food
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jane levi

photographs courtesy NASA
...he had had no plates, spoons, forks, or napkins aboard. He had stretched out his hand to the food containers and taken the first tube there. On the ground it had weighed about 150 grammes but in space it was weightless. Inside the tube there had been a puree, which he had squeezed out into his mouth as if it had been toothpaste. For his second course he had had a meat and a liver pate, and had then washed all this down with some black currant juice, also out of a tube.
—Yuri Gagarin and Vladimir Lebedev, *Psychology and Space*

So proceeded the first human meal in space, eaten by the Russian cosmonaut Gherman Titov on 6 August 1961. Yuri Gagarin's flight into orbit a few months earlier marked the beginning of the space race, but if Titov hadn't proved that eating in weightless conditions was possible, human spaceflight would have been limited to day trips. No wonder the tube shot to fame as the ultimate in futuristic eating. In fact, tube feeding was hardly space-age even in the 1960s. These semiliquid, semisolid comestibles had first been developed in the 1940s and '50s for high-altitude and high-speed fighter pilots, and their use in the space program was a convenient re-use of existing technology. As journeys into space extended to durations of days and months, space food developed in a number of ways, from tubes and cubes of unrecognizable, vile-tasting mush to more familiar-looking and flavorsome food in cans and pouches. Now, as missions lasting years are being contemplated, space food is set to launch into a new phase that emphasizes self-sufficiency. Mirroring current earthly concerns about sustainable agriculture and local produce, onboard food production will be an essential component on the journey to Mars.

The creation of onboard farms and kitchens certainly has the potential to make dining in microgravity more appealing. Throughout its development there has been conflict between technological efficiency and culinary excellence in space food. Some programs treated food as an inconvenient necessity, while others saw it as a critical factor in well-being, morale, and performance. Were the astronauts Air Force daredevils, focused on their mission and impatient with the time wasted eating during short-term space travel? Or were they intellectuals, experimental astroscientists examining every aspect of long-term space living, who hence saw food as a primary consideration for the success of the mission? The quality of the food was highly dependent on the answer to these fundamental questions of approach.

When you consider the colossal budgets for space development in the second half of the twentieth century, it is surprising how bad the early food really was. The space programs were at the cutting edge of engineering and technological achievement, working with the best of everything, and many of the inspired inventions that emerged as solutions to space-travel-related problems have famously found their way into the daily lives of Earth dwellers: water purification systems, Teflon, ultra-lightweight textiles, digital cameras. A review of food-related space inventions is less impressive. Tang, rehydratable mashed potatoes, and freeze-dried ice cream are classic examples, and they can hardly be said to have improved our meals here on Earth, or sparked anything more than novelty interest.

It now seems extraordinary that a project focused on manned flights should have treated the human aspects of these grueling journeys as an afterthought, but in the US race to the moon the whole business of storing food, carrying food, eating food, and clearing up after eating was viewed as a major inconvenience, adding awkward weight and bulk to a tiny and already overloaded capsule. Food as an essential factor in the astronauts' comfort and psychological well-being was not given a high priority. One researcher in the late 1960s commented dismissively that "Interviews with each astronaut regarding his food likes and dislikes have proved to be of little value"
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(Vishniac and Favorite 278). When astronauts complained about their meals, their comments were met with irritation and a demand for “concrete evidence,” perhaps using obscure tools like the “Arthur D. Little Flavor Profile Method” (Sauer 56). Even in the 1980s it was being suggested that crews should think of their flights as “camping trips,” where inconvenience is tolerable because duration is limited (Sauer 20). Only in the last ten years have US nutritionists stated categorically that “Highly acceptable foods can play a primary role in reducing the stress of prolonged space missions” (Perchonok and Bourland 916).

From the beginning, the Russians took a different approach, perhaps because one of their objectives had always been to establish a long-term presence in space (on space stations), leading them to take seriously the realities of actually living far from Earth. Yuri Gagarin himself co-authored a book with the space psychologist Vladimir Lebedev called Psychology and Space, demonstrating how fundamental such psychological considerations were to the Russian program. The complexities of the dinner question were given their due importance: “Having a good meal is, of course, something more than downing one’s food. It’s a complicated process combining physiological and psychological elements. Even in a short flight tasty, favorite dishes can provide the astronauts with relaxation during their strenuous work” (27). The Russian cosmonauts’ tastes, preferences, and gastronomic opinions were taken into consideration when foods desirable for longer-duration flights were being developed. Vacuum-packed meals would only keep for a few days, and to preserve food longer, lyophilization (dehydration and compression) would be necessary. “It is only fair to say that this is not delightful a prospect [sic], but then science does call for sacrifices…” (Gagarin and Lebedev 28). US astronauts were not permitted such freedom of expression about their menus for several decades.

