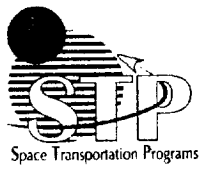


Monthly Technical Progress Report No. 26

Contract NAS8-99060
NRA 8-21

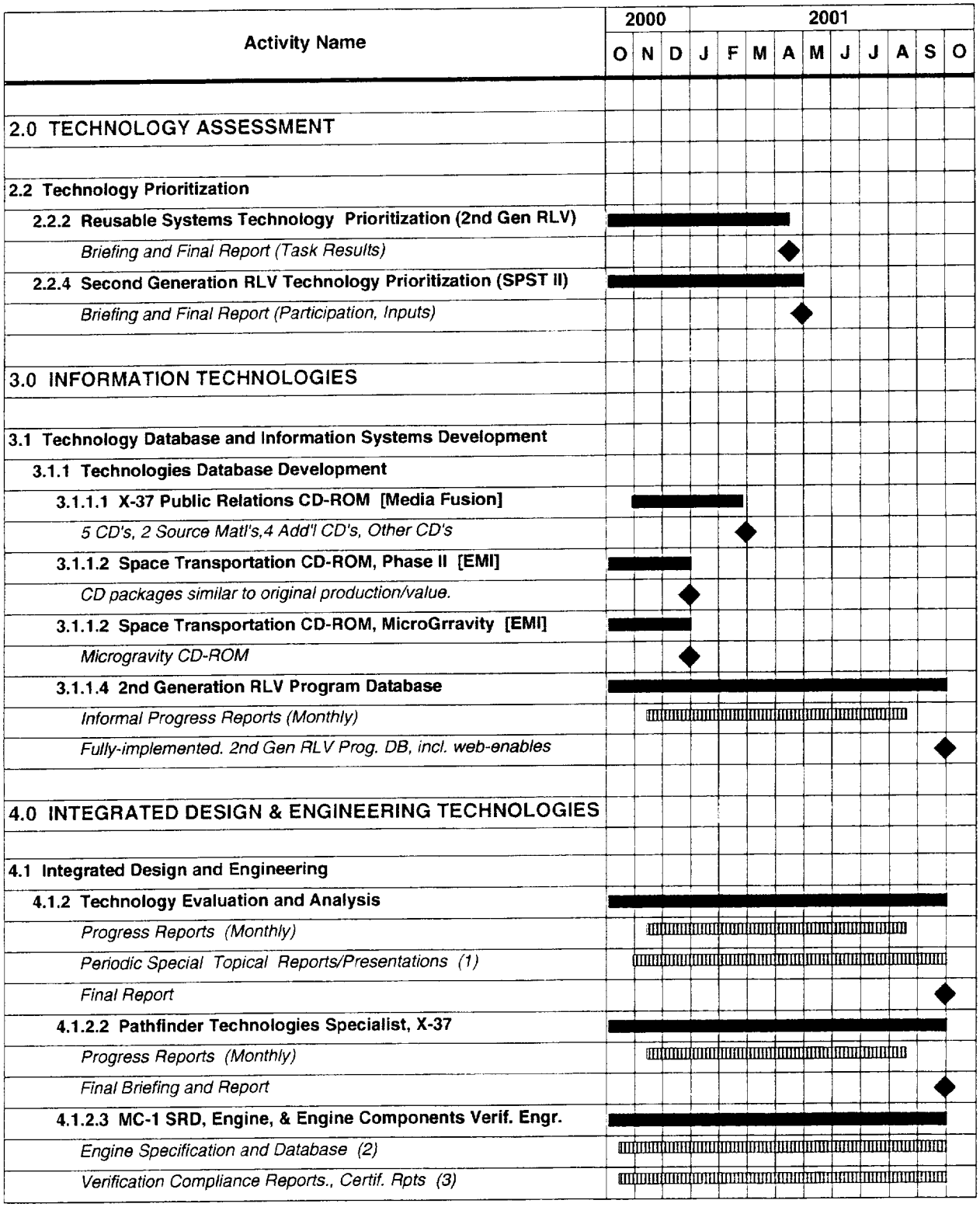
Report No. NAS8-99060-MPR026

For the Reporting Period

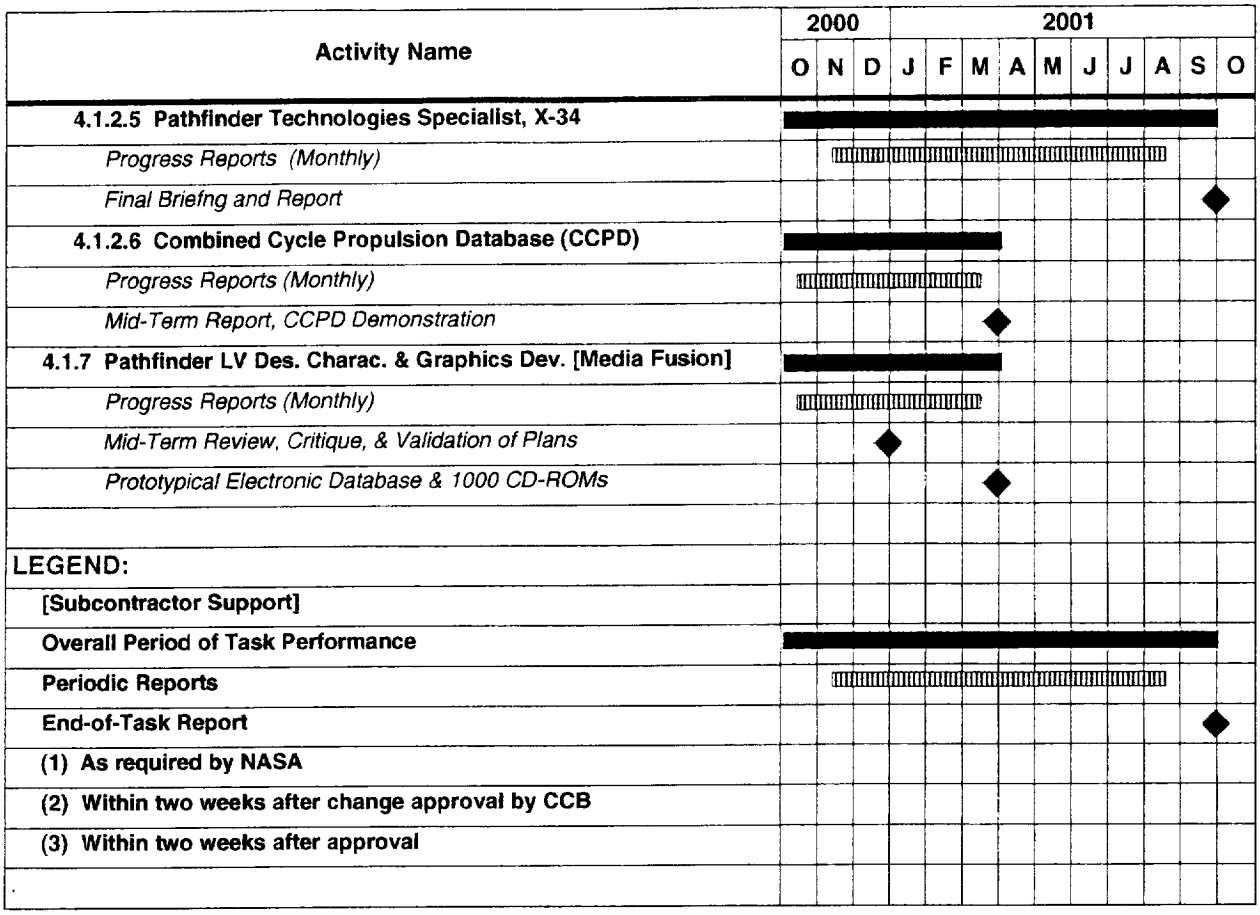
January 20, 2001
through
February 16, 2001

1.0 OVERALL TASK SCHEDULE:

CONTRACT NAS8-99060 - OVERALL TASK/DELIVERABLES SCHEDULE (Year Three)



CONTRACT NAS8-99060 - OVERALL TASK/DELIVERABLES SCHEDULE (Year Three)



2.0 TECHNOLOGY ASSESSMENT

2.1 TECHNOLOGY ASSESSMENT

2.2 TECHNOLOGY PRIORITIZATION

2.2.2 Reusable Systems Technology Prioritization (2nd Gen RLV)

Progress Description: Because of the competitive NRA proposal evaluations at MSFC, the technology prioritization activity specifically for the Second Generation RLV Program continues to be limited. SAIC has continued to develop and assess processes and approaches that can be applied to Second Generation RLV technologies prioritization. A new approach based on the use of analytic Saaty scale functions has been defined, and is being investigated. This approach enables the use of systems analysis data for given Second Generation RLV system concepts to be translated directly into inputs to the Analytic Hierarchy Process algorithm for determination of technology priorities.

