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AN EXPLORATION NEAR AGADES AND TIMBUKTU
IN ADVANCE OF THE 1973 TOTAL SOLAR ECLIPSE

By

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ON THE COVER: Dogon tellem figure. Wood. Bandiagara region, Mali.

Introduction

In keeping with our flexible format, we publish this piece by Jay M. Pasachoff, Research Fellow in Astrophysics at the Hale Observatories of the Carnegie Institution of Washington and the California Institute of Technology. Pasachoff was affiliated with the Harvard College Observatory at the time this piece was first written.

In 1973, there will be a total eclipse of the sun which in West Africa will be of exceptional duration: a full seven minutes, close to the theoretical maximum. Because of the unique opportunity, Pasachoff, along with Donald H. Menzel, former Director of the Harvard Observatory, examined the suitability of viewing sites in Niger and Mali and they reported on their findings to the 1970 General Assembly of the International Astronomical Union. In this piece, Pasachoff gives an account of his inquiry and of his thoughts on the matter.

Pasachoff's narrative should be of particular use to the many astronomers, professional and amateur, who are considering expeditions to Africa for this event. Setting up satisfactory facilities requires more than mere geographical coordinates; the details and impressions contained herein should thus be very helpful.

While the eclipse is of obvious scholarly significance, Dr. Pasachoff's report is of interest for other reasons as well. More than most professional communities, the scientific community is truly international; Pasachoff's narrative will be of value to those who are concerned with the full implications of this fact. Perhaps a majority of American scientists lack a first hand appreciation of the problems posed by the social, political, and economic environments in which scientific work must be carried out in many areas of the developing world. While some scholarly work has been written on this topic, the informal and anecdotal nature of this report state the problems more forcefully than do these other writings, and the very nature of the areas which Pasachoff "explored" illustrates the problems most vividly.

Pasachoff's report will be of interest to Africanists as well. Pasachoff can be seen as a member of the new category of personnel who span the West and Africa: the technical and scientific cadres, many drawn to Africa as a part of the development efforts of African nations, and many as part of international programs sponsored by governments, international agencies, and business enterprises. To what degree his reaction typifies the reactions of other members of this category, each reader will have to judge for himself. Nonetheless, typical or not, Pasachoff's reactions do yield insight into the reactions of this new group to Africa and into the images of Africa which they transmit abroad. It is my impression that while a new kind of person is now going to Africa from the West, with backgrounds and purposes

which differ from their predecessors, they nonetheless respond to Africa in a manner similar to that of their compatriots in the pre-independence period. The changing structure of relations between Africa and the West, and the changing composition of the category of persons who maintain these relations, does not necessarily entail changing images of Africa, either on the part of those who deal with Africa directly or on the part of those whose images they help to form. If this impression is true, it is of obvious significance. Documents such as the one we publish by Pasachoff should allow us to judge its validity.

R. H. B.

It is still almost impossible to get information in America about some parts of Africa, and we were intrigued when a reconnaissance trip into the Sahara desert seemed advisable. For in its millions of square miles of parched, unpeopled terrain will come nature's most spectacular event: a total eclipse of the sun.

Millions of Americans in the Eastern United States observed the 7 March 1970 blackout, and thousands of tourists joined hundreds of the world's astronomers in Southern Mexico for the three and a half minutes of midday night that was visible. The perfect weather, the deep blue sky, and the event were so awesome and moving, both to veterans of several eclipses and to novices, that immediately a collective cry went up: "See you in Africa, in 1973."

We are astronomers from the Harvard College Observatory and our 2-1/2 tons of equipment don't fit in an overnight bag, so our jocular salutation soon turned into serious study. For in a rectangular tract a few kilometers wide and a few hundred long, in Northern Mali and Niger, the total eclipse of June 30, 1973 will last more than a magic seven minutes, close to the longest that is ever possible for us on earth. The eclipse path itself is thousands of miles long, crossing the Atlantic from Brazil and sweeping across Africa from west to east until, as totality grows shorter, it disappears into the Indian Ocean past Kenya. All that we knew was summarized in a recent report reprinted as Appendix I. But who would settle for second best when the longest eclipse of our time will be available? Seven minutes it must be, if at all possible. And when we hear that Niger has a big game reserve called the "W" National Park after a "W"-shaped bend in the Niger River, we know that we must go as soon as possible.

The bright surface of the sun, dazzling to the eye, masks a faint, hot, important part of the solar atmosphere. The corona surrounds the sun and extends millions of miles into space. But it is a million times fainter than the surface, and the blue sky hides it. By a fortuitous accident the moon, which is 400 times smaller than the sun, is also 400 times closer. Every year or two, it glides between the sun and us, blocking the light from the solar surface before it can scatter around in the earth's atmosphere. The alignment is good enough only in a narrow band, about 150 miles across. So astronomers who work with eclipses often find themselves in distant places -- South Pacific islands in 1965, Bolivia in 1966, Siberia in 1968, southern Mexico in 1970 and Canada in 1972, setting up complicated instruments to carry out experiments that can be performed only in those few seconds or minutes.

A trip to "unknown" parts of West Africa, independent from France since 1960, is not usually quickly arranged, but with our fingers crossed and airline tickets in hand, we set out for Niger and Mali in time for the June 30 minus-third anniversary of the eclipse. The two huge land-locked countries, bordered on the west by Mauritania

and Senegal, on the south by Guinea, the Ivory Coast, Upper Volta, Dahomey and Nigeria, on the east by Chad, and on the north by Algeria and Libya, were unknown quantities. Could we eat? Drink the water? Hire cars or hotel rooms? Survive the temperatures that supposedly went to 130°? Armed only with copies of letters explaining our purposes that we had sent to the Presidents of Niger and Mali and to the United States State Department (and from none of whom we had yet received replies) and an assurance from the Mobil Oil Company in response to our request that they would help us make arrangements in Africa (after all, their scientists were allowed to analyze rocks from the moon, they wrote), we started our journey.

June 24th and 25th

I shall be the advance man in Niger, but I am shortly to be joined by two colleagues. The first, Donald H. Menzel, is the dean of eclipse watchers, having seen thirteen dating back to 1919, perhaps an all-time world's record. Paine Professor of Practical Astronomy and Professor of Astrophysics at Harvard, at sixty-nine he has recently stepped down from his administrative position of Director of the Harvard College Observatory. Completing our group is Laurence K. Marshall, a resident of Cambridge, who has come along because he is an expert on African deserts. He is the head of the famous Marshall family, whose epic study of the Bushmen in the Kalahari desert is well known.

The big DC 8 of the French-founded African airline known as UTA leaves late at night twice a week for Niamey, the capital of Niger, thus far chiefly famous for the procession of 2,600 camels mounted for the 1967 meeting of African Chiefs of State. Delayed four hours at Le Bourget, it is daybreak when the plane passes over small groups of picturebook straw huts gathered in round compounds spread around the parched land and swings over the trees of the capital's boulevards (bless the French for providing the greenery) to land. Awaiting me are M. David Petrier of Mobil, who is himself flying off on the continuation of my flight, and Miss Marilyn Johnson of the United States Information Service, who takes me to my hotel. An overnight plane trip is enough to wreck anybody's cerebration, but after a day's nap at my hotel and a quiet dinner chez Marilyn I can start my orientation. The food is French, we drink bottled Evian or filtered local water, the air conditioning hums away, and everything is going to be all right.

June 26th

I am staying at Les Roniers, an inn located just west of town. The rooms are in round mud buildings with conical thatched roofs, but it is mock-native. The rooms are large and air-conditioned, and the plumbing is modern. There are also a few hotels closer to the center of town, but a conference of a committee on the Lake Chad river has filled them this week. Vince Hovanec, Marilyn's second-in-com-

mand, picks me up early, and drives me in to the U.S.I.S. headquarters. The U.S.I.S. functions semi-independently from the Embassy here in Niger, and is located in a building of its own, the Centre Culturel Américain. This is our first real chance to discuss our mission, and to begin to arrange local appointments and modify our travel schedule.

I have been told to see Neagu Djuvara, the counsellor to the President, and I go to his office to explain our mission. Afterwards, he takes us to the Cartographic Agency to look for the latest charts. I succeed in getting 1:200,000 maps of the region around Agades, the site of the commercial airport nearest the eclipse path, except of course for the section we want the most, which has not yet been done. We really do need accurate maps, and will even have to do our own surveying later, if we are to be located right where the eclipse is longest and not off to the side.

Marilyn and I also pass by the Tourist Office, for we have heard that the rainy season has begun south of us, and that the W Park may therefore be inaccessible or closed. The lady behind the desk blithely says that the Park is open, but we don't get the impression that she really knows.

I must get some Central African Francs (272 to the dollar) so we pass by the bank, one of two in town and the only one that handles foreign exchange. It is only a quarter to 12, but the bank closed at 11 and won't be open until tomorrow morning.

The fanciest lodging in town is at the new Grand Hotel. It is one of a French-owned chain, with hotels at four African capitals as well as Angkor Wat in Cambodia. Hertz Rent-a-Car has just come to Niamey, and has its office here. They are willing to rent us an ordinary car for an excursion on Sunday, and a Land Rover for a subsequent trip to the W Park. Jacques Lang, the pilot and owner of the charter company Air Transimage, has his office there too, and we discuss whether we can use his services. He has a Piper Aztec and a Cessna 206, and has been in business in Niamey for eight months. We would consider flying north with him to inspect the eclipse sites, and perhaps even south to look over the W Park. But, alas, he is booked for Monday, Tuesday, and Wednesday, so we shall carry on with our plans to go up to Agades in the north via the commercial twice-weekly flight.

The hotel overlooks the John F. Kennedy bridge, now under construction, which will contain a causeway to a little island and an arched span over the main channel of the Niger. It should be finished next year. Meanwhile, men work even through the heat of the day, as flocks of sheep ford the river and women wash clothes on the shore. There has been some criticism that it will block the channel, but the Niger isn't navigable anyway from the sea. The Egyptians are building a big skyscraper nearby called the NASR,

that will be mostly offices but will have a 200-seat Egyptian restaurant and a night club. There don't seem to be too many Egyptians in town. Who will go there? The Israelis, for home cooking? They have an Embassy here, one of only seven.

A dozen people are drinking and sunning themselves around the hotel pool, but I go in to lunch -- for 850 CFA: fish, soup, sauce, salad and pastry, beautifully prepared and served. I hesitate at the salad -- but this is the Grand Hotel. Feeling guilty after two bites, I decide I had better ask anyway whether it is safe for Americans to eat. Of course, I'll never really know the answer unless I try it.

Taxis never wait at the Grand Hotel. I stand in the road and a driver, leaving the hotel after dropping somebody off, stops and gives me a lift to the Cultural Center in his Peugeot.

John Garrett, the Associate Peace Corps director in Niger, offered to provide the Volunteer who knows about the W National Park if Marilyn will play tennis with him. So we stop at my hotel, in the suburbs ten minutes out the other side of town, for my things. The U.S. recreation center was built by the previous ambassador. Somewhat rattletrap looking, it is no showplace, but it provides a pool and tennis court and a place for everyone to sit around in the late afternoon, now that the Embassy is on a 7 to 2 schedule (7 to 12 on Saturdays). A roof covers an area with chairs, and on one side is a wall that doubles as a handball backboard and a movie screen. Everyone says the movies are atrocious, though tonight's Jim Brown flick may be above average.

Susan Garrett, John's wife, is a typical, bright, New York schools' product, since then out of Antioch, where she met her husband. They've been here for two years, with six months left, and will probably return to the States "unless something fabulous comes up." John has done two years of traditional graduate work at Johns Hopkins in American History, but now is looking to change subjects and work on the concept of volunteerism. Antioch, forever constant, has an open program with but one six-week series of seminars a year, so that may be the answer. John and Susan seem to get along fine here -- on paper, they function independently and parallel to the USIS and to the Embassy. Susan had been sent home to have her third baby a few months ago -- she wasn't allowed to stay here (no emergency facilities) and the alternative of Europe would have left her with nobody to care for the other kids. And, legally, it's so much easier to have been born in the States.

John appears with the Peace Corps volunteer, a Louisiana boy out of LSU from whom words are scarce. But he is living in the W and even with our 20 to 1 word ratio, I think I get the picture. The mud bridge at the entrance to the park is covered with water, but he has left a motorcycle on the other side pending his return on Tuesday. He will radio up to the Tourist Office on Thursday to let us know how things are and whether we can indeed enter the park. I tell John about the possibility of renting a plane and overflying to see

the elephants. Since he can't afford to charter a flight himself for his people, and since a flight over the park would be useful for the Peace Corps project, if we take two of his people along he might then open the park for us and send us down in a Land Rover if the water is down.

John and Marilyn try to play tennis but the eastern sky darkens and appears like a dust cloud or Dorothy's Kansas tornado. It turns out to be rain, the first of the season in Niamey, about three months delayed. So much for my tennis. A few hamburgers are consumed -- the snack bar being the only facility at the recreation center -- but the rain keeps up and Susan invites me home for pot luck. Their cook has been given his first opportunity to make a soufflé all by himself (he had already made two under Susan's watchful eye). We run to the tin-can 2-CV Citroen and pile in; John has the truck. We stop at an intersection to photograph streets flooded by the cloudburst, but the children keep running in front of me. I'd love to have them in the picture, but not standing there posing.

Dinner is light and good, and Aaron, age 5, has lots of questions about astronomy. The salad is guaranteed safe to eat, and the ice cream, I am assured, is grey only because the chocolate and the mint melted together. But John has left Susan's purse out in the truck just outside the gate, and the wallet is missing. What about their guard sitting right outside the gate? Why didn't he see it? Anyway it is Susan's New York drivers license that matters and not the \$40 (though it is a small fortune to the guard, whom the Embassy has been paying \$20 a month since the Garretts' house was robbed some months ago). The cook, from neighboring Dahomey, gets \$50 a month. Dahomeyans seem to make good cooks. The Garretts lent him CFA 30,000 when his two children died -- one from measles and the other from fever, and he is paying it back at 1000 (\$4.00) a month. Alas, the wallet doesn't turn up and a search outside doesn't find it discarded.

At Les Roniers, I discover that they have changed the reservations (though they deny it) and Menzel and Marshall have no rooms! The boy at the desk doesn't even want me to talk to the manager -- there are just no rooms -- but a friendly visit to the Patron turns up the fact that someone is leaving on the same plane. They will change the sheets at 2 a.m. and all will be O.K. By the time I fall asleep it is 1 a.m., and at 2:15 Marilyn is knocking on my door to take me to the airport. She had even met the midnight plane, and found two Peace Corps volunteers passing through on their way home. I don't know how she does it. The airport is crowded and another plane circles and lands as we arrive. No passengers -- the crew looks Russian so it might be from Bamako. Soon the Paris jet comes in and Menzel and Marshall eventually appear, looking dishevelled. The police stamp their passports, the health officer checks their vaccination certificates, the customs man scribbles in chalk on each bag, and we go home and to bed.

