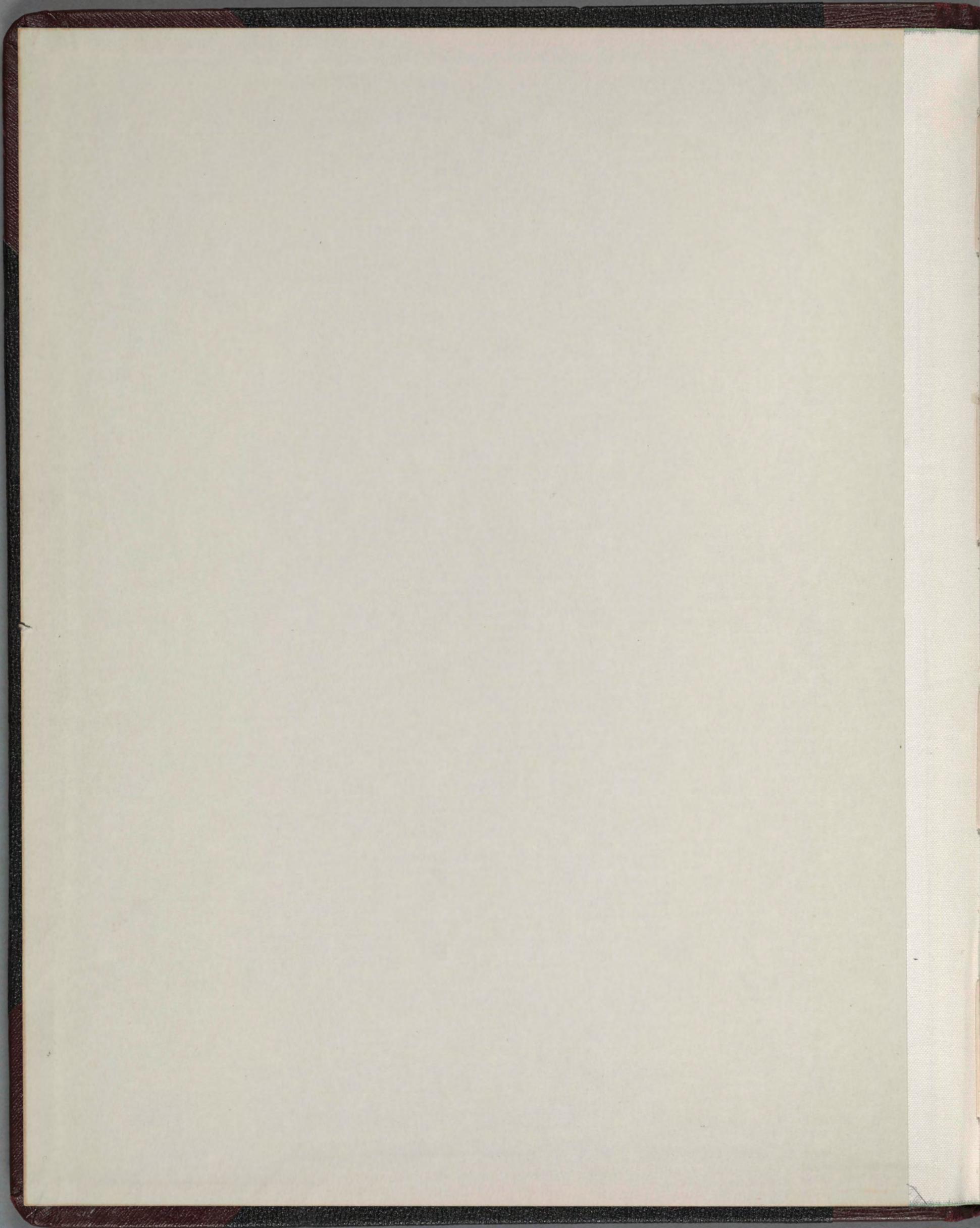


G. E. MOORE

F O R

10/62



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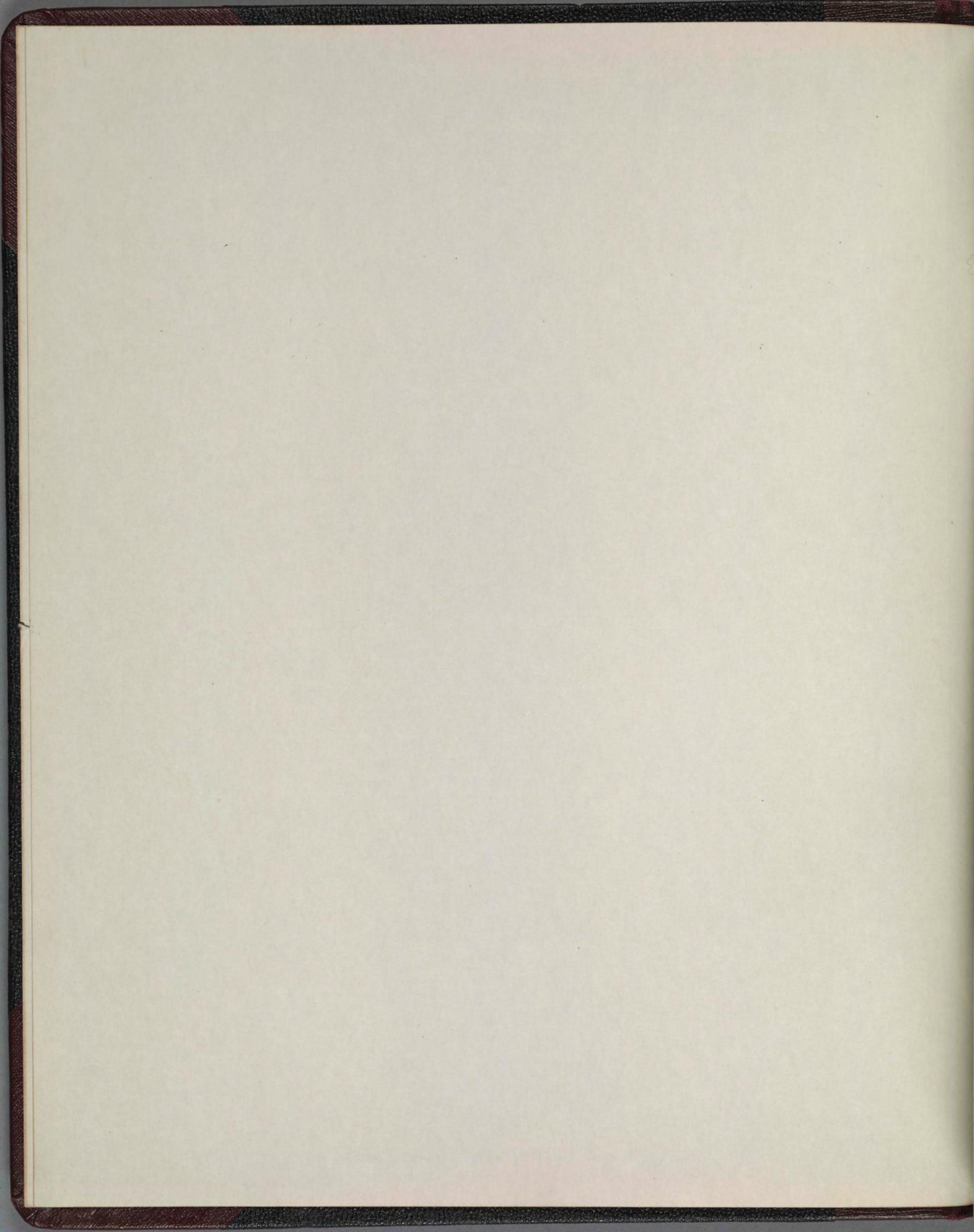
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4/3/67 - From J. A. Martin "The Innovation Process in the Bell System",
Stanford Research Institute, Menlo Park, Calif. Nov. 1965. 1

A statement of some of the tasks which the systems approach performs:

1. To appraise limitations, needs and opportunities - to state overall goals and give them priorities.
2. To identify alternative potential solutions and develop measures of their relative effectiveness.
3. To distinguish between what is known and what needs to be known about goals and alternative solutions, and finally,
4. To select and develop the most promising combinations of problems and solutions.

2

Significant areas for work on Semiconductor Problems

Microstry

1. Film resistors
2. Capacitors ?
3. Multiple chip assembly ?
4. High Q tuning element ?
5. Multilayer Interconnectors ✓
6. More complexity ✓
 - a) Yield improvement
 - b) Living with low yield
7. Smaller size ✓
8. Packaging ✓

MOST

1. Single device, 1 polarity
2. Single polarity integrated circuits
3. Single polarity integrated linear circuits (ac coupled)
4. Complementary individual device
5. Complementary integrated circuitry

Xistor

1. D.C. Power
2. UHF Power
3. High voltage PNP
4. Low current, low noise
5. Power SCR's
6. Field effect transistors

Dioder

1. G.P. Zener
2. Package

Other devices

1. MFESFET
2. SCT
3. ~~EE~~ Tunnel diodes
4. GaAs diode
5. GaAs light emitters
6. Optical transistors
7. Metal base Xistor
8. Surface barrier emitter Xistor
9. Barrier barrier diodes

May 10 - 17

3

1. Talk to RNN about the split of products with SGS and our Instrumentation Div.
2. Stan Prentiss from NASA called regarding low-power circuitry. He would be willing to buy 1000 pieces on our idea of the spec.
He wants 1. a dual 3 input gate
2. a 1-s flip flop - to operate in the 200Kc clock rate range.

He has seen our p/c 1131, 1121 from China from M.V.

He doesn't like TI - 15 mW off "4 FF driver by gate".

Philco has shown their MEL line, gate dr; Drayc. wgh? (300 µwatt on gate)

Sprague has shown 18 mW as opposed to the 15 for Sprague

Action required: If we can see a time to deliver the 1000 units, we should show samples of our present gate and get the order.

