Do you believe that we are being overtaken in the race for technical supremacy? Do you believe that this endangers our national sovereignty, our independence, our way of life? I do, and I am not given to pessimism. In fact, I am not pessimistic now, because I believe there are several things we can do about it. But it will take some doing!

Your Ed. does not have any facts that are new and different. You all know them. But sometimes it helps to take a few recognized facts and lay them out orderly like so we can see the whole picture—and where we fit into it.

In the light (or darkness) of the world situation there are a few prime facts which, taken together, reveal an intolerable situation:

(1) We must maintain military supremacy.

(2) Military supremacy depends upon technological supremacy.

(3) Technological supremacy depends upon technically trained people.

(4) The USSR is training a greater number of technical people than we are.

It doesn’t take computer logic to see the penwriting on the chart!

Is there something wrong with my facts? Let’s hope there is, and in that hope examine them more closely.

Must we maintain military supremacy? I think that for the foreseeable future you will agree that it is imperative. While praying that we never have to use it, we must maintain it, or our diplomats (some may say I use the term loosely) will be completely helpless.

The fact that modern military might depends on technological supremacy is incontestable.

There is likewise little room to question facts three and four individually, but, taken together they not only justify our hope but clearly indicate what must be done! Truly, technological supremacy does depend on technically trained people, but not necessarily on the number of technically trained people. If, while doing everything in our power to increase the number, we can also increase the quality of the work and the quantity of the output, we can prevail over a sheer numerical advantage.

Again, I have nothing new and different to offer, but suggest that we consider the total effect of pressing several simultaneous attacks on the problem.

First, let’s consider how more technically trained people might be made available. The obvious answer is to train more. This must be done, but first we will have to make technical jobs and the required scientific studies more attractive. Every company which is now crying for engineers and which expects to be in business ten years from now should arrange a traveling technical exhibit to be shown in high schools, even in grammar schools, for the express purpose of encouraging students to enter technical fields. And representatives of these companies—as well as all who are interested in the future of our country and a higher standard of living—should take every opportunity to address service clubs and other non-technical groups to extol the advantages of a scientific career. We are sold on it, or we wouldn’t be in it. (Or is it the high pay?) So let’s tell the school kids and all those people who might have school kids.

But education is for the future. A less obvious but more immediate way to increase the number of technically trained personnel is to modify some of our employment practices. Prejudice (or inertia) keeps many technically trained women in menial work, or discourages them so that they turn to “safety pins and bangles.” No secondary sex characteristic involving aptitude for technical work has ever been substantiated. And making part-time jobs available would help. Many technically trained women with homes and children to take care of would welcome an opportunity to escape to the peace and quiet of an office for a part of each day. Part-time jobs would probably be attractive to older men too—those
who have been forced to retire or who have been told by their doctor to slow down. These men, used to an active life, need something to keep them interested. And their experience would make them really valuable.

We should do something about the technically trained people in jobs which fail to make full use of their technical training. Engineers should engineer, and scientists and others should do the work for which they were trained. Management which permits an organizational structure that burdens technical personnel with more and more administrative work as they ascend the ladder are fostering a system which can often severely limit the organization's technical capabilities. All too often management finds that a promotion intended to reward a deserving engineer has not only deprived them of his technical know-how but has gotten them a poor administrator besides.

There are exceptions; I know; there is nothing inherently incompatible about technical and administrative ability. However, because the training required to make a good engineer is different from that required to make a good administrator, the man who does equally well in both capacities is too rare to justify an organizational structure predicated on his kind being in plentiful supply. I also realize that there are jobs which require the administrator to be technically trained. In these cases the organization should be such as to make the most effective use of the man's technical capabilities by providing adequate staff assistance. With technical people in short supply it is ridiculous to have them typing their own memos, answering the phone for others, doing their own expediting or other legwork, or in short doing anything which can be done by others and which is less important than their technical work.

Having considered possible means of (1) increasing the number of technically trained people available, and (2) directing more of the effort of those now employed into technical channels, let’s turn our attention to increasing the quality and quantity of the effectiveness of the work of all technically trained personnel. Though your Ed. believes that all possible pressure should be brought to bear on the problem, it is this latter attack which, I believe, will yield the greatest returns for our efforts. Here we have precedent to guide us; we can learn from the experience of management in their spectacularly successful effort to increase the effectiveness of the industrial worker. They gave him better and more powerful tools and taught him how to use them. In return the worker gave to all of us the highest standard of living the world has ever known.

