INTERNATIONAL INQUIRY ANSWERING SERVICE

SCANDINAVIAN AIRLINES SYSTEM

SAS TOWN TERMINAL
COPENHAGEN

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International inquiry answering service

A computer situated in Copenhagen automatically answers inquiries entered on 200 keyboard interrogation sets situated in five European countries; these inquiries concern the availability of seats on flights to be operated by Scandinavian Airlines System

Railways, theatre ticket agencies, airlines, coach companies and hotel groups have one problem in common—to keep accurate records of reservations to which instant access can be obtained so that sales staff at local offices are always able to answer random inquiries about bookings promptly. Scandinavian Airlines System has installed a computer at Copenhagen to cope with work of this nature, and the methods used for handling seat reservation inquiries on this equipment are notable for several reasons. The initial installation only cost £500,000; inquiry data are transmitted over standard teleprinter lines; the system operates in 12 cities situated in five European countries; within a year it will be extended to another 12 cities in a further five countries; and, eventually the system will handle inquiries from New York.

With this electronic equipment, S.A.S. has improved the service given to passengers, greatly reduced the volume of teleprinter messages transmitted between the Company's regional offices, and increased the probability that each aircraft will be carrying the maximum passenger payload

On November 20th, 1958, the first stage of an automatic inquiry answering system was brought into service by Scandinavian Airlines System. Before that date, all seat reservation inquiries were handled manually. At first, only inquiries originating from the booking offices in the air terminal building in Copenhagen and at Copenhagen's Airport, Kastrup, were answered automatically. Since then, however, the automatic answering service has been extended considerably.

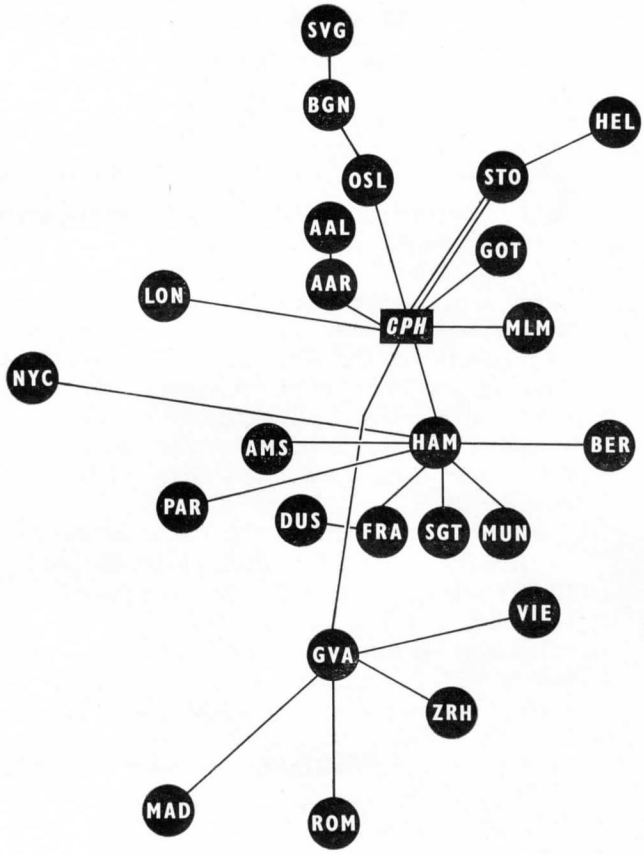
Now queries received from places as far away as Helsinki, Malmö, Stockholm, Oslo, Bergen, Gothenburg, Stavanger, Aarhus, Aalborg, Hamburg and London are dealt with automatically. Within the next few months, the system will be extended to Madrid, Rome, Paris, Vienna, Zürich, Geneva, Stuttgart, Munich, Frankfurt, Berlin, Düsseldorf, Amsterdam and, finally, across the Atlantic to New York. At each of the S.A.S. offices in the cities mentioned, keyboard interrogation sets are provided which communicate with a central computer located in Copenhagen. The computer, which was specially designed for this application, is equipped with two magnetic drums on which are recorded data defining the seating reservation status of every flight operated by, or in conjunction with S.A.S. over the next 70 days.

An answer to an inquiry entered on a keyset located in Copenhagen is obtained from the computer within one second. About five seconds are needed to obtain a reply in London, and it is expected that the time between a query being entered and the answer being received on a keyset in New York will be approximately 20 seconds.

The main advantages obtained from using this system are that the load on the S.A.S. communication network has been considerably reduced. It is estimated that the number of messages received by and transmitted from each of the main regional offices has been cut by at

Inquiries concerning the availability of seats on any flight to be operated by S.A.S. during the next 70 days are entered on keysets located in the ticket sales offices

least 150 a day. In addition, the whole booking procedure has been speeded up, and a greatly improved service is now given to intending passengers. Previously, all flight reservation information was chalked up on blackboards situated at the main regional booking centres. Queries were answered by telephone, and changes in the seat reservations available were received by teleprinter from the central reservations office in Copenhagen. This was a slow, cumbersome data processing system, liable to error, and not in keeping with the volume of traffic handled by the airline in Europe today. Because of the large time delays involved with



All S.A.S. booking offices situated in the cities indicated on this plan are, or shortly will be, served by the automatic inquiry system

