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Ballooning

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ATMOSAT — 6 and 7

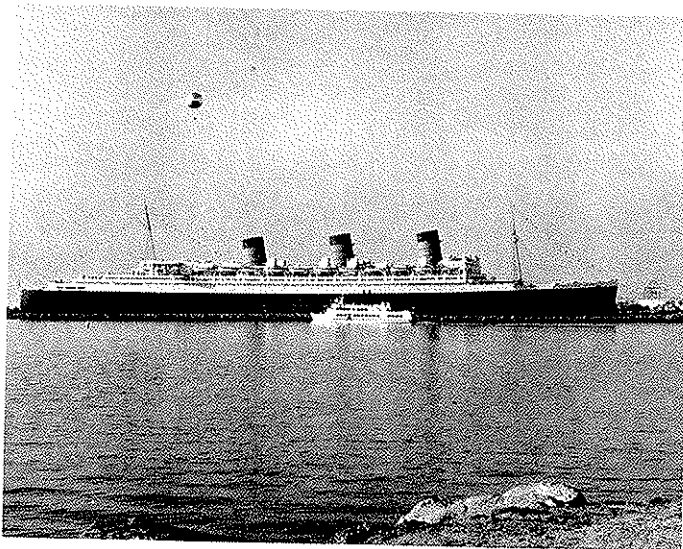
One by Land, One by Sea

A Staff Report



Final countdown before the launch of ATMOSAT-6 from the parking lot next to the *Queen Mary* in the Long Beach Harbor.

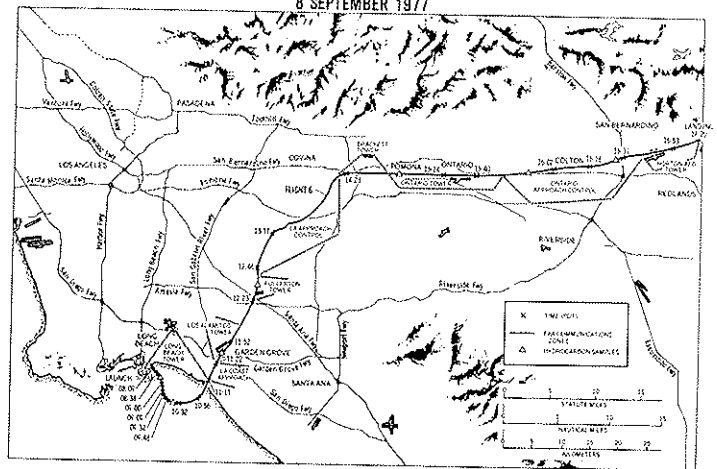
With the ATMOSAT-5 flight from Santa Ana, the ATMOSAT program had entered into its operational phase (see *Ballooning* Vol. X, No. 5). Flight six was completed successfully on September 7, 1977 with a launch from the parking lot next to the *Queen Mary* in the Long Beach Harbor. Lifting off at 8:09 a.m. on a hot, smoggy day, *America* drifted slowly over the stately ocean monarch toward the harbor breakwater. Scientific instrumentation carried aboard measured air quality parameters as the balloon cruised at 200 to 400-foot altitude. At 11:10 *America* crossed the shore at Seal Beach. The next several hours were spent floating over the suburban



Pushed by an early morning breeze, the *America* moved out to sea for about four miles, then headed ashore at Seal Beach where it drifted over Knotts Berry Farm towards the San Gabriel Valley.

communities as *America* drifted inland across the Los Angeles Air Basin. By late afternoon the flight had entirely traversed the basin and was brought down by the crew (Tom Heinsheimer and Pete Neushul) in an orange grove near Redlands. The extensive radio and television coverage of the launch and flight made it one of the most extensively viewed flights of the ATMOSAT series; one commentator estimated that a million people had seen the balloon during its leisurely traverse of the city.

Trajectory of ATMOSAT 6
8 SEPTEMBER 1977



The success of ATMOSAT-6 prompted an urgent request for another flight. The City of Long Beach had been preparing an Environmental Impact Report (EIR) regarding a planned facility for off-loading crude oil being brought by supertankers from the pipeline terminus at Valdez, Alaska. An important issue to be evaluated in the EIR was the effect of tanker emissions on the air quality of the South Coast Air Basin. The City of Long Beach requested the Aerospace Corporation (developer and owner of the balloon system) to organize a flight to trace the direction of the air mass originating in the Santa Barbara Channel shipping lanes about ten miles south of Point Conception and to follow that air mass to determine if it moves onshore anywhere in the South Coast Air Basin.

