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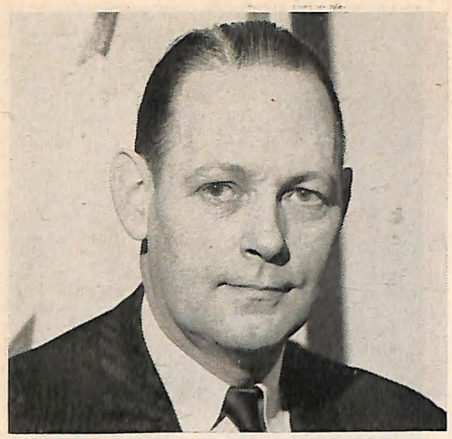
SPECIAL REPORT:

FORECAST

THE SIXTIES—A DEMANDING DECADE

Clairvoyance has been among the rarest of human attributes; even the few individuals who have claimed to possess this ability, have left behind them a notoriously poor record of performance. No reputable method has yet been devised to cultivate a fail-safe farsight, needed particularly by the leaders of industry and state, who bear the burden of collective destinies. In the absence of clairvoyance, only experience can light pathways to the future. In our field, the experience of the men whose daily decisions are shaping the aerospace industry, is probably the most realistic guide to the future. For, no one knows more about the promise and problems of this complex industry than the executives charged with the continuous task of preparedness for the vagaries of the future. The opinions of 15 top executives presented in this special report are a fitting prologue to an epoch of the greatest challenges and opportunities that have ever lured mankind on and beyond this planet.

AEROSPACE MANAGEMENT
FOR TECHNICAL DECISION-MAKING AND LONG-RANGE PLANNING



Cost Reduction Will Be DOD Aim

By **THOMAS D. MORRIS**, ***Assistant SecDef Installations and Logistics***

► Any forecast of future actions in the area for which I am responsible, must be predicted on the underlying policy that the defense of this nation has been, is receiving and will receive, the best in material. There is no other alternative.

With this as a preamble, there are several other conditions which I think are relevant to any I&L prediction for the next three to five years.

First: Any forecast must be based on international conditions as they exist now. Any change in the needs of the defense establishment could make immediate and drastic changes in any predictions made today.

Second: Any substantial change in the country's economic future would have an effect on any projection of I&L programs. The areas I discuss in this article are based on the economy as it is today and as we expect it to be within a period of five years.

There are other qualifications which probably should be stated, but the one which is most pertinent is our need to keep a built-in elasticity in the I&L field. We must be prepared to quickly expand our operations to provide the necessary facilities and supplies in case of an all out attack on our country. We must also be able to diminish our efforts to fit the needs of limited conflict and on down the scale.

A major program which will demand a good portion of the time of this office, in the next few years, is the cost-reduction program which has the three-fold objective of assuring that we buy only what we need, that we buy it at the lowest sound price, and that operating costs are reduced.

The cost reduction program has received strong endorsement by President Johnson and is a continuing concern of Secretary McNamara and the Secretaries of the military departments. I do not see any lessening of this effort in the time period under discussion here. The prime concern of the I&L shop in the next few years is to make sure that the cost reduction program does not become a routine thing. We plan to keep the program energized and continue our vigorous search for new ways to reduce costs. We will do this by assisting defense contractors in their cost-reduction programs. At the same time we will respond to the extent possible to suggestions which can eliminate or reduce some of our own procedural requirements—particularly in paperwork—which have outlived their usefulness. We have found through our own experience that a cost-reduction program can be effective only when people throughout an organization are responsible for the conduct of such a program. They must have and understand goals, and they must be prepared to have their efforts examined and validated through an internal audit.

The Defense Department has initiated some major policy changes in order to achieve cost reduction program goals scheduled for fiscal year 1967. Such things as better program definition, value engineering, increased use of incentive contracts (we hope to see cost-plus-fixed-fee contracts reduced to 12 per cent), contractor performance evaluation and many others are now in the books, and we expect to refine them from time to time as the need for better management in these areas becomes apparent.

In the important area of terminating unnecessary operations, we must realistically appraise the value of all bases to obtain a better return on the defense dollar without weakening military readiness. The closing of installations is not one, however, which can be done without understanding the impact on the community in which the base is located and the effect it may have on the people who are employed on that base. We will try to make the adjustment as smooth as possible. We have a fulltime office of economic adjustment which has been formed for just this purpose.

We are concerned about the future welfare of people who work in an installation. We will continue to render all possible assistance to such personnel in finding other suitable employment.

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Industry Must Adjust to Change

By KARL G. HARR, *JR., President*
Aerospace Industries Association

► The aerospace industry has been created by change, fosters change and thrives on change. Because its primary mission is to provide the products and services vital to the requirements of national security and space exploration, the industry is uniquely responsive to the demands of national policy. As these requirements change—almost always requiring the solution of myriad new technological problems—so does the industry and its technology change.

