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THE FILMING OF
VOYAGE OF THE
HOKULE'A

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The challenge of shooting a film of one of the longest open-sea voyages in the world, Hawaii to Tahiti, aboard a sixty-foot, double-hulled Polynesian canoe



By DALE BELL

"So you really want to make a movie in Hawaii and Tahiti?"

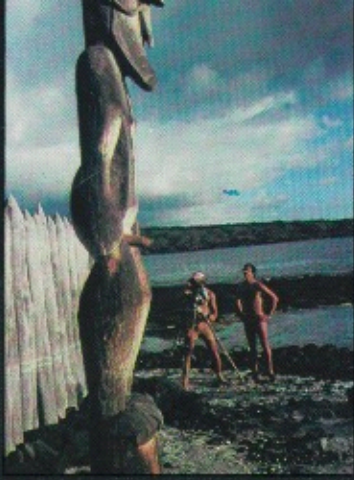
Thus had Tom Skinner begun the conversation as we took off from Los Angeles on our way to Hawaii. The time was August, 1975. Just six months earlier, denied commercial sponsorship and commercial network time, the longstanding National Geographic Specials were not being produced. Having established a previous rela-

tionship with the Society in the production of dramatic films, Tom Skinner, vice president at the fast-growing public television station and national production center in Pittsburgh, WQED, sought underwriting funds from the hometown Gulf Oil Corporation.

Twenty minutes after the conversation began, the people from Gulf were convinced — it was a rare oppor-

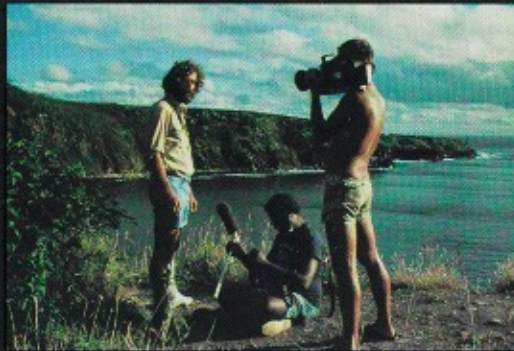
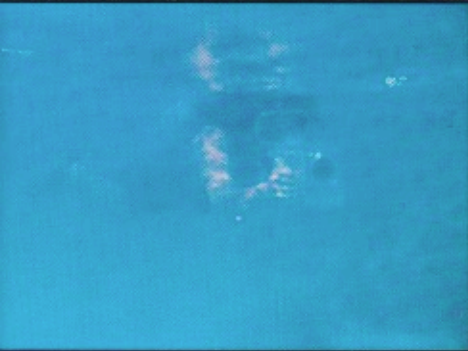
tunity, to bring this award-winning series to public television and to begin a prestigious association with the National Geographic Society, PBS and Pittsburgh's own PBS production center. Gulf Oil Corporation would become the underwriter for three years, supporting four productions each year, produced exclusively by Americans for American Public Tele-

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(LEFT) On Big Island of Hawaii's historic city of Refuge, producer Dale Bell and cinematographer Norris Brock film *k'i'i*, carved statues marking tombs of 23 ancestral chiefs. (CENTER) Brock documents the uncanny skill of Mau Piailug, as he works with his traditional adz. Piailug would later navigate the Hokule'a from Hawaii to Tahiti with stars and ocean swells as his sole guides. (RIGHT) Brock uses a K-100 camera in rigid plastic housing to film launching of model canoe carved by Piailug.

(LEFT) Brock submerges to shoot a short diving sequence of the Hawaiian crewmen who make their living in the water. Plastic camera housing was built by Romano Zihla of Zihla Enterprises. (CENTER) Producer Dale Bell, with broken foot in cast, delivers a final message for WQED, filmed by Brock and soundman John Butler. A day later Brock was aboard Hokule'a, while Bell and Butler tracked the canoe aboard escort vessel Meotai. (RIGHT) Five days out to sea, incapacitated by broken foot, Bell is evacuated from the Meotai by Coast Guard helicopter.



In October of 1975, while on trial run from Kauai to Oahu in the Hawaiian Islands, Hokule'a came close to being swamped when one of its hulls sprung a leak. It is shown here with starboard hull almost completely under water, while crewmen hack the canoe apart, tying sail and hut to the stern to prevent drifting south out of the channel. As crewmen fought frantically to keep the canoe from going under, Brock continued to shoot. All 23 men aboard huddled on the remaining port hull hoping for rescue, which came five hours later, after the inter-island hydrofoil on its normal Sunday run spotted the stricken craft on its radar and stopped to investigate.



"ONE-MAN-BAND" CINEMATOGRAPHY ABOARD THE HOKULE'A

Drenched almost all the time and operating in the most cramped quarters, cameraman spends 34 days aboard sail canoe shooting a double-system documentary of 3,000-mile voyage across the Pacific

By **NORRIS BROCK**

THE ASSIGNMENT:

Film the re-creation of an early voyage aboard a Polynesian canoe sailing from Hawaii to Tahiti for a NGS TV special. Be prepared to shoot one-man sync sound for a month or more on the open ocean in all kinds of weather on the exposed, wet and unsteady deck of a 60-foot double-hulled canoe. Share the available space, food and water with 15 other crew members. Don't get in their way and don't ask for anything to be staged or re-created.

PREPARATION:

The first problem in preparing to film the voyage was to select a camera and recorder rugged and reliable enough to survive the extreme conditions we expected. The second problem was to modify the camera and recorder into a unit that could be operated by one man under these conditions. The third problem was to waterproof the camera/recorder combination against salt water and rain, while keeping the unit small and light enough to be operated hand-held.

In setting out to solve the first problem, we looked at every available 16mm sync-sound camera on the market. We wanted a good, tough, hand-held documentary camera — one with a rugged lens and mount capable of taking hard knocks. It had to be easy to load and operate under difficult conditions. It had to be small and lightweight enough to be hand-held for hours at a time. And it had to be 100% foolproof.

When Peter Schnitzler of Ferco in New York showed us the new Arriflex 16SR, we knew that we had found our camera. Peter made arrangements with Volker Bahnmann, Vice President of Arriflex Company of America, for us to take a 16SR to Hawaii for a preliminary trial on one of our pre-voyage shoots. Volker felt that the voyage would be an ideal test to prove the 16SR, and he did everything possible to help us. The trial filming only confirmed what we already knew — that the 16SR was made to order for this job. When the dailies from the first test filming were screened at our Hollywood post-production facility by chief editor Barry Nye and post-production supervisor Linda Reavey, the 16SR again got raves. They called to tell us we were getting excellent image quality

with the camera.

Upon returning from Hawaii, we informed WQED Film Director Roy Brubaker of the success of the trial filming and he initiated the purchase of one 16SR for the voyage, with the rental of a second as a back-up camera through Ferco.

The choice of a recorder for the voyage was much easier, and we put in an order with Leo Chaloukian of Ryder Sound in Hollywood for several Nagra SN's.

The second problem was not so easy to solve. Since space on the canoe was limited, we could place only one person aboard to film. That person would have to operate both camera and recorder. Not difficult for single-system, where the sound system is built into the camera. But for double-system, not so simple. We talked to Ryder Sound about their remote-control radio slate for the SN and also to Stuart Cody of the Cody Company of Boston which has a similar unit. These units make the

Lacking a third hand, cinematographer Norris Brock holds lens tissue container in his mouth while he cleans salt spray from the lens — a procedure that had to be repeated every few minutes during shooting aboard the Hokule'a. The pouch he is wearing contains Nagra SN recorder and throwaway batteries. Note microphone with wind screen mounted above the lens.



SN, when placed on the subject to be filmed, a slave to the camera, being activated by a remote-control radio signal. Both units turn on the SN in sync with the camera and place a bloop at the head of the take. Easy enough when filming one or two subjects who can be fitted with SN's. But we were filming a crew of 15 on the canoe. And under conditions roughly resembling that of a wet football game.

Wouldn't it be easier to use just one SN and place it on the cameraman? But what about the mike? Well, put that on the camera just like the news boys are doing these days. But sailing means wind, and wind means bad sound. OK, back up a camera mike with a couple of wireless mikes placed on key members of the crew. And where to place the wireless receiver? Why, on the cameraman, of course. And just how does the cameraman handle the camera along with this portable sound studio? Simple. Just have someone design and build a fully-automatic amplifier-mixer unit to handle a camera mike along with a radio mike or two that the cameraman can monitor but not have to ride gain on. And pack all this into a nice neat package that can be waterproofed and worn by the cameraman. And who will design and build this unit? Why, some nice masochistic engineering company with no overriding profit motive who will take on a one-of-a-kind prototype for an application so specialized that chances of selling duplicate units are slim indeed.

So we called Stuart Cody back and told him we liked his remote-control radio-slate unit for the SN, but what we really had in mind was the automatic unit described above. Stuart said the phone connection must be bad, as he couldn't understand us. So we hopped a plane for Boston and presented our problem. Stuart took on the job, quoted us a price, and in about a month produced what he called an "audio interface unit" that did everything we asked and more. It sounded an alarm fed only to the monitor headset in the event of a tape runout or a loss of sync for any reason. In other words, all the cameraman had to do was load the tape on the SN, and monitor the playback mode. The SN started and stopped in sync with the SR and if no alarm was heard everything was recording alright. And the unit was no bigger than the SN. It didn't take long for us to tag the Cody unit with the tag of COMBO.

Another problem that Cody solved for us was one of power supply. Instead of having several batteries for each of the separate units in the camera/recorder package, he incorporated what



Brock crouches to get low-angle shot on the pitching deck of the 60-foot double-hulled sailing canoe. The symmetrical finder of the Arriflex 16SR camera allowed him to shoot at any angle from either side of camera. The harness he is wearing was custom-made by a hang-glider shop to hold camera and sound equipment in case he fell down, which he often did.

he calls his "expedition battery," a non-rechargeable, throwaway, latest state-of-the-art battery that we determined ran about 18-to-20 400' film rolls through the 16SR. That was about 12 more rolls than anyone else's, and perfect for us because it is the size of about five D cells, and lighter. With the additional load of powering the camera, the SN, and the interface unit, the Expo battery, as we dubbed it, would run about 16 400' rolls. To briefly review, we had now put together a sound unit consisting of an SN, an audio interface unit, a wireless mike receiver and a battery. We then faced our third problem, that of putting everything together in a waterproof package that could be worn by the cameraman. We also faced the problem of waterproofing the camera.

