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FINAL REPORT

on

REVIEW OF INDUSTRY INTEREST IN SPACE PROCESSING

(Report No. BCL-OA-TFR-78-2)

by

J. R. McDowell

Sponsored by

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INTRODUCTION

The National Aeronautics and Space Agency has, over a period of 12 years, explored the phenomenon of weightlessness in space on materials processes. NASA's Materials Processing in Space (MPS) Program originated in 1966 to investigate the behavior and potential benefits of materials undergoing physical and chemical changes in the near zero-g environment. Materials processing experiments have been conducted on manned space flights originating with Apollo 14. Experimentation and science demonstrations were continued on Skylab missions and the joint U.S. Soviet Apollo-Soyuz Test Project (ASTP). In addition to manned flights, several sounding rocket flights have been used to conduct research on certain physical and chemical processes in materials.

The MPS Program, through the development of space research facilities and sponsorship of experimentation, encourages basic research in materials processing for the purpose of acquiring increased knowledge in this field of science and technology. In addition, by providing demonstration products made in space, the program intends to stimulate an increasing degree of private industry investment and participation. Processing of materials in space offers intriguing opportunities for industry. The Space Shuttle and the Spacelab will provide routine access to the space environment to support the ultimate goal of commercializing products manufactured in space.

Although materials processing in space is considered by many to be in an exploratory stage, with significant potentials for industrial applications, there is limited interest and actual involvement by industry (especially the non-aerospace industry) at the present time. In view of This situation, NASA had Arthur D. Little, Inc., of Cambridge, Massachusetts, conduct a survey to determine industry interest in materials processing in

space. The survey involved a series of interviews with personnel from a group of U.S. corporations that NASA considers as likely candidates for using the research facilities and capabilities for materials processing in space utilizing NASA's Space Transportation System.

The survey was conducted by A. D. Little (ADL) under a subcontract to Battelle's Columbus Laboratories as Task No. 20 of Battelle's Applications Studies/New Initiatives contract with NASA (Contract No. NASw-2800). While Battelle provided contractual direction for the ADL effort, technical direction to ADL was provided by NASA. This Task Final Report documents the survey by providing a brief summary as to how it was conducted and the organizations interviewed. The ADL final report on the survey was submitted directly to NASA and is not included in this Task Report.

SURVEY APPROACH

The primary objective of the subject survey was to assess the extent of current interest on the part of selected U.S. corporations in using the research facilities and capabilities for materials processing in space utilizing the Space Shuttle. A secondary objective was to evaluate the effectiveness of the interview techniques as a method for gaining insight into the complex array of issues related to materials processing in space.

The survey, conducted by Arthur D. Little, Inc. (ADL), was intended as a random sample of individuals, representing industry, who were currently or had been involved in materials processing in space. The survey, as a sample, was intended to be the first step of a much broader and more in-depth survey as a follow-on task.

The list of organizations to contact for interviews was provided to ADL by NASA. There was no intent to limit the organizations interviewed to particular industry sectors nor was there any intent to exclude any specific industry. In most cases, the NASA list identified an individual name to contact. In some cases, ADL found that the name led to another, more appropriate, individual in the organization. The organizations interviewed by ADL are as follows:

- Bell Telephone Laboratories
- General Electric Company
- Grumman Aerospace Corporation
- IBM Corporation
- Martin-Marietta Aerospace
- Owens-Illinois
- RCA Laboratories
- S. H. Gelles, Associates
- TRW, Inc.
- Westinghouse Research Laboratory
- Wyeth Laboratories, Inc.

ADL has not listed the names of individuals interviewed, since they told these people that any information provided would be accurately reported to NASA, but that interviewee identifications would not be revealed. Further, the company identification, in most cases, is at the corporate level, since an operating division and location identification might tend to correlate informational responses to a specific individual.

The people interviewed, in most cases, were space processing principal investigators (PI) or potential PIs. One or two R&D managers or managers of R&D sections were interviewed. In some cases a group meeting was held. All those interviewed were knowledgeable of the Space Shuttle, the space program and space processing. The interviewees expressed personal views, and it was assumed by ADL that they accurately reflected their respective company's views. Verification of this assumption would be intended as part of a follow-on survey.

Prior to or during the interview, ADL did not provide prepared material or questionnaires nor did they make a statement on NASA's behalf relative to the manufacturing in space program. The interview was simply initiated by a request to discuss views on the extent of current interest on the part of each organization in the NASA program. Again, each individual interviewed was promised that his name would not be released nor would remarks generally or specifically be correlated to a particular company or industry sector.

SURVEY RESULTS

The principal industry views found by A. D. Little, Inc., based on the limited sample described above, are summarized below:

- The space materials processing program is at the basic research level -- at least 15 years away from practical commercial applications.
- The program has suffered from a lack of coherent direction. Quality has been lacking, and there have been too many changes in direction; pressure for a breakthrough has been counterproductive.
- Support for the program seems to come only from those persons and organizations who hope to get NASA funding.
- Some interest has been shown by non-aerospace industry to the extent of keeping informed about progress in space processing so as to not be left behind.
- Non-aerospace industry is unlikely to use space for full-scale manufacturing in the near future. Once industry is satisfied that (a) there are potential benefits and (b) proprietary interinterests will be protected, then research, engineering feasiability and pilot plant operation can be envisioned.
- Industry invests only a small portion of its R&D funding in basic research. Within those research expenditures, space research gets little attention because the risk is high, there are numerous technical, legal and administrative problems as well as danger of loss of intellectual property, and the payback period is so long that other investments are more attractive.
- Calling the current activities "space manufacturing" has been an irritant to informed persons in industry.
- Industry does not feel it should irvest time convincing NASA of the above points.

Additional background, together with some quotations from persons interviewed, are included in the initial informal report to NASA by A. D. Little.*

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* Letter from C.E.M. Johnson of A. D. Little, Inc., to Bradford Johnson, NASA Associate Administrator for Applications, June 15, 1977.