Guide to the H. O. Fuchs. Engineering case program : case files, 1948-1972

Collection number: SC 269

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Descriptive Summary

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Provenance

Gift of Henry O. Fuchs, 1981.

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Biography

Henry O. Fuchs was professor of mechanical engineering at Stanford University, 1964-1973, and director of the Engineering Case Program.

Scope and Content

The Engineering Case Program, which began at Stanford University in 1964, provided written accounts of engineering problems to be used in the training of engineers. This collection consists of the master files from 114 cases where the author was a Stanford faculty or staff member or the event described happened in the San Francisco Bay Area. In addition to the case description, some files include correspondence, memoranda, diagrams, and photographs.

Following the container listing are abstracts for most of the cases included in this collection.

Box 1 Case 1-4: **Ion Exchange Case Study, J. E. Arnold, R. S. Welther, M.I.T., 1955.**

Box 1 Case 1-5: **Box Car Design Project, J.E. Arnold, M.I.T., 1952.**

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Box 1 Case 1: **Hewlett-Packard Company I, (A) Mechanical Design of Coaxial Microwave Connectors, (B) History of Coaxial Microwave Connector design, K.H. Vesper, 1964,(C) Commercial Development of the Sexless Connector by Amphenol Corporation, Sue Hays, 1967.**

Box 1 Case 15: **Hewlett-Packard Company III, (A) Drill Jig Design for a Structural Plate, (B) Drill Jig Tolerances, P.Z. Bulkeley, E. Echterling, 1964.**

Box 1 Case 16: **Pacific Gas and Electric Company, Digital Computer Simulation of a Hydroelectric Plant, R.E. Keller, R.D. Regier, 1964.**

Box 1 Case 17: **FMC Corporation, (A) Need for a Rice Sorter, (B) Rice Sorter Layout, (C) Mechanical Failures in a Rice Sorter, (D) Rice Sorter Redesign, K.H. Vesper, J.K. Williams, 1964.**

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Box 2	Case 69: **City of San Jose-IBM Corporation Computerized Traffic Control, D.O. Covault, G.A. Fleischer, P.F. Williams, 1966.**
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Box 2	Case 72: **Varian Associates, Redesign of a Liquid Nitrogen Container, William S. Chalk, Ivan A. Shirk and Robert B. Thornhill, 1967.**
Box 2	Case 73: **Switching a Tracking Antenna, Sue Hays, 1968.**
Box 2	Case 76: **Precision Instrument Company, Modification of a Portable Video and Broadband Instrumentation Recorder, Karl H. Vesper and William H. Clemens, 1967.**
Box 2	Case 78: **Hewlett-Packard VI, Signal Generator Read-Out Design, Karl H. Vesper, Robert Beardmore and Charles Fernald, 1967.**
Box 2	Case 79: **Chaparral, Bolt Failure on a Racing Automobile, Henry O. Fuchs and William H. Clemens, 1967.**
Box 2	Case 80: **Consolidated Dynamics Corporation, Fracture of a Marine Gear Rim, William H. Clemens, 1968.**

Box 2	Case 82: **Design of an Electric Beam Dump at Stanford Linear Accelerator Center, Munir R. El-Saden, 1967.**
Box 2	Case 90: **Shedding a Toroid Amplifier at Stanford Linear Accelerator Center, Sue Hays, 1967.**
Box 2	Case 91: **Girder Alignment at Stanford Linear Accelerator Center, Henry O. Fuchs and Sue Hays, 1968.**
Box 2	Case 94: **Development of a New Drill at Ingersoll-Rand Company, H.O. Fuchs and Ronald J. Shuman, 1967.**
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Box 2	Case 100: **Pump Plunger Improvements at Kobe Inc., Robert Martin, 1969.**
Box 2	Case 109: **Development of a High Speed Weighing Machine at FMC, Sue Hays, 1969.**
Box 2	Case 111: **Design of a Hand Operated Film Drive Mechanism, John Sondeno, 1969.**
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Box 2	Case 114: **Development of a Circular Strike Plate at Schlage Lock Company, Richard C. Bourne, 1968.**
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Box 3	Case 124: **Warren Deutsch: Design of a Satellite Controlling Instrument Panel, Mitchel Blanton, 1968.**
Box 3	Case 126: **Plastic Pipe Saddle Design, Perm Garg, 1969.**
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Box 3	Case 150: **Drop Master, R. Ganeriwal, 1970.**
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Box 3	Case 157: **Interfaces at Sterling Development Labaratories, Sue Hays, 1970.**
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Box 3	Case 162: **Variable Stability System of the X-14A VTOL Aircraft, J. Hill, G. Kardos, A. Winn, 1970.**

Box 3 Case 174: **To Find a Bullet, Geza Kardos, 1971.**

Box 3 Case 178: **Negligence, Drew V. Nelson, 1971.**

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Box 3 Case 185: **The Design of the Bart-AFC Barrier Drive System at IBM, R. Pizali, 1972.**

Box 3 Case 186: **The Pickup-Head Link Failure, R. Pizali, 1972.**

Box 3 Case 187: **Value Engineering Applied to an IBM Leveling Screw, R. Pizali, 1972.**

Box 3 Case 188: **The Stun-Gun, A. P. Shack and G. Kardos, 1972.**

Box 3 Case 189: **Lazer Hardware, Fred Moreno, 1972.**

Box 3 Case 198: **Transportation of Liquefied Natural Gas, Sterling Beckwith, 1973.**

Box 3 Case 199: **Amphibious Vehicle Models: Calibration and Testing, Al Nahas, 1973.**

Box 3 Case 200: **150 Ton Pipe: Easier To Make Than to Move, Al Nahas, 1973.**

Box 3 Case 201: **Design of an Improved Aircraft Seat, R. Stephen Ball, William B. Goodman, William J. Kennish, 1973.**

Box 3 Case 205: **Peterson Tractor, Albert J. Nahas, 1973.**

Box 3 Case 212: **Air Force A-7D Brake Problem, H.O. Fuchs, 1974.**

Box 3 Case 213: **Paul Hait and the Dental Unit, D. N. Howse, 1974.**

Box 3 Case 215: **Designing a Gantry for Kyung Won, Professor H. O. Fuchs and Professor S. Bae, 1974.**

Box 3 Case 219: **Difficulties with Modular Housing, G. Kardos, 1975.**

Box 3 Case 221: **Thermal Fatigue and Instrument Design, Laurie Rendall, 1975.**

Box 3 Case 222: **Measuring Motor Torque-Speed Curves, G. Kardos, A. Chuman, 1976.**

Box 3 Case 223: **The 3.5 Millimetre Sliding Load, R. Sloss, 1960.**

Box 3 Case 224: **Bart Dead Train Detection, O. Baskind, N. Y. N. Chu, J. A. Palomo, J. F. Rollings, 1976.**

ECL 1001 **The Story of Eighty-Four Minutes, J. P. Den Hartog, 1966.**

Physical Description: Total 26 pages.

Scope and Content Note

A short elementary monograph by Professor Den Hartog on the special properties of a pendulum tuned to a period of eighty-four minutes and on the application of this device to navigation gyroscopes. Thirteen problems related to this pendulum are stated.

