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(NASA-CR-142905) NASA-GIT PREDOCTORAL  
DESIGN TRAINING PROGRAM Final Report  
(Georgia Inst. of Tech.) 28 p HC \$3.75

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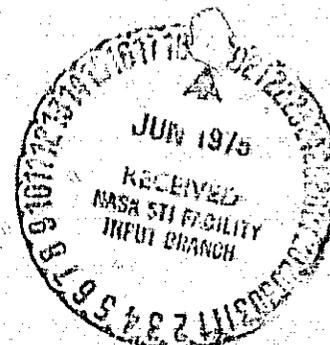
COLLEGE OF ENGINEERING  
GEORGIA INSTITUTE OF TECHNOLOGY  
ATLANTA, GEORGIA

NASA-GIT PREDOCTORAL DESIGN TRAINING PROGRAM

GRANT NUMBER NGT 11-002-064

FINAL REPORT

MARCH 1974



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## NARRATIVE

Georgia Tech and its students have greatly benefited from the NASA Design Training grant. This grant has supported 22 students at one time or another in the period 1967 - 1973. These students received a total of 19 graduate degrees from Georgia Tech - 17 MS plus 2 PhD. Nine dissertations were completed by these students. Three students are still enrolled and expected to eventually receive their PhD. One former trainee received a PhD in night school at another university after leaving Georgia Tech. Table 1 summarizes the quantity and quality of academic achievement of the 22 students who have been supported at least partly, by NASA Design Traineeships. Table 2 lists those dissertations, large; MS which have been completed by the students and those Phd dissertations on which substantial progress has been made. It should be noted that frequently the Masters degree is not required for completion of the requirements for a Master of Science degree.

A part of the NASA Design Trainees program from the beginning has been a series of three special graduate courses in Systems Design developed particularly to support the training program. The first of these courses is a course in the Methodology of Systems Design, while the last two have been project oriented courses based on the model of NASA's summer design faculty institutes. These courses led the way in the buildup of a multidisciplinary design structure at the Institute. This design structure has been a great additional benefit to the Institute of the training program. In the eight projects from 1967 to 1974 approximately 160 graduate students have participated .

More recently the college of engineering has moved to create a number of

multidisciplinary programs in various fields of engineering. There are 17 such programs in the College of Engineering of which Urban Engineering, Systems Engineering, and Engineering Design are of particular significance. The Urban Engineering program has for the past two years included the two complex systems design project courses as an integral part of the MS program. This has resulted in cross listing of the courses in Civil Engineering, Architecture, Engineering Science and Mechanics, and Industrial and Systems Engineering, as well as the original group of Aerospace, Electrical and Mechanical Engineering. In addition, the multidisciplinary committees in Systems Engineering and Design Engineering which have just recently been formed are very likely to include these courses in their curriculums. Dr. Dickerson serves as Chairman of the Systems Engineering Committee and is a member of the Urban Engineering Committee.

The training grants and their attendant support have nourished an activity which has impacted directly on roughly 200 graduate students in the last seven years. Many students who are not design trainees did derive their thesis topics directly or indirectly, from the various projects. Frankly, the activity (multidisciplinary design) was well ahead of its time and is only recently beginning to be widely accepted by faculty other than the originating group. A very long term impact on the education of engineering students is expected.

It is also believed that some of the original students, both Trainees and others, have become sufficiently proficient and enthusiastic to be able to make significant personal contributions to the future course of events in our society.

A short description of the activities and status of each of the former Trainees

follows. Of the 22 students only 4 are not included. These four could not be located for personal telephone interviews.

