Automatic Data Processing
Banking Services Division
200 Broadacres Drive
Bloomfield New Jersey 07003
201 365-7314

ADP

July 8, 1981

Mr. William Gilles
Vice President of Marketing
Mattel Electronics
5150 Rosecrans Ave.
Hawthorne, Calif. 90250

Dear William,

Your firm has been invited to participate in a planned selection and purchase of Home Terminals.

Enclosed is a request for proposal which describes our Home Terminal System requirements and the expected content of your proposal response. If your firm wishes to respond, you should indicate this intent in writing no later than May 30, 1981 to:

>Mr. R. J. Montouro
>Automatic Data Processing, Inc.
>405 Route 3 MS #105
>Clifton, NJ 07015
>(201) 365-7300

Your response should identify the party and address to be used in subsequent mailings.

Proposals must be submitted to ADP by August 2, 1981. Four (4) copies of your proposal should be sent to the above address.

Questions regarding the Home Terminal may be addressed to:

>Mr. R. J. Montouro - ext. 7315
>or
>Mr. J. Gould - ext. 7804

as the same address as above.

This Request for Proposal does not commit ADP to procure or contract for any equipment or services. ADP reserves the right, without qualification, to accept or reject any or all proposals, to negotiate with any and all proposers regardless of the terms of the original proposal, to request additional clarifying information, and to consider any proposals, or modifications received after the due date, should this action be in the best interest of ADP. Additionally, ADP will sign, if required, a non-disclosure agreement.

Proposals should be prepared simply and economically, providing the information requested in the format specified. Ordinary typing, clearly reproduced, is perfectly acceptable. Upon request from any unsuccessful vendor, all copies of his proposal will be returned. All respondents will be informed of our selection in September, 1981.

Your firm was selected to receive this RFP on the basis of a preliminary evaluation. We look forward to your firm's participation in and support of our evaluation effort.

Sincerely,

R. J. Montouro
Manager, Hardware Analysis
E.F.S.

/drn

REQUEST

FOR

HOME TERMINAL SYSTEM

Date Issued: April 1981
        By: Automatic Data Processing, Inc
             405 Main Avenue
             Clifton, N.J. 07015

PROPRIETARY NOTICE

HTS

HOME TERMINAL SYSTEMS

TABLE OF CONTENTS

I. INSTRUCTIONS FOR BIDDERS

1. OVERVIEW

ADP plans to acquire Home Terminal equipment and the associated system software to support planned new services. The services will be offered throughout the United States. All hardware and systems software will be acquired from one vendor. Applications software and consumable supplies are not addressed in this document, however, proposals relating to these two areas will be accepted.

To participate in this selection, vendors are invited to complete two tasks;

.   development of a written proposal
.   live real-time presentations

The expected long term reliance of ADP on the selected vendor for hardware, maintenance and systems software in support of a nation-wide service affects the selection process. Corporate financial strength, overall commitment to the microcomputer marketplace and product line breadth become more important. Specific hardware features or characteristics become less significant.

2. DEFINITION OF MODEL CONFIGURATION

It is intended that these microprocessor based terminals will serve individuals in their homes or small businesses. For evaluation purposes, a profile of a typical customer is listed below. Vendors are encouraged to submit bids even though all the peripherial requirements may not be attainable.

The most important aspect of any response to this specification should be the ability to offer a low cost base configuration for an individual customer.

Typical customer configuration

o (1) one television provided by customer

o (1) one plug for the telephone connection and/or
  (1) one acoustic coupler provided by vendor

o (1) one keyboard provided by vendor

o (1) one switch allowing normal T.V. viewing or
  terminal access

o All necessary connecting cables

Refer to attachment one (1) in the appendix for details on all the above items.

3. PROPOSAL FORMAT AND OUTLINE

This section describes the format and structure to be used in all responses to this Request for Proposal. Vendors are encouraged to include existing materials, such as standard contracts, specification sheets, etc. if they choose, as appendices or attachments to the proposal itself. Such references should be as specific as possible, identifying not merely the document containing the answer, but the chapter, page number, or exhibit number, etc.

Each vendor proposal must contain seven chapters, as follows:

Chapter A Corporate Background and Financial Position

The material in this section will be used to assess the (parent) company's financial standing and strength, and the extent of its commitment to the computer marketplace. Financial data requirements may be met by including the most recent annual report, and quarterly report as an appendix. Other data needed are the names of (computer division) officers, and a description of the marketing organization which will interface with ADP corporate headquarters in Clifton, New Jersey.

Chapter B General Product Descriptions

The actual configuration(s) to be priced are presented in Chapter C. They may contain many common components and utilize common software. In this chapter, to avoid repetition, general information about the product line(s), operating systems, and languages should be presented. This information may include specifications, speed and capacity or performance data, reliability data, and functionality (ex: instruction repertoire).

Models, options or components which are a compatible part of the product line but which were not selected by the vendor for inclusion in the configurations of Chapter C may be described.

Chapter C Model Configuration

In this chapter, vendors must configure and present completely their recommended configurations.

Memory, media storage, and communications capacity requirements are to be developed by the vendor. <u>Submission of a recommended configuration implies a vendor's judgement that expected response and performance objectives for the user can be achieved, assuming competent implementation of applications programs.</u>

For each configuration, a table should be prepared containing the following information in columns:

- o Component Model Number
- o Designation
- o Power consumption and voltage
- o Start and run current
- o BTU output
- o Dimensions
- o Announcement date and/or first installation date
- o Temperature and humidity restrictions
- o Number currently in use
- o UL approval
- o FCC Registration number, (if applicable)

A summary of aggregate power, and any other requirements must be included. A layout or statement of total space requirements is also required.

Chapter D Hardware and Software Maintenance

In this chapter, the vendor must describe (without reference to prices), the terms, policies, and conditions under which he provides hardware and software maintenance for the sytems proposed in Chapter C. These descriptions must include a summary of maintenance strategies and logistics spare parts strategies. This information should be accompanied by a list of the domestic U.S. locations from which the equipments are serviced and a statement as to the number of domestic qualifi services technicians employed as of April 1, 1981 and the number expect as of April 1, 1982.

Chapter E Other Support

In this chapter, vendors should describe the support facilities available from the firm other than field service. This information is desired regardless of whether such services are "bundled" with the hardware and system software bid in Chapter C, or available only at extra cost. Categories of support to be described if available are:

o   Training and Educational Materials
o   Software Technical Support
o   User groups or informal program library arrangements
o   Hardware Technical Support

Chapter F Pricing, Terms and Conditions

This chapter should be presented in parts.

o   Prices and discount schedules
o   Standard terms and contract language
o   Review of Chapter E
o   Delivery Plan

The first section should describe overall prices for each con-figuration for yearly contract quantities of 300/500/1000/5000/10,000/ 20,000. Component by component prices are not necessary, but the system totals should be broken down at least to identify:

o   Hardware purchase
o   One-time software license or royalty costs
o   Ongoing software charges
o   Minimum - cost maintenance option costs
o   Recommended maintenance plans options costs
o   Shipping costs estimates to Clifton, New Jersey
o   Standard prices for training and documentation

All prices except shipping cost estimates must be valid, under vendor-stated terms and conditions, for the period April 1, 1981 to April 1, 1984.

To the greatest feasible degree, options and services normally provided and "bundled" with system prices - such as warrantees, training privileges, initial supplies, installation and manuals - should be excluded from the hardware prices, unless they meet a specific requirement of Chapter 3. Although ADP recognizes the value of such services and is likely to procure these items from the selected vendor, the "bundling" with hardware prices limits the comparability to alternative proposals.

This section should present the vendor's standard OEM terms and conditions, adjusted as appropriate to reflect items unbundled from the quoted prices.

