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May 1986

Wind Load Reduction for Heliostats

A Subcontract Report

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N. Hosoya
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Colorado State University

Prepared under Subcontract No. XX-4-04029-1

Solar Energy Research Institute
A Division of Midwest Research Institute
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FOREWORD

The research and development described in this document was conducted within the U.S. Department of Energy's Solar Thermal Technology Program. The goal of this program is to advance the engineering and scientific understanding of solar thermal technology and to establish the technology base from which private industry can develop solar thermal power production options for introduction into the competitive energy market.

Solar thermal technology concentrates the solar flux using tracking mirrors or lenses onto a receiver where the solar energy is absorbed as heat and converted into electricity or incorporated into products as process heat. The two primary solar thermal technologies, central receivers and distributed receivers, employ various point and line-focus optics to concentrate sunlight. Current central receiver systems use fields of heliostats (two-axis tracking mirrors) to focus the sun's radiant energy onto a single, tower-mounted receiver. Point focus concentrators up to 17 meters in diameter track the sun in two axes and use parabolic dish mirrors or Fresnel lenses to focus radiant energy onto a receiver. Troughs and bowls are line-focus tracking reflectors that concentrate sunlight onto receiver tubes along their focal lines. Concentrating collector modules can be used alone or in a multimodule system. The concentrated radiant energy absorbed by the solar thermal receiver is transported to the conversion process by a circulating working fluid. Receiver temperatures range from 100°C in low-temperature troughs to over 1500°C in dish and central receiver systems.

The Solar Thermal Technology Program is directing efforts to advance and improve each system concept through solar thermal materials, components, and subsystems research and development and by testing and evaluation. These efforts are carried out with the technical direction of DOE and its network of field laboratories that works with private industry. Together they have established a comprehensive, goal-directed program to improve performance and provide technically proven options for eventual incorporation into the Nation's energy supply.

To successfully contribute to an adequate energy supply at reasonable cost, solar thermal energy must be economically competitive with a variety of other energy sources. The Solar Thermal Program has developed components and system-level performance targets as quantitative program goals. These targets are used in planning research and development activities, measuring progress, assessing alternative technology options, and developing optimal components. These targets will be pursued vigorously to ensure a successful program.

This report presents the results of wind-tunnel tests supported through the Solar Energy Research Institute (SERI) by the Office of Solar Thermal Technology of the U.S. Department of Energy as part of the SERI research effort on innovative concentrators. As gravity loads on drive mechanisms are reduced through stretched-membrane technology, the wind-load contribution of the required drive capacity increases in percentage. Reduction of wind loads can provide economy in support structure and heliostat drive. Wind-tunnel tests have been directed at finding methods to reduce wind loads on heliostats. The tests investigated primarily the mean forces, the moments, and the possibility of measuring fluctuating forces in anticipation of reducing those forces. A significant increase in ability to predict heliostat wind loads and their reduction within a heliostat field was achieved.

The work reported here was monitored by L. M. Murphy of SERI.

Approved for

SOLAR ENERGY RESEARCH INSTITUTE

L. M. Murphy, Manager
Thermal Systems Research Branch

L. J. Shannon, Director
Solar Heat Research Division

SUMMARY

The purpose of this study was to develop a more complete understanding of wind loading on solar collectors with a major emphasis on investigating methods of reducing wind loads on heliostats in typical array fields. The reason for decreasing wind loads is to improve the economy of heliostat support structure and drive mechanisms, both of which will become more sensitive to wind loads as gravity loads decrease through stretched membrane technology. Concepts investigated included perimeter fences or berms, fences or other wind-blockage elements within the field, field density, and drag-modifying devices attached to the heliostat. The primary method of investigation was wind-tunnel tests in a boundary-layer wind tunnel designed to model atmospheric surface layer winds.

Wind loads on specific heliostat field geometries had been obtained in earlier wind-tunnel studies, for mean (time averaged) loads. Those tests were not sufficient to provide designers with methods to optimize heliostat field performance and cost by including wind loading as a variable under design control. Wind-tunnel tests in this study were performed on isolated and within-field heliostats mounted on a six-component force and moment balance. The influence of perimeter fences, in-field fences, and field density on heliostat wind loads were determined for mean heliostat loads. Some fluctuating load measurements on heliostats were obtained on a balance for the first time. Initial indications of peak wind loads on a heliostat were obtained to replace gust factor approaches used in the past to determine peak loads from mean loads.

Results of the investigation for reduction of mean heliostat wind loads are summarized in Figure S-1. In this figure C_{F_x} represents wind force, C_{M_y} represents elevation torque and C_{M_z} represents azimuthal torque about the support post. The ordinates in S-1 are the forces or moments in the field divided by the isolated heliostat loads and show the reduction in load as a function of upwind blockage which is the abscissa. The generalized blockage area is the surface area of upwind obstacles such as heliostats, fences, or berms projected onto a plane perpendicular to the wind direction per unit ground area. The data collapse quite well onto or below a single curve. This finding provides a powerful tool for optimization of field layout by designers.

Fluctuating load measurements were limited in scope and complicated by wind-tunnel scaling requirements. The measurements showed that the fluctuating part of the wind load decreases within a field environment in comparison to that on an isolated heliostat. The decreased fluctuating load component combined with a decreased mean load resulted in a net decrease in peak load.

Major conclusions from the study are:

- Mean wind loads on heliostats can be reduced to below 30 percent of isolated heliostats by appropriate design of the field and external fences or berms.

- A simple design-oriented prediction method for mean heliostat wind loads in a field has been developed.

- Peak dynamic loads are significantly lower within a field than at the edge for heliostats in operational positions.

- Limited analysis of dynamic loads has not identified a loading mechanism indicating that on-heliostat spoilers would be beneficial in decreasing mean and dynamic wind loads.

- The strength of a collector should be based on the peak load rather than a mean load multiplied by an assumed gust factor.

- Full-scale wind loads are not available for comparison with wind-tunnel data.

- Design forces perpendicular to the mirror plane for an isolated heliostat are controlled by operational winds (50 mph) while design drive moments are controlled by survival winds (90 mph).

Recommendations for future study include further work on fluctuating loads, local and integral loads on typical isolated stretched membrane heliostats, and additional synthesis of wind-load data into a design-oriented methodology for control of wind loads. Specific tasks include

- Application of the generalized blockage area concept to fluctuating loads

- Better resolution of stow position loads

- Development of a design guideline

- Comparison of wind-tunnel loads with full-scale loads.

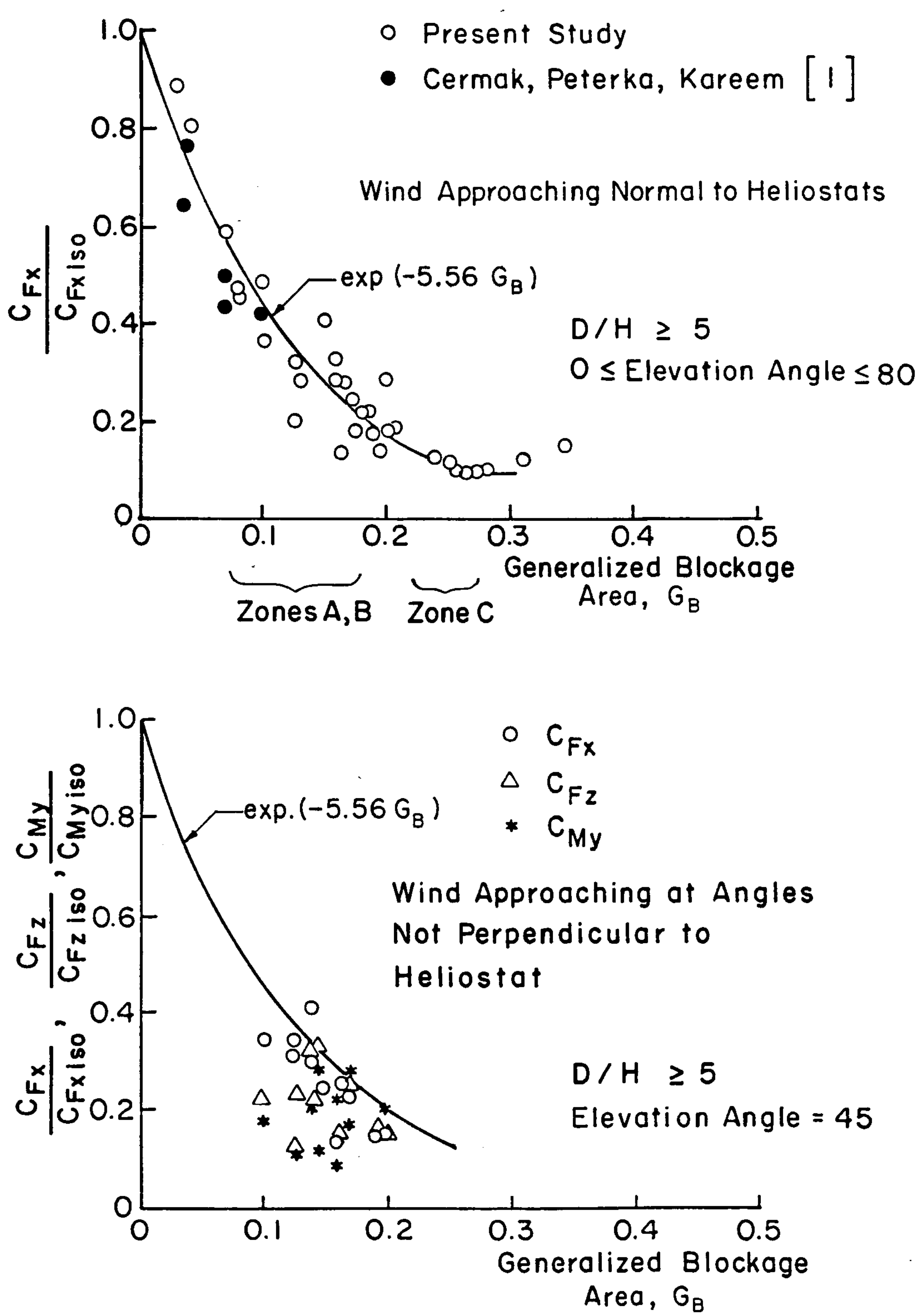

Figure S-1. Mean Load Reduction as a Function of Generalized Blockage

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NOMENCLATURE

Symbol	Definition
A	Constant
AZ	Azimuth angle of heliostat, 270° faces south, 180° faces west
A_B	Blockage area projected onto a plane perpendicular to approach wind direction
A_F	Field area containing blocking elements used for A_B
A_{ref}	Reference area 19.6 in.^{2} model, 489.9 ft^2 full scale
B	Constant
c	Constant
$C_{F_{x,y,z}}$	Force coefficient, $\dfrac{F_{x,y,z}}{(\frac{\rho U^2_{ref}}{2})(A_{ref})}$
$C_{M_{x,y,z}}$	Moment coefficient, $\dfrac{M_{x,y,z}}{(\frac{\rho U^2_{ref}}{2})(A_{ref})(L_{ref})}$
D	Distance from heliostat under consideration to the external fence
E	Hot-wire output voltage
EL	Vertical angle of heliostat, zero degree for vertical
$F_{x,y,z}$	Measured force along axis, positive force in positive axis direction
f	Frequency, Hz
$\tilde{f}$	Nondimensional frequency, $\frac{fL}{U}$
g(t)	Fluctuating part of a time varying signal
G	Gust factor for load or velocity, $\frac{\text{peak}}{\text{mean}}$
G_B	Generalized blockage, $\frac{A_B}{A_F}$
G(f)	Power spectral density

Symbol	Definition
g	Peak factor for load or wind velocity, $\frac{\text{peak - mean}}{\text{RMS}}$
H,h	Heliostat height = 24.2 ft
I	Longitudinal turbulence intensity
L	Length scale
L_{ref}	Reference length (chord) 4.26 in. model, 21.3 ft full scale
$M_{x,y,z}$	Measured moment about axis, sign by right-hand rule
n	Power-law exponent of velocity profile
n	Frequency
n_o	Frequency
$R(\tau)$	Correlation function
t	Time
T	Time scale
U	Velocity in X-direction
V	Velocity in Y-direction
W	Velocity in Z-direction
WD	Wind direction
x,y,z	Coordinate system (see Figure 3.3)
x',y',z'	Coordinate system for data collection
Z_{ref}	Reference height 6.6 in. model, 32.8 ft prototype
λ	Scale ratio
δ	Boundary-layer thickness
ρ	Density of air
ν	Kinematic viscosity of air

Symbol	Definition
$\sigma_{u,v,w}$	RMS velocity in x,y,z directions
β	Wind angle to the deck
ζ	Damping ratio
ω	$2\pi f$

Symbol Subscript	Definition
rms	Root-mean-square
X,Y,Z	Directional indicator
L	Length
T	Time
f	Frequency
ISO	Isolated
mean	Mean value
ref	Reference
U	Velocity
p	Prototype
m	Model

SECTION 1.0

INTRODUCTION

The need to understand and quantify wind loading effects on individual and fields of tracking solar collectors has emerged as an important design and development issue. This understanding is important in the cost effective design of both conventional concentrators and innovative low-cost concepts which can be considerably less robust than their conventional counterparts. Moreover, to aid in the development of that understanding, methods for the adequate modeling and simulation of wind loading on individual concentrators within the actual field environment are needed.

The quantification and understanding of wind loading effects are needed in support of the low-cost development effort from two perspectives. First, realistic design requirements must be set to allow efficient, nonconservative, and thereby low-cost, structural designs which still result in good concentrator performance. The structural design must consider the design of the drive (for tracking) support structure, and foundation in addition to the reflector structure. Second, this knowledge base is needed to ultimately allow the design of collector fields which avoid or minimize the effect of wind loading both during solar operation and when the collector field is being protected in survival loading conditions.

This study was commissioned mainly to find methods for reducing wind loads within a heliostat field to values well below those acting on an isolated unit. The methods for reduction, based on earlier work discussed below, were anticipated to rely on perimeter wind fences, in-field wind fences, field density, and possibly spoilers attached to the heliostats. Primary efforts were directed to mean wind loads; however, initial efforts were expanded to determine the magnitude of fluctuating loads. The results of this study provide a basis for reduction of mean heliostat wind loads and show that fluctuating loads decrease with distance into a field.

1.1 PREVIOUS WORK

A number of studies have addressed the wind loads on ground-based solar collectors and means of reduction of those wind loads [1-14]. These studies measured wind loads on heliostats [1,2] photovoltaic collectors [3,5-7,10-14], and parabolic trough collectors [4,8-9]. Other studies have addressed roof-based collectors [15-18], and older studies of dish antennas [19-21]. A review of wind load studies is given in reference [22].

Design wind loads for photovoltaic panels and parabolic collectors in large fields have been reduced substantially below those which would be required by typical wind codes by appropriate application of wind engineering analysis. Wind-tunnel tests of array fields modeled at small scale in boundary-layer wind tunnels have revealed that the dense packing of the photovoltaic and parabolic array fields provided a natural reduction in wind load below that of an isolated collector module by blocking wind from penetrating into the central area of the field at the height of the collectors. Collector units at the edges of the field were not protected by the field but their wind loads could be reduced to levels comparable to those in the field interior by a properly designed porous wind fence around the field periphery.

In studies of heliostats [1,2], wind-tunnel tests revealed that some reduction in wind load did occur in the interior of the heliostat field. However, the relatively loose packing of the heliostats in the field, in comparison to the photovoltaic or parabolic collector fields, prevented the large reduction in wind loads that were observed in the denser fields. Wind fences at the edge of the field did provide significant reduction in wind loads for heliostats at the edge of the field, but wind loads on units in the center of the field remained unaffected by the periphery wind fence.

The interaction of winds with a heliostat field is shown schematically in Figure 1-1. In Figure 1-1a, turbulent boundary layer winds are shown approaching a field on the left and within the field on the right. The presence of heliostats causes a decrease within the field of mean wind speed over the height of the heliostats as a consequence of wind impingement on upwind heliostats. The reduction in mean wind is accompanied by an increase in turbulent kinetic energy (gustiness) of the wind. In comparison to the heliostat at the edge of the field, units interior to the field experience lower mean wind loads and often decreased fluctuations in wind load about the mean. The reduction in mean wind loads within solar collector fields has been measured in wind-tunnel tests cited above; dynamic loads have only been measured in a limited way for photovoltaic collectors [13,14]. The mean load reduction within the field depends greatly on field density and heliostat pitch and azimuthal angle. Insufficient data were available to generalize the loads in a predictive formula.

