SURFACE WIND CHARACTERISTICS OF SOME ALEUTIAN ISLANDS*

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Our long-range goal is to establish (and, hopefully, exploit) the wind power potential of Alaska, one-fifth the area of the contiguous 48 United States (fig. 1). Important corollary questions are access to promising wind power sites for construction of test or permanent wind machines and shipment of the wind-derived energy. The "packaged" form of the energy must be considered for possible export to the "lower 48" or use in Alaska. Also, the wind regimes involved will dictate windmill design, including, of course, the economics.

A first step is our analysis of near-surface wind data (ref. 1) from some promising sites accessible by ocean transport. We consider a few Aleutian sites (ref. 2) here, to indicate probable velocity[1] regimes and also present deficiencies in available data. Cold Bay and Dutch Harbor are two such wind power sites. (fig. 2, - areas numbered 12 and 15, respectively (ref. 3).)

COLD BAY, ALASKA

Cold Bay has a 5-year average wind velocity of 15.1 knots (17.4 mph). An airstrip accommodating 747's, a harbor permitting 30-foot draft vessels, and a large, wide, unshielded (N and S) plain ideal for a windmill farm all make this area a prime candidate for initial Alaskan large-scale wind power investigations. The monthly average cycle (ref. 4) is shown in figure 3 (more on this later). Figure 4 gives the velocity duration curve averaged for all months. All such curves mask short-term fluctuations, like those of figure 5.

Cold Bay data show surprisingly little wind speed variations with height. Simultaneous measurements at various heights near ground are desirable, as at any site. However, a shift in anemometer height from 88 to 21 feet showed no significant change in monthly velocity distribution curves for comparable months.

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[1]Speed and velocity are interchanged here. Wind direction is not considered, but the winds are cyclonic and, while often from the SW, can shift rapidly in all directions in most areas.

DUTCH HARBOR (UNALASKA ISLAND)

For Dutch Harbor the available wind data (figs. 3 and 6) are disappointing, in view of the fact that it is the best and most sheltered harbor in the Aleutian Chain. These data are a good "horrible" example of data obtained for purposes other than wind power generation. The present values are from an anemometer at the airstrip, which is sheltered on all sides from most strong winds and especially those coming in from the sea, north and south. However, our 1973 on-site inspection indicated that there are at least three areas in the vicinity that seem ideal for windmills; long term weather data should be gathered there.

The Dutch Harbor and Driftwood Bay (also Unalaska Island) monthly mean velocities (fig. 3) illustrate probably typical horizontal differences in the Aleutians for nearby areas. Driftwood Bay is 14 miles northwest of Dutch Harbor. The yearly means are 8.3 and 9.3 knots, respectively (ref. 5).

GENERAL AREA INFORMATION

Table 1 contains data for eight Aleutian sites, including frequencies of selected velocity ranges. The 7- to 21-knot (8 to 24 mph) range covers the cut-in to near peak power speeds for small available generators. In general, in the Aleutians, winds for some degree of power generation are available 77 percent of the time (averages of table 1). Since the data available so far are from sites generally chosen for nonwind power purposes, the values of speed and frequency are probably lower limits for wind power planners.

Wind speeds to 140 mph are reported spasmodically in the North Pacific Ocean - Bering Sea area, but are seldom verified. Peak velocities depend on location. The record at Cold Bay is 73 mph, at Amchitka above 115 mph. At Amchitka winds above 70 mph can last for several hours.

REFERENCES

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2. B. Garfield: The Thousand-Mile War. Ballantine Books, Inc., New York, N. Y., Paperback ed., 1971.

3. Interagency Arctic Research Coordinating Committee: Arctic Research Logistics Support Handbook. National Science Foundation, Dec. 1972.

4. Climatography of the U.S. #82-49, Decennial Census, Summary of Hourly Observations (for various stations), 1956-60 (GPO 1963); also specific location Local Climatological Data, Monthly and Annual Summary. U.S. Dept. of Commerce, NOAA, National Climatic Center, Asheville, N.C. 28801.

5. Unpublished (generally) data, Air Weather Service, NTC - Asheville, as in ref. 4.

TABLE 1

TIME PERCENTAGE OF SELECTED WIND VELOCITY RANGES IN ALASKA

Location**	Annual Mean, Knots	% of Time at 7-21 Knots	% of Time above 21 Knots
Adak NS (AD)**	13.1 (1942-65)	60.9	16.2
Amchitka AFB (AM)	18.3 (1943-50)	60.1	30.7
Cape Sarichef AFS (11)	13.7 (1952-56?)	57.5	18.5
Cold Bay* (12)	15.1 (1956-60)	64.0	24.0
	14.8 (1965-71)	Data discrepancies need resolution.	
Driftwood Bay AFS (15)	8.3 (1959-69)	56.9	1.9
Dutch Harbor NS (15)	9.6 (1946-47, 1950-54)	53.3	6.9
St. Paul Island* (SP)	16.4 (1972)	68.9	24.2
Shemya AFS (45)	15.1 (1943-53)		
	16.2 (1950-72)	Data discrepancies need resolution.	

