

# NASA Technical Memorandum 85650

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## Contracts, Grants, and Funding Summary of Supersonic Cruise Research and Variable-Cycle Engine Technology Programs 1972-1982

Sherwood Hoffman and Mary C. Varholic

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1958-1983





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**Contracts, Grants, and Funding  
Summary of Supersonic Cruise  
Research and Variable-Cycle  
Engine Technology Programs  
1972-1982**

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## INTRODUCTION

The cancellation of the United States Supersonic Transport Program in March 1971 created a void in the potential number of U.S. aircraft which could be offered for both domestic and foreign airline use. This fact in itself was a driving reason to start follow-on studies to assure that an expanded supersonic transport (SST) technology base would be available to proceed with the development of an advanced supersonic transport at a future date. In addition, the follow-on programs capitalized on the government funding already invested in SST technology and the Industrial Research and Development (IRAD) funds expended by Boeing, kept the design teams active, and performed research on major unsolved technology problems.

The defunct U.S. SST program had its beginnings in research conducted in the laboratories of NACA/NASA. NASA configurations were part of the mix of options available to Boeing, and a NASA configuration (SCAT-15F) was the closest contender to the finally selected prototype design (Boeing 2707-300). However, technological problems existed which directly related to factors which terminated the SST program in 1971; for example, concern for engine noise levels; upper atmospheric pollution; flutter characteristics; requirement for stability augmentation systems not within the state of the art; sonic boom characteristics; and low range/payload characteristics due to excessive structural weight fraction, high specific fuel consumption, a marginal configuration concept with insufficient lift-drag ratio, and economics.

The Supersonic Cruise Research (SCR) Program was initiated in fiscal year 1973 by the National Aeronautics and Space Administration at the direct request of the Executive Office of the President and Congress following termination of the U.S. SST program. Originally, the program was entitled Advanced Supersonic Technology (AST); this was later changed to Supersonic Cruise Aircraft Research (SCAR) and, finally, to SCR.

The SCAR Program was a focused Research and Technology (R&T) effort. The overall objectives may be summarized as follows:

1. To provide an expanded technology base for future civil and military supersonic aircraft
2. To provide the data needed to assess environmental and economic impacts on the United States of present and future supersonic transport aircraft
3. To define the potential benefits and trade-offs of advancements in aerodynamic efficiency, materials and structures, propulsion systems, and stability and control methods applied to promising advanced supersonic cruise aircraft concepts

This program included System Studies (SS) and the following disciplines:

- Propulsion (P)
- Stratospheric emissions impact (SEI)
- Materials and structures (M&S)
- Aerodynamic performance (A)
- Stability and control (S&C)

The SCR Program was managed by the Office of Aeronautics and Space Technology (OAST), Aeronautical Systems Division, with Langley Research Center designated as the lead center. The Advanced Supersonic Technology (AST) Office was established at Langley for technical management and coordination of the program. Ames Research Center, Lewis Research Center, Dryden Flight Research Center, and Jet Propulsion Laboratory, in addition to Langley Research Center, implemented the program through contracts with the aircraft industry, research grants to universities, and in-house experimental and analytical work.

The NASA/Lewis Variable-Cycle Engine (VCE) Component Program was initiated in fiscal year 1976 to augment the overall SCR technology effort in the area of propulsion. Phase I provided for the initial development and evaluation of certain critical component technologies unique to VCE concepts for a supersonic cruise aircraft. VCE Phase II Technology Program was intended to build upon the results of the VCE Component Test Program and allow the evaluation of component/system performance and environmental characteristics of the General Electric Double-Bypass Engine (DBE), the Pratt & Whitney Variable-Stream Control Engine (VSCE), and the Turbine Bypass Engine (TBE). Phase II was restructured, beginning in mid fiscal year 1981, as the result of the elimination of funding for fiscal year 1982 and beyond. Large-scale test-bed engine activities were phased out and model nozzle testing and analytical flow-field prediction code development were emphasized in the revised program. Work was completed with remaining fiscal year 1981 funds.

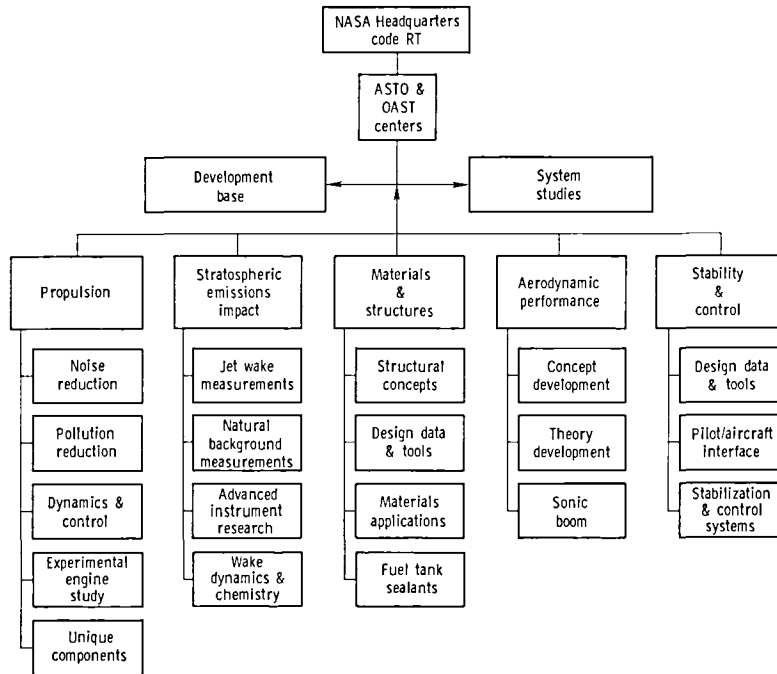
The YF-12 aircraft were utilized in the SCAR Program for demonstration of technological solutions to problems in high-temperature structures, control of engine performance, control for cruise Mach number, and control for altitude.

A block diagram showing the initial organization of SCR in fiscal year 1973 is shown in figure 1(a). As progress was made during the first 7 years, the program structure gradually changed to that shown in figure 1(b). The major disciplines (namely, propulsion, materials and structures, aerodynamic performance, and stability and control) plus system studies remained essentially the same. Stratospheric emissions impact was absorbed into propulsion, and a new discipline which addressed propulsion-system/airframe interaction was initiated in fiscal year 1978. The Variable-Cycle Engine Component Program and the flight research experiments shown in figure 1(b) are other OAST programs which provided technology data for the SCR development base. The relative level of effort expended for each discipline from fiscal year 1973 to fiscal year 1981 is presented in figure 2.

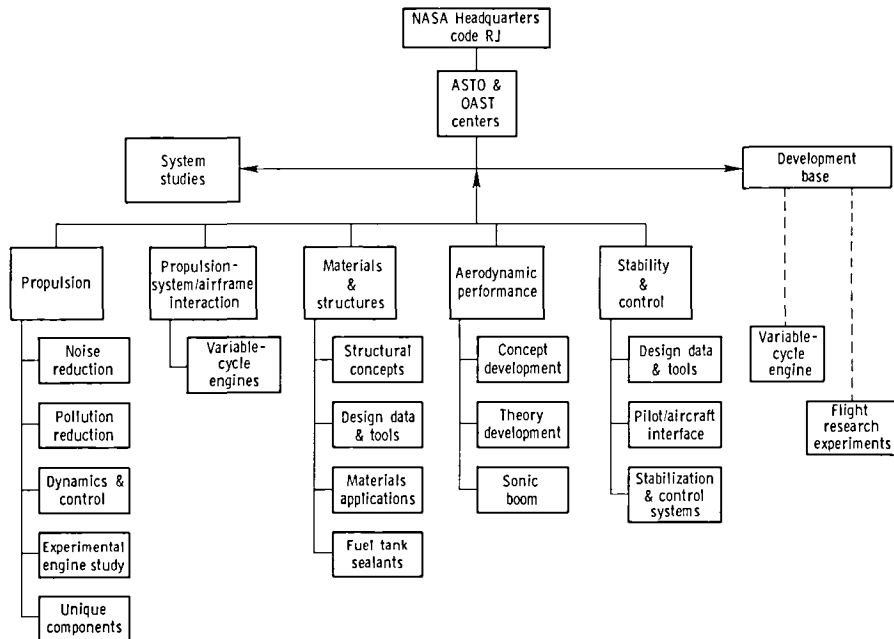
In order to keep the technical community informed of progress, two conferences were held and the proceedings published as NASA CP-001 (ref. 1), and NASA CP-2108 (ref. 2). The conference presentations only highlight the progress and one must turn to the more technical documents for details. All the NASA formal reports, articles, presentations, and contractor reports on record at the AST Office at mid-1980 are listed in two bibliographies, NASA RP-1003 (ref. 3) and NASA RP-1063 (ref. 4).

The purpose of this report is to document the contracts and grants of both programs in order to provide a subject and cost record which would be valuable in planning follow-on programs. This information may be used with the SCR Program bibliographies (refs. 3 and 4) to delineate the areas studied and the level of effort expended, to avoid duplication of effort, and to identify new technological areas for study. The funding data and money for awards have been rounded off and should be used only for technological planning.





(a) Fiscal year 1973.



(b) Fiscal year 1979.

Figure 1.- SCR Program structure.

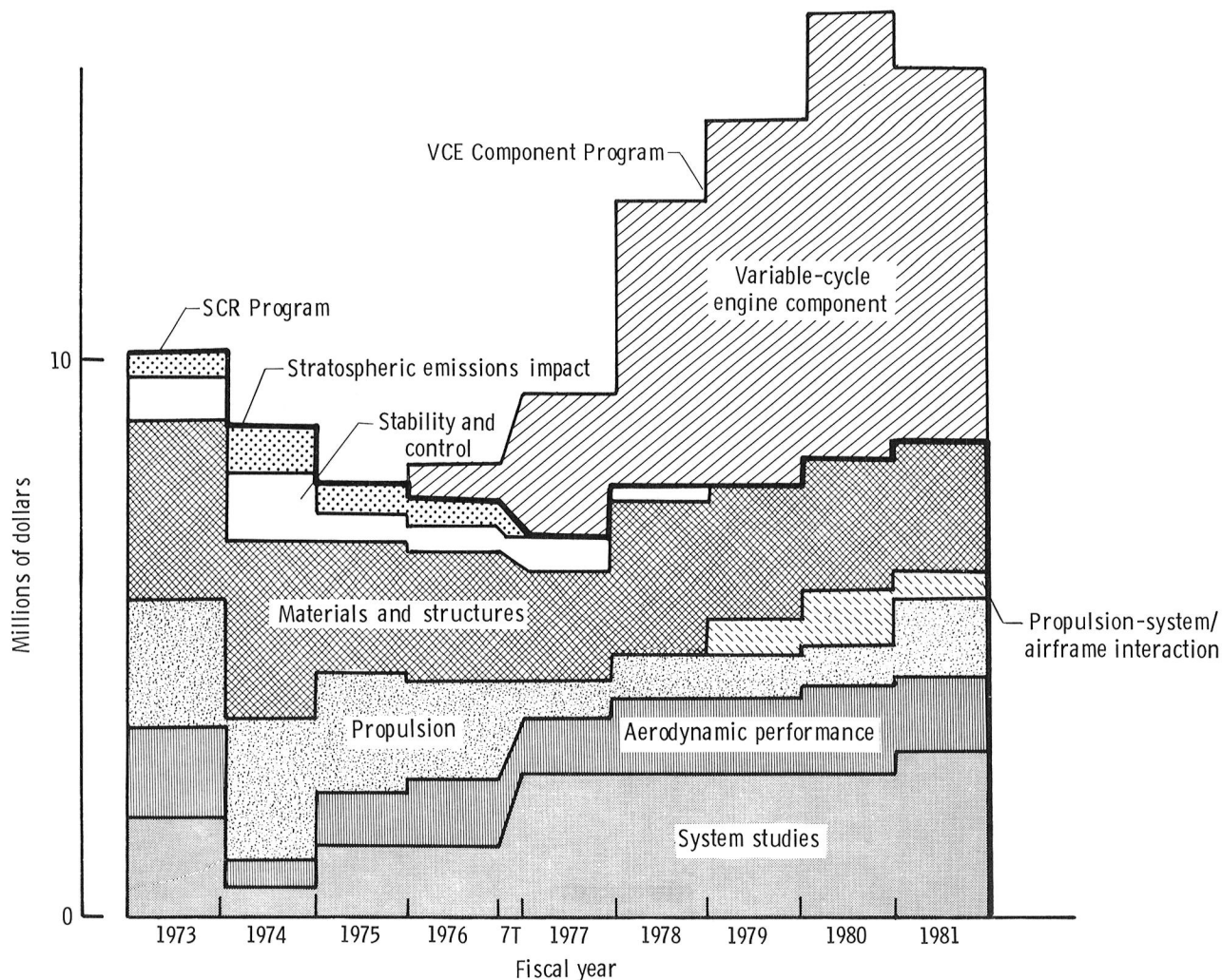


Figure 2.- Net R&D history for SCR and VCE Programs.

#### DISCUSSION

There were six major contractors<sup>1</sup> for SCR and VCE; namely, (1) Boeing Commercial Airplane Company, (2) McDonnell Douglas Corporation, (3) Lockheed-California Corporation, (4) Rockwell International for supersonic aircraft system studies, (5) General Electric Company Aircraft Engine Group, and (6) Pratt & Whitney Aircraft Group for engine studies. Kentron International, Inc. (Vought Corporation) provided engineering manpower support for in-house system studies for the lead center at Langley for the life of the program. The total number of contractors and grantees on record at the AST Office in 1982 was 101 for SCR and 4 for VCE.

Pages 7 to 48 of this document consist of a listing of all contracts and grants on record at the SCR Office (LaRC) at the end of 1982. The contracts and grants are

<sup>1</sup>Over the history of the program, the names of some of the contractors may have changed. Contracts for a corporation having several subcompanies are all summarized under one name.

grouped together by fiscal year (FY) and a cost summary is given at the beginning of each FY tabulation. The data consist of NAS contract/grant number, name of contractor/grantee, a brief title, discipline, and the approximate amount for the contract. The cost or amount for each award was rounded off to the nearest \$1000. In general, the awards were for 1 year and extensions or modifications were made as new technologies were developed or identified for study.

The information given for each award serves as a key to the subject material which, in turn may be used with the SCR bibliographies (refs. 3 and 4) to identify the technical publications. The date and discipline of the contract/grant awards are similar to the date and discipline of the contractor reports in the references. For instance, the FY 1977 contract entitled "SCV Technology Assessment Study of an Over/Under Engine Concept," NAS1-14625. Lockheed-California, System Studies, produced a corresponding publication, report number 59, page 30 of reference 3, entitled "Supersonic Cruise Technology Assessment Study of an Over/Under Engine Concept," NASA CR-159003, 1978, Vols. I and II, Lockheed-California, contract NAS1-14625

The total amounts awarded to each contractor and grantee for all years of both programs are given in tables I and II. During approximately 9 years, the program year (PY) funding to support SCR Research and Development (net R&D), was about \$73,227,000 (table III). The total amounts for contracts and grants were \$63,174,000 and \$3,015,000, respectively, out of a total program authority (506 W) of about \$86,982,000. During approximately 6 years of funding, the amount of money spent on VCE Research and Development (table IV) was about \$31,177,000. The total amounts for contracts and grants were \$27,103,000 and \$750,000, respectively, out of a total program authority (506 W) of about \$31,730,000.

An important factor in the success of both programs was the support provided by company Industrial Research and Development (IRAD) funds, which was considerable in the major contracts and often matched or exceeded corresponding NASA SCR funds.

Table V summarizes the SCR net R&D for each discipline and for each program year. The costs for the first two disciplines, system studies and aerodynamic performance, are listed and then totaled. They were programed separately during the first several years and combined during the later program years. The propulsion and SEI subprograms are summed for convenience. The VCE support is the amount of this sum spent to support the VCE program. Funding for all of the disciplines is broken down by OAST center and program year in table VI. In general, Langley and Ames performed the aerodynamic efforts, Langley did the bulk of materials and structures, Lewis did virtually all of the Propulsion and engine technology efforts, Ames and Dryden performed the control system tasks, and the Jet Propulsion Laboratory conducted the stratospheric emissions impact studies.

The last funding breakdown is presented in table VII. Each page shows the Research and Technology Operating Plan (RTOP) number and title for each program year, OAST center, discipline, and net R&D amount. The large scope of this Supersonic Cruise Aircraft Research Program is evident, and it indicates the Herculean effort in planning, management, and research that was required in order to produce approximately 1000 technical publications consisting of NASA formal reports, NASA contractor reports, company reports, and articles.

## CONCLUDING REMARKS

The Supersonic Cruise Research Program and Variable-Cycle Engine Technology Program were very successful in conducting advanced technology studies for future supersonic commercial and military jet transports. At the close of the program in 1982, the studies identified technologies for producing an efficient supersonic commercial jet transport which could transport 300 passengers nonstop from Los Angeles to Tokyo in about 4 hours. One major problem which has not been solved to date is "sonic boom." Future studies, however, should be conducted in order to optimize such aircraft and to develop transport airplanes for cruising at higher Mach numbers.

Funds expended by SCR between fiscal year 1973 and fiscal year 1981 on contracts and grants were \$63,174,000 and \$3,015,000, respectively. The SCR net R&D was \$73,227,000 and total program authority (506 W) was \$86,982,000. The corresponding level of effort for VCE was \$27,103,000 for contracts and \$750,000 for grants, out of a net R&D of \$31,177,000 (506 W was \$31,730,000).

The total number of contractors and grantees on record at the AST Office in 1982 was 101 for SCR and 4 for VCE.

Langley Research Center  
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Hampton, VA 23665  
June 15, 1983

## REFERENCES

1. Proceedings of the SCAR Conference - Parts 1 and 2. NASA CP-001, [1977].
2. Supersonic Cruise Research '79. NASA CP-2108, 1980.
3. Hoffman, Sherwood: Bibliography of Supersonic Cruise Aircraft Research (SCAR) Program From 1972 to Mid-1977. NASA RP-1003, 1977.
4. Hoffman, Sherwood: Bibliography of Supersonic Cruise Research (SCR) Program From 1977 to Mid-1980. NASA RP-1063, 1980.

