






Division Expenses  
1976

JANUARY							1	2	3								1	2	3	JULY														
	4	5	6	7	8	9	10				4	5	6	7	8	9	10				4	5	6	7	8	9	10							
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	29										29	30	31								1	2	3	4	SEPTEMBER									
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	28	29	30	31	1	2	3				28	29	30	31	1	2	3				26	27	28	29	30	1	2	OCTOBER						
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	30	31	1	2	3	4	5				30	31	1	2	3	4	5				28	29	30	1	2	3	4	DECEMBER						
JUNE							6	7	8	9	10	11	12								5	6	7	8	9	10	11							
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-  SALARIES AND WAGES (108 DAYS)
-  GOODS, UTILITIES, TRANSPORTATION AND SERVICES (110 DAYS)
-  LOCAL, STATE, FEDERAL TAXES (15 DAYS)
-  PENSIONS, INSURANCE, AND DEBT SERVICE (21 DAYS)
-  EARNINGS (PROFIT)(8 DAYS)

# 1976 was a good year; 1977 can be better, if...

by C. B. Hurtt  
Vice President &  
General Manager

After five months on the job, the most frequent question remains: "What are the division's goals?"

My answer is simpler than the execution: "Our goal is not only to get business, but to do business. . ."

Clearly we have more opportunities than we can bid. That is extremely exciting, in light of our win ratio which is better than 50 percent.



However, it is mandatory that on the jobs we do win, that we do the work in the most efficient manner and that we do everything possible to meet our commitments to our customers, avoiding unnecessary work.

Aerospace competition is fierce and our resources—both money and people—are limited. Competitive bidding is tough and managing these new programs is extremely tough. But we must, if we are to remain viable, continue to be perceived by our customers as meeting their standards of excellence.

By all standards, 1976 must be viewed as a very successful year. The division exceeded expectations in orders, sales, and profit. The hardware performance record was incredible: the Vikings landed on Mars; the tenth consecutive year of Titan flights without a Martin Marietta caused failure; the delivery and checkout of the CCMS; and meeting the milestones on the external tank.

By the end of the year our backlog on orders reached \$400 million. All of this was not without agony. We lost the bid for the Interim Upper Stage and it took tremendous perseverance to control our program and overhead costs.

The coming year, 1977, will be just as tough. But, we are in an excellent position to succeed.

Our major customer focus will continue to be the Defense Department and NASA. We are now NASA's number two contractor and we intend to retain that position.

Our business, in the main, is space transportation, spacecraft, command and information systems, and applicable research and development, with the emphasis on the development.

Elsewhere on these pages you will find

more detail on the plans of each product area for 1977 and I commend the material to your attention.

Denver is a good division, in a strong, stable company. We have the talent and the opportunity to be a great division. It may seem an old cliché but, I am convinced we can accomplish greatness with team work, discipline, and the desire to pursue excellence.

## For NASA Programs

### A forward look

by K. P. Timmons  
Director, NASA Programs

As 1977 begins, our focus in NASA programs will be on a 1921 law that governs the executive budget process for the United States. The statute requires President Ford to submit his annual budget to the Congress within 15 days after the start of the session--by January 19, 1977.

If the budget contains a recommended start for the space telescope program, it will signal the start of the procurement cycle and of the final efforts in the division's long pursuit of that program.



We are prepared, Congress appears to be ready to agree to the program, and the Office of Management and Budget--the President's budget arm-- is quoted as "having no problem with space telescope."

NASA has completed its plans and preparations and the nation's astronomers are on the threshold of getting a tool that will increase a hundredfold their ability to examine the mysteries of the universe.

We intend to be announced as the winner of the space telescope contract in September with work to begin in November and continue for at least six years. It's our kind of program. We want it and we need it!

The second major program in our product area, Labcraft, should require a proposal in late Spring. Labcraft is a serendipitous product of our Atmospheric, Magnetospheric and Plasmas in Space (AMPS) pursuit and, like space telescope, it is a large and long-term program. We have made investments in dollars and people which have established us as a strong contender. The AMPS competition had narrowed to

two, but Labcraft has moved ahead of AMPS and has brought with it a pride of four or five hungry "industrial tigers."