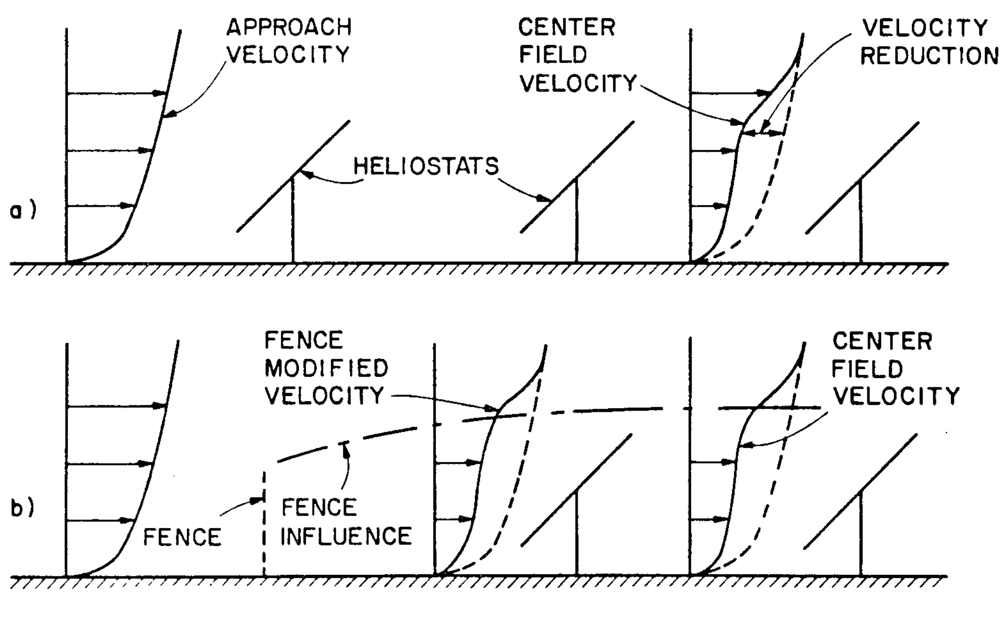


Figure 1-1. Velocity Reductions within a Field of Heliostats

Mean wind loads on collectors near the edge of the field can be substantially reduced with an appropriately designed perimeter fence of 30 to 50 percent porosity, Figure 1-1b. Reduction of wind load on the first collector with increasing fence height is shown in Figure 1-2. The effectiveness of the fence decreases with decreasing angle between wind vector and fence line and with decreasing fence height. In addition, corners in fences, if not properly designed with spoilers, can cause increases in wind loads above those with no fence [2]. Fence costs may be realistic if heliostat costs can be reduced.

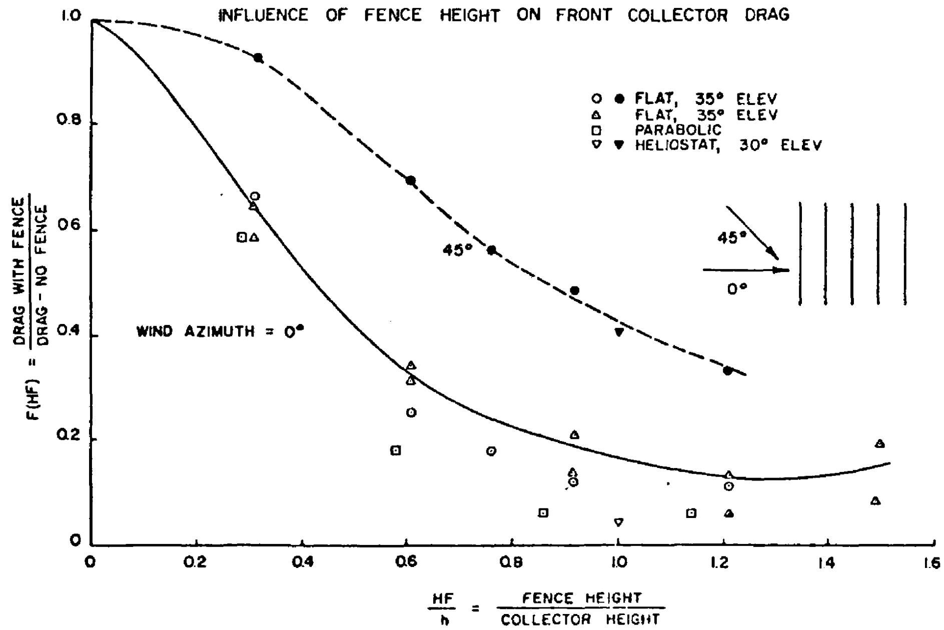


Figure 1-2. Influence of Fence Height on Front Collector Drag Force (data from references 1,4,7,10)

One part of the current study is to evaluate the studies cited above to determine possible methods for wind load reduction. Previous tests provided a measure of the need for reducing interior loads below those resulting naturally from protection by surrounding heliostats. In reference [2], mean wind loads were measured for several heliostats with varying distance from the edge of the field, with and without protective perimeter fences. Two portions, A and B, of a possible field arrangement, Figure 1-3, were studied. Key findings of the study are illustrated in Figures 1-4 and 1-5. Both show base moment coefficients (nondimensional base moments) as a function of distance into the field for various perimeter fences and no perimeter fence. Several conclusions can be drawn from the figures and other data in references [1,2]:

- Edge heliostats have larger mean loads without a perimeter fence than do heliostats within the field.
- The addition of a perimeter fence can cause large reductions in edge heliostat mean loads.
- Heliostat loads in the interior of the field in the dense portion of the field (field A in Figure 4) are substantially smaller, Figure 1-4, than those in the interior of the less dense portion of the field (area B), Figure 1-5.

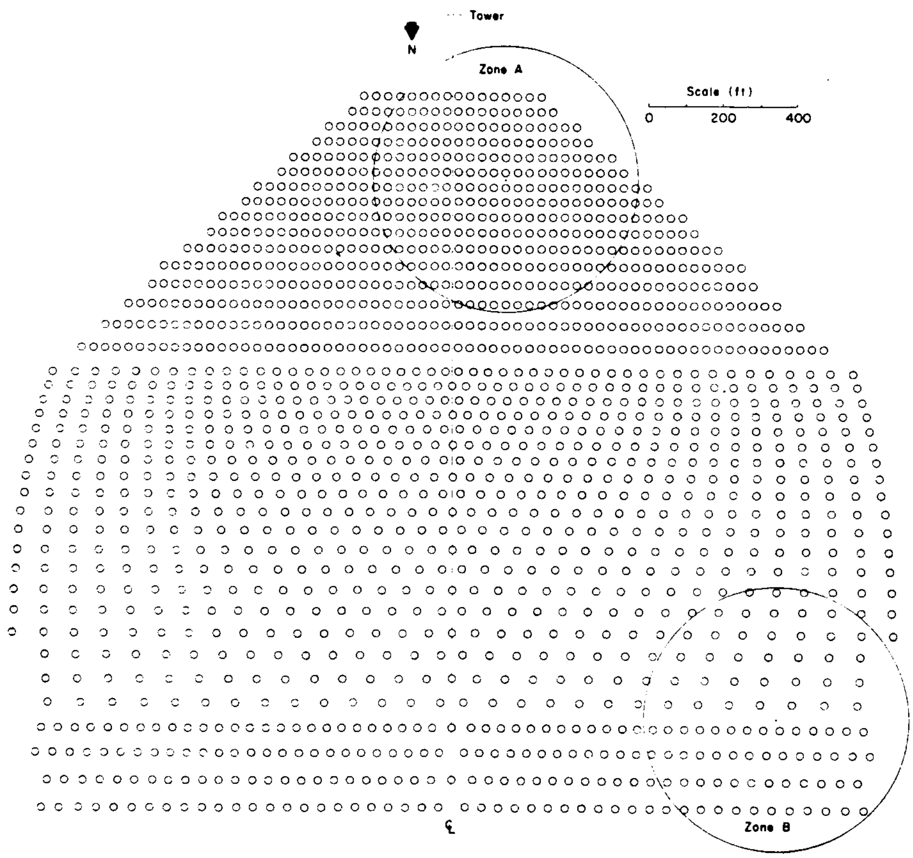


Figure 1-3. Heliostat Field for Tests of Reference [2]

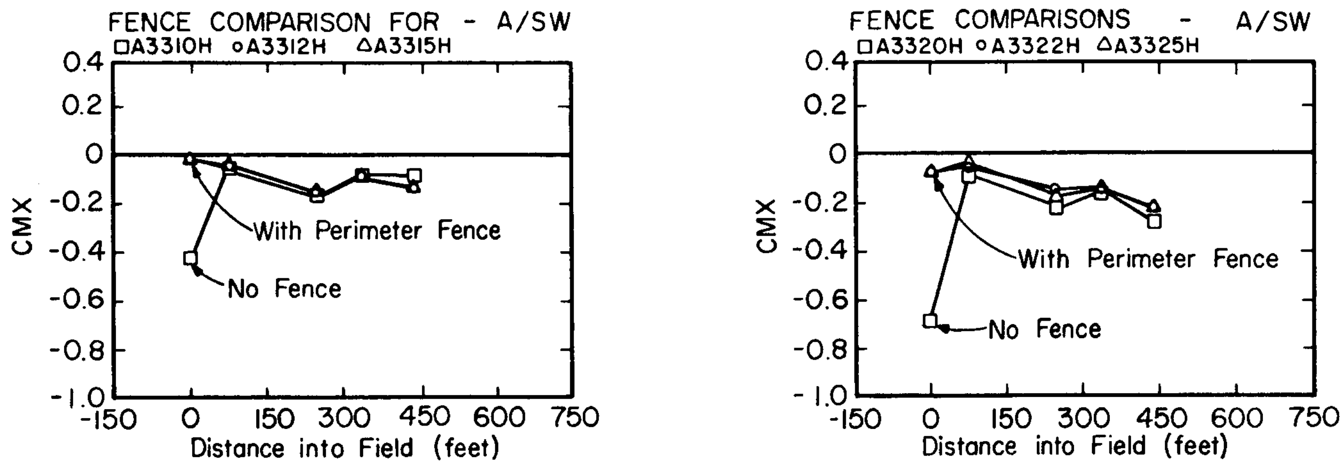


Figure 1-4. Moment Coefficients for a High Density Heliostat Field Array - Zone A

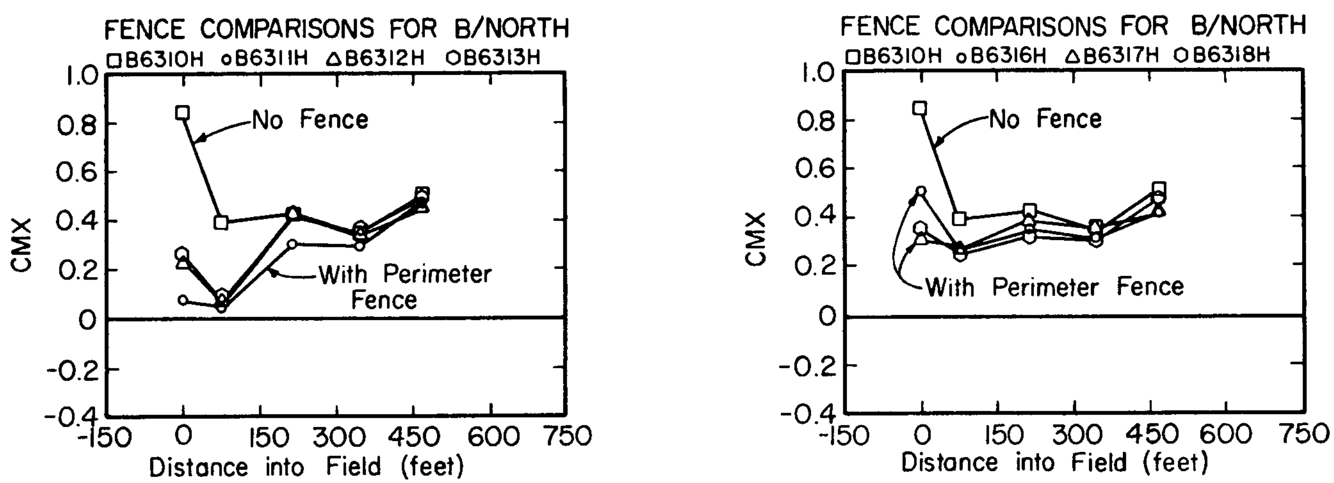


Figure 1-5. Moment Coefficients for a Low Density Heliostat Scale Model Test Field Array - Zone B (Fig. 1-3)

- Interior heliostat loads in field A were comparable to the edge heliostat loads after reduction by perimeter fence.

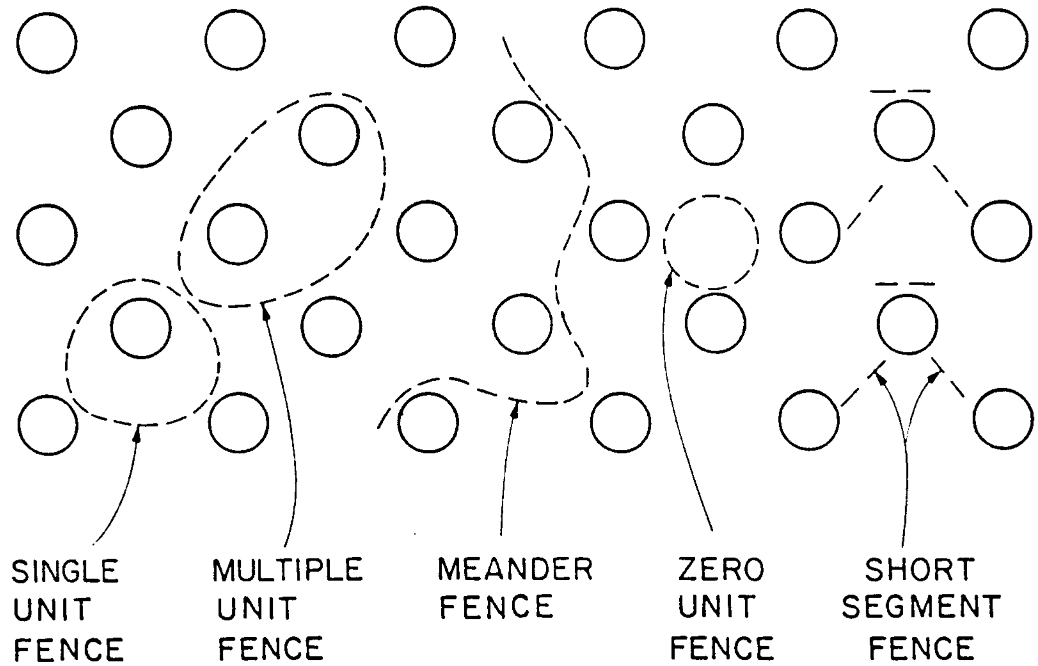
- Heliostat loads in the interior of field B were lower than unprotected edge heliostats but were not affected by the perimeter fence.

The use of fences to decrease wind loads has been in use for many years. Reference [23] provides an early summary of porous fence effects directed at agricultural uses, but has more universal application. More recent references [23-27] provide data and access to additional literature describing the mean wind and turbulence structure downwind of porous fences. While a large number of references exist describing flow behind porous fences, there still remains a need for additional research for wind not perpendicular to a fence, short fence lengths, corners in fences, rows of fences and crossing fences. Use of published data on fences has been used in this and previous studies. However, this information is of limited use when predicting the load on an in-field heliostat whose wind load is determined by upwind heliostats, perimeter fence and in-field fences.

1.2 WIND LOAD REDUCTION

Based on review of previous work, the potential for mean load reduction on heliostats is in the edge units and in the low density field interior units. Edge units can be protected by perimeter fences as previously illustrated [1,2]. It is evident that mean load reduction within the field depends on velocity reduction within the field. This in turn requires additional blockage area in the field interior. Several generic concepts are shown in Figure 1-6 which could represent solid or porous fences. The fences could surround a single, several or no heliostats, could meander through the field in a straight or curved line, or could be a series of fence segments. The fences could vary with height along their length to prevent shadows on the mirrors. One possible scheme is shown in Figure 1-7 in which porous fences are included within the field to increase blockage area. These in-field fences were designed to provide minimal interference with reflected light. Modifications to this concept involve inclusion of fences in only one direction to permit easier access to the field for maintenance. In the horizontal stow mode, selected lines of strengthened heliostats could be left upright to provide fence action in place of actual fences.

Dynamic loads result from two phenomena: 1) from buffeting due to turbulence in wind approaching the field and from disturbances from upwind heliostats, and 2) from 'wake turbulence' generated by separated wind flow as it passes over the heliostat under consideration. No previous dynamic load measurements are available for this specific geometry. However, based on dynamic loading on other shapes, it is expected that reduction of mean loads will have the effect of increasing buffeting through increased turbulence in the approach wind and decreased wake excitation through decreased mean velocity. It is not certain that a decreased mean load will result in a net decrease in dynamic load; however, measurements on other geometries indicate this possibility. Efforts were made during wind-tunnel testing to measure some fluctuating loads so that the total design load, including both mean and dynamic loads, could be determined.