The requirements for this flight were unusually stringent: the balloon had to be launched at sea from a preselected point in the shipping lanes, the flight had to last at least 24 hours (or until the air mass being monitored came on shore), and all preparations had to be completed within one week.

In order to launch the balloon from a position off-shore, one of two methods had to be employed. The uninflated balloon and a helium trailer containing some 20,000 cubic feet of gas could be ship-carried to the launch site. Once on station, the balloon would be inflated and weighed off on the ship, then released. A second method would involve inflation of the balloon onshore, then towing it to sea using a much smaller ship and releasing it when the tow vessel arrived at the launch site. It became clear that the first option would require a large and costly vessel and might require operational procedures that could not be perfected in the short time available between the initial request for the mission and the expected flight date. As the program had already acquired

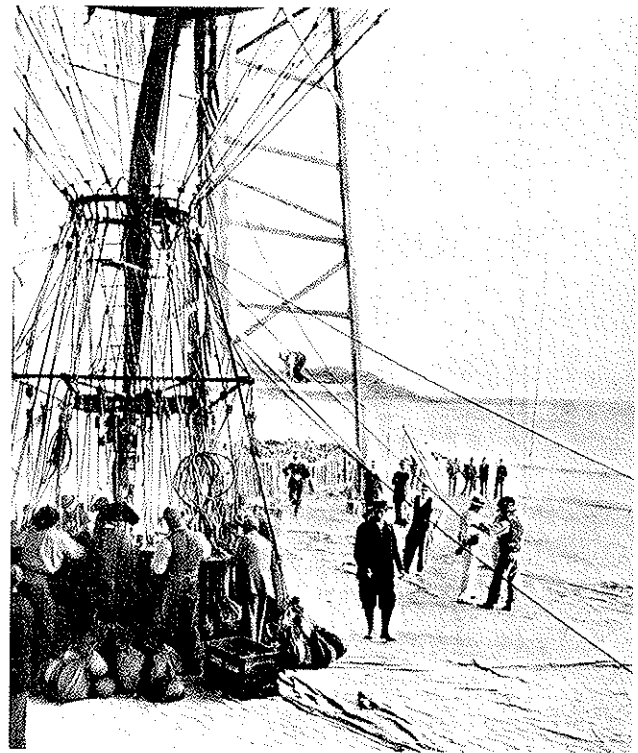
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ATMOSAT-6 AND -7

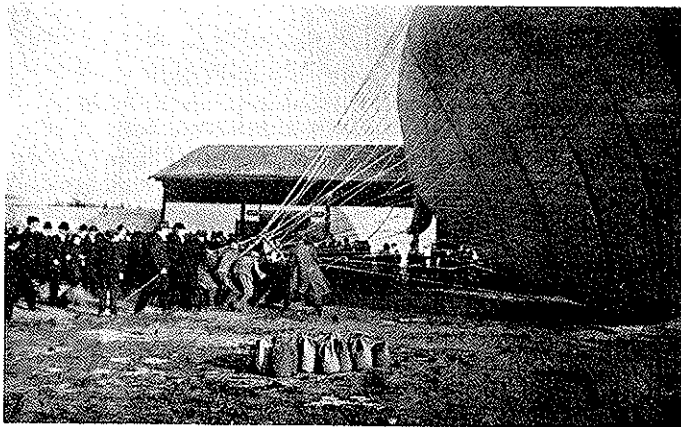
(Continued from page 14)

considerable experience in the inflation of the balloon at remote sites on land but had never even contemplated a shipboard inflation, the second option appeared preferable. Research was therefore undertaken to establish the feasibility of the inflation of the balloon onshore and its subsequent towing to the launch site.