Beyond these two major opportunities, we are going to have to pinpoint our targets with great care, and each employee will have to help in analyzing and selecting the best.

Getting our share will require excellent proposals and good, experienced people.

From the President's budget message to the wrapup of at least two major pursuits of NASA programs, 1977 promises to be a good year. We have selected our targets with care and will add others during the year. All are long-term, high-technology programs. They will be fun to work on and they will be profitable.

It will be a good year.

## Defense systems orders to triple

by H. W. Terbush  
Director, Defense Systems

Defense systems is looking forward to continued growth in 1977, not only in its contributions to Denver division sales, but also in the challenge, opportunity, and satisfaction offered employees working on projects essential to national defense.

Our growth has been outstanding, and we expect our business to expand at a rapid rate. In 1975, defense systems orders were \$1.5 million; this year orders will be about \$17 million. We are projecting orders in excess of \$50 million in 1977. This tripling of business is expected again in the two or three years following 1977.

Major emphasis in 1977 will be on developing fundamental and advanced technology in three areas, antennas, spacecraft dynamics, and advanced power systems.



This work will be the basis for our pursuit of a series of major hardware contracts for which competition will begin in 1979 and continue to about 1985. What we do in 1977--how we perform on contracts, how successful we are in developing our technology base--will determine our business for about the next 10 years.

Our current and potential customers are people oriented. They depend on the capabilities and integrity of individuals and small groups, developing an almost one-to-one relationship.

With the emphasis on individual competence, we have been carefully staffing our organization, drawing heavily on skills that exist in the division.

The end of the primary Viking mission has been significant. People who performed successfully in key technical positions on this most complex space mission in history are now available to transfer their skills and competence to defense systems effort. Some are already in key positions in our organization.

We are in a tough competitive field. Our performance has demonstrated our competitiveness, our technical competence, and our professional integrity.

## CCMS looks for new business in 1977

by E. C. Wood

Director, LPS/Checkout, Control & Monitor Subsystems

The baseline for the future of the checkout, control, and monitor subsystem (CCMS) project has been provided by accomplishments of 1976.

Requirements in 1977 are demanding. It will take every resource of the project to meet them in the factory and in the field.

High-quality performance, in a timely and cost-effective way, must be combined with imaginative and sound ideas to meet the quality, cost, and schedule requirements. The engineering resource of the project must be directed toward new business while maintaining technical excellence on the current contract.



New business opportunities are good for additional contracts for Space Shuttle payload checkout equipment, for Air Force Space Shuttle checkout equipment for the Western Test Range at Vandenberg, and for application of CCMS-type equipment in other areas.

Acquisition of new business is not automatic nor does it come easily. And the resource demands are high.

Continued outstanding performance on the current contract can be a big plus in acquiring new business. This means everyone on the project must be prepared to meet all current and future job requirements.

It is my responsibility and I commit myself and project management to provide the resources necessary to do our day-to-day work and to get new business.

I hope all CCMS people share my confidence that we can continue to be a profitable project for years to come.

## As business changes so do skill requirements

by R. E. Weber

Director, Professional and Industrial Relations

For the first time in several years the division's planned manpower reduction was essentially complete at the end of the first quarter of 1976. We have turned the corner and have had some growth.

A slight but steady growth in overall manpower is expected in 1977.



But, as the business changes, there will be changes in skills required. This can lead to a strange paradox--layoffs while the division is hiring new people.

This presents a dual challenge: adding to the work force in selected areas for program buildup and at the same time retaining as many employees as possible by retraining them for new assignments.

New programs and division growth can provide opportunity for employee advancement and growth with additional opportunity for minorities and females.

Some new programs may require overseas assignments, with the additional challenge of properly handling problems associated with the assignments, especially when work will last long enough for family relocation.

One of the key efforts for professional and industrial relations in 1977 will be proposal preparation support with personnel aspects in winning new proposals more clearly recognized now.

Overhead budgets in 1977, like those in 1976, will limit funds for employee recreation activities.

A prime objective in 1977 will be to improve communication on personnel matters. A comprehensive employee benefits booklet is being prepared by Martin Marietta's corporate headquarters for distribution during the first quarter of 1977. Highlights of the layoff benefit and security program for hourly in-unit employees has been prepared and will be issued soon.

