LONG-RANGE PLAN

1966 – 1972

IBM Federal Systems Division

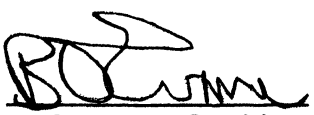
FEDERAL SYSTEMS DIVISION

LONG-RANGE PLAN

1966 – 1972

June 1966

Approved by:



B. O. Evans, President

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Section 1

EXECUTIVE SUMMARY

Using the recently updated FSD 1966-1967 Operating Plan as the point of departure, this long range plan projects FSD's objectives, strategies, and business action plans for 1968 to 1972. This plan is strategic in nature and provides measurable milestones within our major business areas. Thus, it is not as susceptible to revisions generated by organizational changes.

ENVIRONMENT AND ASSUMPTIONS

The environment projected over the life span of this plan results from the following major national goals:

- Defense of the free nations of the world.
- Achievement of eminence in the space age.
- Developing and conserving human and natural resources and improving our environment through the Great Society programs at national and local levels.
- Maintain a sound economy.

This plan is based upon the following major assumptions:

- The national defense will remain at or near its present level.
- The Vietnam situation will not escalate into a major war.
- The growth of the nation's economy will permit development and implementation of the Great Society programs.

The primary business principles of FSD will remain:

- Service to the Federal Government.

- Technical precursor and fallout contributions to the IBM Corporation.
- A reasonable return on invested capital.
- Sound revenue growth.

OBJECTIVES

	1966	1967	1968	1969	1970	1971	1972
			(Dollars in Millions)				
• Sales	$164	$199	$243	$287	$312	$337	$370
• Gross Income	152	180	205	232	257	283	315
• Return on Investment	0.7%	3.0%	3.4%	3.7%	4.2%	4.7%	5.3%

- Improve our ASPR profit yearly, reaching a minimum of 7.6% by 1972.
- Decrease ratio of accounts receivable and unreimbursed expenditures to gross income.
- Establish and implement an integrated interdivisional plan which will ensure FSD fallout to the IBM Corporation by year-end 1966.
- Become one of the top five aerospace special computer contractors by 1972.
- Maintain our position as a major space systems contractor.
- Regain our position in the avionics market place.
- Expand into the ground-based tactical market place.
- Retain and emphasize leadership in information handling systems.

BASIC STRATEGIES

FSD will accomplish these objectives in the following manner:

- Concentrate resources on addressing and winning selected large systems programs which promise major revenue potential. Examples are: AMSA, ADSAF, AAP, MOL, FB-111, SRAM and emerging Great Society programs.

- Identify, analyze, and selectively address new research and exploratory development opportunities in areas offering precursor fallout benefits to the Corporation.

- Develop and market a special purpose computer technology which will effectively satisfy the projected operational and environmental requirements for airborne, spaceborne, and tactical field systems.

- Create and project an expanded major systems capability through a flexible combination of the following:

  a. Full utilization of the total expertise and capabilities of the Corporation, carefully tailored to the problems of the customer.

  b. Judicious application of in-house investment funds to fill major gaps in our capabilities.

  c. Close correlation of development programs with the projected requirements of the market.

  d. Use of teaming and subcontracting opportunities as a method of building or expanding critical skills and as an entry into new or diversified markets.

FSD TECHNICAL PRECURSOR PROGRAM

The FSD Technical Precursor/Fallout Program now in the formative stage, will cause positive involvement of other IBM divisions in the identification, evaluation, and advancement of precursor/fallout technologies and techniques directed toward using government opportunities for:

a. Development of capability in new areas of future importance to IBM.

b. Timely validation of major technologies developed in all IBM research and engineering programs.

For this program to succeed, it is incumbent upon FSD to pursue the technologies, techniques, or products identified so that most significant items can be utilized in FSD or transferred from FSD to other IBM divisions and made part of their long-range planned programs.

Currently, General Engineering in SDD has been designated as the SDD control point for interaction with FSD and will designate responsibilities for effective interfaces in each identified precursor area.

DPD Industry Area Managers will review and comment on the FSD Fallout Summary to determine whether the items identified are indeed applicable to future DP market areas.

The planning for and the mechanism required in evaluating and negotiating agreements between FSD and other IBM divisions, i.e., ensuring that fallout does occur, have reached a point where the long term value of precursor/fallout projects are clear to SDD and DPD as well as to FSD. Potential benefits and examples of specific projects which provide these benefits and which have interdivisional concurrence include:

Benefit	Projects
Validate IBM technology by early use in a government application	System/4 Pi Components
Use FSD capability to advance the schedule of the SDD planned program	Advanced Scanner/Recorder
Use FSD capability to develop a new approach to large programming systems	Evolutionary Systems for Data Processing
Develop IBM capability in new areas of future importance to SDD	Satellite Communications

The FSD technical precursor items are identified by business action area, projected availability, and divisional concurrence in Table 1-1.

Item	FSD Business Area					FSD Projected Availability	Concurrence				
	Avionics	Space	Tactical	Information	Exploratory		Research	SDD	ASDD	DPD	Components
Operational Monolithic Systems	X	X				1967		X			
Next Generation Circuits and Packaging	X	X	X			1968		X			X
Operational Large Scale Integration Systems		X				1969	X				
RO/NDRO Memory Techniques and Applications	X	X				1967		X			
Sensors and Displays	X	X	X		X	1969	X	X	X		
. Scanistor - 2D Mosaics, Linear Arrays											
. Infrared Detectors											
. Solid State Display											
. Digital (Force Sensor) Transducer											
. Digital Strap down Inertial System											
. High Resolution Radar Mapper											
Laser Applications	X	X	X		X	1968		X		X	
TIBOE - Communication											
Laser Radar System											
TRAIL - Tactical Recon Aerial Laser											
System Application of Aircraft Integrated Data System	X					1968				X	
Phased Array Radar Applications	X					1969		X			
Gunn Effect Oscillator Applications	X					1968		X			
Real Time Programming Systems (Application Package)		X		X		1966		X		X	
Configuration Management System Techniques		X		X		1967		X		X	
Real Time Maintenance Systems		X				1967		X		X	
Ultra Reliable Systems (self-repairing)		X				1967		X			
Data Handling System		X	X	X		1967		X		X	
. Data Acquisition-sensors											
. Compaction											
. Exception Reporting											
. Data Sharing											
. Computer Control											
. Closed Loop/Real Time											
. Data Bank											
. Digital Message Entry Device											
. Error Correction System											
Security Control Technology			X	X		1966		X			
Man-Machine Communications			X			1967		X			
Information Retrieval (General Information System)				X		1966	X	X		X	
Computer Assisted Instruction (DP Education System)				X		1967		X		X	
Meteorological Systems				X		1967	X		X		
Systems Integration Modules	X	X	X			1966		X		X	X
Economic Modeling				X		1966-67				X	
Computer Managed Laboratory				X		1968-69			X	X	
Signal Processing Algorithms			X			1967			X	X	

Table 1-1
FSD TECHNICAL PRECURSOR PROGRAM

Item	FSD Business Area					FSD Projected Availability	Concurrence				
	Avionics	Space	Tactical	Information	Exploratory		Research	SDD	ASDD	DPD	Components
Transportation Systems					X	1966-67			X	X	
Satellite Communications		X			X	1968		X		X	
Evolutionary Systems for Data Processing				X	X	1967		X		X	
Advanced Computational Methods		X			X	1968	X				
Laser Development (High Power, Precision)					X	1968	X				
Holography					X	1969	X				
Application of Microwave Devices		X			X	1968	X				
Missing-Core-Read Only Store Applications	X	X	X			1966		X			
Manufacturing Process Development	X	X				1966		X			X
Microminiaturization MIB Technology	X					1966		X			X
Non-Linear Optics					X	1969	X				
DP Hardware Revenue	X	X	X	X		1966-72				X	

(Dollars in Millions)

	(Actual) 1960-1965	1966	1967	1968	1969	1970	1971	1972
DP Revenue	$ 121.3	$24.2	$27.2	$31.5	$37.8	$43.7	$49.5	$56.7

Table 1-1 (Continued)

INTERDIVISIONAL SUPPORT

Technology/Techniques	Other IBM Divisions	Defined	Potential	Start Time
NGT	CD		X	1968
LSI	Research, SDD		X	1968
Advanced Memory	SDD and SMD	X		1966
Laser Development	Research		X	1967
Gunn Effect Devices	Research		X	1967
Light Emitting Materials	Research		X	1967
Scanistor Devices	ASDD		X	1967
Software	SDD	X		1966
Sensors	Research		X	1967
GIS (Type II Program)	DPD	X		1966
Intelligence Security Hardware	SDD, ASDD, Research		X	1967
Meteorological Instruments	ASDD		X	1967
Weather Prediction	Research		X	1967
Education:				
Course Development	SRA		X	1966
Development of CAI Hardware	ISDD	X		1966
Behavioral Studies	Research		X	1967
Numerical Analysis	Research		X	1967
Design Modif. Cypress	SDD	X		1966
Tactical I/O Mod. Std. Hardware	SDD		X	1968
Ground Based Systems Support	DPD	X		1966
Marketing	DPD	X		1966
Manpower Skills (Major Program Win)	DPD, SDD		X	-
Shop Order Support (500K +/Yr.)	SDD	X		1966
Product Program Support (1M/Yr.)	SDD	X		1966
SAC/SAGE Parts Mfg. (200K)	SMD	X		1966

RESOURCES REQUIRED

Investment	Dollars in Millions 1966	1967	1968	1969	1970	1971	1972
IBM	$ 4.6	$ 5.1	$ 5.1	$ 5.1	$ 5.2	$ 5.3	$ 5.4
IRAD	2.9	3.4	3.7	4.2	4.6	5.1	5.6
Total Investment	$ 7.5	$ 8.5	$ 8.8	$ 9.3	$ 9.8	$10.4	$11.0
Total Invested Capital	$ 71.5	$ 81.3	$105.8	$122.4	$139.4	$140.0	$ 147.5
Personnel	11,648	12,769	13,646	14,232	15,128	15,931	16,811
Facilities (Total) (thousands of square feet)	2,030	2,223	2,280	2,340	2,530	2,640	2,760

RETURN

	Dollars in Millions 1966	1967	1968	1969	1970	1971	1972
Sales	$ 164	$ 199	$ 243	$ 287	$ 312	$ 337	$ 370
Gross Income	152	180	205	232	257	283	315
Backlog 12/31	311.7	330.3	368.7	424.1	478.9	532.9	588.4

Revenue by Business Action Areas

	1966	1967	1968	1969	1970	1971	1972
Avionics	$ 7.8	$ 20.6	$ 34.3	$ 38.8	$ 41.9	$ 50.2	$ 51.1
Space	117.4	127.7	133.4	146.0	157.8	166.1	181.0
Information	25.0	24.1	30.1	31.6	39.0	48.8	59.9
Tactical	1.6	6.9	5.2	12.1	14.1	12.9	17.0
Exploratory	.3	.7	2.0	3.5	4.2	5.0	6.0
TOTAL	$152.1	$180.0	$205.0	$232.0	$257.0	$283.0	$315.0

PROBLEMS AND RISKS

The exposures of this plan are primarily those inherent to government business. The possibility of contract termination is ever present, and management is constantly alert to such a possibility. In this plan, a combination of three factors stands out as contract termination preventatives: (1) More than 70% of the Division's business is in the one major area within the government market place reflecting growth — Space; (2) The growth of programmer personnel — particularly at remote locations — provides the Division with a skill inventory which is in great demand and readily reassignable; and (3) The addition of the SLT activity at Owego provides a sizeable buffer of commercial manufacturing work within the Division.

COMPARISON OF PLANS

Dollars in Millions

Sales	1966	1967	1968	1969	1970	1971	1972
5/65 Five-Year Plan	$119.0	$144.0	$213.0	$228.0			
11/65 Two-Year Plan	131.0	185.0					
5/66 Long Range Plan	164.1	198.6	243.4	287.3	$311.8	$337.1	$370.4
Gross Income							
5/65 Five-Year Plan	150.0	169.0	194.0	219.0			
11/65 Two-Year Plan	152.0	180.0					
5/66 Long Range Plan	$152.0	$180.0	$205.0	$ 232.0	$257.0	$283.0	$315.0

In conclusion, we feel this is a challenging - but reasonable - plan for the division. With the help of Corporate resources and an effective market intelligence, the division can perform a significant role for the government and the corporation in advanced state-of-the-art developments.

FIELD SERVICE

At present the Field Engineering (FE) effort needed to support FSD hardware is quite small, and, since the situation varies between contracts, each item is handled on an individual basis. As the hardware effort at the FSC Engineering Laboratory increases during the next few years, there will be a corresponding increase in the need for field service effort. To prepare for this increase in an orderly fashion, a document of understanding will be established between FSD and FED to provide relationships and define responsibilities between the two divisions. It is the intent of FSD that, whenever feasible and practicable, the following will apply:

a. It is FSD's intention to provide full service on all equipments designed and manufactured within the division.

b. FSD will arrange to perform the maintenance or to obtain field services through normal IBM channels for IBM commercial products incorporated in FSD system contracts.

c. FSD will provide service on equipments provided by subcontractors or government furnished equipments where it is in the best interest of the customer.

Section 2

THE FSD MARKET

MARKET ENVIRONMENT

The FSD market environment is determined by the size and content of the federal budget. Projected trends in government spending are, therefore, critical to long range planning. National goals and objectives, formulated according to pressures of the national and international political and economic situation, are the source of the federal budget and are implemented by the budgetary process. The three programs of primary interest to FSD are:

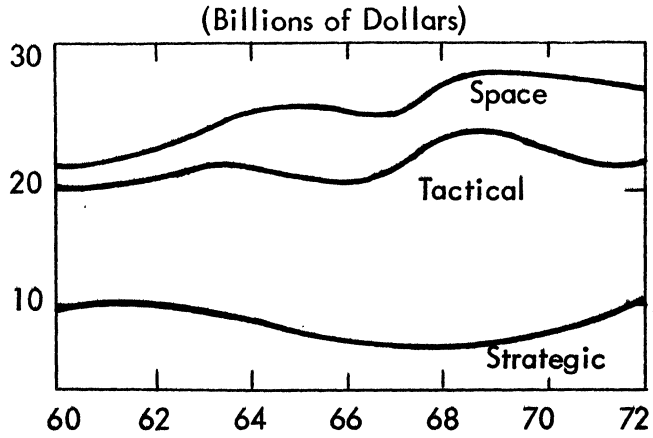
a. National Defense Programs: The Vietnam situation has forced DOD to place top priority on tactical weapons and systems. The large increase in spending for the next two or three years will go mainly to the Army/Navy and Tactical Air Force buildup. Next generation strategic systems are expected to receive increased funding support in the early 1970's after the major tactical procurement funding begins to decline.

b. National Space Programs: Spending peaked at $7.3 billion in 1966 and is expected to decline moderately for the next two or three years before building back to about $8 billion by 1972. Further escalation of the Far East situation — or a change in administration in 1968 — could have an adverse impact upon space expenditures.

c. Great Society Programs: Spending is expected to increase sharply during the next few years. Much of the projected overall budget increases will be caused by the growth of these "civil" programs. Again, events in the Far East or a change in administration could have a major impact.

