

Camarillo, California

November 1952

First Simulation Council Newsletter

39 representatives of 13 organizations met at the Colonial House in Oxnard Friday evening, 7 November 1952, to discuss the formation of an association for simulation.

After dinner in the Saratoga Room, John McLeod of NAMTC led a discussion covering the purpose of the meeting, the objective of the proposed association, and ways in which the objective might be accomplished.

The official objective of the organization, as determined by the group after some discussion, will be "to increase the effectiveness and broaden the application of simulation".

A five-point proposal, which had been distributed for criticism, was then considered. Point 1 of the proposal suggested "that those of us who are sufficiently interested to contribute some time and effort form an organization which might be called the Analog Simulation Council". After considerable discussion and two hand votes, "Simulation Council" was selected as the name best expressing the scope and method of operation of the desired organization. It was felt that longer or more descriptive names, including "Analog" or even "Computation" might discourage consideration of simulation in its broadest aspects.

During discussion of the second point, which suggested "that this be a small group, limited to those who are willing and able to make concrete contributions to the art", it became apparent that there was much more interest among those present in attending monthly meetings of the Council than had been anticipated. Therefore it was decided that the suggested small group be a five-man "steering committee", to be selected at each meeting for the succeeding meeting. This committee would be responsible for selecting the time, place, and subject for the meeting. Individual members of the committee would either lead a round-table discussion on the subject of the meeting, or present an "authority" on the subject to participate in the discussion. Other members and guests of the Council are expected to take part to the limit of their interest.

These decisions were implemented by the selection of John McLeod, NAMTC; Rick Anderson, J. B. Rea Company; Albert Fulton, Hughes Aircraft Company; Walt Mitchell, NEL; and Lee Cahn, Beckman Instruments; as the steering committee for the next meeting.

Point three, which suggested "that the unclassified proceedings of this group be published in the form of a newsletter for all others who care to subscribe", seemed to meet with general approval, but questions were raised as to who would do the work and who would pay the expenses.

John McLeod stated that he was interested enough in the objective of the Council to do the necessary work, with the help of his wife Suzette, who is acting secretary for the Council. In addition, he stated that he would pay the postage and other expenses necessary to produce and distribute the first three issues of the Newsletter, to see if this method of disseminating simulation information has sufficient merit to warrant its continuation. He added that with the third issue, members of the Council would be billed for a one-year subscription at a cost estimated to just cover expenses of production and mailing. If members fail to subscribe, distribution of the letter will be discontinued.

Point four of the proposal, "that in addition to the proceedings of the working group, other information of interest to subscribers be included in the newsletter", was not discussed at length because it was felt that the contents of the Newsletter would evolve from the progress of the Council and material available.

In discussion of Point Five, "that symposia be arranged if and when a sufficient number of suitable papers are available, or at least once a year, so that we can get to know each other", it was mentioned that the IRE Professional Group on Computers holds symposia on the third Thursday of each month, but that they are concerned almost exclusively with digital computers, or computers as mathematical machines, rather than with simulation. Another group, which has held meetings at Rand, Hughes, and J.P.L., seems to have interests more like those of the Council, but heretofore has apparently been composed only of REAC users. It is understood that their next meeting is scheduled for 7 January at NBS in Corona.

The unexpected interest shown by those at the Oxnard meeting in attending monthly Simulation Council meetings made unnecessary for the present a final decision on whether to hold Simulation Council symposia.

The meeting, which did not get started until 9 o'clock because of a late - but very good - dinner, was adjourned at about 10:40.

List of Those Attending the First Simulation Council Meeting

Beckman Instruments, Inc.