*Commercial Airport.

**See Fig. 2.

DISCUSSION

Q: I am interested in the freezing rain potential of your area. Do you think this might come to be a problem?

A: As I see the major problems they are three. Some of them can be checked out early.

One is the mechanical behavior of a large windmill during peak velocities. Can you feather quickly enough? I think the indications are that most of the properly engineered windmills will take above 100 miles an hour. What will they do at 150 miles an hour?

I don't think there is any problem in towers. What I am really concerned about especially in the Aleutians is the prevalence of this high velocity mist they speak about, almost horizontal rains. Experience indicates that in the Aleutians it's almost impossible to seal an electronic device against these winds. If you are going to mount your generators on towers behind the blades, you may have to pressurize the generators to keep them dry.

The problem of icing should be checked out. There are indications in other parts of the world that icing is no problem. It is not particularly cold in the Aleutians, but the snow is quite wet. These are problems that will be faced.

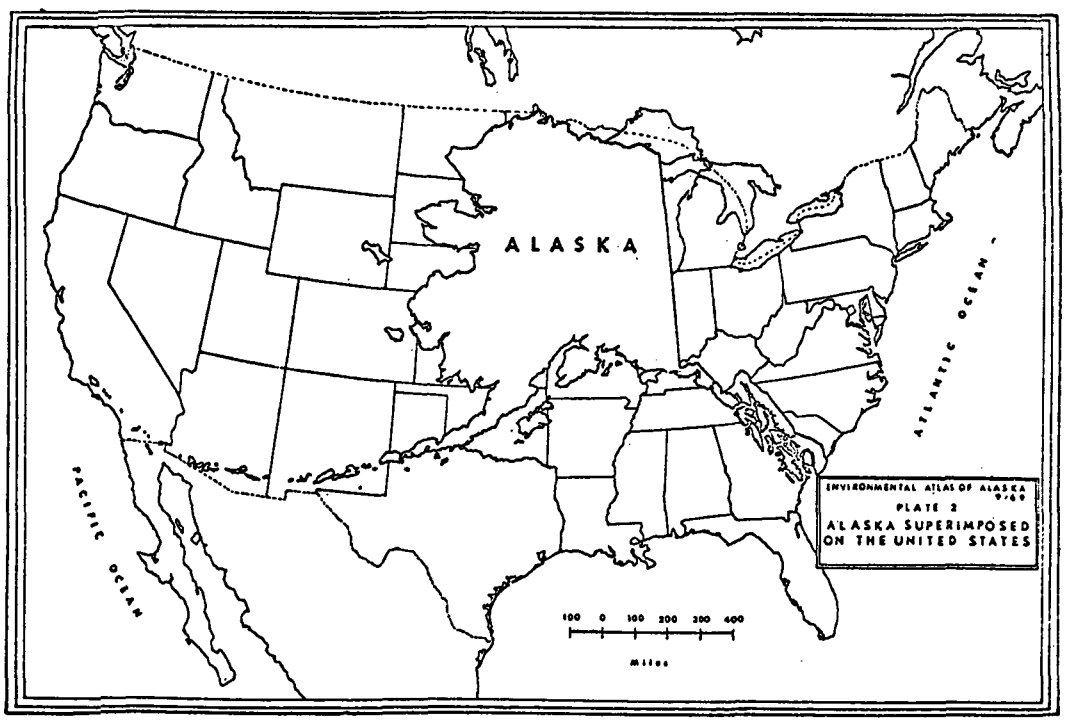

FIG. 1 ALASKA (586,400 SQ. MILES) AND CONTIGUOUS UNITED STATES (3,022,400 SQ. MILES)