To solve the waterproofing problems, we went to the National Geographic Society Custom Equipment Shop, operated by Mike Schaeffer. Mike and his people have extensive experience in designing custom camera and sound equipment for Geographic expeditions. Mike flew out to Los Angeles to meet with us on one of our layovers from shooting in Hawaii. We asked him to design and build a lightweight but rugged waterproof housing for the 16SR camera and the Zeiss 10mm-100mm zoom lens and the Angenieux 5.9mm lens. The camera housing should not interfere with its hand-held operation, yet must offer absolute protection against salt spray and rain and maybe an occasional dunking by a wave. But it did not have to withstand the pressure of submersion underwater.

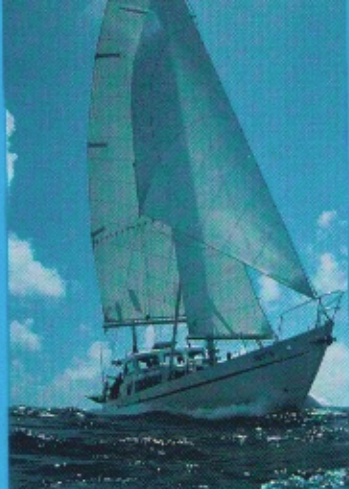
We knew that a conventional under-

water housing was simply too heavy, bulky and restrictive for our purposes. We wanted to protect the camera from water while filming on deck and while being stored below. We did not want to take it underwater. Mike suggested a very lightweight aluminum housing for the camera, but I had an obsession with a soft, flexible housing, sort of a wet suit that would in no way interfere with the very superior handling characteristics of the 16SR. Mike said he might have an answer for that. He also said he had an idea for a lens housing that would waterproof the lens, yet allow for the operation of all three functions.

When we next returned to the East

Decked out in Tahitian shell leis and flower headpiece, Brock is somewhat lighter in weight than he was when the voyage began 34 days earlier.





(LEFT) 65 feet long, with steel hull, the escort vessel Meotai was manned by a six-man crew whose main function was to shoot boat-to-boat footage of Hokule'a under sail. (CENTER) Reflectors were rigged outside the cabin of the Meotai to balance light for interior shooting. (RIGHT) Cameraman/production manager Joe Seamans fixes camera contained in housing to bow of the Meotai for rough weather filming.



(LEFT) As far as the eye can see, more than 15,000 people stand on Papeete's beach for hours, straining for a glimpse of the Hokule'a. (CENTER) Crowd awaiting the giant canoe was the greatest gathering in French Polynesia since the arrival of Captain Cook more than 200 years ago. (RIGHT) Bedecked with flower headdresses, Tahitians in outrigger canoes paddle out to meet the Hokule'a.



(LEFT) Joe Seamans checks installation of 50-foot-load gun camera in a waterproof housing mounted on bow of 16-foot canoe. (CENTER) As Tommy Holmes selects a good wave to ride in his canoe, he triggers the gun camera. The first time this sequence was tried, Holmes was flipped out of the canoe when a 20-foot wave broke over it. (RIGHT) Seamans uses the silent Arri to shoot boat-to-boat action.

coast Mike had laid the plan of attack for the housings and took the camera and lenses for several days to begin work. The approach for the camera body was to make a sort of rubber glove out of PVC and the approach for the lens was to make a rigid multi-piece cover out of solid nylon, O-ringed together at the turning joints for focus, zoom and f-stop ring rotation. The front was to be O-ringed to a Tiffen filter holder and rubber lens shade and the back mated to the mount of the 16SR

and sealed to the PVC camera housing. To make the camera housing, the NGS shop made an aluminum plug the exact dimensions of the camera. The plug was pre-heated to 400 degrees and dipped in liquid PVC, then placed in the oven to bake. After removal and cooling, the PVC cover was peeled off. The cover was made white to eliminate heat absorption from the hot, tropical sun. The problem of opening and closing the cover to change magazines was solved by gluing in a Talon air and

water-tight zipper, the kind used on diving suits. A small transparent window was glued in to allow viewing of the footage counter. We elected to let the 16SR viewfinder stick through the cover unprotected on the advice of Arri. We also left the pistol-grip on-off switch on the outside unprotected. Arri agreed to seal the viewfinder and pistol-grip themselves and felt this would be sufficient. They also went over the rest of the camera and sealed it wherever they thought necessary. They also gave the

electronic package an extra protective coating. As for the power and sync cables which ran to the COMBO sound unit, these were run through a waterproof bulkhead connector sealed into the PVC cover. The final camera housing, consisting of the machined nylon lens cover and PVC camera cover, was a thing of beauty.

The waterproofing of the COMBO sound package was a different sort of problem, because not only did it have to protect and waterproof the sound equipment, it had to allow access inside while filming and had to be worn almost as a piece of clothing by the cameraman, supporting the weight of the units inside. I had in mind a sort of vest unit early on and Mike's people pursued this. However, the COMBO sound unit wasn't yet completed and we were only guessing at size and configuration. The NGS shop completed a prototype vest to hold the SN, Audio interface unit, battery, and wireless receiver, which was watertight and shockproof. They also designed an alternate unit to be worn around the waist.

On the way back to Hawaii we stopped in Los Angeles for final preparations and I took the problem of the COMBO sound package to a sailmaker and manufacturer of hang-glider wings and harnesses. The NGS vest worked just fine, but we had over-

looked one concern of mine: how to attach the camera to my person so that I could have both hands free to hold onto the canoe and to protect the camera in case I dropped it.

We solved the problem at the hang-glider shop by making a harness that would hold the camera in front, but cantilevered its weight against the weight of the COMBO package in such a way that the one almost balanced the other.

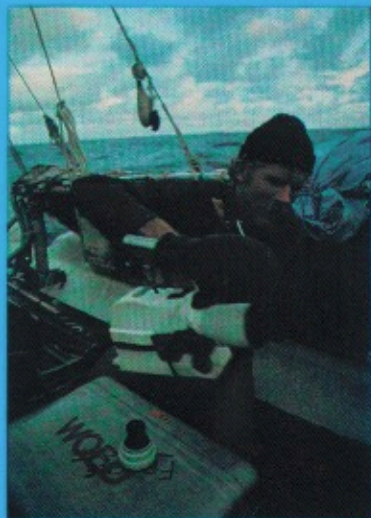
I was pleased with the harness now, but still didn't feel that we had solved the problem of the pouch for the COMBO sound unit. It just wasn't accessible enough or waterproof enough. So, upon arrival in Hawaii a few days later, I was led to a small custom shop that not only made the waterproof pouch I was after, but also made watertight pouches for everything from spare SN's to 16SR magazines to mikes and batteries.

In addition to sync filming on the canoe, we wanted the capability to shoot some underwater footage. With space and weight still a major concern, we turned to Romano Zihla of Zihla Enterprises in Los Angeles, who specializes in custom underwater equipment. He built for us two Plexiglas-housed Kodak K100's for use on the water surface and at shallow depths of 5 to 10 feet. We asked him to make them to minimum specs in order

to keep the weight and bulk down. They were conceived of for filming the canoe from the water by a swimming cameraman and also for filming aboard the canoe in storms too severe to risk the sync-sound equipment. Romano also built us a 50-foot-load gun camera in a rugged aluminum housing to be used for specialized shots, such as running the camera up the mast of the canoe or attaching it to the hull of the canoe. This camera was also mounted on the bow of an outrigger canoe surfing 15-foot waves in Hawaii. It was operated by the canoe paddler and, along with him, survived several wipeouts. These underwater cameras gave us some good footage of the crew swimming and diving off the canoe while in the doldrums.

A Zodiac rubber boat was used on the voyage for boat-to-boat transfers and filming and most of this filming was done with an Arri S. We also filmed canoe and board surfing in Hawaii with this combination. Little attempt was made to waterproof the S and little was needed.

To satisfy the need for night filming on the canoe, Romano built us a portable waterproof light and Ferco got us a couple of Cine 60's new portable lights for slightly drier situations. Ferco adapted these by adding a rheostat to dim the lights down to match the level
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(LEFT) Brock scrunches into a tight spot to shoot a scene. (CENTER) 6 feet 5 inches tall, Brock shared deck and compartment space with 16 other men aboard the Hokule'a. Since his allotted space was 5 x 3 x 4½ feet, his equipment and personal gear had to be individually waterproofed and stored in a compartment of the hull. (RIGHT) In the doldrums, the crew swims while Brock shoots.

(LEFT) After 31 days at sea, navigator Mau Piailug brought Hokule'a into Mataiva, the westernmost atoll of the dangerous Tuamotu Archipelago, 200 miles north of Tahiti. (CENTER) Hokule'a's welcome by the island's handful of ecstatic citizens is recorded by Joe Seamans and John Butler. (RIGHT) Welcomed by the Mataivans, Brock, Seamans, Butler and Ed George proudly display their shell leis and flower crowns.



SOME RECOLLECTIONS OF A TIME IN HONOLULU AND A TIME AT SEA

Predicting equipment needs for an unknown voyage, incredible logistics, and delays due to intermural squabbles add up to a Production Manager's nightmare

By JOE SEAMANS

"I fended off the sharks with the camera itself. It was going to be a great shot." One of my macho dreams of filming in the South Pacific conjured in Pittsburgh in January while we planned and schemed about how we were going to film at sea. As I went about the business of buying up filters, batteries, and lens tissue, I had imaginary visits with Cook, Christian, and the Ancient Mariner himself. The expedition was going to be a first for me; I had to imagine it. In fact, we all did. During the winter months we created a hypothetical voyage that we could outfit ourselves for. Hurricanes, shark attack, sinking ships, ACTION . . . it would have made a great film. Had anything like this happened we could have filmed it in sync sound. Waiting, thinking, and silence, which was more of what the voyage turned out to be, was a lot harder to document than a gale at sea.

