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EDUCATIONAL SYNERGISM IN THE SPACE AND MISSILE INDUSTRY

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Summary

Any synergistic relationship results in accomplishment of objectives by each participant greater than individual effort, and total accomplishment otherwise impossible. There is nothing new about the synergistic relationship. We see it occasionally in nature, in family life, and in the field of marketing. In time of national emergency it flowers, and vast efforts are integrated to produce B-29s, atom bombs, space or oceanographic programs. In one sense synergy can be compared to alloying of metals where the resultant alloy has properties superior to the base metal or any of its additives. If the concept of synergy proves productive of stronger, improved, and more versatile material products, why cannot synergy be applied to education?¹

This paper will show that synergism works. It will provide some guidelines for a synergistic approach.

Now is the time to apply these synergistic principles to education in the missile and space industry. We have everything to gain and nothing to lose if we cut across company and institutional lines, on a voluntary basis, to examine all of the islands of synergistic success. Let us share those that appeal to us, and harness them to develop our only true national asset, our human resources.

Overview

Dr. Koch has given you an example of educational synergism where a junior college and a hospital were welded together. I will present an account of the synergistic relationship existing between Brevard Junior College and NASA, the Air Force, the space contractors and technical societies. I will outline our philosophy and indicate the direction in which I think we should go.

Mr. Stein will expand on this from the point of view of industry and propose a program that would involve a synergistic relationship between colleges.

Mr. D'Braunstein has a videotape presentation on the extensive manpower development program at North American Aviation, Downey, California, and their relationship

to three local junior colleges: Cerritos College, Norwalk, California; Compton College, Compton, California; Orange Coast College, Costa Mesa, California.

Mr. D'Braunstein will join the panel via telelecture for reactions to the papers and contributions to the synergistic approach.

This panel is to be a clearing house for three problem areas in educational programs for the space industry:

1. Keeping the curriculum current with the state of the art through information sharing.
2. Facilitating credit transfers and course equivalency when personnel relocate.
3. Using telelectures via WATS lines to procure authoritative presentations.

The discussion from the floor is to provide an opportunity for direct communication with all the institutions represented.

Examples of Synergistic Relationships Involving Brevard Junior College and the Cape Kennedy/KSC Community in the Fields of Management and Quality Control.

History

When Brevard Junior College opened its doors in 1960, an Industrial Management Associate Degree Program was offered, and well received. Many contractors and the Air Force contributed generously in terms of speakers and instructional materials. Through the years Pan American made the film series that correlated with the texts available. Colonel Ezzard, then Controller, Patrick Air Force Base, spent an entire evening illustrating the functions of the controller, using presentation aids for the previous year's budget for the Cape and Patrick Air Force Base. Many contractor personnel appeared as guest speakers.

¹Adapted from Jack D. Stoops, "About Synergy and Sows Ears," School Arts, Dec. 1960.

John Healey, Martin-Denver, spoke on PERT. Nate Ranck, Transworld Airlines, spoke on "Visaplan" and John Stone, Pan American World Airways, spoke on "Plannet" (both similar to PERT). Mr. M. V. McCormick, Pan American World Airways, spoke on "Administration in Management."

In the Nondestructive Testing course, the Managing Director of the Society For Nondestructive Testing, Philip Johnson, has come from Evanston, Illinois, each year to address the group, and has contributed much technical material. The vendors, such as Magnaflux, Westinghouse X-Ray, Ansco, Branson Instrument and Krautkramer Ultrasonics have sent authorities from New England and other areas to speak and demonstrate equipment.

In the Contamination Control course, DuPont and Milipore Filter have played similar roles.

In the Presentation Techniques course, the class always holds one meeting in Dr. Debus' Conference Room at NASA, KSC. Norman Salmons, Eastman Kodak National Sales/Service Director gives a flawless 35 mm slide presentation identical to the one he gives to the top brass in the automotive industry.

Certain modifications to the original program were made. The Plant Layout and Safety class was dropped; the course never had enough students to form a class in five times offered. The Production Control course was replaced by PERT, due to strong interest in this activity. The American Society For Quality Control liked the Quality Control course in our Management curriculum, and requested that it be expanded to a degree program. The ASQC approved program at San Diego City College was adopted, with one deletion, the Statistical QC course. Since, to oversimplify, the aim of this course was to design your own sampling table, and our work here never reaches a volume of parts sufficient to justify use of sampling tables, this course was replaced by Contamination Control, which was needed here. More detailed information on this course will follow later. A course in Nondestructive Testing has been developed and a course in Value Engineering. The active support of the American Association For Contamination Control, the Society For Nondestructive Testing, and the Society of American Value Engineers has supplied the nucleus and balance wheel for all of these activities.

