Curtiss Wright

Engineering Cadette Graduation Dinner

South Ballroom
Memorial Union
Iowa State College
December 14, 1943.

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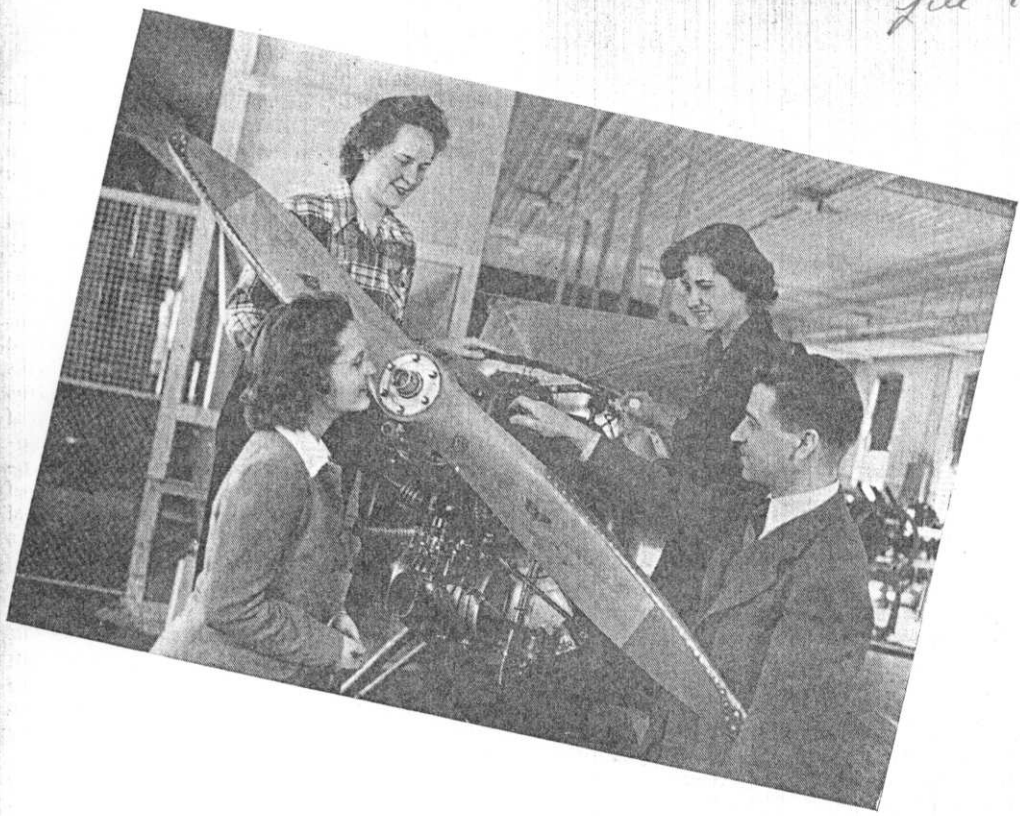

Activities of the College

Engineering Cadettes

DESCRIBED BY MARJORIE ALLEN

Story and picture appeared originally in Iowa Engineer

IOWA STATE has seen many changes on its campus in the last year but none so phenomenal as the coming of ninety-seven Curtiss Wright Cadettes. Not only were women engineers a novelty on the campus but women entering the aeronautical engineering field were almost unheard of. The enrollment in this department nearly doubled when this new program instituted by the Curtiss Wright Corporation sent college women to Iowa State for aeronautical training.

There were two definite schools of thought concerning the new project. One group scoffed at the plan of training girls in engineering who had formerly majored in fields ranging from dietetics to psychology, from art to chemistry. The other group maintained that girls could be given a concentrated engineering course and retain enough to become efficient engineers in aircraft plants. Among the latter group were members of the Engineering Bureau of the Curtiss Wright Corporation and the faculty of the Division of Engineering at Iowa State and other schools.

From November until February, a cross-section of colleges and universities was searched for women qualified to enter this new course. The Corporation pledged to pay room, board, tuition and a salary of ten dollars a week throughout the ten month period of training. The group at Iowa State will be employed in the St. Louis plant upon graduation at salaries ranging from $130 to $150 a month.

A question that confronted every girl who became a Cadette was: Is it worth leaving college and a degree until the war is over to enter this course? For the 711 Cadettes em-

ployed, the answer evidently was "Yes." The group at Iowa State includes several college graduates, many girls who were in their senior year of college, and others who had been working for several years. The girl who became a Cadette put aside her regular schooling in favor of helping with the war effort in this way, but upon her returning to school, credit for these courses may be applied toward a Cadette's degree, if it is possible to correlate the engineering training with her previous major.

Iowa State accepted the Curtiss Wright Cadette training program on the basis that the Cadettes would be enrolled as special students, subject to the ruels and regulations made by the administration. The Cadettes represent the third large group being trained here as a part of the war program, the others being the Naval Air Cadettes and the naval trainees (electrical and diesel).

Corporation, college and Cadettes are closely knit together. The affairs of the company and its relation to the Cadette are handled through a personnel supervisor, Mrs. Jean O'Leary. Through this office, problems concerning the job to be done upon completion of the training program, absences from class, and similar problems are ironed out. This is the busiest place on the campus on Monday, the day that Cadettes receive their weekly pay checks.

Professor W. C. Nelson, head of the Aeronautical Engineering Department, is director of the Cadettes' course while this group is being trained in aeronautical engineering at Iowa State. Through Professor Nelson, his staff and his faculty, the academic problems of the Cadettes are solved.

Training Cadettes for work in the aircraft factory is the primary function of the program. The full training that is given to a regular engineering student is not practical or possible in the length of time allowed by the Cadette program. By concentrating useful subjects to one end, that end being specific jobs that require definite training but not necessarily an engineering degree, girls who had previously had college courses can be quickly trained for these jobs.

Training women in such a technical field as aeronautical engineering and turning them out in such a short time requires very efficient planning and cooperation between the Curtiss-Wright Corporation and the College. This planning has been carried out in great detail which becomes obvious when one looks into the daily routine of the average Cadette.

If you were standing at one end of any of three floors in the upper part of the Memorial Union about six forty-five in the morning, you would be apt to hear a succession of alarm clocks and soon, increasing signs of activity. That would be the beginning of a day with a Curtiss Wright Cadette.

In each room on these three floors live three girls who may be from any one of twenty-two states. A radio is on the bed-side table and the telephone rings about four times a day. The education of the girls may be as varied as their native states, but each is here for the primary purpose of becoming an engineer.

By seven fifteen, the girls are dressed and ready to go down to breakfast. Few customers are in the cafeteria line on the ground floor of the Union other than Cadettes. Every girl down for breakfast gets plenty to eat to keep up strength and morale for the six hour stretch before lunch.

Breakfast over, the Cadettes go back upstairs to make beds, dab on more lipstick and assemble the necessary equipment for the morning class. By 7:30, each is on her way to class. Perhaps some of the girls across the hall are still sleeping, since every girl has one wole morning off each week. The doors of the Union swing constantly for the next ten minutes as group after group of Cadettes start to their morning classes.

A big group heads toward the Landscape Architecture Building where aircraft drafting meets. One five hour morning and a four hour afternoon is put in by each Cadette over her drafting board. The work is done on standard Curtiss Wright paper and each of the problems is graded according to company standards. About every two weeks, problems are blueprinted to show the girls how their work will look in the finished form. All of the problems presented in this course are taken from parts of planes and data sent to the school by the corporation. Detailing is emphasized and accuracy in both drawing and lettering is demanded.

Another group of girls may go toward the Agricultural Engineering Hall where mechanics classes are held. Problems concerning everything from stress and strain through statics and mechanics are studied. Although Cadettes use the regular textbook that the College lists for statics, dynamics and strength, most of the problems for Cadettes are ones made up from data from planes now being produced. The most practical solutions of problems are taught and the mathematics that is learned by the girls in that course is often used in mechanics.

By ten o'clock, after a two hour session in mechanics, Cadettes are bound for mathematics. So far only a review of algebra and introduction to trigonometry have been studied, but soon some analytical geometry and enough calculus to apply to any problems that will be needed on the job will be taught. This mathematics course is one that is designed to increase accuracy and reduce emphasis on large quantities of work with less accurate results. The use of the slide rule, logarithmic tables and trigonometric function tables are taught and practiced. Slide rule practices are given often to keep Cadettes in constant vigilance againts careless readings.

Noon is the hour that most Iowa State students are bound for their dining rooms, but noon to Cadettes means another lecture in job terminology. This course is one of the entire group's favorites. It concerns everything about airplanes from theory of flight to structures. The girls learn many principles of aircraft flight and manufacture both from the lectures and from the manual, which is the Pilot's Manual published by the Civil Aeronautics Authority. A mimeographed outline of the day's lecture is distributed so that as much attention as possible can be focused on the ever-expanding class talks.

By one o'clock, every Cadette is ready for lunch. Good food and plenty of it is insured by government priorities. Lunch is the time that letters from home are read, papers scanned and talk of the morning's classes runs in both light and serious veins.

Afternoon classes begin at two o'clock. If a group of slack-clad, beturbaned Cadettes walks through the lobby of the Union, you may be sure they are bound for materials processing. It is this course that presents an ordinary lectuer for two hours once a week on properties of materials and theory of the processes used in aircraft manufacture; but it is also this course that puts each Cadette behind a pair of welding goggles for five weeks, then on bench work for another five weeks. Four hour labs once a week are filled by either oxygen acetylene welding, soldering, brazing, or arc welding; sometimes demonstrations of carbon-arc welding, atomic hydrogen welding, or other processes are given. An intermission of fifteen minutes is a very welcome break for the Cadettes whose backs are beginning to acquire a permanent bend and whose hands have become curved to the shape of the welding torch.

Supervised study ends the day that is not spent in either the welding or drafting lab. This study hall is required for seven hours of each Cadette's week and is supervised by a mechanics and a mathematics instructor. Usually it is possible to work the problems for mechanics and math in this period. Reading technical magazines during spare time in study hall is encouraged.