TABLE 1. ACADEMIC ACHIEVEMENT OF NASA DESIGN TRAINEES

| <u>Name</u>              | <u>Degrees</u>  | <u>Graduate Credit</u> | <u>GPA</u> |
|--------------------------|---|------------------------|------------|
| Charles R. Andrews       | BEE, MSEE at GIT                                      | 122                    | 3.         |
| James M. Corbitt         | BEE, MSEE at GIT                                      | 50                     | 3.         |
| Edward K. Dahill         | B.S. at Notre Dame, MSME at GIT                       | 40                     | 3.         |
| William I. Crichton, Jr. | BEE at GIT  | 84                     | 3.         |
| Lester D. Dozier         | BME, MSME at GIT                                      | 109                    | 3.         |
| John H. Duckman          | BS at NYU   | 51                     | 2.         |
| David E. Ferguson        | BIE, MSIE at GIT                                      | 33                     | 3.         |
| Robert S. Gordy          | BS at U. of S. Fla.,<br>MSEE, Ph.D. at GIT            | 83                     | 3.         |
| Richard W. Hess          | BME, MSME at GIT                                      | 95                     | 3.         |
| Roscoe M. Hinson, Jr.    | BME, MSME, Ph.D. at GIT                               | 72                     | 2.         |
| Ralph A. King, Jr.       | BS at Virginia Poly                                   | 15                     | 2.         |
| Carroll S. Kirkpatrick   | BS at U. of Texas, MSME at GIT                        | 50                     | 2.         |
| Samuel C. Matthews       | BAE, MSAE at GIT                                      | 62                     | 2.         |
| William I. Pugh          | BCE, MS at GIT  | 95                     | 2.         |
| James M. Petway          | BEE, MSEE at GIT                                      | 52                     | 2.         |
| Charles T. Savelli       | BAE, MSAE at GIT                                      | 55                     | 2.         |
| Charles R. Scraggs       | BME, MSME at GIT                                      | 36                     | 2.         |
| Francis W. Skwira        | BSME at Western New England<br>MSME at Worcester Poly | 45                     | 2.         |

**FOLDOUT FRAME**

C ACHIEVEMENT OF NASA DESIGN TRAINEES

|  | <u>at GIT</u>          |            |                             |                  |
|--|------------------------|------------|-----------------------------|------------------|
| <u>Degrees</u>                         | <u>Graduate Credit</u> | <u>GPA</u> | <u>Ph.D. Thesis Credits</u> | <u>Birthdate</u> |
| E at GIT                               | 122                    | 3.4        | 154                         | 11-21-45         |
| E at GIT                               | 50                     | 3.5        |                             | 5-4-44           |
| Notre Dame, MSME at GIT                | 40                     | 3.3        |                             | 6-9-41           |
| GIT                                    | 84                     | 3.8        | 2                           | 6-9-41           |
| ME at GIT                              | 109                    | 3.1        | 117                         | 7-17-37          |
| YU                                     | 51                     | 2.8        |                             | 6-23-43          |
| IE at GIT                              | 33                     | 3.5        |                             | 6-18-47          |
| of S. Fla.,<br>i.D. at GIT             | 83                     | 3.7        | 129                         | 10-27-41         |
| ME at GIT                              | 95                     | 3.6        | 192                         | 10-26-43         |
| ME, Ph.D. at GIT                       | 72                     | 3.7        | 113                         | 5-23-44          |
| Virginia Poly                          | 15                     | 3.2        |                             | 9-12-45          |
| of Texas, MSME at GIT                  | 50                     | 3.6        |                             | 11-12-41         |
| E at GIT                               | 62                     | 3.7        |                             | 6-25-46          |
| at GIT                                 | 95                     | 3.6        | 125                         | 6-12-46          |
| E at GIT                               | 52                     | 3.7        |                             | 6-11-46          |
| E at GIT                               | 55                     | 3.5        |                             | 10-8-44          |
| E at GIT                               | 36                     | 3.8        |                             | 4-26-45          |
| Western New England,<br>Worcester Poly | 45                     | 3.3        | 20                          | 1-4-44           |

**FOLDOUT FRAME** 3

at GIT

| <u>Name</u>          | <u>Degrees</u>                    | <u>Graduate Credit</u> |
|----------------------|-----------------------------------|------------------------|
| Edward D. Stephens   | BIE at GIT                        | 21                     |
| Stephen L. Stumph    | BA at Brigham Young,<br>MS at GIT | 34                     |
| Harvey C. Taylor III | BME, MSME at GIT                  | 92                     |
| George A. Townes III | BME, MSME at GIT                  | 89                     |

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at GIT

| <u>degrees</u>       | <u>Graduate Credit</u> | <u>GPA</u> | <u>Ph.D. Thesis Credits</u> | <u>Birthdate</u> |
|----------------------|------------------------|------------|-----------------------------|------------------|
| GIT                  | 21                     | 3.3        |                             | 7-1-46           |
| Brigham Young,<br>UT | 34                     | 3.4        |                             | 1-26-41          |
| ME at GIT            | 92                     | 3.9        | 68                          | 3-20-44          |
| ME at GIT            | 89                     | 3.2        | 114                         | 10-30-43         |