27 June

I am up all too early, but Vince picks me up to change travelers' checks at the bank. I try to get money for all three of us to go to Agades, so I change \$650, and get cash and cash and cash -- 176,800 CFA -- in a bundle. On the clerk's advice, I push in front of the crowd at the caisse -- "Messieurs-dames, s'il vous-plait, Messieurs-dames" -- and am finished in record time. But so it must be, for the President is meeting us at 10, and Marilyn has gone to pick up Menzel and Marshall and meet us at the Palace. The Chief of Protocol, a young man in an open-collared uniform shirt and a scarified face, meets us there and takes us out on the veranda to see the view of the Niger River. Somewhere to the right of us is the Presidential tennis court, but I can't see it. We are all wearing suits and ties for perhaps the only time in Niger. Eventually, President Hamani Diori comes. Dressed in a flowing garment, he makes us at ease, and invites Menzel to move next to him on the couch. The President supposedly understands English -- he has been taking lessons from Peace Corps volunteers -- but he doesn't seem to react to what Menzel says, so I explain in French. We are here, I say, to find a site in the Air mountains for the total eclipse of 1973, many astronomers will be coming from around the world, and we are concerned with weather and logistics. We will report to the world's astronomers in August (all the astronomers in the world still fit in one large room every three years and we will all meet this year at the General Assembly of the International Astronomical Union in Brighton, England), and we will be glad to lecture in 1973 to the new joint university being formed by Niger and Upper Volta -- Science in Niamey and Arts in Ouagadougou. The President's questions are well thought out and to the point: How many will come? What about financing? We give him maps and a photograph we had taken of the corona in Mexico on March 7th and promise to poll the astronomers in England for preliminary estimates.

The official photographers come, the President retires, and I give interviews in French for the radio and for the press. Menzel makes some additional comments in English. Then the room is needed for another audience and we are led out. The President will leave in a day or two for a quiet vacation in France, so it is good we were able to see him. A former school teacher, he became President at independence in 1960, was re-elected in 1965, and will probably run again this year, although it hasn't yet been announced. (He has been re-elected - J.M.P.) He is a popular man, has kept the country stable for ten years, and hasn't invested in bankrupting grandiose schemes such as those a recent article in Le Monde described of Mali.

The market is in full swing in town as we pass - the Petit Marché is a street market and much more interesting than the Grand Marché, which has more trucks and shops. People sit on blankets with their wares spread out -- quite similar to what we had

found in Mexico except for the striking contrast of colors. Street markets are the same all over; it must be our supermarkets that are abnormal. The street vendors in Cambridge or Berkeley are part of a world-wide tradition. Laurence Marshall finds a funnel made by hand out of a Heineken's can and buys it for a souvenir. Women, with breasts sagging, are wrapped in colorful fabric and carry their babies on their backs. Men wear mostly robes and some wear western clothes. Some like to be photographed so much that they pose; others turn away.

We pass some time in Marilyn's air-conditioned office, and set our schedule. Stick to the original four days in Agades with a one-day trip to the mountains and another to Arlit, passing the prospective site on the road. If we can't subsequently go to the W Park, Menzel and Marshall will try to leave on Friday, a week early. My vote for staying longer near Agades, seeing the ancient drawings on the rocks, and going into the desert to visit nomads, returning to Niamey by a subsequent plane, was outnumbered.

We had gotten the position of Arlit from the Cartographic Department, something that made us perhaps the only Americans in the world to have its location recorded. Site of a big uranium strike, it is being developed by a joint French-Nigerienne (one must not confuse Nigerienne - from Niger, with Nigerian - from neighboring Nigeria) Company, and by 1973 should boast a modern air-conditioned town, restaurant, and enough lodgings for at least a few of the astronomers. There may be some freight-handling equipment. Arlit will even be a little closer to the central line of the eclipse than Agades.

Alfred Erdos, the American Chargé d'Affaires here, had invited us to lunch, and we go along at 1 o'clock. The last Ambassador had been promoted to Under-Director of AID for some African region. There isn't much for an Ambassador to do here -- just look at the number of your visa, I had been told. Under the seal: *Fraternité-Travail-Progrès*, I find "Washington 083." A new Ambassador had just been appointed two weeks before we left the States, and nothing was known about him here yet. He would move into the new Residence, just opposite the Embassy that will not quite be finished on schedule. Ten minutes outside of town -- he wouldn't like that. And of hideous architecture -- the architect had apparently designed things so that "even if the walls were 1/6 the planned thickness, and the concrete were watered, it would still stand 386 years."

In the meantime, Erdos, as Chargé, is head here. He has some State Department representatives from the Ivory Coast at lunch and I, mostly on request, try to describe to one of them the hopeless feeling on campuses at this time over the Indo-China situation, and how the government was itself risking national security by alienating a whole segment of the population and pushing them toward the leftward brink. They don't particularly agree but at least they listen.

We glean information about prospective eclipse sites in Mali. One thing that makes those sites difficult is that Mali doesn't like people going up to Tessalit in their north for they have had trouble with the Tuareg there over payment of taxes. They have also kept political prisoners at Kidal en route.

The Chargé drives us back to our hotel. Menzel comments on being shown the Embassy that it is far from town, but Erdos advances "no two places here are more than ten minutes apart -- a far cry from New York and Washington. No traffic problem, no pollution." At the hotel at 3:30, my thermometer shows 101° in the shade, the hygrometer reads humidity 40°. And it isn't bad at all.

Tonight we are going to dinner at Marilyn's. I must remember when the Patron wakes up from his nap to get cokes and water for our excursion to Ayerou tomorrow to see the market there and, we hope, giraffes en route. Erdos has already given us water to take along.

I find a typewriter at the hotel, but it proves too difficult to use; too many of the keys are located in strange places: Noz is the ti,e for qll good ,en to co,e to the qid of the pqrtly in lce" The quick brozn fox ju,ped over the lqwy dog. I'd better write my notes longhand.

Also at dinner at Marilyn Johnson's are the visiting Cultural Attaché from Dahomey who is spending a week here with his family. Djuvara is present as is an old French refugee, Michel Tafanelli, who unsuccessfully challenges Mr. Marshall at being the eldest at table and loses by 12 years. Marilyn's sister is visiting from Boston and Side Hassane, a schoolteacher (young-looking, but actually the father of nine children) who is now Secrétaire Général de l'Union Nationale des Travailleurs Nigériens, arrives late. We hear much philosophy from Marshall, Djuvara (who is himself an old Romanian refugee on a Nansen passport who has lived here since 1961, but keeps his wife in an apartment in Paris because he thinks it is too hot to die here when he grows old), and Tafanelli (who has just returned with Marilyn from giving the President his weekly English lesson). M. Hassane had driven from Niamey to Arlit in March and he describes his trip -- Leave Niamey at three and arrive at Tahoua, where he was brought up, at ten. Tahoua to Agades took up the next day ten to ten, and Agades to Arlit took six hours the day after that. Perhaps we can go to Arlit on Tuesday, stay over and return Wednesday night via the mountain route.

Djuvara, at dinner, gives us a copy of a cable sent this morning from M. L. Kaziende, the Minister of Public Works who is doubling as Minister of the Interior:

Message a transmettre PAR LA GENDARMERIE
NATIONALE MINISTRE INTERIEUR P.I. A PREFECT AGADES

No 313/M1/CaB. -PASACHOFF, MENZEL ET
MARSHALL, TOUS TROIS PROFESSEURS UNIVERSITE AMERICAINE
HARVARD, ARRIVERONT AGADES PAR AIR NIGER LUNDI 29 JUIN
POUR PROCEDER DAN L'AIR A ETUDES PRELIMINAIRES A
OBSERVATION ECLIPSE SOLEIL QUI AURA LIEU DANS TROIS
ANS, STOP. PRIERE LEUR DONNER TOURS FACILITES STOP.
RECOMMANDES PAR CHEF DE L'ETAT, STOP. JE PRECISE
QU'ILS UTILISERONT LAND-ROVERS MISES A LEUR DISPOSITION
PAR MOBIL OIL./

L. KAZIENDE.

Marilyn eventually brings us home, and I set up the small telescope I have brought and show her Jupiter with three of its moons, and a spectacular view of the Southern Milky Way. And the sky should be even clearer in Agades.

June 28

Up early again, and our Hertz driver comes with a Renault 16. Alas, the French cuisine proves deficient for our purposes, for we can have but a jus de fruits, a croissant, a brioche, confiture and tea. Where is the substance we need to carry us through our day on the road? We drink lots of water already, and stock up an ice chest, canteens and a polyurethane gallon jug that I have carried all the way from Cambridge.

It is 7:45 when we finally leave, already an hour behind schedule. The paving lasts only 6 km from our hotel, and a road of packed earth lies ahead, the "piste." We rocket along at a steady 80 km/h anyway, passing compounds of straw huts fenced in with straw. About a hundred km from Niamey, we reach the town of Tillabery and stop at the side of the Niger, where a dugout ferry is going across to and from the huts on the other side. People bathe and wash their clothes in the river. Just a few young men are wearing Western dress, and they gather around us. As we leave I tell them that although here they are beginning to wear such clothing, in New York some people are returning to African style.

We had hoped that there would be giraffes along the route, but mile after mile passes by. A month ago there were dozens; apparently there has been enough rain in the bush that the giraffes no longer have to go to the river, which would bring them across the road. So here there is too much water; in Mali I shall suffer from too little water since the river won't be high enough for a journey by boat. I can't seem to win.

By 11:30 we reach Ayerou, after passing through several pre-frontier Police douanes at the various towns. Hundreds of people are there, washing in the river and sitting and standing in the market. More impressive are the Tuareg on their stallions and camels. Sunday in Ayerou is quite something.

It is hot, perhaps 115°, and dry, but we have been drinking lots of water and Coca-Cola, so we feel fine. Indeed, Laurence Marshall, at the age of 81, walks around more than most. But the Ivorian Attache and his family, whom we had met at Marilyn's, aren't in such good shape. Heat exhaustion, but not major. There is a hostel (called a Campement) and lunch is fine: but they soon run out of chilled bottles and liquids and we are afraid to put the ice in our drinks. Anyway, warm Cokes are better than none, and the stuff in our ice chest is still cold.

Issaca, the assistant Patron at the Campement, says that he can find giraffes farther up the road, so the three of us set off with him at about three o'clock. I see nothing, and Donald is just eyeing a suspicious tree, when Issaca shouts "et voilà," and we turn our Renault off the road. It takes me a minute to see them, but there they are, three of the cutest giraffes on earth. We drive up closer, even too close for my 200 mm lens, and they move around, posing in groups with the Niger in the background, putting their heads together and running occasionally with a strange camel-like gait.

We continue farther north until, only about 10 km short of the Malian frontier, we turn off toward the river, passing isolated huts and a pair of beautiful crowned cranes, and find a mound of hippos in the middle of the river. Leaving Donald and Laurence on shore with a half dozen natives and children, I get in a small dugout and am ferried out to a little island for a closer view.

We drive pretty much straight back to Niamey, with brief stops to drop off Issaca at home, buy his embroidered cap as a souvenir and drink liquids. The sun sets quickly, dropping into heavyhaze on the horizon as a village we are passing in the valley below us lights its evening fires. In three hours we are home. One wonders if the giraffes would go as far out of their way to see us.

For dinner we join M. and Mme. Boquet, the only travel agents in town, whom the President has called and instructed to find out what we would need for 1973. We discuss facilities for astronomers and for tourists and stress that information must be generally available about what is open, and be accurate information at that. If the W Park is open in June 1973, some hundreds or thousands of tourists might try to come for a few days in the Park to see the animals, and then a day or two in the Air for the best eclipse remaining this century. Donald points out, "You need more than three giraffes." But he's been in Kruger Park; as for me, three giraffes are sufficient. Even the liability of lack of lodging could be turned into an advantage -- how many people would love to say they spent a night on the sand in the Sahara!

June 29

After all this, 3 o'clock in the morning is too early to get up, but we have a plane to catch at 5. And we have tickets to buy, since TWA said, incorrectly as it turns out, that Air Niger would not honor their ticket coupons. They do honor Donald's TWA ticket, in fact, and an Air Travel card for the other two of us. Though we leave a half hour late, the DC3 flight is smooth and we stop for 20 minutes in the early morning at Tahoua. Tahoua is not much of a town, just some mud houses in the middle of the desert. We have a good view of the "suburbs" as we take off -- a few huts in straw-fenced compounds at the edge of town. We are in Agades ten minutes ahead of schedule.

We meet the Préfet at the airport. M. Idé Yacouba is a young, stately man in a blue bou-bou, the native flowing robe. The small airport building is relatively new, and even has a little fountain inside, a strange sight for the desert. The Préfet takes us into the hotel in his car -- a big black Mercedes with a Nigerienne flag flying from the front fender.

The Mobil representative here (we find out that he is a young man who sells gas and does not have anything at all to do with oil exploration) also meets us at the airport. He has performed the difficult task of arranging cars for us to rent.

The plane is to continue to Arlit with a mob of people. Most of the seats are already taken out of one side for the trip from Niamey, and two big crates were strapped in the DC3. So it may be easier to take our spectrograph to Agades than it was to get it in a 727 cargo hold to Mexico City. Even the doors of the DC3 are double for easy loading.

We have three of the seven rooms in the Hotel de l'Air and they turn out to be air conditioned. A nap is welcome. But at 1 o'clock we are awakened for a big lunch. All six tables in the Hotel are full and I talk with the Patron at his table about our route. Every time you talk to someone else you get different information. Now it seems that Arlit is at least a five hour trip, so the round trip is too much for a day. Moreover, the route back via Ifèrouane and the Air Mountains is even longer. So we must simply make two day-trips to the north going only as far as the eclipse central line each time. The Patron promises to have a big luncheon for us to take tomorrow, with chickens and more.

Donald and Laurence sleep, but I pass the afternoon in reading and writing and arranging film. At four, our Land Rovers arrive, and we check the list that Laurence has made, drawing on his long experience in the Kalahari desert.

(Is driver a mechanic? -- One should be.)

Check: See each piece.

That spare tires as well as running tires are good.

Two extra inner tubes. Air pressure gauge. Tube repair kit.

Tool kit and tire changing lever. Oil can - long spout.