Current Problems: None identified.

Proposed Corrective Action(s): None required at this time.

Work Plan for Next Period: The development of processes for technologies prioritization support of the Second Generation RLV program will be continued as planned.

2.2.4 Second Generation RLV Technology Prioritization (SPST II)

Progress Description: During this reporting period, SAIC has continued to provide key leadership to the national Space Propulsion Synergy Team (SPST) in tasks that will enable future technologies prioritization support of the Second Generation RLV program. These tasks include the planning and facilitation of technologies prioritization workshops, support of the development of systems program algorithms based on the concept of influence diagramming, and the assessment of analogies between aircraft and space systems developments. Plans are being made to provide full progress reports at the next national SPST meeting scheduled to be held at Huntsville on April 10, 2001.

Current Problems: None have been identified.

Proposed Corrective Action(s): None required at this time.

Work Plan for Next Period: SAIC will continue to work with the SPST to plan the required support of the Second Generation RLV program.

3.1 TECHNOLOGY DATABASE AND INFORMATION SYSTEM DEV.

3.1.1.1 X-37 Public Relations CD-ROM (Media Fusion)

Progress Description: Video interviews were held with X-37 personnel at the Dryden Flight Research Center (DFRC). The CD-ROM work is being concluded and a near-final review disc is expected within the next week or so, following a small change in the launch configuration.

Current Problems: None.

Work Planned for Next Period: As related above.

3.1.1.2 Space Transportation CD-ROMs (EMI)

Progress Description: Two tasks under WBS 3.1.1.2 of this contract, "Space Transportation CD-ROM, Phase II (New Horizons)" and "Space Transportation CD-ROM, Microgravity", were completed by Engineered Multimedia, Inc. (EMI) under subcontract to SAIC.

The CD-ROM products associated with these deliverables were completed on schedule and delivery was effected along with a demonstration briefing to NASA/MSFC representatives on January 18, 2001, at SAIC. Advance review copies of the CD-ROMs were provided to the NASA Technical Leads, Mr. Dennis Smith (New Horizons) and Mr. Dan Woodard (Microgravity) prior to the meeting.

Current Problems: None.

Work Planned for Next Period: Changes and/or enhancements to these CD-ROM products are pending further interest on the part of NASA/MSFC.

WBS 3.1.1.4 2nd Generation RLV Program Database

Progress Description;

- Supporting the NRA 8-30 Source Selection Board.

Current Problems: N/A

4.1 INTEGRATED DESIGN AND ENGINEERING

4.1.2 Technology Evaluation and Analysis (CCP Technology)

Progress Description:

Combined-Cycle Propulsion Database (CCPD) Planning Activities – At present, support for the CCPD under this contract ends on 31 March, at the completion of the 6-month Phase 2 effort. Working with the ASTP point of contact, Mr. Eric Hyde, a Phase 3 continuation effort has been planned with emphasis on expanding the technical information content of this Database. This plan is to be presented to the ASTP office shortly, at which time the CCPD's implications to ITAC may also be covered.

Aviation Analog for Spaceflight (SPST) Task Team – This Team met at SAIC on 6 & 7 February to prepare its interim report, as organized by Pete Mitchell, team lead. The report was presented to several MSFC ASTP personnel on the afternoon of the 7th. The rough draft format has been recast by SAIC (W. Escher) into a finished presentation brochure: "Aviation/Space Analog Team Interim Report." Copies have been provided to the Team members and to the NASA personnel who were briefed. The Team's effort will be wrapped up with a mid-April set of presentations to both MSFC and the full SPST.