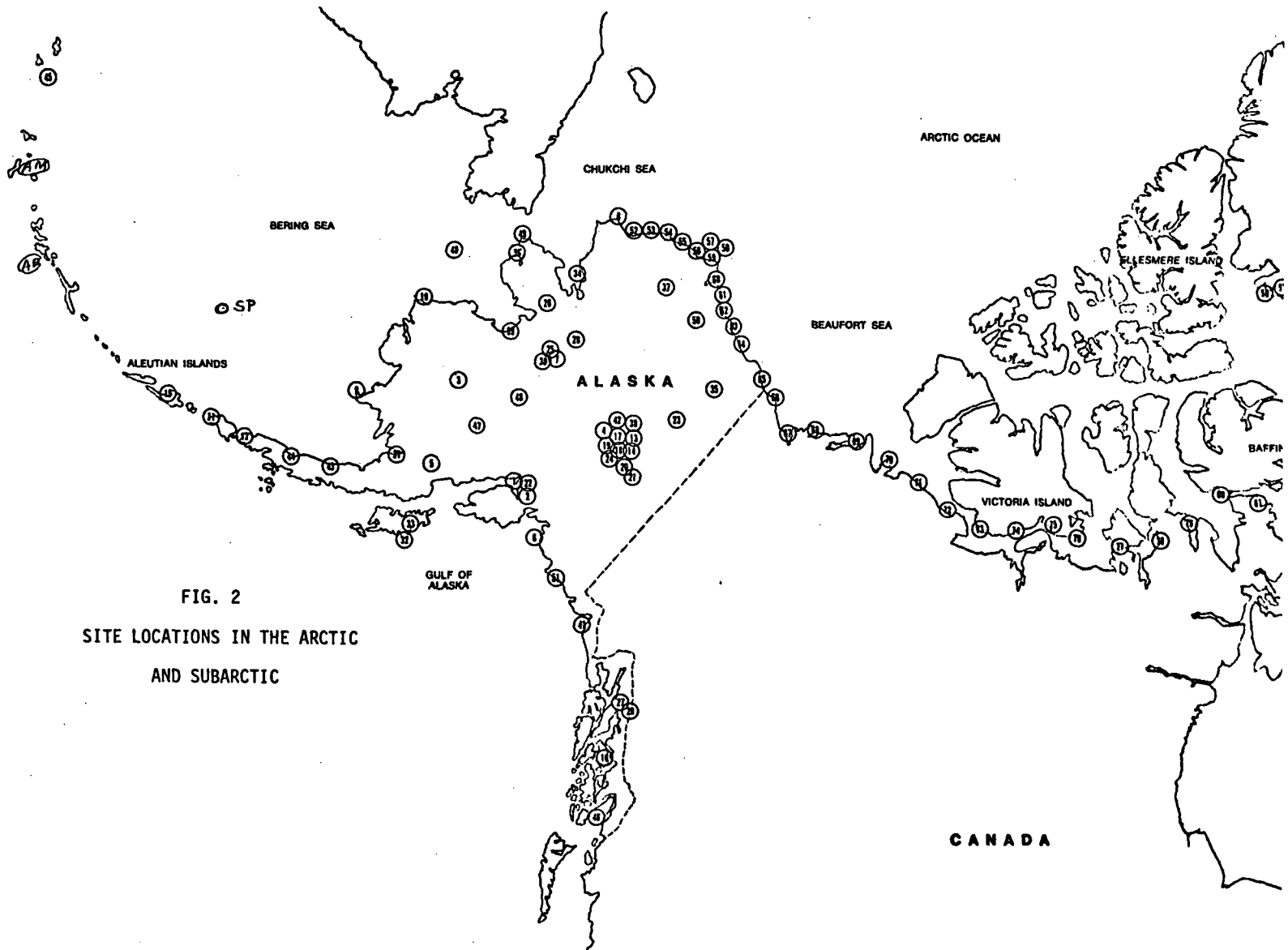

FIG. 2

SITE LOCATIONS IN THE ARCTIC

AND SUBARCTIC

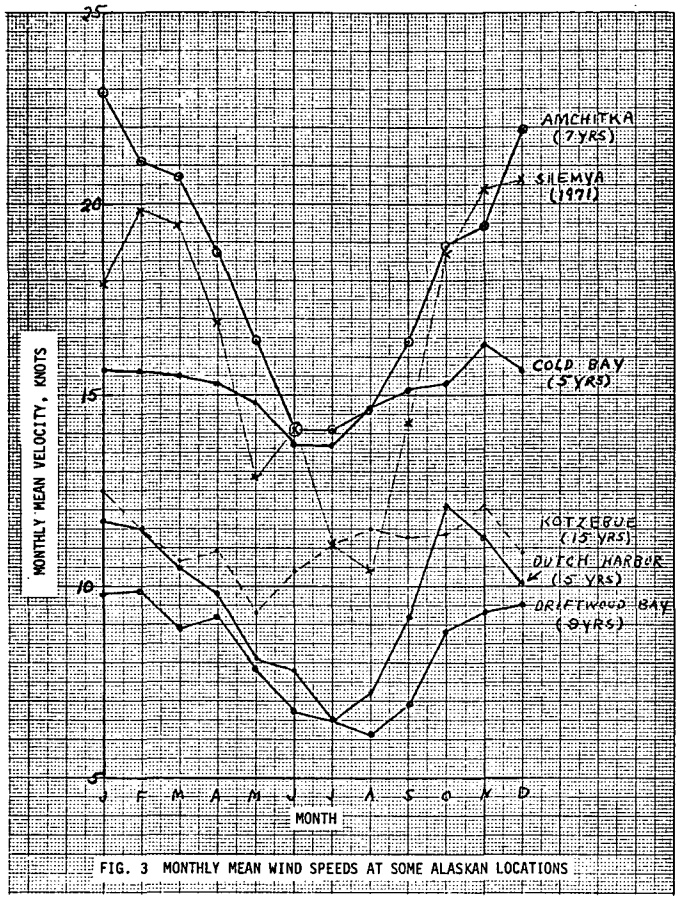

