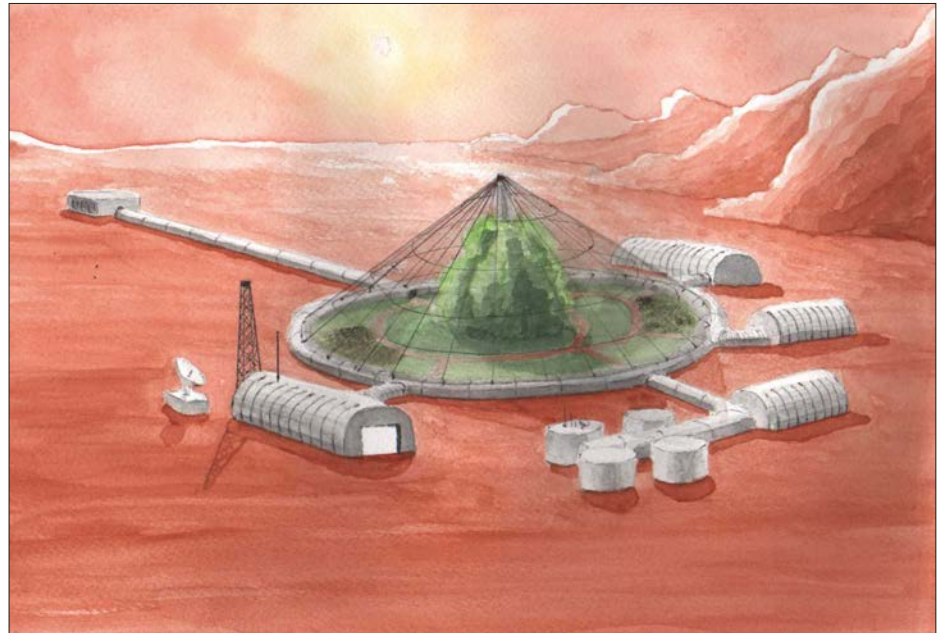


# Life Beyond: planning for Mars in prisons

**Charles Cockell** describes a prison-based outreach programme that encourages inmates to think about how we could live on Mars.



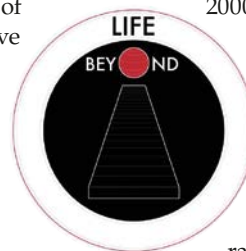
1 Artistic concept of Elysium Station, Mars, painted by a course participant from HMP Glenochil.

One of the most ambitious aspirations held by our society is to establish settlements beyond the Earth: to build stations on the Moon and Mars and to exploit the vast resources of the solar system. But this objective has as much potential as a tool for education as an end in itself: building a successful space-faring capacity encourages many beneficial social characteristics including individuals gaining pride in contributing to a large-scale social purpose and fostering skills in science, engineering, art, writing and many other creative talents.

With this in mind, it occurred to me that the exploration and settlement of space has enormous potential to raise educational opportunities in the prison environment, engaging inmates in an activity that requires individuals to work together to build a better society while thinking about our future. In that sense, one might even think about space exploration and its allied subjects, such as astrobiology, as instruments of social reform, for it is well established that prison education

can reduce rates of reoffending (Stevens & Ward 1997, Jancic 1998, Vacca 2004, Chiras & Crea 2004, Esperian 2010) and enhance social integration after release (Hull *et al.* 2000, Linden & Perry 1983).

In 2016, I approached the Scottish Prison Service (SPS) to discuss developing a course in space exploration entitled Life Beyond. The motivation was to provide an educational opportunity to learn about space exploration and then, with this education in hand, to engage prisoners in designing settlements on other planetary bodies, using their existing skills and abilities.



## Pilot scheme

To test this idea, the University of Edinburgh and SPS ran a pilot scheme across four prisons in Scotland: HMPs Edinburgh, Glenochil, Lowmoss and Shotts. The purpose was to find out what prisoners thought about space exploration in general to decide how best these interests could be mobilized in a refined teaching course. At each prison, the pilot scheme consisted of a two-hour block involving a general lecture on space

exploration and a one-hour prisoner-led discussion on human exploration of Mars. Participants were asked to split into groups and discuss why we would want to go to Mars, what the challenges might be and how one would build a long-term society on Mars. The feedback was very promising: prisoners not only found the content interesting, but they also wanted more.