Fortunately, the project recently came into possession of a rare edition of one of the great classics of lighter-than-air literature, "La Triomphe de la Navigation Aerienne" published in Paris in 1911 by Count Henry de la Vaulx. This remarkable book includes an extensive chapter on aero-marine operations similar to those that were under study for this mission. Some 50 pages of text, drawings, and photographs were dedicated to the problems of balloon operations over the sea, including a detailed discussion of several lengthy flights made by the de la Vaulx group in the years 1901 to 1904. Study of these flights convinced the ATMOSAT team that the towing method was feasible. Examination of the diagrams and photographs showed the hardware configuration used by de la Vaulx. As there was no time for preliminary field testing, the needed hardware was procured to match as closely as possible the equipment used in those early flights over the Mediterranean, and procedures were written that paralleled those explained in de la Vaulx's text. A number of photographs from the 1911 report are included in this report in order to show the two systems. It will be noted that not only are the configurations similar, though separated by some 75 years of technological progress, but the resulting inflights performances are very much alike. The success of ATMOSAT-7 is entirely due to the pioneering work done by the de la Vaulx expeditions, and the generosity of Professor J.E. Blamont of the Service d'Aeronomie who provided the project with one of the few extant copies of this invaluable treatise.



The balloon *Le Meditteraneen* before launch at the beach of Sablettes near Toulon, October 12, 1901. Count de la Vaulx, on the right, oversees the preparation.



A gust of wind during the inflation of the *DJINN* at St. Cloud, September 26, 1903.



A gust of wind during the inflation of the *America* at Gaviota, October 10, 1977.



The balloon *America* before launch at the beach of Gaviota near Santa Barbara, October 10, 1977. Tom Heinsheimer, on the left, oversees the preparation.

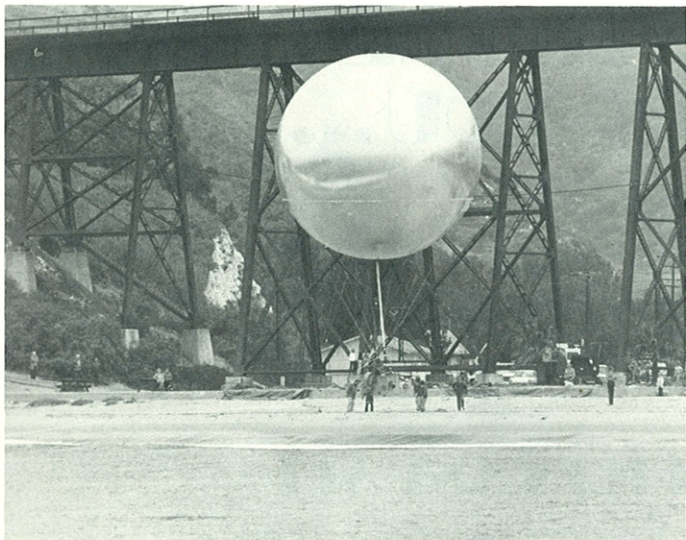
Flight seven of the *ATMOSAT America* started on October 10, 1977 and concluded on October 11, 1977. This flight was made by The Aerospace Corporation under contract to the Port of Long Beach, with the scientific and operational support of the South Coast Air Quality Management District (SCAQMD) and the U.S. Coast Guard.



Ready for liftoff, Peter Neushul (with sandbag) and Tom Heinsheimer embark on their sixth flight, this one intended to monitor the movement of smog over the Los Angeles Basin for the South Coast Air Quality Management District.

The balloon was the same one used on the previous flights. The superpressure was limited to 40 mb before flight and 35 mb inflight (superpressure just after launch was 34 mb). The gondola was the Kevlar/aluminum structure previously flown, weighing 30 kg.

Some of the special equipment carried on board the gondola for this flight was a sea anchor, two 300-foot rolls of ¼-inch polypropylene line, link shackles connecting the load ring, grappling hook and line, and the floating guide rope assembly.



Liftoff of *ATMOSAT-7* at Gaviota Beach State Park, California as the Coast Guard cutter prepared to tow the balloon out to sea.

The Coast Guard cutter used for this flight was the 82-foot *Point Judith*, which was detailed to the mission from her home port of Santa Barbara. In addition to her normal roster of seven officers and crewmen, the cutter carried engineers and scientists from the SCAQMD, the California Public Utilities Commission, the Port of Long Beach, and the Aerospace Corporation.

