Going Hungry in Outer Space – Safeguarding the Right to Food

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Wherein the right to food represents a crucial prerequisite for the direction and future of human spaceflight activities, holding state and non-state actors accountable to international human rights values and principles is crucial in the preservation of human life and dignity across the final frontier. This encompasses aspects of food security and sustainability as tied to basic human existence and survival, and as integral and foundational elements of current and future human spaceflight activities.

Both food, and access to nutritious food, has played a critical role across the history of human exploration. In ages past, pioneers and explorers set sail to discover what lay over the horizon, only to never return because of the lack of access to nutritious food. Reference may be turned to that of the infamous 1845 Franklin or 1910 Terra Nova Expeditions, wherein the inadequate supply and storage of food played a contributing role in the demise of these Arctic and Antarctic explorers. Where environmental conditions have a severe impact on the nutrition and calorie requirements of the human body, parallels can be drawn to the exploration of outer space and across human spaceflight missions.

Packaged food consumed by crews in Low-Earth Orbit (LEO) has supported uninterrupted human presence in space aboard the International Space Station (ISS), however this relies excessively upon continuing resupply missions. A prolonged deep space mission with a closed-loop Environmental Control and Life Support System (ECLSS) - for example a mission to Mars - increases the risk of packaged food degrading over time as resupply missions become impracticable. Food preparation for a crewed mission to Mars brings into focus the storage and shelf-life of food products as integral elements of mission planning.

Consequently, the present uncertainty and unsustainability of a continuous supply of food to individuals residing in outer space for extended periods poses a fundamental risk to their lives - either through starvation or worse, malnutrition. To assure that history does not repeat itself it is imperative that the human Right to Food (RTF), enshrined under contemporary international human rights conventions, is extended to outer space. Consequently, such initiatives must be increasingly prioritised as commercial human spaceflight activities become a reality over the coming decades.

The right to food as a legal right

RTF protections are addressed within both international human rights law (IHRL) and international humanitarian law (IHL). Most relevant are the following three documents – the Universal Declaration on Human Rights (UDHR), International Covenant on Civil and Political Rights (ICCPR), and the International Covenant on Economic, Social and Cultural Rights (ICESCR). These were adopted separately by the UN General Assembly and have been collectively referred to as the "International Bill of Human Rights." These documents form the normative basis of the international human rights system from which RTF and the right to health have evolved as an interconnected right under international law.

RTF is recognised under Article 25 of the UDHR and Article 11 of the ICESCR. Herein, the right is interpreted as the right to feed oneself in dignity and represents a time-honoured human right, as

acknowledged by numerous countries. RTF is authoritatively outlined by the Committee on Economic, Social and Cultural Rights in the General Comment 12 of 1999 as:

"the right to adequate food is realized when every man, woman and child, alone and in a community with others, has physical and economic access at all times to adequate food or means for its procurement." - Para. 6

Accordingly, it is evident that all human beings are in possession of RTF as an inalienable right, as supported through a variety of conditions. The right includes food that is available in adequate quantity, nutritionally and culturally sufficient, physically and economically accessible absent of any discrimination.

Availability, Adequacy, Accessibility

Following established IHRL jurisprudence, reference to the fundamental aspects of RTF highlights the elements of availability, adequacy, and accessibility. In supporting the extraterritorial extension of IHRL, these elements must be structured to suit the unique requirements of outer space.

Firstly, availability – signifies sufficient food being produced for both the present and the future generations. States are obligated to ensure that their citizens are provided with a means to produce food both sustainably and without disruption, or to procure food through markets. Satisfying this requirement of RTF draws attention to an ongoing project called the "The Vegetable Production System" (VPS) which was developed to ensure that the crew of the ISS could grow salad-type crops within the confines of the station. The system has operated to deliver palatable, nutritious, and safe fresh foods to the crew. Consequently, the in-situ production of food based on crops is not only sustainable in the long run, but also provides a source of continuous supply of nutrients to the humans on-board.

As interpreted, RTF is careful in its wording distinguishes its obligations from the act of charity. Elements for future consideration in the outer space context concern the supply and sharing of critical technologies pertaining to agriculture – including advancements in the production, processing, and storage of foods as relevant to ensuring that both individuals and isolated communities possess the ability for self-sufficiency. Consequently, education forms a vital part of RTF and in supporting availability, encompassing knowledge sharing and skills transference in helping individuals feed themselves and maintain their dignity in outer space.