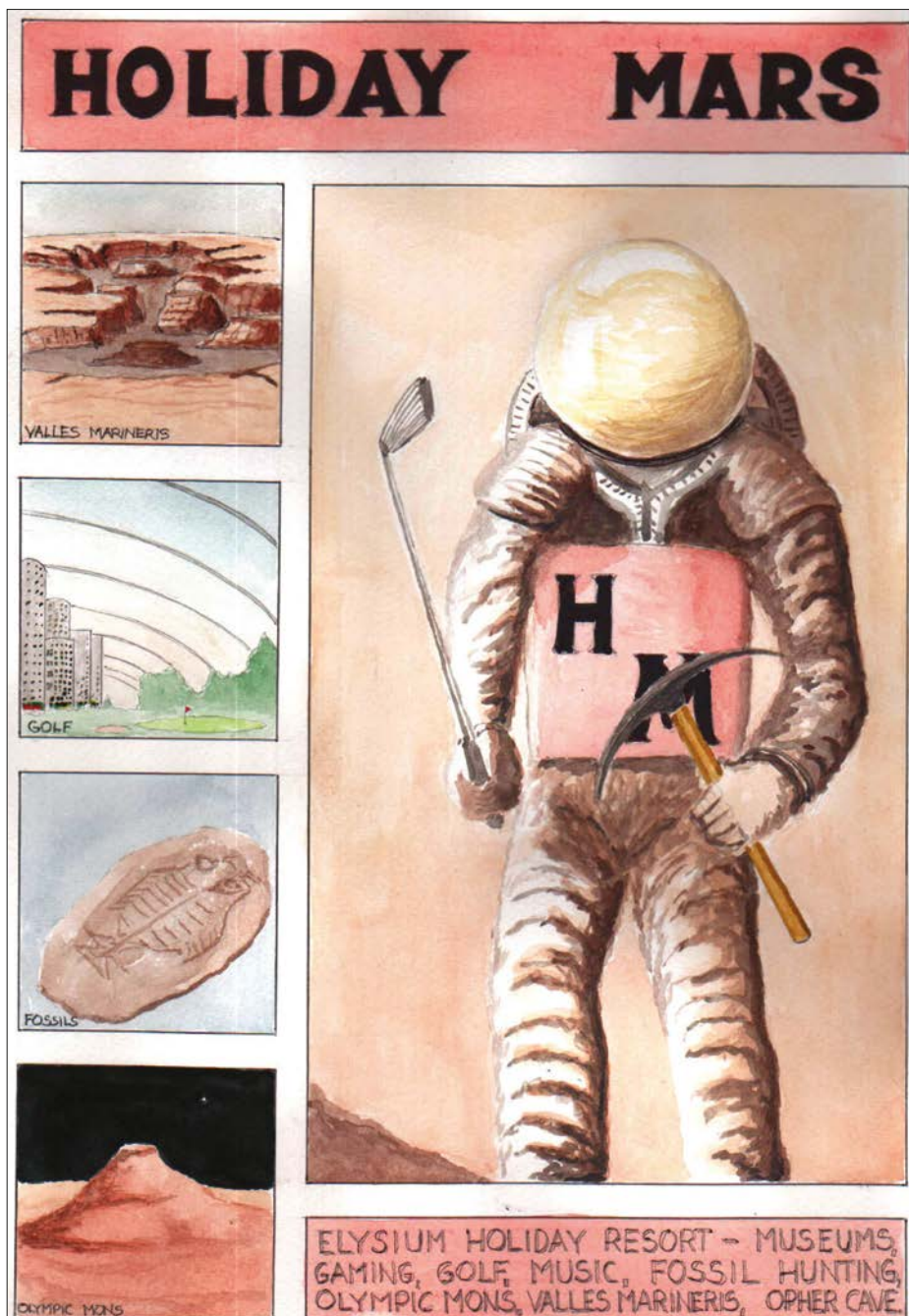
Based on the pilot scheme, the experience of teaching in the prison environment and the feedback, I devised a four-week course, *Life Beyond*, which is now the basis of our core offering to prisons (Cockell *et al.* 2018). It is designed to lead prisoners from thinking about space exploration through to designing their own Mars stations.