POROUS OR SOLID FENCES

FENCE HEIGHTS MAY VARY ALONG FENCE LENGTH

Figure 1-6. Concepts for Interior Field Wind Protection

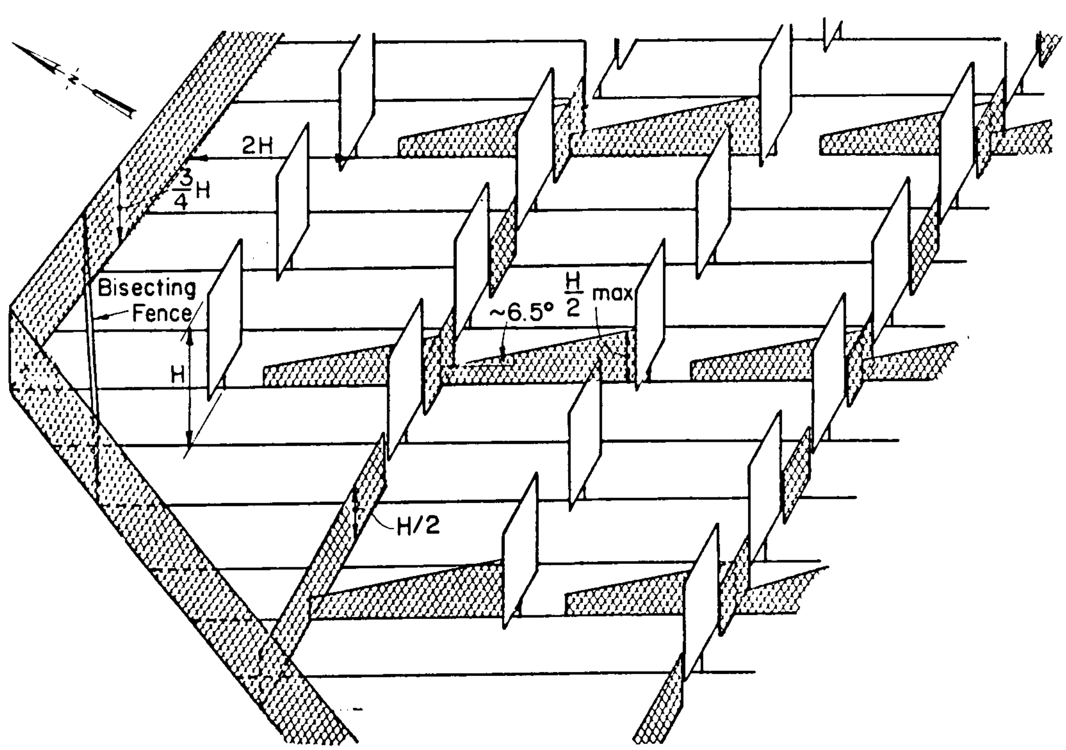


Figure 1-7. Fence Configuration for Lowering Velocities Interior to Field

Reduction of dynamic loads depends critically on the specific mechanism responsible for the dynamic loading. In some cases, wind flow separation from the edge of the heliostat can result in increased dynamic loading. For these cases, attachments to the heliostat such as those suggested in Figure 1-8 might be beneficial in disrupting the shear layer and reducing dynamic loading. These devices are likely, however, to increase mean loading.

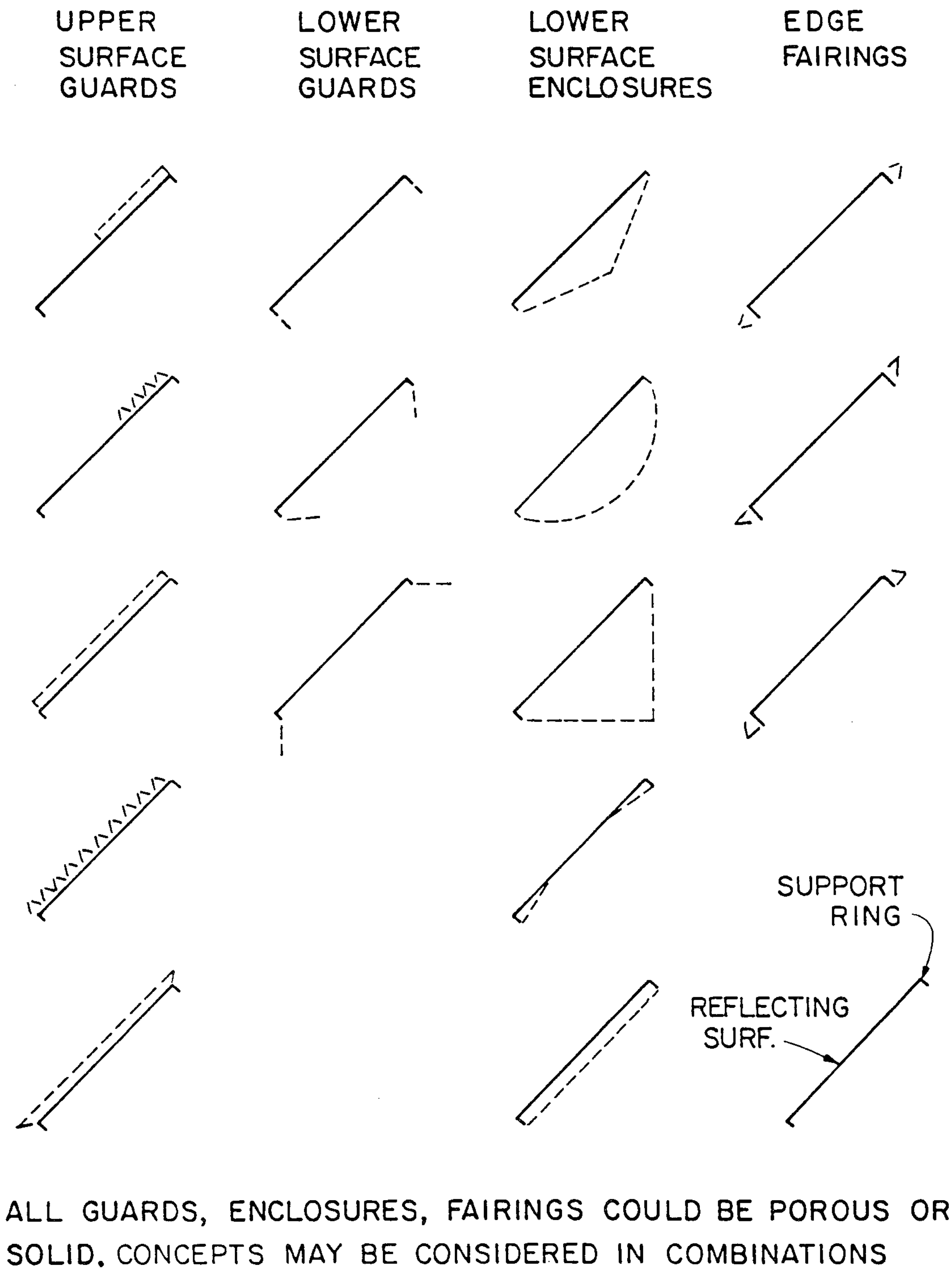


Figure 1-8. Concepts for Reducing Fluctuating Loads

1.3 MODELING OF ATMOSPHERIC WIND LOADS

Measurements of wind loads on ground-based solar collectors outlined previously have all been obtained in wind-tunnel tests. Wind tunnels specifically designed to model atmospheric boundary-layer winds and wind loads on structures in the 1000-2000 ft above the earth's surface have been developed over the past 30 years. Numerous references are available, [28-30] for example, which describe the modeling criteria required for boundary-layer wind tunnels to model atmospheric boundary-layer winds and resulting wind loads. In general, the requirements are that the model and prototype be geometrically similar, that the approach mean velocity at the building site have a vertical profile shape similar to the full-scale flow, that the turbulence characteristics of the flows be similar, and that the Reynolds number for the model and prototype be equal.

These criteria are satisfied by constructing a scale model of the structure and its surroundings and performing the wind tests in a wind tunnel specifically designed to model atmospheric boundary-layer flows. Reynolds number similarity requires that the quantity UL/ν be similar for model and prototype. Since ν, the kinematic viscosity of air, is identical for both, Reynolds numbers cannot be made precisely equal with reasonable wind velocities. To accomplish this the air velocity in the wind tunnel would have to be as large as the model scale factor times the prototype wind velocity, a velocity which would introduce unacceptable compressibility effects. However, for sufficiently high Reynolds numbers ($>2\times10^4$) the pressure coefficient at any location on the structure will be essentially constant for a large range of Reynolds numbers. Typical values encountered are 10^5-10^6 for the full-scale and 10^4-10^5 for the wind-tunnel model. In this range acceptable flow similarity is achieved without precise Reynolds number equality.

The wind tunnel used for this study is described in Section 2.0. Appendix A presents comparisons between model and full-scale studies which illustrate the ability of wind-tunnel models to predict full-scale wind speeds and wind loads. This extensive data showing excellent comparison and the great economy of wind-tunnel tests in comparison with full-scale tests has driven a steadily increasing use of boundary-layer wind-tunnel testing.

SECTION 2.0

EXPERIMENTAL APPARATUS

2.1 THE WIND-TUNNEL FACILITY

The present study was conducted in the Meteorological Wind Tunnel (MWT) of the Fluid Dynamics and Diffusion Laboratory (FDDL) at Colorado State University. Plan and elevation views of this tunnel are shown in Figure 2-1.

The MWT was designed specifically to model atmospheric boundary-layer flow. The tunnel is a closed circuit facility with a 9-to-1 contraction ratio driven by a 250 HP variable-pitch, variable-speed propeller. The test section is 96 ft in length and nominally 6 ft square. The test section walls diverge approximately 1 in./10 ft, and the roof is adjustable to maintain a zero pressure gradient along the test section. The blockage created by the model was less than 2 percent of the tunnel cross section. Hence, it was not necessary to adjust the roof to compensate for the blockage effect. Though the tunnel is capable of simulating thermally stratified planetary boundary layers, all the experiments included in this report were performed with a neutral boundary-layer stratification.

The turbulent boundary layer was tripped at the entrance section of the MWT with a 1.5 in. high sawtooth vortex generator and allowed to develop over the long test section with certain roughness (smooth Masonite with 0.25 in. holes and 0.25 in. diameter x 0.5 in. long dowels placed in a 2 in. x 8 in. pattern). In addition, four evenly spaced 6 ft tall spires were installed at the tunnel entrance to create the desired atmospheric boundary layer within the test section. The turbulent boundary layer developed in this way has been shown to model the atmosphere boundary layer for model scales smaller than about 1:100 (28-30). At a 1:60 scale the larger turbulence scales are not completely represented, as discussed below, but should not affect mean wind load measurements.

2.2 MODEL ENVIRONMENT

2.2.1 Heliostat Models

As discussed in Section 1.0, a major reason for examining wind loads on heliostats is the emergence of stretched membrane heliostats which have a circular shape. It might logically follow that this study would use circular heliostat models. However, more than 200 rectangular models of glass-mirror heliostats at a 1:60 scale were available from a previous study [2]. In addition, typical heliostat field layouts were available from reference [2] and from the existing Barstow demonstration site and no specific field layouts have been published for the circular shape. For these reasons and because results from one flat-plate shape (for example for rectangular to circular) to the next are expected to be quite similar, the rectangular shape was selected for this study. The Barstow site layout, Figure 2-2a, was selected over that from reference [2] since some data on the reference [2] layout had been obtained, since the Barstow site may be more typical of future field geometries, and since a possibility existed for obtaining some field data for

