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November 19, 1997

Dr. Michael A. Minovitch
Phaser Telepropulsion
1888 Century Park East, Suite 1900
Los Angeles, CA 90076

Dear Dr. Minovitch:

I have enjoyed reading the materials you sent me on October 10, 1997. Although we have not met personally, I am familiar with your work and have followed the development of the elegant gravity-assist trajectories of the JPL planetary missions for many years. I came to JPL from U.C. Berkeley at the end of 1960, a few months before you came as a summer employee from UCLA. Your work became a topic of discussion among many of my colleagues then. All of us then recognized your contribution and we still do.

In your references, I was also pleased to see several citations of your contribution to the development of NASA/JPL missions by JPL including our Director at that time, Dr. William Pickering. He wrote "Six years ago, Minovitch first showed that planetary missions could be made more efficient by using near encounters with other planets to change the heliocentric trajectories. This so-called gravity assist technique is of great value for journeys beyond the planet Jupiter."

Both NASA and JPL recognized your contribution in 1972 by awarding you a NASA Exceptional Service Award with the citation: "For the first extensive development of the concept of gravity thrust trajectories for interplanetary flight. This work involved the basic numerical techniques for analyzing such trajectories and identified multi-planet flight opportunities for Venus, Mercury and Mars."

A more recent acknowledgment occurred in a 1989 JPL publication titled *The Voyager Neptune Travel Guide* stating (page 104) "Minovitch was the first to show how to design a trajectory to a target planet in such a way that a gravity assist could be obtained from that planet to go on to another planet."

I am sure you will agree that this small sampling clearly acknowledges the great value of your contribution. In addition, our Deputy Director, Mr. Larry Dumas, will have the documents you sent him archived at JPL for future reference and use.

Personally I hope that some day we will have an opportunity to meet and discuss old times.

With my best regards,

Sincerely,

A handwritten signature in black ink that reads "M. T. Chahine". The signature is fluid and cursive.

M. T. Chahine
JPL Chief Scientist