ECL 1002 **A Critical Meeting on the Development of Inertial Navigation-Related to The Story of 84 Minutes, W. Bollay, 1966.**

Physical Description: Total 24 pages.

Scope and Content Note

Dr. Bollay's report on a confrontation between the proponents of guided missiles and a scientist who had declared such guided missiles to be impractical. A confrontation was arranged by the Secretary of the Air Force and resulted in changing the mind of the scientist.

ECL 1006 **Spin Stability of the Explorer Satellite, William Bollay, 1967.**

Physical Description: Total 49 pages, 14 pages of charts and figures.

Scope and Content Note

This case relates a number of instructive events from the development of the highly successful Explorer satellite. It was designed to spin about its axis of minimum moment of inertia at a rate of about 700 RPM. But anomalies in the signals received from its antenna led to the conclusion that after about one orbit it changed to a rotation about its axis of maximum moment of inertia at a rate of about 120 RPM. Background and observed data are given in Part I. A dynamic analysis which explains the behavior is presented in Part II. Other interesting dynamic phenomena observed in the Explorer are discussed in Part III. The historical background is given in Part IV, documented by extracts from periodicals. The case includes a note for Instructors.

ECL 1-4 **Ion Exchange Case Study, J. E. Arnold, R. S. Welther, M.I.T., 1955.**

Physical Description: Total 48 pages.

Scope and Content Note

State-of-the-art in ion exchange systems is described as background from which student design projects can be selected. A number of needs and problems are indicated to be awaiting solution.

ECL 1-5 **Box Car Design Project, J. E. Arnold, M.I.T., 1952.**

Physical Description: Total 16 pages with 10 text, 6 exhibits.

Scope and Content Note

Illustrates the state-of-the-art in boxcar construction, giving dimensional and other data on the cars and suggesting some disadvantages which may suggest a variety of possible design projects by students.

ECL 1-6 **Sick Room Equipment, J. E. Arnold, G. H. Wood, M.I.T., 1956.**

Physical Description: Total 36 pages with 21 text, 15 exhibits.

Scope and Content Note

State-of-the-art in hospital beds, presenting background data on hospital beds as source material for student design projects. Students are to ferret out their own problems and then develop solutions.

ECL 1-9 **Rice in Burma, J. E. Arnold, A. T. Ling, M.I.T., 1952.**

Physical Description: Total 29 pages with 23 text. 6 exhibits. OUT OF PRINT.

Scope and Content Note

Gives the state-of-the-art in Burmese rice growing. Intended as background from which students can identify design needs as bases for design projects.

ECL 1-11 **Chinese Typewriter, J. E. Arnold, A. T. Ling, M.I.T., 1952.**

Physical Description: Total 38 pages with 21 text, 17 exhibits. OUT OF PRINT.

Scope and Content Note

Tells something about the characters of the Chinese language and about previous ideas for Chinese character typewriters. Intended as a basis for student creative thinking towards better design.

ECL 1-12 **Telephone Information Service, Need for a Better Directory System, J. E. Arnold, Stanford, 1959.**

Physical Description: Total 8 pages. OUT OF PRINT.

Scope and Content Note

Problems of providing telephone numbers quickly and economically to facilitate direct dialing are suggested.

ECL 1-13 **Development of an Oil Well Tubing Stripper Rubber, P. E. Bickel, H. O. Fuchs, UCLA, 1964.**

Physical Description: Total 30 pages with 14 text, 16 exhibits.

Scope and Content Note

Part one is a formal report submitted as evidence of accomplishment in applying for registration as Mechanical Engineer. Part two is an informal tale of adventures recalled on the project.

ECL 1-14 **The Wright Brothers' Airplane, H. O. Fuchs, UCLA, 1964.**

Physical Description: Total 29 pages with 14 text, 15 exhibits.

Scope and Content Note

A history drawn from published sources including quotations of Orville Wright taken from a deposition he gave as a witness in a 1920 lawsuit. Intended for introducing freshmen to engineering design.

ECL 1-15 **Design and Development of an Automatic Refrigerator Car Heater, H. O. Fuchs, UCLA, 1963.**

Physical Description: Total 80 pages with 20 text, 60 exhibits.

Scope and Content Note

History of a product from inception to large-scale use. Told by main customer and chief engineer. Includes samples of engineering reports, patents, drawings, and suggested assignment problems for students.

ECL 1-16 **Selected Design Notes, reproduced from the Flight Safety Foundation.**

Physical Description: Total 10 pages.

Scope and Content Note

A selection of one page illustrated descriptions telling of an aircraft component failure, explaining its cause and the recommended remedy.

ECL 1-17 **Hoover Dam, H. O. Fuchs, P. Searles, UCLA, 1964.**

Physical Description: Total 33 pages with 16 text, 17 exhibits.

Scope and Content Note

Taken from published sources plus interviews with former engineers of the project, this historical description was prepared to illustrate engineering design and its role in society for a freshman.

ECL 1 **Hewlett-Packard Company 1, (A) Mechanical Design of Coaxial Microwave Connectors, (B) History of Coaxial Microwave Connector Design, K. H. Vesper, 1964, (C) Commercial Development of the Sexless Connector by Amphenol Corporation, Sue Hays, 1967.**

Physical Description: Total 65 pages (Parts A, B, C) with 16 text, 49 exhibits.

Scope and Content Note

Anthony Badger, a mechanical engineer has been asked by his management for the mechanical design of a better coaxial connector for microwave frequencies. Part A relates the situation which he faced. Part B of the case shows how Mr. Badger approached the problem, his idea sketches and his detail work. Part C shows the redesign done by Amphenol who purchased the patent and marketed the connector.

ECL 15 **Hewlett-Packard Company III, (A) Drill Jig Design for a Structural Plate, (B) Drill Jig Tolerances, P. Z. Bulkeley, E. Echterling, 1964.**

Physical Description: Total 43 pages (Parts A,B) with 9 text, 34 exhibits.

Scope and Content Note

Part A describes a situation at Hewlett-Packard in which a drill jig is needed. Part (B) is a sequel showing a company engineer's layout of the solution for which precise dimensional tolerances remain to be determined. Part A alone can be used as a design problem. Students could later be given Part B to compare their solutions with a professional's. Or for a drawing problem alone both parts could be handed out together for students to work out the tolerances and put on dimensions. Background description includes how the problem came up, what the jig has to do with manufacturing, and why there is need for solution.

ECL 16 **Pacific Gas and Electric Company, Digital Computer Simulation of a Hydroelectric Plant, R. E. Keller, R. D. Regier, 1964.**

Physical Description: Total 45 pages, with 15 text, 30 exhibits.

Scope and Content Note

Written for a graduate system engineering course which emphasizes mathematical representation of system components and computer simulation of complex systems, this case has also found application in a civil engineering course on hydraulic machinery. The case begins with general discussion of the water power industry, then describes in some detail a particular hydroelectric power station, the Kings River Plant in California.

ECL 17 **FMC Corporation, (A) Need for a Rice Sorter, (B) Rice Sorter Layout, (C) Mechanical Failures in a Rice Sorter, (D) Rice Sorter Redesign, K. H. Vesper, J. K. Williams, 1964.**

Physical Description: Total 96 pages (Parts A,B,C,D) with 22 text, 74 exhibits.