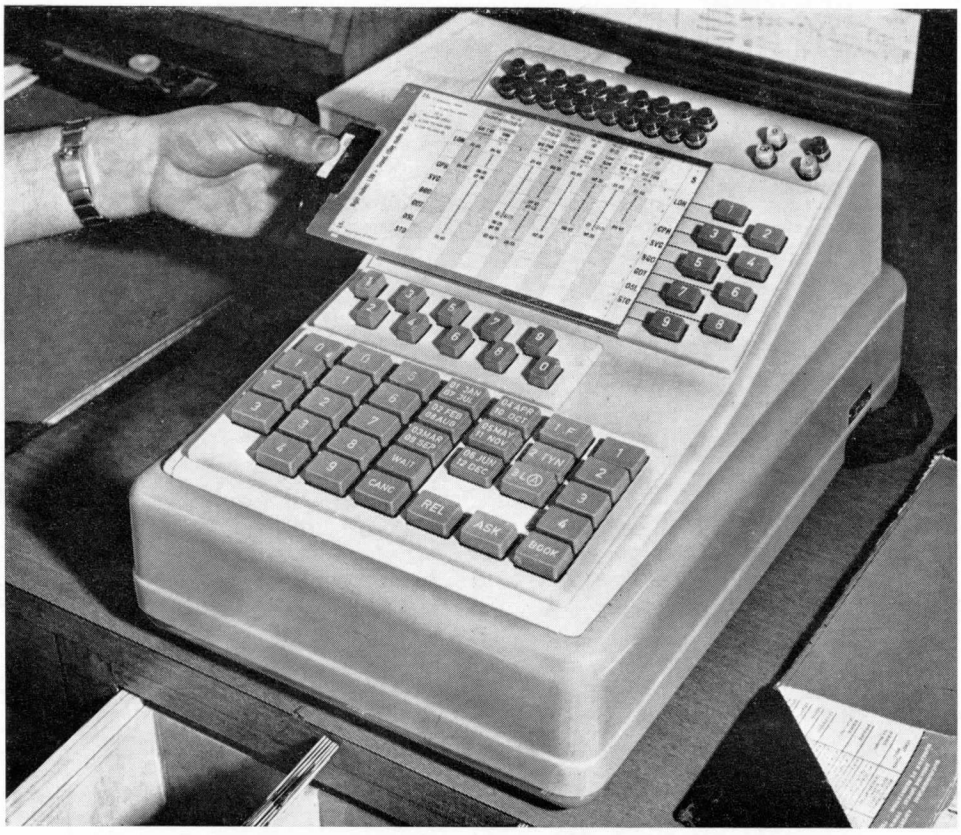
AAL—Aalborg
AAR—Aarhus
AMS—Amsterdam
BER—Berlin
BGN—Bergen
CPH—Copenhagen
DUS—Düsseldorf
FRA—Frankfurt
GOT—Gothenburg
GVA—Geneva
HAM—Hamburg
HEL—Helsinki
LON—London
MAD—Madrid
MLM—Malmö
MUN—Munich
NYC—New York
OSL—Oslo
PAR—Paris
ROM—Rome
STO—Stockholm
SGT—Stuttgart
SVG—Stavanger
VIE—Vienna
ZRH—Zürich

a manual system of the type described, the information displayed on the blackboards at the regional offices is seldom accurate, and to avoid the possibility of offering customers seats on flights already fully booked, only a percentage of the seats available are offered for sale freely. Once this number of seats has been sold what is termed the booking "cushion" level is reached. This means that if a booking clerk wishes to sell one of the few remaining seats, she must send a special message to the central reservations office in Copenhagen and then wait until a confirmatory reply is received before the sale can be completed.

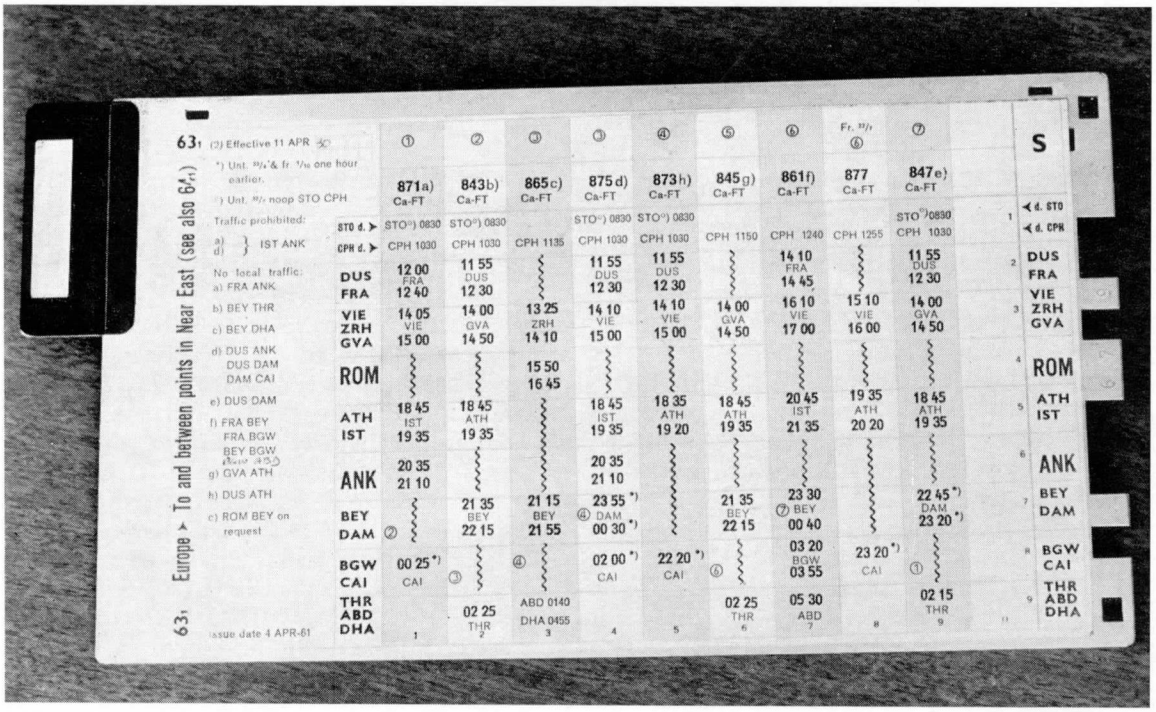
Even though an automatic inquiry system has now been introduced, the cushion level safety margin cannot be eliminated entirely, but the level has been raised with the result that S.A.S. have materially improved their chances of selling all the seats available on a flight. For example, if a man in Helsinki cancels three or four seats on an almost fully booked flight, when this information has been transmitted to Copenhagen and the data stored by the computer has been amended, the fact that extra seats are now free is made available instantly to all other S.A.S. booking offices.

