

Jews in Space

Reflections on Welcoming Shabbat in
Exotic and Off-World Environments

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Foreword

In the winter/spring semester of 2000, I enrolled in the Master of Jewish Studies program at Hebrew College. One of the first classes in which I enrolled was *The Calendar and Sacred Time*, taught by Rabbi Dr. Nehemia Polen.

I had already discovered my passion for Jewish speculative fiction (encompassing folklore as well as modern science fiction and fantasy), and was following developments in spaceflight with great interest. Inspired by Dr. Polen, I wrote my final paper for his class on some practical *halachic* questions that Jewish astronauts and explorers would face in observing Shabbat off-world. At the time, I thought only to use it as a guide for a high school elective and an adult education offering. I could never have anticipated its reach, which has surprised and delighted me.

Dr. Sheyna Gifford, my dear friend, drew on the paper in the blog she maintained during her year-long participation in the NASA-funded Hawaii Space Exploration Analog and Simulation (HI-SEAS) Mars simulation. Rabbi Adam Bellows engaged this paper in his rabbinical thesis, *Eyes on the Horizon* (HUC-JIR, 2018), a thoughtful exploration of the theological and *halachic* questions facing future Jewish settlers. Most excitingly, I had the opportunity to draw upon it during my appearance in the documentary *Fiddler on the Moon: Judaism in Space* (Ironbound Films, 2025).

Over the years, I've updated and revised the paper. New discoveries in the space sciences and new *halachic* deliberations have kept this discussion very active. It's my hope to continue this process for years to come, celebrating new milestones along our path to the stars, *l'shem shamayim* – for the sake of heaven.

Introduction

One of Judaism's enduring strengths is its ability to adapt, thriving in diverse environments. Every age, however, brings new challenges. As recent advances in technology and scientific knowledge have opened new frontiers, they have also raised new questions for Jewish ritual life.

This paper will address the complex issue of determining the correct time in which to observe Shabbat in several exotic environments. While some of these topics have been addressed to general satisfaction, others remain the subject of ongoing debate. Issues regarding the International Date Line (IDL) and extreme latitudes will be addressed first, providing the framework for a subsequent discussion of orbital, near-Earth, lunar and Martian conditions. The paper will conclude with general observations and suggested directions for practice.

A word about method. This paper falls within the context of Hebrew College, a trans-denominational institution. I read the classical *halachic* sources gathered here as a living inheritance that instructs future practice. My aim is not to issue a ruling but to ask how their reasoning might guide Jews who will one day keep Shabbat in places its authors never imagined. In that spirit, *halacha* is given a vote in what follows, and an honored one, though not a veto.

One prior question deserves brief acknowledgment: is it permissible for Jews to leave Earth at all? A stream of halachic voices – from Rabbi Ben-Zion Firrer’s 1969 responsum in *No’am* to Rabbi Moshe Shternbuch’s more recent ruling in *Teshuvot v’Hanhagot* – has argued that Jews are either exempt from *mitzvot* beyond the stratosphere or ought not settle where day and night no longer behave as the Torah assumes. This paper sets that debate aside. A generation of Jewish astronauts have already brought Jewish observance into orbit. The tradition owes them – and all those who may follow – a workable framework for sacred time.¹

Shabbat in Context

Shabbat is one of Judaism’s most cherished practices. This weekly holiday of rest and contemplation is so important that the Fourth Commandment² obligates the entire Jewish people both to remember³ and also to observe the day⁴ in perpetuity. It sets the pace of traditional Jewish life, setting bounds on one’s activities and with rich spiritual overtones.⁵

Within general practice, Shabbat lasts from slightly before astronomical sundown on Friday night to slightly after nightfall on Saturday, lasting slightly longer than the standard solar day.⁶ This rule helps to distinguish the holy day from the weekdays, and offers the opportunity to lengthen the pleasure of one’s observance of this holiday.

It is important to remember that, in ancient times, one could be compelled to rely exclusively on natural phenomena to divine the time and date. Accordingly, the Rabbis offered teachings to clarify when to welcome Shabbat. For example, clouds could occlude the sun, making it difficult to determine when sundown occurred. In such a case, the Talmud points out signs in the natural world:

Rava said to his servant: “You folk, who are not certain about the measurements of the Rabbis, when the sun is at the top of the palm trees, light the [Sabbath] light.” “What if it is a cloudy day?” “In town, watch the chickens. In a field, [watch the] ravens. Alternatively, [watch the] plants (glossed by Rashi as “mallow”).⁷

Based upon the strength of such instructions, we may derive a general rule that the environment can provide sufficient clues to determine the approximate time of sunset and, thus, the new ritual day.

¹ For the Firrer-Kasher exchange in *No’am* Vol. 13 (5730 / 1969–70) and its continuation through Rabbi Moshe Shternbuch’s ruling in *Teshuvot v’Hanhagot* Vol. 5, *siman* 84, see Rabbi Anthony Manning, “Mitzvot in Space (Halacha in Extreme Places Part 3),” OU Israel Center shiur, February 19, 2020, <https://rabbimanning.com/wp-content/uploads/2020/02/Halacha-in-Extreme-Places-Part-3-Space.pdf>. Manning’s source sheet reproduces the relevant Hebrew passages and situates the two positions within the broader early-1970s halachic conversation initiated by Rabbi Menachem Kasher’s *HaAdam Al HaYareach* (Torah Sheleimah Institute, 1969).

² Roman Catholic and Lutheran practice differ from Jewish reckoning and count it as the Third Commandment.

³ Exodus 20:8

⁴ Deuteronomy 5:12

⁵ BT *Beitza* 16a teaches that we are invested with a “second soul” by virtue of the day’s holiness.