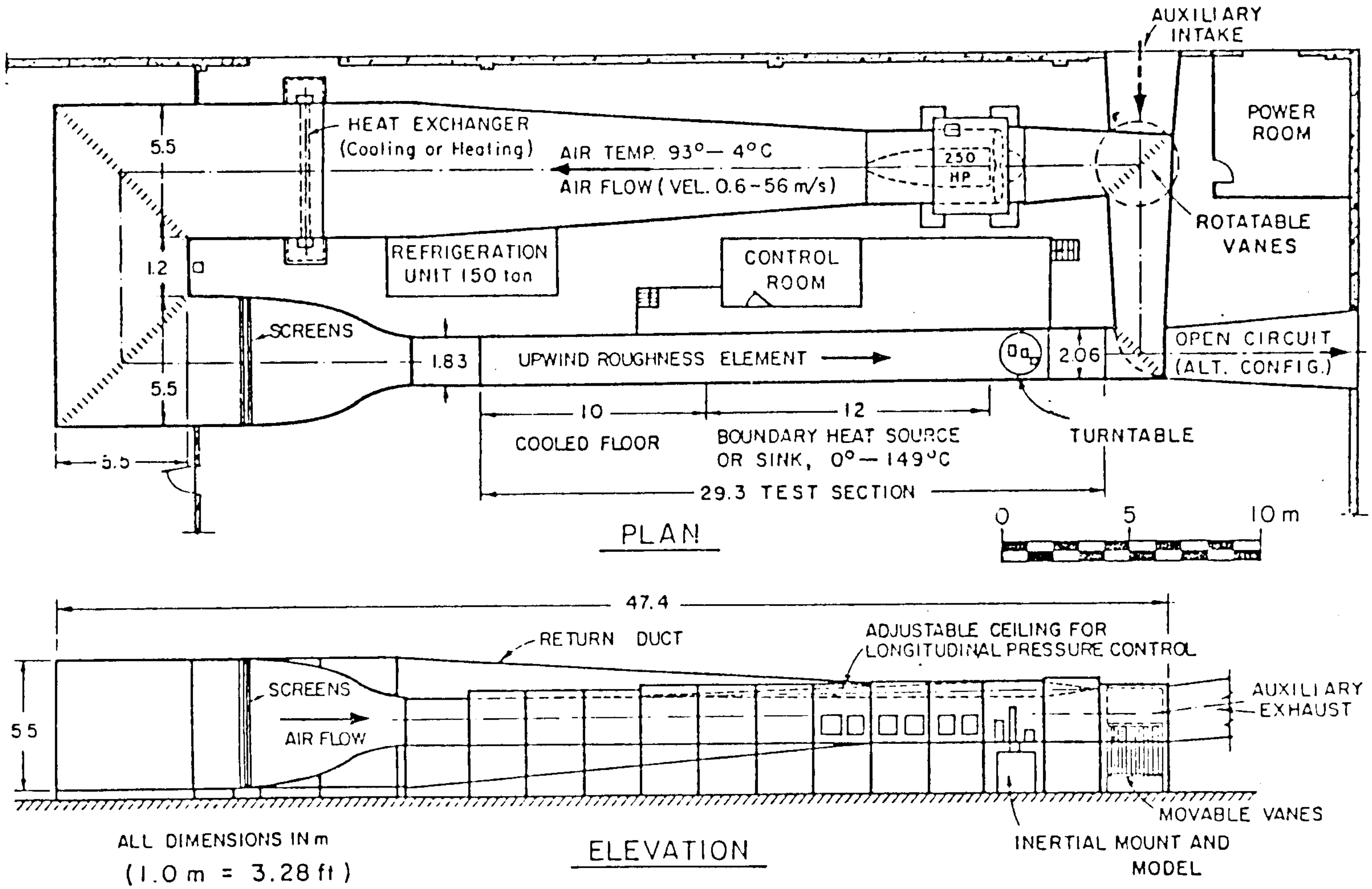


Figure 2-1. Meteorological Wind Tunnel

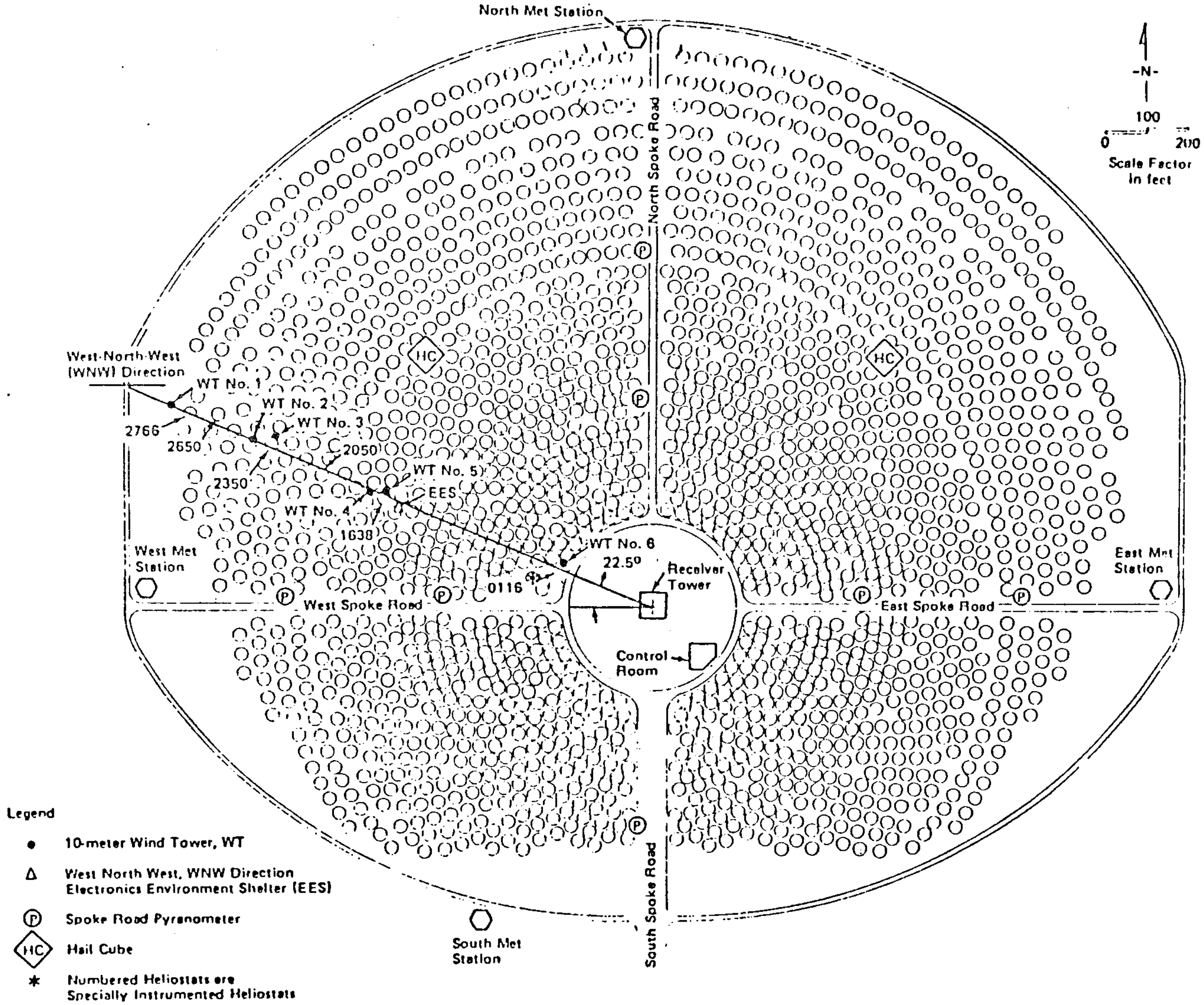


Figure 2-2a. Heliostat Field

comparison with wind-tunnel data for specific heliostats which have been instrumented at the Barstow site.

Five heliostats in the Barstow field were selected for modeling in this test program, see Figure 2-2b. These heliostats are representative of five different environments in the field representing three different densities (A, B, C):

1) edge unit exposed to prevailing WNW winds
2) intermediate density B region in the field
3) high density region C in the field
4) inner edge of the high density region
5) lowest density portion A of the field

Three of the five heliostats (1, 3, 4) are ones which have been instrumented in the Barstow field for wind loads. Heliostats 1-4 lie close to a line of anemometer towers in the full-scale field, Figure 2-2a, which have been measuring full-scale wind data. Thus, comparisons between model and full-scale wind measurements are possible.

The circles surrounding each heliostat in Figure 2-2b represent the 6 ft diameter turntable (and wind-tunnel width) for the model study. For some experiments, only those heliostats on the turntable area were used. For others, heliostats were added upstream of the turntable for specific wind directions to obtain an upwind fetch of heliostats which extended to the edge of the field. Specific field layouts are identified in the section on the test matrix in Section 3.4.

A photo of the 1:60 heliostat models used in the study is shown in Figure 2-3a while drawings of the models are shown in Figure 2-3b. The field layout was placed on a sheet of plywood and holes drilled for each heliostat support post. The field could then be established and changed quickly by inserting heliostats into their respective holes. Heliostats could be set to a specific day and hour by setting azimuthal and elevation angles. Angled blocks were prefabricated for desired angles and quickly set next to heliostats for setting angles. Horizontal and vertical angles were held in place by friction in the bearings.

The heliostat at the center of the turntable (1-5 in Figure 2-2b) was mounted on a six-component strain-gaged force balance, Figure 2-4. The balance was designed and constructed by the Fluid Mechanics and Wind Engineering Program at Colorado State University for general purpose use in measuring mean wind loads. By constructing the instrumented heliostat of balsa wood with a brass post, it was possible to obtain a model/balance natural frequency of 28 Hz. By low-pass filtering the output of the balance, the resonant response of the model heliostat could be virtually eliminated from the output signal permitting the fluctuating loads on the model to be measured up to a frequency of about 18 Hz. Setting wind-tunnel speed to take advantage of velocity scaling laws, see Section 3.1, permitted a reasonable approximation to the true fluctuating forces on the model to be obtained. Additional details of the balance operation are contained in Section 3.1.

Wind-tunnel turntable 6' Φ
Scale 1:60
→ 6 x 60 = 360' Φ

Target Units:

1 - 2766
2 - 2350
3 - 1638
4 - 0116
5 - 2632

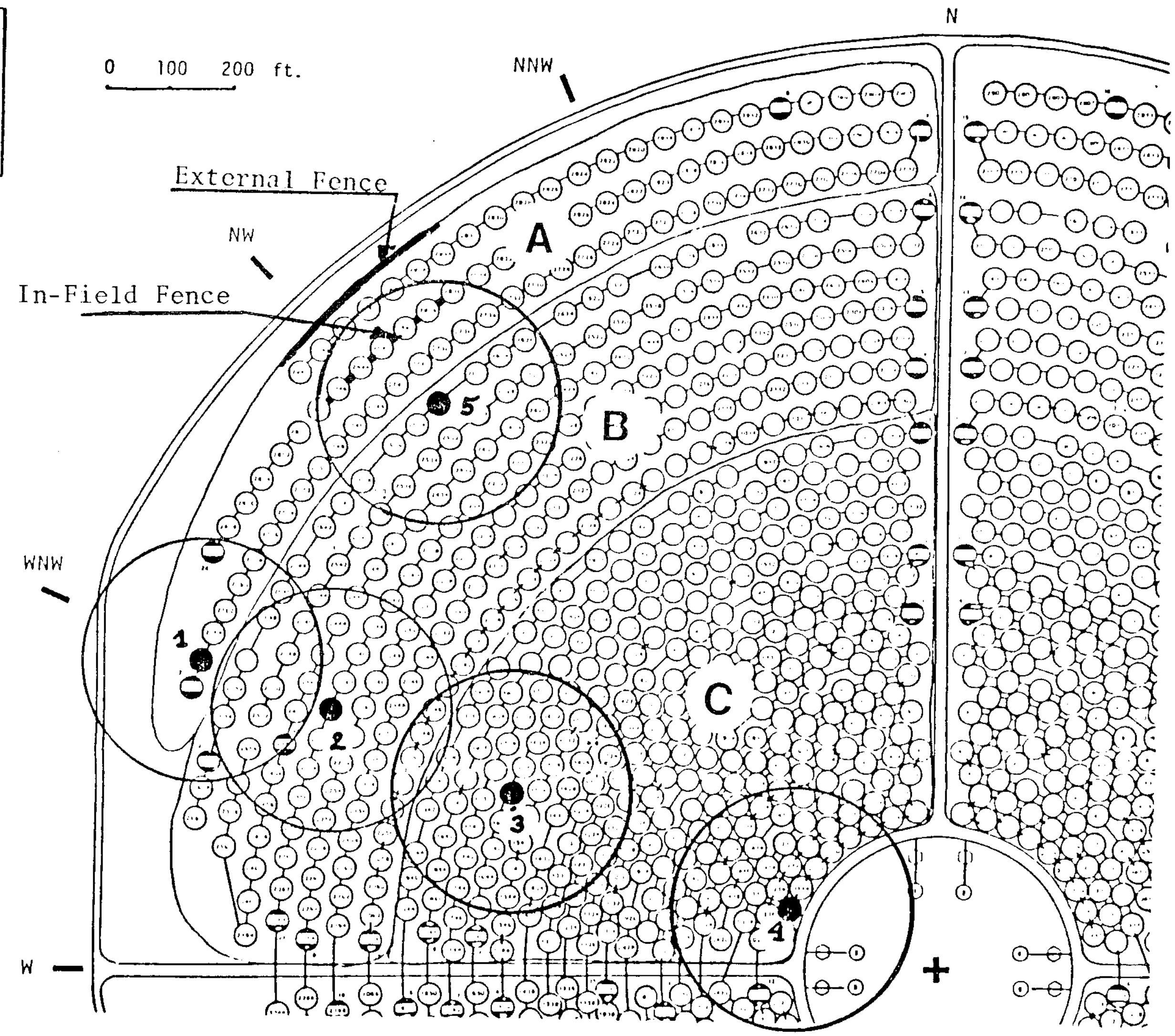
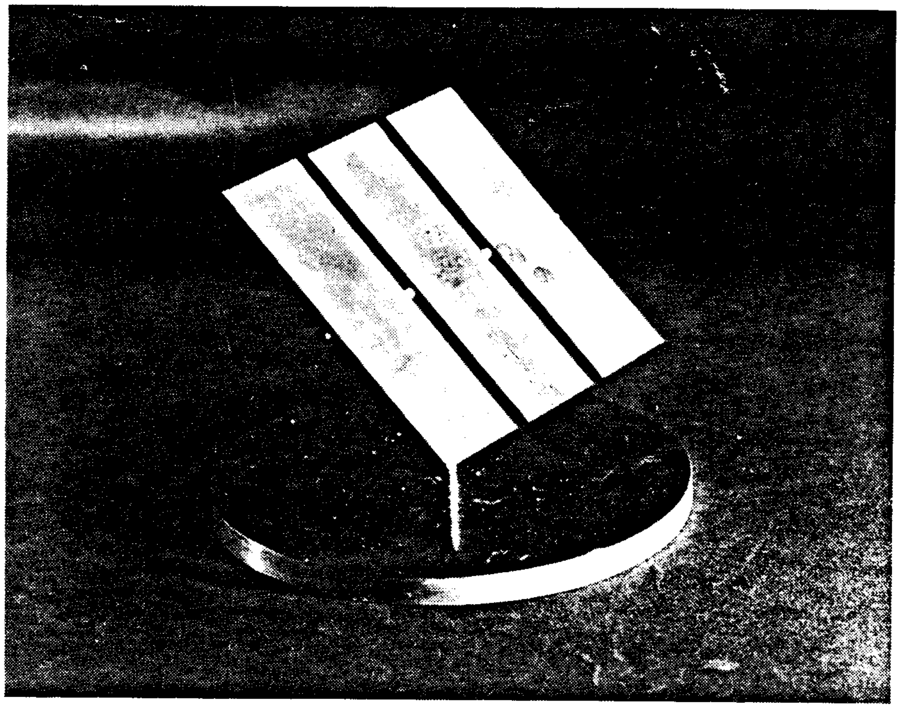


Figure 2-2b. Heliostat Field

(a)



(b)

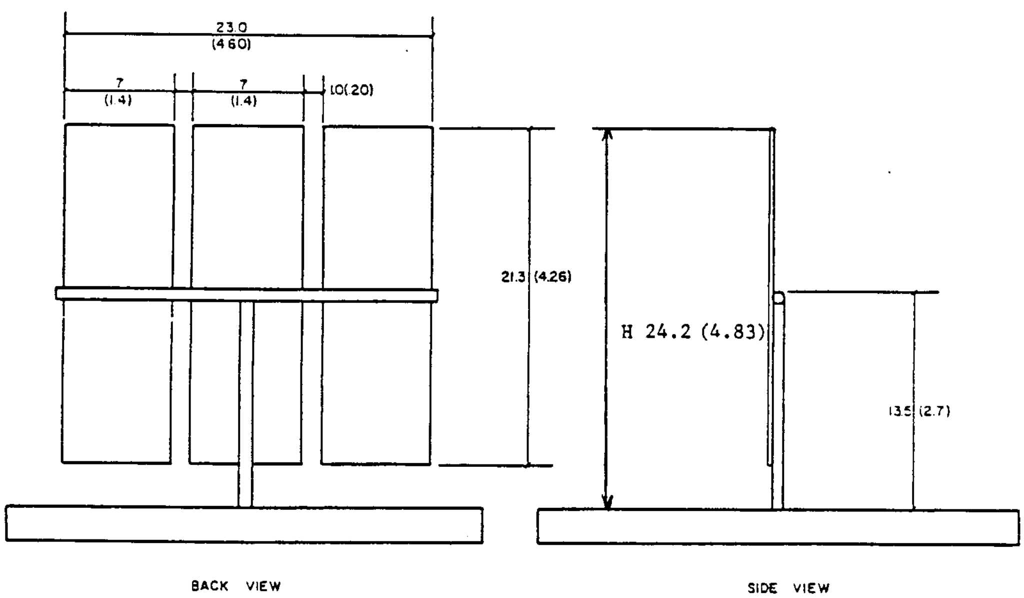


Figure 2-3. Heliostat Model

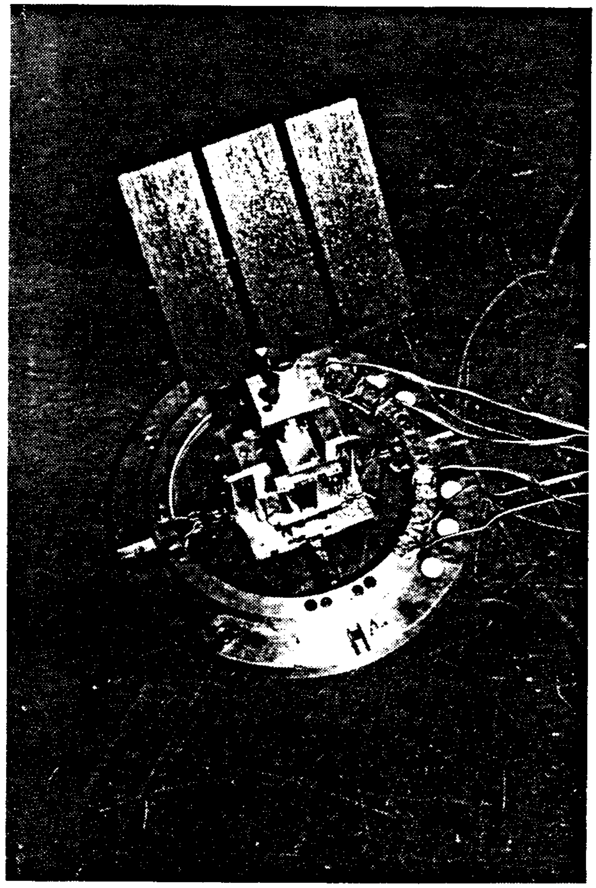


Figure 2-4. Metric Heliostat Mounted on a Six-Component Balance

2.2.2 Wind Protective Fences

Four types of wind fences were used in the test program to reduce wind loads on the heliostats. They were fences of 40 percent, 50 percent and 60 percent porosity and a solid berm with a side sloping 45 degrees to the horizontal. Heights of the fences used were 18.2 and 12.1 ft full scale. One berm height of 18.2 ft was used. Holes in the fence forming the porosity were sufficiently small that jets due to wind flow through a single hole in the fence could not affect heliostat loads. Some fences were placed as external fences outside the field perimeter at a distance of 2 H from the edge heliostat posts (H is the heliostat nominal height of 24.2 ft). Figures 2-5 through 2-9 show external fence locations for use with heliostats 1, 3 and 5.

Fences were placed within the heliostat field for some data runs. In line with concepts discussed in Section 1.0, fences were aligned with rows of heliostats and placed every other row as shown in Figures 2-6 through 2-9. These figures also show variable densities of field used in the study. These are discussed more fully in Section 4.0. Data obtained during test runs showed that the additional fences perpendicular to those of Figure 2-6 were not necessary to obtain major load reductions in a field except at low field density (see Figure 2-9). The particular fences used for each data run are identified in Section 4.0, Appendix C, and Tables 3-2 and 3-3 where the run matrix and data tabulations are given.

The model installed in the wind tunnel is shown in Figure 2-10. Porous fences used with the model are shown in Figure 2-11.

