlivet has also entered the space alcohol world. In what it called “a giant leap for ‘dramkind,’” it partnered with the University of Guelph in Canada to send barley seeds to space.¹⁵

According to a press release, “The seeds were put to test last year as part of a study to see if they could withstand the effects of extreme conditions at the International Space Station and still be used to create a stellar new expression of The Glenlivet single malt.”¹⁶ Glenlivet’s marketing director, Jayne Murphy, explained that “We are always looking for new ways to innovate our single malt production and by partnering with the University of Guelph on their trailblazing space experiment, we had the opportunity to do exactly that.” The voyage into space was only the first step. Murphy added, “We are excited to see how the seeds will perform as they are planted, harvested, malted, and distilled into one of our iconic single malts. We hope it will produce a new, extraterrestrial expression with a wonderful taste.”¹⁷

For the University of Guelph, the project has greater implications than merely the interests of one company. “Historically when humans have discovered new land, they have produced alcohol, including whisky,” commented environmental scientist Mike Dixon. “As a whisky enthusiast, I want to keep this tradition going as we continue to explore the possibility of life on other planets. We look forward to working with The Glenlivet and following the journey of the barley seeds back on Earth.”¹⁸ As with the Anheuser-Busch project, Glenlivet’s experiment could also have implications for the sustainability of space agriculture in future years.

The space-alcohol trend is not just of interest to alcohol producers. The story has also inspired the documentary filmmaker Sam Burbank, who is directing a documentary film based on the *Alcohol in Space* book.¹⁹ Burbank believes that the story of alcohol in space is just a microcosm of a much bigger story. “For me it’s more a representation of the very fact that when you start to live in space, you bring all of humanity along with you, dreamers, drunkards, rockstars, geeks, and everyone and nearly everything else,” said Burbank. “So of course, alcohol will be part of that, just because it’s an important part of

¹⁵ David Morrow, “‘One Giant Leap for Dramkind’: Scottish Distillery Celebrates Barley’s Return From Outer Space, Prepares to Make Whisky With it,” *Whiskey Raiders*, September 1, 2022, whiskeyraiders.com/scotch/glenlivet-outer-space-barley-seeds.

¹⁶ Chivas Brothers, “Welcome to ‘Space’-Side: The Glenlivet Celebrates the Return of Space-Travelling Barley Seeds,” *Glenlivet News*, August 31, 2022, www.chivasbrothers.com/2022/08/welcome-to-space-side-the-glenlivet-celebrates-the-return-of-space-travelling-barley-seeds.

¹⁷ Chivas Brothers, “Welcome to ‘Space’-Side.”

¹⁸ Chivas Brothers, “Welcome to ‘Space’-Side.”

¹⁹ Culture in Space, “Alcohol in Space—Teaser,” 2023, vimeo.com/792808522.

life here.”²⁰ If humanity is ever to become truly spacefaring—to expand human civilization into space—human culture will play a large role in this endeavor. Traditions, customs, vices, religions, art, music, literature, sex, and all other aspects of being human will accompany us and evolve in these new footholds of civilization.

As such, Burbank created a new production company called Culture in Space Productions. Starting with *Alcohol in Space*, the production company will produce films examining human expansion into space from a cultural perspective. What makes us human? What does it mean to really *live* in space? The story of the role of alcohol in space was a logical starting point for Burbank. “I think the primary benefit of allowing our future explorers in space to share a drink from time to time is the camaraderie and relaxation that accompanies a drink with friends,” observed Burbank. “But there are so many facets to this story; people will just have to watch the full film just to hear the various and compelling reasons they are pursuing these endeavors. It’s a small part of a giant story (humans becoming spacefaring), but there’s something about alcohol that is so connected with the evolution of humanity throughout history. By telling this one story, this one facet of a larger story, you get a better sense of just what a phase change becoming spacefaring will be, how hard this will be, and how liberating it will be for our species.”²¹

Why Is This Important and Are These Plans Realistic?