⁶ On adding to the duration of Shabbat at its start and conclusion, see Rambam, *Mishneh Torah, Hilkhot Shabbat* 5:3, and *Shulchan Arukh, Orach Chayim* 261:2-3. On the concept of waiting to end Shabbat until three stars are visible, see BT *Shabbat* 35b and *Shulchan Arukh, Orach Chayim* 293:2.

⁷ BT *Shabbat* 35b

Another striking example of Rabbinic temporal thought regards the case of travelling on the Sabbath. In ancient times, lacking sophisticated timepieces, it was possible for one to lose track of the date while travelling in the wilderness. When should one observe Shabbat in such a case? In the Talmud, Rav Huna and Chiyya bar Rav discuss this exact point.⁸

Both of these authorities take for granted that a Jew who has lost track of the calendar is authorized to institute a personal seven-day cycle for the remainder of their journey. Their only dispute is around whether this cycle should begin with the first day of the work-week or with Shabbat. The general principle that the traveler should maintain their own count is uncontested, and it is this idea – setting aside the specifics of the ordering – that we extend to off-world scenarios.

The practical ramification of this “Traveler Rule”⁹ is that when one is in doubt of the correct date, one should establish a personal calendar, maintaining their own count of the days of the week. While not explicitly covered by Rav Huna and Chiyya bar Rav, it may be assumed that once the traveler returns to civilization, the personal calendar should be discarded in favor of the one observed by the local community.

As has been shown, the commandment to observe Shabbat applies even when one loses track of the correct date. In certain cases, the intent to keep Shabbat is more important than chronological accuracy. A traveler’s own “seventh day” is a valid Sabbath until their personal calendar can be coordinated with an established settlement.¹⁰

The International Date Line (IDL)

As ever-more accurate clocks and high-speed travel became commonplace, a new issue arose: how do time zones affect the beginning of Shabbat? A Jewish community in Israel will see the sun set several hours before their counterparts in Boston. Consequently, they will begin Shabbat in a different moment from that of their American counterparts. Should the global Jewish community thus celebrate Shabbat simultaneously, perhaps coordinated by sunset in Israel (the birthplace of the Jewish religion) or should each community begin its observance at local sundown?

David Pahmer addresses several responses to this issue in his article “The International Date Line and Related Issues”.¹¹ The authorities he surveys all conclude that Jews should begin celebrating Shabbat as the sun sets in their particular location. One justification for this ruling relies upon the unique relationship between God and each member of the Jewish people:

This idea is derived from a *pasuk*, [*Shemot* 31:13]... “For Shabbat is an individualized sign between Me and you...” implying that the Shabbat relates to each Jew individually, which...applies to the issue of time.¹²

⁸ BT *Shabbat* 69b

⁹ The phrase “Traveler Rule” will be used in this paper as a shorthand reference for this *halachic* principle.

¹⁰ See “The Sabbath Feeling” in Buber’s *Tales of the Hasidim* for a profound reflection on how holy time can be perceived and summoned.

¹¹ David Pahmer, *Journal of Halacha and Contemporary Society*, Number XXI, Spring 1991, pages 60-83.

¹² *Ibid*, pg. 62, footnote 2, citing Radvaz, *Teshuvot*, Vol. 1, *siman* 76.

The perspective that Shabbat is a local or personal event, rather than universal, gave rise to an enduring *machloket* (halachic controversy) regarding the IDL. Since Jews live all around the planet, we do not celebrate the onset of Shabbat in the same objective moment. Accordingly, it is essential that each Jewish community know the correct date and time in their location so as to observe the “seventh day” in the proper manner. With this in mind, knowing the effects of the IDL is of great ritual importance.

The modern IDL emerged from the International Meridian Conference in Washington, D.C. in 1884, which established Greenwich as the prime meridian; the 180° antemeridian became the de facto date line thereafter.¹³ It is located at longitude 180°, on the opposite side of the planet from Greenwich, England. Local time in Greenwich is known as Greenwich Mean Time (GMT). Terrestrial time zones can be determined by adding to or subtracting from GMT (Eastern Standard Time, for example, is GMT -5).

One attempt to determine the correct position of the IDL for Jewish ritual purposes relies upon a teaching in BT *Rosh Hashanah* 20b. This passage describes the rules regarding the legal establishment of *Rosh Chodesh* (the new month). The *Beit Din* (Rabbinic court) is only allowed to proclaim the beginning of the new month if *molad* (the new moon) was observed before noon on the current day.

The *gemara*...states that this is a consequence of the requirement that we cannot declare *Rosh Chodesh* unless the newly sanctified *Rosh Chodesh* will last at least 24 hours.... The *gemara* here designates noon Israel time as the latest time for any locale which has not begun the new day. Now, noon is 18 hours after nightfall, which means that there is still a region in the world where *Rosh Chodesh* has not yet begun.... In other words, more than 18 hours west of Israel we cross the date line and enter the next day, 6 hours ahead of Israel.¹⁴

According to this perspective, the religious date line should be placed 90° East of Israel, approximately at longitude 125° East (Jerusalem is roughly 35° E plus 90°). This position falls across the eastern expanse of the former Soviet Union, China, and part of Australia.

The “90° East” decision was by no means universal. The Chazon Ish, writing in 1941, agreed that the date line should be placed 90° from Israel, holding that the time there ran six hours ahead of Israel. Rabbi Yechiel Michel Tukitchinsky drew on the same premise – that Israel is the center of the world – but placed the date line 180° opposite Israel, on the far side of the globe.¹⁵ A third view, associated with Rabbi Tzvi Pesach Frank, set the search for a scriptural line aside altogether.¹⁶ Since the Talmud fixes no date line explicitly, he reasoned, the accepted civil convention – 180° from Greenwich – may simply be followed for ritual purposes as well.