Most phenomenal of all has been the parallel growth of the local American Society For Quality Control chapter and the Brevard Junior College Quality Control enrollment.

Philosophy

The Management and Quality Control Programs at Brevard Junior College are con-

ducted as seminars and employ group dynamics techniques to facilitate the sharing of current information between students and across company lines rather than mere learning of text material.

In the Management curriculum, and to a large extent, in the Quality Control curriculum the text materials are oriented toward mass production. Until very recently, we were a missile test site in citrus country, so that mass production did not apply to us. We have used the texts as springboards for discussions in the current local application of principles or state of the art. Response has been significant, and a body of missile/space industry case histories and useage has been accumulated for compilation and possible publication.

One ever-present problem has been the student business-necessitated absence, which has been solved by requiring prior contact with the instructor for extra assignments. It was one of these absences which produced an outstanding telelecture on Value Engineering by Everett Lindem, General Dynamics/Convair, from San Diego City College.

To facilitate communication, a list of all students in the programs is distributed, usually at the third class meeting. This list gives the names, business phones, employers and a two or three word description of duties, along with class identification.

The list serves many purposes. Its primary purpose is to encourage student interchange of information about class assignments and group projects. It also provides job related information for the solution of everyday problems that a classmate at another firm may have encountered. It is pointed out to students that they will never get this information on company letterhead, and that it certainly isn't in the textbook. Another very real benefit is the clearing house provided for employment information, since Research and Development contracts often "phase out" after as short a duration as three years. It helps the individual to have some knowledge of how other companies operate, and to have grass roots contacts. It is a benefit to the community to develop a pool of technically trained people, and then retain them as citizens rather than have them relocate.

Last, the list permits examination of the programs. It reveals that thirty-four employers are represented in the 176 students enrolled in eight courses at three locations. There are actually eleven classes, three classes are offered at two different locations. Some students take several classes, so that 176 students actually are enrolled in 197 classes.

Present Programs

The IM (Industrial Management) and QCR (Quality Control and Reliability) associate degree programs are designed primarily to meet the employment needs of the space industry but include many courses which are readily transferable to universities. However, many problems arise when these A. S. degree holders try to continue their studies toward a B. S. degree. The community colleges have structured their curriculum to meet present community needs. The areas of specialization are parallel to those of other junior colleges who recognize their obligation to the community in which they are situated. Many of our students already have degrees, but they need training in employment areas that did not exist either as jobs or college courses when they received their degrees. How many of you took course work in PERT, Nondestructive Testing, Value Engineering or Contamination Control in college?

Dramatic knowledge explosion and technological advances have changed employment skills requirements and the community college has changed to keep pace. Now we must examine the rest of the academic structure, so that these people can continue and get a B. S. degree, even though they have had survey courses in specialized areas. I call them survey courses because most of these courses are not aimed at the technician, and do not contain enough detail or lab work to train technicians. These courses are to provide basic understanding of the area, and to form a basis for communication and understanding of the various activities and cooperation within each organization. Sources of further information are detailed and attendance at a meeting of the technical society associated with the course is required. The meeting is usually selected on the basis of an important speaker who will supplement the course material.

In August of 1966, NASA made the Personnel Training Building at Kennedy Space Center available without charge for Brevard Junior College classes. At present we share this building harmoniously with GENESYS and Florida State University. Brevard Junior College conducts three Management, four Quality Control and one Technical Report Writing course at present. All of these courses start at 5 PM. Other Management and Quality Control courses are taught at 7 PM at Cocoa Beach High School and the main Brevard Junior College campus.

The move to Kennedy Space Center has many advantages in addition to "bringing the mountain to Mohamet," as far as the students go. No college in the country has laboratories eight hundred feet away to match NASA's Failure Analysis Lab, or the Betatron at Pan American's Nondestructive Testing Lab, where entire solid propellant motors are x-rayed.

Contamination Control As an example of synergism past and present, we offer the Brevard Junior College course outline in Contamination Control to any school, government agency or contractor which feels the need for training in this new field. Brevard Junior College was the first school in the country to offer a credit course in Contamination Control.

When we found that no suitable text was available, North American Aviation, Space and Information Systems Division, Downey, California, made the services of Miss Jane Killion available. She drew on her fifteen years experience in the field and prepared the course. Later she moved to Florida and is now teaching the course, and is affiliated with Bendix Launch Support Division.

