MEMORANDUM

February 21, 1968

TO: Mr. R. B. Johnson
             Mr. L. D. Stevens

Attached are a batch of stories I prepared with your help on the development of the disk file technology.

I would appreciate very much your comments, corrections and approval as soon as possible.

In addition, I am asking Vic Witt and F. J. Wesley to review the articles and, I will also check with Murray Lesser and J. A. Haddad.

Many thanks for your wonderful cooperation.

Howard K. Janis
IBM News
ext. 7264 Armonk

HKJ:vjd
Attachment

TO:

| FOR YOUR | INFO. | COMMENTS | FILE |

REC'D FEB 23 1968

| PLS. | HANDLE | RETURN | DISCUSS WITH ME |

FROM: L. D. STEVENS

Division/Location _____   Editor _____   Date _____

WORKING HEAD: Disks   Number of Pix _____

Please type from line to line. Double Space. Indent 2 for paragraph.   Elite Typewriter   Pica Typewriter

1st line→   SAN JOSE: Early in IBM's develop-

ment of the disk file there were

critics who ridiculed it as the "San

Jose meat slicer." Today, more

than a decade since, the "folly" is

still producing technological offspring.

Those ubiquitous disk packs, now

1 inch   so often identified with System/360,

are an example. In fact, this latest

"generation" of disk files has become

a multi-firm multimillion dollar

business outside IBM. But the disk

technology story all began with one

IBM development -- the RAMAC

disk file.

2 inches   RAMAC (Random Access Method

of Accounting and Control) started

with the first blush of success of

the early electronic data processing

systems of the 1950s. As business

interest in data processing mounted,

some saw a developing demand for

more accessible information in larger

3 inches   memories. Specifically, this meant

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WORKING HEAD: Disks - 2   Number of Pix_____

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1st line→   substituting a mass storage and random

access systems approach for the

serial approach of the early magnetic

tape systems.

The stage was set and the leading

players were Reynold B. Johnson's

research and engineering group in *established.*

1 inch   ~~the~~ San Jose ~~Laboratory, which~~

~~was organized~~ in 1952.

Seven years later, Rey Johnson

was to be asked by a touring Nikita S.

Khrushchev, then Soviet premier,

how RAMAC was developed. He

gave this answer:

"A group of engineers and marketing

2 inches   people identified the needs in commerce

and industry for up-to-the-minute

accurate information on inventory

and other fast-changing data. To

meet that need, they conceived and

designed RAMAC."

Mr. Johnson, now an IBM Fellow,

recalls:

3 inches   "The RAMAC was a concept that

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[More]   [End]

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1st line→ |crystallized over many months and

involved ~~many, if not~~ most ✗ of the

creative engineers hired during the

first year the San Jose Research

and Engineering laboratory was in

operation. "

 The concept of the file included

1 inch a system of rotating disks on a shaft

with information stored in magnetic

tracks on the disks, and with movable

read-write heads which could retrieve

or insert any record.

 By 1953, a data processing system

using this concept was proposed.

This evolved into the IBM 305 RAMAC

2 inches system, announced in 1956. Its disk

file consisted of 50 iron-oxide coated

disks revolving at 1,200 revolutions

per minute and held five million

characters. Two years later, the

disk file concept was incorporated

in the IBM 650 RAMAC system.

The 305 and the 650-RAMAC established

3 inches the success of the file-oriented computer

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Division/Location_____ Editor_____ Date_____

WORKING HEAD: Disks - 4   Number of Pix_____

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1st line→   Data density on a disk is measured

today in bits per square inch. The

first five million character RAMAC

had about 2,000 bits per square inch.

Today's disk packs hold about a quarter

of a million bits per square inch of

recording surface.

1 inch   Hindsight suggests the inevitability

of success. But when the RAMAC

file development was initiated, it

was considered a "high-risk develop-

ment" because magnetic drums and

tape units were still new technologies.

Explains Rey Johnson:

"It was not until many months of

2 inches   assessment of information we gathered

from field studies and visiting IBM

salesmen that our confidence rose

to the level of enthusiasm. We know

then it would be an important IBM
                    addition to the

product. line.

"On the technical side, RAMAC

led to many innovations. Our engineering

3 inches   confidence rose as we overcame each

*The encouragement and help of
Ed Perkins, now retired
from IBM, was of
particular significance
in convincing us at
an early date that
direct access
storage*

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WORKING HEAD: Disks - 5   Number of Pix_____

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1st line→ major technical hurdle." Mr. Johnson

recalled the main laboratory accomplishments

as:

. The building of a laboratory

model of a disk file with 100 two-

foot diameter disks and demonstrating

that they could be spun without *exclusive* noise

1 inch or vibration. *with a modest size drive motor.*

. Coating a disk with oxide by

spinning out the oxide ~~and varnish~~

mixture from the center of the disk.

. Spacing a reading head accurately

with a cushion of air under pressure.

