Human Factors in Long-Duration Space phrase

The Space Age has transformed the way humans live on Earth (Aporta and Higgs 2005; Lacy, Atwater, and Powers 1988; Litfin 2002). Navigation satellite constellations coordinate the movement of both individuals and goods, and views of Earth from space are routinely seen on social media and in the news. We have also become accustomed to knowing that a tiny human population lives outside the planet in low Earth orbit. In fact, humans have lived for periods of up to 438 consecutive days in various space habitats since the first space station, Salyut 1, was launched in 1971. The current iteration of these space habitats, the International Space Station (ISS), has now been occupied continuously by at least two people for 20 years. Over this time, a space society marked by a distinct material culture has also evolved. Close to half of all humans who have traveled to space (249, roughly 42%) have been visitors to or crew of the ISS, the largest spacecraft ever assembled, as well as the longest inhabited (more than seven years longer than Mir by mid-2020). The ISS is a collaboration of NASA, Roscosmos, the Japanese Aerospace Exploration Agency (JAXA), the European Space Agency (ESA), and the Canadian Space Agency (CSA). People from 19 different nations have traveled there. It is therefore a “natural laboratory” to study the formation of a space-based culture.

Previous studies of space archaeology have addressed on- and off-Earth landscapes (e.g., Capelotti 2010; Gorman 2016; O’Leary and Capelotti 2015), and especially issues of heritage and preservation (Darrin and O’Leary 2009; Walsh 2012, 2015; Westwood, O’Leary, and Donaldson 2017). The explicit goal of the ISS Archaeological Project is to provide an understanding of material culture as a key component of life in space, on par with the research by biomedical and psychological scholars that has been ongoing since the 1960s. We take as our inspiration a phrase first used in the National Academy of Sciences report Human Factors in Long-Duration Spaceflight, which described a crowded spacecraft as “a microsociety in a miniship” (Lindsley 1972:23). There have been several investigations into the religious beliefs of space travelers (e.g., Weibel 2015), but few have considered the material culture that accompanies them. The negotiation of these beliefs is part of the formation of a space culture (or perhaps subculture). In this paper, we are less interested in precisely identifying those beliefs and more interested in how they are manifested materially. A premise of this archaeological study is that the most mundane object can simultaneously operate as a functional tool, a symbol, and a mediator of social relations.

Under the influence of science fiction, space culture is often conceived in the popular imagination as a realm of disembodied science where the messiness of earlier human cultures is sublimated by machines and smoothed by clean plastic and metallic surfaces, which symbolize the future (e.g., Scharmen 2019). The reality is that life in space, although constrained, is every bit as materially entangled as at any terrestrial archaeological site from the past (Hodder 2012) and is shaped by entanglements with contemporary social and political events. A challenge for the ISS since its inception has been the welding of social and technological cultures from around the globe into one enclosed, habitable space. Principally, this has been the domain of the former Cold War adversaries, the United States and the USSR. As well as separate engineering heritages, these now partners bring different approaches to domesticity, science, and the design and organization of space modules (most visibly their interiors).