One point concerning the operation of this system must be emphasized. At present the computer supplies information on the availability of seats only. It does not record the number of seats sold or the names of passengers. There are three reasons for this. First, S.A.S. were pioneers in employing electronic equipment for this type of work. Hence, a cautious approach was necessary if errors—which are bound to be expensive—were to be avoided. Secondly, while electronic systems can be built to perform almost any data processing task, the capital cost involved frequently cannot be justified. All the major S.A.S. offices throughout the world are already linked together by a teleprinter network; consequently, the Company did not wish to establish a second network merely to transmit booking information. Therefore, the inquiry system was designed to operate in conjunction with the existing teleprinter network and, by restricting the amount of information to be transmitted to the minimum, both the computer and the agents' interrogation sets could be of relatively simple design. That this particular aim has been achieved can be gauged from the fact that the existing European inquiry system was established for the relatively modest cost of £500,000.

The third reason why the existing system is limited to handling inquiries is that until all S.A.S. sales personnel are fully conversant with the operation of the interrogation keysets it is not considered advisable to allow them to be able to alter the information stored within the computer. The system has been designed so that, eventually, it will be possible to book seats by pressing the appropriate buttons on the key-



To make an inquiry, the operator first inserts an interrogation plate in the keyset and then depresses the appropriate data keys



All the relevant information about the various flights is printed on the interrogation plate

set. But this means, of course, the sales clerk will actually alter the information stored by the computer—an undesirable facility when a new system is being introduced.

An interrogation set comprises a small keyboard desk unit, about the size of a typewriter, into which a metal plate is fitted on which is printed information about a number of flights. Each plate is divided vertically into ten columns, and horizontally into nine rows. At the head of each vertical column appears the reference number of a flight, such as SAS 502. On the left, against each horizontal row, is printed three letters which identify an airport such as LON for London, CPH for Copenhagen and so on. In the squares formed at the intersections of the rows and columns, one or two times are printed which indicate the hour of arrival and departure of that particular flight at that airport.

Return flights

Flight numbers may be printed above nine of the vertical columns. The tenth column is reserved for a special purpose described later in this article. A further nine flights—usually those that operate in the reverse direction—are printed on the back of the plate.

A number of large square notches are cut in the right-hand edge of the plate leaving a series of protruding lugs. When the plate is inserted into the keyset, these lugs close electric switches and when the settings of these switches are scanned, the signal generated identifies the plate and the side that is uppermost. One hundred different plates can be fitted to an interrogation keyset.

Two rows of ten indicator lights are ranged across the top of the keyset, corresponding with the ten flight columns printed on the plate. The upper row contains red lamps, and the lower row green. Next to these lights are four signal lamps. A group of nine keys, arranged in two columns down the right-hand side of the keyset, is situated adjacent to the flight plate. One key is provided opposite each row, or destination, printed on the plate.

A further line of ten keys, aligned with the ten vertical flight columns, is positioned below the plate. Not all keysets are equipped with this particular line of keys because they will only be used when the system is extended to deal with bookings as well as inquiries. Below these keys, arranged in a series of seven columns, are the keys of the main keyboard.

An inquiry is entered on the keyset in the following manner. First, the booking clerk selects from a file the particular plate on which are printed the details of the flight in which the passenger is interested. She then inserts the plate in the keyset and presses two of the nine keys in the column situated on the right. One key indicates the airport from which the passenger wishes to depart, and the other the destination. Next, the operator indicates the date on which the passenger intends to travel by

selecting two buttons in the first three columns of keys on the left of the main keyboard. If there is only one decimal digit in the date, the operator still selects two buttons, the first, of course, being O. This is necessary because the interrogation signal transmitted from the keyset to the computer must always contain a fixed number of digits arranged in a standard sequence.

After this, the operator presses the month button. Two months are inscribed on each of the six buttons provided for this purpose, but because the system only handles flights operating over the next 70 days there is no risk of ambiguity. Then the operator selects the class in which the passenger wishes to travel by pressing one of three buttons indicating first class, tourist class or special class. Finally, the booking clerk presses a button labelled ASK, whereupon the inquiry data entered on the keyboard are transmitted over either a private or public teleprinter line as a sequence of electric pulses to the seat availability computer in Copenhagen. Reservation data stored on the magnetic drums of the machine are consulted, and the appropriate answer is transmitted back to the keyset from the computer over the same landline. The answer is displayed on the keyset as a pattern of red and green lights.

Indicator lights

A green light over a column on the plate indicates that seats are available on that flight in the class requested by the passenger. A red light shows that all the seats have been booked. When both the red and green lights situated over a flight column are illuminated simultaneously, this usually indicates that the booking cushion level has been reached. However, the meaning attributed to the red-green signal can be altered if required. Such a signal can indicate that the flight is fully booked, but that the passenger may be placed on a waiting list if he wishes and will be given the first opportunity of taking over a cancelled booking.

Absence of either a green or red light above a column indicates that the flight does not operate on the day for which the inquiry was made.

Earlier in the article it was stated that no flight data are printed in the tenth column of the flight plate. Nevertheless, signal lights can appear over this column. When this happens, the sales clerk knows that some temporary alteration has been made to one of the scheduled flights listed on the plate. She can then consult a flight reference file to see what amendments have been made to flights operating on the date to which the inquiry refers, and can inform the passenger how he will be affected by these changes.

