

## An Historical Note on Lambda Corporation, Hugh Everett III, and John Nash

Recently (March 2002), the website [www.cassiopaea.org](http://www.cassiopaea.org) (at page [www.cassiopaea.org/cass/adventures30.htm](http://www.cassiopaea.org/cass/adventures30.htm)) published some comments about some of the material at this website (<http://www.foundationwebsite.org>), and observations about John Nash, Hugh Everett, and Lambda Corporation. Some of the material referenced about Everett was from the website [http://www.geocities.com/capecanaveral/hangar/6929/many\\_world.html#everett](http://www.geocities.com/capecanaveral/hangar/6929/many_world.html#everett). The historical material presented at these sites is a little misleading in places, and the purpose of this note is to present a clarification.

The mathematical theory of global warfare that is presented at this website (<http://www.foundationwebsite.org>) was developed by the author (Joseph George Caldwell) while a member of the technical staff of Lambda Corporation in Arlington, Virginia, over the period 1967-1972. Lambda Corporation was founded by Dr. Hugh Everett III, a brilliant American physicist who is noted for two major contributions to modern scientific knowledge. In the realm of theoretical physics, Everett proposed the “parallel universe” theory (“many worlds” interpretation of quantum mechanics) to explain the behavior of elementary particles. The parallel-universe theory is much cited and debated in the realms of theoretical physics (e.g., [The Economist](#), January 5-11, 2002, “A Survey of the Universe,” page 56), but it has also been heartily embraced by the “New Age” community in recent years (e.g., [Parallel Universes: The Search for Other Worlds](#), by Alan Wolf).

In the realm of mathematics, Hugh Everett developed the theory of Generalized Lagrange Multipliers. The

mathematical theory of Lagrange multipliers was developed a long time ago, as a method for finding stationary points (e.g., maxima, minima) in the case of differentiable functions. This theory is presented in many textbooks on mathematical analysis and optimization (e.g., Apostol, Mathematical Analysis; Karlin, Mathematical Methods and Theory in Games, Programming, and Economics, Vol. 1; and Vajda, Mathematical Programming). Many practical problems, however, involve discontinuous or nondifferentiable functions (e.g., integer-valued functions), and the theory as presented in most textbooks cannot be applied. Everett's tremendously significant contribution to applied mathematics was the extension of the methods of Lagrange multipliers to the case of nondifferentiable, noncontinuous, nonconvex functions. His seminal paper on this subject is "Generalized Lagrange Multiplier Method for Solving Problems of Optimum Allocation of Resources," Operations Research, Vol. 11, No. 3, May-June 1963, pp. 399-417.

Although better known today for his parallel-universe theory, the extension of the theory of Lagrangian optimization to noncontinuous functions is, in my opinion, of much greater practical significance. The Generalized Lagrange Multiplier (GLM) method was the basis for all of the leading optimizing war-game models in the 1960s and 1970s. Because of the very substantial increase in usefulness of the Lagrange multiplier method for solving constrained optimization problems, the Lagrange multipliers in such problems are often referred to as Everett's multipliers, and the methodology is referred to as the GLM method or Everett's method.

The four founders of Lambda Corporation were Hugh Everett III, Dr. George E. Pugh, Dr. Lawrence B. (Larry) Dean (who worked on the Manhattan Project), and Dr. Robert J. (Bob)

Galiano. George Pugh and Hugh Everett collaborated on extension of the GLM method to the case of two-sided constrained optimization problems, which includes the realm of mathematical games. Their articles on this are found in later issues of Operations Research. Prior to forming Lambda Corporation, these men worked for the Weapon Systems Evaluation Division (formerly Weapon System Evaluation Group, and known as WSEG, pronounced “wessig”) of the Institute for Defense Analysis (IDA), in the “paperclip” building on the Virginia side of the Potomac River. Lambda’s offices were first at 1401 Wilson Boulevard in Arlington, Virginia, and later at 1501 Wilson Boulevard.

Lambda Corporation grew rapidly until the early 1970s. With the advent of massive spending on the Vietnam War, and the “Great Society” welfare programs, defense budgets became tight, and the firm was eventually absorbed by General Research Corporation (formerly Defense Research Corporation) of McLean, Virginia.