Long before space travel became a scientific reality, writers of fiction had given creative consideration to the practicalities of eating during journeys in space. Cyrano de Bergerac’s hero in Le Voyage dans la Lune (1657) is one of the first and most fortunate space dinners. He sups on vapors and breakfasts on the ultimate in convenience food: freshly shot larks that fall to the ground already plucked, roasted, and seasoned. Two hundred and fifty years later the heroes of H.G. Wells’s The First Men in the Moon (1901) took advantage of the scientific developments of their age by loading a selection of tinned, compressed foods and essences into their lunar sphere. Jules Verne’s straightforward idea, in De la Terre à la Lune (1865), that the crew simply “sat down to table and breakfasted merrily” in their rocket remains one of space fiction’s most compellingly human scenes. In reality, this vision of natural, convivial living without extreme technological intervention has proved very difficult to achieve. Oddly, once the space age began, fictional depictions moved even farther away from the realm of possibility. Perhaps to avoid the uninteresting reality of space food, most depictions in books and films are sheer fantasy; bright blue wine is served during dinner in Star Trek, and talking cows offer steaks from their own bodies in The Restaurant at the End of the Universe.

The ideas coming out of real-world space programs were often even more fantastic. In the late 1960s US researchers investigated the possibility of using bacteria as a source of food. They chose H. ephorba, which feeds on human urine, converting urea into edible protein; the scientists suggested that after being processed into a dry tasteless substance it could be flavored and made into biscuits or crackers. The mind boggles at the thought of hungry astronauts eating urine cookies. Fortunately, early trials were not successful: the substance caused nausea, vomiting, vertigo, and diarrhea. The experiment
was abandoned. Notably, the Russians had abandoned similar ideas at a much earlier stage, recognizing the “negative psychological effects” (Vishniac and Favorite 263–64).

One US researcher proposed building an edible spacecraft. He suggested that food with high carbon content could act as an effective heat or radiation shield; or that expendable parts such as fuel tanks, instrument casings, and launch facilities could be made from food. How they would taste after performing their primary function was not mentioned. Inspired by Japanese practices in World War II, he also proposed that clothing fibers could be made from edible materials such as soybeans, egg whites, and chicken feathers. In the panel discussion that followed the presentation of this paper, it was suggested that astronauts should be sufficiently motivated by the honor of selection to put up with this or any other innovative food solutions scientists might come up with (such as a liquid formula diet), no matter how disgusting they were. The astronauts’ responses to these proposals were not recorded, but there do not appear to have been any live trials.

The astronauts were not so lucky with other experiments. Technologists developed new extreme desiccation and compression techniques, allowing them to feed the Mercury astronauts in the early 1960s a range of identical bite-sized dried and compressed cubes, which rehydrated when chewed. Flavors included bacon, cheese and crackers, toast, peanut butter, and fruitcake, but it is doubtful that you’d be able to tell which one you were eating if the label had fallen off. NASA scientists were extremely worried about the possibility of crumbs—which could not easily be cleaned up—damaging equipment, clogging vents, and being inhaled by astronauts, and in an attempt to solve this problem various experimental coatings were applied to the cubes. Gelatine, starches, fat emulsions, and hydrogenated oils were all tried, but they either flaked, stuck together, or caused digestive problems. The Russians, on the other hand, decided to accept the inevitability of crumbs and instead think about how to collect them. The cosmonauts were therefore allowed fresh bread, salami, and candied fruit jelly, either made in or cut into bite-sized pieces, and given a small vacuum cleaner to clear up the worst of the mess.

The contents of both the tubes and the cubes had an unpleasant texture, disagreeable mouth-feel, and low palatability. Much of the food returned to Earth uneaten, and the astronauts lost weight. They further testified that conditions in space affected their senses of smell and taste, leading to cravings for stronger, spicier foods than they would have enjoyed on Earth. The precise effect on any individual is hard to predict, and because the food is chosen before departure astronauts have often been stuck with choices they no longer find appetizing. Given that astronauts have a 44 to 67 percent chance of suffering from several days of space motion sickness, and that one of the side effects of weightlessness is increased flatulence, it is perhaps fortunate that the sense of smell is diminished. Nonetheless, as missions grew longer through the late 1960s and early 1970s, and many other adverse physical effects of space travel became apparent, it also became increasingly clear that crews had to eat well. Even though it can’t be easy to tempt the palate in the smelly, stuffy, claustrophobic confines of a space capsule, flavor and palatability were recognized as critically important criteria for space food.

