Air and Space this Week

Item of the Week

THE FIRST VOYAGE OF CAPTAIN COOK

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Air and Space this Week is devoted to aviation and Space-related topics, so why am I writing about an 18th Century naval captain? Well, both exploration of the Pacific and the exploration of Space have the "exploration" element in common. But more importantly, Cook's exemplary use of the movements of the Sun and Moon allowed him to navigate and make charts far more accurately than any previous or contemporary sailor, so there's that link. And even more astronomically, Cook's voyage plan included a stop at Tahiti to observe closely a transit of Venus, part of an international effort to determine the size of the Solar System. He even managed to observe a transit of Mercury, too!

EUROPEAN EXPLORATION OF THE PACIFIC PRIOR TO 1760

Explorers seeking and exploiting contact with the Orient established trade in the latter half of the 1200s CE. But the interesting cultures and riches of the East were largely unknown in Europe until the publication of a book of his travels, in 1300 CE. He had traveled along the "Silk Road" to Cathay (China), where he was received by Kublai Khan, who was so impressed by Polo that he made Polo a foreign emissary, which allowed Polo to visit much of Asia. He lived in Cathay for 17 years, then he returned home to Venice via Persia and Constantinople. He wasn't the first to reach China and return, but he wrote a detailed book on his experiences and the nature of Asia and its peoples.

The lucrative trade made possible with the Orient inspired a lot of additional exploration, and advancing nautical technology enabled it. Sailors began exploring coasts evermore distant from Europe, culminating with Columbus' discoveries in 1492 and beyond. Other explorations came in rapid succession, and in 1513 CE, Balboa sighted the Pacific in what is now Panama, and claimed all the lands washed by the newly-discovered ocean.

Geographers knew by then that the world was round, and they had a pretty good idea of the shape of European and African land masses. They also knew that a large land mass lay west of Europe and Africa, across the Atlantic. But what laid beyond was a blank space on the globe. Might it be possible to reach the riches of Cathay and its surroundings from the east, rather than approach from the west via the Spice Road?

Magellan was the first to circumnavigate the Earth by sea. His ships sailed west to South America, then south to Cape Horn and the straight that today bears Magellan's name. He turned north along the Chilean coast, then moved northwest with the trade winds. He altered course northward in the mid-Pacific, encountering a number of small islands in the Marshall Islands, Guam, and the Philippines, where the Spanish had established a presence by sailing east from Europe. On Mactan Island, off Cebu, he met his doom. But some of his ships and men made the arduous trip westward, eventually making it home to become the world's first circumnavigators.

Magellan encountered a lot of islands along the way, but no large land masses in the Pacific. It was becoming clear that the northern hemisphere had a lot of land, but unless the unknown part of the Pacific held a sizable continent, the world would be unpleasantly "unbalanced," land-wise.

Subsequent 17th Century navigators, notably Mendaña, Torres, Quiros, Schouten and Le Maire, and Roggeven all made east-to-west trans-Pacific crossings in tropical latitude. They found more islands, but the area south of 35° S was still not known.

Meanwhile, a number of Dutch explorers were having success in establishing trade with Java and other islands in what is now Indonesia. The money involved was very large, and the Dutch aggressively expanded their nautical knowledge of the area by vigorous exploration. Abel Tasman's two voyages in the 1640s helped flesh out the map of the Pacific, discovering Tasmania and New Zealand and exploring the northern coast of New Guinea on the first, and exploring the southern coast of New Guinea and northern coast of Australia on the second.

The 18th Century dawned with circumnavigation becoming more common. The Pacific was becoming more important as a place to be exploited than a place to be explored. Toward that end, the British Admiralty determined that they needed a supply base off the South American coast to support and protect nautical trade travel. They assigned the mission of finding and establishing such a base to John Byron in 1764. The South American coast proved too settled by Spain to allow a claim there, so he claimed the Falkland Islands, which led to conflict in 1770 and somewhat later. He completed his circumnavigation in 1766.