Lee Cahn

Computer Research Corporation

R. Douthitt

Glenn L. Martin Company

Floyd E. Nixon

Globe Aircraft Corporation

E. T. Mahar

Goodyear Aircraft Corporation

R. Mayne

L. E. Stilwill

G. A. Wiley

Hughes Aircraft Company

R. Favreau

A. S. Fulton

H. Low

B. D. McVey

List of Those Attending the First Simulation Council Meeting (cont'd)

J. B. Rea Company

E. Ackerlind
R. S. Anderson
J. B. Rea

Naval Electronics Laboratory

H. Englander
F. Fisher
D. M. Lowe
W. P. Mitchell

Naval Air Missile Test Center

W. Abern
E. D. Bush
R. Chapin
R. Gilpin
O. LaPlant
J. McLeod
S. McLeod
J. Pappas
J. Pollard
W. Sedlacek
J. Sherman
D. Teague
W. Uplinger

Northrop Aircraft Company

R. M. Hendrickson

Rand Corporation

E. H. Jacobs
C. Nisson
L. L. Philipson

Snow Electric Company

L. A. Snow

University of Southern California

R. L. Baddorf
R. D. Chamorro
E. J. Jagger

Summary of Decisions Reached at Founding Meeting

of the Simulation Council

1. An organization was formed, to be called the Simulation Council.
2. The nucleus of the Simulation Council is to be a five-man steering committee. The membership of the steering committee and the subject for discussion are to be selected at each meeting for the following meeting. Members selected should be qualified to discuss the particular subject for their meeting, or should invite a guest qualified to take part in such a discussion. These meetings are to be unclassified so long as the subject matter permits, and will be held approximately once a month. All members of the Simulation Council and guests are urged to attend and participate.
3. A summary of the discussions of the meetings will be experimentally distributed in the form of a newsletter for the first three months. With the third issue members will be billed for a yearly subscription. If enough people subscribe, or get their company libraries to subscribe, the Simulation Council Newsletter will succeed. If not, another means of disseminating information will have to be found.

4. Other interesting simulation material will be included in the Newsletter as it is made available by Council members.

5. The desirability of formal symposia will not be settled until (1) We see how membership participation discussions led by the steering committee work out; and (2) We see what other organizations are doing in the field of simulation.

Steering Committee Announces Next Meeting

Immediately following the organizational meeting Friday night the Simulation Council Steering Committee got together and made plans for the next meeting. It was decided that the J. B. Rea Company would arrange for a meeting at the Institute of the Aeronautical Sciences, 7660 Beverly Boulevard, Los Angeles, at 1 P.M. on Wednesday, 3 December 1952. The subject for discussion will be FUNCTION GENERATORS, and each member of the steering committee will be expected to discuss some aspect of the problem of function generation - or bring a guest who can do so. Other Simulation Council members are urged to attend and contribute what they can: questions, answers, or just remarks!

YOUR QUESTIONNAIRE - PLEASE fill in and return immediately to John H. McLeod, Jr.
P. O. Box 731
Camarillo, California

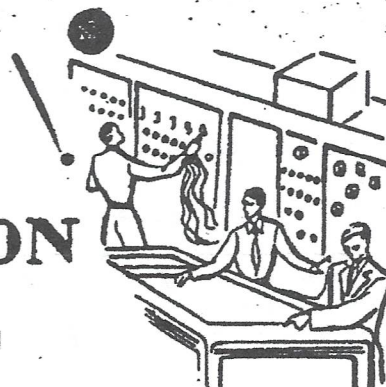
It was decided at the founding meeting of the Simulation Council that all members and others who may be interested in simulation in any of its ramifications be asked to write in their interests. To aid you in this, the Steering Committee has drawn up the following questionnaire, which it will be necessary for you to fill out if we are to have good meetings.

1. How do you happen to be interested in simulation? (I find it interesting; or, I am in the Simulation Branch of my company; or, my company makes simulation equipment; etc.)
2. In what aspect of simulation are you most interested? (Analog computers, digital computers, flight tables, etc.)
3. What topics would you like to have discussed at future meetings? (Multipliers, plotting boards, patching system, etc.)
4. On what subjects could you contribute to the discussion?

