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2023-04-24

# Fleet Numerical Meteorology and Oceanography Center (FNMOS)

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# **Fleet Numerical Meteorology and Oceanography Center (FNMOS)**

*"The Navy's Operational  
Supercomputing Center  
- Providing 24/7 Support  
for Naval Operations  
Worldwide"*

# **FNMOOC – Early Days**

**A pioneer in the application of supercomputing technology to weather prediction.**

**1959** - The Navy Numerical Weather Problems (NANWEP) group moved from Suitland, MD to the Naval Postgraduate School (NPS) campus in Monterey under Capt. Paul M. Wolff, USN.

**1961** - Renamed the Fleet Numerical Weather Facility (FNWF). Shared use of model #1 of the first transistorized supercomputer - CDC 1604.

**1964** – Opened dedicated FNWF computer center with second CDC 1604. Moved electronic design lab to Point Pinos facility.

**1974** – Consolidated operations in new facility in Monterey. (FNWC)

**1993** – Adopted the Fleet Numerical Meteorology and Oceanography Center (FNMOOC) title.

# FNMOC – Today

- FNMOC in Monterey is the DoD's primary central production site for worldwide computer-generated operational meteorological and oceanographic analysis and forecast products.
- Operates the world's largest computing center for weather prediction and the only global Numerical Weather Prediction model meeting DoD cyber security standards.
- Possesses world-class expertise in meteorology, oceanography, climatology, computer science, and military **operations**.

The single most important consideration leading to these advances would be the treatment of the atmosphere and the oceans as a single environment. Thus, the transfer of both heat and momentum to and from the sea surface is the vital link in the single environment concept.

- Philip G. Kesel, Lt., USN, U. S. Naval Postgraduate School

FNWF acts singularly in its treatment of the two fluids as a single, coupled system. Correct solutions to environmental problems demand this approach. Implied in the single environment concept is the transfer of mass and energy to and from the sea surface. This means then, that the task must be accomplished at an agency which generates, as FNWF does, all of the required information, both oceanographic and meteorological.

- Paul M. Wolff, Capt., USN, Fleet Numerical Weather Facility

**Bulletin of the American Meteorological Society (1968)**



# NPS 1955: CDC 102A



This is one of the earliest pictures of the first computer ("electronic automatic digital computer") used for academic instruction at NPS, the Control Data Corporation 102A. This picture was taken 25 March 1955.





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## NPS 1960: Navy's First Supercomputer



*"World's first all-solid-state computer -- Model 1, Serial No. 1 of Control Data Corporation's CDC1604 -- designed, built and personally certified in the lobby of Spanagel Hall by the legendary Seymour Cray."*