Chapter G Customer References

A list of customer references is required so that reference checks can be made. For each customer's reference, the following information is to be supplied:

- o Company Name
- o Company Address
- o Telephone Number
- o Contact Name
- o Equipment configuration installed

4. EVALUATION CRITERIA

Vendor proposals will be reviewed and evaluated along four (4) major dimensions:
- A. Reliability and maintenance
- B. Price
- C. Ease of upward compatability
- D. Other contributing factors

A. Reliability and Maintenance

This factor is vital to the successful operation ADP's Home Terminal Service. Maintenance and reliability are evaluated on the following factors:

- o   Contracts available and costs
- o   Spare parts - number and location
- o   Diagnostics
- o   Preventive maintenance
- o   Timeliness of response
- o   Mean time to failure and repair
- o   Service organization and locations

To determine the quality of the maintenace organization, reference checks may be made with current customers of each vendor evaluated.

B. Price

For each sample case, the configuration prices must be quoted.

C. Ease of Upward Compatibility

- o   The ability to store data at the terminal will be desirable from two aspects;
  - . the capability to downstream load a program module
  - . the capability to load and retain data on some type of removable media (floppy, cassette, etc.) by storing data at the terminal the customer could minimize line expenses and ADP could reduce the network and system resource requirements. The future potential of storing data in the terminal should be covered in depth.

- o   The ability to print screen information or other type reports is also desirable. The potential capability to connect a Thermal, Dot Matrix or other type printer should be discussed in detail.
- o   The potential to add a magnetic stripe reader should also be described.

II. REQUIREMENTS

Three types of requirements have been identified -
1) Operational and availability requirements
2) Technical requirements - Communications
3) Technical requirements - Hardware/Software

1. OPERATIONAL AND AVAILABILITY REQUIREMENTS

a) Availability Definitions

A most important requirement in all of ADP's products and
services is to provide an extremely high system availability for
its customers. In order to insure that high availability of its
systems is achieved, certain system characteristics are required.
These characteristics go beyond supplying reliable hardware and
software components. They include methods or procedures for pre-
venting, diagnosing, and repairing failures as well as methods and
procedures for minimizing down time and circumventing components
that have failed.

The second underlying requirement is that in the event of failure
repair time should be less than 24 hours in 90% of all cases.

b) System Characteristics

In order to achieve these high availability goals, the following
system characteristics are required:

1) MTBF/MTTR - These statistics should be available on a
single system to satisfy the requirements stated earlier.
2) Diagnostics - A full set of hardware diagnostics should
be able to be loaded and run remotely and locally.
Microprogrammed diagnostics, easily initiated by the
customer, should be available. The diagnostics should
be able to be run by customers utilizing clear, easy-

to-use procedures and outputs. Where applicable, preventive maintenance procedures and schedules should be effective, proven, and otherwise meaningful, and should be accessible through remote diagnostic capabilities. The ability to replace boards or other components easily by the customer is highly desirable.

c) Environmental Requirements

It is absolutely essential that high quality visual resolution be maintained at all times for all type and size characters assuming the video monitor is capable of good resolution.

All hardware under review must be able to operate in a normal household environment, in reference to the following requirements.

1) Standard electrical outlets and plugs should be sufficient to accomodate all equipment.
2) Normal household humidity fluctuations should not have any adverse impact on the equipment.
3) No single device should generate more than 300 BTU's per hour.

The terminal must easily connect to the T.V. antenna connection. A switch should be available that allows the user to easily switch from CRT utilization to T.V. viewing.

The electrical fuse should be located in a place that is easily accessable.

A keyboard key lock is desirable.

It is essential that no other TV units in the house be impacted by terminal utilization.

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2. TECHNICAL REQUIREMENTS - COMMUNICATIONS

Baud Rate - Data transmission speeds of 300 to 9600 Baud are required. The Baud rate should be switch selectable and easily accessable.

Data Transmission Mode - The terminal must be able to operate via the switched public dial-up network.

Data Communications Connection - A connection allowing the telephone cable to plug into the terminal is desirable as is an internal acoustic coupler. If an acoustic coupler is not internal to the terminal, an RS 232 connector is necessary to connect to the external coupler.

Parity - Should be switch selectable with odd, even, or no parity checking available. This switch should be easily available.

Acoustic Coupler - Thecoupler should provide the customer with both a carrier and power indicator (Led, light, etc.). The coupler should operate at 300 Baud. Higher Baud rates via switch selection is desirable. A half or full duplex switch is also necessary.

System Busy Indicator - It is desirable to have an indicator showing the system busy state when appropriate.

Clear to Send Indicator - An indicator reflecting a CTS on state is desirable.

Method - Asynchronous: Serial-By-Bit; Serial-By-Character

Code: ASCII: (1) one start BIT, 7 Data BITS, one or two stop BITS, switch selectable.

Mode - Switch selectable, half or full duplex, line-local.

Control Signals - Request to send (output signal), clear to send (input-signal), clear to receive (output signal).

Terminal Identification - A terminal identification code should be hard wired into the unit in such a manner that prevents modification by customers. This I.D. would be separate from any software generated I.D. numbers and passwords.

Auto-Dial - This function would allow the terminal user to establish a dial-up connection by use of a function key. The ability to access a telephone number located in the terminal is also desirable.

Input/Output Overrun - In the event that the terminal receives data too fast, is not ready to receive data, or a handshaking problem occurs or the central computer is not receiving properly from the terminal a specific signal should inform the operator of the nature of the problem.

Line/Local - The capability to utilize the video screen and keyboard in a off-line mode is required.

October 19, 1981

To: Dave Chandler
From: Dave Hostetler
Subj: The Telephone Connection

Interfacing Intellivision to the phone line has applications in data communication, electronic mail, security and home PBX.

Data communication includes data base access, banking, and videotex. These features require a 300 baud modem with auto dial and, for videotex, 1200/75 baud capability. Pulse dialing is required and DTMF (push button) dialing is a desirable option.

Electronic mail adds auto answer to the above requirements. As an option, 1200 baud transmit would greatly enhance this application.

Security would use the phone to report alarms and allow the control of lights and appliances remotely. These applications would use auto dial, auto answer, voice synthesis (if available), and DTMF receive. Voice synthesis could announce the alarm condition to the phone line and DTMF receive would allow acknowledgement of alarms and remote control of lights, etc. Voice recognition could replace DTMF in most cases.

The home PBX feature would allow speed dialing, dial intercom, phone answering, and speakerphone applications. The speed dialing and dial intercom would be simular to existing office electronic phone systems. Phone answering would use speech synthesis to announce and a the cassette to record calls. The intercom function should be a part of Intellinet and, assuming a full duplex audio link, a speakerphone function would be simple to support--including telephone through the TV a la Zenith.

In summary the phone connection should have:
    300 baud full duplex modem
    1200/75 baud receive/transmit modem
    Auto dial
    Auto answer
    DTMF receive and transmit
    1200 baud transmit
    Link to voice synthesis/recognition
    Link to Intellinet
    Link to cassette play/record

October 31, 1981

To: Dave Chandler
      Stav Prodromou

From: Dave Hostetler

Subj: REMOTE KEYBOARD COMPONENT

This is a product proposal for a device (Remote Keyboard
Component for purpose of discussion) that would allow
operation of the current Keyboard Component from a
remote location (ie another room of the house).

A quick scenario best describes the application.
Picture the Intellivision home of the near future: The
Keyboard/Master Component are installed in the living or
family room, perfectly positioned with all the cables
carefully hidden and the game-TV switch attached to the
back of the large screen color TV. A pretty picture
until someone mentions that at different times during
the last week junior wanted to work on his French, dad
wanted to check out his stocks and mom wanted to check
in with Jack Lalane. Unfortunately, each wanted to do
it while someone else was using the room and/or TV.
Sure, they have other TVs, but moving the
Keyboard/Master Component is a pain; as is moving the
other room/TV user. The Remote Keyboard fixes these
problems, and expands the horizons and applications of
the Keyboard Component at low cost. It is not hard to
visualize this product as Intellinet I.