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Table 2

Dissertations Completed

|                          |   |
|--------------------------|---|
| Kevin Dahill (ME)        | An Investigation of Stability for a Class of Stepping Motors.   |
| David Ferguson (IE)      | The Development of a Self-Adaptive Prediction and Control System  |
| Stephen Gordy (EE)       | *A Computer Aided Broad Band Impedance Matching Technique   |
| Roscoe Hinson (ME)       | The Design of a Pressure Control System for a Compressible Flow Test Apparatus<br><br>*A Collision Avoidance Warning Criterion for Maneuvering Aircraft |
| Carroll Kirkpatrick (ME) | A Study of the Pre-Ignition Behavior of the Selected Garmet Fabrics and Consequent Burn Injury Probability  |
| William Pugh (ME)        | A Study of Impact Motion Based on Rheological Modelling   |
| Richard Scruggs (ME)     | Design of a Mechanical Phase-Plane Time Response Analyzer.  |
| Stephen Stumph (ISyE)    | The Synthesis of a Mobile Computerized Health Testing System  |

\*PhD

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Ph. D. Dissertations in Progress

|                    |  |
|--------------------|--|
| Lester Dozier (ME) | Differential Game Theory Applied to the Category III Automatic Landing Problem for STOL Vehicles |
| Richard Hess (ME)  | Strategies for the Sequential Packing of Random Sized Rectangles.                                |
| William Pugh (ME)  | Formulation and Evaluation of Alternative Automated Refuse Accumulators.                         |

Charles R. Andrews was in AFROTC during his undergraduate years at Georgia Tech and was able to have his active duty deferred for several years while attending graduate school. He completed his M. S. and most of the requirements for the Ph.D. in electrical engineering before going on active duty. He still hopes to complete his Ph.D.

At the present time he is assigned to the Rome Air Development Command at Griffith Air Force Base in New York. His work is concerned with configuring minicomputer systems and interfacing these systems with large computers. The systems are used in various intelligence data handling tasks. Charles feels that his group is at the forefront of these activities and as such he is receiving very valuable experience in an increasingly important area.

He indicated that his educational experience in systems design has been quite useful. He is anxious to get into a situation where he can spend more time in this activity. He feels that very frequently the organization he is with spends too much time in managing one crisis after another relative to the time spent in long range planning and design.

Mr. Andrews is married to a Rome, Georgia girl and has one boy. His address is:

RADC/IRDA  
Griffith AFB, New York  
Attn: Lt. Andrews

and the office phone number is 315-330-3126. Charles is 28 years old.

James M. Corbitt was drafted into the Air Force in 1968 and served until early 1974. His assignment in the Air Force was at the Air Development Command where he worked as a Technical Administrator on high speed digital communication systems using tropospheric scatter. He was very pleased with this assignment from a technical standpoint but decided not to re-enlist. Instead he joined Southern Services a division of the Southern Company (3rd largest power network in the United States) as a Engineering Programmer. Southern Services handles the billings and other service functions for all of the operating companies owned by the Southern Company.

Now that he is back in Atlanta, Jim is thinking of returning to Tech for part time graduate work.

He is 29 years old. His office phone number is 404-252-6112.

William I. Crichton is president of Bill Crichton and Associates of Riverview, Florida. The firm, named after his father, does consulting in industrial and systems engineering and in management. They are also sales representatives for products serving the plastics, construction and telephone industries. He is also president of a small firm which he founded, Problem Resources, which is an educational and business consulting firm. This firm is engaged in promoting the "systems approach" as taught in the Georgia Tech systems design courses as a way of tackling many business problems.

Bill has a varied background. He received his B. S. in mechanical engineering from the University of South Florida, a B. S. in electrical engineering at Georgia Tech and pursued his Ph.D. in industrial and systems engineering. He left Georgia Tech before completing his dissertation largely because in his opinion the Ph.D. degree was not worth the income that was being foregone in the process of pursuing it.

Bill was always a strong advocate of innovation and creativity as deficient ingredients in engineering education. In a recent conversation he indicated he still feels that analytic tools furnished students are disproportionate to the creative tools.

