Papers —

Fifth Annual Meeting

December 28, 29, 30, 1964
Chicago, Illinois

ALSO PAPERS FROM

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REGIONAL CONFERENCE
TRANSPORTATION RESEARCH FORUM
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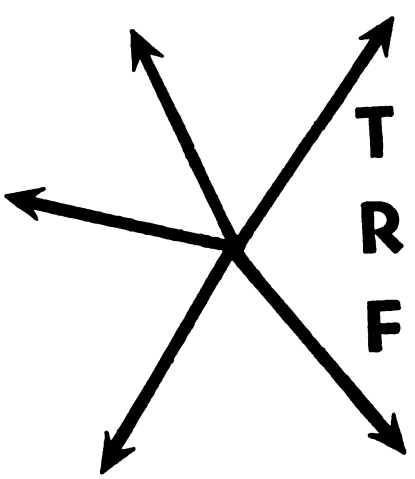

TRANSPORTATION RESEARCH FORUM

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"Use of ADP in the Distribution and Routing of Mail"

This will not be a technical presentation on the programming of a computer to have it produce desired but intricate output. Neither will it present a theory which may in the future have some application to operating problems. It will not even touch upon the sophistication of some present computer oriented systems which now, and in the future, will give us answers to problems we haven't yet envisioned.

If, in presenting it to you, there is a tendency to over-simplify; let me assure you, it is intentional. We need, and believe we have, a system which makes use of the technology of ADP—(or EDP as it is also called)—to produce vital operating information necessary to the day to day running of a very large and complicated service business. This essential information was formerly produced manually in our fifteen regional offices under the direction of the headquarters staff. In those offices we had about 180 odd people engaged in the activity, at a payroll cost of about a million and a half dollars a year. The tremendous growth in mail volume, the increasing complexity of the transportation pattern and the frequent changes in rising and declining modes of mail transportation were adding to their numbers and to our payroll costs every year. Clearly, we needed a better method if we were to avoid strangulation.

We have a fairly complex operation to manage. Over 69 billion pieces of mail received annually from 324,000 collection boxes, 45,000 post offices, stations and branches, and large firm mailers plants. All of these are destined to some 4,300,000 business delivery points and 45 million family mail boxes. In addition to that basic job, we perform special services and support functions.

This mail processing job is accomplished through 587,161 employees in 28,282 postal facilities, utilizing 45,726 postal vehicles, 75 railroad companies lines, 135 airline routes, 77 boat routes, 11,418 contract truck routes and 5,487 mail messenger routes which are generally individual passenger cars, station wagons or light pick-up trucks.

On the national average, the mail which originates in a given city breaks down into the following percentages:—29% is destined for delivery in that city; 33% of it is destined for delivery within the home state or the trade area, while 38% of it is addressed to points outside of the state or area. For our purpose here we will concern ourselves with the 38% even though all of the categories involve scheme distribution and routing to destinations.

**Bureau of Finance and Administration, U. S. Post Office Department*

The overall average distance a piece of outgoing mail travels from sender to receiver is 618 miles with the variation as shown ranging from an average of 1194 miles for an airmail letter down to an average of 438 miles for daily newspapers. Our costs for transporting this mail are large and since the greatest volume moves by surface means our railroad obligations account for 61% of our total transportation expenditures.

Our sortation, or distribution of this mail, is almost entirely manual. To sort the mail to the proper separation, making it a part of a forwardable unit for transportation, requires a plan, or as we call it, a scheme, which the distributor must memorize and retain in memory. A scheme shows the distributor the many possible transportation services which can be utilized to get mail to the sectional center, or core office of a precisely defined area for example, Oklahoma.

Preparation of accurate schemes to efficiently direct mail from origin to destination involves many factors which are common to any routing problem of the movement of goods or material. They include such things as transportation schedules, air, rail and highway, time required for connections at intermediate points, distribution performed at origin, intermediate or destination points, average processing times, delivery deadlines, circuity in routing, etc.

If the transportation schedules were fixed and inflexible, our problem would not be nearly as complicated, but this is not a static age and change is rapid and inevitable. To maintain efficient routing we must keep our schemes up-dated to reflect these changes.

We also face the problems of the "you can't get there from here" type in which no direct transportation service exists between origin and destination.