YOUR NAME AND ADDRESS _____



THE SIMULATION COUNCIL



Camarillo, California

Second Simulation Council Newsletter

December 1952

Function Generators Discussed at the December Meeting of the Simulation Council

Function generators, those imperfect gadgets used to introduce non-linear variables in analog computation and simulation, were cussed and discussed by people who make them and people who use them. The occasion was the second meeting of the Simulation Council, which was held at Truman's Restaurant in Westwood on the afternoon of Wednesday, 3 December.

The following is an incomplete and possibly inaccurate account of that meeting. The remarks attributed to participants in the discussion are not necessarily what they said; they are what we thought they said. If we are guilty of misquoting, or if anyone thinks that their remarks do not convey the correct impression out of context, or if in retrospect they think of something that they wish they had said, they are urged to send comments to the Newsletter. They will appear in the next issue after receipt.

After a good lunch, the meeting was opened by John McLeod (Naval Air Missile Test Center), Chairman of the Simulation Council Steering Committee, who stated that in his opinion the Simulation Council should not be allowed to become a one-man, one-organization, or one-interest group; that representation should be at the working level and well distributed among producers and users of simulation equipment and others interested in the field. He then turned the meeting over to Dr. Rea (the J. B. Rea Company).

Jim Rea got things off to a good start by asking everyone in turn to stand and introduce himself and give his affiliation. A tabulation of the 37 persons who responded indicated that 15 organizations were represented. He then stated that his company was organizing a course to be given at UCLA on automatic control systems for aircraft and guided missiles, and gave the names of speakers and their subjects. These are listed elsewhere in this Newsletter. The meeting was then turned over to Rick Anderson (the J. B. Rea Company), who introduced J. R. Shull (the J. B. Rea Company) as his company's project engineer on their University of Chicago Advisory Board on Simulation contract.

Bob Shull gave the informal explanation which appears under the heading "Need for Function Generators in Aircraft Simulation Work" in this Newsletter. When Bob finished his talk, Rick again took over with a brief discussion of some methods of function generation. Some of his opening remarks are summarized in this Newsletter under the heading "Bi-Variant Function Generators".

Many then participated in a very informative discussion, which revealed that not only serious thought but some very constructive work had been devoted to function generators by those present.

Rea suggested that everyone contribute the names of people they think are doing fundamental work on function generators.

Olds (NOTS, China Lake) has heard of the Smuckler Company (A. F. Smuckler & Co., Inc., 202 Tillary St., Brooklyn 1, N.Y.??) in this connection, but he has been unable to get further information.

Douthitt (Computer Research Corp.) briefly mentioned some work his company is doing. He will be given an opportunity to amplify his remarks and demonstrate equipment at a future meeting - as will anyone else who can contribute.

Leggett and Helfrich (Douglas) described their bi-variant function generator (i.e., one generating an output voltage z as a function of two independent arbitrary variables, x and y), in which a multi-tapped potentiometer (borrowed from Rand until they get 17-tap ones from Fairchild) is used with a switch and padding resistors to give non-linear interpolation between three curves of a family. This seems similar to the method described in Korn & Korn.

John McLeod told of work on bi-variant function generators in progress at NAMTC. Apologetic because his information was only qualitative - "if you can't measure it you don't know much about it" - he described his method as "quick and dirty" - quick if you already have a Reeves cam cutting lathe and dirty in that it is not even theoretically rigorous. In this method any number of a family of curves, representing the variation of z with x for discrete values of y , are cut into the cylindrical cam of a Reeves function generator and filled with conducting paint as furnished with printed circuit kits. The cam is then masked except for the area representing the values of the independent arbitrary variables, x and y , and coated with a semi-conductor. Resistor paint from printed circuit kits has been used, and mono-molecular coatings deposited chemically and by metallic evaporation are under investigation.

Biasing resistors adjust the voltages on the individual curves to represent the values of y for which they stand, and the voltage representing z is picked off the surface by a probe connected to any high input impedance measuring device. The result is an almost linear continuous interpolation between the curves which shows promise of being good enough for some applications where the curves do not cross or converge sufficiently to cause hot spots from excessive current flow.

Hussey (Beckman Instruments) remarked that this method is related to that wherein the cross-section of an airfoil is cut out of a sheet of semi-conductor and a potential placed across the remainder so that the current flow is analagous to the airflow around the foil.