To accomplish its assignment, the industry first had to mobilize the Nation's greatest reservoir of scientific and engineering talent. It then had to provide the environment, facilities and resources for the most productive, creative and efficient use of this brainpower. Finally, it had to bring all these elements together in flexible, adaptable industrial organizations capable of swift response, including major reorientation, to satisfy changing national needs and to capitalize on technological breakthroughs.

The future—even for so short a period as three to five years—of any industry so constituted and so oriented defies accurate forecasting. It will be constantly reorganizing and regrouping to keep pace with the changing requirements of its customers. It will undoubtedly continue to provide the Nation's largest reservoir of scientific and technical competence. In the aggregate, it will undoubtedly also continue to enjoy a high level of sales and provide employment to more people than any other industry. Despite this bright promise for the industry as a whole, there will be widespread fluctuations in the level of activities of individual companies as requirements change, as programs evolve from research and development to production, and as production programs are completed.

As an illustration, the major funding for the first round of ballistic missile research, development and production has been virtually completed. However, for the next two years or so, the industry will continue to deliver the production versions of these missiles at the rate of about one per day, financed by funds already available to the Department of Defense. We can expect that new funding for these programs will be smaller in scale and directed toward improving performance, reliability and maintainability, and that production probably will be limited to a one-for-one replacement of existing missiles as such improvements are made. A similar pattern is apparent in some other major defense programs as well, and each space program is by its nature usually a one-time effort.

Adjusting to the cyclical impact of this weapons and space systems acquisition process, from research and development to production, and again to research and development, is the major problem confronting the industry. This cycle creates constantly fluctuating requirements for manpower, facilities and capital resources.

As we progress through the next several years, the industry's primary objective will continue to be to ensure the qualitative superiority of the defense and space systems it is called upon to design and produce. To do this it must maintain the integrity of the technological capability that has been so painstakingly created. Also, it must be able to compress or expand in accordance with changing needs while at the same time maintaining the capability to meet future challenges. Most importantly, it must continue to make and exploit advances on nearly every facet of the technological spectrum and speedily translate such advances into useful, effective products.

This industry's prospects for the next three to five years are exciting; the problems presented are challenging but not novel. The industry has successfully met similar challenges in the past; it will do so in the future.

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MANAGEMENT SYSTEMS

Simplified Program Status Reports Must Emerge from PERT

By J. STERLING LIVINGSTON, *President*
Management Systems Corporation

► The aerospace manager's burden is paperwork—reports and data requirements that are of relatively little help in getting the job done and consume an inordinate amount of manpower in their preparation. Yet, the outlook is for more reports —reports such as the Defense Contractor Planning Report and fiscal reporting by Material Program Codes. The paradox of this situation is that while vast quantities of information are generated by government and internal company reporting requirements, aerospace managers often lack the kind of information needed for decision-making purposes. This paradox underscores the fact that neither the aerospace industry nor the government has yet found a way to deal effectively with a basic resource of management—information. Perhaps the greatest contribution management systems can make to the industry during the next decade is to solve the problem of information management.

The aerospace industry is experiencing what probably is the last phase of a proliferating and complicating cycle of government reporting. A cycle of simplification must soon begin. In order to start this new cycle, DOD and NASA must unify and consolidate the specialized information requirements. Much duplicate information is now reported in the Financial Management Report, Costs Incurred on Contract, PERT/COST Management Summary Reports, and the Defense Contractor Planning Reports. Since this data must be accumulated on different bases and reported on different formats, contractors are saddled with a considerable burden that could be greatly reduced by a unified information specification.

It is critical, however, that the Government specify its information requirements in terms that are compatible with the conventional accounting, scheduling, and engineering control methods used by industry; otherwise, the aerospace industry will continue to keep two sets of books, one for the Government and the other for internal use.

A related major need is for the industry to develop a common language and a common planning and control structure. Information on the cost status of a program cannot be used effectively for decision purposes unless it is integrated with information on both the schedule status and the technical status of the program. A report indicating that program expenditures are within budget is not meaningful if the program is behind schedule and in technical difficulty. Since the accountants use a different language and control structure from the engineers (i.e., chart of accounts vs. specification tree), it is seldom possible in this industry to obtain an integrated schedule, cost, and technical status report. Yet, without integrated status information, it is impossible either accurately to measure progress in meeting program objectives or to determine the need for management action. Management systems experts, who understand the planning and control techniques, can be the catalysts who will assist the industry to forge a common internal planning and control structure during the next decade.