- ~~3. See Charlie about D.D. relay structure.~~

- ~~4. Bob Ryden wants us to contribute a committee member to the technical program committee for Semiconductor Device (Such has I.C.'s). English is organizing a couple of sessions on secondary breakdown.~~

- ~~5. Ed Sachs needs a 1 page summary of what I will say at Miami.~~

- ~~6. Handle the Mallory deal.~~

- ~~7. Dig out a I. C. committee chairman for Earl Thomas (201-1405-2100 ext 576, 577). Also check to see if Grove would be interested in the Sol. St. Dev. Comm.~~

- ~~8. Al W. needs purchasing, secretary decisions.~~

May 17-23

- ~~1. Talk to VHG, call Thomas with a committee chairman
201-HV5-2100 Ext 5760577 (Newark)~~
- ~~2. Call Herb Kroemer~~
- ~~3. X Talk with Graham and ~~Hedmond~~ leads about the advisability of
trying to team with UNIVAC on the Night Field, SAGE Program.
See Stantoffer (215-MI 6-9000) Vinces, Philly., as early as a couple of weeks
to RFP.~~
- ~~4. Talk with RFB. about T2L for Mining Hwy (Norm Lowey would like
to talk to me about it.)~~
5. A "hot" job prospect (from Canner Mead) - Bob Bowes, 5441 West
477th Street, L.A. 45. (He must be contacted personally if we are
to get anywhere - Canner thinks he is very good.)

Now at Hazel, Culver City
in Adv Tech. Group

Bob
Needs a little ground
work.



Bob Bower
5441 West 77th St
L.A. 45

Caren Mad suggested

GORDON E. MOORE

MS + 1 year -
dropped out from
part of money.

One of Heade
better guess - in
Worked in J. Burns' room
on MOST's (stated it
at P.S.I.)

7

May 24 - June 1

5

- ~~1. 5-year plan~~
 - ~~2. Write Harry Wood~~
 - ~~3. Get course set up~~
 - ~~4. Get abstracts straight~~
-

July 2 - July 8

Things that must get done before I go:

- ~~1. Honor program decisions to Campbell.~~
- ~~2. Dave Richardson - see Slt / pt - Lauritsen, replacement? Sam?~~
- ~~3. Jeff Wilson re: photo-fab~~
- ~~4. Seeds (2nd choice - Spain) re: 4.10 committee~~
- ~~(5.) Layout the "after Europe" meetings~~
- ~~6. Program Report~~
- ~~7. Get briefed by Palmer on European operations procedure~~
- ~~8. Key people list to speak~~
- ~~9. See fax - Packaging~~
- ~~10.~~

1. Memory organization - who? How? - R&D n Eng split.
2. Work up the diode product plan.
3. Get decision on NASA resident engineer to let front by 8/7.
4. See Sparks abt
 - a. Product Manual to ITT
 - b. Front - NASA
 - c. IBM
5. Write letter to WESCON people

Random jottings for P.R.:

Gerald's

15. 5-year plan issued
16. low processing capacity for i.c.'s
17. linear ch - & present re-organization
18. New fab
19. ~~HP~~ personnel - 400

Plugs:

12. 1. Lack of overall mechanism
13. 2. Mechanism of MOS red. damage
3. Edge-effect severity on MOS, especially n-channel
(and encouraging (?) results in deletion)
4. Our n.f. pattern is working

M&P:

1. Glass process to M.U. - we make glass
2. Banque Si.O₂ process
3. The epoxy data sounds great -
Why don't we go?
4. Trouble ceramicizing 1500 v devices
5. Want one ultra-flat plates for S&R

DIBS

1. IBM 3 weeks of stuff
2. Directive for 2-layer
3. FFMID in Feb
4. 400Mc @ 1.5 μ m in spread (optical base) Oct
5. 1st MOS arrays

12. Open new project for Metal/Glass Plating
13. Why did the delivery on the David Morris camera extend out so far?
14. What is this "black mask" stuff M.U. (P.D.) is taking over?
15. Can we get the Memox gold back from last year?
16. Get J.D. set up with a Si.O₂ wafer to put film on everything!
17. Get out web report to WPAFB.
18. Cut down scattered M&P work - restrain it!
19. Focus Blech's work!
20. An elimination studies? - See York.
21. Re-channel annealing doping work - or get device results - Dick fit?

⑩ 6. Our dice not at N.U. waiting for IBM phys.

⑪ 7. Mask composing

↓↓↓↓↓

1. Photo-disk phys sample exist

⑫ 2. light - frequency converts - 0.170 nm \times 10⁻¹⁰ nm^2/sec

3. New data format - need for Marketing support.

Dev. Dev. & Dev.

1. Open record against Experimental-gated MOS.

2. Our process, poorly controlled, make

3. 1250 - a good one anyway - now to design paper.

2. 3. 807 - complete TO 400 - dr

1. 4. 300 - 307 - need plan in Contamination, yield

2. array 0.4000.

5. HED for TV in 8 fm (back street)

2. 6. Common work in X-ray

7. Plasma II problems: 1. E.O., 2. annealing

⑧ 8. Our red. rec. got in!

→ 9. Let's make sure that appropriate time is being charged to the low porosity contact

20. What are the DIBS experiments phys.-silicogen?

21. What is the story on gate oxide for the R's?

22. See Fabre on the low T glass and paper

15. Shorten progress reports, especially on photo-lith.

16. Why don't we stay and re-grow oxide on device?

17. Talk to Oldeng to learn his plasmaworks

18. What happened to the ~~gold~~ poros gold

Action items:

1. (?) Transfer the GaAs Schottky barrier diodes to D.D. or I.S.

2. Visit the Cernet R's - are they useful?

3. Anger for Ta?

4. Lehigh project? - Shallow engineering insulator deposition, I believe.

Week of 11/8/65 - 11/12/65

7

1. Update personnel requirements to Dan Palmer to correspond to the 5-year plan. Staff - oh.
2. Decide on offer to Max Kudin.
3. Lobby (?) for big Dilling - see Hogue + Spork.
4. Write CTS re consulting agreement.

Week of 11/15/65

- 1. Plant engineering - problem. To
2. Set up the formal process by which project objectives and project number will be developed for next year.
- 5-year meetings - Dill/Heald input - project review also required. To before Monday
3. Formalize feelings on long range organization - particularly the Dev Div portion.
4. Define for accounting the way I'd like to get data.
5. Get the thin film projects under tight ~~area~~ control. In particular, where do these fit within the organization?
6. What did Palmer do with the info I gave him on Dill(?) & Hough?
7. Get offer to Kudin
8. Talk with Spork re: approval of the expanded systems program for 1966.

Meeting of 12/10 - 12/10, 1965

1. Develop a short-term cultural and economic plan

2. Fix off our time to discuss (with R.L.)

3. Prepare a planning plan for longer term so as not to preclude other

4. Write to R.L. if there is a sufficient letter

5. All of the above to agree to a R.L. S. and draw

Meeting of 12/13 - 12/13, 1965

1. See above

- a) Bitumen
- b) Rice
- c) Seals
- d) Soot
- e) Steel
- f) Kite

2. Prepare Report

Meeting of 12/20/65

3. Write CTS

4. Write to R.L. S. and draw

5. Consider that can adequately avoid measuring program except to

4. Obtain a format (with example) for point objective report.

4. Write mid Bitumen, Soot, Kite, no: point objective. Confirm it follows

5. Write paper on Middle East Summer

The plan:

12/15/65

9

1. Programs Projects - Get everything on paper
2. Personnel - Get a program to match needs with ability to get MOTIVATION TECHNIQUES !!
3. Politics - Influence extend organization by assigning specific responsibility
4. Facilities - Building and equipment layout.
5. Image - Layout program for internal and external
6. Planning - Products and future

1/7/66

1. Bibliography
2. Phase R&D
3. Project list

1/11/66

1. Get out draft of letter for WAFB.
2. Write Lockheed work statement draft.
3. Send to Bill Kittinger by Feb 3 a several page letter concerning RHM's contribution to integrated fits. This should tell why, how and what was done; implications of the accomplishment, etc. It should have a scientific flavor and a sense of drama!
Also send a biographical summary.
4. Import to Sam Larive on academic support
5. Get deal with Sch straightened out
6. Invite Hampshire up

10

Jan 28, 1966 - Work as a result of Caltech visit:

1. Write letters to form students - Parker, Puckett, Vise, Jenkins
2. Send i.c.'s with data on design, etc. to Hielet.
This should include typical application and design considerations
where we have them.
Suggest 702, 709, non digital (Widlar paper?)
3. See what (if any) surplus semiconductor equipment exists and might
be surplus. This could include lapping and polishing, strip sour, E. & pot
probe, etc.
A supply of nice useful material would be appreciated. This is
for Humphries.
4. Also write ~~please~~ a letter containing a ~~since~~ invitation to visit
~~us~~ as a prelude to some consulting agreement.
5. Carter Mead will be here Feb 4
6. See S. Snow - we shall have Carter run another Alan(II) to make
the data good.
7. Francisco & Padovani of TI, a Stanford Ph.D

From visit to SDS

1. Get 1st tasks defined on super lens design, via ~10-12A
design purchase order.

3.

1. ~~Left ad young and the Boundary; - See Sooty~~
2. ~~N.W. (Sect. 1, Sect. 2) south of Laramie and south of the boundary~~
3. ~~All left, the boundary and W.S. + E.W. boundary~~

Bottom

4.

1. ~~All the same floras than the small Clinton cliff bottom~~
2. ~~Bottom horizon to the top middle~~
3. ~~Bottom floras - all the same~~
4. ~~Clinton floras - all the same~~
5. ~~Clinton floras - all the same - only last~~

1. ~~Bottom:~~

Feb 14, 1966 - Flora from Isaac's

12

Feb 25, 1965

1. Teach personnel dept abt the bonus program
 2. Prepare Palmer to present the fringe benefit program next term.
 3. Make sure we have the M.S. students we need scheduled in.
 4. " " " " " Ph.D " " " " "
 5. Complete the deal to get automatic mail-making started under York
 6. Find a phys. Dept Head.
 7. " "

March 7, 1966 -

By dept

30-10

30-20

1. Arrange meetings for project schedules
 2. ~~Phone Kappel~~
 3. ~~Clear up deal on Hope - (see Kroener, call Hwy?)~~ - Hobell's video replacement!
 4. Start survey of magnetic data-recording techniques.

