FINAL TECHNICAL REPORT

Period covering August 1, 1977 to January 31, 1979

STUDYING THE FEASIBILITY OF AUTOMATIC POULTRY HANDLING AND TRANSFER TECHNIQUES IN THE POULTRY PROCESSING INDUSTRY

By

R. A. Cassanova
R. D. Atkins
L. J. Moriarty

Prepared for

MAR–JAC, INCORPORATED

Under
The National Science Foundation
Grant No. ISPT 77–09749

May 1979

GEORGIA INSTITUTE OF TECHNOLOGY

Engineering Experiment Station
Atlanta, Georgia 30332

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I. BACKGROUND

The U.S. poultry industry produces broilers, hens, eggs, and turkeys for domestic and foreign markets and is a major segment of the food processing industry. Broilers are a key source of low-cost protein and the percentage share of poultry in the U.S. diet is steadily increasing. Broilers are prepared for market and packaged in various forms; i.e., whole birds with and without giblets and cut-up parts.

Since World War II, the production of poultry meat products has grown rapidly from the small family-type operation to the large volume processing plants of today. The processing functions in the 1940's and early 1950's were primarily manual with few machines being used to reduce physical exertion or to improve production efficiency. As the demand for poultry products grew and the competition forced the development of more efficient, labor saving methods, various manual operations were replaced by mechanical devices.

The implementation of the Poultry Products Inspection Act in 1959 was another factor in causing changes in the nature of poultry processing. The routine and consistent inspection procedures resulting from this act not only had an immediate effect on plant operations, but also caused a spin-off effect in new research programs within the USDA and agriculturally oriented universities. The primary concern was to better understand the causes of poor sanitation, contamination, and product spoilage. The development of machinery which reduced product contamination and increased productivity has occurred primarily in the commercial poultry equipment industry. While federal regulations may have been a factor in initiating the faster development of poultry plant mechanization, these same regulations have made experimentation with machines in processing plants very expensive. As expected, the developmental trials of machinery often result in contamination and product downgrading. Consequently, the development of new processing equipment has proceeded at a much faster pace in Europe where regulations are less stringent. Under European regulations, birds which are improperly processed can often be salvaged without loss of salable product; whereas in the U.S. the birds would be condemned and all of the product would be discarded.

In spite of the improvements which have taken place in the past 20 years, in general, poultry processing remains labor intensive with a relatively low level of technology. The existing technology in poultry processing is primarily mechanical with very few electronics or automatic control systems being used. Recently built plants utilize electronic systems more than the long established plants. However, for the most part, poultry plant personnel still avoid using electronic systems because reliability has not been proven in the wet plant environment and personnel with electronics backgrounds are not available.

The objective of this project was to identify functions in the processing plant which could benefit by improved mechanization or automation and technology transfer from other industries. The state-of-the-art in poultry processing equipment was determined through visits to equipment manufacturers and by surveying poultry processing plant operations.

II. DESCRIPTION OF TYPICAL PROCESSING PLANT SEQUENCE

Poultry processing plants are arranged to facilitate the smooth flow of product through the work stations and to minimize the time required between slaughtering and final refrigeration. A timely product flow through the plant is necessary to prevent spoilage and to minimize costs. The bird handling and processing functions can be divided into five major groups which are summarized as follows:

1. Live Bird Receiving and Hanging

   - Transport from growout house by truck
   - Storage in holding shed
   - Coop unloading by forklift, squeeze-lift or manual
   - Removal from coop
   - Hanging on kill line shackles

2. Killing, Scalding, and Feather Removal

   - Stunning with electric charge
   - Killing
   - Bleeding
   - Scalding
   - Feather removal
   - Pin feather removal, if necessary
   - Hock removal

3. Evisceration

   - Transport by conveyor from hock cutter
   - Rehang on evisceration line
   - Oil gland removal
   - Opening cut
   - Eviscera drawing
   - USDA inspection

3. Evisceration (Continued)

- Giblet removal and gizzard cleaning
- Lung removal if necessary
- Neck breaking
- Crop pulling
- Neck skin cutting
- House inspection

4. Chilling

- Remove birds from evisceration line and drop into chiller
- Giblets pumped from evisceration line into separate chiller

5. Packaging

- Birds rehung on packing shackles for sizing and routing
- Grading
- Cut up into parts
- Giblet wrap
- Giblet stuffing into whole birds
- Whole bird wrapping
- Boxing

A discussion of suggested poultry plant layouts can be found in References 1 and 2. While all processing plants are planned with similar sequencing of functions, there can be noticeable differences due to physical arrangements, available space, and the type and volume of end product; i.e., whole bird individually wrapped, whole birds in 65-pound boxes, chicken parts, bulk giblets, etc.

III. PROJECT DESCRIPTION

As a result of a conference attended by members from the poultry industry, the National Science Foundation and the Georgia Institute of Technology, a research opportunity was identified; i.e., to evaluate the technical and economic feasibility of improved and automated handling techniques for the poultry processing industry. It was decided that the research project would be managed by a small poultry processing business, namely, Mar-Jac, Incorporated. Mar-Jac would in turn subcontract the research to the Georgia Tech Research Institute. An advisory committee would be formed from a nationwide selection of industry leaders and would be responsible for assuring the relevancy of the research effort.

The National Science Foundation agreed to provide $49,900 for the feasibility study. The Georgia Tech Research Institute agreed to cost share $25,000 from research funds allocated by the Georgia Department of Agriculture which would be used to demonstrate an automated system in a poultry processing plant, namely, an automatic yield evaluation system for the evisceration line. Georgia Tech provided an additional $10,000 for the purchase of equipment for the project. Mar-Jac, Incorporated provided $2,300 and the Georgia Poultry Federation provided $3,000 in equivalent personnel line for the project.

Research Plan

The project began with the first advisory committee meeting on September 27, 1977 in Gainesville, Georgia. Attending the meeting were:

Abit Massey	Georgia Poultry Federation	Gainesville, Ga.
George Deadwyler	Wilson Foods	Cumming, Ga.
William Falls	Wayne Poultry, Inc.	Pendergrass, Ga.
Rex E. Childs	Agricultural Research Service, USDA	Athens, Ga.
Robert Mitchell	Cagle's, Inc.	Atlanta, Ga.
Carl Nall	Pacific Egg and Poultry Association	Los Angeles, Cal.
L.C. Bryan	Arkansas Poultry Federation	Little Rock, Ark.
Terry Walden	Central Soya Company	Athens, Ga.

Tom Folger, Jr.	Marell Poultry Company	Murrayville, Ga.
Tom Ebert	Mar-Jac, Incorporated	Gainesville, Ga.
Dale Morris	Mar-Jac, Incorporated	Gainesville, Ga.
Charles Hamilton	Mar-Jac, Incorporated	Gainesville, Ga.
Alex Schwarzkopf	National Science Foundation	Washington, D.C.

A proposed research plan for the feasibility study and a description of the concept for the automatic yield evaluation system were presented to the group and discussed. A research plan for the feasibility study consisting of three tasks was approved and is described below.

Task 1: Survey broiler processing plants to determine current handling procedures, space limitations, and any constraints on alternative methods. Survey the current status of handling research and determine the applicability of new technology. Evaluate alternative handling systems within the constraints defined by the surveys.

Task 2: Evaluate the economic feasibility of alternate handling systems.

Task 3: Define the most practical and cost effective approach for the given set of constraints.

The yield evaluation system concept as presented to the group is shown in Figures 1 and 2. The purpose of the system is to provide immediate data on bird weight losses which occur during the evisceration process. The system can provide an immediate indication of abnormal product weight loss which may signal the improper functioning of machinery or personnel. A more complete description and typical data are included in Section V.

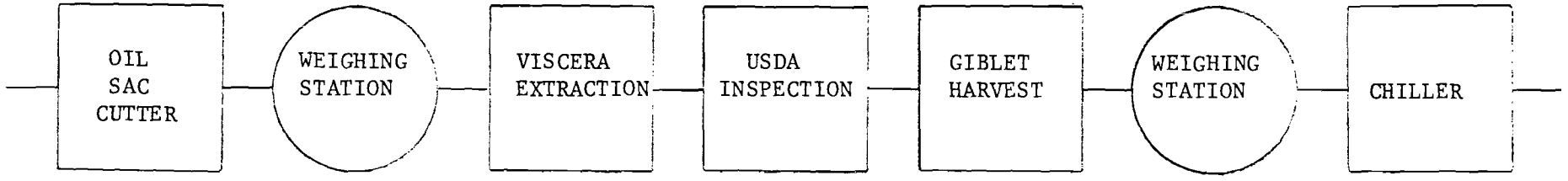


Fig. 1. Weighing Station Locations

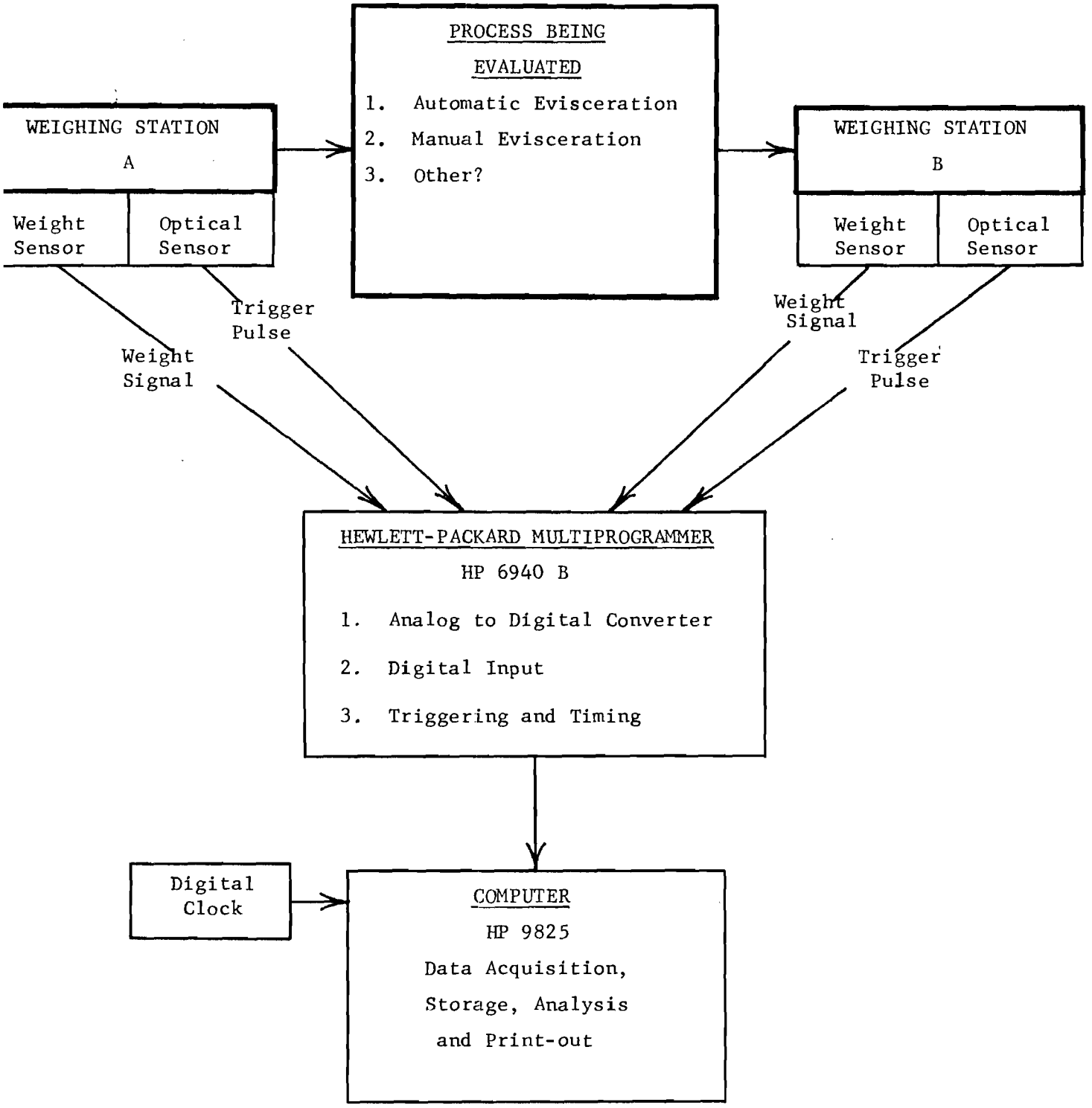


Fig. 2. Schematic of Data Acquisition System

IV. SURVEY DATA COLLECTION AND ANALYSIS

Data Collection

Task 1 was accomplished by surveying twelve plants in the southeastern area which represent typical poultry plants. The surveys included questions which pertain to mechanization: plant size, line speeds, number of employees, space availability, and other questions which were asked to obtain a proper perspective of the plant. A copy of survey questions and the compilation of the survey sheets is in Appendix A. In addition to the survey sheets, photographs were taken to maintain a picture of line configurations and new and unusual mechanical applications such as some "homemade" devices. These pictures were taken with the management's consent and with the understanding that they would not be released for publication or for other plant officials to see.