One of our primary methods is the cataloging of people and elements of material culture (objects and built spaces) from photographs taken during ISS missions, or “expeditions,” as they are known (Buchli 2021; Gorman and Walsh, forthcoming; Walsh and Gorman 2021). We use photos because we are unable to visit the ISS and observe it directly as archaeologists. Such
a visit is cost prohibitive; moreover, the selection of social scientists—explicitly including archaeologists—as astronauts is prohibited by space agencies. The use of photographs in and of themselves as archaeological evidence is a relatively new phenomenon. Our method was inspired by De León (2015), who gave disposable cameras to migrants crossing the Sonoran Desert so that they could document experiences that he could not otherwise observe. The ISS photographs were likewise taken by crew of themselves as they performed various activities ranging from work to leisure. The crew receives training in photography prior to launch and sometimes receives direction from the ground about what kinds of images to capture; they were therefore aware that the photos might be published. The images used here were additionally selected for publication by NASA’s Public Affairs Office on its Flickr page (NASA 2020); they do not include all images that were made. The specific reasons for their being made and publicly distributed are thus complex and somewhat opaque, except for the fact that their publication is intended to promote a positive view of life on the ISS. Here, we describe an analysis of a series of 48 photographs dating between November 2000 (Expedition 1, the beginning of habitation of the ISS) and April 2014 (Expedition 39) that depict life in the Russian Zvezda module.1 This survey forms the first systematic investigation of the material culture of a space habitat. The photographs provide an extraordinary window on the lives, activities, beliefs, and interests of the ISS crew. In this study, we focus on practices of visual display. The items that crew members use to adorn the station walls alter the visual experience of the interior, provide a personal and earthly touch in the space machine environment, and say something about the values of the crew. It is also a material practice that sheds light on the evolution of a space culture. Designs for space architecture that acknowledge and accommodate inhabitants’ desires to modify the appearance of their shared living areas have never been implemented. Astronauts have improvised nevertheless. For example, in the US Node 1 module, on the door of the hatch leading to the Quest air lock, crew members created an expedient memorial to deceased colleagues, including photographs, name tags, and even a nameplate from a terrestrial door (fig. 1). Much of the “empty space” on the surfaces of Node 1 is decorated with stickers representing mission patches for all of the expeditions to date, resonating with similar displays at NASA, ESA, and JAXA centers on Earth (e.g., Kahler 2020).2 In the European Columbus module, on the door of the hatch leading to the US Node 2, a variety of items,

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1. The photographs used as source material in this study, as well as their associated data and metadata, have been permanently deposited in the Open Context repository with a Creative Commons license for distribution and reuse (https://opencontext.org/projects/157-archaeology-of-the-international-space-station, https://doi.org/10.6078/M7/Z0369Q).

2. In addition to plaques representing the patches mounted on walls in Johnson Space Center’s Mission Control Center, ESA’s Columbus Control Centre, and JAXA’s Tsukuba Space Center, patch stickers can be found adorning the outside of Kennedy Space Center’s Neil Armstrong Operations and Checkout Building, over a door where astronauts leave to meet their departing rockets; on the outside of the Zarya training module in the Space Vehicle Mockup Facility at Johnson Space Center; and even in the interior of the Node 1 replica in the same facility, where they have been placed in exactly the same configuration as in the real Node 1 on the ISS (on the basis of our observation in March 2017). By contrast, representations of mission patches are extremely rare at Russian space facilities, appearing primarily on...
including ESA mission stickers, an artwork by the French contemporary artist known as Invader, and a geocaching tag, are displayed (Blakemore 2015; fig. 2). The emphasis on mission stickers and colleagues, out of the entire range of such items that could be chosen, shows the importance of personal and institutional affiliations and connectedness to a space community of those who have gone before and those who will come after.

In the Russian part of the space station, the items displayed include imagery of Russian historic figures, Orthodox icons, and other religious items. Icons are a religious art form that emerged in the sixth century CE from more vernacular traditions of depicting Christ and other religious figures. Veneration of icons has always been a political act. In the eighth and ninth centuries, reactions against portrayals of Christ led to a period of iconoclasm. Icons went underground, as they did later under the state-sanctioned atheism of the USSR Communist regime from 1917 until 1991. A statement attributed to Yuri Gagarin, following his successful orbit of Earth in 1961, that “I looked and looked, but I didn’t see God,” typified a relationship between space, science, and Soviet ideology. Thus, the integration of icons into life on Russian space stations, alongside images of historic “space heroes,” is intimately linked to terrestrial politics.

Cultural Geography of the ISS

Planning for what would become the ISS began in 1982. The space station was originally intended as a US-only project; the Cold War was still in full swing (as suggested by the station’s previous name, Freedom). The fall of the Soviet government in 1991 and the subsequent emergence of European and American cooperation on the Russian Mir space station (1986–2001) led to the development of a joint project. The Russian cargo module Zarya was the first component to be launched, in November 1998, as the station’s original hub for power and life support (fig. 3: the ISS). It was followed the next month by the US module known as Node 1. Over the next 11 years, major modules added were Zvezda (Russia, July 2000), Destiny (United States, February 2001), Columbus (ESA, February 2008), and Kibō (Japan, July 2009), as well as a series of small connector and service modules belonging to NASA, ESA, and Roscosmos (most importantly the US Node 2 and Node 3 and the Russian Rassvet). In its fully constructed state (2010 and after), the habitable volume of the ISS is roughly 1,000 m³ (Kitmacher 2015).