SUPERSONIC CRUISE RESEARCH  
AND  
VARIABLE-CYCLE ENGINE TECHNOLOGY PROGRAMS

1972 to 1982

SUPERSONIC CRUISE RESEARCH - FY 1973

Cost Summary (in Thousands of Dollars)

|                       |              |
|-----------------------|--------------|
| RTOP .....            | (a)          |
| PY .....              | 74           |
| Contracts:            | Cost         |
| Langley (NAS1-) ..... | 5 224        |
| Ames (NAS2-) .....    | 880          |
| Lewis (NAS3-) .....   | 2 059        |
| Dryden (NAS4-) .....  | 0            |
| JPL (NAS7-) .....     | 85           |
| Johnson (NAS9-) ..... | 18           |
| Suballotments .....   | <u>1 042</u> |
| Subtotal .....        | 9 308        |
| Grants .....          | <u>284</u>   |
| Total .....           | 9 592        |
| Net R&D .....         | 10 310       |

<sup>a</sup>501-06, 08, 24, 31, and 32; 760-65.

## ADVANCED SUPERSONIC TECHNOLOGY PROGRAM

| <u>Number</u> | <u>Contractor/grantee</u>            | <u>Descriptive title</u>   | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|--------------------------------------|--|-------------------|---|
| Contracts:    |                                      |  |                   |   |
| NAS1-10900    | Ling-Temco-Vought                    | Nonpersonal Services Support   | A, SS             | 274   |
| NAS1-10992    | Boeing                               | Analysis of the Jackass Flats Sonic Boom Flight Test Data                                    | A                 | 37  |
| NAS1-11085    | Microcraft, Inc.                     | Pressure Distribution and Propulsion Integration Model                                       | A                 | 166   |
| NAS1-11820    | Lockheed-California                  | Continuation of Real-Time Fatigue Testing (Extension)  | M&S               | 41  |
| NAS1-11847    | Dynamic Engineering<br>and Model Co. | Wind-Tunnel Models   | A                 | 368   |
| NAS1-11877    | Boeing                               | Low Sonic Boom SST Feasibility Study   | A                 | 65  |
| NAS1-11938    | Boeing                               | Study of Impact of Advanced Technologies Applied to<br>Supersonic Transport Aircraft         | SS                | 459   |
| NAS1-11939    | McDonnell Douglas                    | Study of Impact of Advanced Technologies Applied to<br>Supersonic Transport Aircraft         | SS                | 399   |
| NAS1-11940    | Lockheed-California                  | Study of Impact of Advanced Technologies Applied to<br>Supersonic Transport Aircraft         | SS                | 376   |
| NAS1-11997    | Boeing                               | Support of Flutter Model Tests at ONERA  | M&S               | 86  |
| NAS1-12020    | Boeing                               | Study of Unsteady Aerodynamics Caused by Motions of<br>Control Surfaces in Subsonic Flow     | M&S               | 39  |
| NAS1-12052    | Boeing                               | Development of Extended Supersonic Aerodynamic Analysis<br>System                            | A                 | 94  |
| NAS1-12079    | General Electric                     | Improved Resins for AST Composites   | M&S               | 100   |
| NAS1-12121    | Lockheed-California                  | Flutter Modules Applicable to Automated Structural Design                                    | M&S               | 174   |
| NAS1-12159    | Arthur D. Little Co.                 | Tunable Diode Laser System   | SEI               | 20  |
| NAS1-12185    | Boeing                               | Analytical Study for Predicting Wing Aerodynamic Loads<br>of Supersonic Aircraft             | M&S               | 70  |
| NAS1-12245    | Rockwell International               | Study of Integrated Variable-Cycle Propulsion Concept<br>in an Advanced Supersonic Transport | P                 | 137   |
| NAS1-12287    | Boeing                               | Study of Structural Design Concepts for an Arrow-Wing<br>Supersonic Transport Configuration  | M&S               | 518   |

ADVANCED SUPERSONIC TECHNOLOGY PROGRAM - Continued

| <u>Number</u> | <u>Contractor/grantee</u> | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|---------------------------|---|-------------------|---|
| Contracts:    |                           |   |                   |   |
| NAS1-12288    | Lockheed-California       | Study of Structural Design Concepts for an Arrow-Wing Supersonic Transport Configuration      | M&S               | 476   |
| NAS1-12308    | General Dynamics          | Study of Time-Temperature-Stress Capabilities of Composite Materials                          | M&S               | 530   |
| NAS1-12436    | McDonnell Douglas         | Storage Computer Study  | M&S               | 50  |
| NAS1-12501    | Boeing                    | Acceleration of Fatigue Test Methods  | M&S               | 207   |
| NAS1-12875    | Boeing                    | Transonic Loads Measurement and Prediction  | M&S               | 137   |
| NAS1-12900    | Analytical Methods, Inc.  | Aerodynamic Characteristics of Configurations Based on Local Mach Number Distribution         | A                 | 72  |
| NAS1-12911    | Boeing                    | Extension of the ATLAS Integrated Analysis and Design System                                  | M&S               | 5   |
| NAS1-12984    | Lockheed-Georgia          | Design, Fabrication, and Test of a Three-Dimensional Oscillating Pressure Wind-Tunnel Model   | M&S               | 213   |
| NAS1-13105    | Rockwell International    | Effects of Engine Size on the Drag of Supersonic Cruise Aircraft                              | A                 | 70  |
| NAS1-13145    | McDonnell Douglas         | Effect of Nominal Cabin Floor Angle on the L/D of a Typical SST Configuration                 | A                 | 35  |
| NAS1-13500    | Ling-Temco-Vought         | Nonpersonal Services Support  | M&S               | 6   |
| NAS2-5006     | Boeing                    | Development of Computer Programs for Predicting Stability Characteristics of Elastic Aircraft | A                 | 41  |
| NAS2-5587     | Applied Space Products    | Support Services  | A                 | 17  |
| NAS2-6006     | LFE Corp.                 | Support Services  | A                 | 33  |
| NAS2-6015     | Univ. of Michigan         | Infrared Atmospheric Model  | SEI               | 6   |
| NAS2-6947     | Northrop                  | Support Services  | A                 | 44  |
| NAS2-6969     | Boeing                    | Noise Source and Footprint Program  | A                 | 21  |
| NAS2-7112     | Whittaker Corp.           | Characterization of Polybenzimidole Composite Foams   | M&S               | 18  |
| NAS2-7331     | Peninsula Chemical Corp.  | Synthesis of Perfluorinated Polyethers for Sealant Applications                               | M&S               | 51  |

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## ADVANCED SUPERSONIC TECHNOLOGY PROGRAM - Continued

| <u>Number</u>           | <u>Contractor/grantee</u>  | <u>Descriptive title</u>   | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|-------------------------|----------------------------|--|-------------------|---|
| Contracts:<br>NAS2-7332 | Lockheed-California        | Advanced LH <sub>2</sub> Supersonic Technology                               | A                 | 107   |
| NAS2-7341               | Boeing                     | Design, Fabrication, and Operation of a Fuel Tank Sealant Exposure Apparatus | M&S               | 48  |
| NAS2-7457               | General Electric           | Advanced Supersonic Technology Propulsion Noise Research                     | A                 | 69  |
| NAS2-7555               | Mayer A. and Associates    | Study of Propagation of Sound Around Barriers                                | A                 | 28  |
| NAS2-7571               | Acurex Corp.               | Potential Flow Program   | A                 | 58  |
| NAS2-7653               | Boeing                     | Redundant Actuator Development Study   | S&C               | 24  |
| NAS2-7729               | Boeing                     | Development of Polyphenylquinoxaline Graphite Composites                     | M&S               | 89  |
| NAS2-7981               | Ultra Systems              | Crosslinking and Degradation Mechanisms in Model Sealant Candidates          | M&S               | 29  |
| NAS2-8103               | Stanford Research          | Synthesis of Heterocyclic-Block Perfluorinated Polyethers                    | M&S               | 16  |
| NAS2-8119               | Lockheed Research          | U-2 Pump System  | A                 | 20  |
| NAS3-16799              | Boeing                     | Development of Polyphenylquinoxaline Graphite Composites                     | M&S               | 89  |
| NAS3-16829              | Pratt & Whitney            | Experimental Clean Combustor Program (Addition)                              | P                 | 288   |
| NAS1-16830              | General Electric           | Experimental Clean Combustor Program (Addition)                              | P                 | 205   |
| NAS3-16948              | Pratt & Whitney            | Advanced Supersonic Propulsion System Study                                  | P                 | 451   |
| NAS3-16950              | General Electric           | Advanced Supersonic Propulsion System Study                                  | P                 | 500   |
| NAS3-17216              | Pan American World Airways | Airline Appraisal of Advanced Supersonic Technology Engines                  | P                 | 28  |
| NAS3-17559              | Advanced Technology Lab.   | Study of Unconventional Variable-Cycle Engine With a Supersonic Inflow Fan   | P                 | 97  |
| NAS3-17770              | TRW, Inc.                  | Development of Autoclavable Polyimides                                       | M&S               | 98  |
| NAS3-17866              | Pratt & Whitney            | Coannular Jet Noise  | P                 | 207   |
| NAS3-18008              | General Electric           | Coannular Jet Noise  | P                 | 96  |
| NAS7-100                | Jet Propulsion Lab.        | Prediction of Service Life of Sealant Materials                              | M&S               | 85  |



ADVANCED SUPERSONIC TECHNOLOGY PROGRAM - Concluded

| <u>Number</u>              | <u>Contractor/grantee</u>       | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|----------------------------|---------------------------------|---|-------------------|---|
| Contracts:<br>NAS9-12087   | National Academy of<br>Sciences | National Research Fellowship  | P                 | 18  |
| Suballotments:<br>A-81652A | Dept. of<br>Transportation      | U2/YF-12 Wake Experiments   | SEI               | 11  |
| A-82433A                   | B&K Instruments                 | Microphones for Noise Measurement   | A                 | 15  |
| A-89535A                   | Ampex Corp.                     | Tape Recorders  | A                 | 15  |
| E-43149                    | USAF Logistics Command          | YF-12 Services - Structural Test Panels   | M&S               | 425   |
| E-43149                    | USAF Logistics Command          | YF-12 Services - Cooperative Control System   | S&C               | 275   |
| E-43149                    | USAF Logistics Command          | YF-12 Services - Inlet Stability System   | S&C               | 283   |
| L-75054                    | Atomic Energy Commission        | Bren Tower Testing Support  | P                 | 18  |
| Grants:<br>NGL-31-001-119  | Princeton Univ.                 | Theoretical Problems Connected With Sonic Booms   | A                 | 15  |
| NGL-33-016-119             | New York Univ.                  | Sonic Boom Research   | A                 | 65  |
| NGR-22-009-378             | MIT                             | Air Pollution From Aircraft   | SEI               | 114   |
| NGR-39-011-161             | Univ. of Pittsburg              | Basic Chemistry of Aircraft Pollutants  | SEI               | 40  |
| NGR-52-012-008             | Technion                        | Automated Wing Structure Design   | M&S               | 10  |
| NGR-52-134-005             | York Univ.                      | Studies of Production Reaction Processes of Oxides of<br>Interest in the Earth's Atmosphere | SEI               | 40  |

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SUPERSONIC CRUISE RESEARCH - FY 1974

Cost Summary (in Thousands of Dollars)

|                       |             |
|-----------------------|-------------|
| RTOP .....            | 743         |
| PY .....              | 74          |
| Contracts:            | Cost        |
| Langley (NAS1-) ..... | 2731        |
| Ames (NAS2-) .....    | 836         |
| Lewis (NAS3-) .....   | 2218        |
| Dryden (NAS4-) .....  | 0           |
| Suballotments .....   | 1435        |
| Subtotal .....        | <u>7220</u> |
| Grants .....          | 349         |
| Total .....           | <u>7569</u> |
| Net R&D .....         | 8400        |

ADVANCED SUPERSONIC TECHNOLOGY PROGRAM

| <u>Number</u> | <u>Contractor/grantee</u>            | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|--------------------------------------|---|-------------------|---|
| Contracts:    |                                      |   |                   |   |
| NAS1-10900    | Ling-Temco-Vought                    | Nonpersonal Services Support  | A, SS             | 388   |
| NAS1-11847    | Dynamic Engineering<br>and Model Co. | Fabrication of Dynamic Models   | M&S               | 79  |
| NAS1-11938    | Boeing                               | Study of Impact of Advanced Technologies Applied to<br>Supersonic Transport Aircraft (Extension)        | SS                | 10  |
| NAS1-11940    | Lockheed-California                  | Study of Impact of Advanced Technologies Applied to<br>Supersonic Transport Aircraft (Extension)        | SS                | 274   |
| NAS1-12052    | Boeing                               | Development of Extended Supersonic Aerodynamic Analysis<br>System (Extension)                           | SS                | 8   |
| NAS1-12079    | General Electric                     | Improved Resins for AST Composites (Extension)  | M&S               | 220   |
| NAS1-12121    | Lockheed-California                  | Flutter Modules Applicable to Automated Structural<br>Design (Extension)                                | M&S               | 65  |
| NAS1-12287    | Boeing                               | Study of Structural Design Concepts for an Arrow-Wing<br>Supersonic Transport Configuration (Extension) | M&S               | 362   |
| NAS1-12501    | Boeing                               | Acceleration of Fatigue Test Methods (Extension)  | M&S               | 28  |
| NAS1-12861    | Boeing                               | Analysis and Tests of Stability Augmentation Systems<br>for Aeroelastic Wind-Tunnel Models              | M&S               | 61  |
| NAS1-12875    | Boeing                               | Transonic Loads Measurement and Prediction (Extension)  | M&S               | 183   |
| NAS1-12911    | Boeing                               | Extension of the ATLAS Integrated Analysis and Design<br>System   | M&S               | 299   |
| NAS1-13002    | Boeing                               | Solution of Transonic Flow Around Oscillating Wings   | M&S               | 63  |
| NAS1-13045    | Arthur D. Little Co.                 | Study of Airborne Infrared Analytical Spectrometer  | SEI               | 26  |
| NAS1-13095    | DWA Composite<br>Specialties, Inc.   | Fabrication of Structural Test Specimens  | M&S               | 15  |
| NAS1-13229    | McDonnell Douglas                    | Engine/Airframe Compatibility Studies   | M&S               | 99  |
| NAS1-13259    | McDonnell Douglas                    | Addition of Flexible Body Option to the TOLA Computer<br>Program  | M&S               | 60  |
| NAS1-13306    | United Aircraft Corp.                | Composite Plate   | M&S               | 12  |

FY 1974

## ADVANCED SUPERSONIC TECHNOLOGY PROGRAM - Continued

| <u>Number</u> | <u>Contractor/grantee</u> | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|---------------------------|---|-------------------|---|
| Contracts:    |                           |   |                   |   |
| NAS1-13500    | Ling-Temco-Vought         | Nonpersonal Services Support  | M&S               | 67  |
| NAS1-13605    | Lockheed-California       | Fatigue Design Module   | M&S               | 30  |
| NAS2-7341     | Boeing                    | Design, Fabrication, and Operation of a Fuel Tank Sealant Exposure Apparatus (Extension)                        | M&S               | 48  |
| NAS2-7571     | Acurex Corp.              | Potential Flow Program (Extension)  | A                 | 26  |
| NAS2-7729     | Boeing                    | FLEXSTAB Computing Program (Extension)  | S&C               | 225   |
| NAS2-7861     | General Motors Corp.      | Study of Molecular Fluorescence   | SEI               | 11  |
| NAS2-7966     | Boeing                    | Development of Handling Qualities Criteria for Large Supersonic Aircraft  | S&C               | 217   |
| NAS2-8071     | Lockheed Research         | Stratospheric Vehicle Wake Synthesis  | SEI               | 94  |
| NAS2-8125     | Texas Instruments         | Infrared Line Scanner System  | SEI               | 13  |
| NAS2-8156     | Peninsula Chemical Corp.  | Synthesis of Perfluorinated Polyethers  | M&S               | 40  |
| NAS2-8200     | Univ. of Denver           | Detectability of Atmospheric Species  | SEI               | 20  |
| NAS2-8213     | Boeing                    | Nacelles for Noise Reduction Experiments  | A                 | 142   |
| NAS3-16948    | Pratt & Whitney           | Advanced Supersonic Propulsion System Study (Extension)   | P                 | 844   |
| NAS3-16950    | General Electric          | Advanced Supersonic Propulsion System Study (Extension)   | P                 | 468   |
| NAS3-17824    | TRW, Inc.                 | Autoclavable Type Polyimides  | SEI               | 95  |
| NAS3-17866    | Pratt & Whitney           | Coannular Jet Noise (Extension)   | P                 | 26  |
| NAS3-18008    | General Electric          | Coannular Jet Noise (Extension)   | P                 | 223   |
| NAS3-18028    | SOLAR                     | Experimental Study of Advanced Combustor Concepts To Reduce Formation of Nitrogen Oxides in Gas Turbine Engines | P                 | 249   |
| NAS3-18539    | Boeing                    | Effects of Motion on Jet Exhaust Noise From Aircraft  | P                 | 49  |
| NAS3-18910    | General Electric          | Boron/Aluminum Fan Blades for Advanced Supersonic Technology Engines  | P                 | 143   |