A literature search was conducted both manually and by computer through the services of the Georgia Tech Library. The search revealed many articles and patents relating to poultry mechanization and poultry research. Some of the articles were written in other countries and were difficult to relate to the United States poultry industry because of the stringent regulations of the USDA concerning equipment and inspection.

During this same period of time, manufacturing concerns were visited to evaluate their position as suppliers of poultry processing equipment. This was an effort to determine the state-of-the-art in poultry processing equipment. The companies visited were Simmons Industries, Dallas, Georgia; Centennial Machine Co., Gainesville, Georgia; Gainesville Equipment Co., Gainesville, Georgia; and Stork Gamco, Gainesville, Georgia. Other companies that were contacted were Gordon Johnson, Barker Industries, and Hi Speed Chekweigher.

Visiting the plants and talking to the staff and management of each of the plants revealed certain characteristics that were common to most of the plants. The first problem that was encountered was yield loss. The most common yield loss is caused by giblets going down the drain. The loss had been generated by the increased line speeds. In essence, it is more profitable to run their line a little faster which results in more loss per

bird. It was estimated by one processor that he lost $250,000 per year in unpackaged giblets. The processors also expressed a desire to see the giblet stuffing area automated because of the higher speed at which the birds were processed.

An additional problem which exists at some of the plants is that of high labor turnover. As can be seen from the tables in Appendix A, there is up to 400% labor turnover at some of the plants. This simply means that there were four times as many W-2 forms sent out as there are people employed in the plant. The high labor turnover is a very costly proposition. It costs additional money everytime someone new has to be trained. In many cases, mechanization will reduce the strenuous labor or boredom associated with the job. This reduction of repetitiveness will enhance the working conditions and perhaps reduce labor turnover.

Another problem that is at least partially related to mechanization is that of water. There is a large range of water usages per bird among plants. This is a twofold problem because the use of more water costs more and it costs much more to process increased amount of the sewage or to have it processed. The amount of water used is related to the type of equipment in the plant. Such things as automatic bird washers, scalders, chillers, and ice-making equipment regulate the amount of water that is used.

Data Compilation

The survey sheets were compiled into tables denoting each plant by an alpha character to maintain the anonymity of the processing plants. Attempts were made at correlating some of the data, but the correlation was limited due to the tremendous variability of the plants. There were some trends evident that will be investigated further as time allows. It is possible to make some comparisons with regard to labor usages in areas common to all of the plants. Economically speaking, the data will give an indication as to the payback time of enhancing work stations by a machine or by replacing some labor by a machine. Therefore, with this baseline data, it will be possible to examine a labor intensive area in conjunction with a high turnover or absentee area and make a projection as to the actual cost of a piece of equipment.

This economic evaluation was developed as Task 2 and resulted in several possible alternative suggestions which seem feasible both technically and economically. This evaluation addresses the availability of system components, expected production costs, costs of modifications to existing facilities which are required for the installation of new systems, and anticipated plant production cost reductions resulting from automating the operations. These cost reductions may take the form of increased production rates, reduced labor input, and improved productions. Each alternative will eventually result in a capital cost payback period, and return on investment information useful for evaluating technical alternatives.

Data Utilization

As a result of examining the survey tabulation and from talking to equipment manufacturers and plant personnel, several possible handling concepts were generated. They are as listed below:

1. Giblet Stuffing Equipment - This equipment would take the giblet packages from the automatic giblet wrapping machine and place the package into the bird carcass.

2. Centralized Monitoring System - This system would utilize appropriate sensors at various process line locations to continuously monitor yield, water flowrates, chilling temperatures, line speeds, trim losses, USDA condemnation, etc. Information would be displayed at one location and could reduce the need for constant supervision along the processing line.

3. Inventory Control System - Data on line bird weights, D.O.A.'s drop-off classifications in the packaging department, box weights, shipment information, etc., could be fed into a centralized computer system for record-keeping and billing.

4. Shackle Identification - The use of magnetic identification strips on each shackle may simplify the more extensive use of automatic drop-off systems for condemned birds, grading and packaging.

5. Conveyor Designs - New concepts in conveyor designs are being considered which will permit the automatic disengagement of the shackle from the driven transport mechanism and the re-engagement of the shackle by another transport mechanism. This concept would allow the birds to be routed to other locations or processes without being removed from the evisceration shackle. Such a concept may offer some advantages if air blast chillers are used extensively.

6. Hermetic Seal Applications - The more extensive use of electronic controls in poultry plants necessitates that better moisture seals are utilized. The use of magnetic couplings with totally sealed motors and switches will be considered.

7. Gamma Ray Weighing Device - This particular device would be mounted on the line to measure bird weights anywhere along the line. Knowing the weights of the birds would be a great aid in controlling yield loss and moisture pick up and monitoring total plant throughout. The concept will eliminate the costly and inefficient method of weighing the birds at the end of the line.

Overview Committee Meeting

After evaluating all of the concepts, a second overview committee meeting was held to discuss the results of the first six months. The survey sheet tabulations were introduced and explained. It was noted that the surveys were used to determine current labor usage practices and the degree of automation which currently exists at various processing line stations. It was also noted that discussions were held with equipment manufacturers to determine the current availability of automated processing equipment and the direction of the equipment development programs. There was much discussion about the survey results and some of the members were somewhat surprised at some of the results.

Some comments on general observations during the survey included:

1. Many plants could be improved measurably by modernization of equipment, tighter quality control, instituting better training procedures for processing line personnel, improved supervision along the processing line, and a more energetic personnel program.

2. Due to variations in the marketing policies and specialty items among the plants, conclusions about relative labor efficiencies should be considered cautiously.

In essence, the poultry plant data summary provides a basis for identifying areas or functions in the processing plants where increased automation would be desirable. Where automation would directly replace manual labor, projected cost savings and a related payback period can be assigned. Some viable concepts involve better quality control, reduced yield losses or more accurate moisture control. For these cases, quantitative data on profit or yield losses are not available and specific payback periods cannot be assigned. However, these items were designated as significant problem areas by the plant personnel and concepts for reducing the related losses were proposed.

In narrowing the scope of developing automation concepts, certain constraints were imposed in order to avoid duplication of on-going efforts by equipment manufacturers. These constraints are:

1. Concepts were not pursued if they are being actively developed by equipment manufacturers and would be commercially available in the near future (i.e., kill-to-evisceration live transfer machines, drawing machines which self-adjust for bird size and gizzard splitting and cleaning machines).

2. Concepts which involve the extensive use of a centralized computer system for inventory control, bookkeeping, temperature measurement, etc., are likewise not detailed here, since the technology for utilizing such a concept is clearly available and is used extensively in other industries. However, the modification and implementation of sensors for computer interfacing and use in the plant environment offer some unique challenges.

Finally, the state-of-the-art in equipment was discussed and the three most feasible concepts were introduced to the committee. The first proposed piece of equipment was the giblet stuffing machine which places pre-wrapped giblets into the bird as it passed by on the conveyor line. The second concept that was introduced was the bird weight and moisture measuring device

which utilizes the gamma ray technology. Thirdly, a bird shackle identification, weighing and transport system was introduced which would use magnetic programmable strips of recording film. Appendix B contains descriptions of these three concepts.

As it seemed unlikely that there would be time or money to adequately pursue each of the three concepts, the overview committee was asked to rank the concepts as to importance to them. It was decided that the gamma ray weighing device had the most immediate promise considering the constraints. It will be pursued with a company which produces the equipment for weighing coal and other commodities.

V. DEMONSTRATION OF A YIELD EVALUATION SYSTEM

A large part of the challenge in contolling and increasing yield in poultry processing plants is the application of quality controls at critical points on the processing line. At the present time, supervision of line operations is carried out visually and quantitative assessment of production is made only on total through-put for the whole plant. Continuous quantitative measurement of bird weights is not made due to lack of a simple and cost effective method which is compatible with existing conveyor systems and processing line speeds.

In more recent years, various processing functions have become more mechanized. Even though machines are able to replace or reduce manual labor at many work stations, the amount of product downgrading and rejection may increase due to the machines' inability to automatically adjust for bird size. Hence, labor costs may be reduced with increased automation, but salable yield may decrease. The greater use of machines in poultry processing has brought about the need to continuously evaluate yield at various processing line locations so that machines can be "fine tuned" for optimum yield and any maladjustments can be detected immediately.

The yield evaluation project has been aimed at two major tasks:

1. Develop a versatile and economically feasible hardware concept which can be utilized for evaluating yield on the evisceration line, and

2. Generate a sufficient quantity of data to demonstrate the operation and potential uses of the system.

The mechanical hardware which will be utilized on the overhead conveyor system must be compatible with existing machinery and be rugged enough to withstand the daily clean-up operation. The electronics must also be extremely rugged and be versatile enough to accommodate the individual requirements of poultry plants and to permit a thorough analysis of acquired data.