Rope for hauling. Jack - we always had two for each vehicle. Wrench for wheel nuts. Something to put under jack if heavy sand. Two axes. Hose and funnel for gas. Are there any filling stations? What capacity gas tanks?

Enough petrol in cans in each car to do whole trip.

Cover to protect gas from sun.

Enough engine oil for one change for each car.

Axle grease.

We always carried at least one (55 U.S. gallons) drum of drinking water for each vehicle. Small coil wire. Heavy pliers.

Our Land Rovers seem well-equipped and we merely ask for more water and gas. Basically, all seems fine.

Air Niger had run out of ticket coupons at Niamey airport, and I must trade in a voucher here. The man in the general store who doubles as the Air Afrique agent tries to put off writing my ticket until Thursday morning, but I make up a story of urgency and he does it on the spot. At least one thing is accomplished.

The Préfet is in his office, and receives us kindly. M. Padovan Guidoni from the Bureau of Public Works, a Corsican, is there too. There are still numbers of Frenchmen working in public positions, but they are being rapidly replaced by black Nigeriens. Guidoni will come with us tomorrow, as will two gendarmes. So now we are up to four Land Rovers in our expedition. The Préfet seems properly impressed with the idea of the seven-minute eclipse. He has already seen an eclipse in 1959. It is hot, and the sub-Préfet comes in with Cokes. They are fascinated by the photograph of the Air we brought, taken from 200 km above the earth by Gemini VI in 1965. Every peak and valley is clearly visible. As we leave, the Préfet tells me, "You are young to be an astronomer." I reply, "Well, you are young to be Préfet," and we all laugh.

Guidoni takes us around the village. Agades has been a major city on the caravan route since the 14th century. It is dominated by the mosque, whose minaret, 10 stories high, is visible

for miles around. Wooden poles stick out on all four sides of the minaret, probably for internal rigidity and to support the inside staircase. Later, Marilyn is to tell me they are also useful as footholds when new mud is packed on for repairs. Dozens of big black birds roost on the poles, always on the shady side -- west in the morning and east in the afternoon. It is a fantastic and picturesque site -- the brown angular walls and the sharp shadows, with veiled men walking back and forth and goats and camels roaming about. We also pass the Sultan's Palace and some of the fancy houses. We had discussed with the Préfet the construction of buildings from this packed earth, "blanco," and asked how sturdy it was. The famous mosque, he told us, had lasted more than 400 years.

At the gas station we buy a drum of Mobil gas, 200 litres at 62 CFA cash. Guidoni has an extra seat in his Land Rover, so we dismiss one of ours. Three Land Rover camionettes: ours, his, and the gendarmes', should be safe enough. Guy will have his chauffeur ride in the rear of the truck. Why, I ask. "First, when he drives, I am afraid. Second, I may want him later for the piste can be tiring..."

The market is set out in stalls of skins and straw mats in a central place, and we stop to shop. The conical straw hats, which look almost Vietnamese, will be good protection from the sun. Even at 200 F apiece, we can only find two, but a search turns up a third.

I would like a Tuareg bou-bou, and a cheich, the turban. Our local friends take me to the store to buy fabric. Black is more authentic for the cheich, but white is cooler and cheaper, and I buy five meters of that and nine meters of blue striped cloth for the tailor to make into a bou-bou. He wants a few days, but we convince him to have it ready tomorrow.

Dinner is on the upstairs terrasse, and it is delightful under the stars. The southern Milky Way is beautiful and brilliant above, and always striking to us Americans, even though we are still at 17° north latitude. We speak of the desert, and of our trip tomorrow. Odd words like "Bilma," (from which salt caravans of camels still come here yearly) and "L'arbre de Ténéré," symbols of the desert, drift over from the other tables. All together we are in this outpost of the Sahara.

At least one of our compatriots at the Hotel de l'Air is stranded. He left Abidjan, in the Ivory Coast, where he is a teacher, for a two month vacation in France in a caravan of three 2-CV's, and his broke down 300 km south of here. His friends continued to Agades, but by the time he repaired his car they were long gone. So he sits in Agades, waiting for a truck that goes by to take him north. One can't cross the desert alone.

June 30

Half-past four! Not yet dawn, and perhaps it is insane after all to go into the desert. But the heat will mount with the sun and we must go on. I try to find our lunch, with images of a French picnic basket à la Grande Jatte, and find nothing. There are but two tiny, scrawny chickens for us to take for the whole day. At five, we find our two gendarmes outside, napping on the ground. Where is their car? They have none. It is a misunderstanding, but our expedition has now shrunk back down to two Land Rover camionettes. M. Guidoni comes up fifteen minutes later and offers to share some of his food. It looks like we can make it, and off we go into the sunrise, already three-quarters of an hour behind schedule.

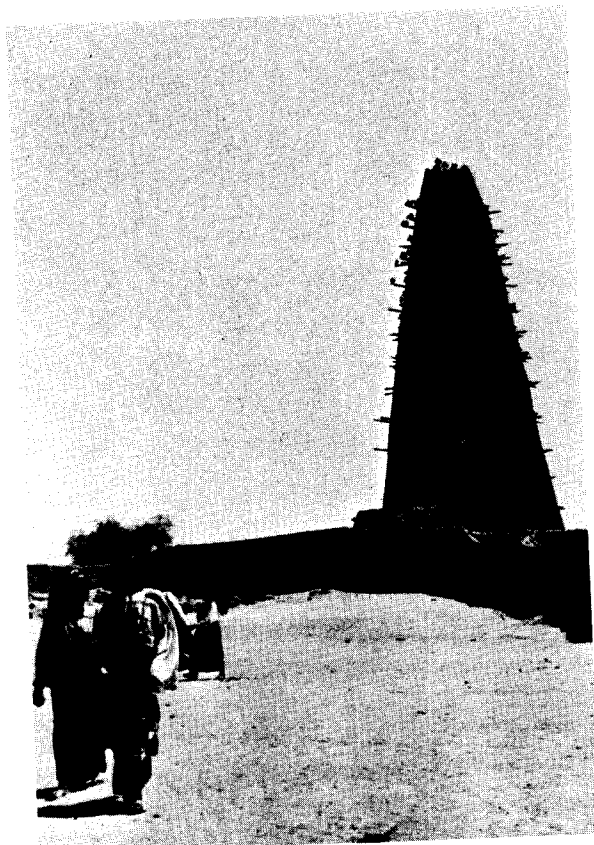
The road we shall take into the Air today doesn't separate from the road we shall take tomorrow for 60 km, and we drive north. We see little campements, igloo-shaped huts, made of wood frames covered with skins and straw. We pass a few Tuareg leading mules, and then a few leading camels. The road continues into desolation. Rocks and lava cover huge areas, but then occasional trees dot themselves over the landscape. What surprises us the most are the regularly spaced, wooded areas. They are "koris," dry river beds for the rain runoff. Palm trees grow along their banks, and there is lots of shade. So if we can find a good kori for our instruments, things won't be as bad as we expected.

We pass a tractor grading the piste. It is very rutted latitudinally, and so is plowed regularly. Guy, who after all is in local charge of the Bureau of Public Works, is not satisfied with the job they are doing and stops to talk. We are by the turn-off to Tafadek and the gendarmes, who are riding in the rear of our truck, tell me that it is a hot mineral water source about 15 miles west. But we haven't time to go.

The sun mounts, and the shadows become less effective for my photographs. We turn off into the foothills and continue. We are following the car that bears Menzel and Marshall, and can see the cloud of dust they carry around them like Pigpen or the desert cartoon characters like Speedy Gonzales. It is nine o'clock when we reach El Meki, after about three hours on the road, our 109th kilometer. First seen in the valley as we come over a hill, it is a welcome sight indeed. The site of a tin mine, there are several banco buildings. A group of Tuareg comes over when we stop, and soon another car comes and a tall man gets out. He is the Sultan of Agades, and lives, of course, in the Sultan's Palace that I had assumed was a ruin. No wonder we couldn't go inside. We decide to go on to the center line and see if there is a kori there. It lies about 20 km ahead, which means perhaps 30 by road, an hour more. But 2 km farther, we realize there is little point in going on. Already we are at 6-1/2 minutes of totality, and the terrain won't change at all. M. Guidoni assures me that there is a kori at the center line and we stop our cars.



Camel caravan in the Air Mountains



The Mosque of Agades



Engravings on the rocks
north of Agades

I break out the telescope that I have carried all the way from Cambridge for this purpose and we project the solar image. It seems clear and steady -- the sunspots are sharp. Not bad. But though the day is clear, there is haze causing a brightness in the sky near the sun. An acceptable day, good by anyone's standards but ours. We want skies of coronagraphic quality -- one should be able to block the sun with his thumb and see pure blue sky up to the edge of the solar disc. But before the day of the eclipse actually arrived in Mexico, we would have been happy with this. Now we are spoiled.

We return to El Meki shortly after ten. We had left the gendarmes there before, and they are camping under a tree.

Donald and Laurence say that they want to go right back to Agades, but I feel that we have come a long way and that it will be hot. I convince them at least to stop for lunch.

There aren't really any spare rooms, and soon the living room of the Chief of the mine is opened for us, and we perch around his table. Guidoni turns out to have brought a veritable feast, with canned fish, sausage and bread, and we contribute our puny chickens. He has been too long in Agades to trust the Hotel.

A truck drives up -- the Chief is returning from a few days in Agades, and reacts very well to finding us in his living room. He makes us welcome and we convince Donald and Laurence to rest here until late afternoon. The temperature outside mounts to 111, humidity 24%. It is hot, but we have seen the same in New Mexico and the New York summer weather I will find on my return home is to prove more oppressive.

By three, Donald and Laurence are very restless, and we send someone for a camel to put in the background for some "publicity" photos of us at the site. But there are no camels in town at the moment (have they all gone to lunch?) and we go to see some of the workers' huts. Perhaps 200 live in domed huts here, and another 200 in a similar town on the other side of the mine. Their igloos are crowded and the families sit around outside in groups for most of the day. One 10-ton truck a month comes up to collect the tin.

The trip home is long but relaxing, a good day's work done. We have learned a lot, and feel that an expedition to here is certainly possible. As we pass through the koris enroute the birds fly around, and pintades, strange birds that look like crosses between armadillos and guinea hens, scurry across the road. So though the desolation is complete in large areas, the koris and El Meki could make things hospitable enough.

July 1

Up before dawn again. Today we'll make an earlier start. We have hired a third Land Rover for the gendarmes -- they

are not used to riding behind. Of course, there is already a man riding in the back of each rented truck. He is part chauffeur-in-training, but mostly he is there to help push if (when?) the car gets stuck in the sand. Things are done so in Agades. As we gather our personnel, Laurence decides not to come today. He is a bit tired and a bit ill, and now that he has looked over our equipment, we can go into the desert without him.

The sun rises as we drive and we go as fast as we can. The beasts of the Air are out today, and a local type of gazelle bounds along the road. Oh so quick, and oh so elusive to try to photograph. Ostriches stand along the road too. We must be in Africa.

Today's destination is farther than yesterday's, but the road is better. A paved route to Arlit will be built to take out the uranium from the new mine, but in the meantime the trucks carrying heavy equipment pass this way. Last week, they carried up a 39-ton motor. No problem with our measly two and a half tons of spectrograph. The heavy trucks don't help the road, though. Periodically their tires have dug through the earth and left potholes of sand. But the problems are not impossible.

With stops for photographing the animals, we reach the central line of totality at kilometer 147, after three hours of driving. Guidoni brags that if we could have gone as fast as he likes to drive, without worrying about the other cars, we could have made it in two hours and a half. There is a beautiful wooded kori, seeming like a mirage, right where the road crosses the central-line, and we pause just short of there to refresh ourselves with Cokes, yes, even here.

The day is fine, like yesterday. The sky is clear, though with a scattered brilliance near the sun, and there is a little less haze on the horizon than yesterday. The two eclipse sites we have seen seem similar -- perhaps this one is a little easier to get to.

M. Guidoni knows where there are engravings on the rocks in the desert and we set off in our caravan of three Land Rovers to go the dozen kilometers. We must traverse small dunes of sand, the first "real" desert we have seen. The grandest Sahara is really that of Ténéré, to the east of Air. The famous tree of Ténéré, a tree standing starkly alone in the middle of 200 kilometers of desert, is a day east of Agades on the caravan route to Bilma. But that is not for us on this trip, alas. Anyway, all this area is just about as inaccessible as any place on earth.

We slalom among the dunes. We are leading and choosing the path, but one dune proves too high for us, and rather than tumble over the edge, Guy stops and the wheels sink in. Gently rock it; slip the clutch. But no matter. We are caught, and the others find secure spots to stop and help us dig out. For being marooned

in a sand dune in the Sahara desert, it isn't too bad. We soon free the car without even having to tow it, and off we go. But I do collect a bagful of genuine Saharan sand. That should confuse the U.S. customs on my way home.

A small mountain looms ahead and we find the etchings on the rocks. They are well made -- a big giraffe, gazelles, and other animals; of course the desert preserves them. And we find two pretty space men drawn on a rock -- complete with round helmets and antennae. The gravures compare very well with others that Donald has seen in Africa. How good of M. Guidoni to show us them, a good present for today, my birthday. There haven't been giraffes near here for thousands of years and the designs are probably Paleolithic, perhaps up to 9000 years old and certainly earlier than 2000 B.C.

There are even better gravures in the other canyon near here, but it is at least another hour by foot for the roundtrip and the sun is mounting. One has to leave at 3 a.m. to do the whole tour, or plan to camp for the day.

We retrace our steps to Agades, but now the animals are out in greater numbers. Gazelles frolic across our path and ostriches appear in a group. We have lost too much time and noon passes with still an hour to go. But the heat isn't oppressive somehow, and we reach the Hotel de l'Air in fine shape, another interesting day.

I thought that Laurence, who stayed behind today, would rest. But no, he has walked all over town, and even climbed the minaret of the mosque, the equivalent of 10 stories. Oh to be 81.

We rest for the afternoon and the weather clouds up as it did yesterday. So we may have established the pattern. Guidoni promises to chart the clouds for us for the rest of the month and subsequently writes that twelve of the next thirteen days are like this.

We would like more time to digest our findings, but the National Science Foundation, which coordinated the Mexican eclipse, is putting out its final bulletin soon, and we want to provide this first information on the 1973 event. I draft a brief report; Donald will mail it from Madrid. (Appendix II)

I haven't spent much time at the market yet, and I wander over to buy a few things. The Tuareg carry their money in leather wallets strung around their necks, and they make not only good souvenirs but also will be fun to wear with some of the tight pants that are now in style back home. When they see I am buying, some of them offer me the wallets from around their necks. I'm sure they can get replacements at better prices than I can. A beautiful sword, with a red, decorated hilt, is a standard part of their costume. I'd love one if it will fit into my suitcase. By eye, it seems to, and

I bargain. Another Targui tries to show me that his is sharper. Finally, I settle on one which, after it is paid for and brought to my room, is too big to fit in my suitcase anyway. The market is conducted in stalls covered by straw mats, and is fascinating though perhaps less colorful to photograph than markets I have visited in Mexico because every one is in the shade. But still the camels come, and the veiled Tuareg men gather round. Many buy a dry tobacco that they cut with the pink crystals that are left behind when salt is dried.

