Thank you.

This is the Fifth VIM/Control Data Executive Symposium and I am sure we again have an interested group of Control Data users who are here to listen and discuss Control Data’s plans and views of the future, and — I hope — how your views and plans relate.

At the past seminars, Dick Neumann had requested that I comment on how Control Data uses or feels about the Executive Symposiums. I think I may describe the mutual benefit I see from such meetings by using the analogy of the Oracles of Greece.

The Oracle at Delphi is of course best known to us. But there were others — the oracle of Zeus at Dadona and a marvelous one at Claros which lasted from early Greek through Roman times. Oracles in our thinking are linked with superstition and ignorance, with phony divination of the future and even outright bribery and trickery. Because they were human institutions, all those things no doubt played a part. But to dismiss them so easily is to overlook the obvious and miss the message they have for us.
The Priests and Priestesses of the Oracles did in fact -- more often than not -- give good advice. They could in fact predict outcomes -- foretell the future if you will -- with more than random accuracy. And the reason was simple. These principals of the Oracles just had more and better information than anyone else. Because people of all types and classes -- from kings to peasants, from consultants to poets -- people of every city, tribe and land came to the Oracle. And in the process of seeking advice left behind information of great variety and perspective.

I should emphasize perspective, because it is perspective that makes information come alive. It is perspective that highlights subtleties and minor themes that will become dominant factors. Perspective is precious -- the Oracles had it and the Czar did not.

As I mentioned, this is the fifth Executive Symposium sponsored by VIM and Control Data. Our perspectives are several. At least in numbers . . . Bob Wesslund told me that at the one session the group represented 600 processors. On the other hand, we may suffer from all being “old hands” of the industry. We do represent good cross-industry perspective, and not the least is we represent vendor and user.

I know for sure that the discussions in past seminars on software trends -- releases, stability and so on, the discussion of memory
TRENDS -- the discussions of migration have helped to focus Control Data's thinking and plans. The system works -- it does help us see the future and shape our actions accordingly.

In short, while I'm sure that no one is about to start referring to the "Oracle at Bloomington", we are at least gaining great insight to our own world -- we are gaining perspective that will help us see the future of computing technology and better apply it in our planning.

Planning also reminds me of another story.

In one of Beethoven's Symphonies, a trumpet player plays several bars by himself. It is supposed to sound as though the notes are coming from a distance.

To make it real, Stokowski decided to put his trumpet player off stage. Since he would then be out of sight of the conductor, the orchestra rehearsed this particular passage many times. They wanted to be sure the man in the wings would be on cue.

On the night of the performance, all went well. The trumpeter came in right on the beat. He played half a dozen notes, then suddenly he stopped.

There was an embarrassing silence. Stokowski waited as long as he dared. But no more notes were forthcoming. He finally managed to pick up the tempo and continued.
As soon as the performance was over, Stokowski rushed off the stage in great anger to find his trumpeter. The man was very dejected. He was sitting in a corner, visibly shaken.

"What happened?" Stokowski demanded. The trumpeter replied, "As soon as I started to play, a stagehand rushed up to me. He grabbed my horn and said 'Shut up, you idiot! Can't you see there's a concert going on out there?"

The subject which has been and will be discussed is certainly no symphony, but I'm sure a little more communication will be helpful to us all.

Hopefully if you all are well informed by means of these seminars and other vehicles, you won't feel the need to snatch the trumpet out of our hands. I can't guarantee the other part about not saying "Shut up you idiot".

Dick has asked that I look ahead toward 1982 and give you my thoughts on how things will look at that time. I'll do that in two parts. First -- some more general thoughts along the lines of the use of computers and second some thoughts, more specifically with regard to Control Data's systems products.

So first let's talk about applications in the 80's.
Computer-Based Education

Of foremost importance in that period will be the application of computer technology to the learning process -- in other words, CBE.

By then CBE will be the fastest growing market segment of the industry and Control Data will be the leading supplier of both CBE education services and computer systems. Briefly, here's why.

The past thirty years or so have produced a base of advancing technologies that have the power to revolutionize the quality, productivity and availability of education. The applicable technologies are the electronic ones -- television, radio, audio and video tapes and disks, computers, computer conferencing, cable TV, microwave and satellite transmissions, and, of course, CBE.

Some of those technologies have been applied individually -- some with high success, others less so but still contributing enough useful experience so that today we have the resources to do what the present educational process does, but to do it with capital-intensive productive technologies, rather than trying to drive still harder a labor-intensive process that can at best only stagger under the loads of higher needs, higher expectations and higher and higher costs.
These resources are in use today in a national network of forty-two learning centers plus a mobile van learning center operated by Control Data. There are more centers in the offing -- a minimum of fifty by the end of 1978.

The system is computer controlled and the main method of delivery is Computer-Aided Instruction with Integrated Terminal Subsystems which include video disks, audio input and output and touch input. Structured Computer Conferences of up to forty students can be held or a single student can interact with another student or with an instructor as desired. Although the major thrust is Computer-Aided and Computer Managed Instruction, other media are available as appropriate.