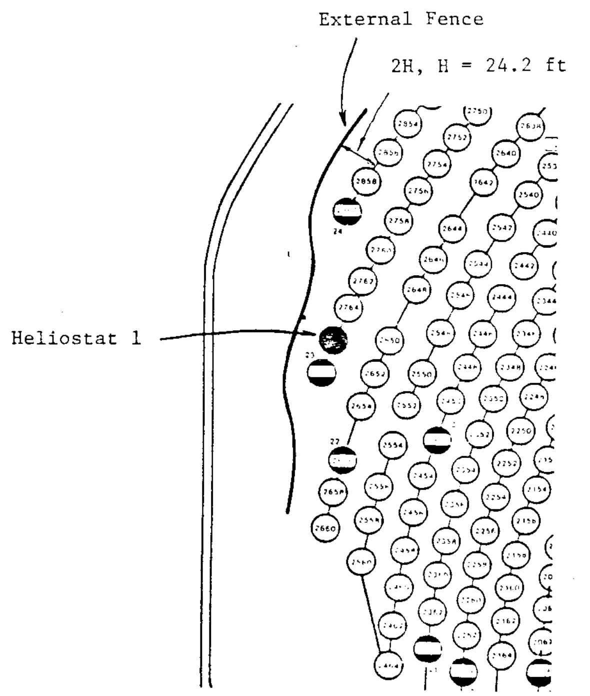


Figure 2-5. Fence Arrangement for Heliostat 1

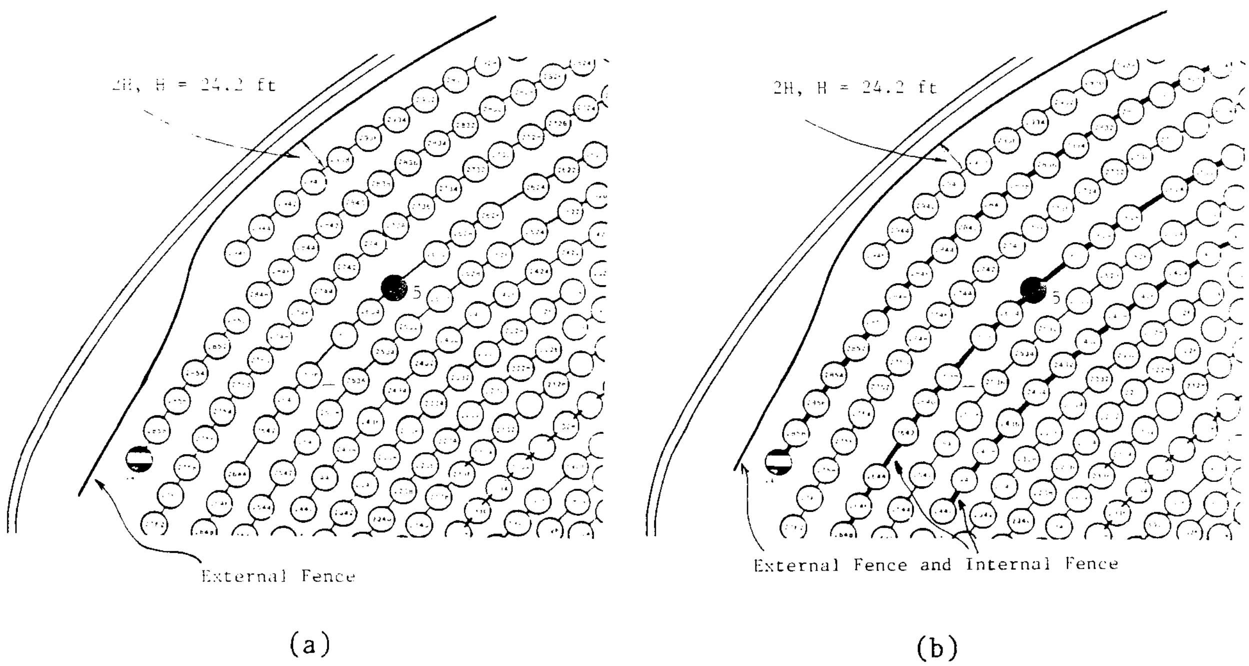


Figure 2-6. Fence Arrangement for Heliostat 5

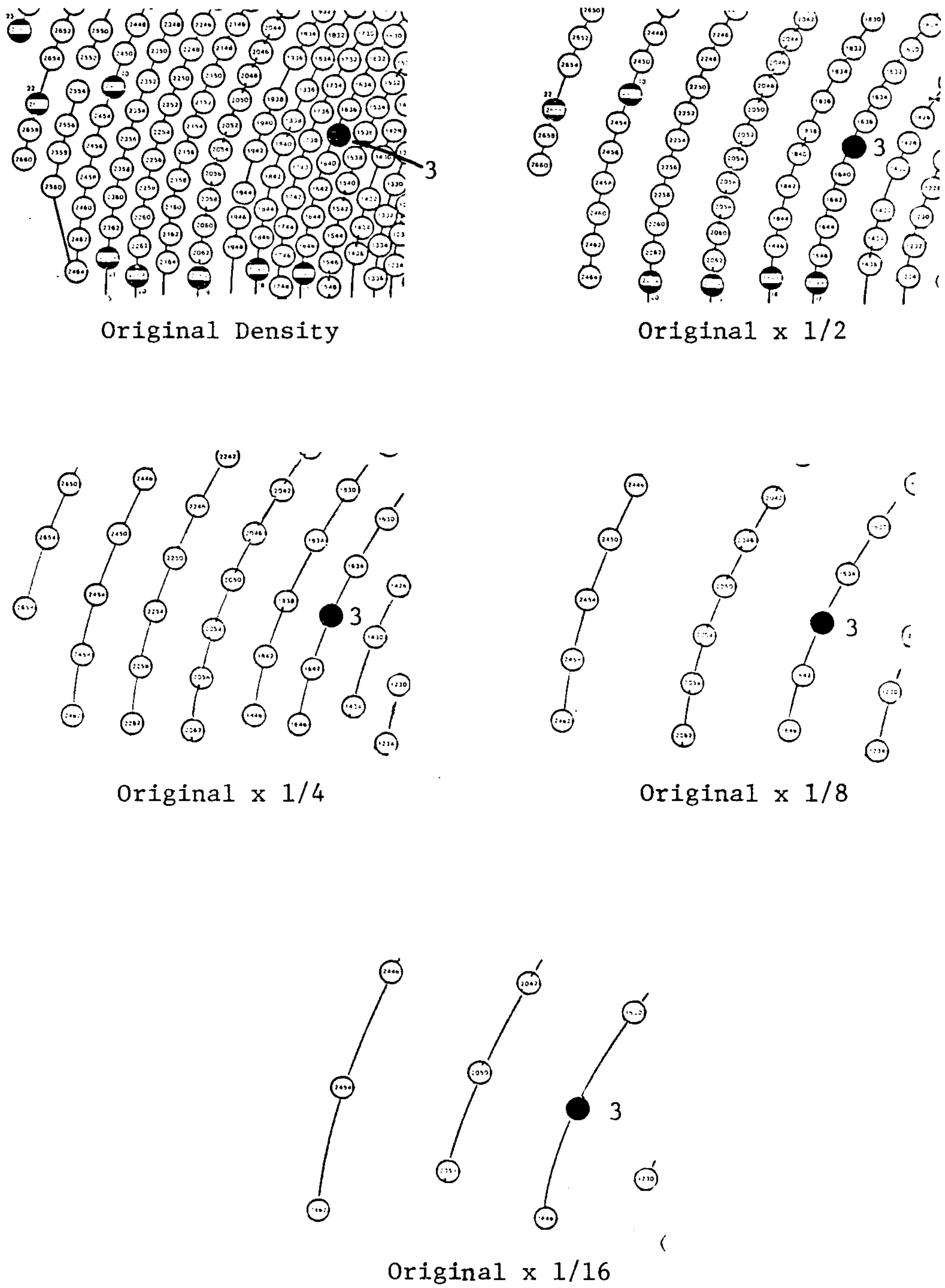
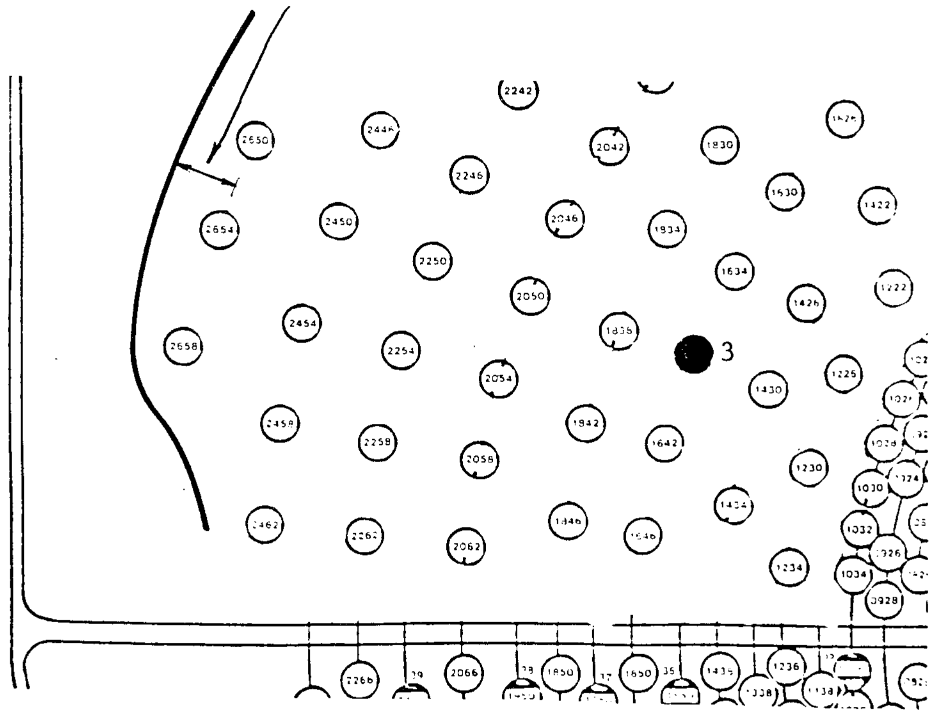


Figure 2-7. Arrangement of Field Density around Heliostat 3

2H, H = 24.2 ft

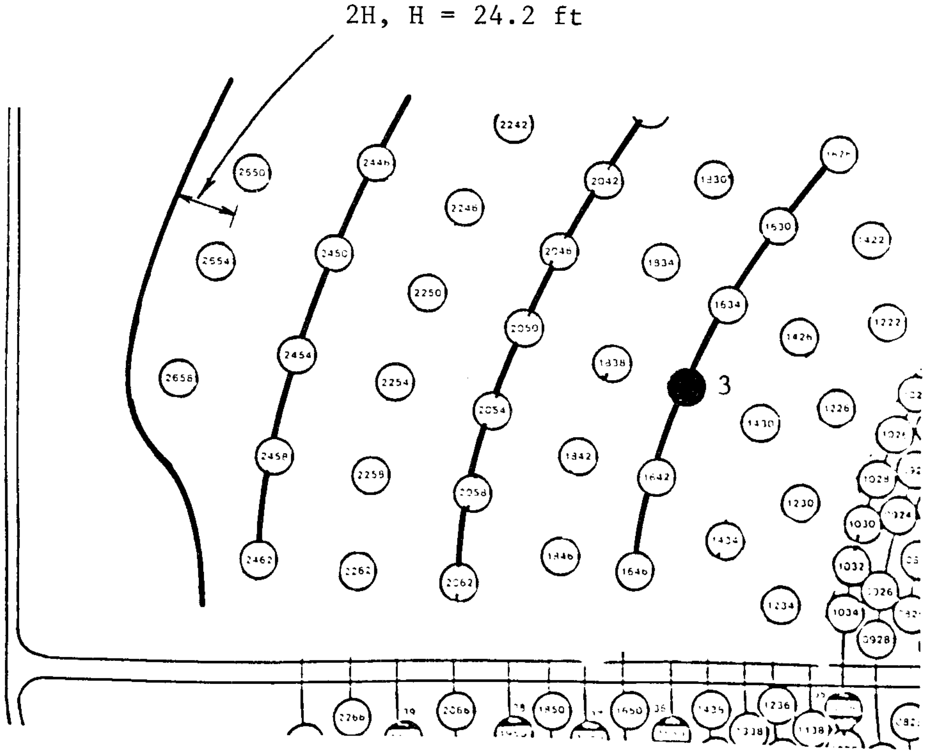
(a)



External Fence

2H, H = 24.2 ft

(b)



External Fence and Internal Fence

Figure 2-8. Fence Arrangement for Heliostat 3 with Reduced Field Density (original x 1/4)

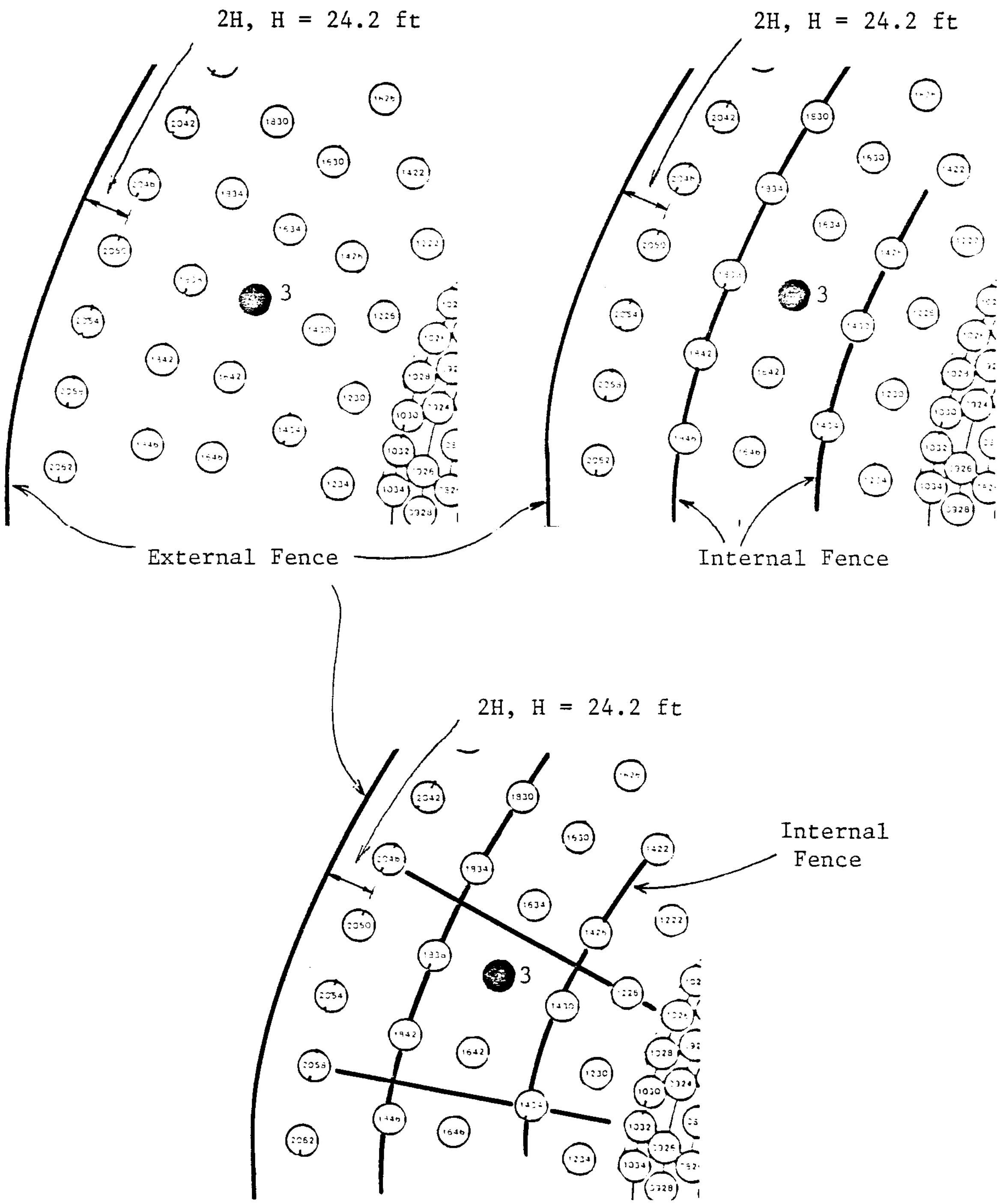


Figure 2-9. Fence Arrangement for Heliostat 3 with Reduced Field Density (original x 1/4)

(a)

(b)