ADVANCED SUPERSONIC TECHNOLOGY PROGRAM - Concluded

| <u>Number</u>         | <u>Contractor/grantee</u>    | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|-----------------------|------------------------------|---|-------------------|---|
| <b>Contracts:</b>     |                              |   |                   |   |
| NAS3-18921            | Westinghouse, Inc.           | Fabrication Process Development of SiC Superalloy Composite Sheet for Exhaust System Components | P                 | 97  |
| NAS3-19544            | General Electric             | Advanced Supersonic Propulsion System   | P                 | 24  |
| <b>Suballotments:</b> |                              |   |                   |   |
| E-43149               | USAF Logistics Command       | YF-12 Services - Structural Test Panels   | M&S               | 476   |
| E-43149               | USAF Logistics Command       | YF-12 Services - Equipment for Stratospheric Wake Measurements                                  | SEI               | 75  |
| E-43149               | USAF Logistics Command       | YF-12 Services - Cooperative Control System   | S&C               | 624   |
| E-43149               | USAF Logistics Command       | YF-12 Services - Data for FLEXSTAB Analysis   | S&C               | 25  |
| E-43149               | USAF Logistics Command       | YF-12 Services - Inlet Stability System   | S&C               | 213   |
| A-1770B               | Sargamo Electric             | Equipment for Wind-Tunnel Tests   | M&S               | 22  |
| <b>Grants:</b>        |                              |   |                   |   |
| NGL-33-016-191        | New York Univ.               | Sonic Boom Research   | A                 | 65  |
| NGR-22-004-030        | Boston Univ.                 | Advanced Subsonic and Supersonic Unsteady Potential Flow Aerodynamics                           | A                 | 53  |
| NGR-22-009-618        | MIT                          | Laboratory Study of Sonic Booms and Their Scaling Laws  | A                 | 47  |
| NGR-22-012-031        | Tufts Univ.                  | Study of Noise Measurements in Wind Tunnel  | A                 | 24  |
| NGR-33-010-203        | Cornell Univ.                | Sonic Boom Research   | A                 | 25  |
| NGR-39-011-161        | Univ. of Pittsburg           | Basic Chemistry of Aircraft Pollutants  | SEI               | 40  |
| NGR-52-012-008        | Technion                     | Automated Wing Structural Design (Extension)  | M&S               | 20  |
| NSG-2007              | Stanford Univ.               | Support of Joint Institute on Acoustics   | M&S               | 50  |
| NSG-2007              | Stanford Univ.               | Research Program Associated With Joint Institute of Aeronautics                                 | A                 | 7   |
| NASW-2567             | National Academy of Sciences | National Research Fellowship  | A                 | 18  |

FY 1974

SUPERSONIC CRUISE RESEARCH - FY 1975

Cost Summary (in Thousands of Dollars)

|                       |            |
|-----------------------|------------|
| RTOP .....            | 743        |
| PY .....              | 75         |
| Contracts:            | Cost       |
| Langley (NAS1-) ..... | 3751       |
| Ames (NAS2-) .....    | 307        |
| Lewis (NAS3-) .....   | 2288       |
| Dryden (NAS4-).....   | 0          |
| Suballotments .....   | <u>354</u> |
| Subtotal .....        | 6700       |
| Grants .....          | <u>302</u> |
| Total .....           | 7002       |
| Net R&D .....         | 7788       |

SCR PROGRAM

| <u>Number</u> | <u>Contractor/grantee</u>            | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|--------------------------------------|---|-------------------|---|
| Contracts:    |                                      |   |                   |   |
| NAS1-10120    | Kentron Hawaii, Ltd.                 | Software for Oscillating Pressure Measurements                                  | M&S               | 80  |
| NAS1-11085    | Microcraft, Inc.                     | Wind-Tunnel Model Modifications   | A                 | 15  |
| NAS1-11847    | Dynamic Engineering<br>and Model Co. | Wind Tunnel Models  | A                 | 114   |
| NAS1-12052    | Boeing                               | Development of Extended Supersonic Aerodynamic Analysis<br>System (Extension)   | A                 | 66  |
| NAS1-12079    | General Electric                     | Improved Resins   | M&S               | 100   |
| NAS1-12287    | Boeing                               | Study of Structural Design Concepts for an Arrow Wing<br>(Extension)            | M&S               | 207   |
| NAS1-12308    | General Dynamics                     | Time-Temperature Stress   | M&S               | 184   |
| NAS1-12506    | General Dynamics                     | Program To Assess Impact of Fatigue and Fracture Criteria<br>on Weight and Cost | M&S               | 40  |
| NAS1-12675    | McDonnell Douglas                    | Test Specimens  | M&S               | 190   |
| NAS1-12911    | Boeing                               | ATLAS Analysis and Design   | M&S               | 89  |
| NAS1-12956    | Honeywell, Inc.                      | F-8C Experimental Aircraft  | M&S               | 10  |
| NAS1-13095    | DWA Composite<br>Specialties, Inc.   | Fabrication and Structural Test Specimens                                       | M&S               | 15  |
| NAS1-13229    | McDonnell Douglas                    | Engine/Airframe Compatibility Studies (Extension)                               | M&S               | 34  |
| NAS1-13306    | United Aircraft Corp.                | Borsic/Aluminum Panels  | M&S               | 12  |
| NAS1-13500    | Ling-Temco-Vought                    | Nonpersonal Services Support  | A, SS             | 573   |
| NAS1-13557    | Lockheed-California                  | Technology Assessment Studies Applied to Supersonic<br>Cruise Vehicles          | SS                | 342   |
| NAS1-13559    | Boeing                               | Advanced Supersonic Configurations Using Multicycle<br>Engines                  | SS                | 398   |
| NAS1-13612    | McDonnell Douglas                    | Technology Application Studies for Advanced Supersonic<br>Transports            | SS                | 476   |
| NAS1-13613    | Lockheed-Georgia                     | Computer Program for Transonic Unsteady Aero Forces                             | M&S               | 27  |

FY 1975

## SCR PROGRAM - Continued

| <u>Number</u> | <u>Contractor/grantee</u>     | <u>Descriptive title</u>   | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|-------------------------------|--|-------------------|---|
| Contracts:    |                               |  |                   |   |
| NAS1-13633    | McDonnell Douglas             | Supersonic Technology Cooperative Wind-Tunnel Test Program   | A                 | 270   |
| NAS1-13681    | Boeing                        | Performance of Aluminum-Brazed Titanium Honeycomb-Core Sandwich Construction                       | M&S               | 68  |
| NAS1-13709    | Bolt Beranek and Newman Inc.  | Nonstationary Spectral Descriptions for Atmospheric Turbulence                                     | M&S               | 16  |
| NAS1-13732    | Boeing                        | Development of Extended Supersonic Aerodynamic Analysis System (Extension)                         | A                 | 67  |
| NAS1-13833    | Boeing                        | Prediction of Aero Load  | M&S               | 80  |
| NAS1-13861    | Boeing                        | SNARK Language Compiler  | M&S               | 35  |
| NAS1-13897    | Boeing                        | Evaluation of Aluminum-Brazed Titanium Spoilers on Boeing 737                                      | M&S               | 33  |
| NAS1-13906    | Rockwell International        | Parametric Analysis of Effects of Nacelle Shape on Drag and Weight of a Supersonic Cruise Aircraft | A                 | 38  |
| NAS1-13978    | Lockheed-California           | Sonic Environment for Aircraft Structure   | M&S               | 32  |
| NAS1-13986    | Bell Aerospace Co.            | Computer Program for Interacting Supersonic Configuration  | A                 | 59  |
| NAS1-14094    | Boeing                        | Development of Extended Supersonic Aerodynamic Analysis System (Extension)                         | A                 | 66  |
| NAS2-8156     | PCR Ink                       | Synthesis of Perfluorinated Polyethers   | M&S               | 40  |
| NAS2-8213     | Boeing                        | Study of Jet Noise Suppressors (Extension)   | A                 | 204   |
| NAS2-8781     | Lockheed-California           | Minimum Energy Liquid Hydrogen Supersonic Cruise Vehicle Study                                     | SS                | 63  |
| NAS3-16829    | Pratt & Whitney               | Supersonic Cruise Combustion Pollution Technology (Extension)                                      | SEI               | 30  |
| NAS3-17866    | Pratt & Whitney               | Coannular Jet Noise (Extension)  | P                 | 548   |
| NAS3-18008    | General Electric              | Coannular Jet Noise (Extension)  | P                 | 21  |
| NAS3-18540    | Lockheed-Georgia              | Effects of Motion on Jet Exhaust Noise From Aircraft   | P                 | 172   |
| NAS3-18563    | General Applied Sciences Lab. | Development of Low NO <sub>x</sub> Combustor   | P                 | 86  |

FY 1975



SCR PROGRAM - Concluded

| <u>Number</u>         | <u>Contractor/grantee</u>        | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|-----------------------|----------------------------------|---|-------------------|---|
| <b>Contracts:</b>     |                                  |   |                   |   |
| NAS3-19431            | Univ. of Mississippi             | Atmospheric Attenuation of High-Frequency Noise                       | P                 | 127   |
| NAS3-19438            | Advanced Technology Lab.         | Supersonic Through Flow Fan Stage With ATL Design Program             | P                 | 109   |
| NAS3-19540            | Pratt & Whitney                  | Advanced Supersonic Propulsion Systems Study<br>(Formerly NAS3-16948) | P                 | 335   |
| NAS3-19544            | General Electric                 | Advanced Supersonic Propulsion (Extension)                            | P                 | 358   |
| NAS3-19737            | General Electric                 | Augmentor Emissions Reduction Technology Program                      | SEI               | 500   |
| <b>Suballotments:</b> |                                  |   |                   |   |
| E-43149               | USAF Logistics Command           | YF-12 Services - Structural Test Panels                               | M&S               | 129   |
| E-43149               | USAF Logistics Command           | YF-12 Services - Cooperative Control System                           | S&C               | 225   |
| <b>Grants:</b>        |                                  |   |                   |   |
| NGL-33-016-191        | New York Univ.                   | Sonic Boom Research (Extension)                                       | A                 | 65  |
| NGR-22-004-030        | Boston Univ.                     | Aero Flow - Lift Body   | A                 | 53  |
| NGR-22-009-378        | MIT                              | Air Pollution From Aircraft   | SEI               | 79  |
| NGR-33-010-203        | Cornell Univ.                    | Sonic Boom Research (Extension)                                       | A                 | 37  |
| NSG-1093              | Old Dominion Univ.               | Thermal Structural Analysis of SCRAM-JET Structures                   | M&S               | 18  |
| NSG-1185              | Univ. of Cincinnati              | Thermal Studies   | M&S               | 8   |
| NSG-1266              | Illinois Institute of Technology | Automated Sizing of Aerospace Structures Under Multiple Constraints   | M&S               | 36  |
| NSG-2101              | Univ. of Texas                   | Exact Solution of Potential Flows Related to Flight Vehicles          | A                 | 6   |

FY 1975

SUPERSONIC CRUISE RESEARCH AND VARIABLE-CYCLE ENGINE PROGRAMS - FY 1976

Cost Summary (in Thousands of Dollars)

|                       |             |            |
|-----------------------|-------------|------------|
| RTOP .....            | 743         | 511        |
| PY .....              | 76          | VCE 76     |
| Contracts:            | Cost        | Cost       |
| Langley (NAS1-) ..... | 3347        | 0          |
| Ames (NAS2-) .....    | 0           | 0          |
| Lewis (NAS3-) .....   | 2120        | 0          |
| Dryden (NAS4-) .....  | 0           | 652        |
| Suballotments .....   | 614         | 0          |
| Subtotal .....        | <u>6081</u> | <u>652</u> |
| Grants .....          | 478         | 0          |
| Total .....           | <u>6559</u> | <u>652</u> |
| Net R&D .....         | 6816        | 740        |

SCR AND VCE PROGRAMS

| <u>Number</u>            | <u>Contractor/grantee</u>            | <u>Descriptive title</u>   | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|--------------------------|--------------------------------------|--|-------------------|---|
| Contracts:<br>NAS1-10120 | Kentron Hawaii, Ltd.                 | Software for Oscillating Pressure Measurements<br>(Extension)              | M&S               | 20  |
| NAS1-11847               | Dynamic Engineering<br>and Model Co. | Fabrication of Dynamic Models  | M&S               | 458   |
| NAS1-12288               | Lockheed-California                  | Study of Structural Design Concepts for an Arrow Wing<br>(Extension)       | M&S               | 13  |
| NAS1-12308               | General Dynamics                     | Time-Temperature Stress (Extension)  | M&S               | 306   |
| NAS1-12675               | McDonnell Douglas                    | Test Specimens   | M&S               | 95  |
| NAS1-12911               | Boeing                               | ATLAS Analysis and Design (Extension)                                      | M&S               | 72  |
| NAS1-13500               | Vought                               | Technical Support Services for Aerospace Research and<br>Development       | SS                | 237   |
| NAS1-13557               | Lockheed-California                  | Technology Assessment Studies Applied to Supersonic<br>Cruise Vehicles     | SS                | 350   |
| NAS1-13559               | Boeing                               | Advanced Supersonic Configurations Using Multicycle<br>Engines (Extension) | SS                | 428   |
| NAS1-13612               | McDonnell Douglas                    | Technology Application Studies for Advanced Supersonic<br>Transports       | SS                | 275   |
| NAS1-13649               | Lockheed-California                  | Real-Time Fatigue Tests on Coupons (Formerly NAS1-11820)                   | M&S               | 18  |
| NAS1-13809               | IIT Research Inst.                   | Miniature Hydraulic System   | M&S               | 13  |
| NAS1-14094               | Boeing                               | Repair Low-Speed SST Active Control Model (Extension)                      | S&C               | 26  |
| NAS1-14108               | Rockwell International               | Spanwise Variations of Drag  | M&S               | 59  |
| NAS1-14141               | Boeing                               | Loads Measurement  | M&S               | 100   |
| NAS1-14172               | Midwest Research Inst.               | Hot Fatigue Correlation  | M&S               | 69  |
| NAS1-14204               | Boeing                               | Unsteady Transonic Aero  | M&S               | 100   |
| NAS1-14205               | Boeing-Wichita                       | Arrow-Wing Flutter Suppression   | M&S               | 97  |
| NAS1-14206               | Rockwell International               | SCAR Titanium Fabrication Study  | M&S               | 89  |
| NAS1-14374               | Amercom, Inc.                        | Composite Material   | M&S               | 17  |

FY 1976

## SCR AND VCE PROGRAMS - Continued

| <u>Number</u> | <u>Contractor/grantee</u>        | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|----------------------------------|---|-------------------|---|
| Contracts:    |                                  |   |                   |   |
| NAS1-14397    | Aeronca, Inc.                    | Titanium Honeycomb  | M&S               | 10  |
| NAS1-14413    | Bolt Beranek and<br>Newman Inc.  | Non-Gaussian Turbulence Study (Extension)   | M&S               | 14  |
| NAS1-14435    | Lockheed-California              | Impact of Cruise Speed on Scheduling and Productivity                                       | A                 | 150   |
| NAS1-14445    | General Dynamics                 | Composite Stiffeners  | M&S               | 46  |
| NAS1-14459    | Textron, Inc.                    | Active Landing Gear   | M&S               | 113   |
| NAS1-14488    | McDonnell Douglas                | Noise Impact  | A                 | 50  |
| NAS1-14491    | General Dynamics                 | Titanium-Clad Borsic/Aluminum Material  | M&S               | 12  |
| NAS1-14591    | Amercom, Inc.                    | Titanium-Clad Borsic/Aluminum   | M&S               | 24  |
| NAS1-14601    | McDonnell Douglas                | Test of a Douglas Jet Noise Suppressor Under a<br>Supersonic Technology Wind-Tunnel Program | A                 | 74  |
| NAS1-14671    | Ferro Corp.                      | Graphite/Polyimide  | M&S               | 12  |
| NAS3-18563    | General Applied<br>Sciences Lab. | Development of Low NO <sub>x</sub> Combustor (Extension)                                    | P                 | 29  |
| NAS3-19431    | Univ. of Mississippi             | Atmospheric Attenuation of High-Frequency Noise<br>(Extension)                              | P                 | 2   |
| NAS3-19438    | Advanced Technology<br>Lab.      | Supersonic Through Flow Fan Stage With ATL Design<br>Program (Extension)                    | P                 | 20  |
| NAS3-19540    | Pratt & Whitney                  | Advanced Supersonic Propulsion System Study (Extension)                                     | P                 | 298   |
| NAS3-19544    | General Electric                 | Advanced Supersonic Propulsion System Study (Extension)                                     | P                 | 353   |
| NAS3-19735    | Westinghouse, Inc.               | Lightweight Components  | P                 | 100   |
| NAS3-19737    | General Electric                 | Augmentor Emissions Reduction Technology Program<br>(Extension)                             | SEI               | 20  |
| NAS3-19770    | SOLAR                            | Advanced Combustor Concepts To Reduce Nitrogen Oxides<br>in Gas Turbine Engine (Extension)  | P                 | 250   |
| NAS3-20360    | TRW, Inc.                        | Lightweight Components  | P                 | 171   |

SCR AND VCE PROGRAMS - Continued

| <u>Number</u>         | <u>Contractor/grantee</u>                     | <u>Descriptive title</u>                                | <u>Discipline</u> | <u>Amount, thousands of dollars</u> |
|-----------------------|---|---|-------------------|-------------------------------------|
| <b>Contracts:</b>     |   |   |                   |                                     |
| NAS3-20361            | General Electric                              | Lightweight Components                                  | P                 | 225                                 |
| NAS3-19777            | General Electric                              | Plug Nozzle Tests                                       | VCE               | <sup>a</sup> 224                    |
| NAS3-20041            | General Electric                              | Front Fan Design Study                                  | VCE               | <sup>a</sup> 199                    |
| NAS3-20048            | Pratt & Whitney                               | Test-Bed Engine Design and Development                  | VCE               | <sup>a</sup> 100                    |
| NAS3-20061            | Pratt & Whitney                               | Nozzle Definition                                       | VCE               | <sup>a</sup> 118                    |
| NAS3-20602            | Pratt & Whitney                               | VSCE Duct Burner  | VCE               | <sup>a</sup> 11                     |
| <b>Suballotments:</b> |   |   |                   |                                     |
| E-43149               | USAF Logistics Command                        | YF-12 Services - Cooperative Control System             | S&C               | 400                                 |
| E-43149               | USAF Logistics Command                        | YF-12 Services - Structures Test Panels                 | M&S               | 195                                 |
| L-29067A              | National Oceanographic and Atmospheric Admin. | Sonic Boom Studies                                      | A                 | 8                                   |
| L-36218A              |   | Lenses - Data Systems                                   | A                 | 5                                   |
| L-42089A              | National Oceanographic and Atmospheric Admin. | Sonic Boom Studies                                      | A                 | 6                                   |
| <b>Grants:</b>        |   |   |                   |                                     |
| NGL-33-016-119        | New York Univ.                                | Sonic Boom Research (Extension)                         | A                 | 31                                  |
| NGR-09-010-078        | George Washington Univ.                       | Structures and Dynamics                                 | M&S               | 35                                  |
| NGR-22-004-030        | Boston Univ.                                  | Grant E-SCAR Analysis                                   | M&S               | 20                                  |
| NGR-22-004-030        | Boston Univ.                                  | Aero Flow Lifting Body                                  | M&S               | 55                                  |
| NGR-33-010-203        | Cornell Univ.                                 | Sonic Boom Research (Extension)                         | A                 | 11                                  |
| NSG-1085              | Virginia Polytechnic Institute                | Kinetics of the Reaction of Acids and Hydrides (Shared) | SEI               | 1                                   |
| NSG-1228              | George Washington Univ.                       | Fracture-Resistant Composites                           | M&S               | 31                                  |
| NSG-1248              | New York Univ.                                | SCAR Analysis   | A                 | 38                                  |

<sup>a</sup>VCE Program contract amounts not included in SCAR totals.