Scope and Content Note

Part A presents background in processed rice. Part B gives the concept selected by the company, carrying the story to the point where layout of a specific design is needed. Part C describes some problems which arose in the first machine. Part D tells how an FMC engineer went at the problems.

ECL 18 **Oxford Laboratories, Prothrometer Design, R. H. McKim, J. K. Williams, 1964.**

Physical Description: Total 39 pages, with 20 text, 19 exhibits.

Scope and Content Note

An industrial design consultant, Robert H. McKim, has been asked to redesign a device for measuring blood clotting time (prothrometer), to improve its ease of assembly, ease of operation, and appearnace. The case is intended to give students practice in asking questions. It comes with a selection of additional handouts and with an Instructor's Note to respond to student questions asked about the general problems stated in this case.

ECL 19 **Hewlett-Packard Company II, Mechanical Design of a Rotary Vane Microwave Attenuator, P. Z. Bulkeley, E. Echterling, Revised by Sue Hays, 1967.**

Physical Description: Total 13 pages (Parts A,B) with 4 text, 9 exhibits.

Scope and Content Note

In the first of two parts of this case, company engineers are faced with cracking in some shrink-fit parts of a rotary vane waveguide attenuator. Suitable as a problem in stress analysis. In Part B of the case, the Hewlett-Packard engineers have decided on the modification required to prevent cracking, and the remaining problem is to put dimensional tolerances on the parts, a problem suitable for freshman drawing. An Instructor's Note is included.

ECL 20 **Hewlett-Packard Company IV, Component Layout of an Electronic Signal Analyzer, P. Z. Bulkeley, E. Echterling, 1964.**

Physical Description: Total 41 pages, with 8 text, 33 exhibits.

Scope and Content Note

Layout drawings are needed showing the arrangement with dimensions of electronic components and controls for a new model electronic signal analyzer. Intended as a problem for freshmen, its background illustrates the role of mechanical drawing in design of electronic equipment.

ECL 21 **Hiller Aircraft Company I, Preliminary Design of a Light Observation Helicopter, P. Z. Bulkeley, E. Echterling, 1964. Revised 1968 by Richard C. Bourne.**

Physical Description: Total 38 pages, with 7 text, 31 exhibits.

Scope and Content Note

Intended as a simple design and sketching problem for freshmen, this case presents background of a major Hiller project in development of a new helicopter to compete for an Army contract for the largest single quantity of aircraft purchased since World War II. Description of how the project proceeds in the company and how compromises are required include by implication some of the constraints which the student should observe in his arrangement of major components and sketching of possible configurations.

ECL 22 **Data International I, A Portable Sawmill, P. Z. Bulkeley, R. D. Regier, 1964.**

Physical Description: Total 35 pages, with 11 text, 24 exhibits.

Scope and Content Note

A letter has been received from a Colombian missionary expressing need for a lightweight portable machine for cutting logs into boards at stump site. Case intended to launch students into design projects of their own with minimal time wasted. Information on conventional sawmill practices and existing machinery plus some words of advice from experienced sawmill equipment designers are included.

ECL 23 **Guy F. Atkinson Company, Clearance Between a Conveyor and Support Tower, H. O. Fuchs, R. D. Regier, 1965.Revised 1968 by Richard C. Bourne.**

Physical Description: Total 13 (Parts A,B) with 6 text, 7 exhibits.

Scope and Content Note

Two parts comprise this case. The first presents a problem in descriptive geometry to assure clearance between a conveyor and a tower over which it must pass at a skew angle. The other concerns design of a simple bracket for fastening one end of the conveyor. All events are taken from circumstances of a current California canal construction project. General aspects of the project are included in description of the background from which the problem emerges.

ECL 25 **Philco Corporation I, (A) Satellite Tracking and Commanding Console Layout, (B) Student Console Layout Solution, (C) Panel Evaluation and Testing, R. H. McKim, J. K. Williams, 1965.**

Physical Description: Total 55 pages (Parts A,B,C) with 15 text, 40 exhibits.

Scope and Content Note

Is human factors engineering really just application of simple common sense or does it require special professional competence? Part A describes a test designed by the company to compare skills of professionals in this field with those of amateurs. Part B shows the performance of one of the amateurs. Part C presents further overall results of the test from which conclusions are to be drawn.

ECL 28 **Hiller Aircraft Company II, (A) Design of a Supercharger Inlet Duct, (B) Filter Housing Clearance Considerations, (C) Structura Bracket Design, (D) Engine Shroud Design, P. Z. Bulkeley, H. O. Fuchs, E. J. Echterling, 1964.**

Physical Description: Total 42 pages (Parts A,B,C,D) with 14 text, 28 exhibits.

Scope and Content Note

The company has decided to install a supercharger on the model 12-E helicopter to give it higher altitude capability. The addition requires modification of an inlet duct. In the first of four subcases, the duct design is complete except for drawing the intersection of two pieces, a descriptive geometry problem. Paper cutout patterns are included to save students' time. In Part B, Bill Lancaster, a power plant engineer in the company has decided that clearance between the duct and part of the airframe should be checked, another descriptive geometry problem, requiring consideration of motion of the engine on its mounts as well. Part C presents the need for a simple structural bracket design. Part D presents the need for an engine shroud design, mainly a sketching problem.

ECL 30 **Radiation Products Company, Failure of a Rotating Mirror, H. O. Fuchs, J. K. Williams, 1965.**

Physical Description: Total 28 pages, with 13 text, 15 exhibits.

Scope and Content Note

The company has been having problems with a mirror designed to rotate at speeds of around 10,000 revolutions per second for taking high-speed photographs. Attempts at solution over a period of years have not yet provided the answer and the question is what should be done next.

ECL 31 **Precision Instrument Corporation, Experience with a Tape Reel Hold-down Mechanism, H. O. Fuchs, R. D. Regier, 1965.**

Physical Description: Total 26 pages, with 9 text, 17 exhibits.

Scope and Content Note

Company engineers are dissatisfied with existing hold-down knobs used in one of their tape recorders, feeling they are not simple or inexpensive enough. The case presents their viewpoints plus data on existing devices as background for student design projects.

ECL 35 **William Wohlfort, Design of a Variable Frequency Oscillator, R. E. Miller, W. Wohlfort, 1965.**

Physical Description: Total 30 pages (Parts A,B,C,D) with 15 text, 15 exhibits.

Scope and Content Note

Electronic circuit design of a variable frequency oscillator is the focus of this case. Each of the first three sections ends with an unresolved problem answered by the professional in the start of the succeeding section.

ECL 37 **Allied Solid Rocket Corporation, E. J. Fisher, 1965.**

Physical Description: Total 47 pages (Parts A,B,C) with 26 text, 21 exhibits.

Scope and Content Note

Need for expansion of a large and fairly complex facility for mixing solid rocket fuel has raised a variety of engineering problems which are presented in three sections of the case. The first concerns decision among three specific alternatives for general design of the expansion. The second concerns selection of a heat exchanger, and the third concerns selection of a pump to move the mix.

ECL 38 **Dymo Industries, Inc., Design of a Tapewriter Component, H. O. Fuchs, J. A. Alic, 1965.**

Physical Description: Total 12 pages (Parts A,B) with 5 text, 7 exhibits.