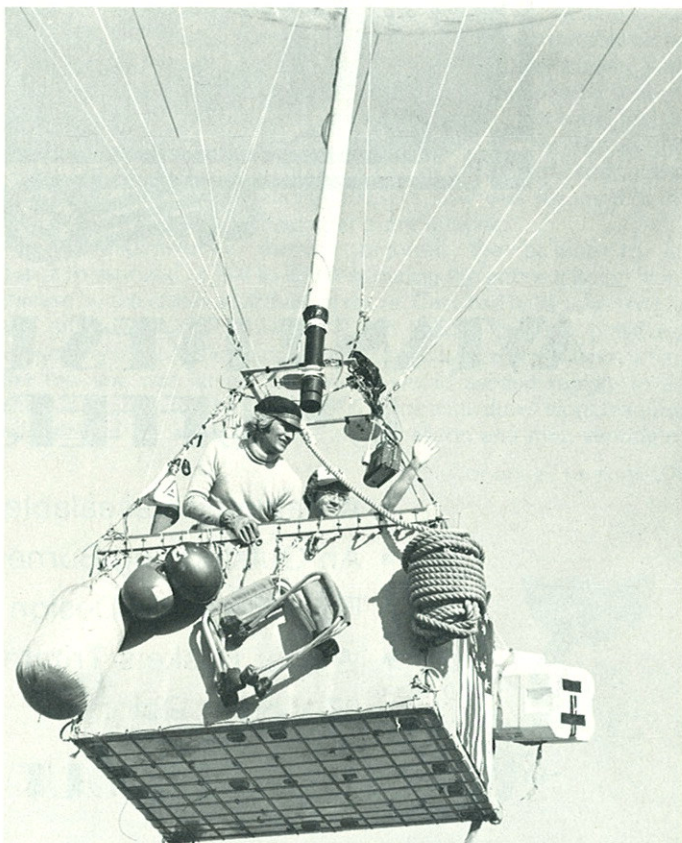
A 65-foot commercial vessel, the *Summer Tide* was leased by the Aerospace Corporation for conveyance of needed equipment and personnel to and from land and the cutter and to lend assistance when needed.

The balloon, gondola, flight crew, and equipment arrived at Gaviota Beach State Park Sunday afternoon October 9. The balloon and gondola were set up for inflation and all equipment was checked out.

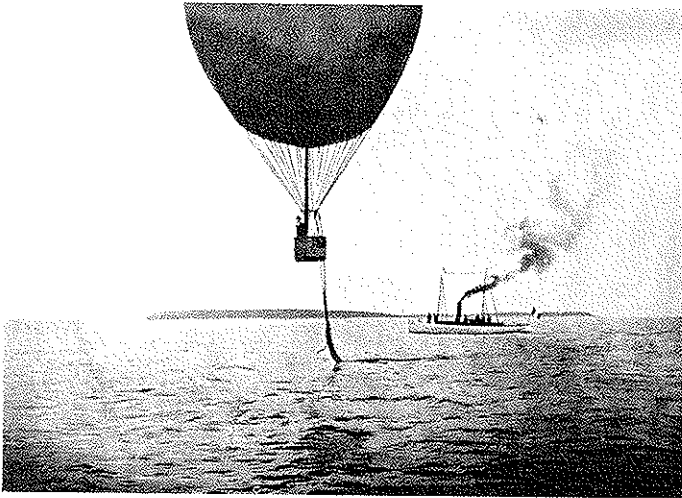
At 6:00 a.m., October 10th, the weather analysis of the SCAQMD gave an okay for the operation. Arriving at the launch site, the inflation crew was dismayed to find that a 15-knot wind channeled down the Gaviota canyon in an area where otherwise, for miles around, the air was calm. By 7:00 a.m., however, the winds were down to 8-10 knots (with a few gusts to 12) and the decision to inflate was made. By 7:30 a.m. helium was rushing into the silvered envelope that flapped about heartily in the breeze. A heavy hand on the helium supply soon had enough gas in the balloon to overcome the wind.

When the *Point Judith* and the *Summer Tide* arrived from Santa Barbara at 7:41 a.m., activity became frenetic — inflation and checkout of the balloon, communications checks on the marine radio and on the special UHF communications network, layout of the rigging lines on the beach, loading of the towing lines and equipment onto the cutter, transfer of personnel from shore to ships, photography, and final calibration of instruments.