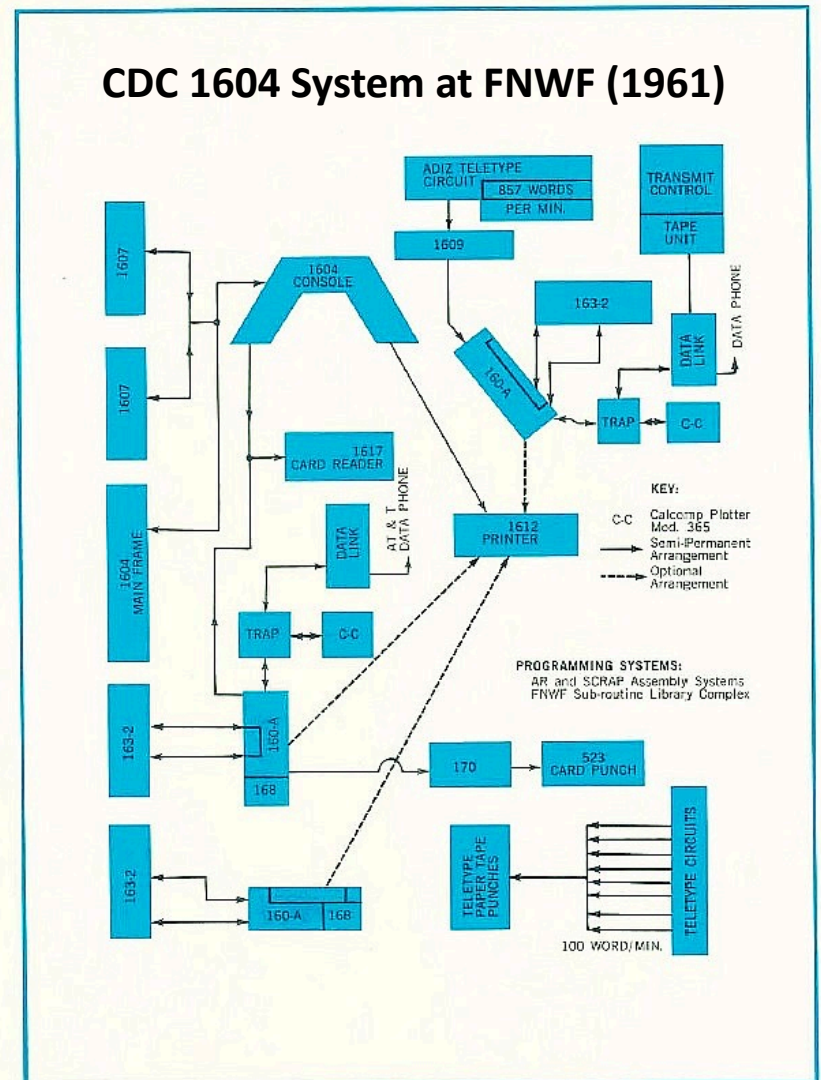


Diagram of Control Data computer system at Navy's FNWF, Monterey, California.

CDC 160A managed peripherals, including tape units, punches, Varian 530 plotter, and ASR-33 Teletypes.



## Weather Central Process(Circa 1967)

- Plot FNMOC hemispheric NWP charts on CalComp Plotter.
- Project area of interest onto larger-scale chart.
- Trace contours onto larger scale chart with marking pen.
- Overlay with a blank chart on light table.
- Modify NWP product using synoptic techniques on clear acetate using grease pencil.
- Trace acetate contours onto facsimile master.
- Fax the resulting chart manually over flat bed scanner.
- Hope that somebody out there could actually copy it!

From: NWP and Naval Operations: The Real Story Bob Cash (1997)

[https://www.powershow.com/view/120909-N2NIN/NWP\\_and\\_Naval\\_Operations\\_powerpoint\\_ppt\\_presentation](https://www.powershow.com/view/120909-N2NIN/NWP_and_Naval_Operations_powerpoint_ppt_presentation)

# Late '60s FNWF/FNWC Computing Capabilities

- **Two CDC 1604s in use since 1961 were replaced in 1967 by a “giant” CDC 6500 dual-processor machine - comparable to the 386 microprocessor in FP performance.**
- **Other machines in use included two CDC 3200s and a CDC 8090.**
- **A second 6500 acquired in 1969 was configured as a four-processor system to support a Northern Hemisphere Primitive Equation model.**
- **Processors shared model data through extended core storage (ECS) for the “world’s first multi-processor production code.**

# **FNWF Communications Milestones**

- **First digital transmission of weather data enabled over conventional analog phone lines (c. 1961)**
- **First transmission of weather data via SYNCOM communications satellites. Raw data and finished charts transmitted error-free to Hawaii and Guam at rates better than 3,000 wpm (1964)**
- **First numerical weather products (pictures of predicted conditions) transmitted via TACSATCOM-1 satellite to mobile platforms (USS Guadalcanal & USS Lexington) (c. 1969)**
- **All programming, computer operation and maintenance, and development and fabrication of communications and interface devices performed in-house.**

# Resources

1. ***Weather by Computer*, Control Data Corporation (1963)**
2. ***Annual Report 1964* United States Naval Postgraduate School Monterey**
3. **“Environmental support for naval operations,” Philip G. Kesel, Bulletin of the American Meteorological Society (1968)**
4. **“Oceanographic data collection,” Paul M. Wolff, Bulletin American Meteorological Society (1968)**
5. **“NWP and Naval Operations: The Real Story,” Bob Cash (1997) - ppt**
6. **“30 Years of Navy Modelling and Supercomputers; An Anecdotal History,” Tom Rosmond (c. 2005) – ppt**
7. **Overview of Research at NPS using High-Speed Networks and High-Performance Computers,” Jeffrey L. Haferman (2008) - ppt**