SAMPLE

Solar System Missions: Ulysses

Over the Sun's Poles

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Conclusion

This free sample contains the Introduction and Chapter 1. The complete book contains the full contents above.

Introduction

Ulysses was the spacecraft that left the road everyone travels and went around the Sun the hard way. A joint mission of Europe and America, launched from the Space Shuttle in October 1990 and flown until June 2009, Ulysses was built to study the Sun from latitudes no spacecraft had ever reached, over the poles and out of the ecliptic, the flat band of the solar system in which every planet and every probe before it had lived. To get there the mission took the strangest route in the trade's early history: a two-year fall outward to Jupiter, a gravity assist over the giant's pole, and then a swing back into the inner solar system on a steeply tilted orbit that carried the spacecraft repeatedly over the Sun's north and south poles, the only machine ever sent to those latitudes, the

Sun, seen from above and below.

The mission's findings remade the picture of the heliosphere, the Sun's atmosphere of wind and field that fills the solar system. Ulysses found that the solar wind is not one wind but two, a fast, steady stream from the polar regions and a slow, variable wind near the equator, and that the Sun's magnetic field, far from fanning out evenly, keeps its structure with latitude in ways the textbooks had not predicted. It measured cosmic rays and interstellar dust, crossed the tails of comets by accident, watched the solar cycle turn from minimum to maximum from a vantage point no other mission held, and kept working for eighteen years and nine months, a longevity record for a deep-space mission built for five.

This book tells the mission whole: the origins in the question of what the Sun's poles might hide, the Shuttle launch and the Jupiter flyby that tilted the whole trajectory out of the band, the two great polar passes of the 1990s and the second pair during the solar maximum, the instruments and their discoveries, the voyage named for the Greek who took ten years to come home, the spacecraft's log, the engineering that kept an old probe alive, and the legacy of the only polar view of the Sun anyone has ever flown, the reader, carried, around the great circle, from which the Sun was finally seen whole.

A brief word on the numbers: the dates and distances throughout are the mission's public record, from the October 1990 launch through the February 1992 Jupiter flyby, the 1994 southern and 1995 northern polar passes, the second passes of 2000 and 2001, and the June 2009 decommissioning, quoted as the mission's own literature reports them. Where the later probes and the accreting stories have added layers to the record, the account sticks to the primary sources. Readers who want the raw material will find their way marked in the closing chapters.

The name deserves one word of clarification at the start: the spacecraft honors the Greek, Homer's resourceful traveler, not any later bearer of the name. The European team chose it for the trajectory's likeness to the epic, a decade of detours on the way home, and readers who know the poem will recognize the itinerary as a fair translation: the long way round, past the giant's island, home by patience. The mission's log kept faith with the name to the last page.

How the pages ahead are arranged: the early chapters set up the problem and the reasoning, the middle chapters cover the machine itself and the physics of the flight path, two chapters replay the mission in the order it actually flew, and the last chapters gather what was found, what went wrong, what is still unexplained, and where the record stands today among newer missions. A one-line preview for the impatient: a single spacecraft left the planets' plane, borrowed a giant's pull, and looped over the Sun's north and south poles on repeated passes, and the result is that the Sun's domain has been understood in three dimensions ever since. Everything that follows expands that sentence.

Chapter 1: The Discovery of Ulysses

The discovery story of Ulysses begins with a gap in the map: everything the trade knew about the Sun in 1977, when the mission was first proposed, came from the ecliptic, the plane in which Earth and the planets orbit, and every spacecraft ever flown had stayed in that plane, riding the same flat band, seeing the Sun from the same narrow range of angles. The Sun's poles, the high latitudes, the regions above and below the band, had never been visited, their winds and fields unmeasured, a third of the solar surface effectively unexplored, the gap the mission was proposed to close.

The proposal that became Ulysses was originally called the International Solar Polar Mission, a two-spacecraft joint venture of the European Space Agency and NASA, two probes, one over each pole, the pair to be launched in 1983 by the Shuttle, the plan scaled back in 1981 to a single spacecraft, Europe building the probe and America providing the launch vehicle and the nuclear power source, the mission renamed for Homer's hero, the traveler whose route home went the long way, the name the spacecraft carried to Jupiter and around the Sun.

The real discovery behind the mission was intellectual: the realization that a twenty-year-old question could not be answered from where every spacecraft stood. The solar wind, the Sun's outflow of charged particles, had been sampled for two decades, but only near the ecliptic, and the theorists' arguments about the poles, with some predicting smooth flows and others turbulence, could not be settled from that band. Settling them required a machine willing to leave the band altogether. The discovery chapter's closing thought is the mission's founding insight: some questions are geometric, and their answers live in places the ordinary routes do not go, the Sun, understood, only by going around, the long way, the insight the whole campaign was built on.

The chapter should also credit the audacity of the trajectory, which the following chapters detail: the mission's designers faced the plain fact that no rocket could lift a spacecraft out of the ecliptic directly, the plane's gravity too economical to abandon, and chose the trade's first great workaround, a trip to Jupiter to borrow the giant's gravity, the bend that cost years of flight and a billion kilometers of detour, the discovery story's patient middle, the long way chosen deliberately, because it was the only way, the odyssey, planned, before the spacecraft flew.

The discovery chapter's spare note is the mission's other ancestor, the cancelled twin: the original plan flew two probes, one for each pole, and the

1981 economy kept only one, the partner dropped in the budget's arithmetic, the mission that survived doing both hemispheres in sequence rather than in parallel, the reader who studies the early plans sees the ghost of the second probe in the mission's name's plural past, the twin, cancelled, and the survey, doubled anyway, by one machine's patience, the discovery story's road not taken, noted, and compensated, by the orbit's design.

The chapter also marks the mission's institutional birth: the European Space Research Organisation's early studies and NASA's partnership, the two agencies' committees that shaped the probe's questions, the science teams assembled across two continents, the discovery story's human layer, and the reader who follows the mission's papers will find the collaboration's fingerprints on every instrument, the teams, joint, from the first proposal, the program, born cooperative, and flown that way, to the end, which is the trade's lesson from this mission, and the diplomacy's, too.

The final credit belongs to the builders. The European teams who assembled the drum worked under the mission's austerity, and a reader who studies the probe's construction finds the craftsmanship in the sparseness: a machine engineered for the long way, with patience built into its simplest parts. The ship had to exist before the odyssey could sail, and the people who built it are the discovery story's last and best credit.

The discovery chapter's final spare note is the mission's timing in the trade's history: the proposal of 1977, when the wind's latitude structure was a theorist's argument, and the flight of 1990 through 2009, when the argument became a map, the discovery story's whole span, and the reader who charts the decade's solar science sees the mission's dates bracketing the change, the argument, ended, by arrival, and the map, drawn, by one orbit, the note the chapter closes on, and the discovery, dated, and the science, delivered, in its season.

End of free sample. The full book is available at putrabooks.github.io

ABOUT THE AUTHOR

Aira Astralis is a science writer specializing in astronomy and space exploration. Her work spans the full breadth of humanity's relationship with the cosmos -- from the earliest naked-eye observations to the engineering marvels of modern space missions.

Her books are built on a foundation of primary sources: peer-reviewed research, mission archives, and direct engagement with the scientific community. She writes for readers who want to understand not just what we know about the universe, but how we came to know it.

She believes that the most important frontier is not out there but in the gap between what scientists discover and what the public understands. Her books exist to close that gap.