TECHNICAL STUFF

To make a Remote Keyboard, take a length of TV coax
cable (the kind that you buy at Radio Shack for your TV
antenna, it comes in various lengths complete with F
connectors); at the Keyboard/Master Component location,
split the RF output from the Master component and send
half to the local TV and the other half to the cable.
While you are at it, arrange to put power (5 VDC) on the
cable and receive serial data (1200 baud) and audio from
the cable (they will be current modulated). At the far
end of the cable, the game/TV switch box will route the
RF to the TV and the power/data/audio to the Remote
Keyboard through a simple two-conductor cable and
connector. Inside, a National Semiconductor MM57499
Serial Keyboard Interface IC (see attached data sheet)
will decode/debounce the key matrix while another

standard   IC   amplifies the microphone signal and
modulates the line current with data and audio.

Since the Remote Keyboard is a little smaller than the
current   Master   Component, it is easily portable
(remember that it plugs into the switch box with a
simple two-connector plug).   Therefore, it can support
multiple remote positions by the addition a selector
switch, cable and special switch box.

![National Semiconductor logo]

National Semiconductor

Electronic Data Processing

MM57499 96 or 144-Key Serial Keyboard Interface (SKI)

General Description

The MM57499 keyboard interface, an NMOS silicon gate technology device, is designed to be a minimum IC solution for the purpose of interfacing detached keyboards to terminals. It can reduce the usual 18 to 24-wire keyboard to terminal interconnection to a 5-wire connection.
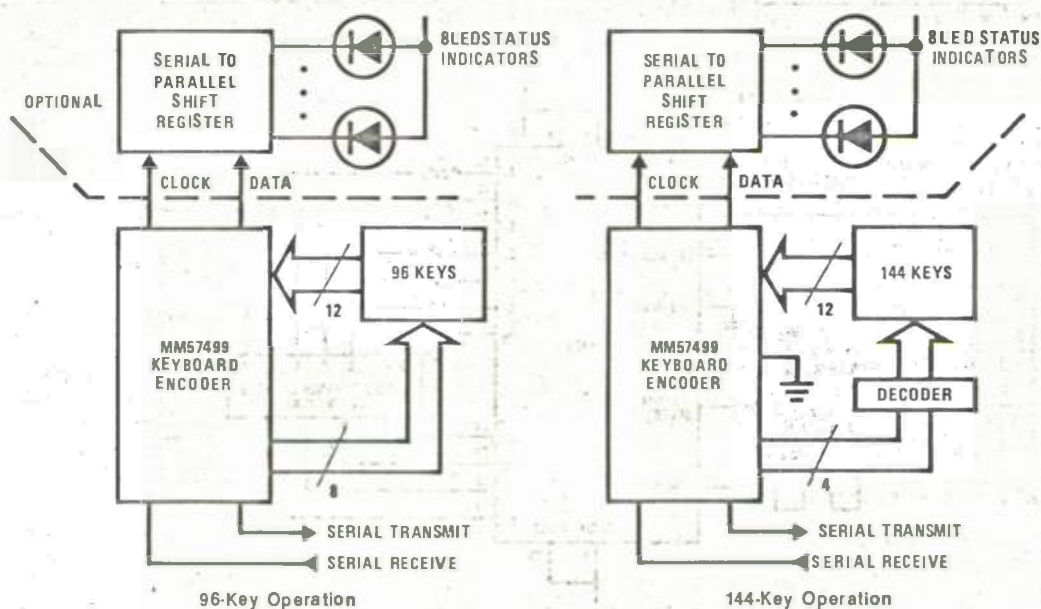
The 96-key operation is a simple direct interface to a 12 × 8 matrix keyboard. The additional capability of a 144-key option can be obtained by implementing an inexpensive 4 to 12-line decoder IC between the MM57499 and a 12 × 12 matrix keyboard. If fewer than 96 or 144 keys are used, no connection is required in the matrix at the unused key locations.

Features

- Full upper and lower case ASCII codes, numeric pad & function encoding on-chip

- On-chip oscillator utilizes the standard 3.58 MHz color burst crystal
- On-chip baud rate generator
- Serial transmit and receive *—1200 BAUD*
- 400 WPM burst rate (typical)
- 2-key lockout
- Auto repeat on all keys
- Manual repeat key
- Programmable phrase storage
- Shift, cap loc, control, modes
- 144-key strap option
- Status information for up to 8 indicators
- Single 5V supply
- 2.5 kΩ maximum ON resistance
- TTL compatible
- 28-pin dual-in-line package

Basic Application

96-Key Operation

144-Key Operation

Functional Description (Continued)

Functional Application 96-Key Mode

STATUS LEDS

3 4 5 6 10 11 12 13

1
2
8

MM74C164
SERIAL-TO-PARALLEL SHIFT REGISTER

9

V_{CC}

MM57499   2   TTL CLOCK

ALTERNATE
CLOCK INPUT
METHOD
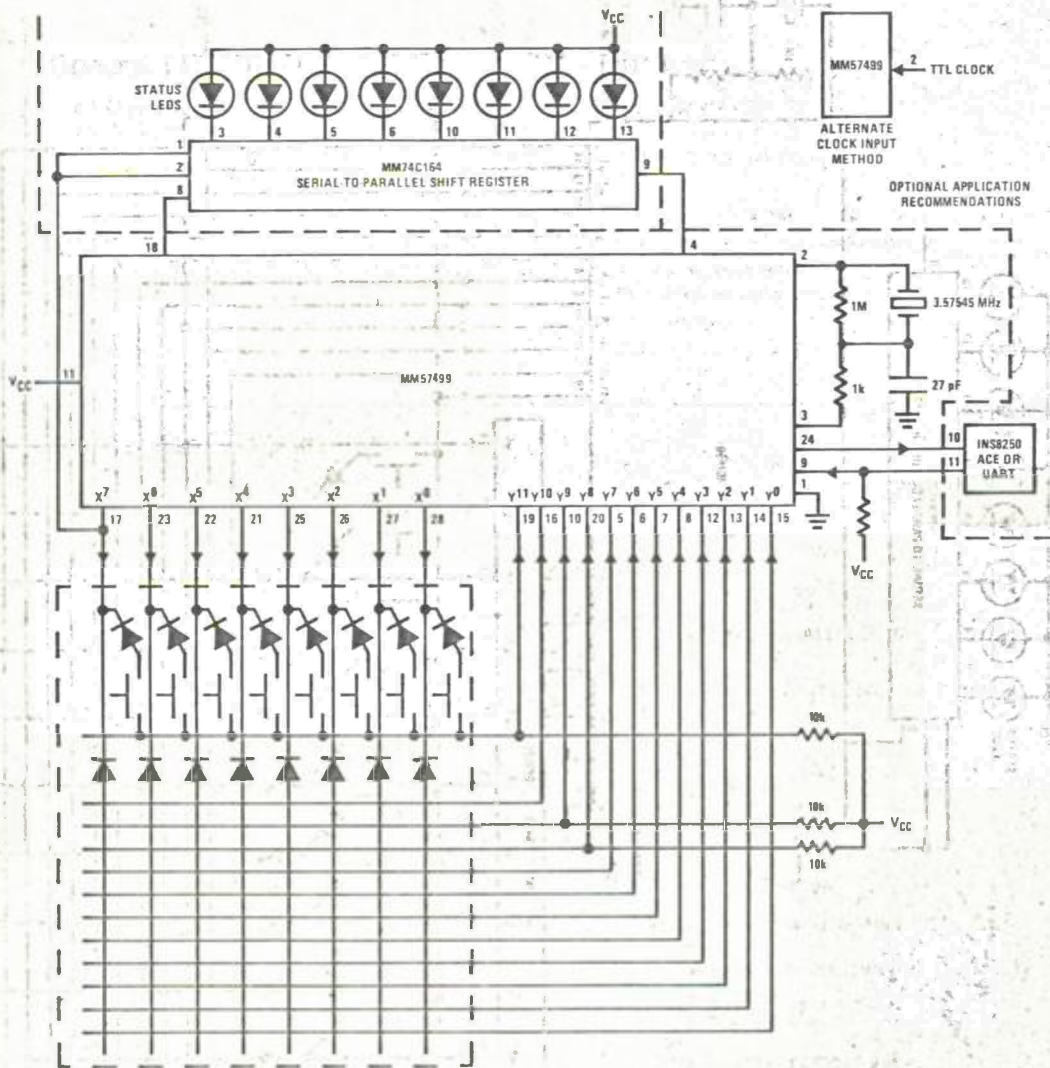
OPTIONAL APPLICATION
RECOMMENDATIONS

18   4

2

1M   3.57545 MHz

V_{CC} 11

MM57499

1k   27 pF

3

24
9   INS8250
ACE OR
UART

10
11

x^7 x^6 x^5 x^4 x^3 x^2 x^1 x^0 $y11$ $y10$ $y9$ $y8$ $y7$ $y6$ $y5$ $y4$ $y3$ $y2$ $y1$ $y0$

