1993 NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM

JOHN F. KENNEDY SPACE CENTER
UNIVERSITY OF CENTRAL FLORIDA

KSC MANAGEMENT TRAINING SYSTEM PROJECT

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NASA/ASEE MANAGEMENT SCIENCE
FACULTY FELLOWSHIP PROJECT

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FINAL REPORT- SUMMER 1993

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1.0   OBJECTIVES

The stated objectives for the Summer of 1993 were:

1. Review the Individual Development Plan Surveys for 1994 in order to automate the analysis of the Needs Assessment effort.

2. Develop and implement evaluation methodologies to perform ongoing program-wide course-to-course assessment. This includes:

    - Propose a methodology to develop and implement objective, performance-based, assessment instruments for each training effort.
    - Mechanize course evaluation forms and develop software to facilitate the data gathering, analysis and reporting processes.
    - Implement the methodology, forms, and software in at least one training course or seminar selected among those normally offered in the summer at KSC.

Section 2 of this report addresses the work done in regard to the Individual Development Plan Surveys for 1994. Section 3 presents the methodology proposed to develop and implement objective, performance-based, assessment instruments for each training course offered at KSC.

2.0 THE INDIVIDUAL DEVELOPMENT PLAN SURVEYS FOR 1994

Section 2 of this report deals with the first objective, the Individual Development Plan Surveys for 1994. The information stored in the Personnel Training Developmental System (PTDS) was transferred to a Windows platform and processed using FoxPro for Windows. Section 2.1 presents the SQL commands used to query the data bases and produce the requested reports. As an example, the first page of each report is presented in the next pages. The full reports, already delivered to NASA, are considered part of this Final Report. Section 2.2 discusses issues associated to training cost and priority and presents recommendations for further research.

2.1 Commands Used to Query the Data Bases

2.1.1 Report #1 -- Courses by Type of Training by Organization

```
SELECT DISTINCT Report1.unit, Report1.tot, Report1.course_num,;
 COUNT(Report1.course_num), SUM(Report1.cost), Courses.title,;
 Traintyp.type, Units.unitname;
FROM Report1, Courses, Units, Traintyp;
WHERE Courses.course_num = Report1.course_num;
 AND Units.unit = Report1.unit;
 AND Traintyp.tot = Report1.tot;
 AND Report1.unit = "AC";
GROUP BY Report1.course_num;
ORDER BY Report1.tot;
INTO CURSOR Repot1
CREATE REPORT report1.frx FROM Report1 WIDTH 0 COLUMN NOOVERWRITE
REPORT FORM report1.frx TO PRINTER NOCONSOLE
```

2.1.2 Report # 2 -- Type of Training by Organization

```
SELECT DISTINCT Report1.unit, Report1.tot, COUNT(Report1.course_num),;
 SUM(Report1.cost), Traintyp.type, Units.unitname;
FROM Report1, Courses, Units, Traintyp;
WHERE Courses.course_num = Report1.course_num;
 AND Units.unit = Report1.unit;
 AND Traintyp.tot = Report1.tot;
GROUP BY Report1.unit, Report1.tot;
ORDER BY Report1.unit, Report1.tot;
INTO CURSOR Report2
CREATE REPORT report2.frx FROM Report2 WIDTH 5120 COLUMN NOOVERWRITE
REPORT FORM report2.frx TO PRINTER NOCONSOLE NOEJECT
```

1994 Individual Development Plans

Organization: AC   --   Comptroller

Type of Training: 10   --   Executive and Management

Course	Course Title	Number of Requests	Cost
		1	$0.00
K1894	CONF SE EXEC PUB POL ISSUE	1	$1,775.00
K2176	SCIENCE TECH AND PUBLIC POLICY	12	$24,000.00
K534	NASA MANAGEMENT EDUCATION PROG	1	$2,175.00
K545	EXEC DEVELOPMENT SEMINAR	5	$4,465.00
K6140	RES MGT EDUC PROGRAM	1	$1,350.00
K6166	MANAGEMENT DEV SEM	3	$3,750.00
K6339	HUMAN ELEMENT (THE)	3	$630.00
K6427	COMMUNICATION & INFLUENCE	1	$670.00
K6715	MEP UPDATE:MGMT PRACTICES & ORGAN. CLIMATE	2	$6,600.00
K6777	UNDERSTANDING BUSINESS POLICY & OPS.	4	$0.00
K753	MANAGEMENT DEVELOPMENT SEMINAR	3	$5,325.00
K8164	ADMINISTRATION OF PUBLIC POLICY	9	$4,140.00
K8176	CROSSING DEPARTMENT LINES	3	$0.00
K9716	TASK MANAGEMENT (NASA)	1	$0.00
K9941	SEMINAR ON MANAGERIAL COMPETENCIES	2	$0.00
K9942	EXECUTIVE PROJECT MANAGEMENT		
		52	$54,880.00

