1) Overview

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2) PORTABLE COMPUTER STRATEGY AND DIRECTION

Over the years calculator products and computer products have grown closer and closer in functionality, configuration and appearance. Due to each product category's historical roots, certain attributes have prevailed, maintaining a clear separation between the two. This is no longer necessary and as a result some of the preconceived ideas of high-end calculator implementation can and should be discarded for more flexible and far reaching concepts.

Background of Calculators

Calculators evolved from an idea of replacing the mechanical adding machine with an electronic version of the same. As time transpired, additional facilities were added, most notably portability, specialized mathematical functions and memory registers. The major gating factor for the evolution of these facilities was cost. Eventually more functions and registers were added and programmed control of both registers and functions became an implementable concept. Cost again dictated implementation and the programming languages developed provided highly efficient usage of registers in order to control costs of memory. Along with increased register space came a need for hard copy program and program output documentation as well as needs for magnetic storage of programs. Ultimately programmable calculators were to be provided with interfaces to magnetic tape storage and register tape printers. This evolution of calculator products has rightly or wrongly left its imprint on the attributes of today's product: /CARDS

1) Battery operation
2) Handheld size
3) Dedicated function keys
4) Hardware dictated operation
5) Register oriented programming
6) Magnetic tape for program storage
7) Harvard Architecture /CARDS

Background of Computers

Computers grew from a much different environment, on in which cost was much less constrained and feasibility, practicality and size were the controlling design parameters. Application development began in the scientific and experimental research labs but quickly spread to business accounting and control functions which quickly dominated the field. Register oriented machine programming (i.e., assembly language) was quickly found to be inadequate for implementing the large and constantly

FORTRAN   (Common Business Oriented Language)

changing requirements of the laboratory and accounting departments. The result was the development of high level languages, in particular Fortran (Formula Translation) for analytical tasks and COBOL for the large data handling tasks of businesses. To handle these languages and their varied applications, generic interfaces were developed using the typewriter keyboard as the model. As costs came down and functionality increased, more and more individuals gained access to computers. To teach good programming technique, several individuals developed languages that have since been refined and expanded. Two of the most popular languages, PASCAL and BASIC, developed in this manner.

As computer development proceeded, computers became smaller and less expensive while maintaining or increasing functionality. Throughout this transmutation, computers have retained several key attributes:

- o Generic user interface (hardware)
- o Tailorable user interface (software)
- o Soft loadable programming languages
- o Flexible architecture for peripheral attachment and communications.
- o Heavy use of mass storage and data files.
- o *Von Neumann Architecture*

The Computer/Calculator Connection

The barriers that have separated calculators from computers are no longer relevant. Size and cost of computers are coming within range of calculators, and calculator functionality is growing within the range of computers (see Exhibit 1). The roots of calculators, especially low-cost dedicated function, need no longer restrict implementation.

Costs of memory and storage are dropping at such a rate that it is no longer necessary to restrict programmable calculators to highly efficient register oriented languages and architectures. Instead, user-friendly and well understood higher level languages, along with computer-type architectures, can be applied to these products with only a small sacrifice in cost. To accommodate the change to high level languages and the added flexibility they provide, several changes must occur to these portable units:

o   Handheld size must be sacrificed for an improved user interface yielding a slightly larger ~~casing~~. *physical package.*

o   The standard computer interface of a typewriter style keyboard must be substituted for the dedicated keyboard. *with a larger alphanumeric display added.*

o   Languages should be loadable into the machine in order to accommodate various uses. *and The Von Neumann architecture used.*
     STANDARDIZED

o   Flexible\I/O architecture must be provided for easy configuration.

o   Mass storage systems must be developed for handling large programs and data files.

Providing these capabilities opens up a new category of growth product with access to the markets of high level language literate consumers, as well as packaged application driven computer purchasers.

Several studies support the move to flexible language support. In a survey of BASIC language calculator purchasers, 61% of the respondents expected keystroke programmables to disappear within 5 years. One on one interviews of 45 potential consumers held in Chicago in April 1982 showed a strong preference for high level language machines. Most respondents conveyed entirely different attitudes toward flexible language machines as opposed to keystroke programmables. Where programmables were already discarded as of no value, the portable computers were viewed as potential problem solvers. The same attitude was carried through in focus group studies of 80 potential consumers in an August 1982 study. The desire and need for flexibility of languages was conveyed in both studies with languages such as Assembler, COBOL, Fortran and PASCAL mentioned as highly desirable.

Language Development

Integral to the development of portable computers is the availability of programming languages to end users. Several dozen languages have become popular over the years and many more are being developed. It is essential that TI choose the broadest appeal languages to address the greatest number of potential purchasers. This report recommends the development of BASIC, ~~Fortran, PASCAL~~ and Assembler languages with the consideration of C or Forth as

FORTRAN, Pascal

additional future languages. BASIC is very popular among hobbyists and is often the first language learned by neophyte programmers. Because the language is very easy to learn and use, it is a must for the product. Fortran enjoys a strong user base in the technical community. Even though its popularity is on the decline, this installed base makes Fortran a prime choice. PASCAL is the rising star, especially on desktop computers. This is due to its structured nature, transportability and relatively low memory requirements. Due to its current and expected popularity, as well as the fact that a majority of third party programs are written in PASCAL, it should be developed for the product. C and Forth are structured languages similar to PASCAL. They do not of yet command the presence of PASCAL, but will probably gain momentum. This is especially true of C since the Unix operating system written in "C" is virtually given to universities free of charge and is, therefore, popular on college campuses. C is also becoming increasingly popular (along with Unix) for 16-bit computers.

The only truly popular language discarded from implementation is COBOL. While this language is very popular among business students and MIS professionals, it is not feasible to usefully implement it on a portable machine. Both the program and typical applications take a great deal of memory space and applications generally involve manipulation of large data files.

Market Impact

The impact of implementing a general purpose portable computer should be large. This strategy will impact four separate market areas: TI-59 owners, HP-41 owners, computer users and naive individuals. The direction of the market is clear, and with HP's announcement of its HP-75C BASIC language computer, it has been reaffirmed. The future of the market is high level language computing. This market movement eliminates RPN/AOS arguments and provides a new proving ground for product performance between TI and HP. By eliminating keystroke product from the line entirely, TI sets a concrete commitment to portable computing, eliminating confusion in the market and resultant lost sales. It will give potential TI-88 owners a clearer choice and assure them of long-term support that would not have been evident in a two product line approach.

