> "1965 Caltech graduate student Gary Flandro puts forward the idea of gravity-assist to reduce journey times to distant planets."

As in the case of all the other claims, this claim is not credible. The work that Flandro was referring to in the interview with Kerrod was actually assigned to him during the summer of 1965 by Elliot Cutting because Minovitch was not able to continue the work at that time.[147] (See Fig. 11.) Thus, Flandro began his work four years after Minovitch wrote his 1961 JPL paper and over two years after he gave his technical seminars on the concept to JPL's engineering staff.[208] As described above, Flandro was given both of Minovitch's JPL Technical Reports on gravity propelled trajectories where, on page 9 in the first Report, Minovitch explicitly claimed originality for proposing the concept that became known as gravity-assist trajectories by citing his 1961 JPL paper. The second Report contained the planetary configuration diagrams showing the relative positions of all the outer planets corresponding to various Earth-Jupiter launch windows. These diagrams made it possible to identify possible planetary encounter sequences by inspection without having to compute them. The third item that Cutting made available to Flandro was Minovitch's gravity propelled computer program (equipped with an extended ephemeris) to numerically compute the encounter sequences identified from the configuration diagrams that Minovitch also constructed. Thus, in actuality, Flandro's work during the summer of 1965 was "data processing" on a previously invented concept, using the concept and research tools that Minovitch invented and developed during the previous three years. Determining the numerical values of previously identified encounter sequences does not involve "discovering" or "inventing" anything. The Voyager 2 encounter sequence Earth-Jupiter-Saturn-Uranus-Neptune, and several other outer planet encounter sequences, were known and discussed at JPL during the summer of 1964 one year before Flandro was given his assignment. JPL lunar gravity pioneer William Sjogren commented on these interesting sequences in Minovitch's office, an exchange confirmed by one of our authors (Ridenoure) in a 1993 discussion with Sjogren at JPL. (See page 31 Ref. 2 and page 17 Ref. 118.) Minovitch originally identified these encounter sequences at UCLA during February 1962 prior to his numerical computations. (See page 5 Ref. 118 and pages 5-8 Ref. 2.)

Richard H. Battin

The first paper that Richard Battin wrote describing an Earth-Venus-Mars-Earth gravity-assist trajectory was entitled, "The Trajectory Problem As It Relates To The Mission For Interplanetary Flight."[209] This paper was part of a collection of papers published in a book entitled *Air, Space, and Instruments*, that was published in 1963. Battin claimed credit for discovering the first gravity-assist trajectory Earth-Venus-Mars-Earth in a 1994 paper[210] by asserting that the manuscript of the book was delivered to the publisher (McGraw-Hill) in 1961 but the publisher delayed publishing the book for over one year. He offered no supporting evidence to confirm this assertion. Quoting directly from pages 5 and 6 of his 1994 paper,[210] Battin states:

> "A volume of original contributions titled *Air, Space, and Instruments* was planned to honor Charles Stark Draper on his sixtieth birthday which would occur on October 2, 1961. Hal Laning and I contributed a chapter 17 on our trajectory work for interplanetary missions. Unfortunately, the actual publication of the Draper Anniversary Book was delayed by the publisher and it did not appear until early in 1963. ····Needless to say, I was most anxious to publish the result. Our chapter for the Draper Anniversary Book was already underway and the multiple fly-by orbit would provide a really dramatic climax for our contribution. I would have published it in a separate paper had I known that McGraw-Hill would slip their publication schedule for the Draper volume by more than a year."

A careful reading of the various papers published in that book reveal that the manuscript could not have been submitted before May 16, 1962. On page 72 of that book a reference (50) was made, *in the past tense*, to a paper[211] that was presented by the author (Herbert Weiss) at a Naval Research Conference during May 14-16, 1962.[212] Quoting directly from this reference that was published in the Draper book:

> "Foreseeable Changes in Operations Research Tasks, Techniques and Organizations, paper presented at the 20th Anniversary Conference on Operations Research sponsored by Office of Naval Research, May 14-16, 1962."

This provides conclusive evidence proving that the manuscript of the papers for the book was sent to the publisher by the editor (Sidney Lees) *after* this date. This is because the manuscript of the Draper book that contained Battin's paper, as well as all the others, was sent to the publisher (McGraw-Hill) by the editor of that book (Sidney Lees) as one entire manuscript. It was not sent one paper at a time. The editor collects the papers, and delivers them to the publisher at the same time in the order that they will appear in the published book. Therefore, references to papers published in 1962 obviously mean that the manuscript for that book could not have been delivered to the publisher in 1961. (A copy of the paper that Weiss submitted at that conference is provided herein.[212]) There are other papers in the book citing other articles and books published in 1962. (For example, see Ref. 74 page 73, Ref. 4 page 96, and Refs. 4, 5 page 445.) In addition, an investigation conducted by McGraw-Hill in 1997 indicated that the manuscript of the book was probably delivered between May and September 1962.[213, 214] Therefore, Battin's claim that the book containing his paper was sent to the publisher for publication in 1961 is not credible. Consequently, his 1963 paper[209] can obviously not be used as *documentary evidence* for establishing a date for Battin's claimed Earth-Venus-Mars-Earth gravity-assist trajectories predating Minovitch's August 23, 1961 JPL paper.

The fact that Battin did not make the invention can be proved conclusively. In 1962, Battin acknowledged Walter Hollister as having made the invention. As described above, Hollister used his claimed innovation for satisfying the important innovative requirement for a Ph.D. Dissertation in Battin's Department of Aeronautics and Astronautics at MIT. The fact that Battin acknowledged Hollister's claimed innovation can be established by the fact that he actually assisted Hollister compute his claimed bi-elliptical (gravity-assist) trajectories. Quoting

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