Subtotals for type 10   --   Executive and Management

Organization: AC -- Comptroller

Type of Training:	Number of Requests	
10 -- Executive and Management	52	$54,880.00
20 -- Supervisory	68	$37,784.00
3J -- Engineering - General	3	$325.00
3M -- Engineering - Aerospace	2	$2,550.00
3Q -- Engineering - Electrical/Electronic	1	$0.00
3T -- Engineering - Systems, Industrial	1	$390.00
4A -- Public or Business Administration	46	$13,136.44
4B -- Finance, Accounting, Auditing	89	$33,332.00
4C -- Personnel	9	$960.00
4D -- EEO, Race or Ethnic Studies	2	$0.00
4E -- Procurement	97	$24,871.00
4G -- Policy, Program, or Management Analysis	7	$3,050.00
4N -- Security or Investigation	2	$500.00
4U -- Program and Project Management	25	$8,084.00
4Z -- Other Administrative	1	$320.00
5A -- Systems, Safety and Area Access Training	4	$0.00
5B -- Academic Course Work	101	$22,797.88
6A -- Basic Clerical	8	$634.00
6B -- Inter-personal and Office Management	11	$1,009.00
6C -- Administrative Systems	10	$750.00
6D -- Other Clerical	2	$99.00
8A -- Orientation	1	$0.00
8E -- Nets/Quality Circles	3	$131.00
8F -- Productivity	1	$386
8G -- Professional/Personal Development	13	$1,418.00
8H -- Communication Skills	25	$2,438.00
8Z -- Other General	1	$595.00
9A -- Telecommunications, Networking	2	$1,210.00
9B -- Programming and Programming Languages	26	$1,255.00
9D -- Office Automation/AIM, Business	4	$2,500.00
9E -- Software Management, Systems Software	2	$1,127.00
9Z -- Other Computer Hardware and Software	2	$0.00

TOTALS FOR AC -- Comptroller	621	216,532.32

2.1.3 Report # 3 -- Summary by Organization

```
SELECT DISTINCT Report1.unit, COUNT(Report1.course_num),;
  SUM(Report1.cost), Units.unitname;
 FROM Report1, Courses, Units, Traintyp;
 WHERE Courses.course_num = Report1.course_num;
  AND Units.unit = Report1.unit;
  AND Traintyp.tot = Report1.tot;
 GROUP BY Report1.unit;
 ORDER BY Report1.unit;
 INTO CURSOR Report3
 CREATE REPORT report3.frx FROM Report3 WIDTH 640 COLUMN NOOVERWRITE
 REPORT FORM report3.frx TO PRINTER NOCONSOLE NOEJECT
```

2.1.4 Report # 4 -- Summary by Type of Training

```
SELECT DISTINCT Report1.unit, COUNT(Report1.course_num),;
  SUM(Report1.cost), Units.unitname;
 FROM Report1, Courses, Units, Traintyp;
 WHERE Courses.course_num = Report1.course_num;
  AND Units.unit = Report1.unit;
  AND Traintyp.tot = Report1.tot;
 GROUP BY Report1.tot;
 ORDER BY Report1.tot;
 INTO CURSOR Report4
 CREATE REPORT report4.frx FROM Report4 WIDTH 640 COLUMN NOOVERWRITE
 REPORT FORM report4.frx TO PRINTER NOCONSOLE NOEJECT
```

2.2 On Training Costs and Priorities

2.2.1 The Financial Impact of Training

Training is expensive, however, lack of training could be even more expensive! Reliable estimates of training costs are needed for informed decision making by management concerning what training to offer and what to postpone. In PTDS, the COURSES.DBF's data base fields "TUITION", "BOOKS", and "OTHER COSTS" store information about each course's cost. Unfortunately, the information is not always available, and even when available, it is not always current, nor complete. There are a number of costs associated to a training effort, some of which are not included in the current data bases.[1]

- *Direct*: Materials, instructor, tuition, cost for media, cost of employee travel and per diem, employee salary during training, opportunity cost of foregone production.
- *Indirect*: Administrative, office space, computers, simulators, depreciation of facilities.
- *Intangibles*: Costs associated with potential failure of personnel to perform a task or job; savings associated to finishing a job early due to good performance by everybody involved.

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[1]   The terms "direct" and "indirect" costs refer here to its accepted use in industrial engineering cost analysis studies. At KSC, "direct" cost may be understood as the cost borne by the trainee's organization, while "indirect" is any cost borne by a different organization.

1994 Individual Development Plans

Summary by Organization

Organization		Number of Requests	Cost
	-- No mail code provided	13	$4,764.00
AC	-- Comptroller	621	$216,532.32
CC	-- Chief Counsel	7	$2,389.00
CD	-- Center Director	20	$23,616.00
CM	-- Payload Management and Operations	40	$18,154.00
CP	-- Payload Projects Management	318	$193,895.11
CS	-- STS Payload Operations	2318	$1,321,368.35
CV	-- Expendable Vehicles	170	$121,802.00
DE	-- Engineering Development	136	$59,804.00
DF	-- Facilities Engineering	900	$484,378.92
DL	-- Electronic Engineering	1033	$572,131.68
DM	-- Mechanical Engineering	1225	$459,930.46
EO	-- Equal Opportunity Program	28	$5,742.00
EX	-- Executive Management	55	$19,647.00
HM	-- Human Resources and Management Systems	12	$5,607.00
MD	-- Biomedical Operations and Research	294	$148,244.18
MK	-- NASA Headquarters/Space Shuttle Operations	156	$55,289.00
OP	-- Procurement Office	710	$301,214.91
PA	-- Public Affairs Office	221	$126,324.01
PM	-- Personnel Office	733	$103,086.00
PT	-- Technology and Advanced Projects Office	154	$81,938.00
RM	-- Mission Assurance	490	$294,545.!
RO	-- Quality Assurance	2464	$548,692.18
RQ	-- Reliability and Quality Assurance	50	$30,072.66
RT	-- Safety and Reliability	659	$226,156.10
SI	-- Center Support Operations	1254	$544,933.96
SS	-- Space Station Project Office	262	$159,045.00
TE	-- Grounds Engineering	985	$811,079.95
TL	-- Shuttle Logistics Project Management	363	$180,313.00
TM	-- Shuttle Management and Operations	471	$267,918.92
TP	-- Shuttle Operations	842	$338,121.95
TV	-- Vehicle Engineering	3066	$1,388,009.52