What is needed to utilize effectively the fifth resource of management, information (the first four, of course, are men, money, materials, and facilities), is a fully integrated management information system that will provide the tools required by aerospace managers to use available information more effectively. The role of management systems during the next decade will be that of converting information and decision technology from the language of the scientist to that of the manager.

In order to convert information technology from the scientific to the management realm, it will be necessary to approach information system design from the view of the manager. It will be necessary to begin with an analysis of the decision and control responsibilities of management and derive the information requirements from this analysis. This will help to provide useful and meaningful information tailored specifically to the manager's needs.

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AIRCRAFT

A Robust Market Persists For Well-Managed Firms

By JACKSON R. McGOWEN, *V. P. & General Manager*
Aircraft Div., Douglas Aircraft Company

► Under the energizing influence of airline traffic growth, the market for commercial aircraft during the next five years—indeed for the remainder of the present decade—remains robust.

Virility of the aircraft market is manifest in the predicted expansion of the world airline traffic from more than 91-billion passenger miles during 1963 to nearly 131-billion in 1968 and some 180-billion passenger miles during 1970.

When equipment requirements of the burgeoning air freight traffic are added to those for passenger service, the market for commercial aircraft aggregates $4.714 billion through 1968 and approximately $6 billion through 1970.

The U. S. domestic portion of this, while continuing to grow, is falling behind the export market from a level of about 50 per cent of world traffic in 1960 to perhaps 35 to 40 per cent by 1970.

Despite the multi-billion dollar potential, complexities inherent in the historically venturesome commercial aircraft field require sober analysis by management.

Airplanes are technically intricate and expensive products sold at fixed prices for future delivery, and the producer is confronted with the inescapable consequences of doing business in a buyers' market created by excessive competition. Non-U. S. firms, strongly supported by their national governments, continue to make forceful bids for control of the large market.

Despite the enormous sums spent for transports each year, concessions to airlines and uneconomical changes—both forced by competition—tend to increase manufacturing costs excessively. Cost forecasting and cost control require assiduous management attention.

Although much of the technical progress in the commercial field is a fallout from defense developments, commercial activity is burdened with the many cost and procedural restraints typical of government contracting. It must also compete with producers of defense aerospace products for materials and for its professional and production manpower, probably paying a higher price for both as a consequence.

Other problems revolve, as they do in all business, around the multitude of information services, customer requirements and government regulations.

In the environment described, management's responsibility to maintain surveillance over operations to insure compliance with every element of original intent is evident. To assist in this enormous task, Douglas has adopted such government-sponsored management tools and procedures as PERT, program management, and electronic data processing.

Currently, Douglas has two models in production: The DC-8 and the new DC-9. The DC-9, like the DC-8, is a private venture of the purest type. A number of companies have joined forces to produce what all of them are confident will be an essential transportation vehicle over the next 15 years. The fact that the SST scheduled for service in the 70's, will be the first commercial transport ever directly financed by the U. S. Government, may be symptomatic of a trend for future models.

The problem of financing aircraft purchases, of concern both to the manufacturer and the customer, has been aggravated by progressive price increases from the $100,000 of a DC-3 to $6.5 million for a DC-8. It seems probable that in the future more procurement may be financed either by the manufacturer or by leasing companies. Equipment trust certificates and other financial mechanisms may be expected to become more common in the domestic market.

For the remainder of this decade at least, Douglas will concentrate on the "bread and butter" portion of the airline business.

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SPACE VEHICLE
Common Hardware for Military and NASA

By **HARRISON A. STORMS,** ***President***
Space & Information Systems Div., NAA Inc.

► The man who develops a crystal ball that accurately forecasts the requirements of the government for aerospace products such as space vehicles would gain eternal fame in our industry. It is not likely that one will be developed in the immediate future. In the absence of this crystal ball or any particular sense of clairvoyance, some general comments on the future of the space vehicle market are offered here.

Our nation is committed to a program of spacecraft development aimed at landing Americans on the moon in this decade. A broad segment of our industry is engaged in designing and manufacturing the hardware and supporting equipment required to survive the rigors of ground launch, the hostile environment of space, re-entry into the Earth's atmosphere and safe landing. It is a momentous challenge but, from my position as one of the industrial contractors, it appears that it is being met vigorously in the workshops, laboratories and offices of our nation.

Within the next few years we can anticipate the launch of boosters 20 times more powerful than the Atlas and 7 to 10 times as powerful as Russia's current rockets. We can expect unmanned vehicles to impact and explore the moon. We can confidently predict that manned spacecraft will orbit the earth, rendezvous with each other and finally journey to the moon and return. That each of these events will take place automatically or easily is patently absurd. But, I do not have the slightest doubt that they will occur and, most likely, within the scheduled time. The point to be made, and I feel that the majority of us in industry are very much aware of it, is that the eyes of the nation are upon us to accomplish these things within the scheduled dollars. To do this requires as much attention to financial management, cost reduction programs and careful administration as to engineering detail. I think our industry is making great strides in all of these areas.