17 23 22 21 25 26 27 28   19 16 10 20 5 6 7 8 12 13 14 15

V_{CC}

10k

10k V_{CC}

10k

urrent

.3V (MAX)
.5V (MAX)
.3V (MIN)
.5V (MIN)

October 31, 1981

To: Stav Prodromou
       Dave Chandler

From: Dave Hostetler

Subj: Chemical Bank -- Terminal Proposal

With respect to our conversation with Bill Cornfield on Oct. 27, I would like to make the following proposal for a terminal using the Intellivision Master Component.

I propose that we supply a terminal peripheral built in the speech peripheral housing with the following features:

        40 x 24 High Resolution Alpha Display
        Low Cost Direct Connect Autodial Modem
        Light Pen

Using a standard cartridge housing, which will plug into the terminial housing, we would provide the program ROM and the required EEPROM (it may be necessary and desirable to provide the EEPROM enable from the terminal peripheral). In addition, a full alpha keyboard will be available as an option.

The high resolution alpha display generator should be straight forword and may or may not benefit from the use of a CRT controller chip. We are currently studying a very low cost approach to the modem problem that may have application here. Additionally, a 75 baud transmit/1200 baud receive feature may be possible to increase the efficiency of communications for Videotex applications. The light pen is included as standard with the keyboard optional because it is lower cost and I feel that it will serve the needs of the bulk of Chemical Bank's customers. Further, most current Videotex terminals use only a numeric keypad. By the way, the keyboard could easily be exactly the same as the one described in my memo on the Remote Keyboard Component (10/31/81). It would plug into the terminal peripheral using the same connector as in the Remote Keyboard application. This allows a simple field upgrade of the terminal when the customer feels the need for electronic mail, etc. I alsobelieve that Playcable could make use of the keyboard module and large parts of the terminal circuitry and software in their two-way applications.

DAVE C.

PROPOSAL FOR CHEMICAL BANK PRONTO TERMINAL

PHYSICAL CONFIGURATION--The terminal will be housed in the voice peripheral plastic. The keyboard module will be similar in appearance and slightly smaller than the existing Master Component. A model is available for examination.

DISPLAY--The display will be our current Master Component graphics overlayed with terminal generated high resolution alpha-numeric characters. Through software, the graphics will be a form of DRCS (Dynamically Redefinable Character Set); a subset of the ATT standard will be implemented. The high resolution alpha-numerics will be 40 characters per line and 24 lines per screen. Full cursor control will be provided by software.

MODEM--The modem will feature direct connection to the phone line through a modular connector and autodialing with both pulse and tone. 300 baud full duplex and 75 baud transmit/1200 baud receive, also full duplex, will be standard. Call progress monitoring (ringing,busy signals) will be provided by routing audio from the phone line to the TV audio system. Under software control, the same routing can be made allowing synthesized voice from the host to be heard by the user.

CARTRIDGE--The cartridge will contain a 4K x 10 PROM or EPROM (currently under development). A number of unprogrammed addresses will be allocated to allow field customizing per Chemical Bank requirements. By allowing sufficient space, several updates of this data can be made extending the life of the cartridge. This approach is expected to be less expensive than using EEPROMs.

LIGHT PEN--The light pen will be provided as standard. It will be a four foot long fiber optic cable with a quick disconnect plug at the terminal end; this allows the phototransistor to be mounted on the printed circuit board. This light pen is designed primarily for menu selection, but short alpha strings can be input if a keyboard is displayed on the screen. Through an appropriate protocol, the host establishes the string to be returned for each menu selection.

KEYBOARD MODULE--The keyboard module is optional and would

find application only when large amounts of alpha data must be entered (ie electronic mail). To allow easy field upgrade, it will attach to the terminal using a standard modular cable. This cable will supply power and, using the same two wires, return serial data to the terminal. If the keyboard module is the same as that proposed for the Remote Keyboard Component, the audio from the microphone would also be sent to the terminal. This audio, with very few extra components, can provide a speakerphone option. For remote operation, this keyboard can be used in another room with a simple adapter on each end.

POWER SUPPLY--A plug mount power supply will be supplied (may not be needed if CMOS is extensively used).

David Hostetler
November 9, 1981

PROPOSAL FOR VIDEOTEX TERMINAL COMPONENT

SYSTEM BLOCK DIAGRAM

The system block diagram is shown in an attached figure.
The bulk of the circuitry is in the 40 x 24 hi res alpha
generator block. This block consists of a 6502 uP, 1K x 8
RAM, 1K x 8 ROM, character generator ROM, Intellivision bus
interface and assorted support circuitry. The 6502 will
synchronize to the CBLANK signal and, during the active
display time, step through the RAM to present data to the
character generator ROM. Once each line, a sample of the
modem, keyboard and light pen serial outputs will be taken.
During the vertical blanking time this data will be analyzed
by a software UART function. Communication between the 1610
and the 6502 will also take place during vertical blanking.

The modem block contains the telephone line interface and
filters for the different modes of operation. The telephone
line interface uses a reed relay for pulse dialing, a
transformer for isolation and a simple op-amp circuit for
the hybrid function. For transmit the tones are generated
in the Master Component sound chip and filtered to eliminate
interfering harmonics before being applied to the phone
line. On the receive side, the filters reject local carrier
and noise. Both filters are expected to use switched
capacitor technology; while standard parts are available, a
custom will be cheaper and better.

The light pen interface is a phototransistor and another
transistor providing a one bit input to the 6502.

The remote keyboard interface supplies five volt power to
the keyboard connector and separates the current modulated
data and audio from the line.

The keyboard module itself uses a National MM57499 to scan
the key matrix and serialize the results. Another IC
current modulates the data onto the five volt power line.
There are simpler ways to go with four conductors available,
but doing it this way maintains full compatability with the
Remote Keyboard Component previously proposed; even allowing
this keyboard to be remotely located with ease.

The cartridge contains a 4K x 10 PROM or EPROM (currently under development). A number of unprogrammed addresses will be allocated to allow field customizing per banking requirements. By allowing sufficient space, several updates of this data can be made extending the life of the cartridge. This approach is expected to be less expensive than using EEPROMs.

PHYSICAL CONFIGURATION

The terminal would be housed in the voice peripheral plastic. The keyboard module would be similar in appearance and slightly smaller than the existing Master Component. A model is available for examination.

PRELIMINARY COST ESTIMATES

Cost estimates are attached; be aware that a rule-of-thumb factor (x3) was applied to arrive at the "A" price from a very rough parts list.

PERFORMANCE SPECIFICATIONS

DISPLAY--The display will be our current Master Component graphics overlayed with terminal generated high resolution alpha-numeric characters. Through software, the graphics will be a form of DRCS (Dynamically Redefinable Character Set); compatability with the ATT standard is still being examined. The high resolution alpha-numerics will be 40 characters per line and 24 lines per screen. Full cursor control will be provided by software.