Occasionally, the computer may refuse to accept an inquiry. In these instances the ASK button is automatically released. Because of traffic agreements with other airlines, it may not be permissible to carry passengers between two local points of call on a long-distance through flight. Consequently, if the booking clerk attempts to inquire about the availability of seats between these points, the computer automatically rejects the inquiry.

Comprehensive data display

When an inquiry is made, signal lights appear over every appropriate flight column printed on the card. Therefore, if the flight by which the passenger wishes to travel is fully booked, the sales clerk can immediately inform him of seats available on other flights without having to transmit a second inquiry to the computer. The computer can retrieve data about all the flights operating over a particular route just as quickly as one flight. In fact, less information has to be entered on the keyboard of the interrogation set because the particular flight in which the passenger is interested does not have to be specified. Thus, the more comprehensive data display does not occupy any additional computer time, nor add to the operating costs.

Whenever the clerk makes a mistake, or a technical fault occurs, one of the group of four signal lights situated in the upper right-hand corner of the keyset is illuminated to indicate the nature of the error. All inquiry signals must contain a standard number of characters, and if the operator has forgotten to select a key, a white light engraved with the letters CR is switched on. CR means check and repeat.

Reliability of computer

Should an inquiry be made about a special flight that may be printed on the plate but about which the computer has no information, then a white signal lamp inscribed N/A is illuminated—N/A for not applicable. In the event of the system failing because of a technical defect, or should the computer be disconnected for servicing, these conditions are indicated by a red signal lamp marked US. The red US light is, however, unlikely to appear as the

computer has proved to be extremely reliable in operation. No regular period has had to be set aside for servicing, and the machine has suffered very few failures—only two in the two and a half years that it has been in use.

Most booking offices are equipped with more than one keyset—the London office has six—and it is customary to connect the sets in pairs to a relay buffer store. The purpose of the buffer store is to hold the inquiry information while it is being transmitted from the keyset to the computer, and to store the answer when it is received. If the ASK button on one keyset is pressed while the buffer store is handling an inquiry entered on the other, a white signal light inscribed with an O (occupied) is illuminated.

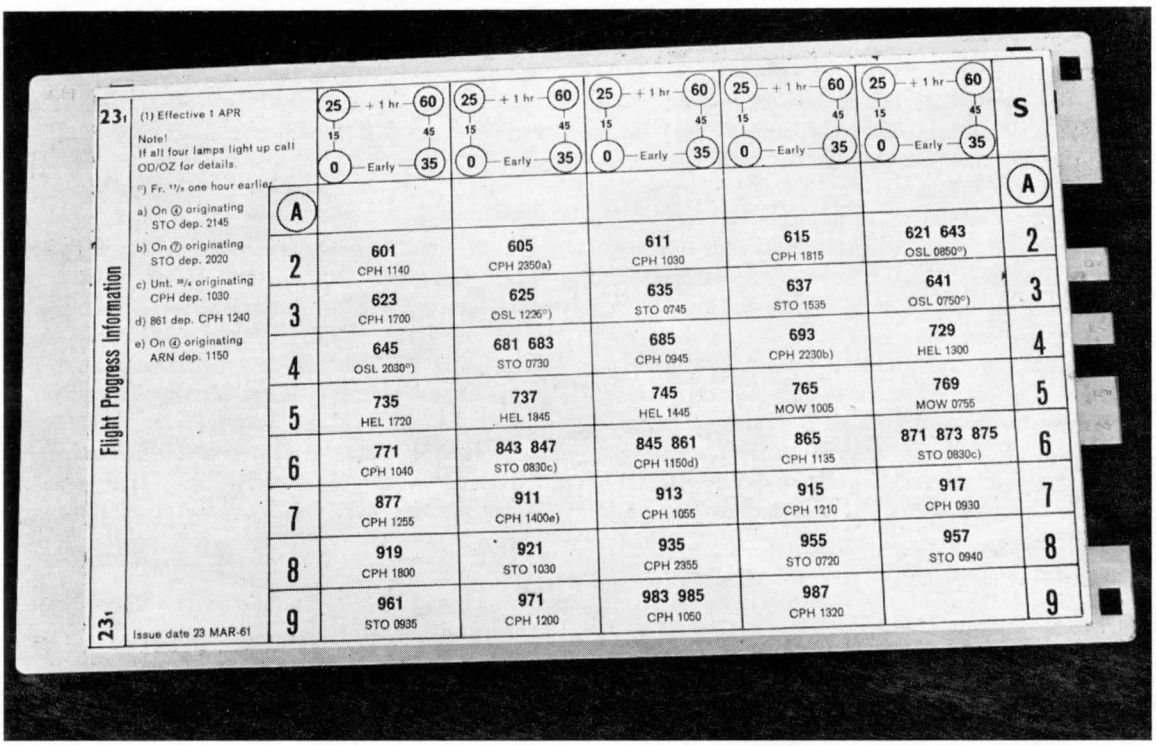
Because the answer to an inquiry is presented as a pattern of lights some provision must be made to confirm that the keyset and all the signal lights are in working order. A test plate is supplied for this purpose. At intervals throughout the day the booking clerk inserts this plate in the keyset and presses the ASK button. If everything is correct, all the lights are switched on, including the four error signal lights.

Another type of inquiry can also be handled by this data processing system. By placing a plate of different design in the machine and pressing the appropriate buttons the booking clerk can discover how flights in operation that day are progressing. In this particular application, the flight numbers are printed in the rectangles formed by two vertical columns and one horizontal row. According to which of the four lights are illuminated above the double column containing the selected flight number, an indication is given as to whether the flight is on time or whether it is early or late, and by approximately how much.