After supper at 6:30, the Cadette has almost reached the end of the planned day. On Tuesdays and Thursdays the women's gym accommodates the hundred girls for an hour's physical education. The two classes now offered are swimming and group activities.

Being in classes for forty hours each week might seem enough for any one student, but Cadettes also enter extra-curricular activities. They have been invited to become student members of the Institute of the Aeronautical Sciences and have started their own organization known as Cadette Engineering Society. This society is to correlate the actual work going on in aviation today with their own work here at Iowa State. Talks, motion pictures, and demonstrations are planned that will give Cadettes a more thorough understanding of various parts of planes, theories, and practices. Soon officers plan to center some of the program around talks by men from the St. Louis plant.

Many Cadettes have continued in the activities in which they were engaged at their former schools. Mortar Board and sorority members have been especially active since coming to this campus. The Cadette Column is published in the Daily Student once each week and Cadettes have become members of the working committees of the Institute of the Aeronautical Sciences. For weeks before the Curtiss Wright Cadettes came to Ames, speculation ran high as to what hey would be like The Iowa State student has found that the Cadettes are very much like Iowa State coeds. The average Cadette is nineteen and one-half years old, a junior in college and has had about two years of college mathematics.

Cadettes have now been at Iowa State for over two months and have become part of the College itself. Soon they will be going out into industry. With them the Cadettes will take the knowledge acquired at schools they previously attended, but most important, they will be using what they have learned and accomplished at Iowa State to their own and their country's advantage.

Tau Beta Pi Pledges

PLEDGES of Tau Beta Pi, national engineering scholastic honorary, were elected Dec. 6 and pledged Dec. 8, Richard Boerner, president of the society, announced recently. Membership into the organization is based primarily on the promise of success shown by students.

At the pledging ceremony Prof. L. T. Brown, of the mechanical engineering department, made a short address. Initiation of these pledges will take place on Jan. 26 due to an early graduation date and will be the first winter quarter initiation that Tau Beta Pi has ever held at Iowa State.

The neophytes of the society are Harlan Bentzinger, M. E. Jr.; Richard Bianco, E. E. Jr.; Dwight Bilharz, E. E. Jr.; Delmar Bloem, C. E. Jr.; Warren Booth, M. E. Sr.; Merril Brown, Chem. E. Sr.; and Richard Dunham, E. E. Jr.

Merle Evers, Aero. E. Jr.; George Geick, E. E. Jr.; Carl Jepson, Chem. E. Jr.; Earl Kasdorf, M. E. Jr.; Paul Klingsporn, Chem. E. Jr.; Robert Lueder, Arch. E. Jr.; Richard Moehl, G. E. Jr.; Wayne Peterson, M .E. Jr.; Eric Sohlberg, E. E. Jr.; Carleton Vangsness, Chem. E. Jr.; Alex Weinstein, Arch. E. Jr., and Gert Weisemann, Chem. E. Jr.

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Women Train Here

UNDER the direction of the Curtiss-Wright Corporation, one of the largest aeronautical concerns in the country, Iowa State College will participate in a program designed to train about 800 women for engineering work in the aviation industry. This program will begin the first week in February, as was recently announced by Dean M. D. Helser of the Junior College.

This plan for the training and employment of women to replace and aid engineers in wartime production is the first of its kind to be introduced. The women who are selected for this opportunity will be assigned to one of the eight schools in the program where they will be on the company's payroll as well as receive board, room and tuition. After an intensive year of training, they will be employed in the Curtiss-Wright plant at Passaic, N. J.

The trainees will be recruited from all over the country. Two years of college education, including a year of college mathematics, are required to be eligible for a position. Women will be chosen on the basis of scholastic record, character recommendations by the school they attended, a short screening test and an interview.

Other schools besides Iowa State College which will give the training are Cornell University, Ithaca, N. Y.; University of Minnesota, Minneapolis, Minn.; Northwestern University, Evanston, Ill.; Pennsylvania State College, State College, Pa.; Purdue University, Lafayette, Ind.; Texas University, Austin, Tex.; and Rensselaer Polytechnic Institute, Troy, N. Y. This training will be carried out in two 5-month terms. The curriculum for the first term will vary according to the individual's previous training in mathematics and science. In

ENGINEERING EVENTS AT IOWA STATE

Women Arrive on Campus

ONE-HUNDRED women students, employees of the Curtiss-Wright Aircraft Company, arrived at Iowa State College February 15 to begin work in a training program designed to fill a shortage of engineers in the Cutiss-Wright plants caused by the war effort. Women enrolled in the program were recruited from all parts of the country and will be housed in Memorial Union, while on the campus. College expenses are to be paid by the Curtiss-Wright Company.

All the trainees have completed at least two years of regular college work, including two years of college mathematics. Some colleges have announced willingness to grant college credit for this work if the students should apply for readmission after the war. None of those selected for training at Iowa State came from this college. Those from this area were sent to one of seven other schools also undertaking this project. The students will wear no uniforms or other means of identification, and will be under the supervision of the aeronautical engineering department as regular college students. Standards of excellence of work and grading will be the same as that for the College.

The ten-month training period will be divided into two five-month sections. Courses to be studied are engineering mathematics, aircraft terminology, theory of flight, aircraft drawing and design, engineering mechanics, strength of materials, aircraft structure analysis, properties and processing of aircraft materials and materials testing. Instructors are selected from the regular faculty of the various departments involved in the program, including the aeronautical, general, and mechanical engineering, and the drawing and T & AM departments. Professor W. C. Nelson, head of the aeronautical engineering department, announced that a woman representative of the Curtiss-Wright Company will arrive on the campus to help direct the program.

The women will be given 30 hours of classroom work each week, together with 10 hours of supervised study. The course, properties of aircraft materials, will include 4 hours of practical lab work each week. Upon completion of the training, about December 15, the trainees will be sent to various Curtiss-Wright plants to work as engineers, employed in engineering designing, elementary stress analysis, weight control, shop liaison, and as assistants to project engineers. According to Professor Nelson, the women will be especially well adapted to aircraft designing.

Trainees from Iowa State will probably be sent to the aircraft plant at St. Louis, Missouri. Trainees from Cornell, Minnesota, Penn State, Purdue and the University of Texas will be employed in the Buffalo, Columbus, or Louisville aircraft plants; while the women from Northwestern and Rensselaer Polytech will be employed in Curtiss-Wright propeller plants.

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War Program Announced

PROF. C. M. DODD, of the personnel office, recently announced the addition of two new programs in the Engineering Science Management War Training Program.

To supply present war needs in engineering fields, one of the programs is designed for high school graduates that have completed two

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A.I.E.E. Welcomes V-12's

TO WELCOME the Navy V-12 electrical engineering students to the campus, the A.I.E.E. student branch held an informal smoker in South Ballroom, Memorial Union, Wednesday evening, August 11. The V-12 E.E.'s, representing several midwestern universities and colleges, were welcomed in a short address by Prof. M. S. Coover, head of the department, and were addressed by Lt. L. P. Jordan, officer in charge of the program. Prof. J. D. Ryder of the department entertained those present with his presentation of a humorous letter on the problems and events arising within the profession, and regular students William Shafer and Melvin Shepherd set forth in engineering style their impression of "the internal characteristics of a V-12 student" in a short skit. After group singing led by Ray Cunningham of the Y.M.C.A., an invitation to join the organization was extended by Ben S. Willis, faculty counselor.

New officers elected to serve through fall quarter are John Lagerstrom, chairman; Lowell Brown, vice-chairman; Stanley Peterson, secretary; Owen Holbrook, treasurer; Ben Olsen, senior class representative; and Paul Teich, junior class representative.

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Cadettes on Leave

NINETY-ONE Curtiss-Wright Cadettes recently enjoyed a five-day leave between semesters of their engineering training at Iowa State College. At the end of the second term and of the course on December 15, the Cadettes will enter the engineering department of the Curtiss-Wright plant at St. Louis, Mo., which manufactures attack bombers for the Army and Navy.

Six other colleges and universities in addition to Iowa State College are participating in the training project. These institutions are training approximately 700 women engineers—about 100 at each—who will go into aircraft manufacturing plants of the company as engineers doing detail design, stress analysis and lofting.

Electric Stitching

AMERICAN warplanes can now be sewn together at speeds as fast as 1800 welding "stitches" a minute with the aid of electronic tubes much like those in an ordinary radio set, Edwin H. Vedder, a Westinghouse engineer, reported recently at a meeting of the Pittsburgh section of the American Institute of Electrical Engineers.

Peak production in airplane plants, according to Mr. Vedder, manager of the electronic control section of this company, depends upon resistance welding, a speedy new process that stitches metals together just as an electric sewing machine runs down a seam.

This fast method of fabricating aluminum and stainless steel for planes depends upon precise control—and that is now being supplied by electronic tubes that have no moving parts to get out of order. Some of these tubes act as switches, jumping into action in one twenty-five hundredth of a second to start the weld. Previous methods of starting the weld were many times slower than this. Other tubes measure out electric power in exact doses to make each stitch uniformly strong.

Resistance welding, he explained, in done by machines which have water-cooled copper jaws that bite down to hold together the two pieces of metal being welded. Then electricity shoots through the jaws and into the metal, creating heat to weld the two inner surfaces tightly together. On some jobs the jaws are replaced by copper wheels that roll over the metal, making a continuous seam between the two pieces.

Some metals used in aircraft, Mr. Vedder explained, are so difficult to weld that a fingerprint on their surface will increase the metal's resistance, create more heat and noticeably effect the strength of the seam. That is why the length of the time the electric current flows must be regulated so precisely—sometimes to within less than a hundredth of a second. Such a division of time, a veritable impossibility with earlier equipment, is easily measured out by electronic tubes which have no moving parts and thus no mechanical delay.