Page 5

The end result should be an ability to recapture in excess
of 80% of TI-88 sales with the portable computer (in fact,
with the clearer direction capture rate could exceed 100%).
In addition, playing off the HP-75C and its high price
point (\$995) we should be able to capture HP-41 potentials.
That is, the confusion the HP-75C brings to the HP
product line, combined with the TI commitment to portable
computers, will pull a great deal of potential HP-41 sales
to the TI portable product. Last, the additional
flexibility and growth potential of multiple language
machines opens the market up to a base of computer literate
individuals and third party programmers that was left
totally untapped by the programmable calculators.

PROCESSING POWER vs. COST
(ARROWS INDICATE TIME TRENDS)

HIGH
COST

Mainframes

Minicomputers

Desktops

Portable
Computers

DECREASING ← → PROCESSING POWER

INCREASING

EXHIBIT 1 - ?

Basic Language

Programmables

Slide Rule

Hand helds

CALCULATORS

LOW
COST

(ARROWS INDICATE TIME TRENDS)

SIZE
LARGE SIZE

Mainframes

Minicomputers

DECREASING

DeskTops

Processing Power

INCREASING

Portable Computers

Basic Calculators

Slide Rule

HandHelds

CALCULATORS

SMALL SIZE
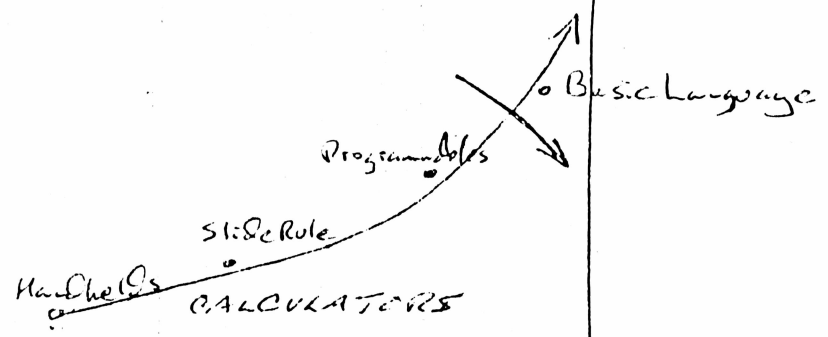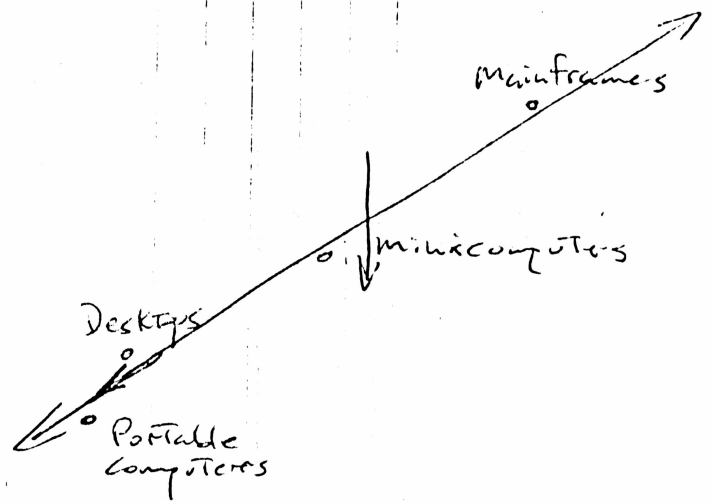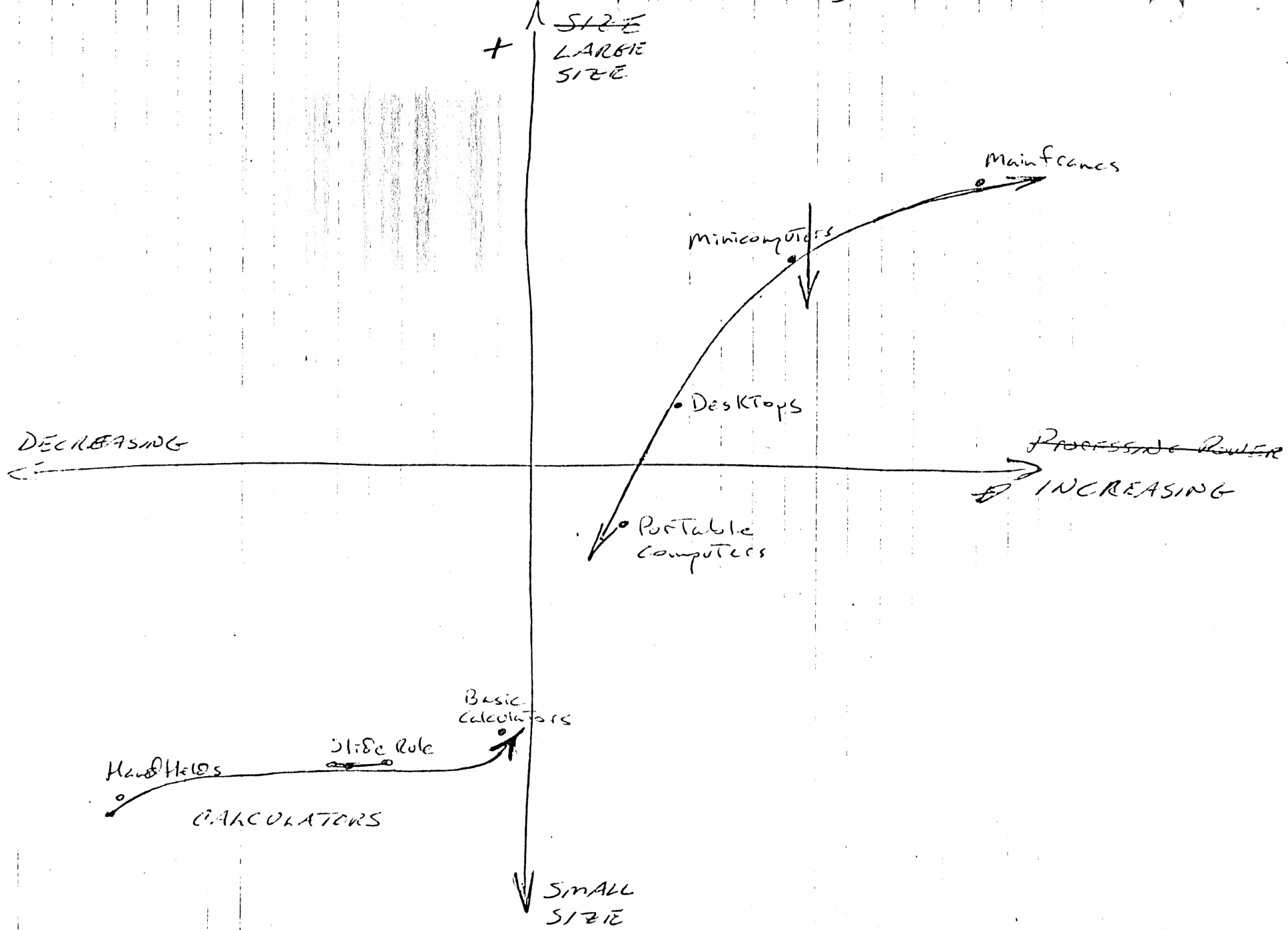
EXHIBIT 2-2