Investment from the alcohol industry towards space-related projects is a positive development. By committing in these projects, processes, and promotions, alcohol companies are not only (potentially) benefiting their business, but they are also contributing to the expansion of the space economy, helping to create sustainability in space. While a significant amount of attention has been focused on the development of launch and crew vehicles (for good reasons), long-term sustainability in space will require thousands of other technologies and non-traditional players. This includes innovations enabling us to eat, drink, and breathe. It also includes advancements in medicine, artificial intelligence, agriculture, and many other capabilities needed to support every aspect of human life. As noted earlier, when companies like Anheuser-Busch invested in barley experiments aboard the ISS, they were also directly investing in space agriculture. Similarly, when other companies develop glassware for microgravity (or even Lunar and Mars gravity), the technology is beneficial to overall quality of life in space, and it advances our understanding of fluid dynamics in space. This knowledge is extremely important for matters that go well beyond consuming alcoholic beverages, including in the operation of vital space systems.

As the number of nontraditional companies (of all sizes) entering the space industry multiplies, we will likely see an acceleration in the speed of space development, new

²⁰ Interview with Sam Burbank.

²¹ Interview with Sam Burbank.

markets here on Earth, and new innovations critical to human space activities and quality of life on Earth. However, it remains to be seen whether many of the more ambitious plans, such as sending full barrels of whiskey into space or even distilling alcohol (in any sizable quantity), are viable over the next decade. One of the lessons of the past two decades is that commercial space plans are rarely as easy as they initially seem. For example, when SpaceShipOne won the Ansari X-Prize in 2004, Virgin Galactic was predicting the start of its private astronaut service in 2007. In fact, after two decades of development, that company only began commercial service in the summer of 2023. Nevertheless, access to low Earth orbit and beyond is now far more available than it ever has been in the past and more money is being invested in commercial space concepts than ever before. There has never been a better time for innovative companies of all kinds to enter the space sector.

Conclusion

Drinks have played a major role in human culture for thousands of years. These inebriating beverages will almost certainly influence our fortunes as our species expands into the cosmos. While there is unquestionably a dark side to alcoholic beverages, these fermented and distilled drinks have also generated substantial benefits throughout the development of human civilization in such realms as in agriculture, human health, comradery, ceremonies and religion, stress relief, and many other parts of life. Whether the role of alcohol in space is positive or negative is largely up to us. If we pretend that the consumption of booze has not taken place and/or is *not* inevitable in future years, the result is far more likely to be negative. We will remain hesitant to conduct the necessary science to understand the impact of alcohol on the human body in space better, and we will not acknowledge the positive role that responsible drinking can (and has) played in space to build camaraderie and relieve stress. By acknowledging this reality, perhaps the relationship between alcohol and humans will become more balanced and healthier as we live and work in space. As Adam Anderson states, "Humanity is going to the stars, but we can't leave the best of us behind when we go."²²

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²² Interview with Adam Anderson.



About the Author: Chris Carberry is the CEO and co-founder of Explore Mars, Inc. (Explore Mars), a 501(c)(3) nonprofit space advocacy organization. In this role, he has overseen Explore Mars’ annual Humans to Mars Summit, the largest annual conference focused on sending humans to Mars, and he has spearheaded dozens of programs, projects, and outreach efforts. Prior to joining Explore Mars, Carberry served as Executive Director of the Mars Society. Carberry has presented oral (and written) testimony to both the United States Senate and the United States House of Representatives. He is also the author of over 100 articles that have appeared in publications around the world, and he has been featured in over 100 national and international television and radio programs and podcasts. Carberry is the author of the 2019 book, *Alcohol in Space: Past, Present and Future*, which is currently being adapted into a documentary film for release in 2023. Carberry also has two books scheduled for release: *Scoring Space* (2023) and *A Future Spacefaring Society* (2024).