Like soldiers going off to war the six of us left Pittsburgh in a snowstorm. It was early March. We were anxious to get to Honolulu because we felt the canoe would be leaving soon for Tahiti. We were well supplied with over fifty cases of equipment, which represented a partial inventory of what we thought we needed. The remainder of our equipment would arrive in Honolulu after we set up shop. Some people thought we might be taking too much. Never having done anything like this, I couldn't evaluate that.

While we waited for the canoe crew to ready the *Hokule'a* for the voyage, we tested and retested the equipment,

trying to simulate the conditions of the voyage. I remember going out to a park on a windy day and running around with microphones strapped to our waists and foreheads to try to figure out how to mike somebody with no shirt in a thirty-knot breeze. I also remember filming surf while the sun rose over the Blue Pacific, testing the camera housings, coming back to the hotel with damp equipment, but slowly learning how to keep our cameras dry.

As production manager I felt very strongly that the volume of equipment should not interfere with the filming itself. With all of our voyaging gear we had the look of a circus train as we went out to film the simplest thing. It became a concern that we all shared. The canoe's departure was repeatedly delayed to indefinite future dates. We were spending much more time doing routine documentary work than we had planned, with the epic voyage hanging in the future like a darkening cloud on the horizon. The film was turning out to be a difficult one to make. It was no longer a travelogue, as I had originally thought. In Honolulu the Hawaiian canoe crew was taking a very difficult interior voyage, rediscovering and dealing with their cultural roots, as they readied the boat. This process was causing the delays and frustrating our goals as filmmakers which were to get out to sea and document the voyage. The group's conflicting relationship with the non-Hawaiian group which had conceived of the canoe project in the first place was growing into a stalemate; conflicts over how the canoe

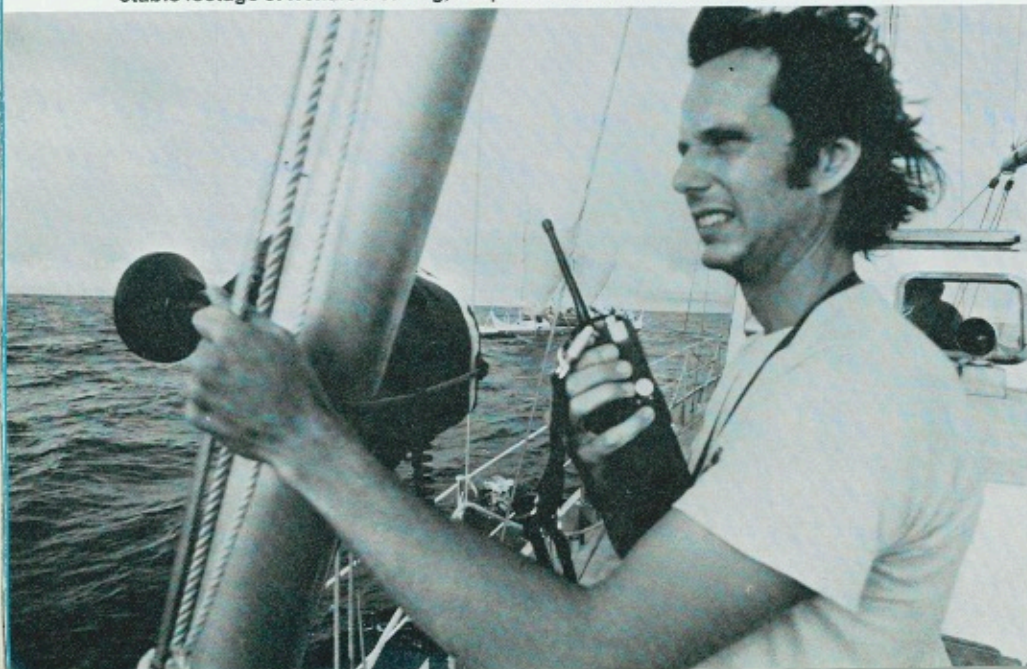
should be outfitted and who should be the captain. The struggle was important, and we had a lot at stake in it. At times I was convinced that the canoe project would flounder, and that it would never leave, and we would never have the chance to make our film.

But while the voyage seemed more and more part of an uncertain future, we realized that it was critically important to document what was occurring in Honolulu around the canoe. It required great flexibility on our part because events were spontaneous, unpredictable, and often explosive. At that time we needed a flexible system more than a water-tight technology. We had to learn to work as a group, and we tried to develop a sense of shared anticipation and expectation of events which we could often not understand or express in words to each other, events which would take months for me to feel I understood.

We left Pittsburgh to go on the high seas with sophisticated equipment, and now we were filming *cinema verité* in downtown Honolulu. And the delays continued week after week. To maintain our flexibility and our sanity we had to keep the voyage equipment and our continuing work on it separate from the land equipment and its continual, heavy use. But the difficulty was that much of the equipment being used on land was also going to be used at sea in some modified form. Although the functions and specifications of the equipment were entirely different for each situation, there were many shared elements. In the confusion it was conceivable that we might have filmed a heated argument between two people with a camera in an underwater housing. To prevent this from ever happening and to make sure that we would get the best use of our incredibly versatile equipment, it was a full-time job to know what equipment was in what case and what its status was for current filming on land and for future use at sea.

The concern about interfacing equipment was due not only to our reorientation to subject matter and to filming conditions, but also because we were using custom-made equipment which we were redesigning up to the last minute. A small modification in design, changing a power cable, for example, might have serious repercussions if we were to find out too late that the connector for the recharge-

Production manager Joe Seamans, who also doubled as second cameraman aboard the escort vessel, could communicate by walkie-talkie with Norris Brock on the canoe. Seaman's camera, weightlessly suspended on the ship's rigging, enabled him to obtain incredibly stable footage of *Hokule'a* sailing, despite lack of actual stabilizing device.



able batteries we were using on land might not fit the expedition battery we intended to use at sea. A change of lenses in our inventory would probably mean that a different interface with the camera housing would be necessary, but it might also mean a change in filter size, or a new adaptor ring. I had a recurring nightmare that something small would be overlooked, and that an essential piece of expensive equipment would be rendered useless at sea for want of a small, inexpensive part.

We had no idea when the canoe was going to leave, but we had to be ready when the time came, moving our land operation to sea. In the middle of the last week in April, it was suddenly decided that the canoe would leave the upcoming Sunday, May 1st. We did as much prepacking as we could, but since most of the equipment would be in continuous use before, during, and after the moment of departure, our move really had to be made at the last minute. In one day we would have to close down our land base, move equipment from the hotel to two different boats in two different harbors, and shoot the departure, finally ending up at sea with modified equipment. On Sunday, plans changed. Twice the canoe crew moved the departure to other days. Finally the canoe left late that day, as originally planned. Somehow we managed to film it all and leave with the canoe.

I could not possibly have packed all the equipment cases on the chase boat, a 60-foot ketch. I had to pack individual items wherever I could find space and ship the cases to Tahiti. I also shipped things ahead that we wouldn't need, like tripods, which I could only see as dangerous weapons in a tossing boat. I did keep one tripod on board in the event that we landed someplace other than Tahiti, God forbid. By the time we got to Tahiti, some thirty days after departure from Hawaii, we were knee-deep with equipment inside the cabin. Finding things wasn't a problem, though, the real problem was making sure it was on board in the first place. I planned to write a list of things we forgot, but I ended up making a list of the things we didn't need, a useless list for future reference since the next time things would, no doubt, happen differently. To our great satisfaction the voyage equipment was working well.

Of all the things we brought to protect our equipment, I feel one of the least exotic but most important things was a vast assortment of ziploc bags because they had so many versatile uses. When we landed on Mataiva, a small atoll 200 miles north of Tahiti, the



After arriving at the atoll of Mataiva, the first landfall of *Hokule'a* on its voyage from Hawaii to Tahiti, Joe Seamans films welcome of the tiny island's sparse population. The crew and their equipment were moved back and forth between boat and land through the surf-pounded reef on Mataivian boats, like the one shown here, which tip over very easily.

ziplocs were the items that the people there wanted most of all that we offered them for their hospitality.

Norris had a substantial job to do on the canoe, but since there were no major equipment breakdowns, we on the chase boat didn't have to do much except repair the COMBO unit once or twice, which John Butler did in heroic fashion on hot and rough days in a closed cabin. Routinely I made up film and equipment shipments, packing materials in ziplocs inside sealed buckets, and taking them to Norris in a Zodiac. He sent us back exposed film and audio tape. The high quality he was getting was exciting. When we wanted to hear music we would play the Hawaiian music he had recorded on the canoe, blasting it through the monitor out of the cabin onto the deck.

The filming on the chaseboat included boat-to-boat shots of the canoe and navigation sequences on board. The boat-to-boat perspective would have been a real test of the Steadicam or a Tyler gyro mount, but these things were unavailable to me. The roll of the boat, a small monohull, was thirty to forty degrees; I never measured it, but it felt at least that. The forward motion into the waves was sudden and jarring, and the up and down motion was also constant. Without a visual foreground reference on the chase boat, it was hard to justify any horizon motion in the film frame at all. My solution was to tether myself at the waist to the mast to give me something to lean against. With both hands free I could bend over and hold the NPR which was hung from a shroud by a series of bicycle inner tubes and bungee cords. By leaning forward or back at the waist I could give a controlled movement to the camera which

would counter the motion of the boat. The solution was embarrassingly crude and far from perfect, but the rig was quick and easy to move around, which was important on a boat that small, and in a situation where the relative positions of the two boats were constantly changing. With practice I was able to get the required shots.

The filming that I did in the interior of the cabin necessitated boosting the light level. I did this with small, waterproof reflectors fastened to the cabin window exteriors with suction cups. The additional fill looked more natural than artificial light because it moved with the motion of the boat.