At five we go to pay a courtesy call on the Préfet, and, though we are expected, he is busy and we have to wait. The time drags on. The sub-Préfet's office is across the hall, and a mob of supplicants are waiting there. I find a letter from the Préfet on the bulletin board, chastising the government workers for arriving late and leaving early -- it could have been any business firm, anywhere.

Le Préfet du Département d'Agadez
à

Tous les Services Administratifs

Il m'a été donné de constater et cela à plusieurs reprises que des Fonctionnaires de toute catégorie font totalement fi de la ponctualité. Ils viennent à des heures fantaisistes au service qu'ils désertent quelques minutes après.

Or nul n'ignore qu'une des premières qualités du Fonctionnaire consciencieux, c'est la ponctualité.

J'entends donc qu'il soit mis un terme à cette manière de faire. L'horaire officiel d'ouverture et de fermeture des Bureaux doit être scrupuleusement respecté.

Je souhaiterais ne pas avoir à revenir à ce problème qui conditionne la célérité et l'efficacité de Fonctionnaire modèle.

Idé Yacouba

Finally, after three-quarters of an hour, the Préfet will see us. I thank him and we say several courteous things. We promise to send our final recommendations and, to our surprise, the Préfet offers to pay our hotel bill. But we do not accept, and leave with smiles.

Laurence has suggested that we visit one of the suburban settlements and we find one just a kilometer or two up the road. The children run to greet us -- some naked, some dressed. A girl kneels in a straw-covered hut, boiling water in a kettle while she washes clothes in a bucket. Her mother pounds the millet with a mortar. Around us is a low fence to keep out the goats. It is so authentic that it seems unreal.

Just ahead a camel drinks bucket after bucket of water, and there is the well. A wizened old man pulls up a skin on a rope hand-over-hand from a hole ten meters deep, and dumps the contents into a bucket, which the waiting women take to camels (we watched one drink at least six) or to their homes.

Our chauffeur asks if I am married, and I tell him no, and ask about him. Yes, he is, indeed he has two wives. I say "Two wives would be nice, but we aren't allowed to have that many." He offers me one of his, but I don't think he is serious.

I ask the name of the village but can't understand the response until one of the children kneels to write it in the sand. "Toudou." I ask the boy how old he is. "Thirteen." His head is shaved except for a small tuft of hair on top. Does he go to school in town? "Yes." How many days a week? "Five." Which ones? "Monday, Tuesday, Wednesday, Friday, Saturday."

Our new friend takes us over to see the community garden which has some fruit, some vegetables and a basin near a second well for washing clothes. An old man stops carving something with his mallet as we come in. These people eke out their existence with their goats, and their garden, occasionally selling some fruit in town to buy something. The published report of a per capita income of \$80 per year now seems high to us; this average must be considerably elevated by the salaries of the government workers.

An official of the Ministry of the Interior is at the Hotel for dinner and Guidoni brings him to meet us. Over cognac, we describe our expedition and how satisfied we are. The minister has some water experts with him, and we discuss the possibility of drilling for a well at the site we choose. On the subject of the paved road to Arlit, it is hard to say if it will be finished in time. It is not entirely financed yet.

Everyone is upset to hear that we have been told that the W Park is closed, and denies it vehemently. The water is not that high, they say. I think that they are probably right, but we have changed our minds so many times now that Donald and Laurence will not be willing to go.

The pilot who had flown them up tells us an interesting story of Agades. The Hotel de l'Air is the old French Palais de Justice. In 1917, when the Western Front opened and the French couldn't send any troops, the Tuareg revolted and took the town. It was not until 1921 that the French could send troops down, and when they entered the Palais de Justice, they found the five or six Frenchmen who had been held as hostages swinging from the rafters in what is now the dining room. So the town was leveled, except for the mosque and the building we are in. A fascinating story, if true.

My birthday is ending and I receive a toast. Quite a good day.

July 2

To fly from Agades to Niamey one can get up at a more civilized hour than to travel into the desert. We even get a bit of petit dejeuner, which I won't dignify by calling breakfast. Donald and I have time to climb the tower of the Mosque. We wander over to some Tuareg sitting along the wall in a row and ask how to get in. I am continually surprised that everyone really talks French. The men call to someone who has the key, and he ambles over, unaccountably wearing a wool overcoat. The desert, in July.

We almost crawl under what must be the foundations, and come to a galvanized door in the banco. Padlocked, it looks very official, and has a trademark of a big red hand and a "Made in England" sign stenciled on it. Laurence has told us of 103 steps, and they seem endless. We sometimes have to crouch but the view is worth it: the whole town, parched and flat. The day is clear again, with haze on the horizon.

The hotel patron, Yves Decayeux, takes us to the airport, my Tuareg sword sticking out of my green Harvard bookbag. At the plane we see two of the Frenchmen we had seen at the Hotel. With their unshaven two-day growths, we had thought them intrepid explorers in from the salt caravan, like Victor Englebert. But they have just been on two weeks holiday in Niger and four days in Agades, and they didn't even get out of town! I carry my sword onto the plane -- that would certainly not be allowed anymore in New York.

We are ahead of schedule again as we set down and we phone Marilyn from the airport. I spend the afternoon in catching up on writing and tending to my cameras. I meet Djuvara at the swimming pool of the Grand Hotel, where I am now staying, and he tries to arrange an appointment with the Chief Meteorologist. But the meteorologist is not in, and I make a trip to get mail at the Mobil Oil office. Five day service from New York. So Niamey really exists. M. Petrier cables ahead to his Bamako counterpart that with our trip to the W Park cut out, I am arriving a week ahead of schedule. I hope there won't be a problem with a hotel room.

Donald and Laurence have gone back to the Roniers for the night and I must get out there to meet them for dinner. But there are never any taxis waiting at the Grand Hotel. I go out to the road, but none pass. After a while, the man from the Hertz agency comes roaring out on his way home in his Peugeot 403 convertible. The Roniers is way out of his route but he insists on taking me. It strikes us as typical of Niamey. Can you imagine the Hertz manager even at the Plaza running me up to the Bronx?

July 3

No alarm clock today. Djuvara and I see the meteorologist, a Frenchman, C. Steinmetz, and he has exactly the information I need. Cloud coverage, temperatures and humidities for Agades, Bilma, Arlit and even Ifèrouane in the Air. He has put some work into compiling the last ten years of Agades data for me, and I copy the June 1969 monthly averages for Arlit: 0 out of 8 at 6 a.m., 1 out of 8 at noon and 3 out of 8 at 6 p.m. Steinmetz promises to send photo copies of more data, and I am very pleased.

The cloud fractions include high cirrus, which would allow us to see the eclipse but would diminish the value of our observations. I shall be interested to compare our evaluations with his for the days we were here, and he promises to send that on to me.
(Appendix III)

Donald and Laurence have spent the morning in town, getting their tickets straightened out, and we go to the airport with Marilyn. The Peace Corps group is there again, this time seeing off two volunteers and awaiting a visitor. People here seem to spend major fractions of their time at the airport. They invite me to their 4th of July party tomorrow, but I shall be in Bamako. The Embassy here is not having an Independence Day gathering this year, ostensibly to save funds for the rounds of welcoming parties they will have next month in honor of the new Ambassador.

The big DC8 takes off, and I am relieved that this phase of our work is over. Donald has 20 rolls of exposed film to mail from Madrid for processing, and I just hope that those fool customs inspectors looking for narcotics don't x-ray the box.

At the USIS, I find newspapers and a place to rest before lunch. A local tailor has fashioned some material I bought at the Petit Marché into a shirt, with a big sun emblazoned fore and aft. He had a shirt to model from, though Marilyn told him to make a normal collar. That apparently didn't get through, and I now have perhaps the only African-made shirt in Niamey with a button-down collar. Everyone at the USIS is still busy notifying the 60 guests that Marilyn invited for a party tonight that the guests of honor, a group of Crossroads Africa, just weren't on the plane yesterday. No notice, no reason, such is life.

I find a reference to SOMAIR, the uranium company, in a local magazine. They bring in their supplies by boat to Cotonou, then 400 km by railroad to Parakou, also in Dahomey, and then by truck 800 km on the road and 800 km on the piste to Arlit.

A cable from Bamako has arrived with good news:

SECOND VICE PRESIDENT BABA DIARRA HAS INFORMED EMBASSY THAT HE WILL RECEIVE PASACHOFF 1970 JULY 13 ON BEHALF CHIEF OF STATE.

A quiet dinner chez Marilyn. Her sister and the USIS regional librarian for Africa, who is in town for a week's stop on his inspection tour, are the guests. The librarian's first recommendation had been to buy more chairs for the library, a good sign.

I try to fit all my things in my suitcases, and make the mistake of trying to sleep for a few hours. As I doze off, a buzzing on the phone introduces a Targui, a primitive artist who paints beautiful market scenes. I had met him at the USIS offices -- they are all fans of his there -- and arranged to buy one of his works. But why did he have to come now?

July 4

One hour of sleep is worse than none, and I stagger to Marilyn's car. As we drive to the airport, I think of how we must come back on the Nigerienne national day of December 18 to see the camel races. I am too sleepy to hide my extra pieces of luggage well enough when I check in, and UTA sticks me with considerable overweight for my five pieces: suitcase, briefcase, two camera cases and Tuareg sword. They even insist on weighing my cameras. The DC8 carries me off into the night, and the next I know we are landing in Ouagadougou (dougou means town in Bambara), the capital of Upper Volta. As I wait on the terrace for my connecting flight to Mali, the sun rises with a glow of red underlighting the clouds -- our best African sunrise. Now I shall fly on Air Afrique, the second of Africa's major international airlines. Bobo Diolasso, our first stop, has just had a light rain, and the air feels delightful after all that time in Niamey, where the rainy season has not yet come.

In Mali, Mr. Auneau (oh-no) of Mobil Oil meets me at the Bamako airport, thank God. He has made my reservation at the Grand Hotel, which sounds luxurious. I am ready to go, but customs looks at my two Nikons and balks. I have to wait for the chief of the douane. "Il faut aller doucement" says Auneau and we wait. In the end, there is no trouble and we are off.

The Embassy's Fourth-of-July reception turns out to be at noon, so I will put off my sleep. We should stop to get my photo permit first, anyway, but the tourist office doesn't give them and won't tell us where to go. We try the Sécurité, et voilà, but they say I must submit a formal letter and a photograph. We go back to the Mobil office to type it out. What would an ordinary tourist do, especially one who didn't speak French? The first impression confirms what I had heard about it being more difficult to do anything in Mali. Certainly in Niger, we hadn't needed permits to photograph anything.

At the Sécurité again, we go to see the Chief. With a searching glance, he asks me twice whether I have movie or still equipment. Apparently satisfied, he scrawls "fiche exceptionnelle" on my letter and we take it next door. They must keep my passport for an hour to work on it. Auneau will send someone to pick it up.

Ah, the Grand Hotel. The beds aren't made, and four people say "right away." But it takes an hour -- there goes my nap. Half the lights are broken, the toilet won't flush (and has remains from the previous occupant), and I can't call the Embassy Public Affairs Officer because the telephones are out. At least the air conditioning works, although it takes a while to get it going. Mrs. Auneau is to ask, "How was the Hotel?" "It only lacked 5 or 6 things." As always! Anyway, it's the best in town."

Auneau picks me up to go to the Embassy. There aren't many things for the small foreign community to do in Bamako and the 4th and 14th of July are two treasured days. The police had insisted that I appear in person to pick up my photo permit so that they could brief me on what the limitations are. We get there just before their noon closing; in time to pick up my passport and the permit. "It is forbidden," says a policeman with a gold ring in his right ear, "to take pictures of lepers or the sick on the streets." "Oui," I say. "You must also not take pictures of naked children, nor of women washing their clothes down by the river, nor of anything detrimental to Mali." "Oui," I say. And he gives me the permit to sign. It bears a list of what I may take.

Un Peuple-Un But-Une Foi

No. 723

Places et lieux publics

Institutions et immeubles officiels

Ouvrage d'art

Cites touristiques

Scènes folkloriques

Je m'engage à ne pas prendre des vues
susceptibles de porter atteinte à la Réputation du Mali.

Don't the women on the riverbank and the naked children qualify as tourist scenes? But I say nothing. And I mustn't photograph the one big fancy bridge over the Niger. They must think that it has strategic value.

The Embassy has usually celebrated our national day on Washington's Birthday because of the rainy season that coincides with the Fourth of July, sort of a Queen's Official Birthday, but this year the Ambassador had been away at a Chiefs-of-Mission meeting. We find some dozens of visitors and Embassy personnel standing on the lawn of the Ambassador's residence, a large house whose lawns face a soccer field and some shacks with the Niger river and the bridge beyond. Here is a good chance to meet the organization: Ambassador Clarke and his wife (who, unfortunately for them, had to stand dressed in formal clothes, to welcome people), Joseph Christiano (Deputy Chief of Mission, always abbreviated as the DCM), Lewis Pate (the Public Affairs Officer), and others.

At one point in the proceedings, we paused to hear the two national anthems played over a loudspeaker in what I think is ordinary fashion. But the Malians all rave at the rendition of their own. It seems that the Embassy had sent the music to Washington for recording by the US Army band.

The informal gathering later in the afternoon at Christiano's house to which I am invited is more fun, and more relaxing. The house seems even grander than the Ambassador's. It had been the British Ambassador's house until the United Kingdom and Mali broke relations in 1965 over Rhodesia; the British Ambassador in Dakar is currently accredited to Mali but is not resident here.

A typical American Fourth of July, the kind we don't have at home anymore. Of course the softball game (Ambassador Clarke playing 2nd base for his side, dressed in tennis whites) which boasts of all the once-a-year players, is stopped a few times by women waddling across the field carrying a week's laundry balanced on their heads, en route home from washing in the river. After an infinite number of innings we win, 29 to 28. There are several minor casualties, Ambassador Clarke's skinned leg, wounded when he slipped rounding third base, among them.

The basketball team from Builford College is present, in the midst of their African tour. They are a little tired of it all by now, with schedules changing and never knowing what they will be doing next. Also, they had been supposed to be just giving exhibitions of fundamentals and had brought only 5 players, a coach and a manager. But everyone wants to actually play, so they have had it.