In addition to the currently defined space vehicle projects, it is my belief that we will see within the next two to three years definitive programs to operate space stations in Earth orbit for both scientific and military research purposes. Systems concepts will be developed for interplanetary manned expeditions. Our initial landings on the moon will be exploited by establishing lunar basing concepts. And, we will have a program for the design of economical space transport systems for conveying supplies and men to and from Earth orbit.

Because of the inherent high costs of these programs, we can anticipate maximum consideration for use of common hardware, technology and personnel. Only in this way can our national space budget be kept in hand. This will require skillful planning now on the part of both government and industry which, indeed, is taking place. If we do our jobs well now and do not disappoint the American public, the necessary finances will be available. It is within our power to hand down to future generations the heritage of a sound and progressive space program and this is worthy of our best efforts now.

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SUBCONTRACTING
"Sophisticated" Production Will Expand the Market

By F. H. ROHR, *President*
Rohr Aircraft Company

► Because of the increasing complexity of many of the components required in the aerospace industry, we expect to experience a substantial growth in our sub-contracting business in the next few years. This will be particularly true in those areas of manufacture which require specialized facilities and technological skills.

One example is the growing number of bonded-type structures being used in subsonic aircraft, and another is the use of brazed stainless steel honeycomb structural panels in supersonic planes. Many prime contractors do not find it feasible to install the special facilities required for the manufacture of these components for a single program. The sub-contractor, however, who has specialized in these products eco-ically can produce them for several customers. Early recognition of the growing demand for stainless steel honeycomb justified the development of special machines which are now producing steel core of higher quality, in greater quantity, and more economically than ever before. Thus, specializing has enabled Rohr to offer a product that most of its customers would find too costly to produce themselves.

The same principle holds true, perhaps to an even greater degree, in the manufacture of space products. Specialized techniques are required in the fabrication of such products as rocket nozzles, engine skirts, heat shields, filament-wound rocket-engine cases, fuel cases and other components for space vehicles. With a sub-contractor possessing the facilities to produce these components for several customers, it is neither necessary nor economical for each prime contractor to install them.

We have heard some pessimists contend that the aircraft industry is fading and that missiles and rockets rapidly are replacing the manned airplane. Obviously, missiles and rockets are gaining an increasingly important role in the military services, but we do not share the opinion that the airplane is obsolete. To the contrary, while fewer of the larger and faster commercial planes handle the volume of traffic that once required larger fleets of piston-engine aircraft, it must be kept in mind that the traffic volume also is increasing rapidly. Moreover, the use of aircraft for freight transportation has hardly begun, and the replacement of obsolete piston-engine planes for short feeder lines is a certainty. It is estimated that in the next few years at least 5000 of these obsolete airplanes will have to be replaced with jets.

As one of the leading sub-contractors in the aircraft industry we see no reason for gloom. Currently we are producing jet-engine pods and numerous other components for eight different multi-engine airplanes, both military and commercial, and another is scheduled for production in mid-1964. Most of our programs are scheduled for long production runs.

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A $1.5 to $2.0 Billion Market for Rocket Engines

By S. K. HOFFMAN, *President*
Rocketdyne Div., NAA Inc.

► The rocket propulsion industry is approaching maturity. However, the future should be no less interesting and even more challenging than the past. We foresee a national commitment for rocket engines and related services of between $1.5 to $2.0 billion per year during the next three to five years. Of this, it is expected that the large liquid rockets for the various stages of booster vehicles and for strategic missile programs will account for approximately 30 to 40 per cent of the total. Two hydrogen burning engines and the larger F-1 engine are already under development for the Saturn boosters to be used in the Apollo lunar program. Development may also be started on more advanced larger engines for the next generation boosters. The smaller liquid engines, 1 lb to 10,000 lb. of thrust, for tactical military systems involve the production of large quantities of low cost engines in direct contrast to small engines for spacecraft which are highly sophisticated, expensive and produced in limited quantities.

Solid rocket motors will be used for a wide range of applications including small ordnance motors, such as anti-tank rockets; a large variety of military air-to-surface and surface-to-surface tactical rockets; rockets for anti-ICBM and improved ICBM missiles; and, possibly large solid rockets for space boosters. Solid rocket programs may well be 40 to 50 per cent of the total during the next three to five years. Nuclear powered propulsion, including nuclear rockets, electric propulsion systems, etc., should constitute about eight to 10 per cent of the national commitment through 1968.