I had no death struggle with *JAWS*. The week we spent in the Doldrums was a struggle of sorts . . . I thought we would drift aimlessly forever . . . but it was memorable for its lack of eventfulness more than anything else. The voyage itself was quite uneventful for me, which was due in part to the fact that we were well prepared, as it turned out. We had had so much time to rehearse and get ready in Honolulu. For me the real events seemed to have already occurred on land. That was a much busier time. Life at sea was very routine by comparison.

On the thirty-first day the canoe spotted land, and we were busy again, running around the coral atoll of Mataiva filming the beautiful and unexpected events which were unfolding there. We moved ourselves and our equipment back and forth between boat and land through the surf on the reef in the tippy Mataivian boats. I could speak no Tahitian, and the Mataivians spoke no English, but I felt home again. Things were jumping . . .

Three days later the canoe would arrive in Tahiti, and it would all be over.

A WATERTIGHT ARTIFICIAL SKIN FOR A MOTION PICTURE CAMERA

To protect the camera and lens from the ravages of rain and sea spray to which they would be subjected aboard the *Hokule'a* required not an underwater housing, but instead an ingenious custom-designed, form-fitting "wet suit"

By MIKE J. SCHAEFFER

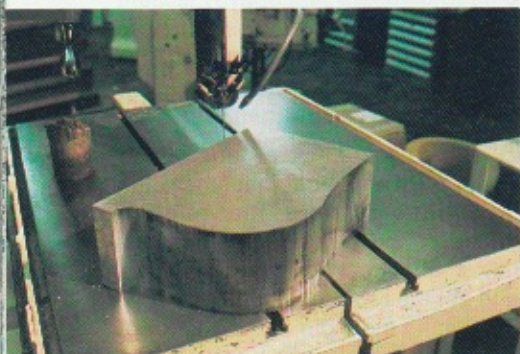
In 24 years of designing specialized equipment for the National Geographic Society I have had some pretty unusual requests: unique lighting features for rare exhibits; deep-cold weather housing for delicate sound systems; and a 12-projector revolving drum for photographic displays.

But what do you do when someone asks you to design a wetsuit for a motion picture camera? Not an underwater housing or a pressure chamber,

but an actual wetsuit such as many of us wear for snorkeling, surfing, or kayaking? In a sense you do what any good tailor does — choose your materials, get our your tape measure, invite the subject in for a fitting, and start to work. In this case the tape measure was a set of highly sensitive dial calipers, the subject was an aluminum model machined to thousandths-of-an-inch accuracy, and the material was a substance once labeled as a cancer-

producing agent — polyvinyl chloride, better known as PVC.

The project grew out of one of the most exciting television concepts in recent years: re-creation of the ancient Polynesian voyages of navigation and discovery in replica of the great *kaulua*, or double-hulled canoes, that roamed the Pacific more than a thousand years before Christ. With sponsorship by Gulf, and in conjunction with the National Geographic Society's Tele-

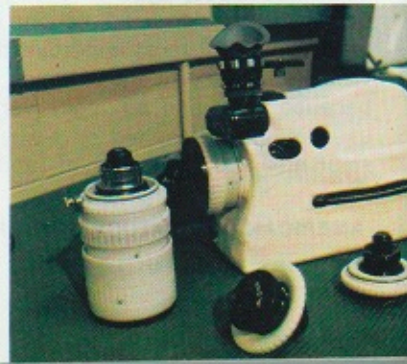
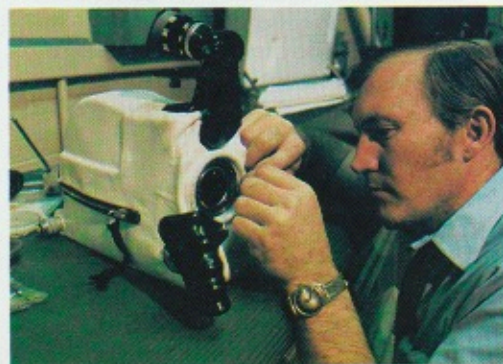


At the National Geographic Society custom shop in Washington, D.C., Mike Schaeffer and his staff create a "wet suit" for the Arriflex 16SR to be used aboard the *Hokule'a*. (LEFT) A mold of solid aluminum, an exact replica of the camera form, is machined to tolerances of thousandths of an inch. (CENTER) The aluminum mold is heated to 380 degrees Fahrenheit. (RIGHT) The heated mold is then dipped in liquid Polyvinyl Chloride (PVC).

(LEFT) The PVC, which, in its liquid state, has the consistency of house paint, adheres to the heated mold, resulting in a "skin" roughly an eighth-of-an-inch thick. (CENTER) After having been placed in a 380-degree oven for 5-10 minutes to "cure" or solidify the coating, the coated mold is withdrawn from the oven and the newly formed skin is slit along one surface and peeled from the mold. The result is a flexible tough skin that exactly fits the contours of the camera. (RIGHT) Following roughly the same process, a separate skin is created for each exterior control.



(LEFT) After the separate skins for the external controls have been joined to the main skin with a watertight seal, access to the camera inside is made possible by "welding" a special Talon zipper across the initial slit in the skin by means of a powerful adhesive called Loctite 404. (CENTER) A plate of optical glass, set in a similar watertight seal, will protect the lens. (RIGHT) The final result is a totally original, lightweight, flexible protective casing for the valuable camera and lens. Not a single piece of camera equipment suffered from water damage or moisture during the voyage.



vision Department, documentation of the voyage was undertaken by the talented staff of WQED television studios in Los Angeles.

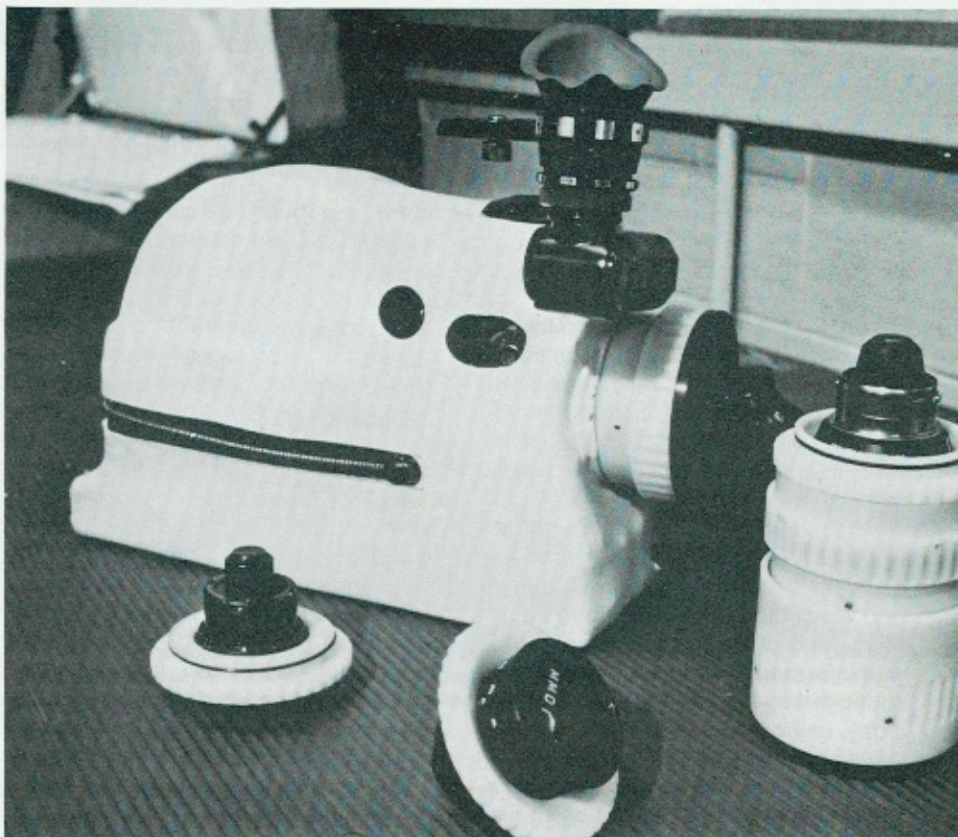
The spectacular results of that project were broadcast in an hour-and-a-half program over the Public Broadcasting System January 18, and the film speaks eloquently for itself. My own small contribution, and that of the staff of the National Geographic Society's Custom Equipment Shop, began with Dale Bell's and Norris Brock's request for the unusual wet-suit.

Dale is a producer-director for WQED and Norris is one of its highly skilled cinematographers. Faced with a 3,000-mile voyage between Hawaii and Tahiti in an open canoe, both men foresaw serious problems with equipment. Frequent saltwater immersion and constant spray would damage and probably destroy complex and costly camera gear. Could the National Geographic design and build adequate wet-water protection for the cameras?

Rigid housings of plexiglas or other material would not do in this case. They are not only cumbersome aboard a crowded boat, but they tend to rob the cinematographer of the "feel" for his camera, a vital factor in recording an essentially human drama. What we needed was a strong but pliable material that lent itself to waterproof seals and was immune to corrosion. I had already worked with such a material in designing an experimental globe for the National Geographic and it suddenly came to mind — PVC.

With a supply of polyvinyl chloride from Plast-O-Merics, Inc. of Brookfield, Wisconsin, we set to work in our combination laboratory and machine shop at the National Geographic in Washington, D.C. The first order of business was a working mold — an exact replica of an Arriflex 16 SR motion picture camera down to the very last detail of housing, lens and exterior controls. Naturally one does not dip a \$15,000 Arriflex in a bath of PVC, so we built the mold of solid aluminum, machining it down to tolerances of thousandths of an inch, and provided exact-dimension outlets for the exterior controls as well as an aperture for the lens.

To produce a PVC "skin" roughly an eighth-of-an-inch thick, we then heated the mold to 380 degrees Fahrenheit and prepared a bath of PVC for dipping the heated mold. At that level polyvinyl chloride has the consistency of house paint and will adhere to a mold in the desired thickness. After approximately 20-30 seconds in the bath the coated



A closer look shows the camera in its "wet suit". On the advice of Arriflex engineers, the viewfinder was not covered with PVC. For the lens (left) a rigid multi-piece housing was machined from solid nylon, O-ringed together at the turning joints for focus, zoom and f-stop rotation. The front of the lens housing was O-ringed to a Tiffen filter holder and rubber lens shade. The back was sealed to the PVC camera housing.

mold was withdrawn and placed in a 380-degree oven for 5-10 minutes to "cure," or solidify, the coating. After the material had cured we removed the mold from the oven and slit the newly formed skin along one surface, peeling it from the aluminum mold inside almost as one peels off a rubber Halloween mask.