Throughout an inquiry sequence all the buttons selected remain down, hence the booking clerk can quickly check the information entered on the keyboard. If the passenger arbitrarily decides to change the day on which he wishes to travel, all the booking clerk has to do is to depress two buttons indicating the new date and press the ASK button once more. Hence, from the clerk's point of view, the keysets are extremely easy to use. In addition, for the convenience of the booking clerk, a considerable amount of additional information is displayed on the plate. A group of standard abbreviations and symbols is printed adjacent to each flight number. These inform the clerk, among other things, of the type of aircraft used for the flight, the classes of passenger carried, and the days on which the flight operates—all this in addition to the airport arrival and departure times which are printed in the column below.

Although each plate is divided into nine vertical columns, more than nine flights may be recorded on each plate. Where two flights operate through the airports listed down the side of the plate but call at different points, then details of

A flight progress information plate



these two flights can be printed in the same column. Obviously, it is desirable to include as many flights as possible on one plate so that the clerk does not constantly have to replace plates in the keyset.

It is apparent that when making an inquiry the booking clerk does not have to perform any operations which are not reasonably straightforward. Consequently, only a minimum of instruction is necessary. Also, as stressed earlier, at this stage in the development of the system, nothing the booking clerk may do can alter the accuracy of the information stored within the computer. When restricted to processing inquiries the system is virtually foolproof.

Whenever the ASK button is depressed, the keyset is automatically connected to a buffer store and, depending upon the keys selected, so a series of relays are operated. A scanning circuit then examines the setting of each relay in a pre-determined sequence and transmits a serial pulse signal along a landline to the seat availability computer.

All the keysets in Copenhagen, both at the airport and the air terminal booking office in the centre of the town, are permanently connected by private landline to the computer, which is situated in the basement of the air terminal building. Keysets located in the more distant centres such as London and Hamburg are connected by lines that form part of the S.A.S. world-wide teleprinter communication network. As a rule, these lines will be occupied transmitting teleprinter signals at the moment a booking clerk presses the ASK button of her keyset. When this happens the inquiry data are transferred from the keyset to the relay buffer store, then the teleprinter message is interrupted automatically, and the teleprinter line is connected to the buffer store. The inquiry signal is transmitted to Copenhagen, where a switching unit directs it to the computer. The circuit established in this way is maintained until the reply has been received from the computer and transmitted back to the relay buffer store. Then the line is relinquished, it is re-connected to the teleprinter that was stopped, and the transmission of the teleprinter message continues from the point at which it was interrupted. All these actions are performed automatically.

A reservation inquiry initiated in London seldom interrupts the transmission of a teleprinter message for more than five seconds.

Within a year interrogation sets will be installed in centres such as Stuttgart, where the volume of traffic does not merit S.A.S. leasing a special line, and so the public teleprinter lines are to be used. As far as the operator is concerned, the procedure for transmitting inquiry data remains the same. However, after the ASK button has been pressed, and the data have been transferred to the relay buffer store, a dialling signal is automatically sent to the local Telex exchange to connect a line to Copenhagen. When the link has been established, the inquiry signal is transmitted to Copenhagen. As soon as the reply has been received at Stuttgart, the public teleprinter line is relinquished automatically without the operator having to perform any further action.

Handling inquiries economically

An inquiry from Stuttgart will normally be dealt with in eight seconds, consequently, the hire charges for the use of the public teleprinter line for this length of time will be modest. For centres where the number of inquiries is not high, say, less than 100 a day, this is the most economic means of connecting a keyset and the computer together.

At certain points in the S.A.S. communication network, such as Geneva, a special unit called a sub-concentrator is installed. The purpose of this unit is to receive signals via leased teleprinter lines from up to ten satellite sales offices located in other cities, and to re-transmit these signals over the S.A.S. private line to the computer in Copenhagen.

After the connection between the computer and a keyset has been broken, the information sent in reply to an inquiry is not lost but it is held in the relay buffer store and the indicator lights on the desk set will remain illuminated as long as the booking clerk wishes. When the inquiry has been dealt with, the clerk cancels the lights on the set and clears the buffer store by pressing a key marked REL (release).

While information is being displayed on one keyset, an inquiry entered on the second keyset connected to the buffer store cannot be handled. If an attempt is made to transmit this inquiry the white signal light marked O (occupied) is illuminated. However, as soon as the first operator presses the release key on his set, the O signal light on the second set is extinguished, and the second operator then knows that the relay buffer store is free to accept and transmit his inquiry.

The seat availability computer located at Copenhagen was specially designed for this work by Informatikwerk, a division of Standard

The seat availability computer was built by the Informatikwerk, a division of Standard Elektrik Lorenz A.G.

Elektrik Lorenz A.G. of Stuttgart, Germany. It comprises two magnetic drums together with the necessary electronic control circuits.

Each drum contains 320 recording tracks and an electromagnetic read-write head is provided over each track. One thousand bits* can be recorded in each track; consequently, each drum has a capacity of 320,000 bits. The drums rotate at 3,000 r.p.m.

It has been emphasized previously that the computer does not keep totals of the seats booked on particular flights but only the status, or availability, of the various classes of seat offered on each flight. There are four degrees of availability, corresponding with the four light signals displayed on the keyset. To recapitulate, there are: green light—seats can be sold freely; red light—flight fully booked; red and green lights simultaneously—cushion level reached, bookings to be confirmed individually; no light—flight does not operate that day. A two-bit code group is sufficient to indicate all four conditions.

Information about flights operated daily are recorded on one drum and data concerning periodic flights on the other. A complete flight record comprises a sequence of entries—one for every stage over which the flight operates for every class of passenger carried. In the case of daily flights each entry is recorded in a single row spanning 160 tracks on the drum—that is half the width of the drum. Details identifying the particular flight are recorded in the first 20 tracks of each entry. This part of the entry is called the address, and contains information such as the code number and side of the interrogation plate on which the flight data are printed, the flight stage and the passenger class. In the next 140 tracks allocated to the entry are recorded 70 two-bit code groups which define the seat reservation status for that passenger class over that flight stage for the next 70 days.