## Division seeks major role for Missile X

by R. M. Davis

Director, MX Systems

Missile X (MX), the nation's next strategic intercontinental ballistic missile (ICBM), is scheduled to be operational by the mid-1980s. More accurate, larger, and

carrying more warheads than Minuteman, it is one of the nation's responses to the recent weapons buildup by the Soviet Union. As Minuteman has, MX will serve best as a major deterrent to nuclear warfare.

To enhance MX survivability, it will be deployed in new mobile bases rather than in fixed silos.



Full-scale missile development will begin soon while the validation of mobile base concepts is beginning. Base full-scale development will be about two years later than the missile.

Work in 1976 has been on understanding the MX program and pursuing opportunities that fit division capabilities and provide business for 1977 and beyond. It has included:

- Study of the postboost stage of the missile. Called Stage IV, it is bipropellant and similar in many ways to the Titan Transtage.
  - Study of integration and systems support opportunities for missile and mobile base development.
  - Mobile vehicle design for the mobile base was a major effort aimed at 1977 business.
- I look forward to a win with contract activity to begin in late December or in January.
- In strategic operations analysis the division developed insight into the Russian threat and resulting MX systems requirements that guided hardware and integration activities that will continue in 1977.

The 1977 challenge is to get a major role in missile development—Stage IV or ATSS contract—and continue efforts for a contract in ground mobile base development, started by the mobile vehicle design proposal.

MX promises to be a program that can bring the division a large and continuing work base similar to the Titan program.

## New business activities successful

by Howard F. Keyser

Vice President, Program Development

Since last year's long range plan (LRP) was published, the division has won contracts for the tactical flag command center (TFCC), SCATHA, Department of Defense space transportation system ground support system (GSS), and the solid rocket booster (SRB) decelerator, as well

as a large number of valuable contracts in technical operations.

Although we were disappointed in not winning the contract for the interim upper stage (IUS), I am pleased with our new business activities. Our win rate on competitive proposals of about 50 percent in the past one and one-half years is commendable.

While specific plans have not been announced by President-elect Carter, campaign statements and action by Congress during the 1977 fiscal year budget cycle would seem to indicate no significant impact on Denver division product lines.

The fiscal 1977 NASA appropriation was approved at \$3.69 billion. We expect the NASA budget will continue at this level during the division's current five-year LRP with upward adjustments to offset inflation effects.



For the Department of Defense the fiscal 1977 appropriation was \$104.3 billion. While Mr. Carter has said he will reduce the DOD budget \$4 to \$7 billion, we expect the budget will remain well above \$100 billion for each of the next five years with a modest growth in real purchasing power each year.

We base this conviction on the belief that the realization of the growing Soviet military capability will partially relieve pressure to divert defense funds to social programs.

We forecast an increased budget in the division's DOD product lines. While Titan III funding will decline as Shuttle comes on line, there are growing launch vehicle opportunities in connection with the DOD Shuttle.

Major efforts in 1977 will be on these key business acquisition programs or product lines:

**Defense Systems** - We will persist in our long-range independent research and development, contract research and development, and study contracts to provide a sizeable product line;

**Missile X** - During 1977 we will select key opportunities and implement win plans;

**Viking Follow-on** - We will be helping the Jet Propulsion Laboratory and NASA define and sell to the Administration and Congress a follow-on mission;

**Command and Information Systems** - We plan to pursue a sufficient number of multimillion dollar opportunities to provide a growth rate of 20 percent a year; and,

**Labcraft** - We plan to complete our study contract and prepare a winning proposal

for the hardware program during the year.

In addition to these programs, we will exploit our position on the DOD Space Shuttle and work with the Air Force in establishing a version of Titan III as the nation's consolidated large expendable launch vehicle as a transition to the reusable Space Shuttle and as the Shuttle backup.

We will continue the practice of acquiring technology contracts to support division objectives and maintain critical skills.

We have demonstrated we can write the highest quality proposals, compete against industry giants, and win a fair share of the new contracts. We cannot afford to let down during 1977 because of past success.