U.S. Air Force Launch Operations Technology Planning IPT Effort – Continuing to follow up ITAC interests in Gen3 RLV systems and technologies as these might be applied to DoD mission needs, the extended launch-system concept paper noted in last month's report was further expanded and forwarded to the Air Force Space & Missile Center. The subject is a CCP-powered SSTO Vertical-Ops Spacelifter concept. The requested Mission Needs (Section 3) addendum was complete, per the specified template provided. Coordination of these inputs with the ASTP office continues.

Videotape Presentation of Combined Airbreathing/Rocket Propulsion Subjects – Work continues at low level on the existing video workprint, "Back to the Future," toward a possible revised and expanded version highlighting more recent progress under the ASTP ART and ISTAR initiatives. The original script has now been edited in this direction.

Current Problems: None Identified

Proposed Corrective Action(s): No corrective actions are required at this time.

Work Plan for Next Period: In-hand documents will be completely processed with additional abstracts, perspective and synopsis write-ups being prepared. Based on decisions to be made by the ASTP office momentarily, plans for the post-March activity will be firmed up. An MSFC/SAIC document-gathering trip to the Dayton area is planned. Actions regarding holdings at the NASA Langley Center will also be pursued.

Continuing support of ITAC, the SPST and the Air Force TPITP effort will be followed on. A set of meetings and presentations are to be held in the early April timeframe.

4.1.2.2 Pathfinder Technologies Specialist, X-37

Progress Description:

Program -- With the program in a phase of reconsidering costs, schedule, etc., it may be time to think about the validity of the B-52 test. The B-52 flights are driving the program very hard in many areas and costing substantial amounts of money. It might be well to consider what the B-52 flights provide in return for the cost and difficulty. Compared to the helicopter drop, the B-52 offers higher altitude (more flight time) and a higher Mach number. While this is all to the good, it is worth considering that the flight is still subsonic. It is not clear that the higher subsonic Mach number tells us a lot. In most vehicles, the major uncertainty is in the transonic regime, say Mach 0.8 to 1.5. Early in the program, it was planned to do powered flights off the B-52 to explore the transonic regime. However, this was dropped for cost reasons and only the glide flights were left. It is not clear that the B-52 flights really reduce risk much. (JRF, 1/20/01). The B-52 flights get close to the lower end of the transonic regime but do not reach the real conditions of interest. The B-52 drops do provide information on flare and touchdown but those data could be obtained on a helicopter drop test (like X-40A), a much cheaper and simpler operation that would not impact vehicle structure as the B-52 loads do. The greater altitude, longer flight time and higher speed of the B-52 tests allow the X-37 to fly the Heading Alignment Circle (HAC). Recommend that eliminating the B-52 flights in favor of alternate approaches be evaluated. (JRF, 2/3/01)

Propulsion -- The Boeing propulsion team is working with MSFC to define what they are calling a "Global Solution" to all the issues involved in using hydrogen peroxide in the Shuttle payload bay. These issues include materials compatibility, adiabatic compression-induced detonation, and other safety related issues. (JRF, 1/20/01) The expected delay in the main engine program is causing some uncertainty in the schedule for the Brassboard Propulsion test article. That system was predicated upon the use of the refurbished Qualification engine. If that engine is delayed, the future or at least the schedule for the Brassboard is very uncertain. The RCS system is generally going well. The only significant problem in the past few weeks was the discovery that a required change to the thruster valves had not been made. (JRF, 2/3/01) The discussions of the Brassboard test article at the recent TIM at MSFC clearly indicate the importance of that item. This is especially true since the Brassboard activity is defined as including a number of smaller preliminary tests. One issue that was raised involves the possibility of eliminating the AR2-3 main engine in favor of additional, perhaps larger, hydrogen peroxide axial thrusters. The Tiger team on hydrogen peroxide compatibility seems a good thing and seems to be well run. The investigation of adiabatic compression detonation (ADC) that they propose is worth doing. (JRF, 2/10/01)