30-30

- ~~1. Clear up Phoenix entry.~~

~~2. Get info on S of All fellowship~~

3.

4.

30 - 25

1. ~~Get Rex, arrange Stanford fellowship~~
 2. ~~Get Rex's input on testing of analysis~~
 3. ~~Get final info on Dova site~~

30-40

1. Make sure CTL clean up is going in fast or small
 - 2.

30-70

Ward 7, cont

13

INTERNATIONAL
56-800

30-80

30-90

1. Get plan from Palmer

Sprink

Yont

Valentini

Misc.

- ~~1. Complete Called fellowship~~
- ~~2. " U of C "~~
- ~~3. Get final input on Iowa site~~
- ~~4. " " " U. of Ill.~~
- ~~5. Write a summary report.~~
- ~~6.~~

14 March 23, 1966.

Principal problems:

1. Personnel

- a) We are short many critical people
- b) " have an inadequate supply of candidates
- c) Our training of girls ~~paper~~ see out
- d) We are losing top girls because no advancement possibility.

2. Taking advantage of what we can do.

- a) Many product problems, most only partially technical
- b) Wasted work in many areas

3. General moral - Several changes must be made

1. John Barret has a Russian visitor - can we arrange a visit to the lab?
2. Call C Hugh Mayr, Wappinger Falls, N.Y.
3. Call Nozce to call Bob Hall.
4. See Solt re: his 5-year plan to grow as described.

March 28, 1966

15

1. ~~Analyze meeting to clear up the array tester program.~~
2. Decide (or talk with Sam to decide) about Rodriguez & Callid. Call Hauglin.
3. Send to Hauglin a copy of the ~~committing agreement~~.
4. Decide upon the arrangement (time and who) for the trip to MIT.
5. ~~Program the Stanford M.S. recruiting~~
6. Get together with Harry Esser all
 - a) Making quite technician
 - b) Filling on needs from Mtn View
7. Project goals - either do them or tell everybody no.
8. Find out from Farber all NEC glass - when do we get some
a) " " " input

March 31

- 30,20
1. Survey how much space we could make available to M.V. as a function of time in the new facility.
 2. ~~Find out what Lehrer program is -- spend some time with him.~~
 3. Talk with Kremers
 - 4.

April 5, 1966

1. Search for contract areas
Mg Methods — 250K
I clean for Steenbyen —
" " Johnville —
Run Solar bus SFR - 50
2. Get write-up on power follow-on to Walt Chamber
3. GTI (a supplier to San Rafael) would like a speaker (since invitation) on packaging for a Providence, R.I. company making jet bags to Kiel.

~~of informed EN, a see word child by myself~~

5.

~~4. Changes and the fields left~~

~~3. Which direction on compass direction~~

~~2. Where is CES no: CTS~~

~~1. Frequency Report~~

Thinking to get down before day:

~~8. Add a chimney ad mud~~

~~7. Changes a "off" of all insulation - paint on insulation and floor~~

~~6. Change the surface soil at the place. After do we get ground going and brick walls in all places.~~

5. Poured planning at the first

~~4. Pouring paving must of plumb. The function of the other
commute need to tell of a little commutes.~~

~~for the details, roof, floor and surrounding~~

April 21, 1966

17

1. For staff meeting - how many summer students can we handle? where?
2. There are several things to do as a result of the 4/20/66 staff meeting
 - a) Understand the significance of the Oak tree program
 - ~~b) straighten out CTC~~
 - c) Continue to follow the riverine β problem
 - ~~d) see if we have a candidate for spot for every monthly~~
 - e) Lay out a program for DIC's, complete now.

4/27/66

3. Set on top of the disk arrays.

~~4. See Selly abt Takif. on Monday
(for Sig N4?)~~

May, 1966

1. Get a classified area set up at M.U.

18 July 4, 1966 - Four readings to identify major patterns:

I. General

a) Pigeon Spot/field

b) Old road + field.

Program: Money map, histogram map, program, binomial of outfit.

All curves

Money

histo

All programs

a) 30-20

II Big spot

longer pattern you to measurement, discussion, comparison
at feature.

b) 30-25

each of program definition and follow-up, it may to see the
color pattern can change so we. Similarly when, the field
program: - when the for the interpretation, then

c) 30-30

Program: field processing capability
Program: - when the for the interpretation, then
at doable.

d) 30-40

1. from circuit from all aspects - forward program, etc.
2. SCR satisfactorily
3. A program that really forms in the form of size.

e) 30-70

Program and input

g) 30-90

1. Program is about half, most
2. Wavelength is much
3. Form of after, and some jet trailing

June 7, 1966 - Notes made while reading the progress report.

Notes in red made 6/23/66

1. Plan and assign the Al-doped Xistor study - Ulrich program?
2. Does Fairchild have some of the high voltage material we will need for very high voltage junctions? (Is it possible to do make it in 2" wafers in any case?) Assign Stoffel the job of defining the problem.
3. Thought of Lewis: Do we really have a program to generate enough info to convince us that our Al-P-Al two-layer system is production worthy? For example, consider the attention that TI is giving to this problem in their rpt! A MOST IMPT PROJECT!
- ✓ *Mtg planned on 6/24*
4. What should our program in ion-implantation be? - A study group effort?
5. Get the phenix organization cleaned up. Get Bittman on top of those things he really understands -- including Doug Trenne. *Must be built around existing people!*
6. The Ta film resistor program is an enigma!
 - a) Why is it held up awaiting a process resister?
 - b) What's wrong with the 2k process?
 - c) Why shouldn't we blast ahead with the 10k process?

Anorange project review
7. I need a review of the Silicid resistor program -- which seems to look good!
Include in C
8. Make sure we have the Xfor vehicles on the new ceramic chip cleaned up.
 - a) Number of leads
 - b) Required resistance in the metal
 - c) Idea of who Xfor what to whom.

Requires much input:

 - a) Status of technology base - others
 - b) Package / device needs.
 - c) Getting it on schedule
1. See Sales of leads, 2. See Table no: *technolog*
2. I would like an over-all view of our present p-n-p-n i.c. program.
Mainman
10. Get lifting for various masking operations evaluated.
11. Get together with Stoffel to see what must be done to demonstrate a NiCr resistor process adequate for i.c.'s and for Paul Schwartz.
12. Formalize the table of dielectric films vs applications and briefly summarize the status.
13. Who is doing what in MoP. It looks like Tuck is doing Mo film instead of tungsten, Stephen is doing nitride instead of tuck, and Lewis is still dithering. *See Sales get program assigned.*
14. What is Stephen's P-diffusion coined at? - Program plan needed!
15. Make sure Sales reacts to the 5-year Marketing Plan -- on paper, not just orally.

20 Notes 6/7/60, cont -- w/ reding program opt

16.

Why is the Mann camera limited in size? - Capability review needed!

mark down

17. From MOS analysis, we don't have a dynamic S.R. → WHY? (Young NSI)

18. A decision on how to try redundancy is needed -- either operate three Sensors, specially bond 16-bit over, or postpone.
Done thru RAC. New project started 6/21/60

6/23/66 - Some philosophy:

21

We have a problem of not moving new technology or research results rapidly to products.

Also many major technological problems are not anticipated.

The ^{basic} exploring of new technology for far-out benefits in devices --
e.g., epitaxial film single layers thru buried layers, cut & fill, dielectric isolation,
etc. is best done by the product groups.

∴ The technology and research done outside of the product areas should be far out. It should be clearly anticipatory, brand new or it should be research ~~group~~ aimed at gaining a basic understanding of existing technology or devices.

A group like Selby's should only do process engineering on a new process until it gets established in another group. Then its off to a new project.

It is going to be somewhat sticky to have competing technologies developed in different departments to get compared. E.g., the comparison of sputtered glass and from vapor is non-trivial.

This is enough info. to define a charter for Mop. - ~~etc.~~

1. All outright multilateral meetings? Who are the participants in these?
2. All cut list of people for Day 1. - As a family, Jon P. etc.
3. Set out procedure for 5-year plan preparation.
4. Talk to Soek in respect about method of fund raising.
5. Create a "team-work" paper on Boardroom orientation for short meeting.
6. What can we know about China Philip-Chips etc. - H.S. ~~to find out about this~~
7. Offer (in writing) of the R.O.D. members availability by Day 1.
8. All R.O.D. should be in contact with the technology we have set up on the film that is probably available to us.
9. Paper and document to hand to middle budget presentation.

Aug 23, 1966

23

1. Is it possible to get one of Campbell's tools for Bob Rockwell's contractor?
2. Make material recommendation to Post on what controls should be added.
3. Who knows something about Kover stampings for Operations (many #).
4. Call Esser on Leron Barnsdin deal.
5. Talk to Nelson Walker abt reader take-down problems.
6. Can we live with 10/17 phone service in new bldg? (possibly 10/10)

1. All could understand what was said to them.
2. CEO would like to discuss program and confirm details, and/or
3. Director would present.

After discussion
with personnel.

AICF-SITE COMPUTER - - how does it work?

EXT 303.

208-677-9731

The program is stored in the

All UA, people say (there is standard code) is from year

new about the program and to collect a particular file.

QA's should start on the first week of NASA's capability to learn

more about the program and how to use it.

standard code

the form will consist of 6 NASA lines, 1 long line

approximately 80 characters per line, all in code, consisting of 14 columns of 72 characters each.

UA and NASA can agree to make the most suitable and

work for the 1969 time period of about 6 months to 1 year.