Second, adequacy – refers to the dietary needs of an individual which must be fulfilled in terms of quantity, cultural and religious requirements, and in terms of nutritious quality of the accessible food. This bears specific relation to the food requirements of children, the elderly, or vulnerable people – who may possess certain illnesses or allergies which preclude their ability to consume certain foods. Similarly, religious rules surrounding food preparation and consumption present a concern in maintaining RTF and respecting individual dignity.

It is acknowledged that long duration spaceflights involve minimum and precise nutrient requirements in ensuring the health and wellbeing of crew across the harsh conditions of the space environment. This intersects with the environmental impacts of space upon the human body, which may significantly variate the nutritional requirements of spaceflight - including microgravity, radiation, and spacecraft and spacesuit temperatures. The stressful and unpredictable environment of space makes humans highly susceptible to malnutrition, in-turn having a direct impact upon their health and wellbeing – impacting their ability to withstand common diseases or ailments considered inconsequential on earth. Access to culturally relevant and nutritious food thus forms an important part of the ongoing human rights dialogue concerning RTF in outer space.

Third, accessibility – includes economic and physical access to food. Concerning economic accessibility, this implies that the financial costs incurred for the realisation of food for a sufficient diet do not threaten or endanger the realisation of other basic needs, for example, health, education etc. On the other hand, physical accessibility implies that everyone should be guaranteed access to adequate

food – including those situated in areas afflicted by armed conflict, natural disasters, or remote and isolated regions.

As relating to RTF, accessibility to food in outer space should adhere to similar conditions as on Earth. This draws attention to a host of issues tied to minimum living standards which may prove relevant to future space labourers and inhabitants – including that of labour rights, and of a minimum wage or universal basic income through which people may afford and procure food. Furthermore, the physical accessibility to food in outer space draws attention food supply chains considerations, including that of transportation and infrastructure. It is envisioned that RTF thus encompasses the topic of food resupply missions, given the present absence of other means for obtaining food in outer space. When there is a shortage of food for the crew aboard a spacecraft, the food is supplied to the crew from Earth through un-crewed cargo spaceflights.

However, as humans begin to work and reside at greater distances from terra firma, it becomes unfeasible to arrange for the timely and ordered resupply of food. Constant resupply missions are not only impractical because of costs, but also given the inherent risks posed by any mission to both the crew and the outer space environment. To ensure continuous and uninterrupted supply of food to humans in outer space, the affordability, interoperability, and distribution of agricultural technologies such as the VPS will play a crucial role. Where outer space remains a domain dominated by governments, states will continue to play a major role in respecting, protecting, and fulfilling RTF in outer space in the near future.

State Responsibility

Under Article 2(1), 11(1) and 23 of ICESCR states assented to obligations under international law to take the necessary steps, within the reasonable bounds of their available resources, to fulfil RTF. Indeed, states are under the obligation to respect, protect, and fulfil RTF in abiding by the international principle of non-discrimination. This has been clarified under subsequent agreements, including the 1989 Convention on the Rights of the Child (CRC) and 2006 Convention on the Rights of Persons with Disabilities (CRPD). Accordingly, vulnerable, disadvantaged and marginalised must be identified and considered under the ambit of RTF.

Consequently, the obligation of non-discrimination extends extraterritorially across the scope of state activities in outer space, both under international agreements and as aspects of international customary law. This covers states' responsibility to develop and invest in critical technologies which may, in turn, provide access to a continuous supply of food. Likewise, a consideration RTF bears relation to the topic of education – as states are obliged to equip their citizens with the knowledge and skills to use sustainable technologies in creating and producing food with dignity.

Summary

As humanity voyages beyond LEO and the near-earth environment into the great unknown, it becomes increasingly paramount that the extraterritorial extension of RTF into outer space be recognized and discussed by both governments and commercial spaceflight companies alike. The three core considerations in adapting RTF – availability, adequacy, accessibility – must be fashioned to suit the unique and harsh conditions and requirements posited by outer space.

In driving the recognition and enforcement of RTF across outer space, policymakers and stakeholders must acknowledge the relevance and impact of the unique environmental conditions, immense geographical distance, and the resultant impacts of such elements upon the physiological and psychological state of individuals. Herein, States must assume both responsibility and leadership in the collective development and sharing of sustainable technologies which provide an uninterrupted supply of nutritious food, while upholding the rights and dignity of individuals in outer space.