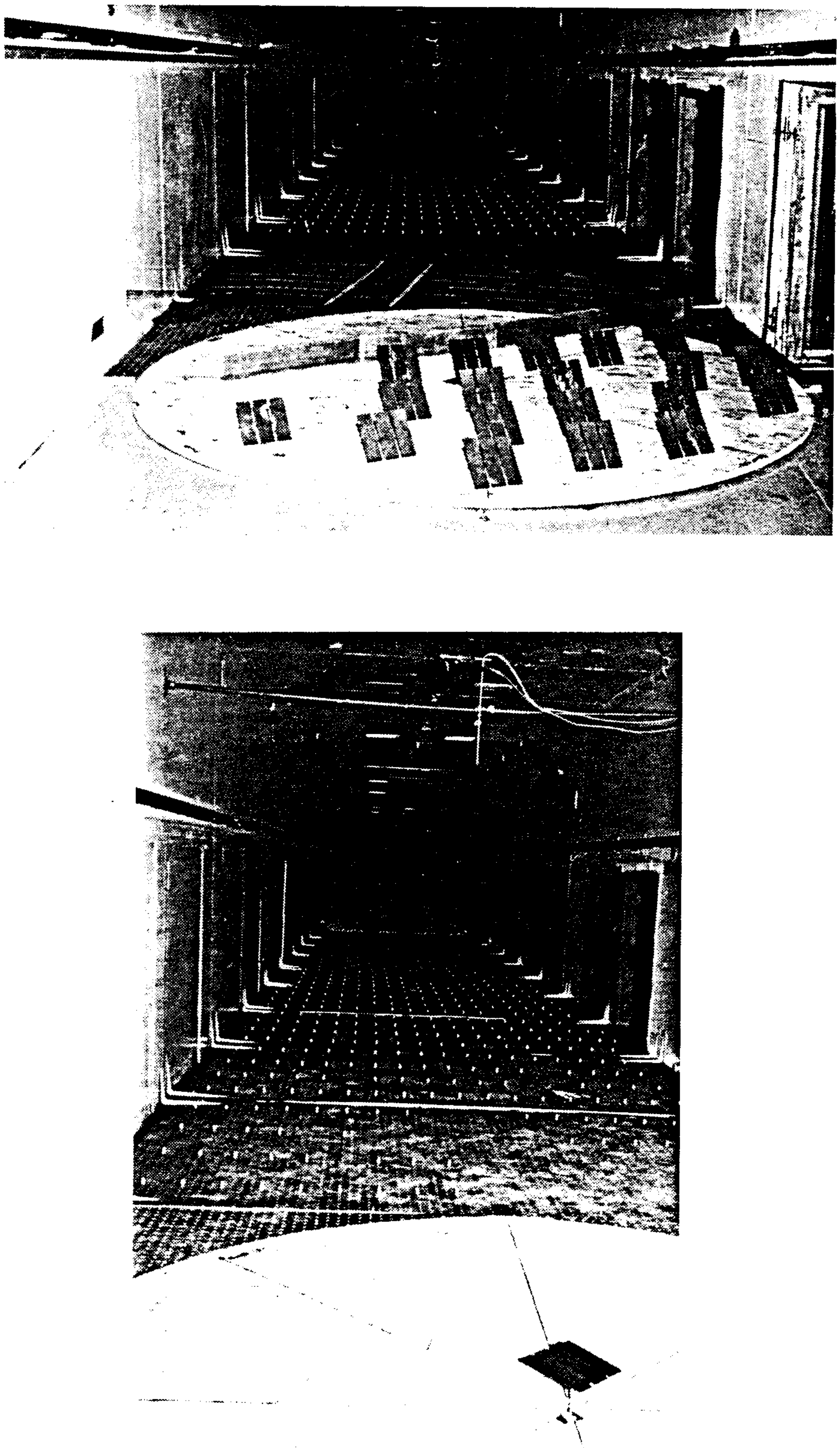
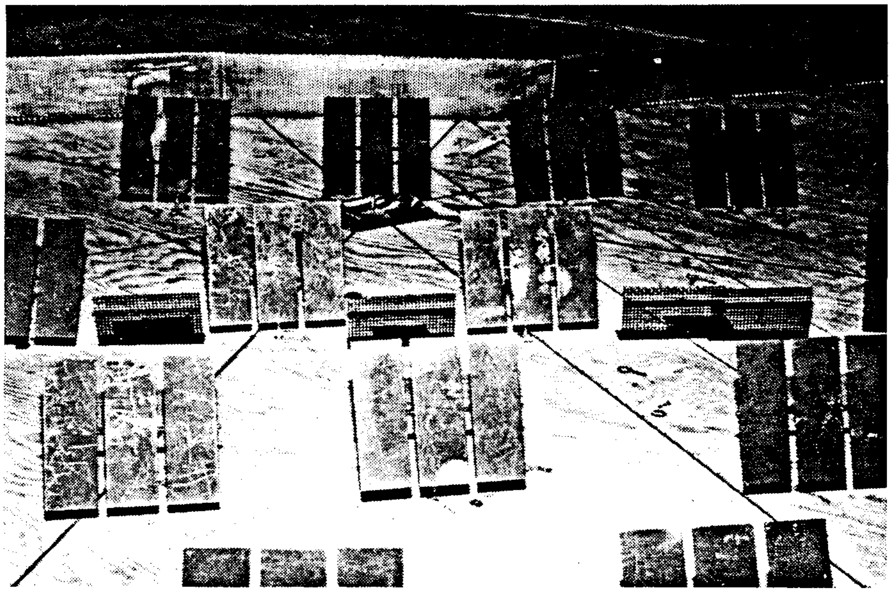
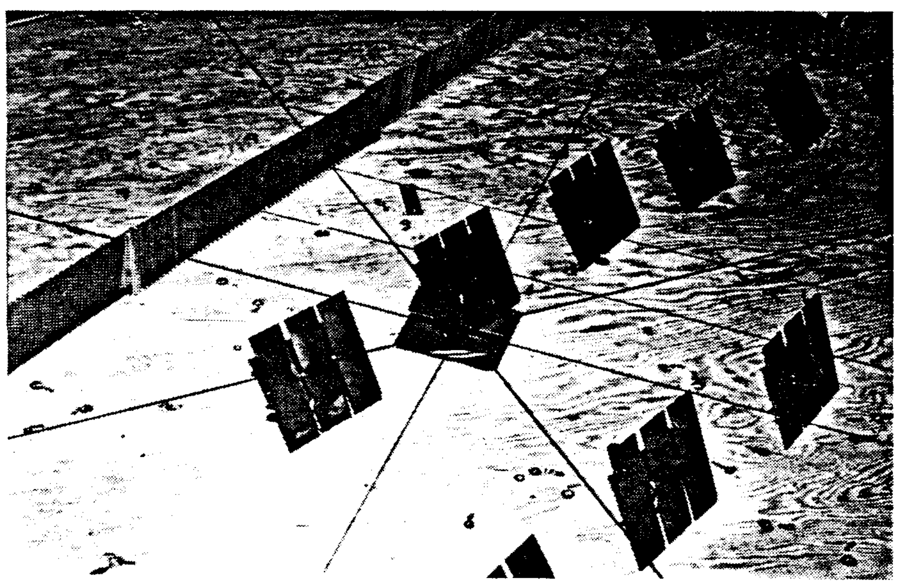


Figure 2-10. Model Installed in the Wind Tunnel



(c)



(d)

Figure 2-10. Model Installed in the Wind Tunnel

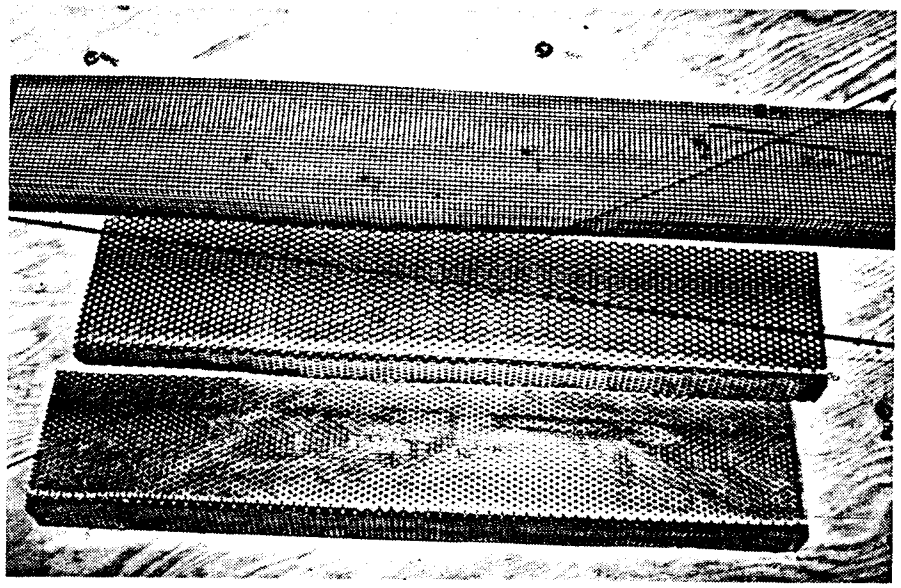


Figure 2-11. Porous Fence Segments Used with the Model

SECTION 3.0

INSTRUMENTATION AND DATA ACQUISITION

3.1 SELECTION OF VELOCITY SCALE RATIO

In addition to the boundary-layer simulation, similitude of velocity between the model and prototype is considered in order to interpret the wind-tunnel results. The velocity scale ratio may be obtained from dimensionless analysis

$$\lambda_U = \frac{U_m}{U_p} = \frac{L_m}{L_p}\frac{T_p}{T_m} = \lambda_L \lambda_T^{-1},$$

where L, U and T represent length, velocity and time, and subscripts m and p represent the model and prototype parameters. λ_U, λ_L and λ_T are the scale ratios of velocity, length and time between the model and prototype. λ_L can be obtained from the geometric scale ratio as $\lambda_L = 1/60$ (the scale of the heliostat model as noted in Section 2.2). λ_T is related to the scale ratio of frequency, $\lambda_T = \lambda_f^{-1}$. The velocity ratio between model and prototype is then

$$\lambda_U = \lambda_L \lambda_f$$

The frequency ratio between model and prototype is established by considering the nondimensional frequency $\tilde{f} = fL/U$. Similarity requirements [28-30] for wind-tunnel modeling require that $\tilde{f}$ be the same in model and full scale, $\tilde{f}_m = \tilde{f}_p$:

$$\lambda_f = \lambda_U \lambda_L^{-1}$$

Given a scale ratio λ_L, a testing wind speed was selected which caused frequencies of interest in the prototype, O(1 Hz), to fall within the allowable frequency range of the model/balance combination, 0-18 Hz (see Section 3.3). By appropriate selection of wind-tunnel speed, a single measurement of the loading spectrum (frequency decomposition of the time varying loading) permits the spectral loading for a range of full-scale velocities to be determined. Thus for $\lambda_L = 1/60$, $f_p \cong 1$ Hz and U_m = 20 fps, the range of full-scale velocities represented in a spectrum is 45 mph and up. A larger frequency range in the model would permit lower full-scale velocities to be simulated. Such a capability is now in final stages of completion.

The wind-tunnel Reynolds number is approximately 3-7 x 10^4 at the testing wind speeds used for this study which are sufficiently large to achieve Reynolds number independence of the aerodynamic coefficient. Hence, the wind load data measured in the wind tunnel are directly applicable to the design of the full-scale heliostat structure.

The largest limitations of the dynamic model tests were the relatively low model/balance natural frequency (18 Hz limit on frequency--a value of 100 Hz or higher would provide a wider range of frequency in the spectral loading) and a modest mismatch between wind-tunnel boundary-layer turbulence scale and model scale. The latter limitation causes a decrease in low frequency quasi-static gust amplitudes for collectors near the edge of the collector field. Further discussion of these issues and methods for their resolution are contained in Sections 3.2 and 4.0.

3.2 VELOCITY MEASUREMENTS

Mean velocity and turbulence intensity profiles were measured without the presence of the model to determine that an approach boundary-layer flow appropriate to the site had been established. Tests were made at one wind velocity in the tunnel. This velocity was well above that required to produce Reynolds number similarity between the model and the prototype as discussed in Section 1.0.

Measurements were made with a single hot-wire anemometer mounted with its axis vertical. The instrumentation used was a Thermo Systems constant temperature anemometer (Model 1050) with a 0.001 in. diameter platinum film sensing element 0.020 in. long. Output was directed to the on-line data acquisition system for analysis.

Calibration of the hot-wire anemometer was performed by comparing output with the pitot-static tube in the wind tunnel. The calibration data were fit to a variable exponent King's Law relationship of the form

$$E^2 = A + BU^c$$

where E is the hot-wire output voltage, U the velocity and A, B, and c are coefficients selected to fit the data. The above relationship was used to determine the mean velocity at measurement points using the measured mean voltage. The fluctuating velocity in the form U_{rms} (root-mean-square velocity) was obtained from

$$U_{rms} = \frac{2\ E\ E_{rms}}{B\ c\ U^{c-1}}$$

where E_{rms} is the root-mean-square voltage output from the anemometer.

Velocity and turbulence profiles are shown in Figure 3-1. The boundary-layer thickness in the wind tunnel, δ, is shown in Figure 3-1 as 220 ft full scale. This depth is not the full-scale boundary-layer height but represents a partial-depth modeling of the atmosphere boundary layer. The mean velocity profile approaching the modeled area has the form

$$\frac{U_{mean}}{U_{ref}} = \left(\frac{Z}{Z_{ref}}\right)^n ,$$

where U_{mean} indicates the local mean velocity and U_{ref} is the mean wind speed at the reference height, Z_{ref}. The value of velocity at Z_{ref} = 6.56 in.

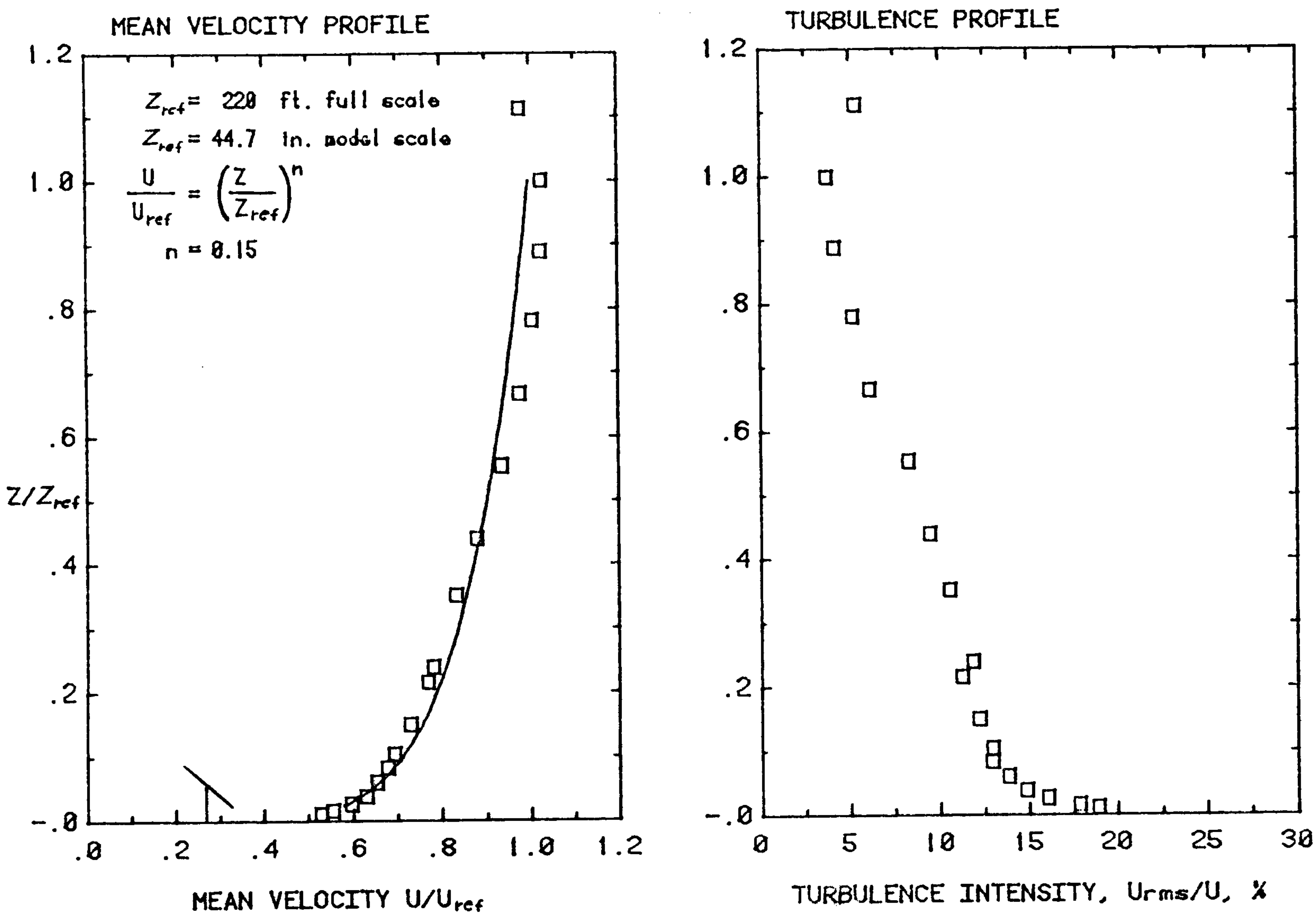


Figure 3-1. Approach Wind Profiles

in the model, which corresponds to 10 m in prototype, was used to calculate the force and moment coefficients. The exponent n for the approach flow established for this study is 1/7 which is representative of an open-field environment. Turbulence intensity in the velocity profile measurement is defined as:

$$I = \frac{U_{rms}}{U_{mean}} \times 100 .$$

Uncertainties in velocity were within 1-3 percent of the maximum within the boundary layer.