Fortunately, we are now in a position to give the technical worker better and more powerful tools—and the results should be even more important than the Industrial Revolution. The better and more powerful tools are, of course, the equipment and techniques for machine computation. And the reason for the greater importance is that they will not only help us to accomplish our primary objective—that of increasing the technical man's capabilities—but they can also be applied to machine tools to increase their capabilities. Thus they all compound their effect. This will take some doing, for it will entail a prodigious educational effort. Computer manufacturers are ready and eager to supply the computers. But management must be taught their value, scientists must be educated in their use, and technicians must be trained to install, maintain, and repair them. This won't be easy. The equipment is expensive, and those with enough experience to teach its use are few.

To give some insight into the problem, let me quote from a letter received from J. N. Macduff, Professor of Mechanical Engineering at Rensselaer Polytechnic Institute:

"I have been reading with considerable enjoyment, interest and hope your Simulation Council Newsletters in Instruments and Automation magazine. It is a pleasure to be able to absorb technical information without having to wade through several tons of stuff-shirted English.

"My interest and hope in your project arises from my plight in attempting to teach Mechanical Engineering students in the general area of Serendipity*, Mechanical Controls, Design, Mechanical Vibrations, and Use Your Head.

"*The knack of finding that which is not specifically searched for, particularly something pleasant or beneficial.—ED.

Our system is closely coupled with the usual academic situation of practically no budget, infinitely small laboratory space, and high impedance of all hands.

"My hope is that the great Chiefs of the Simulation Council will occasionally remember that in most well regulated tribes there are often more Indians than Chiefs. Could the steering committee once in a while devote a session to the problem of giving the future engineers of the nation in the uses and possibilities of simulation.

"It will take considerable effort and skill at impedance matching for such a discussion to be of value. For student use, and I mean student use with their own little hands, we have a home-made baby analog simulator consisting of 10 Philbrick operational amplifiers. Our precision resistors and capacitors are the normal 20% variety we steal from our electrical friends. This is horrible enough to make the normal Big Chief take to firewater. We, however, do achieve our purpose of giving the student a basic insight into the possibilities and uses of an analog simulator, and also acquaint him with the strange and wonderful language used.

"In this area, the engineering educator needs help in the way of simple and cheap suggestions. Some items that might be of considerable value are:

1. Listing of references that are primarily for the amateur.

2. Suggestions of ways of building simple function generators, plotting tables, nonlinear circuit elements and similar devices. Note that most of the devices listed in such works as Korn and Korn are beyond the means and time of the average educator.

3. Suggestions of circuits for simple digital devices. A digital computer for solving sixth to tenth order determinant with the students pushing the buttons for input and reading the output on light bulbs would be of the right order of magnitude. We are trying to encourage serendipity and not make complete experts.

4. Passing of the word that schools are charitable institutions which would welcome the direct gift of hardware. I would love to have someone give me a Good-year computer with the string attached that it was for student use only, but I would also welcome a box full of old resistors, potentiometers or similar useful parts.

5. Visits from the Big Chiefs.

6. Item h from Table 1, page 1808, Instruments & Automation, Vol. 28, No. 8."

*This was "prey"—ED.
Now see what I mean "it'll take some doing"? Here is a man in a position to contribute to the salvation and improvement of our way of life. But his efforts are severely handicapped by lack of a few millibucks. If he were able to educate one engineer to use one computer to solve one problem which would eliminate the need for one of our more elaborate guided missile flight tests, he would save us taxpayers enough money to equip several universities with complete computing centers. Ideas, anyone?

Bits

Now, having gotten my two-bits' worth off my chest concerning a problem which has been bothering me, I will give you bits of information about what you may expect in the rest of the Newsletter (if you've read this far).

First, under Pieces, there are excerpts from Hal Coleman's notes on the Midwestern Simulation Council meeting of 12 September at WADC. For your ed., Hal's notes raised more questions than they answered, but this Newsletter has never claimed that it could give you all the answers, so perhaps Hal, who is reporting on a meeting for the first time, is right in the groove. He tells you who had something to say and on what subject. If you want details of what they said, perhaps you would be better off to get them firsthand by writing the people directly.