Nutritionists argued that the solution was to make the astronauts’ meals more familiar and appetizing, providing the variety of textures, appearances, and sensations we naturally crave in our food. The Russians had achieved this by turning to an existing, highly flexible technology: a large proportion of Russian space food was canned, and could be heated on board; even the earliest Soviet space stations had
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small ovens or warming trays. Refrigerators were also provided to store fresh produce. The Americans, driven by their ongoing concerns about bulk and weight, were keen to find new, cutting-edge solutions. To make the food itself lighter, and to avoid taking up valuable space with kitchen facilities, they developed dehydrated meals in pouches that could be rehydrated with waste or recycled water. The early attempts were revolting; initially only cold water was available and as a result one of Gemini's major discoveries was that astronauts don't like cold instant mashed potatoes. Even by the late 1960s and early 1970s when hot water began to be provided on the Apollo spacecraft and Skylab, these meals were only marginally more appealing. "I found that if I reconstituted the peas, the beans and the asparagus early, and then reheated them, Pete Conrad quipped, 'I still didn't like them, but they were a lot easier to choke down than when I added the hot water, shook up the bag and then tried to get them down'" (Crouch 246). Meanwhile the Russians were apparently tucking into meat croquettes, caviar sandwiches, and fresh fruit.

When the impact of good food and conviviality on human performance and physical well-being was at last recognized, the lot of astronauts began to improve. Space food technologists stopped trying to lead the way with innovative food solutions and instead looked to existing Earthly options. Thermostabilized (heat-sterilized) food in cans or pouches provided the astronauts with ready meals that didn't need to be rehydrated and massaged into life, and the first of these, on Apollo 8 at Christmas 1968, proved to be a genuine boost to morale. Jim Lovell said all the right things on the live link with Earth: "It appears that we did a grave injustice to the food people. Santa Claus brought us a TV dinner each which is delicious: turkey and gravy; cranberry sauce; grape punch—outstanding" (Apollo). The most enthusiastic responses to food during Apollo were for exactly this sort of comfort food; TV dinners to remind the astronauts of home.

Gradually, other classic American dishes like frankfurters, meatballs, and chicken à la king found their way onto the US menu, and the number of complaints began to fall. By the 1980s the NASA bill of fare included increasing quantities of ready-packaged foods, recognizable to anyone as "normal" meals.

Before the cost-cutting forced on them by the collapse of the Soviet Union, the Russian Space Agency sent up caviar and pâté for New Year's and birthday celebrations, delicacies rumored to have been washed down with bootleg vodka or cognac. For everyday eating, classic Russian favorites were supplied. Cosmonauts could choose from cabbage soup, rye or black bread, beef stroganoff, beetroot soups and salads, tvorog (cottage cheese with nuts), spiced and pickled perch, and buckwheat gruel. Fresh apples, onions, and garlic were delivered along with scientific equipment in Progress resupply vehicles. Cosmonauts were also known to eat the experimental plants they had grown in onboard experiments, especially onions; perhaps these helped to satisfy the craving for strong flavors as well as fresh food. French astronauts visiting the Russian Mir space station and later the US Space Shuttle set a new standard for space cuisine by bringing along canned gourmet feasts: boned quail in wine sauce, lobster, Alsace-style juggled hare, duck confit with capers, pigeons in wine-and-tomato confit, pâte de fruit, and cheese. The Chinese developed "Chinese food for Chinese astronauts," offering Szechuan gong bao chicken, shredded pork with garlic, eight treasure lotus porridge with lotus seeds and longan, and—appropriately—moon cakes.

Now that we are entering the next phase of manned space exploration, the fantastical and the actual have once again begun to collide. On Earth many people are increasingly challenging the industrialization of our food supply, and turning to organic, home-grown, and
natural solutions. Meanwhile, NASA is working out how to support a minimum two-year mission to Mars. The sheer impossibility of pre-packing enough food and keeping it for so long has led to the conclusion that self-sufficiency is the only way for such a mission to succeed. Once again, the example of the Russians in space, eating their own freshly grown produce, has shown the way. The Mars astronauts will grow lettuce, tomatoes, spinach, herbs, radishes, peppers, cabbages, and strawberries on board, and plans are afoot to hydroponically farm soybeans, wheat, rice, peanuts, and beans on arrival. Scientists from the European Space Agency have been working with the famous French chef Alain Ducasse to develop recipes from these ingredients. The technologists have a new set of plans, including growing meat from muscle cells in cell-culture fluid, and using high-protein spirulina algae as a food source. Whatever the final menu turns out to be, it is clear that rather than the heroic man-machines astronauts needed to be in the twentieth century, those of the twenty-first will have to be farmers and cooks. Throughout most of its history, space food has proved to be a technical success and a culinary failure. In the future, as interplanetary travelers themselves take control of the farm as well as the kitchen, a new space gastronomy worthy of the name may emerge.

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