Longitudinal turbulence spectra were measured at the 10 m height used for reference velocity. Longitudinal refers to velocity fluctuations in the direction of the wind. The turbulence spectrum is compared to the atmospheric turbulence spectrum in Figure 3-2. A discussion of spectra and the presentation format is discussed in Section 4.1. The integral length scale was four times larger than the characteristic length of the heliostat model. The wind-tunnel does not simulate the lower frequency gustiness due to the limitation of the tunnel cross section size for a 1:60 model scale. This can result in underestimation of peak fluctuating wind load on the heliostat from the lack of the low-frequency spectral content. However, inside the heliostat field, the turbulence characteristics are dominated by the small eddies generated by upstream heliostats which are no greater than the size of the heliostat. Thus, while the peak fluctuating loads on edge-field heliostats may be slightly underestimated, loads on in-field heliostats should be well represented. The quantitative evaluation of the effect of the missing low-frequency turbulence can be accounted for with additional research.

3.3 FORCE AND MOMENT MEASUREMENTS

3.3.1 Force Balance

The force balance used in this project is shown in Figure 2-4. It is a strain-sensing apparatus consisting of four main parts: a reaction or inertial ring, a steel sprung plate supported by steel cross-beams, two nested portal gages and a stem of aluminum tubing. The reaction ring is bolted to the wind-tunnel turntable below the floor level. The entire balance rotates along with the model on the turntable, and thus defines a body-centered coordinate system. A right-handed coordinate system (Figure 3-3) is oriented with the z-axis coinciding with the model and force balance vertical axis, and the x and y axes in the horizontal plane at the pivot point of the heliostat 13.5 ft above ground level. Moments about the x and y axes were actually sensed about x' and y' axes parallel to the x,y axes but at the height of the reaction ring placed below floor level. Moments were transferred from x',y' axes to x,y axes at each data sample point in time by classical methods of statics.

The model was designed to be as light as possible to obtain a high natural frequency of the model/balance permitting measurement of dynamic loading without excessive resonant amplification. Figure 3-4 shows the response of the balance to fluctuating load inputs for the six components. The response of all six channels can be represented by two curves: the shape of Figure 3-4a occurs from a flat response attenuated at higher frequencies by an

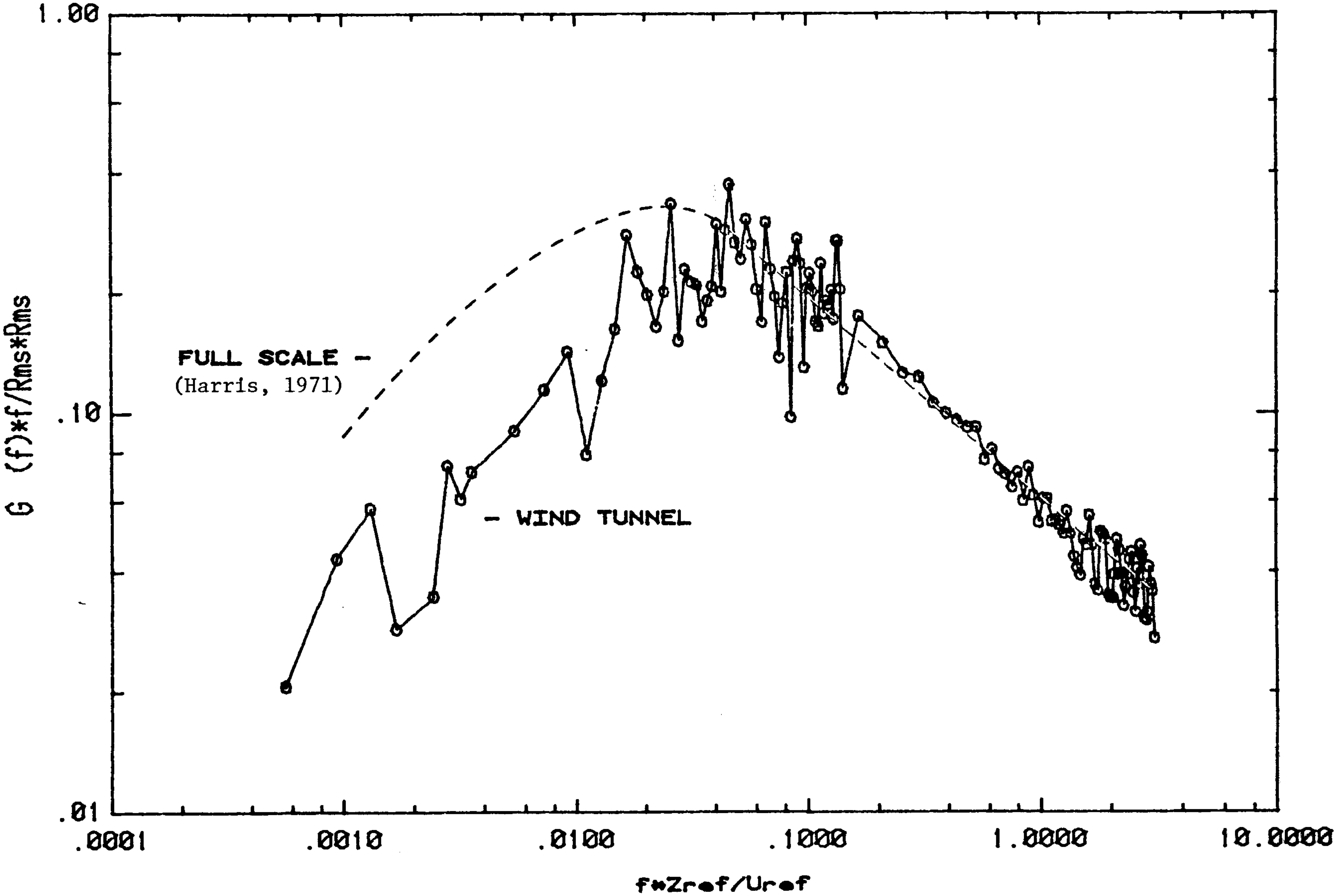
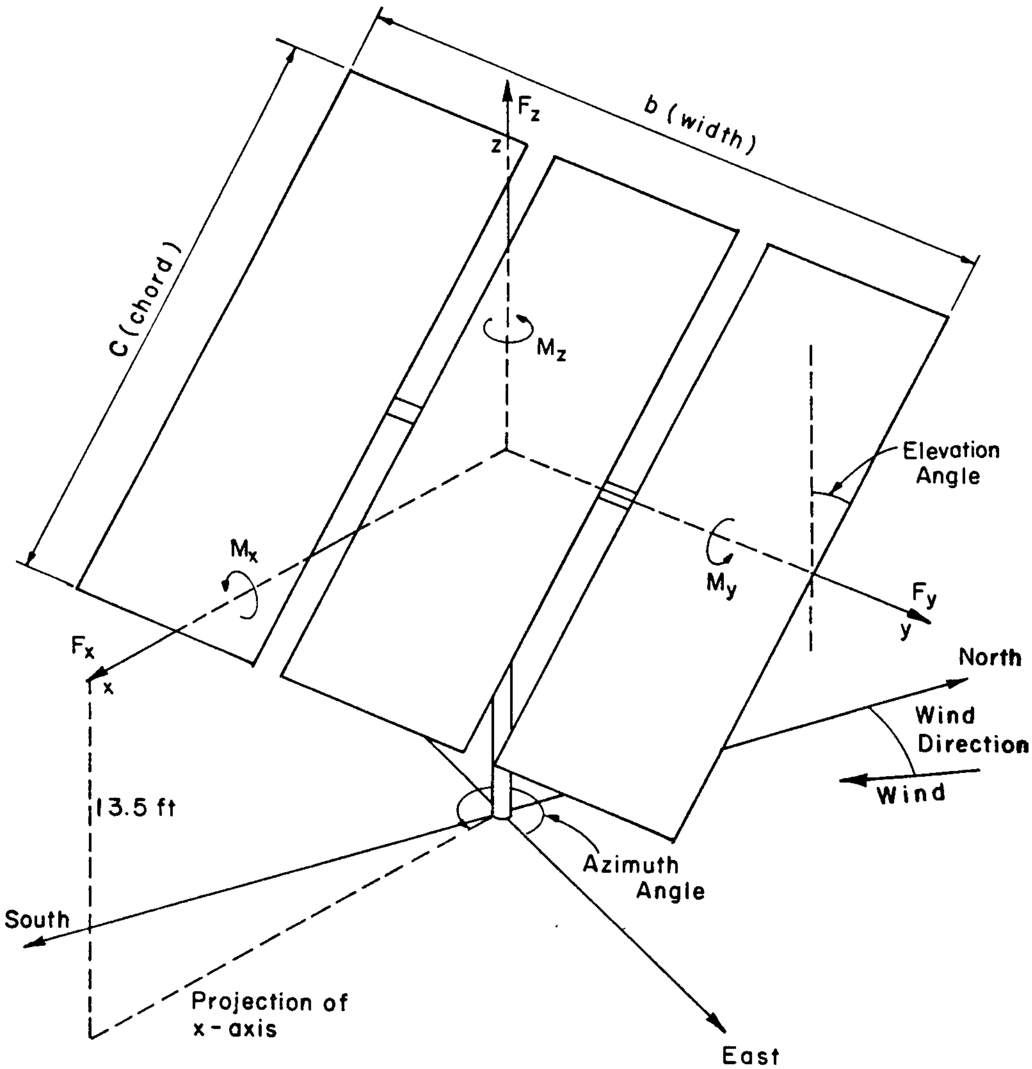


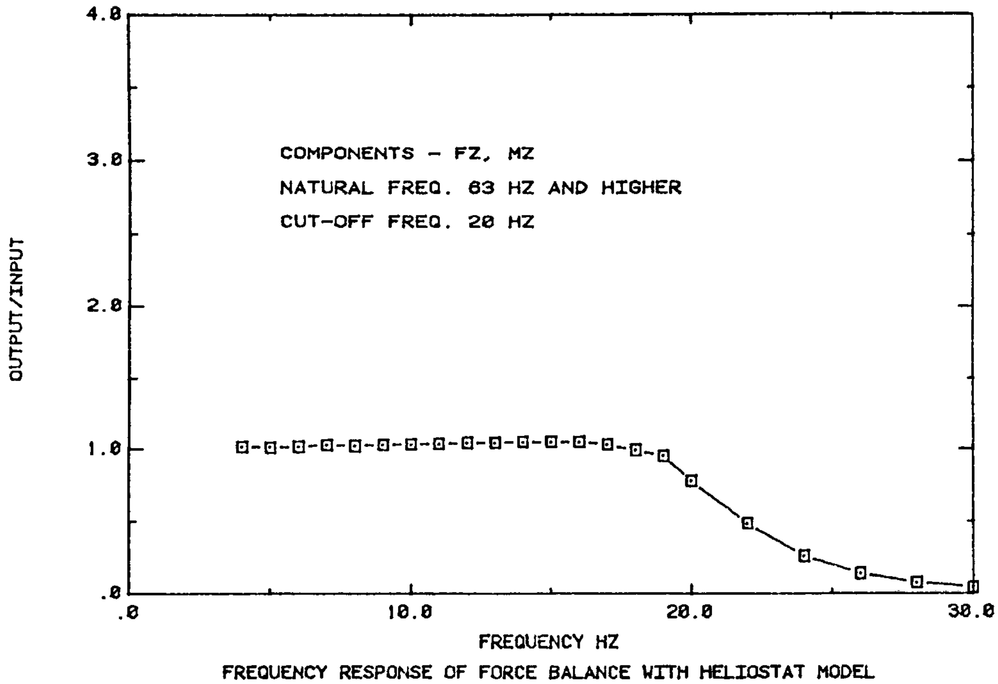
Figure 3-2. Turbulence Power Spectrum of Approach Wind



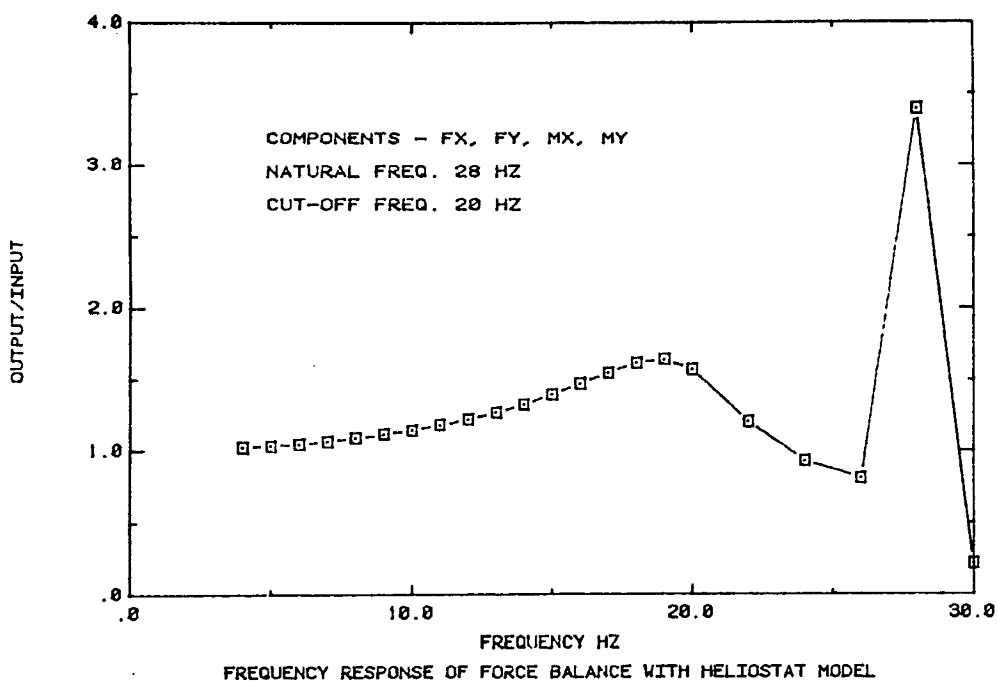
Reference Length L_{ref} = C

Reference Area L_{ref} = b·C

Figure 3-3. Force and Moment Coordinate System



(a)



(b)

Figure 3-4. Force Balance Frequency Response anti-aliasing roll-off filter; the shape in Figure 3-4b occurs as a combination of a 28 Hz model natural frequency for the four components represented with a roll-off filter. The response of the z force and moment about Z was flat to 18 Hz where a low-pass filter cut the signal. The response for the other four components was not as satisfactory: the 28 Hz natural frequency caused distortion in the response curve, even with the low-pass filter, which would not be acceptable for determining design quality information. However, the approximate magnitudes of dynamic loading and trends of loading with various variables can be determined. The difficulties with the response shown in Figure 3-4b can now be eliminated with the completion of a new balance where response in all six components should be flat to 100 Hz or more.

Calibration of the entire force balance system was performed in the wind tunnel using the same electronics and data-acquisition system used during testing. Weights and a fish-line were used to pull on the stem at a certain position and the output was monitored at the same time. The resulting calibration curves were very linear over the measurement range. Interactions between the six channels were always less than 2-3 percent and linear. Interactions were removed using standard balance measurement techniques.

Accuracy of measurement was about 5 to 10 percent or better of the maximum value recorded in that channel. Thus the only data subject to concern because of accuracy are the stow position loads. Most of the effort in this measurement program was directed at operational conditions.