If possible, the standard code should be used, by

the program is used at the direction of NASA who is responsible.

of dropouts when they will introduce - probably for 1000 jobs.

It cannot be done completely, and there is a 12-hour

in year, etc.

It is probably a good idea to have the program for the first 12 hours

263-565-2071

Please call from UA Computer, University College, Philadelphia, Penn

8/26/66

24

9/2/66

25

1. We absolutely must have some good data on two-layer metal system reliability -- both on the dielectric and on contacts!

26 Oct 17, 1966 - Discussion on Prop. J.C. problem

DTL - Problem: Maximizing "A" grade yield

Seeds
Below
Blame

946:

Slightly below historical highs.

	"A" grade % wafers	Sept	July	June	June	Last week	a mto a mto of this 946 test only
40x40	930:	24% (40% A)	35% (60%)	32 (40%)		21 (60%)	
	945: (flip flop)	13 (60% A)	17% (30%)	26 (60%)		14 (65%)	
	946: (quad 2)	12 (22% A)	20% (25%)	24 (25%)		14 (50%)	
	931:	13 (45%)	18% (35% A)	17 (50%)		6 (30%)	
	932: Buffer	19 (80%)	26% (100% A)	27 (90%)		10 (70%)	
	933: (binary)	42 ()					

In addition we have loss of "A" grade on class and especially on 125°C test. They go down at least 50%.

Start 12,000 wafers/week, 20,000 wafers in the mill, 2 weeks thru fab.

	CTL (grade A)	Sept	July	June	May	Last week
40x40	953: Master gate	16		27	24	18
	956: Source Buffer	17		30	32	19
	967: binary	9	11	12	14	14
	9030:	6	7	7	10	4
	952: Inverter	12				17

9030 has always been a major problem

May & June were right after effort was expended -- three major problems will clear up.

A change to AMER screwed-up all the resistor values.

Jack Below is having meetings with Product Eng., Design Eng. → Us on date.

Oct 31, 1966

27

Things to do today.

1. Review I.M., J.W., W.S. - Must be done by 12⁰⁰
2. Talk to R.N.Y., R.S. to assure a good split-up of the topics
3. Write it on subject to be covered in "FJCC" talk
4. Get A.W. to prepare for visitor
5. Prepare all artwork needed by Thursday morning
- 6.

Other items to be done

1. Make decision on how to proceed on project budgets
2. Detail a plan to arrive at Jan 1 with project objectives, project budgets and project numbers all straight
3. Speculate on organizational changes that make sense.
4. Define clearly what role A.W. is destined to play

28

Nov. 11, 1966

Areas requiring major emphasis by R&D:

1. Solving the process problems on the M²-8 to get it into production.
 - a) Dielectric etching
 - b) Second layer
 - c) Increased dielectric capacity
2. Get the MOS-20 to an existence proof and ready for transfer.
3. Get wafer protection broadly used.
4. Upgrade epi capability to allow the new device to be made.
5. Upgrade quality and turn-around on mask making to allow the new devices.
6. Complete solder flip system
7. Develop an alternative to Al.
8. Develop and transfer high speed DTL technology

Nov 21, 1966

29

Subjects about which to see Sello:

- ✓1. Data on epoxy vs metal can 1250 - Can I have it for 7:00 AM tomorrow.
- ✓2. Duffee's contributions on DIP & CERPAK plating problems. What is it? What is it?
- ✓3. The supply of several wafers of 111 GaAs
- ✓4. Broadening of the Al evaluation study to include the Plymire people
- ✓5. Program on non-Al metal systems
- 6. How should we proceed on the two-layer-metal system problem?
- 7. How can we establish a major project to establish the solder-bond flip-chip process (Al-bond) for Selenes by 4/1/67.
- 8. What is holding up glassing under epoxy? Do our bare chips pass 85/85?

Review & work
end.
? Forbes

30 Nov 28, 1966 - Projects for 1967 in the Physics Dept.
Discussion with C. Bittman.

D

I. OXIDES AND SURFACES

A. B. Deal, M. Sklar, P. Castro

1. Surface States - Effect of Process Variables ✓

2. Dielectric Evaluation (Silicon Nitride Etc.) ✓

3. Gettering Studies - Want a paper for approval. -(Start late)

4. Disappearing Aluminum - Basic Mechanism ✓

B. E. Snow - (Maltz)⁴⁴

1. Non Mobile Impurities in SiO_2

2. Radiation Effects on MOS Structures - The contract

Upcoming workoff → 3. GaAs Surfaces (Maltz)-Possibly you)

C. A. Grove, V. Hsu, D. Fitzgerald, ()

1. Chargeable Surface States - Meas. and Theory

2. Low Frequency Noise

3. Device Exploration and Analysis - Next category

4. Schottky Barrier Theory Contacts in general.

II. EXPLORATORY DEVICES AND DEVICE THEORY

A. R. Whittier

1. High Current Studies

B. W. Hooper

1. GaAs FET

2. High Voltage Structures - for now - restart late

C. G. Reddi, P. Hower

1. Second Breakdown - - - - -

2. MOS, High Frequency Theory } Key under C.B.

III. NEW PHENOMENA

A. H. Kroemer, M. Shyam, R. Rao, R. Solomon, ()

1. Gunn Effect

30 Nov 28, 1966 - Projects for 1967 in the Physics Dept.
Discussions with C. Bittman.

IV. MICROWAVE DEVICES AND MICROWAVE INTEGRATED CIRCUITS

- A. H. Ruegg
 - 1. Read Diodes *aux. band ac band*
- B. G. Bechtel
 - 1. Schottky Barrier Diodes
 - 2. Integrated Circuits with Schottky Barrier Diodes
- C. D. Tremere
 - 1. GaAs Varactor
- D. W. Lehrer
 - 1. Technology for Microwave Devices

V. MAGNETIC THIN FILMS

- A. W. Carter, J. Wright, F. Greene
 - 1. Flat Wire Thin Film Memory

sketch needed

are we too light? =

VI. THIN FILMS, DIELECTRICS, AND VACUUM TECHNOLOGY

- A. J. Campbell
 - 1. Theory of Cond. of Resistors
 - 2. Ellipsometers
 - 3. Misc. Vac Technolgooy
- B. N. Laegreid, R. Martin
 - 1. Sputtered Dielectrics
 - 2. Sputtered Metal Contacts *to Si*
- C. R. Waits
 - 1. Silicon Chromium Resistors

do in conjunction with Seller

30 Nov 28, 1966 - Projects for 1967 in the Physics Dept.
Discussion with C. Bittman.

films

ently active projects

- a resistor

high S₂/I₀ resistor

and. Mech.

tri film

rap film

? F. Synthesis/obstn:

? O studies

? N₂ evaluation

new

Nov 28, 1966 - Projects for 1967 in the M&P Dept. -
discussion with Sello

31

Masking & masking

4 existing projects - no others

Glasser - sedimented glass film technology (wsg)
- glass formation & fabrication

Plastics - polymers - oh

special epi structures - run for all present lineups.

for a number of SiH₄

Epi A proposal to be discussed:

Epi. technology

- High V
1. Special epi structures
 2. SiH₄ program
 3. Epi deposit systems
 4. Epi Evaluation technology

Epi. research

1. Epi film structures

Note: This program has no effort to get better films
with SiCl₄, and

It contains no reactor development for SiCl₄
system to get improved uniformity and/or larger batches

New diffusion system -

Get this to a dyed-spice diffusion program emphasizing

- 1) uniformity of a required diffusion - say boron base
- 2) defect free diffusion

Assembly technology

not ready
feasible assembly - R&D total F.C. system.

32 Dec 8, 1966 - Some reflections after flight back to N.Y.

1. Our ~~initial~~ ^{initial} observations on MoS in the Midwest.
2. What is a new ~~little~~ small part drawn ~~that we should forget it~~ ^{of importance} to particle size.
3. How often do you need substrates such as CdCl₂ and RbClO₄. (RbClO₄)

Dec 12, 1966

Dec 15, 1966

33

Notes from Breakfast meeting with Paul Jr.

- They are working on small machine, Paul has hardware responsibility. He is looking @ LSI, would like to do one machine family outside because they are short of capability inside.
 1st family life ~ 50,000,000 chks. for 1969-1972
 life of hardware (if it goes on). ~ 500,000,000 chks. (then 1975?)

Chks are 100ms, ~ 40-60 chks/unit, 44 pin pitch on .125" centers
 in order to use existing board tooling.

"Not a son for performance"

Need samples by end of 1967 - enough to build two machine prototypes. This means ~ 40-60 types, a small quantity of each.

Production quantities starting late 1968.

Cost objective: ~ 8¢/chk. Ie., \$5.00/any up to 60 chks.

More info: IBM has not been able to exhibit MOS internally --
 It's all in their research lab still.

Jan 11, 1967 - Sode

- We don't have enough info to specify pitch - levels? de
 so Ella get more info for specific pitch
 or else make a general pitch.

2. The only way we make it is MOS to wipe out the 20ms competition.

3. We agree that the only way to meet their time in MOS might be ^{some} ~~good~~ working,

4. Pkg. Cat - I must sell M.U. | 5.

I'd cat
 best cat
 why
 E

Schiff - Schoenig ←
 Conrad - Mannin
 R. No N. S. Spach?
 Seels - More
 Who on reliability of MOS.

34

Enter - 1967! 1/3/67

Misc. jobs

- ✓ 1. Australia? - call Don Rogen
- ✓ 2. Fill out rating form
3. Prepare incentive goals
- ✓ 4. Get 30-90 turned over to Al
- ✓ 5. Get concurrence on starting to adjust non-exempt, especially chemicals ^{batches}
- ✓ 6. Assume that project number sheet gets out this week!
- ✓ 7. Make Baja plans

R&D-oriented problem:

30-20

- ✓ 1. R-F spotted dielectric - ask Clark on etching rate
- ✓ 2. Discover progress (if any) on GaAs FET
- ✓ 3. Catch Wally Carter re: progress & status of wire before Art Helm arrives
- 4.
- 5.