MODEM--The modem will feature direct connection to the phone line through a modular connector and autodialing with both pulse and tone. 300 baud full duplex and 75 baud transmit/1200 baud receive, also full duplex, will be standard. Call progress monitoring (ringing,busy signals) will be provided by routing audio from the phone line to the TV audio system. Under software control, the same routing can be made allowing synthesized voice from the host to be heard by the user

LIGHT PEN--The light pen will be provided as standad. It will be a four foot long fiber optic cable with a quick disconnect plug at the terminal end; this allows the

phototransistor to be mounted on the printed circuit board. This light pen is designed primarily for menu selection, but short alpha strings can be input if a keyboard is displayed on the screen. Through an appropriate protocol, the host establishes the string to be returned for each menu selection.

KEYBOARD MODULE--The keyboard module is optional and would find application only when large amounts of alpha data must be entered (ie electronic mail). To allow easy field upgrade, it will attach to the terminal using a standard modular cable. This cable will supply power and, using the same two wires, return serial data to the terminal. If the keyboard module is the same as that proposed for the Remote Keyboard Component, the audio from the microphone would also be sent to the terminal. This audio, with very few extra components, can provide a speakerphone option. For remote operation, this keyboard can be used in another room with a simple adapter on each end.

POWER SUPPLY--A plug mount power supply will be supplied (may not be needed if CMOS is extensively used).

COMPATIBILITY

VOICE PERIPHERAL--Compatability with the voice peripheral should not be a problem; however, the videotex terminal must be plugged into the Master Component first. This is because the voice peripheral reassigns some of the cartridge pins to its own use.

KEYBOARD COMPONENT--Again, some pins are reassigned forcing the hi res alpha-numerics to come from the Keyboard Component. In addition, few users would opt for the keyboard module when the Keyboard Component already has one. Different software or software that adapted to its environment would solve these problems. The net result is that a large part of the terminal hardware would go unused and the software will be more complicated. An alternate Keyboard Component approach would be to use a modem/light pen module at a rear expansion port with new software.

PLAYCABLE--Assuming that the voice unit is compatible, the videotex terminal should be also. However, a videotex/voice/Playcable combination may have timing problems (due to Playcable's delicate clock regeneration scheme).

FUTURE PLAYCABLE--I see a future Playcable Component

consisting of the videotex terminal (hi res alpha generator, remote keyboard interface and light pen interface, but an rf modem), 16K x 10 RAM and a small PROM (for terminal ID). This unit would allow the cable system to provide videotex and banking services. They could own the system or only provide communications services. The housing would be like the existing Playcable Component. This would create yet another market for the proposed keyboard module. The same remote operation possibilities also exist in this application.

ALTERNATIVES

KEYBOARD COMMUNICATIONS TERMINAL—This would be a unit that consists of a keyboard mounted in a housing about the same size as the existing Master Component and containing most of the circuitry described above. The keyboard interface would be simplified to a parallel interface keyboard scanning IC. It is also possible that the 6502 could handle debouncing the key matrix. The unit would either sit next to the Master Component and plug directly into the cartridge port or sit in front with a short flat-cable connection to the cartridge port. Advantages are somewhat lower cost and one less module if a keyboard is required for all applications. A disadvantage is the slightly awkward side-by-side configuration or the FCC difficult flat-cable.

COMMUNICATING MASTER COMPONENT—In one unit slightly larger than an existing Master Component, the existing Master Component circuit and that described above for the keyboard communications terminal would be combined. Savings would be recognized because of the combined package only; the circuit cost would remain the same. Lower production volumes could offset some or all of the savings. Production problems could result due to longer build time and more dollars tied up in limited marketability units (as compared to other approaches where the Master Component can be shipped to anyone and the terminal component is lower cost). Development time will be longer than other approaches because of larger PC board and case and more design decisions (hand controler mounting, unit appearance and shape factor, etc).

David Hostetler
November 9, 1981

In reference to Fig. (1); the system consists of a Viewdata module that plugs directly to the Intellivision's Master Component via a 40 pin connector; on the other end of the module there is a 40 pin connector where a cartridge may be plugged in. Up to 4K program can be programmed into such cartridge. With the Viewdata module plugged into the Master Component; the user may plug either a game cartridge for game play or a Viewdata cartridge for Viewdata program.

Attached to the Viewdata module a light pen used for data entry; a keyboard (optional) and a modular phone cord for plugging the unit directly to the phone lines.

Note: That there is no extra power cord needed to power the system as all power is supplied from the Intellivision Master Component.

FIG.(1)
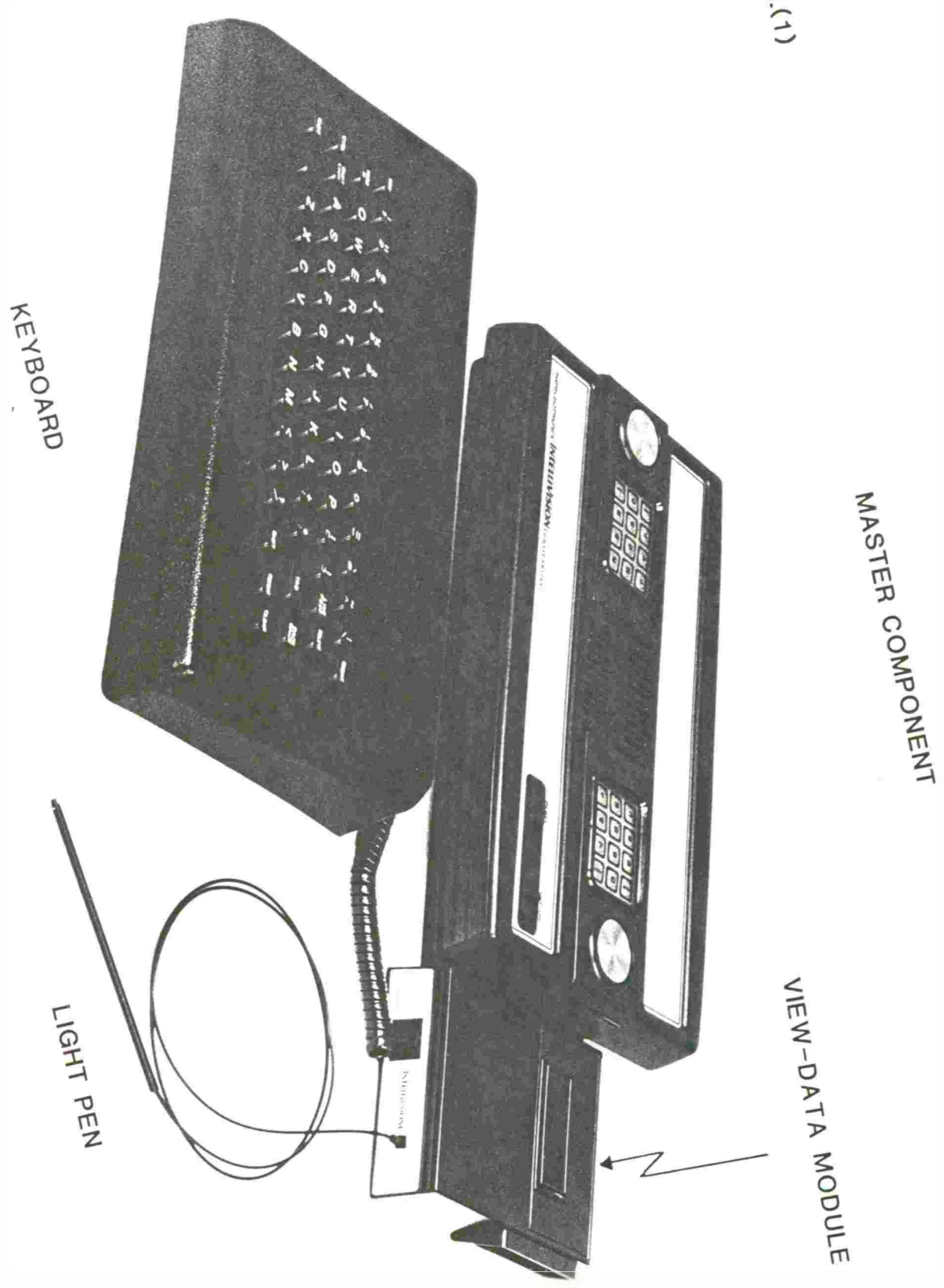
MASTER COMPONENT

KEYBOARD

LIGHT PEN

VIEW–DATA MODULE

In order to make the man-machine interface as simple as possible and to prevent errors from long LOG-IN procedures the phone number and the LOG-IN sequence will be stored in the cartridge PROM; so on power-on and at a touch of a button or a stroke of a Light Pen the unit will dial up the host computer and LOG-IN to the system.