Defense spending will grow sharply to a peak of about $65 billion in 1968-1969 and taper back to about $60 billion by 1972. Space expenditures will suffer a temporary decline because of the increased defense spending, but will recover moderately by 1972.

Projected trends in the defense/aerospace market are shown below.



The defense/aerospace market is mainly the RDT&E and hardware procurement expenditures of DOD and NASA. This graph shows the history and projected trends in the three major elements of the market: space, tactical military systems, and strategic military systems.

Defense/Aerospace Electronics Market

(Billions of Dollars)

Customer	1966	1968	1970	1972	L/R Trend
DOD	$ 7.9	$ 8.8	$ 9.3	$ 9.3	Up + 18%
NASA	1.9	2.0	2.1	2.4	Up + 26%
AEC/FAA	0.2	0.2	0.2	0.2	Level
Great Society	0.1	0.2	0.5	1.0	Up + 900%
Total	$10.1	$ 11.2	$ 12.1	$12.9	Up + 28%

The electronics elements of the defense/aerospace market are FSD's primary business area. The ratio of electronics costs to total systems costs has been increasing steadily and is expected to continue growing during the next few years. DOD is and will remain the largest potential customer, with numerous new systems entering development and production phases. NASA is the second

largest customer, and, if current plans for expanded manned space and unmanned space programs are approved, this market area will see a resurgence of growth by 1970. The AEC/FAA electronics market is relatively stable and about evenly divided. The Great Society programs promise the largest percentage of growth and will lead to expanded market opportunities in the mid-1970's.

FSD Addressable Market

(Millions of Dollars)

Application Area	1966	1968	1970	1972	L/R Trend
Avionics	$ 750	$ 850	$ 1050	$ 1200	Up + 60%
Space	850	950	1050	1150	Up + 35%
Tactical-Surface	250	500	450	400	Up + 60%
Special Information-Ground Systems	500	500	800	800	Up + 38%
Total	$ 2350	$ 2800	$ 3350	$ 3550	Up + 53%

The FSD addressable market is that portion of the electronics market for which FSD is qualified to bid. Such items as radar, infrared devices, standard communications, and television are eliminated. The avionics market is mainly aircraft and airborne missile guidance and navigation, airborne computers for reconnaissance and target acquisition, airborne fire control, instrumented data collection, and related areas. The space market includes spacecraft and launch vehicle instrumentation, guidance and control, digital data compaction and communication, ground support and checkout systems, and range telemetry and mission control. Tactical surface systems include mobile command and control, weapons fire control, mapping and image interpretation, digital communications, and related areas. The special information area covers fixed base command and control, intelligence data systems, and computer-assisted educational systems. The projected growth of 53% in our addressable market is about double that of the overall electronics market. This reflects the increased FSD technical competence resulting from current and projected in-house development programs.

FSD Sales Potential

Non-Preempted Market Potential	(Millions of Dollars) 1966	1968	1970	1972	L/R Trend
Avionics	$ 150	$ 250	$ 500	$ 750	Up + 400%
Space	160	520	850	1000	Up + 550%
Tactical-Surface	25	150	250	250	Up + 900%
Special Information-Ground Systems	160	190	450	600	Up + 275%
Total	$ 495	$ 1110	$ 1950	$ 2600	Up + 440%

The FSD sales potential is the non-preempted segment of the addressable market from which we can expect to win new business. This non-preempted segment is very small in the near-term but will show a significant long-range increase.

a. The avionics market includes such projects as AMSA, AWACS, AIDS, SRAM, FB-111, PASS, STAAS, VFAX and FX.

b. The space market includes Saturn, MOL, AAP, Mariner, Surveyor, OAO, Gemini B, and Ranges and Mission Control Complexes.

c. The tactical surface market includes ADSAF, TIPI, Poseidon, SAM-D, and Sonar and ASW programs.

d. The special information-ground systems market includes the Air Force "L" Systems, NMCC, IDHS, management systems, computer-assisted education systems, mass transport, resource control, balance of payments and other evolving Great Society programs. Similar state and local government problems are in this business area.

MARKET OBJECTIVES

Increased Sales and Revenue Contribution to the Corporation. A major divisional objective is the annual growth of gross revenue at a rate of about 12% yearly. Winning the necessary new business sales to achieve this objective is the basic goal of the FSD marketing organization.

Develop and Expand FSD Role in Precursor Technology. Close marketing surveillance of developing advanced research opportunities and intracorporation

coordination in addressing suitable projects will lead to an expanded and significant precursor role.

Concentrate Efforts and Resources on Potential Major Systems. Early identification and concentration on winning potentially large systems business is a key factor in:

a. Improving our profit position by increased hardware sales, which will provide a stronger balance between production and R&D workloads.

b. Ensuring that our in-house product and technology development program investments return an acceptable profit ratio.

c. Achieving new business sales with a profitable ratio of return for marketing and proposal costs.

Improve Customer Image as a Major Defense Aerospace Contractor. Win customer acceptance as a major systems contractor rather than as a subcontractor for components and subsystems. Position ourselves for prime or associate prime contract awards.

Achieve Projected Sales Goals. The projected overall sales goals shown below are objective rather than calculated percentages of the available market.

(Millions of Dollars)

1966	1967	1968	1969	1970	1971	1972
$ 164	$ 199	$ 243	$ 287	$ 312	$ 337	$ 370

Increased sales are the pacing factor of this long-range plan. To achieve these goals, we must develop our competitive posture to improve our current win ratio from about 0.07% of the available market dollars to about 10% of these dollars by 1971-1972. This will require:

a. Improved analysis of the market and early identification of new business opportunities.

b. Concentrated control and direction of the Division's total talents and resources toward the most promising business areas.

c. Development of products and capabilities which have

positive correlation with the stated and projected demands of the market.

d. A vigorous and sustained marketing campaign to improve our overall competitive posture.

e. Improved planning, reporting, and measurement techniques and procedures.

FSD MARKETING CONCEPT

Defense/aerospace marketing is now a highly specialized and complex function. Essentially, the market consists of one customer with a single source of funds — the Federal Budget — but there are many cross-currents of conflicting priorities, varying contractual procedures, overlap of missions and requirements, and multiple usage of techniques and equipment. A wide range of environmental factors and operational parameters limit and shape the requirements.

The FSD marketing concept is tailored to these unique requirements. It calls for a closely coordinated team, technically oriented and managed at the functional level and strongly guided and supported by customer-oriented specialists, market-and-application-oriented analysts, and environmental and operational specialists.

The FSD marketing organization is structured to permit maximum flexibility of operations while applying necessary resources to opportunities at hand. The management structure is typical: FSD Headquarters coordinates, guides, and supports; center headquarters do the same for their individual programs; and program managers have basic responsibility for selling. The support structure is unique: Field Marketing provides close customer liaison and interface with the center program that can best address the customer problem; Advanced Program Technical Marketing concentrates on selling its specialty to customers with an identified need. Specialized staff functions such as market analysis, operations analysis, proposal preparation, and supporting scientific expertise are centralized to the maximum permissible degree, both within centers and at FSD Headquarters.

The history of our market and of FSD sales shows that only a small percentage of the numerous projects started ever reach high dollar-value production. To ensure that our marketing effort and talents and resources are applied in proportion to the areas of greatest promise, we have developed the FSD Main Thrust Marketing

Project procedure. The salient points of this procedure are:

a. A main thrust project is one which promises substantial sales and revenue return to the division.

b. After careful analysis, the center managers designate their own main thrust projects and allocate the necessary resources to ensure a major development and marketing effort.

c. A special listing of main thrust projects is maintained and distributed to all division marketing management. Management attention and support at all levels is centered upon winning these key projects. Frequent progress checks and reviews are scheduled, and special support, including proposal preparation, is rendered as required.

A projection of marketing manpower over the planned period follows:

	1965	1966	1967	1968	1969	1970	1971	1972	Compounded Growth Rate
Marketing	229	267	290	320	340	370	410	420	9.0

Section 3

BUSINESS ACTION PLANS

AVIONICS

Environment and Assumptions

The avionics business area consists of the on-board electronics systems carried by military and civil aircraft, air-launched missiles, and related test equipment.

From 1968 through 1972, DOD is expected to stress improvement of tactical mission performance through the use of common, multipurpose avionics. Specific demands will be made for improved precision navigation, target sighting, weapon delivery accuracy, surveillance, reconnaissance, communications, penetration aids, serviceability, and ultra reliability. Microminiaturization of avionics equipment is essential for tactical and strategic aircraft. Development of air-launched missiles will increase.

Procurement will stress maximum cost/effectiveness and interservice commonality through use of contract-definition-phase techniques. Nearly all major avionics systems will be integrated by air frame manufacturers with subsystems procured by these manufacturers on a fixed price basis.

The number of competitors is not expected to increase from 1968 through 1972. More than 25 major competitors can now be identified, many of whom possess computer capability and additional strength in platforms, radars, and other subsystems. Organizations having skill in computers, ancillary subsystems, and components are expected to receive the greatest share of the market.

FSD has identified 18 programs valued at $1.5 billion which are within the Division's capability.

Objectives

a. Reestablish ESC as major avionics supplier by 1968

b. Achieve revenue as follows:

	Millions of Dollars						
	1966	1967	1968	1969	1970	1971	1972
	$ 7.8	$20.6	$34.3	$38.8	$41.9	$50.2	$51.1

c. Technical Precursor Role

1. Avionics equipment usage of next generation technology prior to commercial

2. 2 D display development

3. Advanced manufacturing processing techniques

4. System 4 Pi development

Major Milestones

The success of the effort in avionics is dependent on being chosen to perform on several major programs and the completion of technical work now in progress. The following milestones will be critical to the course of events from 1967 to 1972:

a.	Power on TM	July	1966
	CP	October	1966
	EP	December	1966
b.	Win Advanced Manned Strategic Aircraft Contract (AMSA)		1966
c.	Win Short Range Attack Missile Contract (SRAM)		1966
d.	Win Mark II Computer Contract (FB-111) or MOL Data Management System		1966

Failure to achieve these milestones will result in reversion to the alternate business strategy, which addresses the nonpreempted portion of the avionics business area.

Return

The table below summarizes the financial return anticipated for the avionics business area.

	Dollars in Millions						
	1966	1967	1968	1969	1970	1971	1972
Sales	$30.2	$37.9	$56.3	$61.9	$62.1	$63.2	$65.9
Revenue	7.8	20.6	34.3	38.8	41.9	50.2	51.1

Strategy

Achievement of FSD objectives will be accomplished through the exploitation of precursor technologies in the development of computers and avionics equipment. Specifically,

a. The tactical/general forces avionics aircraft business area will be addressed.

b. The next generation technology will be used in advanced computer development.

c. Growth in I/O and peripheral avionics will be achieved.

d. Federally supported B-52 bomber modernization will be pursued. This activity, coupled with current (AMSA) Advanced Manned Strategic Aircraft studies, will provide continuity of business opportunity in the avionics field.

e. Gunn devices and lasers will be applied to new avionics equipment.

f. The 4 Pi computer family will be defined by 1968, and the technical improvement program will be underway. This program will guarantee the availability of a marketable base product for the years 1969-1972.

g. Gunn Effect radar equipment will be developed to apply to both tactical and strategic aircraft and exploited in conjunction with other radar capabilities (PASS, radar processors).

h. Scanistor, light-emitting diode, and force sensor development will provide display and airborne sensing capability, and microminiaturized analog circuitry will be developed, thereby giving FSD capability in technologies ancillary to airborne computation. The primary strategy is to exploit precursor technology through the development of System 4 Pi and to expand the strategic avionics work currently being performed under contract.

i. Technical competitiveness will be maintained in the 4 Pi family over the planned period by converting to NGT, updating memories, and developing military I/O adapters. Exploratory development in magnetic matrix switching and new logic design will be necessary when the advanced digital technical technology from IBM is available and determined applicable to our military computer line.

Should the primary strategy be only partially successful, a secondary position has been evolved. Major decisions on DOD avionic programs are forthcoming in 1966. Should FSD be chosen to perform on significant contracts, the 4 Pi program will be directed toward providing specifically useful equipment for those contracts won. If FSD is not chosen, the investment program will be redirected to address the nonpreempted portion of this market.

Technical Requirements

The major technical requirements for success in selling avionics are as follows:

a. Hardened tactical interface boxes are necessary if 4 Pi computers are to be useful. This area will require particular attention if 4 Pi computers are to be sold in the tactical market.

b. Next generation technology components are desired to keep the 4 Pi computer family technically competitive. Corporate support is required in this area.

c. An improved phased-array radar based on Gunn Effect is necessary to address target acquisition, damage assessment and penetration aids problems. Current phased-array radar systems have poor cost effectiveness ratios. Improvements will come from application of advanced technology such as Gunn Effect devices.

Table 3-1 summarizes the investment required to reach the avionics business area objectives:

Table 3 - 1

AVIONICS INVESTMENT REQUIREMENTS

	Dollars in Millions						
	1966	1967	1968	1969	1970	1971	1972
Investment							
IRAD	$ 2.0	$ 2.0	$ 1.1	$ 1.5	$ 1.6	$ 1.7	$ 2.0
TD	2.3	1.8	2.4	2.0	1.9	1.8	1.5
TOTAL	$ 4.3	$ 3.8	$ 3.5	$ 3.5	$ 3.5	$ 3.5	$ 3.5

The annual $3.5 million investment provides an average of $2 million per year for computer development. The remaining $1.5 million is allocated for development of new avionics equipment.

Major Risks

Major risks in the avionics business area can be summarized as follows:

a. The loss of proposed business will have serious affect on the 4 Pi development program because the customer decisions affecting FSD come early in the plan period.

b. Corporate development of the next generation technology and its applicability to the 4 Pi system will bear directly on the future marketability of the improved 4 Pi computer family.

c. Support from within FSD for Gunn Effect and laser development is required. Investment is presently insufficient for this work; contractual coverage must be obtained.

Interdivisional Support

Support from CD is necessary in the development of next generation technology components. Such support is dependent on Corporate decisions regarding the commercial line. Additional support is necessary from ASD in the development of scanistor devices.