Then under information (without theory) there are some random comments concerning possible commercial availability of magnetic-tape dead-time simulators; a paper on "An Analog Computer Technique Using Magnetic Amplifiers" which seems to give one answer to the September Newsletter question about the use of logarithms for multiplication; some remarks on a new (to us) kind of precision potentiometer; and other incidental intelligence.

Then in closing, "Thots" presents an idea which will not interest everyone, but if you have read that far you might just as well go on to the end!

Bob Howe observed that the generation of logarithmic and trigonometric functions can be accomplished by attenuating integrator input by the rate of the variable, which caused Roger Gaskill (Willow Run Research Center, Ypsilanti, Mich.) to point out that the rates are not always available and that to obtain them would require additional equipment.

Milt Warszawsky (WADC) indicated that his demonstration later in the afternoon would show how they obtained derivatives.

Bob Howe remarked that in much missile work, particularly in coordinate transformation, the rates in question are available.

Estes on Simulation Techniques

Next Bruce Estes (McDonnell Aircraft Corp., St. Louis, Mo.) discussed various simulation techniques employed by their organization. The first was a device for measuring the frequency response of components, using computer elements. With this technique it is possible to obtain the gain and phase shift of a device for a particular frequency by measuring a pair of potentiometers used in a nulling circuit.

The second technique was designed to save time in the simulation of transfer functions. For this, he showed a scheme of switching whereby with a single setup it would be possible to put in any or all of the terms of a quadratic divided by a quadratic. Any of the terms can be made zero or any appropriate value by potentiometer setting, amplifier gain, and switch position.

Generation of nonlinear functions such as hysteresis and backlash by use of diodes and batteries, and circuits for simulating coulomb friction and constant torque with dead space were then explained. Bruce concluded by showing three techniques for obtaining the absolute values of a variable using servos, diodes, and relays.

ARL-WADC

After intermission Braun discussed the facilities of the WADC Aeronautical Research Laboratory, in particular the patchboard verifier. This is a device which takes a Reeves patchboard, examines all of the pins, and writes out in coded form the connections between the leads. The technique involves a matrix which

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**MEETING OF THE MIDWESTERN SIMULATION COUNCIL**

by H. B. Coleman (Bendix Aviation Corp., Detroit, Mich.)

The Midwestern Simulation Council meeting held at Wright Air Development Center, Ohio, on 12 September began with an election, in which Jim Stone ( Battelle Memorial Institute) was elected Vice Chairman (to succeed automatically to the chairmanship in six months), and Hal Coleman was elected Secretary.

**Dee Rhoner on Division**

In the first paper Miss Dee Rhoner (Goodyear Aircraft Corp., Akron, Ohio) described computer techniques for division which yield several linear functions of x. Division by $x, 1 + ax$, $1 - bx$, and $bx - 1$ using only a single servo multiplier and then using an electronic multiplier were described.

Miss Rhoner next discussed the operation $x^2/(x-y)$ and the extension of the previous techniques to demonstrate division by a function of two variables. The last points Dee covered were a circuit for the variation of nonlinear damping and the logarithm of a dependent variable. Bob Howe (University of Michigan, Ann Arbor, Mich.) asked if the effect of drift had been investigated, to which Dee answered that this problem had not yet been evaluated.

At this point W. G. Braun (WADC) called the attention of the computer manufacturers to the fact that when a division circuit happens to divide by zero it is possible to put 200 volts across some of the potentiometers. As these pots are normally rated at 2 watts, he indicated that some form of protection should be considered. Dee commented that the variables she had been considering had not approached zero.
indicates the location of the plug by row and column, and the number of the plug.

Because time was running short the meeting was closed and those present split into two groups—one toured the Flight Control Laboratory with Lieutenant A. C. Robinson and observed the operation of a Link Flight simulator representing an F-80. A television monitoring set was so placed that the visitors could view the control panel display in the Link cockpit. Also of interest, in addition to the regular 1:1 time-scale equipment, was the array of Philbrick equipment.*

Later the groups switched and the first group was taken to the Aeronautical Research Laboratory by Milt Warshawsky, who demonstrated a test circuit setup and its use on the REAC. A patch panel is set up to use all of the inputs and outputs of the amplifiers on a standard REAC in such a way that it gives a good quick check of the amplifiers and gains. The second trick which Milt displayed was a device for regulating sine and cosine oscillation. It involved the introduction of a perturbation which kept a sine-cosine oscillation at constant amplitude. The last stunt was the differentiation of an arbitrary function, which was an airplane cross-section area wired on a plotting board. This was differentiated by a lead-lag circuit.

