# Z-MACHINE DEVELOPMFNT PLAN

CARL COY

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PRELIMINARY

# Z--MACHINE PRODUCT DEVELOPMENT

The Z-Machine development has the potential to be the most interesting (and most exciting) product development program that the Heath Computer Group has undertaken. The computer is an exciting product and has the potential to generate a great deal of revenue; the program itself offers a rare opportunity to exercise the technical skills of an excellent group of people dedicated solely to the development of the Z-Machine.

The development schedule is ambitious, but realistic. We have an experienced project leader who can devote full time to the program, and we will have a firm development plan that will enable us to monitor the progress of the project. We have good support groups: Computer Aided Design, Drafting, a Model Shop with exceptional capabilities for fabricating styling models and prototype parts, and a Regulatory Compliance Lab with an excellent track record.

There are some risks involved in the hardware development, but they are manageable:

The speech synthesis function has not been fully defined. The technology is not yet mature, and if a good solution cannot be found quickly, this feature will be made an accessory that can follow the initial product introduction without delaying the development.

The MODEM function is intended to be implemented in a single-chip microprocessor. This development will be done by an outside firm that is familiar with MODEM technology, and the effort will have to be closely coordinated to coincide with our hardware schedule.

Compliance with the FCC regulations is another area of risk. There is no doubt that the computer can be made to meet the specs, but doing it within the development timetable is going to require some extra effort. We intend to use RFI consultants as early as possible in the development to assure that the board layout and packaging techniques are consistent with good RFI design practices. The RFI compliance effort will continue throughout the program so that the final prototypes can be used for the FCC certification process.

Though there are some risks, the product will be based on technologies that have been fully developed and that have stood the test of the marketplace.

# HARDWARE DEVELOPMENT PLAN

The Z-Machine hardware development will consist of five major phases:

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| Groundwork and concepts | Sept. 1 to Oct. 1 |
| Electrical design | Oct. 1 to Dec 1 |
| Mechanical design | Oct. 1 to March 1 |
| Prototype construction | Dec. 1 to March 1 |
| Certification | March 1 to April 1 |

*The Groundwork phase will produce a working document that will fully define the Zenith Home Computer and that will serve as a definitive design guide for all the people working on the project. There are a few unresolved concepts going into this phase, namely, speech synthesis and the implementation of a MODEM, and the goal is to have all the loose ends tied together by October 3rd. This phase will include the styling and industrial design for the product.

*The electrical design phase will produce a paper design for the computer. Complete electrical documentation will be generated to serve as a project record and to aid in later product support and maintenance. This design phase will include a formal third party design review

*The mechanical design phase will produce final drawings that can be used to tool all non-electrical parts of the computer. This phase will include the development of temporary tooling to produce parts for prototype construction. Major plastic or metal parts that require long tooling lead times will be designed and released ahead of the normal electronic parts.

*The prototype construction phase will include the layout of printed circuit boards, design verification, and initial RFI and safety checks. Six to ten prototypes will be built in this phase.

*In the certification stage, formal tests will he made for FCC certification, and units will be submitted to UL and CSA. The logic design will also be exercised with diagnostic software, and the complete package will be subjected to temperature, humidity, and transportation testing.

BABU RAJARAM..... INITIAL TASKS

* Develop an architecture specification or internal bus structure for the computer. The spec would include a system timing definition that all the designers on the project could use for designing the peripheral elements.

* Develop a generalized I/0 and interrupt scheme for the computer. In general, the Z-Machine and the expanded Heath version will be very I/0 intensive so the I/0 design must he as flexible as possible.

* Develop a RAM addressing/multiplexing scheme that will support, various combinations of 16K 32K and 64K RAMs. The expanded version of the computer could require 128K of RAM on board.

* Develop a timetable for all the tasks necessary to complete the groundwork/concepts phase of the Z-Machine development. The goal is to have all of the unknowns resolved by October 1st. Since the concept stage lasts for only a month, the timetable will include short-term milestones, perhaps three or four a week.

DOUG WOOD.... INITIAL TASKS

Make initial styling contacts and try to determine which is the best approach of the three:

- Heath styling group. Zenith styling group (if any) outside industrial design firms.

Tradeoffs will probably involve speed, availability, and consumer product experience.

Work out a generalized packaging concept based on Larry's product plan and updates. The major components of the package include:

- Keyboard with Selectric layout + some special keys. A built-in 5 1/4" floppy disk mechanism. One major PC board containing most of the components. A switching power supply providing 30 to 50 watts. Connectors for the accessories:
  - Printer
  - Game joysticks
  - MODEM
  - Music keyboard
- Connectors for the video Output cables going to the monitor or TV set.