Specific supporting technology requirements are listed below:

a. Dependent on Components Division — Next generation technology

b. Dependent on Research Division — Light emitting materials, etc.

c. Dependent on SDD and SMD — Advanced memory technology

d. Dependent on CES — Laser development

e. Dependent on CES — Gunn oscillator development

Technical Precursor/Fallout to IBM

Benefits for IBM commercial divisions fall into three general categories:

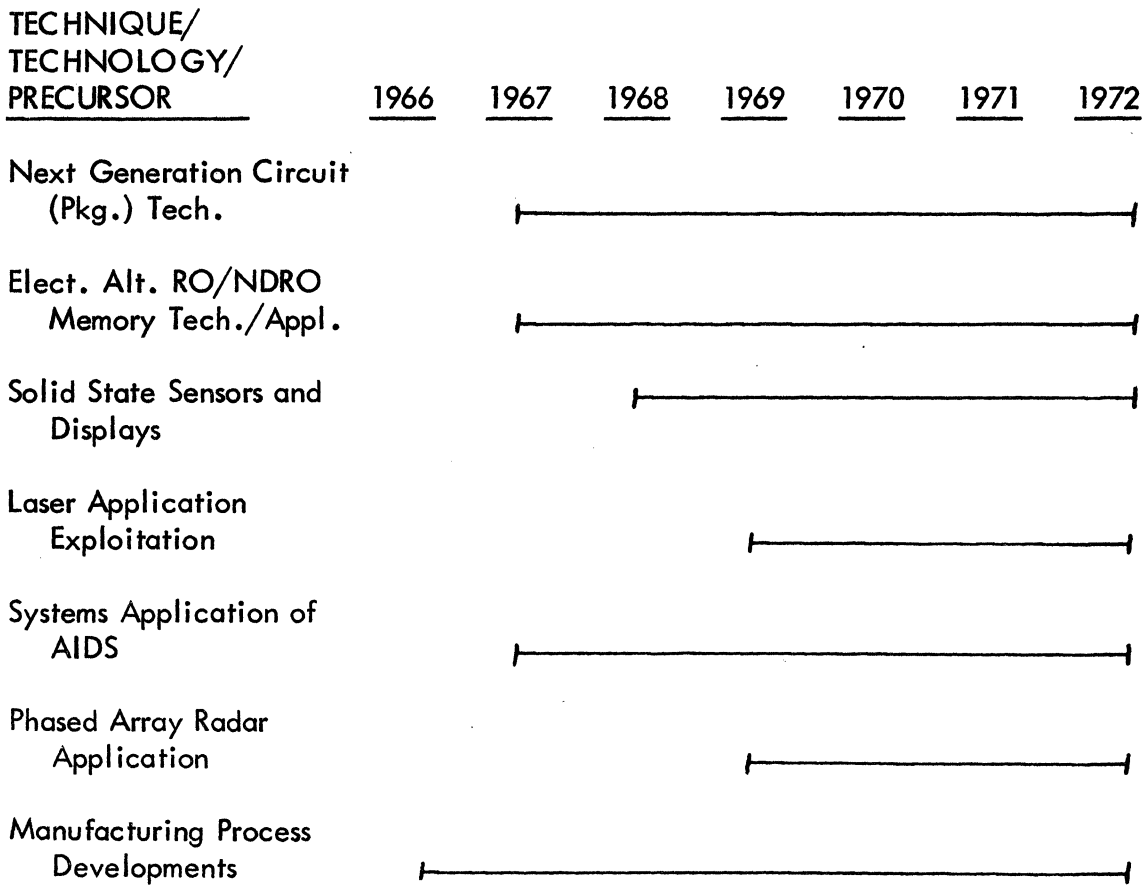
a. Commercial product potential using state-of-the-art knowledge. The AIDS method of performance monitoring and analysis and its equipment now has a small identified market. Success on current contracts using this equipment could produce a commercially

saleable product.

b. Commercial product potential using precursor technologies. IR and laser applications may have commercial potential for IBM diversification.

c. Application of precursor techniques, next generation technology, and advanced manufacturing methods prior to general use in IBM provides early equipment usage of next generation technology, absorbs some of the high cost of pilot production, and yields equipment experience prior to commercial use.

Time phasing of precursor/fallout to IBM is shown below:



SPACE SYSTEMS

Environment and Assumptions

After intensified activity culminating in a manned landing on the moon, the manned space program will be focused on continuous research in lunar orbit, lunar surface and earth orbit. The Apollo Applications Program (AAP) will mark the end of the era of feasibility determination and the beginning of the era of exploitation: an era of defining the benefits that man can derive from orbiting vehicles and an era of implementing practical space projects with economic benefits to the United States. In addition, the next seven years will lay the engineering and scientific foundation for interplanetary exploration by manned vehicles.

The military space program will retain its high degree of importance in the interest of national security. The Air Force's manned orbiting laboratory (MOL) will make possible world-wide surveillance for defense purposes. The unmanned satellite program will continue to contribute to surveillance programs as will military communications, navigation/traffic control, and weather systems.

The total space budget for DOD and NASA is expected to stabilize at its current level of $7 billion: DOD, $2 billion; NASA, $5 billion. Budget stabilization is possible because major development expenditures for launch vehicles (Saturn, Titan III) and spacecraft (Apollo, Gemini) are, or soon will be, completed, and MOL and AAP will make maximum use of these and other existing equipments.

Procurement methods and management techniques will continue to be highlighted as a means of achieving cost effectiveness in major system procurements. Competitive awards during the contract definition phase, configuration management and value engineering, incentive-fee and fixed-price type contracts are some examples of the ways that the government intends to maintain budget control over the contractors.

Competition

The major aerospace companies have developed an impressive capability in terms of environmental, facility, personnel and technological expertise. With such major investments, continual utilization of these capabilities is a strong motivational force. Accompanying this is the fiercely competitive cost arena wherein lie the future programs.

Prime competitors are the major aerospace companies with established capabilities in the field. A number of smaller aerospace-oriented industries also offer strong competition.

Another area of competition exists in the major companies with electronics subsystem capabilities which largely parallel FSD areas of interest.

A third group of competitors is the major universities, which have taken—and will continue to receive—a meaningful share of studies, grants, and experimental tasks in defined areas of expertise.

Lastly, there is a certain reluctance on the part of NASA Centers to totally abandon their in-house technological capabilities to industry. This results in a more gradual disbursement of contractual effort to outside organizations.

To meaningfully compete in the market, systems, management, and electronics capabilities must be broadened to include environmental, facilities, and technical expertise so that FSD will be acknowledged as a fully competent and self-sustaining prime contractor.

Major Areas

Manned Space: Programs include AAP, Gemini B, Earth Orbital Applications, Advanced Orbital Laboratories, Permanent Lunar Base, Interplanetary Missions, MOL/Recon/Satellite Inspector, and related R&D. FSD has submitted proposals on the two main thrust programs, AAP Payload Integration and the MOL Data Management System. In May 1966, awards will be made for the AAP contract definition phase and the MOL acquisition phase. Main thrust will shift to the advanced MOL, earth orbital applications and advanced orbital laboratories in 1968 and 1969.

Unmanned Space: Application areas include physics/astronomy, lunar and planetary exploration, meteorology, communications, and navigation. These application areas are germane to numerous satellite programs such as Explorer, Pioneer, and the Application Technology series. FSD will place emphasis on becoming a major subcontractor in the unmanned satellite area.

Guidance and Navigation: Programs include Control Moment Gyro, Advanced Reentry Study, Advanced Guidance Systems Study, ICBM X, ABRES follow-on, Recoverable Launch, Manned Hypersonic Vehicle, Aerospace Plane, PRIME follow-on, Advanced Lifting Reentry, Manned Maneuverable Spacecraft, Start

Residue/Hi-Lo, and Advanced Space Guidance System. This has been the traditional FSD market in the space and missile programs. The main thrust areas are the ballistic missiles and lifting reentry bodies.

Ground-Based Space: Programs include RTCC, National Space Stations, Manned Spacecraft Center Support, Goddard Space Flight Center Support, and Ranges. The ground systems are concerned with space vehicle tracking, data acquisition and management and communications. The principal application is for standard IBM data processing systems with special purpose FSD peripheral gear. The main thrust areas are the ranges and the expansion of the Houston operations.

Objectives

The initial objective is the continuation of superior administrative and technical performance on present contracts. This entails the utilization of all FSD capabilities to support the Division's primary objectives: service to the government, exploitation of commercial areas, growth, and reasonable returns on investment.

FSD will acquire the necessary technical expertise, facilities, and management techniques to become a prime contractor in major manned space programs and to maintain a significant subcontractor role in both unmanned satellites and space experiments. A specific objective is to win an R&D contract to participate in a lifting reentry program such as START, Advanced MOL, or hypersonic vehicles, and in the Advanced Space Guidance System program.

To broaden FSD's marketing base in the space systems area, relationships with SSD, Langley, Patrick, and leading aerospace companies will be strengthened.

Skilled personnel with backgrounds in such advanced scientific fields as biomedicine, computer managed laboratories, astrodynamics and laser applications will be acquired to enhance FSD's role in the areas of AAP and space experiments.

Full participation with NASA and DOD personnel in the assessment, development, and implementation of management techniques and applications will continue. This will cover the spectrum of AF375 and LPC 500-1 requirements in configuration management, as well as the implementation of new techniques in fiscal accounting and control. This will be done utilizing a judicious application of computer, program and display techniques.

Areas of potential application of IBM commercial equipment in both range activity and on-site checkout will continue to be addressed. Such projects as OCALA, wherein benefits to both commercial and federal systems are evidenced, will be addressed. Investment programs are similarly oriented to indicate a commercial application in displays, image processing, and communications.

Strategy

Capitalize on Strength: The starting point for IBM's space business is proven performance, present capabilities and company image. IBM's space business has three basic cornerstones:

Data Handling	Traditional IBM Forte
Systems Integration	Traditional FSD Forte
Guidance and Navigation	Traditional FSD Forte

Eliminate Weaknesses: Performance on major space programs requires more scientific personnel and facilities than are available in FSD. To remedy these weaknesses, this plan includes substantial capital investments, such as an environmental test lab, simulation laboratories, and scientific laboratories. There will be significant IRAD and company funded investment projects in the area of space experimentation and technology applications studies.

Interlocking Aspects: The activities in manned space are applicable to unmanned space and vice versa. The IBM/FSD forte, the performance on present manned space contracts, and the investments in space experiments and facilities will have an overlapping effect. For example, developing AAP integration knowledge and need-to-know should naturally lead to AAP experiments and to space feasibility testing of various technologies. It is equally true that navigation work and space experimentation activities should have direct influences in manned and unmanned space programs.

FSD strategy in the space systems business area is pictured in Figure 3-1.

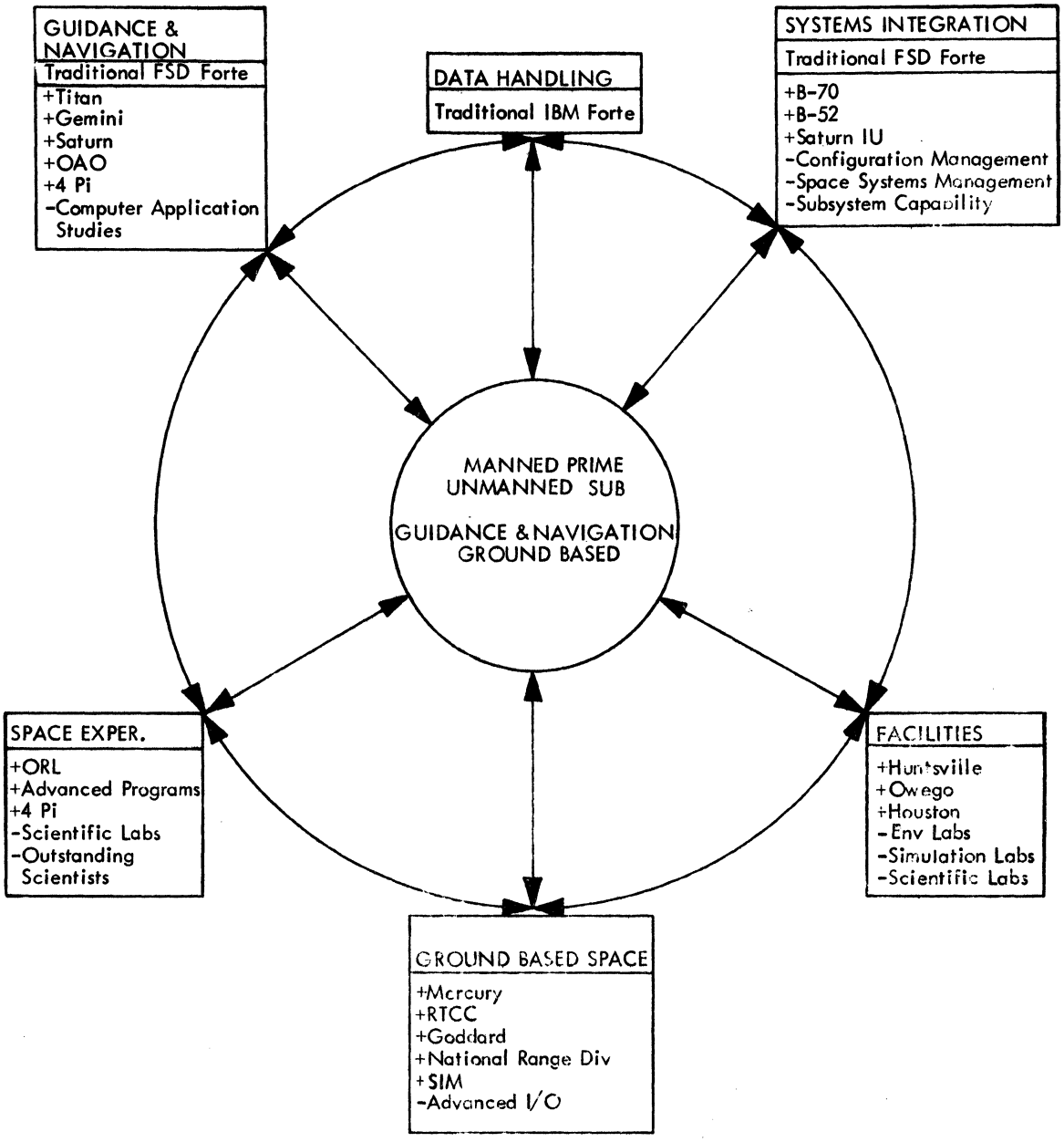


Figure 3-1. Space Business Strategy Summary

Major Milestones

Manned Space

a. MOL Award of Phase IC May or June 1966. Phase II, September 1966.

b. AAP Award of Phase I August or September 1966. Phase II, February 1967.

c. Obtain funding in at least one additional manned space program by 1969.

Unmanned Space

a. Achieve the goal of a major subcontract by 1969.

Guidance and Navigation

a. The groundwork for advanced guidance and navigation system will be completed in late 1966 or early 1967.

b. Obtain a significant contract for advanced guidance and navigation by year end 1968.

Ground Based Space

a. By year end 1966, the success of FSD's approach to the range business should be evident by both contract support and customer attitude.

b. By June 1966, a contract decision on the White Sands Missile Range Telemetry Data Center program should be made.

c. Win consolidated telemetry checkout contract from the Western Test Range in 1966.

d. Obtain funding for AAP experimental data handling effort in 1968.

e. Install a multiprocessing system in the Houston Manned Space Center during the first quarter of 1968.

f. Win the contract for the White Sands Missile Range Data Processing Center in July 1968.