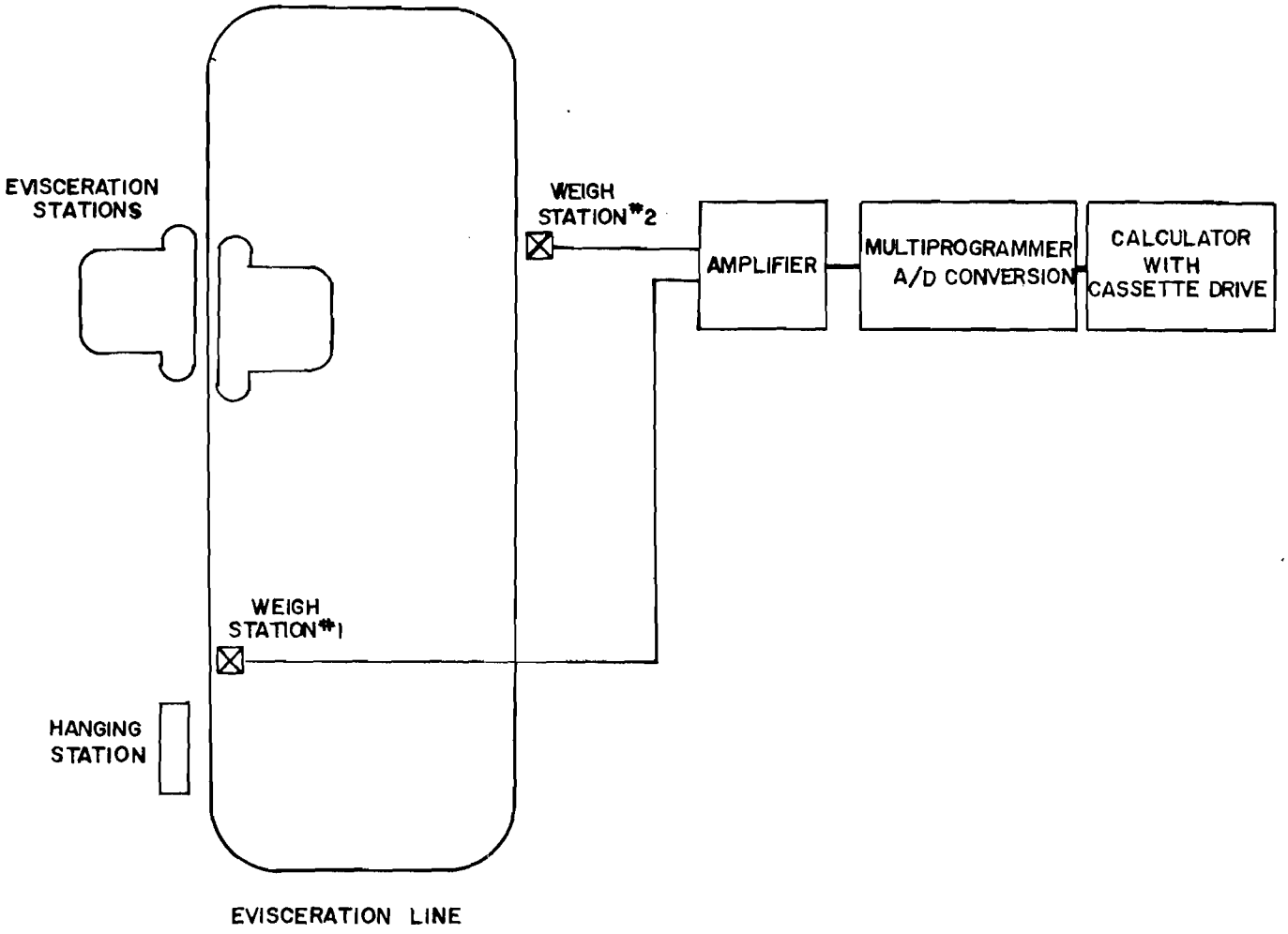


Fig. 3. Overall System Organization

Yield Evaluation System Concept

A system concept was developed to satisfy the above mentioned requirements and, where feasible, to utilize commercially available components. The heart of the system is a Hewlett-Packard 9825 desktop calculator which can store up to 32,000 entries and can be programmed to acquire and analyze data from a number of weighing stations. By using a programmable calculator for which data acquisition and analysis programs can be written, the size and complexity of the system can be increased at any time. This concept has not been used before in poultry weighing systems. Commercially available weighing and drop-off systems use hard-wired components and modules which limit the utility of these systems.

The following sections describe in detail the various systems and components which have been developed and discuss the initial group of data collected from the system installed at the Mar-Jac, Incorporated processing plant.

Description of Hardware and Software

The overall organization and operation of the yield evaluation system installed at the Mar-Jac plant in Gainesville can probably best be understood by referring to Figure 3 which shows the various system components and the relationships among them. At the left hand side of the diagram, the location of the two weighing stations are shown. The first station is located before the evisceration line, while the second station is located after the line, thus enabling yield values to be determined by comparing bird weights at Station 1 and Station 2. The bird weights are converted into low level electrical signals at the weighing stations, and clue signals are then fed over about 100 feet of shielded instrumentation cable to a two channel amplifier and signal conditioning unit. In addition to amplifying the signals by a factor of about 4000, the amplifier and signal conditioning unit also filters the signal to attenuate any frequency components greater than 30 Hz. This low pass filtering is done to reduce the efforts of both induced 60 Hz electrical noise and mechanical vibrations present at the weighing stations. From the amplifier and signal

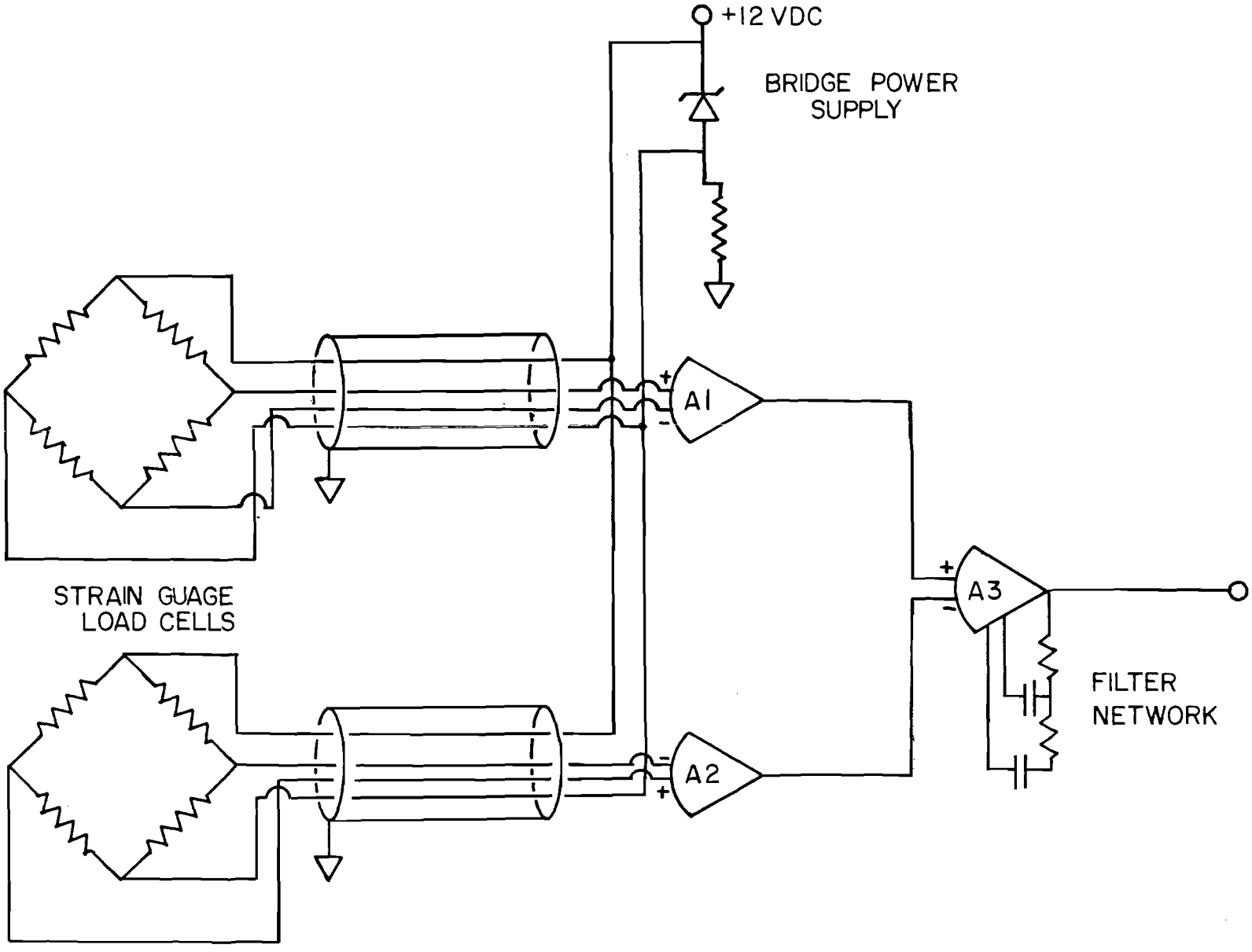


Fig. 4. Amplifier and Load Cell Circuitry for One Weigh Station

conditioning unit, the signals are then fed into an HP6940B Multiprogrammer unit in which the analog electrical signals are converted into 12-bit digital signals for use by the HP9825A calculator. Under control of the calculator, these digital values representing bird weight are then stored on a cassette tape cartridge for later analysis.

A more detailed picture of the system hardware is shown in Figure 4. The heart of each weighing station consists of two strain gauge load cells powered by a common 10 volt zener diode voltage supply. The sensitivity of the load cells in such that a one pound force applied to either cell will change the bridge output by 400 micro volts. Shielded instrumentation cable is used between the load cells and amplifier to alternate the effects of the strong 60 Hz electrical fields present in the plant. The bridge output voltages are fed into two stages of AD521K integrated circuit instrumentation amplifiers. The first stage provides a gain of 833, while the record stage serves as a combination of summing point, 30 Hz low pass filter network, and amplifier with a gain of 5. The output voltage is then a signal obtained by adding the two load cell voltages, amplifying them by a factor of about 4000, and filtering to remove any frequency components greater than 30 Hz.

As mentioned earlier, the overall operation of the system is under control of the HP9825A calculator. A simplified block diagram of the system software is shown in Figure 5. After reading the time of day and date from real time clock module, the calculator goes into a scanning mode in which station one is constantly interrogated to determine if a bird is on the weighing pan. When a bird is detected (indicated by a positive voltage readout) the calculator goes into a wait state for 200 msec, after which ten readings are taken at 12 msec intervals. The 200 msec wait is to allow the voltage reading to stabilize and ten readings are taken to obtain a good average value for the weight. The calculator then returns to a scanning mode in which it is now looking for a bird to clear the weight pan. When this occurs (indicated by the voltage going negative), the calculator pauses for 200 msec and then ten "zero" readings are taken and averaged. The difference between these two averaged readings is calculated and the result after being multiplied by an appropriate conversion factor is stored in the calculator memory as the sum of the bird