FIG. 3 MONTHLY MEAN WIND SPEEDS AT SOME ALASKAN LOCATIONS

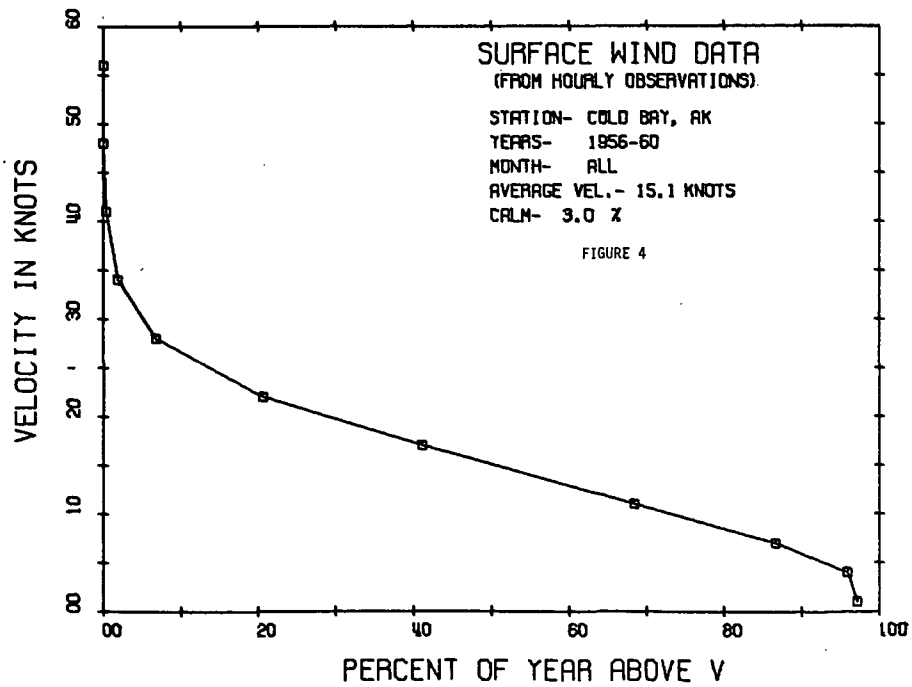

FIGURE 4

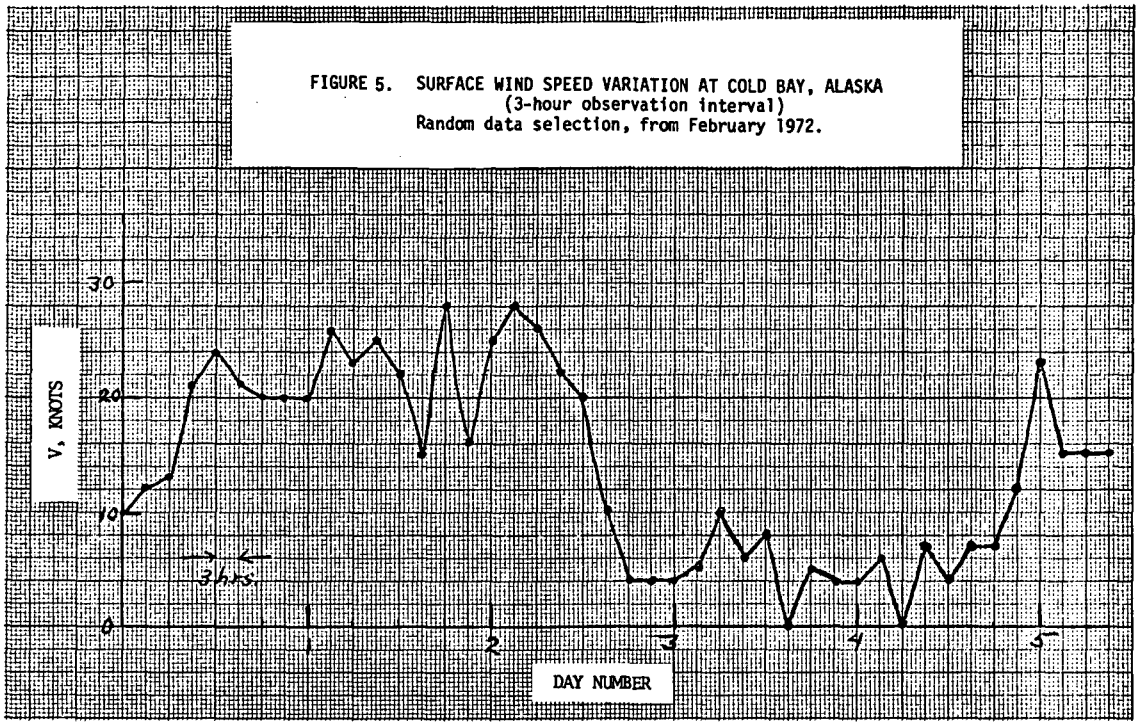

FIGURE 5. SURFACE WIND