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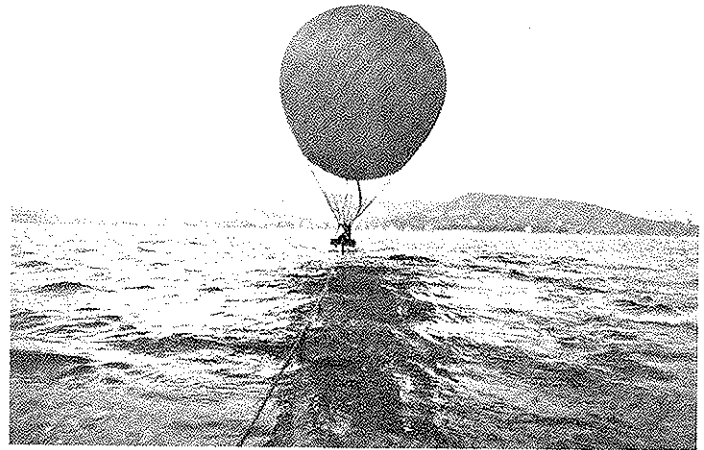


Liftoff at 8:09 a.m. on September 7, 1977. The balloon carried scientific instruments for measuring air quality parameters as the balloon drifted between 200 and 400 feet.



The *Eilatac* on its stabilizer near Cannes with the French naval frigate *Dauphin* in attendance, March 18, 1904.

By 9:30 all was in readiness, with all personnel at their proper stations on the beach, onboard the ships, in the balloon, in the chase vehicle that would follow the operation from shore, and at the control center in downtown Los Angeles, a final GO was given, and the mission commenced. A ninety pound, 50-foot long section of floating guide rope (a braided polypropylene cord) was stretched out on the beach aimed at the cutter. With the tow line attached between the load ring and the cutter, the *ATMOSAT* dropped several sand bags until she lifted some 30 feet into the air, stabilized by the weight of the guide rope on the sand, and by one control line being held by a member of the launch crew. At 9:38, the cutter pulled the tow line taut, the control line was released, and the mission was underway. A moment later the floatable guide rope snaked through the surf as *America* left the beach at an altitude of

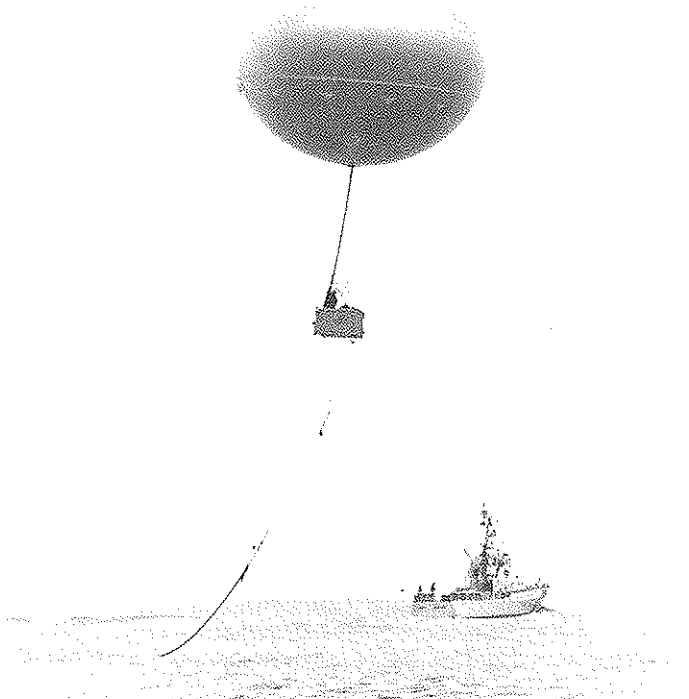


The balloon *Eilatac* being towed too rapidly by the *Dauphin* suddenly descends near Cannes, its gondola touching the sea, March 18, 1904.

50 feet. The flight crew of Tom Heinsheimer and Pete Neushul kept a wary eye on their altitude. Though launch was effected with a 6-knot land breeze, they knew that when the shoreline was left behind the wind would revert back to the northwest creating a greater drag on the tow line, and perhaps, causing sudden fluctuations in balloon altitude. Another bag of sand was soon sent over the side as altitude oscillations started. While less than a mile from shore, an unexpected problem arose; the convoy passed through a kelp bed. Soon the tow lines and the drag rope were snagging heavy masses of long, yellowish plants. As the cutter slowed to a near standstill the *Summer Tide* skillfully closed with the snagged lines, cutting loose the weeds that had been dragging the gondola uncomfortably close to the water. With the kelp bed left behind the cutter's speed was increased, one knot after another. At ten knots airspeed a sudden oscillation ended in a SPLASH and a quick taste of salt water for the crew. The gondola rebounded immediately from the sea as the cutter backed down. With another bag of sand overboard, and a longer tow line, now extending 500 feet, tow was resumed at 10 knots with the *America* staying at a dry altitude.