Bill can be reached at

Bill Crichton and Associates  
P. O. Box 278  
Riverview, Fla. 33569  
813-677-5115

Kevin Dahill is a mechanical engineer for Control Data Corporation. His present project is the design of the control system for the read/write heads for a new disk unit. His activities since joining Control Data have been almost entirely in the area of design of control systems for memory devices. Kevin was at Georgia Tech slightly over one year (1969-70) during which he majored in the field of automatic control. For purposes of his current work he feels his preparation was more than adequate in as much as many of the techniques learned in graduate school have yet to be put into practice in his industry.

Kevin is 26 years old. His address is

5524 Chanty Rd.  
Edina, Minnesota 55436

and office phone number is 612-830-5606.

Lester Dozier has been a part-time graduate student continuously since September of 1965 except for a period of active duty during the Vietnam conflict and for a period during which he was a NASA trainee.

While a part-time student he has been employed by Lockheed Georgia Company and is presently a Senior Electronics Engineer. In the last few years his work has been almost exclusively in the preliminary design and analysis of advanced Flight Control Systems. Presently he is working on a Lockheed proposal to NASA for construction of a STOL test vehicle.

Lester has majored in automatic control and dynamics during his studies at Tech. His PhD thesis topic is concerned with optimal strategies for STOL vehicle landings in the face of adverse wind conditions. This problem, a mini-max problem, has proved to be exceedingly difficult.

Mr. Dozier is married, has three children and lives at:

159 Timbercreek Terrace  
Smyrna, Georgia 30080

R. Stephen Gordy is a project engineer in the research and development laboratories of Electronic Communications, Inc. In this capacity he is responsible for the design of "acoustic surface wave device processors." As a general rule, Steve must prepare technical proposals to (largely military) users as well as design and supervise the construction of the processors if the proposals are accepted. He apparently has been quite successful. He has seven patents applied for and one application in preparation. Two projects of which he is particularly proud are a "PSK state-of-the-art modem" and a "spread spectrum modem."

Steve received both his M. S. and Ph. D. in electrical engineering from Georgia Tech. He feels that Tech gave him an excellent education. He has mixed feelings about the time and effort required to complete a dissertation. In his case, he does not work on projects directly related to his dissertation but does feel that the dissertation work gave him a technique and methodology of development work which has been quite valuable in his work.

Steve is 32 years old and has a family. His office phone number in St. Petersburg, Florida is 813-397-1120.

Richard Hess was nearly a permanent fixture at Georgia Tech prior to his leaving in 1973. He had done his B. S. work here under co-op with Beloit Corporation from 1961-1966. His graduate work in Mechanical Engineering extended from 1966 until 1973. Throughout these years he was involved in campus activities as well as studies. He served as vice-president of the academic senate, president of the sailing club and as a dorm counselor for many years.

There is little doubt that Richard will finish his Ph. D. Prior to leaving he completed all the work for the Ph. D. including the thesis. His committee has approved his work but it remains for him to complete the document itself. It is expected before Summer 1974.

Mr. Hess concentrated on mechanical design and automatic control during his graduate work. He has just begun to work for Texas Instruments in Dallas, Texas as a Senior Design Engineer. His work there is closely allied with his studies as he is involved with the design and construction of automatic machines for the manufacture of electronic components.

He felt that his education at Tech has been good. He commented that it might be useful to furnish students with certain practical information regarding the availability and use of vendor information.

Richard is 30 years old, married and lives at

Creekside North Apartments  
13564 Maham Road  
Dallas, Texas  
214-238-3575

Roscoe Hinson completed his Ph. D. at Georgia Tech in 1972. He has since been employed by Lummus Industries in Columbus, Georgia and by Georgetown Steel Co. in Georgetown, S. C. where he is presently employed. His job title is Senior System Analyst and is responsible for technically oriented systems and computer applications in the rather small company. Typical activities include simulation of operations in the steel mill and development of digital process control for the mill.

Roscoe majored in controls and mechanical design during his graduate work. He also developed a remarkable facility to use the digital computer during his Ph. D. thesis work. He wrote a number of general purpose programs which are widely used by graduate students in the Mechanical Engineering Department today.

Upon graduation Roscoe was determined to work for a small company and he has not regretted this decision.

Mr. Hinson is married with 2 children; is 29 years old; and his office phone number is 803-546-6173.

Carroll S. Kirkpatrick (Stony) is with the consulting engineering firm of Haag Engineering. This firm specializes in investigating failures of all types of machinery and structures and is internationally recognized in this line of work. Stony frequently travels to the sites of various failures. Their principle clients are insurance companies and lawyers.