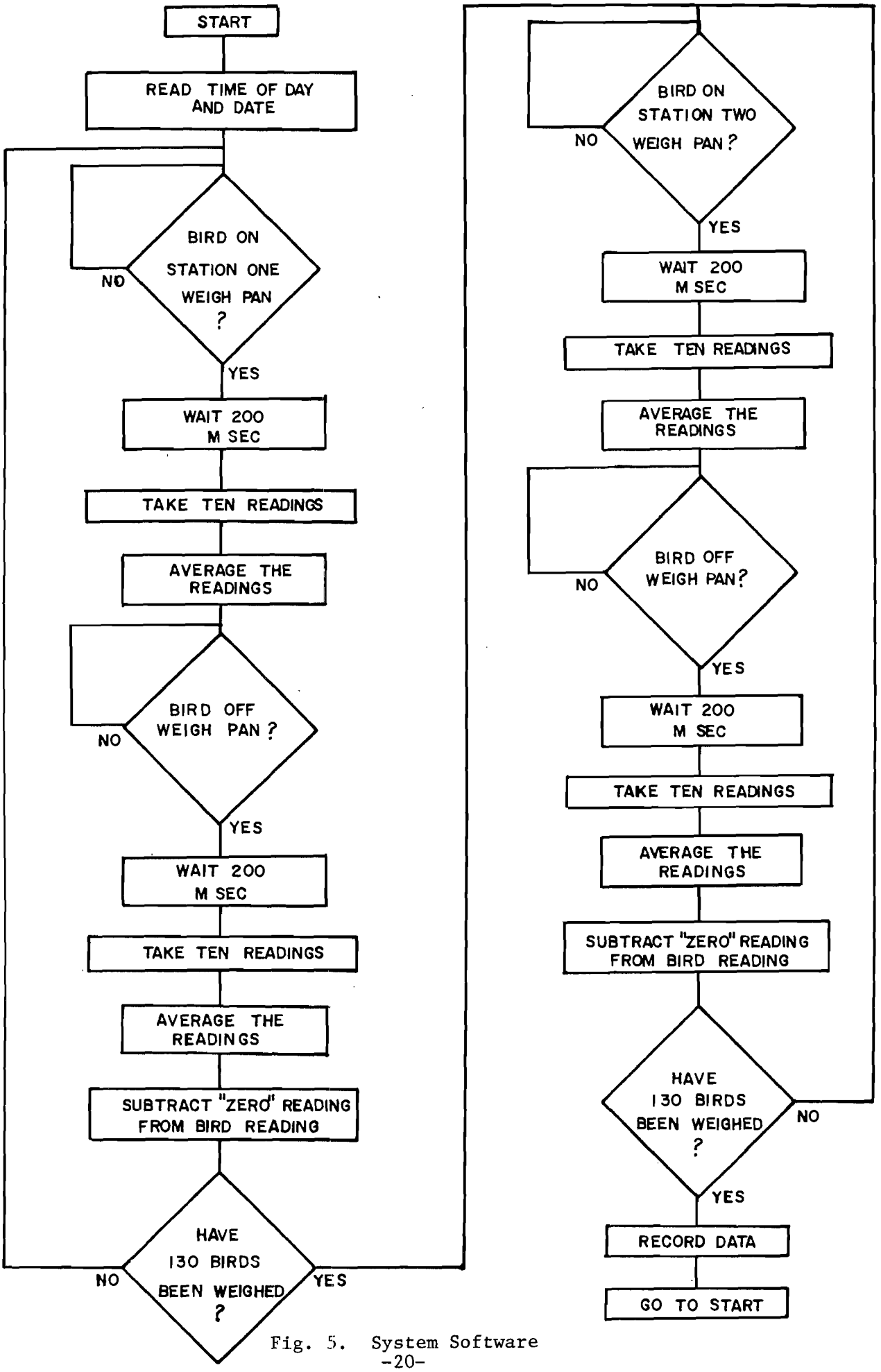


Fig. 5. System Software

weight and shackle weight. By taking a "zero" reading with each bird reading, errors due to both long term and short term drift are eliminated. After reading 130 birds at station one, the calculator enters a state in which station two is now scanned. Upon reading 130 birds at station two, the calculator records the station one and station two data along with the data and time of day on a cassette data cartridge. This set of data constitutes a data file. After recording the data, the calculator then returns to scanning station one and the process is repeated as often as desired. Assuming a 15-minute cycle time and eight hours of operation daily, 32 files containing over 8000 readings, representing one day of production can be recorded as a single cassette cartridge completely automatically.

In addition to controlling the operation of the yield evaluation system, the calculator is also used to reduce and analyze the resulting data. After subtracting the shackle weight and eliminating any obviously bad data (birds less than two pounds or more than five pounds) the average bird weight and standard deviation are calculated and printed for station one and station two. The average yield percentage is then calculated and printed, as well as maximum and minimum bird weights and the weight distribution. Figure 6 shows a sample printout for one data file.

Summary of Data Collection and Analyses

Large amounts of data have not yet been collected and analyzed, but some preliminary results have been obtained that are quite encouraging. For sets of data have been collected so far with each data set consisting of the weights of about 115 birds taken both prior to and after evisceration. Although the individual bird weights varied between two and four pounds, the average weights and average yields were remarkably uniform, with the results indicating that the lighter birds may be providing slightly higher yields. This conclusion is highly tentative, though, and much more data needs to be collected and analyzed to support any firm conclusions. These results are presented in Table I.

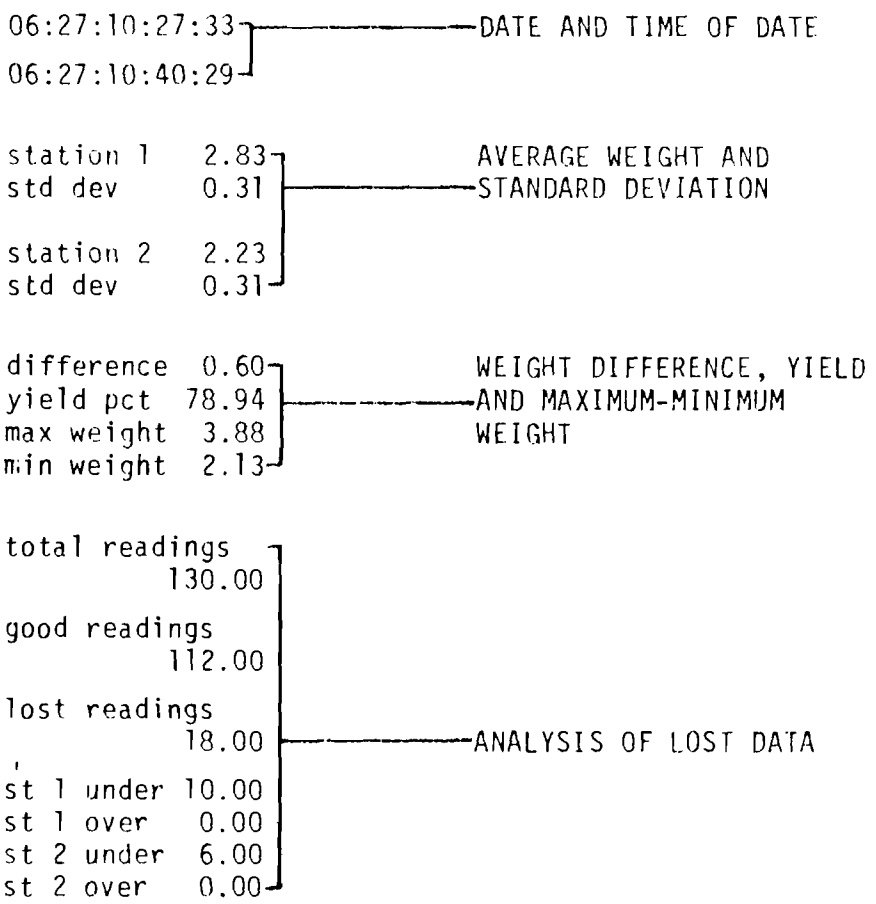


Fig. 6. Sample Data Analysis Printout

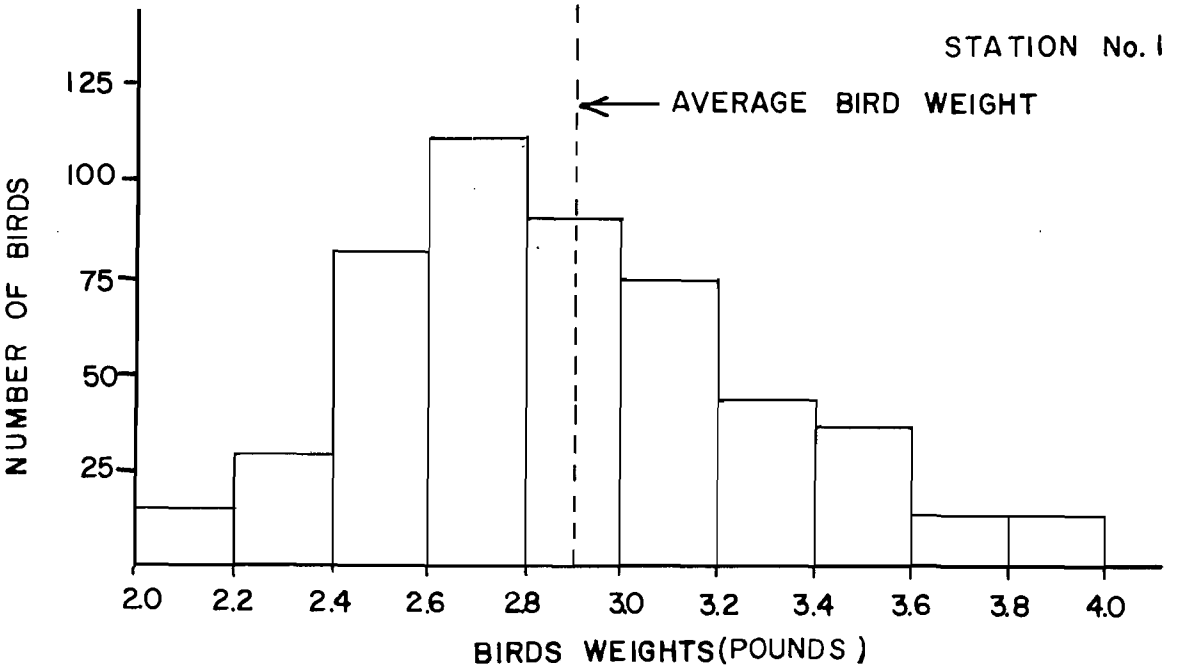
TABLE I

Yield Evaluation Results

File Number	1	2	3	4
Average Bird Weight - Station 1	2.83 lbs	2.83 lbs	2.90 lbs	2.89 lbs
Average Percent Yield	78.9%	78.6%	78.1%	78.2%

Composite histograms of the preliminary data are shown in Figure 7. As might be expected, the weight distributions are approximately Gaussian.

During the proposed project effort for FY 78-79 with funds from the Georgia Department of Agriculture, three more weighing stations will be added to the Mar-Jac, Inc., evisceration line to obtain more comprehensive data on the locations and amounts of yield losses. The electronic hardware will be modified to accommodate the additional stations and to make a more compact unit. A four-color digital plotter has recently been purchased with Georgia Tech funds which permits a graphic display of on-line data and daily summary data. It is anticipated that the yield evaluation project will continue several more years and similar systems will be installed in other poultry processing plants. Several processing plants have expressed an interest in purchasing a system for their evisceration line.



