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Living on the Next Frontier

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James E. Oberg and
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Foreword by Isaac Asimov

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TO OUR ANCESTORS,
WHO BROUGHT US TO THIS THRESHOLD,
AND TO OUR DESCENDANTS,
WHO WILL CROSS OVER IT.

foreword

ADVANCE — into the — KNOWN

Isaac Asimov

Life—*all* life—has tended to be adventurous, whether consciously or not.

About 650 million years ago, living cells, having remained single and separate for over two billion years, launched the experiment of multicellularity. About 400 million years ago, sea creatures began venturing out onto dry land, which, till then, had been sterile. Perhaps 10 or 20 million years ago, certain primates ventured out of the trees and became ground-dwellers.

In every case, of course, intelligence was limited or, by our own standards, nonexistent. What was done was done without possible forethought, and was done over a long period of time. It was done with who knows what losses, what fiascos, what harvests of death, and came who knows how close to overall failure.

Then came modern man, and he was adventurous, too, breaking new ground and extending the human range. Some

25,000 years ago, human beings ventured out of Asia eastward into the empty (of humanity) American continents and southeastward into equally empty Australia. In early historic times, Phoenician ships ventured out of the Mediterranean into the Atlantic ocean. Later, Polynesian vessels crisscrossed the vast Pacific in magnificent feats of island-hopping. Still later, Vikings plied the unknown northern seas.

In these cases, it was intelligent beings that were involved, people who could weigh what they were doing—but in no case did they (or *could* they) know what awaited them. The early Siberians did not know what unexpected dangers might exist in North America. The early Polynesians did not even know for certain that they might actually come across an island. They survived, however (at who knows what cost), and these human explorations took place far more quickly than earlier nonhuman victories had taken place.

In the last great wave of exploration, between 1400 and 1900, when Europeans explored all the coastlines and continental interiors of the world, leaving only Greenland and Antarctica for the twentieth century, matters went even more rapidly, yet there was still no certainty as to what might be found. The explorers might hope they would be finding wealth in the form of gold or trade—and sometimes they did—but they might also fear they would be finding hostile and perhaps powerful natives—and sometimes they found that, too.

Now, as the twentieth century winds to its close, we stand at the brink of another great wave of exploration, another stride into a new and greater realm; and it is something that dwarfs all that has gone before.

All earlier experiments of life—all expansions of range—have at least been confined to Earth. There remained certain factors of environment that remained constant: there was always the ocean, always the atmosphere, always the Sun and the Earth's rotation, always the seasons and buoyancy and gravitational pull. Life had always held on to these things.

But now, as we launch ourselves into the greatest adventure

of all, we are abandoning Earth for infinite space. We are going beyond the air, beyond the water, into strange realms of the abnormal. We can't rely on a surrounding ocean of air, or water always within reach, or the comforting temperatures that are neither too high nor too low. Even gravitation itself fails us.

Yet despite this, we go with a rational confidence that no preceding explorers, human or otherwise, can possibly have had. There will be losses, we can be sure, but they will be fewer losses and on a smaller scale than exploration has ever seen, and we can be sure of that.

Why this confidence? Are we perhaps being lured into overweening and dangerous overconfidence?

No, we are right to be confident, for we have what no earlier explorers had; not Captain Cook; not Columbus; not Leif Ericsson; not Hanno the Phoenician; and certainly not that first small living thing that lifted itself onto land and withstood the down-beating of undiluted sunlight. We have knowledge.

We know the land we are invading. We understand the laws that govern it, and have known them since the days of Newton three hundred years ago. We know the lands that lie beyond, thanks to the instruments we have manufactured—from telescopes to rocket probes.

We even know some of the problems that will face us in day-to-day life in space for human beings have already traveled to the Moon, and have remained in space for up to eight months at a time. What's more, these explorations have been the common adventure of the United States and the Soviet Union, the nations which, in all other respects, are firm and resolute antagonists. (So perhaps the cooperation and understanding that elude us on Earth may be reached in the otherwise unfriendly emptiness of space.)

Here, in this book, the Obergs, who have been painstaking observers of both American and Soviet space exploration through all its as-yet short history, summarize what we know

about life in space and what we may expect as such life multiplies and expands.

They are both comprehensive and comprehensible. They talk soberly and interestingly of the great imponderables such as light, and warmth, and air, and food—and the nitty-gritties such as toilets and privacy. The physical factors may be solved, but what of the psychological factors? That gets full treatment.

No one reading this book can fail to be impressed by the difficulties that lie before us; or fail to be even more greatly impressed by the excitement and opportunities. Surely, we cannot fail to see that stepping across this new threshold (as the Obergs phrase it) is the most exciting thing that will have happened to humanity so far, and the most worthwhile.

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To our marriage, which proved that a couple can work synergistically, and that the totality of our effort—and life—together is far greater than the sum total of our work—and existence—separately. We both grew while working on this book, but not in one another's shadow.

contents

introduction

Aboard the permanent manned-orbital outposts of the near future, there will be new ways of working, of seeing, of breathing, of thinking. In the contrast between new forms of ordinary human activities and the ways things have been done before, a new threshold in thought will be crossed, and a new arena of human activity will be embraced.