Nationalities and Segments

As of mid-2020, there have been 63 expeditions to the ISS. Each expedition has lasted roughly three to six months, with 122 crew members taking part (many of them, especially Russian cosmonauts, doing so multiple times). The international nature of the crew is permanent. For the first 13 expeditions, until late 2006, the crews were composed exclusively of NASA and Roscosmos personnel. More recently, the United States and Russia have typically each placed two or three crew members on board, with

the inside of the shuttle bus that carries crew to the launchpad at Baikonur Cosmodrome (we thank Julie Patarin-Jossec for this information).

3. By mid-2020 (Expedition 63), Roscosmos had sent 47 cosmonauts to the ISS for a total of 14,584 person days. By contrast, NASA had sent 146 astronauts for a total of 14,984 person days. The average amount of time that an individual cosmonaut has spent on board is three times greater than that of an American astronaut (310 days compared with 103).
ESA or JAXA sometimes supplying the sixth occupant; CSA crew have been more occasional participants.

Management of the spaces on the ISS has been divided broadly between the “Russian Orbital Segment” and the “US Orbital Segment.” The segments meet at the Pressurized Mating Adapter, which connects the US Node 1 and the Russian Zarya modules (fig. 3). The division between segments is also evident from the distribution of both resources and costs among the ISS partner agencies according to international agreements. Roscosmos is responsible for 100% of the activities and expenses in its segment, while the other agencies have divided costs and resources for the rest of the station, such that NASA has a 76.6% share, JAXA 12.8%, and ESA 8.3%, and CSA 2.3% (NASA and RSA 1998; St.-Arnaud et al. 2013).

Analysis of the Zvezda Module Interior

From the very beginning of the station’s history, Zvezda has been a hub for all kinds of activity (fig. 4). From 2000 to 2009, there were only two permanent crew quarters for rest and privacy on the ISS; these were (and continue to be) located at the aft end of the Zvezda module. Although crews as large as four began serving on the ISS as early as 2006’s Expedition 14 and six crew members became the norm in late 2007, two more permanent crew quarters were added to Node 2 only in November 2008, followed by a second pair in August 2009. Following the addition of the new US permanent berths, the crew quarters in Zvezda began to be inhabited exclusively by Russian crew.

Given that one of the purposes of the ISS was to develop the human capacity to live in space, the ad hoc nature of provisions...
for something as basic as sleep seems remarkable. However, as Gary Kitmacher (2002:15) has noted, the original plans for the space station did not envision a long-term crew larger than three members. Planning for additional crew berths happened only after the earliest modules had already been built and placed in orbit. The disjunctions between what designers took into consideration for the physical disposition of interior spaces on the one hand and the needs and desires of crew on the other hand created opportunities for adaptation and reinterpretation (fig. 4).

In addition to two crew quarters, Zvezda also contains one of the two galleys on board, one of the two latrine facilities, and a treadmill for exercise. This module is also where crews display items such as paintings, photographs, flags, patches, and more (fig. 5). This phenomenon was visible from the first moment of habitation. Already in Expedition 1 (November–December 2000), a small icon (roughly 10 cm high) was placed at the highest point of the aft wall, in the center, making it highly visible from the primary direction of approach (fig. 6). This location implies that the icon had a particular significance for the Russian crew. Soon after, many more photographs and paintings, frequently pertaining to Russian Orthodox beliefs, were placed in this area. Unlike the displays in the US segment, these items appeared and disappeared over time; they were moved around and re-organized (fig. 7).