. Moving a reading head over one

and a half feet and two changes of

2 inches direction in less than a second and

transferring information back and

forth between punched cards and disks.

Before the first RAMAC ~~project~~ *was*

delivered to a customer. ~~was even transferred from the research~~

~~group to product engineering~~, the

concept of an advanced disk file took

shape. ~~That led to the 1301 disk file~~ *This concept of multiple ganged heads one for each disk surface.*

3 inches *which was announced* in 1961.

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[More]   [End]

Division/Location_____ Editor_____ Date_____

WORKING HEAD: Disks - 6   Number of Pix_____

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1st line→ In 1957, Research began developing the concept of the replaceable single disk file and demonstrated that it could have a capacity 100 times that of the RAMAC, with more than twice the access speed. Engineering development resulted in the 1311 disk pack file (50,000 bits per square inch).

Continued research and development, combined with new manufacturing technology, made possible later products such as the 2311 disk pack file (100,000 bits per square inch) and the 2314 modular disk file, now used with System/360 (200,000 bits per square inch).

"Except for the voracious appetite for data that computers developed subsequent to the first introduction of large memories in RAMAC," says Rey Johnson, "the RAMAC file development might not have had the impact it did in the computer industry,"

# # # #

John M. Jack, Harker, now responsible for advanced storage products in San Jose recognized the significance of this technology and put together the first practical model of a disk file with a removable disk pack.

ENP of 3/25/68 IBM NEWS ARTICLE

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Division/Location_____ Editor_____ Date_____

WORKING HEAD: Disk Sidebar   Number of Pix_____

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1st line → SAN JOSE: Evolution of the random

access disk memory from engineering

idea to IBM product in the 1950s

was as much the story of a timely

management decision as a technological

breakthrough.

By late 1953, the "wild ducks"

1 inch in the fledgling San Jose Laboratory

had a key development, the read-

write head which rode on a cushion

of air, and had begun to build experi-

mental equipment. But that was a

far cry from a multimillion dollar

development program.

A significant factor in bringing

2 inches management attention to bear on the

new development was a memorandum

written October 8, 1954 by F. J.

Wesley to his boss, L. H. LaMotte,

now a member of the IBM board of

directors, then head of the Data

Processing Division, which encompassed

product development.

3 inches The subject was a new approach

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1st line→ to electronic data processing. The

memo was significant because Mr.

Wesley's judgment was accepted.

The next month the RAMAC develop-

ment engineering program began

with L. D. Stevens as senior engineer

responsible for development of both

1 inch disk file and the IBM 305 system,

which was to incorporate the first

commercially available disk file

memory. Mr. Stevens is now manager

of the Los Gatos laboratory.

and the late N. S. Gifford, a pioneer IBM salesman took over the product planning assignment.

   Mr. Wesley wrote in part: "The

entire present EDPM area is devoted

to a serial storage approach in the

2 inches form of magnetic tapes. I am convinced

that this serial approach is not

what business needs to accomplish

the fundamental requirements found

in the business accounting areas.

We must immediately proceed on the

basis of supplying tremendous storage

capacity and attack accounting problems

3 inches under the philosophy of handling

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[More]   [End]

Please type from line to line. Double Space. Indent 2 for paragraph.

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1st line→ each business transaction as it

occurs, rather than under the present

conceptions of 'batching' techniques,

which are necessary to magnetic

tape approaches.

   "The real ideal way in which business

facts should be arranged, added to,

1 inch deducted from and summarized,

is through a horizontal storage of these

facts with the ability to 'reach in'

and use any single record at will.

Present tape approaches do nothing

but solve present accounting techniques

at higher speeds than those which

are provided by punched card methods.

2 inches This is not new, nor is it exactly

what business needs in the way of

a new philosophy of employing electronics.

   "We must build storage and peripheral

equipment which can spread out into

individual accounts every business

fact (random access storage) and

allow operation of a new concept

3 inches for handling business information

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1st line→ concurrently with its inception. "

Says Mr. Stevens, "As best I can

recall it was Jerry (Jerrier A.)

Haddad who thought up the name

RAMAC. It first stood for Random

Access Memory Accounting Machine.

Later, it was changed to Random

1 inch   Access Method of Accounting and

Control. "

# # # #

2 inches

3 inches

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1st line → SAN JOSE: In 1954 the "wild ducks"

of the first laboratory here -- some

15 or so strong -- were the first

IBM employees to ~~crack one~~ drink

(and smoke,)

coffee during working hours. They

also had a dream.

Lou Stevens, RAMAC system

1 inch development engineer, recalls it:

"If we could develop a random

access disk file capability, we would

change the whole concept of data

processing by providing large-scale *direct access .*

storage .