FY 1976

## SCR AND VCE PROGRAMS - Concluded

| <u>Number</u> | <u>Contractor/grantee</u>         | <u>Descriptive title</u>   | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|-----------------------------------|--|-------------------|---|
| Contracts:    |                                   |  |                   |   |
| NSG-1260      | Old Dominion Univ.                | Thermally Loaded Stresses  | M&S               | 56  |
| NSG-1262      | Virginia Polytechnic<br>Institute | Vortex Flow Research   | A                 | 5   |
| NSG-1297      | Clemson Univ.                     | Orthotropic Material   | M&S               | 32  |
| NSG-1298      | New York Univ.                    | SCV Emissions Study  | SEI               | 20  |
| NSG-2007      | Stanford Univ.                    | Research Associated With Joint Institute of Aeronautics              | M&S               | 103   |
| NSG-2101      | Univ. of Texas                    | Exact Solutions of Potential Flows to Flight Vehicles<br>(Extension) | A                 | 14  |
| NSG-2186      | San Jose State Univ.              | Study of Fluorocarbon Ether Elastomer                                | M&S               | 26  |

SUPERSONIC CRUISE RESEARCH AND VARIABLE-CYCLE ENGINE PROGRAMS - FY 197T

Cost Summary (in Thousands of Dollars)

|                       |            |          |
|-----------------------|------------|----------|
| RTOP .....            | 743        | 511      |
| PY .....              | 7T         | VCE 7T   |
| Contracts:            | Cost       | Cost     |
| Langley (NAS1-) ..... | 904        | 0        |
| Ames (NAS2-) .....    | 0          | 0        |
| Lewis (NAS3-) .....   | 298        | 200      |
| Dryden (NAS4-) .....  | 0          | 0        |
| Suballotments .....   | <u>180</u> | <u>0</u> |
| Subtotal .....        | 1382       | 200      |
| Grants .....          | <u>50</u>  | <u>0</u> |
| Total .....           | 1432       | 200      |
| Net R&D .....         | 1700       | 300      |

## SCR AND VCE PROGRAMS

| <u>Number</u>  | <u>Contractor/grantee</u> | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|----------------|---------------------------|---|-------------------|---|
| Contracts:     |                           |   |                   |   |
| NAS1-13500     | Vought                    | Technical Support Services                                      | M&S               | 30  |
| NAS1-14623     | Boeing                    | Advanced Concept Studies for Advanced Supersonic Transport      | SS                | 275   |
| NAS1-14624     | McDonnell Douglas         | Technology Application Study of a Supersonic Cruise Vehicle     | SS                | 318   |
| NAS1-14625     | Lockheed-California       | SCV Technology Assessment Study of an Over/Under Engine Concept | SS                | 275   |
| NAS3-17866     | Pratt & Whitney           | Coannular Jet Noise (Extension)                                 | P                 | 6   |
| NAS3-20048     | Pratt & Whitney           | Test-Bed Engine Design and Development                          | VCE               | <sup>a</sup> 0                              |
| NAS3-20061     | Pratt & Whitney           | Nozzle Definition, VCE  | VCE               | <sup>a</sup> 200                            |
| NAS3-20810     | General Electric          | DBE Program Definition  | P                 | 149   |
| NAS3-20811     | Pratt & Whitney           | VSCE Program Definition   | P                 | 149   |
| Suballotments: |                           |   |                   |   |
| E-43149        | USAF Logistics Command    | YF-12 Services - Cooperative Control System                     | S&C               | 100   |
| E-43149        | USAF Logistics Command    | YF-12 Services - Structural Test Panels                         | M&S               | 80  |
| Grants:        |                           |   |                   |   |
| NSG-1228       | George Washington Univ.   | Fracture-Resistant Composites                                   | M&S               | 50  |

<sup>a</sup>VCE Program contract amounts not included in SCAR totals.

FY 1977 (July 1-Oct. 1, 1976)



SUPERSONIC CRUISE RESEARCH AND VARIABLE-CYCLE ENGINE PROGRAMS - FY 1977

Cost Summary (in Thousands of Dollars)

|                       |            |          |          |
|-----------------------|------------|----------|----------|
| RTOP .....            | 743        | 511      | 551      |
| PY .....              | 77         | VCE 77   | VCE 77   |
| Contracts:            | Cost       | Cost     | Cost     |
| Langley (NAS1-) ..... | 4268       | 0        | 0        |
| Ames (NAS2-) .....    | 165        | 0        | 0        |
| Lewis (NAS3-) .....   | 700        | 2302     | 777      |
| Dryden (NAS4-) .....  | 0          | 0        | 0        |
| Suballotments .....   | <u>525</u> | <u>0</u> | <u>0</u> |
| Subtotal .....        | 5658       | 2302     | 777      |
| Grants .....          | <u>342</u> | <u>0</u> | <u>0</u> |
| Total .....           | 6000       | 2302     | 777      |
| Net R&D .....         | 6000       | 3100     |          |

## SCR AND VCE PROGRAMS

| <u>Number</u> | <u>Contractor/grantee</u>            | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|--------------------------------------|---|-------------------|---|
| Contracts:    |                                      |   |                   |   |
| NAS1-12308    | General Dynamics                     | Time-Temperature Stress (Extension)   | M&S               | 225   |
| NAS1-12675    | McDonnell Douglas                    | Make Gr/Ep Tail Safe Specimens  | M&S               | 32  |
| NAS1-12900    | Analytical Methods,<br>Inc.          | Computer Program for Wing-Body-Tail Configurations  | A                 | 41  |
| NAS1-13500    | Vought                               | Technical Support Services for Aerospace Research<br>and Development  | M&S               | 100   |
| NAS1-13500    | Vought                               | Technical Support Services for Aerospace Research<br>and Development  | A                 | 224   |
| NAS1-13557    | Lockheed-California                  | Technology Assessment Study Applied to Supersonic<br>Cruise Vehicles (Extension)                            | A                 | 350   |
| NAS1-13559    | Boeing                               | Advanced Supersonic Configurations Using Multicycle<br>Engines (Extension)                                  | A                 | 30  |
| NAS1-13681    | Boeing                               | Effects of Simulated and Flight Service Environment on<br>Performance of Aluminum-Brazed Titanium Honeycomb | M&S               | 9   |
| NAS1-14031    | Boeing-Wichita                       | Model ACT Digital Control and Multimode Flutter Test<br>Support   | S&C               | 11  |
| NAS1-14206    | Rockwell International               | SCAR Titanium Fabrication Study   | A                 | 15  |
| NAS1-14445    | General Dynamics                     | Borsic Aluminum Composite Stiffeners  | M&S               | 50  |
| NAS1-14564    | Dynamic Engineering<br>and Model Co. | Dynamic Free-Flight Model   | M&S               | 70  |
| NAS1-14564    | Dynamic Engineering<br>and Model Co. | Dynamic Free-Flight Model   | A                 | 136   |
| NAS1-14580    | Craft Engineering<br>and Metal Corp. | Research Equipment  | M&S               | 34  |
| NAS1-14601    | McDonnell Douglas                    | Cooperative Wind-Tunnel Test of a Douglas Jet Noise<br>Suppressor   | A                 | <sup>a</sup> 16                             |
| NAS1-14623    | Boeing                               | Advanced Concept Studies for Supersonic Vehicles  | SS                | 859   |
| NAS1-14624    | McDonnell Douglas                    | Technology Application Study of a Supersonic Cruise<br>Vehicle  | SS                | 825   |

<sup>a</sup>Total contract \$74,000, balance of \$58,000 from RTOP 505-11-15.

SCR AND VCE PROGRAMS - Continued

| <u>Number</u>  | <u>Contractor/grantee</u>     | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|----------------|-------------------------------|---|-------------------|---|
| Contracts:     |                               |   |                   |   |
| NAS1-14625     | Lockheed-California           | SCV Technology Assessment Study of an Over/Under Engine Concept | SS                | 825   |
| NAS1-14837     | Bolt Beranek and Newman Inc.  | Non-Gaussian Turbulence Study                                   | M&S               | 25  |
| NAS1-14905     | Lockheed-Georgia              | Creep-Formed Stringer   | M&S               | 17  |
| NAS1-14962     | Boeing                        | Cambered Wing Load Predictions                                  | M&S               | 158   |
| NAS1-14994     | Wye Electric Co.              | Raceway B-1265  | M&S               | 11  |
| NAS1-15030     | MTS Systems Corp.             | Electronic Hardware   | M&S               | 129   |
| L-24699A       | Calspan                       | SCAR In-Flight Simulator  | A                 | 76  |
| NAS2-7981      | Ultra Systems                 | Cost Linking and Degradation Mechanism                          | M&S               | 59  |
| NAS2-8156      | PCR Ink                       | Synthesis of Perfluorinated Polyethers (Extension)              | M&C               | 106   |
| NAS3-20602     | Pratt & Whitney               | Duct Burner Rig Tests (VCE Support)                             | P                 | 489   |
| NAS3-20603     | General Applied Sciences Lab. | Pre-Mix Fuel  | P                 | 0<br>a(80)                                  |
| NAS3-20616     | SOLAR                         | Full Annular Low NO <sub>x</sub> Emission Combustor             | P                 | 212<br>b(393)                               |
| NAS3-20048     | Pratt & Whitney               | F100/Test-Bed Acoustic Program                                  | VCE               | c702  |
| NAS3-20061     | Pratt & Whitney               | Aero/Acoustic Performance of Coannular Nozzles                  | VCE               | c368  |
| NAS3-20582     | General Electric              | Duct Burner Test-Bed Engine Definition                          | VCE               | c1600                                       |
| NAS3-20619     | General Electric              | Aero/Acoustic Performance of Annular Plug Nozzles               | VCE               | c409  |
| Suballotments: |                               |   |                   |   |
| E-43149        | USAF Logistics Command        | Support of YF-12 SCAR Co-Op Control Program                     | S&C               | 475   |
| E-43149        | USAF Logistics Command        | Support of YF-12 SCAR Structural Test Panels                    | M&S               | 50  |

<sup>a</sup>Total not SCR.

<sup>b</sup>Total contract \$393,000, balance of \$181,000 from SCERP.

<sup>c</sup>VCE Program contract amounts not included in SCAR totals.

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## SCR AND VCE PROGRAMS - Concluded

| <u>Number</u>  | <u>Contractor/grantee</u>        | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|----------------|----------------------------------|---|-------------------|---|
| Grants:        |                                  |   |                   |   |
| NSG-1228       | George Washington Univ.          | Fracture of Advanced Composite Materials  | M&S               | 50  |
| NSG-1262       | Virginia Polytechnic Institute   | Vortex Flow Research  | A                 | 5   |
| NSG-1266       | Illinois Institute of Technology | Automated Sizing of Aerospace Structures Under Multiple Constraints                                     | M&S               | 25  |
| NSG-1297       | Clemson Univ.                    | Fracture and Crack Growth in Orthotropic Laminates  | M&S               | 9   |
| NSG-1298       | New York Univ.                   | SCV Emissions Study   | A                 | 29  |
| NSG-1409       | Univ. of Delaware                | Concepts in Structural Synthesis  | M&S               | 7   |
| NSG-7373       | Technion                         | Study of Active Control Systems in Application to Supersonic Cruise Aircraft                            | S&C               | 25  |
| NGL-330-16-199 | New York Univ.                   | Sonic Boom Research (Extension)   | A                 | 41  |
| NGR-05-007-337 | Univ. of California              | Elevated Temperature Bolted Joint Composite Materials   | M&S               | 5   |
| NGR-09-010-078 | George Washington Univ.          | Structure and Dynamics  | M&S               | 30  |
| NGR-22-004-030 | Boston Univ.                     | Unsteady Potential Flow of Arbitrary Lifting Bodies   | M&S               | 76  |
| NA 2357        | Technology Development           | Software for Flight Loads Research Facility   | M&S               | 13  |
| NA 2472        | Optimization Software, Inc.      | Calculation of Structural Response in Unsteady Aerodynamics of a Typical Section in Incompressible Flow | M&S               | 8   |
| NG 4012        | Univ. of Kansas                  | Interfacing Between Ground Computer and Fly-by-Wire Control System                                      | M&S               | 19  |

SUPERSONIC CRUISE RESEARCH AND VARIABLE-CYCLE ENGINE PROGRAMS - FY 1978

Cost Summary (in Thousands of Dollars)

|                       |            |          |          |
|-----------------------|------------|----------|----------|
| RTOP .....            | 743        | 511      | 551      |
| PY .....              | 78         | VCE 78   | VCE 78   |
| Contracts:            | Cost       | Cost     | Cost     |
| Langley (NAS1-) ..... | 5200       | 0        | 0        |
| Ames (NAS2-) .....    | 81         | 0        | 0        |
| Lewis (NAS3-) .....   | 1087       | 3557     | 2197     |
| Dryden (NAS4-) .....  | 0          | 0        | 0        |
| Suballotments .....   | <u>80</u>  | <u>0</u> | <u>0</u> |
| Subtotal .....        | 6448       | 3557     | 2197     |
| Grants .....          | <u>360</u> | <u>0</u> | <u>0</u> |
| Total .....           | 6808       | 3557     | 2197     |
| Net R&D .....         | 7500       | 6030     |          |

## SCR AND VCE PROGRAMS

| <u>Number</u>            | <u>Contractor/grantee</u>            | <u>Descriptive title</u>   | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|--------------------------|--------------------------------------|--|-------------------|---|
| Contracts:<br>NAS1-12308 | General Dynamics                     | Time-Temperature-Stress Capabilities of Composites<br>(Extension)                              | M&S               | 125   |
| NAS1-12675               | McDonnell Douglas                    | Test Specimens   | M&S               | 12  |
| NAS1-13500               | Vought                               | Technical Support Services for Aerospace Research<br>and Development                           | A                 | 240   |
| NAS1-13500               | Vought                               | Technical Support Services for Aerospace Research<br>and Development                           | A                 | 345   |
| NAS1-13681               | Boeing                               | Effects of Simulated and Flight Service Environment of<br>Aluminum-Brazed Titanium (Extension) | M&S               | 12  |
| NAS1-13897               | Boeing                               | DOT Spoilers   | M&S               | 20  |
| NAS1-13897               | Boeing                               | Ti Spoilers  | M&S               | 6   |
| NAS1-14459               | Textron, Inc.                        | Active Landing Gear  | M&S               | 40  |
| NAS1-14564,<br>15496     | Dynamic Engineering<br>and Model Co. | Dynamic Free-Flight Model  | A                 | 108   |
| NAS1-14580               | Craft Engineering<br>and Metal Corp. | Research Equipment   | A                 | 7   |
| NAS1-14601               | McDonnell Douglas                    | Jet Noise Suppressor   | A                 | 10  |
| NAS1-14623               | Boeing                               | Advanced Concept Studies for Supersonic Aircraft   | SS                | 957   |
| NAS1-14623               | Boeing                               | Inlet Study  | A                 | 3   |
| NAS1-14623               | Boeing                               | Multipurpose High-Speed Transports   | A                 | 73  |
| NAS1-14624               | McDonnell Douglas                    | Technology Application Study of a Supersonic Cruise<br>Vehicle                                 | SS                | 950   |
| NAS1-14624               | McDonnell Douglas                    | Inlet Study  | A                 | 104   |
| NAS1-14624               | McDonnell Douglas                    | Reference Aircraft for ICAO Working Group E  | A                 | 5<br>(50-DOT)                               |
| NAS1-14625               | Lockheed-California                  | Supersonic Cruise Vehicle Technology Assessment<br>Study of an Over/Under Engine Concept       | SS                | 967   |
| NAS1-14625               | Lockheed-California                  | Inlet Study  | A                 | 102   |

SCR AND VCE PROGRAMS - Continued

| <u>Number</u>                         | <u>Contractor/grantee</u>        | <u>Descriptive title</u>   | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------------------------------|----------------------------------|--|-------------------|---|
| Contracts:<br>NAS1-14625              | Lockheed-California              | Common Case Study  | A                 | 0<br>(25-DOT)                               |
| NAS1-14837                            | Bolt Beranek and<br>Newman Inc.  | Characteristics of Non-Gaussian Turbulence<br>(Extension)                  | M&S               | 22  |
| NAS1-14962                            | Boeing                           | Arrow Wing Loads   | M&S               | 40  |
| NAS1-14972                            | College of William<br>& Mary     | Physical Life Sciences   | M&S               | 5   |
| NAS1-15275                            | Boeing                           | Critical Design Loads  | A                 | 81  |
| NAS1-15296                            | CVI                              | Nitrogen Piping  | M&S               | 11  |
| NAS1-15314                            | McDonnell Douglas                | Supersonic Cruise Vehicle Wing Design Program                              | M&S               | 255   |
| NAS1-15455                            | Textron, Inc.                    | Active Control Gear  | M&S               | 166   |
| NAS1-15492                            | Boeing                           | Composite Panel  | M&S               | 25  |
| NAS1-15527                            | McDonnell Douglas                | Superplastic-Formed Ti6Al  | M&S               | 370   |
| NAS1-15534                            | Boeing                           | Boeing Aero System   | A                 | 74  |
| L75228A<br>(AF F33-615-<br>78-C-3602) | Calspan                          | In-Flight Simulations  | A                 | 65  |
| NAS2-9779                             | Ultra Systems                    | Study of Cross Linking and Degradation Mechanisms<br>in Sealant Candidates | M&S               | 40  |
| NAS2-9863                             | Stanford Research<br>Institute   | Study of Heterocyclic Perfluorinated Polyethers                            | M&S               | 41  |
| NAS3-20061                            | Pratt & Whitney                  | VCE Nozzle   | P                 | 185   |
| NAS3-20602                            | Pratt & Whitney                  | VSCE Duct Burner   | P                 | 482   |
| NAS3-20603                            | General Applied<br>Sciences Lab. | Effects of Flame Holder Geometry   | P                 | 33  |
| NAS3-21388                            | General Electric                 | VCE Propulsion System Features   | P                 | 245   |
| NAS3-21389                            | Pratt & Whitney                  | Engine Cycle-Propulsion System Studies                                     | P                 | 142   |

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## SCR AND VCE PROGRAMS - Concluded

| <u>Number</u>  | <u>Contractor/grantee</u>           | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|----------------|-------------------------------------|---|-------------------|---|
| Contracts:     |                                     |   |                   |   |
| NAS3-20582     | General Electric                    | Early Acoustic Test   | VCE               | <sup>a</sup> 2197                           |
| NAS3-20048     | Pratt & Whitney                     | Test-Bed Engine - Design and Development                                      | VCE               | <sup>a</sup> 3557                           |
| Suballotment:  |                                     |   |                   |   |
| E-43149        | USAF Logistics Command              | YF-12 SCR Support   | A                 | 80  |
| Grants:        |                                     |   |                   |   |
| NSG-1248       | New York Univ.                      | SCAR Analysis Supersonic Flow   | A                 | 20  |
| NSG-1266       | Illinois Institute<br>of Technology | Wing Structures   | M&S               | 26  |
| NSG-1289       | New York Univ.                      | Structure Material  | M&S               | 29  |
| NSG-1297       | Clemson Univ.                       | Fracture and Crack Growth in Orthotropic Laminates                            | M&S               | 31  |
| NSG-1409       | Univ. of Delaware                   | Composite Joint Test  | M&S               | 15  |
| NSG-1449       | George Washington<br>Univ.          | 3-D Laminate Analysis   | M&S               | 20  |
| NSG-1507       | Old Dominion Univ.                  | Photoelastic Joint Research   | M&S               | 12  |
| NSG-2186       | San Jose State Univ.                | Study of Fluorocarbon Ether Elastomers  | M&S               | 15  |
| NSG-2273       | San Jose State Univ.                | Synthesis of Fluorocarbon Ether Elastomers                                    | M&S               | 12  |
| NSG-4003       | Purdue Univ.                        | Handling and Ride Qualities of Large, Flexible<br>Control Configured Aircraft | S&C               | 25  |
| NGL-330-16-119 | New York Univ.                      | Sonic Boom Research   | A                 | 36  |
| NGR-09-010-074 | George Washington<br>Univ.          | Research in Flight Sciences   | A                 | 15  |
| NGR-22-004-030 | Boston Univ.                        | Unsteady Potential Flow Around Arbitrary Lifting                              | M&C               | 80  |
| NGR-23-005-528 | Univ. of Michigan                   | Fiber-Reinforced Solid  | M&S               | 24  |

<sup>a</sup>VCE Program contract amounts not included in SCAR totals.