Scope and Content Note

In the first of two parts a company engineer is asked to redesign a tape label dispenser so it can handle two different widths of tape. The second part then goes on to tell how he did the job. An instructor's note is available.

ECL 39 **Rucker Company, (A) A Centrifuge Project, (B) Inertia Starter for the Centrifuge, (C) Centrifuge Clutch Design, H. O. Fuchs, O. Lorentsen, A. Krauter, 1965.**

Physical Description: Total 16 pages (Parts A,B,C) with 7 text, 9 exhibits.

Scope and Content Note

The design of a centrifuge is described in three installments, each ending with some unsolved problems. Suggested questions for the student appear at the end of each installment.

ECL 41 **Hughes Tool Company, Aircraft Division, Development of a Light Observation Helicopter for the United States Army, K. H. Vesper, E. J. Echterling, 1965.**

Physical Description: Total 36 pages (Parts A,B) with 12 text, 24 exhibits.

Scope and Content Note

The first of two parts describes the need for sketching possible fuselage configurations for a new light observation helicopter. The second part tells how the craft was designed by the company to win competition for a large Army contract. A brief instructor's note presents a viewpoint regarding what can be learned from the experience.

ECL 42 **Gar Wood Industries, Inc., Failures at Welded Joints in a Hopper Trailer, H. O. Fuchs, J. A. Alic, 1965.**

Physical Description: Total 27 pages (Parts A,B,C) with 11 text, 16 exhibits.

Scope and Content Note

In three installments this case tells of attempts by company engineers to eliminate some failures which are occurring in welded joints of a hopper trailer pulled by large diesel trucks.

ECL 43 **Peterson Tractor Company, Design of a Side Sloper, H. O. Fuchs, J. A. Alic, 1965. Revised by Richard C. Bourne, 1968.**

Physical Description: Total 30 pages (Parts A,B,C) with 13 text, 17 exhibits.

Scope and Content Note

An angled blade for a bulldozer needs to be drawn, confronting one of the company engineers with a problem in descriptive geometry. The first of three parts describes the problem situation and gives suggested questions for the student. The second consists of notes for the instructor, and the third tells what the company engineer actually did.

ECL 44 **Dynasham Truck Company, Ltd., Truck Suspension Bolt and Bushing Failures, H. O. Fuchs, J. A. Alic, 1966.**

Physical Description: Total 37 pages (Parts A,B,C) with 13 text, 24 exhibits.

Scope and Content Note

Lance O'Leary, a young graduate engineer, is confronted with failure of a bolt and rubber bushing which connect a leaf spring to a truck frame. By repeated analyses of the failure, investigation of the part, and redesign, he succeeds in overcoming the problem. He also develops some designs which he would have used if the problem had not been solved by his earlier attempt. Lance's work in this case includes stress calculations, life test specifications, material selection, and consultation with various suppliers.

ECL 45 **Marvetti, Inc., Design and Development of a Printing Calculator, H. O. Fuchs, J. A. Alic, 1966.**

Physical Description: Total 91 pages (Parts A,B,C,D,E) with 20 text, 71 exhibits.

Scope and Content Note

Part A gives the background of the company, the state-of-the-art of printing calculators, and organization chart of Marvetti, and a brief history of the management decisions before Harvey Shaw was assigned as Project Engineer. Part B discusses the extensive test programs used in the development of business machines. Part C shows some of the moves which were made in order to start production of this machine in a European plant of this American company. Part D shows a number of the design changes which were necessary to debug the machine after pilot production had been started.

ECL 46 **Beckman and Whitley, Inc. I, Design of a 16mm Portable News Film Camera, H. O. Fuchs, D. A. Horine, 1966. Revised by Richard C. Bourne, 1968.**

Physical Description: Total 34 pages, with 9 text, 25 exhibits.

Scope and Content Note

A leader in the field of scientific high-speed cameras enters the field of cameras for TV spot reporting. Progress of the project from the initial decision through early idea sketches and several prototypes to the successful production design is described in this case.

ECL 47 **Systron-Donner Corporation, Design of an Analog Computer, H. O. Fuchs, J. A. Alic, 1966.**

Physical Description: Total 36 pages (Parts A,B) with 10 text, 26 exhibits.

Scope and Content Note

Dick Dunlop is charged with the overall design of a small analog computer from given components and subsystems. Part A gives the background of the company and of the product. Part B shows a number of Dick's early sketches and the finished product. It also discusses a detail mechanical problem connected with a latch mechanism.

ECL 51 **Travaglio Engineering Company, Manufacturing Design for a Cycle Timer, R. E. Keller, 1966.**

Physical Description: Total 14 pages, with 9 text, 5 exhibits.

Scope and Content Note

Mr. Dalny Travaglio, consulting design engineer, had developed and tested the conceptual design for a high accuracy, high repeatability cycle timer. This case presents the information required for carrying out the final mechanical design of the timer and is intended as an exercise in design for mass manufacture.

ECL 52 **Development of A Dynamic Seal at Beckman Instruments, Inc.-Spinco Division, William J. Clemens, David Horine, 1967.**

Physical Description: Total 14 pages, with 4 text, 10 exhibits.

Scope and Content Note

Mr. Chet Arnessen, a young employee of Beckman Instruments, was asked to redesign part of the buffer pump of his company's Model 130 Spectrochrom Analyzer. A few of Beckman's customers had complained that the moving seals in this pump developed leaks after very little use; these complaints were reaching the company at the rate of one or two a month with some repeats. Beckman's customers were scattered all over the world and, since the Spectrochrom Analyzer is not portable, the company had to send its Field Service personnel to them to make whatever repairs were necessary.

ECL 53 **Ford Motor Company, Design of an Automatic Welding Machine, J. A. Alic 1968.**

Physical Description: Total 25 pages; 9 drawings, 3 reproduced from Ford Motor Company originals, and 6 pages of other exhibits.

Scope and Content Note

Ray Rogers and Bill Fleming are assigned the problem of designing an automatic welding device to replace the manual spot welding of rocker panels on the Mustang. Part A outlines the problem. Part B shows the solution which, however, introduced a new problem: the machine interfered with the smooth flow of bodies along the production line. Part C shows how this difficulty was overcome.

ECL 54 **Beckman and Whitley, Inc. II, Design of a Mirror Mount, H. O. Fuchs, D. A. Horine, 1966.Revised by Richard C. Bourne, 1968.**

Physical Description: Total 12 pages (Parts A,B) with 5 text, 7 exhibits.

Scope and Content Note

Les Brown, who was in charge of the job said, We wasted a considerable amount of time due to the fact that we had all forgotten our descriptive geometry. The case concerns the determination and communication of the specifications for a block which fits into the camera and holds a mirror which reflects the light at 90 degrees to the side and 30 degrees upwards. The erroneous original sketches and the finished shop drawing with tolerances are shown beside the data necessary as background for this part. An instructor's note is available.

ECL 57 **Lawrence Radiation Laboratory, An Ultra-High Vacuum Flange Seal, K. H. Vesper, J. A. Alic, 1966.**

Physical Description: Total 7 pages, with 4 text, 3 exhibits.