¹³ On the 1884 International Meridian Conference and the emergence of the modern date line, see Dava Sobel’s *Longitude* (Walker & Company, 1995)

¹⁴ Pahmer, “The International Date Line and Related Issues”, pp. 63-64.

¹⁵ *Ibid*, pp. 65–71.

¹⁶ On Rabbi Tzvi Pesach Frank’s acceptance of the civil IDL, see Rabbi Chaim Jachter, “A Sephardic Approach to the Halachic Dateline,” *Jewish Link*, October 25, 2018. Pahmer records the same position in the name of Rabbi Menachem Kasher (p. 64) and notes that it “has been rejected by nearly all later *poskim*.”

As of the 2020s, no universally accepted decision has been made regarding the establishment of a religious date line. Accordingly, many Jews disregard *halachic* subtleties in favor of the more convenient IDL and celebrate Shabbat accordingly. For now (and likely for the foreseeable future), the decision as to which IDL to recognize for ritual purposes rests with the individual traveler's preferences and opinions.¹⁷

Determining the location of the IDL leads to a further question: for a Jew traveling across time zones or the IDL itself, should the *halachic* date be derived from the point of origin or from the eventual destination? Consider a ship that leaves port just before sunset on Friday, crosses the IDL to Thursday, and docks in its destination as dusk falls – when should the crew observe Shabbat?

Several approaches have been suggested. Within the framework this paper adopts, the port at which a vessel is currently docked defines its *halachic* time zone. When the vessel sets out, it is treated as an extension of its origin point, so the crew's observance follows that of their home port. When the ship reaches its destination and is moored at the new dock, it becomes bound by the local time of its current location.¹⁸ As a result, its passengers would then celebrate Shabbat according to their new port, rather than following the time of their origin point.¹⁹

A related question, considered briefly here, concerns the traveler who must consider not only their position in space but also in time. What of a Jew who boards an aircraft after Shabbat has concluded in their location and flies westward “into” Shabbat as observed in a different time-zone? Or the reverse – departing during Shabbat and, by crossing the date line eastward, arrives in a place where the regular week has already resumed? Pahmer canvasses several positions on this question.

The Kazhiglover, invoking the Talmudic principle *ein muktzah le-chatzi ha-Shabbat* – that the status of an object established at the onset of Shabbat governs the span of a standard Shabbat – holds that a traveler who begins Shabbat under obligation must continue to observe it, even when crossing into weekday territory. The Gerer Rebbe reasons in the mirror direction: a traveler who flies from a weekday into Shabbat has not experienced the day's onset and therefore incurs no biblical obligation, though rabbinic stringencies may still apply.²⁰

¹⁷ One might ask whether the *halachic* principle of *dinah d'malkhuta dinah* – literally, “the law of the kingdom is the law” – bears on the traveler's default reliance on the civil IDL. This principle, articulated in BT *Nedarim* 28a and elsewhere, holds that Jews are bound by the civil laws of the societies in which they live. It is classically restricted to civil and monetary matters rather than ritual observance, so it cannot resolve the underlying *machloket* over the religious date line. Even so, it is a recognition that shared timekeeping is itself a communal good.

¹⁸ The phrase “Ship Rule” is used in this paper as a shorthand label, not as a ruling derived from any single source. It names the organizing idea that a vessel may be treated as keeping the time of a chosen Earthly anchor rather than recalculating with every crossing of the IDL. The image is loosely suggested by the discussion of a boat's territorial status in *Gittin* 7b-8a, which concerns the status of the ground beneath a vessel, not the reckoning of sacred time. The application here is my own, offered as an organizing metaphor rather than a settled *halachic* conclusion.

¹⁹ For the *Gittin* 7b-8a analysis upon which Rabbi Firrer draws, see J. David Bleich, “Survey of Recent Halakhic Periodical Literature: Mizvot on the Moon,” *Tradition: A Journal of Orthodox Jewish Thought*, Vol. 11, No. 3 (Fall 1970), pp. 68-79, reprinted in *Contemporary Halakhic Problems*, Vol. I, Ch. IX, “Miscellaneous Questions” (Ktav Publishing House, 1977).

²⁰ Pahmer, “The International Date Line and Related Issues,” pp. 73–75.

The framework this paper develops for off-world observance does not resolve these questions but shares their underlying instinct: *halachic* time is shaped by lived human experience of the day's boundaries, and the traveler's obligations follow the day they have actually entered.

Matters become more complicated for a vessel that crosses the IDL twice in a single voyage – first when outbound and then when returning to its home port. Should Shabbat be observed by the time of its home port (in this case, both origin and destination) or locally, with the influence of the IDL?

Three approaches could be considered. The first holds that since the boat does not intend to ground at any location other than its home port, it may preserve the candle-lighting times of its origin. The second holds that since the crew are aware of the IDL, they are bound to observe local time. The third holds that since the correct religious date is in doubt, the crew should count sunsets in accordance with the Traveler Rule.

The third position may swiftly be discarded. The Traveler Rule does not apply in this case, as it is only applicable when one has no knowledge of the date. Here, the issue is which of two otherwise valid dates has priority.

The second position is more difficult to reject but is ultimately unconvincing. If the crew were to adjust their clocks and calendars whenever they crossed the IDL, Shabbat restrictions would need to be observed accordingly. It is easy to imagine scenarios where this becomes impractical. If a research vessel repeatedly crossed the IDL in pursuit of a wandering pod of whales, the ship might enter and leave Shabbat many times in a single hour. Such examples render this position unworkable.

It seems most plausible to maintain the first position: for *halachic* purposes, the ship should retain the time of its home dock. That said, if the captain decided to change the ship's clocks – as might happen if the mission called for the crew to remain on the far side of the IDL for some time – the crew would adopt the newly established time and celebrate Shabbat accordingly.