Next up, Samuel Wallis took command of the ship used by Byron. He was particularly suited for continuing the exploration of the Pacific. Phillip Carteret, who had also sailed with Byron, commanded Wallis' supporting ship. They had a terrible time passing Cape Horn, and their ships became separated. Magellan's men had suffered greatly from scurvy and other diseases brought on by poor diet, and Wallis and Carteret tried hard to find ways to improve the health of their crew. The crew did better than those before, but scurvy soon became a problem anyway. Carteret ended up sailing a westward path that was somewhat south of Wallis'. His ship was in poor condition, but he persevered, discovering Pitcairn Island and revisiting (but not recognizing) the Santa Cruz Islands discovered earlier by Quiros. He then sailed along the northern Solomon Islands to the Philippines, thence to Batavia and home.

Wallis' more northerly parallel course took him to a large island, Tahiti, which he named George the Third's Island. A large number of native canoes came out to greet him as he anchored in

Copyright 2023 by Steven H. Williams Non-commercial educational use allowed Matavai Bay. They had found Paradise: lots of food, fresh water, timber, and women. He stayed at Matavai for more than a month, and he (and his crew) found it very difficult to leave. Their description of this island would, not surprisingly, cause a great sensation when they got home.

The English had competition in the mid-Pacific. Louis Antoine de Bougainville was sent on a mission that was similar to that of Wallis. He was too late to make a serious claim on the Falklands, but he spent more time and effort in Tahiti, and that is why it and the surrounding Society Islands are French territory today (even though their collective namesake is the British Royal Society!).

Slowly but surely, Europeans were learning the geography of the entire Pacific Ocean, but many unresolved questions remained. Australia and New Zealand had been discovered, but their size, shape, and relationship with other islands/lands were poorly known. The Pacific south of the tropics had not been explored; was there a large continent east of New Zealand at mid/high latitudes?

THE 1769 TRANSIT OF VENUS

The burgeoning scientific discipline of planetary astronomy was making great strides in the mid-18th Century. The size of the Solar System, at least in terms of the Earth-Sun distance, had been pretty-much worked out. But the actual distances between the planet in miles, kilometers, etc. had eluded them.

However, trigonometry came to the aid of the astronomers again. If the position against the face of the Sun as seen during a transit of Venus could be observed from a number of different places on Earth, then trigonometry <u>could be used to determine</u> the actual distances from Earth to Venus and Earth to the Sun. IF the observations could be accurate enough in space and time.

The Royal Society was determined that the Royal Navy should participate in this effort. To not do so was deemed a "dishonor to the British nation." They recommended that observations be made at three widely-separated locations: Hudson's Bay, Lapland, and somewhere in the middle Pacific.

The British Admiralty was on board with helping in this effort, and they knew From Wallis' observations that newly-discovered Tahiti would make an ideal place for making transit observations. A scientific expedition was quickly mounted, and would include not only astronomers, but biologists and other natural scientists, too. Time was of the essence, for the transit would occur on June 3, 1760, and the next lie more than a century in the future.

The Admiralty also had an expedition commander in mind, an inspired choice who proved even more capable than they had hoped. His name was James Cook.

CAPTAIN JAMES COOK

James Cook was born in the small Yorkshire village of Marton-on-Cleveland on **October 27**, **1728**, **295** years ago next week. His father was a day laborer, but he had a benevolent and generous boss, who recognized young James' potential and paid for his early schooling. But the lure of the sea called James more than the prospect of a comfortable life as a shopkeeper. He apprenticed to John Walker, a successful coal merchant from Whitby, and began his maritime life on the North Sea. His hard work and sharpness of mind and he quickly climbed the ladder of responsibility, aiming toward his own command.

The line between merchant and military sailing was sometimes blurred, especially in the mid-1750s, when a series of naval skirmishes in advance of the Seven Years' War broke out. Cook volunteered for the Royal Navy, participated in several minor battles, and continued his climb in rank. A better understanding of the St. Lawrence River was needed prior to the British invasion of Quebec, and Cook was sent to make a survey. The quality of the resulting charts, and the speed with which Cook prepared them, gave him a reputation as a skilled marine surveyor. His success there led to an assignment to make a systematic survey of Newfoundland to be used in England's dispute with France there. Cook's charts of Newfoundland and Labrador were excellent; some of them remained in use for over two centuries!

Cook had the fortune to see a total eclipse of the Sun in 1766. He wrote up a report of his observations of the event and sent it to the Royal Society, whose members received it and were impressed with Cook's thoroughness of observation and presentation of his results.