In examining our scheme preparation work, we found that most of it was repetitive searching and selection based upon guidelines which could be predetermined. Although it did not represent our greatest volume of mail, we decided to try ADP for air schemes preparation because: this was our highest priority service mail requiring the best available service; it accounted for a significant portion of our transportation costs—18.8% of our direct transportation outlay plus a proportionate share of other transportation costs in moving it to and from airports;—a single mode of transportation was normally involved which gave us a simplicity of schedules;—and the industry involved was doing more work in ADP fields than any other.

In a manual preparation of airmail schemes, the basic document was the printed airline schedule which gave us available flights to be used.

At each of our fifteen regional offices, printed airline schedules were received as soon as they came off the presses and technicians in each office began the task of selecting the flights that would be used in the airmail schemes. This was a touch and go proposition, with a question always present as to whether or not the schemes would be ready by the effective date of the schedule.

The technicians posted the flight information from the schedules to 4x6 word cards, one for each flight they would use, showing stop points and departure and arrival times on the cards.

The cards were manually sorted to chronological order of departure for each origin point the technician was concerned with. He then posted this information to a work sheet or spread sheet which had been previously prepared with spaces for destination points in a general geographic area.

After the sort and the posting, he then examined his spread sheet for gaps in direct service available, selection of latest departure–earliest arrival flights, and began the search through the schedules for flights which could be used to provide connections at intermediate points. Meanwhile the distributor who needed the scheme to properly distribute mail was gnawing his finger-nails down to the first finger joint worrying if they would be ready on time.

It was not very easy to read or use the finished product, but distributors, being an alert bunch generally, soon learned to get the maximum potential from it.

To get specific dispatch information down to the distributor on the individual state letter case we produced what we called a tie out sheet giving him a coded, chronological listing of the times he should dispatch mail from his case and the point to which it should be dispatched.

As a first step in the approach to ADP we designed a form (2708) to take the place of the 4x6 index cards, setting this up in a format adaptable to key punching of IBM cards which could be sorted by machine.

This form coded for required punching provides space for route, trip, origin point, departure time, destination point and arrival time as well as additional information on station order, card type and number and effective dates. It is a transmittal document to get the written information into machine readable language.

Once these forms were prepared, the technician went through the first print out, to select latest departing–earliest arrival flights, and to fill the gaps with connection trips as necessary. This additional information was key punched into cards, which were then filed manually in the tub file of cards and once again run through the printer for final product.

On the first print-out, the machine system gave us the listings shown here in black and the technician supplied those shown in red. The machine sortation and reruns took quite a while but were much faster than the old written method. At this stage of development there was none of the Automatic of an ADP system.

With this initial step we did get simpler and earlier production of our schemes, and by card sort and rearrangement, some by-products which had formerly been produced manually. These were origin and destination listings for quick reference; and tie out sheets for use at cases and pouch racks.

Our next step was to produce some of the necessary input data in one central location, to be transmitted to our regional offices in the form of punched cards for insertion in their tub files. We did this by having copies of airline schedules sent to us at headquarters, where technicians of middle management level designed simplified forms for key punching. Codes were used to designate airline companies, and the frequency of the flights shown.

A form (1324X) contained all the information needed to have a computer, properly programmed, manipulate the data, store in memory information needed as the run progresses and recall and use the stored information as it is needed in the program.

With this input information so arranged, we get, depending on the number of stops made by the flight, up to 6 output cards for one input, 28 output cards for two input, etc. up to 190 output cards for 5 input if we had a flight with 20 stops which is an unlikely event. The output cards contains information essential to the technician in preparing his material for the scheme to be used at a particular point. We get schedule information regarding arrivals at all downline points of the flight; if the air stop is a multicity stop such as Canton-Akron-Youngstown, Ohio, the computer searches for this and produces a record for each; if arrival at the air stop point is between the hours of 2:00 a.m. and 8:00 a.m., we have instructed the computer to show an additional city pouch—because these are the critical hours for citywide delivery of mail, business and residential, and we need a separate city pouch, regardless of volume, to avoid a rehandling at the Airport Mail Facility. The computer also automatically changes the frequency of the trip in cases where the departure from the initial point is before midnight on a daily except Saturday frequency to show it as daily except Sunday at downline stations, where it arrives after midnight.