Mr. Kirkpatrick has recently become registered as a professional engineer in Texas and expects to soon be promoted to Senior Engineer in the firm.

An unusual aspect of Stony's situation is that he is married to one of few women mechanical engineers to be graduated from Georgia Tech. His wife Jackie has a B. S. and M. S. in mechanical engineering from Georgia Tech and is also employed by Haag Engineering.

Stony feels that additional graduate work would be very beneficial to him especially if he could broaden his background with more courses in such subjects as economics, civil engineering and electrical engineering. He thinks there is a need at the graduate level for more "survey courses" which would have the objective of greater breadth rather than the common graduate emphasis on depth.

Haag Engineering is located in Addison, Texas.

James M. Petway is Systems Manager for Data Processing for the First National Holding Corporation of Atlanta, Georgia. This company owns the First National Bank, a major bank in Atlanta. The data processing activities are primarily to provide computer services for large corporate customers of the bank.

Mr. Petway was a student at Georgia Tech for only a short period.

It is very common in Atlanta to find engineering graduates of Georgia Tech involved in seemingly non-engineering tasks with banks, insurance companies, securities firms, law offices, etc.

Jim is 27 years old.

Samual C. Mathews is a Senior Experimental Engineer at Pratt and Whitney in West Palm Beach, Florida. He has been with Pratt and Whitney since leaving Georgia Tech in 1969 after receiving both his B. S. and M. S. in aerospace engineering. Although the plant there manufactures jet engines, he has worked on research and development projects in a variety of fields involving most recently rocket research and lasar applications. Much of the details are classified.

Looking back, Sam wishes he had taken more courses in the materials and manufacturing processes areas. He is now 27 years old and does not expect to pursue further graduate work. His employment address is

Pratt and Whitney  
Florida Research and Development Center  
P. O. Box 2691  
West Palm Beach, Florida

William E. Pugh has accepted a position as a Member of Technical Staff at Bell Laboratories in their laboratory in Atlanta. He is well established in Atlanta having attended Georgia Tech continuously since 1965 and owning his own home here.

He is very near completing his Ph.D. Dissertation which is attempting to apply the most modern concepts of control theory and simulation to the design of a remote manipulation for garbage and trash collection. Bill is an exceptionally competent design engineer. He has a good combination of practical experience and theoretical capabilities. Much of his undergraduate and graduate education was partially supported by work at the Engineering Experiment Station at Georgia Tech. He lists a total of 31 projects he worked on during this experience ranging from the design of a nut cracker to a cotton blender.

Bill lives at:

1309 Lanford Drive  
Lilburn, Georgia 30247

C. Thomas Savell is Manager of Theoretical Aeroacoustics for General Electric. The principle application of theoretical aeroacoustics at General Electric is in quieting turbojet engines. His work is highly mathematical and is supported by basic experiments.

Tom received his B. S. and M. S. in Aerospace Engineering from Georgia Tech in 1967 and 1968 respectively. He began his Ph. D. work but became discouraged about the amount of time required for (and limited value of) a Ph. D. in Aerospace Engineering. He left to go to work for General Electric. However, he completed his Ph. D. at night at the University of Cincinnati in 1973. His dissertation concerned the Design of Air Foil Blades in Fans.

Mr. Savell had a number of comments on engineering education. He felt that in general an engineering student needs to be exposed to more management and legal material as well as receive more directed training in English writing and grammar with particular emphasis on technical writing. He suggested that very specialized courses were not needed and that systems engineering required very little course work and was best evolved on the job. In comparing Georgia Tech to the University of Cincinnati he stated that Georgia Tech had the superior programs and faculty.

Tom is 29 years old. His address is

1140 Wionna Avenue  
Cincinnati, Ohio

and phone number is 513-243-2177

Charles Richard Scraggs was perhaps the sharpest all around engineer in the Design Traineeship Program at Georgia Tech. He received his B. S. with a 3.8/4.0 grade point average and during his senior year had won the ASME national design competition. He continued directly into graduate school and completed his M. S. before being confronted with an imminent draft into the Army because of a low lottery number. He then left Tech for a defense related position at Western Electric. He there became a Senior Engineer and finally a Department Chief. However, he felt that it was best to leave defense work and moved back to Atlanta recently as Assistant to the Director of Operations at Olympic Manufacturing Division of Consolodated Foods. This division is primarily involved in the manufacture of fleet washing equipment.