SIZE – PROCESSING POWER MATRIX THROUGH TIME

Exhibit 22 — Programming Languages

LANGUAGE	APPLICATION	MEMORY REQUIREMENTS	COMMENTS
BASIC	General Purpose	Small	o Very broad based support o Generally first course in programming o Popular on desktops in particular
FORTRAN	Scientific & Engineering	Medium	o Large base of support o Declining popularity o Used mainly on minis and mainframes
COBOL	Business data handling	Large	o Large base of support o Known by most MIS programmers o Used mainly for manipulating large amounts of data
PASCAL	General Purpose	Small-Medium	o Very popular on desktops o Used heavily by software authors o Relatively transportable code o Becoming increasingly popular
C	General Purpose	Small	o Becoming popular for 16-bit machines o Known as the emerging language o Highly transportable
Assembler	7000 Native Language	Small	o Required for third party development

Other Languages

APL
PL/1
ALGOL
LISP
PL/M
SmallTalk
Pilot

Installed User Base (y-axis)

Time (x-axis), starting at Present

BASIC

PASCAL

COBOL

COBOL

"C"

FORTRAN

"Other" Languages

Exhibit 7 of 44
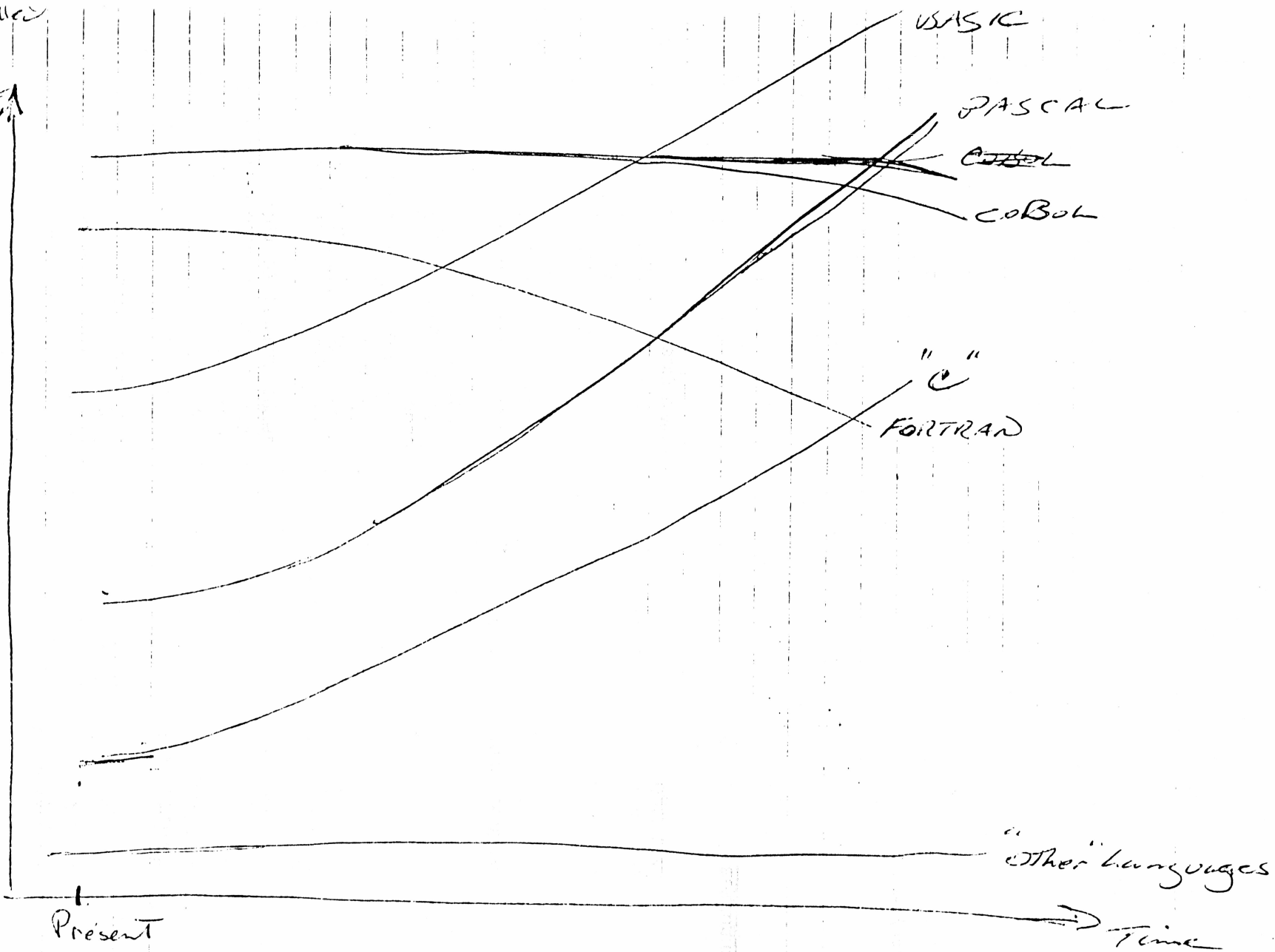
3) ## Hardware Development Plans

Three upscale console products are proposed for continued
market exploitation off of the ALC-A. These products are
the ALC-A2, ALC-C, and ALC-T. All three products are on a
linear path off of the ALC-A (i.e., development and
development efforts are utilized in each successive
product).

ALC-A2

The ALC-A2 is a multi-language version of the ALC-A. The
major differences between the A and A2 are 1) 1/4" thicker,
2) addition of a plug-in (flat pack) programming language
module, 3) expansion of the language ROM space to 64KB, and
4) expansion of internal RAM capacity to ~~32KB~~. Each of
these modifications is provided in order to obtain the
multi-language capability required: *34KB*

- o   64KB ROM is required in order to house more ex-
     Tem ~~pan~~sive languages such as PASCAL or Fortran.

- o   32KB RAM is required to 1) run the more sophisti-
     cated programs expected to be developed from
     higher level languages, and 2) aid in the compi-
     lation speed of compiled programs.