The Crown agreed with the importance of a trip to Tahiti for astronomical observations, and Cook was named to be in command of the mission. The civilian scientist pushing for the mission wanted to be in command of the ships involved as well as the observing team, something the Admiralty refused, naming Cook instead, who had just been promoted to Lieutenant in May, 1768.

The Navy purchased a Whitby-built collier, a bark of 368 tons, well-built with excellent sailing properties. His crew, both naval and civilian, numbered 96. A number of additional modifications were made to make the *Endeavour Bark* even more sea-worthy and suitable for the support of a major expedition (the "Bark" was needed to distinguish Cook's ship from another *Endeavour* already on the naval rolls). Great care was taken by Cook in the additional features of his ship, and in her victualling – Cook would prove to be extremely concerned about the health of his crew.

The main civilian naturalist aboard would be Joseph Banks, whose large wealth could self-fund a big piece of the cost of the expedition, including a number of other scientists, artists, and servants, and a lavish budget for equipment and supplies. His principal assistant was Daniel Solander, a pupil of Linnaeus.

Another development that greatly affected the pending voyage, and Cook's career, was the publication in 1767 of the first *Nautical Almanac*, sparkplugged by Astronomer Royal Nevil Maskelyne. The tables within it could allow accurate navigation by observing the positions of the Sun and Moon, and Cook would soon become a master of the procedure.

Cook's orders were for him to sail directly around the Horn for Tahiti and make the necessary observations of the transit of Venus. After that, he was to sail southward to a latitude of -40° in order to traverse the region where no ships had gone before. The Admiralty wanted very much to have a much better understanding of Pacific geography.

THE FIRST OF COOK'S VOYAGES OF DISCOVERY

The *Endeavour Bark* sailed from Plymouth on August 26, 1768. First port-of-call was Madeira, where Cook scored a lot of wine and a lot of onions, which he used to good effect in fighting scurvy. They got hung up in red tape in Rio de Janeiro in November, but they were able to leave after a few weeks. He then sailed through the Strait of Le Maire, charting the passage so accurately that his sailing directions remained in use well into the 1900s! He anchored in the by-then well-known Bay of Success for wood and water, and a goodly supply of scurvy-grass. He passed Cape Horn on January 27, 1969, and aimed directly at Tahiti, allowing him to pass over one area of the Pacific that might hide a large land-mass. It didn't, but he began encountering islands previously discovered (Tuamotus). Tahiti was sighted on April 11, and the *Endeavour Bark* anchored on the 13th in Wallis' Matavai Bay. A good stretch of coast of the Bay was identified for an observing site, known then and today as "Point Venus." An observatory and fortification were built there, while Banks and his team botanized to their heart's content.

Transit Day came and the weather was good as usual. Cook had taken the precaution of splitting the observing team into three separate groups, protecting against observing problems that might be encountered. The necessary observations were made successfully. The ship needed an overhaul, which the crew handled ably, while Cook and Banks made a detailed survey of the Tahiti coastline, finding Bougainville's former campsite. The ship was made ready, and Cook and company sailed on July 13. They visited and charted a number of the smaller islands in the vicinity, including Huahine, Tahaa, and Raiatea. Cook then took possession of the entire group of what he called the "Society Islands," a nod to the British Royal Society. The *Endeavour Bark* left the region on August 9.

Cook's orders were to sail southward to 40° S latitude, then sail west. He was to traverse the unknown region to find any land there, or see only open ocean until he hit New Zealand. He made the turn off the southward leg on September 2. There was no land until October 6, when New Zealand's North Island. Cook had taken a Tahitian youth, Tupaia, aboard earlier, and was delighted to find that the New Zealand Marois and Tupaia could understand one another. [I wonder if/how much Cook pondered over the implications of that – evidence of the Polynesian diaspora!] The Maoris were not very friendly, resisting a landing. Cook coasted the shoreline, rounded East Cape, and entered the Bay of Plenty. Cook was impressed with both the country he was encountering and its inhabitants, and would soon claim New Zealand for Britian.

But not before conducting one more bit of astronomical observations.

Venus was not the only planet that would transit the Sun in 1769. Mercury horned in on the act on November 9. *Endeavour Bark* had landed to prepare for the event and to make observations, which could also, theoretically, be used to determine the size of the Solar System.