### Environment

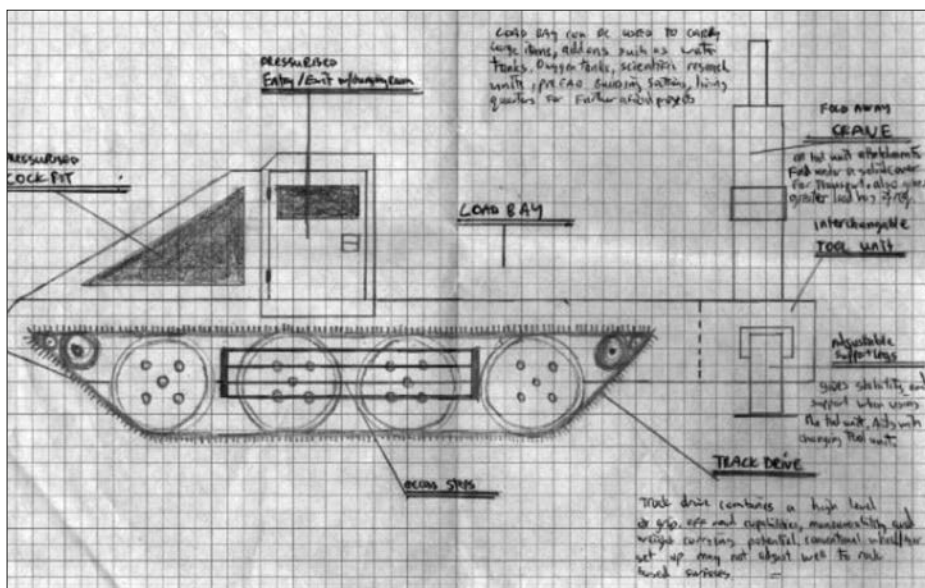
In the first week of the course, participants consider what challenges there are to living on Mars. In groups of four or five, they design their own station, although movement between groups to share ideas and knowledge is encouraged throughout.

The questions they discuss are focused on the environmental realities of Mars and how they might overcome them. For the enthusiastic space explorer some of these problems are well known, but many do not have this insight so the first stage of the course is to get participants up to a basic level of competence. They learn about atmospheric pressure, dust storms, radiation, the lack of liquid water and other characteristics that define the martian environment from the standpoint of a human presence. This is a chance to discuss the general problems, read (we provide every prison with a set of books) and to begin to think about how these challenges can be overcome (for instance, the need for an energy-producing module, the need for pressurization in habitats). The participants begin to consider what types of technical infrastructure are needed to overcome the major environmental threats.

In the second week, the prisoners transition into designing their own Mars station (figure 1), incorporating the challenges identified in the first week, such as oxygen



2 A poster beckons the adventurous to Mars, to play golf and – perhaps optimistically – hunt for fossils.



3 Attention has focused on the development of rover concepts for Mars exploration at HMP Glenochil.

4 A painting of the Elysium holiday complex in the 23rd century. The original station (figure 1), now a museum for visiting tourists and built two centuries before, can be seen in the right-hand corner of the interior of the station.



and food production. They focus on an intensive effort to consolidate the station design and its key features.

A two or three-week break at this point in the course gives time for participants to work on their designs either as a group, depending on their learning schedules and prison timetabling, or on their own. At this stage they work on engineering diagrams, concept drawings or calculations about food, fuel, oxygen and other requirements.

### Occupation

At the beginning of week three, each team presents its station design. Having now established a station on Mars, the participants consider what the occupants at the station would do, such as planning expeditions or conducting science. This is the week in which ancillary activities are devised. For example, a writing competition was organized in HMP Glenochil: prisoners had to draft their first email from Mars back to loved ones on Earth, explaining their experiences, what they felt and how things were going on the Red Planet. We also asked each prisoner to come up with an artefact of their first Mars exploration foray, which could be a tourist poster (figure 2), an extract from an expedition diary, a design for an expedition Mars rover (figure 3) or some other activity.

In the final week, they consider how a society would be run on Mars. What challenges in governance, civic responsibilities and management confront a group of people living in a station on the Red Planet? They can use their own experiences in prison to think about some of these issues, stimulating discussion on interdependence of societies, democracy and active citizenship.