Scope and Content Note

While developing a new ultra-high vacuum seal needed for connecting pipes in nuclear fusion research equipment (Project Sherwood), Mr. Tom Batzer, a mechanical engineer, had to determine the size, spacing, and torque for flange bolts. A one page conclusion section describes how he approached the problem.

ECL 59 **Stanford Linear Accelerator Center I, (A) Development of a Remotely Operable High-Vacuum Coupling, (B) The SLAC Design, (C) Ring-Spring Analysis and Load Spring Design Problems, (D) Coil Spring Design, (E) Material Selection, (F) Ring-Spring Material Selection and Casting Problems, J. A. Alic, 1966.**

Physical Description: Total 49 pages (Parts A,B,C,D,E,F) with 14 text, 35 exhibits.

Scope and Content Note

The six parts present the history of a remotely operable high-vacuum coupling design. The story presents problems in materials selection (including indium and stainless steel), elastic analysis and deflections, and design.

ECL 60 **Art Whiting, To Weigh A Man In Space, K. H. Vesper, 1966.**

Physical Description: Total 15 pages, with 6 text, 9 exhibits.

Scope and Content Note

Intended for freshman orientation, this case dealing with design of a means to weigh a man in space has also been used successfully at graduate level. The analytic problem faced by Mr. Whiting at the end of the case is to determine the man's mass from Newton's second law from stopwatch experimental data. The question then is what to do about the fact that the accuracy is not quite satisfactory. Teaching objectives are similar to ECL 58, namely, to let the freshman see that his elementary science applies but he needs more to become a pro.

ECL 61 **Stanford Linear Accelerator Center II, Beam Pipe Cooling System, J. A. Alic, 1966.**

Physical Description: Total 93 pages (Parts A,B,C,D,E) with 29 text, 64 exhibits.

Scope and Content Note

After general agreement had been reached that the pipe should be cooled by circulating liquid the question for SLAC mechanical engineer Al Lisin was, how? In five parts this case unfolds the history of the design. Intended primarily for use in a graduate-level heat transfer course.

ECL 62 **General Electric Company, Vallecitos Atomic Laboratory, Ventilation Exhaust Stack, P. Z. Bulkeley, D. A. Horine, Revised by Sue Hays, 1967.**

Physical Description: Total 16 pages (Parts A,B,C,D) with 9 text, 7 exhibits.

Scope and Content Note

During extension of the ventilation stack one of the construction engineers noticed cracks in the concrete base. Mr. Don Brown, a mechanical engineer, undertook to analyze the problem and propose a solution. Four chapters describe how he proceeded with the analysis, in which he assumed that wind-induced vibrations caused the cracking.

ECL 63 **Data International II, Voltage Regulation, J. W. Hill, 1966.**

Physical Description: Total 19 pages (Parts A,B,C) with 5 text, 14 exhibits.

Scope and Content Note

A practical case intended to interest students in the application of circuit analysis, presented in three parts. Need for an inexpensive method for reducing the fluctuation of the voltage supplied to a mission in Guatemala is expressed in a letter from a missionary. The first part defines the problem through an exchange of letters between Data International and the missionary. The second part gives a solution suggested by a consultant, and presents a second letter from another missionary in Darjeeling, India who has a similar problem. The third part is an answer from another consultant who uses a different approach to the problem.

ECL 64 **Data International III, Electrical Appliances, J. W. Hill, 1966.**

Physical Description: Total 11 pages, with 2 text, 9 exhibits.

Scope and Content Note

A letter was received by Data International from a missionary going to Urguay raising some interesting questions regarding the use of United States manufactured appliances on both the 60 cycle United States current and the 50 cycle Uruguyan current. Three consultants replied in different ways, providing material for a comparative critical review.

ECL 67 **Hewlett-Packard V, Microwave Switch, W. E. Bullock, J. W. Hill, G. R. Powley, 1966.**

Physical Description: Total 27 pages (Parts A,B,C) with 14 text, 13 exhibits.

Scope and Content Note

In three parts this case briefly summarizes key engineering problems in the development of a high-speed broadband microwave switch. Two main points of focus are concerned with innovations in the design and problems of transferring the design to manufacturing.

ECL 68 **Ampex Corporation, Tape Recorder Capstan Shaft, K. H. Vesper, J. A. Alic, 1966.**

Physical Description: Total 44 pages (Parts A,B) with 5 text, 5 exhibits.

Scope and Content Note

The first part of this short case describes design of a capstan shaft, which must operate smoothly in a precision tape recorder, stopping at the point where bearings must be selected. A second part tells how the engineer on the job designed the bearings and, in particular, how he solved problems of lubrication.

ECL 69 **City of San Jose-IBM Corporation, Computerized Traffic Control, D. O. Covault, G. A. Fleischer, P. F. Williams, 1966.**

Physical Description: Total 61 pages (Parts A,B,C,D) with 38 text, 23 exhibits.

Scope and Content Note

Part A of this case describes how IBM and San Jose try using a digital computer to control city auto traffic. Part B describes the system, C describes strategies with which it was applied, and D gives the results which convinced the city to install a modified system for regular control of certain intersections. Suggestions for the instructor are included.

ECL 70 **Bechtel Corporation, Process Analysis and Optimization of a Desalting Plant Design, J. W. McCutchan, R. P. Vail, E. N. Ziegler, 1966.**

Physical Description: Total 39 pages (Parts A,B,C) with 15 text, 24 exhibits.

Scope and Content Note

Mr. Rufus Crawford in 1964 was asked to help analyze large scale flash distillation of saline water to (1) improve the company's competence in desalting technology and (2) to develop experience in computer aided optimization. The first part presents the problem of deriving a general scheme and criteria for evaluations. The second part poses the problem of developing heat and mass balance equations. A third section describes how Crawford went at the job. An instructor's note is included which suggests assignments and references.

ECL 72 **Varian Associates, Redesign of a Liquid Nitrogen Container, William S. Chalk, Ivan A. Shirk and Robert B. Thornhill, 1967.**

Physical Description: 35 pages; 10 graphic exhibits.

Scope and Content Note

Varian Associates use a liquid nitrogen container made of polystyrene with metal inserts on their cold trap vacuum pumping system. This container gave rise to a number of customer complaints. Paul Hait was assigned the problem and solved it. Part A presents historical background with examples of trouble reports. Part B relates Paul Hait's attack on the problem and its solution. Part C draws conclusions and examines future prospects.

ECL73 **Switching a Tracking Antenna, Sue Hays, 1968.**

Physical Description: Total 14 pages: 6 pages text, 8 pages exhibits

Scope and Content Note

In 1963, Philco-Ford's Western Development Laboratories accepted a contract to design and assemble a sixty-foot satellite tracking antenna for the military. Mr. Ed Fish was one of about one hundred engineers in the department that was to design the antenna. His particular section was responsible for the design of the antenna's control system; this case concerns one aspect of that design-the system of push buttons used to switch the antenna from one to another of its four operating modes.

ECL 76 **Precision Instrument Company, Modification of a Portable Video and Broadband Instrumentation Recorder, Karl H. Vesper and William H. Clemens, 1967.**

Physical Description: 13 pages; 6 graphic exhibits.