Return

1966-1972 Sales Objectives

Dollars in Millions

	1966	1967	1968	1969	1970	1971	1972
Firm & Follow-on Sales	$ 42.0	$ 17.0	$ 7.9	$ 5.4	$ 2.0	-	-
New Business Sales							
Manned	46.2	72.2	86.0	99.2	112.9	$ 121.6	$ 134.6
Unmanned	0.1	0.6	3.0	3.0	4.0	8.0	15.0
Guidance & Navigation	1.0	2.0	2.5	5.0	7.3	14.4	20.4
Ground Based Space	17.5	29.7	44.6	57.6	58.1	52.7	44.2
Total Sales	$ 106.8	$ 121.5	$ 144.0	$ 170.2	$ 184.3	$ 196.7	$ 214.2

1966-1972 Revenue Objectives

Dollars in Millions

	1966	1967	1968	1969	1970	1971	1972
Firm and Follow-on Revenue	$ 105.9	$ 91.8	$ 67.6	$ 46.7	$ 24.4	$ 6.1	$ 3.7
New Business Revenue							
Manned	3.1	23.8	42.3	57.4	77.8	98.3	109.3
Unmanned	-	0.7	0.8	1.5	3.2	4.4	6.9
Guidance & Navigation	0.2	1.1	1.5	1.9	3.0	5.3	9.6
Ground Based Space	8.2	10.3	21.2	38.5	49.4	52.0	51.5
Total	$ 117.4	$ 127.7	$ 133.4	$ 146.0	$ 157.8	$ 166.1	$ 181.0

Technical Requirements

The space business area to be addressed by FSD is significantly different from the traditional IBM role of data processing and subsystem integration. The dual goals of systems integration of a major manned space program and participation as a major subcontractor for an unmanned satellite require a change, as well as an upgrading of FSD skills. They also require facilities and equipment which are more familiar to major competitors than to IBM.

The technical skills to be upgraded are those of data management and those associated with the Saturn IU contract. The skills to be changed or acquired are those of a major space integrator—systems engineering, configuration management, satellite design, simulation, large component environment testing; those of data acquisition—experiment design and control, sensor definition, pattern recognition, communications; and those of data processing for the user—displays, man-in-the-loop control, data filtering. For purposes of emphasis, the investment program to achieve these skills is broken into four categories: manned space, unmanned space, guidance and navigation, and space-related 4 Pi and SIM. These investment areas are interdependent and assume the interplay and correlation of an integrated program.

The IBM technical requirements needed to compete in the space business are:

For Airborne Systems

a. The development of the 4 Pi computer family.

b. Systems integration capability including proficiency in the areas of sensors, experiments, data processing, and management control.

c. Technical competence in the space experiments areas including earth survey missions.

d. Simulation capability with the ability to incorporate development hardware.

e. Engineering facilities near the customer's location.

For Ground-Based Systems

a. Development of a telemetry data buffer and film reader for the range programs.

b. Development of advanced display systems.

c. Development of new I/O techniques and devices.

d. New processing techniques for specialized data, such as map processing and photo interpretation and correlation.

e. Additional telemetry equipment experience including development of hardware for conversion from the rf to digital signals ready for transfer to a computer interface.

Technical requirements, investment levels and technology applications are summarized in Tables 3-2 and 3-3.

Major Risks

The major risks for the space business action plan are the results of being in a market that is defined and controlled by the customer. Some of the specific risks are:

a. Continuous readjustment of government funds. The effect of the Vietnam crisis, the possibility of building a manned bomber, the building of an anti-missile missile and a Russian "space-first" could cause major changes in the amount of space funds.

b. The government could decide to perform in-house some of the major tasks that FSD is planning to do.

c. A cutback in the amount of funding for research projects would limit research funds available to FSD.

d. There is always the risk of hardware exclusion being imposed by the government if a contractor has participated in system studies.

e. Current sole source contracts, such as those at Goddard, could go out for competitive bids.

Other items that could become problems are:

a. The inability of FSD to hire enough of the skills required by this plan because of competition for highly skilled people.

Table 3-2

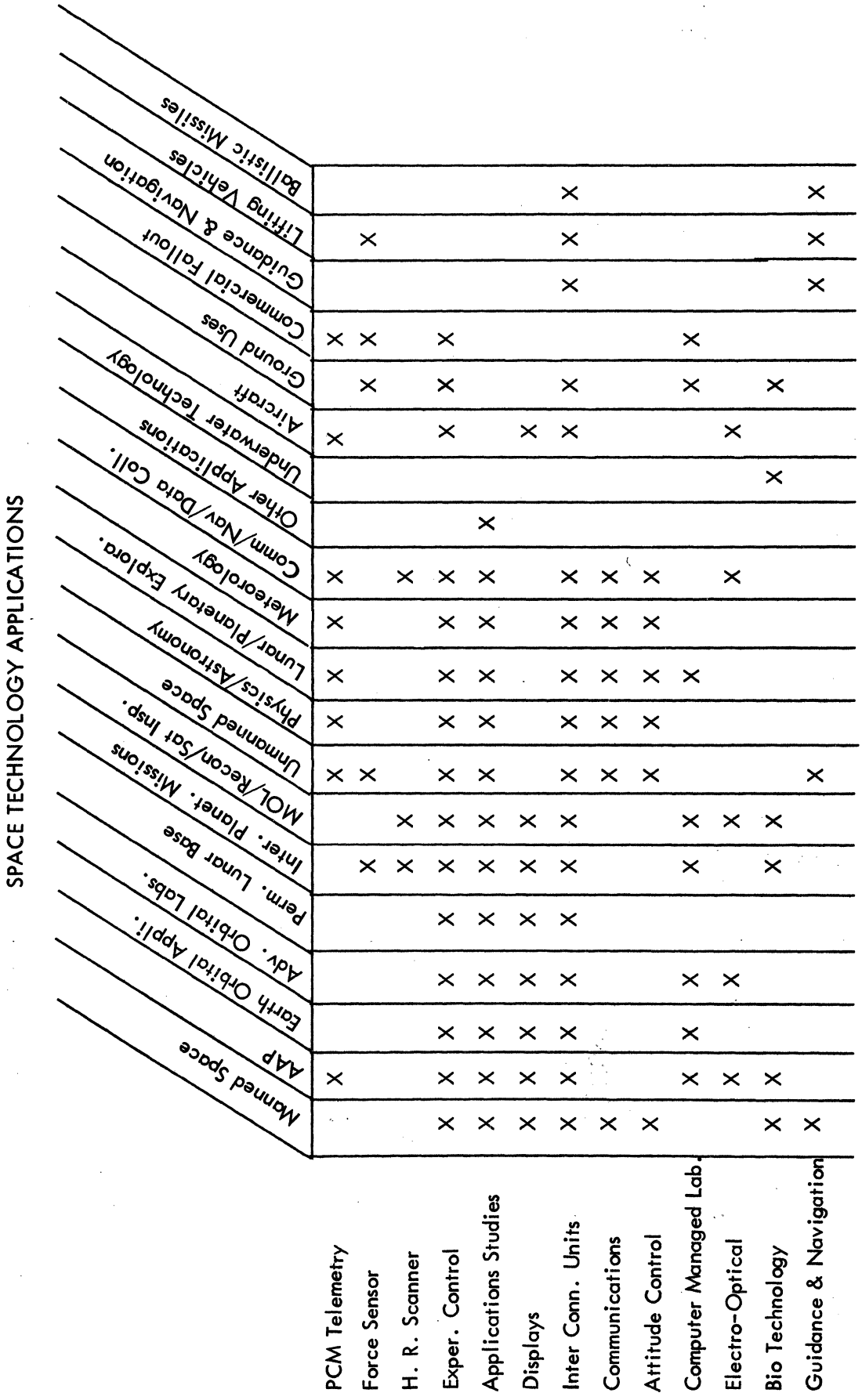
SPACE TECHNICAL REQUIREMENTS

TECHNOLOGY/ TECHNIQUE REQUIREMENT	1966	1967	1968	1969	1970	1971	1972
4 Pi	X						
Systems Integration	X	X					
Simulation		X					
Scanners			X				
Telemetry		X					
Satellite Subsystems				X			
Experiment Dev.			X				
Displays				X			

INVESTMENT	Dollars in Millions						
Manned Space	$0.40	$1.10	$1.1	$1.1	$1.0	$1.0	$1.0
Unmanned Space	-	0.40	0.625	0.6	0.5	0.5	0.5
Guidance & Nav	-	0.2	0.2	0.2	0.2	0.2	0.2
Other	-	-	-	-	0.2	0.2	0.3
Total	$0.40	$1.70	$1.925	$1.9	$1.9	$1.9	$2.0

Table 3-3

SPACE TECHNOLOGY APPLICATIONS



b. Inability to mount the effort required to win major prime business because of cutback in company funds.

c. FSD will continue to perform on contracts that will receive a great deal of coverage from the public news media; for example, the Gemini and Apollo programs. Such programs offer tremendous prestige for performance, but could be detrimental to IBM's image if a space catastrophe occurred. FSD management will continue to work with NASA in the Manned Awareness Program to minimize this risk.

d. The critical phasing of awards on major programs requires a demonstration of capabilities prior to award. Typical examples are the Facility Survey and Source Evaluation Board utilized on all major contracts. Of necessity, this requires a firm demonstration of capabilities (facilities, personnel, capital) prior to award, or, at the minimum, a commitment to develop such capability. The long-lead nature of certain items requires significant investments prior to award.

Interdivisional Support

The space business action plan will require continued leadership in the area of large-scale standard data processing equipment. Manpower support is another area in which the space business action plan will require support from time to time.

When the AAP program is implemented as currently planned, 100 engineers of various skills will be required from other divisions to meet the rapid build-up required in 1967 and 1968. The appropriate divisions have been notified of this pending requirement.

Fourteen System/360 analysts and programmers are needed from SDD for nine months to develop and implement an internal management information system at Huntsville, needed to meet the configuration management requirements of the Saturn IU contract.

There will be times in the future, due to the nature of the space business area, that FSD will have to call on the other divisions of IBM for manpower support for a rapid build-up on a large program.

Extensive support is necessary from the DP Division in the area of space ground-based systems to install and maintain commercial equipment and convert to System/360

when it is desirable.

Component Division support is another critical area in the space business action plan. Continued support will be needed from the Components Division for such items as cores and ULD's for Saturn I and V, as well as next generation technology for use in the aerospace environment.

Assistance and approval of the real estate and building required to house the people, laboratories and equipment to accomplish this plan will be required from the Real Estate and Construction Division.

Interdivisional support requirements are summarized in Table 3 - 4.

Technical Precursor/Fallout to IBM

Direct commercial sales benefits will result from FSD's activity at the several test ranges and the space control centers. FSD will spearhead system design, integration, and programming support for commercial and commercial/special equipment systems at these locations. Near term systems in the area include the Data Systems for SCF and the Consolidated Telemetry Checkout System for WTR. Other ground systems using commercial equipment sales will also benefit from FSD studies and from support and knowledge of the customer requirements. Examples of such systems are the MOL Mission Simulator and the Operational Computer Complex which will be purchased for the Air Force by Douglas and the Titan III checkout and launch sequence monitoring system which will be purchased for the Air Force by Martin.

The contribution of trained personnel to the commercial division of IBM is important and will continue to be an important facet of the space business action plan.

FSD's technical plan for this time period calls for studies in several areas that may benefit the commercial divisions. Examples of these are:

Advanced Data Processing Techniques
PCM Telemetry
Packaging Techniques
Electro Optical
Communications
Image Processing

FSD past and current studies of the economic and social benefits of earth-orbiting

Table 3-4

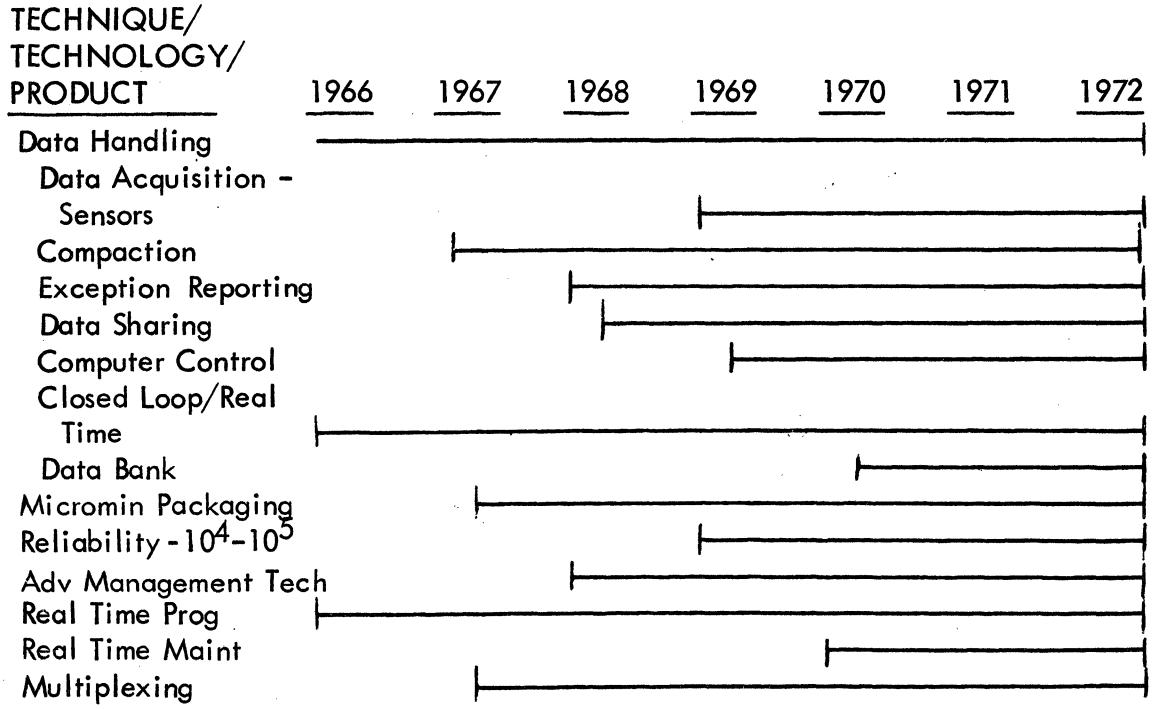
INTERDIVISIONAL SUPPORT FOR SPACE

TECHNOLOGICAL/FUNCTIONAL	Internal FSD	Other IBM Divisions
PROCESSOR	ESC	
DISPLAY	ESC/SSC	
STORAGE	ESC/SSC	Components Division
SPECIAL I/O	ESC/SSC	
SENSOR	ESC/SSC	Research Division
SPECIAL HARDWARE		
Electro-Optical	CES	Research Division
SIM	FSC	
SOFTWARE	FSC	SDD
MARKETING	Field Mktg.	
MANUFACTURING	ESC	

satellite experiments have resulted in strong evidence of the future contributions that may be derived from earth oriented experiments such as meteorology, communications, navigation and traffic control and experience concerned with surveying the features and resources of the earth. The principal contributions of these programs in relation to commercial benefits will be that SSC should be able to identify the extent to which satellites could be used in the above mentioned applications of earth-oriented systems through direct participation in manned and unmanned satellite experiment programs. Beneficial systems would be defined in their entirety, including the ground based data management and control facilities which would use commercial hardware.