Jim Rea observed that this is similar to an electrolytic tank and that Dr. Soroka at UC, Berkeley, has done similar work using conducting paper.

Rick asked if anyone has tried to use Reeve's Input-Output table with a potentiometer card riding on more than one wire of a family of curves.

This has been done at Rand. Others volunteered that they had tried it but found it difficult to maintain contact. Cook (NBS, Corona) has successfully used

a non-standard backing of sponge rubber. McLeod has heard that Markite conductive plastic is good for the purpose.

Rick then introduced Lee Cahn (Beckman Instruments), who demonstrated the EASE function generator (page 5).

* * * * *

After the demonstration, McLeod stated that some feel equipment manufacturers should be excluded from Simulation Council meetings so that users can discuss the shortcomings of their equipment frankly. Mac disagreed on the grounds that anyone worthy of staying in business will appreciate frank talk, and that the user will benefit from improved equipment.

Rick then got the meeting down to cases by asking what users have found out about the Reeves function generator.

Helfrich volunteered that he had heard complaints about preparing and adjusting the slides, but that they have the entire process reduced to 15 minutes with standard Reeves equipment and would buy the same photographic equipment again. The bottleneck is calibration, for which line voltage must be stabilized.

Hussey mentioned the error caused by halo around the spot. Helfrich agreed that the halo causes the spot to jump sharp peaks and valleys, in which case they resort to manual tracking.

Rick next asked about the William Miller function generator.

Greenwood (Lockheed) said that their Miller equipment works well; that in most physical systems the curves are not sharp enough for the halo to cause trouble. Only trouble is the system for returning lost beam to curve, and that is not basic. Getting slides is slow because they must go through their photographic department.

NAMTC is preparing to cut masks directly from curves with a pantograph engraver.

Rick then asked for criticism of the Beckman function generator. No one present had one, so Cahn volunteered that four have been ordered by Wright Field, and that we will soon know. In answer to criticism of discontinuity in cases of differentiation, he explained that break points are not sharp because the diodes take $1/4$ to $1/2$ volts to cut in.

In answer to Rick's request for general comment on available function generators, Burke (J.P.L) said that their criticism is based on accuracy and need of adjustment. Because of problems wherein a missile must be guided many miles to within a few feet of a target, they must be able to turn on equipment and get 1/10% accuracy without adjustment after the original setup. Therefore, they are developing digital equipment to handle function generation and multiplication for their otherwise analog simulation.

Rick asked for comment from digital people; Douthitt replied that he did not know how well their present equipment will tie in with analog installations.

This general problem will be the subject of a future Simulation Council meeting.

Rick asked what we would like in a function generator.

Leggett wants a generator that is stable, accurate to 1/10%, able to set up a new function in 15 minutes, and to store and replace functions easily. Olds wants to be able to adjust the function during a problem to facilitate working backwards, i.e., determining cause from effect, or "curve fitting". One part of the curve should be adjustable without affecting the rest. Knudsen pointed out similar requirements for wind tunnels: Rick would like a calibrated adjustment. Knudsen's question, "How fast is fast for a function generator?" was answered, "50 cps - to be compatible with other components."

The above is only a sample of the way the discussion went on for approximately three hours. If you would like a better idea of how interesting such a meeting can be, come around sometime. Bring your own secretary if you want better reporting (or companionship).

Let's Have More Info!

Function generators got a pretty good going over at the meeting, but there's lots more that can be said. The Newsletter would like to continue the discussion in its pages. If anyone can add anything, or knows of anyone who can, please write us. Like everything else, the more you put into this thing the more you will get out, so please do your part and drop us a line.

Bi-Variant Function Generators

At the December meeting of the Simulation Council Rick Anderson described two methods of function generation which may not be familiar. The first was developed by Professor G. D. McCann of Cal. Tech., and the second by Mr. E. A. Goldberg of RCA.

