Building CP/M 2.2 for Northstar Double Density Disk Controller on a Sol-20.

Finding Bootable Disk Images

I created a version of the PC2FLOP utility configured for the Sol-20 with a Northstar DD controller. I found and downloaded several disk images of CP/M 2.2 for the Northstar DD controller from Dave Dunfield's website, however, these images are all for the Northstar Horizon computer, not the Sol-20. These images will not run without patching the console I/O area of the BIOS.

The most promising of the images was the unmodified CP/M 2.2 distribution disk from Lifeboat (C223A_24.NSI as named by Dave). This distribution uses Lifeboat's CONFIG utility to allow selecting different console I/O options by simply patching a single byte in the CONFIG.COM program. See the document titled "Lifeboat CONFIG and SAVEUSER.pdf" (the CP/M configuration manual for the Northstar Horizon computer) for more information. The list of pre-defined console options is on page 6.

Note: Many of the .NSI images assume a fast stepping drive (e.g. 5ms or better). Note this if using a slow stepping drive like the SA-400. The disk will tend to boot, but subsequent disk operations fail.

Lifeboat's CONFIG.COM and User Area Overview

On a fresh CP/M image (e.g., immediately after MOVCPM), the user I/O area in Lifeboat CP/M is not configured for any particular console type. Instead, it points to a routine, that during cold start, runs a special entry point of the CONFIG.COM program. At startup, CONFIG patches the user I/O area of the BIOS *in memory* with the code to support the console type specified in CONFIG.COM. This is done each time the computer is cold started. The program SAVEUSER can be run to permanently write the patched content in RAM to the CP/M boot image on the disk. Until SAVEUSER is executed, the user is alerted each time CP/M cold starts that SAVEUSER can be run.

This technique requires that CONFIG.COM be on any new disk the first time it is booted, and remain there until SAVEUSER is executed. However, doing a new MOVCPM and SYSGEN requires that CONFIG.COM be on the newly SYSGEN'd disk, so it's best not to delete CONFIG.COM.

Using a hex file editor, I found the CONFIG.COM file in the disk image and changed the console type byte from 83h (Horizon) to 81h for the Sol-20. The console type byte is at offset 20h in the CONFIG.COM file or 120h when loaded in memory (e.g., with DDT). This byte is at offset 5620h in the C223A_24.NSI image file.

As an alternative, you can also run Dave Dunfield's Horizon emulator, mount the C223A_24.NSI disk image as drive zero, boot CP/M and patch CONFIG.COM with DDT as documented in the "Lifeboat CONFIG and SAVEUSER.pdf" document. IMPORTANT: Note that CONFIG.COM must be saved after patching by typing the command "SAVE 24 CONFIG.COM" and not "SAVE 10..." (this version of CONFIG.COM is larger than the one documented in the .pdf file). The image file "CPM 223DQ-24K-SS.NSI" has the console type byte patched to 81h.

Permanent User Area Patch Instead of CONFIG.COM

An alternative to using CONFIG.COM to patch the user area is to write your own console I/O routines for the user area. The file SOLIO.ASM provides Sol-20 console I/O with "normal" destructive backspace instead of echoing the deleted characters. Instructions for patching the custom user area into a

MOVCPM image are in the header of the SOLIO.ASM file. The resulting 48K CP/M 2.2 image file is saved as “CPM 223DQ-48K-SS.NSI” (single sided) and “CPM 223DQ-48K-DS.NSI” (double sided).

Note: As of 11/22/2017, a customized MOVCPM is present on the 48K disk images that generates a ready to run system for the Sol-20. CONFIG.COM is not required on the disk, nor does the image generated by MOVCPM have to be patched with SOLIO (unless you change SOLIO.ASM, of course).

Single Sided vs Double Sided

MOVCPM has been modified to configure all drives as double-sided capable with slow seek times. This allows any diskette/drive combination to boot without patching. With the original MOVCPM, the drives were configured as single sided with slow seek time. In this case, a double sided disk would boot, but CP/M could not access the file system.

To understand the details of this change, see the file CBIOS.ASM. The symbols DSKDLY and DBLSIDE reference a single location at B9F8 in a 48K BIOS. The MS nibble contains the flags for single/double sided and the LS nibble contains the flags for seek time. In the original MOVCPM, this byte was 00h (all drives single sided with slow seek). The modified MOVCPM sets this byte to F0h (all drives double sided with slow seek). Note that CP/M still looks at byte 5Ch on sector zero to determine whether a *diskette* is single or double sided. These flags, instead, define the *drive’s* capabilities.

This byte can be changed using the SETCPM utility on the CP/M disks. It can also be manually changed by patching the byte at offset 25F8 in the disk image or at offset 26F8 when in memory after a MOVCPM.

Sol-20 BIOS Source File for CP/M 2.2 and Northstar DD Controller

The source file “CBIOS.ASM” is for Lifeboat Version 2.22 DQ. The image files mentioned above are for Lifeboat version 2.23 DQ. I’m not sure what the differences are in the two versions other than in the Sol-20 console code. In the BIOS source file (version 2.22), the Sol-20 console code in the user area has issues when RETURN is pressed and/or echoed to the console. Each time RETURN is pressed after a command, the line just entered disappears. Double spacing after lines is not uncommon either. This has been fixed in the Sol-20 console code generated by CONFIG in version 2.23. Both versions echo deleted characters as DEL is pressed instead of performing a destructive backspace.