- o   Plug-in languages on flat pack modules provide
     the ability to exchange languages on the machine.

- o   Additional thickness is required to house the
     additional memory and plug-in module.

Several languages will be developed to run on all four machines (flat packs on the ALC-A2, T, C and modules on the ALC-A). BASIC, Fortran and PASCAL will be developed in interpretive as well as compiled versions. Interpretive versions will allow the user to create and run programs in a portable environment while compiled versions will allow generation of object code from the source language in a non-portable environment (in conjunction with mass storage) for running of the object code portable environments (see ~~Appendix A~~ *Exhibits*). The availability of compiled code will allow applications developed in any language to run on any ALC-A2 machine, thus significantly enhancing the usability of the machine by third party authors.

Other languages may be considered at a later date (C and Forth).

The additional cost of the ALC-A2 over the ALC-A should be ~~significantly~~ *sufficiently* small to warrant the phase out of the A product once the A2 product becomes established. The ALC-A2 will run any of the ALC-A application modules (see ~~Appendix B~~ *Exhibit 6*).

ALC-C

The ALC-C product is an expansion off of the ALC-A2 to enhance the product for use in higher utility applications, specifically high level professional and managerial support. The major emphasis is to provide improved user interface features to make the product applications easier to use.

By definition, the ALC-C will be an ALC-A2 in a larger case (notebook size) with a 6X40 LCD display, full travelling typewriter keyboard, and built-in tape mass storage. Critical to the product will be an ~~flat pack~~ module *applications* containing a word processing and spreadsheet package. The ALC-C will be able to run any ALC-A2 application or language modules.

ALC-T

The ALC-T is a sister product to the ALC-C/ *Dave* and provides the added feature of a built-in 300 ~~board~~ modem and telecommunication software. With this added feature, the

executive/manager can do remote teleprocessing involving
file exchanges, private database access, public database
access and electronic mail, all in a single package. Each
application package will have its own telecommunications
interface. All application or language modules will run on
the ALC-T.

ALC-LC

In addition to these upscale ALC products, a low cost ALC
will be developed to cover the low price point position of
high level language portables. The ALC-LC will be a
16-character LCD display computer with 1.6KB of memory, and
a reduced functionality BASIC language. The unit will have
no plug-in module capability, but will have full I/O bus
(peripherals) compatibility.

Appellant's EXHIBIT 3-1

DIFFERENCE IN COMPILED LANGUAGES

LINE INPUT

SOURCE CODE LISTING → SINGLE LINE → LINE LINE BY OTO INTERPRETER & EXECUTOR → EXECUTOR

LINE FETCH

See attached
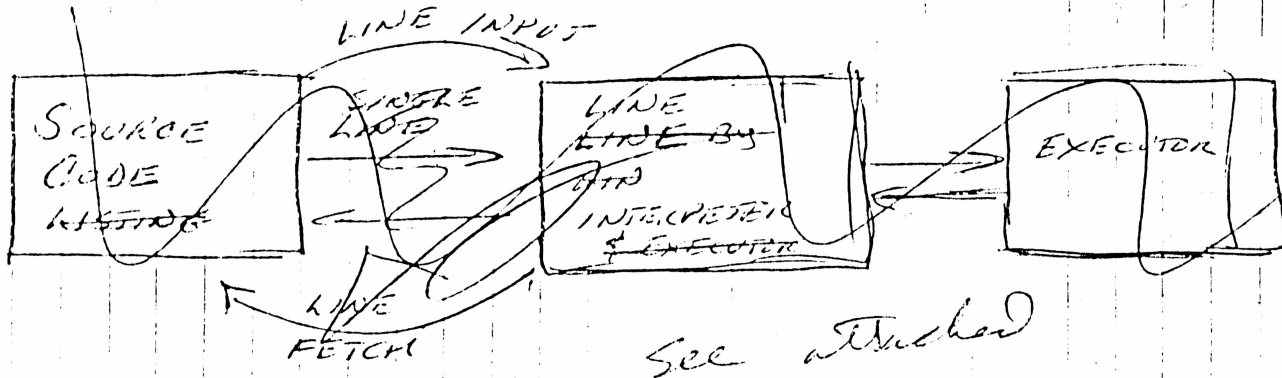
○ SOURCE CODE IS INTERPRETED, READ AND EXECUTED, LINE AT A TIME AT RUN TIME

SOURCE CODE → COMPILATION → OBJECT CODE (MACHINE LANGUAGE) → EXECUTOR
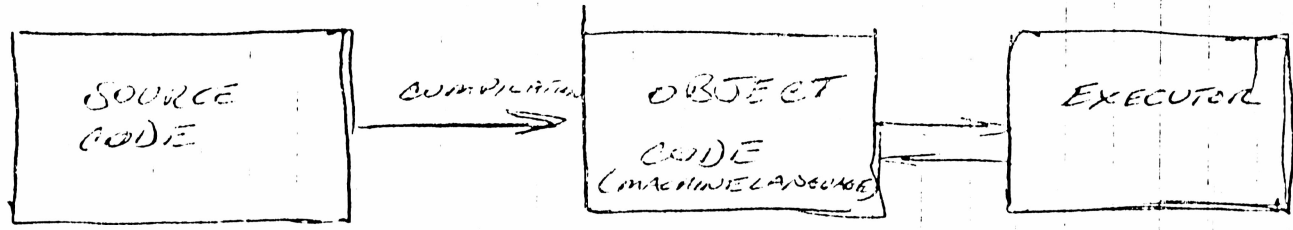
○ SOURCE CODE IS TURNED INTO OBJECT CODE IN A BATCH PROCESS

○ OBJECT CODE IS EXECUTED AT RUN TIME

○ REQUIRES OBJECT AND SOURCE CODE BE RESIDENT IN MEMORY SIMULTANEOUSLY

	RUN TIME SPEED	DEVELOPMENT SPEED	MEMORY REQUIREMENTS
INTERPRETER	SLOW	FAST	LOW
COMPILER	FAST	SLOW	HIGH

* Because of the high memory requirements of compiled languages, mass storage (microtape or microfloppy) will be required for their use.