## Command and information systems completes first year-successfully

by Donald W. Chrisman  
Director, Command and Information Systems

The first year of business for command and information systems was an outstanding one. We received two new major contracts with a potential total value of \$50 million. The contracts are with new customers for new products not previously produced by the division. We started 1976 with 25 employees and will end the year with about 250.

As with all the division, we have two major objectives in 1977: (1) perform on current contracts; and (2) expand our business.



Our most recent contracts resulted from highly competitive priced bids. It is essential we perform on these contracts within schedule and budget and, more important, completely satisfy the customers. Our ability to grow in this product area depends on our performance on these new contracts. We also must continue to maintain our high level of performance on the Central Valley project, Martron, and simulation contracts transferred to the organization.

Among new business opportunities to be pursued by command and information systems are:

**Navy Command and Control System Integration (NCCS):** The company winning this contract will define the Navy's command and control system architecture so the Navy gets maximum effectiveness from its various command and control programs.

**Operational Application of Special Intelligence Sources (OASIS):** An Air Force program to update and expand the operational intelligence capability in Europe.

**Division Tactical Operations System (DTOS):** The Army is working to define requirements for a tactical operations system to support division level forces. Early in 1977 we will do preliminary work to be ready to compete for the program in late 1977 or early 1978.

**Intelligence Systems:** Progress was made in 1976 in developing potential business with Department of Defense intelligence organizations. We will aggressively pursue this type of business in 1977.

**Related Programs:** We hope to expand business for Martron, the Central Valley project, and for electromagnetic environment simulators.

The year ahead will be a challenging one. Each person must be alert to new ideas and to new ways of getting the job done efficiently.

## Titan continues as prime launch vehicle

by C. E. Carnahan  
Vice President, Launch Vehicles

Titan, long the mainstay of the division's business, will continue in 1977 as the primary space launch vehicle for the Department of Defense.

In 1977, the division will pursue the use of Titan as the transition vehicle for the orderly progress from expendable boosters to the space transportation system with its reusable components.



A major step toward participation in the Space Shuttle program for the division's launch vehicle product area was taken in 1976 with the award of the ground support system program. Successful performance on this 23-month program at Vandenberg, Johnson Space Center, Marshall Space Flight Center, and Kennedy Space Center, will serve as a base on which we can expand our Space Shuttle involvement.

With the national objective to consolidate civilian and military launch capability in Space Shuttle, the near-term acquisition of Space Shuttle roles is critical to future business for the launch vehicle product area.

Under consideration is the pursuit of the

integration role for DOD payloads on Space Shuttle.

In addition to the continued launches planned at Vandenberg, two Titan IIIE vehicles will be used to boost NASA Mariner Jupiter/Saturn spacecraft at Cape Canaveral. The MJS missions will fly by Jupiter in March 1979, through the rings of Saturn in 1980, and may extend to a look at Uranus in 1986.

Support will continue for the Titan II operational fleet.

## Division 'builds' technology

by Walter O. Lowrie  
Vice President, Technical Operations

A major product of the Denver division is technology and the responsibility for "building technology" rests with technical operations.

The building of technology involves the development of people, facilities, techniques, and tools, and ranges from the identification and incubation of new areas of technology to the maintenance and maturing of established technologies.

The emphasis in technical operations in 1977 will be on the building of technology.

The paraphrase an old saw, "Time and technology wait for no man." It is important for people in technical operations to understand division needs and to seek out and pioneer new areas of technology.

In 1977, as we pursue the development and product phases of such products as the 10 megawatt solar collector, high density tape recorders, capillary tanks, and various software packages, we benefit from the pioneering work performed sometime back by talented individuals in the division.

Work of this nature will continue in 1977 as we explore such areas as passive cooling systems for infrared sensors, high data rate transmission, the space sextant, integrated computer emulation/system simulation, video guidance handling and imaging, and orbital maneuvering systems.

Emphasis will be on winning study and development contracts that fund these and other growing technologies.

In addition, division independent research and development (IR&D) funds will be committed to such tasks as basic software research, further development of our data



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handling electronics, communications, spacecraft attitude control capabilities, exploration of composite structures, and advanced manufacturing technology.