FSD plans to obtain contracts for studying and developing computer managed experiment subsystems for both manned and unmanned satellite programs. These programs are directly related to the commercial plans for automating industrial and hospital analytical laboratories. They will be concerned with automatically sampling, measuring, and analyzing organic and inorganic substances using precise laboratory instruments.

Time phasing of precursor/fallout to IBM is shown below:



TACTICAL SYSTEMS

Environment and Assumptions

The ground-based tactical systems market includes all systems used by the Department of Defense in a field environment. The hardware in these systems must satisfy severe military specifications for reliability, maintainability, and mobility.

The need for tactical systems to meet requirements of limited war situations will increase through 1972. Funding will increase for tactical systems and associated R&D and general support at the expense of strategic systems. But, since the operational use of tactical systems includes field replicas of headquarters applications, current know-how in strategic systems is applicable to some tactical procurements. The remaining tactical systems are unique in the field environment and require special hardware and systems abilities.

Examples of headquarters replicas occur in information handling and air defense/air traffic control:

Command and control of military forces — plans and operations
Management information in the field — personnel, logistics, etc.
Intelligence data handling
Communications control and switching
Control and surveillance of aircraft

Examples of applications unique to the field environment are:

Control of weapons, missiles, and surveillance sensors
Fire planning and direction of weapon resources
Surveillance and reconnaissance
Field support of engineer units and other special technical forces

During the period 1966 through 1972, DOD will spend about $85 billion on tactical programs. The electronic portion of the market is expected to be about $34 billion, of which about 10% is for the ground-based electronics. FSD will address nonpreempted ground-based systems of about $480 million over the forecast period, leading to sales of $111 million.

Competition

FSD's competition in the tactical market is strong and well established. At the present time, FSD's share of the tactical market is negligible.

All major, and many of the smaller, electronics companies are prime competitors in the tactical market. Two of these competitors, for example, have installed tactical systems in the Marine Corps (MTDS) and the Navy (NTDS), respectively, and have a present competitive advantage due to their good systems reputation. Our strongest competitor on the ADSAF program has built militarized equipment and delivered it to both the Army and Navy. However, the market for the next generation of equipment is not totally preempted.

Many of our competitors actively develop hardened I/O equipment and some have installed hardened displays, magnetic tapes, and card punches in the field.

Our competitors have a variety of business approaches in this area. Some, who affect our plans most directly, seek to be prime contractors for major systems, supplying or procuring all system elements. Others prefer to specialize in a single product or technical capability. Still others bypass concept and prototype contracts to bid on production reprocurements where they can capitalize on their favorable manufacturing costs. This has led to the practice of competitive reprocurement of all large tactical system production orders.

Objectives

In addition to hardware sales of mass memory units and 4 Pi computers, FSD will address four main programs:

ADSAF — The Automated Data System for Armies in the Field contains three significant subsystems which will be pursued:

- TACFIRE: Weapons allocation, inventory status, fire direction
- TOS: Tactical operations, deployment, planning, resource control
- CSSS: Combat support systems of administrative type

TIPI	Tactical Image Processing and Interpretation; primarily a multisensor (photo, radar, elint) storage, retrieval, and analysis system
DTAS	A Digital Transmission Automation System for beach communications with the Marine Tactical Data System
SAM-D	Surface-to-Air Missile Development, an Army defense system against aircraft and tactical missiles.

To make a significant penetration in the tactical area, technical problems must be solved and the potential customer must be convinced that FSD can do his job. Therefore, a competence center will be required as the nucleus of the tactical programs. Early success in each program area, similar to that achieved in the initial study of the ADSAF integration problem, is necessary to enable FSD to respond to major procurements starting in 1968.

Strategy

FSD's major strategy will be to concentrate on bidding as a systems prime contractor. The purpose of this strategy is to give FSD control of the "make or buy" decisions and minimize the likelihood of FSD hardware, even if bid initially by a prime, being dropped in favor of the prime's own product or lost during competitive reprocurement.

This strategy will be achieved by assembling a 4 Pi processor, FSD tactical I/O (mass memory, DMED, other future units), and vendor I/O in a configuration tailored to demonstrate our system integration competence to each major prospective customer. FSD will not build all types of I/O in-house, but will make better use of investment funds by building only high-return items while designing system interfaces for vendor I/O in all other cases.

Exploitation of accomplishments in strategic systems will ensure FSD systems competence in headquarters replica tactical systems. In the unique applications, high quality performance on early studies and concept development phase contracts will establish our competence with the customer. In-house concept developments will be aimed, in addition, at anticipating future tactical systems so that FSD can eventually lead the customer rather than simply respond to his requirements.

Total systems capability will be further demonstrated by continued development and marketing of advanced digital peripheral devices:

Sonar signal processing and display
Communications error control
Communications switching
Photointerpretation work stations
Security control devices

Major Milestones

Major milestones in the tactical systems business action plan are tabulated below:

3Q66	Win 4 Pi contract for TIPI
1Q67	Win ADSAF TACFIRE prototype development contract
2Q67	Win sonar backfit contract (SQS-23 or SQS-24)
1968	Win ADSAF TACFIRE first production contract
1970	Win TOS

Return

Dollars in Millions

	1966	1967	1968	1969	1970	1971	1972
Follow-on Sales	$ 0.5	$ 0.2	-	-	-	-	-
New Business Sales	5.9	10.6	$11.1	$ 15.4	$18.5	$ 20.7	$ 27.8
Total Sales	6.4	10.8	11.1	15.4	18.5	20.7	27.8
Revenue	$ 1.6	$ 6.9	$ 5.2	$ 12.1	$ 14.1	$ 12.9	$ 17.0

Technical Requirements

Investment and contract tasks in progress in 1966 will provide hardware for sonar signal processing and display, digital message entry, and tactical switching and multiplexing. The SIM program plus SDD van mounting work will provide interim capabilities for stiffened and hard packaging of interface modules, error control devices, and mounting of standard hardware in vans. The requirements for electromagnetic compatibility are to be met by SDD for commercial hardware by July 1967. FSD will apply their results to 4 Pi hardware.

In the 4 Pi program, competitive activity is highly responsive to government requirements for advanced technology. The trend toward multicircuit integrated modules will produce competitively priced NGT-like hardware in 1967-1968. FSD must be prepared to meet this competition on a price/performance basis with the added possibility that actual technology will be specified by the customer. For ground tactical applications, manual entry, cards, paper tape, magnetic tape, displays, and bulk storage are required as are programming support packages of the IBM Type I category. Tactical I/O can be obtained from vendors in most cases; manual entry and bulk storage are not preempted. FSD will plan to procure the I/O and interface it with System 4 Pi. Investment will provide I/O interface designs plus integration tests in the early years. Later, selected second generation I/O devices may be built in-house. FSD programming systems will be minimal since customers should procure software and hardware separately. Nevertheless, the FSD systems approach calls for maximum EP compatibility with System/360 to permit the use of GIS and other IBM programs.

The forecast time periods for meeting these requirements and investment level by technical area are shown in Table 3 - 5.

Major Risks

Procurements in the tactical area are characterized by prime contractors who possess or want to build digital computer hardware, particularly the CPU, whenever possible. This is true even when they must develop a processor from scratch. If System 4 Pi were bid to such a prime, FSD would be exposed to losing the hardware award at any time up to final negotiation of all contracts. This risk is augmented by loss of resources and marketing flexibility during the period of the teaming arrangement.

Price sensitivity in tactical systems is a major factor. In anticipation of production quantity follow-ons, many firms will set low prototype prices. Some of these firms work on a very small margin, therefore, FSD would have to be significantly ahead

Table 3 - 5

TACTICAL SYSTEMS TECHNICAL REQUIREMENTS

Technology Requirement	1966	1967	1968	1969	1970	1971	1972
Sonar Signal Processor	X						
4 Pi	X						
Tactical I/O - IBM			X				
4 Pi Next Generation Technology		X					
4 Pi Foreign Interface	X						
FS-222 Electromagnetic Compatibility		X					
Tactical Communications Switch		X					
DMED	X						
Investment ($K)							
Sonar	$ 320	$ 200	$ 200				
Tactical I/O		200	400	$ 600	$ 700	$ 900	$ 900
New Technology			80	100	370	660	750
Joint Development	80	90	___	___	___	___	___
TOTAL	$ 400	$ 490	$ 680	$ 700	$ 1070	$ 1560	$ 1750

technically to make a profitable competitive bid.

If, due to schedule conflicts or technical problems, FSD is not ready at bid time to demonstrate I/O capability, the objective of bidding as system prime is jeopardized.

Interdivisional Support

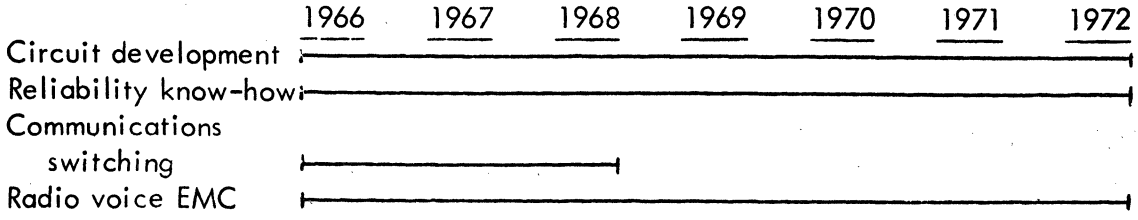
FSD plans for 4 Pi rely on continuing advanced technology support from CD to ensure the ability to bid the latest technology. Government procurements lead commercial in all aspects of technology and application complexity. The FSD competitive position depends on offering the type of technology specified by the customer, even when the job can be done with current components.

SDD will be called on to modify standard hardware, particularly I/O machines to support FSD interim prorotypes and longer term van-mounted systems such as CSSS. SDD will also be expected to solve the FS-222 problem for commercial by July 1967.

FE may be requested to bid on maintenance subsystems, particularly domestic prototype installations.

Technical Precursor/Fallout to IBM

By leading commercial organizations in terms of requirements backed by dollars, the Government develops precursors in technology. FSD's participation in tactical programs both underwrites the IBM commercial programs and provides guidance as to which technical routes are most promising. FSD also precurses SDD in data transmission in that FSD is directly engaged in modulation, line switching, and transmission for the military. This know-how is directly applicable to better design of communications terminals. Similar experience in signal processing of analog signals of all frequencies — sonar through radar — has hardware implications in ROS design for special applications. It also leads to detection and classification methods based on advanced mathematical analysis that would be pertinent to medical diagnosis, image compaction and pattern recognition, and geophysical data reduction. The time periods during which these benefits will accrue to the Corporation are shown below:



INFORMATION SYSTEMS

Environment and Assumptions

The information systems market consists of such applications as intelligence, command, management, education, meteorology, and the requirements of FAA. During the planning period, three major shifts are evident in the information systems market. The first is a change from practically all DOD customers to a greatly increased number of federal, state, and local government agencies. This is a result of the high expenditure of the Great Society programs (e.g., housing, urban development, weather forecasting control) as well as the increasing expenditures reflected at the state and local government level.

The second major change in the information systems market is that basic techniques developed from military programs will have direct application to many civil programs. This will necessitate a greater functional understanding of application areas (e.g., law enforcement, public accounting, resource control).

The third major shift, which involves FSD's military and intelligence customers, is the declining strategic market. It is not anticipated that any large strategic command or intelligence systems will be procured in the foreseeable future. Rather, system upgrading and refinement will be continued throughout this planning period.

Presently, emphasis is being given to capitalizing on capabilities developed in the intelligence and command program areas and expanding into promising new growth market areas:

a. Great Society programs such as housing, urban development, and weather forecasting control.

b. State and local government, particularly in the management systems area.

c. Educational systems, applying systems capability and CAI hardware to the needs of educational institutions.

Competition

Information systems is an extremely competitive business area. The list of competitors is formidable, ranging from large hardware manufacturers to software concerns of varying sizes. Also, significant competition results from non-profit organizations.

It can be expected that continued and strong competition will prevail throughout this planning period.

FSD enjoys a prominent competitive position in the command and intelligence software market. This is a strong complement to the similar DPD position in the standard equipment market. However, along with the present trend of developing in-house capability, strong competition from software-oriented concerns and hardware manufacturers will continue.

The competition in the management marketplace is intense, involving a wide and large variety of firms. Currently, FSD has not as yet established a strong position in this area, particularly with the civil agencies. FSD does, however, enjoy a relatively good competitive standing within military management systems, especially in the logistics and personnel areas.

The large automated education market has attracted many organizations because of its large dollar potential. Many hardware firms have acquired specialized educational companies, as IBM has with SRA, in order to obtain the necessary functional competence to penetrate this market. Presently FSD, supported by the CAI hardware line and "expertise," is in a strong position to gain a commanding competitive edge.

In the meteorology market, FSD has — despite strong competition — established excellent customer relationships as a result of our competence studies and will continue to enhance this position.

Objectives

a. Attain approved sales and revenue goals during the plan period.

b. Achieve significant participation in the development of next generation C/I systems.

c. Extend current and planned techniques into new market areas to broaden the FSD revenue base.

d. Establish a major revenue base in the state and local government market, with 30% of information systems sales in this area by 1972.

e. Establish a sound technological and contractual base in educational

systems, with 35% of information systems sales in this area by 1972.

f. Win a significant meteorological contract during 1967 to position FSD as a significant systems contractor in this market by 1970.

Strategy

a. Actively exploit command and intelligence techniques (FFS) through emulation and GIS into new market areas.

b. Increase contact with DP marketing in the development of joint marketing strategies for state and local government and educational systems.

c. Develop meaningful problem solving demonstrations at the new Gaithersburg Data Center.

d. Prepare education and management application packages in cooperation with ISDD for areas offering high potential and a large customer base.

e. Sponsor Customer Executive seminars for advanced information systems.

f. Place special emphasis on market areas and applications, particularly in command and intelligence, which present opportunities for special hardware requirements.

g. Conduct short advanced studies of customer groups with whom FSD does not have direct contractual contact.

h. Develop appropriate clauses, acceptable to the government and IBM, to avoid hardware exclusion in FSD contracts.

Major Milestones

FSD will attempt to establish special hardware requirements for intelligence agencies at the national level by exploitation of PAYDAY, REGATTA, and PREMSS tasks by the end of 1966 to serve as a basis for hardware expansion starting in 1968.

In the command area, a major milestone in 1967 is to extend the current NMCS contract into the commands involved in the World Wide Military Command System for system analysis and programming. Also, FSD will participate in next generation command systems planning and development through an ESD-sponsored contract in 1967.

To penetrate and establish a sound business base for the 1968-1972 time frame in the state and local government market, it is necessary to obtain a major management contract by 1966 and to expand this with contracts in at least five states by 1967.