At certain moments, the religious items were drastically reduced in number or vanished completely from the photographs. The deployment of imagery of Russian heroes, Orthodox icons, and other religious items on the ISS is a material practice that sheds light on the evolution of a space culture. Each icon is a replica of an original sacred prototype, and none of any given type—apart from those to which miracles are attributed—is considered more significant than any others. Analysis of images in the Zvezda module reveals patterns over time in the placement of religious icons and pictures of Soviet space heroes that had not previously been observed, demonstrating the potential of archaeological methods to offer new insights into social behavior on the ISS. Indeed, in a separate article, we have identified the way the “niche” and activities around it functioned to create a hierotopy, or a formally constructed sacred space with defined boundaries, purposely arranged structures or decorations, and the performance of specific activities (Salmond, Walsh, and Gorman 2020; see also Lidov 2006).

Images of Soviet space heroes also appeared early on. These heroes include the first human in space, Yuri Gagarin; the Russian scientist who, in the early twentieth century, first theorized life in space and conceived of multistage rocketry, Konstantin Tsiolkovsky; and the original director of the Soviet space program, Sergei Korolev (fig. 8). They most frequently appear in a niche directly over a portal that leads to the docking adapter for Soyuz and Progress vehicles—in a sense, they are located over one of the station’s front doors. The Russian crew visually lay claim to a significant space heritage by their display of these portraits in such a prominent position. Since Zvezda has been one of the most frequent venues for videoconferences with Earth

Figure 5. From left to right, NASA astronaut Michael Barratt, Japanese Aerospace Exploration Agency astronaut Koichi Wakata, and Hungarian American space tourist Charles Simonyi (Expedition 19, March 28, 2009) are shown in front of the aft wall of Zvezda. On the wall are, clockwise from top center, a gold cross and Russian flag, a mission patch for the Soyuz TMA-13 vehicle, a patch for the Russian cosmonaut corps, a photo of Konstantin Tsiolkovsky, an icon of the Mother of God of Kazan, a toy spacecraft based on the Russian Kliper prototype, a small landscape painting, a photo of Yuri Gagarin, another photo of Tsiolkovsky, a miniature painting of the Troitse-Sergieva Lavra church, and icons of Saint Sergius of Radonezh and Christ. Another icon of the Mother of God of the Sign with saints is visible over the crew quarter door in the far upper right corner. Photograph courtesy of NASA, used with permission.
Figure 6. Roscosmos cosmonaut Sergei Krikalev (Expedition 1, December 2000) exercises in front of the aft wall of Zvezda. In the center of the “top area” is a small icon of Saint Theodor Tiron. To the left, above Krikalev’s head, is a mission patch for STS-106, a prehabitation flight by the space shuttle *Atlantis* to the International Space Station in September 2000 that stocked the station with supplies for Expedition 1. Photograph courtesy of NASA, used with permission.

Figure 7. Roscosmos cosmonaut Oleg Kononenko (Expedition 17, July 17, 2008) works in front of the aft wall of Zvezda. In the top area, from left to right, are icons of Saint Sergius of Radonezh and Saint Nicholas, a mission patch for Expedition 17, a gold cross, a Russian flag, a mission patch for Soyuz TMA-12, a patch for the Russian cosmonaut corps, and an icon of the Mother of God of the Sign with saints. In the niche area, from left to right, there are a photo of Konstantin Tsiolkovsky, a photo of Yuri Gagarin, a toy spaceship in the form of the Russian Kliper prototype, an icon of the Mother of God of Kazan, and another photo of Tsiolkovsky. Photograph courtesy of NASA, used with permission.
audiences, the displayed items are placed in a location that also makes them visible beyond the ISS.