Because 1,000 rows can be recorded round the circumference of the drum, and a similar group of records can be stored on the 160 tracks available on the other half of the drum, a complete list of the reservation status of 2,000 separate flight stages on each of the succeeding 70 days can be accommodated on this unit.

Seat availability data are arranged in a somewhat different format on the second magnetic drum. Periodic flights may only operate once or twice a week, but these services are always flown on the same day, or days. Consequently, it is more convenient to arrange the seat availability information on the drum in the

* For a simple explanation of the binary code see "The universal language of computing," *Data Processing*, January-March, 1959.

following manner. As before, the data are recorded in rows spanning the width of the drum, only in this instance each flight entry occupies 40 tracks. The first 20 tracks are for the address, and in the remaining 20 tracks are recorded ten two-bit code groups which define the seat reservation position for the next ten Mondays, Tuesdays or other appropriate day on which the flight operates. Seven thousand flight entries of this type can be accommodated on the second magnetic drum. This leaves 40 tracks free for other purposes.

Six master keysets are connected to the computer for altering the reservation status data recorded on the drums. Four of the sets are located in Copenhagen—one in the computer room, the other three in the central reservations office at Kastrup airport. Of the remaining two keysets, one is installed in the S.A.S. booking office at Stockholm, and the other at Oslo.

Records of the total numbers of seats sold on the majority of flights operated by S.A.S. are maintained in the central reservation office—this procedure is described later in this article—and when the number of seats booked on a particular flight reaches the cushion level, or the full total has been sold, then a message is sent to one of the master keyset operators to alter the status information recorded on the drums of the computer.

The master keysets are similar in design to the interrogation sets, and to alter a reservation status the operator inserts the appropriate plate in the keyset, selects the particular flight affected by pressing one of the buttons in the horizontal row situated immediately below the plate and then enters the date, the class, and the cities between which the seat availability status is altered and a key which indicates the new status. When the ACT (action) button is pressed the new information is recorded over the old data on the magnetic drum.

Sometimes a change in the reservation status for one stage of a flight will affect other stages of the same flight, and perhaps interconnecting flights as well. For example, if a flight starting from Helsinki calls at Stockholm and Copenhagen on its way to London, and the Stockholm-Copenhagen stage is fully booked, then obviously no more passengers can be accepted for the through flight from Helsinki to London.

Although six master keysets are in use, no confusion results because each booking centre is made responsible for a particular group of flights. In point of fact, Oslo and Stockholm only control local flights operating through these airports. Booking information on all other flights is kept up to date by the Copenhagen office.

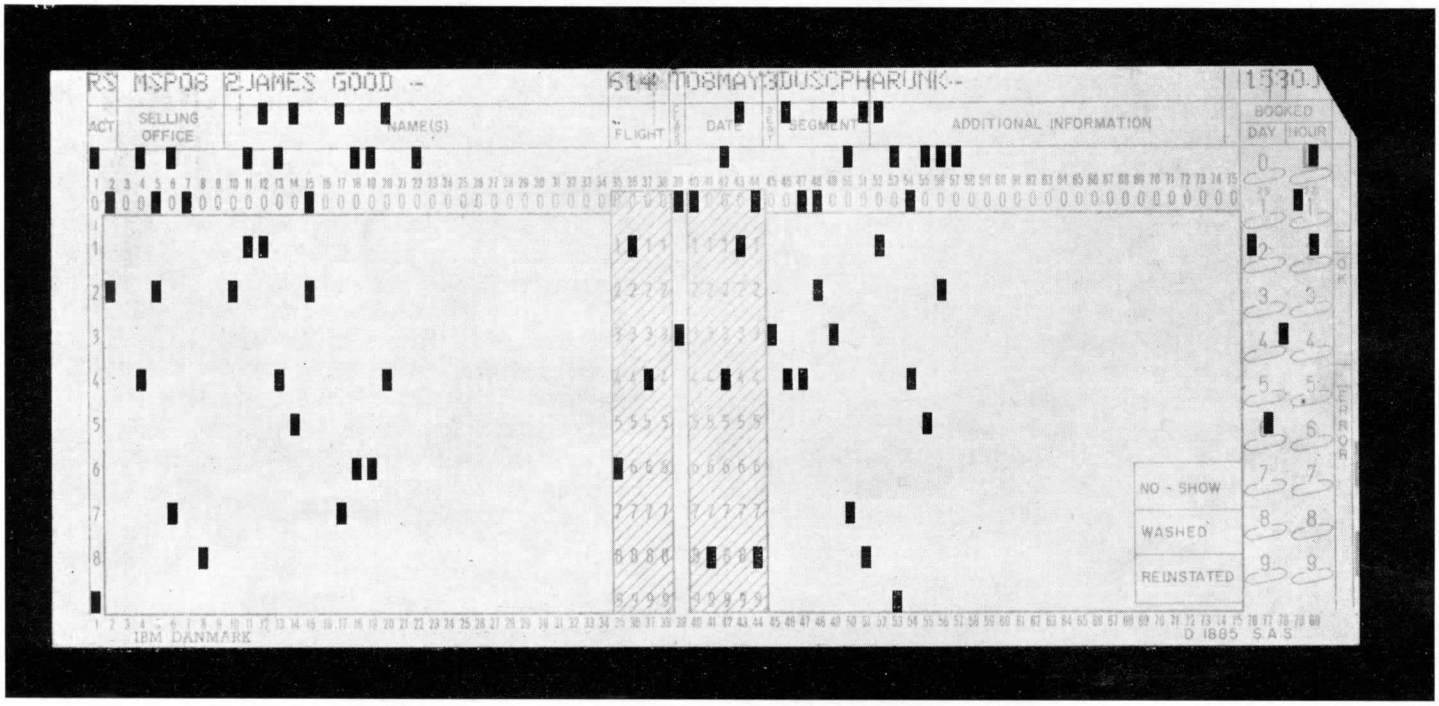
If any other information recorded on the drums has to be changed, such as the inclusion of new flights, this alteration can only be made from the central control console situated in the computer room. A large push button panel is provided on which a complete flight record can be entered manually, and when a recording key is pressed, this information is transferred to the selected location on one or other of the magnetic drums. Also fitted to the console is a large panel of lights on which the data recorded at any selected location on the drum can be displayed for the convenience of the computer operating staff.