Education system sales in 1967 are directed towards a prestige CAI contract to a military agency for vocational training, an initial educational information systems contract in a major city, and an initial regional laboratory systems contract.

A major meteorological milestone involves winning a significant follow-on or new contract to the present data acquisition award. Also, to increase the probability of early payoff in special meteorology hardware development, the feasibility of a sky-condition sensor must be established before 1967.

Return

Unlike the avionics or space business areas, information systems is characterized by having a large number of individual contracts distributed among a great number of customers. The biggest contract in the command and intelligence market contributes approximately six million dollars of revenue during any one year. Loss of any one contract, therefore, while affecting the potential in those markets to some degree, does not significantly reduce total revenue potential to any significant extent since other market areas exist to make up the loss.

The projected revenue from follow-on sales and new business sales is tabulated below:

	1966	1967	1968	1969	1970	1971	1972
Follow-On Sales	$11.7	$ 7.8	$ 5.5	$ 4.5	$ 4.3	$ -	$ -
New Business Sales	8.5	19.1	23.6	31.4	37.8	50.8	55.9
Total Sales	$20.2	$26.9	$29.1	$35.9	$42.1	$50.8	$55.9
Revenue	$ 25.0	$ 24.1	$ 30.1	$31.6	$39.0	$48.8	$59.9

Technical Requirements

Basic technical requirements for the information systems business area can be categorized into technique requirements, application analysis needs, and special personnel skill requirements.

Of major importance is the successful development of the Generalized Information System. In conjunction with this is the need for application packages for the management and education systems to achieve successful market penetration of new information system business areas. This is especially true in the state and local government and the ground-based meterological market.

With a major shift to civil programs, effective marketing and contract performance will require personnel with unique backgrounds in, for example, education, public administration, law enforcement, housing, urban development, transportation, and public accounting.

During the last few years, information systems have assumed a new dimension. Communication capabilities which allow the direct transmission of data to a data processing center will extend the power of data-based information systems to each user within his own environment. Looking forward to this terminal-oriented mode of operation, the need for conversational system design is evident. This requirement will cause research and development to emphasize the following areas:

a. File storage with capacities and access times consistent with in-line data processing requirements.

b. Terminal functions which match the education and experience levels of human operators.

c. Voice, graphic, and image input/output technologies, which are appropriate for communication with people.

d. Real-time systems operation, the central processing complex of which can manage the terminal complex with a high degree of efficiency and offer the highest degree of reliability.

e. Means by which data processing systems may be planned and proposed as control systems of large operational or business units.

The critical problems are in the area where the system deals directly with the human being. One can never be sure that a terminal specification is sound until customer

personnel have actually operated the terminal within an environment which approximates reality. A number of factors may be miscalculated:

a. The terminal configuration may demand heavy expenses in education on the part of the customer.

b. The error rate characteristics of this human operation may demand an entirely new systems approach to solving the problem.

c. The data service proposed does not contribute as originally projected, and a redirection of systems planning will provide a more tangible data service to the user.

New input/output facilities such as graphic displays and voice and image processors will require extensive testing to determine the best tradeoffs between software and hardware. It will be necessary to prove customer acceptability of these new products. A systems experimental test laboratory will be the "wind tunnel" for these experiments. Consideration will be given to establishing a system development laboratory based on planned Gaithersburg facilities, backed up by Corporate Systems at Yorktown. The laboratory would have the following functions:

a. Conducting experiments for new systems concepts, particularly in the man-machine interaction area.

b. Testing software concepts relative to the efficient operation of large-scale real-time systems.

c. Testing systems checkout software and procedures required for preinstallation customer testing.

The system proposed can be used directly to conduct many diverse experiments involving the attachment of new hardware features through the I/O channels. As new work is proposed, the facility will be coordinated with those planned for engineering tests and demonstration so as to minimize redundancy. Technology requirements and investment levels for the information systems area are shown in Table 3-6.

Major Risks

FSD will face major exposure if System/360, 1500-Series and supporting software,

Table 3 - 6

INFORMATION SYSTEMS TECHNICAL REQUIREMENTS

Technology Requirement	1966	1967	1968	1969	1970	1971	1972
Software							
Mgmt Appl Pkg		X					
Educ Appl Pkg				X			
GIS		X					
Display Language			X				
Hardware	feasibility		device				
Sky-Condition Sensor	X		X				
Multi-Level Security			X				
Digital Correlators				X			
Data Compression Black Box				X			
Digital Image Store		feasibility			X		
Image Info Devices		X	X				
Facility (system experiment lab)		X					
Investment			Dollars in Thousands				
Software Applications	$ 50		$ 800	$1000	$ 800	$ 500	$ 500
Hardware (not including SIM)							
Image Handling	120	100	130	150			
Special Purpose			200	550	600	700	700
Systems Experiments		100	350	350	400	430	450
Software Studies	60		340	350	530	610	600
Joint Development	70	110	___	___	___	___	___
TOTAL	$ 300	$ 310	$1820	$2400	$2330	$2240	$2250

and GIS are not delivered on schedule and if GIS does not provide the stated capabilities.

Major growth areas which are integral to the FSD mission but which also have great commercial interest may be transferred to Commercial. Specifically, these involve the education program and the development of management systems for state and local governments.

Interdivisional Support

Because of the large number of geographically dispersed customers, FSD will require the close cooperation of DPD in successfully marketing to state and local governments and educational institutions. Expansion of present market areas (Intelligence and Meteorology) will require hardware support from SDD, ASDD, and Research. FSD's specific support requirements are tabulated below:

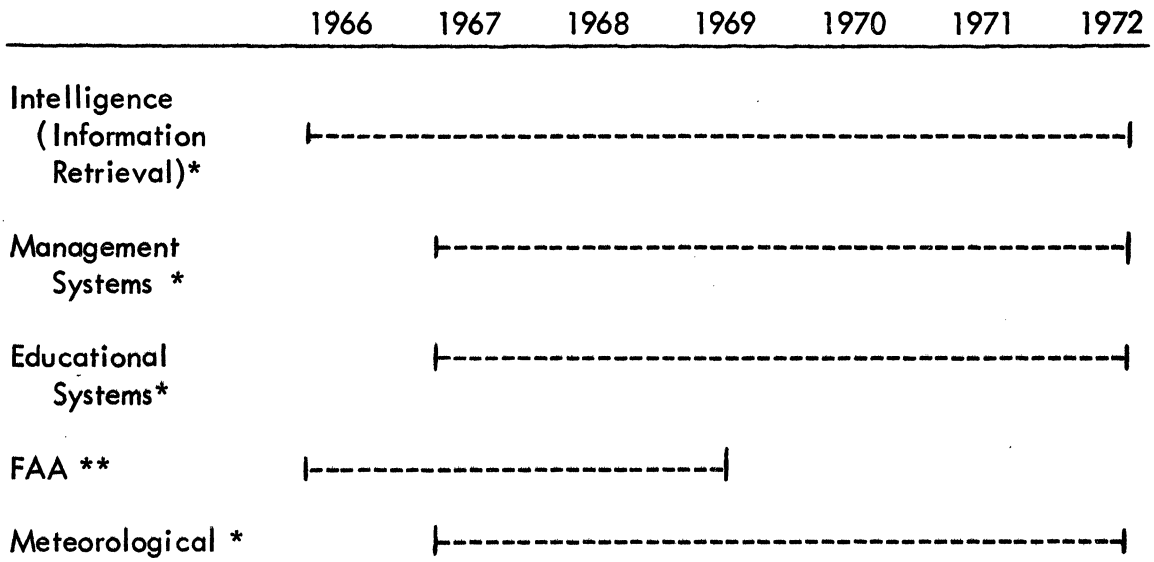
GIS	DPD, Type II Program
Intelligence Security Hardware	SDD, FS-222 ASDD, Research; Multilevel security
Meteorological Instruments	ASDD
Weather Prediction	Research
Education	SRA, Course Development ISDD, Development of CAI Hardware Research, Behaviorial Studies
Special Purpose Hardware	Research, numerical analysis
Image Handling	SDD, design modification of Cypress
Marketing	DP, coverage at state and local level

Technical Precursor/Fallout to IBM

A major contribution of the information systems business area to IBM lies in the

development of software concepts and techniques having commercial applications. Also, a hardware contribution is made involving potential commercial precursor value as well as the immediate sale of standard IBM equipment.

The time periods during which these benefits will accrue to the Corporation are shown below:



* New markets for DP hardware as well as applications know-how.

** Sales of 9020 systems and multiprocessing know-how.

EXPLORATORY DEVELOPMENT

Environment and Assumptions

The major exploratory development activities of FSD take place within the Center for Exploratory Studies (CES),which was established early in 1966. By performing analytical and development studies, CES complements and supports the activities of the other three FSD operating centers and of the FSD Headquarter's staff.

FSD will assign an increasing share of its resources to securing contract coverage for exploratory development activities. The performance of a share of FSD's exploratory development work under contract coverage will prevent in-house efforts from becoming too parochial by forcing personnel to maintain an understanding of government needs and objectives. Through proper staffing and management, the in-house effort will be coupled with contract effort to provide maximum benefit to FSD.

The major market areas that FSD will address for contract coverage are included in the research and exploratory development budgets of DOD and NASA. In addition, FSD will market an analytic capability to government agencies (particularly those concerned with civil affairs) to assist with evaluation and cost/effectiveness studies of alternative public policy programs. Although the size of this market is relatively small, the value to be derived by FSD and the Corporation through gaining insight into novel new business areas is expected to be significant.

Objectives

FSD will concentrate its exploratory and precursor development efforts on the following objectives:

a. Identify and evaluate longer-term trends in the technological, economic, political, and social environment and relate them to present and prospective FSD markets. The primary emphasis will be in business areas which today are not emphasized by FSD, but which offer promising opportunities five to ten years in the future.

b. Initiate experimental exploratory development programs in the areas cited above that meet established investment criteria, and conduct such programs through the feasibility demonstration stage.

c. Facilitate the transfer of technical knowledge between FSD and the other divisions of IBM.

Strategy

The broad areas of subsystem technology included in or ancillary to FSD's present exploratory development market scope will be emphasized:

Sensors and Displays
Communications
Computer Mathematics
Guidance and Control

Subsystems technology is integrated from a business point of view by a commonality of analytic methods. A computer-managed laboratory, such as the automated biological laboratory (ABL), requires each of the several subsystems. The system requirements and interfaces between subsystems are determined through system analysis. The economic potential of a program is then assessed.

In the area of sensors and displays, efforts will center on the development of:

a. Solid state and gas lasers for potential application to avionic systems and space communications.

b. Identification of phased-array radar antenna requirements using Gunn Effect or other bulk semiconductor effect oscillators.

Exploratory development work in communications subsystems will encompass the feasibility of using digital communications techniques for tactical satellite communication systems and deep space communications (possibly using lasers).

The present and projected exploratory development effort in computer mathematics subsystems relates to:

a. Evolutionary Systems for Data Processing (ESDP), a machine-directed documentation process.

b. Mathematical computation, such as automatic numerical problem solving, round-off error analysis, finite algebra macro operations, and error-free computation methods.

c. Machine architecture studies, including microprogramming, look-ahead logic, and virtual memory design.

In the area of guidance and control subsystems, the exploratory development program is directed to space trajectory analysis and related celestial mechanics problems, geoid determination from satellite observations, and mathematical problems related to rocket guidance.

The intent of the economic analysis program is to secure funded studies relating to economic policy evaluation of government programs in integrated social systems, such as instructional TV satellites and computerized transportation systems.

Major Milestones

Major milestones relate to the attainment of contract coverage and the accomplishment of major investment tasks.

The achievement of contract coverage objectives reflects a proper evaluation of the exploratory development market as well as the technical competence of personnel. Contract coverage objectives are:

1966	1972
28%	65-70%

The major investment task milestones which must be achieved in order to obtain either significant contract coverage or to provide the foundation for product development efforts at the other centers are as follows:

a. Evolutionary Systems for Data Processing (ESDP)

Construct an operating prototype for machine-directed documentation, processing, and computer assisted interrogation/instruction/query in on-line man-machine operations. Achieve sufficient progress by January 1967 to win a cost-sharing contract with the USAF/ESD to further develop ESDP and study its implications for planning systems such as 473L.

b. Solid State Lasers

Determine the life of a room-temperature GaAs laser by February 1968, and achieve state-of-art progressive advancement in the phase lock properties of solid state lasers.

c. High Power Lasers

Obtain diffraction-limited operational gas lasers and undertake the propagation limitations of high-power beams in the atmosphere and materials. In addition: (1) DOD must decide to use high-power laser radars for the discrimination role in ballistic missile defense, and (2) NASA must decide to use lasers for deep space communications.

d. Gunn Effect Oscillator

Confirm the feasibility of using Gunn Effect oscillators and bulk negative conductance devices (non-Gunn Effect) in phased-array radars.

e. Clear Air Turbulence Detection and Warning

Determine the applicability of a special purpose volumeter and improve understanding of heat transfer problems as they relate to clear air turbulence.

Return

The expected sales return to be derived from dollars invested in exploratory development is shown below. The fruition of most of these activities is reflected as sales and revenue by other FSD centers.

Dollars in Thousands

ITEM	1966	1967	1968	1969	1970	1971	1972
Sales	$ 522	$1,540	$2,900	$3,875	$4,790	$5,750	$6,550
Revenue	335	700	2,000	3,500	4,200	5,000	6,000

Investment Required

The projected extension of the laser and other optical sensor development programs established the need for an optics laboratory facility. The cost of this facility, to be located at Gaithersburg, Maryland, is estimated at $1.1 million.

Investment specifically earmarked for exploratory development is:

Dollars in Thousands

1966	1967	1968	1969	1970	1971	1972
$500	$550	$675	$800	$1000	$1200	$1400

Technical Precursor/Fallout to IBM

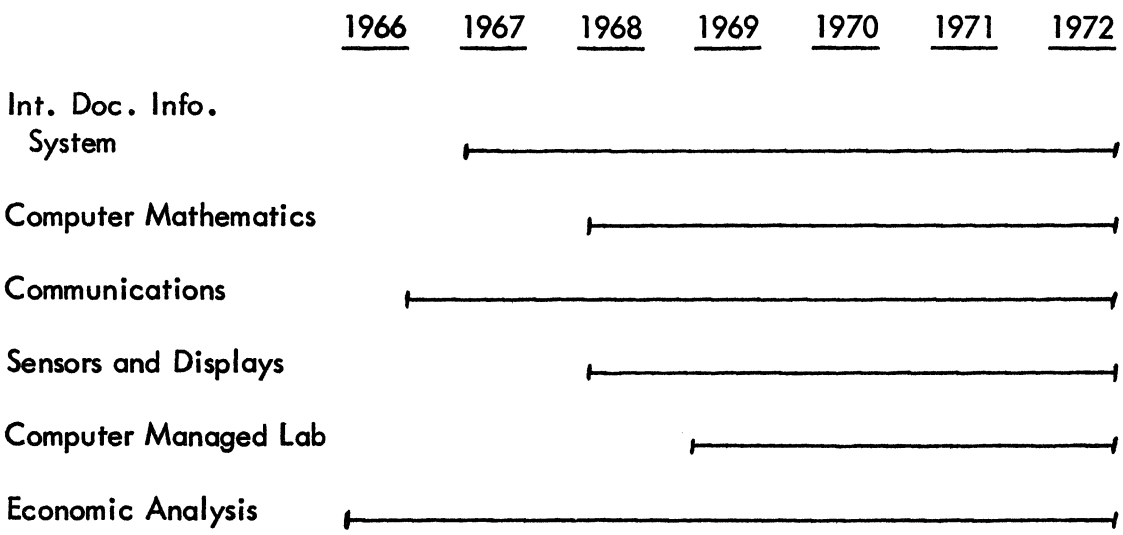
The effort relating to the development of a prototype internally-documented information system (evolutionary systems for data processing) will contribute significantly to System/360's versatility in large and highly complex programming applications, e.g., defense command/intelligence systems. In a more general sense, the program for computer mathematics will increase the versatility and efficiency of data processing systems.