Although not considered in this paper, one might wonder if there are methods beyond coming into physical contact with land that would make a vessel be considered part of that country for *halachic* purposes. Might coming into sight of land be sufficient? What about being in a country's territorial waters? While intriguing, such questions must be held in abeyance for now.

Arctic Latitudes

One result of the Earth's axial tilt is that its polar regions experience periods when the sun may never fully rise (or set, depending on the season). This creates obvious problems for residents of extreme latitudes who wish to observe Shabbat. How might one sanctify "the seventh day" if the sun only sets a handful of times in a season?

The *halachic* challenge of extreme latitudes has long been recognized by religious authorities. Pahmer notes that the Tiferet Yisrael, in his nineteenth century commentary on *Berachot*, considered whether the *halachic* day in arctic regions might be governed by a 24-hour period regardless of the sun's visible movement – a position Pahmer describes as "not rooted in concrete

sources and...questionable.” Rabbi Chaim Volozhiner, confronting the same problem, offered advice of a different kind: religious Jews should simply avoid traveling to these regions, since no clear *halachic* resolution was available.²¹

The issue of observing Shabbat in arctic latitudes was addressed during World War II by The Commission on Jewish Chaplaincy.²² They adopted the practice of Jewish communities in Norway and Sweden who simply observed the candle lighting times of the nearest city that possessed a conveniently workable daylight schedule:

Jewish soldiers in the northern latitudes should pick the hours of the Sabbath observed in New York or Seattle and fix their Sabbath Service accordingly, regardless of whether twilight (in summer) or darkness (in winter) has yet come.²³

This “Arctic Rule”²⁴ maintains that, when in regions lacking a roughly 24-hour diurnal cycle, one should observe the candle lighting times of the nearest settlement that observes such a schedule.²⁵ This allows one to disregard Talmudic phenomenological indicators for beginning the Sabbath, providing a workable framework for the conditions that Rabbi Volozhiner recommended avoiding.

Although it may feel jarring to celebrate the beginning of Shabbat in full daylight or darkness, it is even more unsettling to believe that it could occur more frequently in certain locations on Earth than others. From a religious standpoint, this would be tantamount to assuming that certain places on the planet are forbidden to Jews at certain times, such as a fast day that, observed in the Arctic, could have a span of several thousand hours.

This is not a theoretical issue. Sub-arctic Alaskan Jewish communities, such as Anchorage and Fairbanks, observe candle-lighting eighteen minutes before actual sunset even when sunset falls near midnight, and end Shabbat when the stars first appear in the small hours of Sunday morning. Above the Arctic Circle itself, where the sun does not set for weeks at a time and there are no permanent congregational Jewish communities, the Arctic Rule would apply directly. Alaska’s congregations south of that line already follow a milder version of that same accommodation.²⁶

Near Earth Orbit

Humanity’s process of exploring beyond Earth continues to accelerate. To the Jews, a people who have existed in the Diaspora for generations, the idea of living outside of one’s ancestral home is

²¹ Pahmer, “The International Date Line and Related Issues,” p. 78.

²² “Friday Evening Services in Arctic Regions,” *Responsa in War Time* (National Jewish Welfare Board, 1947)

²³ *Ibid.* p. 15.

²⁴ The phrase “Arctic Rule” will be used in this paper as shorthand to refer to this ruling by The Commission on Jewish Chaplaincy.

²⁵ The Commission’s original ruling specifies “New York or Seattle” for American servicemen, yet the underlying principle does not rely on nationality. What makes a settlement *halachically* usable as a reference is that it possesses a roughly 24-hour diurnal cycle within which candle-lighting and *havdalah* can be meaningfully calculated.

²⁶ See Rabbi Dovid Heber and Rabbi Moshe Heinemann, “Halachos in Arctic & Polar Regions: When Does One Daven and Begin Shabbos?” *Kashrus Kurrents* (Star-K, Summer 2007, updated June 2026), <https://www.star-k.org/articles/kashrus-kurrents/515/when-does-one-pray/>, whose worked examples use Anchorage as the paradigm case for summer observance below the Arctic Circle.

taken almost as a given. Many of the religious issues facing a successful migration to extraterrestrial environments are complex in the extreme. When considering extraterrestrial *halacha*, this paper will work from the center outwards; from near-Earth environments to other planetary neighborhoods.

Questions of religious practice in near-Earth and orbital environments are not idle exercise. Jewish-American astronaut David Wolf spent the High Holidays of the Jewish year 5758 in orbit aboard the Russian space station Mir (September 1997 through January 1998).²⁷ Jewish-Israeli astronaut Ilan Ramon observed Shabbat aboard the ill-fated voyage of the shuttle *Columbia* in 2003. And Jewish-American astronaut Jessica Meir celebrated Chanukah on the International Space Station (ISS) in 2019, sharing a photo of herself wearing holiday-themed socks against Earth's backdrop.²⁸ Life in orbit poses new questions for practicing Jews, especially on how to determine when to celebrate Shabbat.

The simplest case involves a space station in geostationary orbit around the Earth – remaining above a fixed location on the planet. Since the station is situated miles above the surface, it sees the sun continuously, without sunset. Only during two brief “eclipse seasons” each year, near the equinoxes, does the station pass through Earth's shadow at all, and even then only for a matter of minutes.²⁹ In this respect the geostationary case resembles not the ISS's rapid-sunset problem but the polar-latitude one: the phenomenological markers are absent for months at a time, and the Arctic Rule applies directly. A city perched at the North Pole and a station perched in geostationary orbit face the same halachic question, and answer it the same way.

