In *Far beyond the Moon*, David P. D. Munns and Kärin Nickelsen tell a counter-history of the space age from the vantage point of “the problem of waste management” (p. 3). Something of an entry into the subdiscipline of discard studies, the book picks up the methodological challenge, put forth by anthropologist Mary Douglas some fifty odd years ago (in *Purity and Danger: An Analysis of Concepts of Pollution and Taboo* [1966]), to study the mechanism of social ordering via what is intentionally cast aside. For Douglas, dirt famously became a medium through which rituals of purity maintained a particular social formation. Similarly, waste in space, for Munns and Nickelsen, does not mark the absence of order within the artificial life support systems produced by the American and Soviet space programs but its very apotheosis. Human waste was fashioned as a scientific and technological problem through iterative efforts to reincorporate it into the large-scale project of rendering the hostile environment of space humanly habitable.

Accordingly, the two authors artfully dissect twentieth-century imaginaries of long-term inhabitation of space, arguing that futuristic visions of the colonization of the cosmos were subtended by a far more terrestrial problem: how to dispose of—or, more importantly, make useful—human waste. For many of Munns and Nickelsen’s actors, the closed ecology of the space cabin and space station would be literally rooted in human excreta. Indeed, it was the “operating assumption” of both American and Soviet scientists that “long-term life support in space required astronauts to use biological waste to grow their own consumables in meticulously controlled artificial environments” (p. 4). In this fashion, spacecraft were imagined not solely as vehicles per se; in their ideal form, they were “moving ecosystems” of humans, plants, and machines, tightly managed to ensure the most efficient use of enclosed biological material toward the goal of sustaining the human occupants (p. 9). Waste management, for these actors, thus became a problem not of disposal but of reintegration or, even, recycling; indeed, this is a story of “how bodily wastes—urine, feces, and sweat—became nutrients” (p. 17).

This story unfolds across five substantive chapters. The first, apropos of the book’s title, looks to the efforts of the National Aeronautics and Space Administration (NASA) “beyond the moon,” relocating the successful Apollo missions...
of the 1960s within a far broader imaginary of establishing long-term human habitation of space in the form of “space stations, interplanetary flights, and Mars missions” (p. 23). This amounted to a “biological conquest of space,” conducted via the vast network of NASA scientists and aerospace contractors endeavoring to build life support systems capable of sustaining astronauts for far longer—and even indefinite—lengths of time (p. 29). Munns and Nickelsen maneuver deftly through a litany of projects, some seemingly far-fetched, to construct artificial closed ecologies and populate them with terrestrial astronauts, often with suffocating results. Waste figured heavily in many of these projects, as efforts to close the “food-waste loop” attempted to secure precious nutrients for these mock astronauts. Perhaps inevitably, this proved frustrating, as engineers grew wide-eyed at the “known unknowns” with which biologists comfortably operated.

This theme is further explored in the second chapter, which places waste at the center of this “biological conquest” by tracing two competing mechanisms for dealing with it: the extraordinarily crude and self-explanatory fecal bag—exactly as abject as it sounds, if not more—and the comparably elegant algatron. Designed by sanitary engineers at UC Berkeley and, sadly, plagued by problems in development, the algatron made use of algae to recycle waste as food, water, and other useful products. Using methods drawn from the history of technology, the authors here are concerned with why defecating in a plastic bag, something intended as a stop-gap measure, became “viewed in retrospect as the natural method of dealing with feces in space” (p. 56). In the process, the chapter details the rise and fall of algae as a ubiquitous, all-purpose biotechnological solution for the Cold War world.

The third chapter attempts to put the machinations of life support scientists in international view, looking to Soviet scientists whose efforts to “study intensively the functioning of ecological systems and the use of algae and higher plants for the development of bioregenerative environments ... were more comprehensive and often earlier than the Americans’ attempts” (p. 72). Indeed, the work of the Siberia-based BIOS project greatly anticipated and even surpassed later attempts to engineer livable artificial ecologies. Soviet scientists spent as long as a year living within these “planet-ship ecological systems,” intended as a precursor to self-sustaining space stations that their American counterparts might only dream about (p. 74). As the authors note, this chapter is hampered in part by the difficulties, linguistic and otherwise, of doing comparative research on Cold War science. In English, at least, much of the history of Soviet space biology remains unwritten.