It is important, as we pursue the building of new technology, that we do not neglect the maintenance and maturing of technology in established product areas. Technical operations is the steward of the division's skills, standards, procedures. There will be a continuing effort to improve productivity in electronic manufacturing, the factory, and elsewhere. Ideas, such as those that improved productivity on Bell helicopter parts production and Titan III in 1976, will be sought out in 1977. We will continue to look at new systems.

Emphasis will continue on development of facilities such as the man-computer interaction laboratory and the orbiter aft flight deck simulator.

Development and maintenance of the skills, technology, facilities, tools, and discipline required for products as varied as the new programmable automatic control equipment (PACE) for Titan III, capillary tanks for the Intelsat V communications satellite, futuristic "space scooters" for orbital assembly tasks, electronic warfare environment simulators, heliostats for solar collectors, and large structural elements for external tank and Titan III offer us all significant challenges in the year ahead.

## Viking landers to provide bonus data

The planned 90-day primary mission to Mars has ended, but scientific exploration of the planet by two Viking landers has not.

The bonus of scientific data could continue for "a couple more years," according to Henry Von Struve, who was lander science group chief during mission operations. Von Struve returned to Denver recently for a new assignment in the division's defense systems organization.

"All systems worked so well, all instruments are in such good health, that I believe we can collect useful scientific information for a couple more years," he said. "Our only limit is power and I see no

problem there for the next one or two years."

Since early November, Mars has been slipping almost behind the Sun interrupting radio communication with the Viking landers. During the conjunction, soil samples are being incubated in the biology instruments for analysis when full communication is restored.

Mars began emerging from the vicinity of the solar corona in mid-December and landers will be in full operation about December 21.

In an interview with *Martin Marietta News*, Von Struve discussed primary mission accomplishments and the outlook for continuing scientific exploration of the planet.

- Chemical composition of the soil was determined by the x-ray fluorescence spectrometer with the instrument detecting mostly iron oxide, silicon, small amounts of aluminum, and traces of other elements.
- Composition of the atmosphere was analyzed in several ways, first with entry instruments like the accelerometers and radar altimeter, then with the retarding potential analyzer and upper atmosphere mass spectrometer, and, finally, when the lander was on the surface of the planet, with the gas chromatograph mass spectrometer. The analysis showed mostly carbon dioxide, with small amounts of nitrogen and argon.
- Cameras on the landers provided a good measure of atmosphere optical density characteristics for the summer time period, mainly examining the amount of soil particles and other materials suspended in the atmosphere.
- A large number of multispectral pictures of the Mars scene were made which included three channels of color (blue, red, and green), three channels of infrared, and one channel of black and white. The pictures will permit detailed compositional analyses.
- The meteorology instrument determined the summer weather patterns on the planet, reporting, for example, low wind velocities and cyclic changing directions. The winds blew from the eastern quarter during the day and shifted to the western quarter at night. Scientists could predict wind change times within 30 minutes.
- Using the pressure sensor on the landers, scientists were able to determine the lowest atmospheric pressure inflection point, important in measuring global flow conditions. The pressure trend as fall approached was downward.
- In the biology area, Von Struve's judgment is that scientists have determined "potential biological activity on the surface." He calls it "potential" be-

cause there was no verification of carbon-based organic material.

- Indications point to low or no seismic activity so far on the planet.

"During the extended mission," Von Struve said, "there will be investigation of the trends in meteorological and seismic activity, further atmospheric condition measurements, as well as the all-important continuation of biology experiments."

Surface samplers also will be active. One major effort will be to dig more deeply into the surface, perhaps creating a trench a foot deep, to see if permafrost exists below the planet's surface.

However, not all scientific study will be based on new information.

"In the imaging area (pictures) alone," Von Struve pointed out, "we have enough data to keep scientists busy for five years, perhaps even 10 years."

## Improvements planned for 1977

by Dan A. Linn  
Executive Director, Administration

As the Denver division completes its twentieth year, the level of activity continues as in the recent past. In 1977, the challenges we met so well in 1976 will continue, and we anticipate that more will be added.