The industry is already heavily involved in creating the technologies for these new rockets. In order to obtain greater performance, we are using higher energy propellants and higher combustion chamber pressures and temperatures in our liquid rockets. For the first time we are constrained by the structural and thermal limits of materials. We will be searching for improved high-temperature materials as well as better techniques for cooling. More work will need to be done to achieve high flow rates at high pressure with propellant pumps of reasonable size and weight. Many of our engines will be "man-rated" to extreme levels of reliability and long life. It is expected that the life of our future rocket engines will be two orders of magnitude better than it is today. Another trend is toward a higher degree of integration between the engine and the vehicle structure. Some very novel engine designs will be evolved which will look entirely different from today's configurations. Some of these may induce and mix air into the rocket exhaust to achieve thrust augmentation.

The smaller liquid engines for space will become increasingly sophisticated to include wide variations in thrust magnitude and direction of thrust, multiple restarts, and very high reliability after prolonged periods of exposure to the space environment. Combined techniques of cooling (e.g., transpiration, ablative, film, and radiation) will be needed. These engines will pioneer much of the technology for the larger engines which will follow.

The state-of-the-art of solid rockets will also continue to advance rapidly. Much work is and will be done to achieve higher specific impulse, preferably with safe, low explosive classification, propellants. Some of this can be achieved with more energetic ingredients, but it will be even more important to evolve unique and novel approaches for the design of the propellant grain. Performance must be coupled with improved physical properties and high structural strength in the grain because many of these solid rockets will be exposed to the military environment of rough handling, long term storage, vibration, temperature cycling, and acceleration extremes. For the specific application of anti-ICBMs, it will be necessary to achieve propellants with very fast burning rates to produce the extremely high thrust needed by these fast accelerating interceptors.

It is too early as yet to predict the direction that our advanced propulsion system development will take. However, such systems will eventually replace several of our chemical engines, which sooner or later will reach a level status.

Under investigation are graphite, metallic, and gaseous core fission reactors for nuclear rockets, and various types of electric propulsion. Somewhat more limited applied research work probably will be continued in such areas as controlled fusion for use in magnetohydrodynamic and other plasma techniques.

Funding Will Flatten . . . Competition Will Increase

By WILLIAM E. ZISCH, *President*
Aerojet-General Corporation

► I view the next few years with both caution and optimism. Today it is less clear than it has been for several years where specific new programs will emerge. Nevertheless, it seems apparent the country's military-space objectives will certainly put new and demanding requirements on the propulsion industry. There will be very serious, even agonizing, adjustments in the industry resulting in fewer companies in the business—those remaining will continue a growth record.

For the first time in five years of corporate-wide planning, planners in the various plants and divisions of Aerojet see only a nominal increase in funded aerospace programs in this coming year. The FY 1964 budget for DOD does not show the upward trend observed in recent years; rather it shows a decline. Further, NASA did not obtain the full funding requested from Congress; another reversal of past trends.

This situation has developed because several quite unrelated conditions have emerged simultaneously. Most of the major strategic military systems have been or will shortly be fully deployed. There appear to be no large systems in the wings clamoring for entrance. Some of the Army's limited-war pipelines are practically full. There is serious talk of easing the Cold War tensions and of Arms Control. There is public concern with the total cost and uncertainty as to the ultimate direction of the Apollo program. Finally, the public appeal of tax cuts in the face of a sluggish civilian economy is considerable.

A funding plateau would thus appear to be emerging. This does not spell disaster for the aerospace industry. It does spell more challenge, higher competition, greater emphasis on providing the best possible technical brain-power and increased importance in effective utilization of the individual to encourage initiative and creativity. Cost awareness must become a vital way of life. Adroit and perceptive management is both a requirement and a reward.

With the completion of development of many large weapon systems, the impression is created that the technological spiral seen yesterday has ceased to exist today. This is not true. In fact, it is possible to foresee a number of new developments that will have a profound effect on missile and space projects and their propulsion requirements. Large and improved enemy warheads coupled with better guidance (particularly, terminal guidance) may well render our fixed retalitory force highly vulnerable. The USSR may soon disclose a new and larger space engine, their first since 1958. If they do, the repercussions will be a series of crash programs throughout our lunar, geocentric and military space programs, strong support for new mobile and dispersed ballistic missiles, as well as increased support for missile defense systems. The technology necessary for operation in the environment of space is intimately related to the security of our nation.

In the propulsion industry, we face a series of difficult and demanding challenges. It is important to provide maneuverability, particularly in geocentric space where even a few degrees of maneuverability for manned space vehicle will be a major problem. Our throw-away, no-return booster policy must be supplemented by recoverability as we venture more often into space. In addition to improved chemical propellants, nuclear, ion and other exotic energy sources are needed. The more complex space missions of the future require long duration engines with longer life in space, higher reliability, and improved start-stop capabilities. The trend toward larger and larger propulsion engines will continue and will require both liquid and solid types.