In an interactive mode of operation; the user may use the Light Pen AND/OR the keyboard to select one of several services offered by the host computer (e.g. Homebanking, Yellow Pages, Ticket Reservation, Maintenant Schedules,...etc.).

On the screen there will be different display modes; where graphics and alpha-numeric data can be displayed simultaneously; also different sizes of the alpha-numerics can be displayed (For more details see display Features section).

The Viewdata unit will have a modular cable, which is directly pluggable in the wall phone jack; so there is no acoustic coupler or any extra accessories needed for connection with the phone lines. (For more details see Communications section).

There are two different means of data entry:

a)   Light Pen

b)   Keyboard (Optional)

The Light Pen can be used for menu selection by pointing at a high-lighted spot on the screen corresponding to the selected item. It can be used also for alpha-numeric data entry by pointing at the desired character from a full keyboard displayed on the lower or upper 4 lines of the screen.

The keyboard can be used for menu selection by typing in the number corresponding to the selected item from the menu. Also it can be used as a regular keyboard for alpha-numeric data entry. The following sections will outline the main features of the Viewdata system.

1. Plugs directly to the cartridge port of the Intellivision Master Component.

2. No extra power cord needed for the system as power is supplied from the Master Component.

3. Viewdata module is completely transparent to the Master Component i.e. user can plug a game cartridge and have all the game features without unplugging the Viewdata module.

4. Just by changing cartridges different protocol standards (AT &T, NBC,...) can be met.

5. Directly pluggable into wall phone-jack via a modular plug for direct connection to the phone lines i.e. no acoustic couplers needed.

DISPLAY FEATURES
_____

There are two display modes that can co-exist on the screen. HI-RES Mode and Color Graphics Mode.

a) HI-RES Mode

1. 40 pastel characters/line, 24 lines/screen. On a colored screen.
2. Full ASCII character set; (5X7 matrix on a 6X8 card.)
3. A complete AT&T mosaic Set.
4. A complete AT&T seperated mosaic set.
5. Full ASCII character set in a double width mode.
6. Full ASCII character set in a double height mode.
7. A double width double height full ASCII character set.
*8. Two different intensities in displaying the character set (Regular and Hi lighted).
*9. Regular character set can be displayed in reverse video mode.
10. The regular character set and mosaics can be displayed in a Flashing Mode.

* Due to hardware limitation reverse video and half intensity cannot CO-EXIST with double width and double hight on the same screen simultaneously

b) Color Graphics Mode

1. 20 Cards/line 12,lines/screen each card is an 8X8 matrix.
2. Full ASCII colored character set up to 8 different colors can be displayed simultaneously.
3. Very powerful colored graphics capabilities (up to 16 different colors).
4. 64 Different DRCS (Dynamically redefinable character set). Can CO-EXIST on a particular screen.

COMMUNICATION

Communication with the host computer is done over the phone line directly i.e. no acoustic coupler is needed.

Features:
1. Auto dial the host computer at a touch of a button.
2. Programmable data rate that can match several different communication standards.

e.g.

a - 300 BAUD, Bell 103 Standard

b - 1200/75 BUAD, CCITT V.23

c - 600/75 BAUD, CCITT V.23

DATA ENTRY

A. LIGHT PEN

1. Transparent to the host computer i.e. There is no software overhead at the host computer side needed to handle the Light Pen.

2. Optimum for menu selection.

3. Can be used for alpha-numeric data entry by pointing at the desired character from a full type-writter like keyboard displayed on the screen.

4. Rugged and very easy to use.

5. Replaceable.

B. KEYBOARD (OPTIONAL)

1. Full type-writter keyboard.

2. Can be used for menu selection or alpha-numeric data entry.

MEMORANDUM

TO: W. F. Gillis   DATE: February 22, 1982

FROM: Gary S. Moskovitz

SUBJECT: Chemical Bank Pronto Project/Update To My January 7th Memo

As you know, Bill Cornfield was here on February 5, for discussions with Dave Chandler and his staff. Cornfield gave a technical status report and discussed technical details with Dave Chandler and Dave Hostetler. A February 23 review meeting has been set up in New York with Cornfield's technical staff to review the current Master Component/ "Intelliphone" modem proposal. Outstanding issues to be settled, besides the actual interface data structure, include resident ROM Memory in the Master Component/Intelliphone unit, and whether E^2 ROM can be utilized.

In a follow-up telephone conversation with Cornfield, he gave the following Chemical Bank milestones:

- Currently, Pronto is interfaced into 35 Chemical Bank employees' homes.

- An additional 100-150 employees/customers will be connected to Pronto by mid-March.

- Three months of field test will be completed at the end the June.

- Cornfield estimates that beginning in July, 500 Chemical Bank customers per month will be added to Pronto.

- In addition, Cornfield feels that 50-75 banks may be "licensed" to use Pronto software by the end of the year. Cornfield will limit each bank to a maximum of 200 terminals at present, due to processing capacity.

- Cornfield feels that Pronto's growth will be limited for two years by the availability of terminals.

- Cornfield stated that AT&T will be offering their home terminal for sale by September, 1983, at a price of $550.

- Dave Chandler advised Cornfield that we would be finalizing our "Intelliphone" modem hardware specifications by the end of February, and could be in production within the First Quarter, 1983.

- As you are aware, Cornfield is currently using Atari
  400s as Pronto home terminals. He is very interested
  in pursuing the project at Mattel, but will not change
  from Atari until we have produced units that work with
  his system.

We should, therefore, be in a position, after Dave Chandler's
staff returns from the February 23rd meeting, to assess our
technical and hence commercial posture for Pronto.

In the interim, I have contacted several resource companies to
assess:

1.   The long range prospectus for in-home transaction
     terminals (with emphasis on any banking information).

2.   The active participants in in-home banking trails.

3.   Any participant that might be looking for a terminal
     partner.

Link Resources has provided the following information:

- Currently six banks are involved in in-home banking tests
  (see attached data, with contact information).

- Link's opinion is that CitiBank is the most advanced
  and also the most willing to discuss some sort of
  partnership.

- Link offered the following rationale for market projections:

  Personal Computers

  - There are presently 1.2 million installed
    personal computers

  - By 1985, there will be 4.0 million

  - By 1990, there will be 15.0 million

  Videotext Terminals

  - By 1985, there will be 2.0 million videotext
    terminals/modified personal computers. These
    terminals will account for $1 billion in
    transactions.

- By 1990, there will be 14.0 million videotext terminals/modified personal computers accounting for $7 billion in transactions. The 14 million terminals will be made up of 12 million modified personal computers and two million dedicated videotext terminals.

We should be in a position to assess our next step on this project by March 5.