As of this writing, however, every crewed orbital habitat has had a non-geostationary orbit, meaning that they did not remain fixed over one Earthly point or landmark. As a case in point, the International Space Station (ISS) has an orbital period of roughly ninety minutes. This means that the ISS crew observes sixteen sunrises and sixteen sunsets each Earth day.³⁰

The non-geostationary case cannot be solved by the Arctic Rule. In the Arctic, the phenomenological markers to begin Shabbat are absent for months at a time, and the ruling supplies a stationary reference: the nearest settlement with a workable diurnal cycle. In fast orbit, the phenomenological markers are not absent – there are simply too many of them, and none of them coordinated with any Earthly community.

²⁷ Wolf launched aboard STS-86 on September 25, 1997, and returned aboard STS-89 on January 31, 1998, spending 119 days on Mir and 128 days on orbit. See NASA, “STS-86,” <https://www.nasa.gov/mission/sts-86/> and NASA, “STS-89,” <https://www.nasa.gov/mission/sts-89/>

²⁸ Jessica Meir posted the photo on December 22, 2019, the first night of Hanukkah. See “NASA astronaut proclaims ‘Happy Hanukkah’ from space,” *Times of Israel*, December 23, 2019, <https://www.timesofisrael.com/nasa-astronaut-proclaims-happy-hanukkah-from-space/>

²⁹ Geostationary satellites enter Earth's shadow only during two “eclipse seasons” each year, approximately twenty-one days on either side of the vernal and autumnal equinoxes, with maximum eclipse duration of about seventy-two minutes at the equinox itself. See Space Weather Services, Australian Bureau of Meteorology, “Satellites, Geostationary orbits and Solar Eclipses,” <https://www.sws.bom.gov.au/Educational/5/4/3>.

³⁰ On the ISS's orbital period and sunrise/sunset frequency, see NASA, “What Time Is It In Space?” <https://science.nasa.gov/solar-system/resources/faq/what-time-is-it-in-space/>

Regarding our space station, the crew is not looking for a proximate substitute sunset; they are already tethered to a specific Earthly location by their mission clock. That tether is covered by the Ship Rule: rather than seek a substitute sunset, the vessel keeps the time of a fixed Earthly reference point. As we will see, this has already become the practice of Jewish astronauts themselves.

For fast-orbit spacecraft, then, the Arctic Rule gives way to this shipboard logic. The question is no longer which nearby city but which Earthly point of connection: mission control, launch site, or (as we shall see) some framework decoupled from Earth altogether.

The situation is made more complicated by modern time-keeping standards aboard spacecraft. Our spacecraft coordinate their operational clocks with mission control. Aboard Mir, this was straightforward: the Russian mission control center at Korolyov, outside Moscow, ran on Moscow time, and the crew synchronized their onboard clocks with that ground station. Operational (mission) time and Earthly ground time were the same, and both coincided with a real Moscow sunset. The ISS has a more complicated setup. Because it is jointly operated by NASA and Roscosmos – with mission control centers in Houston and Korolyov running on Central Time and Moscow Time respectively – the ISS itself needed a neutral onboard clock. For this reason, it adopted Coordinated Universal Time (confusingly known as UTC).³¹

UTC is the atomic-clock international standard that succeeded Greenwich Mean Time (GMT) in 1972. Where GMT was originally the local solar time of Greenwich – a real place with a real sunset – UTC is a global coordination convention, not intended to refer to any particular location on Earth.³²

One *halachic* consequence of this situation is that the ISS is effectively decoupled from any single Earthly “home.” The crew runs its sleep and work schedule on UTC, but they cannot simply “light candles at UTC sunset”. That time scale isn’t firmly connected to an Earthly location, and there are sixteen observable sunsets a day, none of them coordinated with UTC. So when should a Jewish astronaut aboard the ISS light candles?

The *halachic* conversation offers several answers. The first is tied to the mission control location. This is, presumably, what David Wolf would have followed on Mir, where the operational clock and a real Earthly sunset coincided in Moscow. The second is the time at the astronaut’s point of departure. Notably, Ramon himself consulted with Rabbi Zvi Konikov of Chabad of Cape Canaveral before his mission.³³ He ultimately elected to observe Shabbat according to Cape Canaveral time – his launch point – rather than Houston mission control. It is this precedent, and the ruling behind it, rather than any single classical text, that gives the launch-site answer its authority.

³¹ On UTC as the operational standard for the ISS, see NASA, “What Time Is It In Space?” <https://science.nasa.gov/solar-system/resources/faq/what-time-is-it-in-space>

³² On the GMT-to-UTC transition, see NASA’s Eclipse Web Site, “Time Zones and Universal Time,” <https://eclipse.gsfc.nasa.gov/SEhelp/TimeZone.html>

³³ Rabbi Levi Yitzchak Halperin, *Im Esak Shamayim: Kiyum Ha-Mitzvot Ba-Chalal* (Jerusalem: Machon Mada’i *Technologi la-Halakhah* / Institute for Science and Halacha, 2003). For the accessible English account of Ramon’s consultation and the resulting ruling, see Rabbi Zvi Konikov, “Shabbat in Space: The Legacy of Ilan Ramon”, https://www.chabad.org/library/article_cdo/aid/632169/jewish/Shabbat-in-Space.htm

Thinking creatively, one might imagine a third possibility: observance tied to Jerusalem, the traditional *halachic* anchor for questions of Jewish ritual and time. While I have not been able to locate a *posek* who has proposed this for orbital observance, this absence strikes me as an invitation for future exploration. As Jewish life moves off-world, whether Jerusalem might serve as a fixed ritual anchor – a kind of prime meridian for sacred time – is a question I hope others will take up, in *teshuvot* yet to be written. Of course, there is always a fourth option: some framework decoupled from Earth altogether – a possibility that becomes important once we consider the possibility of habitations beyond any planetary body.