Women find their place in the home of

The Helldivers

By Marjorie Allen, Cadette, '43

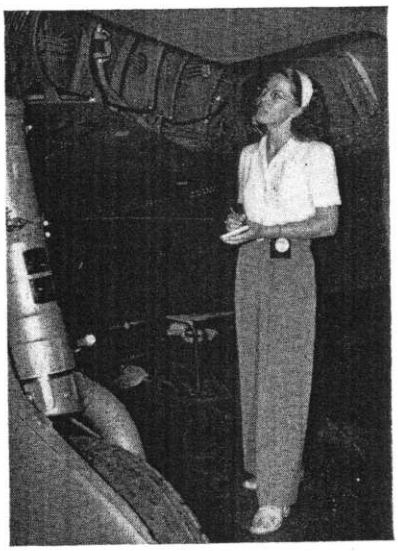
WELL past the raised eyebrow stage, former Curtiss Wright Cadettes are filling men's places in industry. The company, now accustomed to the feminine touch in laboratory and drafting room, indicates no regret for the investment made to train the women war workers at Iowa State College and other technical schools.

The Columbus-bound Iowa Staters reported to the vast factory known as "The Home of the Helldivers" early last January after the Christmas vacation that followed their graduation at Iowa State. For the first fortnight the girls all were in the liaison section of the engineering department, incorporating changes into drawings. The entire group of Purdue and Minnesota University Cadettes also were in this section.

Almost immediately the new employees were segregated, some going to the design groups, the structures section, the materials processing laboratory and a few to aerodynamics. Within a month the liaison section had only a few of the original group left within its ranks.

Cadettes found the engineering department at the Columbus plant one of the busiest and most intriguing in the entire corporation, thanks to ever-expanding production of the new models of the Helldiver and to the experimental work being done.

Iowa State College Cadettes filtered into service engineering, writing bulletins which give instructions for changes to be made on airplanes in service or compiling various handbooks to be used on both production and experimental airplanes; into the design groups, writing engineering change orders and designing detail parts; into the checking group, inspecting changes made on installations; into production design, planning changes for the manufacture of parts used on experimental airplanes which will be converted to a production basis; into field engineering, investigating and reporting trouble for field engineers and service representatives,



This Cadette from the liaison and shop contact department inspects a SB2C Helldiver landing gear part.

and into the industrial artist group, drawing perspective and isometric drawings for the use of service engineering and production design. A few remained in liaison, making shop contacts, writing and incorporating changes.

Although scattered throughout the plant, Iowa State Cadettes are found together at lunch in the cafeteria lunch room or on the lawn outside the buildings. Seven are living together in a large house near Ohio State University, where four of the group were attending the same calculus class in night school

Two production design Cadettes plan the conversion of an experimental airplane to production status. A third from the checking department verifies their computations.

during spring quarter. Two more occupy a house with Cadettes from other schools. A week seldom goes by without one of the 14 coming to work with some news of the Ames campus. A copy of the Iowa Engineer recently made the rounds of

Lunch pail in hand, the author, left, and three other Cadettes show the guard their passes as they leave the plant.

the girls, the Iowa State alumni employed here and innumerable other engineers.

Ironical as it may seem to some Iowa State College students, the Cadettes from Ames are quick to defend the college in discussions of engineering schools, loud in their praises of its campus and quite nostalgic when a dance or football weekend is recalled. Some of the first friends they made in Columbus were Iowa State graduates who had preceded them here.

Assimilation into a large industry might have been difficult and trying at times. However, the step was far easier for them than it might have been for girls coming directly from college work. Their training was an introduction to industry and a preparation that made adjustments to a position different from college a gradual change rather than an abrupt one. They already had become financially independent, they had been shown the way a large corporation operates and they had learned what efforts were expected of them. Only the responsibility of providing their own housing and food was new.

Each and every Cadette trained at Ames realizes that she is by no means a full-fledged engineer but that she received some of the best training offered to the entire lot of Cadettes. Her courses in drafting and job terminology have proved to be the most useful.

Drafting and job terminology were the first subjects the Cadettes employed when they arrived at Columbus. Since no ink work had been done in class at Iowa State, they learned to use ink instruments on tracing cloth the hard way. Already familiar with the engineering drafting manual, aircraft standards parts and Curtiss Wright drafting procedure, they found their first jobs "not too difficult." Some of the Iowa State College girls report that drafting and job terminology still are the only courses they have used to any extent.

Their shop practice and materials and processes lectures have aided several Cadettes to a great degree. Invesigation work often requires ability to comprehend the method of manufacturing a part as well as its design. Cadettes in production design must be familiar with many shop procedures.

Although no Iowa State College Cadette is employed in the structures section, each has benefited from her study of mechanics, mathematics and aerodynamics. Occasionally problems arise requiring an elementary stress analysis or a computation of tolerances and clearances. The inevitable off-the-record discussions and arguments that occur among all engineers are good occasions to dig up recollections of that performance problem on the Thunderbolt or to try to solve the question of just why an airplane flies.

None of those who went to Columbus had exceptionally high grades from Iowa State College, but supervisors report that each has adapted herself to her job with interest and has proved herself capable.

For their part, the girls are happy and interested in the work. Their enthusiasm is indicated by the many nights of overtime—at time and a half—they have given the company since last January.

After the war is over, Iowa State College students may look back on the year that the girls called the Curtiss Wright Cadettes occupied the Union, studied in Engineering Library and ventured into a world formerly occupied only by men. Iowa State College will remember training thousands of young men in the army and navy so that they would be better equipped to do their part in the war. The Cadettes ask Iowa State College to remember them, too—as the women Iowa State trained for war industry.

These service engineering department Cadettes, all trained at Iowa State College, relax from their work long enough to scan the pages of a copy of the Iowa Engineer.

Curtis-Wright Engineering Cadette School
Iowa State College

THE ORGANIZATION AND OPERATION

OF A PRACTICE PRODUCTION LINE

In the Curtiss-Wright Engineering Cadette School, the course known as B-5 Materials Processing and Assembly, includes one section which has to do with production lines. The portion of the work that is presented in the laboratory is scheduled for four periods of three hours each. These periods come once a week.

During the first part of the first period, the class meets in the lecture room for a short introductory talk. The general plan for the work is outlined and the specific product onwhich the work will be performed is introduced. The product is a 20 inch model of the A-25 bomber. It is examined and divided up into the following units:

Propeller	Wing spars
Engine cowling	Radio mast and antennae
Main fuselage section	Bulkhead
Rear fuselage section	Cabin
Rudder and fin	Cabin "plexiglas"
Elevators and stabilizers	Painting
Wings	Insignia

Each section of 15 cadettes puts out 18 plans which is enough to supply a plane to each one with a few extras for staff members. The class elects a foreman, tool superintendent, materials dispatcher and inspector.

The duties of the foreman consist of learning the job of each of the subcontractors who are responsible for the production of the units listed above, for checking absenteeism and for changing workers from one job to another to avoid bottlenecks.

The tool superintendent issues all tools, jigs, fixtures and templates and sees that they are in good working condition. Receipts are required for pieces of this equipment as it is issued to the workers. Most of the templates, special dies, jigs and fixtures are prepared before the class begins work on this project. Planning and making them would be quite desirable, but, with only four periods to devote to this part of the course, there is not enough time available. Some of the simpler soldering fixtures however are designed and made by the cadettes.

The materials dispatcher issues all unprocessed material. It is roughed out into pieces convenient for making enough of the parts for 18 planes. Receipts are required for materials as well as for tools. This serves to encourage economical use of materials and careful handling of tools.

The inspector looks over all parts being made to see that they attain the necessary degree of accuracy. She also inspects the finished planes for strength, accuracy and neatness.

As was mentioned previously, the various units listed are subcontracted. The cadettes are given their choice, in so far as possible, in determining the unit for which each is responsible. In addition to the work of producing the subcontracted parts, there are also the jobs of fuselage and wing fitting, soldering, finishing and "plexiglas" fitting.

During the latter part of the first period, the class goes to the laboratory and practices on a few of each of the parts they are to make or on the processes they are to carry on.

The second period's activity consists in getting out as many parts as possible for the 18 planes. As soon as the parts are finished, they are turned in at a table where they are inspected and then passed on for assembling.

The work of the third period is to complete the cutting, forming and the fitting together of the parts. During this period the foreman has much reassigning of jobs to handle, in order to avoid bottlenecks. Several workers must be transferred, especially to soldering.

The last period is taken up with the completion of the assembling and soldering, the smoothing up of soldered joints, cutting out of insignia (these parts are cut from paper and pasted to the planes after finishing), cutting and forming "plexiglas" cabin canopies (made from sheet celluloid) and the finishing of the planes with a spray gun.

Blanking dies are not used for cutting sheet metal parts due to the time and expense involved in making them. Instead, templates are used for marking and snips and drills for cutting. A cupping die and a dimpling die are used for the engine cowlings and a Guerin die for embossing an aluminum disc with the initials CW. The disc is used on a base which supports the finished plane.* A drill jig is used for drilling holes around the edge of the cowling through which 3/4 inch nails are driven to hold the cowling to the wooden bulkhead. Another drill jig guides the drill through the nose of the hub in making the hole for the propeller shaft. Still another drill jig guides the drill into the propeller hub in making 3 pairs of holes spaced 120° apart to receive the blades. A small chisel-like tool is driven into each pair of holes to form a slot. The wings have their leading edges folded back to give the appearance of thickness and to enclose the wing spars which are made from number 9 wire.**

* The cupping and Guerin dies are operated by a tensile testing machine

** These folded-back edges somewhat resemble de-icing boots.

A single piece of wire passes through the body and extends about 4 inches out into each wing. This is bent slightly to give the proper dihedral angle. Slits are cut in the wings to form the ailerons and small ridges are pressed into them to represent the aileron hinges. The rudders and fins are made in one piece as are also the elevators and stabilisers. Ridges are used here also to indicate the dividing lines and hinges. Heavy black thread is used for the radio antennae. The retracted landing gears and bomb bay doors are marked on the bottom with white ink.