The experimental mission required the balloon to fly superpressurized at 200 to 250 feet during the entire mission from release by the cutter to arrival on shore. Care had to be taken not to put out too much ballast, for if the balloon became positively buoyant with all of the guide rope out of the water, then later, when the tow line was let go the balloon would ascend rapidly to an altitude too high for the mission. To come back down would require releasing of the superpressure in the balloon and then venting of

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The *America* on its stabilizer near Gaviota with the U.S. Coast Guard cutter *Point Judith* in attendance, October 10, 1977.

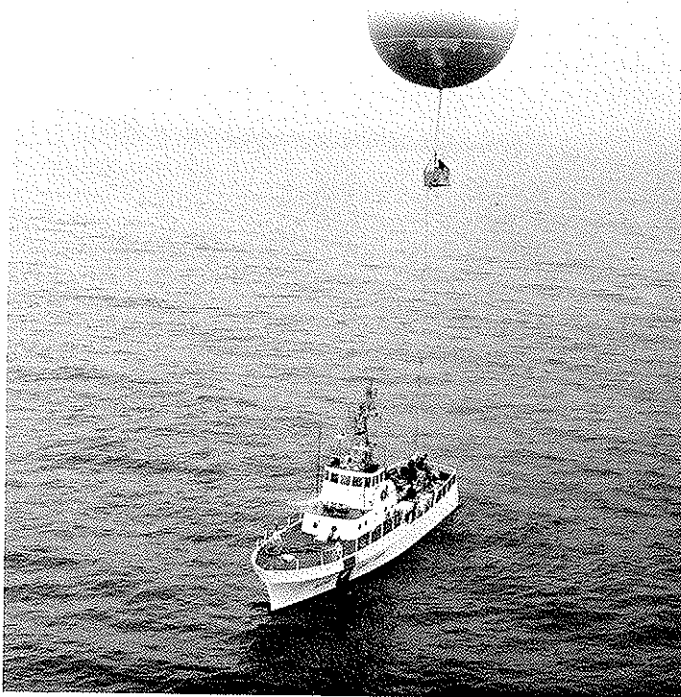


The balloon *America* being towed too rapidly by the *Point Judith* suddenly descends near Point Conception, its gondola touching the sea, October 10, 1977.

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helium. When the balloon returned to the desired altitude it would no longer be superpressurized, losing the stability needed to maintain the narrow altitude limits.

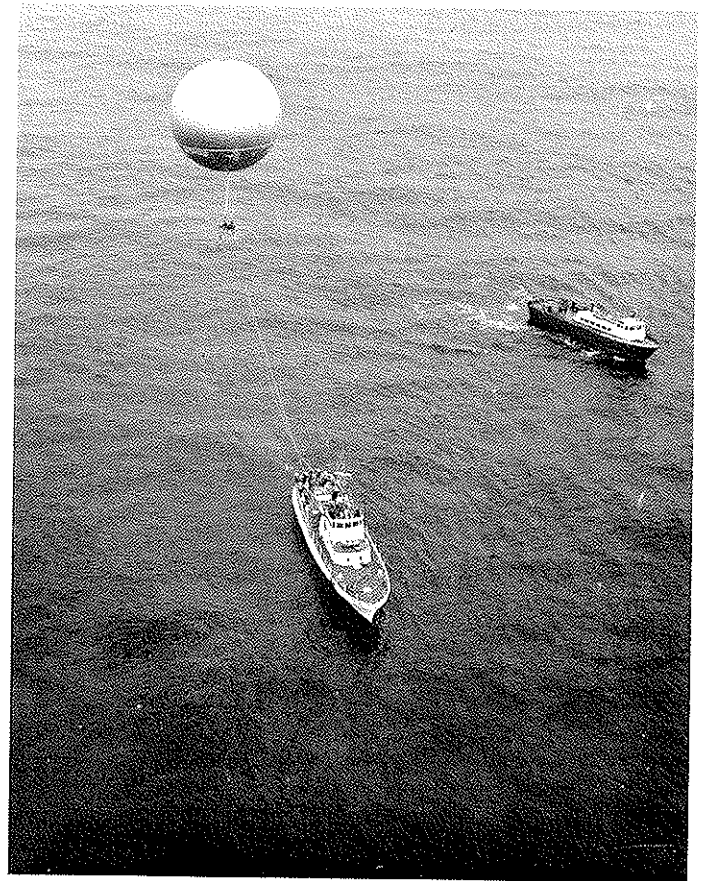
This ballast constraint meant that to raise the flight altitude, in order to allow a faster towing speed, a longer and heavier guide rope would have to be used. At 11:00 the convoy slowed again, the *Point Judith* winched down the *America* to 50 feet, keeping just enough forward speed to prevent the balloon from overflying the ship and snagging the ship's mast or radar. The *Summer Tide* fished the end of the drag rope out of the water, passing it to the cutter. An additional 100 feet of nylon line and a second ninety pound section of floatable guide rope was attached to the end of the first guide rope section. This extended the total length of the floatable guide rope array to some 240 feet, sufficient (it was hoped) to allow speedier towing. The balloon was let out on the tow rope again, and as three more bags of beach sand were put out of the gondola, 1100 feet of tow rope was deployed. As had been expected, the new configuration allowed safe towing at wind speeds of 12 to 14 knots, sufficient both for the transport to the release site, and for any eventuality requiring emergency towing during the mission.