The offerings of the system are cost-effective today for business training, special education and segments of vocational education. The widespread use of CBE in vocational education and in virtually all other areas of education will develop over the next five years as costs of traditional education rise and CBE costs decrease. Department of Health, Education and Welfare figures show that traditional instruction costs have been increasing at an average compounded rate of about 8.2 percent -- in the last three years at 13 percent. On the other hand, the costs of technologies for CBE are decreasing about 5 percent per year coupled with an annual 10 percent improvement in performance.
Early in the 1981-1986 era, we forecast that CBE educational service revenues from our Learning Center Network will be approaching the $150-$200 million range.

CBE computer system sales will also be significant by that time.

Technology Management

Not unrelated to CBE is computer services and systems for technology management. These and similar data base communications systems will also be enjoying rapidly growing usage by 1980. What I am talking about includes Control Data's TECHNOTEC, FIRMTEC, SKILTEC and MARKETEC.

FIRMTEC, for example, is the identification and listing of technology within an organization. Its objective is to reduce technology development time and cost; at the same time improving the development environment and the technology quality by helping to reduce duplicate efforts, finding the best resources and more uses for existing technologies.

TECHNOTEC facilitates the transfer of technology from one organization to another.

SKILTEC identifies and lists skills of professionals.

MARKETEC is a marketing service to assist owners of technology, manufacturers and distributors in locating each other.
These offerings are available through our worldwide data services network. As experience is gained by customers in their application and usage builds up, the service will be replaced by the installation of a computer system by the larger user organizations.

**Computer Communications**

Associated with these applications are computer communications, computer conferencing, teleconferencing, or whatever it may come to be called. This type of usage will be developing rapidly within the next five years and should be in wide usage by 1986.

Today PLATO CBE has a capability of "on-line" communication between parties or message routing to individuals or groups of people. These messages can be sent to any format; i.e., data, memos, requests, etc. Our CBE development organization utilizes PLATO for all internal communications with provisions for hard copy output if desired.

In the relatively near future we will soon be using computer conferencing within Control Data to provide a better environment for communications between management and employees. Management will be able to communicate better, back and forth, with a broad cross-section of employees in depth and on a continuing basis. In other words, all classes of employees -- management on down -- will have dialogue continuously. It will provide:
1. For a large number to participate in the review of an issue,
2. for direct communication among all classes of employees,
3. for achieving adequate control; i.e., in keeping it confined to the assigned issues, and
4. for achieving the required degree of anonymity while maintaining integrity.

Obviously this program is a prelude to many other ways of using teleconferencing.

**Scientific Problem-Solving**

Not to be overlooked is scientific problem-solving. The outlook over the next ten years for Control Data’s large-scale scientific computers was never better.

An important point is that the most rapidly growing needs for large computers are in assisting in solutions to the problems to be solved in meeting the needs of society -- many of them immediate, urgent and worldwide.

That is a dramatic switch from nineteen years ago when Control Data entered the scientific market and for many years thereafter -- then the major focus of scientific computers was on military applications.
The problems that I am talking about include those involved in Seismic Data Reduction, Reservoir Simulation, Nuclear Reactor Design and Safety Considerations, Simulation for Commercial Air Transport Design, Turbulence Studies, Structural Design, Weather Forecasting, Earth Satellite Image Analysis to Increase Efficiency of Natural Resources Usage, Environmental Pollution, Earthquake Prediction, Econometric Modeling and many areas of research.

All of this bodes well for Control Data, the world's recognized leader in computers for scientific problem solving. In the years ahead our large computer business will sparkle with a brilliance even beyond that of the early years.

So with that background it is appropriate for me to turn now to Control Data's systems products and the future. In a word, I see "more of the same". I see a few reflections of "Good God, not that!" on your faces as you reflect on some of the problems we have. But what I mean is more of the same — in terms of progress. And the situation today we have with the CYBER 170 is enormous progress over that of 3 or 4 years ago. By 1982 we will look back and see at least that much progress in reliability, in cost performance, in usability, and so on. And certainly one of the things that is going to fall into place is data communications — networking if you will.
And clearly the core -- the central thread of our thinking is evolution. From 1969 until the summer of 1971 Control Data's product strategy was still based on "cold turkey" conversions kind of thinking. It took from then until the fall of 1972 to get the evolutionary concept -- which resulted in the CYBER 170 -- hammered into place. I'm not about to give it up now.

But before I move on to discuss enhancements let me state one other thing. By more of the same I also mean that there will be migration problems. We simply are not going to get where we know we can get in operating system and networking technology without migration problems. What we can do much more of, however, is share our plans with you early enough to plan better how to deal with those problems. The presentations you have received and will receive in these two days is a positive indication of our intention to share our plans.