The object of all of these manufacturing activities is to develop in the cadettes an appreciation of the importance of coordinated action in the operation of a production line. The cadette who has the position of foreman has the opportunity of exercising her administrative abilities in recognizing the need for moving workers from one job to another to avoid bottlenecks and in so moving them. The inspector has the opportunity of detecting instances where improvements can be made and encourage as well as demand accuracy. Workers engaged in cutting, forming and assembling parts are given the chance of observing how templates, jigs and fixtures increase speed and accuracy. If they are alert to what is going on, they will realize how dependent the accuracy and proper functioning of one part is to the accuracy and proper functioning of related parts.

Submitted by

R. W. Breckenridge

D.R.S.
7/8/43

TENTATIVE

CURTISS-WRIGHT ENGINEERING CADETTE PROGRAM
IOWA STATE COLLEGE

DESCRIPTION OF COURSES

(Hours shown are for a 5 month period for all courses)

Curtiss-Wright A-1 Engineering Problems. (0-6-0) Cr. 5
Prerequisite: College mathematics through algebra.
Theory and use of slide rule; logarithms; trigonometry; areas, volumes, and weight; use of planimeter; Simpson's Rule; centroids, moment of inertia, radius of gyration, Pappus rule; review algebra through quadratic equations.

Curtiss-Wright A-2 Airplane Design and Construction. (3-0-0) Cr. 2
Prerequisite: College mathematics through algebra.
History of flight; types of airplane; airfoil characteristics; forces in flight; control and stability; wing construction; fuselage construction; powerplant and propeller operation. Organization of typical aircraft company and detailed organization of the engineering department. Detailed study of Curtiss-Wright Engineering Manual: dimensioning; screw threads; AN standards; stock sizes; tolerances and fits; forgings and extrusions; engineering change orders; design and layout practices.

Curtiss-Wright A-3 Aircraft Drafting. (3-0-6) Cr. 7
Prerequisite: College mathematics through algebra.
The course A-3 will parallel our E.D. 131, E.D. 133 Engineering Drawing courses, and will cover approximately the same subject matter, with problems and exercises being applied directly to the aircraft field, with the following exceptions:

1. E.D. 131 2 cr.
   This entire course will be covered with the exception of ink tracings. Exercises in pencil tracing will be given.
2. E.D. 132 3 cr.
   Essentially the entire course will be covered, with particular emphasis on certain phases of the course which apply especially to airplane design, and the application of these problems to this field.
3. E.D. 133 3 cr.
   All of the work as taught in this course will be presented, with the exception of ink tracings. Lettering in ink will be presented.
4. In addition to the 3 courses listed above, additional work will be presented, including the use of the Curtiss-Wright Standard Books, Army-Navy Standards, specification and use of standard parts, aircraft nomenclature, and additional assembly drawings. The work in making detail parts drawings will be more complete than that taught in E.D. 133.

Curtiss-Wright A-4 Elementary Engineering Mechanics. (6-0-0) Cr. 5
Prerequisite: College mathematics through algebra and classification in Curtiss-Wright A-1.
Definitions and properties of materials. Use of the stress-strain diagram. Composition and resolution of forces, triangle and parallelogram laws, moment of a force, couples. Resultants of force systems. Free-body diagrams and equations of equilibrium. Graphic statics. Friction. Buoyant forces and stability of floating bodies. Rectilinear and curvilinear velocity and acceleration. Newton's laws of motion. Equations of motion for translation, rotation, and plane motion. Work and energy, impulse and momentum. Direct central impact.

Curtiss-Wright A-5 Properties and Processing of Aircraft Materials. (2-0-4) Cr. 6 3
Prerequisite: College mathematics through algebra.
A series of lectures dealing with aluminum and its alloys, magnesium and its alloys, steels used for both aircraft construction and for tools, die casting materials, plastics, plywood, and fabrics. A second series of lectures dealing with measurements, metal casting, machine shop tools and operations, power press work, welding, finishing of aircraft parts and testing and inspection methods. Laboratory work consisting of sheet metal lay-out, cutting, forming and riveting sheet metal, welding, soldering, brazing, torch cutting, casting, power press forming and blanking, machine shop operations on lathe, grinders, milling machine, drill press, and power hack saw, use of rubber dies for cutting and forming, "nail and glue" type of wood construction, and use of measuring instruments.

Curtiss-Wright B-1 Aircraft Problems. (0-3-0) Cr. 3
Prerequisite: College mathematics through algebra and Curtiss-Wright A-1.
Analytical geometry, 11 weeks; Rectangular, polar and logarithmic graph papers; construction of charts; ratio charts; graphical solution of equations; empirical equations; straight line law, method of averages and method of least squares for curve plotting; curve fitting; plotting of normals and tangents to irregular curves.

Curtiss-Wright B-2 Theory of Flight. (0-3-0) Cr. 3
Prerequisite: College mathematics through algebra and Curtiss-Wright A-2.
Properties of air; lift and drag equations; parasite drag; airplane engine; propeller action; power required and available; performance analysis of climb, cruising, glide, dive; turns; landing; spins; stability and control; gust and maneuvering loads; load factors; applied load distribution. Wind tunnel testing of airfoil and airplane.

Curtiss-Wright B-3 Aircraft Drafting and Design. (3-0-9) Cr. 9
Prerequisite: College mathematics through algebra and Curtiss-Wright A-3.
This course will cover detailing of wood joints and general wood construction; detail of welded parts and welded assemblies; major assemblies and installation drawings, Curtiss-Wright Engineering change-orders, title blocks and bill of materials, layout and design, and the use of the various standard books and reference material. The work will be of advanced details and assembly drawings, and will involve some original design work.

Curtiss-Wright B-4 Strength of Materials and Aircraft Structural Analysis: (6-0-3) Cr. 7
Prerequisite: College mathematics through algebra and Curtiss-Wright A-4.
Stress determinations in axially loaded tension and compression members riveted and welded joints, shafts, and beams. Shear and moment diagrams. Columns and column formulas. Torsion of hollow and non-circular sections, the membrane analogy. Combined stresses. Buckling of thin sheets. General design considerations.

Curtiss-Wright B-5 Aircraft Materials and Assembly. (0-0-3) Cr. 2
Prerequisite: College mathematics through algebra and Curtiss-Wright A-5.
Laboratory work in the use of such inserted fasteners as rivets, screws, bolts, pins, keys, and special vibration-proof fasteners. Laboratory work in the use of jigs and fixtures. Laboratory work on a fabric covered wing panel. Laboratory study of friction fits. Observation of maintenance work at the airport. Projected pictures of aluminum manufacturing, welding and riveting procedures, plastics, use of power machinery in cutting metals, use of measuring instruments, and the die casting of metals. Series of lectures on production engineering during latter part of course.

CURTISS-WRIGHT ENGINEERING CADETTE PROGRAM
IOWA STATE COLLEGE, Ames, Iowa

(Course conducted from Feb. 15, 1943-Dec. 15, 1943)

DESCRIPTION OF COURSES

First 5-month period
~~(Hours shown are for a 5-month period for all courses)~~

Curtiss-Wright A-1. Engineering Problems. * (0-6-0) Cr. 5 quarter credits
Prerequisite: College mathematics through algebra.
Theory and use of slide rule; logarithms; trigonometry; areas, volumes, and weight; use of planimeter; Simpson's Rule; centroids, moment of inertia, radius of gyration, Pappus rule; review algebra through quadratic equations.

Curtiss-Wright A-2. Airplane Design and Construction. (3-0-0) Cr. 2
Prerequisite: College mathematics through algebra.
History of flight; types of airplane; airfoil characteristics; forces in flight; control and stability; wing construction; fuselage construction; powerplant and propeller operation. Organization of typical aircraft company and detailed organization of the engineering department. Detailed study of Curtiss-Wright Engineering Manual: dimensioning; screw threads; AN standards; stock sizes; tolerances and fits; forgings and extrusions; engineering change orders; design and layout practices.

Curtiss-Wright A-3. Aircraft Drafting. (3-0-6) Cr. 7
Prerequisite: College mathematics through algebra.
The course A-3 will parallel our E.D. 131, E.D. 133 Engineering Drawing courses, and will cover approximately the same subject matter, with problems and exercises being applied directly to the aircraft field, with the following exceptions:

1. E.D. 131 2 cr.
   This entire course will be covered with the exception of ink tracings. Exercises in pencil tracing will be given.
2. E.D. 132 3 cr.
   Essentially the entire course will be covered, with particular emphasis on certain phases of the course which apply especially to airplane design, and the application of these problems to this field.
3. E.D. 133 3 cr.
   All of the work as taught in this course will be presented, with the exception of ink tracings. Lettering in ink will be presented.
4. In addition to the 3 courses listed above, additional work will be presented, including the use of the Curtiss-Wright Standard Books, Army-Navy Standards, specification and use of standard parts, aircraft nomenclature, and additional assembly drawings. The work in making detail parts drawings will be more complete than that taught in E.D. 133.

Curtiss-Wright A-4 Elementary Engineering Mechanics. (6-0-0) Cr. 5
Prerequisite: College mathematics through algebra and classification in Curtiss-Wright A-1.
Definitions and properties of materials. Use of the stress-strain diagram. Composition and resolution of forces, triangle and parallelogram laws, moment of a force, couples. Resultants of force systems. Free-body diagrams and equations of equilibrium. Graphic statics. Friction. Buoyant forces and stability of floating bodies. Rectilinear and curvilinear velocity and acceleration. Newton's laws of motion. Equations of motion for translation, rotation, and plane motion. Work and energy, impulse and momentum. Direct central impact.

Curtiss-Wright A-5 Properties and Processing of Aircraft Materials. (2-0-4) Cr. 2
Prerequisite: College mathematics through algebra.
A series of lectures dealing with aluminum and its alloys, magnesium and its alloys, steels used for both aircraft construction and for tools, die casting materials, plastics, plywood, and fabrics. A second series of lectures dealing with measurements, metal casting, machine shop tools and operations, power press work, welding, finishing of aircraft parts and testing and inspection methods. Laboratory work consisting of sheet metal lay-out, cutting, forming and riveting sheet metal, welding, soldering, brazing, torch cutting, casting, power press forming and blanking, machine shop operations on lathe, grinders, milling machine, drill press, and power hack saw, use of rubber dies for cutting and forming, "nail and glue" type of wood construction, and use of measuring instruments.

