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MEMO TO: MARSHALL REED AND SUE PRESTWICH

FROM: MIKE WRIGHT

SUBJECT: TRIP REPORT: LOS AZUFRES AEROMAGNETIC SURVEY

DATE: May 19, 1988

Howard Ross and Mike Wright were in Mexico for the time period 1 May 88 to 17 May 88 for the purpose of flying aeromagnetic surveys over the Los Azufres geothermal area. Two separate surveys were flown -- a Low-Altitude survey was flown in a Lama helicopter belonging to CFE and a High-Altitude survey was flown in a Piper Cherokee fixed-wing airplane that was chartered and paid for by CFE.

Planning for the survey was done by A. Razo, H. Lira, O. Campos and R. Huitron of CFE and H. Ross and M. Wright of UURI. The flight crew, in addition to the pilot, consisted of Hector Lira of CFE as navigator, Howard Ross of UURI as magnetometer operator, Mike Wright of UURI as video operator. Neither of the pilots had had previous experience in this type of work, but both learned quickly. After the first day of each survey, we functioned as a crew very effectively.

An estimated total of 527 line-km were flown in the Low-Altitude survey in an area of 96 sq km, for an average line spacing of 0.18 km. We had originally planned to cover about 113 sq km, so the data were about 85 percent complete at the termination of the survey due to mechanical problems with the helicopter. The altitude of the survey was a smooth drape of topography at an attempted terrain clearance of 100 m, but due to the very rugged topography, terrain clearance was sometimes much more. The helicopter was used to the limits of its performance (rate of climb about 1500 ft/min, rate of descent about 2000 ft/min) under the conditions of altitude, temperature and wind in doing the drape, and we believe that it could have been done no better. We are very happy with the flying and with the pilot.

An estimated total of 1390 line-km were flown in the High-Altitude survey in an area of about 1500 sq km, for an average line spacing of 1 km, excluding tie lines. The Los Azufres geothermal system as presently defined was in the center of the area, and the survey was designed to cover the entire area of volcanic features (possible caldera) associated with Los Azufres and the nearby Araro geothermal area. The survey was flown as planned and is considered to have been 100 percent completed. The survey altitude was originally planned to be a smooth drape at 500 m above terrain, but due to limitations in the rate of climb for the aircraft under the prevailing conditions of altitude and temperature, the survey was actually flown at a nearly constant altitude of 11300 ft, except over parts of San

Andres volcano, where altitude reached 12500 ft. We do not consider this departure from plans to be too significant, and we are pleased with the data, with the flying and with the pilot.

The only major problems with the survey work were the functioning of the helicopter, the initial lack of adequate batteries to run the magnetometer system and the presence of smoke from burning of fields. The helicopter had recently been overhauled, and was not quite adjusted properly. The first pilot complained that it did not produce the amount of power that it should, and he was reluctant to fly when the temperature rose too high, generally after about 1100 hrs. We completed all the flying actually done in the helicopter with this pilot (Eduardo Hernandez). When the pilot was changed, the new pilot (Teliz) was reluctant to fly the machine in its condition. An attempt to fix the helicopter was not successful, and the surveying had to be terminated. Teliz had had a recent helicopter accident, and was apparently being very cautious. We respected his judgement, however.

CFE initially supplied low-capacity car batteries, and on two helicopter flights, we ran low on power and had to quit surveying. CFE later obtained four heavy-duty batteries, and there was no further problem.

The smoke problem was significant only for the High-Altitude survey because of the much smaller terrain clearance in the Low-Altitude survey. Navigation was very difficult in the High-Altitude survey because the horizontal visibility was at times less than 5 miles. It was not possible to see features far enough ahead to line up and fly toward them, and we were restricted to using navigation points more nearly under the plane. The quality to the video pictures which will be used to recover the flight path is significantly degraded in the High Altitude survey due to the smoke.

A brief summary of daily activities is as follows:

May 1, Sunday. Fly to Mexico City and ride to Morelia in CFE truck. Luggage, including part of equipment needed for survey lost by Delta between Salt Lake and Mexico.