SUPERSONIC CRUISE RESEARCH AND VARIABLE-CYCLE ENGINE PROGRAMS - FY 1979

Cost Summary (in Thousands of Dollars)

|                       |            |           |          |
|-----------------------|------------|-----------|----------|
| RTOP .....            | 517        | 743       | 511      |
| PY .....              | 79         | 78        | VCE 79   |
| Contracts:            | Cost       | Cost      | Cost     |
| Langley (NAS1-) ..... | 5122       | 833       | 0        |
| Ames (NAS2-) .....    | 65         | 121       | 0        |
| Lewis (NAS3-) .....   | 709        | 0         | 7162     |
| Dryden (NAS4-) .....  | 200        | 0         | 0        |
| Suballotments .....   | <u>716</u> | <u>40</u> | <u>0</u> |
| Subtotal .....        | 6812       | 994       | 7162     |
| Grants .....          | <u>320</u> | <u>25</u> | <u>0</u> |
| Total .....           | 7132       | 1019      | 7162     |
| Net R&D .....         | 7706       |           | 6792     |

## SCR AND VCE PROGRAMS

| <u>Number</u> | <u>Contractor/grantee</u>            | <u>Descriptive title</u>                 | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|--------------------------------------|--|-------------------|---|
| Contracts:    |                                      |  |                   |   |
| NAS1-13500    | Vought                               | Technical Support Services               | M&S               | 154   |
| NAS1-13500    | Vought                               | Technical Support Services               | A                 | 283   |
| NAS1-14564    | Dynamic Model                        | SCR Wind-Tunnel Models                   | A                 | 85  |
| NAS1-14564    | Dynamic Model                        | SCR Wind-Tunnel Models                   | M&S               | 84  |
| NAS1-14580    | Craft Engineering<br>and Metal Corp. | Engineering Service                      | P                 | 10  |
| NAS1-14601    | McDonnell Douglas                    | Jet Noise Suppressor                     | M&S               | 15  |
| NAS1-14623    | Boeing                               | SCV Concepts Study                       | SS                | 988   |
| NAS1-14624    | McDonnell Douglas                    | SCV Technical Application Study          | SS                | 1027  |
| NAS1-14625    | Lockheed-California                  | SCV Technical Assessment Study           | SS                | 1015  |
| NAS1-14837    | Bolt Beranek and<br>Newman, Inc.     | Aircraft Response to Turbulence          | M&S               | 12  |
| NAS1-15183    | Rockwell International               | Aero Applications Systems                | M&S               | 70  |
| NAS1-15183    | Rockwell International               | Design, Fabrication, and Test GR/PI      | M&S               | 25  |
| NAS1-15183    | Rockwell International               | Fiber-Reinforced Solid                   | M&S               | 24  |
| NAS1-15416    | Microcraft, Inc.                     | SCR Wind-Tunnel Models                   | A                 | 184   |
| NAS1-15416    | Microcraft, Inc.                     | Wind-Tunnel Models                       | P                 | 75  |
| NAS1-15527    | McDonnell Douglas                    | Superplastically Formed Ti-6Al           | M&S               | 98  |
| NAS1-15527    | McDonnell Douglas                    | Compression Panels                       | M&S               | 250   |
| NAS1-15568    | Lockheed-California                  | Forming Beta Ti                          | M&S               | 250   |
| NAS1-15605    | Boeing                               | Adhesive Contract                        | M&S               | 132   |
| NAS1-15608    | Kentron                              | Modifications to DAS Amplifier           | M&S               | 11  |
| NAS1-15644    | Boeing                               | Design, Fabricate, and Test GR/PI Joints | M&S               | 322   |
| NAS1-15667    | Modular Computer<br>Systems, Inc.    | Computer Systems                         | M&S               | 8   |

SCR AND VCE PROGRAMS - Continued

| <u>Number</u> | <u>Contractor/grantee</u>                        | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|--|---|-------------------|---|
| Contracts:    |  |   |                   |   |
| NAS1-15675    | General Electric                                 | SCAR Exhaust System Study                                       | P                 | 98  |
| NAS1-15678    | Boeing   | Aero Load Arrow Wing  | M&S               | 133   |
| NAS1-15686    | Hodges and Bryant                                | Fume Hood   | M&S               | 10  |
| NAS1-15720    | Rockwell International                           | Advanced Supersonic Blended Wing/Body Study                     | A                 | 94  |
| NAS1-15720    | Rockwell International                           | Supersonic Jet ARCF   | A                 | 19  |
| NAS1-15720    | Rockwell International                           | Blended Wing/Body   | A                 | 23  |
| NAS1-15788    | Rockwell International                           | SPF/DB Sandwich Study   | M&S               | 267   |
| NAS1-15792    | Analytical Methods,<br>Inc.                      | General Triplet Singularities                                   | A                 | 52  |
| NAS1-15932    | McDonnell Douglas                                | Test Specimens  | M&S               | 36  |
| NAS1-15943    | Atmospheric and<br>Environmental<br>Research Co. | Turbulence Study  | A                 | 31  |
| NAS1-15998    | Hex Col.   | CELION/LaRC-160 (YF-12) and Brazing Platens                     | M&S               | 28  |
| NAS2-3239     | Technochemi GBH                                  | Synthesis of Ether Diacielfluoride                              | M&S               | 45  |
| NAS2-9779     | Ultra Systems                                    | Crosslinking and Degradation in Sealant Candidates              | M&S               | 35  |
| NAS2-9863     | Stanford Research<br>Institute                   | Study of Heterocyclic Perfluorinated Polyethers                 | M&S               | 41  |
| NAS2-10334    | Hughes Aircraft                                  | Studies on New Perfluoroether Elastometer Fuel Tank<br>Sealants | M&S               | 65  |
| NAS3-20048    | Pratt & Whitney                                  | Test-Bed/Coannular Noise  | VCE               | <sup>a</sup> 3053                           |
| NAS3-20061    | Pratt & Whitney                                  | VCE Nozzle Definition   | VCE               | <sup>a</sup> 127                            |
| NAS3-20061    | Pratt & Whitney                                  | VCE Nozzle Definition   | P                 | 100   |

<sup>a</sup>VCE Program contract amounts not included in SCAR totals.

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## SCR AND VCE PROGRAMS - Continued

| <u>Number</u>             | <u>Contractor/grantee</u> | <u>Descriptive title</u>  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------------------|---------------------------|---|-------------------|---|
| Contracts:                |                           |   |                   |   |
| NAS3-20582                | General Electric          | Test-Bed Definition/Early Acoustic                                  | VCE               | <sup>a</sup> 3100                           |
| NAS3-20602                | Pratt & Whitney           | VSCE Duct Burner Testing  | P                 | 79  |
| NAS3-20619                | General Electric          | Acoustic Coannular Plug Nozzle                                      | P                 | 71  |
| NAS3-21388                | General Electric          | Propulsion System Studies, VCE Features (Extension)                 | P                 | 0   |
| NAS3-21608                | General Electric          | Coannular Plug Nozzle Suppressor                                    | VCE               | <sup>a</sup> 482                            |
| NAS3-22000                | General Electric          | GE Inlet Study and Technology Evaluation                            | P                 | 176   |
| NAS3-22111                | Pratt & Whitney           | Noise and Economic Study for SCR                                    | P                 | 283   |
| NAS4-2651                 | Rockwell International    | SPF of a Primary Structure for a Supersonic Aircraft<br>(T-38 Tail) | M&S               | <sup>b</sup> 200                            |
| A/F F33-615-<br>78-C-3602 | Calspan                   | Handling Qualities of SST's   | A                 | 42  |
| Suballotments:            |                           |   |                   |   |
| 3110-0144                 |                           | Suballotment to DFRC as of April 30, 1979                           | A                 | 15  |
| 3110-0163                 |                           | Suballotment to LeRC as of April 30, 1979                           | P                 | 100   |
| 2512-0210                 |                           | Suballotment to DFRC as of April 30, 1979                           | A                 | 25  |
| NAS1-15720                | Rockwell International    | SSX Jet Studies - Suballotment to LaRC                              | P                 | 76  |
| NAS1-14623                | Boeing                    | Supersonic Inlet Fan Noise - Suballotment to LaRC                   | }                 | 210   |
| NAS1-14624                | McDonnell Douglas         | Supersonic Inlet Fan Noise - Suballotment to LaRC                   |                   |   |
| NAS1-14625                | Lockheed-California       | Supersonic Inlet Fan Noise - Suballotment to LaRC                   |                   |   |
| NAS1-14623                | Boeing                    | SCR Inlet Studies - Suballotment to LaRC                            | }                 | 330   |
| NAS1-14624                | McDonnell Douglas         | SCR Inlet Studies - Suballotment to LaRC                            |                   |   |
| NAS1-14625                | Lockheed-California       | SCR Inlet Studies - Suballotment to LaRC                            |                   |   |

<sup>a</sup>VCE Program contract amounts not included in SCAR totals.

<sup>b</sup>Also \$320,000 from 533-01-14 and \$450,000 from A/F.

SCR AND VCE PROGRAMS - Concluded

| <u>Number</u>       | <u>Contractor/grantee</u>            | <u>Descriptive title</u>                    | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------------|--------------------------------------|---|-------------------|---|
| Grants:<br>NSG-1248 | Polytechnic Institute<br>of New York | Supersonic Flow                             | A                 | 20  |
| NSG-1576            | New York Univ.                       | Sonic Boom                                  | A                 | 36  |
| NSG-1615            | Del Mar College                      | Atmospheric Turbulence                      | M&S               | 12  |
| NSG-2186            | San Jose State Univ.                 | Fluorocarbon Ether Elastomers               | M&S               | 145   |
| NSG-2367            | Univ. of Idaho                       | Perfluoroether Triazine Elastomers          | M&S               | 6   |
| NSG-4018            | Oklahoma State Univ.                 | Flying Qualities of Large Flexible Aircraft | A                 | 25  |
| NGR-4030            | Boston Univ.                         | Aero Flow Lift Body                         | M&S               | 101   |

FX 1979

SUPERSONIC CRUISE RESEARCH AND VARIABLE-CYCLE ENGINE PROGRAMS - FY 1980

Cost Summary (in Thousands of Dollars)

|                       |            |            |           |          |
|-----------------------|------------|------------|-----------|----------|
| RTOP .....            | 533        | 517        | 743       | 535      |
| PY .....              | 80         | 79         | 78        | VCE 80   |
| Contracts:            | Cost       | Cost       | Cost      | Cost     |
| Langley (NAS1-) ..... | 6618       | -10        | 0         | 0        |
| Ames (NAS2-) .....    | 106        | 13         | 0         | 0        |
| Lewis (NAS3-) .....   | 1211       | 0          | 0         | 6769     |
| Dryden (NAS4-) .....  | 200        | 176        | 0         | 0        |
| Suballotments .....   | <u>30</u>  | <u>100</u> | <u>15</u> | <u>0</u> |
| Subtotal .....        | 8165       | 279        | 15        | 6769     |
| Grants .....          | <u>223</u> | <u>111</u> | <u>0</u>  | <u>0</u> |
| Total .....           | 8388       | 290        | 15        | 6769     |
| Net R&D .....         | 8396       |            |           | 7915     |

SCR AND VCE PROGRAMS

| <u>Number</u> | <u>Contractor/grantee</u>   | <u>Descriptive title</u>          | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|-----------------------------|-----------------------------------|-------------------|---|
| Contracts:    |                             |                                   |                   |   |
| NAS1-14564    | Dynamic Model               | Model Fabrication                 | A                 | 150   |
| NAS1-14623    | Boeing                      | SCR Nozzle Integration Test       | P                 | 160   |
| NAS1-14623    | Boeing                      | P-Inlet Model                     | P                 | 94  |
| NAS1-14624    | McDonnell Douglas           | 2.2 M High-Speed Tests            | A                 | 30  |
| NAS1-15084    | Lockheed-California         | Computer Program                  | P                 | 20  |
| NAS1-15183    | Rockwell International      | GR/PI Specifications and Elements | M&S               | 63  |
| NAS1-15416    | Precision Model             | Model Construction                | P                 | 176   |
| NAS1-15455    | Textron, Inc.               | Active Control Gear               | M&S               | 14  |
| NAS1-15527    | McDonnell Douglas           | Superplastically Formed Ti-6Al    | M&S               | 238   |
| NAS1-15527    | McDonnell Douglas           | Superplastically Formed Ti-6Al    | M&S               | <sup>a</sup> (59)                           |
| NAS1-15534    | Boeing                      | Boeing Aero System                | A                 | 150   |
| NAS1-15568    | Lockheed-California         | Forming Beta-Ti                   | M&S               | 82  |
| NAS1-15605    | Boeing                      | Adhesive Contract                 | M&S               | 160   |
| NAS1-15720    | Rockwell International      | Market Business Jet               | A                 | 87  |
| NAS1-15788    | Rockwell International      | SPF/DB Study                      | M&S               | 102   |
| NAS1-15792    | Analytical Methods,<br>Inc. | General Triplet Singularity       | A                 | 60  |
| NAS1-15876    | Advex Corp.                 | Material Specifications           | M&S               | 16  |
| NAS1-15886    | Hew Es Co., Inc.            | SCR Bibliography Typing           | A                 | 1   |
| NAS1-15927    | Lockheed-California         | Multibody Aircraft                | A                 | 50  |
| NAS1-15932    | McDonnell Douglas           | Test Specimens                    | M&S               | 13  |
| NAS1-15998    | Hex Col.                    | Materials                         | M&S               | 1   |
| NAS1-16000    | Kentron                     | Technical Support Services        | A                 | 670   |
| NAS1-16000    | Kentron                     | Technical Support Services        | A                 | <sup>a</sup> (6)                            |

<sup>a</sup>Prior FY.

## SCR AND VCE PROGRAMS - Continued

| <u>Number</u>                         | <u>Contractor/grantee</u>  | <u>Descriptive title</u>                  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------------------------------|----------------------------|---|-------------------|---|
| Contracts:                            |                            |   |                   |   |
| NAS1-16000                            | Kentron                    | Technical Support Services                | M&S               | 350   |
| NAS1-16000                            | Kentron                    | Technical Support Services                | M&S               | <sup>a</sup> (41)                           |
| NAS1-16048                            | Lockheed-California        | Integration Technology Study Advanced SCR | SS                | 1010  |
| NAS1-16048                            | Lockheed-California        | Integration Technology Study Advanced SCR | P                 | 150   |
| NAS1-16147                            | McDonnell Douglas          | Technology Application Study for SCR      | SS                | 1000  |
| NAS1-16147                            | McDonnell Douglas          | Technology Study for Advanced SCR         | P                 | 150   |
| NAS1-16150                            | Boeing                     | Technology Study for Advanced SCR         | SS                | 979   |
| NAS1-16150                            | Boeing                     | Technology Study for Advanced SCR         | P                 | 150   |
| NAS1-16150                            | Boeing                     | Support of P-Inlet Tests                  | A                 | 42  |
| NAS1-16150                            | Boeing                     | Support of P-Inlet Tests                  | P                 | 46  |
| NAS1-16150                            | Boeing                     | SCV Flutter Research (SCAT-15 Model)      | M&S               | 16  |
| NAS1-16152                            | Burtek, Inc.               | Controller for Simulator                  | A                 | 50  |
| NAS1-16319                            | Boeing                     | Arrow Wing Models                         | M&S               | 83  |
| NAS1-16403                            | TRW, Inc.                  | Sic/Ti Development                        | M&S               | 121   |
| NAS1-16457                            | Precision Model            | Model Construction                        | A                 | 96  |
| L-75228A<br>(A/F F33-6179-<br>C-3618) | Calspan                    | SCR Flying Quality Study                  | A                 | 38  |
| L-75228A<br>(A/F F33-6179-<br>C-3618) | Calspan                    | SCR Flying Quality Study                  | A                 | <sup>a</sup> (2)                            |
| NAS2-9741                             | Computer Sciences<br>Corp. | Concorde Math Model Document              | A                 | 30  |
| NAS2-10334                            | Hughes Aircraft            | Elastomeric Sealants                      | M&S               | <sup>a</sup> (13)                           |
| NAS2-10334                            | Hughes Aircraft            | Study of New Perfluorether                | M&S               | 54  |

<sup>a</sup>Prior FY.