Second 5-month period

Curtiss-Wright B-1 Aircraft Problems. (0-3-0) Cr. 3
Prerequisite: College mathematics through algebra and Curtiss-Wright A-1.
Analytical geometry, 11 weeks; Rectangular, polar and logarithmic graph papers; construction of charts; ratio charts; graphical solution of equations; empirical equations; straight line law, method of averages and method of least squares for curve plotting; curve fitting; plotting of normals and tangents to irregular curves.

Curtiss-Wright B-2 Theory of Flight. (0-3-0) Cr. 3
Prerequisite: College mathematics through algebra and Curtiss-Wright A-2.
Properties of air; lift and drag equations; parasite drag; airplane engine; propeller action; power required and available; performance analysis of climb, cruising, glide, dive; turns; landing; spins; stability and control; gust and maneuvering loads; load factors; applied load distribution. Wind tunnel testing of airfoil and airplane.

Curtiss-Wright. B-3 Aircraft Drafting and Design. (3-0-9) Cr. 9
Prerequisite: College mathematics through algebra and Curtiss-Wright A-3.
~~This course will~~ cover detailing of wood joints and general wood construction; detail of welded parts and welded assemblies; major assemblies and installation drawings, Curtiss-Wright Engineering change-orders, title blocks and bill of materials, layout and design, and the use of the various standard books and reference material. ~~The work will be of~~ advanced details and assembly drawings, and ~~will involve~~ some original design work.

Curtiss-Wright. B-4 Strength of Materials and Aircraft Structural Analysis: (6-0-3) Cr. 7
Prerequisite: College mathematics through algebra and Curtiss-Wright A-4.
Stress determinations in axially loaded tension and compression members, riveted and welded joints, shafts, and beams. Shear and moment diagrams. Columns and column formulas. Torsion of hollow and non-circular sections, the membrane analogy. Combined stresses. Buckling of thin sheets. General design considerations.

Curtiss-Wright. B-5 Aircraft Materials and Assembly. (0-0-3) Cr. 2
Prerequisite: College mathematics through algebra and Curtiss-Wright A-5.
Laboratory ~~work~~ in the use of such inserted fasteners as rivets, screws, bolts, pins, keys, and special vibration-proof fasteners. Laboratory ~~work~~ in the use of jigs and fixtures. Laboratory ~~work~~ on a fabric-covered wing panel. Laboratory study of friction fits. Observation of maintenance work at the airport. Projected pictures of aluminum manufacturing, welding and riveting procedures, plastics, use of power machinery in cutting metals, use of measuring instruments, and the die casting of metals. Series of lectures on production engineering during latter part of course.

IOWA STATE COLLEGE
CURTISS WRIGHT ENGINEERING CADETTES

A-1 Engineering Mathematics -- 6 hours per week for 22 weeks

1. Logarithms - 12 hours

   Definition of logarithms; Common logarithms for multiplication, division, powers, and roots. Natural logarithms and conversions.

2. Slide Rule - 12 hours

   Addition and subtraction with simple scales; relationship to logarithms; multiplication, division, powers, and roots by slide rule; rules for decimal points.

3. Trigonometry - 60 hours

   (a) 42 hours - Definitions, functions, solution of right triangles
   (b) 18 hours - Solution of general triangles, and problems. Functions of double angles.

4. Areas and Volumes - 18 hours

   (Coordinate with manual and handbook)
   Areas of plan figures; volumes and areas of surfaces of prism, cones, pyramids, frustums; volumes of revolution (include Simpson's rule and Pappus's rule). Centroids of simple areas and volumes. Use of planimeter.

5. Review of Algebra - 30 hours

   Through quadratic equations.

A-4 Elementary Engineering Mechanics - 6 hours per week for 22 weeks

1. Introduction - 10 weeks

Fundamental concepts dealing qualitatively with the following:

Force; weight; mass; density; specific gravity; lever; pulley; gears; screw; hydraulic and pneumatic pressure systems; tension; compression; flexure; functions of columns; beams, tension members; brittleness; ductility; hardness; friction; viscosity.

2. Statics and Dynamics - 12 weeks

The following items should be covered on the basis of qualitative determinations and that liberal use be made of problems based on aircraft design:

a. Statics - 7 weeks

Force, Vectorial representation, couples, combination and resolution of forces, concurrent and non-concurrent force systems, reactions, space systems, truss analysis, buoyancy, metacentric height.

b. Dynamics - 5 weeks

Laws of motion, linear and angular velocities, acceleration, energy, work, inertia, momentum, impact, motion on inclined plane, friction.

A-5 Properties and Processing of Aircraft Materials- 6 hours per week for 22 weeks

1. Shop - 4 hours per week for 22 weeks
(To be given simultaneously with lecture (a) and (b)

AIM: TO FAMILIARIZE THE STUDENT WITH SHOP PROCEDURES AND SHOP TOOLS AND THEIR OPERATIONS AS USED IN AIRCRAFT ENGINEERING

a. Bench work
Use of hammer on sheet metal aluminum alloy, file, layout, and drilling of aluminum alloy, use of hand taps and dies, sheet metal layout on aluminum alloy, cutting and forming of aluminum alloy, riveting (flush, blind, and machine).

b. Lathe work
Straight turning, screw thread cutting, chuck work, boring, internal threading.

c. Milling machine work
Plane milling, index milling, production milling.

d. Shaper and planer
Surfacing and squaring

e. Routing machine

f. Turret lathes and screw machines
Set-up and operation; production.

g. Press operations on aluminum alloys
Mechanical and hydraulic; use of punches and dies; kirksite dies, rubber dies, temporary dies and wood dies.

h. Demonstration of miscellaneous machines
Boring mills, grinders, hobbing machines, do-all machines.

i. Precision measurements
Use of instruments; use of gauges, indicators, and gauge plots.

2. Lecture - 1 hour per week for 22 weeks
(a) (To be given simultaneously with shop and with lecture (b)

a. Manufacture of aluminum and aluminum alloys

b. Rolling, forming, and shaping of aluminum alloys (rolling, forging and extruding)

c. Aluminum alloys
Physical properties and specifications.

d. Heat treating of aluminum alloys
Annealing, hardening, anodizing. In this connection, there will be demonstrations of heat treating, heat treating equipment, and hardness testing machines.

e. Aluminum castings
Physical properties and specifications

f. Manufacture of iron and steel
Physical properties and specifications

g. Tool steels and other cutting materials
Physical properties and specifications; carbon steel, hi-speed steel, stellite and cemented carbides.

h. Welding of aircraft materials
Techniques and equipment; demonstration of both in the laboratory.

i. Plastics
Physical properties and specifications. (Stress application of plastics -- not chemical makeup)

j. Die casting
Production methods, physical properties and specifications; zinc base, aluminum base, and magnesium base metals.

k. Magnesium alloys
Physical properties and specifications.

3. Lecture - 1 hour per week for 22 weeks
(b) (To be given simultaneously with shop and with lecture (a)

a. Shop terminology and machine operations

b. Bench and hand work
Lectures dealing with specific machine tools beyond that type of work that can be accomplished in the shop, including filing, layout, and riveting of aluminum. (Emphasizing the use of aircraft materials.)

c. Lathe, turret lathe, and screw machine

d. Milling machine

e. Drilling machine

f. Grinding machine

g. Broaching

h. Surface finishing
Honing, lapping, buffing, and polishing

I. Press working ofmetals
(With particular reference to aircraft machines)

j. Measurement and measuring devices

MONTANA STATE UNIVERSITY
MISSOULA

March 12, 1943

Registrar
Iowa State College
Ames, Iowa

Dear Sir:

I understand that at the present time the Curtis-Wright Corporation is sponsoring at Iowa State College a course for engineering cadets which covers work in engineering methods, engineering mechanics, drafting, processing, etc., in order to receive some sort of engineering certificate.

This may be a little early to request this information, but since two of our students are enrolled in this course, we should like to know what Iowa State College is prepared to do by way of accepting toward their degrees at a later date credits earned by these cadets who might wish to apply them in the manner indicated. In other words, we should like to know if you consider this work as strictly of college level and if it could possibly be applied to major or minor requirements in fields related to engineering.

Thank you very much for any help you can give us in this matter.

Very truly yours,

Registrar

HW:ad

JEFFERSON CITY PUBLIC SCHOOLS
JEFFERSON CITY, MISSOURI

April 20, 1943

Mr. James R. Sage, Registrar,
Iowa State College,
Ames, Iowa

Dear Mr. Sage:

Miss Searle Lee Hultmark, who had completed 51½ hours in our Junior College at the end of the first semester of this year and had completed all of the required courses for her Associate in Arts Degree in the field of Arts and Science, is now enrolled in Iowa State College in the Engineering Program of Curtis Wright directive.

She is enrolled in a Mathematics course meeting 6 hours per week, a Mechanics course meeting 6 hours per week, a Drafting course meeting 9 hours per week, a combination course in Materials and Processing laboratory and Properties of Materials 2 hours lecture per week, and 2 hours per week of Physical Education.

After contacting the Registrar of the University of Missouri, our accrediting institution, I am told that you have worked quite extensively in the matter of accrediting courses carried under certain military programs as to their quality in terms of regular college credit.

Miss Hultmark is desirous of securing her degree from the Junior College this year and thinks it might be possible to transfer acceptable credits back to Jefferson City in order to complete the 64 required hours. I should appreciate a statement of your policy, a further statement as to the number of hours of credit acceptable out of the courses being carried by Miss Hultmark, and your recommendation as to what we may be able to do for her.

A reply from you at your earliest convenience will be appreciated.

Very truly yours,

Walter L. Cooper

Walter L. Cooper, Dean,
Junior College

S

APR 22 1943

EL DORADO JUNIOR COLLEGE

EARL WALKER, DEAN

EL DORADO - - KANSAS

Call Nelson
Re- marks for
minor

APR 29 1943

April 21, 1943

Registrar,
University of Iowa,
Iowa City, Iowa.