And I am exhausted, never having made up for a missed night's sleep. As the rest of the party settles down to watch a hodge-podge of USIS movies, I go home and sleep the sleep of the just.

July 5

Breakfast on the terrace of the Grand Hotel -- even an omelette. And the man selling imitation Bambara sculpture lowers his price so much to meet my bargaining offer -- down to one-eighth of his original asking price! -- that I can't turn him down although it is still a mistake for these pieces. I have been looking for art to buy, but Niger has none at all. Mali is the place though, and I shall look out for high-quality things. At one point an Anne Frank-style siren splits the air, followed by two minutes of silence. The President is coming to open an exhibition at the neighboring Lycée and the streets are being cleared. Eventually, a lone motorcyclist dressed in white roars down the street, followed half a block later by more motorcyclists escorting a white VW bus and two Citroens. The policemen standing by, 50 feet apart, salute. Then follows a phalanx of 4 motorcyclists preceding the black Citroen DS-19 bearing the President and his wife, with 2 more motorcyclists on each side of them, 4 more in the rear,

and a trailing car. It makes me think of Nixon's new uniforms for the Palace guard at the White House.

Lunch with crudités of avocado, cucumber, and tomato, entree of pigeon, '62 Bordeaux, Evian water, cheese and coffee. Delicious. Mme. Auneau, and her cook, did themselves proud. Why does one always wind up talking of food in France or in French West Africa?

Michel Nevel, a Mobil manager visiting from Paris, drives up to "Point G" (there are no others) with me to see the view of the city. We also find an overlook from which we can see not only the city but also the modern Russian-built football (soccer) stadium. As we stand, two dozen locals gather to watch what turns out to be, luckily, the finals of the Coupe du Mali soccer tournament. Everybody watches the President and his entourage come in, and everybody settles down to root for the Bamako team. Two gendarmes try to clear the freeloaders off their perch, but when we leave they are standing and watching with everyone else.

The Zoo is also on the heights. So at least I've seen, and photographed, zebra, lions and boar in Africa.

I finally catch up with Eliot Elisofon, the professional photographer who had preceded me through Niger and who is staying, needless to say, at the Grand Hotel. He is a real dynamo, and we find common ground in our Harvard connection -- he is Honorary Curator of the Primitive Art collection of our Peabody Museum. He is now filming 4 one-hour documentaries for Westinghouse on the Africa from which most American blacks came, and simultaneously writing 4 high school books for Macmillan, one of them on the Niger basin. Interest in Africa is currently very high.

Elisofon has been carrying around a lot of overweight with all his camera equipment -- \$1100 worth on a previous trip -- and we speak of logistic problems. He has arranged to film some native dances on Tuesday, and I may alter my schedule to go with him. His assistant cameraman, an Englishman, came down with malaria, presumably caught in the bush near Niamey -- he had only been taking his pills once a week as prescribed. Elisofon says the stuff wears off by the 5th day and one should take at least another pill midweek -- he himself had been taking one a day until that excess made him a little sick.

July 6

I visit the Embassy first thing, and explain some of our thoughts on eclipse logistics to Ambassador Clarke and Lew Pate. The Embassy seems much more unified here than in Niamey, and the USIS less independent. The difficulties of getting up to Tessalit seem less than I had thought, but it requires a government military

plane and so will depend on how my meetings go. Christiano is to call Baba Diarra to see if he can see me this week instead of next.

Elisofon is going off to look at native sculpture and I go along. He has written two beautiful picture books -- one, "The Sculpture of Africa," is now a collector's item, and the other, "The Nile," is less scholarly but even more beautiful. By now, Eliot is a world's expert on African sculpture, and has one of the best collections in America. One of Elisofon's dealers, a young man in a fancy car, drives us into the market place. We are taken into a back room of a clothing store and greeted there by a large man who, in his bou-bou, reminds me of Sidney Greenstreet. They bring out sculpture after sculpture, and Elisofon really knows his stuff. This one is a fake, that one has termites, that one is very good, watch the worm-holes. He is buying for the new Museum of African Art in Washington, and also considering the Peabody, which sad to say, has no acquisition funds at all. There are some beautiful pieces, and some fakes. I get a lovely Bambara gazelle. This is the archetypal structure of this tribe, which is dominant in this region of Mali. The statues are worn as headdresses in ceremonial dances. I also buy some small but handsome bronzes from the Senufo tribe of the Ivory Coast, and a bronze of a large man on a small horse that the Ashantis used as a weight to measure gold.

In our rounds of some of the other dealers, we visit several back streets and courtyards around Bamako. In one place, for example, we enter an unprepossessing door into a large courtyard with a dozen members of several families sitting around, two pounding millet, one cooking something, two others playing a game something like checkers. This is how the people live. But in these places they pull out incredible riches in beautiful sculpture to show us. Eventually Eliot chooses a huge Dogon mask for me. It is white and a piece extends nearly two feet high with two crossbars laced on with leather. It is worn in ceremonial dances in the Dogon region slightly west of here.

The Embassy has a message: Baba Diarra will see me this week instead of next, but his first free time is Wednesday morning. Christiano and I find a new plane itinerary for me, cutting two days off my stay at Timbuktu but allowing me to visit Mopti, where everyone says I must go to see the Dogon country. We may not have heard of it stateside, but it is unanimous advice here. If only Air Mali has room but, alas, they are full en route to Tombouctou, as Timbuktu is known in French. But I speak with the chief, and he works on things. "Ça va," he says finally, but I must come back tomorrow to know for sure.

I walk back to the hotel, passing another street market. Everything is fascinating to watch. The Tourist Bureau is on my route, but I have no real questions to ask. However, even they have

a big stock of Malian sculpture of all sizes and prices.

Elisofon has also been busy all afternoon, photographing sculpture for a forthcoming revision of his sculpture book, this time in color. We share a quiet dinner at the hotel.

July 7

We are ready at 8 when Dr. Pascal Imperato drives up in a huge Dodge Powerwagon. Pat is a medical doctor working here for a few years to combat measles and smallpox, and in his travels around Mali has become an expert on local customs. Today he has arranged a set of dances for Eliot to film for TV.

We load an incredible amount of movie equipment, and take off. Our route passes through Bamako and across the bridge (so it does lead somewhere). A few miles farther on the pavement, we meet an internal customs post, which takes thirty seconds to clear, and soon after we turn off onto dirt. Not far down the road the huts of Sirakoco come into view. Just a few mud huts with straw roofs, out in the middle of nowhere. Here we are, just a few kilometers from the capital, and civilization and its trappings, like electricity and running water, are gone. A few men are hoeing in a field, a few women are pounding millet, but most of the town (including all the children) gather for our arrival. The group looks so fascinating and so colorful that we shall obviously have a wonderful time. We move everyone into the sun easily enough, but before we take any pictures, we have to deal with the anachronisms. "Get that bicycle out of the background. Why are you wearing a European shirt? Striped, no less? And that black brassiere. Why, in fact, are the girls wearing anything on top? They don't normally, do they? Will they take it off? They won't? Why not? They will? Roll 'em."

The drums beat and 3 Bambara men bound out, with the beautiful gazelle statues tied on top of their heads, dancing the traditional Tji Wara. Eliot darts in and out with several Nikons for black and white and for color and Beaulieu 16 mm movie camera. His assistant, John Smith, mans a 16 mm Bolex on a tripod. I take pictures too but try to keep out of the way. It isn't my show and I am lucky to be along.

Pat's Malian assistant translates into Bambara, and explains to the dancers that they must stop their advance at a certain point. The Bolex is carefully set upon the tripod pointing there, and the dancers proceed to stop somewhere else. Again and again we try. One cut is ruined by a bicycle rolling by, another by that one girl inexplicably putting on her black brassiere. It isn't shyness. Nobody else wears one. She obviously considers it a valuable garment and wants to put it on for company. At last the filming is successful and if it is at all an image of what we saw it must be truly beautiful.

Next, a lone dancer who bears a different kind of antelope on his head dances the N'Tomo. A beautiful mask, but he is wearing a khaki bush shirt and plastic sandals. Ah, 20th Century. While Eliot and John change film, the drums keep up the beat. I tap my foot, and finally come out in the middle and do a dance and the townspeople laugh and cheer. It is well-received. But it turns out to be more than just fun for me -- I have successfully held their interest and kept them from wandering while the photographers were doing chores. The third dance is the Zantegeba. A man shuffles forward in a fantastic, heavy, baboon-symbol costume that covers his whole body, so we must be quick because of the heat. Of course we have an umbrella carrier, our "parapluie boy." He holds a big black umbrella to shield the photographers and our cameras from the hot sun. But the baboon dance must be filmed out in the open. His costume is so interesting that we take shot after shot until he can't take any more. Finally, the women burst into their own type of frenzied dance to the N'Tomo music, arms flailing, breasts bobbing, as one at a time they come into the center. The dance had brought the house down, I hear, when a troupe from Mali came to New York a few years ago, and here we are with straw and mud huts all around.

Noontime passes and we are done. What a morning it has been. But what of the future of these dances? Will they still be done as time goes on? At least now Elisofon has captured them on film. Dr. Imperato is continuing his studies of how often they are authentically performed from village to village, and has written an article for UCLA's African Arts magazine.

I am now an hour late for luncheon with the Ambassador, and Pat drops me off as we get back to Bamako. I enter with trepidation. But Mr. Clarke knows that I had been going into the field, and I am kindly received. All that I lost was my chance to swim. There are several guests for luncheon. Another is Sarah Errington, a free-lancing female journalist from Somerset, wending her way around West Africa by local taxi, lorry, and hitchhiking. On other trips in the past she has sold enough photographs to pay her expenses, so here she is. What a way to travel. She has come down from Morocco, to Spanish Sahara and Mauritania, and through Senegal and Portuguese Guinea. I can get a lot of information about prospective eclipse sites and find out about the roads in Mauritania.

There is a bad omen about Mauritania. Sarah tells the story of how a policeman came up while she was taking a picture of a public building in Nouakchott, the capitol, and asked if she had permission to photograph that. When she simply said "no" he asked her nationality. To the answer "British," he gave a sign of satisfaction. "I'm sorry," he said, "I thought you were American." There is apparently a lot of anti-Americanism in Mauritania because of our support of Israel. The United States, in fact, only resumed diplomatic relations three months ago. That might not bode well for future expeditions.

The Ambassador still sports bandages and scrapes on his skin and palm resulting from the slide he took rounding third base in July 4th's softball game. He is interested in what is going on, and knowledgeable, and it is a pleasure to be there with him.

After lunch, Lew Pate takes me to see Professor Babba Haidara, as he might be considered a representative local intellectual. I describe the eclipse to him, and the educational campaign that should be mounted to protect the people. He is interested, but plainly wants to make clear that he has no authority. "We understand," I say, "I am going to see Baba Diarra tomorrow." M. Haidara is being sent for a month's American trip by the Embassy, so I may even see him at Harvard. Many of the leaders seem to get a chance to go stateside.

Mohammed Sissako, the chief of the Meteorology service, greets me kindly at his airport office, and I get a lecture on Saharan climatology. Though the rainy season advances from the coast to the south, it doesn't reach the desert by June 30. Our talk confirms my impressions from the Air. We shall probably see the eclipse in 1973, but there may be scattering in the air. Sissako will gather the records from the last 5 years on clouds, temperature and humidity from Tessalit, Kidal, Gao and Tombouctou. That will be very important. I shall have to come back tomorrow to pick them up.

Dinner at Lew Pate's. He has amassed some beautiful pieces of sculpture during his stay here. A side benefit, but really small consolation for being so isolated for so long.

July 8

Baba Diarra is a tall handsome man, and cuts a striking figure in his uniform. His first words, after introductions are made by Joe Christiano, the American DCM, are "you are scientists and can go anywhere in the country you like." I explain the eclipse and the circumstances in Mali. The Vice-President suggests Kidal or, more to the north the frontier city of Tin-Zaouaten, east of Bouresse. Then, realizing that totality crosses Tessalit, he tells me of the airport on the military base there, big enough for Antonov 24's or DC3's, but not for Caravelles.

They grow lots of vegetables at Tessalit and there is plentiful water. And with a month's notice they could lodge some people. "How about 20?" "With a month's notice, yes." "Forty, then?" "With notice, even a hundred." There are some rooms, and camp beds. I might even get to fly up next week with a military plane if there is one going, but there is no commercial service. I tell the Vice-President about the necessity for easing customs procedures for eclipse expeditions. When I relieve his anxiety by assuring him I am speaking only of scientific goods that will be re-exported, he is in general agreement. But he makes no official commitment to me. Official things like that would have to come through the Embassy.

I apprise him of the tourist possibilities -- a combination of Tombouctou, the Dogon country and the grand eclipse, and the idea seems to register but he does not pick up the lead. We are not only trying to help them handle a possible influx, but also keep the tourists out of the astronomers' hair.

My business finished, Baba Diarra then tells Joe Christiano that he accepts our government's offer to visit the United States for a month on a Leadership grant. The Vice-President wants to see New York, Chicago, things to do with livestock, Houston -- and the Embassy will send over someone to help him plan his itinerary in time for a departure 3 weeks hence.

I stop again at the meteorology office and they have stacks of records for me from Tessalit and Kidal near the eclipse path, and Gao and Tombouctou further south. They have also computed some 19-year means, and I am disappointed to see that the average cloud-cover in June and July is 3 or 4 eighths. The last year, though there weren't any particular clouds on June 30, the sky was totally obscured by dust or haze for the first part of the day. At first glance, the statistics look worse than those for Arlit, but I also have breakdowns of the types of clouds, and must look at things in more detail. (Appendix IV) It is tedious to make the wet copies at the Embassy -- oh, for a Xerox.

An Embassy car takes me back to the hotel, and after lunch I go with Elisofon, his assistant, and Pat Imperato to photograph sculpture for the Harvard photo archives. We use the Pates' patio, and natural light, since it is obviously impossible to set up a lighted studio. Eliot has carried a heavy 5 foot-wide roll of terra-cotta color paper all around with him just for this purpose, for he has found that the terra-cotta background shows off the sculpture to best advantage. The Ambassador's wife comes by to watch and to help measure the size of the sculpture.

The day is very hot and Eliot and I borrow suits and swim occasionally in the pool -- the water is delightful. Eliot has also arranged for me to buy an N'Tomo mask like the one we saw at the dances, and also a Kurumba mask, representing another type of antelope as depicted by a tribe in Upper Volta. There are technical matters to discuss. A permit is necessary from the museum to export any sculpture. It seems that Mali mainly wants to collect a 10% tax, although they are also starting to safeguard national treasures. In any case, they have sometimes confiscated things at the airport as people tried to take them out. But I shall be in Tombouctou until I am ready to leave, and Lew arranges for someone to get the permit for me. I hope it goes smoothly so that I can pick it up on Sunday.