Scope and Content Note

A team of four engineers are working to modify an existing video tape recorder so that it can be operated without depending on 60 cycle ac. current supply. Manchi Colah is one of the engineers on this team. The case is concerned with the experiments, calculations, and inquiries which he made in order to arrive at a suitable motor to drive the tape of this recorder.

ECL 78 **Hewlett-Packard VI, Signal Generator Read-Out Design, Karl H. Vesper, Robert Beardmore and Charles Fernald, 1967.**

Physical Description: 47 pages.

Scope and Content Note

Anthony Badger's ingenious solution to the problem of packaging an extended instrumentation scale into a small space and keeping it readable is shown in some detail with much interesting background. Seventeen pages of Part A contain mainly background. Sixteen pages of Part B show the first solution with many pages of the notebooks of Anthony Badger and of Peter Rich. This first solution is not satisfactory. Part C explains the final solution in three pages of text and eleven pages of photographs and notes reproduced from Mr. Rich's notebook.

ECL 79 **Chaparral, Bolt Failure on a Racing Automobile, Henry O. Fuchs and William H. Clemens, 1967.**

Physical Description: 3 pages of text and 2 pages of exhibits.

Scope and Content Note

Mr. Jim Hall, designer and driver of the famous Chaparral race car, gave a talk shortly after reports of bolt failures on his car had appeared in the press. He was asked about these bolt failures. His explanation of the failures and of the way he fixed them are given in the case, together with some additional information.

ECL 80 **Consolidated Dynamics Corporation, Fracture of a Marine Gear Rim, William H. Clemens, 1968.**

Scope and Content Note

The rim of a large marine gear breaks during fabrication. Mr. George Reynolds, head of the metallurgical laboratory investigates the failure and prescribes a remedy. Part A describes the problem and Part B shows the steps which Mr. Reynolds and his staff took. Part A consists of 4 pages of text, 7 pages of graphic exhibits and 5 pages of a laboratory report prepared by Mr. Reynolds at Consolidated Dynamics. Part B consists of 1 page of descriptive text and a 13 page laboratory report by Mr. Reynolds with 1 page of microphotographs. A brief instructor's note for this case is available.

ECL 82 **Design of an Electron Beam Dump at Stanford Linear Accelerator Center, Munir R. El-Saden, 1967.**

Physical Description: 16 pages: 7 text and 9 exhibits.

Scope and Content Note

Early in 1964 Dieter R. Walz, a member of the technical staff at SLAC, was placed in charge of developing a beam dump. This device is a heat exchanger capable of absorbing and dissipating the high energy electron beams which must be disposed of at the end of the 2 mile long accelerator. The case describes performance and maintainance requirements for the beam dump and tells how Walz proceeded with his design.

ECL 90 **Shielding a Toroid Amplifier at Stanford Linear Accelerator Center, Sue Hays, 1967.**

Physical Description: Total 8 pages

Scope and Content Note

Scientists at the Stanford Linear Accelerator Center planned to mount a field strength detecting device inside the pipe through which the electron beam travels. The signal from this device would be passed through an amplifier mounted on the outside of the pipe, then transmitted to a remote oscilloscope. This brief case study describes the design and construction of a shield used to protect the amplifier from stray electromagnetic fields produced by power sources for the accelerator. Included as exhibits are the chassis layout and cover assembly drawings prepared by Pete Demos, the designer assigned to the job.

ECL 91 **Girder Alignment at Stanford Linear Accelerator Center, Henry O. Fuchs and Sue Hays, 1968.**

Physical Description: Total 21 pages; 12 text, 9 graphic exhibits.

Scope and Content Note

The alignment within 1/8 inch of the two mile long Stanford Linear Accelerator presents problems in metrology and in structures. These are explained in part A. Part B is concerned with one of the details: the interconnection and support of the 250 girders which carry the support tube. This interconnection permits adjustment of the alignment if it should ever be disturbed. Detail drawings of parts which connect the girders are shown as originally made and as revised to conform with better drawing practices.

ECL 94 **Development of a New Drill Steel at Ingersoll-Rand Company, H. O. Fuchs and Ronald J. Shuman, 1967.**

Physical Description: Total 20 pages, including text, drawings, material specifications, and a patent application.

Scope and Content Note

Rock drills are used in mining, in excavating, and in other applications where it is necessary to remove hard rock. The drills produce holes into which blasting charges are later inserted. These holes may be as shallow as a few feet or as deep as one hundred feet. Depths of fifty feet are common. The holes are produced by a bit which is attached to one end of the drill rod (or steel). A pneumatic hammer hits the other end of the drill steel, through a so-called shank piece. The drill steels themselves, each about ten feet long and one and a half inches in diameter, are threaded at both ends and joined by couplings. This case study provides some background on the drilling process and the characteristics of existing drill steels, then traces the development of an improved drill steel.

ECL 96 **Development of an Undersea Power Supply at Aerojet General Corporation, William J. Clemens, 1967.**

Physical Description: Total 18 pages; 10 text and 8 exhibits.

Scope and Content Note

In March of 1967, Mr. Carl Carney of Aerojet General's Nucleonics Division in San Ramon, California, was completing plans for modifications to be included in the second prototype of Aerojet's Undersea Radioisotope Power Supply (URIPS). Mr. Carney had been working on the project since late 1965 and this prototype was scheduled to be the last design model in the URIPS series before production was started.

ECL 100 **Pump Plunger Improvements at Kobe Inc., Robert Martin, 1969.**

Physical Description: Total 20 pages: 3 pages text, 17 pages exhibits

Scope and Content Note

Kobe Inc. manufactures a positive displacement type triplex pump which is used in their hydraulic oil well pumping system. To achieve reliability in these pumps, which must operate continuously at high pressures (up to 30,000 psi.), Kobe engineers must continually refine their design. As an example of such refinement, this case follows the development of the pump plunger and liner over a period of 24 years.

ECL 109 **Development of a High Speed Weighing Machine at FMC, Sue Hays, 1969.**

Physical Description: Total 23 pages: 17 pages text, 6 pages exhibits.

Scope and Content Note

The overall design process is traced step-by-step from an original concept to the manufacture of several commercially useful prototypes. The designer was seeking a quantum improvement in a food-weighing device by using fluidics instead of electronics.

ECL 111 **Design of a Hand Operated Film Drive Mechanism, John Sondeno, 1969.**

Physical Description: Total 19 pages: 9 pages text, 10 pages exhibits

Scope and Content Note

This is the story of a mechanical design undertaken by the R. A. Morgan Optical Engineering Company: a microfilm reader-printer was to be modified so that it could accept 105 mm. roll film as well as 105 mm. cut sheets. The task, according to Mr. Morgan, was to design some sort of transmission to manually turn drive shafts for the film spools in a manner that would be convenient to the operator and aeshetically attractive.

ECL 113 **The Go-Matic Accessory for Motorcycles, Prem Garg, 1969.**

Physical Description: Total 23 pages: 10 pages text, 13 pages exhibits

Scope and Content Note

Go-Matic is a gear shift mechanism which, when installed in place of the final drive sprocket on a lightweight motorcycle, enables the rider to select either of two speed ranges (high, street range or low, trail range) by moving a lever. This case traces the development and marketing history of the device from the point of view of Mr. Neal Williams, President of the Go-Power Corporation, which manufactured it.