Ap 23 10 30 AM '43

Dear Sir:--

I am writing you concerning Miss Catherine Minor, Curtiss-Wright Engineering Cadette from El Dorado Junior College.

She was one of our outstanding students, and she had completed three full semesters of regular work here before leaving.

If her present Engineering Cadette work, can be given a college hour evaluation justifying it, we would like very much to accord her the honor of "in absentia" graduation at our commencement exercises here May 21st.

Please write me fully and frankly about this at the earliest possible date.

Yours truly,

Earl Walker

Earl Walker.

April 24, 1943

Professor C. M. Dodd,
Engineering.

Dear Professor Dodd:

I am enclosing the following:

1. A copy of a letter which I received from Dean Walter L. Cooper of the Jefferson City Junior College, Jefferson City, Missouri.

2. A copy of my reply to him.

3. A copy of the letter which I have just written to Professor Wilbur C. Nelson.

Dean Cooper's letter indicates to me the necessity of evaluating our courses that are being given to various special groups from time to time.

I think we should go back over the EDT and the ESMWT courses and evaluate them as nearly as possible in terms of our regular courses given by the various departments. If any one of these special courses was not on the college level we should record that fact. In other words, the record concerning each course should be complete. The evaluations should be arrived at while the content of the various courses is fresh in the minds of all concerned.

I am assuming that this is a part of the responsibility which President Friley placed on the special committee consisting of Mr. Holmes and you and me.

Sincerely yours,

S/s

April 24, 1943

Professor W. C. Nelson,
Aeronautical Engineering.

Dear Professor Nelson:

I am enclosing a copy of a letter which I have received from Dean Walter L. Cooper. I am also enclosing a copy of my reply.

I think that, as soon as we can do so conveniently, we should attempt to evaluate all of the Curtiss-Wright courses in terms of quarter credits so that we may be able to respond to the kind of request we have had from Dean Cooper. Furthermore, such an evaluation is important so far as our own records are concerned. Some of these girls will be returning to Iowa State after the war to continue in some of our curricula. We should be able to tell them how many credits they would receive toward their degrees if they were to return here for further work.

We shall also be needing this information so that we may be able to send significant transcripts to other colleges in case these girls later return to the institution from which they came or go to other colleges to complete their education.

If I can be of assistance to you in any way in the evaluation of these courses I shall be glad to discuss the matter with you at any time.

Sincerely yours,

S/s
encl.

April 24, 1943

Dean Walter L. Cooper,
Jefferson City Public Schools,
Jefferson City, Missouri.

Dear Dean Cooper:

I received your letter of the 20th in which you asked that we evaluate the courses which Miss Searle Lee Hultmark is taking in the Curtiss-Wright program so that you may determine whether she can qualify for her Associate in Arts Degree at the end of the current year.

I am taking this question up with Professor Wilbur C. Nelson, Head of the Department of Aeronautical Engineering, who is in charge of the Curtiss-Wright program. I am asking him to evaluate the courses in question in terms of quarter credits or semester hours. As soon as we can make an evaluation, I shall report promptly to you.

Sincerely yours,

S/s

IOWA STATE COLLEGE
OF AGRICULTURE AND MECHANIC ARTS
AMES, IOWA

DEPARTMENT OF AERONAUTICAL ENGINEERING

April 26, 1943

Mr. J.R. Sage, Registrar
Beardshear

Dear Mr. Sage:

This will refer to your letter of April 24 concerning the evaluation of course credits for the Curtiss-Wright curriculum and the transfer of credits for Miss Searle Lee Hultmark.

We have not as yet been able to reach a final decision on quarter credits for this course material but we do know that the total credits to be granted will approximate 45 quarter credit hours in the engineering division. I am enclosing herewith a brief description of all the courses being taken together with the grades which Miss Hultmark has acquired thus far. I would recommend that this information be transmitted to Dean Cooper with the recommendation that he grant the necessary credits to Miss Hultmark to complete her Associate in Arts Degree.

After she has completed the first term of five months here on the campus and has received her course grades together with our evaluation of the credits hours, we will then be in a position to send an official transcript.

Miss Hultmark's grades are as follows:

Engineering Mathematics	C	Engineering Mechanics	D
Job Terminology	C	Properties & Processing of Aircraft Materials	C
Aircraft Drafting	C		

Yours very truly,

W.C. Nelson
Head of Department

Curtiss-Wright Course Director

WCN:mt
Encl.

APR 27 1943

MONTANA STATE UNIVERSITY
Missoula

June 28, 1943

Curtis, Maxine D.

Mr. W.C. Nelson, Curtiss Wright Course Director
Iowa State College of
Agriculture and Mechanical Arts
Ames, Iowa

My dear Mr. Nelson:

I am again writing with regard to the possibility of securing definite information about credits for the above named individual in the Curtiss-Wright Engineering Course.

You mentioned in your letter of May 22 that faculty action had not yet been taken on your recommendation for course credit toward graduation from Iowa State College. Has such action been taken as yet?

Also would you please tell me at what time 2/3 (approximately 30 credits) of work will have beem completed by Miss Curtis.

After faculty action necessary for the approval for the credits toward a degree has been taken, should we request a statement from the Registrar of the Iowa State College with regard to it?

I am sorry to trouble you with this matter but Miss Curtis is very anxious to receive her degree, and will be able to do so upon the completion of 2/3 of the course there after credits are approved by Iowa State College and are indicated as completely satisfactory.

Thank you very much for your help in this matter.

Very truly yours,

(s) J.B. Speer
Registrar

hw/rc

JUL -5 1943

IOWA STATE COLLEGE
OF AGRICULTURE AND MECHANIC ARTS
AMES, IOWA

DEPARTMENT OF AERONAUTICAL ENGINEERING

June 29, 1943

J.R. Sage, Registrar
Beardshear

Dear Mr. Sage:

The first term of our Curtiss-Wright Engineering Cadette program will be completed on July 15 and at that time our class cards will be turned in to your office with the first term grades on them. However, the Curtiss-Wright Corporation has requested that all grades be kept confidential until the end of the program on December 15, 1943. At that time the release of grades for both the first and second terms will be in order. Therefore, will you please see that this material is kept confidential.

Yours very truly,

W.C. Nelson
Head of Department

WCN:mt

Answered by telephone.

JUN 30 1943

IOWA STATE COLLEGE
OF AGRICULTURE AND MECHANIC ARTS
AMES, IOWA

DEPARTMENT OF AERONAUTICAL ENGINEERING

COPY

July 5, 1943

J.B. Speer, Registrar
Montana State University
Missoula, Montana

Dear Mr. Registrar:

This will refer to your letter of June 28 concerning the course credits for Miss Maxine D.Curtis in our Curtiss-Wright Engineering Cadette course.

A total of 45 quarter credit hours for the course has been recommended by the Engineering Division to the general college faculty and we expect final faculty action on it sometime during the summer.

Two-thirds of the course will be completed on September 15. I am forwarding your letter to the Registrar and I am sure that he will be pleased to send you a statement when the necessary faculty approval has been received for official credit.

Yours very truly,

W.C. Nelson
Head of Department

Curtiss-Wright Course Director

WCN:mt
cc. Mr.Sage, Registrar ✓

JUL -5 1943

July 23, 1943

Mr. J. B. Speer, Registrar,
Montana State University,
Missoula, Montana.

Dear Mr. Speer:

The Faculty has finally taken action in regard to the number of credits to be assigned to each of the Curtiss-Wright courses. The Faculty action is as follows:

C-W. A-1.	Engineering Problems. (0-6-0)	Cr. 5
C-W. A-2.	Airplane Design and Construction. (3-0-0)	Cr. 2
C-W. A-3.	Aircraft Drafting. (3-0-6)	Cr. 7
C-W. A-4.	Elementary Engineering Mechanics (6-0-0)	Cr. 5
C-W. A-5.	Properties and Processing of Aircraft Materials (2-0-4)	Cr. 3
C-W. B-1.	Aircraft Problems. (0-3-0)	Cr. 3
C-W. B-2.	Theory of Flight. (0-3-0)	Cr. 3
C-W. B-3.	Aircraft Drafting and Design. (3-0-9)	Cr. 9
C-W. B-4.	Strength of Materials and Aircraft Structural Analysis. (6-0-3)	Cr. 7
C-W. B-5.	Aircraft Materials and Assembly. (0-0-3)	Cr. 2

Further detailed information is contained on the enclosed mimeographed material. In this connection I need to explain for you the parenthetical material which appears on the first line of the description of each course. The first number in parenthesis indicates the number of lectures per week, the second number indicates the number of recitations and the third the number of hours of laboratory a week. For example with reference to course C-W. A-1, the parenthetical expression (0-6-0) indicates that there are no lectures, 6 recitation periods and no laboratory work.

We regard the Curtiss-Wright courses as being given on the college level and have agreed to give college credit in the amounts stated for each course for each five months of study. We would expect to apply these credits toward an engineering degree in case these students should wish to continue in the study of engineering here after the war.

If you have any question concerning this I shall be glad to respond.

Very cordially yours,

Ss

IOWA STATE COLLEGE
OF AGRICULTURE AND MECHANIC ARTS
AMES, IOWA

DEPARTMENT OF AERONAUTICAL ENGINEERING

November 24, 1943

Mr. J. R. Sage
Registrar's Office
Beardshear

Dear Mr. Sage:

We would like to have you join with us in the Curtiss-Wright Engineering Cadette dinner to be held at 7 p.m. Tuesday, December 14, in the Memorial Union. The group will meet in the Faculty Lounge, and then proceed through the downstairs cafeteria line and up to the South Ball Room for the program.

President Friley will give the commencement address and diplomas will be presented to each cadette.

Please call Miss Haug (X-363) before December 1 and indicate whether or not you will be able to attend.