INTERPRETIVE LANGUAGE

```
┌─────────────┐   LINE          ┌─────────────┐ MACHINE CODE   ┌─────────────┐
│   SOURCE    │  INTERPRETED →  │             │  EXECUTED) →   │   MACHINE   │
│   CODE      │                 │ INTERPRETER │                │    CODE     │
│  IN MEMORY  │ ←  LINE         │             │ ←  CODE        │  EXECUTOR   │
│             │    FETCH        │             │    FETCHED)    │             │
└─────────────┘                 └─────────────┘                └─────────────┘
```
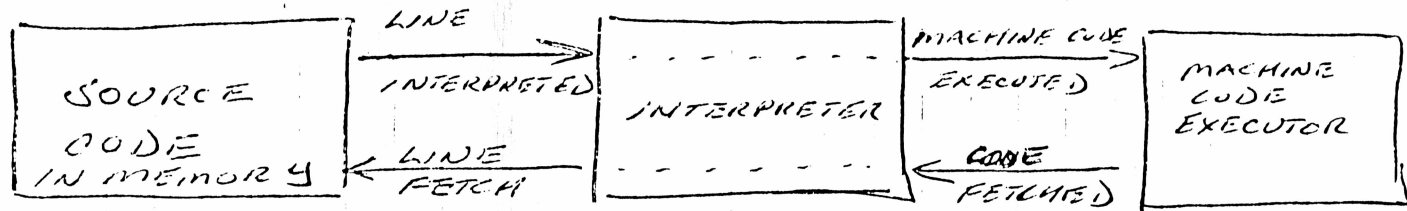
o SOURCE CODE
  IS READ AND
  EXECUTED LINE
  AT A TIME

COMPILED LANGUAGE

Product Module Compatibility

Exhibit B-2

Application

Language
Module
Compatible

Upwardly
Application
Module
Compatible

Upwardly
Language
Compatible

I for Bus
(Peripheral)
Compatible

ALC-LC

ALC-A

ALC-AL

ALC-C

ALC-TC

4) Software Requirement / Development
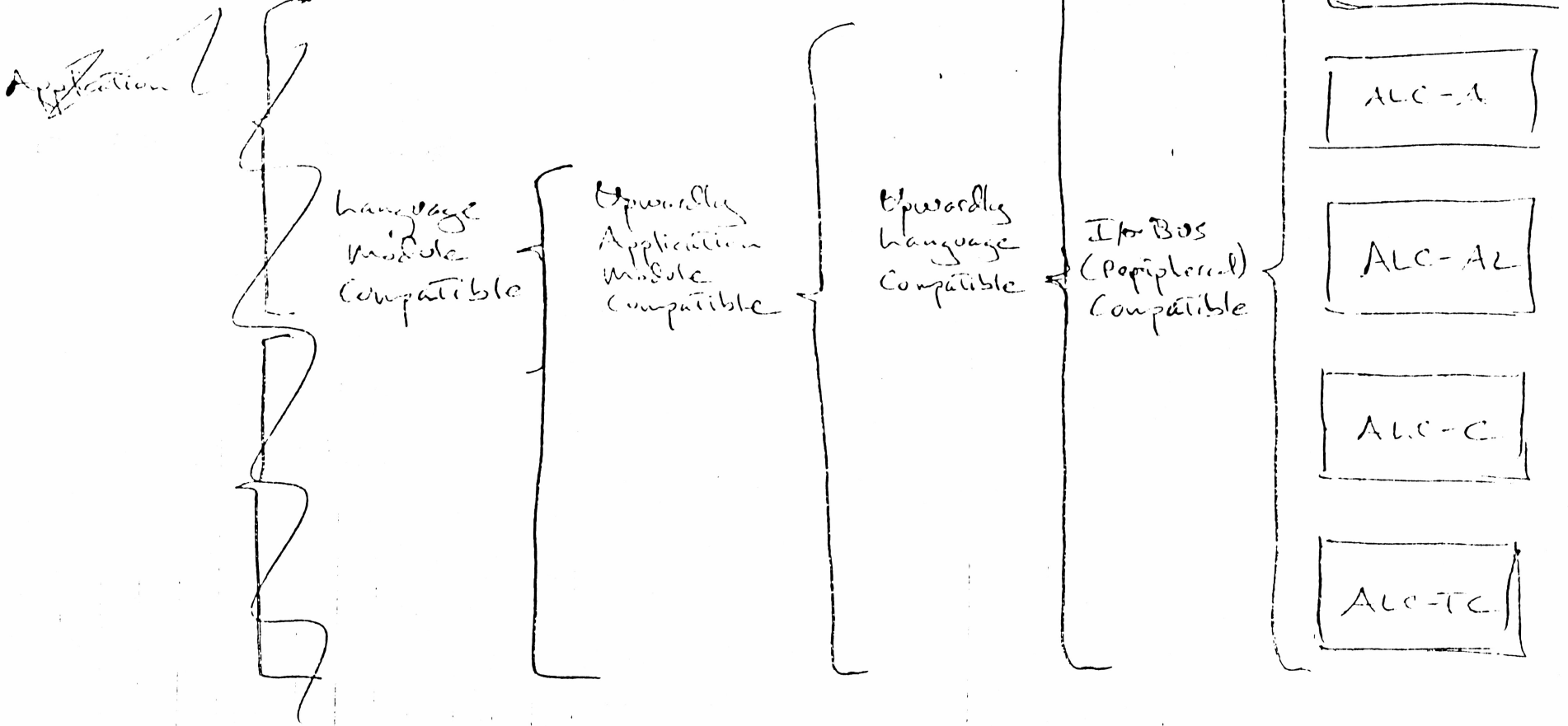
The applications below were selected ~~so~~ to enhance
the ~~above~~ ~~features of the portable program~~ portability features
of the ALC. The intent of ~~these packages~~ the ALC with this software
will be to provide a portable tool to aid in problem solving & function as a desk top unit

Horizontal Applications are defined as those that
could be used by anyone that buys the hardware. Typically
these applications are so important to the user that they
can drive hardware sales (users will not buy the hardware
unless this type of application is available). The ~~following~~
~~are the targeted these~~

Appendix outlines the application, what type of machine
it ~~can~~ will ~~to~~ run on, how it will be developed, the cost,
and when it will be available. The following are the
targeted ~~test~~ horizontal applications:

FUNDED & UNDER DEVELOPMENT
* Math - includes general formulas available ~~to the~~ for managers
    and engineers. ~~The targets of this application are the~~
    ~~Busy. Professionals who need some problem~~

* Finance includes financial calculations and formulas to aid
    the manager in problem analysis.

* Statistics includes ~~formulas~~ general formulas to analyze groups
    of data.