SCR AND VCE PROGRAMS - Continued

| <u>Number</u> | <u>Contractor/grantee</u>     | <u>Descriptive title</u>                    | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|-------------------------------|---|-------------------|---|
| Contracts:    |                               |   |                   |   |
| NAS2-10789    | S.A.R., Inc.                  | Quantum Calculation of Fluoroether Polymers | M&S               | 10  |
| NAS2-10804    | Printronic, Inc.              | Line Printer for D.B.                       | M&S               | 12  |
| NAS3-12512    | General Electric              | JP-4 Fuel                                   | P                 | 6   |
| NAS3-19442    | Pratt & Whitney               | VSCE Nozzle Definition Program              | P                 | 30  |
| NAS3-20048    | Pratt & Whitney               | Test-Bed Noise                              | VCE               | b <sub>1</sub> 403                          |
| NAS3-20048    | Pratt & Whitney               | Supersonic Jet Shock Noise Reduction        | VCE               | b <sub>2</sub> 22                           |
| NAS3-20048    | Pratt & Whitney               | Test-Bed Noise                              | P                 | 200   |
| NAS3-20048    | Pratt & Whitney               | Turbine Bypass Propulsion Study             | P                 | 190   |
| NAS3-20048    | Pratt & Whitney               | VSCE Test-Bed Definition Program            | VCE               | b <sub>5</sub> 3                            |
| NAS3-20582    | General Electric              | VCE Test-Bed Definition, Acoustic           | VCE               | b <sub>2</sub> 884                          |
| NAS3-20582    | General Electric              | JP-5 Fuel                                   | VCE               | b <sub>6</sub> 7                            |
| NAS3-20582    | General Electric              | Test-Bed Definition, DBE                    | VCE               | b <sub>1</sub> 200                          |
| NAS3-22111    | Pratt & Whitney               | Noise and Economic Study                    | P                 | 30  |
| NAS3-22111    | Pratt & Whitney               | Propulsion System Study                     | P                 | 158   |
| NAS3-22137    | General Electric              | Acoustic Shielding of Supersonic Jet Noise  | VCE               | b <sub>8</sub> 31                           |
| NAS3-22137    | General Electric              | Thermal Acoustic Shield                     | VCE               | b <sub>7</sub> 50                           |
| NAS3-22509    | General Applied Sciences Lab. | Supersonic Fan                              | P                 | 137   |
| NAS3-22514    | General Electric              | Supersonic Jet Shock Noise Reduction        | P                 | 460   |
| NAS3-22738    | Pratt & Whitney               | REL/VP Suppressor Ejector Nozzles Program   | VCE               | b <sub>6</sub> 00                           |
| NAS3-22738    | Pratt & Whitney               | VSCE Nozzle Program Definition              | VCE               | b <sub>1</sub> 65                           |
| NAS3-22773    | General Electric              | Suppressed Coannular Ejector Nozzles        | VCE               | b <sub>9</sub> 3                            |
| 38908D        | General Electric              | Fuel  | VCE               | b <sub>3</sub> 7                            |

<sup>b</sup>VCE Program contract amounts not included in SCAR totals.

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## SCR AND VCE PROGRAMS - Concluded

| <u>Number</u>         | <u>Contractor/grantee</u>         | <u>Descriptive title</u>   | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|-----------------------|-----------------------------------|--|-------------------|---|
| <b>Contracts:</b>     |                                   |  |                   |   |
| 85598C                | General Electric                  | Fuel-DBE Test-Bed Definition   | VCE               | b <sub>35</sub>                             |
| 88303C                | General Electric                  | Turbine Engine   | VCE               | b <sub>32</sub>                             |
| E-43149               | USAF Logistics Command            | Documentation of SCR Wing Panel Program and Fuel Tank Sealant Research   | M&S               | 150   |
| NAS4-2651             | Rockwell International            | SPF/DB of a Primary Structure for Supersonic Aircraft                    | M&S               | 200<br>a(626)                               |
| <b>Suballotments:</b> |                                   |  |                   |   |
|                       |                                   | Concorde Math Model (Suballotment from LaRC to ARC as of April 30, 1980) | A                 | 30  |
| 3110-0163             |                                   | Suballotment from LaRC to LeRC as of April 30, 1980                      | P                 | a(100)                                      |
| 3110-0144             |                                   | Suballotment from LaRC to DFRC as of April 30, 1980                      | M&S               | a(15)                                       |
| <b>Grants:</b>        |                                   |  |                   |   |
| NSG-1248              | Polytechnic Institute of New York | Supersonic Flow Study  | A                 | 20  |
| NSG-1297              | Clemson Univ.                     | Micro Fracture   | M&S               | 16  |
| NSG-2367              | Univ. of Idaho                    | Perfluoroether Triazine Elastomers                                       | M&S               | a(11)                                       |
| NCC1-24               | George Washington Univ.           | Aero Fellowship  | A                 | 23  |
| NCC2-00081            | San Jose State Univ.              | Synthesis Characterization of Fluorocarbon Ether Elastomers              | M&S               | 63  |
| NGR-2200-4030         | Boston Univ.                      | Aero Flow Lift Body  | M&S               | 101   |

<sup>a</sup>Prior FY.

<sup>b</sup>VCE Program contract amounts not included in SCAR totals.

SUPERSONIC CRUISE RESEARCH AND VARIABLE-CYCLE ENGINE PROGRAMS - FY 1981

Cost Summary (in Thousands of Dollars)

|                       |            |            |
|-----------------------|------------|------------|
| RTOP .....            | 533        | 535        |
| PY .....              | 81         | VCE 81     |
| Contracts:            | Cost       | Cost       |
| Langley (NAS1-) ..... | 3815       | 0          |
| Ames (NAS2-) .....    | 10         | 0          |
| Lewis (NAS3-) .....   | 631        | 3500       |
| Dryden (NAS4-) .....  | 0          | 0          |
| Suballotments .....   | <u>642</u> | <u>750</u> |
| Subtotal .....        | 5098       | 4250       |
| Grants .....          | <u>307</u> | <u>0</u>   |
| Total .....           | 5405       | 4250       |
| Net R&D .....         | 8611       | 6300       |

## SCR AND VCE PROGRAMS

| <u>Number</u> | <u>Contractor/grantee</u>         | <u>Descriptive title</u>                  | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------|-----------------------------------|---|-------------------|---|
| Contracts:    |                                   |   |                   |   |
| NAS1-14623    | Boeing                            | Refurbishment of P-Inlet                  | A                 | 12  |
| NAS1-15080    | Virginia Polytechnic<br>Institute | GR/EP Tests                               | M&S               | 11  |
| NAS1-15416    | Precision Model                   | SCR Models                                | P                 | 15  |
| NAS1-15605    | Boeing                            | Adhesive Contract                         | M&S               | 71  |
| NAS1-15605    | Boeing                            | High-Temperature Adhesives                | M&S               | 11  |
| NAS1-15678    | Boeing                            | Aero Loads, Arrow Wing                    | M&S               | 40  |
| NAS1-16000    | Kentron                           | Technical Support Services                | M&S               | 248   |
| NAS1-16000    | Kentron                           | Technical Support Services                | A                 | 211   |
| NAS1-16048    | Lockheed-California               | SCR Advanced Aluminum Alloys              | M&S               | 50  |
| NAS1-16048    | Lockheed-California               | FRAT for SCV                              | A                 | 150   |
| NAS1-16048    | Lockheed-California               | SCR-Lockheed-Test SPT                     | P                 | 223   |
| NAS1-16147    | McDonnell Douglas                 | SCR System Studies, Inlets                | SS                | 163   |
| NAS1-16150    | Boeing                            | SCR System Studies                        | SS                | 1103  |
| NAS1-16150    | Boeing                            | Advanced SCR Configuration Concepts       | A                 | 250   |
| NAS1-16150    | Boeing                            | SCR System Studies, Propulsion            | P                 | 180   |
| NAS1-16150    | Boeing                            | Advanced SCR Configurations Concepts      | P                 | 100   |
| NAS1-16150    | Boeing                            | Aero Acoustic Report                      | P                 | 18  |
| NAS1-16369    | Dynamic Model                     | SCR Models                                | A                 | 218   |
| NAS1-16403    | Lockheed-California               | Titanium Composites                       | M&S               | 70  |
| NAS1-16408    | Lockheed-California               | SCR Advanced Aluminum Alloys              | M&S               | 75  |
| NAS1-16424    | Lockheed-California               | Aluminum Alloy Evaluation                 | M&S               | 11  |
| NAS1-16463    | ABAR Corp.                        | Vacuum Furnace                            | M&S               | 190   |
| NAS1-16596    | ICARUS                            | Viscous Unsteady Flow at Transonic Speeds | M&S               | 25  |

SCR AND VCE PROGRAMS - Continued

| <u>Number</u>                         | <u>Contractor/grantee</u>   | <u>Descriptive title</u>                    | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|---------------------------------------|-----------------------------|---|-------------------|---|
| Contracts:                            |                             |   |                   |   |
| NAS1-16647                            | McDonnell Douglas           | Military Supersonic Cruise                  | A                 | 250   |
| NAS1-16696                            | General Electric            | SCR Exhaust System Analysis                 | P                 | 50  |
| NAS1-16740                            | Boeing                      | Aero Loads, Arrow Wing                      | A                 | 5   |
| L-75228A<br>(A/F F33-6179-<br>C-3618) | Calspan                     | SCR Flying Qualities Study                  | A                 | 65  |
| NAS2-10789                            | S.A.R., Inc.                | Quantum Calculation of Fluoroether Polymers | M&S               | 10  |
| NAS3-22111                            | Pratt & Whitney             | Propulsion System Study                     | P                 | 30  |
| NAS3-22137                            | General Electric            | Acoustic Shielding of Supersonic Jet Noise  | VCE               | <sup>a</sup> 52                             |
| NAS3-22243                            | General Electric            | VSCE Nozzle Definition Program              | VCE               | <sup>a</sup> 25                             |
| NAS3-22244                            | General Electric            | TAS Aero Performance                        | VCE               | <sup>a</sup> 33                             |
| NAS3-22254                            | General Dynamics            | Remote Augmented Lift, Turbine Bypass       | VCE               | <sup>a</sup> 264                            |
| NAS3-22700                            | General Electric            | Design and Test of VCE Nozzles              | VCE               | <sup>a</sup> 30                             |
| NAS3-22738                            | Pratt & Whitney             | VSCE Nozzle Definition Program              | VCE               | <sup>a</sup> 42                             |
| NAS3-22749                            | General Electric            | Propulsion System Study                     | P                 | 201   |
| NAS3-22773                            | Pratt & Whitney             | REL/VP Suppressor Ejector Nozzles           | VCE               | <sup>a</sup> 57                             |
| NAS3-23038                            | General Electric            | DBE Model Nozzle, Aero Performance          | VCE               | <sup>a</sup> 537                            |
| NAS3-23039                            | Pratt & Whitney             | Nozzle Performance                          | VCE               | <sup>a</sup> 674                            |
| NAS3-23050                            | Pratt & Whitney             | Turbine Bypass Engine Study                 | VCE               | <sup>a</sup> 245                            |
| NAS3-23150                            | Digital Electronic<br>Corp. | VCE Nozzle Definition Program               | VCE               | <sup>a</sup> 17                             |
| NAS3-23166                            | Pratt & Whitney             | Coannular Jet Shock Noise Reduction         | VCE               | <sup>a</sup> 400                            |
| NAS3-23166                            | General Electric            | Supersonic Jet Shock Noise Reduction        | VCE               | <sup>a</sup> 63                             |

<sup>a</sup>VCE Program contract amounts not included in SCAR totals.

FY 1981

## SCR AND VCE PROGRAMS - Concluded

| <u>Number</u>         | <u>Contractor/grantee</u>         | <u>Descriptive title</u>                                    | <u>Discipline</u> | <u>Amount,<br/>thousands of<br/>dollars</u> |
|-----------------------|-----------------------------------|---|-------------------|---|
| <b>Contracts:</b>     |                                   |   |                   |   |
| NAS3-23221            | General Electric                  | VSCE Nozzle Definition                                      | VCE               | <sup>a</sup> 359                            |
| NAS3-23275            | General Electric                  | Outer Stream Suppressor/Ejector for VCE Application         | VCE               | <sup>a</sup> 771                            |
| <b>Suballotments:</b> |                                   |   |                   |   |
|                       |                                   | Aero/Acoustic Tests Using SCR Inlet - Suballotments to LaRC | P                 | 642   |
|                       |                                   | Coannular Nozzle - Suballotments to LaRC                    | VCE               | <sup>a</sup> 750                            |
| 61057D                | Digital Electronic Corp.          | VSCE Nozzle Definition                                      | VCE               | <sup>a</sup> 65                             |
| 55682D                | Pratt & Whitney                   | Fuel - VSCE Nozzle  | VCE               | <sup>a</sup> 10                             |
| 58145D                | Digital Electronic Corp.          | Fuel - Test of VCE Nozzles                                  | VCE               | <sup>a</sup> 17                             |
| 88303C                | General Electric                  | Fuel - DBE Test Bed   | VCE               | <sup>a</sup> 32                             |
| 38918D                | General Electric                  | Shock II Fuel   | VCE               | <sup>a</sup> 32                             |
| 3815D                 | General Electric                  | Shock I Fuel  | VCE               | <sup>a</sup> 16                             |
| 38920D                | General Electric                  | Suppressor Ejector  | VCE               | <sup>a</sup> 19                             |
| 38908D                | General Electric                  | Fuel  | VCE               | <sup>a</sup> 70                             |
| <b>Grants:</b>        |                                   |   |                   |   |
| NSG-1248              | Polytechnic Institute of New York | Supersonic Flow Study                                       | A                 | 12  |
| NSG-1570              | Univ. of Maryland                 | Research in General Aviation Aerodynamics                   | A                 | 12  |
| NCC1-24               | George Washington Univ.           | Flight Sciences   | A                 | 49  |
| NCC2-0081             | San Jose State Univ.              | Synthesis Characterization of Fluorocarbon Ether Elastomers | M&S               | 108   |
| NGR-2200-4030         | Boston Univ.                      | Aero Flow Lifting Body                                      | A                 | 76  |
| R3-256                | Univ. of Washington               | High-Speed Inlet Code Verification                          | A                 | 50  |

<sup>a</sup>VCE Program contract amounts not included in SCAR totals.

TABLE I.- SUMMARY OF SCRA<sup>a</sup> CONTRACTORS, GRANTEES, AND AMOUNTS

| Contractor/grantee                                  | Amount,<br>thousands of dollars |
|---|---------------------------------|
| ABAR Corporation                                    | 190                             |
| Acurex Corporation                                  | 84                              |
| Advanced Technology Laboratories (ATL)              | 226                             |
| Advex Corporation                                   | 16                              |
| Aeronca, Inc.                                       | 10                              |
| Amercom, Inc.                                       | 41                              |
| Ampex Corporation                                   | 15                              |
| Analytical Methods, Inc. (AMI)                      | 225                             |
| Applied Space Products                              | 17                              |
| Arthur D. Little Company                            | 46                              |
| Atmospheric and Environmental Research Company      | 31                              |
| Atomic Energy Commission                            | 18                              |
| B&K Instruments                                     | 15                              |
| Bell Aerospace Company                              | 59                              |
| Boeing (Commercial Airplane Company and/or Wichita) | 13 738                          |
| Bolt Beranek and Newman Inc.                        | 89                              |
| Boston University                                   | 615                             |
| Burtek, Inc.  | 50                              |
| Calspan (Advanced Technology Center, Arvin)         | 288                             |
| Clemson University                                  | 88                              |
| College of William and Mary                         | 5                               |
| Computer Sciences Corporation                       | 30                              |
| Cornell University                                  | 73                              |
| Craft Engineering and Metal Corporation             | 51                              |
| CVI   | 11                              |
| Del Mar College                                     | 12                              |
| Department of Transportation                        | 11                              |
| DWA Composite Specialties, Inc.                     | 30                              |
| Dynamic Engineering and Model Company               | 1 333                           |
| Dynamic Model                                       | 537                             |
| Ferro Corporation                                   | 12                              |
| General Applied Sciences Laboratory (GASL)          | 365                             |
| General Dynamics                                    | 1 518                           |
| General Electric Company                            | 5 081                           |

<sup>a</sup>Includes prior designations of AST and SCAR.

TABLE I.- Continued

| Contractor/grantee                                    | Amount,<br>thousands of dollars |
|---|---------------------------------|
| General Motors Corporation                            | 11                              |
| George Washington University                          | 303                             |
| Hew Es Co., Inc.                                      | 1                               |
| Hex Col.  | 20                              |
| Hodges and Bryant                                     | 10                              |
| Honeywell, Inc.                                       | 10                              |
| Hughes Aircraft                                       | 132                             |
| ICARUS  | 25                              |
| Illinois Institute of Technology (IIT)                | 100                             |
| Jet Propulsion Laboratory                             | 85                              |
| Kentron International <sup>b</sup>                    | 1 607                           |
| LFE Corporation                                       | 33                              |
| Ling-Temco-Vought, Vought                             | 2 945                           |
| Lockheed (California Company and/or Georgia Company)  | 8 729                           |
| Massachusetts Institute of Technology (MIT)           | 240                             |
| Mayer A. and Associates                               | 28                              |
| McDonnell Douglas                                     | 8 297                           |
| Microcraft, Inc.                                      | 455                             |
| Midwest Research Institute                            | 69                              |
| Modular Computer Systems, Inc.                        | 8                               |
| MTS Systems Corporation                               | 129                             |
| National Academy of Sciences                          | 36                              |
| National Oceanographic and Atmospheric Administration | 14                              |
| New York University                                   | 475                             |
| Northrop Services                                     | 44                              |
| Oklahoma State University                             | 25                              |
| Old Dominion University                               | 86                              |
| Optimization Software, Inc.                           | 8                               |
| Pan American World Airways                            | 28                              |
| PCR Ink   | 146                             |
| Peninsula Chemical Corporation                        | 91                              |
| Polytechnic Institute of New York (PINY)              | 52                              |
| Pratt & Whitney, United Aircraft Corporation          | 5 504                           |
| Precision Model                                       | 287                             |

<sup>b</sup>Associated.