Very recently Richard was promoted to Director of Engineering and Manufacturing at the company.

When asked what he felt might be changed about his education at Georgia Tech he emphatically said that his industrial experience indicated that Georgia Tech graduates were generally the best prepared. He felt that perhaps a little more humanities wouldn't hurt and was fearful that since his departure Georgia Tech may have grown soft on students. (This is in reference to the past and possibly current propensity to demand the impossible from students).

Mr. Scraggs is still unmarried at 28 years of age. His office phone number is 404-351-5002.

Harvey C. Taylor works at the headquarters of Coca-Cola USA, only about 500 feet from where he went to undergraduate and graduate school in mechanical engineering. He is currently a staff engineer responsible for design, testing, and implementation of new Coke bottles. This work is very closely related to his graduate work where he studied primarily mechanical design with special emphasis on solid mechanics. He had completed everything required for his Ph. D. except the thesis when he left for financial reasons. Even the thesis was well along. However, Harvey doubts that he will finish the dissertation in as much as he sees little advantage in his present employment.

Harvey is currently 29 years old and married.

Edward R. Stephens received his B.S. in industrial engineering from Georgia Tech in 1967. He returned for graduate school in 1969 but due to financial problems in his family had to leave again in 1970 before receiving his M.S. He has been employed since 1971 for Industrial Nucleonics, a firm which is prominent in the manufacture and installation of process controls for the paper industry. Ed is primarily concerned with development of control algorithms and with interfacing requirements for particular installations. Recently he has been concerned with control systems for digesters.

Prior to his employment with Industrial Nucleonics he had been employed by International Paper.

Ed is married, has one child and is 27 years old. His address is

Control Systems Division  
Industrial Nucleonics  
Columbus, Ohio

and phone number is 614-261-2000

Francis W. Skwira is in the marketing program of General Electric's large steam turbine division. He is currently working as a sales engineer. Francis came to Georgia Tech with his M. S. already in hand from Worcester Poly and already working for General Electric. His Ph. D. program progressed satisfactorily except that he had some problems completing the qualifying requirements. When he left Georgia Tech after 21 months to return to General Electric he had completed all course requirements and the foreign language requirement and lacked "only" the thesis and a special requirement for his fluid mechanics qualifier.

Francis has indicated a desire to return to Georgia Tech to complete his Ph. D. He would need to get transferred to Atlanta to do this since for financial reasons he can only proceed on a part-time basis. One incentive for this is that while at Tech he met and married an Atlanta girl. In the meantime his brother-in-law has become President of the Atlanta City Council. This would make it an exciting time for the Skwiras to live in Atlanta.

Francis is 29 years old.

**Address:**

Francis W. Skwira  
2302 Lucretia Avenue Apt. #1  
San Jose, California 95122  
408-279-1091 (home)

George A. Townes is a mechanical engineer for Gulf Atomic Corporation in Barnwell, South Carolina. The plant he is employed at is gearing up to recover uranium and platinum from spent fuel units from nuclear power plants. It is scheduled to begin operations in December of 1975. George's responsibilities are in the design, construction and check out of specialized equipment for the plant. In particular, he is responsible for the units which will cut up the used fuel units. As with all such processes in the plant, handling of materials is done remotely. Since Mr. Townes studied primarily mechanical design and automatic control in graduate school his job function is well suited to his education.

George received two degrees from Georgia Tech in mechanical engineering. His B. S. in 1965 and his M. S. in 1967. He was well along toward his Ph. D. by Summer 1968 when he left to fulfill his ROTC obligation. Upon returning he received the NASA traineeship and continued to work on a Ph. D. dissertation concerning the design of "impact dampers." This topic was developed initially with the help of a professor who had left Georgia Tech while George was in the service. After nine months of additional effort it appeared that the topic could not work out and Mr. Townes left to work for his present employer in October of 1971. He feels it is doubtful that he will ever complete his Ph. D.

In reviewing his education he felt that more technical composition was needed in the curriculum. He also felt somewhat deficient in his exposure to codes and standards and suggested that some exposure to the structure of codes and standards is desirable.

George is married and has one girl two years old. Address

George A. Townes III  
P. O. Box 917  
Barnwell, S. C.  
803-259-1711 (office)

Age: 30