Professor McCann's method requires that the function be of a form which can be represented as a product of some functions of single variables. Then the function can be generated in an analog computer by two uni-variant function generators and an electronic multiplier. Actually Cal Tech has found it necessary to use only one function generator, because in every practical case so far it has been possible to generate the bi-variant function as a product of one variable and a function of the other variable.

The function generator developed by RCA is, essentially, a cascade of electronic flip-flops with successively greater bias on each element. A diode matrix prevents more than one element of the cascade being "on" at any time. The varying input voltage causes successive elements to turn "on". When these are connected to the input resistors of a standard operational amplifier a curve is generated by a series of straight-line segments, similar to that produced by a biased diode function generator.

It is possible to represent a bi-variant function by a combination of such flip-flop cascades, one for each of the independent variables. A linear interpolation between points chosen by the bias settings generates the function. It is possible to represent functions whose slope goes negative in some regions by cross-connecting to the amplifier.

Details of this function generator, included in a secret report issued under subcontract No. 4 of AF 33(038)-15068, claim an accuracy of 1/2%. However, approximately five vacuum tubes per segment of curve are required.

Steering Committee Discussion

The five members of the Simulation Council Steering Committee - Rick Anderson (J. B. Rea Company), Lee Cahn (Beckman Instruments, Inc.), Al Fulton (Hughes Aircraft Company), John McLeod (NAMTC), and Walt Mitchell (NEL) - got together at the second Simulation Council meeting to discuss the future course of that organization:

Membership of the Steering Committee

It was suggested at the founding meeting that the membership of the Steering Committee might be selected at each meeting for the following meeting. The idea was that members could be selected who were particularly qualified to lead a discussion on the subject selected for that meeting. However, the work done by the Steering Committee in preparation for the second meeting indicated that more stability of membership would be desirable. It was therefore decided that the present members will continue to serve until sufficient experience is gained to allow formulation of a reasonable plan for rotating membership. One new member each meeting might be advisable.

Formality of Organization and of Meetings

It was unanimously decided that the Simulation Council should be kept as informal as it is now - no charter, no by-laws, no officers, and no dues. Meetings should be opened by one or more informal discussions of the selected subject and continued as a free-for-all discussion. Only sufficient restraint should be exercised to keep this technical bull session on the selected (or a reasonably related) subject. The Newsletter will be kept in the same vein in order to encourage questions and comment by all who are interested in Simulation instead of just those who can speak with authority.

Sponsorship

The desirability and disadvantages of sponsorship were discussed. Sponsorship by a government activity would facilitate travel to the meetings by government employees, but would probably snarl all our efforts in red tape. Affiliation with a professional society might add prestige, but prestige is not our objective. And it would give us a means of publishing formal papers, but formal papers - invaluable though they may be - are not our objective either. Such papers are usually the result of some unique accomplishment. To serve its purpose, the Simulation Council should be concerned with the ground work, the problems and solutions, the people and the equipment that make these accomplishments possible.

Sponsorship by one of the member organizations might give us a meeting place, but one of the advantages of our present system of rotating the meeting place is that we are able to see what is going on at other establishments. Or it might defray the expenses of the Newsletter, but these are so little that if it can't pay its own way it should be discontinued anyhow.

Function Generator Demonstrated at Second Simulation Council Meeting

The Beckman EASE Function Generator, which approximates arbitrary functions with 22 straight-line segments, was demonstrated to members of the Simulation Council at their December meeting. The slope of each of the 22 segments may be adjusted continuously and independently, both positive and negative. The value of the input voltage for which each segment begins to become effective is fixed in one design, and independently variable in another. Setting up is straightforward, since adjustment of any segment does not affect adjustment of previous segments. Once set, functions remain stable and do not need to be readjusted. Phase shift is small up to 100 cps. A wide variety of characteristics can be set up on this function generator, including those with several points of inflection. The fixed base unit sells for \$300, and the variable-base one for \$400.