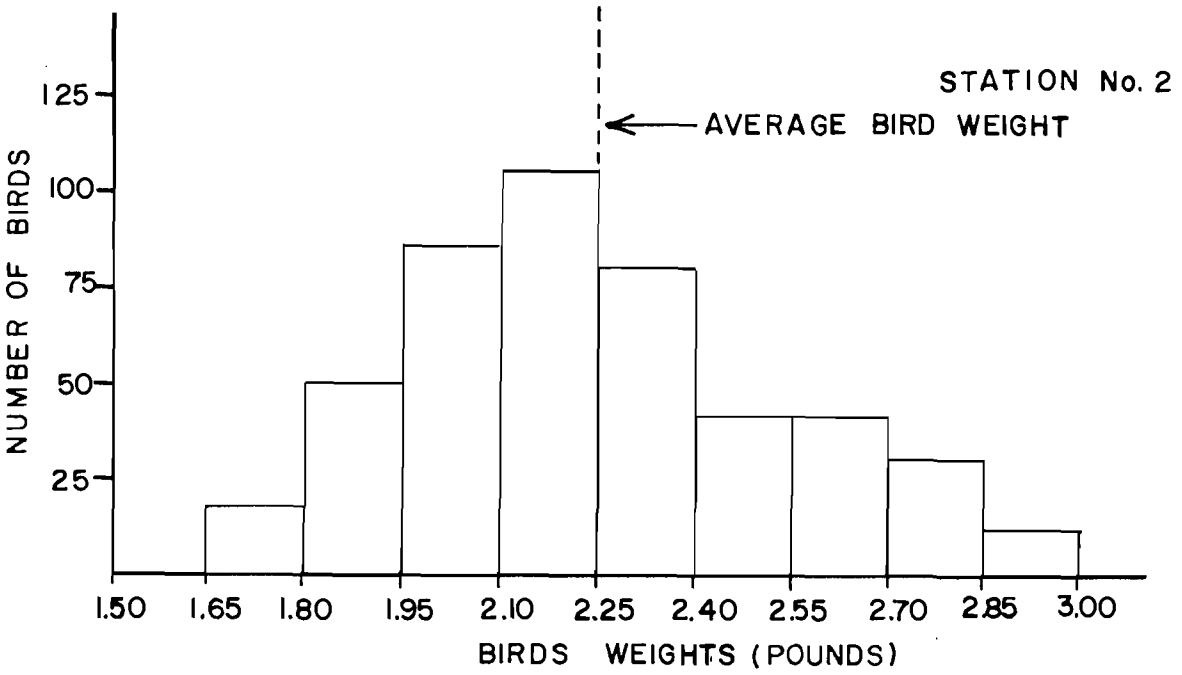
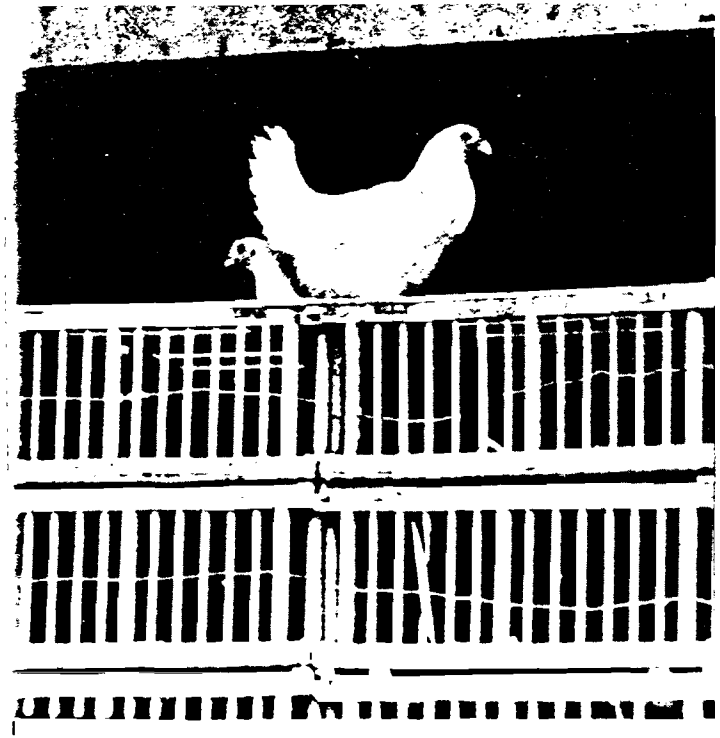


Fig. 7. Composite Histograms of Preliminary Data

VI. DISSEMINATION OF PROJECT RESULTS TO INDUSTRY

The dissemination of survey information, proposed handling concepts, and a description of the yield evaluation system hardware is an essential part of the project plan. In order to assure the relevancy of the research to general needs of the industry, the direct involvement of the overview committee in the project planning and conduct was solicited and received. Broader distribution of project information was accomplished through newsletters mailed to the industry. Appendix C contains the news releases on the preliminary project results.

A final oral report was given to a broad cross-section of industry representatives as part of a conference held at Georgia Tech on November 6, 1978. The conference was organized primarily to begin a more detailed state-of-the-art survey on the "Catching, Loading, and Hauling of Poultry." This survey is continuing under sponsorship of the Georgia Department of Agriculture. A copy of the program is shown in Figure 8. Table II gives a listing of the conference attendees. A summary of the NSF project results was presented at the conference and followed by a question and answer section.



Catching, Loading and Hauling of Poultry

November 6, 1978 – C & S Tower, 19th Floor
North Avenue and West Peachtree,
Atlanta, Georgia

Conducted by
ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY

Sponsored by
GEORGIA DEPARTMENT OF AGRICULTURE
NATIONAL SCIENCE FOUNDATION
GEORGIA POULTRY FEDERATION
MAR-JAC, INCORPORATED

Purposes

To gather a nationwide perspective of hauling problem areas, and variations in live hauling methods

To enhance communication between industry researchers, university researchers, and processors.

To identify alternate hauling systems, causes of downgrading, economic considerations, and constraints in the field and at the plant.

To discuss the feasibility of improved mechanization of the catching, loading and hauling functions.

Who Should Attend?

Anyone concerned with the live hauling of poultry – university researchers, plant managers, live haul managers, plant engineers, etc.

For Further Information Contact:

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Technology and Development Laboratory
Engineering Experiment Station
Georgia Institute of Technology
Atlanta, Georgia 30332
(404) 894-3448

Program

Time	
9:00	**Introduction and Objectives of Confer** Dale Morris Mar-Jac, incorporatec
9:15	**Don Shackleford** **John Holladay** **Jim Thomson** Athens Georgia
10:00	**Larry Rassett** Foster Farms Delhi California
10:45	Coffee Break
11:00	**Dr. R. L. Wesley** Virginia Polytechnic Institute and State University Blacksburg, Virginia
11:45	**Lunch**
1:15	**Dr. Jerry Baughman** North Carolina State University Raleigh, North Carolina
2:00	**Dr. Jerry Cox** Gold Kist
2:45	Coffee Break
3:00	**Dr. R. H. Brown** University of Georgia Athens, Georgia
3:45	**Summary of National Science Founda Project** Dr R A. Cassanova Dale Atkins Larry Moriarty
4:30	**Closing Remarks and Adjournment** Dale Morris

Fig. 8. Catching, Loading and Hauling Conference Program

TABLE II

CATCHING, LOADING AND HAULING OF POULTRY

CONFERENCE ATTENDEES

Name	Affiliation	Location
Don E. Burson	Wayne Poultry - Allied Mills, Inc.	105 Riverside Plaza Chicago, Illinois 60606
Kerry Baker	Gold Kist	Box 467 Ellijay, Georgia 30540
Gerald R. Baughman	N.C. State University	Box 5096 Raleigh, N.C.
James Bledsoe	Tyson Foods, Inc.	Rt 3/Box 284 Elkin, N.C.
Floyd Bowen	Conagra	P.O. Box 349 Athens, Alabama 35611
Jimmy L. Burruss	Tip Top Poultry	327 Wallace Road Marietta, Georgia
Ervin Cantrell	Fieldale Corp.	Baldwin, Georgia
Martin E. Clark	Jamestown Broilers	Drawer M Jamestown, Tennessee 38556
Jerry Cox	Gold Kist	Athens, Georgia
George H. Deadwyler	Tyson Foods	Cumming, Georgia
Ronald P. Dockery	Dockery Poultry Live Haul for Tyson Foods	Rt 3 Dobson, N.C.

TABLE II (Continued)

Name	Affiliation	Location
Bill Edwards	Hugh Pfaff Poultry Co.	Tobaccoville, N.C. 27050
Harold Ford	Southeastern Poultry	1456 Church Decatur, Georgia
Joe Gardner	Holly Farms	Box 88 Wilkesboro, N.C.
Jack H. Greene	Tyson Foods	Cumming, Georgia
Charles E. Hamilton	Mar-Jac	P.O. Box 49 Cainesville, Georgia
I.T. Hammontue	Central Soya of Chattanooga	414 West 16th Street Chattanooga, Tennessee
Allen E. Harless	Swift and Co.	Box 1207 Douglas, Georgia 31533
Ed Hyde	Tip Top Poultry	327 Wallace Road Marietta, Georgia
Hershell L. Jones	Swift & Co.	Rt 4 Douglas, Georgia
John R. Koatz	National Science Foundation	Washington, D.C.
Michael Kent	Wayne Poultry	Box 69 Pendergrass, Georgia
Jerry Lane	Mar-Jac, Inc.	P.O. Box 49 Gainesville, Georgia
Ed Lindorme	Gold Kist	P.O. Box 318 Commerce, Georgia

TABLE II (Continued)

Name	Affiliation	Location
Cay McGlamery	Holly Farms Poultry	Box 88 Wilkesboro, N.C.
Charles E. Martin	Tyson Foods, Inc.	P.O. Box 1048 Sanford, N.C. 27330
Randy Mattison	Georgia Tech - EES	Atlanta, Georgia 30332
Bobby May	Claxton Poultry	Claxton, Georgia
Bob Mitchell	Conagra	P.O. Box 458 Dalton, Georgia 30720
Dale Morris	Mar-Jac, Inc.	P.O. Box 49 Gainesville, Georgia
Milton Moyer	Holly Farms	Glen Allen, Virginia
Carl E. Nall	Pacific Egg & Poultry Association	9800 S. Sepulvada #618 Los Angeles, CA 90045
Don Nash	Cagle's Inc.	Madison, Florida
Bill Rittenhouse	Spring Valley Farms of Alabama	P.O. Box 3508 Oxford, Alabama 36202
Horace Sewell	Conagra	Dalton, Georgia
George Stevens	Claxton Poultry	Claxton, Georgia
Lester Strain	Strain Poultry Farms, Inc.	P.O. Box 570 Forsyth, Georgia 31029
Walt Talley	Mar-Jac, Inc.	Gainesville, Georgia

TABLE II (Continued)

Name	Affiliation	Location
Harold Thomas	Central Soya Co.	414 W. 16th Street Chattanooga, Tennessee
David Thomason	Extension Service USA	Athens, Georgia
Dr. R. Lewis Wesley	VPI & SU	Blacksburg, Virginia
Tom Zorn	Tedruth Plastics Corp.	P.O. Box 1763 Gainesville, Georgia 30501
J.E. Morrison	Russell Research Center	Athens, Georgia 30605
Tom Hurst	Monsanto Co.	320 Interstate N. Pkwy Atlanta, Georgia 30339

VII. REFERENCES

1. Methods and Equipment for Eviscerating Chickens, Marketing Research Report No. 549, U.S. Department of Agriculture, Agricultural Research Service, 1962.

2. Guidelines for Poultry-Processing Plant Layouts, Marketing Research Report No. 878, U.S. Department of Agriculture, Agricultural Research Service, 1970.

3. An Evaluation of Poultry Processing, Hale, K.K., Jr., Thompson, J.C., Toledo, R.T. and White, H.D. University of Georgia College Experiment Station, Committee on Automation in the Poultry Processing Industry, March 1973.