ECL 114 **Development of a Circular Strike Plate at Schlage Lock Company, Richard C. Bourne, 1968.**

Physical Description: Total 50 pages (Parts A,B,C,D): 21 pages text and 29 pages exhibits

Scope and Content Note

Most doors are held in a closed position by a system comprised of a retractable latch bolt located in the door edge and a strike plate fastened to the door frame, the plate being cut with a hole to receive the latchbolt. In 1963 Mr. Ernest L. Schlage, Director of Research at the Schlage Lock Company, undertook the design of a new circular strike plate which could be installed with a single boring operation rather than the hand chiseling or routing required with the traditional rectangular strikes. Part A of the case includes background on the components of the Schlage cylindrical lock and design requirements for the new strike. Part B describes the steps taken which resulted in the design and introduction of a circular strike meeting these requirements. Parts C and D deal with the refinement and modicication of Schlage's original design which led to production of an adjustable circular strike.

ECL 120 **Harvey La Branche: Spring Failures in a New Toy Rifle, Karl H. Vesper, 1968.**

Physical Description: 26 pages total (parts A and B): 8 text, 18 exhibits

Scope and Content Note

Mattel Incorporated was about to introduce a new toy rifle which used a recording to produce its cracking sound. Orders for thousands of these rifles had been received and production tooling was underway. Some handmade samples of the guns had been assembled, then cocked and fired over 6,000 times without failure. Then some phosphor bronze clutch springs began to break on the first batch of 100 guns which had been assembled from production parts. Mr. Harvey LaBrance, Director of Product Development Engineering, had to decide on a cure for the problem.

ECL 124 **Warren Deutsch: Design of a Satellite Controlling Instrument Panel, Mitchel Blanton, 1968.**

Physical Description: Total 31 pages (Parts A and B); 12 text and 19 exhibits

Scope and Content Note

Ground control stations are equipped with instrumentation for sending to a satellite commands controlling its functions. Technicians must be able to handle large numbers of such functions (Perhaps 100 for a typical satellite) from a single control panel. To accomplish this task Philco-Ford engineers had designed a device called POK (Page Overlay Keyboard) which consisted of an array of buttons plus overlays, or pages, which could adapt the panel to a variety of functions. Warren Deutsch, head of the Value Engineering Department at Philco-Ford, felt this system was unnecessarily cumbersome and set out to improve on it. Part A of the case describes the problem and Mr. Deutsch's approach to it. Part B deals with refinements of his design.

ECL 126 **Plastic Pipe Saddle Design, Prem Garg, 1969.**

Physical Description: Total 43 pages: 9 pages text, 34 pages exhibits.

Scope and Content Note

Pipe saddles are functionally similar to T-joints. They are used extensively in piping networks for branching off from the main line and can be mounted on existing networks without interrupting the flow in the main line. In 1965 there were no saddles satisfactory for use on plastic pipe which had become increasingly popular for municipal, irrigation, gas and industrial uses. The case describes the design and manufacture of a suitable plastic pipe saddle.

ECL 127 **Three Years to Design a Door, Drew V. Nelson, 1969.**

Physical Description: Total 46 pages (A and B): 10 pages text, 36 pages exhibits.

Scope and Content Note

Part A tells how the Schlage Company started to design a service door for the Hilton Hotel in San Francisco and shows the first two iterations including the patent issued for this design. Part B shows the final design and the end result of this 3 year effort on which about 5,000 man hours of engineering time had been spent. Instructor's Note is available.

ECL 137 **Design of a Centrifuge Rotor Cap, P. C. Garg, 1969.**

Physical Description: Total 16 pages: 8 pages text, 8 pages exhibits.

Scope and Content Note

Mr. Ken Jacobsen, project engineer at the Spinco Division of Beckman Instruments Inc., had proposed to incorporate new features in an ultracentrifuge. These features had been developed in a national laboratory. They now had to be improved and refined for the Spinco production model. Some background on the operation of ultracentrifuges is given; attention is focused on the detail design of a subsystem and on the technical difficulties which Mr. Jacobsen had to surmount to achieve a satisfactory product.

ECL 138 **Electron Beam Collimator, M. J. Lum, 1969.**

Physical Description: Total 11 pages: 8 pages, text, 3 pages exhibits.

Scope and Content Note

Research physicists at Stanford Linear Accelerator Center discovered secondary radiation effects accompanying certain experiments with the electron beam. Because of these effects, the beam's cross section was difficult to define. The scientists asked the Research Area Department at SLAC to design a collimator, an adjustable device to block out the outer portion of the beam allowing only the central beam core to pass through. Dr. Ed. Seppi, head of the Research Area Department, gave the job to Mr. Aaron Baumgarten, who told the case writer how he designed the collimator.

ECL 144 **A Special Testing Problem at IBM, K. J. Waldron, 1970.**

Physical Description: Total 24 pages: 8 pages text, 16 pages exhibits.

Scope and Content Note

Chris Jako was asked to design a machine which would detect oil-canning of computer drum memory reading heads. Oil-canning is caused by small differences in the lengths of six beryllium copper strips. They are mounted between a fixed base and the moving head and serve as springs and conductors. This case can be used to practice elastic stability theory, amplifier circuit design, or electro-mechanical precision design.

ECL 146 **Howard Ameson's Pool-Sweep, P. C. Garg, 1970.**

Physical Description: Total 27 pages: 15 pages text, 12 pages exhibits.

Scope and Content Note

In 1958 Mr. Howard Arneson, rather fortuitously, came across an idea for a device to clean swimming pools automatically. To pursue this idea further, he started a tiny company with $8,000 in 1960. By 1965 the device was in production and in 1969 his company had sales exceeding six million dollars. Mr. Arneson now heads the company he sold to Castle and Cooke Inc. for 9 million dollars in 1969. The case tells Mr. Arneson's story.

ECL 149 **Design of a Ball Transfer Unit for Air Cargo, R. K. Ganeriwal, 1970.**

Physical Description: Total 11 pages (Parts A,B,C): 4 pages text, 7 pages exhibits

Scope and Content Note

Westscope was one of the companies which was requested to quote on a ball transfer unit for the cargo system on the Boeing 747. This case describes the development of a suitable unit at Westscope. The case is written in three parts, each part describing a different phase of the design development.

ECL 150 **Drop Master, R. Ganeriwal. 1970**

Physical Description: Total 23 pages (Part A and B): 11 pages text, 12 pages exhibits.

Scope and Content Note

Drop Master is a device used for monitoring the rate of fluid administered intravenously. The device was invented and developed at Smith Kline Instruments Inc. After the Drop Master was put on the market, a number of service calls from the customers indicated that the device was too sensitive to temporary flow rate changes. This case describes how the difficulty was overcome.

ECL 151 **Underwater Pipeline, Dean C. Ing, 1970.**

Physical Description: Total 20 pages: (Parts A,B,C): 17 pages text, 3 pages exhibits.

Scope and Content Note

Robert Kinner, a structural analyst, had been loaned to the undersea pipeline project to check the design of pipe bundles which drop down from a height of about 15 feet above the sea floor and are subject to several design constraints. He found that the pipes would buckle unless the design was changed and proposed a feasible design. When the project management doubted Rob's analysis he devised a very quick and inexpensive test to prove his assumptions. Part A outlines the problem. Part B shows Rob's solution. Part C show his tests and the associated calculations. The case is useful in connection with beam bending theory and to show the mechanics of interdepartmental cooperation in a large company.