The following course outline shows our basic approach. More detailed information will be supplied on request.

Course Outline For Contamination Control

Catalog Number: QCR 208

Course Purpose: The purpose of this course is to establish guidelines for Contamination Control for the field technician whose responsibility is the maintenance and repair of spacecraft, and to provide the knowledge basic to the understanding of Contamination Control for those whose work is affected although they are not actually working in this field.

This course will cover the basic principles of contamination as related to clean rooms, cleaning methods, basic filtration design, field assembly techniques, test methods and equipment. Packaging materials and methods, parts protection and handling methods, and other related topics will be discussed, if time permits.

It is the intent of this course to clarify the role that contamination or the absence of contamination plays in a successful space mission.

Contact Hours: Three (3)

Credits: Three (3)

Text: None (Handouts)

References: Austin & Timmerman, "Design and Construction of Clean Rooms." Selected articles from the monthly Journal of the American Association for Contamination Control, Government Specifications and Standards.

Introduction and Definitions: What is

contamination? What is clean?
Why is it necessary? Field trip to a
clean room.

Construction and Use of Clean Rooms:
General construction, clean room support
equipment, operating criteria,
maintenance, personnel and their effect
on the realization of design character-
istics.

Cleaning Methods: Mechanical and
ultrasonic.

Solvent Selection: Discussion of the
factors involved in the selection of
a solvent for use in the clean room
and in field cleaning. (This lecture
delivered by a Technical Representative
from a chemical manufacturer.)

Filtration and Design Concepts: Various
types of filters are discussed and their
placement in open and closed systems.
Consideration is given to the service
media of the system.

Field Cleaning and Assembly Techniques:
A broad brush treatment of in-place
cleaning in the field and the replace-
ment of contaminated components with
clean hardware.

Test Methods and Equipment: A discuss-
ion of the microscopic and automatic
methods of particulate counting as de-
fined by ASTM and SAE. This is suppl-
mented by a class demonstration of the
equipment used.

Packaging Materials and Protection
Methods

Parts Handling and Storage

First Paper: Design of a Clean Room*

Due: 8th week

References: Federal Standard 209,
MSFC 246, A. F. TO-00-25-203

Specific Topics to be Covered:

1. Type
2. Operation
3. Personnel population
4. Type of operating equipment
5. Filtration and air changes
6. Use of work stations
7. Maintenance instructions
8. Personnel instructions
9. Justification for your design
and criteria

Second Paper: Cleaning Operation*

Due: 15th week

References: KSC 123D, MSFC 10M01671,
MSFC 164, A. F. TO 42C-1-11

Specific Topics to be Covered:

1. Choice (component/field system)
2. Detail steps of operation
(including chemicals)
3. Levels of cleaning capability.
4. Test methods for control
5. Justification

*Ground Rules For Two Required Papers:

1. Work must be original.
2. Elaborate design drawings are
not necessary.
3. Keep the operational criteria
simple.
4. Other references are acceptable
if properly annotated.

This concludes the brief presentation
on Contamination Control. More detail-
ed information is available upon request.

In-House Programs

Three varieties of in-house training
programs are in use in this area. One is
the credit course after hours on company
property, open to all. This is exemplified
in the Management/Quality Control courses
at Radiation, Inc., twenty miles south of
the main campus. The non-credit Management
in-house courses taught on Pan American
premises represents another type. Still
other programs are taught by Brevard Junior
College instructors acting as individual
private educational consultants, since
specific training for a single employer is
not a proper use of tax dollars. An ex-
ample is a recent Quality Control Concepts
course for NASA personnel, giving instruct-
ion in specific procedures. This course
was taught on duty time in the Vehicle
Assembly Building. Similar courses have
been conducted for contractors in Rapid
Reading, Public Speaking and Management.

Future

New courses will be initiated as the
need arises. To complement our computer
courses in the business department, courses
in Computer Field Engineering and Computer
Management are planned. Game Theory and
Operations Research are also under consid-
eration. Laser and Maser Techniques will be
offered this fall. The college has a laser
ready to go.

It is the objective of the Community
Junior College to anticipate the needs of the
particular community in which it is located
and satisfy them. We at Brevard Junior
College are vitally interested in adding to
the stability of the community by providing
a pool of skilled technical personnel in
Management and Quality Control.

Now let's spread the yeast of synergy
across the land so that all of our space and
missile people can go first class - to the
moon and beyond - in their educational
opportunities.