Efforts underway in the use of satellite communications for IBM internal use will greatly reduce present internal communications costs, as well as travel costs. A study effort has been proposed to the Agency for International Development (AID) to assist education in developing nations by means of instructional television via communications satellites. Contract funding would require a joint effort by FSD, Science Research Associates, and World Trade Corporation.

The program to develop laser and radar capabilities affords the opportunity for IBM to market a broadened systems capability. In addition, the radar program provides a means to bring to product development the Research Division's work in semiconductor microwave devices.

The program for national policy modeling will provide useful knowledge of industry and technology trends, changes in work processes, and shifts in Government policies that affect major market segments of the U. S. economy. In addition, improved analytical methods of evaluating our non-capital investments are being developed and implemented. These methods will ensure in-depth review of funding requests and an increased expected payoff on investment and will provide an analytical procedure for use by other IBM divisions.

Time phasing of precursor/fallout to IBM is illustrated below:



Section 4

TECHNOLOGY AND ENGINEERING

The FSD Two-Year Operating Plan sets the tone for the long-range technical plan in that its major investment programs capitalize on the increased performance capabilities and low cost of IBM components in FSD equipment designed to satisfy unique government requirements. This approach is seen in the System 4 Pi computer family and the System Integration Modules (SIM), which take advantage of standard circuit components, system architecture, design automation, and even programming systems support where possible. Successful development of these two programs and the related business action areas by the end of 1967 will permit expanded emphasis on exploratory development. The combined IBM technical development and IRAD investment dollars, supplementing development contracts, will increase during the 1968-1972 period but will represent a continually decreasing percent of gross revenue:

(Dollars in Millions)

	1966	1967	1968	1969	1970	1971	1972
Investment	$7.5	$8.5	$8.8	$9.3	$9.8	$10.4	$10.9
Gross Income	152	180	205	232	257	283	315
Investment % Gross Income	4.9%	4.7%	4.3%	4.0%	3.8%	3.7%	3.5%

TECHNOLOGY TRENDS

The continuing trend toward digital techniques in more and more applications is expected to accelerate. The 4 Pi computer family addresses general purpose digital computer requirements in the airborne, space, and ground tactical environments defined by military specifications. This program supports all the FSD business action areas objectively with a compatible computer family which can serve multiple customers per computer. System 4 Pi, tailored to specific applications and compatible with non-mil spec machines, has cost/performance superiority and high reliability for mission effectiveness.

SIM extends the power of standard IBM equipment into the special hardware area, particularly in input, output, and communications. This program, which also extends across the FSD business action areas, will provide rapid, effective, and low cost response to the special integration hardware requirements of special data systems for the Federal Government. The demonstration of shelf-system design based upon ROM techniques augments the commonality offered by SIM. This approach offers flexibility in meeting "customized" user requirements by providing a base capability which can be adapted to a variety of federal government RFPs with a minimum of redesign effort.

Digital techniques in the sonar program, e.g., phased-array radar, and other sensors, carry FSD capabilities into new applications further removed from traditional data processing.

Other significant trends reflected in the long-range plan are:

a. Integrated circuits will become standard in FSD equipment by 1968; however, special interface modules will continue to contain some SLT where required for compatibility with existing SLT. FSD must maintain the capability to design, build, and maintain both technologies.

b. Processor price/performance in all environments will continue to improve. As in the commercial market, the dollar value of processors will shrink, and the relative value of the I/O portion of each system will grow. By the end of the period, data processing system revenue should be split approximately as follows:

20%	Processor
55%	I/O
25%	Storage

The increase in I/O will be a result of new devices for on-line data acquisition, image handling, display, communications, switching, and terminals.

c. Data processing vendors will have more opportunities to sell non-data-processing equipment and to manage large aerospace and weapons systems as the users recognize the importance of the information handling subsystem to the effectiveness of the total system.

d. Limitations in software manpower, particularly experienced programmers, will lead to an increase in applied research and development to increase programmer productivity. The R&D will emphasize automated documentation, terminal-oriented on-line programming and testing, more effective procedure-and problem-oriented languages, general purpose application programs, and programming project management techniques.

e. The introduction of microprogrammed read-only stores for computer control will increase the number of special purpose programs in use, in spite of the cost and difficulty of maintaining such programs.

f. Users, observing the success of Gemini/Apollo, FAA and similar projects, will gain confidence in computer control of processes where human safety is important. Their confidence will accelerate data processing applications in medicine, education, urban environment control, and natural resource management.

TECHNICAL OBJECTIVES

The primary objective of the technical plan is to successfully complete the FSD Two-Year Operating Plan investment program. The availability of the three members of the 4 Pi computer family and the catalog of system integration modules are, as previously indicated, prerequisites to the long-range business action plans.

SYSTEMS

Associated with System 4 Pi are various computer-controlled sensors, the most important of which is the phased-array radar. By applying the Gunn Effect oscillator and/or laser techniques to achieve a high-power, low-cost phased-array radar, FSD will expand its systems competence into the sensor area. The multimode functions of the radar can be controlled by a 4 Pi computer, permitting a total system approach. Related techniques of digital beam forming and signal processing appear in the sonar, seismic, and satellite communications areas. The mathematical capabilities associated with signal processing also are needed to solve problems in data compression, signal analysis, pattern recognition, and classification.

Computer control of other specialized systems will be the objective of several more data processing oriented tasks. The completion of work on aircraft integrated data systems (AIDS) will be followed by developments in computer-managed space

laboratories, meteorological and hydrological data acquisition systems, and automatic film reading and recording systems.

In less specialized applications of 4 Pi and SIM, new types of militarized I/O will be needed. This is particularly true in ground tactical systems where, to take full advantage of existing programs developed in an office environment, the customer will require disks, tapes, terminals, displays, etc. FSD must have the capability to provide such devices either by modifying standard items or by initiating a new design. Wherever possible, hardened I/O will be developed under contract.

As progress is made in the business action plans, decisions will be required to allocate investment dollars to exploratory development. Candidates for major programs of the 4 Pi type starting in 1968 or later are scientific satellites with associated on-board experiments and ground support throughout the mission, a major education research and development laboratory which will initiate and conduct full scale experimental classes, a network of communications satellite ground terminals, or a counter-insurgency weapons development laboratory. Whether major commitments of this type will be made depends on a significant improvement in a particular business area. The decision points for making such commitments should coincide with preparation of the annual Two-Year Operating Plan.

GENERAL SUPPORT

To be competitive in the business action areas where many large aerospace firms are already well established, FSD must develop capabilities in system integration. The investment program will provide the capability to supply equipment and software at low cost and on short schedules. This ability must be supplemented by suitable facilities for integration and test of the separate parts. Planned facilities include the central computer complex and SIM demonstration facility at Gaithersburg; a space environment simulator at Huntsville; a space laboratory and bioscience experimental facility, perhaps at Gaithersburg; and expanded computing complexes at Houston, Owego, and other locations. Proper use of these facilities will require, in addition to experiment and test design and operation, management procedures to make their use economical. Under consideration for this purpose are special software developments for time-sharing of facilities, evolutionary systems data processing (ESDP), read-only store microprogram compiling, software library automation, computer controlled reconfiguration, etc. A specific development of value to the technical plan is required, first of all, to comply with government configuration

management procedures. The appropriate systems and procedures will be designed and tested and then used in the support facilities for project control purposes.

Other general support requirements include scientific competence. The permanent FSD staff will include only such scientists as are regularly needed to perform on contracts. Short-term scientific consultants will be obtained from Research and, since many FSD problems are outside IBM's normal scope, from various universities. Typical specialities where university assistance will be needed are seismology, astronomy, radiation physics, physiology, and education. In addition, commercial consultants will be used to augment FSD staff in such areas as urban economics, transportation, civil engineering, and resource management. Table 4-1 summarizes investment requirements for FSD by business action area. Table 4-2 summarizes the technical requirements.

Table 4-1
INVESTMENT REQUIREMENTS

	Dollars in Millions						
	1966	1967	1968	1969	1970	1971	1972
Avionics	$ .50	$1.00	$1.65	$1.65	$1.65	$1.65	$1.65
Space	.40	1.70	1.92	1.90	1.90	1.90	2.00
Tactical	.40	.49	.68	.70	1.07	1.56	1.75
Information	.30	.31	1.82	2.40	2.33	2.24	2.25
Exploratory	.50	.55	.68	.80	1.00	1.20	1.40
Computer Dev	3.80	2.85	1.85	1.85	1.85	1.85	1.85
SIM	1.60	1.60	.20	-	-	-	-
Total	$ 7.50	$8.50	$ 8.80	$9.30	$ 9.80	$10.40	$11.90

Table 4-2
TECHNOLOGY & ENGINEERING
TECHNICAL REQUIREMENTS

Technology/Techniques	Information	Tactical	Space	Avionics	Exploratory
Processor					
4 Pi EP		x	x	x	
CP			x	x	
TM	x	x	x	x	
Special Processor					
large store, small logic	x	x	x		
small store, small logic		x			
large store, large logic	x	x	x		x
small store, large logic			x	x	x
Display (various sizes)	all	all	small	small	all
2D B/W	x	x	x	x	
2D Color	x	x	x		x
3D B/W	x	x			
3D Color	x	x			x
Storage	*	*	subusec	subusec	subusec
* best commercial price/perf.				NDRO	
I/O - (all standard types)					
environmentalized		x	x	x	
SIMS	x	x	x		
I/O - Special					
Image Handling	x	x			
Data compression	x		x		x
Error control of communication	x	x	x		x
Digital switching	x	x			
Digital correlation	x	x	x	x	x
Analog conversion	x	x	x	x	x
Telemetry data	x	x	x		
Sensors					
Beam forming arrays - radar, sonar		x	x	x	x
Infrared			x	x	x
Force sensor				x	
Biophysic instrumentation			x		x
Components					
Laser	x	x	x	x	x
Oscillator (Gunn - semiconductor)		x	x	x	x
Analog circuits	x	x	x	x	x
NGT	x	x	x	x	x
LSI			x		
Software					
Application packages	x	x	x		
Exp and Sim facilities	x		x		x
Production technology	x		x		x

Section 5

RESOURCES AND FUNCTIONAL DATA

PERSONNEL

Continued growth throughout FSD is dependent upon the Division's ability to develop and maintain a flexible resource capability to meet the ever-changing market environment. The current trend of the labor market, increased requirements throughout the corporation, and the diversity of skills needed to meet these requirements necessitate an effective long-term plan for manpower acquisition and skill maintenance. Compliance with corporate policy, the mix of personnel at individual locations, use of non-regular personnel, overtime policies, intracompany transfers, skill planning, and consideration of needs of remotely-located personnel will be of major concern in carrying out this plan.

Full Employment and Manpower Requirements

The projected growth of FSD necessitates an extensive effort to acquire manpower and to maintain a proper balance of skills throughout the Division. A favorable position with our workload buffer will be maintained with no threat to the full employment practice of the Corporation.

The critical labor market continues to place increasing demands on our programming and systems engineering talent. The growth of the Division is closely related to the ability to acquire these skills in the required numbers. These skills will be acquired through a balanced program of hires and transfers. The goal of the transfer program will be to obtain personnel with experience (and IBM maturity) gained through exposure to commercial operations.

Mix Policy

The mix of personnel at major remote locations is continually improving with regard to IBM experience. The experienced base already established will continue to mature as the Division continues to grow. The development of new locations will be monitored closely to ensure that the level of IBM experience is sufficient to minimize exposure to outside influences.

Non-Regular Personnel

Non-regular personnel will be used to ensure flexible, quick response to the sudden increase in business. The shifting contractual characteristic of FSD business requires this flexibility. In some areas, the use of non-regular personnel is the only reasonable method of buffering full employment. This practice will continue to be managed closely within the guidelines of Corporate policy. The critical areas where policy extensions have been allowed — namely, Bethesda programming and Huntsville engineering — will be relieved in this plan period through better planning for the balancing of workload and manning and through stepped-up hiring.

Overtime

FSD continually monitors overtime activity very closely at all levels of management. The business will continue to demand periods of excessive overtime activities — particularly when the demands of FSD participation in the National Space Program increase as space flights become more frequent and of longer duration. In cases where peak loads are not a factor, permanent people will be hired to ensure adherence to policy. Overtime is a most critical area in the personnel operations of FSD, and it will continue to receive the appropriate management attention.

Transfers

FSD has proposed an interchange of personnel on an annual basis between the commercial organizations and FSD. This interchange should encompass a range of professional skills so that efforts at various levels can benefit from the cross-pollination resulting from the exchange of skills and thinking. The transfers not requiring large-scale geographic moves would be favored to minimize expense.

Skill Planning

The continued growth of the Division, the competitive labor market and the diversity of skill needs require the development of a meaningful program to maximize the efficient utilization of manpower. This program will necessitate an intensified long-range recruiting effort, with a continued emphasis on college hires. It will also help reduce costs, raise morale, and provide a greater flexibility for contractual requirements of the military market. The PDS program provides a basis upon which a skills utilization program will be developed within the Division.

Remote Locations

In keeping with the continuing trend of FSD contractual commitments, increasing numbers of personnel will be located on or in close proximity to the customer's premise. This location of personnel away from the mainstream of IBM activity requires greater management attention to morale and individual concerns. This need will be addressed through continuing executive visits, family events through IBM Club activities and manager-employee meetings. The staffing of these locations will be closely monitored and a responsible personnel representative assigned as the need dictates.