The first two courses we ran had impressive results. They were run at HMP

Glenochil and HMP Edinburgh and concluded with Mars station designs of considerable detail. One of the most satisfying opportunities that the course offers is for a group of participants to work as a team in designing their station, but within that team each individual can pursue their own interests and capacities. Some of the participants focused on engineering, others on art and others on human factors. In HMP Glenochil, one participant with an interest in music engaged two friends and produced a *Martian Blues* song, an impressive synthesis of blues music with science fiction lyrics and Zulu chants. It was even performed at the prison Christmas party. One day, when explorers are sitting on Mars listening to blues music, they should remember that the first blues song written for future Mars explorers was composed at HMP Glenochil, Scotland!

An example of the considerable imagination and capacities shown by prisoners are two designs from Glenochil. Elysium Station (figure 1) is assembled from units surrounding a large garden/crop growth area under an enormous graphene dome. The Glenochil group then fast-forwarded 200 years and considered the time when the original station has become a museum in a much larger tourist station on Mars (figure 4). The group wrote a fictional timeline of all terrestrial and martian political and scientific events that occurred and influenced the development of Elysium between its founding and the 200-year mark. Then they considered the technical and engineering requirements of the station at these two time points.

A second group at Glenochil compiled an 80-page document on a Mars station 50 years on from initial settlement. Terra Nova

(figure 5) is located in the upper northern latitudes of the Vastitas Borealis. The participants considered an ancillary polar station and orbital platform in support of this main station.

The level of detail across all requirements for Terra Nova, including transportation, food production, communications, power and others, makes the design worthy of the title Glenochil Reference Mission. For example, detailed concepts for water extraction and purification using *in situ* resources were developed (figure 6). For a four-week study, I think it is not unreasonable to claim that it would make the most competent space agency proud. Almost all of the participants had no prior interest in space exploration.

### Learning outcomes

The course material is linked to formal learning outcomes integrated within the wider interests of prison education. For example, the course can: improve science knowledge, literacy and numeracy skills; improve organizational skills (studying, collating and analysing information); engage participants in art projects including creative writing; engage participants in discussions about the long-term goals of society; and engage participants in what it takes to hold together a society. The overarching vision of Life Beyond is simple: from behind prison walls, you can direct humanity to the stars.

The materials from the first two courses at HMP Glenochil and HMP Edinburgh are to be published as a book in association with the British Interplanetary Society later in 2018. We will distribute these free to space agencies, space societies and companies

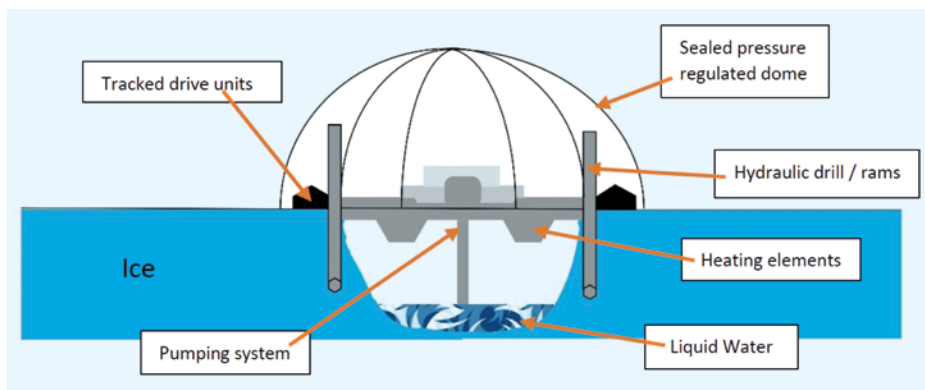


**5** The logo, painted by one of the participants at HMP Glenochil, for the Terra Nova Mars station. An explorer on Earth peers through a telescope towards Mars, surrounded by colours representing the fusion of Earth and Mars cultures.

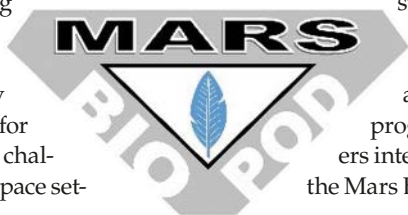
with the hope of not only making the work of the prisoners widely known, but perhaps even providing the seeds of ideas that other organizations with more time and technical resources might build upon. This model of producing original technical work from prisoners and distributing it through the internet, it seems to me, offers an incredible and previously unavailable opportunity for prisoners to contribute to challenges as demanding as space settlement in a meaningful way. Most importantly, the inmates are producing something tangible that they can hold up as evidence of their abilities. Life Beyond has helped harness the often latent talents of people in prison, helped generate positive contributions to society and stimulated hope for rehabilitation and future plans for life beyond prison.