APPENDIX A

PROCESSING PLANT SURVEY SHEETS AND SURVEY COMPILATION

POULTRY PLANT PROCESSING SURVEY

DATE:_____

PLANT:_____

LOCATION:_____

CONTACT PERSON:_____

1. LIVE SHEDS

CONSTRUCTION--SIDES: OPEN CLOSED

VENTILATION: YES NO

FAN SIZE_____

NUMBER OF FANS_____

NUMBER OF STALLS_____

COOPS PER TRUCK_____

BIRDS PROCESSED PER DAY_____ NUMBER OF SHIFTS_____

SEXED BIRDS: YES NO

LIVE BIRD WEIGHT_____

NUMBER OF DOA: SUMMER_____ WINTER_____

2. LOADING DOCK

UNLOADING PROCEDURE: FORKLIFT OR SQUEEZE LIFT OR TRUCK BACKIN

PLASTIC OR WOODEN COOPS

PEOPLE UNLOADING FULL COOPS_____

PEOPLE RELOADING EMPTIES_____

DOCK: INDOORS OUTDOORS

COVERED YES NO

HEATED YES NO

DESCRIBE ANY RELATED TECHNIQUES OR SYSTEMS: _____

_____

_____

3. LIVE HANGING AND KILLING

LIVE HANG: NUMBER OF KILL LINES_____

PEOPLE PER LINE_____

NOISE LEVEL_____

CONVEYOR DESIGN

I-BEAM T-BEAM OTHER_____

CHAIN OR CABLE

WHEELS: PLASTIC STEEL

LIGHTING: LEVEL_____ COLOR_____

SHACKLE BRAND_____

HANGING RATE BPM_____

STUNNER: BRAND NAME_____

KILLER: BRAND NAME_____ MANUAL BACK UP NO YES

BIRDS MISSED PER MINUTE_____ BLADE TYPE_____

REASON FOR MISSED BIRDS_____

4. PICKING ROOM

SCALDER: BRAND NAME_____ PASSES_____

RESIDENCE TIME_____ WATER TEMP_____

METERED MAKEUP OR OVERFLOW OR NONE (WATER)

STEAM INJECTION OR OTHER_____

INSULATED: YES NO COVERED: YES NO

AGITATION METHOD: PADDLE WATER JET OTHER_____

NOISE LEVEL_____

PICKERS: BRAND NAME LENGTH USE

1. _____
2. _____
3. _____
4. _____
5. _____

BIRD DAMAGE YES NO EXTENT_____

FEATHER DRAINAGE SYSTEM: FLOOR TROUGH OTHER_____

NOISE LEVEL_____

SINGERS: YES NO

GAS FLOWRATE_____

OUTSIDE WASHERS: YES NO BRAND NAME_____WATER FLOW RATE_____

HEAD PULLER: BRAND NAME_____ BACK UP YES NO

5. TRANSFER

HOCK CUTTER: BRAND NAME_____ BLADE TYPE_____

YIELD LOSS_____

TRANSFER CONVEYOR: SPACE AVAILABLE_____ NUMBER OF REHANG PERSONNEL____/LINE

ACCUMULATION PROBLEM_____

6. EVISCERATION

NUMBER OF LINES_____

CONVEYOR DESIGN: I BEAM T BEAM CHAIN CABLE

SHACKLE BRAND_____LINE SPEED_____BPM

LINE DIVIDERS_____TAGS

SPEED CONTROL: VARIABLE PULLEY ELECTRONIC OTHER_____

TIME LOSS DUE TO STOPPAGE OR SLOW DOWN_____

REASON FOR STOPPAGES OR SLOWDOWN USDA_____% EQUIPMENT_____%

NECK BREAKER: MANUAL AUTOMATIC

OF PEOPLE_____LINE BRAND NAME_____

OIL SAC CUTTER: MANUAL AUTOMATIC

OF PEOPLE_____LINE BACK UP YES NO

TAIL CUT: MANUAL AUTOMATIC

OF PEOPLE_____LINE BRAND NAME_____

OPENING VENT CUT: MANUAL AUTOMATIC

OF PEOPLE_____LINE BRAND NAME_____

BACK UP YES NO

DRAWING: MANUAL AUTOMATIC BRAND NAME_____

OF PEOPLE_____LINE LUNGS PULLED YES NO

INSPECTION: # INSPECTORS_____LINE # CUT & TRIM_____LINE

GIBLET REMOVAL: LIVER_____PEOPLE/LINE

HEART_____PEOPLE/LINE

GIZZARD_____PEOPLE/LINE

GIZZARD HARVESTING: MANUAL AUTOMATIC BRAND NAME_____

OF PEOPLE PEELING_____ PEOPLE ON MACHINE_____

OF PEOPLE INSPECTING ___ PEOPLE PULLING OFF_____

PEOPLE INSPECTING_____

LUNG REMOVAL: NA MACHINE GUN BRAND NAME_____

NOISE LEVEL_____ FAT LOSS_____

CROP PULLING: # OF PEOPLE_____/LINE PULLING TECHNIQUE_____

_____HOUSE INSPECTION # OF PEOPLE_____/LINE

_____WASHING BRAND NAME_____ FLOWRATE_____ COLLECTING FAT?

NECK SKIN CUTTER: BRAND NAME_____ BLADE TYPE_____

UNLOADER: MANUAL AUTOMATIC

OF PEOPLE_____/LINE BRAND NAME_____

COMPATIBLE WITH FLEXI SHACKLE YES NO

MODE OF OPERATION_____

7. CHILLING

PRECHILLER: BRAND NAME_____ TEMPERATURE_____

AUGER PADDLE ICE CHILL WATER COVERED INSULATED

LENGTH_____FT MAKE UP WATER CHILLER CITY OTHER_____

CHILLER: BRAND NAME_____ TEMPERATURE_____

AUGER PADDLE ICE CHILL WATER COVERED INSULATED

LENGTH_____FT AUTOMATIC CONTROL_____

DESIRED MOISTURE PICK UP_____ USUAL RANGE_____

GIBLET CHILLER: BRAND NAME_____ TEMPERATURE_____

ICE CHILL WATER COVERED INSULATED

DESCRIBE:_____

_____

8. PACKING OPERATION

REHANG LINES_____ LINE 1 LINE 2 LINE 3

OF PEOPLE _____

SHACKLE TYPE _____

LINE USE _____

SPEED _____

LENGTH _____

RES. TIME _____

SINGER _____

WOGS UNLOADER _____

CUT UP DROP _____

GIB STUFF # _____

GRADE A DROP _____

DROPS _____

PACKING _____

GIBLET WRAP: MANUAL AUTOMATIC

OF PEOPLE_____/LINE PEOPLE LOADING_____

TRANSPORT_____ PEOPLE UNLOADING_____

TRANSPORT SYSTEM_____

GENERAL QUESTIONS:

GRADED AT WHAT POINT?_____

DATA GIVEN BY SIZER?_____

HOW DO DOWN GRADES MOVE TO CUT UP?_____

BOXING OPERATIONS:

BOX CONSTRUCTION: MANUAL AUTOMATIC BRAND NAME____

OF PEOPLE BOXES

MAKING BOXES_____ LIDS

MAKING LIDS_____

STAPLED GLUED

PRODUCTION RATE?_____

ICEING # PEOPLE/LINE_____

ICE CO_2

WEIGHING #PEOPLE/LINE_____

MANUAL SCALES YES NO

9. REFRIGERATION NUMBER 1 NUMBER 2 NUMBER 3

CHILLED WATER COMP SCREW OR PISTON _____

SUCTION PRESS. _____

DISCHARGE PRESS._____

BRAND NAME _____

REFRIGERANT _____

HORSEPOWER _____

TONNAGE _____

ICE MAKER COMP. SCREW OR PISTON _____

SUCTION PRESS. _____

DISCHARGE PRESS._____

REFRIGERANT _____

TOTAL PRODUCTION _____

STORAGE CAPACITY._____

ICE MOVING SYSTEM AUGER VATS

10. CUT UP OPERATION

8 PIECE BIRD 9 PIECE BIRD

PEOPLE _____

CUT RATE _____

SMALL PACK LIVER YES NO BULK PACK LIVER YES NO

OF PEOPLE_____ # OF PEOPLE_____

OTHER SPECIALTY ITEMS_____

GENERAL QUESTIONS

1. Where are the greatest losses in yield? Why? Are there any interfacing problems with different types of equipment?

2. Where is the greatest potential for yield improvement?

   If this function could be replaced by automatic equipment, how much space would be available and what cost would be acceptable?

3. If drawing is done automatically, do you feel the pre-sizing of birds would be advantageous and what cost would be acceptable?

4. What percent grade A birds do you process? Can the number of grade B birds be related in any way to a particular process line function or to any particular equipment?

5. Is there any expansion of facilties or production rate change planned?

6. Is there one particular area that prevents you from increasing your line speed?

7. Birds/day Avg._____

   Ga. of water/day Avg._____

8. What is the total number employed?

9. What is the plant yield percentage?

10. How many people are in the maintenance crew? Day_____
Night_____

11. How many people are in the clean-up crew?_____

12. How many birds are purchased pre-processed for cut-up?

13. What is overall Plant turnover rate?

14. Blue Print available?

15. Noise level overall-special regulation concerning noise

16. Labor turnover and absenteeism by area

	Labor Turnover	Absenteeism
A. Loading Dock		
B. Live Hang		
C. Transfer		
D. Drawing		
E. Crop Pulling		
F. Neck Breaking		
G. Oil Sac		
H. Lung Guns		
I. Opening & Vent		
J. Giblet Harvest		
K. Cut-up		
L. Packing		
M. Maintenance		

POULTRY PROCESSING PLANT SURVEY RESULTS

On the following pages is a summary of the data collected during the plant visits. The listed data was obtained by actual inspection of processing line operations and by interviews with plant managers or plant engineers and is believed to be a reasonably accurate representation of labor usage even though several plants were considering changes in the near future. The summary is organized to give a perspective of the overall plant operation as well as specific information on particular processing functions.

GENERAL INFORMATION

PLANT	BIRDS PROCESSED DAILY	SHIFTS	EMPLOYMENT	WATER USAGE/ BIRD	PLANT YIELD %	USDA GRADE A %	LABOR TURNOVER %	LABOR ABSENTEEISM %
1	80,000	1	350	8 gal	75	75	2	4
2	48,000	1	273	6 gal	75		10	5
3	100,000	1	550	7.5 gal	77	80	15	
4	100,000	2	400	7-10 gal	76	75	50	3
5	200,000	2	639	5.6-7.5 gal	78	81	47	3
6	95,000	1	397	6.2 gal	77	80	300	6
7	64,800	1	205	7 gal	75	83	350	8
8	90,000	1	265	11 gal	75	72	unknown	unknown
9	60,000	1	215	13 gal	74	75	400	unknown
10	100,000	1	380	7-8 gal	75	71	200	unknown
11	110,000	1	309	5 gal	76	85	227	
12	248,000	1	1700	8.9 gal	77		4	5

LIVE SHEDS, LOADING DOCK

PLANT	CAPACITY OF LIVE SHED	AVERAGE LIVE BIRD WEIGHT	UNLOADING PROCEDURE	NO. PEOPLE UNLOADING FULL COOPS	NO. OF PEOPLE RELOADING EMPTY COOPS	TYPE OF COOPS
1	6 trucks	3.8-4 lbs.	Special Forklift	1	3	Wooden
2	7 trucks	2.1-13 lbs.	Truck Backin	1	1	Plastic
3	7 trucks	3.7 lbs.	Truck Backin	4	4	Plastic
4	10 trucks	3.75 lbs.	Forklift	1	1	Plastic
5	10 trucks	3.8 lbs.	Forklift	2	2	Plastic Wooden
6		3.83 lbs.	Truck Backin	4	2	Wooden
7	6 trucks	3.65-4.25 lbs.	Forklift	2	1	Wooden
8	4 trucks	3.8-3.85 lbs.	Truck Drive Thru	4	4	Wooden
9	10 trucks	3.85 lbs.	Truck Backin	2	2	Wooden
10	2 trucks	3.9 lbs.	Truck Backin	4	2	Wooden
11	15 trucks	3.68 lbs.	Fork, Squeeze Lift	2	3	Wooden
12	34 trucks	4.25	Forklift	1	1	Plastic