We followed roughly the same process for each exterior control, fashioning a separate skin for each item and joining it to the main skin at the proper point with a watertight seal. A plate of optical glass set in a similar watertight seal protected the lens. To provide instant access to the camera inside we "welded" a zipper across the initial slit in the skin by means of a powerful adhesive called Locktite 404.

No one, I'm sure, ever kept track of the hours we spent on developing our unconventional wetsuit. It absorbed the waking thoughts, and I've no doubt the dreams, of five colleagues as well as myself: Louise Blosser; Henry Levy; Luther Dillon; Darwin Helmsdollar; and Steve Mamakos. Our one regret is that none of us could accompany the new invention on its maiden voyage — space on a *kaulua* is in short supply. But over weeks of punishment from Pacific storms and the ocean itself, the new housing held up even beyond our expectations — not a single piece of

equipment suffered from water damage or moisture.

"The equipment," Dale Bell wrote me after the voyage, "worked, was protected, and lasted for 34 grueling days. Please express my gratitude to the other very capable members of your staff who contributed to the success of the voyage, and thereby to the first 90-minute special for the National Geographic Society."

Since that initial success we have adapted the new housing to still cameras, tape recorders, and other types of equipment for National Geographic expeditions. On a recent voyage down the Grand Canyon, whose hazards are perhaps greater than those of the Pacific, photographic equipment remained dry and in perfect working order beneath its protective artificial skin.

One of the members of that expedition is a longtime friend and colleague, Gilbert Grosvenor, Editor of the National Geographic Magazine, who is an ardent scuba diver. "Thanks to you and your staff," he told me afterward, "our cameras stayed a lot drier and snuggier than I ever felt in a wetsuit. Now that you've solved that problem, what about a waterproof housing for your friends?"

Unhappily that takes a little larger mold. ■

SALTWATER TO ELECTRONIC EQUIPMENT IS LIKE DYING

Despite devastating effects of seawater, miniaturized, custom-built recording unit endures to provide sync-sound for every foot of film

By JOHN BUTLER

It is almost impossible to record continuous sync sound on a moving boat. On a sailboat, it's easier — no man-made noise. But the sea, the sound of the waves, wind, saltwater spray, rust, humidity — all these things can cause failure to microphones and recorders. This is the time when you put sound gear away. As for a storm, what sound or dialogue can you record that can be used anyway . . . ?

I discussed with our producer/director, Dale Bell, the formidable problems of keeping the recording equipment dry. We could not risk our good equipment recording in these conditions. I was informed that I was to shoot sync sound in any kind of weather, 24 hours a day, day or night — "I don't care how you do it, but do it!"

The voyage canoe *Hokule'a* presented an impossible situation. It was an open double-hull canoe with a platform between the two hulls without shelter — not even for the crew. Hence, there was no way to keep the equipment dry.

Our first trial sail was to Kauai the next day. We left the mainland with all conventional sound recording equipment. We expected this voyage of *Hokule'a* to Kauai to take a day or so in which we could test our conventional sound gear. We had plastic bags to keep our equipment dry.

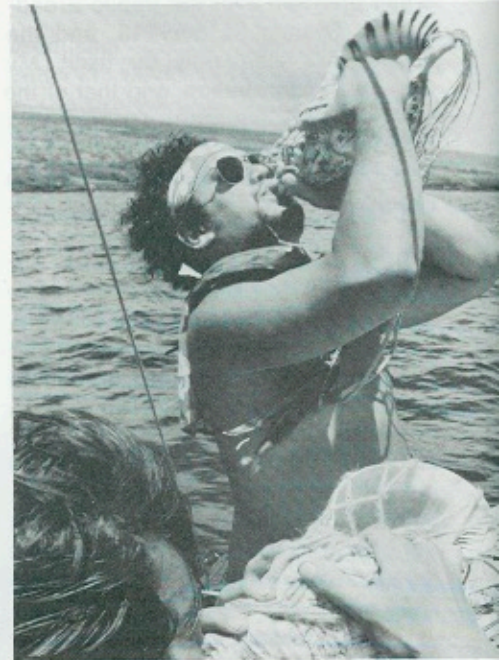
Ryder Sound and Larry Johnson had spent some time putting together a mixer to be used with the SN recorder, knowing that the Nagra IV would be too

large and bulky to carry around the neck at sea. We elected to use an 815 mike that Ryder Sound built for us. The Nagra IV system was to be used on land only, for standard documentary filming. In short order we discovered that our plastic bags were not enough to keep the SN mixer or the SN recorder dry. We had problems of changing tapes and the wind noise was too great for the 815 windscreens. The wireless receiver gave us moisture problems, too. Our past experience with this equipment had worked well. All we had to do was keep it dry and we could get good sound. But our editor could not find slates, and mike taps were not enough to do the job of slating on the double-hulled canoe.

Our next trip to Hawaii was to be our proving ground. For our new slating system, we now had a waterproof case for the SN and mixer, thanks to Mike Schaeffer and the NGS Special Projects Department which had built underwater housing for cameras and an SN recorder. We now had a waterproof system. For slating, we chose to use Cody's wireless start-and-stop system and the old standby 815 with new windscreen. Our sail back to Oahu from Kauai through the Kauai Channel turned out to be the proving seas for the Polynesian Voyaging Society and the film crew. The canoe swamped. Again, we got our list to count our sound casualties, lick our wounds and find out who's winning — the sea or us.

Electronic equipment is destroyed

On board a 75-foot ceremonial canoe, Tahitians wait in the morning sun for *Hokule'a*. Organized by the Tainui Association of Tahiti, thousands of Tahitians feverishly prepared a festive welcome for their Polynesian brothers from the north. The voyage, verifying an ancient mode of open-sea migration, held great symbolic significance for the island people.



Conch-shell trumpets blare a traditional farewell as adventurous Hawaiians set forth on historic voyage 3,000 miles across the open Pacific, unaided by charts or instruments.

by saltwater. Immediate effects are to be heard in frequency response, pattern and sensitivity. The deterioration by rust continues unabated. With some help and proper waterproofing, these problems could be solved. As a result of the PVS Board of Inquiry findings as to why the canoe swamped, the number of people on the canoe was reduced, and we could only have one cameraman aboard. (Our original plans were for soundman, cameraman and producer/director.)

We began again. Record sync sound, double-system without a soundman. This was fine for the cameraman — no microphones in his shots. At last the cameraman could shoot without worrying about a soundman telling him, "Camera noise." Again our producer, Dale Bell, spoke. "I want sync sound double-system on every foot of film — and it better be good!"

Roy Brubaker, Director of the Film Department, told Joe Seamans (Assistant Cameraman), Norris Brock (Cameraman), and myself, "You have 30 days to solve the problems. Let me know if I can help." If only we could have replied, "You solve the problems."

Chuck White, WQED Post Production Center, our best critic who always gave us feedback on what was



wrong, suggested using the Nagra SN cables that would start and stop with the camera, plus one mike. It would take five pages to list the other suggestions we got from various experts. The one we all liked was, "Forget the whole thing — it can't be done without a soundman." What we were looking for was a one-man operation. After a million suggestions, again Ray said, "Well, what do you have?" At this point, we had nothing but a lot of thoughts.

After my talk with Leo Chaloukian of Ryder Sound, and the Cody Company, all of us agreed on the Nagra SN Recorder for our recording. Next step was to build an interface unit to perform the following functions:

1. Two mike inputs with selection mike I or mike II or both with roll-off filters, a passive mixer.
2. Start-and-stop recorder and slate with camera.
3. A warning system if sync is lost.
4. Audio level indicator.
5. A warning system when tape runs out.
6. Monitor before and after at all times.
7. Choice of camera sync inputs or crystal.
8. Manual operation of recorder without using camera.
9. Waterproof.
10. Size no larger than the SN.
11. Self-contained power from camera supply.
12. Microphones level adjustments.
13. Alarm for power failure.
14. The interface with Arri 16SR must work with any camera without any changes.
15. To be fitted to a vest assembly.

This interface unit would take commands from the camera, roll the recorder and slate the recorder in sync with the camera's slate light, without any other operational function from the cameraman.

The success of this system of shooting double-system sound without a soundman was like shooting single-system without a soundman's know-how of what microphones to use and when to use them. The performance of the SN Nagra was excellent. We now had sound that transferred to mag film just as in the normal double-system operation. Correction could be made in the transfer if needed, without damage to the negative or original film one would use on a single-system audio. In some of our shoots, all cameramen say they would still like to have the soundman present.

Our timetable would not allow for our fabrication, nor could we tie up Ryder Sound for one unit. The Stuart R. Cody Company was selected to put these



Shooting sequence of children singing the Marsellaise, with sound recorded by the Nagra IV, which was the equipment used on land only for standard filming. Insistence by the producer on total sync-sound for the voyage, despite impossible conditions, led to development of new fully-automated, incredibly sophisticated miniaturized recorder/microphone/amplifier/mixer combination.

suggestions into a working unit called Arriflex 16SR SN/Nagra interface, nicknamed COMBO, (for Cody One-Man Band Operation). The project began on February 20th. First unit was ready for test on March 5th. The system worked fine for our test. With a few modifications, we were able to make this system work. We were to use a microphone shock-mounted on the camera for sound pick-up and a wireless to be placed on any crew member for additional sound. Mikes used were the EV RE 16 Swintex Wireless. Since we would be at sea for 30 days, we chose to carry with us five SNs, 3 wirelesses, 2 COMBOS — (we were using the concept of Noah's Ark — "use two of everything"). From our past experiences, we knew we would lose something to the elements. We were too far from Ryder to get replacements and we

didn't know how reliable the SN would be. Thanks to Nagra, it proved to be very reliable. We only used one SN for the whole voyage, and our COMBO unit proved to be just what we wanted for our sound on the canoe. We did have some minor problems but they were easy to solve. As a result, we never had any film exposed without sync sound. No complaints on how to sync the footage up. Only one big problem — we forgot to add an alarm for the cameraman to let him know when he had a film run-out.