The central production by computer is constantly being refined and updated to provide better, more timely scheme information. The form 1324 converted to a punched card is fed into the computer along with punched cards now received from 12 airline companies, containing in our format, their flight schedule information. The program for the computer incorporates such items as deadline arrival times (to effect delivery of mail to addresses); transfer time requirements at connection points; restrictions on transfers, including cost and circuity features; and likely transfer points. From this we get punched cards to be shipped to our regional offices; a master scheme of air service showing all direct service to and from all domestic air stop points (and some Canadian); inbound and outbound lists of flights at air stop points; origin and destination listings for all air stop points; and transfer routings or connections involving the 91 largest cities.

Output from the form 1324 input material gives us pouch listings for every destination from every stop point made on the flight used.

The Origin-Destination list produced by the machine shows direct flight routings—for example, between Washington and Cincinnati, as well as connection routings through 4 separate connection points.

Our Master Airmail Scheme, lists by destinations, in chronological order, not only the flight arrivals, but where the flights came from and the time they departed those places.

With the Master Scheme, the punched cards we have furnished from a central production unit and the local schedules and distribution information, the schemes technician in the regional office is now ready to produce the needed scheme.

When the technician has completed his punched card file he sends it to one of six Postal Data Centers, where it is processed through the IBM 1401

system and the printed schemes are shipped back to him for distribution to the local post offices.

The finished products are—Origin and Destination—Scheme—Tie-Out Sheets. Our 1401 systems in the 6 Postal Data Centers are 8K with 4 low speed tape drives. Eight separate programs are used in this production and all are unblocked. The whole routine—edit—explode—sort—Master Scheme and Origin and Destination listing—search for connections—cull—sort—and final select takes 30 hours of 1401 processing. With the tape capability of the 1401 our files which previously consisted of 20 boxes of punched cards are now in one reel of magnetic tape.

In our central production we use the computer to verify the correctness of stop codes. We also have the computer code origin and destination with its state, geographic area and ZIP Code.

The twelve airlines who are now furnishing punched card schedule information in our input format account for about 65% of our input requirement. The remaining airlines have promised cards also as they go to computer oriented preparation of schedules.

Others such as the Ready Reference Guide are showing transfer or connection information in their output, but in producing this information for the 91 largest points we cover, there is no limitation on the points at which the connections can be made. They can be at any one of the other 89 on the list. As near as we can tell, we are slightly ahead in this feature.

In the near future, we will be able to remove the card files from our regional offices as this information will be stored on tapes.

We will issue the Master Scheme on a monthly basis and it then will be possible to send corrections to our Postal Data Centers on tape for the up dating of all schemes produced.

Our present efforts are centered on the development of a system for producing surface dispatch schemes. We now include limited surface dispatch items in the air schemes, to provide best available service for relatively nearby points at hours when flight schedules are not available, but these are manually inserted in punched card decks at regional headquarters. Our problem here is one of incompatibility between air and surface systems and railroads as far as we can learn are not yet using computers in schedule preparation work.

Data transmission from computer to computer—headquarters to Postal Data Centers is not too far over the horizon as we measure time today. Schedule information from carriers is also in that realm.

We have contracted for the production of optical scanners to read and sort mail. The routing instructions necessary for the scanner and related equipment to efficiently make-up and dispatch the mail will be in the ADP produced scheme.

Since most of the 69 or 70 billion pieces of mail are dispatched in sacks or pouches, we have a real problem in producing labels used in the movements. In our own label printing units, we produce 1,800,000,000 labels or bag tags and 2,700,000,000 paper facing slips per year. We are in the pro-

cess of having developed for us a high speed electrostatic printing system which will produce these labels and slips for magnetic tape input which is the schemes tape. When this is operative we estimate annual savings of $1,500,000 in production costs.

You will recall that in the beginning, I mentioned some 180 odd people working on scheme production in fifteen regional offices. These were increasing year by year until we started on this system of scheme production. In the last five years, we have not added a single body to that force and in the latter stages of our preparation schedule we will have reduced that total to about 70 and most of these will be doing other work related to distribution and routing of mail.

We now have 600 people in our Label Printing Units. When the new system is fully developed, this number will be reduced to 100.