The future will require that industry be able to cope with the few massive, highly competitive, strategic and space programs forthcoming, while at the same time effectively performing the many smaller programs in other areas. Both drive and flexibility are necessary. To be successful we must achieve higher technical capability, greater effectiveness of the individual and a higher degree of cost consciousness. We must also solve successfully the challenge of a major conversion of technology to the civilian economy.

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COMMAND-CONTROL

Expanding Market Will be Dominated By Smaller, More Flexible Systems

By C. W. HALLIGAN, *President*
The Mitre Corporation

► Command systems, in the early part of the period, will probably show more emphasis on small systems with limited features, using available equipment. There will be less interest in large tailor-made complex systems. This emphasis will be caused in part by the need for mobile and portable systems and the need for greater reliability, shorter lead time and lower cost. The use of modular techniques in computer design will increase.

Later in the period, as more familiarity is gained in the use of automated command systems and as the need for greater capacity, speed and flexibility increases, there may be renewed interest in larger and more complex command systems.

The effort to improve the means of communication between command personnel and their equipment will continue, and techniques like "implicit programming" which permit the user to make on-line changes in both the stored data and in the program, will be developed further. Progress in this area during the period will make a very substantial reduction in the cost of programming and may also substantially reduce the need for computer programmers making field changes in the programs.

There will be increased emphasis on the training of command personnel in the use of automated equipment.

The use of simulation and experiments in laboratory systems to help determine initial requirements, check critical features, and improve systems after operation will continue to increase.

Displays used in command systems will receive a great deal of attention. Improved and more flexible displays will be developed. There will be continuing work in the field of three-dimensional displays.

There will be continuing study and improvement in the basic functions of pre-planning, situation monitoring, decision execution, reconstitution and re-planning.

The use of switching arrangements in the voice and data communication networks will increase, to provide better reliability and traffic efficiency. This will place more emphasis on authenticity and security.

The need for mobility and maximum capacity, with minimum weight and size, will give emphasis to further progress in the development of microminiature components, and the use of thin films and similar techniques for memories and circuit components.

In control systems the use of automation will continue to expand. Applications to air traffic control, weapons and satellite control, and the processing of logistics data will continue to grow. In control systems the need for high speed, large memories and faster circuitry will result in continued interest in large systems, especially for problems such as cataloguing and controlling space vehicles, and in the logistics data processing problems.

Studies under way for improving the management of the systems acquisition process will continue. Further emphasis will be given to the initial definition of requirements, the program definition phase of acquisition, and to design for evolutionary growth.

More emphasis will be placed on R&D work aimed at producing standard components such as displays, input-output equipment, communications facilities and computers for common use in these systems.

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DATA PROCESSING

Laser, Maser, Thin-Film Devices Will Emerge as ADP Matures

By **RALPH A. PFEIFFER**, *V. P & Federal Regional Manager*
International Business Machine Corporation

► The United States Government, if you can view such a vast, diversified operation as a single factor, is the world's largest single user of electronic data processing.

It is a user with interests ranging from space exploration to national defense, from cancer research to printing and power production.

Washington today is a marketplace which demands a tremendous diversity of interests and abilities on the part of the people and companies which are solving the federal government's data processing problems.

Because of this and because of the sincerely patriotic desire of many companies to serve their government's needs in the best way they know how, Washington today represents a vigorous and healthy competitive marketplace.

More than two dozen data processing companies have opened offices here in Washington. Only Los Angeles, heart of the aerospace industry, comes close to that figure.

We at IBM who work with the federal government feel strongly that the federal marketplace is the most dynamic, most vital, most stimulating, and most demanding marketplace in which we work.

There is a great sense of urgency in helping solve the government's data processing and data handling problems.

The range of areas in which we must bring our problem-solving ability to bear is very vast: The federal market requires message processing on a world-wide scale. It requires the most powerful scientific problem-solving capability. Conception and design of command and control systems is a vital necessity to our defense.

And throughout, the government's demands for on-line, real-time systems exceed those of private industry in both urgency and scope. The government's urgent need for ultra-high-speed data transmission and retrieval are sure to lead our industry into extended work in such diverse areas as masers and lasers, cryogenics and thin-film storage.

And the federal government—as our most sophisticated user of ADP—has gradually changed its approach to procuring ADP equipment.

Some of the trends and tendencies which have appeared in recent years include:

- A continually increasing interest and involvement by government managers in Washington concerning ADP procurement at all federal locations.
- Procurement of ADP has hinged increasingly on guidelines set by arms of government such as the Bureau of the Budget, Department of Defense and General Accounting Office.
- A trend is underway toward multiple systems procurements as contrasted to individual systems procurements. The tendency is to procure larger numbers of identical systems in an effort to provide uniformity and continuity within similar applications, and to attain programming economies.