Copyright 2023 by Steven H. Williams Non-commercial educational use allowed Astronomer Green made the observations successfully, and Cook dubbed the site "<u>Mercury</u> <u>Bay</u>," a name still in use today. After that, he circumnavigated New Zealand, making accurate charts along the way. He was particularly taken with the beauty and utility of the deep gulf of the river he called the Thames, and the harbor at the Bay of Islands.

Cook fought weather in December, but still managed to chart the western coast of North Island most accurately, reaching a tall volcano he named Mt. Egmont after the First Lord of the Admiralty; it only recently reverted to its Maori name, Taranaki. On January 14, he put in at a place he called Ships Cove in a long inlet he called Queen Charlotte's Sound, which would become one of his favorite anchorages. The *Endeavour Bark* needed overhauling, and this was an ideal spot. While this was being done, he used the ship's boats to survey the area.

Cook's mission was now fully complete, and a resounding success. After completely circumnavigating New Zealand, and proving it consisted of two islands (the separating strait bears Cook's name). It was now March, 1770, and it was time to turn for home.

Cook's orders allowed him the choice of going east and rounding Cape Horn again, or to sail west and go home via the Cape of Good Hope. The latter was the safer route, but precluded any further discoveries. The Cape Horn route would allow him to further demolish (or prove) the notion that there was a sizable land mass in the southernmost Pacific. It was late in the sailing season to be at high latitude, and the *Endeavour Bark* was showing some strains from the voyage, so he held a council of his officers and concurred with their unanimous assessment, to return home westward by way of the East Indies. They all agreed to sail westward until they encountered the shore of "New Holland" (Australia), then go northward along the coast. A momentous choice.

Cook had hit the Australian coast in its southeast corner; a gale prevented him from learning that the land Tasman had named for himself was but an offshore island, separated from Australia proper by the Bass Strait. Instead, he went north, past the site of present-day Sydney to a marvelous bay filled with rays. Banks and the botanists were ecstatic at the diversity of life there, and called it "Botany Bay" as a result. He kept moving north, naming but not entering a bay he named Port Jackson (after another Admiralty secretary), which turned out to be one of the world's finest harbors. Soon thereafter, he encountered Bustard Bay ("The bustard's an exquisite fowl, who has no reason to yowl, for he is saved from you see, illegitimacy, by the sake of a fortunate vowel!" Thank you, Isaac Asimov.) and Moreton Bay (the present site of Brisbane).

Sailing northward, he encountered the greatest danger of the entire voyage, the Great Barrier Reef. They were in need of fresh water and a safe place where they could clean the ship's hull again, so the coasted along even at night, by brilliant moonlight. Coral shoals began appearing all around, and in spite of taking soundings as quickly as possible, the ship ran into a reef. They might be able to get off at high tide, but even if they did, the damage could be bad enough that they would sink immediately. The crew turned to and managed to get the ship off the reef, and although the hull was leaking, the ship's pumps could keep up with it, unless it got worse.

Midshipman Jonathan Monkhouse suggested that Cook "fother" the ship, a procedure he had seen done another time when a ship was in distress. An old sail was lined with oakum and wool, and covered with dirt, was placed over the bow of the ship and dragged along the hull to cover the leaking area. The mixture would be drawn into the leak, sealing it, with the sail holding the material in place. The trick worked, and the ship's pumps had the hold dry in fifteen minutes. A suitable river inlet was found, and two days after the grounding the ship was moored and being emptied so it could be drawn up on shore and repaired. The damage was bad, but luck was on Cook's side. A piece of coral had broken off and stuck in the hole; had it dropped out, the *Endeavour Bark* would have been *in extremis*. The repairs were made and the *Endeavor Bark* was re-floated on July 4. Reloading, supplying, and the weather precluded further travel until August 6. The ship was sea-worthy, but its condition was getting progressively worse.

One last discovery awaited. Cook came across a large indentation in the coast, and he wanted to see if New Holland and New Guinea were parts of one continent, or if they were separated. He knew if he went into the indentation and it wasn't a passage between NH and NG, he would have a very difficult time tacking his way back east again, especially with the condition of the ship. They encountered a number of small islands as the indentation narrowed, but they made it through, passing between NH and NG south of the location through which Torres had travelled before, finally proving to the Admiralty that New Holland and New Guinea were separate land masses.