May 2, Monday. Meet with CFE personnel at the Gerencia office to discuss survey plans. Meet with Hector Alonzo and Arturo Gonzalez of CFE to appraise them of survey plans. Magnetic equipment still in Mexican customs in Mexico.

May 3, Tuesday. Meet with CFE personnel at the Gerencia office. Magnetic equipment and luggage coming from Mexico (arrived late evening). In afternoon, drive to the Los Azufres area to view conditions from the ground and tour the area. Helicopter arrives in Morelia.

May 4, Wednesday. Install magnetic survey system in helicopter and make a test flight. System operating well.

May 5, Thursday. First survey flight for Low-Altitude survey over Los Azufres. Data quality good.

May 6, Friday. Second helicopter survey flight for Low-Altitude survey. Data quality good.

May 7, Saturday. Third helicopter survey flight for Low-Altitude survey. Data quality good. In afternoon, gave a demonstration of flight-path recovery using the video system at the CFE office.

May 8, Sunday. Day off. Attempted to drive to Paricutin, a volcano that was formed in a farmer's field in the 1040's. CFE loaned vehicle, with which we had some mechanical problems.

May 9, Monday. Fourth helicopter survey flight for Low-Altitude survey. Some electrical noise due to loose component in inverter (cause discovered after flight). Data usable but noisy. New helicopter pilot arrives.

May 10, Tuesday (Mother's Day in Mexico). New helicopter pilot communicates with previous pilot on the condition of the helicopter are determines that he does not want to fly it without repair. Transfer magnetic equipment to fixed wing airplane for High-Altitude Survey and perform test flight.

May 11, Wednesday. First flight for High-Altitude survey. Data quality good.

May 12, Thursday. Second flight for High-Altitude survey. Data quality good.

May 13, Friday. No approval for take-off due to limited visibility because of smoke. Worked on annotation of previous flight records.

May 14, Saturday. Fourth flight for High-Altitude survey. Data quality good.

May 15, Sunday. Fifth flight for High-Altitude survey. Data quality good. Transfer equipment back to helicopter, which has been under repair most of the week.

May 16, Monday. Attempt helicopter flight to redo some of the more noisy data from the last helicopter flight on May 9 and to observe some additional lines. Helicopter still does not operate well at high altitudes of Los Azufres (9000 to 12000 feet). After about 1 hour of trial flight, helicopter pilot determines that machine is not functional enough to survey. Remove equipment from helicopter and pack it for shipment back to the U.S. Fly to Mexico by charter.

May 17, Tuesday. Return to Salt Lake City. Luggage does not make the transfer in Los Angeles because of late arrival from Mexico and slow processing through U.S. Customs, which was totally inadequate to process passengers from the several arriving planes in any reasonable amount of time.

In addition to the activities detailed above, CFE treated us to dinner on one evening, and we treated some of the CFE people and wives to dinner on another evening. Those we took to dinner included Ramon Reyes and wife, Antonio Razo and wife, Hector Lira and wife, Oscar Campos, R. Huitron and wife, and others from the electronics shop and Razo's driver, who had donated his Sunday to picking us up in Mexico City and driving us to Morelia upon our arrival.

When we left Morelia, we brought back all of the video tapes except one, which was left for copying. The others had already been copied. We left the originals of all of the magnetometer records, which CFE is to copy and mail the originals to us. These records are difficult to copy well. When we get the originals, we will do some further annotation and make another complete copy. The Mexicans will also be mailing some maps. We made a list of all of the data documents we generated, their locations and current status and left copies of the list with CFE. We should therefore all be on the same wavelength. The Mexicans will be checking and compiling the magnetic data into maps for both surveys, and UURI will independently undertake the same effort. This will require several months. We plan to communicate throughout this process and be able to compare results before the GRC meeting. We agreed with the Mexicans that when the map making is complete, the originals of all data will be sent to CFE for permanent storage. They are much more likely to have the need to refer to the data in future years than we are.

As expected, we were very well received and hosted in Morelia. Our Mexican colleagues are very gracious hosts, and we appreciated all of the help, support and encouragement they gave us. We are looking forward to the compilation and interpretation of the magnetic data with them.