Need for Function Generators in Aircraft Simulation Work

Bob Shull (J. B. Rea Company) gave a very interesting talk on the application of function generators in simulation at our December meeting. He began with a discussion of the source of non-linearities, including the operation of aircraft control surfaces which are multi-variant functions. Bob considered resolvers and multipliers as special types of function generation and then went on to describe the complications involved in helicopter analysis. Helicopters exhibit many of the non-linearities of other aircraft plus many more peculiar to themselves. For instance, the rotor can simultaneously operate with the inboard portion in a stalled condition and the central portion in normal flight while the tip is in the compressibility region.

Control surface stops and the torque and velocity limitations of actuators introduce non-linearities, as do backlash and friction. Bob also discussed the effects of non-linearities caused by the saturation of computer circuits and the characteristics of sensing elements.

Unfortunately, space - and our comprehension - do not allow us to cover the subject as well as Bob did. However, those at the meeting certainly appreciated his talk which contributed so much to the interesting discussion which followed.

J. B. Rea Company Visited by Members of the Simulation Council

The J. B. Rea Company was host at an inspection of their facilities by many Simulation Council members preceding the luncheon and December meeting of the Simulation Council.

Besides being shown through the offices and shops, the visitors were given interesting talks on the projects handled by the company by the responsible project engineers.

Jim Rea told of the history and aims of the company. Rick Anderson described their project to produce a book "Automatic Aircraft Systems", and Maier Margolis explained the application of digital computing techniques to automatic flight control. Walter Hinds and Richard Walton described a helicopter stability analysis; then E. E. Noneman explained an automatic hovering control for rotary wing aircraft which the company is developing.

L. G. Campbell told of a contract to adapt the analysis methods and testing procedures used for aircraft to the underwater torpedo field; J. R. Shull explained a cruise control project, and the interesting visit was concluded by a trip to the laboratory, where James Mitchell described the company's present capabilities and future plans.

Organizations Represented At the December Meeting

Beckman Instruments, Inc.
Bendix Computer Division
Computer Research Corporation
Douglas Aircraft Company
Hughes Aircraft Company
J. B. Rea Company
Jet Propulsion Laboratory, Cal Tech

Wallind-Pierce Corporation

Lockheed Aircraft Corporation
Marquardt Aircraft Company
National Bureau of Standards, Corona
Naval Air Missile Test Center, Pt. Mugu
Naval Electronics Laboratory, San Diego
Naval Ordnance Test Station, China Lake
Rand Corporation

UCLA Course

Because all details of the course mentioned on the first page of this Newsletter have not been settled, the list of subjects and speakers will appear in the January issue instead of this one.

Meetings

There will be no January meeting of the Simulation Council because many of the members plan to attend the meeting to be held Wednesday, 7 January, at the Corona Laboratories of the National Bureau of Standards. However, there will be a January issue of the Newsletter.

MULTIPLICATION IN SIMULATION will be discussed at the February meeting of the Simulation Council, to be held at the Hughes Aircraft Company. The date will be announced in the January Newsletter.

The RDB is sponsoring a symposium on the application of information theory to guided missiles under the auspices of JPL, Cal Tech, on 2 and 3 February.

The Joint Computer Conference Committee of the Institute of Radio Engineers and the American Institute of Electrical Engineers has scheduled the first meeting of the Western Computer Conference at the Hotel Statler in Los Angeles for 4, 5, and 6 February.

Subscriptions to Newsletter requested

All who are interested in the objective of the Simulation Council - "to increase the effectiveness and broaden the application of Simulation" - are requested to support its work by subscribing to The Simulation Council Newsletter. There are no other dues or obligations of any kind connected with any organization's or individual's affiliation with the Simulation Council. The cost of producing and distributing the Newsletter, and any incidental expenses in connection with meetings or other activities of the Council, must be covered by your subscription.

Your next issue of the Newsletter will be sent to you free, whether you subscribe or not. However, to assure receiving your February Newsletter (in fact, to assure that there is a February Newsletter) please send, or have your library send, \$6.00 for one year's subscription to the Simulation Council, Post Office Box 731, Camarillo, California. Make checks or money orders payable to the Simulation Council.