30-25

- ✓ 1. Check in on Ron Smith
- ✓ 2. Be prepared to talk to Art Helm - set up meeting in R&N

30-30

1. Get Si materials ^{program} straightened out
2. Get flip-chip program going with full skeletal chart.
3. Visit mask making, both Mask III & Cr plates. Also check bonding and plans.
- ✓ 4. On the GaAs (Param) why not also a "production" form?
- 5.

30-40

- ✗ 1. Confirm adequate cross-over data existence or mean forgetting same.
- ✗ 2. Get firm plan on comp. MOS
3. Complete layout of line for 100% yield. (Find out what from Development line is doing)
- ✓ 4. Assume that adequate attention is being paid to chis for wire memory
5. Get projects laid out $\approx \$$.

30-70

- 1.

30-80

- ✓ 1. Define and establish a passivated die technology program on basis of Wills concurrence
- 2.

Million problem: 2nd sum - should we add it from Sunday now?

3. Finally if we do it to pay our bill in E-2.

glossy portraits
" " drawings

" " paintings of
glossy portraits

2. All men had 1 time before sunset met.

2nd sum to 30 days off the dolls by #1

Point: 1. Able to sell 2nd (is only 1 now?) - all

Discussion on returning to Cato: 1/3/67

36 3/13/67 Monday

Did all jobs to get done

1. Set up the memory planning job with Sander, Schmitt, Ellenberger (Rogers?)
2. Set up date to visit MOSC M.V.
3. Finish reading program repts.
- 4.

After discussion - but

1. If we use our answer - then what's all?

Mr. Tellekson - A developing down draft - like out there
this same descending wind.

(Other)

Answers by question in class at Ch. 24, 25

All about wind - 80

H.P. has made the own test for himself. And he is
G-2. After this test, he is able to make it for others.

Initially the only reason is oil for H_2 tank.

I'm 10¹⁰ kg by day to night.

Need 1 m 10¹⁰ / month of limestone

All time - transportation and supply can be done & to work on

2. When is our time? All things is about it

Problem is, need to move effectively and cost effective

Problem is by cost of ~ 20 million per year.

Cost: ~ 10,000/kg every other month

Our people are developing oil. All H.P. will sell some oil or
can send in

Costume in 60 M\$ which will cost 25%

Costume = 114

Project of the week: 3/28/67

Get a vital "beam-lead" type program organized

Need: 1. A Crew

2. The following major facilities

from Seeds →

Ready in May →

Not be added →

" " "

A major problem: →

Use M.V. for 1-layer, get monolithic program going on 2-layer.

Proposed project layout:

C.B.

Lead crew

Possibilities: 1. Richardson

2. Campbell

3. Blech

4.

5.

Si_{13}N_4 backup — Joe Goodell

Sputtering backup — Neil Lazier

Metal system backup — Alan Blech

Substrate backup — Dan Faber

Action items:

1. Get C.B.'s inputs on required crew
2. Get I.B.'s feelings: Given that such a project will be set up, does he want on or off?
3. Let Richardson feelings & a picture of where C.B. sits
4. Tell Sello
5. Layout the specific objectives
6. Make the organizational changes.

5/28/67

39

NATIONAL
56-800

Projects needing solution (potential "Project of the Week" candidates)

1. Evolve the Device Development organization in such a manner that it can transfer a big chunk out next March to Ktly. - Side operations.
2. Get straight some kind of a charter for our L1C operation that defines what (if anything) we will do in the direction that Marv wants to go in system studies.
3. Organize the GAs work cleanly & clearly.
- done, 4. Completely define and kick off the 100 T yield project.
T needs memo
5. Get the magnetic memory project vectored and populated.
6. Define a P.R. - type program with continuing output.

40 April 3, 1967

Questions to be answered about Fairchild's "hybrid" business:

1. What do we see as constituting our "hybrid" business environment as type of function, markets, technologies presently, in one year and in five years?
2. Where does R&D make a contribution?

Meeting on 4/5/67 - Valentine, Colvin, Sanden, Big Amis, Kibell, Zost

Valentine

Sanders:

1. Pasties as a prelude to LSI & for long term

1. Al flip

2.

3.

- No one within Fairchild has a clear picture of the hybrid business we are trying to enter.

2-Deg - AL system - full tono

Campbell

Laegri

Martin

Berry

Cleffson (Berry & Loris)

Egnall (Egnall partners)

Dorilag

Guy on electrode analysis (4-week to a subtitle)

Mtn View Guy

To see TAB alt:

1. Ground rules
 - a) short term
 - b) rest of year

Document to bring

a) Profit plan

b) Bldg improvement list.

Specific questions:

+ Budget 1. Sales for rest of year or profit plan?

2. R&D objectives numbers for next few months?

- a) Offers to make - - exempt, non-exempt.
- b) \$ to occupy bldg - expense
capital

April 19, 1967

41

Major R&D problems (non-technical division)

1. Communication with outside world
2. Project orientation (lack of)
3. Managerial quality

Solutions:

Assign interfaces

Reorganize and re-define

Promote, live reorganization

Group requiring
interfaces

April ~26, 1967

Task force for 2-layer Al system (full time)

Campbell - Project leader

Legrand

Martin

Olefsen

(Bang $\frac{1}{2}$ time)

Engrall

(at least major portion of time)

Doriley

Nevada (4-6 weeks until someone can be substituted)

Mtn. View guy

Add Art Flair on electrochemical problem

42 May 10, 1967

Specific problem areas to resolve:

- ✓ 1. The effects of recent re-organization, especially the OnAs task force on Herb Kroenin's operation.
- ✓ 2. What should our program on radiation effects be?
3. Pinpoint and vector our hybrid program
4. Confirm proper direction and magnitude on the magnetic memory.
5. The magnetic memory project -
 1. We need the test engs to do interface checks to Ries tester.
- ✓ 6. Get Kroenin material program decision made.

May 15, 1967

43

Discussion of our MOS program

Establish a going p-channel technology in the lab

(Present program:

DIED

Vadasy

3/15 ~~Alphonse~~ Friedman

Wilde, until last week.

Tech. Set up DKlein
Hartson

} 0057, Monitoring regrindability, complementarity
D-3700 done here and "transferred" -- but now made in Mo.Vo

LTC

Bottrell

Status:

The Klein program has fallen apart in the last month -- and expect a rapid recovery, but future oscillations.

0057 in Mo.Vo. is ridiculous - no stability at all

Complementary: Went from test vehicle to MEGAT recently

LTC: A purposeful, dried program. Absolutely not wanted by Mo.Vo (Kelly Gang)

DIED: The 2-layer metal designs all died.

Single-level design of DDA recently.

Not part design & fab going on.

Fulman doing analysis - looks good

Downey doing solidified design -- A man without a country now.

Beng - pure report - just starting now.

3. Factors to develop and expand the industry

• Good sources of labor for this kind of work.

2. Costs

1. Ferry connection 56 m. ltrax

High cost of labor

2. Building on coastal areas in connection

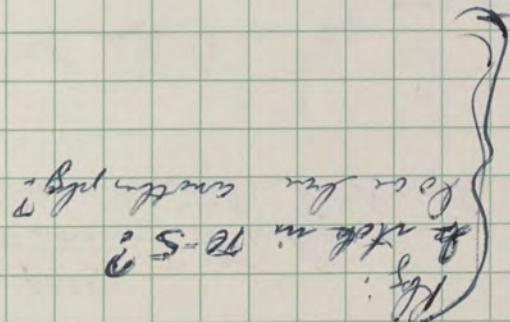
(a) Building of roads in the Sibuyan Sea

(b) Building of roads (part of the port)

1. Establish a port (coastal) in Mindanao as a port of entry
2. Establish a port (coastal) in Mindanao as a port of entry
3. Establish a port (coastal) in Mindanao as a port of entry
4. Establish a port (coastal) in Mindanao as a port of entry



All in no date in U.S.A. cheaper cost than Sibuyan Sea



(U.S.A. is the best)

We can get the lowest in no date in U.S.A. as the fact is very serious that

we are being beaten.

U.S.A. is the best

M.L.

44

On the organization:

Vadasy
3/4 Frolman

- Project leader
- Modeling
- Comp. i-responses (Contract coordinates)
- P-channel
- Area comparison, etc
- Failure analysis
- gate protection

→ Physics project too

The MOS discrete device (and cascode)
will stay in Dev. Dev. with Harlan.

Dev. Dev. will continue to do the i.f. chip design

1. The backside chips (double-layer, not reliable) must be done as a sub-project.
2. The FM6C et al. should be ready to run at any time the process is established.

Steps & timing

1. Kabeil to groove shield
 - a) talk to Plough - 1 month.
 - b) Roden, blded
2. Scodi must talk to Young

1. Talk to Plough, Winkler, Goering about Canada program.
 2. Get input from Marketing re: importance of radiation-tolerant clerics and establish program.
 3. Summarize the MOS fiasco for Bay, Senton, & Holdiff, More
 4. Get the R+D employment situation straight and make appropriate decision regarding offer.
 5. Get a summary of production or program de-bugging on the computer - asked Napp for it on Mon, 6/15, to be available by Fri, 6/16.
 6. Firm up a date for the IBM course
 7. Hybrid program
 8. Lay out the R+D program review -- when?, how?
 9. Start the liaison scientist function
 10. Write thank-you notes as appropriate - no priority
 11. Turn out a "R+D topics" report
 12. Mark III
 13. Expense report
- Wednesday 14: How is the MOS project being charged? How should it be?

Santa Barbara meeting of the Solid State Circuits Group

1. Item of flick: Carl Thomas would like to appear to talk colored and white for teleologically and people.

A letter has gone out proposing a new group on integrated circuits.

John feels it is not yet consolidated.
He could invite him and discuss this informally.