Now I'd like to talk a bit about upcoming enhancements that are designed to positively impact the price-performance of the CYBER 170 line. In the next few months, we'll be announcing enhancements related to new technology memory chips. As we get more speed and greater density in our memory chips, we expect to increase price-performance 15-20 percent.
We are also implementing selected logic elements in LSI that will improve price-performance. And we are launching a program that will reduce the amount of central memory required, which will effectively improve system throughput, especially in the lower CyberS.

As Frank Vince discussed yesterday, we have paid a price in code size because of use of higher-level languages used in system programming. In addition, we will continue to add features to the programs, and we're going to get creative about how to retain these features but with less resources required. Computer speed and central memory. But we'll accomplish this by greater distribution of functions either to the front end, the PPU’s or simply to a non-resident, until needed.

Another computer requirement we are attending to is ease of use—a term that's been tossed around the computer industry for many years. The meaning is changing now. With computers becoming more integrated into business operations and more non-technical people accessing them, simple procedures are necessary.

Probably the simplest, yet most dynamic use of a computer today is Control Data PLATO, the highly interactive education system. We have kindergarten students, those with impaired hearing and a whole range of academic levels, along with business and industry technicians and executives using it. All the same way but for different reasons.
Yesterday's scientist or engineer saw programming a challenge and was anxious to learn in order to solve problems. That's no longer true. Today these people want to speak to the computer in simple form, not just interface with an operating system, but know his problem statement will be understood.

This effort to increase usability takes me into the third computer trend that deserves attention, and that is better interface communications. As networking increases... and there's no reason it won't... it is important the user at the terminal can reach his application program with a minimum of overhead and a minimum change when the network changes.

To clarify that last statement -- as the network changes. It changes in two ways. First, as it grows there are changes in size, complexity and connected devices. Secondly, there are dynamic changes as portions of the network degrades, due to line failure.

The interface communications we are now looking at provides consistent interface for the applications program to the communications subsystem and consistent interface of the terminal to the network. Combined with this we see a controlled communications network to assure that the data is carried to its destination in a most efficient manner.
We see this as vitally important because user's data will reside in many places throughout the network and ready access to it will depend on reliability communications interfaces.

Most of you have relatively small networks. But each year they will grow. We are convinced our development work on network systems is exactly what you'll be needing in the 1980's. We fully intend to pursue an intense program devoted to development, refinement and constant tuning . . . all aimed at better utilizing computer resources.

As you are well aware, Control Data has built an excellent reputation as the leading supplier of large systems. Clear evidence of this is shown by our successes with the original 1604, followed by the 6600 and then the 7600. In 1964 we started the development of the STAR-100, a machine even more powerful than the 7600. In the STAR-100, we also introduced the concept of vector hardware which allows arrays of data to be processed at extremely high speeds.

I don't want to gloss over the difficult technical problems we have encountered in the STAR project. These difficulties severely impacted our ability to deliver operational hardware on schedule. Nevertheless, we do have three STAR-100 systems running in customer operational environments and which we operate as a STAR Services machine.
Despite the delays and difficulties, CDC remains dedicated to the STAR project. We are now in the process of developing new models of STAR which will utilize high-speed LSI circuits and semiconductor memory chips. This is being done in phases to allow us to have deliverable hardware as we introduce the various improvements. The LSI effort is important not only to the STAR program, but we also intend to apply what we learn to some of our other advanced programs.

The architectural concepts of vector processing used in STAR has been accepted by the sophisticated user community to the point that three competitive machines have appeared in the market. I am convinced that we are on the right track in this approach, if only for the reason that the rate of improvement in circuit speed has slowed down over the past 10 years. Therefore, we as manufacturers and you as users must jointly seek ways to exploit new architectures and techniques. I just want to assure you that CDC remains dedicated to the super computer field, and we see STAR as one way to advance the state-of-the-art.

We can hardly talk about future trends and how we are addressing them without talking about reliability. With every passing year it becomes more important as more operations are "on-line" to the computer. If the computer fails . . . business comes to a standstill.
In the early days of the computer, downtime wasn’t so utterly destructive because what the computer had accomplished to that point so exceeded manual or semi-automatic methods that maintenance time was insignificant.

While speed and productivity is highly important and will continue to be a design priority, users today are just as concerned that the system operates every second as they are about the operations per second.

We are pursuing this reliability issue very intently. For example, in the CYBER 170 memory, we included Single Error Correction/Double Error Detection. This is only the beginning of our efforts. We visualize systems that will be more “forgiving” of both human and machine errors by self-diagnosing themselves...correcting the errors where possible. They will attempt to bypass the failed element and operate in a degraded mode. When this is not possible, they will ask for help rather than crash. The design of the future will stress failsoft rather than the crash.

The top management of Control Data is strongly committed to reliability improvement. Quality Assurance has more than a thousand people now assigned to product quality tasks. This all-out effort has already begun to show results in one area -- during 1976 the CYBER 170 set an all-time single year record for system acceptance.
This afternoon, Larry Jodsaas, Vice President of New Product Programs, will present to you the Advanced Product Line which will include many of the product features I have mentioned.

I have some time before lunch, so if you have a question or two, I will entertain them now.