It is conceivable that space stations or starships will become capable of sustaining themselves without regard to Earthly resources or perspectives. In such a case, Jews in that environment might well determine their own calendar without Terran referents. Lacking phenomenological indicatives (such as if the station were placed in a non-geostationary orbit or at a stable LaGrange point at a distance from the Earth) Jewish residents would count six “station days” and observe the seventh as the Sabbath. In many ways, this is the ultimate extension of the Traveler Rule, but in this case, the “traveler” could be forever voyaging.

There is a suggestive echo of this concept in the *sugya* that inspired the Ship Rule.³⁴ In asking whether a document written aboard a boat counts as written in the Land of Israel, the Talmud treats a vessel floating on water as connected to the ground beneath it. Its logic is that the water is reckoned like solid earth, meaning that the boat takes on the status of whatever territory lies below its hull. The Talmudic counter-case is a perforated flowerpot raised on pegs: because a layer of air intervenes between the pot and the ground, the connection between the two is broken, and it carries no earthly status at all.

A spacecraft in orbit or in deep space is the ultimate “flowerpot”. Nothing but vacuum lies beneath it; no medium connects it to any terrestrial ground. Read this way, the same discussion that lets a docked vessel take on local time also implies that a craft severed from the Earth is no longer bound to terrestrial time, which is why its residents would need to keep their own count.

I offer this idea as food for future thought rather than a ruling, but can’t resist noting a satisfying resonance. One of Jewish tradition’s oldest lines of reasonings about boats and borders already gestures, however faintly, toward the day when craft will be “floating” between the worlds.

The Moon

On July 20, 1969, a human first walked on the surface of the moon, making one of humanity’s oldest dreams a reality. Since that time there have been a handful of subsequent crewed lunar expeditions, although there are new plans, including NASA’s Artemis program, to establish a long-duration human presence on the lunar surface.

As a matter of religious practice, the lunar experience is little different from that of extreme arctic latitudes on Earth. A lunar day, as measured by sunsets, lasts for almost exactly 30 Earthly days (as is visible on Earth as the moon’s variable phases). Just as on Earth, this span is far too lengthy to be of practical use to determine religious time.

³⁴ BT *Gittin* 7b–8a.

With a degree of modification, the Arctic Rule could apply to lunar conditions just as in orbital scenarios. As phenomenological indicatives of time fail to apply to a settlement on the moon, alternate perspectives must be adopted. The only point to be determined is the standard by which the lunar base chronometers are set.

Rabbi Menachem Kasher, in his response to Rabbi Ben-Zion Firrer, argued explicitly that lunar time-reckoning should follow the same principle as Arctic time-reckoning: alternating twelve-hour periods of “day” and “night” reckoned on a twenty-four-hour basis, regardless of the presence or absence of solar illumination.³⁵ It is worth noting that Kasher’s separate proposal on the IDL – that *halacha* simply adopt the civil line – found little favor among later *poskim*. His lunar reasoning, however, stands on its own footing and does not refer to the date line argument. The framework this paper advances arrives at the same conclusion by independent reasoning.³⁶

Lunar expeditions have thus far coordinated with an Earthly schedule and could utilize the candle lighting times of mission control. It is exciting to consider the question of a self-sustaining station: how would its residents establish local time? Would they continue to follow an Earthly reference point? Would they begin afresh with a new calendar? While currently theoretical, such issues will need to be carefully weighed by those wishing to live a Jewish life on the moon. In any case, the expanded Traveler Rule outlined above may be of assistance to the Jewish colonist wishing to celebrate Shabbat in their new home.

Mars

With multiple robotic missions active exploring on the Martian surface – and with SpaceX and other actors advancing plans for crewed Mars missions – questions pertaining to human life on Mars are only theoretical at present. Hopefully, it will not be long before such issues must be resolved in practice.

Mars presents a new *halachic* complication. The major distinction between Mars and any other previously discussed scenario is that Mars is a planetary body in its own right with a near-Earth diurnal cycle. A day on Mars lasts for 24 hours, 39 minutes and 35 seconds. This is similar enough to a Terran daily period to make phenomenological determinants of the date not only possible, but also practical. It is unlikely that any human settlement on Mars would ignore the local day/night cycle in favor of a blind adherence to Earth’s far-distant calendar.

When should Shabbat be celebrated on Mars? Two contrasting positions can be formulated, each with Biblical and halachic validation. Should one determine the Sabbath by counting local sunsets (as is permitted by Talmudic sources) or should one adhere to an Earthly schedule (maintaining Shabbat’s unity to Jews throughout the solar system)?

³⁵ As noted above, this discussion appears in the 5730 issue of *No’am* (dated 5730, published 1969–70); Kasher subsequently gathered the same material into his *HaAdam Al HaYareach* (Torah Sheleimah Institute, 1969). The journal article and the book are the same discussion in two forms.

³⁶ See Bleich, “Mizvot on the Moon,” *Tradition*, Vol. 11, No. 3 (Fall 1970), pp. 68–79.

The latter perspective maintains that Earthly time is the only one which should apply to practicing Jews. The Arctic Rule implies that all Jews should experience Shabbat on the same subjective day and with the same relative frequency. Additionally, the Rule allows one to disregard local phenomena if they are impractical for determining religious time. Jews in the Arctic should not experience fewer Sabbaths in the year than their brethren in warmer climes and a Jew on Mars should not celebrate Shabbat less frequently than a Jew on Earth.

In a spiritual sense, one might additionally argue, humans are made from the Earth. The Torah teaches that we are quite literally made from the Earth itself.³⁷ We will always be linked to our Earthly home; we are bound to this planet by ancient license and heritage.