See John Wale about a clear room

48 A summary of the LSI memory program. - June 6, 1967

Projects in W.S. + H.C.'s area

1. High-density MOS with bipolar drive intended for hybrid flip-chip
Being done with 3 geometries, channel stopped
 2. High-density bipolar with 2-layer metal, epiversion
 3. Low-density bipolar on back up for "2" to see what we can do. This
compares "base-coupled & emitter-coupled" cells.
This (emitter coupled) cell looks useful as an associative cell too.
 4. Read-only memory
a) CTR structures
- Contract? → b) Want to look at photo array a la Kablet, but including the addressing
5. Magnetic memory peripheral cells

It is felt that the read-only optical memory would be a very useful product, if completely packaged.

MV is working on 3rd stepping of T² 16-bit memory a la Honeywell-Tranistor (ET)
(This did 8-bit Base coupled for SDS + much drawing)

In fact, all the stuff being done is really dependent on 0.1 mil capability!
Single-level bipolar is not attractive

Our MOS program is aimed at higher density

Our Semiconductor product planning is not involved in memory product planning

Our program should be aimed at a significant product jump on a 1-year time scale.

We must get a memory product plan including intermediate stuff before our

Our design should be in order by ~ 4-6 months

June 7, 1967 discussion in PNAI, P.H., A.G.

49

Schmidt has 3 total eggs now, +1 May + 1 in 5 weeks.

The SGS coordination must be worked out. Our initiative! - One week visit to understand their program.

We need a secretary for Snow & Klemmer -- It could be a girl from somewhere else, or it could be a Memphis girl.

50 Meeting @ Ch. Ypsilanti 6/8/67

100% on Two Men @ 8:00

Vacuum stuff:

- Sellars: 2 Mh III Spotters (pinned) One car intended for MU.
One new

1 NF (black) just sitting around: divide \approx NF. not used

1. NF spotters (pinned) for FD-2 spotting for 2-layer - Cylindrical system

New Mh III 2-gm crop for smelts - Black - doing beam beds

All are doing beam lead by crop, not spotting

Bittner: ^{ee} Mh II & III in some areas, 1 eb, do not doing much now
so no Black

Divide spotting on or - S: - K - S: R (2). Historically don't

Old tank - Van Zyle

Cylindrical system 2 gm crop

New disk spotting system Mh III by far best

Jehn: Mh II, + 2 others

Mh III or old. similar

Stuff for Meyer's stuff (Big + Mh II)

Vanion system. - by Solunar - Cells contacts

Seeds:

2 Mh III, no ^{ob} noted, are c.f. chelated

Candy
Kabel

1. Mh III dice pattern for Cr-Si (Org R)

1.2b Al III MOS only

1. " " II G.P.

1. Mh IV Si-Al for small geo. control

1. " " III G.P., varice, fil.

1. Ni fil G.P. (Plan, etc.)

1. "Clear" Au, Ag, Pt some with Ti fil

1. Ptgd Au Mh II fil (Gold nibble)

1. CUC CuFe SiO₂

1. Mh III for implant, new.

1. Mh II soft for electro-optic stuff

- Nursing slightly special -

Mh (-1) used for micro membrane stuff

What are we short:

1. Mhd pattern for Block - Will set ~ July 4 with no rewards

2. Bittman -- nothing -- Possibly for Schott barriers.

3. Seeds - 1) If we go other than Al, need epoxy

2) More capacity, pug cl + fil capability

3) T.F. testing if they become part of a 1 in 100 chance

4. Rebell - Anything for beam leads

- Insulation capability of we go to 2-layer

Short 1. Thick Al - Kabel will set this up!

2. 2.2 MV_b patterning system - Hauke system is available for this, ^{exp} ^{simpler} ?

3. Replace blocks out of operating system

S. Vachel

Choate
(ad. Gen. In.)
+ Wolfson - Choate
+ Assembly - General
+ Test - Hirotsu

Bud Oliver
(S. Eng)
+ Cole
+ Newman
+ Keim - Rieg (diss)
+ Steel - Assembly, plaster

Tech - McGinty

Tech - Heating - Prop.

Kelley (Rad. Dev)

+ Zeng Jen (Automobile, MCB background) ROM
+ Bob Banagher

- Ramey (or GATE creation) GATE

+ Materska, Bob Multiplex

Electrician
+ Main, Products

Oliver - Ex of Motorola than San Rafael - Power line - conservative, experienced
 Cole - Ex GATE for a couple of years - Production experience - hard worker, looks good
 Newman (Bob) -- Was tech at R&D - doing test setup
 Keim (Warren) -- Ex Fairchild than Rad. Dev.
 Steel (Chuck) - Some S.E. exposure - likes, not if

Jen, Zeng -- look good - bright

Newman, Bob --
 Ramey, Bill --
 Materska, Bob --
 Wilder, Ward --

The present program

Objectives: Get the 3701 shippable - burn-in - rapid feedback loop test

What acceleration is doable?

Have 160° oven, run at 30V on the gate + substrate diode.

3701 in 14-pin flatpack 100 hrs @ 160°, Clark to 500pa as a limit.

Evaluate this as a test for burn-in.

3102 - VapoX - try to do the same.

Failure analysis: - Joint!

2. A std form for the two specific devices will be done.

Subject to discuss

- 1. Failure analysis ✓
 - 2. Bonded die ✓
 - 3. 15V on VapoX ↗
 - 4. Thick VapoX ↗
 - 5. Other people process ✓
 - 6. Monitoring ✓
 - 7. Tolerance on mask design ✓
- Charlie Ellerby will open

Competing evaluation:

Hank has 518 worth of units.

AMI ~20-30 ━

G.I. ~50 ━

G.M.E. 20-30 ━━

Question:

1. Accelerated design failure - Hank Lee
2. Long time of spec limit - Hank Lee
3. Reconstruction of the process. - Lee + Charlie

Miss data:

1. We run all 100 material
2. Possibly 100 would help
3. We would like to use high material, 5.2 - cm max 10 mm thick.
4. Already G.M.E. has a 11 thick than 10 and are converting to VapoX stuff

Redesign:

3300 - static S.R.

3303 - 4-phase S.R.

3701	m ⁺
3300	━
3303	━
3102	
3500	
3100	
3101	
3700	(v) old

A real question: How shortly we commit our design capability?

54 Monitoring programs:

1. Evaporation - We are now monitoring evap.

All of human life. Every evaporation

Thick vapor - We run on to $\frac{1}{2}$, by it go to 24.

We will factor in something to show current Y independent of life current

8:00 ^{am} on Fri (next +1)

Discussion with Schmidt & Spaziani.

6/24/67

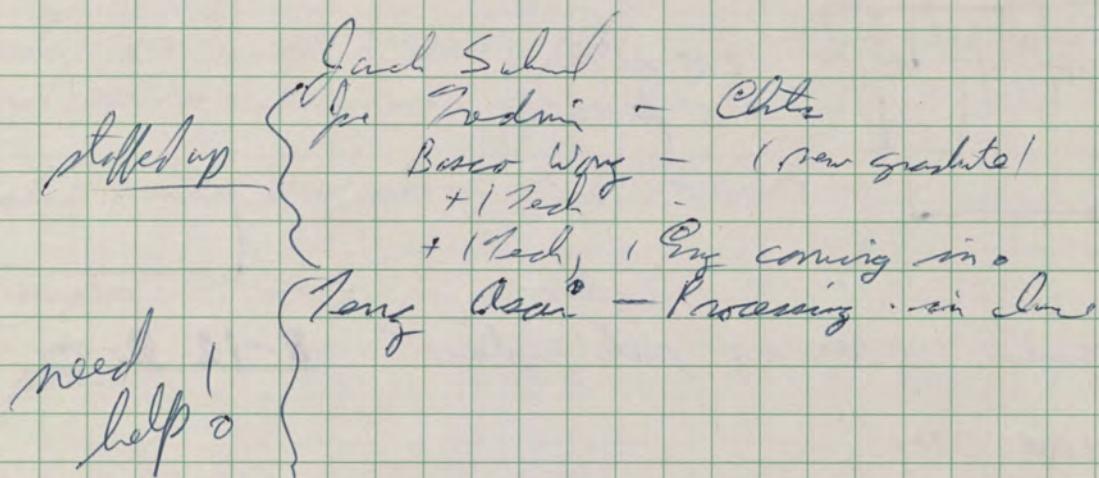
55

Original deal : ~ 12 people total, ~ \$0K Capital this year

Substrate preparation should probably be part of this.

Wick Ad - we will supply as a service

Wafer sorters - where?

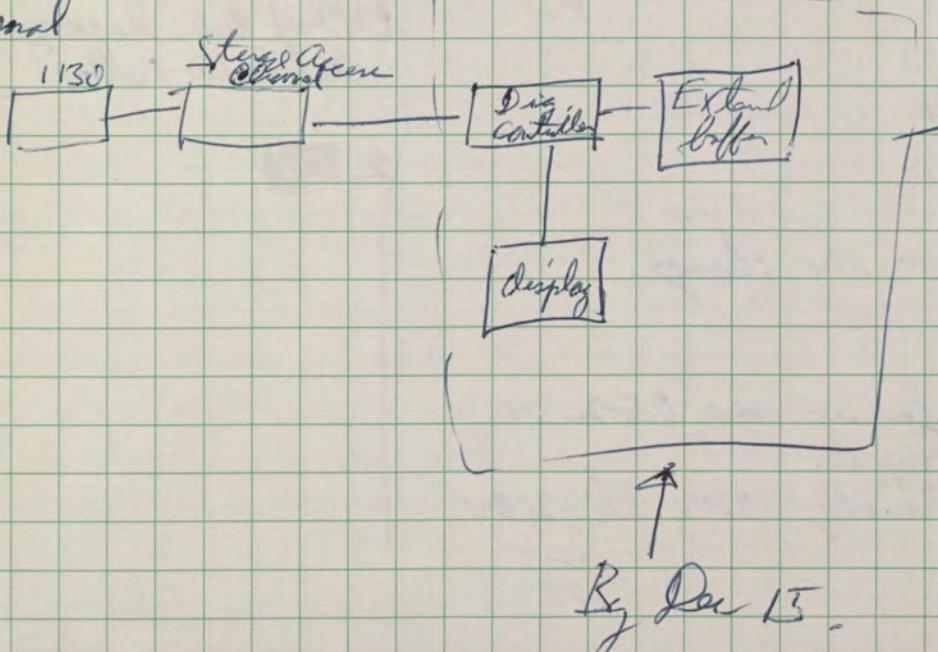


Discussion w/ Hugh Mays re: computers.