UNFUNDED IN RANK ORDER
* Spreadsheet - the ~~worst some~~ most ~~rated the a~~ successful application
    package ever written for microcomputers. this package
    allows analysis and reporting of data in a row &
    column format. Professionals can use the ALC with this software
while away from their desk (previewing the results on the portable printer), then plug the ALC into an 80
column printer ~~with~~ to print out final results.
* Formula Solver This package was written by the same author that
    wrote Visicalc. It allows users ~~to set~~ to set
    up formulas in a meaningful format. The package
    then solves for the unknown (s). Thus it eliminates
    the need for users to become programmers when
    trying to solve equations. Engineers can use the ALC with
    this package in any environment in that it ~~can~~ could function without a printer.
  Personal Word Processor
* ~~Menu writer~~ - this package will be designed for the user that
    needs to write single page memos or notes ~~to~~
    while away from ~~the~~ his or her workstation.
  The user could ~~make~~ create memos or notes while away from
    his ~~own~~ work station, preview the messages on the portable
    printer, and print out the final copy when he returns to
    ~~his~~ his work area.

move up dates, and instantly see the current status of the overall project.

while away from his desk,

* <u>Graphics</u> - This package will be designed for the user needing professionally done pie chart, line graphs, bar charts, and text presentation material. The user will be able to design the graph ~~now~~ e preview it on the portable plotter, then have ~~it printed at~~ the production copy done on a large plotter.

* <u>Project Management</u> - This package allows the user to break up a project into activities plotted over a period of time. The user can perform a what-it analysis on the time ~~constraints~~, manpower, or cost constraint to determine how it affects the overall project. A user could take the ALC e this package to a meeting, enter activity delays or

* <u>File Manager</u> This package is useful for ~~most~~ generating mailing list, data collection, and reporting upon collected data.

* <u>Games</u> While few customers will buy the ALC just for games, this application represents another reason to buy the ALC.

~~Research Series~~

* <u>Math II</u> This package in addition to the basic includes PecoMath, a software package with a number of built in math routines.

* <u>Financial Investment</u> - This package includes financial formulas with specific ~~~~ financial decision making ~~~~ (ie lease us buy, ~~NPV, ~~ net present value, and Payback period calculations

Horizontal Applications

Application	Software Media		Hardware Configuration		Potential Source	Cost of Development	Terms & Conditions	Predicted Availability
	Rom	Microtape	Portable	Desktop				
Funded & Under Development								
Math	✓		ALC-A & portable printer	~~ALC A 80 column printer~~	Internal	9 man months	—	12/82
Finance	✓		ALC-A & portable printer	~~ALC A 80 column printer~~	Internal	7 man months	—	12/82
Statistics	✓		ALC-A & portable printer	~~ALC A 80 column printer~~	Internal	9 man months	—	12/82
Unfunded in Rank Order								
Spreadsheet	✓	✓	ALC-A w portable printer) ALC-C w portable printer	ALC A & C with 80 column printer	Pocket Info Corp. Sorcim Visicorp Decisions Technology Internal	10K up front 15% royalty. 6 man months	3rd party developed & TI produced/marketed	10/83 Rom ALC-T 5/83 microtape ALC-A
Formula Solver	✓		ALC-A w portable printer		Software Arts	25% of list price	3rd party developed & produced; TI marketed.	10/83
Personal Word Processor	✓	✓	ALC-A with portable printer ALC-C with portable printer	ALC-A w 80 column printer ALC-C w 80 column printer	Sorcim Micropro Internal	10 K up front 20% royalty 6 man months	3rd party developed with TI produced & marketed	10/83 Rom ALC-T 6/83 microtape ALC-A

Category								
Data Communications	✓	⊘	ABCD	ALC-A with 80 column printer & modem ALC-T w 80 column printer & modem	Telos	10k upfront 20% royalty	3rd party developed with TI produced & marketed	10/83 3-Rom
Graphics	✓	✓	ALC-A with portable plotter for previewing ALC-C with portable plotter for previewing	ALC-A with portable plotter +8½x11 plotter ALC-C with portable plotter +8½x11 plotter	American Micro BPS Internal	5k up front 15% royalty 6 man months	3rd party developed w TI produced & marketed	15/83 MICROTYPE ALC-A 10/83 Rom-ALC-T
Project Management	✓		ALC-A with portable printer for previewing ALC-C with portable printer for previewing	ALC-A with portable 80 column printer portable ALC-C with portable 80 column printer	Organic Software Westico Visicorp	20k up front 15% royalty	3rd party developed w TI produced & marketed	10/83
File Manager	✓			ALC-A w 2 microdrives & 80 column printer ALC-C with 2 microdrives & 80 column printer	Ashton Tate Softwere Publishing Corp	20k up front 15% royalty	3rd party developed w TI produced & marketed	10/83
Games	✓		ALC-A with portable printer ALC-C with portable printer	ALC-A with 80 column printer ALC-C with 80 column printer	Internal	6 man months	—	11/83

Secretary/ (appointment scheduler + authoring)	✓✓		ALC-T/ with portable printer	NIC-C ys modem + portable printer		In room			
Math II	✓		ALC-A with portable printer	ALC-C with portable printer	Internal	8 man months	-	12/83
Finance/ Investment	✓		ALC-A with portable printer	ALC-C with portable printer	Internal	8 man months	-	11/83

Verticle ~~Software~~ Market Software.

Verticle application software is defined as solutions for specific types of industry professionals. While everyone may be interested in purchasing a word processing package, only electrical engineers have a need for ~~database systems~~ CAD/CAM ~~other~~ or wirewraping software. We have identified a number of verticle markets to pursue based on market research in the field, the size of the market, and available software authors.

~~A verticle market~~

A number of these packages ~~has~~ Are being converted from the TI-59 library. ~~As Approach presents~~ As with the approach to horizontal markets, ~~product~~ portibility plays a key role in the use of the ~~product~~ solution.

Application	Software Media		Hardware Configuration		Potential Source	Cost of Development	Terms & Conditions	Predicted Availability
	Rom	Microtape	Portable	Desktop				
Funded & Under Development								
Electrical Engineering	✓		ALC-A w Portable printer / ALC-C with portable printer		Internal	8 man months		1/83
Photography		✓	ALC-A with Portable printer / ALC-C with portable printer		Internal	3 man months		1/83
Solar Energy		✓	ALC-A with portable printer / ALC-C with portable printer		Internal	3 man months		1/83

Inventory	✓	ALC-A with portable printer	Internal	3 man months	83
		ALC-C with portable printer			
QA Sampling	✓	ALC-A with portable printer	Internal	3 man months	1/83
		ALC-C with portable printer			
Fluid Dynamics	✓	ALC-A with portable printer	Internal	3 man months	1/83
		ALC-C with portable printer			
Probability Analysis	✓	ALC-A with portable printer	Internal	3 man months	1/83
		ALC-C with portable printer			