### Ways forward

Where do we go from here? We are focusing on several possibilities. We will continue the course with further Mars station design elements and will take the course to different prisons. We will repeat it at HMP Glenochil, where we will focus on designing a station to fit within prescribed limits,



**6** A concept developed by participants at HMP Glenochil for the pressurization, melting and extraction of ground-water ice on Mars in support of Terra Nova station. The movable dome generates surface pressures to bring the ice to above the triple point, allowing it to be melted into liquid water and pumped to filters.



**7** The Mars Biopod project is a hands-on life-support system research programme at HMP Glenochil involving crop growth.

such as within a SpaceX rocket. By repeating the course, we may benefit from peer-to-peer learning, where prisoners involved in previous iterations of the course can help guide new participants.

There are new practical directions that such a course can encourage. At Glenochil prison, we have implemented a life-support research programme with prisoners interested in horticulture: the Mars Biopod (figure 7). This project is a collaboration between the prison and the University of Edinburgh and developed around existing horticulture activities at Glenochil. One of the polytunnels used by prisoners for growing plants has been converted to life-support research efforts. We will grow various things of interest to Mars exploration, such as salad crops, in simulated martian regolith – 200 kg of basaltic rock has been delivered for use in the Biopod project. We will investigate plant growth, the nutritional value of the crops and the microbial communities in the basalt rock. The effects of basalts with amendments (such as sulphate or chloride salts) typical of Mars will be investigated. The objective is to write peer-reviewed papers on crop

growth. Ancillary research objectives are to see if we can ameliorate volcanic rock using droppings from the prison's chickens, thus investigating the use of an animal component in life support and food production units on Mars. The Biopod project will be linked back to the Life Beyond course in providing prisoners with a focus to think about new conceptual designs for horticultural units on Mars. Its most useful contribution is to give prisoners the opportunity to engage in real hands-on research.

### Conclusion

Although our objectives are constrained by people available to teach and the time commitments both on our side and within Scottish prisons, it is evident that the course we have developed could lead in a vast number of directions. Depending on locally available expertise, Life Beyond could be used to develop discussion in science, arts, philosophy, music and more. As we show here, even within the first iterations of this course in Scotland, prisoners have engaged in science, engineering, music, creative writing, painting and, more recently, practical life-support system research.

The human exploration and settlement of space has already proved a remarkable tool for engaging prisoners in science and art education – and is an enriching instrument of social reform. ●

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### ACKNOWLEDGMENTS

We would like to thank Jim King, head of learning and skills at SPS, and Katharine Brash, director Fife College (Prisons), who guided and supported the development of the course within SPS.

We are very grateful to John Warrtig and Peter Reilly at HMP Glenochil and HMP Edinburgh, respectively, who oversaw the implementation and smooth running of the courses in collaboration with us at the University of Edinburgh, and to others in the learning centres at the respective prisons for their support. We thank the prison governors for their support in allowing the implementation of the project. Above all, we thank the

participants, whose efforts, enthusiasm and hard work has led to new designs and ideas for the human exploration and settlement of Mars.

### REFERENCES

**Chiras D & Crea D** 2004 *American Economic Review* **94** 155  
**Cockell CS et al.** 2018 *J. Correctional Education* **69** (in press)  
**Esperian JH** 2010 *J. Correctional*

*Education* **61** 316

**Hull KA et al.** 2000 *J. Correctional Education* **54** 261

**Jancic M** 1998 *J. Correctional Education* **49** 152

**Linden R & Perry L** 1983 *J. Offender Counseling Services Rehabilitation* **6** 43

**Stevens DJ & Ward CS** 1997 *J. Correctional Education* **48** 111

**Vacca JS** 2004 *J. Correctional Education* **55** 297

### READ ALL ABOUT IT

*Life Beyond: from Prison to Mars* Charles S Cockell 2018 (British Interplanetary Society) £6 pbk