Totals for KSC

		20070	$9,114,747.17

07/27/93

1994 Individual Development Plans

Summary by Type of Training

Type of Training		Number of Requests	Cost
10	Executive and Management	1211	$1,892,420
20	Supervisory	2691	$1,655,615
3A	Legal	31	$17,805
3B	Medical and Biomedical	33	$4,620
3C	Physical Sciences	19	$6,655
3D	Earth Sciences and Natural Resources	112	$65,637
3F	Human Factors	15	$0
3H	Mathematics and Statistics	5	$178
3J	Engineering - General	186	$44,420
3K	Engineering - Aeronautics	33	$4,322
3M	Engineering - Aerospace	698	$391,765
3N	Engineering - Chemical, Petroleum, or	146	$56,735
3P	Engineering - Civel, Architectural,	190	$115,939
3Q	Engineering - Electrical/Electronic	473	$358,319
3R	Engineering - Mechanics/Mechanical	165	$97,324
3S	Engineering - R & QA	246	$128,603
3T	Engineering - Systems, Industrial	55	$72,268
3U	Engineering - Safety	100	$58,419
3W	Other Legal, Medical and Scientific	46	$5,565
4A	Public or Business Administration	1224	$138,947
4B	Finance, Accounting, Auditing	249	$75,729
4C	Personnel	291	$423,196
4D	EEO, Race or Ethnic Studies	272	$16,439
4E	Procurement	745	$188,475
4G	Policy, Program, or Management Analysis	53	$14,938
4J	Quantitative Analysis or Operations	32	$5,226
4K	Safety Systems and Operation	34	$12,407
4N	Security or Investigation	84	$12,470
4P	Logistics	59	$22,669
4Q	Supply	20	$3,345
4R	General Safety and Health	288	$59,557
4S	Foreign Language	14	$6,876
4U	Program and Project Management	1065	$836,679
4Y	Sales, Marketing and Customer Service	22	$5,545
4Z	Other Administrative	86	$27,610
5A	Systems, Safety and Area Access Training	1325	$0
5B	Academic Course Work	2050	$552,941
5C	On-the-Job Training	24	$0
6A	Basic Clerical	109	$9,086
6B	Inter-personal and Office Management	354	$35,828
6C	Administrative Systems	242	$30,297
6D	Other Clerical	107	$9,989
7B	Engineering and Science Support/Journeyman	39	$4,945
7Z	Other Trade, Craft, Apprentice and	7	$7,000
8A	Orientation	24	$0
8B	Career Planning	243	$6,836
8C	Pre-Retirement	75	$1,188
8E	Nets/Quality Circles	472	$29,117

1994 Individual Development Plans

Summary by Type of Training

Type of Training		Number of Requests	Cost
8F	Productivity	67	$73,907
8G	Professional/Personal Development	943	$156,450
8H	Communication Skills	1117	$271,057
8Z	Other General	85	$68,633
9A	Telecommunications, Networking	117	$95,060
9B	Programming and Programming Languages	764	$710,244
9C	Engineering Applications	146	$106,807
9D	Office Automation/AIM, Business	586	$66,532
9E	Software Management, Systems Software	71	$40,547
9F	Artificial Intelligence, Expert Systems	6	$1,875
9Z	Other Computer Hardware and Software	104	$9,690
TOTALS FOR KSC		20070	$9,114,747

2.2.2 The Priority of Training

PTDS' IDP.DBF database file currently stores a "PRIORITY" field for each training request. Unfortunately, the field reflects the order in which the employee listed his/her requests (i.e., the first course listed is assigned priority 1, the second one has priority 2, etc.). Obviously this does not reflect the potential impact of the training for the Center, nor for the person making the request.

2.3 Recommendations for Further Work

2.3.1 On the Financial Impact of Training

Ensure that the training-related management information system (of which PTDS is currently the major component) includes the very best possible estimate of costs associated to each training course. The responsibility of keeping this data base up to date belongs to the Human Resources Development Branch. The cost data base should store, for each course, the training components (i.e, hours, units of resources, travel requirements, etc.), rather than the actual dollars spent. At report time the computer will calculate the dollar cost with actualized values per hour, unit of resource spent, etc. Whether the particular training component represents a direct cost to the trainee's organization or to other NASA organization should also be part of the training-related management information system.

2.3.2 On the Priority of Training

Include in the data base a field that reflects the potential importance that the requested training has for the Center and for the person making the request. This may be the result of an employee and supervisor review of the current requests. It would be time consuming, but it may be the best method to ensure that the user (NOT the Training Branch) defines the potential impact for the Center and the trainee.

As a possible indicator of priority of content and timing, the following scales were used in the Summer of 1992 in the Needs Assessment effort conducted by the author at KSC:

Potential Impact	Weight
Helps organizational performance	4
Helps individual's performance in current position	3
Enables person to perform more responsible position	2
Useful but not essential	1
There is no need for training in this subject matter	0

Priority on Timing	Weight
Needed within next three months	4
Needed within next six months	3
Needed within next year	2
Not an urgent need	1

3.0 THE EVALUATION OF TRAINING

3.1 Existing Evaluation Procedures

Evaluation of training courses is limited to KSC Form 13 (see next page). This form is processed manually and its major problems are that it is not linked to KSC's goals and objectives, there are no cost/benefits considered, the form is not used to assess performance improvement, and the results are not used for formal reporting.