In its heyday, Lambda did much work for the Pentagon. One of its clients, Dr. Ivan Selin (one of Secretary of Defense Robert McNamara’s “whiz kids”) founded (with Charles Rossotti, now head of the US Internal Revenue Service) the well-known management-consulting firm, American Management Systems (AMS). As defense budgets shrank, Lambda moved into other areas of consulting. It did some contract work for AMS. About 1970, Lambda was awarded (from Merck & Company) the largest private operations research contract ever awarded, to conduct an analysis of the economic feasibility of modular manufacturing methods for production of chemicals and pharmaceutical drugs. The work at Lambda was always stimulating. I recall a discussion at one time between Hugh Everett and Dr. John Y. Barry (of Merck; also credited by Nelson Dunford and

Jacob Schwartz' as having solved all of the exercise problems in their classic text, Linear Operators) concerning whether the Brauer fixed-point theorem or the Kakutani fixed-point theorem applied to a particular problem.

Hugh Everett left Lambda Corporation in 1972 or 1973, and formed a database design firm with Dr. Don Reissler. I moved from Virginia in 1981, and lost track of the rest of the Lambda "alumni." (In the event that someone is interested in researching some more history of Lambda Corporation, some of the names of staff who were there while I was are Fred Miercort, Larry King, Jim Bick, Dennis Eisen, Stan Dick, Tom Schreiber, Tom Muench, Ken Willis, Bob Titchen, Bob Goodrich (of Forecast Master), John ("Jim") Mayberry (of Princeton, Mathematica and Brock University), Paul Flanagan, Gary Lucas, Alan Penn, Adolph Hendrickson, Herb Miller. Neil Killalea, who later formed Killalea Associates) was director of personnel, and recruited most of the technical staff. Arthur O. ("Duke") Wooldridge was financial controller.)

Hugh Everett died in 1982. Neil Killalea wrote a nice eulogy, but I no longer remember where it was published. Someone once noted that Hugh Everett should have been declared a "national resource," and given all the time and resources he needed to develop new theories. Larry Dean died in the 1970s, as did Bob Galiano. I lost track of George Pugh.

Lambda Corporation's specialty was solving constrained optimization problems, especially two-sided optimization problems, such as occur in warfare. Lambda developed the Quick General War Game Simulator for the Department of Defense. Many of the applications involved mathematical game theory, and in particular, the solution of resource-constrained games. That is the area in which I worked much

of the time. And this brings us to John Forbes Nash. Nash's significant contribution to game theory is the specification of the "bargaining solution" of a nonzero-sum (general-sum) game. As elegant as this solution is, its practical value is limited because of the fact that it is a "nonconstructive" solution. He specifies conditions that both players would agree to (the "Nash equilibrium"), but he does not show how to find that solution. One of the problems that I worked on while with Lambda Corporation was that of finding a method of finding the Nash bargaining solution, in the case of conflict between two parties. I was able to find a very general method for finding an approximation to the Nash bargaining solution to a general sum game -- the paper presenting this result is included on this web site.

Unlike the situation for Everett, about whose life relatively little is known to the general public, very much is known about John Nash. His life is the subject of the book and recent Academy-Award-winning film, A Beautiful Mind.

The Cassiopaea web site implies some sort of conspiracy concerning the death of Hugh Everett at a relatively early age (52). I worked and socialized with Hugh for five years, and I find the case for a conspiracy weak. Hugh was overweight, and a chain smoker. He also enjoyed alcohol. In view of his lifestyle, it is not remarkable that he died at an early age. Larry Dean died of brain cancer. I have forgotten what Bob Galiano died of – as I recall, it was an unusual disease. I worked and socialized with these people on a day-to-day basis. Every Friday afternoon was "Sherry Hour" at Lambda Corporation. Once a month we had a "pot luck" square-dance dinner. Once a month we played poker in the Lambda poker group, which evolved from the WSEG poker group. There was an annual Lambda family picnic. Hugh and Fred Miercort bought a beach condo in Charlotte Amalie

in the US Virgin Islands, and a number of us stayed there. Hugh was married to a very pleasant, down-to-earth lady. Hugh Everett was brilliant, and energetic, and he enjoyed life very much. He really enjoyed solving difficult problems. He enjoyed game theory (differential games, resource constrained games), strategic analysis, and poker. His home had an indoor swimming pool. He drove a long black 1964 Lincoln Continental, and enjoyed eating in fine restaurants. He enjoyed taking pictures with the microfilm camera that he always carried in a small case attached to his belt. He smoked his cigarettes with a filter, had long, swept-back black hair and a mustache/goatee, which he stroked while reviewing his poker hands. It is often very difficult to "prove a negative," but in my opinion, Hugh Everett probably died from an indulgent lifestyle, not because of some alien conspiracy.

Joseph George Caldwell. Drafted 6 April 2002 (minor changes 28 April 2002).

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