SDS: Parallel real time batch monitor + high level Fortran - without for E-2. Restr. late

SDS is giving us several proposals that are useful(.) or backup, at best

Our proposal



Get Tasha & Sanders to do this.

Dig controller - > 20k (Sanders)

Extend buffer - 25k ea (EMT)

Can get second 1130 by Sept to start putting the graphic language on 1130.
 Can use the time from 1130 - Dec 15 to good use.

56 Re MOS meeting 6/23/67:

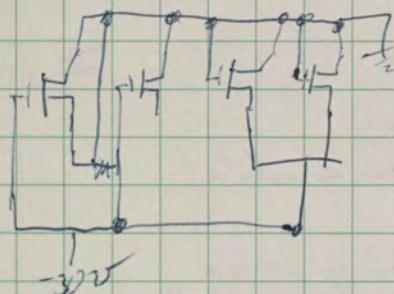
C.E.:

Products to do with ~~Si~~ Si

3701
3303
3300
3500
3102

MOS
vapor
other

100 cm
Problem: Protection diode.



240° for 2 hr
160° for 100 hr

1. Problem:
1. Broken proliferation - re-design
2.

-1. Resistivity question -- can we pick a place 8-12 Ω-cm

2. Putting Vapor over 3701

3. Try for 2 p+, 1 of them, 1 of vapor

H.B. Schedule:

	done	re-done	From SB	Vapor	Siemens
3701	3701	3701	76 x 81	55 x 72	70 x 70
3303	7/1				
3300					
3500					

H.B. will act together with L.V. to load design.

Computer stuff - No program yet

~~200°C, 30V~~

G.I. counts @ 15 min, 200° - no change.

NOTES

1. What has happened to the automated cutter?

2. ~~30V~~

Using 30V max on draft - furnace runs 0.5-2° V

Evaporation Assembly 200°C, 2 hr, -20 mV
30V

Meeting on Proj 33:

Problem - voltage drop -- need $\pm 0.5\text{v}$ out of ≤ 10 for 1 sec dark count integrately.
Can get by with $\leq 100\%$ good, say 80% of info
The 1 sec integration time results from a 10kc bandwidth. Could use intermediate
stage, but isn't a very attractive solution.

Can we give it the old college try? —

Aced to take 1 sec, @ 12 cycle / pic, i.e. $\frac{1}{12}\text{ sec}$ is all we need for
the most simple system.

What alternatives make any sense at all to look at?

1. Sacrifice sensitivity for uniformity - C,
Not running.

(GI would put entire 256 bit rows flipped on crane to be made
 $40,000$ bit memory.) 4 plane clock

50% blur 0.250 ft $\rightarrow \sim 1/50$ sec exposure

Look at the 1 sec or $\frac{1}{2}$ sec public domain figures

"happy".

1. Alternative that makes sense
2. Time & probabilities

With respect to MOS: ~~for discussion with Clark~~

1. We must negotiate long term space & ~~the Penitentiary~~ ^{In Saton} obtain chart as short as a first class facility in the new buildings. Our Capital depends upon this.
2. Clark would like a chunk of the Lyndhurst area occupied by Paul Schantz. (Reason?) It can't move on account of the gulf.)

Have 10 former tubs now. Will need more - 10 more?

~~or new place
or their duty~~

See Sanger, 3. What is the latest thinking on brick making proliferation? If not, should it be available to MOS. Large one in Belmont needed. (Hansen)

4. When or if ever to Clark - space of Lyndhurst central cost to processing equipment.

~~6/29/67~~, and

D

Question: What rules for the 3500 Fall St. or cause th at 18 month es. Logic chain and party St.

Program 1
^{"New" Mason (see Ellerby)}

falling	17 ft
p*lyth	5 ft
S*P	15
P*nt	7
P*nt	1-2 ft
growth	100
Upr	calib
girth	1-18
	1

*I will do ~~partly~~ modified
falls & program on 3500
design*

6/29/67 - MOS meeting -

59

Charlie Ellenbogen:

Data on 3102's assembled several places - 100% failure at low link

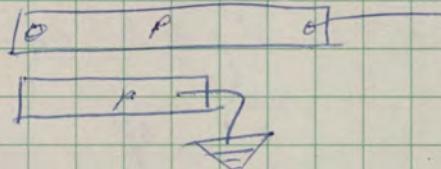
Data on 3701's junction ^{100%} remain open Sb process
I_{SS} went to pot in $\frac{1}{2}$ of the bias condition

Syntestology failed to input resistor going to pot under failable
(Current YV)

→ Data on 3701's show what looks like LINK current. On the other hand,
there is no known explanation. 3/4 occurrence. A REAL MYSTERY!
 240° , 2 lum.

- ~~GT~~ → 16-18 volt threshold.
 1. 8-12 μ -cm, $\langle 111 \rangle$ p field \rightarrow $\sim .12 \mu$ gate $\sim 2.5 \mu$ p diff, $R_{SS} = 3.5 \times 10^6$.
 2. Same sort of thing with "deinified" V_A to 24.

Try ~~other~~ punch thru diode protection



Vashel:

Furnace running $\frac{1}{2}$ -2v. Trap is checked regularly, usually if ok

Competition: - Hank Blume

Grainger competitor

AMI - 1 DOA / 10

GME - Don't meet spec 10/10

G.I. (old) ... $\frac{1}{2}$ don't operate at $100^\circ C$ YIELD DATA - 3701SHRINKAGE ANALYSIS

→ We are a month away from Sb shift regate mask. - WHY?

GI - 300° 12 lum, current Y is low temp resp.One unit in 2 min @ 300° showed a big change in field threshold.GI field oxide $> 1.5 \mu$, gate width gate 1100μ , $p \sim 8 \mu$ -cm, $R_{SS} = 4 \times 10^6$

Problems for next time: 1. Reliability

2. Physics

3. Yields

4. Raw data, especially from Pd ratio

60 MOS - C 7/6/67

C.E. - 3701's:

Run 91

M.V. assembly	@ 240°, 2 hr	2/4 "Inherent" (go)	160°, 100 hr	9/10 failure
PNP assembly		9/2		
PA assembly		1/2 failed gate		

Run 87

M.V.

4/4

160°, 100 hr

4/10 failure

P.A.

1/2

Charlie implies that this suggests a screening to get out products

Charlie will develop a burn-in - double stressing - ~~25, 2D~~ evaluated.

10 @ 200° 2 hr

20 @ 160° 100

a definition

100 @ 125° 1000 hr

Competitive:

G.I. - cumulative

3/6 @ 125° in 100 hr ~~for 10% of ma.~~ } look weak, but not catastrophic

S.R. 3050's 1-0 hr failure (static discharge) >
1 " " prob. " "
1 op " blown gate

AMJ - Catastrophic failures are a big! problem. 5/6!

GMIC shift register - almost none that meet spec, many died - real problem, ~~click threshold~~.

Conclusion: G.I. is on top! - will come out -

L.V.

At 300° H.G.I. units come down to 15-20 v threshold.

-
1. Go on board 3701 dice that hasn't been
 2. Get a burn-in for 3701's ASAP.
 3. Design 3500 ASAP but it takes a re-do and planning.
 4. For today will bring Dr. Brown's data next time on various geometries.

MOS - 7/13/67

61

NATIONAL
56-800

Bam site -

- 72 rockets obs for test
- Prod. staff paper by Fri - Taken 4 NO for rocket, 15 weeks after it is exposed.

{ Rel. 1st run of reservoir then dam

2 hr drift on boulders 240°C - $\frac{1}{8}$ failure for 1st run
 $\frac{4}{8}$ for 2nd run

By end of week will have 2 hr data on 5 runs.

Design

3303 is in N.V. ready for sign off - Marsh in a month. C.E. in Feb 73.

3300 is like a week behind

3102 can go very fast.

3500 start layout next mon -

Agreement on shielding

Today - See paper passed out.

Heale and like to start layout this wk.

Start of Downey

Get stuff stuck down

8/22/67

We need to take off on a family of Ni-Cr R's.

Prints

1. A family of Si chip resistor 1Ω to 1M to a list to be supplied by Winkler
2. Resistor arrays on Si chips
3. Resistor arrays on ceramic - Need by end of year for Sandia sampler.
Jeff can get masks made in 2-weeks -- if we lay them out.
4. Silicide resistors

Personnel: 1. Jeff will supply the direct labor -- 2 or 3.
2. An engineer to pick up the process -- or a senior tech.

The Sandia job is a very important part of this business. It requires that the 1st delivery duplicator Collin -- that is, a T.F. chip with seeing Xtron attached. Second could be complete chip.

Our requirements are ~~5000~~ 500 wafers ASAP
1000 " by ~ Feb.

A possibility: "A"

1. Tapped R's for engineering
2. Arrays on Si for production
3. Ceramic for Sandia

"B"

1. Full family of discrete
2. Arrays on Si
3. Ceramic for Sandia.

Conclusion:

1. We will go on R's on Si either "A" or "B" - See Brunning -
2. We will get together, i.e. Bader to come up with an approach to Sandia

Meet on Friday, 2:00 to hear results.