Also displayed was the patchboard verifier which Braun had told us about.

*Dr. George A. Philbrick will tell you in no uncertain terms that the GAP/R is also 1 to 1 time-scale equipment.—ED.

Information
(WITHOUT THEORY)

Twelve-two representatives of 10 organizations met at Tullahoma, Tennessee on September 30th to organize the Southeastern Simulation Council. They selected W. H. Bradley (Murphy and Cota, Atlanta, Ga.) as Secretary, and decided to hold their next meeting under the auspices of Georgia Tech at Atlanta, Georgia, in connection with the IRE Instrumentation Conference and Exhibit, November 28-30. More on this organizational meeting in the next issue.

On Dead Times:

A letter from Frank C. Smith, Jr. of Southwestern Industrial Electronics Company (2831 Post Oak Rd., Houston 19, Tex.) says in part:

"We are pursuing development of our magnetic tape dead-time simulator in two forms, one for long-time delays (more than 30 seconds), and one for short-time delays (1/10 second to 30 seconds)."

We also spoke to Comer Davies at the ISA Convention, and he indicated that his Davies Laboratories (4705 Queensbury Rd., Riverdale, Md.) has a tape device for the purpose.

On Logarithmic Networks:

In the Simulation Council Newslet
cer writeup of the Eastern Simulation Council discussion of analog multipliers, the question of using logarithmic devices for analog computing was raised. However, it seemed that no one knew much about it. Now we have a paper, "An Analog Computer Technique Using Magnetic Amplifiers," by B. E. Davis and I. H. Swift of NOTS, China Lake, Calif., which not only describes the use of magnetic amplifiers to gain high reliability for analog computing equipment, but which describes the use of logarithmic networks. This is AIEE paper No. 54-389.

We were interested to note that both magnetic amplifiers and logarithmic networks were used in the SEL "Flowmeter of the Future" displayed at the ISA Convention. Also of interest to us was the Tapot potentiometer (Howell Instrument Co., 1106 Norwood, Ft. Worth, Tex.) which seemed to consist of a wire glued to the back of a white tape which passed under a hair line in a window between two reels. The tape had individual calibration on it, which made for high accuracy, while the continuous rather than mandrel-wound resistance wire gave "infinite" resolution.

Thots
(To Think About)

We have just received our National Simulation Conference General Announcement No. 2 from Louis Wadel, the General Chairman (3905 Centen-

ary Drive, Dallas 25, Tex.), and are surprised and impressed with the number of papers of interest. More than half of the 34 papers to be presented at the Conference (which will take place in Dallas from 19 to 21 January 1956) are of unusual interest to us. And because we are interested in simulation we believe that they will be unusually interesting to anyone else interested in simulation.

Hence the "THOT": How about an interest-Council get-together of all Simulation Council members who can make the trip "deep in the heart of Texas"? It could be social (lunch, cocktails, or dinner), technical (though I believe that the Conference will offer enough of that), or just a bull session on Council activities, problems, and plans.

If you will let your Ed. know your wishes, it can be arranged.

Computer Events

other events on page 1858

Eastern Simulation Council
Date: Monday, 21 Nov. 1955; 1:30 PM
Place: Massachusetts Institute of Technology, DACL Laboratory, Cambridge 39, Mass. Host: Dr. William Siefer, DACL, MIT.
Subject: "The Use of Digital Computers in Solving Simulation Problems."

Southeastern Simulation Council
Meeting will be held under the auspices of Georgia Tech in Atlanta, Ga., in connection with the IRE Instrumentation Conference and Exhibit, November 28-30.

Western Simulation Council
Date: 12 January 1956
Place: Ramo-Woolridge Corporation, 5740 Arbor Vitae, Los Angeles 45, Calif.
Time: 1300
Subject (tentative): Noise—Analog digital combinations

National Simulation Conference
Date: January 19-21
Dallas-Fort Worth Chapter of IRE Professional Group on Electronic Computers National Simulation Conference, Dallas, Texas. For information contact J. R. Forester, 2104 Huntington, Arlington, Texas.

High-Speed Computer Conference
Date: 14-17 February 1956
Place: Louisiana State University, Baton Rouge, La. For information write Dr. Leon C. Megginson, Department of Business Administration, Louisiana State U.