Structure -- Repair work continues on the lower fuselage section, in the areas that experienced core collapse, as previously discussed. Other parts, notably the avionics cover on the back of the vehicle and other skin parts on the upper portion have been scrapped due to core collapse as well. Boeing is giving up on the light-weight core and going to a heavier core in critical areas. This will result in some delays in delivery of the new parts. It is planned to deliver the fuselage structure on 30 May. This is contingent upon a successful repair of the lower fuselage. If a new one has to be made, a six month delay is predicted. Most of the upper fuselage being fabricated now is to support the B-52 tests. (JRF, 1/20/01) Repair of this fuselage section is the longest pole in the technical schedule right now but, given the probable schedule stretch out due to funding problems, the repair will probably not be an issue. (JRF, 2/3/01)

Weight -- The current weight estimate shows 6636 lbs., about 160 lbs. below the limit that can be achieved with placards on vehicle operation. The currently catalogued potential weight increases and decreases are about equal. However, this does not include the impact of the cable weight underestimate reported previously. Fiberoptics has been suggested & would save a great deal of weight, but it is a bit late for changes of that magnitude. (JRF, 2/3/01)

Flight Sciences -- This area continues to be one of the most successful on the program. Wind tunnel testing at Ames Research Center is complete as is the Mach 10 RCS testing on Tunnel C at AEDC. Data continue to look good. The CFD for RCS testing correlates well with the tunnel data. The next tunnel entry is scheduled for April in the Polysonic tunnel. The purpose of these tests will be to deal with details such as hinges, control surface gaps, etc. This will conclude the currently planned wind tunnel tests. (JRF, 2/3/01)

4.1.2.3 MC-1 Engine Verification

Progress Description: The Level IV CCB approved SCN-4 to the MC-1 Engine Specification on 13 Feb 01. Approved changes have been incorporated into the specification and Revision D has been released to the Repository. The MC-1 Valve specifications (10 each) Screening Group comments continue to be incorporated. Billy Gonterman traveled to Stennis Test Center (SSC) to support a five day readiness assessment of progress on the activation of the MC-1 E2Cell 2 test facilities, shop areas, and resident office. Photographs were taken and brought back to MSFC to provide additional information to the MC-1 team.

Implemented modifications to the MC-1 Engine TPA Component Database. List of modifications made: changed open script, streamlined screen layouts and reports, changed color scheme, deleted unnecessary layouts and data fields, modified document tracking numbers and dates to include global information allowing for cascade updates. This brings the total of converted databases to four out of five. The following component databases have been completed and reset on the server: MC-1 Main Igniter, MC-1 Nozzle, MC-1 Injector and MC-1 TPA.

Current Problems: None.

Work Planned for Next Period: Updating of MC-1documents will continue. The MC-1 Valve specifications (10 each) will continue to be worked this period. The MC-1 Turbopump specification will be completed and submitted to the Screening Board for review. Work will continue on developing detailed verification plans for each engine specification requirement. Incorporate modifications to the MC-1 Gas Generator Igniter component database, thus completing the component databases conversion process.

4.1.2.5 Pathfinder Technologies Specialist, X-34

Progress Description:

No significant activity other than telecons with the Project Office and WSTF personnel. (JRF, 2/3/01)

Work Planned for Next Period: Continue to assist with issues of overall system design, test, and operation of the X-34 and Second Generation Pathfinder vehicles.

4.1.2.6 Combined-Cycle Propulsion Database (CCPD)

Progress Description:

- Replaced 25 documents on the server that were modified to meet quality control standards. These documents were than re-indexed to include them in the search process.
- Modified the log-on screen to include a direct email link to Annie Tucker for users to contact when they have logon difficulties (i.e. forgot logon ID or password).
- Prepared a summary CCPD presentation describing development phases I, II (current), and III (proposed). A meeting with Garry Lyles and Steve Cook has been scheduled for 2/26/01 to review the aforementioned presentation and to discuss the funding possibilities for Phase III that extends the current period-of-performance by six months (9/30/01).
- Added additional users per Eric Hyde's direction. The CCPD now has a total of 25 users. Most recent additions were Tim Olive and George Young. A complete listing of CCPD users is listed below. Uwe Hueter (TD15), Craig McArthur (TD15), Steve Cook (TD15), Tim Lawrence (ED34), Tim Olive (TD53), George Young (TD20), Richard Tyson (TD15), Eric Christensen (SAIC ITAC), Bill P. Pannell (TD15), Bill Anderson (TD61), Jason Quinn (TD51), Mike Fazah (TD51), Scott Jackson (TD51), Lance Moore (TD15), Garry Lyles (TD15), Frank Curran (SAIC ITAC), John Hutt (TD15), Karl Nelson (TD51), Eric Hyde (TD15), Annie Tucker (SAIC), Matt Homan (SAIC),

Jordan Roddy (SAIC), Howie Lester (SAIC), Mary Heck (SAIC), Daric Escher (SAIC ITAC).