The government will continue, as the years go by, to grow in sophistication and use of ADP. And in doing so, I believe it will help our industry grow and mature so it can better serve not only the needs of the federal government, but those of our entire economy.

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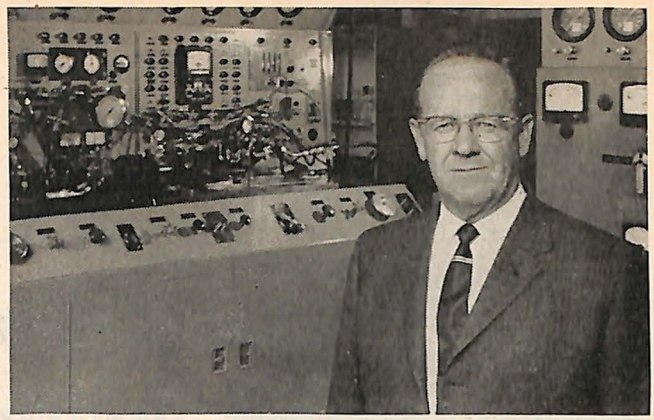
OFF-THE-SHELF... A Dying Concept in Components



By J. F. FORSTER, ***President***
Vickers Inc. Div., Sperry Rand Corp.

► Possibly the most significant trend the fluid power industry has experienced is that we no longer find it practical to sell components or subsystems as cataloged or off-the-shelf items. It has now become necessary to be in the business of selling the science of fluid dynamics as it logically applies to the aerospace industry.

Closely tied to this trend of marketing total fluid dynamics capability and experience, is the increasing need for the component supplier to know more about overall system design. Today, persons responsible for procuring system components make it a point to maintain an awareness of development capabilities and rely on the supplier as a consultant to suggest or propose the optimum component design path to follow. I think this trend will be emphasized in the future and will dictate the need for a more flexible and creative interpretation of the use of fluid dynamics.

The historical development challenges will still be with the designer for the next five years. They are: increased temperatures, more horsepower per pound and higher speeds —all under the critical eye of the budget director. The 500°F hydraulic system is past the prototype stage—longer life will be the future goal. Accurately controlled work is being derived from gases at 2500°F and probing excursions up to 5000°F are planned. Fluids thought impossible to tame three years ago are on the way to becoming commonplace; for instance, hydraulic systems that utilize engine fuels are well beyond the development stage. Also, I think we can expect an increasing blend of mechanical, electronic and fluid dynamic principles to be applied to fluid power products whenever the creative combination of these skills will do the optimum job.

Along with the broader interpretation of fluid dynamics will come the expansion of research and the facilities to support it. Basic research in materials holds the key to advancements that our present technology has poised in the wings while awaiting the discovery of new alloys, ceramics, coatings, etc.

From all indications, the limited funding approach by the Government with its financial and technological milestone reviews will be on the increase. This continuous monitoring by the Government, coupled with similar reviews by the prime contractors, will be an increasing administrative challenge to the fluid power equipment supplier. Most fluid power equipment suppliers are second and third tier contractors, and should the primes upstream miss a milestone in a current program, the conflict between budget and scheduling greatly increases our risks. We will need to be as creative and dynamic with our management techniques as we are with design and development if we are to keep the lid on pending explosions in overmanaged programs and duplication of effort. Such wastes cannot be tolerated in an industry whose profit margins are already under extreme pressure.

Because of the complexities of the products and systems involved and the large number of persons on each project that must stay informed, I expect the supplier to forge ahead who adds effective communications to his overall capabilities. The ability to define succinctly and inspire complete understanding among all project principals of the original task, as well as for the ever-present amendments throughout a complete program, will be a key requirement in contracting.

Continued pyramiding of the number of buying influences for our products can be expected. The days of one man selling a product to another man and coming away with the contract are gone. Today's marketing effort is a team selling and a team buying process. Many times complete personal contact between the complex combination of buying influences and the supplier will never take place. This most certainly will challenge our abilities to identify, seek out, and communicate with one another.

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ELECTRONICS Trend is Toward Integrated Circuits

By MARK SHEPHERD, JR., *Executive V. P.*
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► The acceptance of integrated electronic circuits, for both avionic and ground-support systems, probably ranks among the most significant developments of the aerospace industry in 1963. The timing and scope of acceptance exceeded all expectations of the circuit manufacturing industry, with the result that intensive efforts were made to advance technological developments and build up production capacity to meet an unprecedented demand for circuits of wide functional variety.

Practically all of the year's production was absorbed by the aerospace industry, for application in improved versions of currently-operational systems, or new systems now in their design or prototype stages. The impact of this acceptance, primarily results from the inherently better reliability of integrated circuits over discrete-component circuits, as well as from their smaller size and weight and lower power requirements. These advantages will be felt in full within the next three to five years as the new or improved systems become operational.