Accordingly, the administration department must continue to fulfill its obligations with the same dedication and competence as in the past, as I am sure it will. However, there will be one noticeable change in emphasis.

Because the plant has been operating for twenty years, normal wear and tear is catching up with our facilities and equipment. Repair, replacement, and refurbishment increase in

importance with the passage of time. The 1977 maintenance and repair program will emphasize our efforts to preclude potential breakdowns. For example, the air-conditioning refurbishment effort that began this year will continue in 1977.

To maintain a competitive position and improve our ability to meet future demands, substantial capital expenditures have been authorized. These will be applied to both buildings and equipment.

The administration department is responsible for maintaining competitive overhead rates. Because the department is the heaviest contributor to these costs,



our challenge is to improve our services while living within our budget. To do this, we must continue our programs of energy conservation, limited vehicle leasing, and economical reproduction methods. Furthermore, the pursuit of new business requires continued improvement in the efficiency of our preparation of proposals.

To contribute to economical performance of the division's contracts, the administration department must also continually improve its direct and indirect cost position. New contract requirements like accounting and life-cycle-cost/design-to-cost standards require constant attention from all of us.

Some of our new product lines significantly increase the importance of plant protection and security. To further our goal of continuing in such work, increased security consciousness is required of all of us.

Few factors affect our morale more directly than food services, which faces the continuing struggle to cope with inflation while maintaining quality and variety at reasonable prices. Inflation and highly competitive contract bidding also severely tax the ingenuity and professionalism of those in the materiel function. One solution to the problem is early involvement of materiel personnel in our proposal efforts.

We successfully met the challenges of our division's twentieth year, and I am confident that we will be equally successful in 1977. To this end, I am committed to the continued support of all your innovative ideas and to the improvement of all communication channels.

## External tank program to meet major milestone

by George E. Smith  
Vice President, Michoud Operations

Next year the external tank (ET) program at Michoud will move from the design and tooling stages to the delivery of hardware—all according to schedule.

Three years of employee hard work and dedication in overcoming obstacles of facility modification, fiscal funding limitations, and design and tooling changes will make delivery of the first complete external tank for NASA's Space Shuttle possible.

The first complete external tank—called the main propulsion test article (MPTA)—will be delivered next summer to the National Space Technology Laboratory (NSTL) in Mississippi. It will be mated with three Space Shuttle orbiter main engines for static firing. The tests will assess orbiter/external tank main propulsion performance.

Delivery of the MPTA, however, is not the first major hardware delivery in 1977. In March, an intertank, one of three major components of an external tank, will go by barge to the Marshall Space Flight Center (MSFC), Huntsville, Alabama, for static testing. The intertank is designated ISTA for intertank static test article.

One of the last major program milestones comes in December 1977 when the remaining two major external tank components, a liquid oxygen tank (LO<sub>2</sub>) tank and a liquid hydrogen tank (LH<sub>2</sub>) with their load rings, are sent by barge to MSFC to complete the static testing begun earlier with the ISTA.



Flight hardware will go into production in 1977 with fabrication scheduled to begin on the first two external tank flight articles (ET1 and ET2). ET1 is scheduled for delivery to the Kennedy Space Center (KSC), Cape Canaveral, Florida, in October 1978.

So facilities at KSC will be ready for ET1, Michoud operations has established the external tank test operations at the Cape where it will be responsible for external tank tests, checkout, and launch operations.

Since the division won the external tank contract in 1973, all activities have been centered at NASA's Michoud Assembly Facility (MAF) in New Orleans. However, in 1977 Michoud personnel will be working at four major NASA facilities: Michoud Assembly Facility, Marshall Space Flight Center, Kennedy Space Center, and the National Space Technology Laboratory.

While Michoud will continue to be the center of activity, increased program work at the other locations will require travel for employees and, in some cases, temporary relocation to support specific tests.

There are 1500 employees at Michoud.

NASA's Space Shuttle schedule calls for the second phase of the external tank program to begin in November 1977 when long-lead procurement will signal the start of additional tooling. Production of additional flight tanks is set to begin in November 1978.

The rewards of three years of outstanding performance by all employees at Michoud will come in 1977 with the delivery of the first hardware and the beginning of critical testing of that hardware.