Yours very truly,

Wilbur C. Nelson

Wilbur C. Nelson
Course Director

WCN:lh

IOWA STATE COLLEGE
OF AGRICULTURE AND MECHANIC ARTS
AMES, IOWA

DEPARTMENT OF AERONAUTICAL ENGINEERING

COPY

November 30, 1943

Mr. H. C. Gregg, Business Manager
125 Beardshear

Dear Mr. Gregg:

In checking over our Curtiss-Wright 400-20-16 fund I find that we have allocated $500 to the Registrar for his services on this program.

Will you please transfer this amount from the above budget to the credit of the Registrar's Office.

This matter has been discussed with Mr. Sage and has his approval.

Very truly yours,

Wilbur C. Nelson
Head of Department

WCN:lh
cc Mr. Sage

THE IOWA STATE COLLEGE
OF AGRICULTURE AND MECHANIC ARTS

AMES, IOWA

This Certifies that

Belly Clayborn

has completed the

Curtiss-Wright Engineering Cadette Training Course

conducted by The Iowa State College in cooperation with the
Curtiss-Wright Corporation from
February 15, 1943 to December 14, 1943.

DEAN, DIVISION OF ENGINEERING

COURSE DIRECTOR

PRESIDENT OF COLLEGE

Graduation Exercises

Curtiss-Wright Engineering Cadettes

THE IOWA STATE COLLEGE
AMES, IOWA

In South Ball Room, Memorial Union
Tuesday Evening, December Fourteenth, at Seven o'Clock
Nineteen Hundred and Forty-Three

PROGRAM

DEAN T. R. AGG, PRESIDING

I. SELECTIONS . . . . . CADETTE SEXTETTE

White Christmas
My Ideal
Goodbye

NORMA BERRY, ELOISE ENGLE, BETTY BELLE GARDNER
JANE ALYS RAGSDALE, EDNA SUYDAM
Director: NANCY SOLLITT

II. ADDRESS . . . . . CHARLES E. FRILEY
President, Iowa State College

III. AWARDING OF CERTIFICATES . . . . . PRESIDENT FRILEY

CANDIDATES

COURSE CONDUCTED FROM FEBRUARY 15, 1943 TO DECEMBER 14, 1943

Geneva Maye Acton	*Columbus, Indiana*	Mary Jane Blacet	*St. Joseph, Missouri*
Annice Vivian Acuff	*Gosport, Indiana*	Emily Carnall Black	*Sallisaw, Oklahoma*
Harriet Dolores Adams	*Colorado Springs, Colo.*	Jane Lee Boniface	*St. Louis, Missouri*
Marjorie Nell Allen	*Pawhuska, Oklahoma*	Joyce Esther Cambier	*Orange City, Iowa*
Mary Alice Anderson	*Fairfield, Iowa*	Joan Barbara Carlson	*Palestine, Texas*
Marion Eleanor Bagley	*Park Ridge, Illinois*	Mary Carol Clevenger	*Monroe, Iowa*
Ruth Emilie Ball	*St. Louis, Missouri*	Mary Louise Converse	*Mantua, Ohio*
Annette Marie Baumgartner	*St. Louis, Missouri*	Kathryn Mercedes Cooney	*Belleville, Illinois*
Norma Dean Berry	*Stuttgart, Arkansas*	Norma Austin Crawford	*Sandoval, Illinois*

Maxine Doris Curtis	*Richland, Montana*
Alice Jo Douglas	*Wonewoc, Wisconsin*
Eloise Engle	*East St. Louis, Illinois*
Gussie Adelle Frymire	*Chenault, Kentucky*
Betty Isabel Gardner	*Parsons, Kansas*
Patricia May Gilbert	*Dillon, Montana*
Betty Jo Glanville	*Kansas City, Kansas*
Betty Claybourn Goettsch	*Joplin, Missouri*
Wanda Goodwin	*Trindad, Colorado*
Sarah Kathleen Graddy	*Farmersburg, Iowa*
June Elizabeth Grant	*Crookston, Minnesota*
Helen Marjorie Grundon	*Fort Dodge, Iowa*
Murray Hake	*Arlington, Virginia*
Leah Jean Harlow	*Spokane, Washington*
Anna Lee Harris	*Elk City, Oklahoma*
Lucy Lair Hartshorn	*Longmont, Colorado*
Elizabeth Ann Heckman	*Independence, Kan.*
Lillian Fern Henderson	*Morning Sun, Iowa*
Ethelyne Elvera Hendrickson	*Aspen, Colorado*
Dorain Izella Hettmannsperger	*Charlotte, Mich.*
Rose Lorraine Hillen	*Ft. Collins, Colorado*
Searle Lee Hultmark	*Washington, D. C.*
Mary Elizabeth Johnson	*Saint Louis, Missouri*
Mary Josephine Johnson	*Garland, Kansas*
Mildred Marie Johnson	*Ferguson, Missouri*
Sarah Vivian Johnson	*Sedgwick, Colorado*
Helen Ruth Johnston	*Ranchester, Wyoming*
Lola Louise Judd	*Raymondville, Texas*
Virginia Else Kammerer	*Saint Louis, Missouri*
Palla Jayne Koenig	*Webster Groves, Missouri*
Grace May Krappe	*Carbondale, Illinois*
Wilma Jean Landaal	*Waupun, Wisconsin*
Mary Elizabeth Laughlin	*Batavia, Iowa*
Lois Ruth Lee	*Peoria, Illinois*
Doris Katherine Lehmann	*Ithaca, New York*
LaVon Esther Littler	*Boulder, Colorado*
Doris Jane Livesay	*DuQuoin, Illinois*
Mary Jean Logan	*Ruthven, Iowa*
Ellen Louise Loomis	*Akron, Ohio*
Jean Matheson	*Simla, Colorado*
Geneva Grace Metcalf	*Coon Valley, Wisconsin*
Jeannette Marie Minnick	*Egbert, Wyoming*
Catherine Lee Minor	*El Dorado, Kansas*
Shirley Mason Myers	*Pueblo, Colorado*
Norma Lee Nash	*Saint Louis, Missouri*
Sue Jean Nickerson	*Bushton, Kansas*
Thelma Jo Noble	*Lawson, Kentucky*
Nadine Verda Nyffeler	*Columbus, Nebraska*
Oma June Padget	*Monte Vista, Colorado*
Eleanor Ann Palmes	*Fort Collins, Colorado*
Loyce Ernestine Patterson	*San Antonio, Texas*
Dolores N. Polk	*Austin, Texas*
Geraldine Mayhew Pressly	*Kansas City, Mo.*
Mary Margaret Ragland	*Newton, Kansas*
Jane Alys Ragsdale	*Okmulgee, Oklahoma*
Anne Rill	*Chicago, Illinois*
Jeane Louise Ritter	*Fort Collins, Colorado*
Gloria Mildred Schleuter	*Ferguson, Missouri*
Florence Evelyn Scribner	*Carroll, Nebraska*
Elizabeth Ruth Scrogham	*Peoria, Illinois*
Golden Juanita Short	*Jackson, Kentucky*
Nancy Blanche Sollitt	*Evanston, Illinois*
Marie Louise Stevens	*Paris, Texas*
Kathryn Pirkey Stoll	*Lexington, Kentucky*
Jewell Elizabeth Story	*W. Frankfort, Illinois*
Phyllis Ludwika Surwillo	*Rochester, New York*
Edna Reid Suydam	*State College, Pennsylvania*
Marjorie Leah Swarts	*Cement, Oklahoma*
Anne Marie Sweeney	*Mt. Pleasant, Pennsylvania*
Doreen Gaston Todd	*Oak Park, Illinois*
Dorothy Frances Trembley	*Webster Groves, Mo.*
Jane Anita Wight	*Downers Grove, Illinois*

IV. MOTION PICTURE

Curtiss-Wright Engineering Cadette Training at Iowa State College

Filmed by PROF. H. L. KOOSER, *Visual Instruction Service*
Planning and arrangements by Cadette Engineering Society

CURTISS-WRIGHT CADETTES

Graduation Instructions
December 14, 1943

1. Herewith you will find the following:

   a. A numbered alphabetical list of the candidates.