Cook crossed the strait and made landfall on the southern coast of New Guinea for food and water. They were in "known" waters now, and made their way to Batavia (Jakarta) on the west end of Java. The Endeavour Bark was a floating wreck and needed a complete refit. The Dutch shipwrights showed Cook the astonishing amount of near-fatal damage the ship had suffered, but they were good at their craft, and had the necessary repairs to the hull were completed by November 14. The ship still needed a lot of supplies and work, and could not be made ready to sail until December 26.

Cook could take great pride in the fact that he had not yet lost a man to anything but old age. He rigorously enforced cleanliness and diet management and acquired foods capable of holding off scurvy and other diseases that had decimated previous long-distance voyages. No commander had ever had such success against sickness, and many of the tactics he used were of his own invention.

Alas, Batavia was a bastion of sickness, and no amount of precautions by Cook could protect his crew from the diseases that ran rampant there. By late November, almost everyone was sick. By the time *Endeavour Bark* could sail for home, seven of her crew were dead, forty more were sick, and the rest quite ill. Twenty-two died within a few weeks, including Tupaia, Monkhouse the surgeon, Monkhouse the fothering midshipman, and Green the astronomer. Lt. Hicks, who had started the voyage suffering from tuberculosis, succumbed some time later.

Endeavour Bark made landfall at the Cape of Good Hope on March 10, 1771, and they stayed there a month reprovisioning and healing. The made St. Helena on May 1, and espied Land's

End on July 10. On July 13, the *Endeavour Bark* anchored in the Downs, and Cook left the ship to report to the Admiralty in London.

Both the Admiralty and the Royal Society were enormously impressed with Cook's report, and rightly so. Cook and Banks both recommended another voyage, which was immediately approved.

Alas, it turned out that the observations made by Cook and others were insufficiently precise to allow a meaningful estimate of the size of the Solar System to be made.

SHORT SYNOPSIS OF THE OTHER TWO COOK VOYAGES

Cook's reputation soared after the first voyage. Banks' did, too. But there still a number of blank spots on the maps of the Pacific, and France, building on the moderate success of Bougainville's voyage, was shaping up to be serious competition with Britian for making territorial claims and establishing trade. Cook would soon be tasked with a second voyage of discovery.

The near-loss of the *Endeavour Bark* convinced both Cook and his superiors that two ships, not one, should be acquired for the voyage, and the Admiralty purchased them from the Whitby shipbuilders, chosen on Cook's strong recommendation. The *Endeavour Bark* was used up (but would soon return); the *Resolution* and the *Adventure* would be used. The former was considerably larger than the *Endeavour Bark*, which was about the same size as the *Adventure*. Cook would command the *Resolution*, while Tobias Furneaux, who had sailed with Wallis, would command *Adventure*. Banks again spent lavishly on items relating to scientific exploration and personal comfort, but his insistence that his party of 15 would be fully included. Space constraints nixed that idea, and Banks and his party left in a huff. A number of replacements were made, some less easy to deal with than their predecessors.

Cook was a master of celestial navigation, allowing him to prepare charts of amazing accuracy. On this second voyage, he had another quite useful tool to help him determine longitude, the <u>Harrison Chronometer</u>. He would amply demonstrate its value on the coming voyage.

Cook worked closely with the Admiralty to prepare his sailing orders. The resulting track chart showed that he had covered the blank areas on the globe quite well. A few islands could evade his notice, but his second voyage would show that there were no continental-sized land masses awaiting discovery. The reception of his successes this time would be more muted than after his first voyage, in large part because King George III and Britian were distracted by the Revolutionary War.

But not entirely. Cook had an extended audience with the King, and was unanimously selected as a Fellow of the Royal Society, which also award him the prestigious <u>Copley Medal</u>. Wales, the astronomer on the second voyage, was appointed the mathematics master at Christ's Hospital, a significant career appointment, and Cook himself applied for an appointment there, too. Of course, he got it, but he made the proviso that if his special set of skills and experience were again needed by the Royal Navy, he would answer the call.

Copyright 2023 by Steven H. Williams Non-commercial educational use allowed They called, he went. The *Resolution* would lead the *Discovery*, commanded by Charles Clerke, a veteran of the second voyage. The goal was to refine some of the previously-made observations, but more importantly, search for the Northwest Passage. They two ships sailed on August 1, 1776. Britian was at war with both France and Spain, but both countries recognized the purely scientific nature of Cook's mission, and granted him safe passage.