If early imaginaries of American space colonization crashed against the shores of the global recession of the 1970s, they were dusted off and repurposed as Ronald Reagan-era neoliberal spectacle. The fourth chapter examines NASA’s Controlled Environment Life Support System (CELSS) within the context of this brief resurgence. Reagan’s insistence on a space station program, a volley in a renewed Cold War, held open a frame for a resurgence of scientific research on the self-sustaining closed ecologies in space, beginning a new round of American experiments in closed ecology agriculture and waste management that drew, in no small part, on advances made by the Soviets. CELSS, however, took form within a newly utilitarian space program, marked by an image of the astronaut “commuting” to work via the rather pragmatic space shuttle, the cosmic equivalent of a long-haul truck or, less charitably, a minivan. Indeed, the International Space Station (ISS), perhaps the lasting legacy of the abortive Reagan station, largely eschewed the fruits of CELSS’s terrestrial experimentation. As Munns and Nickelsen note, “the ISS remains firmly tethered to resupply from earth,” reliant on shuttles to supply food and remove waste (p. 115).
In a gesture toward the continued utopian resonance of many of these projects, the final chapter of this book looks to Biosphere 2. Importantly, Munns and Nickelsen relocate Biosphere 2 within space history rather than its customary scholarly place within environmental history. Read as such, the Biosphere project becomes an extension of these earlier efforts by Soviet and American scientists, albeit “at a scale unmatched by previous attempts” (p. 123). This chapter proceeds accordingly, retelling the well-trod tale of Biosphere 2 from this different vantage point.

A key intervention of this book is thus to push back against a historiography that has perhaps too neatly placed the artificial ecosystems built by the American and Soviet space programs within a genealogy of the ecological sciences. Beyond a failed proposal by prominent ecologists Howard and Eugene Odom for an algae-based life support system, Munns and Nickelsen claim that “there is little evidence that the science of ecology had any influence on the engineering of life-support systems” (p. 32).[1] At NASA, biologists were tasked with working with engineers and physical scientists to produce life support systems within rubrics that would have been largely foreign to their ecological contemporaries, prioritizing both cost and weight efficiency and the survival of the human subject. Accordingly, Munns and Nickelsen argue that, while ecologists sometimes worked with isolated model ecosystems, this research was, appropriately enough, a world apart from the parallel endeavors of space biologists; ne’er did the two meet. Far beyond the Moon thus departs from prior scholarship, which has largely placed NASA’s ersatz ecosystems in close conversation with the work of ecological scientists, often citing Biosphere 2 as the culmination of this conversation. [2]

If there is a criticism to be made of this excellent book, one might suggest that the cultural and political meaning of human waste have gone slightly under-theorized. Bathrooms have long been powerful mechanisms for ordering bodies and enforcing the performance of gender, both in space and on earth. Although the authors make mention of the erasure of human waste management in space to preserve a heroic status reserved for (largely, male) astronauts, I think there is more here. If, as feminist scholars of science and technology have long argued, the astronaut looms large in the cultural formation of twentieth-century masculinity, what else might be said about abjection of the fecal bag in this broader context? Cultural scholars of space, take heed; there are gaps in the shit-erature.

One might further ask whether the waste produced by both astronauts and the space program was merely biological in nature. While this is beyond the authors’ scope, it might be quite productive to extend the insights of this book toward a consideration of both Cold War waste more broadly and “space junk” more specifically. The management of both nuclear waste and defunct satellites in orbit around the earth was parallel to and, most likely, occasionally overlapped with the problem of biological waste in space. Toward these ends, this book would make an excellent pairing with the recent work of historian Lisa Ruth Rand.[3]

A reviewer would be remiss not to comment on the quite effective use of scatological puns and jokes throughout this book. Let me respond in kind. Truly, this is the shittiest book in space history to date. By which, of course, I mean, this is quite easily the best book on space shit—or, more mundanely, waste management in space—yet written and an excellent addition to the space historiography, currently undergoing nothing less than a renaissance.

Notes

[2]. For one example of this historiography, see Peder Anker, “The Ecological Colonization of Space,” Environmental History 10, no. 2 (2005): 239–68.


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