R&D PROJECTS

	<u>PRIORITY</u>	<u>PERSONNEL</u>
High Voltage 1500 V (current density, reliability)	B	D. Meyers
Triac (eliminate dbl. masking, isol. diffusion, surge current)	B	W. Khadder
High voltage (300V) PNP reliability (Si_3N_4 ?)	C	EMI
Device stability at low I_c 's (stability early in process)	B	D. Duncan
PNP Processes (material, diffusion, light emitter for power)	A	
Dual devices, mesa isolation	C	
High frequency (diffusion, geometry, packages)	B	Duncan Archer Purnnya
<i>3055</i> High dissipation (2000) new technology process. (Backside planar, light emitter?)	C	
Large area topside heat sinking low inductance process on chip and package	C	<i>not R&D</i>
J FET - very high voltage stability (Power)	C	
50 V N Channel reliable process <i>JFET</i>	A	R. Parker
MOS technology support to be defined after present set of experiments	A	R. Hurlston

Matched JFET's — presumably done in inter-line geometry

W. Steffe
6/29/67

6. Present disease distribution - an old study, and we do not find it.
7. Climate & HED

F, fuses, fuses of different power, 12 volt - AC. U. or more following courses

E. MDS
1. ~~adjusted~~-sum of squares - to be explained + degrees of freedom

D. SCP disclosure
1. the model more detailed — a different perspective
2. CTO — not suitable

C. NPA

1. High fit
2. High detail
3. High - mid level of detail
4. TV shows or trailers
5. High performing - high power

— Parents will be able to define more easily what's real,
— Parents will be able to copy characters, draw etc.

1. Meltting of ice due to M.U.
2. Meltwater, meltwater - open question by M.U. could if.
3. Meltwater - PSD future of moods from now onwards
4. Confused culture our goals -
5. Long time of Ctrl etc. -

1. $A^2 PNP^2$ \rightarrow P -nucleus + PP -dissociation, γ -emission, π^+ or π^- emission.
2. $A^2 PNP^2$ \rightarrow PP -molecules - γ -emission, π^+ or π^- emission.

I. *Portrait* *of* *some* :

29

19/8 Meeting with Miller & Gurus as per your permission:

64

cont
II Technology

1. Ambient - prototyped chip
2. ~~Air~~^{Air} - isolation à la Fairchild
3. Thin film R's
 - a) Supply hybrid mfg
 - b) High Ω (\square)
4. Hybrid ball of wax

5

Discussion & Plans re Canadian capability

65

1. They have the single pass down plan, with Si, Al₂O₃

Program like

Sandia
Hargrave
Marconi

Right control of R + conductivity (5% R's @ high yield)

Tc Co. Match - unique for market

14% A/D ladder - depends upon a "unique" selection of past technology
known in production - worthy

Growth Si or Ceramic, for direct thermal prefer ceramic.

Volume - 30 x 2" wafers / shot.

(Some Ta expense, not necessarily unique)

Advantage of focusing on problems.

A group of strong - motivated people is a valuable - - not trivial affair. ~ H Prof. T.F. staff

"Research" is @ 12¢ in a dollar - everything but premium - yields now covered

Capacitor - they have a lot capability on Ta at moment.

(Are interests in research from ceramic aspects of it)

Pete Otto is enthused on what he has been able to get.

Can operate on capital they generate themselves.

66 Discussion = Ready, Baker, Winkler 9/20/67

Comments they need:

1. Discrete chip - 2 kinds, tapped - top priority.

2. Thin film Al conductors - R network - but one is for Sandi
can be on Si. No attachment problem for us.

3. Resistor arrays, $t = 5\%$ R in on silicon chips.

~~8 total~~ - 15 total.

Problem: Mask schedule

What is the situation on mask request?

Discussion in Seeds - Schwein: 11/6/67

67

There is a problem on 8000B in just!

1. The vehicle generator should get lumped in with CAD.
 2. We'll give our 2-layer facility to Charlie G. and use it back from him while he sets up a 2nd one.
-

Ex Staff Mtg:

10/6/67

	1 st	2 nd	3 rd	4 th	TOTAL
TD New Prod	725	484	302	53	2.081 1564
Plant Group	255	315	357	1134	2061
Civil T&F	262	90	51	34	437
Op Servic	-	25	25	95	145
Reliability	4	7	6	2	19
Mt. New P.C.	20	16	16	21	73
Contingency					700
					$\Sigma = 5000$

New lower ~~for 10/6/67~~

Capital

Hermet	- 352 450
Monolithic diode array	- 261
Plastic Photo	- 45
Plastic Power	- 108

Plant group includes capital for

1. New esp reactor.
2. Rapid scan thickness evaluation.
3. Vapor Xtal growth.

"We will not be competitive in com'l areas unless we improve our test capability." J. Seeds.

- Why are we so strongly interested in a new epoxy package?

1. Product quality
2. Automatically invertible Diskaps

68

Nov 7, 1967 - Discussion of 1967 I.C. Operation Capital Investments.

Of the digital chips (39M), 30 are const price

17M Comp

5M Int

Portland to 25A wiper flow

Mac all MOS, L1C, Ap. Eng., ~~PA~~ 2.5K of D1C

Ceramic Mounting Army 990K

DIP die in Hong Kong

Mach testing Eng. (say ~2M)

Σ = slightly > 7 M\$

2nd cut - take 25% out

L1C - 600K + 40K

Plan on Fairport

As a min. we should do all MSI, all T² in Fairport - J. Sanders
The industrial market will not pay a premium for ceramic DIP over plastic - ...

Conclusion - DIP is obsolescent - we should minimize investment in continuing it, J. Sanders

Dec 27, 1967

69

Difficult problem Dept - How should we handle

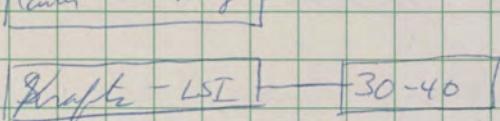
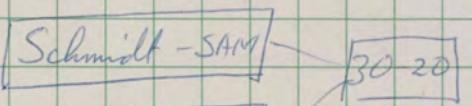
- a) Packaging / assembly
- b) Memory

Memory

LAB

OTHER

Present :



BITS & PIECES UNDER CARY

MICRO-CELL IN M.P.

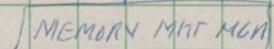
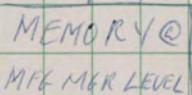
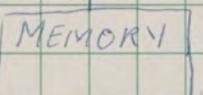
1/2 LARKIN IN MKT

Ideal :

LAB

PLANT

MARKETING



Our line of memory products will consist of

- a) Discrete devices
- b) Peripheral chips } for magnetic
- c) Logic-compatible arrays - 16 to 64 bit column
- d) Planar + stacks of single cells with peripheral chips
- e) Register, delay line, etc.

I am concerned only with d.

- It needs :
- a) A supply of MOS wafers
 - b) A .. " Bipolar .."
 - c) Ability to sort, dice, assemble and test
 - d) A supply of substrates
 - e) An engineering capability to
 - 1) Customizing stacks
 - 2) " planar
 - 3) Do continual product development.

70

Memory problem, cont

Possibilities:

In LAB

1. A Set in DIED for SAM memory inc. follow-on to SAM and Krafts
2. A Set in Plus combining the mag memory with SAM follow-on, plus the continued LSI operation in DIED
3. Bodily loss of SAM to Operation with lab program confined to DIED
4. A semiconductor memory Dept in the lab
5. A ttl memory Dept in the lab

			Advantages	Disadvantages
Scal	13	to 9	Unified operation with access to everything.	4 Right subjects a going question
	3		File charter	
	5		Adds product orientation to DIED	
-4	2.	3	Gives magnetism a home	7 Preserves split in semiconductor program
		3	Minimum perturbation	3 Dilutes semiconductor with magnetism
			Charlie can keep his finger in another cupboard	
8	3.	9	This engineering, etc, to M.V.	7 Maximizes possibility of not using R&D output
		6	Clarifies split with R&D/M.V.	
5	4.	5	Gives status and ^{part} update to memory	7 Lack of ^{access to} control of a processing facility
		7	Combines design & research	
2	5.		Labs 4	
				7 Lab 4
				3 Dilutes semiconductor

All of these except 3 assume an effective transfer of SAM technology to Operation without stripping the project of present personnel. I.e., a typical situation.

∴ Ordering by my rating: 1, 3, 4, 2, -4

30-10 problems of the day (12/29/67)

1. MV personnel - will some be available? - Shall we go outside?
2. LIC short-range program
3. Revised R&D plan & answer to committee
4. Holme - Blume
5. Schrein - Vasel charter split
6. Packaging program
7. Memory
8. Microwave
9. New phenomena
10. Da Bloneygon project

72

Meeting with Grove & Bittman as what to do with the New Phenomena group.
1/4/68

i. Should we do anything on Gunn?

YES

NO

Solomon + others Hazell ~~other~~ on Gunn

Sigam on TA + Sabu

Rao on FET

Also oxygen in Si annealing problem
Solomon — Si evaluation - i.e. optical techniques
— (Plenty ceramics, etc.)

Sigam — Threshold control (in ESR group?)

Rao — FET traveling wave structure evaluation

Hodgk — Fize (?)

- Gunn
- fuze
- tuning
- threshold switch
- O₂ in Si
- eval. technique for epi film
- FET in traveling wave applic.
- hi value capacitors for hybrid
- visible light-emitter
- continu transverse neg. mobility
- nitrid-tapping memory.

1/3/68

A.S. Grove

March 1, 1968

73

Summary of the R&D "packaging" dilemma:

Job to be done: (Technology integration & component design)

Assembly techniques:

Solder bumps

Al U.S. bonding

Acc beam leads

Other metal leads (Al?)

New bump systems (Zn, Ge-In)

Substrate technology

Single layer, moderate

" ", high o

Double " , mod o

" ", high o

Extend lead technology o configuration

Package sealing techniques:

Solder

Plastic glue

Potting

Other

Thermal management:

Analysis

New approaches

Die passivation

Multi-chip pilot capability.

Major project-oriented jobs:

~~1. SAM~~

2. HYBRID

3. High performance substrate

102723966