We cataloged 414 instances of 75 unique items on display in 48 historic images dating from 2000 to 2014. All of the images were accessed from NASA’s Johnson Space Center public Flickr account (NASA 2020). Each photo was chosen because it showed some change in the configuration of items in the aft space of Zvezda relative to earlier images. The locations of the items were also recorded so that their appearance, disappearance, movement, and relationships to other items and the general area could be assessed. The results revealed spatial and symbolic patterns. First, the items appeared in waves, rather than simultaneously or at a steady pace (fig. 9). Periods when large numbers of items were on display occurred in November 2002 and early 2008 through the end of 2009, while few items appeared between 2004 and 2005 and there were few items again in 2011–2012. It is

Figure 8. NASA astronaut Tim Kopra (Expedition 47, April 12, 2016, the fifty-fifth anniversary of Yuri Gagarin’s flight) is shown in front of the “niche.” In the niche are a Russian flag with the words “Ya lyublyu Rossiyu” (I love Russia) printed on it and, from left to right, four photos, of Konstantin Tsiolkovsky, Sergei Korolev, Yuri Gagarin, and Gagarin and Korolev together. Photograph courtesy of NASA, used with permission.

Figure 9. Chart of item counts per photograph for Zvezda’s aft wall, November 2000–April 2014. Chart by Justin St. P. Walsh.
notable that the second period of increase corresponds to the time when Zvezda started to be inhabited only by Russian crew, beginning in 2008.

Religious items specific to Russian Orthodoxy made up one-third of the items (138 instances of display vs. 276). They made up a notably larger proportion of items on display between late 2006 and late 2008, peaking in early 2008 with nine religious items compared with six secular ones (fig. 10). The most common object type on display was photographs (27% of all items), followed by icons (20%); other pictures, such as landscape paintings (17%); mission and agency patches (11%); flags (8%); and other religious items, such as Orthodox crosses, relics, and books (6%). The photographs primarily consisted of images of Soviet space heroes. Among the religious items were copies of the New Testament, a gold cross, and a reliquary cross of Saint Athanasius. Seven icons appeared in the Zvezda photos: a small icon of Christ, a medium icon (roughly 25 cm high) of the Mother of God of Kazan, the Mother of God of the Sign surrounded by saints, a miniature icon of Saint Nicholas, a small icon of Christ PANTOCRATOR, a medium icon of Saint Sergius of Radonezh, and a large icon of the Mother of God of Kazan. Other icons known from news sources to be present on the ISS during this period were apparently not displayed on the aft wall when the photographs in the Flickr archive were taken.

There were two significant zones of display: the niche, the setback area of the aft wall directly over a portal leading to the crew and cargo vehicles, and, located over the niche, the “top area,” which was probably the most prominent zone for placement. Between 2000 and 2014, item types appeared as follows: 74% of the photographs appeared in the niche, 58% of the other religious items, especially crosses, appeared in the niche, 48% of the icons (a plurality of them) appeared in the top area, 64% of the flags appeared in the top area, and 73% of the mission patches appeared in the top area. These patterns seem to indicate different meanings associated with the two zones—a mostly secular shrine to space heroes below and a more religious and nationalistic area up above.

When we turn our attention to specific items, other patterns emerge. The most common item was a famous photograph of Gagarin holding a dove, a widely accepted symbol of peace. This image was first seen on board the ISS during Expedition 2 (April 2001), probably in commemoration of the fortieth anniversary of his flight (fig. 11). It was first displayed on the aft wall in 2002, during Expedition 5, and it has appeared on the wall in every single photograph taken of Zvezda’s interior from that point forward. With one exception, when it was placed in the top area in the center, it has appeared in the niche. By contrast, the second most common item was an icon of the Mother of God of Kazan (fig. 12), which appeared 25 times following its first appearance during Expedition 2 in 2001 (fig. 13). Half of these times, it was placed in the top center position. A small Russian flag appeared in 19 images (i.e., 40% of the time). This was three times as frequent as the next most common flag (which belonged to the United States). Seventy-four percent of the time, the Russian flag was in the top area, especially top center. These examples seem to underline the implicit significance of different display zones on Zvezda.