Back at the hotel, a driver arrives with a note and a package for me from the Ambassador's wife. Mrs. Clarke has sent over two cans of Evian water, some insect repellent and some salt pills for my trip.

July 9

The plane for Tombouctou leaves at nine on Thursdays, and Auneau's assistant takes me to the airport early. Air Mali's Antonov 24 seats 50 people. We are an hour and a half late in leaving, and on each of the three wheels one of the two tires is threadbare. But as a distinguished American Congressman said, when the first giant C5 lost a wheel in landing on delivery, that's why there are so many tires.

At Mopti airport, two Americans say hello. They turn out to be from Harvard, too, a type of encounter that so often happens in traveling. Alan Coes, a teaching fellow and graduate student in Latin American history, and Blue Magruder (a name that shows Southern ancestry) who has just graduated from Radcliffe. As a switch on the usual parents-visiting-children theme, Alan's parents are in Liberia where his father is a Doctor in the Peace Corps. Alan and Blue have been to visit them. I had actually seen my new friends before at the Air Mali office in Bamako, where they had been told that there was no room on the Bamako-Mopti section of the flight, so they took a native taxi up yesterday -- 9-1/2 hours of driving for \$6 each. But the road doesn't go farther than here. It is quite difficult to get to Tombouctou if you don't fly.

The plane follows the Niger, and in another hour and a half reaches our goal. I am greeted as I step off the plane by Chekna Moulay of the Tourist office and Abbes Kader of Mobil Oil. (Moulay is such a common name here that we must use his given name too.) "Welcome to Tombouctou" they say, and I marvel at the sheer insanity of an organization having representatives everywhere in the world.

Kader drives us to the campement in the Tourist Office Land Rover. Glory be, new air conditioners glisten in the walls. We stroll up to a caravan of camels that has stopped at a nearby waterhole, and inspect the herons in the other waterhole, and then settle down to a lunch of braised celery, roast lamb, macaroni and melon, with lots of Evian water and Ivory Coast beer. No problem here. There is even a telephone, but it is only a local system, not connected with outside. Our telephone number in Tombouctou? Seven.

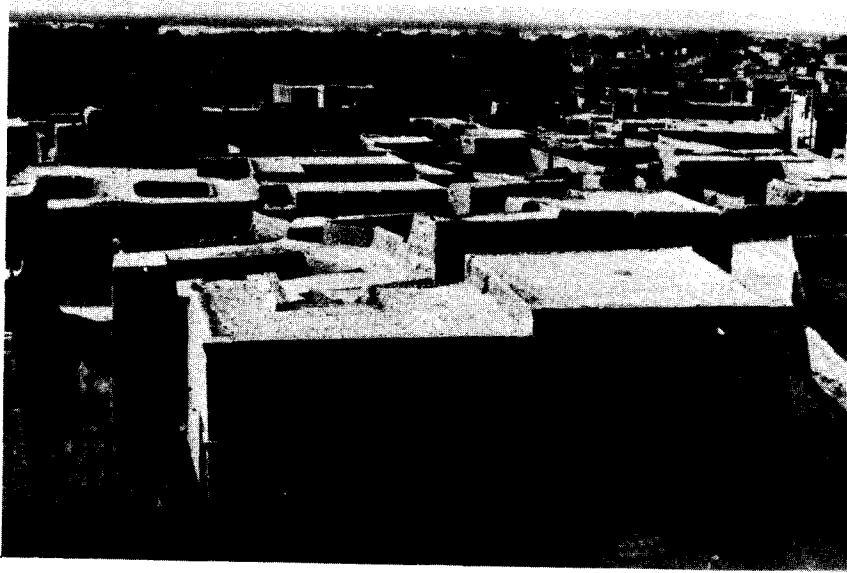
At 4, when the sun is a little lower, Kader and Chekna Moulay return in a Land Rover to take us around town. Everything looks more solid than I had expected. The buildings are made of big, square bricks of earth or stone which look carefully finished. Corners are squared off, and the primitive feeling adobe gives is largely absent. Many of the buildings have two stories, and they all have drains running through the upper walls and overhanging the streets. We climb to the top of the main mosque, reconstructed in the 16th century. In the catacombs beneath, one lone Moslem is praying as we pass, barefoot in the sand.

Driving and walking around Tombouctou is a revelation for Alan and Blue, but disappointing for me, since I've seen Agades. The town is old, but the market is covered with a steel roof and ubiquitous electric poles spoil the composition of my photographs. We pass a plaque honoring Alexander Gordon Laing, the Englishman who "discovered" Tombouctou and was killed trying to make his way back to civilization. Infidels were not treated kindly there. Rene Caillié, in 1828, was more careful, or perhaps luckier. Anyway, he never went out in the daytime, and they didn't catch on to him. He returned to tell the tale, and the story of the city in the desert grew. But even then it was a shadow of the old Tombouctou whose university, actually an institute for study of the Koran, flourished and once made the trade in books the city's major industry. Now, Tombouctou's importance is probably less than it held at the time of its foundation by the Tuareg 800 years ago. I have heard that everyone since the time of Caillié has been disappointed in Tombouctou, and I can understand why. Yet there are women pounding millet in courtyards, children playing all around, families sitting around their doorsteps, some beautifully decorative old doors, and camels passing, on any of which I can ask to mount and on which to pose for photographs. And as Caillié said, there is something impressive about this huge settlement, the houses built so solidly in the middle of nowhere.

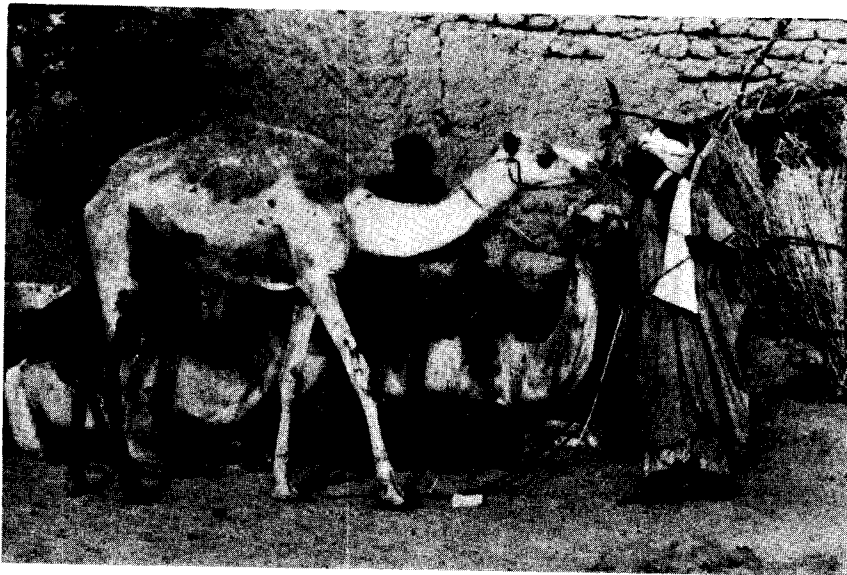
I must have my ticket back to Bamako rewritten to allow my stop at Mopti, but the Air Mali office in the market place is shut every time we go by. Finally Kader takes us to a house on the outskirts of town, and voici, his friend the Air Mali agent taking the afternoon off. He takes my ticket and promises me the exchange at the airport in the morning. "Keep up the hard work," we joke as we drive off. I express fear that the ticket won't be there, but I am reassured. "Pas grave, Air Mali is just us. And besides, if there is no ticket, we won't give him gas for the plane."

We drive through on the lone paved road, back past the airport to the town that serves as Tombouctou's port. The Niger is but a few feet wide, and it is hard to imagine that in a month all the fields we see will be flooded and passenger boats bearing hundreds will come up to this dock, now perhaps 30 feet above the water level. We must come back for Christmas, when the water is high and they arrange spectacles with the native tribes.

On the way back, Chekna Moulay takes a turn into the sand and, by and by, stops at the edge of a valley. "We're going to see some pals," he says, and we follow him up a sand dune. On top we find six men in typical dress of pantaloons and robes. They are all shopkeepers of Moroccan ancestry in town. They have spread out an oriental carpet, and on it they unwrap a whole roasted lamb on a spit. We cut off chunks to eat. Lamb has never tasted so good. They even have cans of Evian water for us to drink, though they find it too light for their tastes. Dessert is tourmé, delicious deep fat fried batter cakes.



Overall view of
Tombouctou



At a street corner
in Tombouctou



Child in an elaborate
doorway in Tombouctou

As we sit on the flying carpet on the sand in the Sahara near Tombouctou, I look toward the setting sun and see a silver tea service set out on our dune. It just can't be real, but yes, tea is soon served in small glasses, with a flourish, after one short time-out for our hosts to face Mecca and pray as the sun disappears. Later on, Alan, Blue and I sit on the sand and wait to be in the second carload, prolonging our stay in this heaven. "Alberca," we say, "thank you" in Sonrai, the language of Tombouctou.

I ask about a trek to the place where the eclipse will pass the closest to Tombouctou, 300 km to the north, where there is nothing but sand. "If seven maids with seven mops swept it for half a year . . ." There are now three Land Rovers in town, that could take up a total of perhaps 20 tourists plus provisions. And there are some army trucks that could run a shuttle of provisions if a camp should be established. There is no problem lodging even hundreds of people in Tombouctou, between the campement and private homes, so it all depends on how many Land Rovers the government can send here in advance, and whether Air Mali could fly up the people.

On our way back to town we stop to see Pastor Marshall, an American who has lived here off and on for 18 years serving the Baptist Evangelical Missions. His wife, a head and a half shorter than the towering Evangelist, and their two daughters are also there. Sandy, the elder, has just finished high school in Niamey. She has been so isolated in mission schools in Africa for so long. We do not know how to interpret the girls' silence, but the company on the whole is lively. Mrs. Marshall's parents and brother live in Cambridge, which completes our little circle. Today they received two air mail letters from Cambridge -- one was mailed just 6 days ago, and the other took two months. It is the latter situation, they say, that is unusual. Someone has left a letter to be sent back surface mail to his draftboard informing them of his return to eligibility. We shall hope for the slow service for him.

The Pastor does most of his missionary work in the villages along the river, though he does pull a tooth or two a day on the side. There aren't many converts. The mission is now building a place alongside the Marshall's house, to contain a reading room to supplement their store in town, a dental office, and apartments for their missionaries when they report to base. Though the New Testament has been translated into the Sonrai language, it is really only a French transliteration. So there isn't too much need for translating the Old Testament. Once the people learn to read, they may as well use a French version.

July 10

Tombouctou is at its best in first light. Herons gather at the water hole as the sun rises in haze, and a caravan of camels comes to drink. This is their periodic visit to the Big City to drink up,

and they may not have been here in weeks. From our vantage, the town appears jumbled together and sprawls up a hill, reminiscent of Caillié's 1828 drawing.

We climb to the roof of the building next door, which turns out to be 30 more rooms for the campement. None are air conditioned, so the two Americans we meet who had been staying there for a few days had moved their beds up to the roof. But our air conditioning, even though new, hadn't been satisfactory either. Mine drew too much current for the circuit breaker on its cool position, and had to be left in recirculate, and the others were probably too near the louvered doors and were simply recooling the hot exhausts. I had opened my door, but decided to sleep under the mosquito netting inside rather than sleep on the mattress they had put out for me on the patio. They assured me that there were no mosquitos, but I thought I felt some gnats so I stayed in.

One disease that we had kept asking about before we came was cholera. A vaccination lasts only six months, and can give a reaction, so we didn't finally have the shots. It took some time to find someone who could explain the situation, but we finally learned that cholera had never been reported south of the Sahara. Unfortunately within months after our trip, a cholera pandemic spread, and many cases were found in Guinea, just to the south. It is frightening to think how cholera could spread with the local lack of particular sanitary methods. This problem will bear watching on everyone's behalf.

The town is wide awake as we stroll through. Children carry buckets of water on their heads from a water hole. Women pound millet. Laden donkeys wend their way down the crooked streets past the substantial-looking houses that often boast big beautiful doors of wood with metallic decoration. Tombouctou is alive.

I take advantage of my private bathroom and shower and feel refreshed. Abbes Kader and Chekna Moulay drive us to the airport, and bid us au revoir. There we find that the merchants had too many beautiful necklaces and sandals for us to resist. Much of the jewelry is of yellow dried wheat, formed in chains and known as Tombouctou gold, and the sandals are hand painted in black, yellow and green in the Tuareg fashion. My return ticket is ready and waiting as promised, and finally the AN 24 arrives to whisk us away. The first reports that I shall eventually write are in Appendix V.

At Mopti, Alan and Blue continue on their way, and Jahjah, the Mobil man, comes up to take me on. He is very kind and, since he is going to Bamako on the continuation of the same plane, tells me to take his room at home and introduces me to the head of the Tourist Bureau, a gaunt man in a blue bou-bou and white cap. The tourist chief has arranged for a Land Rover to take me to the Dogon country at 3 o'clock and Jahjah gives me a choice of driving to Mopti now with his little brother, or with the local official. I chose the

brother but somehow wind up with the official who begins talking just of money, 33,000 Malian francs for the trip to Sanga, 2,000 for a trip around town. Finally I must tell him to shut up. Doesn't he know that he is doing himself more harm than good?

Mopti is 13 km from the airport, and we pass oxen plowing fertile fields, the best I have seen in Mali. The town is bustling, and the waterfront is full of small boats. I am delivered to a store with a sign reading: "Jahjah, négociant, import export, tel 76," and am heartily welcomed inside by Mrs. Jahjah and her 18 year old son, Fayès. A Lebanese family, the Jahjahs have been in Mopti for thirty years. Fayès introduces me to his pretty cousins from Bamako, one eighteen and the other seventeen and even wearing a miniskirt. We drink some dense coffee. It is the older brother I have met at the airport; the father is visiting Lebanon.

I am shown a large room, but don't feel like sleeping and go out. But there are no cafes to be found, and I sit on the quai with my book. It is difficult to ignore the crowd that gathers, and my English photographer friend is standing 10 feet away gazing across the harbor. I surprise her with "Sarah, the view is better from here." She is with two Peace Corps Americans who have just arranged for her to go up the river in a small pirogue to Tombouctou, a trip that will be five days by boat followed by three days overland by camel.