3.2 Objectives

The evaluation of training at KSC is envisioned as having the following properties:

- Linked to KSC Mission, Goals and Objectives.
- Has a performance and values-based focus.
- Measures results in terms of performance improvement, financial impact, productivity and quality improvement, team building accomplishments, and less employee turnover.
- Resets priorities based on results.
- Tracks training and performance data.

The link to KSC's mission, goals and objectives and the performance and values-based focus will be ascertained through user involvement. It is the user (NOT the Human Resources Development Branch) who must define what is "required level of performance". The evaluation process will determine the training's impact on performance by asking the users: "What is the expected result of training?" and "What may happen if no training is given?"

3.3 Evaluation: A Literature Search

A literature search was performed to ensure that the proposed evaluation procedure agrees with standard practice. The following sections discuss the sources, most common approaches identified, typical methods to conduct the evaluation and an indicator of performance effectiveness, the "Content Validity Ratio". A detailed discussion of the search findings is provided in the appendix, along with the list of references used. Copies of all references were submitted to NASA in a separate binder and are considered part of this final report.

3.3.1 Sources

The literature search yielded 782 hits when the keep words "TRAINING", "EFFECTIVENESS", "ASSESSMENT", and "EVALUATION" were used. From those 782 titles, a total of 78 abstracts were selected and printed. The analysis of those abstracts resulted in 22 promising articles of which 14 were available at UCF's library (or though inter-library loans). Most articles are rather theoretical in nature but a few described specific applications in government agencies such as the Department of Agriculture (Plant Protection and Quarantine and Forest Service divisions), NASA Headquarters, the Department of the Navy's Navy Finance Center, and the Office of Personnel Management.

PARTICIPANT'S EVALUATION

SEMINAR :

PARTICIPANT'S NAME | **ORGANIZATION**

MAIL SYMBOL | **TELEPHONE NUMBER** | **DATE(S)**

SUPERVISOR'S NAME

PLEASE INDICATE YOUR EVALUATION OF THE SEMINAR IN TERMS OF THE FOLLOWING:

	EXCELLENT	GOOD	FAIR	POOR
1. Overall evaluation of seminar.				
2. Seminar content — amount of detail and extent of coverage.				
3. Level of presentation.				
4. Effectiveness of hand-out materials.				
5. Effectiveness of audio/visual aids.				
6. Instructor(s) knowledge of subject.				
7. Instructor(s) effectiveness.				
8. Application to your job.				

COMMENTS:

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SIGNATURE | **TITLE**

KSC FORM 13-192 (REV. 8/77)

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3.3.2 Approaches

Training evaluation usually takes one of four emphasis: (1) **Reaction**, where the evaluation is conducted at the end of the training exercise and focuses in the trainee's immediate feelings about the environment, instructor, and the material covered; (2) **Learning**, where the evaluation focuses on whether the student mastered specific knowledge or skills through exams or tests about the subject taught; (3) **Behavior**, where the evaluation consists on following the trainee over a period of time to ensure that the person's behavior changed as a result of the training; and (4) **Results**; where the emphasis of the evaluation is not the trainee's learning (or lack of it) or behavior but its impact on the organization's benefits accrued as a result of the training.

3.3.3 Methods

The most commonly used methods to gather evaluation data are surveys and questionnaires; interviews (individual or group); performance observations; and miscellaneous inquiries (from co-workers and supervisors). The Participant Action Plan Approach (PAPA, implemented by the Office of Personnel Management) asks the trainee at the end of the training session for a number of personal goals to achieve as a result of the training and comes back a year later to check whether those goals were attained. The main problems with observations, interviews, inquiries, and the PAPA method are that they may lack objectivity and require vast resources (time, personnel, and money) to conduct. For an on-going training evaluation system designed to include a large number of training programs, the best recommendation is a set of standardized surveys which printing, distribution, collection, analysis and reporting can be mechanized.

3.3.4 Content Validity Ratio (CVR)

The Content Validity Ratio is an indicator of the degree of acceptance of a given statement by a group of respondents. It ranges from -1 (absolute rejection) to +1 (unanimous approval). It is calculated as follows:

$$CVR = (\text{number who approve} - \text{number who reject})/\text{number of respondents}$$

For example, if among 20 persons surveyed, 15 agree with the statement "I recommend that this training be taken by others in my organization", while 3 respondents disagree and 2 do not respond to the question, the CVR would be 0.67 [(15-3)/18 = 12/18 = 0.67]. Note that the indicator is non-linear.

3.3.5   References

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Geroy, Gary D., and Wright, Phillip C., "Evaluation Research: A Pragmatic, Program-Focused, Research Strategy for Decision-Makers," Performance Improvement Quarterly, v1 n3, 1988, p17-26.

Hawley, John K., " A Practical Methodology for Determining Cost-Effective Instructional Programs," Performance and Instruction, v30 n5, May-Jun 1991, p17-23

Korotkin, Arthur L., "A Taxonomic Approach to Integrating Job Analysis with Training Front-End Analysis," Performance Improvement Quarterly, v5 n3, 1992, p26-34.