Crewmen of the *Point Judith* adding a second guide rope assembly which allowed towing to proceed at 12 to 14 knots.

At 12:45 PDT, the convoy reached the release site, the northern end of the Santa Barbara shipping channel, off of Point Conception. The weather was overcast with a 700-foot stratus ceiling that was not expected to disperse during the day. To keep the balloon from going too close to the ceiling, the system was weighed off some 20 pounds heavy, so that the lower end of the guide rope just trailed in the water. The tow rope was released at 12:58; *America* was in free flight.

With the two escort vessels in leisurely pursuit, *America* floated down the shipping channel at 8 knots for the first four hours. At 4:45 p.m. the civilian passengers who were not staying the night on the



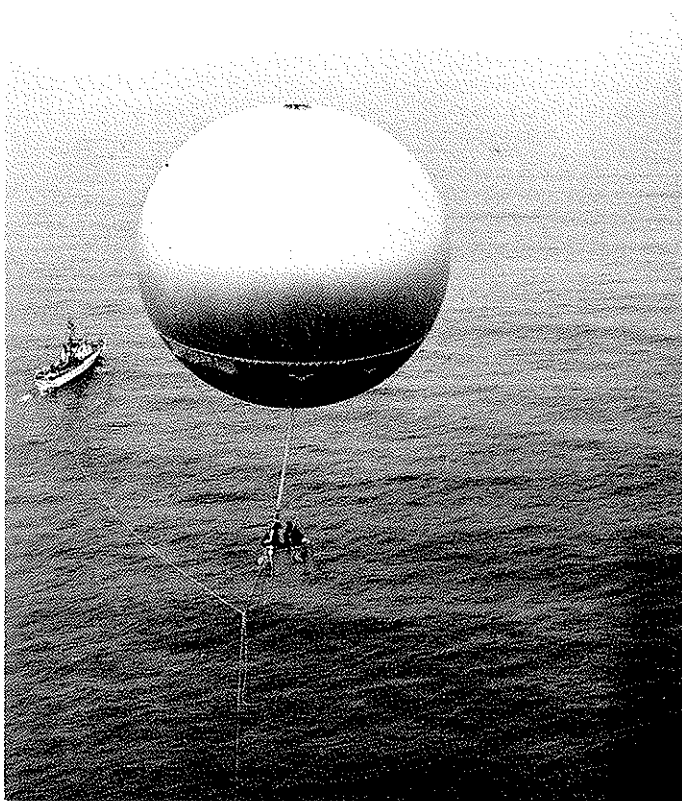
ATMOSAT *America*, *Point Judith*, and chase vessel *Summer Tide* during towing operations which placed the balloon in the shipping lanes of the Santa Barbara channel.

cutter braved a transit to the *Summer Tide* in the cutter's inflatable dinghy. Followed by a school of porpoise, *Summer Tide* sailed away. Soon thereafter the flight's progress became less and less rapid, finally slowing to 2 to 3 knots as nightfall approached. The balloon crew amused themselves in the gathering darkness watching for marine wildlife — though no whales were seen there were enough sharks, seals, porpoise, sea turtles, sunfish, and gulls to warrant a lively lookout.