It is a good time for a walk around town. Fascinating businesses are going along the quai and people throng the streets. The big Niger riverboats are tied up here for the dry season, and around it women and girls are bathing and washing clothes. Some are beautiful and young, with firm round breasts; some are pretty, and wear colorful costumes which they nimbly shuck to go in the water, and some are flabby and parched and old. The bottom half-inch around the outsides of their feet are painted black, covering the lighter-toned areas, and many have their lips tattooed blue. Some have huge, heavy earrings dangling from pierced holes in their lobes a half-inch across, and some wear little nose rings as well.

Sarah has come up to Mopti with some Frenchmen in a hired taxi en route east. As we walk it begins to rain and we make for Jahjah's. After coffee we further investigate the bustling streets and market and I deliver her to her French companions. They will also come to Sanga, the campement in the Dogon country, if the Peugeot taxi makes it.

The Jahjah's have a lovely lunch, all sitting around a big table in their quarters above the store, and I meet Fayès' twin brother Farès, and their little sister as well. The brothers will go to university in Marseille in the fall and are eager to talk of American authors, especially Bernard Malamud. Lunch is rice and meat and pancakes and Lebanese salad and sweet bread in sugar and milk for dessert. Who knows what lies ahead for me to eat?

The port is busy all day, and I find merchants with piles of dried fish, men constructing a pirogue, and all kinds of buying and selling. The boats go in and out, and now and again a woman jumps into the river for a bath.

At 3, the chauffeur Douda comes for me in one of the Tourist Office Land Rovers. It has U.N. Development Program markings; I suppose the tourist industry is a good thing to develop. The first 65 km road of the road to Sangha, as far as Bandiagara, is good, though the paving stops not far outside Mopti. Once, the Land Rover stops and Douda gets out. He fiddles under the hood and then goes and gets the crank. He explains that the electrical system is broken. He fiddles around, and strips a wire. Finally, the engine starts, he puts away his tools and the crank, and we continue.

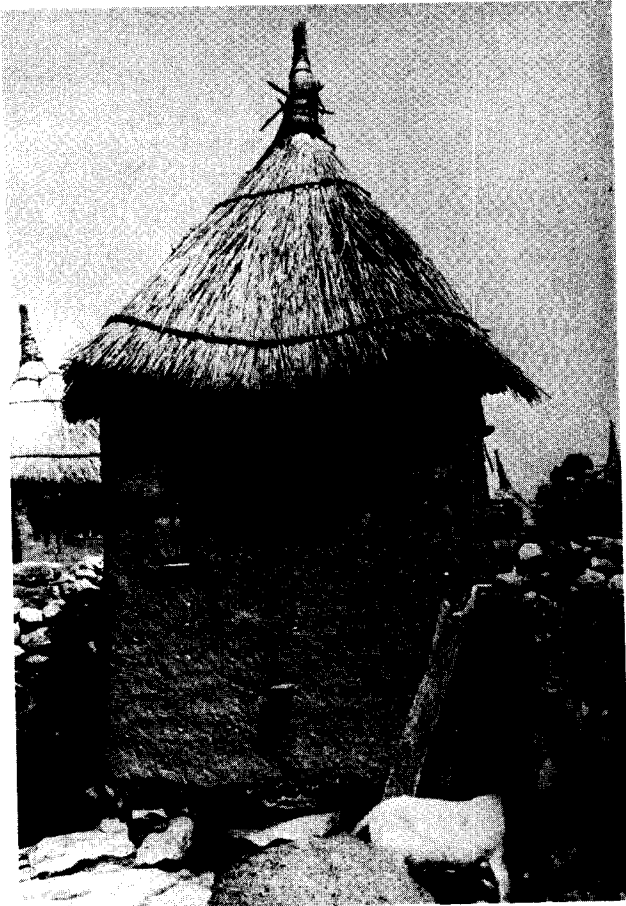
A police blockade marks the entrance to Bandiagara and I enter and register. A gendarme who doesn't write too well tediously copies a selected amount of information from my passport into a big book. Land Rover, license RMB 1834, coming from Mopti, going to Sanga, 16:50, driver Douda. Then he enters Douda's name in yet another book. And we must stop at the Commissariat of Police, which we do after a brief stop at the Campement for a beer.

"Doucement" is the word for how to take such bothersome things. I have learned by now, and I fix a smile on my face and shake everybody's hand as I enter the Police Station. The Chief shakes my hand, asks where I'm from, takes my passport and examines all the visas. I smile still more and joke and tell him how much I like Mali. He smiles, shakes my hand, writes down my name, and waves us on. What a colossal pain.

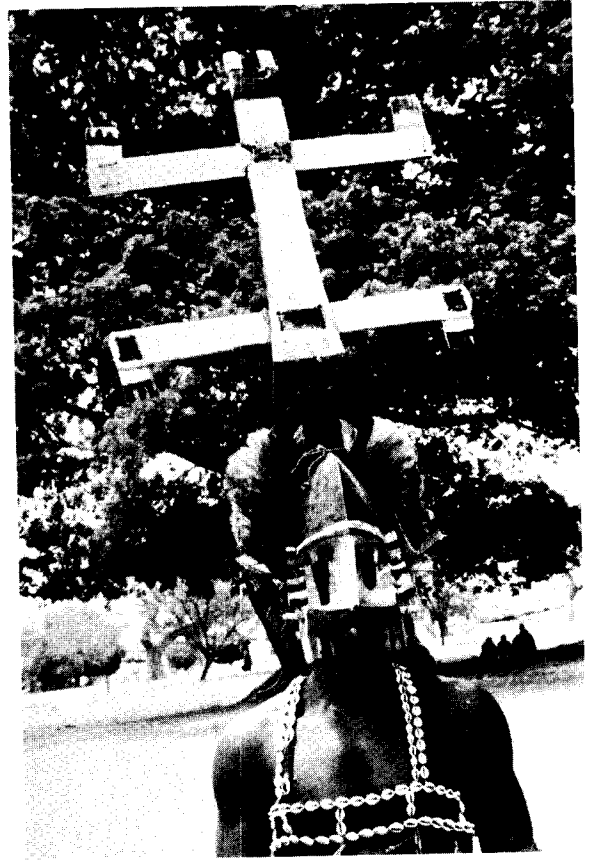
Past Bandiagara, the road quickly degenerates. Soon the electrical system gives out again, this time for ten minutes. We stop at the prettiest imaginable Dogon town, with its many funny buildings looking all mixed up together. We pass a shepherd boy with his flock of goats and several baobab trees, backlighted by a beautiful sky. And the car stops again. Suddenly it strikes me where I have seen all this. "Le Petit Prince" by Antoine de Saint Exupéry. Here I am, my machine broken down. Lots of baobab trees. St. Exupéry even had an astronomer reporting to an international congress of astronomers (though he wasn't believed at first because he was wearing native costume. I had better not wear my Agades bou-bou when I give my report). I've been in lots of desert, the flavor of which was honestly evoked in the book. I wouldn't be at all surprised to be asked to draw a sheep.

July 11

The sun is poking over the cliffs in the east at half-past five, and the women carry water from the well. The sky is clear as we set out on foot for the Dogon country. The first hour carries us between



A Dogon granary

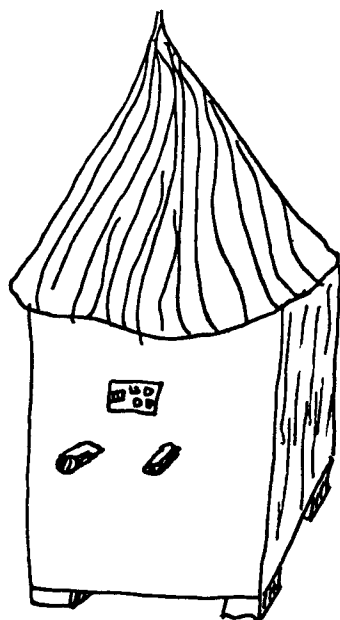


Dancer wearing the Dogon
canaga mask at Sangha



Dogon women with children

horizontal cliffs and across a stream. We descend sharply towards a tiny pond with a lone tree by it, hundreds of feet below us. My guide, a young school teacher who is the son of the Guide of Sangha points out cliff dwellings reputedly made more than a hundred years ago by the Tellem pygmies, supposedly long since departed. Most modern authorities, finding stylistic continuity between "Tellem" and Dogon pieces doubt this story. Anyway, the constructions are beautiful. They remind me of the Bandalier National Park cliff-dwellings in New Mexico. And then we see it! Through a pass in the cliffs we look down on Ireli, beckoning like Brigadoon. Such a jumbling of shapes.



JMP

Dogon house in Mali

The Dogon live in villages that are so picturesque as to be unreal. Their houses are of mud, and each is surrounded by several granaries, which have four walls of mud higher than their 8 foot width, with thatched roofs that are wavy on the roofline and come to a point on top. The granaries are raised on blocks a few inches from the ground and, oriented every which way and built into an escarpment, they present as pretty a sight as I have ever seen anywhere in the world. In one side is a little window, with a one-piece shutter that closes with a carved cross-bar, the famous Dogon lock.

My guide and I start the long descent -- an interesting and not too difficult rock climb. After all, the natives do it every day. Some houses are built into the side of the hill, and smoke rises from courtyards. Ireli is just as interesting up close as from far above, and we wend our way around corners. We don't see many inhabitants. Some of those we come across don't mind being photographed but most do. The people are handsome and tall, and many of the women wear golden rings in their noses.

The sun mounts and we have been en route for two hours when we reach the plain. We hike down the road a few kilometers, passing men and women working in the field with trowels, and women carrying bowls of water on their heads and babies on their backs coming and going. Our guide greets the people as we pass. In "Games People Play," Eric Berne defines perhaps three polite "strokes" in our English greetings. "Good morning, how are you" (1). "Fine, how are you?" (2).

"Fine thanks" (3). The Dogons have 10 to 16 strokes: "Hello." "Good morning." "How are you?" "How's your Mother?" "How's your Father?" "How's your Brother," and so on.

High above us to the left in the escarpment I see more houses built into the side of the rock. The people either climb down to farm below or climb up what seems to be a sheer face to Sangha.

And now we come to the town of Banani, and its subdivisions. Banani-Na, Banani-Siron, Banani-Kakoro and Banani-Amami, that is, Banani-one, two, three and four. We climb through the town and up a kind of staircase built of rubble. A beautiful green and orange lizard runs across when we stop to rest, highlighting the view between cliffs showing Banani below and a thin waterfall plunging over the edge of another cliff behind.

My guide knows a source of water if I descend over the edge again a little, and I find a Dogon taking a shower in water flowing from an opening in the rock. Three little girls come with orange bowls to gather water. I wash myself in the clear waterfall and feel refreshed.

The promenade is over after nearly five hours, and Douda has the Land Rover waiting not far from the top. I have asked the Guide to arrange some dances, which is why he stayed behind this morning and sent his son with me.

Two drummers come to the square just outside the town of Sangha, near the modern school buildings. And then a stream of half a dozen dancers with masks atop their heads. Many have the basic canaga Dogon masks, a face-mask with a bar sticking up 18 inches and two cross pieces across, and come strutting out. One man wears a silove, which has a bar extending 6 feet into the air! Another wears a rabbit mask. The masks are painted various colors, and the dancers leap and bend and twist to the rhythm of the tom-tom. Then still another dancer comes on the scene, perched atop a pair of stilts. Some of the dancers, all of whom are men, wear black beaded brassieres in their roles of female impersonators.

The others from the campement have gathered around and we see several types of these Go dances. Sometimes the dancers twist their bodies, sometimes they bend so as to slap their cross-pieces simultaneously against the ground, sometimes they jump. Then it stops, the music is over, and the dancers parade home.

The drive back to Mopti is long, but I am inspired by the morning's walk. I have seen sights I shall never forget -- perhaps the highlight of the trip at its penultimate moment.

The Jahjahs welcome me back in town, and I rest.

July 12

The plane flies straight to Bamako, bypassing its scheduled stop at Segou. All is in order. M. and Mme. Auneau take me for a pleasant lunch, and Joe Christiano reports that there will be no Tessalit plane next week. Lew Pate's assistant had obtained the necessary export permits for my sculpture, and my major problem becomes how to wrap and send my suitcase-size, 20-kilo package of art. Alan and Blue help solve that by suggesting that I tie things up in a native blanket, and we go out to buy the camels-hair blanket in the marketplace and cord from a man on the street who winds his rope fresh daily. We tie up the package as the electricity in the Grand Hotel flickers on and off.

Niger and Mali are just too fantastic to sink in all at once. But there they are, ready and waiting. The world is still such a varied place. But now the road home, via Casablanca (which will seem so European) and Paris, awaits.

JULY 1970

APPENDIX I

SITES FOR THE TOTAL SOLAR ECLIPSES OF 1972 AND 1973

Jay M. Pasachoff
Harvard College Observatory

With the marvels of the 1970 eclipses still fresh in memory, many astronomers will plan observations of the next two eclipses, the first, in some cases, because of its convenient location, and the other because of seven minutes of totality.

On 10 July 1972, the path of totality (Figure 1) will begin in the Sea of Okhotsk and cross the Koryakski Khrebet in the Soviet Union, hit the United States in northern Alaska, and sweep southeast across Canada. It will pass near the route taken by the exploratory oil tanker "Manhattan" near Demarcation Point as it attains 2-1/2 minutes of duration. The central line will pass near Baker Lake, where there is a military station and an airstrip, and cross Hudson Bay before the duration again dips below 2-1/2 minutes. Maximum totality is 2 minutes and 35 seconds. The path will next cross the city of Great Whale River to northwestern Quebec on the shore of Hudson Bay, and then will come to more populated and accessible regions of eastern Canada. Many will wish to set up in Godbout or Baie Trinité on the western bank of the St. Lawrence, or near Cap Chat on the Gaspé peninsula, for roads and airports are nearby. The central line will pass just south of Shippegan, New Brunswick, right through Charlottetown, Prince Edward Island, and across eastern Nova Scotia and the 1970 eclipse track, with totality still lasting longer than 2 minutes and 6 seconds. Since the variation in the length of totality is so small, many will opt for the accessibility of eastern Canada. It is unfortunate that the press, in hailing the 7 March 1970 occurrence as what could be properly specified as "the last total eclipse passing directly over populated regions of the eastern United States this century," neglected to point out the nearness of totality to New England in 1972.

At first glance, the weather across this route does not seem favorable, particularly since clouds will have a chance to build up in Quebec, Prince Edward Island and Nova Scotia by the afternoon hour of 2030 UT when the eclipse occurs. Weather data will be of great interest. The sun will only be at a maximum elevation of 46° , at 37° on the Gaspé peninsula, and down to 32° when the eclipse passes out to sea.