Locate a source for temporary tooling that can simulate high-pressure molded parts.

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MTKE GORBUTT... INITIAL TASKS

Develop an approach for the Z-Machine disk system. The system will be a single-sided single density 5 1/4" mini-floppy in the basic machine, but should be easily expandable to double-sided double density for the Heath version.

Develop a specification for the disk mechanism. The spec will be used for vendor quotations and qualification. At least two vendors will be necessary.

Develop an approach for the mechanism motor and solenoid controls, and an approach for the read/write circuitry. All the vendors have indicated that we can copy their circuits, but it may be advantageous to develop our own.

Develop an approach for the LSI controller and data separator. Standard parts in the Western Digital 179X family will do the job inexpensively and with a minimum parts count.

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PHIL STAUB .... INITIAL TASKS

Investigate sources for a switching power supply. The technology is available at Zenith Radio Corp., as well as at a number of outside vendors., Astec, for instance, is a vendor that can supply low-cost switchers to our specifications. It may also be to our advantage to design the supply in-house and incorporate it on the main PC board.

Develop a source for a low cost printer accessory. Larry has done some groundwork with Trendcom, and it appears to be a good possibility.

Develop a parallel interface for the printer.

Develop a concept for an interface for the Zenith/RCA video disk.

Serve as a watchdog and liaison for the mechanical designer for all RFI aspects of the Z-Machine design.

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MARK NICOL ....INITIAL TASKS

Build 15 more Z-Machine prototypes based on the current breadboard. Mark Rogers can requisition the parts and write the purchase order requests.

Investigate the voice synthesis IC from Votrax. If it offers acceptable speech, it will be the easiest system to implement on the Z-Machine board. Other systems include the TI synthesis chip and ROMs, and a similar National Semiconductor approach.

Develop a sound synthesis concept. The most likely chip is the TT 76482 used on the breadboard, but others may be acceptable.

Investigate the BSR X-10 controller system and how it can be adapted to the Z-Machine. RFT, UL, and CSA requirements must be considered, as well as the feasibility of using the system on foreign power lines (the modules may not be available in other countries).

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MARK ROGERS .... INITIAL TASKS

Build 15 more Z-Machine prototypes based on the current breadboard. Requisition the parts and write the purchase order requests.
Assist Neil Beneditz in the prototyping of the H-8 and H-89 disk controllers.

EILEEN HICKEY.. ..THINGS TO DO LIST

Phase I report for trainer. The report would include:
Product definition Bill of
material Cost to develop Tooling
cost Schedule Cost of options and
accessories

Z-Machine video generation development with Babu. This effort would have to be closely coordinated to avoid duplication of effort.

On-going product support and RFI assistance to Phil.

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NEIL BENEDITZ .... THINGS TO DO LIST

H88 and H8 double density disk controllers, Phase I on concept by October 17th.

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General purpose I/0 board for H8 Concurrent with disk controllers. Priority not quite as high as the disk controllers.

Z-80 CPU board from Sigma. Evaluation and modifications as necessary. Probably will require a trip to Sigma.

64K memory board from Sigma. Evaluation and modifications as necessary. Probable trip to Sigma.

Firmware development board for H88 and/or H8. The board would include:

- An EPROM programmer for 16K, 32K, and 64K EPROMS.
- Socket(s) for ROMS/EPROMS.
- 8K x 8 OF RAM
- The RAM and ROM should be capable of being executed externally.

Support on Z-Machine. Serve as a floating resource for Mike Gorbutt, Mark Nicol, and Phil Staub. Assist Eileen and Babu in development of the video portion of the Z-machine and trainer.

## LIAISON ACTIVITIES

During this project, a great deal of coordination and co-operation will be necessary between the Heath Engineering group and various Zenith groups, including Purchasing, Production Engineering, and Design Engineering. The level of liaison activity will peak at the end of the development phase, and again at the pilot run and early production stages.

Bills of material, drawings, and specifications generated by the Heath Engineering group will have to be translated into a form that can be used by the Zenith Purchasing and Production groups. In most cases the conversions can be done simply but in any event, they must be dealt with at the outset of the program.

Heath's mechanical engineer must work closely with Zenith's production engineering group in the choice of assembly methods and fasteners; the electronic designers will work with those at Zenith responsible for switching power supplies, color monitors, and RF modulators.

Heath has a large number of vendors currently qualified to supply computer components. These vendor qualifications will have to be reviewed by the appropriate Zenith groups, and be accepted or re-qualified as deemed necessary.