Kruger, Michael J., and Smith, Kay H., "Evaluating Management Training," Performance and Instruction, v26 n9-10, Nov-Dec 1987, p22-26

Private Industry Council of Marin County, San Rafael, CA., "Training Program Evaluation Plan and Procedure," National Alliance of Business, Inc., Washington, D.C., Sponsoring Agency: Employment and Training Administration (DOL), Washington, D.C. Available from: Private Sector Initiative Program Clearinghouse, 1015 15th Street, N.W., Washington, D.C. 20005, Feb 1981, 38p.

Salinger, Ruth, and Roberts, Cynthia, Evaluating the Impact of Training: A Collection of Federal Agency Evaluation Practices. Volume 2, Office of Personnel Management, Washington, D.C., Training Resources Management Division, 1984, 198p. Includes summaries of Volume 1.

Stevens, Matthew D., and Hellweg, Susan A., "Toward a Standard of Communication Training Effectiveness Evaluation," Paper presented at the Annual Meeting of the Speech Communication Association (76th, Chicago, IL, November 1-4, 1990), 35p.

Wreathall, John, and Connelly, Edward M., "Using Performance Indicators to Evaluate Training Effectiveness: Lessons Learned," Performance Improvement Quarterly, v5 n3, 1992, p35-43.

3.4   The Evaluation Procedure

The proposed evaluation procedure consists of a set of two evaluations and three reports. Copies of the evaluations (as proposed and as implemented) are included in the next pages.

3.4.1   The Scanning Process

An OpScan Model 5 from National Computer Systems (NCS) was purchased by KSC in early 1993 to mechanize the processing of all evaluation forms. The forms are designed with the help of DESIGN, a Windows based graphics package. DESIGN allows the user to define the questionnaire, to specify the types of responses and the response areas, and to print the questionnaire in forms supplied by NCS. Another NCS software, SURVEY, processes the designed forms and reads the scanned data into a file. A statistic (or a data base) package is then needed to analyze the data and produce reports. SPSS for Windows and FoxPro for Windows will be tried with the data collected in the first few training courses.

3.4.2   Evaluations

The proposed End-of-Course Evaluation is a "reaction" type evaluation. It has four sections. The first one, "Externals," deals with the training environment (location, handouts, etc.). The second, "Instruction," focuses in the instructor; the third, "Focus," on the contents; and the last, "Assessment," provides the trainee's feedback of the perceived value for the organization. An overall "Happiness Index" will be associated (based on a CVR type of analysis) to the trainees' reaction to each training course.

A Follow-Up Evaluation was proposed, to be delivered about six months after the training. Both the trainee and the supervisor were targeted. The form focused on the training's effect on performance, productivity, and satisfaction. It asked also for suggestions for improvement and recommendations for continuation of training. Although a standard form was proposed for both trainee and supervisor, the analysis of the trainee's responses would have concentrated in "behavior modification" issues, while the analysis of the supervisor's responses would have focused on the "organizational impact." An overall "Effectiveness Index" was to be associated (based on a CVR type of analysis) for the trainees' and supervisors' delayed assessment of the real impact of each training course.

In order to streamline the overall procedure, KSC's Human Resources Development Branch decided to replace the proposed Follow-Up Evaluation by a briefer form that targets only the supervisor. A copy of that form is also provided. A limited "Effectiveness Index" may be associated (based on a CVR type of analysis) to each training course, on the basis of the supervisor's delayed assessment.

3.4.3   Reports

The "Reaction" Report will be an End-of-Course Evaluation Report to be submitted to the Human Resources Development Branch. It will include information such as course ID, date, time, place, instructor, attendance, cost, student reactions, and an overall "happiness index" for the course

The "Assessment of Impact" Report is the result of the follow-up evaluations. As this evaluation stands now, the report will essentially reflect the supervisor's assessment of the training impact on the organization's performance as reflected by his recommendation for future similar training for personnel under his supervision.

An End-of-Quarter Report is planned which will summarize the number of courses taught, the number of students, cost, and indicators of overall happiness and overall effectiveness.

KENNEDY SPACE CENTER
TRAINING BRANCH
INITIAL EVALUATION OF TRAINING

SSN: _____ - __ - ____
MAIL CODE: _____

COURSE: _____
INSTRUCTOR: _____
COURSE DATE(S): _____
SITE: _____

INSTRUCTIONS: Indicate the degree to which you agree with the following statements using
SA=STRONGLY AGREE   A=AGREE   D=DISAGREE   SD=STRONGLY DISAGREE   NA=NOT APPLICABLE

	SA	A	D	SD	NA
EXTERNALS					
1. The environment was suitable for learning.	◯	◯	◯	◯	◯
2. There were no distractions during the session.	◯	◯	◯	◯	◯
3. Handouts used at the session were effective.	◯	◯	◯	◯	◯
4. Audio/visual aids used at the session were effective.	◯	◯	◯	◯	◯
INSTRUCTION					
5. The instructor delivered the lessons clearly and effectively.	◯	◯	◯	◯	◯
6. The instructor was knowledgeable of the material taught.	◯	◯	◯	◯	◯
7. The instructor kept my interest throughout the session.	◯	◯	◯	◯	◯
8. The instructor showed concern for the student's understanding of the material.	◯	◯	◯	◯	◯
9. The hands-on component was delivered effectively.	◯	◯	◯	◯	◯
10. Enough time was alloted to hands-on practice.	◯	◯	◯	◯	◯
FOCUS					
11. The material in this class is consistent with the actual and current requirements of my job.	◯	◯	◯	◯	◯
12. The training focused on the specific tasks, knowledge and skills needed for acceptable job performance.	◯	◯	◯	◯	◯
13. The knowledge and skills were taught to the appropriate level of proficiency.	◯	◯	◯	◯	◯
14. Training was included that is NOT needed on the job.	◯	◯	◯	◯	◯
15. Required skills and knowledge were NOT adequately covered.	◯	◯	◯	◯	◯
16. The level of knowledge attained in training meets the level needed for acceptable job performance.	◯	◯	◯	◯	◯
ASSESSMENT					
17. Overall, I am pleased with this course.	◯	◯	◯	◯	◯
18. This training will help me on my job.	◯	◯	◯	◯	◯
19. This training course is right on target with KSC's needs.	◯	◯	◯	◯	◯
20. I recommend that others from my organization attend this course.	◯	◯	◯	◯	◯