Integrated circuits' improved reliability factor, largely a theoretical concept two years ago, has been substantiated by life-test experience acquired since then. The low failure-rates predicted then have been achieved or exceeded in intensive testing programs conducted by the circuit manufacturers.

Factory sales of integrated circuits for 1963 are believed to have approximated $9 million and are expected to at least triple during 1964. By 1968 the device market is expected to exceed $150 million. Integrated circuits currently are technically capable of filling better than 33 per cent of the new designs for military rockets now being filled by discrete components. By 1965-68 this will increase at least to 50 per cent, and by 1968-72 to 75 per cent. Rapid changes are taking place in integrated circuit design, leading more and more to a broader use of semiconductor materials and their phenomena.

A continued and large expenditure is required for the research which will enable integrated circuits to perform a majority of the functions that future electronic systems will be expected to incorporate. They also promise considerable simplification of logistics by shortening the time required to get into systems production and by reducing the problem of spares for maintenance, both at the parts and systems levels.

By relieving the systems manufacturer of the time and effort previously devoted to circuit design and circuit assembly, use of integrated circuits will permit him to devote this engineering talent to the higher-level effort of "black box" design, systems assembly, test and installation. It is now assured that integrated circuitry will be less expensive, as well as smaller, than discrete-component circuitry. Historically, reductions in component cost and size have led to additions to systems functions and complexity. We foresee the same trend, as integrated circuits replace discrete components in systems.

In conclusion, the availability of integrated circuits provides the systems manufacturer with opportunities to simplify and speed up his own operations by reducing his lead-times and providing increased flexibility in systems applications. He also will benefit in the areas of incoming component testing, systems design, assembly, and final test. For the integrated circuits industry, wholesale acceptance of integrated circuits by the aerospace industry will speed the opening of industrial and consumer markets for the devices. These markets are expected to develop during the next three to five years.

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LABOR

Concern Mounts Over Job Security and Training

By JAMES B. CAREY, *President, IUE-AFL-CIO*

► No industry is more necessary to the welfare and security of this country than is the aerospace industry. The labor movement is proud of the contribution that has been made by its membership in producing the missiles, the spacecraft, the planes, the electronics equipment, so necessary to the safety of the country and its place in the space age.

Yet labor-management relations are in a chaotic state, with serious problems that even federal mediators have not been able to solve.

This industry which is the most modern in the country in terms of technology, has labor relations policies that are antiquated.

This industry provides much less security than do most American industries. Jobs themselves are subject to rapid and sudden change in terms of their content. Changes in contracts often wipe out jobs in a moment while the layoff benefit plans are much inferior to those in most basic industries.

While there have been many optimistic predictions with regard to a rapid increase in employment, there has been a large shift from those who man the production lines, to scientists, technicians and engineers.

From 1958 to 1963, for example, while total employment in the aerospace industry increased by about 70,000, employment of production workers dropped by 90,000.

This trend is expected to continue and with the result that we will be getting less and less employment for every dollar spent.

One estimate is that by 1970 production workers will make up only 29 per cent of the total work force, with engineers, scientists and technicians making up 32 per cent.

This together with the rapid increase in productivity now estimated at about 5 per cent a year for this industry, will further curtail the opportunities for employment.

An adequate employment security program including adequate benefits on layoff or severance is urgently needed.

The problems that automation and changes in technology bring have not been fully met in terms of the impact upon workers.

The industry needs a highly trained and highly specialized work force. Yet it also needs workers who can change their skills and their occupations with changes in technology and product. This requires an adequate program of training to enable workers to fit themselves for the new jobs. At present adequate training programs do not exist.

In addition seniority programs should be such as to provide the broadest possible opportunity for workers in a plant or among plants to be eligible for new jobs.

Wages have not kept pace with general wages of industry even for those of equivalent skills. Labor has been hampered in its collective bargaining by the obligation put upon it by government to prevent strikes and other serious disputes. In many sections of the industry, management has not been willing to provide adequate wage rates; many job descriptions are obsolete and do not correspond to the work done.

This industry lags behind most basic industries on the important question of union security.

It is our conviction that many employers still have not recognized that unions are here to stay and that they represent a powerful and necessary force in this vital industry.

Studies show that very little has been done by firms in this industry to prepare for the eventuality of disarmament and the need to reconvert to non-military goods. Some estimates indicate that with disarmament, even spread over a number of years, 90 per cent of the jobs in parts of the areospace industry will be lost.

Responsibility is upon management in cooperation with government and labor to plan so when disarmament comes, even though it might be gradual, the shift can be made without any serious effect upon workers or communities.

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