And God blessed them, and God said to them, “Be fruitful, and multiply, and fill the Earth, and subdue it; rule the fish of the sea and the birds of the sky and everything that creeps upon the Earth.”³⁸

The heavens are the heavens of the Eternal; but [God] has given the Earth to human-kind.³⁹

While we may travel to Mars and even live there, we will never be more than visitors to the planet – latecomers without a history. This position maintains that Earth should be the only standard to which we look to determine religious time. No matter where we voyage through the cosmos, it will always be the cradle from which we emerged; our true home.

The contrary position holds that Shabbat can be determined regardless of one’s planetary location. As discussed above, Shabbat is to be determined locally, as “an individualized sign” between God and every observant Jew. The Traveler Rule indicates a tacit acknowledgement from ancient times that Jews might have to observe Shabbat on a different day from other Jews. As was mentioned above, the desire to observe the Sabbath overrides any unavoidable inaccuracies in the calendar.

There is no reason to assume that sunset observation on Mars should be invalid in determining when Shabbat should begin. Assuming that settlers on Mars would observe local day/night cycles to regulate their daily activity (and it is exceedingly unlikely that they would not), religious time should be observed accordingly.

The only religious directives regarding establishing Shabbat are that the Sabbath should be observed on the seventh day of the week, and that day begins at local sunset. As the Torah teaches, “Six days shall work be done; but the seventh day is the Sabbath of rest, a holy gathering; you shall do no work in it; it is the Sabbath of the Eternal in all your dwellings.”⁴⁰ Martian colonists would have every right to observe Shabbat according to their local time.

Although both positions are compelling, this perspective is the only one that is entirely applicable. The Arctic Rule is irrelevant in determining Martian religious time except for Martian cities

³⁷ *Bereshit* 2:7

³⁸ *Ibid*, 1:28

³⁹ *Tehilim* 115:16

⁴⁰ *Vayikra* 23:3

located in extreme latitudes, and even then would apply only to Martian settlements. This Rule can only apply in cases where the city in question is either located on the same planetary body, or in orbit around it. Mars is a planet in its own right, with a day/night cycle completely applicable to its colonists. There is every reason to conclude that a Martian day would be a valid religious interval for those Jews living there.

From a practical perspective, ignoring the Martian day in favor of the Earthly calendar would become a matter of extreme discomfort and disorientation to observant Jews. After a certain term on Mars, a Jewish colonist would have to wake up in the middle of the night to celebrate the beginning of Shabbat! Such an artificial and disruptive practice is hardly compatible with the grace with which religious practice should integrate into a Jewish life:

Certainly this commandment with which I charge you this day is not too astounding for you nor distant... Rather, the matter is very close to you – it is in your mouth and your heart – to do it!⁴¹

In this case, inappropriately applying the Arctic Rule violates the intent with which it was first created: to facilitate religious observance when local phenomena make meaningful temporal determinants impossible. Martian settlers should feel no need to disregard a viable sunset at their “dwellings” to synchronize with a distant Earth.

From the earliest times, Jews were quite aware of the world around them. Blessings of gratitude for observing rainbows, the new moon, and other wondrous natural events help to keep modern urban Jews in touch with nature (and perhaps more mindful of humanity’s inherent responsibility to the Earth). Dismissing the natural events of any world in favor of abstract calculation hardly seems in keeping with the emotional and aesthetic sweep of Jewish tradition.

To resolve this issue, it should be noted that Shabbat is already observed at different times on Earth depending on one’s location relative to the IDL. Shabbat on Mars is a different matter only in that its daily span is slightly longer than an Earthly one. If Martian sunsets are considered valid for demarking religious time, then Shabbat will come to Jews across the solar system not only at different *times* that last for different *durations*!

This should not be seen as a barrier to utilizing local phenomena for determining when to observe Shabbat. Unlike other festivals, there is no requirement that Shabbat should be celebrated on a specific *date*. Rather, it is to be held on a specific *day*. Shabbat lasts forty minutes longer on Mars than on Earth, but rather than confusion, this should be a source of rejoicing to Martian Jews.

Since this paper was first drafted, Rabbi Ben-Tzion Spitz has proposed an elegant working Martian *Luach* (ritual calendar).⁴² Without some form of adjustment, the Martian ritual calendar would steadily drift out of sync with that of Earth, as 36 sols (Martian days) approximate 37 Earth days. Accordingly, Spitz’s proposal has three components:

⁴¹ *Devarim* 30:11, 14

⁴² Ben-Tzion Spitz, “The Martian Jewish Calendar,” ben-tzion.com, ongoing project since 2017; practical *Luach* for Tishrei 5784 published September 2023, <https://ben-tzion.com/mars-jewish-calendar/>

- (1) daily *halachic* observance follows the Martian sol (solar day), with local sunrise and sunset governing the daily prayers and Shabbat timing;
- (2) the Hebrew months and years remain roughly synchronized with Earth by subtracting one day from a Martian *chodesh* (month) roughly every one or two Earthly months (converting a 30-day *chodesh* to 29, or a 29-day *chodesh* to 28); and
- (3) every seventh sol is Shabbat.

Spitz's proposal and this paper agree on the important practical point: local Martian sunset governs the *halachic* day on Mars, and Shabbat is counted once out of every seven local days. Spitz optimizes for Earth/Mars festival synchronization, which could be an important framework for Jewish colonists.

That said, this paper argues that we will also need a framework scalable across increasingly exotic environments – including those in which synchronization with an Earth-anchored Hebrew calendar becomes impossible. What happens on Ganymede, Titan, or an exoplanetary settlement whose day-year ratio makes the “skip a day every 36 sols” mechanism impractical? Hopefully, some of the theoretical considerations raised in this paper and practical experience from Martian settlements will provide support for whatever might follow.