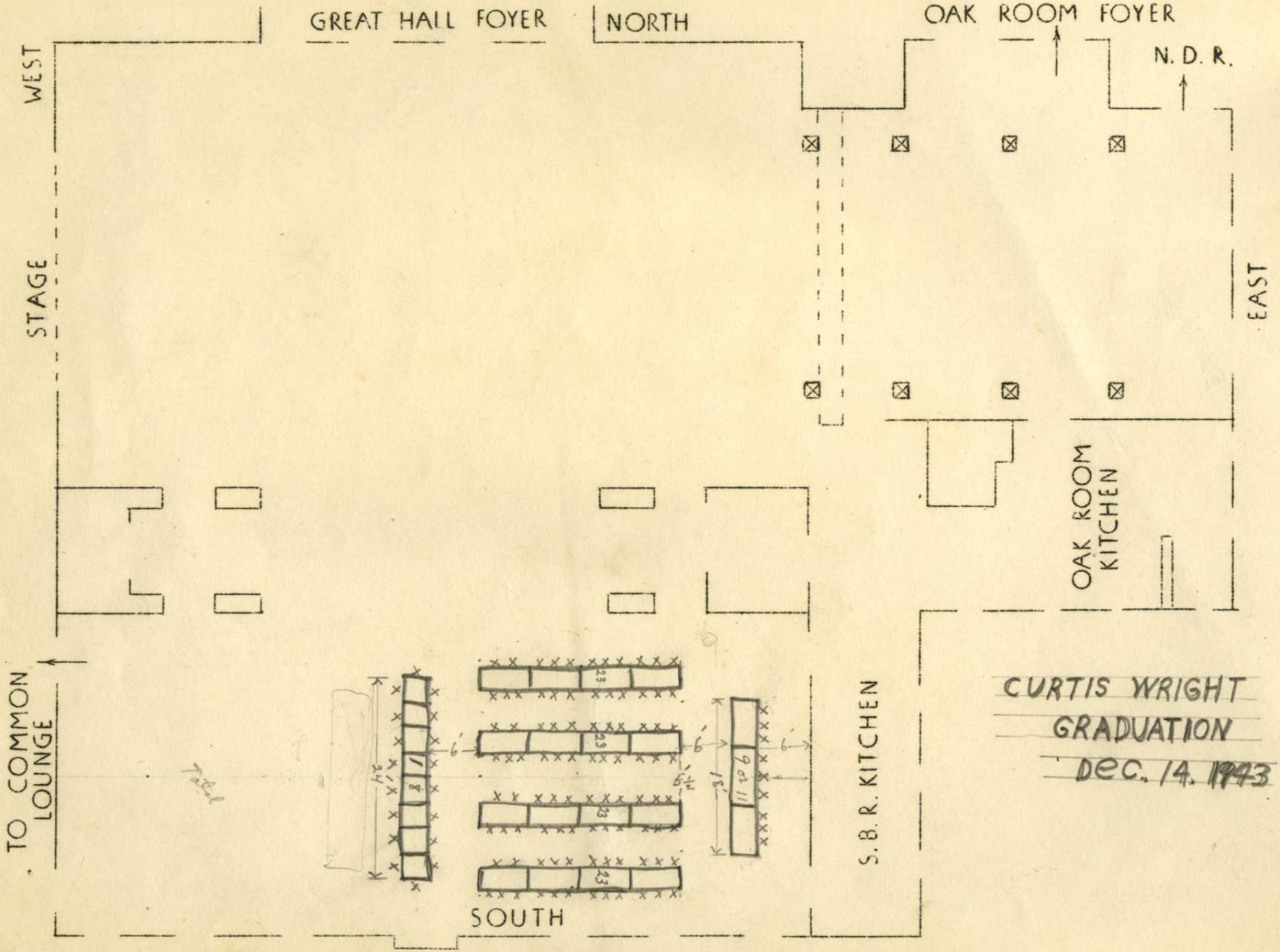
   b. A diagram of the seating arrangement for the South Ball Room, Memorial Union, where the graduation dinner will be held. Your seat number at the banquet table will be the same as your number on the alphabetical list.

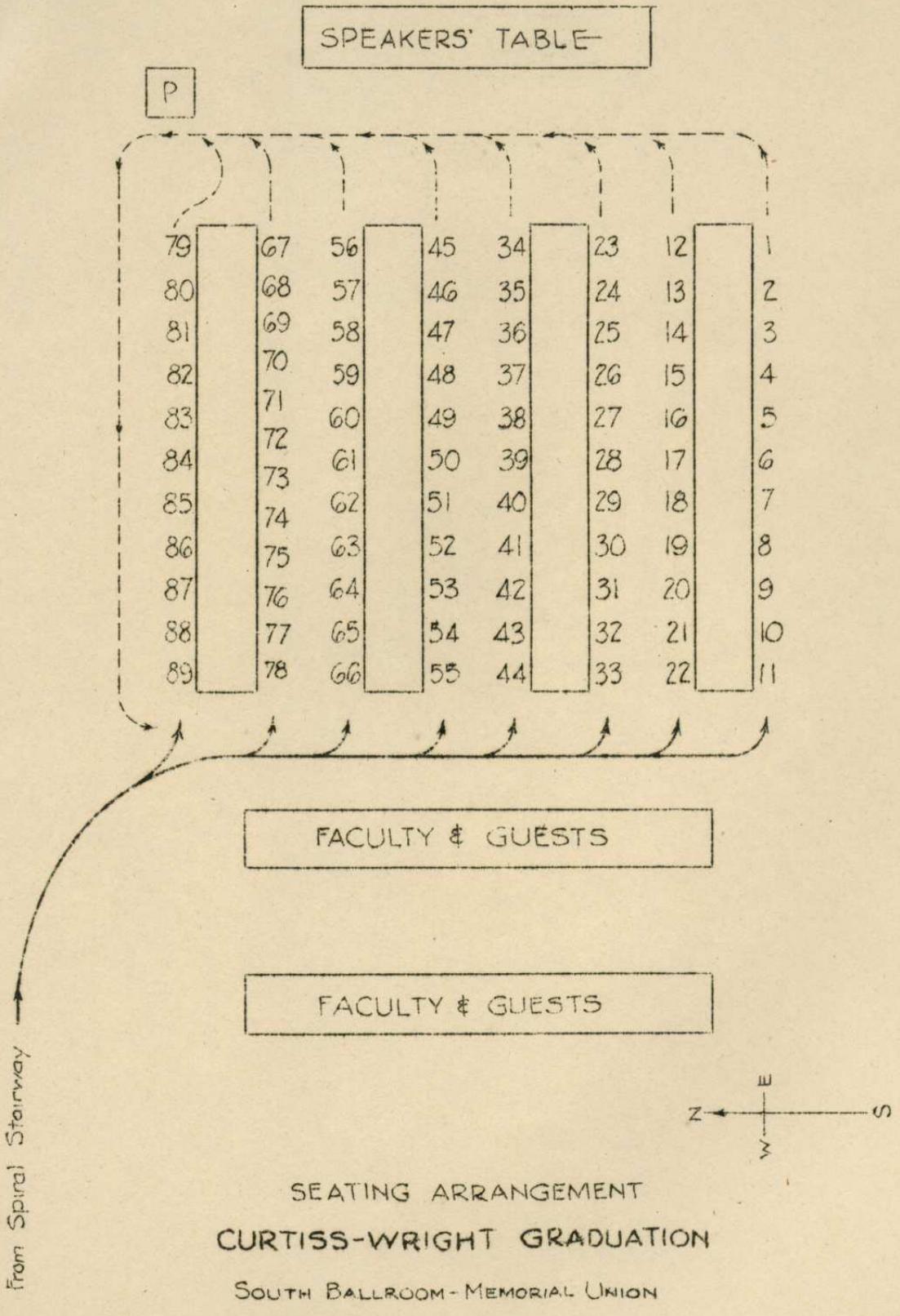
2. At 6:40 assemble in the corridor of the second floor of Memorial Union. Line up in the order in which the names appear on the list. You will then go down the stairs in this order and go through the cafeteria line in the usual way and take your trays up the spiral stairway to the South Ball Room. The solid lines and arrows on the diagram will indicate your direction of movement to your place at the table. Remain standing until those at the speaker's table sit down.

3. When the time comes for awarding the certificates, Professor Nelson will ask you to stand. He will then recommend you to President Friley for your certificate.

   As soon as the President has awarded the certificates you will pass by his table in numerical order and receive your certificate. When delivering the certificates the President will stand at the place marked "P" at the north end of the speaker's table. The line of march for receiving your certificate and returning to your seat is indicated by the broken line and arrows. All candidates will remain standing until all have received their certificates and until the President sits down.

   It is good form to thank the President when you receive your certificate.


GREAT HALL FOYER
NORTH
OAK ROOM FOYER
N. D. R.
WEST
STAGE
EAST
OAK ROOM KITCHEN
TO COMMON LOUNGE
S. B. R. KITCHEN
SOUTH
CURTIS WRIGHT
GRADUATION
DEC. 14. 1943



SEATING ARRANGEMENT

CURTISS-WRIGHT GRADUATION

SOUTH BALLROOM - MEMORIAL UNION

DECEMBER 14, 1943

C H R I S T M A S

G R E E T I N G S

oo

CURTISS-WRIGHT CADETTE
COMMENCEMENT, DEC. 14, 1943

ADESTE FIDELES

O come, all ye faithful, joyful and triumphant;
O come ye, O come ye to Bethlehem;
Come and behold Him, born the King of angels;
O come, let us adore Him,
O come, let us adore Him,
O come, let us adore Him,
Christ the Lord.
Sing, choirs of angels, sing in exultation,--
Sing, all ye citizens of heav'n above:
Glory to God--in the highest:

IT CAME UPON THE MIDNIGHT CLEAR

It came upon the midnight clear, That glorious song of old--
From angels bending near the earth, To touch their harps of gold
"Peace on the earth, good-will to men From heav'n's all-gracious King."--
The world in solemn stillness lay to hear the Angels sing.

Still thro' the cloven skies they come, With peaceful wings unfurl'd:
And still their heav'nly music floats O'er all the weary world:
Above its sad and lowly plains They bend on hov'ring wing,
And ever o'er its Babel sounds The blessed angels sing.

UP ON THE HOUSE-TOP

Up on the house-top reindeer pause, Out jumps good old Santa Claus;
Down thro' the chimney with lots of toys, All for the little ones, Christmas joys.

Ho, ho, ho! who wouldn't go! Ho, ho, ho! who wouldn't go!
Up on the house-top, click, click, click,
Down thro' the chimney with good Saint Nick.

SILENT NIGHT

Silent night, holy night
All in calm, all is bright
Round yon Virgin Mother and Child.
Holy Infant so tender and mild,
Sleep in heavenly peace,--
Sleep in heavenly peace.

Silent night, holy night,
Son of God, love's pure light
Radiant beams from Thy holy face,
With the dawn of redeeming grace,
Jesus, Lord, at Thy birth,--
Jesus, Lord, at Thy birth.

JOY TO THE WORLD

Joy to the world! the Lord is come;
Let earth receive her King;
Let ev'ry heart prepare Him room,
And heav'n and nature sing,
And heav'n and nature sing,
And heav'n, and Heav'n, and nature sing.

JINGLE BELLS

Dashing thru' the snow In a one-horse open sleigh,
O'er the fields we go, Laughing all the way;
Bells on bobtail ring, Making spirits bright;
What fun it is to ride and sing A sleighing song tonight!

Jingle, bells! jingle, bells! Jingle all the way!
Oh, what fun it is to ride In a one-horse open sleigh!
Jingle, bells! jingle bells! Jingle all the way!
Oh, what fun it is to ride In a one-horse open sleigh!

A day or two ago I thought I'd take a ride,
And soon Miss Fannie Bright Was seated by my side;
The horse was lean and lank, Misfortune seem'd his lot,
He got into a drifted bank, And we, we got upset!