The remoteness of the site, the total absence of moonlight, and the thick cloud cover all contributed to produce an unusually dark night. With the ceiling still at 700 feet but threatening to descend, and a visibility into the surrounding haze of 1 to 2 miles there was nothing to be seen from the balloon but the rhythmic flashes of the *America*'s strobe light and the running lights of the *Point Judith*. Suddenly, at 7:00 p.m. the stillness of the night was pierced by the cutter's shrieking siren. The flight crew was informed that the radar officer had determined that *America* was on a slow but inexorable collision course with an off-shore oil platform. After a quick radio council of war it was decided not to ballast (thereby sending the balloon into the clouds) but to capture the trailing guide rope and to guide the balloon around the obstacle. As the lights of the tower emerged from the haze, the *Point Judith* captured the guide rope and slowly pulled the balloon north of its previous trajectory until it was well clear. The vigorous rocking motion imparted to the gondola by this operation caused copilot Pete Neushul to become the first superpressure balloon pilot to become seasick in flight. To his great relief the tow line was released at 7:43 as the tower passed to starboard, then faded slowly back into the haze.

Soon thereafter, the balloon was virtually becalmed, making only some ten miles all night on a meandering course. At dawn the

(Continued on page 47)



Upon reaching the release site, the America was set free to drift down the shipping lanes where it recorded pollution data for studying the effect of tanker emissions on the air quality of the South Coast Air Basin.

crew watched fishing boats setting their nets nearby as America flew over a string of lobster traps. The early morning hours brought no change in the weather, still overcast and hazy with little wind. Time was spent on the marine radio returning the calls of radio news reporters who were eager to broadcast the voices of the crew telling of their experiences — such as a description of the antics of a small land bird that had alighted on the load lines and was flying around the balloon snatching moths that had landed on the damp envelope

during the night. It was clearly a slow news day.

By noon the sky was brightening and soon the sunshine started to burn through the overcast, brightening up the day and enhancing the wild life lookout. With the sunlight came the strengthening sea breeze that soon was propelling the balloon towards shore at 6 to 8 knots. At 3:30, in the brilliant sunshine of a glorious Southern California afternoon, land was sighted. At 3:50 the cutter again took hold of the guide rope, bringing the balloon to a standstill just over the surfline, while the cutter itself stayed 400 yards off shore. While steaming slowly southward in search of a clear landing site two final scares were overcome. A helicopter chugging northward along the beach at balloon altitude passed obliviously within 200 yards of the balloon, and a speedboat racing south along the surfline heard the cutter's siren just in time to veer off before passing over the tow line. These incidents done with, a suitable landing site was chosen and a final 100 yards of line was released by the cutter, bringing the balloon over the beach. A heavy hand on the valve was needed to bring the balloon down, buoyed as it was by some 180 pounds of drag rope in the air. With the help of the chase crew that had been driving up and down the coast since the day before waiting for something to do, and the local surfboard brigade, the balloon came down to a smooth landing on the sand at Oxnard Shores.

With the completion of the 31-hour mission, the America had logged four flights of over 30 hours each during her career, the remaining flights being "only" 6 to 8 hours each. Superpressure ballooning as a scientific tool has come of age.

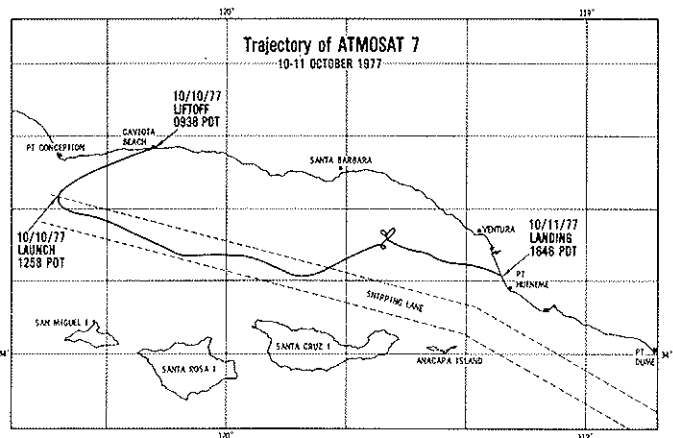



Photo credits: Bob Bachus, Ted Carrington, and Ruth Leverton.



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