This system was designed to record sync sound on the canoe, not to replace the soundman, only a tool to help the soundman do his job. For there was no take two on any of the scenes, only a prayer that we had it in the first take. COMBO made that possible. ■

The film crew saw *Hokule'a* for the first time on Makaha Bay before an overnight sail from Oahu to Kauai. Producer/director Dale Bell, Cinematographer Norris Brock and soundman Larry Johnson, together with 18 crew members, made the crossing in 16 hours. On the return trip the canoe was swamped when one of the twin hulls sprung a leak.



VOYAGE OF THE HOKULE'A
Continued from Page 150

vision. And Tom Skinner would join with Dennis B. Kane, chief of the television division of the Society, as executive producer of the new project. The two would have equal authority in the creation and supervision of the new series. Within the year Gulf would announce massive and unprecedented promotional support for the National Geographic specials, and the first four programs would become the four highest-rated programs in public television history.

Early in their planning, WQED and the National Geographic decided to avail themselves of the talent pool built in Los Angeles over the years when the Geographic specials were being produced for commercial television. Quickly and enthusiastically, relationships were established with such veteran producers as Nicolas Noxon and Irwin Rosten of Ronox Productions. But WQED, as part of the new arrangement, was to produce one of the four new specials every year with its Pittsburgh-based staff.

I had joined WQED just three months earlier. My previous credits included *WOODSTOCK*, *MEAN STREETS*, and *THE GROOVE TUBE*, as features, dozens of commercials and industrials, and numerous documentaries for public television. My job at WQED was to set up and supervise the production of the specials, and already, by August of 1975, we had several WQED/NGS

The author, Dale Bell, producer of "VOYAGE OF THE HOKULE'A", wet suited for a trial run aboard the modern-day replica of an ancient vessel.



film crews on location throughout the world.

Dennis Kane had been to Hawaii more than a year earlier, sniffing out the television prospects of a project which had already been committed to the National Geographic magazine. But because the Hawaii project was going to take place over the period of three years, and because the specials had not found a commercial home, he had reluctantly put the idea on the shelf. The new alliance with WQED and Gulf Oil Corporation now altered his original thinking. As Tom and Dennis were deciding which special WQED would produce with its own staff technicians, the Hawaii project began to crystalize once again.

I was asked if I wanted to make this film in Hawaii. Tom said I could have equipment available at WQED, and any of the personnel. With Barry Nye and Linda Reavely, I had been helping to establish our new post-production facility in Hollywood, WQED West. Having met only a few of the people in Pittsburgh, and without an equipment inventory in hand, I nevertheless readily accepted the challenge. Although Tom, Dennis and I had discussed the production, we could not possibly have anticipated the outcome of the project.

This was my first trip to the Hawaiian Islands. Tom had been earlier, establishing our relationships with people on the islands. Like most westerners who visit Hawaii for the first time, I came with my own preconceived baggage of impressions. Surf, Waikiki Beach, hulas, syrupy music, guitar strings and steel drums. Beyond that was a void.

As we quickly flew to the island of Molokai, my first impressions changed. For there, at Kaunakakai Harbor on the south shore of Molokai, tugging eagerly at her anchor lines, lay *Hokule'a*, the huge double-hulled replica of an ancient Polynesian voyaging canoe. *Hokule'a*, and the people devoted to her, was to be the focal point of this new Geographic special. Sixty feet long, held together with miles of lashings, she looked majestic, awesome. An artifact from the past, although built of fiberglass and plywood, she seemed a stranger in contemporary, westernized Hawaii.

Hokule'a was the dream of three men from Hawaii: a Hawaiian artist, a "haole" (non-Hawaiian) waterman, and a "haole" anthropology professor. The three men formed the non-profit "Polynesian Voyaging Society" and raised more than \$100,000 to build and provision the canoe. The round-trip Hawaii-to-Tahiti route was selected because it represented one of the

longest open-sea voyages that ancient Polynesian mariners had taken in their discovery and cultivation of myriad tiny islands dotting the Pacific Ocean. The project had begun with specific motivations. But after the canoe was built by Hawaiians, and haoles alike, it became a symbol for Hawaiians, in proportions far greater than its original creators had intended.

Hokule'a attracted many people to her decks, all from diverse backgrounds. The first voyaging canoe to be built in hundreds of years, she represented different things to different people.

My first sail off the shores of Molokai taught me several lessons clearly: filming on board was going to be wet, potentially dangerous, and crowded. Although her overall measurements were 60 feet by 20, the platform of useable space was 40 by nine, usually inhabited by the sailing crew of Hawaiians and haoles. Her shallow hulls enabled her to ride the tops of the waves and swells, but few waves did not splash heavily over the bow. The sailing crew was incredibly energetic, but few of them had any great sailing experience. And *Hokule'a*, being of somewhat unorthodox design, was constantly instructing them.

Already I could see some of the struggles going on behind the scenes among the men and women who had been attracted to the canoe. While the film was to be about this voyage of rediscovery, it seemed quickly apparent that much of this proposed sea voyage would take place on land among the men.

As Tom and I left Hawaii after several days of research and meeting people, had evolved a plan. The building and launching of the canoe had taken place six months earlier. It had been filmed by a local cameraman, on negative film, and we had arranged to purchase it for possible inclusion in our special. *Hokule'a* was in the process of completing inter-island sails, training and recruiting crew members for the voyage to Tahiti. The date of their departure for Tahiti was set for April 1, 1976, more than six months away.

I would return to Hawaii in early September, ready to shoot the last inter-island sail, from Oahu to Kauai. There the canoe would remain for three weeks, conducting practice sails for those expectant crew members aspiring to be selected for the voyage to Tahiti. Then, *Hokule'a* would be sailed back to Oahu, refitted during the winter. Final crew selection would be made. Crew training would take place in March on the island of Maui. It looked to me as though we would be

able to schedule four two-week shooting periods over the next six months. Our last scheduled shooting period would coincide with the departure of the canoe to Tahiti. We had decided that we would not film the return voyage.

Now, back on the mainland, in our post-production offices in Hollywood and in the production center in Pittsburgh, I had only a few short weeks in which to make my production plans more specific. From WQED, I would take Norris Brock as cameraman, John Butler as soundman. Larry Johnson, the expert soundman who worked with me on *WOODSTOCK* and other productions, would coordinate the assemblage of equipment on the west coast. We viewed several films which had been produced on the open sea, and quickly determined that if we were to make this film distinctive, we would need sync sound on the voyage portions. The land-based photography would be routine enough. But between the sails on the open sea, and the land filming, there lay a vast middle ground.

All of the crew of the *Hokule'a* were in one way or another "watermen." Surfers, or canoe paddlers, or divers, they were never far from the water which surrounded them. While we didn't necessarily have to find equipment which could be used underwater, we did have to be prepared to board any water craft or to shoot at water level whenever the occasion demanded it. Another preliminary judgment required that we shoot everything possible with sound, call it *cinema verité* if you will.

The WQED equipment inventory available for the project yielded one NPR and a Nagra. Beyond that, nothing that would suit our needs. Roy Brubaker had recently joined WQED from WGBH in Boston. His mandate — to beef up the WQED film department and specifically to help support field production for the "specials". Consulting with him, Norris, and Tom, we decided that if we wanted to make this film in a professional manner, if we wanted to upgrade the station's film department, WQED would have to invest heavily in new, specialized equipment, tailored primarily for this production, but flexible enough so that it could be used on subsequent productions. Both Norris' and John Butler's documentary experience had been confined primarily to local and/or dramatic endeavors. Making this film was going to be a great challenge for everyone.

We had decided to shoot in Kodak negative, #7247. In its dramatic productions, WQED had already enjoyed previous experience with #7247. Some



A vessel 60 feet long and 20 feet wide sounds big enough for all practical purposes, but when staffed with a crew of 16 (plus a "one-man-band" cameraman) and all their gear, it gets pretty crowded during a 3,000-mile open-sea voyage. Those aboard were almost constantly drenched by rain and salt spray.

of our early material was shipped to Los Angeles for processing, but soon thereafter, we were shipping everything from Honolulu directly to TVC in New York. Although the film's voyage was twice as long, no time in synching dailies was lost in our post-production facility. And the quality reaffirmed our confidence in Dan Sandberg.

In early September, we returned to Hawaii to shoot the sail on *Hokule'a* from Oahu to Kauai. The first overnight sail in the last six months, it was deceptively simple. Norris and Larry Johnson and I shared meager deck space that night, our hastily assembled WQED gear wrapped in plastic bags and stored in one compartment in the twin hulls. Ryder Sound had designed and hastily built a small mixer for the Nagra SN Recorder. Larry's microphone was a Sennheiser 815 in a zeppelin windscreen. Having hoisted anchor at Makaha Bay in late afternoon sunlight on a Friday, we arrived at picturesque Hanalei Bay on Kauai, hours earlier than expected, at 9 the following morning. Our support crew, which had flown over, had not yet arrived.