Identifying a Russian Space Station Culture: Space Heroes, Icons, and the Origins of a Tradition

Historic Context of the “Trinity”

In more recent years, the niche area over the portal became the primary—indeed, practically the exclusive—space for the placement of the images of Soviet space heroes. Portraits of Tsiolkovsky and Gagarin, both alone and together, were abundant in the Soviet Union and later in Russia from the 1960s onward (Thomas 2010:16–17, 111–115, 122). Korolev, whose identity was a state
secret until his death in 1966, began to appear in portraits in the 1970s (Siddiqi 2010). The three men have been described as a kind of secular “holy trinity” in the atheist late Soviet Union (Thomas 2010:69); they were promoted by the state as national heroes, similar to the general secretaries of the Communist Party, through the dissemination of their pictures. Images of Tsiolkovsky, Korolev, and Gagarin appeared in sculptures, stamps, paintings, mosaics, and other state media, as well as in popular culture. For example, Tsiolkovsky and Gagarin were prominently featured in a scene from Andrei Tarkovsky’s film Solaris (1972), where their portraits formed the backdrop to a meeting of an official space commission (Thomas 2010:53; fig. 14).

Traditions of Display

Hero portraits also appeared in the earlier Salyut and Mir space stations. While some cosmonauts have commented on the act of bringing icons to space (Salmond, Walsh, and Gorman 2020), none have spoken about the use of images of space heroes or why a particular item might be placed in a specific location. The analysis of material culture that follows is not a quantification analysis similar to the one above for the ISS, however, because the imagery from earlier space stations is both rare and difficult to acquire. One example appears in an image from the Mir EO-23 mission in early 1997 where a photo of Gagarin is clearly visible above NASA astronaut Jerry Linenger (fig. 15). To the right of this image was another one depicting Tsiolkovsky and, slightly lower, a calendar with a photo of a Soyuz rocket launch and an inset portrait of Korolev. Another photograph, from the earlier
Mir EO-20 mission in 1996, shows that there had previously been two icons flanking the Gagarin portrait (fig. 16). The placement of the icons, with their formal presentation-style hinged frames, seems carefully organized around Gagarin, creating a shrine-like, ritualized space to bring the atheist past and the religious present together. Below are the three crew members; behind them were placed flags of Russia and the ESA, indicating that the background for the photo was carefully chosen, constructed, and framed. All of these items were located in the top area of the aft wall of the Mir Core Module (the main living space on that space station), directly over the passageway leading to the primary docking adapter for visiting Soyuz and Progress spacecraft. In other words, the pictures were in precisely the same location in Mir as the later images on the ISS were in Zvezda. The Mir Core Module, whose form derived from the so-called durational orbital station type, which included all of the seven Soviet Salyut stations from 1971 to 1986, was itself the basis for Zvezda’s design (Harland 2005; figs. 17, 18). In fact, Zvezda was originally designed and built to serve as the core of Mir-2, a planned Russian successor to the original Mir station. In general terms, they share a highly similar layout, to the extent that one NASA astronaut who visited Mir and Zvezda reported a sense of déjà vu (Chladek 2007). Moreover, nine Russian cosmonauts flew on at least one Salyut and on Mir; 15 other cosmonauts flew on both Mir and the ISS. Traditions including the decoration of the walls and (in the post-Soviet period) the
Figure 15. NASA astronaut Jerry Linenger (Mir expedition EO-23, February–May 1997) floats in front of the aft wall of the Mir Core Module. Behind him in the “top area” is a photo of Yuri Gagarin in his flight suit, with a portrait of Konstantin Tsiolkovsky to the right and a small landscape painting to the left. Photograph courtesy of NASA, used with permission.

Figure 16. Crew of Mir expedition EO-20 (from left to right, cosmonauts Sergei Avdeyev and Yuri Gidzenko—with a golden EuroMir 95 mission patch behind his head, reminiscent of a halo—and European Space Agency [ESA] astronaut Thomas Reiter, September 1995–February 1996) pose in front of the aft wall of the Mir Core Module. Above their heads is a photograph of Yuri Gagarin in his flight suit, flanked by two icons of Saint Anastasia. Photograph courtesy of ESA, used with permission. We thank Joachim Becker of spacefacts.de for access to a high-resolution version of this image.
collaboration of cosmonauts with church authorities to transport icons and relics to space were likely transmitted from one group of crew members to another. The social links between and among these crew can be mapped to show how such cultural transmission could happen (fig. 19).