ECL 156 **Positioning a Microwave Diode, S. Hayes and R. Ganeriwal, 1970.**

Physical Description: Total 14 pages: 10 pages text; 4 pages exhibits

Scope and Content Note

The micro switches for the Apollo antennas had to withstand a temperature range of 140° and high vibration levels during lift-off. The problems and the solutions are described in the case.

ECL 157 **Interfaces at Sterling Development Laboratories, Sue Hays, 1970.**

Physical Description: Total 15 pages (Parts A,B,C)

Scope and Content Note

Sterling Development Laboratories contract was a large one: To build a complete data collection system which included two antennas, two receivers, a transmitter, a data processing display, and recording center. Customer constraints and the nature of the electronic interface between the digital recorder and the computer magnetic tape controller combined to cause difficulties.

ECL 159 **Jumping a Derrick, Professor Ralph J. Smith, 1970.**

Physical Description: Total 13 pages: 8 pages text, 5 pages exhibits.

Scope and Content Note

In this case study in construction engineering, Dan Jeffrey, a young civil engineer, on his first field assignment for the Bethlehem Steel Corporation, explains the decisions he must make in determining the safety of storing steel on a partially completed floor of a new building. Instructor's note is available.

ECL 160 **Expansion of the Danville Pumping Plant, James C. Collins, 1970.**

Physical Description: Total 55 pages: 20 pages text, 35 exhibits.

Scope and Content Note

Increase in water demand and expansion of pump capacity for the Danville-San Ramon area, selection of pumps and reservoir sites, and problems of design constraints are described chronologically from 1959 through 1969 when the new pumps were installed and tested.

ECL 161 **Development of a Stainless Steel Trashrack, R. J. Shuman, 1970.**

Physical Description: Total 29 pages: 9 pages text; 20 pages exhibits

Scope and Content Note

Few people have seen the second largest stainless steel structure in the United States-the trashrack system for the Oroville Dam powerplant. The case details how stainless steel was substituted for mild steel. The substitution had to be justified on a superior function and lower cost basis, leading to a sophisticated analysis of a rather prosaic component. The case is interesting both as a technical achievement and as an example of the way engineering innovations are accomplished.

ECL 162 **Variable Stability System of the X-14A VTOL Aircraft, J. Hill, G. Kardos, A. Winn, 1970.**

Physical Description: Total 28 pages: 7 pages text (Parts A&B); 21 pages exhibits

Scope and Content Note

The first part of this case describes the original control system and reasons for adding a variable-stability auxiliary system to the Bell X-14 experimental aircraft. By means of excerpts from the original project notebook, the student is provided with the technical requirements of the system. The second part includes the project notebook calculations for the first part and poses the additional problems of writing a preliminary progress report, designing a simulator for the control system, and drawing a block diagram of the control system. A brief instructor's note is available.

ECL 174 **To Find a Bullet, Geza Kardos, 1971.**

Physical Description: Total 31 pages: 10 pages text, 21 pages exhibits

Scope and Content Note

This case tells of an unusual application of the engineering method, the location of a missing bullet in a police case. The construction of the case is to show and to lead the student through the solution as carried out by Jorgen Vindum, the principal investigator. The case is divided into three parts: each section ends at a critical decision point and students can be asked to discuss the course of action to be followed. The case involves a mixture of technology, computer application, intuition, experimentation, logical thinking and plain luck. Instructor's Note is available. Parts A, B, C.

ECL 178 **Negligence, Drew V. Nelson, 1971.**

Physical Description: Total 65 pages: 57 pages text, 8 pages exhibits.

Scope and Content Note

A case study concerning a products liability lawsuit which arose out of an industrial accident in which Plaintiff was severely injured while operating a large mechanical press. Emphasis is on engineering aspects of the case, as extracted from depositions of expert witnesses. Important elements of Plaintiff's trial brief, legal arguments, etc. are also presented. Parts A, B, C, D.

ECL 181 **A Four Barrel Step-and-Repeat Camera, Geza Kardos, 1971.**

Physical Description: Total 32 pages

Scope and Content Note

Paul Piper was hired by the Friden Research Center to design, develop and produce a microphotographic camera for the production of final stage integrated circuit masks. Piper's problems are described from the management decision to make instead of to buy the camera through the design to the testing and modifications of the unit. An Instructor's Note is available.

ECL 185 **The Design of the Bart-AFC Barrier Drive System at IBM, R. Piziali, 1972.**

Physical Description: Total 53 pages: 35 pages text, 18 pages exhibits

Scope and Content Note

This case describes in part the design effort and decision process associated with the development of an actuating system at IBM, San Jose. The case starts when delivery is due in 16 months and only an unsatisfactory prototype exists. Parts A, B, C.

ECL 186 **The Pickup-Head Link Failure, R. Piziali, 1972.**

Physical Description: Total 27 pages: 12 pages text, 15 pages exhibits

Scope and Content Note

The IBM 2321 is a vast storage device which reads and writes data on a magnetic strip. These strips are stored in cells and mechanically taken from the cells for read-write operations and then returned. With the 2321 in full production and in the field, the pickup-head link began to fail. After a metallurgical fix of the link failed, stresses due to three independent loads were re-examined.
Later the link was redesigned, but the pin on the end of the link began to fail. Further redesign involved metallurgical and structural analysis. Parts A, B.

ECL 187 **Value Engineering Applied to an IBM Leveling Screw, R. Piziali, 1972.**

Physical Description: Total 19 pages: 9 pages text, 10 pages exhibits

Scope and Content Note

This case provides a brief look at the methodology of Value Engineering. A leveling screw for the IBM 1311 disk storage drive was assigned to students in an IBM Value Engineering Seminar. The students applied their newly learned techniques to redesign the leveling screw to reduce cost while maintaining function. Their solution was so successful that it was put into production on many IBM systems resulting in over one million dollars in savings.

ECL 188 **The Stun-Gun, A. P. Shack and G. Kardos, 1972.**

Physical Description: Total 29 pages: 12 pages text, 17 exhibits.

Scope and Content Note

Bob Mawhinney recalls the invention and development of a riot-control weapon which shoots a non-lethal spin stabilized bean bag. Part A gives the background feasibility calculations. Part B relates development of a cartridge suitable for military use. Part C shows how a complete system suitable for civilian use was developed.

ECL 189 **Laser Hardware, Fred Moreno, 1972.**

Physical Description: Total 56 pages: 32 pages text, 24 pages exhibits

Scope and Content Note

Fred Moreno, mechanical engineer in Sylvania's Electronic Systems group is assigned to work with the Electro-Optics Organization on devices for satellite laser communication. Work on temperature control and on mirror alignment for the breadboard demonstration model are described in Part A. Part B discusses thermal contact resistance and choice of materials for space vacuum. Part C relates work on the later functional test model, where weight, space, and demonstrated reliability become additional constraints. Part D describes three technical problems: energy for warm-up, vibration resonance, thermal conductance and modulator operating temperature. Part E shows Fred's solutions of these technical problems.