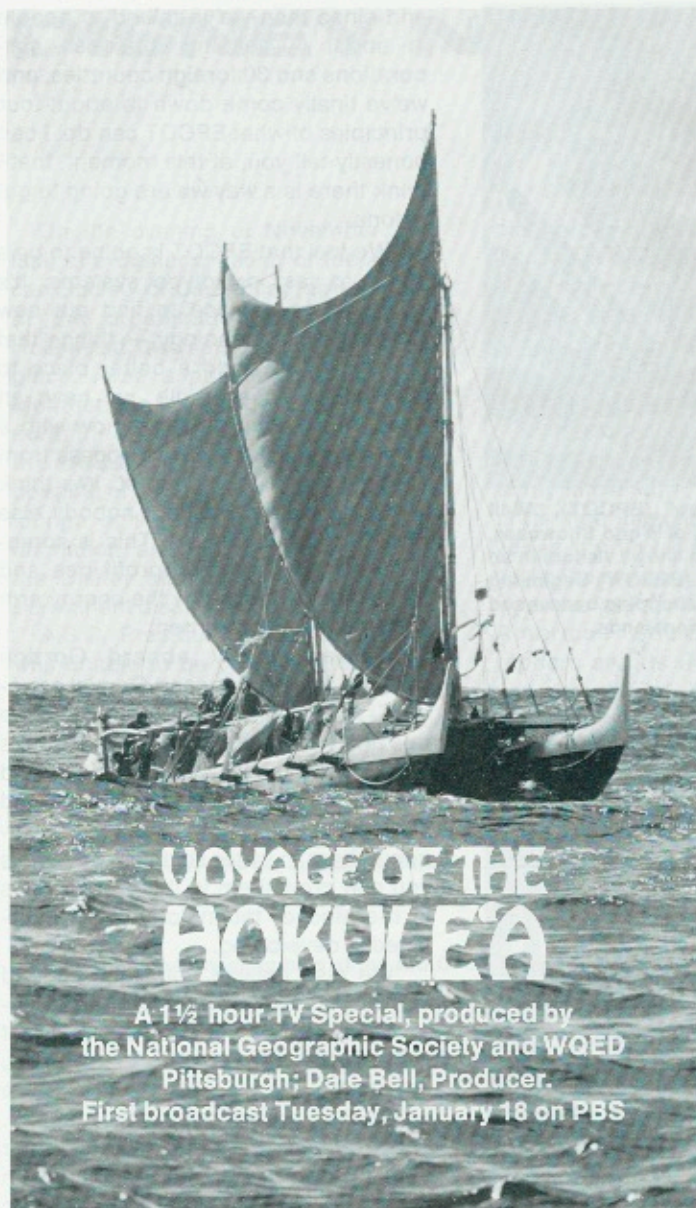
After a short week of land filming at Kauai, we returned to the mainland. The return sail to Oahu, against contrary winds, was scheduled for two weeks away, and it promised to be more difficult. We would be out for two nights, possibly three, as we tacked north above the channel to make headway against the prevailing east winds.

We returned to Kauai, still with the

NPR and the Ryder SN mixer, but this time, both were encased in splash-proof housings. The condensation damage we had incurred in the first sail would theoretically be eliminated. Joe Seamans, another cameraman from WQED, now joined us as assistant to Norris, and production manager to me. He headed the support crew of John Butler and Tip Davis, a local cameraman. Again, Larry, Norris, and I, joined the other twenty crew men and women aboard *Hokule'a* for the return sail to Oahu. The support crew was to meet us two days later. Leaving Hanalei Bay on a Friday, the canoe headed north in 15-knot winds across the sometimes treacherous channel which separates the two islands. As the crow flies, the distance is one hundred miles. Tacking would make our voyage more like five hundred miles. At the end of our first twenty-four hours, we surprisingly found ourselves only ten miles off the shore of Kauai. Resolutely, we tacked again, still further north, in an effort to make more headway.

But by daybreak Sunday, we were just twenty miles off Kauai. A disappointing performance. Immediately after we had awakened, we found that the starboard hull was almost completely under water! Disaster! A jib was tried, but failed. The canoe was hacked apart, the sail and the hut tied to the stern to prevent us from drifting south, out of the channel. Fortunately, we had elected to store our gear in the port hull for the trip. Most of it was still

Continued overleaf



PHOTOGRAPHS BY NICHOLAS DE VORE III, ED GEORGE AND ALASTAIR RIACH.

**3,000 miles
across the Pacific
in a sail canoe.
Drenched every day,
even sleeping wet.
Humidity. Salt.
One-man film crew,
room for one
sync-sound camera:
Arriflex.**

Cinematographer Norris Brock wore a vest and harness that let him operate the camera, recorder, mike, battery, wireless receiver and mixer, and *still* have both hands free to reload or to prevent himself from falling overboard. The camera wore a wet suit.

Without charts or navigation instruments, could the early Polynesians have sailed deliberately between Tahiti and Hawaii?

Ancestors

That was the question this voyage set out to answer. If successful, it would help to prove that 15,000,000 square miles of the South Pacific were methodically settled by the islanders, centuries before Columbus crossed the Atlantic.

No staging

Hokule'a was a reproduction of an early Polynesian voyage canoe. For 34 days, Norris Brock's job was to shoot on board. Filming was *not* the pur-

pose of the voyage, so he had to keep out of the way. Nothing could be staged.

Cramped

Space was in short supply. Mr. Brock had to sleep and store his equipment in a space 5ft x 3ft x 4½ft. The upper (sleeping) level was soaking wet. The lower (storage) level leaked badly. Both were hot and humid.

Wet

Except for some sunny periods in the doldrums, everyone on board was permanently soaked by spray, waves, and rain. From the first day out, Mr. Brock reloaded the Arriflex's magazines with wet hands, inside a wet changing bag.



Shooting one-handed and keeping out of crew's way. Note custom-made harness.

Negative

"Having used 7247 negative for the pre-voyage sequences, we wanted to use it at sea, too," says Mr. Brock. "Negative meant double-system; and we originally planned on a three-man film crew?"



Crowded and laden canoe meant sync-sound filming had to be done by one man.

One man

"But after a trial sail, during which we nearly sank, we were told we must lighten the load. *One* man would have to shoot and record the sound, with only one sync camera on board."

Stars only

"There would be a radio-equipped escort boat following us at some distance, to plot with instruments the course our navigator set by the stars. But we had no guarantee of access to it."

No radio

"As it turned out," says Mr. Brock, "*Hokule'a's* walkie-talkies were done in by the physical battering and the salt water, so we sometimes lost contact for several days. I had a 50ft load gun camera in an underwater housing. And I had four Nagra SNs. And *one* Arriflex 16SR."



Norris Brock, wet. Note mike mounted above lens.

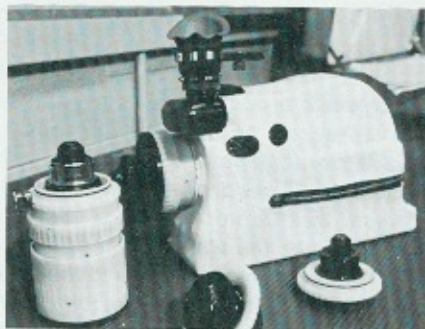
Gamble

"For this job, WQED had looked at every camera on the market. The 16SR was a new and, for us, untried camera. But we figured that the cameras we

did know would not hold up. We decided to bet on Arriflex's reputation for reliability?"

Wet suit

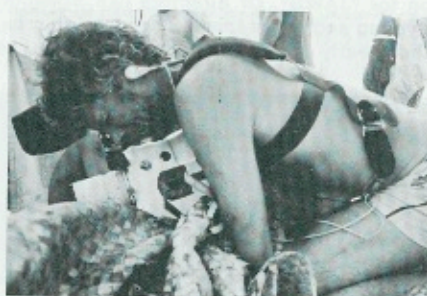
"The National Geographic Society made an amazing PVC wet suit for the camera, with a watertight zipper so I could change magazines. The finder and handgrip with its on-off switch we left uncovered."



Arriflex 16SR in custom made PVC wet-suit, lenses in solid nylon housings.

Nylon blocks

"I chose two lenses," says Mr. Brock, "The Zeiss 10-100mm zoom and the Angenieux 5.9mm. National Geographic machined housings for them from solid blocks of nylon, with waterproof O ring seals."



Symmetrical finder let Mr. Brock shoot at any angle on either side of camera.

Harness

"National Geographic also made me a vest with pouches for recorder, camera battery, wireless receiver, audio control unit — and a lifetime supply of lens tissue! And I had a harness made for the camera at a hang-glider shop in California."

Knocks

"Once at sea, I didn't dare put the camera down on deck, so I had to wear it (with the harness) for hours and days on



Wiping off salt spray every few minutes. Throw-away battery in pouch.

end. I fell down countless times. Having both hands free let me save myself and the camera from the worst knocks."

Quick

"The Arri's built-in meter really saved the day, too," says Mr. Brock. "The action was unpredictable. I couldn't walk around taking readings. I'd just start shooting and set the f/stop simultaneously."

Corrosion

"After two weeks at sea, the rotating finder froze up from salt-water corrosion. I oiled it and coated it with silicon... worked perfectly. Other than that, *no camera problems*."

Delivered

"I shot about 12,000 feet on the voyage," says Mr. Brock. "We had all our eggs in one basket with that camera — and it delivered."



ARRI
ARRIFLEX COMPANY OF AMERICA

Arriflex Company of America: P.O. Box 1102C, Woodside, New York 11377; phone: (212) 932-3403. Or 1011 Chestnut St., Burbank, Calif. 91506; phone: (213) 845-7687.

VOYAGE OF THE HOKULE'A Continued from Page 171

islands, she became a rallying cry.

Most of our photography between the end of October and the end of March was land-based. Larry Johnson's duties completed, he went off to work on other projects. The WQED crew of Norris, John, Joe, and I handled this part of the filming. We visited the islands twice more after the swamping for two-to-three-week periods.

With the memory of the swamping still vibrant, I was determined to produce a one-hour special, even if the canoe never sailed again. I could see that she meant so much to so many people that the story of her fight for survival could easily comprise the basis of the one hour.

During this time, we prepared the equipment for the voyage, should it ever take place. Our first rule of thumb was to find two of everything. Originally, we had planned to have a cameraman and a soundman on board *Hokule'a* for the trip to Tahiti. The swamping changed that, too. We could only have one person. Hopes for sync sound faded. Everyone told us it was going to be practically impossible to get sound if there was no soundman on board. (Because we were using delicate negative, we had decided not to go the single system route.)

We selected the camera from the many available possibilities. The new ARRI SR was the overwhelming choice. Compact, with extremely up-to-date electronics, through-the-lens metering, light weight, it boasted a shape which could be waterproofed. But could we get two of them? All of them were in Austria, covering the winter Olympics. None had been tested in this country on

long productions.