The display of Russian space heroes on the aft wall of Zvezda is a sign of a broader Russian space station cultural practice, with continuity from one station to another and spanning the Soviet and post-Soviet periods. In a black-and-white still image from a videoconference with the first crew of Salyut 5 (July–August 1976), an official portrait of Gagarin in military uniform was carefully centered between the two cosmonauts (fig. 20). A copy of this portrait later appeared in Zvezda’s top area in Expedition 2. The Salyut 5 photograph is the earliest identifiable example of the phenomenon of using images (of whatever kind) to decorate the interior of a Russian space station. The third crew of Salyut 5 (February 1977) can be seen in a similar video still, this time with an image of Soviet leader Leonid Brezhnev behind them. The timing and formal placement of these images may indicate that these were official rather than personal displays.

The gradual transformation of the interior space of the cosmonauts’ quarters over their long history mirrors this trend of displaying images and objects unrelated to the mission. What changes are the kind of images, their placement, and the frequency of their appearance. Images of Gagarin were frequent. Tsiolkovsky appeared occasionally on Mir (but apparently not the Salyut stations), and Korolev was barely present. There was also an overall shift from an unorganized display with little visual hierarchy or intentionality to a relatively organized, although never static, visual field. In the 1970s, the personal effects of the cosmonauts were scattered wherever a place could be found for them. A calendar with a photo of the beloved singer Vladimir Vysotsky was displayed on Mir in EO-3 (1987), while a graphic portrait of Futurist poet and revolutionary icon Vladimir Maiakovskiy was placed on the “ceiling” of Salyut 7, probably in honor of his birthday, and glossy advertisements for cars can be seen in other photos—choices that reflect the private lives and enthusiasms of individual Soviet citizens. In the early 1990s, the interior space of the Soviet modules underwent a noticeable change. In the middle of the Mir EO-9 mission (May 18–October 10, 1991), the Communist Party was overthrown. The red Soviet flag was replaced by the tricolor flag of the former Russian Empire. A degree of hierarchy or order was now established for visual displays.

Figure 17. Salyut 7 space station (1982–1986; aft end at lower left). Diagram courtesy of NASA, used with permission.

Figure 18. Mir Core Module (1986–2001; aft end at upper right). Diagram courtesy of NASA, used with permission.
the space as domestic: a re-creation of the icon corner, the space in an Orthodox home where revered family icons are displayed. The symbolic associations of this devotional space were so ingrained in Orthodox Russian consciousness that, after the death of Vladimir Lenin in 1924, its format was co-opted for the purposes of immortalizing the dead leader, and “Lenin corners” (or “red corners”) subsequently became a common feature of public and private life in the USSR (Buchli 2000). The reemergence of icon corners in homes and private spaces after 1991 has been a particularly potent symbol of Communism’s demise and the Orthodox Church’s resurgence.

Space stations, from Salyut to the ISS, embody a series of tensions between laboratory and home. Attention to habitability is meant to resolve these tensions, providing a space designed so that crew comfort contributes to their productivity. Soviet space stations had pastel interiors intended to create a “homey” feel (Bluth and Helppie 1986:i:110; Meuser 2015). This was, however, a home without women (who, even now, make up only 11.5% of all people who have traveled into space and 14% of ISS long-term residents). Svetlana Savitskaya, the second woman in space, spent time on Salyut 7 in 1981 and 1983; the next female cosmonaut was Yelena Kondakova, who stayed on Mir for five months in 1994–1995. Yelena Serova was the fourth female cosmonaut and so far the only one to visit the ISS, in 2014–2015. In contrast to the ubiquity of Gagarin’s image in the Zvezda module, it is notable that the first Soviet woman in space, Valentina Tereshkova, does not appear once. In this framing, to be reminded of home by the spatial symbolism of the icon corner may be to reinforce the gendered separation of space from home in USSR and Russian ideology. An additional possibility, not necessarily precluding the first hypothesis, is presented by the appearance of a portrait of Alexei Leonov, the first person to perform a space walk, in the niche for the first time in mid-2020. Leonov died in October 2019, suggesting that the niche might be reserved for deceased space heroes, similar to the US memorial in Node 1 (described above). Since Tereshkova is still living, she may be considered ineligible for memorialization.