GSM:kmt

Attachment

cc: Josh Denham
      Dave Chandler

	SOFTWARE	HOST	TERMINALS	DELIVERY	CHARGES	USERS
INFOMART GOVT. OF CANADA INFORMATION BANK (7/81)	Telidon	DEC PDP 11/70	ElectroHome	Phone	Free	100
VNU/TVS TV Amsterdam (1980)	Prestel	GEC 4082	*	Phone	*	50
TELEGLOBE NOVATEX Canada and 20 embassies (1/82)	Telidon Modified PLP	DEC PDP 11/70	ElectroHome Hemton EPS-1	Phone	Variable	30

CURRENT VIDEOTEX TESTS
North America

	SOFTWARE	HOST	TERMINALS	DELIVERY	CHARGES	USERS
AMERICAN FARM BUREAU GREEN THUMB 8 states (10/81)	Proprietary	TRS-80 Model II	TRS-80 (all) Z-89 HeathKit	Phone	Free	400
CITIBANK HOMEBASE New York City (6/81)	Proprietary TTI	DEC 20/20 20/40	Transaction Technology Inc.	Phone	$10/month	300
HOMSERV/COX INDAX San Diego, CA (12/81)	Proprietary	Tandem	Oak Dimension II	Cable	$5.95/month	300
FIRST BANK SYSTEMS FIRSTHAND ND, MN (12/81)	Steria Videopak 300	Honey-well DPS-6	TRT Magnavox	Phone	Selected homes	285
FIRST INTER-STATE BANK DAY & NIGHT VIDEO BANKING San Fernando Valley, CA (10/81)	Proprietary	DEC PDP 10	TRS-80 Color Videotex & Computers	Phone	Free	250
CHEMICAL BANK PROJECT PRONTO New York City (10/81)	Proprietary	Tandem Non-Stop	Atari 400s	Phone	Free	200
CHASE HOME BANKING (7/81)	*	*	Apple IIs	Phone	*	*

Handwritten notes:

① Chris Ricid
ROGER Taylor 212 750 1806

② STUART McIntire
612-370-5172

③ Mickey Fennell
213-614-3438

④ Bill Kornfield (2)
212-770-3861

⑤ 212-223-7787
ThomAs Healy

@LINK

	SOFTWARE	HOST	TERMINALS	DELIVERY	CHARGES	USERS
TIMES MIRROR /INFOMART L.A., Mission Viejo, Palos Verdes, CA (3/82)	Telidon	DEC VAX 11/780	ElectroHome E-COM modem Norpak	Phone Cable	Free	350
AT&T/CBS VENTURE ONE Ridgewood, NJ (9/82)	AT&T (pre-PLP)	DEC PDP 11/70 (3 or 4)	AT&T	Phone	Free	200
CONTINENTAL TELEPHONE CONTELVISION Manassas, VA (6/82)	Aregon IVS-3	DEC VAX 11/750	*	Phone	Free	100
SASKATCHEWAN TELECOMMUNI- CATIONS PATHFINDER Regina, Yorkton (6/82)	enhanced Telidon	DEC PDP 11/70	Under con- sideration	Phone	Free	100

(handwritten, circled: 6)
(handwritten: Bank of America Pat DUNBAR 415-953-2024/2058)

	SOFTWARE	HOST	TERMINALS	DELIVERY	CHARGES	USERS
BRAZIL TELESP Sao Paulo (1982)	Steria	CII Honey- well-Bull Level 6s	Matra	Phone	Free	1,500
VENEZUELA INFORMATICS (1982)	Telidon	*	*	*	*	35

	SOFTWARE	HOST	TERMINALS	DELIVERY	CHARGES	USERS
ITALIAN TELCO VIDEOTEL Gaties (2/82)	Prestel	GEC 4082 (2)	*	Phone	*	1,000
SPANISH CTNE (1982)	*	*	*	Phone	*	750

<u>MEMORANDUM</u>

TO: W. F. Gillis   DATE: March 17, 1982

FROM: Gary S. Moskovitz

SUBJECT: Chemical Bank - Pronto/Status

A meeting was held with Dave Chandler and his staff on March 10th to review the progress made at the recent Mattel/Chemical Bank technical review meeting in New York.

The highlights of the meeting and present status are as follows:

- Chemical Bank has contracted with Jim Fleming to act as their consultant on the project. As I understand the situation, Fleming is ex-ATT/Bell Labs and worked on the AT&T PLP Text project.

- Fleming appears clearly oriented towards there being a dedicated home videotext terminal-closely aligned with the now apparent AT&T terminal plans. The concept of having a videotext peripheral to a videogame unit appears to be a "foreign" concept to Fleming.

- It is clear to all Mattel individuals that Fleming must be sold not only on our capabilities, but also on the viability of our proposed approach.

We next discussed the steps that should follow:

- Mattel needs to meet again with Chemical Bank to continue discussions with Cornfield/Fleming and to begin influencing Fleming in our direction.

- It was felt that the most significant step would be a hardware demonstration of the following Mattel system:

              - Master Component
              - Keyboard Component (expedient for demo)
              - Modem/Auto Dial
              - Light Pen
              - Software

- We believe we should demonstrate the system operating on Pronto software and also feel it would be highly desireable to tie into the Source and Comp-U-Serve networks.

- We could demonstrate our proposals for various alternative alphanumeric input devices such as a light pen or our hand controllers, in addition to a separate Keyboard unit.

- During the hardware/mock-up demonstration, we could informally present the economics of our proposed peripheral ($150 retail without Keyboard) and compare it to dedicated terminals (ATT $550 retail) or modified home computers (Atari/modem $400 retail).

- We will be in a position to demonstrate the above proposed system within 30-60 days after the engineers involved begin the work. We estimate that time period to be during the first two weeks of May.

  This was felt to be too lengthy a time delay between the past meeting in New York (February 23rd) and a next hardware demo meeting (say May 15th).

- Our next "useful" step, it is felt, would be to review our detailed written specification with Chemical Bank and Jim Fleming. The spec is estimated to be complete by April 9th.

- Since there is a Videotext Conference/Exhibition in New York the week of April 12th, it makes sense to target for our next meeting in New York at that time.

- We will be assessing our posture on this within the next week. In addition to the above, we are taking three actions to assist videotext/home banking knowledge:

  - We are following up on a dialogue begun between the Chairmen of the Boards of Times-Mirror and Mattel. As you are aware, Times-Mirror is just beginning a Videotext trial in Palos Verdes (via telephone) and Mission Viejo (via cable). Bank of America is participating regarding home banking. Dave Chandler and staff agreed that it would be useful to be tied into the Palos Verdes test (even if it meant having the system hooked up at an employee's home). Josh Denham has kindly agreed to follow up on this with the Mattel and Times-Mirror executives involved.

  - First Interstate Bank is conducting home banking trails in the San Fernando Valley. I will be contacting them about our participation as an observer.
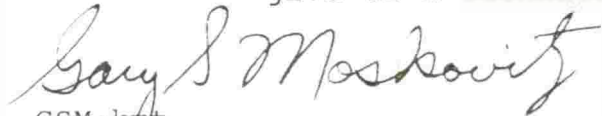
- We will be having the U.S. representative for
the Antiope Text System coming to Hawthorne to
give us a technical briefing and status report.

Gary S Moskovitz

GSM:kmt

cc: Josh Denham
Frank O'Connell
Dave Chandler

VIEWDATA SYSTEM SPEC'S

1. DISPLAY:

    The Viewdata terminal is capable of displaying a FULL-ASCII character set in a "HI-RES" MODE 40 characters/line; 24 lines/screen. On a pasted screen. Also; a complete AT&T Mosaics set may be displayed.

    In a non "HI-RES" mode 20 cards/line, 12 lines/screen the terminal is capable of having background graphics, the elements of which is pre-defined (either in cartridge ROM or GROM). Also the terminal is capable of handling up to 90 characters of a DRCS in this mode.
    The terminal will have a very limited PDI capabilities at most it will be able to draw some of the graphic primitievs.