TABLE I.- Concluded

| Contractor/grantee                   | Amount,<br>thousands of dollars |
|--------------------------------------|---------------------------------|
| Princeton University                 | 15                              |
| Printronic, Inc.                     | 12                              |
| Purdue University                    | 25                              |
| Rockwell International               | 2 284                           |
| San Jose State University            | 369                             |
| Sargamo Electric                     | 22                              |
| S.A.R., Inc.                         | 20                              |
| SOLAR                                | 1 104                           |
| Stanford Research Institute          | 98                              |
| Stanford University                  | 160                             |
| Technion, Israel                     | 55                              |
| Technochemi GBH                      | 45                              |
| Technology Development               | 13                              |
| Texas Instruments                    | 13                              |
| Textron, Inc.                        | 333                             |
| TRW, Inc.                            | 485                             |
| Tufts University                     | 24                              |
| Ultra Systems                        | 163                             |
| University of California             | 5                               |
| University of Cincinnati             | 8                               |
| University of Delaware               | 22                              |
| University of Denver                 | 20                              |
| University of Idaho                  | 17                              |
| University of Michigan               | 30                              |
| University of Mississippi            | 129                             |
| University of Pittsburgh             | 80                              |
| University of Texas                  | 20                              |
| University of Washington             | 50                              |
| Virginia Polytechnic Institute (VPI) | 22                              |
| Westinghouse, Inc.                   | 197                             |
| Whittaker Corporation                | 18                              |
| Wye Electric Company                 | 11                              |
| York University                      | 40                              |

TABLE II.- SUMMARY OF VCE CONTRACTORS AND AMOUNTS

| Contractor/grantee                           | Amount,<br>thousands of dollars |
|--|---------------------------------|
| Digital Electronic Corporation               | 99                              |
| General Dynamics                             | 264                             |
| General Electric Company                     | 16 179                          |
| Pratt & Whitney, United Aircraft Corporation | 12 779                          |

TABLE III.- R&D (IN THOUSANDS OF DOLLARS) FOR SCR PROGRAM, CONTRACTS, AND GRANTS

| PY .....                          | 73           | 74           | 75          | 76          | 77         | 77          | 78          | 79          | 80         | 81           | Total         |
|-----------------------------------|--------------|--------------|-------------|-------------|------------|-------------|-------------|-------------|------------|--------------|---------------|
| RTOP .....                        | (a)          | 743          | 743         | 743         | 743        | 743         | 743         | 517         | 533        | 533          |               |
| Net R&D .....                     | 10 310       | 8 400        | 7788        | 6816        | 1700       | 6000        | 7500        | 7706        | 8396       | 8 611        | 73 227        |
| Support (IMS <sup>b</sup> ) ..... | <u>1 424</u> | <u>1 694</u> | <u>1206</u> | <u>1840</u> | <u>380</u> | <u>2000</u> | <u>1500</u> | <u>1294</u> | <u>982</u> | <u>1 435</u> | <u>13 755</u> |
| Total (506 W) .....               | 11 734       | 10 094       | 8994        | 8656        | 2080       | 8000        | 9000        | 9000        | 9378       | 10 046       | 86 982        |
| Contracts .....                   | 9 308        | 7 220        | 7002        | 6081        | 1382       | 5658        | 6448        | 6812        | 8165       | 5 098        | 63 174        |
| Grants .....                      | 284          | 349          | 302         | 478         | 50         | 342         | 360         | 320         | 223        | 307          | 3 015         |
| Other work and carry-in .....     | <u>718</u>   | <u>831</u>   | <u>484</u>  | <u>257</u>  | <u>268</u> | <u>0</u>    | <u>692</u>  | <u>574</u>  | <u>8</u>   | <u>3 206</u> | <u>7 038</u>  |
| Total.....                        | 10 310       | 8 400        | 7788        | 6816        | 1700       | 6000        | 7500        | 7706        | 8396       | 8 611        | 73 227        |

<sup>a</sup>501-06, 08, 24, 31, 32; 760-65.

<sup>b</sup>Internal Management Services.

TABLE IV.- R&amp;D (IN THOUSANDS OF DOLLARS) FOR VCE COMPONENT PROGRAM, CONTRACTS, AND GRANTS

|                                   | 76  | 7T  | 77      | 78      | 79   | 80   | 81                | Total  |
|-----------------------------------|-----|-----|---------|---------|------|------|-------------------|--------|
| PY .....                          | 76  | 7T  | 77      | 78      | 79   | 80   | 81                | Total  |
| RTOP .....                        | 511 | 511 | 511/551 | 511/551 | 511  | 535  | 535               |        |
| Net R&D .....                     | 740 | 300 | 3100    | 6030    | 6792 | 7915 | <sup>a</sup> 6300 | 31 177 |
| Support (IMS <sup>b</sup> ) ..... | 200 | 10  | 30      | 20      | 108  | 85   | 100               | 553    |
| Total (506 W) .....               | 940 | 310 | 3130    | 6050    | 6900 | 8000 | 6400              | 31 730 |
| Contracts.....                    | 652 | 200 | 3079    | 5754    | 7162 | 6769 | 3487              | 27 103 |
| Grants.....                       | 0   | 0   | 0       | 0       | 0    | 0    | 750               | 750    |
| Other work and carry-in .....     | 88  | 100 | 21      | 276     | -370 | 1146 | 2063              | 3 324  |
| Total .....                       | 740 | 300 | 3100    | 6030    | 6792 | 7915 | 6300              | 31 177 |

<sup>a</sup>Reduced to 5117 on 6/30/82, and reduced again to 4980 on 9/30/82 during closeout in FY 1982.

<sup>b</sup>Internal Management Services.

TABLE V.- SCR NET R&D (IN THOUSANDS OF DOLLARS) BY DISCIPLINE

| PY .....                       | 73           | 74          | 75         | 76         | 7T         | 77         | 78          | 79         | 80          | 81          | Total        |
|--------------------------------|--------------|-------------|------------|------------|------------|------------|-------------|------------|-------------|-------------|--------------|
| Discipline:                    |              |             |            |            |            |            |             |            |             |             |              |
| System studies .....           | 1 746        | 747         | 1463       | 1465       | 1070       | 2900       | 3000        | 3000       | 3000        | 3000        | 21 391       |
| Aerodynamic performance .....  | <u>1 659</u> | <u>192</u>  | <u>772</u> | <u>697</u> | <u>0</u>   | <u>320</u> | <u>1150</u> | <u>920</u> | <u>1585</u> | <u>1322</u> | <u>8617</u>  |
| Total .....                    | 3 405        | 939         | 2235       | 2162       | 1070       | 3220       | 4150        | 3920       | 4585        | 4322        | 30 008       |
| Materials and structures ..... | 3 237        | 2971        | 2280       | 2130       | 230        | 1480       | 2350        | 2150       | 1871        | 2524        | 21 223       |
| Propulsion and SEI .....       | 2 820        | 3150        | 2758       | 1985       | 300        | 700        | 900         | 1636       | 1940        | 1765        | 17 954       |
| VCE support <sup>a</sup> ..... |              |             |            |            | 149        | 489        | 430         | 179        | 30          | 201         | 1 478        |
| Stability and control .....    | <u>848</u>   | <u>1340</u> | <u>515</u> | <u>539</u> | <u>100</u> | <u>600</u> | <u>100</u>  | <u>0</u>   | <u>0</u>    | <u>0</u>    | <u>4 042</u> |
| Grand total .....              | 10 310       | 8400        | 7788       | 6816       | 1700       | 6000       | 7500        | 7706       | 8396        | 8611        | 73 227       |

<sup>a</sup>Amounts not to be added in determining grand total.

TABLE VI.- SCR NET R&amp;D (IN THOUSANDS OF DOLLARS) BY DISCIPLINE AND CENTER

PY 1973

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total               |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|---------------------|
| Ames    |                | 286                     | 350                      | 225        | 210                            | 450                   | 1 521               |
| Lewis   |                |                         | 192                      | 1663       | 587                            |                       | 2 442               |
| Langley | 1746           | 1373                    | 2695                     |            | 20                             | 88                    | 5 922               |
| Dryden  |                |                         |                          |            | 5                              | 310                   | 315                 |
| JPL     |                |                         |                          |            | 110                            |                       | 110                 |
| Total   | 1746           | 1659                    | 3237                     | 1888       | 932                            | 848                   | <sup>a</sup> 10 310 |

<sup>a</sup>Total program authority (506 W) = 11 734.

TABLE VI.- Continued

PY 1974

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total             |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|-------------------|
| Ames    |                | 220                     | 106                      | 148        | 500                            | 560                   | 1534              |
| Lewis   |                |                         | 96                       | 2381       | 65                             |                       | 2542              |
| Langley | 587            | 192                     | 2735                     |            | 31                             | 102                   | 3647              |
| Dryden  |                |                         | 29                       |            | 25                             | 623                   | 677               |
| JPL     |                |                         |                          |            |                                |                       |                   |
| Total   | 587            | 412                     | 2966                     | 2529       | 621                            | 1285                  | <sup>a</sup> 8400 |

<sup>a</sup>Total program authority (506 W) = 10 094.

PY 1974

TABLE VI.- Continued

PY 1975

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total             |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|-------------------|
| Ames    |                | 170                     | 150                      | 50         | 230                            | 250                   | 850               |
| Lewis   |                |                         | 100                      | 2220       | 65                             |                       | 2385              |
| Langley | 1463           | 690                     | 2000                     |            | 50                             | 40                    | 4243              |
| Dryden  |                |                         | 30                       |            |                                | 225                   | 255               |
| JPL     |                |                         |                          |            | 55                             |                       | 55                |
| Total   | 1463           | 860                     | 2280                     | 2270       | 400                            | 515                   | <sup>a</sup> 7788 |

<sup>a</sup>Total program authority (506 W) = 8994.



TABLE VI.- Continued

PY 1976

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total             |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|-------------------|
| Ames    |                | 75                      | 200                      |            | 180                            |                       | 455               |
| Lewis   |                |                         |                          | 1780       |                                |                       | 1780              |
| Langley | 1465           | 647                     | 1875                     |            | 25                             | 139                   | 4151              |
| Dryden  |                |                         | 30                       |            |                                | 400                   | 430               |
| JPL     |                |                         |                          |            |                                |                       |                   |
| Total   | 1465           | 722                     | 2105                     | 1780       | 205                            | 539                   | <sup>a</sup> 6816 |

<sup>a</sup>Total program authority (506 W) = 8656.

PY 1976

TABLE VI.- Continued

PY 197T

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total             |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|-------------------|
| Ames    |                |                         | 30                       |            |                                |                       | 30                |
| Lewis   |                |                         |                          | 300        |                                |                       | 300               |
| Langley | 1070           |                         | 200                      |            |                                |                       | 1270              |
| Dryden  |                |                         |                          |            |                                | 100                   | 100               |
| Total   | 1070           | 0                       | 230                      | 300        | 0                              | 100                   | <sup>a</sup> 1700 |

<sup>a</sup>Total program authority (506 W) = 2080.

TABLE VI.- Continued

PY 1977

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total             |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|-------------------|
| Ames    |                |                         | 200                      |            |                                |                       | 200               |
| Lewis   |                |                         |                          | 700        |                                |                       | 700               |
| Langley | 2900           | 320                     | 1240                     |            |                                | 100                   | 4560              |
| Dryden  |                |                         | 40                       |            |                                | 500                   | 540               |
| Total   | 2900           | 320                     | 1480                     | 700        | 0                              | 600                   | <sup>a</sup> 6000 |

<sup>a</sup>Total program authority (506 W) = 8000.

PY 1977

TABLE VI.- Continued

PY 1978

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total             |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|-------------------|
| Ames    |                |                         | 200                      |            |                                |                       | 200               |
| Lewis   |                |                         |                          | 900        |                                |                       | 900               |
| Langley | 3000           | 1150                    | 2100                     |            |                                | 50                    | 6300              |
| Dryden  |                |                         | 50                       |            |                                | 50                    | 100               |
| Total   | 3000           | 1150                    | 2350                     | 900        | 0                              | 100                   | <sup>a</sup> 7500 |

<sup>a</sup>Total program authority (506 W) = 9000.

TABLE VI.- Continued

PY 1979

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total             |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|-------------------|
| Ames    |                |                         | 250                      |            |                                |                       | 250               |
| Lewis   |                |                         |                          | 1306       |                                |                       | 1306              |
| Langley | 3000           | 920                     | 1700                     | 330        |                                |                       | 5950              |
| Dryden  |                |                         | 200                      |            |                                |                       | 200               |
| Total   | 3000           | 920                     | 2150                     | 1636       | 0                              | 0                     | <sup>a</sup> 7706 |

<sup>a</sup>Total program authority (506 W) = 9000.

PY 1979

TABLE VI.- Continued

PY 1980

| Center  | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total             |
|---------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|-------------------|
| Ames    |                |                         | 150                      |            |                                |                       | 150               |
| Lewis   |                |                         |                          | 1540       |                                |                       | 1540              |
| Langley | 3000           | 1585                    | 1700                     | 400        |                                |                       | 6685              |
| Dryden  |                |                         | 21                       |            |                                |                       | 21                |
| Total   | 3000           | 1585                    | 1871                     | 1940       | 0                              | 0                     | <sup>a</sup> 8396 |

<sup>a</sup>Total program authority (506 W) = 9378.

TABLE VI.- Continued

PY 1981

| Center                             | System studies | Aerodynamic performance | Materials and structures | Propulsion  | Stratospheric emissions impact | Stability and control | Total                      |
|------------------------------------|----------------|-------------------------|--------------------------|-------------|--------------------------------|-----------------------|----------------------------|
| Ames<br>Lewis<br>Langley<br>Dryden | 3000           | <sup>a</sup> 1322       | 186<br>1700<br>638       | 1500<br>265 |                                |                       | 186<br>1500<br>6287<br>638 |
| Total                              | 3000           | 1322                    | 2524                     | 1765        | 0                              | 0                     | <sup>b</sup> 8611          |

<sup>a</sup>Includes \$340,000 reserves.

<sup>b</sup>Total program authority (506 W) = 10 046.

PY 1981 (Net R&D on Aug. 1, 1982)

TABLE VI.- Concluded

PY 1982

| Center                             | System studies | Aerodynamic performance | Materials and structures | Propulsion | Stratospheric emissions impact | Stability and control | Total          |
|------------------------------------|----------------|-------------------------|--------------------------|------------|--------------------------------|-----------------------|----------------|
| Ames<br>Lewis<br>Langley<br>Dryden |                |                         |                          |            |                                |                       | 0              |
| Total                              | 0              | 0                       | 0                        | 0          | 0                              | 0                     | <sup>a</sup> 0 |

<sup>a</sup>Total program authority (506 W) = 0.



TABLE VII.- RTOP, DISCIPLINE, AND NET R&D BY PROGRAM YEAR FOR EACH OAST CENTER

| Center            | RTOP          | Title                               | Discipline | R&D,<br>thousands of dollars |
|-------------------|---------------|-------------------------------------|------------|------------------------------|
| Ames              | 501-31-71     | Fuel Tank Sealants                  | M&S        | 350                          |
|                   | 501-24-20     | Pollution Reduction                 | SEI        | 210                          |
|                   | 501-24-19     | Propulsion Noise                    | P          | 225                          |
|                   | 760-65-01     | Option Aero Design                  | A          | 250                          |
|                   | 760-65-04     | Low-Speed Aero Methods              | A          | 12                           |
|                   | 760-65-06     | FLEXSTAB                            | S&C        | 250                          |
|                   | 760-65-07     | Handling Quality Criteria           | S&C        | 200                          |
|                   | 760-65-08     | Control System Mechanization        | S&C        | 0                            |
|                   | 501-06-11     | Sonic Boom                          | A          | 25                           |
| Total             |               |                                     |            | 1 522                        |
| Lewis             | 501-31-72     | AST Materials                       | M&S        | 192                          |
|                   | 501-24-19     | Propulsion Noise                    | P          | 303                          |
|                   | 501-24-20     | Pollution Reduction                 | ↓          | 587                          |
|                   | 501-24-21     | Integrated Propulsion Control       | ↓          | 283                          |
|                   | 501-24-22     | Experimental Engine Study           | ↓          | 1 077                        |
| Total             |               |                                     |            | 2 442                        |
| Langley           | 501-32-01     | Structure Design Concepts           | M&S        | 680                          |
|                   | 501-32-02     | Flutter Design Models               | ↓          | 174                          |
|                   | 501-32-03     | Loads and Aeroelastic Technology    | ↓          | 436                          |
|                   | 501-32-05, 06 | Titanium and Composites Structures  | ↓          | 1 267                        |
|                   | 501-08-11     | Atmospheric Measurements for AST    | ↓          | 138                          |
|                   | 501-24-20     | Pollution Reduction                 | SEI        | 20                           |
|                   | 760-65-09     | AST System Studies                  | SS         | 1 746                        |
|                   | 760-65-03     | Aero Performance Concepts           | A          | 935                          |
|                   | 760-65-04     | Low-Speed Performance Prediction    | A          | 238                          |
|                   | 501-06-11     | Sonic Boom                          | A          | 200                          |
|                   | 501-32-07     | ACT Wind-Tunnel Techniques          | S&C        | 87                           |
| Total             |               |                                     |            | 5 921                        |
| DFRC              | 501-32-04     | Materials and Structures Components | M&S        | 35                           |
|                   | 760-65-05     | Co-Op Controls                      | S&C        | 275                          |
|                   | 501-24-20     | Pollution Reduction                 | SEI        | 5                            |
| Total             |               |                                     |            | 315                          |
| JPL               | 501-24-20     | Pollution Reduction                 | SEI        | 110                          |
| Total (SCR) ..... |               |                                     |            | 10 310                       |