SPEED VARIATION AT COLD BAY, ALASKA
(3-hour observation interval)
Random data selection, from February 1972.

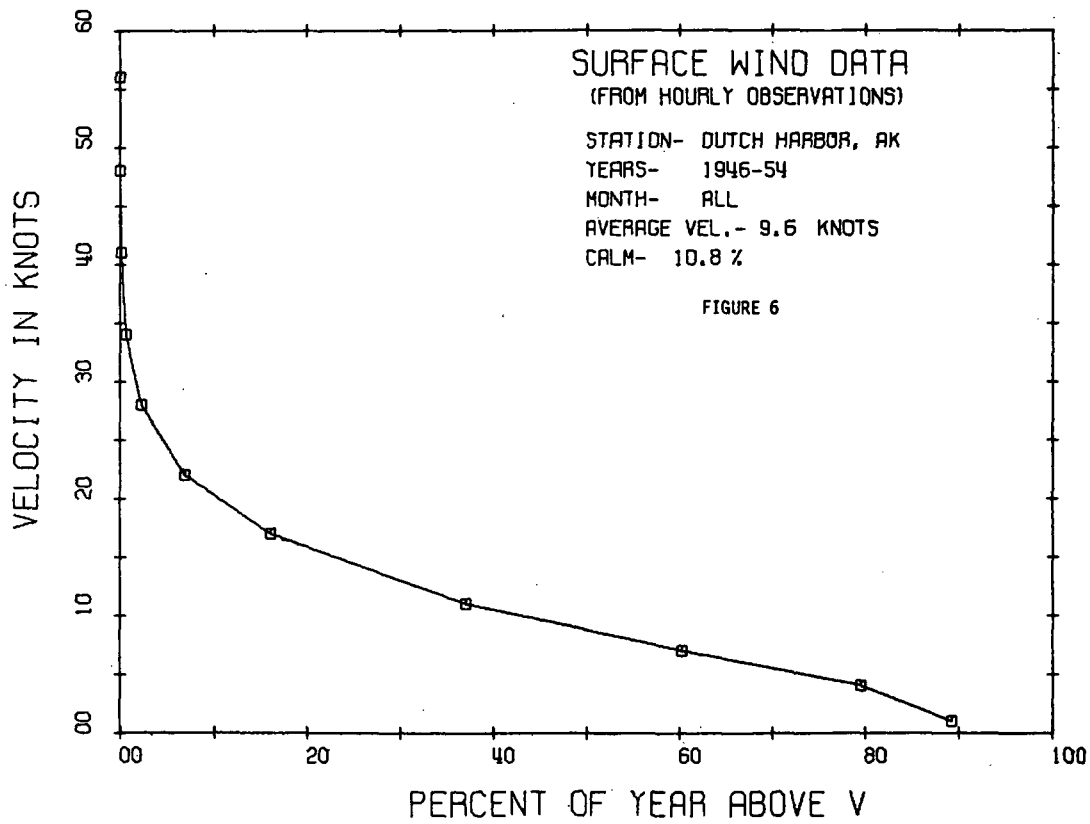

FIGURE 6