Cook rounded the Cape of Good Hope, but both ships were showing signs of damage. They made repairs and acquired two-years' worth of stores at Table Bay. The paused at already-known Kerguelen Island, then sailed east. The passed south of Australia, seeing only the tip of Tasmania (still thought to be attached to Australia), and proceeded to Cook's favorite New Zealand harbor. He then sailed northward, aiming for Tahiti, but adverse winds compelled him to go to the Tonga Islands, instead. After making more repairs and gathering food and water, they made for Tahiti, arriving August 12 and sailing away on September 29. They found a new island on December 24, and of course named it "Christmas Island," where they stayed for a few days to observe an eclipse of the Sun.

The Northwest Passage, if it existed, would have an exit somewhere almost due north of Tahiti, so that's where they went. Rather than make a beeline, Cook sailed to the northeast until he hit what is now known as the Oregon coast. He coasted the shore northward, but found only one potential passage, the Juan de Fuca Strait. Denmark's Vitus Bering had already explored this area, and found no passage, and Russian commercial fishing ships had plied this coast before. Cook made careful charts as he approached then cleared the Bering Strait. He made it past the Arctic Circle before pack ice blocked further northing. Cook turned west and made for Kamchatka, then back east to Unalaska Island, in the Aleutians. Then he turned south to start the trip back home.

And he sailed straight into the Hawaiian Islands. He named them for John Montagu, the 4th Earl of Sandwich. Imagine! Having a series of important positions in his career and being the namesake of a wonderful set of paradisical islands, and yet be <u>best known today</u> as the inventor of a popular food item.

Cook had found the Sandwich Isles to be a paradise greater that even that of Tahiti. His ships needed significant repairs, and his science team found plenty to do. Relations with the natives on both Maui and the Big Island were very good. They left on February 4, and ran into a storm that caused significant damage to both Cook's ships. The returned their former Hawaiian anchorage, and while their initial visit had been met with friendliness, the return was not (primarily for religious reasons). A violent clash resulted, and Cook was killed. His crew was thunderstruck.

Lt. Clerke assumed command of the mission, and carried on with the mission. He sailed for Kamchatka, thence through the Bering Strait again. He was stopped at the same latitude as in the previous attempt, and the expedition was forced to give up further search for the Passage. Clerke had been ill for some time prior, and finally succumbed on August 22, with Lt. Gore taking command. They sailed along the Kuriles and Japan, stopping at Macao. The rest of the voyage was routine, and the anchored of the Nore on October 4.

The third voyage was a success. Cook had proven that astronomical research could be conducted at remote locations, given naval resources.

But Cook was gone forevermore.

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A full-sized replica of the *Endeavour Bark* was constructed and is now a major exhibit at the Australian National Maritime Museum in Sydney; see: <u>https://www.sea.museum/whats-on/our-fleet/hmb-endeavour</u>

Wikipedia: https://en.wikipedia.org/wiki/First voyage of James Cook

DIDJA KNOW

Point Venus is remembered for two historical events. The first was the observation of the 1769 Transit of Venus by Cook's science team. The second is that Point Venus was the disembarkation point for a ship with a load of breadfruit trees, a dissatisfied crew, and a tyrannical captain. Yes, I'm talking about the *HMS Bounty* and Captain Bligh in 1790. The mutiny would occur soon after sailing and Fletcher Christian took the ship to Pitcairn Island, where his descendants still live. There are monuments to both events (<u>here</u> and <u>here</u>) and their participants at Point Venus to this day, or at least until 2010, when I was able to visit as part of my excursion to Easter Island to see the total solar eclipse that year.

The *Endeavour Bark* was rebuilt after Cook's first voyage, and renamed the Lord Sandwich. It was one of thirteen vessels scuttled in the <u>Battle of Newport</u> (Rhode Island) in August, 1778,

Copyright 2023 by Steven H. Williams Non-commercial educational use allowed during the Revolutionary War. Its wreck has been found and studied in 2002. The report on the wreck investigation is at:

http://www.anmm.gov.au/webdata/resources/oaiFiles/EndeavourRPT2000No2b2.pdf.

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