LIVE HANGING & KILLING

PLANT	NO. OF KILL LINES	NO. OF HANG PERSONNEL PER LINE	LIGHTING LEVEL & COLOR	SHACKLE BRAND	HANGING RATE	STUNNER BRAND	KILLER BRAND
1	2	5	Low White	Gamco	90 bpm	Gamco	Gamco
2	1	8	Moderate White	Gamco	77 bpm	Marietta Poultry	Marietta Poultry
3	2	6	Low Red	Gamco	108 bpm	Barker	Homemade
4	1	7	Low Red	Barker	120 bpm	Gamco	Simmons
5	2	5	Moderate White	Gamco	108 bpm	Gamco	Gamco
6	2	6	Low Red	Gamco	108 bpm	Meyn	Centen.
7	1	9	Moderate White	Homemade	135 bpm	Gamco	Centen.
8	2	6	Outdoors	Unknown	100 bpm	Gamco	Manual
9	1	7	Low Blue	Barker	120 bpm	Barker	Barker
10	2	7	Low Blue	Gamco	134 bpm	Simmons	Simmons
11	2	7	Low Red	Gamco	135 bpm	Simmons	Centen.
12	4	7	Low White	Gamco	128 bpm	Gamco	Simmons Gamco

SCALDING & PICKING

PLANT	SCALDER BRAND	NO. OF PASSES	WATER TEMP.	RESIDENCE TIME	AGITATION METHOD	PICKERS
1	Gordon Johnson	4	129°F	87 sec	water jet	2 Meyn-whole bird 1 Barker-Neck & Hocks
2	Gamco	2	133°F	90 sec	paddles	3 Gamco-whole bird
3	Gamco	2	128°F	≈1 min	paddles	5 Gamco-various parts
4	Barker	4	128°F	2 min		2 Meyn, 1 Gamco
5	Gamco	4	130°F	141 sec	water pump	4 Gordon-Johnson per line
6	Gamco	3	130°F	100 sec	paddles	3 Meyn
7	Gamco	4	129°F	117 sec	paddles	1 Meyn-whole bird 1 GJ 2 Gamco
8	Barker Gamco	3 4	125-128°F	2 min	paddles	5 Gamco 3 Gordon-Johnson
9	Gamco	3	130°F	2 min	paddles	Gamco
10	Gamco	2	124-127°F	107 sec	paddles	2 Gamco 3 Barker 2 G-J
11	Gamco	2	128°F	107 sec	paddle	6 Stork, 1 Centennial
12	Gamco	4	128°F	2 min	paddle	Gamco, Barker Gordon Johnson

EVISCERATION

PLANT	HOCK CUTTER	REHANG PEOPLE	NO. OF LINES	LINE SPEED	SHACKLE BRAND	SPEED CONTROL	SEXED BIRDS	OIL GLAND CUTTER	OPENING CUT	VENT CUT	DRAWING
1	Gamco	4/Line	4	44 bpm	home-made	variable pulley	Yes	Simmons 2/Line	1/Line	2/Line	3/Line
2	Gamco	3/Line	2	50 bpm	Tishner	Variable pulley	No	2/Line	1/Line	2/Line	4/Line
3	Gamco	2/Line	4	54 bpm	Gamco	Motor Speed	Yes	Gamco	3/Line	3/Line	Gamco
4	Gamco	3/Line	2	62 bpm	Gamco	electronic	Yes	Pritchard	1/Line	3/Line	Meyn
5	Gamco	3/Line	4	55 bpm	Gamco	variable pulley	Yes	Pritchard	2/Line	4/Line	4/Line
6	Barker	2/Line	4	54 bpm	Meyn	variable pulley	No	Pritchard	1/Line	3/Line	Meyn
7	Gamco	1/Line	3	45 bpm	home-made	motor speed	No	1/Line	1/Line	1/Line	3/Line
8	Barker Gamco	4/Line	4	50 bpm	Barker	variable pulley	Mixed	Simmons Pritchard	1/Line	3/Line	Pritchard
9	Barker	1/Line	3	40 bpm	Barker	variable pulley	Mixed	1/Line	1/Line	2/Line	3/Line
10	Barker	2/Line	6	44 bpm	Gamco	variable pulley	No	1/Line	2/Line	3/Line	4/Line
11	Gamco	2/Line	5	56 bpm	Centen-nial Gamco	variable pulley	No	Centen.	4/Cent. 1/Gamco	3/Line	3/Line Gamco
12	Barker	2/Line	8	64 bpm	Gamco	motor speed	No	Simmons	1/Line	Gordon Johnson	Gamco

EVISCERATION (continued)

PLANT	USDA INSPECTORS/ LINE	GIBLET REMOVAL PEOPLE/ LINE	GIZZARD CLEANING/ LINE	GIZZARD INSPECTION PEOPLE/LINE	LUNG REMOVAL	NECK BREAKER	CROP PULLING PEOPLE/ LINE	HOUSE INSPECTION PEOPLE/LINE	NECK SKIN CUTTER	UNLOADER
1	2	4	1	1	Lung Guns 2/Line	Manual 1/Line	2	2		Manual 2/Line
2	3	5	1	1	Lung Guns 2/Line	Manual 2/Line	3	2	Moore	Manual 1/Line
3	3	2	1	1	NA	Barker	3	4	Gamco	Manual
4	4	4	1	1.5	NA	Pritchard	3	1	Barker	Gamco
5	3	6	1.5	same as cleaning	Lung Guns 2/Line	Pritchard	4	1	Home made	Manual 3/Line
6	3	5	2	1	NA	Pritchard	2	2	Barker	Meyn
7	2	4	1	1	Lung Guns 2/Line	Manual 1/Line	2	1	Home	Homemade
8	3	5	2	1	Lung Guns 2/Line	2/Line & Pritchard	3	2	Gamco	Barker Pritchard
9	2	4	1	1	Lung Guns 2/Line	Manual 1/Line	2	1	Moore	Barker
10	2	4	1	1	Lung Guns 2/Line	Manual 1/Line	2	2	Moore	Gamco
11	3	3	1	2 Total	Lung Guns	4 Centen-nial 1 Gamco	3	1-2	Cent	Manual
12	4	4	2	1.5	Gamco Lung machine	Homemade	3	2	Homemade	Manual

CHILLING

PLANT	BRAND	°F TEMPERATURE	ICE OR REFRIG.	FT. SIZE	BRAND	AGITATION METHOD	°F TEMPERATURE	ICE OR REFRIG.	INSULATED	FT. LENGTH	USUAL MOISTURE PICKUP
1	Barker	49	Ice	20	Barker	Oscillating Paddle	33	Ice	No	40	9-11%
2	Barker	65	Ice	40	Gamco	Auger	42	Ice	No	45	11-12%
3	Barker	50-56	Ice	30	Barker	Paddle	34-36	Ice	No	50	9.8%
4	Barker	65	Refrig	20	Barker	Oscillating Paddle	36-38	Refri	No	50	9.8%
5	Barker	46	Ice	30	Barker	OSC Paddle	34	Refri	No	50	9.6%
6	Zebarth	55	Chilled Water	20	Zebarth	OSC Paddle	35	Ice	Yes	60	8-12%
7	Barker	45	Ice	20	Barker	OSC Paddle	37	Ice	No	60	10.5%
8	Gordon Johnson	45-48	Ice	20	Gordon Johnson	Rotating Paddle	34-36	Refri	No	50	9-11%
9	Gamco	50	Chilled Water	20	Gamco	Auger	34	Ice	No	60	9%
10	Zebarth	40	Chilled Water	20	Zebarth	OSC Paddle	32	Ice	No	50	10%
11	Zebarth	50-55	Chilled Water	20	Zebarth	Rotating Paddle	34-36	Ice	No	60	6-7%
12	Home Made	50	Chilled Water	20	Home Made	Drag Thru	35	Refri	No	70	8%

PACKING OPERATION

PLANT	REHANG LINES	REHANG PEOPLE	GRADING PEOPLE	DOWNGRADE TRANSPORT	GIBLET WRAP TYPE	GIBLET WRAP PEOPLE	PEOPLE STUFFING GIBLETS	DROP STATIONS	DATA RECORDED	PEOPLE LOADING BOXES
1	3	6	Rehang	Conveyor	Manual	6	12	10	None	6
2	1	3	1/Line	Vat	Manual	6	3	6	None	
3	2	4	3	Vat	Auto	4	3	7	None	2
4	1	3	Rehang	Vat	Gordon Johnson	4	4	7	None	5
5	2	6	Rehang	Vat	Manual	16	NA	7	Weight Count	6
6	2	6	Rehang	Conveyor	Gamco	6	3	8	None	6
7	1	4	Rehang	Conveyor	Manual	6	NA	3	None	4
8	3	8	Rehang	Conveyor	Gamco	4	8	10	None	1
9	1	5	Rehang	Vat Conveyor	Gamco	4	4	6	None	
10	2	6	Rehang	Vat	Gamco	4	8	11	Weight Count	2
11	4	5	Packing	Conveyor	Manual	24	NA	7	Weight Count	8
12				Conveyor Vat	Manual			0	NA	NA

APPENDIX B

POULTRY HANDLING CONCEPTS

GIBLET STUFFING EQUIPMENT

General Description:

This equipment concept replaces the manual giblet stuffing operation with an automated system. Giblet packages from the automatic giblet wrapping machine or from the manual giblet wrapping conveyor belt would be fed directly into the giblet stuffing machine which would then insert the package directly into the bird carcass.

Number of Personnel now used for Stuffing Giblets:

3 to 6 persons per line.

Estimated Savings by Using Automatic Giblet Stuffing Equipment:

At least 2 to 5 persons per line ($15,000 to $45,000 per line). The stuffing machine would probably handle a greater volume of birds than one packaging line now furnishes so that actual savings could be higher.

Technical Description:

The automatic giblet stuffing machine would be synchronized with and driven by the packing line overhead conveyor system. The giblet packages would feed into the stuffing machine on a conveyor belt with contoured compartments to assure proper orientation of the package. Synchronization of the transfer belt with the wrapping machine could be controlled by electronic timing and feedback electronics with a variable speed motor on the wrapping machine.

The giblet package would be placed in the carcass opening with a funnel-like device which spreads the opening enough for the package to be smoothly inserted by a cam-driven plunger. The bird would be constrained in proper position by a contoured cradle during the insertion process. Repeatable positioning would necessitate that the birds be hung on the Altenpohl packaging shackles by the same leg.

BIRD WEIGHT AND MOISTURE MEASUREMENT WITH GAMMA OR BETA RAYS

General Description:

This equipment can be utilized to measure the cumulative weight of birds and number of birds passing a location on the processing line. For instance, cumulative live weight and number of birds could be measured on the kill line after stunning. Moisture pick-up in the chillers could be measured by measuring the cumulative product weight passing through the gamma ray device before and after chilling. The advantages of this nuclear ray device over electromechanical (load cell or LVDT) devices is that it would not require special shackles or weighing rails on the overhead conveyor lines and would be an inherently simpler device than currently available weighing conveyors.

Economic Advantages:

The actual cost savings in processing plants can vary widely depending on the type of operation. The use of the nuclear weighing system would furnish continuous monitoring of product weights through critical points on the processing line without the addition of personnel or changing any present manual or automatic operations.

Technical Description:

The nuclear weighing system consists of an emission source (gamma or beta rays) on one side of the birds hanging from the overhead conveyor and a detector on the other side. For birds on conveyor belts, the source and detector would be located above and below the belt. The attenuation of the ray can be calibrated against bird weight and then used as a weight indicator.

The intensity of the emission source is low enough so that personnel hazards would be minimized. Due to the nature of the radiation, there would be no residual radiation in either the birds of the conveyor hardware.