2. DATA ENTRY:

    There are two ways of inputing data (i.e communicating with the host computer).

    a) Light Pen/Handcontrollers

        In case of a menu selection, the light pen may be used to point at a high- lighted spot on the screen corresponding to the selected item or the handcontroller can be used to move a cursor along the different menu items and an "action button" can be pressed to select a particular item.

        In the case where a full keyboard is needed; a full character set will be displayed on either the lower or upper 4 lines of the screen depending on where the data need to be entered on the screen.

        The light pen or the handcontroller will be used to select a character in the same manner as used in selecting menus.

    b) Keyboard (Optional)

        A full ASCII keyboard will be available as an option to be used for data entry (i.e communication with the host computer). It may be used for either menu selection or data entry.

3) COMMUNICATION LINK:

    The viewdata will be able to auto-dial the host computer. Data communication will be done VIA a "Programmable Modem" where different baud rates will be available for different communication systems.

    The following baud rates will be available:

    1. 300 Baud full duplex answer and originate.

    2. 1200 Baud half duplex with 75 (150) Baud back-channel.

    3. 600 Buad half duplex with 75 (150). Buad back-channel.

AM/bb

TO: Dave Hostetler

FROM: Ali Mostafa   *A.M.*

SUBJECT: VIDEOTEX '82

The following are some events that happened at the
Videotex '82 Conference, in New York, followed by
observation and my recommendation for our "Viewdata"
peripheral.

EVENTS

*   AT&T announced their Videotex terminal "ViewTron";
there were no technical information or a picture of the
terminal released.

*   AT&T and CBS will run a videotex trial in Ridgewood,
New Jersey. The announced AT&T terminal will not be
used in that trial.

*   Bill Cornfield (Chemical Bank) announced their
Videotex trial. They are using ATARI 400/800 and
Xerox 820 as the home terminal. They will market the
product by selling license to different banks nation
wide.

*   A draft standard for North America Presentation Level
Protocol Syntex (PLPS) was announced jointly by Canadian
Standards Association and American National Standards
Institution.

OBSERVATIONS

*   The number of attendees at Videotex '82, was the same
as Videotex '81; an indication of a slow down in the
Videotex market.

*   It is expected that it will be a while (by the 1990's)
before cables contribute significantly in the Videotex
communication links due to lack of two way cable in the
market (less than 2%) and also due to the fact that there
is additional hardware needed for efficient Videotex
communication.

*   There is a trend of having several grades of terminals
with wide price range; i.e. The Host's Software will not be
tailored for a specific terminal.

RECOMMENDATION

Based on different events at Videotex '82; I recommend
that we should keep pursuing the "Viewdata" peripheral
but with some caution in order to have a better view of
the market place as well as to have a better perspective
of the North American Videotex Standards.

December 3, 1982

TO: Dave Chandler
           Dave Hostetler

FROM: Ali Mostafa

SUBJECT: VIDEOTEX WEST

During the period of November 29, to December 1,
I've attended "Videotex West" Conference. The
following are my observations and comments on the
Conference main events.

Basically the Conference covered a run down on field
trials from different participants (AT&T Times Mirror,
Time Inc.,etc.) and the user's response to videotex
through a feedback survey and field study done by
Booz Allen.

Observations On Field Trials

While most of the Field Trials were a typical Video-
tex demo with nothing exciting Time,Inc. (Publisher
of Time Magazine) has the most appealing system (even
though it is a teletext).

Main features of Time,Inc. Teletext are:

        (a)   Full channel transmission (more then 5000
              frames).

        (b)   Down loadable software

        (c)   Interactive video games

        (d)   High resolution (using PLPS)

        (e)   Graphics animation

        (f)   Decoder will be offered free to the customers
              with $10.00/month subscription fee.

        (g)   System will be available nation wide by middle
              of '84'

        (h)   64 K of RAM

Observation On User Response

Booz Allen and MIT coordinated a field study covering
4 states (800 house holds). They came up with the
following results:

   (a)   Participants were very reluctant to use
         keyboard.

   (b)   1200 baud is a real handicap

   (c)   10 - 15 sec. wait (for teletext) is not
         acceptable

   (d)   Participants were not attracted to computer
         graphics

   (e)   Man-machine interface is very, very important
         factor and it has to be as simple and friendly
         as possible.

Comments

I am really impressed by Time, Inc. trial. I suggest
that we should get on their system or at least have a
close look at it. Also, I think we should consider
adding RAM in DECADE and be able to execute code from that
RAM.

I think that Time, Inc. system presents a real threat to
DECADE (pricing, service and timing) and if we don't take
the matter seriously, we might be left in the cold.

VLSI Technology, Inc.
18662 MacArthur Blvd
suite 200
Irvine, Ca. 92715
714 833-3103

January 26, 1983

Mr. Ali Mostafa
Mattel Electronics
5150 Rosecrans Avenue
Hawthorne, Ca. 90250

Subject: Foundry Information:

Dear Ali:

Enclosed is the information you requested regarding VTI's foundry operations.
Please review the data, and feel free to contact me if you have any additional
questions.

The non-disclosure forms for the design rules are being sent to me this week.
You can expect to receive them early next week at the latest.

VTI would like to extend an invitaion for you to visit our facilities in San
Jose.   Please let me know if you can schedule a visit to see our fabrication
facilities, in addition to meeting the people in the foundry area.

If I can be of any further assistance, please do not hesitate to call.

Best regards,

Michael D. Garvey
Sales Engineer
Southern California

attachment

cc:	Mattel	VTI	Varigon
	------	---	-------
	Karen Myers	Mac Wilson	Ken Wyzard
		George Steres	
		Anne Bakewell	

General Information on Foundry Prototyping

We offer dedicated wafer runs and MPW services to our customers in HMOS, CMOS, and NMOS.

1. Dedicated Wafers

    a. Customers can supply tooling (to be inspected/approved prior to acceptance) or VTI can generate masks. Optical tooling is dependent on die size and number of layers for each process. Prices are:

Process/Level	150 sq mil	200 sq mil	250 sq mil
NMOS 7	13,650	15,575	17,500
HMOS 9	17,350	19,825	22,300
CMOS 10	19,200	21,950	24,700

    One defective die/sq inch.

    Delivery 3 weeks

    E-Beam tooling is approximately $1600 per level, 3 defective die/sq in, delivery 5-7 working days.

    All tooling is 5", low expansion. Optical masks are one-step master tooling. All tooling for VTI Fab is positive photo-resist.

    Preferred data input for E-Beam masks is CIF; PG DM3000 for optical. Calma GDSI and II in LU format can be accepted for both types of tooling. However, conversion costs will be necessary. Please contact factory.

    b. Prototype wafer runs

    Start 12 wafers, guarantee minimum 5 wafers out.

    NMOS $5000
    HMOS $6000
    CMOS $6000

    Delivery 10 working days after acceptance of tooling.

    We will assemble 20 visually inspected, optically good "cut and go" devices in up to 40L ceramic packages (dies sizes up to 225 mils on a side). Additional assemblies are available at $20 each.

2.   MPW Runs

MPW pricing is:

NMOS $5000 w/out buried contacts; $6000 with BC
HMOS $6000
CMOS $6000

Delivery 6 weeks after commencement of MPW run.

Preferred input is CIF. Please contact factory for other
formats.

20 cut and go's are included. Extras at $20 each. Please
contact us for die sizes in excess of 225 mils and lead counts
greater than 40L.

SCHEDULE:

	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
HMOS	14	14	4	30	13	25	22	26	24	21	18
CMOS			4	30	27	13	8	5	10	7	12

By the above dates, we require CIF tapes and a p.o. from
the customer, plus their bonding requirments.

That's about it for Foundry prototyping services. For volume programs
(wafer, die, or packaged parts), we can quote on an individual basis.

PLEASE NOTE, MASK PRICING IS BUDGETARY ONLY. WE WILL HAVE FIRMER PRICING
WITHIN THE NEXT FEW WEEKS.