So far, voyages into space have been characterized by their temporary nature. There have been quick dashes to the Moon, not unlike the races to the North and South poles early in this century. There have been marathon orbital endurance runs, glorified space campouts with well-defined endings. These accomplishments have not lacked courage, ingenuity, and productive results. What they have lacked is permanence.

The first steps in this direction have already been taken. America's Skylab space platform was our world's first successful venture in long-term space endurance; in 1973–74, a series of teams of astronauts conducted productive activities aboard the module for as long as 84 days. The Soviets also

demonstrated the depth and breadth of their commitment by launching a sequence of small Salyut space stations for occupancy by cosmonauts. Participation broadened in 1983 when the first Spacelab modules were carried into orbit aboard space shuttle missions; although brief, these missions were characterized by a vast amount of advanced equipment, participation of true scientists and specialists (who were not professional astronauts), and contributions of the European Space Agency that built the module.

These activities will continue throughout the 1980s, leading to the as yet uncrossed threshold of a permanent human presence in space. After that moment there will never again be a time when all Earthborn life is restricted to a single world in the universe.

The arrival of this stage—and the public perception that this stage has arrived, which is bound to follow soon afterward—will have a fundamental impact on our concepts of our world, our universe, and ourselves. Practical benefits will accrue to the nations directly involved; philosophical insights will be available to humanity as a whole.

The precise technology and architecture of the tools and habitats of space stations are not particularly crucial to the main benefits such activities will bring. Numerous designs—a "Space Operations Center," a "Power Tower," a "space train," a "honeycomb alignment"—have been drawn up, and no doubt many will be built. But the important thing, which this book stresses, is what can and will be experienced aboard these facilities, what will be the essential features of human life in orbit.

The volume of Russian material on space-flight psychology is astounding, as is their cosmonauts' candor in discussing many delicate aspects of human behavior in orbit. Long excerpts from inflight diaries—by Lebedev, Aleksandrov, Ryumin, Kubasov, Savinykh, and others—have been published in the U.S.S.R., along with in-depth interviews and postflight reports of other cosmonauts' impressions. Few Americans on Skylab kept diaries, and none has ever been published.

Besides, between 1971 and 1984 there were fewer than six-hundred man-days of American space station experience, compared to almost four thousand Soviet man-days aboard a succession of Salyut vehicles. Consequently, much of this book is based on Soviet material. But the kinds of experiences and insights described are human, not national or ideological or even parochially culture-specific. In the 1990s, more than a thousand human beings from more than a score of nations will be sojourning in space on months-long missions, and they will add a symphony of experiences to these sketchy outlines.

While it cannot be overlooked that these diaries were written by a subset of Soviet spacefarers—only the civilian flight engineers (not the pilots), and only those on the scientific (not the military) Salyut missions—still and all the material is unique in the annals of human exploration, invaluable in preparation for American space station efforts of the early 1990s, and quite assuredly authentic (if noticeably incomplete).

Because of the general unfamiliarity of the spacefarers' names and their mission details, the appendices include brief biographies and mission descriptions of the people and events referred to in this book. And we use "Soviet" to refer to government functions, and "Russian" to refer to ethnic subjects.

As the population base for American spacefarers widens, more impressionable and more expressive individuals will experience spaceflight and will candidly reveal their feelings and insights. That is a natural process, and it is already occurring, but an awareness of the vast sweep of the Russian spaceflight soul barings is bound to accelerate it. Both trends contribute to a better public appreciation of the spaceflight experience, and a more rapid impact on our entire culture.

The space experience is an essentially human one, deeply rooted in our history; the technological trappings are merely secondary, however much easier they are to display to the public. Space is being pioneered by our souls as well as by our machines. That is the theme of this book.

chapter one

SPACEFARERS' DIARY

When is the exact moment one crosses the threshold between Earth and space? Perhaps it is when one first perceives the huge bending of the horizon, the first glimpse of the Earth's curvature. Or perhaps it is when one lets go of a pencil and it floats, as American astronaut William Lenoir and Russian cosmonaut Valeriy Ryumin did. The first perception of crossing over is whenever the mind perceives the departure from the familiar. "There was convincing evidence of weightlessness as soon as I released the flight plan or a pencil," Ryumin noted in his inflight diary. For the first time, the mind verifies the bizarre, alien, unearthliness of space, and says, "Yes, this is it. I am here, in outer space."

Once the cosmonauts had docked their spacecraft to the station, they prepared to go over into it. The transfer tunnel was filled with air, and one of them entered it to unlatch the station's front hatch, which had spent the previous several months exposed to airless space and searing sunlight. Later he recalled a momentary impression: "In the docking unit we sensed the odor of burnt steel—the odor of space."

Cosmonauts Lyakhov and Ryumin woke at eight in the morning to the sound of a "disgusting siren." After exercising for half an hour, they washed up, and had a breakfast of canned meat, cottage cheese from a tube, a roll, and instant coffee. The coffee is made from their own recycled perspiration.