Conclusion

This paper has argued that traditional Jewish religious observance should be able to thrive in any number of exotic environments, both on Earth and off-planet. As humanity prepares to ascend to the skies for the first time since the Tower of Babel, we may gain the stars without challenging heaven. There is no question that observant Jews are bound to their ancient moral and practical laws wherever they dwell. Whether on land, at sea, in the air or upon other worlds, traditional Jewish religious practices can be maintained with a minimum of adjustment.

The framework advanced by this paper holds that in regions with regularly spaced sunsets at roughly one-Terran-day intervals, Shabbat should be observed once every seven sunsets. This structure is applicable in most Terran and Martian environments. Regions with sunsets lacking roughly 24-hour intervals should adopt the sunset times of the nearest city that has an applicable day/night cycle. Ground-dependent satellites, lunar bases and short-range spacecraft should utilize the times of their mission control or any other applicable ground-based settlement.⁴³ Planets with a non-Earthlike day/night cycle (such as Venus) should follow the expanded Traveler Rule and observe one calendar day of Shabbat for every six, as defined by whatever period the colony determines a day to last.

For festivals that must be celebrated on a specific date, such as the High Holidays, Jews historically looked to Jerusalem. In ancient times, the new month could only be legislated into being by the *Sanhedrin* in Jerusalem. Following the destruction of the ancient Temple, Jews in the Diaspora determined when to observe the *chagim* on their own. Accordingly, off-planet Jews might well

⁴³ Any self-sustaining craft gain the status of settlements in their own right and have their own local time. The only exception to this is when such a craft docks at a port, in which case local religious time must be observed as it becomes part of the country which governs the dock.

decide when to hold their own festivals, in turn. This would follow the finest traditions of Earth-based Judaism.

The *halacha* of the Jewish Diaspora has never been monolithic. Sephardi and Ashkenazi communities developed distinct *minhagim* (traditions and customs), as have Yemenite and Ethiopian Jewry. In each case, local Jewish life took root, and the tradition grew with it. There is no reason to expect off-world Jewish life to be different. To the objection that Jews ought not leave Earth because the *mitzvot* were given in a Terran setting, one answer is that the tradition has always adapted its assumptions to lived experience. The question is not whether off-world Jewish life will develop its own textures; it is whether the wider Jewish world will recognize those textures as authentically ours when they do.

It is theoretically possible that, after much deliberation, off-world Jews will be able to establish new ritual calendars with no consideration of Earthly standards. It is true that the biblical rules for determining the date are exact, and Jerusalem is well known to be of critical importance in such religious matters. Nonetheless, it has been accepted from ancient times that the Jewish people have a degree of latitude in establishing the date, even for the most important holidays of the ritual calendar.

[If] the *beit din* (Rabbinic court) said: “Today is Rosh Hashanah.” The Holy Blessed One says to the ministering angels, [“Prepare the Heavenly Court,] as My children have said, today is Rosh Hashanah.” [But] if the *beit din* reconsidered [and determined that the new year would begin] the next day, the Holy Blessed One tells the ministering angels [to prepare the Court] the next day.

This is like [the case of] a king who had a time-piece. When his son grew up, he gave it over to him.⁴⁴

It is not out of the question that there could be a different religiously valid date on a different planet, although certain key practical issues assert themselves. Mars, for example, has two moons. Even if one could create an official Jewish calendar for that planet, such as Spitz proposes, how could one determine *molad*? Would that consideration no longer apply? If so, what other *halachic* guidelines might be changed or even discarded? Although fascinating, this issue falls outside the range of this paper.

The point may be taken, however, that we need not bind ourselves inextricably to Earth because it was never *explicitly* stated in ancient times that we might live on other planets. In the compelling words of Maimonides:

Do not expect that everything which (our sages) have mentioned regarding astronomy should agree with the actual facts; for the theoretical sciences were deficient in those days, and they did not speak of them on the basis of a tradition

⁴⁴ *Yerushalmi Rosh Hashanah*, 1:3

received from the prophets, but rather because they were scientists by the standards of their times or because they had heard about these matters from such scientists.⁴⁵

Leaving the Earth need not be seen as abandoning traditional Jewish practice, but rather lead to a more complete understanding of the power and beauty of the cosmos and Creation. Surely any Lunar Jewish settlement would devise a *bracha* to celebrate witnessing the majestic spectacle of an Earthrise. We have been given the key to the time-piece; it only remains for us to set it in motion, as is our birthright.

A word in closing about the question I set aside at the outset. Whether a Jew ought to leave Earth at all is a real theological question. Rabbi Firrer and Rabbi Shternbuch are not wrong to notice that the *mitzvot* were given in a setting of regular sunrises and sunsets, of six days and Shabbat. One of the earliest idealized forms of ritual Judaism takes place in an earthly sanctuary built from earthly materials by earthly hands. To move beyond that world is to move beyond the context in which *halacha* is predicated, at least in part.

And yet, the *halachic* tradition has, at its best, always adapted to where Jews actually live – from Babylonian exile to Arctic outposts and submarines. Jews have already been in space for decades, and brought their traditions with them. Ilan Ramon davened aboard *Columbia*. David Wolf observed Jewish holidays on Mir, as did Jessica Meir on the ISS. Jared Isaacman consulted with Chabad before *Polaris Dawn*.

The question is no longer whether we will be in space. The question is whether our tradition will accompany us along this next stage in the human adventure. This paper is one attempt to say yes.

⁴⁵ *Moreh* 3, 14 as cited by Azriel Rosenfeld in “The Torah in the Space Age”, *Proceedings of the Association of Orthodox Jewish Scientists*, vol. 2 (1970). pg. 177.

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