- Continuing to correct and improve the quality of each document per the comments section of "Rework" Excel Spreadsheet.

Current Problems:

- Phase II funding did not include travel or labor dollars for Bill Escher/SAIC. Mr. Escher has identified several key locations that need to be visited in order to capture valuable CCP data before it is destroyed. The locations include: AFRL-WPAFB; AFRL-EAFB; and NASA Centers LaRC, DRFC, and GRC.

Proposed Corrective Action:

- SAIC has proposed in Phase III the necessary funding to allow Mr. Escher to both plan and make the trips identified.

Work Planed for Next Period:

- Have begun processing ~50 additional documents to be included into the CCPD. Have started the process of scanning and OCR'ing these documents. Will begin creating cut sheets and cover sheets for these documents.
- Continue Web server administration functions.
- Continue making progress on making QA modifications to existing documents.
- If CCPD Phase III funding is approved, SAIC will begin firming up data collections trips.

4.1.7 Pathfinder Launch Vehicle

Progress Description: A milestone deliverable, "WBS 4.1.7 - Mid-term Review, Critique, and Validation of Plans" was completed by Media Fusion under its subcontract to SAIC. This deliverable, provided to MSFC, is a document that outlines content structure for the final deliverable, due March 31, 2001.

Current Problems: None.

Work Planned for Next Period: Continue work leading to the final product that is due on March 31, 2001.

13. ABSTRACT (Continued)

- Continued to develop and assess processes and approaches that can be applied to Second Generation RLV technologies prioritization. An approach based on the use of analytic Saaty scale functions has been defined and is being investigated. (2.2.2)

- Planned and facilitated technologies prioritization workshops, supported development of systems program algorithms based on the concept of influence diagramming, and assessment of analogies between aircraft and space systems developments. (2.2.4)

- Video interviews held with X-37 personnel at Dryden. The CD-ROM is being concluded and a near-final review disc is expected soon. (3.1.1.1)

- CD-ROMs were produced by Engineered Multimedia, Inc. (EMI) under subcontract to SAIC. These two CD-ROM products, "Microgravity" and "New Horizons", were delivered to MSFC technical representatives at a briefing at SAIC on January 18, 2001. (3.1.1.2)

- Presentation brochure, "Aviation/Space Analog Team Interim Report" was provided to Space Propulsion Synergy Team (SPST) members and to NASA personnel. Wrap-up of effort will be a mid-April briefing to both MSFC and the full SPST membership. Support to Phase 2 of CCPD ends 3/31/01. Phase 3 continuation effort planned with emphasis on technical info content. (4.1.2)

- Recommended that eliminating the B-52 flights of the X-37 in favor of alternate approaches be evaluated. Discovered that a required change to the thruster valves of the X-37 had not been made. Repair work continues on the lower fuselage section of the X-37, in the areas that experienced core collapse. The currently catalogued potential weight increases and decreases are about equal, but this does not include the impact of the cable weight underestimate reported earlier. The CFD for RCS testing correlates well with the wind tunnel data. (4.1.2.2)

- The Level IV CCB approved SCN-4 to the MC-1 Engine Specification. Approved changes have been incorporated into the specification, and Revision D has been released to the Repository. Billy Gonterman, SAIC, traveled to SSC to perform a five-day readiness assessment on the progress of facilities activation. Implemented modifications to the MC-1 Engine TPA Component Database. (4.1.2.3)

- Replaced 25 Combined-Cycle Propulsion Database (CCPD) documents; modified the low-on screen to include a direct email link for user contact; prepared a summary presentation of current and proposed tasks. (4.1.2.6)

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13. ABSTRACT *(Maximum 200 Words)*

During this twenty-sixth reporting period, January 20, 2001 through February 16, 2001, SAIC made significant accomplishments that are summarized on the following page.

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