BIRD IDENTIFICATION, WEIGHING & TRANSPORT

General Description:

This system concept is aimed at improving grading identification, weighing, yield monitoring, and automated transport of birds. An important feature of the system is that each bird is accounted for throughout the process and all information on bird weight, moisture pick-up, and grade are automatically recorded. Birds would be automatically dropped off or rerouted to other locations according to weight and grade.

Economic Advantages:

If a complete system is incorporated into the plant layout, the potential savings in personnel would be in the range of 3 to 14 persons for the entire plant; or as follows for the various functions:

1. unloading at chiller, 0 to 3 persons per line
2. rehang and grading after chilling, 3 to 8 persons
3. downgrade transport, 0 to 3 persons

Technical Desciption:

The heart of the system is the magnetic reader device. Magnetic strips, similar to those used on credit cards, would be placed on each shackle and have a pre-recorded identification number on each. As each bird progresses through the system, it would be automatically weighted at critical locations such as before and after evisceration and chilling. The weight data and identification number would be recorded in a centralized computer system. The recorded identification number would be read at any desired location by magnetic readers and, based on the grade and weight data associated with that number, the bird could be automatically dropped off or rerouted.

Automatic rerouting and conveyor line splitting would be accomplished with an overhead conveyor which incorporates gravity fed sections. Each shackle would be individually supported by rollers. The transport mechanism for moving the shackles would be separable from the shackle support system so that the shackles can disengage from the transport system and roll down gravity fed sections. Since the shackles are not attached to each other on the gravity fed sections, dividing the shackles into multiple lines or rerouting of selected shackles would be possible. After the shackles are rerouted on the gravity fed system, another transport system would re-engage the shackles for movement through the processing stations.

By using a gravity fed section prior to chilling, each evisceration line could be divided into slower moving, multiple lines. The birds would remain on the same shackles and be transported through the chiller (water or air-blast types) at a controlled rate. After leaving the chiller, the shackles could be rerouted back into a fewer number of lines for packaging or cut-up. The birds could be identified and weighed again to check moisture pickup. Drop-offs and rerouting to cut-up would be controlled by magnetic readers at critical locations which would read the identification number on each shackle. Based on the data stored in the computer and associated with a particular I.D. number, the bird would be dropped at the appropriate location.

APPENDIX C

NEWS RELEASES

VEWS FROM THE
ENGINEERING EXPERIMENT STATION
GEORGIA INSTITUTE OF TECHNOLOGY • ATLANTA, GEORGIA 30332

Contact: Jim Donovan/Sharon Sebaly
Publications and Information Office
(404) 894-3405 or
Peggy Simcic/J. B. Shaw
Technology & Development Laboratory
(404) 894-3412

TECH'S EES STUDIES BROILER PROCESSING JOBS

October 11, 1977

For Immediate Release

ATLANTA, GA.....Upgrading jobs in the broiler processing industry is the object of research recently begun by Georgia Tech's Engineering Experiment Station (EES) in cooperation with the Georgia Poultry Federation.

Working under a $46,000 National Science Foundation grant with the Mar-Jac Corporation of Gainesville, engineers at the Station's Technology and Development Laboratory hope to mechanize certain broiler processing steps that are presently inefficient and marked by high labor turnover.

One such operation is the evisceration (entrail removal) process. This job is unpleasant for most workers and therefore difficult for the broiler plants to keep filled.

According to Dr. Bob Cassanova, project director, mechanization of this process would eliminate the manual handling of the more unpleasant aspects of the process. It would also upgrade working conditions.

Cassanova points out that the mechanization of these processes would not eliminate the need for labor. "The steps that mechanization would eliminate are the steps that the broiler plants can't keep people in

anyway because nobody wants to do them. The object of this project is not to eliminate labor but to put it to better use."

The poultry mechanization project is part of a national program designed to apply science and technology to industry which affects national needs. Poultry products are important to the U.S. economy, and they are becoming an increasingly popular source of protein.

EES will be working in cooperation with the Mar-Jac Corporation, the Georgia Poultry Federation and other state and national poultry trade associations.

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vol. 2 no. 2

POULTRY HANDLING RESEARCH

Currently, the Technology and Development Laboratory is conducting a survey to determine the present status of poultry process handling and mechanization. For example plants in the southeast area are being surveyed as to the types of electrical and mechanical equipment, the number of personnel doing particular jobs, water usage and line speeds. The report will contain some of these comparative statistics showing the different methods used in various plants. The plants will remain anonymous. Possible projections for the future in terms of electrical and mechanical labor saving devices will also be outlined in this report which is sponsored by the National Science Foundation.

YIELD EVALUATION SYSTEM

In addition to the NSF project, a state sponsored project is being conducted to determine yield losses throughout the plant. The first Yield Evaluation System will be installed in Mar-Jac Company in Gainesville in March. Initially, the birds will be weighed prior to and just after evisceration. Once sufficient data is collected, the weighing stations will be moved closer together to obtain additional information about bird count, yield loss, and the number of birds removed from the line at a particular spot. The system will consist of waterproof electronic weight sensors which will transmit the data to a minicomputer which will be housed in a control room. The minicomputer program can be modified to reflect the desired information. As soon as sufficient data is generated, and if time and money allow, it is hoped that the equipment will be moved to a second, less automated, plant where additional data will be collected for further mechanization studies. For further information please contact Dale Atkins or Dr. Bob Cassanova at Georgia Tech. The telephone number is (404) 894-3623.

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POULTRY PROCESSING SURVEY

A survey of poultry processing mechanization and handling techniques in twelve processing plants in Georgia, Arkansas, and North Carolina has been completed under the sponsorship of the National Science Foundation. The following table lists some of the information collected:

	Range	Median
Employees	215 to 1700	365
Labor Turnover (%)	2 to 400	50
Water Use (gal/bird)	5 to 12	7.5
Broiler Live Weight (lbs.)	3.65 to 4.25	3.8
Live Hang Line Speed (birds/min.)	77 to 135	114
Evisceration Line Speed (birds/min.)	40 to 64	52
8 Hour Production (birds)	60,000 to 248,000	92,500

Lung guns were in use in nine of the twelve plants, and six of the twelve plants were using automatic drawing equipment.

The final report for this project will contain projections for the future for the poultry processing industry in terms of possible applications of electrical and mechanical labor saving devices. Contact Dale Atkins or Dr. Bob Cassanova at Georgia Tech for further information.

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YIELD EVALUATION PROGRAM

The poultry processing yield evaluation program was undertaken to develop an automated system to accurately monitor bird weight during the evisceration process. The system consists of two electronic weighing stations interfaced to a small stand-alone computer.

Line yield, which is defined as the average bird weight after evisceration divided by the average bird weight prior to evisceration, is calculated and displayed every fifteen minutes. The average weight, number of empty shackles, and the bird weight distribution is also computed and displayed. This gives the plant management an immediate indication of how well the line is operating so that adjustments can quickly be made if necessary.

At the end of each day's production, a summary of the line yield and weight distribution is calculated and displayed. This information is also stored on a tape cassette for use in preparing monthly summaries, samples of which are shown in Figures 1 and 2.

Figure 1

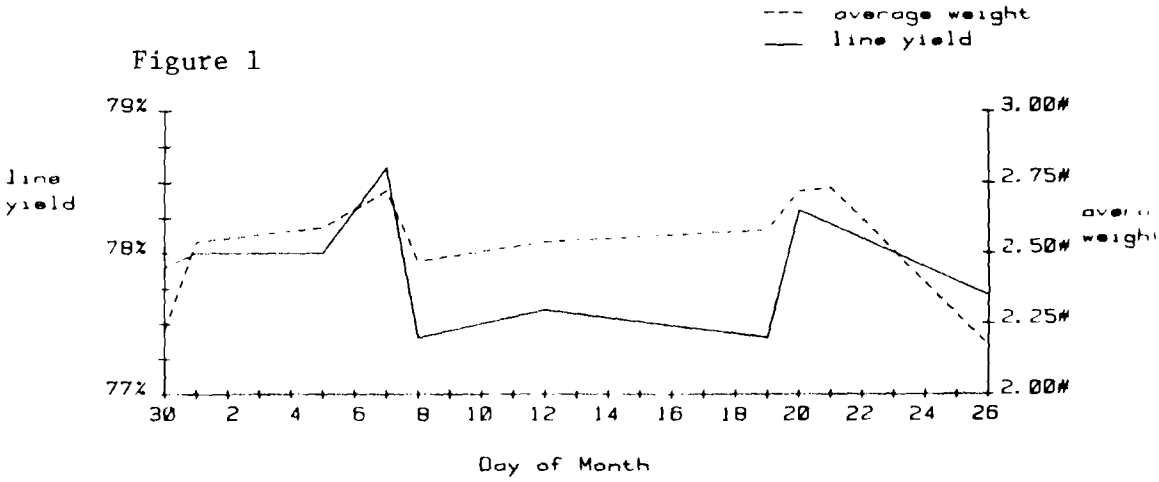
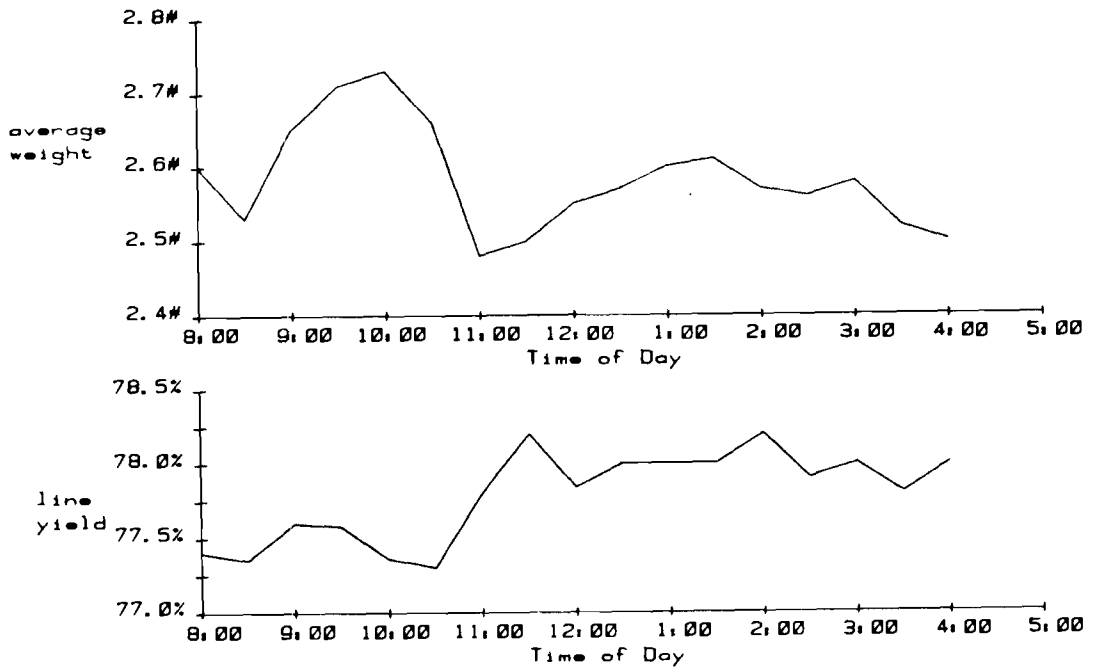


Figure 2



This program is being developed under the sponsorship of the Georgia Poultry Federation with funding from the Georgia Department of Agriculture. Further information can be obtained by contacting Larry Moriarity at 894-3375 or Dr. Bob Cassanova at 894-3448.