TABLE VII.- Continued

| Center            | RTOP          | Title   | Discipline | R&D,<br>thousands of dollars |
|-------------------|---------------|---|------------|------------------------------|
| Ames              | 743-31-01     | Fuel Tank Sealants                            | M&S        | 106                          |
|                   | 743-34-22     | Stratospheric Emissions Impact                | SEI        | 500                          |
|                   | 743-34-11     | Noise Reduction                               | P          | 148                          |
|                   | 743-61-11     | AST Optimum Design                            | A          | 92                           |
|                   | 743-65-21     | Aero Performance Theory                       | A          | 128                          |
|                   | 743-36-01     | FLEXSTAB                                      | S&C        | 300                          |
|                   | 743-36-11     | ACT Handling Quality Criteria                 | S&C        | 137                          |
|                   | 743-36-12     | Control System Mechanization                  | S&C        | 123                          |
| Total             |               |   |            | 1534                         |
| Lewis             | 743-31-24     | AST Materials                                 | M&S        | 96                           |
|                   | 743-34-22     | Stratospheric Emissions Impact                | SEI        | 65                           |
|                   | 743-34-11     | Noise Reduction                               | P          | 294                          |
|                   | 743-34-21     | Pollution Reduction                           | ↓          | 250                          |
|                   | 743-34-31     | Inlet Stability System                        | ↓          | 363                          |
|                   | 743-34-41     | Experimental Engine Study                     | ↓          | 1360                         |
|                   | 743-34-51     | Low-Noise Engine Study                        | ↓          | 114                          |
| Total             |               |   |            | 2542                         |
| Langley           | 743-32-01     | Structural Concepts Advanced Configurations   | M&S        | 1054                         |
|                   | 743-32-11     | Structural Design Methods                     | ↓          | 147                          |
|                   | 743-32-12     | Loads and Aeroelastic Technology              | ↓          | 324                          |
|                   | 743-32-13     | Atmospheric Turbulence Measurement Technology | ↓          | 209                          |
|                   | 743-32-21, 22 | Titanium and Composites Technology            | ↓          | 1006                         |
|                   | 743-34-22     | Stratospheric Emissions Impact                | SEI        | 31                           |
|                   | 743-60-01     | Aero Performance System Studies               | SS         | 587                          |
|                   | 743-65-12     | Aero Performance Concepts                     | A          | 54                           |
|                   | 743-65-21     | Aero Performance Theory                       | A          | 0                            |
|                   | 743-65-31     | Sonic Boom                                    | A          | 138                          |
|                   | 743-36-04     | ACT Wind-Tunnel Techniques                    | S&C        | 96                           |
|                   | Total         |   |            |                              |
| DFRC              | 743-32-23     | Materials and Structures Technology           | M&S        | 29                           |
|                   | 743-36-22     | Co-Op Controls                                | S&C        | 624                          |
|                   | 743-34-22     | Stratospheric Emissions Impact                | SEI        | 25                           |
| Total             |               |   |            | 678                          |
| Total (SCR) ..... |               |   |            | 8400                         |

TABLE VII.- Continued

| Center            | RTOP      | Title                               | Discipline | R&D,<br>thousands of dollars |
|-------------------|-----------|-------------------------------------|------------|------------------------------|
| Ames              | 743-01-02 | Fuel Tank Sealants                  | M&S        | 150                          |
|                   | 743-02-22 | Stratospheric Emissions Impact      | SEI        | 230                          |
|                   | 743-03-11 | Propulsion Noise Technology         | P          | 50                           |
|                   | 743-04-11 | Optimum Aero Design                 | A          | 75                           |
|                   | 743-04-21 | Aero Performance Theory             | A          | 95                           |
|                   | 743-05-01 | FLEXSTAB                            | S&C        | 175                          |
|                   | 743-05-11 | Handling Qualities Criteria         | S&C        | 75                           |
|                   | 743-05-12 | Control Systems Mechanization       | S&C        | 0                            |
| Total             |           |                                     |            | 850                          |
| Lewis             | 743-01-24 | Materials                           | M&S        | 100                          |
|                   | 743-02-22 | Stratospheric Emissions Impact      | SEI        | 65                           |
|                   | 743-03-11 | Noise Reduction                     | P          | 743                          |
|                   | 743-03-21 | Pollution Reduction                 | ↓          | 575                          |
|                   | 743-03-31 | Inlet Stability System              | ↓          | 0                            |
|                   | 743-03-41 | Engine Study                        | ↓          | 800                          |
|                   | 743-03-51 | Unique Components Technology        | ↓          | 100                          |
|                   | Total     |                                     |            |                              |
| Langley           | 743-01-01 | Structures Concept Study            | M&S        | 520                          |
|                   | 743-01-11 | Computer-Aided Design               | ↓          | 100                          |
|                   | 743-01-12 | Loads and Aeroelasticity Technology | ↓          | 320                          |
|                   | 743-01-13 | Atmospheric Turbulence              | ↓          | 180                          |
|                   | 743-01-22 | Materials Applications              | ↓          | 880                          |
|                   | 743-02-22 | Stratospheric Emissions Impact      | SEI        | 50                           |
|                   | 743-04-01 | Aero Performance System Studies     | SS         | 1553                         |
|                   | 743-04-12 | Aero Performance Concepts           | A          | 350                          |
|                   | 743-04-21 | Aero Performance Theory             | A          | 150                          |
|                   | 743-04-31 | Sonic Boom                          | A          | 102                          |
|                   | 743-05-04 | ACT Aeroelastic Response            | S&C        | 40                           |
| Total             |           |                                     |            | 4245                         |
| DFRC              | 743-01-23 | Materials and Structures Technology | M&S        | 30                           |
|                   | 743-05-22 | Co-Op Controls                      | S&C        | 225                          |
| Total             |           |                                     |            | 255                          |
| JPL               | 743-02-22 | Stratospheric Emissions Impact      | SEI        | 55                           |
| Total (SCR) ..... |           |                                     |            | 7788                         |

TABLE VII.- Continued

| Center            | RTOP                       | Title                               | Discipline | R&D,<br>thousands of dollars |
|-------------------|----------------------------|-------------------------------------|------------|------------------------------|
| Ames              | 743-01-02                  | Fuel Tank Sealants                  | M&S        | 200                          |
|                   | 743-02-22                  | Stratospheric Emissions Impact      | SEI        | 180                          |
|                   | 743-03-11                  | Propulsion Technology               | P          | 0                            |
|                   | 743-04-21                  | Aero Performance Theory             | A          | 75                           |
| Total             |                            |                                     |            | 455                          |
| Lewis             | 743-03-11                  | Noise Reduction Technology          | P          | 170                          |
|                   | 743-03-21                  | Pollution Reduction                 | ↓          | 290                          |
|                   | 743-03-31                  | Inlet Stability System              |            | 0                            |
|                   | 743-03-41                  | Engine Study                        |            | 820                          |
|                   | 743-03-51                  | Unique Components Technology        | ↓          | 500                          |
| Total             |                            |                                     |            | 1780                         |
| Langley           | 743-01-01                  | Structural Concepts                 | M&S        | 550                          |
|                   | 743-01-11                  | Computer-Aided Design               | ↓          | 160                          |
|                   | 743-01-12                  | Loads and Aeroelasticity Technology |            | 300                          |
|                   | 743-01-13                  | Atmospheric Turbulence              |            | 145                          |
|                   | 743-01-22                  | Materials Applications              | ↓          | 720                          |
|                   | 743-02-22                  | Stratospheric Emissions Impact      | SEI        | 25                           |
|                   | 743-04-01                  | Aero Performance System Studies     | SS         | 1465                         |
|                   | 743-04-12                  | Aero Performance Concepts           | A          | 534                          |
|                   | 743-04-21                  | Aero Performance Theory             | A          | 71                           |
|                   | 743-04-31                  | Sonic Boom                          | A          | 42                           |
|                   | 743-05-04                  | ACT Aeroelastic Response            | S&C        | 40                           |
| 743-05-31         | Active Flutter Suppression | S&C                                 | 99         |                              |
| Total             |                            |                                     |            | 4151                         |
| DFRC              | 743-01-23                  | Materials and Structures Technology | M&S        | 30                           |
|                   | 743-05-22                  | Co-Op Controls                      | S&C        | 400                          |
| Total             |                            |                                     |            | 430                          |
| Total (SCR) ..... |                            |                                     |            | 6816                         |
| Lewis             | 511-56-01                  | Variable-Cycle Engine Program       | VCE        | 740                          |

PY 1976 Transition (7T)

TABLE VII.- Continued

| Center            | RTOP                       | Title                               | Discipline | R&D,<br>thousands of dollars |      |
|-------------------|----------------------------|-------------------------------------|------------|------------------------------|------|
| Ames              | 743-01-02                  | Fuel Tank Sealants                  | M&S        | 30                           |      |
|                   | 743-02-22                  | Stratospheric Emissions Impact      | SEI        | 0                            |      |
| Total             |                            |                                     |            | 30                           |      |
| Lewis             | 743-03-11                  | Noise Reduction Technology          | P<br>↓     | 0                            |      |
|                   | 743-03-21                  | Pollution Reduction                 |            | 0                            |      |
|                   | 743-03-31                  | Inlet Stability System              |            | 0                            |      |
|                   | 743-03-41                  | Engine Study                        |            | 0                            |      |
|                   | 743-03-51                  | Unique Component Technology         |            | 300                          |      |
| Total             |                            |                                     |            | 300                          |      |
| Langley           | 743-01-01                  | Structural Concepts                 | M&S<br>↓   | 50                           |      |
|                   | 743-01-11                  | Computer-Aided Design               |            | 0                            |      |
|                   | 743-01-12                  | Loads and Aeroelastic Technology    |            | 0                            |      |
|                   | 743-01-13                  | Atmospheric Turbulence              |            | 30                           |      |
|                   | 743-01-22                  | Materials Application               |            | 120                          |      |
|                   | 743-04-01                  | Aero Performance System Studies     |            | SS                           | 1070 |
|                   | 743-04-12                  | Aero Performance Concepts           |            | A                            | 0    |
|                   | 743-04-21                  | Aero Performance Theory             |            | A                            | 0    |
|                   | 743-04-31                  | Sonic Boom                          |            | A                            | 0    |
|                   | 743-05-04                  | ACT Aeroelastic Response            |            | S&C                          | 0    |
| 743-05-31         | Active Flutter Suppression | S&C                                 | 0          |                              |      |
| Total             |                            |                                     |            | 1270                         |      |
| DFRC              | 743-01-23                  | Materials and Structures Technology | M&S        | 0                            |      |
|                   | 743-05-22                  | Co-Op Controls                      | S&C        | 100                          |      |
| Total             |                            |                                     |            | 100                          |      |
| Total (SCR) ..... |                            |                                     |            | 1700                         |      |
| Lewis             | 511-56-01                  | Variable-Cycle Engine Program       | VCE        | 300                          |      |

TABLE VII.- Continued

| Center            | RTOP      | Title                               | Discipline | R&D,<br>thousands of dollars |
|-------------------|-----------|-------------------------------------|------------|------------------------------|
| Ames              | 743-01-02 | Fuel Tank Sealants                  | M&S        | 200                          |
|                   | 743-02-22 | Jet Wakes                           | SEI        | 0                            |
| Total             |           |                                     |            | 200                          |
| Lewis             | 743-03-11 | Noise Reduction Technology          | P          | 0                            |
|                   | 743-03-21 | Pollution Reduction                 | ↓          | 400                          |
|                   | 743-03-31 | Inlet Stability System              |            | 0                            |
|                   | 743-03-51 | Unique Component Technology         |            | 300                          |
| Total             |           |                                     |            | 700                          |
| Langley           | 743-01-01 | Structural Concepts                 | M&S        | 200                          |
|                   | 743-01-11 | Computer-Aided Design               | ↓          | 125                          |
|                   | 743-01-12 | Loads and Aeroelastic Technology    |            | 200                          |
|                   | 743-01-13 | Atmospheric Turbulence              |            | 100                          |
|                   | 743-01-22 | Materials Application               | ↓          | 615                          |
|                   | 743-04-01 | Aero Performance System Studies     | SS         | 2930                         |
|                   | 743-04-12 | Aero Performance Concepts           | A          | 140                          |
|                   | 743-04-21 | Aero Performance Theory             | A          | 150                          |
|                   | 743-04-31 | Sonic Boom                          | A          | 0                            |
|                   | 743-05-04 | ACT Aeroelastic Response            | S&C        | 100                          |
|                   | 743-05-31 | Arrow Wing Flutter Suppression      | S&C        | 0                            |
| Total             |           |                                     |            | 4560                         |
| DFRC              | 743-01-23 | Materials and Structures Technology | M&S        | 40                           |
|                   | 743-05-22 | Co-Op Controls                      | S&C        | 500                          |
| Total             |           |                                     |            | 540                          |
| Total (SCR) ..... |           |                                     |            | 6000                         |
| Lewis             | 511-56-01 | Variable-Cycle Engine Program       | VCE        | 3100                         |

TABLE VII.- Continued

| Center            | RTOP                                | Title  | Discipline          | R&D,<br>thousands of dollars |
|-------------------|-------------------------------------|--|---------------------|------------------------------|
| Ames              | 743-01-02                           | Fuel Tank Sealants   | M&S                 | 200                          |
| Lewis             | 743-03-22                           | SCAR Propulsion Technology   | P                   | 900                          |
| Langley           | 743-01-03<br>743-04-13<br>743-05-03 | Materials and Structures Technology<br>Aero Performance Technology<br>ACT Aeroelastic Response | M&S<br>A, SS<br>S&C | 2050<br>4150<br>100          |
| Total             |                                     |  |                     | 6300                         |
| DFRC              | 743-01-04<br>743-05-04              | Materials and Structures Technology<br>Stability and Control Technology                        | M&S<br>S&C          | 50<br>50                     |
| Total             |                                     |  |                     | 100                          |
| Total (SCR) ..... |                                     |  |                     | 7500                         |
| Lewis             | 511-56-01                           | Variable-Cycle Engine Program  | VCE                 | 6030                         |

TABLE VII.- Continued

| Center            | RTOP      | Title                                    | Discipline | R&D,<br>thousands of dollars |
|-------------------|-----------|--|------------|------------------------------|
| Ames              | 517-53-11 | Fuel Tank Sealants                       | M&S        | 250                          |
| Lewis             | 517-53-32 | Propulsion Technology                    | P          | 976                          |
|                   | 517-53-62 | Propulsion Airframe Integration          | P          | 330                          |
| Total             |           |  |            | 1306                         |
| Langley           | 517-53-13 | Materials and Structures Technology      | M&S        | 1700                         |
|                   | 517-53-43 | Aero Performance Technology              | A, SS      | 3920                         |
|                   | 517-53-63 | Airframe Propulsion System Interaction   | P          | 330                          |
| Total             |           |  |            | 5950                         |
| DFRC              | 517-53-14 | Materials and Structures Flight Research | M&S        | 200                          |
| Total (SCR) ..... |           |  |            | 7706                         |
| Lewis             | 511-56-02 | Variable-Cycle Engine Program            | VCE        | 6792                         |



TABLE VII.- Continued

| Center            | RTOP      | Title                                  | Discipline | R&D,<br>thousands of dollars |
|-------------------|-----------|--|------------|------------------------------|
| Ames              | 533-01-11 | Materials and Structures Technology    | M&S        | 150                          |
| Lewis             | 533-01-32 | Propulsion Technology                  | P          | 900                          |
|                   | 533-01-62 | Propulsion System Airframe Integration | P          | 640                          |
| Total             |           |  |            | 1540                         |
| Langley           | 533-01-13 | Materials and Structures Technology    | M&S        | 1700                         |
|                   | 533-01-43 | Aero Performance Technology            | A, SS      | 4585                         |
|                   | 533-01-63 | Propulsion System Airframe Integration | P          | 400                          |
| Total             |           |  |            | 6685                         |
| DFRC              | 533-01-14 | Materials and Structures Technology    | M&S        | 21                           |
| Total (SCR) ..... |           |  |            | 8396                         |
| Lewis             | 535-02-12 | Variable-Cycle Engine Technology       | VCE        | 7915                         |

TABLE VII.- Concluded

| Center            | RTOP      | Title                                  | Discipline | R&D,<br>thousands of dollars |
|-------------------|-----------|--|------------|------------------------------|
| Ames              | 533-01-11 | Materials and Structures Technology    | M&S        | 186                          |
| Lewis             | 533-01-32 | Propulsion Technology                  | P          | 900                          |
|                   | 533-01-62 | Propulsion System Airframe Integration | P          | 600                          |
| Total             |           |  |            | 1500                         |
| Langley           | 533-01-13 | Materials and Structures Technology    | M&S        | 1700                         |
|                   | 533-01-43 | Aero Performance Technology            | A, SS      | 4322                         |
|                   | 533-01-63 | Propulsion System Airframe Integration | P          | 265                          |
| Total             |           |  |            | 6287                         |
| DFRC              | 533-01-14 | Materials and Structures Technology    | M&S        | 638                          |
| Total (SCR) ..... |           |  |            | 8611                         |
| Lewis             | 535-02-12 | Variable-Cycle Engine Technology       | VCE        | <sup>a</sup> 6300            |

<sup>a</sup>Reduced to 5117 on 6/30/82, and reduced again to 4980 on 9/30/82 during closeout in FY 1982.







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| 16. Abstract<br><br>The NASA-SCAR (AST) program was initiated in 1972 at the direct request of the Executive Office of the White House and Congress following termination of the U.S. SST program. The purpose of SCR was to conduct a focused research and technology program on those technology problems which contributed to the SST termination and, also, to provide an expanded data base for future civil and military supersonic transport aircraft. Funding for the Supersonic Cruise Research (SCR) Program was initiated in fiscal year 1973 and terminated in fiscal year 1981. The program was implemented through contracts and grants with industry, universities, and by in-house investigations at the NASA/OAST centers. The studies included system studies and five disciplines: propulsion, stratospheric emissions impact, materials and structures, aerodynamic performance, and stability and control. The NASA/Lewis Variable-Cycle Engine (VCE) Component Program was initiated in 1976 to augment the SCR program in the area of propulsion. After about 2 years, the title was changed to VCE Technology Program. The total number of contractors and grantees on record at the AST office in 1982 was 101 for SCR and 4 for VCE. This paper presents a compilation of all the contracts and grants as well as the funding summaries for both programs. |  |   |   |
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