~~memories~~." Mr. Stevens, now manager

of the Advanced Systems Develop-

ment Division's Los Gatos laboratory,

2 inches adds:

"That turned out to be true. And

many of the concepts that System/

360 is based on were bantered around

in those days. The way the data

is transferred in and out of the

machine by describing field lengths

(sets of data to be treated as units

3 inches of information) was part of the RAMAC

concept. The 305 ~~did just that.~~ *was the first*

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Elite Typewriter | *Pica Typewriter*

to handle

1st line → ~~It did not use field marks but described~~

the variable record lengths by a

specific identifier in the instructions. "

The key technical challenge,

says Mr. Stevens, was getting the

magnetic read-write head in between

closely spaced disks and following

1 inch   the disk surface with its "hills and

valleys" at high speed.

"People thought we were crazy

to talk about moving a magnetic head

at 100 inch per second velocities

and sticking it in between a rotating

disk and a 60-mile gale, " he says.

"That was considered sheer folly.

2 inches It was absurd.

"But the air bearing head was the

the problem of accurately following

answer to high velocity movement

over the disk, ~~and~~ One by one our

other problems were overcome ~~to~~

by a very dedicated group of engineers. "

One achievement that "has survived

the storms of many years and is

5 inches still being used" is the disk coating

*following the disk surface with a
magnetic head. and a
high performance servomechanism
using IBM developed magnetic
Powder Clutches provided.
are answer to this*

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[More]   [End]

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1st line → paint developed by the RAMAC team.

basic principles of the original.

Says Mr. Stevens: "The ~~actual~~ paint

and the spin coating techniques are *in use today*

~~essentially unchanged today.~~ "

What was it like to be part of a

small advanced engineering group

somewhat remote from the rest of

1 inch the company in those days?

"We had the attitude that we were

going to do something the world wasn't

yet quite ready for, " says Lou Stevens.

"The absence of a plant and large-

scale operations allowed us the

opportunity to question the status

quo without feeling too far out. It

2 inches was a lot of fun.

"The environment was certainly

conducive to some pretty original

thinking. Of course, when we got

to the point of ~~really~~ having to produce *a product we had*

~~that was~~ a real problem~~s~~. Without

the resources the IBM Company had

in other places, we were at a dis-

3 inches advantage. It takes time to build *engineering and.*

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[More]   [End]

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1st line→ manufacturing skill.

"Then we all got a great shot in
the arm when the company brought *the late*
some top-notch manufacturing men
to San Jose to develop a plant for our
little wild duck project.

There were a number of difficult
1 inch technical problems during RAMAC
development.

"You've seen the RAMAC 350
work, with the arm diving in between
the disks, " Mr. Stevens explains.
"We had the problem in the early
days of occasionally the arm missing
the space between disks and hitting
2 inches the disk.

"There were many proposed solutions
which seemed good, but we didn't
really understand the basic cause
of the problem, so we felt obligated
to find out exactly what the cause
was rather than patching and curing
the symptoms. Painstaking detective
3 inches work revealed the culprit to be related

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1st line→ to the design of the carriage and its

stability, and we corrected it."

At the time the 305 system was

under development the IBM Company

was in the middle of an industrial

design-face-lifting. What was a

radically different machine in its

1 inch basic hardware design thus *also* required

the solution of a new set of problems

relating to physical appearance.

# # # #

2 inches

3 inches

Division/Location_____ Editor_____ Date_____

WORKING HEAD: 305 System   Number of Pix_____

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1st line→ ARMONK: As the concept of the

random access memory was being

developed in San Jose, other new

technologies were also rapidly over-

taking computer designers. Thus,

in retrospect, it may seem para-

doxical that in the 305 system which

1 inch saw the introduction of the RAMAC

memory, the decision was also

made to stay with vacuum tubes rather

than use transistors.

The stored program concept for

main memory was also still new when

the RAMAC file memory was de-

veloped.

2 inches Before IBM's first internal stored

program memory was developed

for the 701, the tranditional approach

to storage was the "plug board"

approach, which required a metic-

ulous wiring of the circuits in a

machine in accordance with a

specific sequence of instructions.

3 inches

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[More]   [End]

Division/Location _____ Editor _____ Date _____

WORKING HEAD: 305 System--2   Number of Pix _____

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1st line→   Murray L. Lesser, director of

systems technology, CHQ, recalls

his participation in the development

of the 305 RAMAC:

"Most of us in those days were

plug board men. There were a few

stored program people, but not

1 inch many. We decided that what we

wanted to do in order to get a min-

imum cost machine was to try to

take the best of both worlds.

"We literally designed a lot of

that system around a table. We asked

ourselves what we could best do by

stored program means and what best

2 inches by plug board. We decided one could

transfer data best with a stored

program -- that was always a

nuisance in the plug board with all

those wires to string -- but one

could make decisions a lot easier

on a plug board.

"That's how we arrived at the

3 inches organization of the 305 machine.

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[More]   [End]

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Number of Pix_____

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Elite Typewriter   Pica Typewriter

1st line→ The decision-making was done on

the plug board and the data transfers

on the stored program, and we

provided control paths back and

forth between the two. "

           #   #   #

1 inch

2 inches

3 inches

Approved_____