Revising data on magnetic drum

Every morning, data of flights operated the previous day are erased from the drum and replaced with data for flights to be operated on the new seventieth day. Because the pattern of flights operated on similar days generally remains the same, the bulk of the information can be copied directly from an existing record on the drum. The practice is to copy the flight information for the sixty-third day into the space cleared on the drum for the seventieth day. While the data are being transferred, all the seat status information indicating fully booked (red light) or cushion level (red and green) are automatically converted to seats freely available (green light). Records of flights not operating (no light), and seats freely available (green light) are transferred without alteration.

After the new day's flight data have been copied on to the drum, the computer operator checks with the central reservations office to ensure that the information is correct, that no extra flights are to be operated on that particular day, and that no large block booking has been made which changes a reservation status. Any alterations of this nature that may be necessary are keyed in manually. After this has been done, a wire is changed on a small plug-board to associate the new group of flight records with the correct date, and then the computer is ready to handle the day's inquiries.

Eliminating the old records and substituting and amending those for the seventieth day seldom takes the computer operator more than five minutes to perform, and the work is always completed before the majority of the S.A.S. booking offices open for business.



Bookings made by passengers are recorded in punched cards

The only time the data transfer operation involves any considerable amount of work is when the change is made from winter to summer time-tables, or vice versa. Then, information about many new flights has to be added and others eliminated. However, once this procedure has been performed every morning for a week, the job of converting from one schedule to another is complete because from then on, as already explained, the flight data for the seventieth day is always copied from that of the sixty-third day.

10,000 inquiries per hour

It has been estimated that 10,000 inquiries an hour (approximately three per second) can be handled by the seat availability computer. Should two inquiries be received together, the second one is held and automatically attended to as soon as the first has been dealt with. When the system has been fully developed, about 350 interrogation sets will be able to communicate with the computer.

Once the passenger has been told of the accommodation available and has made his choice, the seats have to be booked. The passenger's name, number of seats required, class, flight number, date, the code number of the sales office placing the order, and similar data, are sent in a teleprinter message arranged in a standard format to the central reservations office at Kastrup airport. As the message is received, the data are punched in 5-channel paper tape. The tape is then fed through an IBM 047 tape-to-card converter, and the information is transcribed into a standard 80-column punched card and simultaneously printed (interpreted) across the top of the card.

These punched cards are then passed through the reader of an IBM Ramac computer. The Ramac computer is unusual because it is equipped with a store from which information can be retrieved at random. The store comprises a stack of 50 metal discs, each two feet in diameter, mounted on a common spindle rather like a series of gramophone records. Data are recorded in a number of tracks on the surface of these discs which rotate at a constant speed of 1,200 r.p.m. Electro-magnetic reading and writing heads attached to mechanical arms can be moved rapidly to read or record information on a particular track on a particular disc. In the S.A.S. application, the total number of seats

that have been booked in each class, for each stage, of all the flights operating over the next 70 days are recorded on the Ramac discs.

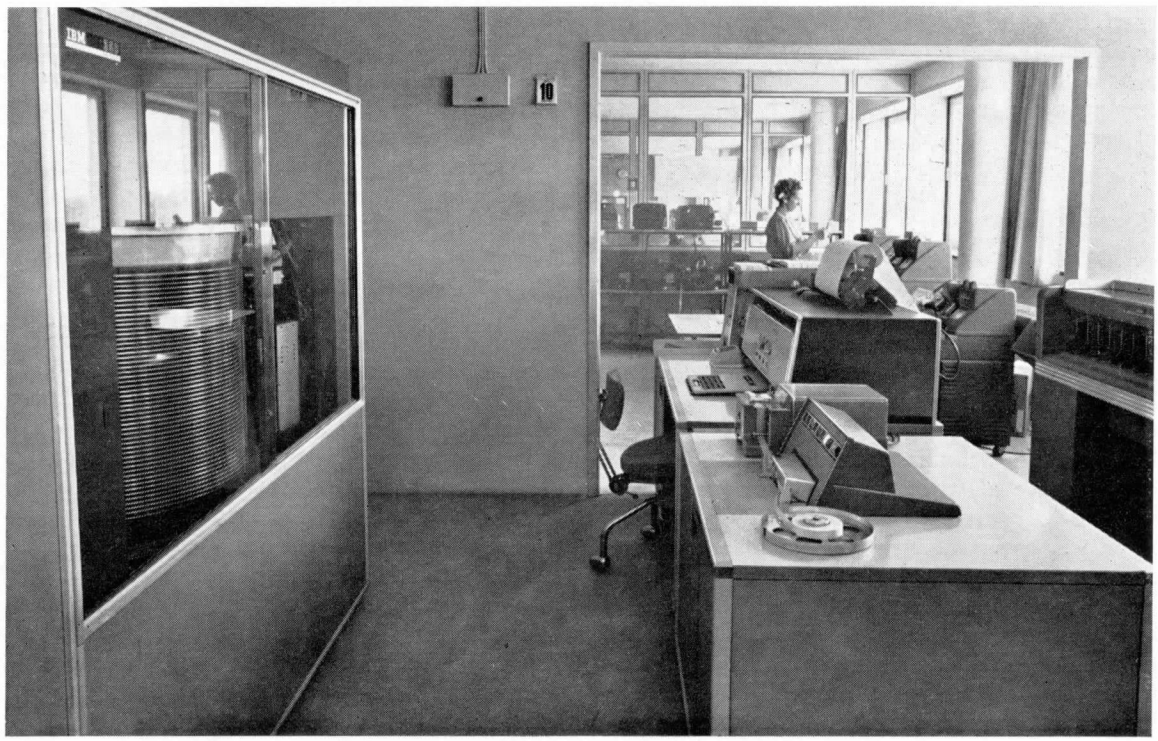
As the punched cards containing sales data are passed through the Ramac reader the appropriate total is retrieved from the disc store, amended, and then recorded back in the original location. In this way, the totals of seats sold are kept constantly up to date. The cushion level for each flight is recorded on the Ramac discs along with the other flight data, and when the number of seats sold reaches this figure, the Ramac immediately and automatically prints out a report stating that the cushion level has been reached on a certain flight stage for a particular day. This information is supplied to one of the master keyset operators who makes the necessary alteration to the reservation status of the flight as recorded in the seat availability computer. The same report is also transmitted over the S.A.S. teleprinter network to all those sales offices which are not equipped with interrogation keysets. A few hours before a flight is due to start, the Ramac produces a list showing the numbers of passengers booked to be carried on the various stages of the journey. A copy of this list is sent to the catering department responsible for preparing the meals.