Mechanical Engineering	✓	ALC-A with portable printer ALC-C with portable printer	Internal	3 man months	1/83
Physics	✓	ALC-A with portable printer ALC-C with portable printer	Internal	3 man months	1/83
Non Parametric Statistics	✓	ALC-A with portable printer ALC-C with portable printer	Internal	3 man months	1/83
Production Planning	✓	ALC-A with portable printer ALC-C with portable printer	Internal	3 man months	1/83
Regression Analysis	✓	ALC-A with portable printer ALC-C with portable printer	Internal	3 man months	1/83

QA Control Charts		✓	ALC-A with portable printer ALC-C with portable printer	Internal	3 man months	1/83
3D Graphics		✓	ALC-A with PORTABLE PRINTER ALC-C with portable printer	Internal	3 man months	1/83
<u>Unfunded Programs</u>						
Real Estate Analysis	✓	✓	ALC-A with portable printer ALC-C with portable printer	Howard Soft Palmer Berge Pocket Info Corp	10k up front 15% royalty	3rd party developed TI produced + marketed	6/83 ALC-A 6 months 12/83 ALC-C Rom
Contractor Package		✓	ALC-A with portable printer ALC-C with portable printer	Timberline DDS Business Software	10k up front 15% royalty	3rd party developed TI produced + marketed	12/83
Industrial Engineering		✓	ALC-A with portable printer ALC-C with portable printer	Society of Industrial Engineers	5k up front 10% royalty	3rd party developed + TI produced + marketed	6/83

Horse Race Handicaps	✓	ACC-a ~~ACC-a~~ ACC-c	H&E Computronics ~~Pocket~~ Permaseta/inc	5k upfront 10% royalty	3rd party developed & TI produced & marketed	6/83
Banking	✓	~~ACC-a with~~ ACC-a with portable printer ACC-c with portable printer	~~ACC~~ outside consultants	5k up front 10% royalty	3rd party developed & TI produced & marketed	8/83
Civil Eng	✓	ACC-a with portable printer ACC-c with portable printer	outside consultants ~~in house~~ ~~consultants~~ VDB	~~6 months~~ 5k up front 10% royalty	3rd party developed & TI produced & manufactured	~~12/83~~ 9/83
Structural Engineers	✓	ACC-a with portable printer ACC-c with portable printer	outside consultants	5k up front 10% royalty	3rd party developed & TI produced & manufactured	9/83
Operations Research	✓	ACC-a with portable printer ACC-c with portable printer	outside consultants	5k up front 10% royalty	3rd party developed & TI produced & manufactured	10/83
Heating Ventilating ~~HOUSE~~ & air conditioning	✓	ACC-a with portable printer ACC-c with portable printer	outside consultant	5k up front 10% royalty	3rd party developed & TI produced & marketed	10/83

APPLICATION	PORTABLE	COMPUTATION, SERVICE BUREAU OR OEM DEVELOPERS WORKSTATION	PRIMARY SALE
OIL MODULES	✓	✓	ALL OIL COMPANIES AND SUPPORT DRILLING COMPANIES.
RETAIL DATA	✓		ALL GROCERY, AUTO AFTERMARKET, DRUG CHAINS, SPECIALTY STORES, BROKERS, HARDWARE ETC
SURVEYING	✓		MODULE APPLICATION FOR SURVEYORS
OPTICAL SURGERY	✓		MEDICAL
MATERIALS RESEARCH USAF	✓	✓	USAF
BANKING	✓	✓	DAVIS GILBERT
AUTOMOTIVE SALES COMMUNICATIONS	✓	✓	MAJOR AUTO COMPANIES
SOCIAL SECURITY	✓	✓	GMS
DRAPERY ESTIMATING	✓	✓	SPRINGCREST
GRAPHIC ARTS	✓	✓	QUICKPRINT

Application	Portable	Workstation	Primary Site
Advertising Rates	✓	✓	Telmar Group
Actuarial Tables	✓	✓	Oota Life Assoc
Casualty Ins Sales	✓	✓	Great American Ins
Nuclear Effects Targeting		✓	Horizon Tech
Aircraft Loading Specifications	✓	✓	USAF
Route Acctg	✓	✓	Frito Lay, Coke, Pepsi
Tax Audit	✓		State of New York
Data Decryption	✓		Department of Defense
~~Encryption Transmission~~	✓		~~Chase Manhattan Bank~~
Car Dealer Payroll System		✓	Reynolds + Reynolds
Public Pension Fund Mgt		✓	MTD
~~Tax~~			

3rd Party
~~Hardware~~ Needs

Currently, two simulators are available to lend to software suppliers for program development. These machines simulate the ALC-A with the capability to attach peripheral simulators. ~~Over the past few that~~ Three other simulators we be available within a month. Although, shortly 5 machines will be dedicated to 3rd party development, those machines only run basic.

(5) CURRENT RISK

c) DETAILED Description of ALC-R2 Development

Hardware & Software

We have several options to achieve at least the ~~short term~~ goal of ALC products with additional high level languages (such as PASCAL and FORTRAN).

Option 0: Produce 64K byte language modules which plug-in to the present ALC. These would make the machine then be dedicated to the new language until removed or replaced with another language.

Option 1: Replace the 32K ROM code in the present ALC with another ROM (which needs to be larger — 64K), thereby creating separate "flavors" of ALC consoles (BASIC, PASCAL, or FORTRAN).

Option 2: Rework the case for the present ALC so that by introduction of the new language software, a new plug-in port could be provided on the bottom of the unit to accept the new languages in "language modules".

Option 3: Replace the 32K ROM code in the present ALC with 3 such chips to provide 96K and include in that amount three languages (BASIC, PASCAL, and FORTRAN).

Some of the factors that apply to each option are shown below:

	option 0	option 1	option 2	option 3
Languages and applications can reside simultaneously	NO	YES	YES	YES
Applications will run regardless of language	NO	NO	YES	YES
Languages may be added in the future	YES	NO	YES	NO

— 1 —

It is felt that all three points in the list above are sufficiently important to indicate option 2 (addition of a language port) as the preferred approach. The software for the new language modules can also be provided in a compatible application module for PDS4000 units in the field, so option 0 is also provided for retrofit. Option 3 is seen as too restrictive for the long term and less marketable (some buyers feel they are buying capability they will never need, the generality of option 2 is lacking and the SRP will be higher).

A further conclusion is that additional RAM capability inside the console will be needed to support this larger strategy. The main reason is to all large applications (such as TK! SOLVER) to have at least 32K of RAM even though they take up all the applications module port. (The present PDS4000 can have only 18K internally, plus 16K in the application module port.) A secondary reason is to allow soft media applications to gain access to 50K (34K internal and 16K in the applications module port). This objective is met by providing two additional RAM sockets in the console (for 8K chips only) and adding logic to the logic array to allow software paging of that 16K with a portion of the present module address space.