The eclipse of 30 June 1973 in Africa will occur under much more favorable circumstances from the astronomical point of view, although its remoteness for American observers will discourage many (and encourage some). It is interesting to note that the great circle distance from New York to Dakar, Senegal is roughly the same as that from New York to Paris, France.

Since the eclipse occurs near the equator near noon, totality will surpass seven minutes in Mali and Niger. The eclipse

will begin in Brazil, and by the time it has crossed the Atlantic and hits Mauritania, it will have surpassed 6 minutes of totality. The path then will cross northern Mali and northern Niger, central Chad, and, as totality decreases, cross the southern Sudan, northern Uganda and northern Kenya. Since our preliminary studies indicate that we encounter the rainy season in Chad, and totality has decreased to 4-1/2 minutes by Kenya, we have concentrated on Mauritania, Mali and Niger.

In the first two thousand miles of the eclipse path in Africa, only three areas with roads, none of them paved, are crossed. The track crosses some of the most isolated terrain in the world: the Sahara desert. It is unfortunate that we cannot average in the temperature in Alaska from the 1972 eclipse. The region under investigation is the former French West Africa, and French is the lingua franca. I have gathered information from a number of sources, including available books, several persons who have lived or travelled in this area, the New York Times, and the United States Department of State. A first summary of this information follows.

Two of the roads are in the central portion of the eclipse, with more than seven minutes of totality. The first leads north from Agadez in Niger. One can fly to Niamey, the capital, in a 727, 707 or DC8 from Paris or Madrid. At the moment, there is only one flight a week, a DC3, flying between Niamey and Agadez. Agadez lies on the southern edge of the 160-mile wide band of totality. Readers may enjoy the pictures of sand and camels in Victor Englebert's article, describing a Saharan salt caravan to Agadez in the November 1965 issue of National Geographic. Mr. Englebert has been very helpful to my investigation.

Niger has a population of about 5 million, and covers an area larger than Texas and California combined. 97 per cent of the population is rural, and the percapita income listed in the 1968 New York Times Economic Review was \$82.

One could use Agadez as a base, though it seems much less developed than Míahuatlán, Oaxaca, Mexico. At an altitude of 1706 feet, it has an average daily maximum temperature in June of 107°F and July of 104°F, and average daily minimum temperatures of 75 and 75, respectively. The average monthly rainfalls are 0.6 and 0.9 inches, and the average numbers of days with precipitation greater than 0.04 inch are 1 and 5. The averages were computed by the Meteorological Office of the French Air Ministry for 4 years out of the period 1931 to 1940 and 1949 to 1955. Since the absolute maximum temperatures listed are 115 and 113, and the absolute minima are 67 and 65, the weather conditions seem consistent from day to day. Nobody goes out at noon (although the day of the eclipse, when the sun is covered, should prove an exception). We have one estimate of a 99.9 per cent chance of clear weather, but an evaluation of astronomical seeing transparency requires a report by a trained observer.

North of Agadez is the Air Massif, a series of plateaus and mountains that are pictured in photograph S65-63158 taken from Gemini VI on 16 December 1965 and included on page 54 of NASA Publication SP-171, Earth Photographs from Gemini VI through XII (available from the Superintendent of Documents, Washington, D. C. 20402, for \$8). The central line passes across Monts Baguezane, which has a broad plateau at an altitude of 1900 meters, with exactly 7 minutes of totality. The main road, a track up to the old French Foreign Legion outpost, Fort Laperrine, now known as Tamanrasset, passes to the west of the Air, but since uranium was discovered north of Agadez, a new town, Arlit, is being constructed and a road through the mountains north from Agadez is being improved.

The second route to consider, in Mali, leads north from Gao to Algeria, and has historically been the main caravan route from Timbuktu. The Mali and Songhi Empires flourished in this region from the 11th to the 15th century. More recently, it was part of French West Africa, and then gained independence in 1960. A military coup changed the government in 1968 and limited the "Socialist option" that had been under way.

Mali is about the same size as Niger, about twice that of France, and has an average yearly income quoted in 1968 as \$70. One can fly to Bamako, the capital, in a Caravelle or DC8 from Paris, Berlin or Budapest. The connection with Niamey is via Ouagadougou, Upper Volta. Internal flights change from time to time, but at the moment there are three each week from Bamako to Gao, two in an Antonov 24 and one in a DC3. Unfortunately, it is about 250 miles through the desert from Gao up to the central line, which passes through mountains known as the Adrar des Iforas. The mountains would make an eclipse site there somewhat more hospitable than the desert, for there is some low shrubbery, but conditions would still be very difficult.

If the previous two sites prove inaccessible, or if the temperatures prove unbearable, the Mauritanian site might prove best, even though totality is only (!) 6 minutes. One can fly to Dakar, Senegal from many places around the world, and Caravelles and Antonov 24's fly to Nouakchott, the new, small, capital of Mauritania, 4 days a week. The population of Mauritania is just over one million, spread over an area four-fifths that of Alaska. The 257-mile road from Dakar to Nouakchott is scheduled to be paved by the end of 1970, so there may be some logistic advantage here. Nonetheless, the central line passes about 100 miles north of Nouakchott along the coast, but the road goes toward iron mines in the interior and takes 250 miles before reaching the center line. A site on this road would already be in the Sahara desert, so the possible advantage of lower temperature resulting from an ocean location would have disappeared. A first-hand report on the usability of a Mauritanian site for eclipse expeditions would be very useful.

It is interesting to note that the annular eclipses of 24 December 1973 (6 months after the total eclipse), and 29 April 1976, both pass through Mauritania and Mali, crossing the 1973 track in eastern Mauritania. The 20 May 1966 annular eclipse, which many viewed from Greece, crossed along the longest dimension of Mali, passing near Bamako and Timbuktu, and through the Adrar des Iforas.

I appreciate the assistance of the Cartographic Division of the National Geographic Society and their permission to publish their copyrighted maps. The locations of the paths were taken from Circular Number 101 of the United States Naval Observatory. We are also grateful to the Mobil Oil Company for their assistance with local arrangements in Africa.

APPENDIX II
PRELIMINARY SURVEY OF AFRICAN SITES ALONG PATH
OF THE 1973 SOLAR ECLIPSE

Donald H. Menzel and Jay M. Pasachoff
Harvard College Observatory

In late June and early July, we are visiting Niger and Mali, the two countries in which totality will surpass seven minutes on 30 June 1973. As of this moment, with the visit to Niger almost concluded, we list the following:

1. Sites in Niger seem to be more accessible than sites in Mali.
2. The weather is probably similar throughout the seven minute portion.
3. We estimate at least a 95% chance of weather clear enough to see the eclipse for seven minutes. The sky has been an ordinary light blue, with considerable brightening near the sun (but perhaps perfect conditions like those in Miahuatlán, Oaxaca, Mexico, the prime site for the 1970 eclipse, are too much to hope for).

The horizon was clearer on the 1st than on the 29th or 30th, but clouds formed in mid-afternoon on the 30th and 1st. The visibility, in any case, was on the order of 20 miles. And the cooling of the atmosphere by the eclipse itself should retard the cloud formation.

4. The prime sites are 135 km north of Agadez, Niger. Access will be either from Agadez or from a new town under construction, Arlit, a similar distance north of the central line west of the Air Mountains.
5. The center line itself is readily accessible, and we inspected two possibilities.
 - a. On June 30, we traveled 112 km, 3 hours north of Agadez by Land Rover in the Air Mountains, to the tiny settlement of Elmaki, the site of an open tin mine. About two hundred people live there, mostly in tents. There is more vegetation than we had supposed, and areas with shade trees appear regularly where the road crosses rain runoffs. The center line crosses about 20 km due north of Elmaki, and would probably take another hour in a Land Rover. There is an area with trees there.

- b. On July 1, we traveled 140 km by the route to Arlit, 3 hours north of Agadez to the center line, where there is a wooded area. We traveled in a Land Rover, although other makes would probably be satisfactory. This site is probably marginally preferable to the other because of easier access.
 - c. A new, paved, route is soon to be constructed from Agadez to Arlit, and may be finished by 1973. If it is ready, the best sites would probably be along it.
- 6. Trucks pass regularly to the tin mine in the Air, and trucks of up to 80 tons travel daily to Arlit by the current unpaved route. We shared the weekly DC3 we took to Agadez from Niamey with a 1m X 1m X 4m packing crate that continued to Arlit with the plane. Several seats on one side of the plane had been removed to accommodate it.
 - 7. Expeditions would probably have to be self-contained as far as housing, water can probably be obtained in Agadez, and we shall try to work out a method of supplying food there, too.
 - 8. The government of Niger will do everything possible to help us. We discussed the problems of several hundred astronomers and perhaps a thousand or more tourists with President Diiori personally, and shall be making detailed recommendations to him.
 - 9. There are an insufficient number of cars available in Agadez and even Niamey. Kano, Nigeria might be a good source of vehicles.

Trucks for transporting equipment can probably be rented in Agadez.

- 10. The visit to the sites was worthwhile, for much of this information was unobtainable elsewhere. For example, of the 3 prime sites, two are not shown on any maps. The site we had in mind at first from maps and the Gemini photograph, les Monts Baguezane, turns out to be accessible only by camel.

We shall make a more complete report as soon as possible, and hope to discuss our survey at the IAU General Assembly in Brighton. We have many photographs of the area that should be of great assistance for those considering expeditions.

We promised President Diari that we would ask for a very preliminary estimate of the number of astronomers who would come for a period of weeks, and of tourists. Accordingly, may we ask all those interested to write us immediately at the Harvard College Observatory, Cambridge, Massachusetts 02138, U.S.A., simply stating whether you will be considering an expedition to Niger, with the number of people and for how long.

Agadez, 1 July 1970

APPENDIX III. METEOROLOGICAL CONDITIONS IN NIGER.

a. Averages compiled for June by the Meteorological Department of the government. Cloud cover includes cirrus.

	Time	Temperature		Humidity %	Cloud Cover eighths	
		°C	°F			
<u>Agadez</u>	6 a.m.	28.9	84		6.3	1960-69
	noon	39.3	103		6.5	
	6 p.m.	38.4	101		6.6	
<u>Arlit</u>	6 a.m.	32.9	91	32	0	1967-69
	noon	40.1	104	23	1	
	6 p.m.	41.1	106	18	3	
<u>Iferouane</u>	6 a.m.	29.1	84	37	2	1960-69
	noon	39.9	104	20	3	
	6 p.m.	39.3	103	20	4	

b. Yearly averages at noon from June 21 through July 10, compiled from copies of official records.

	Year	Cloud cover		
		eighths	%	
<u>Agadez</u>	1966	6.0	75	
	1967	4.4	55	
	1968	5.4	67	
	1969	6.6	83	
	1970	5.5	68	
<u>Arlit</u>	1969	0.4	5	(July 1-10 only)
	1970	0	0	
<u>Iferouane</u>	1968	1.0	13	
	1970	2.7	34	

APPENDIX IV.

METEOROLOGICAL CONDITIONS IN MALI

a. Averages compiled for June by the Meteorological Department of the government.

	Time	Cloud Cover eighths	
<u>Tessalit</u>	6 a.m.	3.7	June 1969
	noon	3.1	
	6 p.m.	4.4	
Mean Temperatures	Minimum	Maximum	
Mean Humidities	28°C (82°F)	44°C (111°F)	
		12%	26%
	6 a.m.	3	1951-1960
	noon	2	
	6 p.m.	4	
<u>Tombouctou</u>	6 a.m.	4	1951-1960
	noon	3	
	6 p.m.	4	
<u>Kidal</u>	6 a.m.	3	1951-1960
	noon	3	
	6 p.m.	4	

b. Yearly averages at noon from June 21 through July 10, compiled from copies of official records.

	Year	Cloud Cover eighths	%
<u>Tessalit</u>	1967	2	25
	1968	4	50
	1969	3	40
<u>Tombouctou</u>	1968	4	50
	1969	3	40
<u>Kidal</u>	1968	2	25
	1969	3	40

APPENDIX V
SUPPLEMENTARY REPORT ON 1973 ECLIPSE SURVEY

Jay M. Pasachoff
Harvard College Observatory*

Continuing the investigation of conditions that Professor Menzel and I have undertaken for observing the 1973 eclipse for 7 minutes, I traveled on to Mali in early July 1970.

I was well received by M. Babba Diarra, the 2nd Vice-President, who was very cordial. We discussed the advantages of Kidal and Tessalit, and it appears that Tessalit might be a better center because of its airstrip, larger even than that of Bamako, and able to receive DC3's and Antonov 24's. Tessalit is a military base, and, with advance notice, space could be found to lodge scientists. Water and vegetables are plentiful, but planes would have to be chartered from Air Mali to fly in supplies and other food.

There are a few occasionally annoying things about traveling in Mali, although some of the tourist opportunities, such as a visit to the Dogon country near Mopti, are fantastic. A photo permit must be obtained by tourists. I was carefully questioned at the airport before my cameras passed customs. There are occasional internal customs checks on the roads. I told the Vice-President of the eventual need to facilitate customs for astronomical equipment.

Material would have to be flown to the Tessalit site, or brought in Land Rovers by road from Gao. They could be driven to Gao from Niamey -- the road from Bamako is difficult. Advance equipment could be shipped up the Niger, but this would have to be done before January 1973, for the river is too low in the spring.

Some astronomers or tourists could go to the Sahara desert north of Tombouctou. Land Rovers would be necessary but if the government should agree, a shuttle of supplies to an established camp could be run from Tombouctou in military trucks. Tourists might want to travel up from Tombouctou the day before the eclipse and spend the night on the sand, if enough Land Rovers can be sent up from Bamako in advance.

The weather should be similar to that in the Air, that is, somewhat disappointing. The sun should be visible, but with haze. The actual cloud statistics seem less encouraging, but must be looked at in detail. I made photocopies of the official meteorological records from Tessalit, Kidal and Tombouctou for the past few years.

Dr. Menzel and I would like to thank the Mobil Oil Company for facilitating our trip. MM. Harry Gasarch in New York,

*As of 25 September 1970, Department of Astronomy, California Institute of Technology.

Ivan Kerno in Paris, Daniel Petrier in Niamey and Jacques Auneau in Bamako have been especially helpful, as well as their correspondents in Agadez, M. Abbas Kader in Tombouctou and Jahjahs in Mopti, and MM. R. Prijol and Benabdessadeq in Casablanca.

Miss Marilyn Johnson and Mr. Vincent Hovanec of the United States Information Service and Mr. Alfred Erdos, the Charge' d'Affaires were of great aid to us in Niger, and Ambassador Clarke, Mr. Joseph Christiano and Mr. Lewis Pate of the American Embassy were very helpful to me in Mali.