The Ramac is also used to answer requests for the last few seats available on a flight, when the cushion level has been reached. These requests are referred to as "need" messages. The request is received from the sales office in the usual way, over the teleprinter network, and the data are punched into tape and then transcribed into an 80-column card. The card is fed through the Ramac reader, and if seats are available, the total held on the disc store is adjusted immediately. Alternatively, if the flight is fully booked, the request for seats is transferred to the flight waiting list. Whatever the result, an answer, stating that a seat is available or not, is relayed back to the sales office.

Preparing passenger lists

The punched cards are used for one further purpose. After providing input data for the Ramac, the cards are filed away in date order under the appropriate flight numbers. A few hours before the start of a flight, the pack of

An IBM Ramac computer keeps records of the numbers of seats sold on all flights to be operated during the next 70 days



cards referring to it are retrieved from the file and passed through an IBM accounting machine which prints a passenger list complete with names.

The Ramac computer was installed in the central reservations office of S.A.S. during November, 1960, and since then it has been used to compile and keep account of all seat reservation totals. Before the computer became available, a check was kept on the numbers of seats sold by manually counting the punched cards filed away for each flight.

The Ramac, in conjunction with the seat availability computer, has increased the speed with which information about the changing status of reservations is obtained and disseminated. As a result, S.A.S. has been able to raise the cushion level considerably without increasing the possibility of a flight being oversold.

In about one year's time, the system will be extended to handle bookings as well as inquiries. To cope with this additional work, the seat availability computer is to be equipped with additional magnetic drums to accommodate the extra information that will have to be stored, for instance, the total numbers of seats available on each flight for the next 70 days. In addition, although a considerable number of the agents' keysets are already equipped with full keyboards, some will have to be fitted with the extra keys needed to handle bookings. The horizontal row of ten keys situated immediately below the interrogation plate is provided for this purpose, also the final column on the right of the main keyboard.

Booking seats

With the booking system in operation, after an inquiry has been made and the passenger has chosen his flight, the sales clerk will press the key immediately beneath the column in which details of the selected flight are printed, then a key indicating the number of seats required (from one to four) and, finally, the BOOK key. The date, the departure point, and the destination do not have to be entered because these keys will already have been selected during the inquiry sequence completed beforehand. When the BOOK signal is received at the computer, the appropriate total will be retrieved, amended, and then re-recorded on the drum. Should the transaction alter the reservation status of the flight, then this information will be changed automatically at the same time. The passenger's name will still have to be sent over the teleprinter network, and will be punched in a card as before. These cards will then be kept on file, and will be used as the master reference for queries and for preparing passenger flight lists.

Two other buttons provided on a keyset that may be used during a booking sequence are marked CANC and WAIT. Reservations already made can be cancelled by the CANC key. Passengers can be placed on a waiting list, if desired, by operating the WAIT key.

Punched-card master file

When the system has been developed to the extent that bookings can be accepted, the sales clerks will be altering the information actually held on the computer's magnetic-drum stores. A few mistakes may be made and it is for this reason that the master punched-card file is to be kept. In the event of a dispute, the punched-card file will be taken to be correct. In fact, from time to time, the total numbers of seats booked as recorded by the computer will be reconciled with the corresponding numbers as indicated by the punched-card file.

By introducing this method of handling seat reservation data, S.A.S. has speeded up the entire procedure and provided their passengers with a better and more accurate reservation service. In addition, the Company has improved its chances of ensuring that each flight is carrying the maximum number of passengers, without the attendant risk of selling too many seats. Further, a tremendous burden has been removed from the Company's communication network which was in serious danger of being overloaded. Before the introduction of the seat availability computer, more than ten million messages were transmitted annually by teleprinter and, of these, about 75 per cent related to seat reservation inquiries and bookings. As the volume of this traffic tends to increase by about 20 per cent each year, the need to reduce the load on the communication network by extending the automatic inquiry service to the other cities served by S.A.S. is obvious.

The regional booking offices have also benefited by the introduction of the new system, because all the manual clerical work associated with keeping reservation records written on a blackboard up to date has been eliminated. All these advantages have followed from installing a European—soon an intercontinental—inquiry system at the relatively modest cost of £500,000.

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