KENNEDY SPACE CENTER
HUMAN RESOURCES DEVELOPMENT BRANCH

INITIAL EVALUATION OF TRAINING

NAME:

COURSE: _____
INSTRUCTOR: _____
COURSE DATE(S): _____
SITE: _____

INSTRUCTIONS: Indicate the degree to which you agree with the following statements using

SA=STRONGLY AGREE   A=AGREE   D=DISAGREE   SD=STRONGLY DISAGREE   NA=NOT APPLICABLE

PLEASE COMPLETELY FILL IN THE APPROPRIATE BUBBLES WITH A #2 PENCIL.

	SA	A	D	SD	NA
EXTERNALS					
1. The environment was suitable for learning.	◯	◯	◯	◯	◯
2. Handouts used at the session were effective.	◯	◯	◯	◯	◯
3. Audio/visual aids used at the session were effective.	◯	◯	◯	◯	◯
INSTRUCTION					
4. The instructor delivered the lessons clearly and effectively.	◯	◯	◯	◯	◯
5. The instructor was knowledgeable of the material taught.	◯	◯	◯	◯	◯
6. The hands-on component was delivered effectively.	◯	◯	◯	◯	◯
FOCUS					
7. The material in this class is consistent with the actual and current requirements of my job.	◯	◯	◯	◯	◯
8. The level of knowledge attained in training will help improve my job performance.	◯	◯	◯	◯	◯
ASSESSMENT					
9. Overall, I am pleased with this course.	◯	◯	◯	◯	◯
10. This training course is consistent with KSC's needs.	◯	◯	◯	◯	◯
11. I would recommend that others from my organization attend this course.	◯	◯	◯	◯	◯

Suggestions for improvement or other comments:

_____
_____
_____
_____
_____
_____
_____

KENNEDY SPACE CENTER
TRAINING BRANCH

FOLLOW-UP EVALUATION OF TRAINING

SSN: ___ - ___ - ___

MAIL CODE: _____

COURSE: _____

INSTRUCTOR: _____

COURSE DATE(S): _____

SITE: _____

INSTRUCTIONS: Indicate the degree to which you agree with the following statements using

SA=STRONGLY AGREE   **A**=AGREE   **D**=DISAGREE   **SD**=STRONGLY DISAGREE   **NA**=NOT APPLICABLE

On the basis of this employee's performance after the referred training course, the following have improved:

	SA	A	D	SD	NA
1. employee's supervisory and management skills.	◯	◯	◯	◯	◯
2. personal productivity.	◯	◯	◯	◯	◯
3. organization's productivity.	◯	◯	◯	◯	◯
4. employee's satisfaction.	◯	◯	◯	◯	◯
5. customer's satisfaction.	◯	◯	◯	◯	◯
6. job performance-quality.	◯	◯	◯	◯	◯
7. job performance-quantity.	◯	◯	◯	◯	◯
8. organization's morale.	◯	◯	◯	◯	◯
9. safety.	◯	◯	◯	◯	◯
10. stress reduction.	◯	◯	◯	◯	◯
11. team building.	◯	◯	◯	◯	◯
12. cost awareness and control.	◯	◯	◯	◯	◯
13. environmental awareness.	◯	◯	◯	◯	◯
14. This training course is right on target with KSC's needs.	◯	◯	◯	◯	◯
15. I recommend that others from my organization attend this course.					

THIS FORM WAS FILLED OUT BY: ◯ EMPLOYEE ◯ SUPERVISOR

TODAY'S DATE: _____

10098

SURVEY NETWORK®
451

Form Number 75612-5-85

TO: _____   MAILCODE: _____

(SUPERVISOR'S NAME)

KENNEDY SPACE CENTER
HUMAN RESOURCES DEVELOPMENT BRANCH
FOLLOW-UP EVALUATION OF TRAINING

PARTICIPANT'S NAME:

COURSE: _____
VENDOR: _____
COURSE DATE(S): _____

Approximately six months ago, the employee identified above attended the referenced training class. In order to assess the long range effects of this training, please indicate the degree to which you agree with the following statements using:

SA=STRONGLY AGREE   A=AGREE   D=DISAGREE   SD=STRONGLY DISAGREE   NA=NOT APPLICABLE

PLEASE COMPLETELY FILL IN THE APPROPRIATE BUBBLES WITH A #2 PENCIL.

	SA	A	D	SD	NA
1. This employee's job performance has improved as a direct result of this training.	◯	◯	◯	◯	◯
2. I would recommend that others from my organization attend this course.	◯	◯	◯	◯	◯

TODAY'S DATE: _____

Suggestions for improvements or other comments concerning this training:

_____
_____
_____
_____
_____
_____

PLEASE RETURN THIS SURVEY TO **HM-PER-1** IN A U.S. GOVERNMENT MESSENGER ENVELOPE.