The manager of the National Geographic custom shop, Mike Schaeffer, a pioneer in the manufacturing of plastics, designed and built the housings for the camera.

Our cameraman, Norris Brock, would have to take sound himself, double-system. He, John Butler, Joe Seamans and Roy Brubaker posed the problem to Stuart Cody in Boston, renowned for his ability to miniaturize any piece of gear. They developed COMBO, the Cody One Man Band Operation. It would permit Norris to record from a microphone atop his camera, wiring the microphone to an SN he would carry on his person in a waterproof vest. Further, COMBO would enable him to place wireless microphones on various subjects, listen in on conversations through his headsets, and elect to record either those conversations, or those closer at hand to the mike on his camera. Warning signals were built into COMBO to alert Norris to possible malfunctioning of gear or signal. Cody's battery, nicknamed EXPO, allowed Norris to run more than twenty four-hundred-foot magazines before he threw the disposable battery over the side. SN tapes were prepared in "cassettes" to permit Norris easy loading capability. Three K-100's were purchased and housed in rigid plastic by Romano of Zilla Enterprises. He found us a 50-foot-load gun camera, and housed it as well. John Butler tested a dozen different kinds of microphones and windscreens to determine which combination would eliminate background ocean and wind noise. Wireless mikes, transmitters and receivers were purchased from Swintek, all on the same frequencies, so that Norris could record from one or all of them simultaneously.

So busy were they all with the

preparation of the gear that it seemed unlikely they would be able to get it, test it, and bring it to Hawaii in time for the departure of *Hokule'a*, now slated for mid-April. To give them more time, I brought David Myers, another cameraman with whom I had a long association, to Hawaii with his crew to shoot for a week in mid-March.

Finally, towards the end of March, the WQED crew returned to Hawaii. We had added Ed George as assistant cameraman from WQED. He was to help Joe get Norris' gear ready for the voyage, pack it, provision him, while we continued to shoot the story which never seemed to stop.

I had settled on an escort vessel for the voyage. Sixty-five feet long, of steel hull, it was to be the support base for the canoe. Tracking the canoe from a distance, the *Meotai* would enable us to get exposed film on and off *Hokule'a* on a once-a-week schedule. We purchased a zodiac and outboard engines to effect these transfers.

In early April, amidst ceremony, *Hokule'a* was hoisted off oil drums and gently placed in the water again. Working for months on the refitting of the canoe, the Hawaiian crew now claimed her as their own. A widening rift had grown between the leaders of the project and the crew. The navigator of the crew, Mau Piailug, had arrived from the distant Micronesian island of Satawal. One of the few men in the world who can sail on the empty ocean without compass, sextant, or any instrument, it was his job to navigate the canoe to Tahiti against the prevailing trades, using only stars, ocean swells, cloud formations, and the flight of birds as his guides.

As *Hokule'a* conducted her test sails off Waikiki Beach, we tested out our new equipment. Except for minor repairs and adjustments, it appeared to be in fine working order.

On April 24, we broke our bond with Oahu and sailed eastward for the island of Maui. There, traditional ceremonies, not practiced for centuries, would be conducted for the men who would relinquish their ties with land and become men of the ocean. From Maui, *Hokule'a* would sail still further east and north, so as to put her in better position for making a southeasterly direction against the prevailing trades. Tahiti lies some 250 miles to the east of the longitude of Hawaii. The canoe would have to effect a curved course into the wind in order to make a proper landfall three thousand miles away.

Norris' gear was loaded aboard the canoe. At six feet five inches tall, he would have to sleep in an area which was no larger than five feet eight

At Hanalei Bay on Kauai's north coast, outrigger canoes come to visit *Hokule'a*, and to help transport the film crew from canoe to shore. On the Hawaii-to-Tahiti official run, the impressive craft was sailed against the prevailing trades, using only stars, ocean swells, cloud formations and the flight of birds as navigational guides.



Luckily, he had one puka (one compartment) in the hull for himself and his equipment. He had spent weeks fashioning the shelves and racks for his puka, which measured 3 feet by 3 feet by 5½ feet. These would enable him to have every piece of gear directly in front of him, each individually watertight. Tools, stock, silica gels, plastic . . . everything off the floorboards in case the canoe continued to leak. He would have to eat the same food as the 16 crew members: ancient Polynesian foods such as taro, poi, dried fish and bananas, so as not to diminish the food experiment which we had always accepted as part of the voyage criteria.

It was not going to be easy for Norris. An experienced long-distance sailor, he did not have to worry about seasickness or the confinement of a boat. His main preoccupation was that of maintaining the gear, loading, logging his exposed material, being cameraman, soundman, assistant, all at the same time. He would have thirty days at sea in which to photograph as many aspects of life on the canoe as he could. His gear was versatile enough to permit him to get shots in any kind of weather. Repairs on equipment could be done on the escort vessel.

On May 1, 1976, *Hokule'a* pulled anchor from Honolulu Bay in Maui. It was a month later than they had originally intended. It was almost seven months after she had swamped off Kauai. We had shot almost 90,000 feet of 16mm, enough so that even if the canoe swamped again after only several days at sea, we would still have an hour show in the can. Followed by the *Meotai*, with Joe, John, Norris' son, Robert, and myself on board, *Hokule'a* started her tack for Tahiti. Joe, who had been doing some of the filming during the last few days before departure while Norris was finalizing his puka, would shoot the boat-to-boat footage, and the relevant navigational scenes on board the tracking vessel. I could be in touch with Norris with the various walkie-talkies we had on board. The captain of the *Meotai* could speak directly to the captain of *Hokule'a*.

Five days out, as we were making our last tack northeast of Hawaii's Big Island, I decided to get off the *Meotai*. Two weeks earlier, I had broken my foot. And although my leg was in a fiberglass cast, I found it extremely difficult to work on board. The Coast Guard lifted me off by helicopter. Ed George, almost airborne on his way back to the mainland, was flown in from Oahu. As the Coast Guard evacuated me, they left Ed in my place. The voyage continued.

Through Bill Myerson of the U.S.



A temporary "two-man-band". Producer Dale Bell holds the COMBO, a fully-automated amplifier/mixer unit, designed by Stuart Cody to work in conjunction with the miniature Nagra SN recorder and handle a camera microphone, along with a radio mike or two. Cinematographer Norris Brock holds the Arriflex 16SR, neatly shrouded in its custom-made "wet suit".

Navy Marine Corps MARS radio network, I was able to be in touch with the *Meotai* from the islands and the mainland. In the middle of the voyage, I returned to Hawaii to film some short segments which could be inserted by Barry Nye, our editor, into the voyage section. Ten days before the anticipated arrival of *Hokule'a* in Tahiti, I flew there to set up final filming arrangements with Sylvain, a French-speaking cinematographer I had met in Hawaii months earlier.

The anticipated arrival of *Hokule'a* was the sole topic of conversation in Papeete. On French television, I would give updated position-reports in French. I lined up the only helicopter, and various boats. The French government declared a holiday, *Hokule'a* Day, for her anticipated arrival. The Tainui Association in Papeete had summoned all the paddling canoe clubs to the beach at Papeete. Once *Hokule'a* made her first landfall at the remote island of Mataiva, 175 miles northeast of Tahiti after 33 days at sea, we knew it would be only a matter of a day or so before she would sail triumphantly into Tahiti.

On June 5, at nine in the morning, *Hokule'a* accepted a tow to speed her towards the waiting crowds. No one expected such a gathering, least of all the exhilarated crew on the canoe. As *Hokule'a* approached the harbor, she saw people wading in the water on coral reefs, straining for a glance at the canoe. And on the beach, less than a half-mile distant, had assembled the largest crowd ever since the arrival of Captain Cook, nearly two centuries

before. More than 15,000 people were packed onto Papeete's shoreline. Fifty paddling canoes escorted *Hokule'a*. The big 75-foot long ceremonial canoe from Tahiti, with a band on board, welcomed her.

On deck, Norris was shooting the arrival with the same ARRI SR and the same Nagra SN with which he had left Hawaii. As Tahitians say, "No problem!" Joe Seamans and John Butler, who had arrived the previous evening aboard *Meotai*, were shooting from land. Sylvain was in the helicopter. Ed George was shooting from water-level in the harbor. I was filming from the speedboat I had rented for the morning festivities.

We had shot almost 20,000 feet on the voyage alone. Uneventful though it was, without storms or danger to life, we had succeeded at what we had set out to do. We had shot double-system, *Cinema verité* style, on the open craft for 35 days. Norris immediately shaved his beard. We took the film back to Los Angeles, for shipment to TVC in New York.

"VOYAGE OF THE HOKULE'A" is probably the most difficult film with which I've ever been associated. It aired nationally on the 256 stations of the Public Broadcasting Service on January 18, 1977. With extra grant-support from Gulf Oil Corporation, Tom Skinner and Dennis Kane authorized expansion of the show to 90 minutes. Barry Nye and Ted Strauss, the writer, have helped enormously to make this the first ninety-minute National Geographic special ever. ■

Masterpiece of Accomplishment

Producer/Director
DALE BELL

Sound Supervisor
JOHN BUTLER

Sound and Picture
NORRIS BROCK

Sound Service by
RYDER SOUND SERVICES, INC.

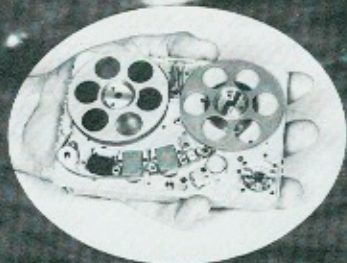
Production Manager
JOE SEAMANS

Produced by
WQED/ Pittsburgh and the
National Geographic Society

VOYAGE OF THE HOKULE'A

We salute
the dedication
and spirit
that resulted
in this inspired
undertaking!

Space being
at a premium
aboard the Hokule'a
it was necessary
that one man
handle both sound
and picture
simultaneously . . .
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Our pride in the selection of the NAGRA SNN to compliment this great effort is now more than justified in the resulting performance of superior capability and high level professional product reliability under the most extreme conditions.

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