General Considerations

a. The divisional salary program will be sensitively administered in keeping with the Corporation's objectives. The exempt and nonexempt position measurement program will be finalized and a continuing maintenance program developed. Critical skills will be closely monitored to maintain a competitive position in the market environment.

b. A management-by-objectives appraisal program will be completed during this period at all levels. The full development of an individual's potential will be a key objective. A closer monitoring of employee performance will increase the effectiveness of the appraisal program and allow earlier identification of performance problems.

c. A continuing audit of all personnel programs will be performed at each center with the objective of ensuring compliance to corporate policies and practices.

d. Plans for Progress will continue to receive close attention. The training programs developed in the past will continue and are a necessity to attract the skills and number of personnel available through the labor market.

e. An increased loss of draft-age personnel to the Selective Service, particularly within less experienced professional programming groups, is expected as a result of the continuing Vietnam situation. These losses will be monitored closely as they could have severe impact on contractual commitments.

f. The development of a resource capability also requires an effective

training effort. FSD will provide an educational environment conducive to motivating its management, engineering, programming and systems talent to expand their skills to a more advanced level.

Manning Levels

Figure 5-1 indicates FSD personnel requirements by location.

FACILITIES

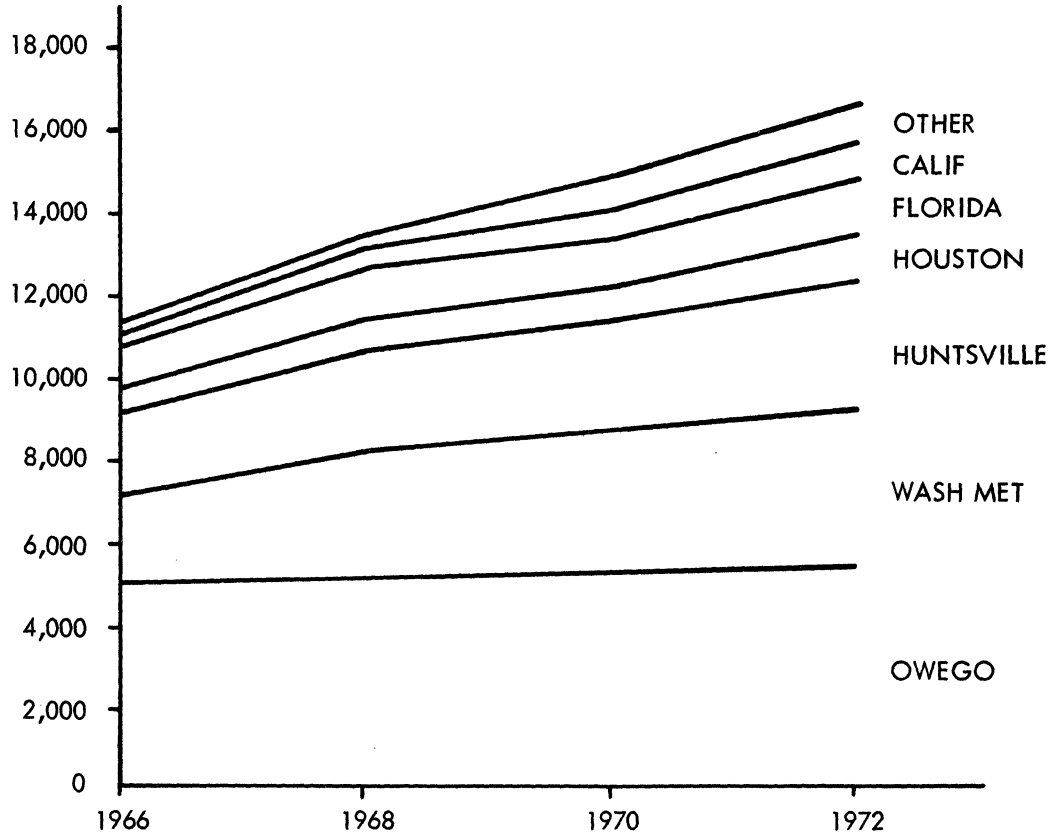
During the period of the plan, the principal expansion of plant and laboratory facilities will be at Cape Kennedy, Owego, Gaithersburg, Huntsville, and the West Coast.

At Cape Kennedy, a 200-man leased office facility is planned for early 1967. Plans for this facility will contain an option for 100% expansion if it becomes necessary to house additional personnel off the customer's premises.

Owego currently uses a number of small, substandard, leased buildings for warehousing. A consolidated warehouse and parts distribution center is planned for 1968, at which time the leased facilities will be terminated.

A site feasibility study of the Gaithersburg property indicates that the existing facility can be readily expanded with an addition of 195,000 square feet to house a total population of 2,200 people. This expansion will consist of additional laboratory and office space required by mid-1968 to implement the tactical systems business action plans and to house Space Systems Center personnel previously located in leased facilities. In addition, the expanded facility would house the growth of the IBM-premise portion of the information systems function.

The site feasibility study further indicates that the Gaithersburg facility could logically be expanded in two additional phases to an ultimate capacity of 6,000 people, including a 225,000 square-foot light manufacturing and manufacturing administration facility. This expansion would be phased during the period of the plan to meet the growth requirements of the tactical and information systems function and of the Montgomery County portion of the Space Systems Center.



OWEGO	4907	5445	5562	5705
WASHINGTON METROPOLITAN	2339	2953	3303	3924
HUNTSVILLE	1888	2325	2553	3004
HOUSTON	702	759	883	987
FLORIDA	1052	1125	1270	1352
CALIFORNIA	342	564	645	781
OTHER	418	475	912	1058
TOTAL	11648	13646	15128	16811

Figure 5-1. Manpower Summary, Major Locations

The manned space systems activity at Huntsville will require expanded office and laboratory space, including a large environmental lab, and a simulation facility. A 45,000 square-foot laboratory and high-bay assembly building, now in design, will be completed in January 1967. A 60,000 square-foot office building is planned for occupancy during the first quarter of 1968, principally to house expansion associated with AAP. A need for an additional 150,000 square-foot assembly and office building is anticipated in 1971 to house the increased manned space systems activity.

A site feasibility study of the Huntsville property indicates that the maximum capacity of the present site is limited to 3,045 people because of limited parking facilities. Additional land to bring the capacity of the site to a minimum of 5,000 people will be purchased to provide maximum flexibility for business expansion into commercial areas, as well as manned space systems, should the need arise.

Increased office space requirements for manned space systems activities at Houston will be satisfied during the early period of the Plan by the new 750-man building scheduled for completion at Nassau Bay in September, 1966. Design of the building incorporates an expansion capability of 100%. This will be phased in as required later in the plan to match the growth of the contract base.

Business action plans in the unmanned space areas of satellites, ranges, and space experiments dictate the need to develop an integrated FSD facility on the West Coast, during the early period of the plan. This facility will consist of a development engineering laboratory for work in the areas of satellite subsystem (power supplies, thermal conditioning, communications, structures), sensors, and experiment control/techniques. The facility will also include office space for engineering, systems, marketing, and administrative personnel associated with FSD's West Coast activities.

Table 5-1 illustrates the time phasing of additional facilities.

MANUFACTURING

Manufacturing will assume an increasingly important role for FSD in the future. The revenue growth goal will be achieved by quantity production of System 4 Pi computers and the follow-on of existing Gemini and Saturn programs in the Manned Orbital Laboratory and Apollo Application Programs.

Gaithersburg will maintain a model shop capability as a part of its engineering program to fabricate sufficient hardware models to prove feasibility and prepare the

Table 5-1

ADDITIONAL FACILITIES
(In Square Feet, 000 Omitted)

Location	1966	1967	1968	1969	1970	1971	1972	Total Incl Exist Sq Ft
Montgomery County	X 245 office, lab		X 195 office, lab		X 120 office, lab			676,000
Huntsville		X 45 lab, high bay	X 60 office		X 150 office, lab			601,000
Los Angeles	X 15 office	X 30 office, lab			X 40 office			100,000
Owego			X 80 warehouse					1,067,000
Houston	X office							136,000
Cape Kennedy		X 6 office		X 50 office				80,000
Total Facility Requirements in square feet (000 omitted)								
Owned	1349	1394	1727	1727	1727	1997	1997	
Leased	681	830	550	611	805	638	767	
	2030	2224	2277	2338	2532	2635	2764	

product for release to manufacturing at Owego.

Huntsville will continue its component checkout, final assembly, and systems test of instrument units for the Saturn launch vehicle.

Owego will be the prime manufacturing location for all FSD quantity hardware products. The highly automated process technology card manufacture of System/360 and the anticipated follow-on effort on the Saturn V computer, data adapter and switch selector, orbiting astronomical observatory processors, Gemini computers and auxiliary tape memories, militarized disk files, and B-52 bombing navigation systems in support of the Vietnam conflict all provide a firm workload base. The following new-business hardware will provide the real growth for manufacturing.

4 Pi EP Computer
4 Pi CP Computer
4 Pi TM Computer
Air Bearing Memory Drum
Poseidon Data Storage Unit

These products continue the shift in orientation of manufacturing technologies from mechanical and discrete electronics to the physical and chemical sciences (monolithics, optics, magnetics, lasers, and electron beams) requiring process-controlled production techniques. To satisfactorily prepare for this change, greater emphasis is being placed on both manufacturing research and advanced manufacturing engineering.

The newly created Manufacturing Engineering Laboratory will be used to advance the state of the art and develop skills in such areas as: electron beam welding, brazing, soldering, machining, and etching; laser microradiometry, luminescent phosphors, X-rays, and beta rays; advanced interconnection and bonding processes; micromagnetic materials and processes; photosensitive materials and processes; and optical inspection and measurement tools. Pilot lines will be established to translate these results into processes, procedures, methods, and equipments for the manufacture and test of the hardware to be produced.

More standardized hardware designs and manufacturing equipment will substantially increase manufacturing productivity and enable a relative reduction in manufacturing support effort. Quantity hardware will be manufactured using such facilities as

the Graphic Arts Machine (GAM) for efficient automated artwork generation, numerically controlled machine tools for complex machining, Multilayer Interconnection Board (MIB) processes for complex interconnections, and the Manufacturing Test Data System (MTDS) for evaluation and test of products from incoming components to finished systems. Multiple shifts will be used to permit maximum utilization of these facilities. The direct workload buffer will gradually increase to 50% by 1970, primarily through extensive subcontracting. Figure 5 - 2 shows the relationship between workload and manpower projected for the time period of this plan.

The manufacturing facilities will be modernized and expanded to handle the increasing workload. In most cases, this will merely involve duplicating existing MTDS equipment. Only in the potentially toxic machining of beryllium for the air bearing drum will unique facilities be required. The general purpose precision tool and model shop will be sustained to handle special tool, jig, fixture, and automated equipment maintenance as well as the existing support to engineering development of experimental and prototype hardware.

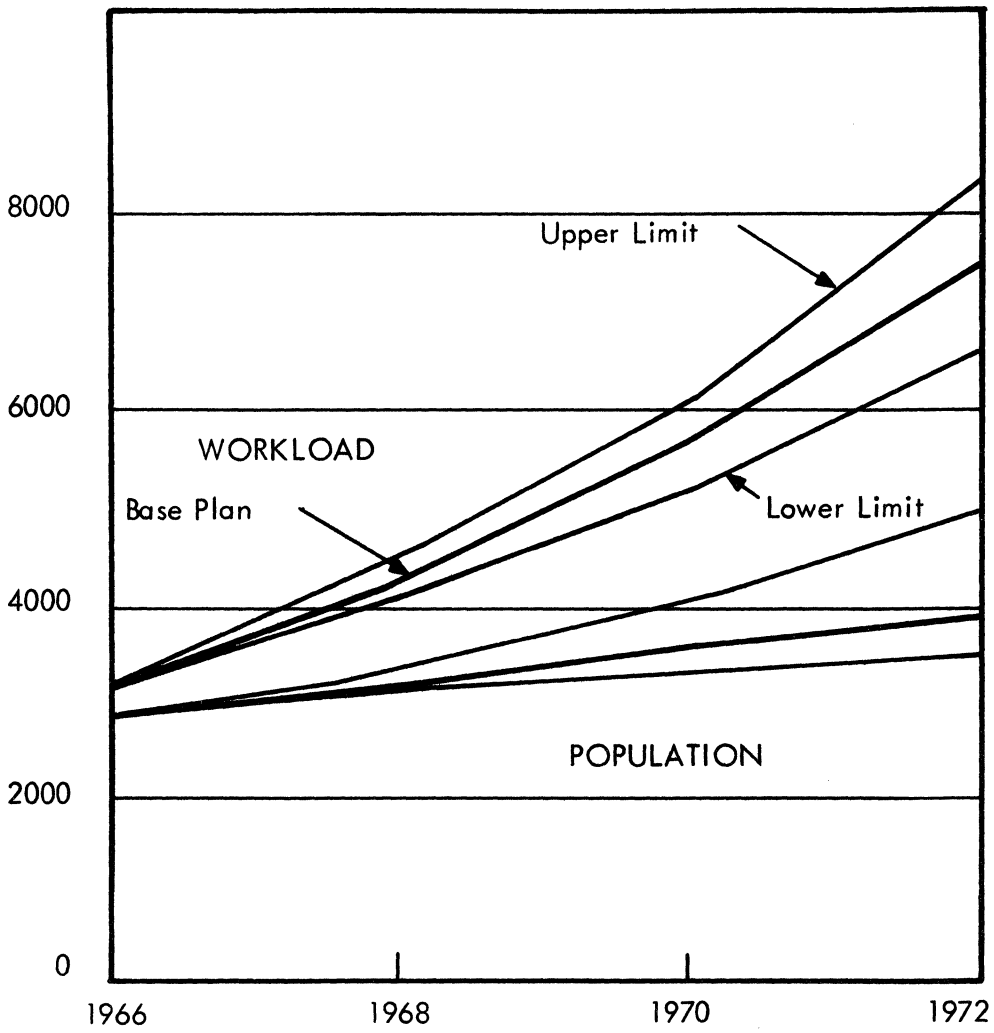


Figure 5-2. FSD Manufacturing Workload/Manpower*

*Total Aerospace and Process Technology Manufacturing and Manufacturing Support

Section 6

FINANCIAL DATA

Summary Income Statement

(Dollars in Thousands)

	1966	1967	1968	1969	1970	1971	1972
Sales	$164,118	$198,637	$243,433	$287,322	$311,322	$337,099	$370,436
Gross Income	152,000	180,000	205,000	232,000	257,000	283,000	315,000
ASPR Profit	7,659	11,989	14,500	16,700	19,100	21,300	24,000
% Gross	5.0%	6.7%	7.1%	7.2%	7.4%	7.5%	7.6%
Net Before Tax	1,000	4,721	7,000	8,800	10,800	12,600	14,900
% Gross	0.7%	2.6%	3.4%	3.8%	4.2%	4.5%	4.7%
Net After Tax	520	2,455	3,640	4,576	5,616	6,552	7,748
% Gross	0.3%	1.4%	1.8%	2.0%	2.2%	2.3%	2.5%
Return on Invested Capital	0.7%	3.0%	3.8%	4.0%	4.3%	4.7%	5.3%
Investment							
IBM	4,567	5,100	5,100	5,100	5,200	5,300	5,300
IRAD	2,933	3,400	3,700	4,200	4,600	5,100	5,600
Total	$ 7,500	$ 8,500	$ 8,800	$ 9,300	$ 9,800	$ 10,400	$ 10,900

Financial Section Omitted