4577

SURVEY NETWORK®

Form Number 75612-5-85

3.5   Expectations

The proposed evaluation procedure will (a) examine training requests from the perspective of KSC goals and objectives, (b) determine if performance improves as a result of investment in training, and (c) keep a continuous review of the training results. This will allow the Human Resources Development Branch to document and report to management and to departments (a) the time and resources needed to provide training, (b) the employee time and Center resources spent in training, and (c) an objective evaluation of the results obtained (aggregate values).

3.6   Recommendations for Further Work

3.6.1   On Evaluation:

The first recommendation is to implement the proposed evaluation procedure. It is suggested to try the proposed evaluation forms in at least two courses and to develop software to produce standard reports. Then, use the software to generate reports, and obtain feedback from the evaluators and from the report recipients.

3.6.2   On the Training Management Information System:

The second recommendation is to link the evaluation data to the PTDS (NTDS?) information system. The data should include (a) Cost data (NOT in dollars, but in hours, units of resources, etc.); (b) delivery data (who, where, how, when, how long, why, what (syllabus), number of attendants, instructor, student's initial and delayed evaluations, supervisor evaluation, comments); and (c) training evaluation data.

3.6.3   On the Needs Assessment:

The whole Training System should be consistent and dynamic. The evaluations should be used as a tool for constantly revising needs and priorities of what is being trained (Needs Analysis), how (Method/Means Analysis), and how often. A procedure to this effect should be devised and implemented.

4.0   APPENDIX: Literature Review

The following pages were prepared by Joseph Espino, a SHARP (Summer High School Apprenticeship Research Program) student assigned to work under Dr. José A. Sepúlveda's mentoring during the Summer of 1993. In addition to preparing this literature search, Mr. Espino was instrumental in getting the NCS scanner in operation. He also wrote an operator manual for this hardware.

TRAINING EVALUATION - An Overview Of Existing Practices

Four categories of training evaluation are reaction, learning, behavior and results [Stevens & Hellweg, 1990].

Reaction is the trainee's liking of the training course. This response should be determined as soon as possible after the session is completed [Dewine, 1987]. Questions dealing with the atmosphere, physical environment, instructors and training media should be included on the first questionnaire. An example of a reaction based question is:

6. Rate the use of handouts in the training.   _Excellent _Good _Fair _Poor

Learning is the evaluation of whether the trainee remembers (not necessarily uses) facts, principles and behaviors taught in class. This is the least relevant level of evaluation for an organization because increased knowledge does not necessarily mean the knowledge is used on the job [Stevens & Hellweg, 1990]. An example of a learning based question is:

2. Pentium class microprocessors must be super-cooled prior to use.   _True _False

The **behavior** level is the most complex level of evaluation. This deals with the actual job improvement of the trainee. The behavior evaluation should come from trainee, its supervisor, subordinates, and peers. It should be performed at least three months after the training

[Stevens & Hellweg, 1990]. An example of a behavior based question is:

6. I am capable of speaking to large groups: _Excellently _Well _Acceptably _Poorly

Results are the actual effects that training has had on an organization. Items such as turnover, absences, sales, customer satisfaction, quantity and quality of performance, morale, cost reductions, grievance reductions, accident rates, suggestions, employee satisfaction and time use should be evaluated [Stevens & Hellweg, 1990].

8. Morale at the worksite has (since my training).   _Increased significantly
                                                     _Remained about the same
                                                     _Decreased significantly

The outcome of one of the four areas may affect other areas [Dewine, 1987]. The amount of time between training and a post training evaluation is not a standard. Ranges of suggested times are from two weeks to twenty-three months [Stevens & Hellweg, 1990]. An average time is from four to six months.

An alternate method of evaluation of training is content evaluation. **Content validity** is the evaluation of how the training content is related to the job. The training content must be identified. Items that are included are knowledge, skills, abilities, and other personal characteristics(KSAOs) that are needed for job performance. The content is then evaluated through a Content Validity Ratio (CVR) approach. People who have a thorough knowledge of the job rate each KSAO on its importance to the

job. The following formula is used to determine validity
[Ford & Wroten, 1984].

$$CVR = \frac{\text{People stating KSAO is important - People stating KSAO is unimportant}}{\text{Total Number of People}}$$

Positive CVRs mean that greater than half of the people
stated that the KSAO was important and negative CVRs mean
that less than half of the people stated that the KSAO was
important. A method for matching the CVR data and training
needs would include the following steps. First divide the
KSAOs into categories. Have your job experts rate the
important KSAOs on a scale. This scale would determine how
training intensity and resources should be spent on
different areas of subject content [Ford & Wroten, 1984].
These methods would work well. However, they would require
customized forms for each course and extra manpower because
the procedure could not be automated.

Kruger & Smith (1987) recommended two different
surveys: a skills/behavior survey and a health/stress
survey. Both surveys use a system of examining statements
and choosing to what degree you agree with the statements.
The following is an example:

3. I am able to communicate with my manager.   AGREE 9 8 7 6 5 4 3 2 1 DISAGREE

The **skills/behavior** survey deals with what was
learned, how the trainee's performance has changed and how
it has affected the organization. A survey is filled out by
the trainee, its supervisor and some others. A sample

question on a skills/behavior survey might be:

6. I am capable of speaking to large groups: _Excellently _Well _Acceptably _Poorly

The **health/stress** survey identifies health and stress

risks to the employee. It is only be filled out by the

trainee. A sample question on a health/stress survey might

be:

6. My knowledge of safety that is required for the job is: _Proficient
_ Adequate
_Not Adequate

Existing Training Evaluation Programs

The following are some training evaluation programs currently in place at different governmental and non-governmental agencies.