The phenomena shown in the photos confirm our original suggestion that even if the ISS is “international” in many respects, there are not only distinctly national features but also national customs that can and do frequently occur. No religious items have been observed yet in publicly available images of the US, European, or Japanese modules (even though the religious beliefs of many American astronauts have been well documented; Weibel 2015). The Zvezda objects are therefore notable. The absence of religious imagery in the US Orbital Segment modules, even as other kinds of display have emerged over time, is itself a reflection of one aspect of American culture—the claim of separation of church and state, although in daily terrestrial life the United States’ historical roots in Christianity are often highly visible. Such symbolism has not carried over into US spaces in space.

Since at least 2017, it appears that there have been no icons displayed on Zvezda’s aft wall, although they have been seen in recent images and videos of other parts of the module. During
the arrival of the Expedition 57 crew in June 2018, there were no religious items on the wall—only the photographs of Gagarin, Tsiolkovsky, and Korolev. The gold cross returned to the wall in time for the arrival of the Expedition 61 crew in July 2019. The coming and going of images and objects in the Zvezda niche suggest that this location continues to play an especially important part in the highly ritualized division of space on the ISS, where nations typically work hard to stress international collaboration. The contents of the niche fluctuate back and forth between a celebration of Russian, Orthodox, and patriotic values and the old secular rhetoric of the Soviet program centered around space heroes. Paradoxically, this pattern gives the post-Soviet Russian Orbital Segment of the ISS some of the qualities of Soviet-era society: a continued differentiation between “us” and “them” and a self-conscious awareness that by using images in certain ways, visual statements are being made about Russia’s assertive presence in space and in the geopolitical arena. The persistent presence of the image showing Gagarin with a dove could be read as a visual reassurance of commitment to the peaceful uses of outer space as enshrined in UN treaties. The three space heroes continue to dominate, as they did in the Soviet era, but the way they are interspersed with icons and relics heightens the sense that they, too, are icons, thereby dismantling the atheist and materialist rhetoric about space science from the Soviet period. Following Malinowski, Weibel and Swanson (2006) argue that cosmonauts’ space rituals are a form of “magical thinking” drawing on the pre-Soviet philosophy of cosmism, which combines “theosophy, panslavism and Russian Orthodox religious thinking, with the technological optimism of that era” (Lytkin, Finney, and Alepko 1995:370).

Analysis of images in the Zvezda module reveals patterns over time in the placement of religious icons and pictures of Soviet space heroes that had not previously been observed, demonstrating the potential of archaeological methods to offer new insights into social behavior on the ISS. It is worth emphasizing that, despite the long-standing tradition of visual display on space stations that we have identified, the practices observed here were seemingly unanticipated by Zvezda’s designers—there are no frames or holders for the items and no guidance from the architecture or decor about how and where to place them. Space station habitability might be improved by designs that take into account the likelihood that crew will want to decorate various spaces by providing architectural and decorative accommodations for visual displays to happen. Even so, the evolution of such practices so far demonstrates that such displays will also happen organically according to the needs and desires of individual crew members as well as those of the group as a whole.

4. Architect Galina Balashova, who was responsible for many of the design cues found in Soviet spacecraft (including a two-tone color scheme for identifying “up” and “down” that also appears in Zvezda), did include bungees holding what appear to be paintings to the wall of a speculative crew cabin (Meuser 2015). Bungees are attached to the lower aft wall of Zvezda at left and right, but from the available images, it appears that they are used to hold mission documents. It is also worth recalling that in the Tarkovsky film Solaris, the space station’s library includes artworks on the shelves and walls, most notably Pieter Bruegel the Elder’s 1565 painting The Hunters in the Snow (in the original novel, by contrast, the narrator says of the library, “Display for its own sake was improbable in these surroundings” [Lem 1970:110]).
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