The key hardware activities to achieve option 2 are:

1. Add several key features to the logic array in the PDS4000. (Additional page bits to allow 64K system ROM, two additional 8K RAM chips inside the console case and paging control logic to page ROM and RAM in one half of the module address space.) These are changes that are necessary for ALC-C anyway and will allow the architecture of the new language machine and ALC-C to be identical.

2. Add the capability to have a user replaceable language module port. This can be accomodated possibly by increasing the thickness of the present PDS4000 case. Some additional tooled items would be required (simply bottom case, language module plastics, module clip, module door).

The key software activities to achieve option 2 are:

1. Write a PASCAL interpreter language.

2. Write a FORTRAN interpreter language.

3. Write a PASCAL compiler

- 2 -

4. Write a BASIC compiler

5. Write a FORTRAN compiler

These activities are added to the following key hardware and software tasks already identified for 1982 activity. The definition of ALC-C in depth and the modem, B/W TV, and microdisk peripherals are very important as there use with the new languages will be important for good human factors and compatability (both with ALC and 99/4 products).

HARDWARE   SOFTWARE

ALC-C   TELECOM (COMMUNICATIONS, SCHEDULING)
ALC LOW COST   ALC-C BASIC AND OPERATING SYSTEM
MODEM   SPREADSHEET
B/W TV INTERFACE   PERSONAL WORD PROCESSOR
MICRODISK   TK! SOLVER
                                  ONE LINE SPREADSHEET
                                  ALC LOW COST
                                  ALDS COMPLETION

Risk of Development

The hardware risks are small compared with those taken during the past year on the ALC design. It appears that language software development will pace this activity and that effort will require until late 3Q 1983 at least for the first language.

1. For the best solution the 76040 is required. However, this device will be completed first pass by January, 1983.

2. The logic array must use a larger package (48 pin to about 72 pin). This is consistent with our plan to cost reduce the logic array and upgrade it for ALC-2. Internal development of this new package internally in the necessary time poses significant schedule and cost risk. However, the needed package is being used by some manufacturers now and an approach to have devices assembled externally can be expected to have reasonably low risk.

3. Logic additions are required for the logic array. These can be defined before the end of 1982 to give sufficient time for cost effective implementation using modular design techniques. A back up gate array implementation can be considered if necessary.

4. Tooling changes are needed for implementation of the language module and provision for additional RAM inside the console. These changes are relatively minor compared to the initial tooling effort. The approach can be defined and modeled with 4 to 6 weeks and if that effort is successful then implementation will be low risk.

7) Schwarz / Dermal / Peake Measurements

The development of the new language product based on addition of a language port will require the following investment:

ITEM	1983				1983
	1Q	2Q	3Q	4Q	TOTAL
HARDWARE DESIGN					
SOFTWARE DESIGN					
OVERHEAD					
MATERIAL					
MECH DESIGN					
DRAFTING					
IND DESIGN					
PRINTWARE					
OTHER					
TOTAL					

The other hardware and software items listed above will require the following investment:

ITEM	1983				1983
	1Q	2Q	3Q	4Q	TOTAL
HARDWARE DESIGN					
SOFTWARE DESIGN					
OVERHEAD					
MATERIAL					
MECH DESIGN					
DRAFTING					
IND DESIGN					
PRINTWARE					
OTHER					
TOTAL					

This will make the total investment needed for the ALC area in hardware and system software (not counting applications software, third party software and product planning/marketing):

ITEM	1983				1983
	1Q	2Q	3Q	4Q	TOTAL
HARDWARE DESIGN					
SOFTWARE DESIGN					
OVERHEAD					
MATERIAL					
MECH DESIGN					
DRAFTING					
IND DESIGN					
PRINTWARE					
OTHER					
TOTAL					

8) TI CoDamin ...

CUSTOMER	RECEIVED'88	S/W WRITTEN	COMMENT
MTD INC	YES, JVL	Loan Tax IRA	MTD has made three initial calls-Coopers & Librand, Hanover Bank and Mercantile Bank-Can sell 1K ALC in Dec. Switch to ALC possible hire.
STANDARD OIL OF INDIANA	NO	Territory Mgmt	S/W done on simulator they have not made a decision yet. We could lose this opportunity because the HP rep told them we would never come out with the 88. Switch to ALC may be impossible
RV WEATHERFORD INC.	YES, JULY	Small Ins	RV Weatherford has talked to a few insurance companies. Switch to ALC here unknown due to credit past and current business problems
HORIZON TECH	YES, JULY	Experimental only	Has large module business. Possible switch to ALC
GMS	YES, JULY	Experimental only	Can be switched to ALC Has large module business
KODAK	YES, JULY	Experimental	Has large base of 59/ PG1000/cutom modules. But they can be switched to ALC.
OTHERS(14)	NO	NONE	Other module customers that cover oil, banking military, financial etc. Can be switched but with time.
CHASE MANAHATTAN BANK	YES, JULY	NONE	Is possible to switch to ALC although they have said their is a place for the 88.
TAX MANAGEMENT	YES, JULY	NONE	Have reviewed both 88 & ALC with no decision on which to go with. Still looking at the Sharp 1500, Panasonic, HP41CV or 25

CUSTOMER	RECEIVED'88	S/W WRITTEN	COMMENT
SYSTEM 7/ SYSTEM PROGRAMMERS	YES, JULY	NONE	Still Looking for modular solutions to oil/insurance mkt. can be switch to ALC although they are doing business with

CC 807

CALCULATOR PRODUCTS
TI-88 FAMILY PHASEOUT LIABILITY (HK)

ON-HAND INVENTORY — LUBBOCK 548.9
                   — DMT 132.4
                   — TIT 779.7
                   — TIPI 5.3
                   TOTAL 1466.3

PIECE PART/INVENTORY COMMITMENTS 701.8

PIECE PART/TOOLING COMMITMENTS 119.2

CAPITAL — CIP 758.8
        — BOOK VALUE 117.8
        — COMMITMENTS 15.0
        TOTAL 891.6

EXPENSE — BURN-IN RINKS/SOCKETS 71.5
        — S/C (OEM BOARDS/TOOLING) 259.8
        — TI 88 APPLICATION SOFTWARE ... 104.5
        — TI 66 SOFTWARE/TOOLING 135.0
        — 88 800 OS/TOOLING COMMITMENTS 30.3
        — CASIO ✓ ✓ ✓ 27.8
        — TI 88 ✓ ✓ ✓ 115.5
        TOTAL 744.4

OTHER 150.0

TOTAL 4075.3