Department of Agriculture-Plant Protection and Quarantine:

The Department of Agriculture's Plant Protection and Quarantine branch currently uses an evaluation program in which the evaluation is done by front-line supervisors. The supervisors are first trained in the skills needed to evaluate the trainees. The supervisors are then assigned to evaluate recently trained officers. The evaluators may use questionnaires, interviews, performance observations and miscellaneous inquiries to gather data. These are all used after the training. The trainees supply data concerning their performance through either questionnaires and interviews. The evaluators gather their own data through on-the-job performance evaluations and candid inquiries. The data is collected by a central organization and compiled to determine if the skills taught actually assisted the officers with their jobs. Advantages of this program include providing relevant data for evaluation and actively involving supervisors in the evaluation. Disadvantages include long length of time needed for process, requiring supervisors to do work solely on evaluation causes need to hire temporary replacements and expensive travel costs of

supervisors. A final disadvantage is that the evaluation is based on the specific job or supervisor's objectives and not those of the entire organization [Salinger & Roberts, 1984]

Department of Agriculture-Forest Service: The Forest Service currently uses a questionnaire-based evaluation system. Standard questionnaires are completed by the trainee, its supervisor and subordinates before the training session and four weeks after the session. Copies of the questionnaire are also completed by untrained personnel and their supervisors and subordinates in order to have a control population. Questions in the questionnaire are behavior based such as the following

To what extent do you think training:	GREATLY							NOT AT ALL	
Will improve your ability to be a better supervisor?	9 8 7 6 5 4 3 2 1								
Will increase productivity?	9 8 7 6 5 4 3 2 1								
Is a good use of your time?	9 8 7 6 5 4 3 2 1								
Improve your communication skills on the job?	9 8 7 6 5 4 3 2 1								

Results are statistically tabulated. The results are then compiled and reported to the specific organizations. The questionnaires are behavior based and completely confidential. The tabulation stage tests the statistical significance of questions, trainee, supervisor and subordinate perceptions and comparison of trained results versus the control's results. Advantages of this program include accurate results due to use of a control group and small amounts of time and resources needed. The only significant disadvantage is the possibility of low return rate of questionnaires [Salinger & Roberts, 1984].

National Aeronautics & Space Administration: The evaluation program described below was for a career seminar sponsored by NASA Headquarters. The evaluation was directly built into the training program. The evaluation consisted of both pre and post training questionnaires, group interviews and individual interviews. The questionnaires contained general, open-ended questions dealing with current and future job goals. A sample question on a survey might be:

7. What have you done to achieve your goals in the past 30 days?

In the group interviews, the trainees spoke about their own job plans and how they were using what they learned. Trainees could hold optional individual interviews with the instructor concerning their own progress. There were also informal evaluations during the course. The instructor was the only evaluator involved and there was no major computation of data in the evaluation. The instructor had to be available after the training session for many months in order to do the personal interviews. Advantages of the evaluation program included adaptability. Disadvantages include the fact that it is not very structured, forms need to be customized for different courses, constant need for the instructor, no organizational input and most of work has to be in groups which may be difficult to assemble [Salinger & Roberts, 1984].

Department of the Navy- Navy Finance Center: The Navy Finance Center evaluated one of its Interaction Management

Courses through a system of questionnaires done in a group setting. The questionnaires were completely behavior based with questions such as:

When my supervisor speaks to me regarding disciplinary action, he/she ...

	Always					Never
Uses my ideas when I offer them.	6	5	4	3	2	1
Acknowledges my feelings about the situation.	6	5	4	3	2	1

The questionnaires were completed by employees, their managers and subordinates that did and did not take the course. The evaluation was done before the training and two years after. The results were then computer tabulated to create statistical averages of how the training works through the perceptions of the employees, their managers and subordinates. Reports were then created from that data. Advantages of this evaluation method includes involvement of all members of an organization, use of a control (the untrained sample) to ensure accuracy of results and high return rate because of the group approach to completing the questionnaire. Disadvantages include a management commitment and travel expenses if the respondents are not in a common geographical area [Salinger & Roberts, 1984].

Office of Personnel Management: The OPM devised a generic training evaluation program called the Participant Action Plan Approach (PAPA). The evaluation system asked each participant to identify certain behaviors or actions related to the course that he/she would like to change. Here the evaluator would either interview the trainee (by phone or in person) or use questionnaires (six months after the

training) to determine whether the actions were carried out. The evaluation also checked for results of tried action plans and why untried action plans were not attempted. The questionnaire also asked how the course could be changed to better teach the trainee. Problems and obstacles that deterred the trainee from carrying out the plan were also identified. The result were computer tabulated. Results were used to create reports and eventually modify the course. The program provides data primarily concerning behavioral changes brought about by the course. Advantages of this program include ability to be used for many courses and it can accurately describe what actions came from the training. Disadvantages include the need of self-reports and skilled interviewers, large amount of time needed and it does not involve supervisors and subordinates in the evaluation process [Salinger & Roberts, 1984].

1993 NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM

JOHN F. KENNEDY SPACE CENTER
UNIVERSITY OF CENTRAL FLORIDA

*** REPORT NOT AVAILABLE AT PUBLICATION TIME ***

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