The forces and moments measured on the heliostat model are expressed, respectively, in terms of the nondimensional coefficients C_{F_x}, C_{F_y}, C_{F_z}, C_{M_x}, C_{M_y}, C_{M_z}. They are defined as follows:

force coefficient along the x-axis

$$C_{F_x} = \frac{F_x}{\left(\frac{\rho U_{ref}^2}{2}\right)(A_{ref})} ,$$

force coefficient along the y-axis

$$C_{F_y} = \frac{F_y}{\left(\frac{\rho U_{ref}^2}{2}\right)(A_{ref})} ,$$

force coefficient along the z-axis

$$C_{F_z} = \frac{F_z}{\left(\frac{\rho U_{ref}^2}{2}\right)(A_{ref})} ,$$

moment coefficient about the x-axis

$$C_{M_x} = \frac{M_x}{\left(\frac{\rho U_{ref}^2}{2}\right)(A_{ref})(L_{ref})} ,$$

moment coefficient about the y-axis

$$C_{M_y} = \frac{M_y}{\left(\frac{\rho U_{ref}^2}{2}\right)(A_{ref})(L_{ref})},$$

moment coefficient about the z-axis

$$C_{M_z} = \frac{M_z}{\left(\frac{\rho U_{ref}^2}{2}\right)(A_{ref})(L_{ref})},$$

where

U_{ref} = reference mean velocity at 10 m (6.6 in. model)

ρ = density of air,

A_{ref} = reference area 19.6 in.^{2} model, 489.9 ft^2 full scale

L_{ref} = reference length 4.26 in.^{2} model, 21.3 ft full scale

F_x, F_y, F_z = measured force along axis, positive force in positive axis direction

M_z, M_x, M_y = measured moment about axis, sign by right-hand rule

For each coefficient component, five values were computed:

- mean - time average
- rms - root-mean-square of the fluctuating value about the mean
- peaks - the largest and smallest values recorded during a time of roughly 10 to 30 minutes full scale (32 seconds model scale)
- gust factor - G, peak divided by mean
- peak factor - g, $\frac{(\text{peak - mean})}{\text{rms}}$

The significance of the gust factor is that current wind code formulations use a gust factor approach to obtain peak values from mean coefficients. This approach has significant limitations in that fluctuating loads are not always proportional to the mean load. The peak factor is the number of standard deviations of the peak from the mean. This calculation approach permits dynamic loads to be analyzed separately from the mean load and then added to the mean. This approach is associated with random vibration theory, an approach to analyzing dynamic loading which has the greatest promise for systematically defining peak loads.

3.4 TEST PROCEDURE AND TEST MATRIX

Prior to the data acquisition phase, a tentative test plan was established whose intent was to guide the data acquisition. The test plan revolved about the recognized need to measure data cross sections across several variables:

- heliostat setting angles (day of year, time of day)
- position of heliostat in field
- approach wind direction
- presence of external fence
- presence of internal fence along lines of heliostats
- presence of internal fences perpendicular to lines of heliostats
- height of fences
- porosity of fences (including solid berms)
- density of field (number of heliostats per unit area of ground surface)

In order to adequately cover the ranges of variables, it was found necessary to change the test plan somewhat during the testing in response to findings earlier in the test program. For example, the protection afforded to heliostats in the denser portions of the Barstow field by upwind heliostats was sufficiently high that low sensitivity to in-field fences was noted. For this reason, additional field density experiments were added to show how in-field fences provided protection. The result of the modified test plan was a set of curves which effectively collapsed mean load data from most of the variables listed above onto very few curves.

The test plan can be broken into two basic parts--wind loads on isolated heliostats and wind loads on heliostats in a field of units. Both mean and dynamic loads were measured for the two situations.

The test matrix for the isolated heliostat is shown in Table 3-1. This data was needed to obtain the baseline loads against which the loads in the heliostat field can be measured. Mean, rms and peak loads were measured for each case. Spectra were obtained for only a limited set of conditions for the purpose of evaluating the dynamic measurements. Data values corresponding to the runs listed in Table 3-1 are listed in Appendix B.

The test matrix for the in-field heliostats is shown in Table 3-2. Because of the large number of individual runs, Table 3-2 provides a summary of test conditions but omits the details of individual values for heliostat angle settings and wind directions. These values are listed in an expanded test matrix form for each configuration in Appendix C. Mean, rms and peak loads were measured for each case. Spectra were measured for selected cases.

The interpretation of the data of Appendices B and C is presented in Section 4.0.

Table 3-1. Test Matrix for Single Heliostat

Elevation Angle	Wind Direction 0	22.5	45	67.5	90	112.5	135	157.5	180
0	115	113	111	109	107	105	103	101	99
15	246	-	244	-	242	-	240	-	238
30	228	-	230	-	232	-	234	-	236
45	136	138	140	142	144	146	148	150	152
60	226	-	224	-	222	-	220	-	218
75	208	-	210	-	212	-	214	-	216
80	81	83	85	87	89	91	93	95	97
84	170	168	166	164	162	160	158	156	154
87	172	174	176	178	180	182	184	186	188
90	206	204	202	200	198	196	194	192	190

Note: The numbers in the table indicate the test run number.
Azimuth angle was set at 270° for all runs--see Figure 3-3.

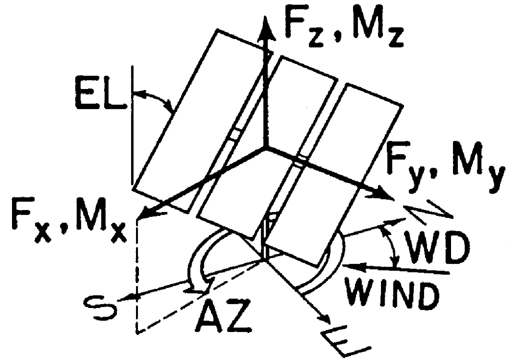


Table 3-2. Test Matrix for In-Field Heliostats

Heliostat	Conf.	Case	# of Wind Directions	Fence*	Note	Data File	Page
1	1-A	Smr AM	7	None	See Figure 2-2 without fences	H1100	115
		Smr Noon	7				115
		Wntr AM	7				115
		Wntr Noon	7				116
		Wntr PM	7				116
		Ver. Stow	1				116
		Hor. Stow	1				116
1	1-B	Smr AM	7	1	See Figure 2-5 with perimeter fence	H1101	127
		Smr Noon	7				127
		Wntr AM	7				127
		Wntr Noon	7				128
		Wntr PM	7				128
		Ver. Stow	1				128
		Hor. Stow	1				128
5	5-A	Wntr AM	6	None	Simulation of heliostat field within circle on Figure 2-2 without fences	H5000	139
		Wntr Noon	6				139
		Wntr PM	6				139
		Ver. Stow	1				139
		Hor. Stow	1				139

*See Table 3-3

Table 3-2 (continued)

Heliostat	Conf.	Case	# of Wind Directions	Fence*	Note	Data File	Page
5	5-B	Smr AM	6	1	Simulation of heliostat field within circle on Figure 2-2 with perimeter fence	H5001	145
		Smr Noon	6				145
		Wntr AM	6				145
		Wntr Noon	6				145
		Wntr PM	6				146
		Ver. Stow	1				146
		Hor. Stow	1				146
5	5-C	Smr AM	6	None	Simulation to edge of field without fences, see Figure 2-2	H5100	155
		Smr Noon	6				155
		Wntr AM	6				155
		Wntr Noon	6				155
		Wntr PM	6				156
		Ver. Stow	1				156
		Hor. Stow	1				156
5	5-D	Smr AM	6	1	Simulation to edge of field with perimeter fence, see Figures 2-2, 2-6	H5101	165
		Smr Noon	6				165
		Wntr AM	6				165
		Wntr Noon	6				165
		Wntr PM	6				166
		Ver. Stow	1				166
		Hor. Stow	1				166

*See Table 3-3

Table 3-2 (continued)

Heliostat	Conf.	Case	# of Wind Directions	Fence*	Note	Data File	Page
5	5-E	Smr AM	6	2	Simulation to edge of field with perimeter and internal fences, see Figures 2-2, 2-6	H5102	175
		Smr Noon	6				175
		Wntr AM	6				175
		Wntr Noon	6				175
		Wntr PM	6				176
		Ver. Stow	1				176
		Hor. Stow	1				176
3	3-A	Ver. Stow	1	None	See Figures 2-2, 2-7, simulation to edge of field, no fences	H3100	185
3	3-B	Ver. Stow	1	None	Effect of number of rows upstream, see Figure 2-7	H3200	187
3	3-C	Ver. Stow	1	None	Effect of field density, see Figure 2-7	H3300	191
3	3-D	Ver. Stow	1	None	Effect of number of rows upstream in field of reduced density (original x 1/4), see Figure 2-7	H3400	194
3	3-E	Ver. Stow	1	1	Effect of number of rows upstream in field of reduced density (original x 1/4), see Figure 2-8, w/perimeter fence	H3401	196

*See Table 3-3

Table 3-2 (continued)

Heliostat	Conf.	Case	# of Wind Directions	Fence*	Note	Data File	Page
3	3-F	Ver. Stow	1	2	Effect of number of rows upstream, in field of reduced density (original x 1/4), see Figure 2-8 with perimeter and internal fence	H3402	198
3	3-G	Ver. Stow	1	5	Effect of number of rows upstream in field of reduced density (original x 1/4), see Figure 2-8, same as 3-F with 50% fence porosity	H3405	200
3	3-H	Ver. Stow	1	6	Effect of number of rows upstream in field of reduced density (original x 1/4), see Figure 2-8, same as 3-F with 40% fence porosity	H3406	202
3	3-I	Ver. Stow	7	None	Effect of reduced density (original x 1/4), 2 rows upstream, see Figure 2-9, without fences	H3500	204
3	3-J	Ver. Stow	7	1	Field of reduced density (original x 1/4), 2 rows upstream, see Figure 2-9, with external fence	H3501	207

*See Table 3-3

Table 3-2 (continued)

Heliostat	Conf.	Case	# of Wind Directions	Fence*	Note	Data File	Page
3	3-K	Ver. Stow	7	2	Field of reduced density (original x 1/4), 2 rows upstream, see Figure 2-9, with external and internal fences parallel to rows	H3502	210
3	3-L	Ver. Stow	7	3	Field of reduced density (original x 1/4), 2 rows upstream, see Figure 2-9, with external, internal and crossing fences	H3503	213
3	3-M	Ver. Stow	7	4	Field of reduced density (original x 1/4), 2 rows upstream, see Figure 2-9, with perimeter berm, without internal fences	H3504	216
3	3-N	Ver. Stow	7	5	Field of reduced density (original x 1/4), 2 rows upstream, see Figure 2-9, same as 3-K with 50% fence porosity	H3505	219
4	4-A	Smr AM	1	None	11 rows upstream were present, see Figure 2-2, 11 rows modeled upstream, 265° wind	H4100	222
		Smr Noon	1				
		Wntr AM	1				
		Wntr Noon	1				
		Wntr PM	1				
		Ver. Stow	1				
		Hor. Stow	1				

*See Table 3-3

Table 3-3. Description of Fences

Configuration	Elements	Porosity	Height	Distance	Figures
1	External Fence	40%	3/4H	2H	2-5,2-6, 2-8,2-9
2	External Fence	40%	3/4H	2H	2-6,2-8, 2-9
	Internal Arc Fence	60%	1/2H	-	
3	External Fence	40%	3/4H	2H	2-9
	Internal Arc Fence	60%	1/2H	-	
	Internal Cross Fence	60%	1/2H	-	
4	External Solid Berm	0%	3/4H	-	2-9
5	External Fence	40%	3/4H	2H	2-9
	Internal Arc Fence	50%	3/4H	-	
6	External Fence	40%	3/4H	2H	2-9
	Internal Arc Fence	40%	3/4H	-	

Note: H = 24.2 ft

SECTION 4.0

RESULTS AND DISCUSSION

4.1 SINGLE HELIOSTAT

Wind loads in coefficient form for an isolated heliostat are shown graphically in Figures 4-1 through 4-13. The heliostat was always pointing directly south (AZ = 270°). The elevation angle and wind direction were systematically varied. Force and moment coefficients as a function of approach wind direction are shown in Figures 4-1 through 4-6 for elevation angles of 0° (heliostat vertical), 45°, 80°, 84°, 87° and 90° (heliostat horizontal). Figures 4-7 and 4-8 show forces and moments as a function of elevation angle for wind directions of 0° and 45°. Wind directions are specified as wind azimuths with the wind approaching from the quoted direction with the angle measured clockwise from true north (see Figure 3-3).

C_{F_x}, the force coefficient in the x direction, is maximum for a vertical heliostat with wind approaching perpendicular to its broad face and decreases uniformly as heliostat tends to the horizontal or as wind direction approaches tangent to the heliostat surface at 90°. C_{F_y}, the force coefficient in the y direction, is always small because of a small projected area in that direction. C_{F_z} reaches a maximum at 60° elevation angle, or 30° to the horizontal in a manner characteristic of an airfoil. Moment coefficients reflect the movement of the center of wind pressure away from the pivot center which is also the center of heliostat area. The movement is due to two primary effects: the higher wind speeds at higher elevations which can increase wind loads near the top of the heliostat and more importantly the aerodynamic lift caused by the flow separation near the upstream edge of the heliostat when placed at an angle to the flow (roughly the same mechanism causing lift on a wing).

Conclusions can be obtained from the isolated heliostat data shown in Figures 4-1 through 4-8 about whether stow position loads will drive the design of heliostats. We can calculate the ratio of velocity in stow position to velocity in operational position which, for maximum loading orientation, will cause particular mean or peak forces or moments to reach the design strength. These ratios are somewhat tentative because the stow loads in this study were not far above the resolution level of the balance. These ratios are:

Mean Force or Moment	F_x	F_z	M_x	M_y	M_z
Stow Position Velocity / Operational Position Velocity	4.2	4.0	2.1	1.5	1.6

Peak Force or Moment	F_x	F_z	M_x	M_y	M_z
Stow Position Velocity / Operational Position Velocity	4.4	2.1	1.3	1.5	1.5

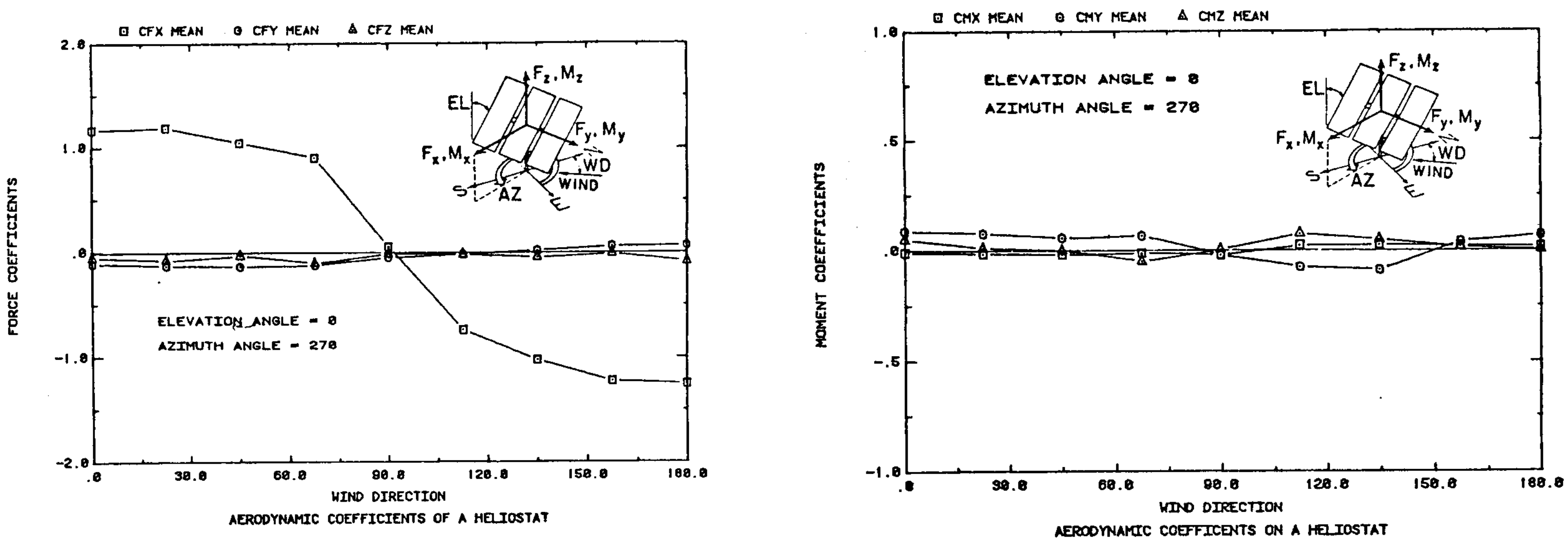


Figure 4-1a,b. Mean Force and Moment Coefficients for an Isolated Heliostat; EL = 0°, AZ = 270°

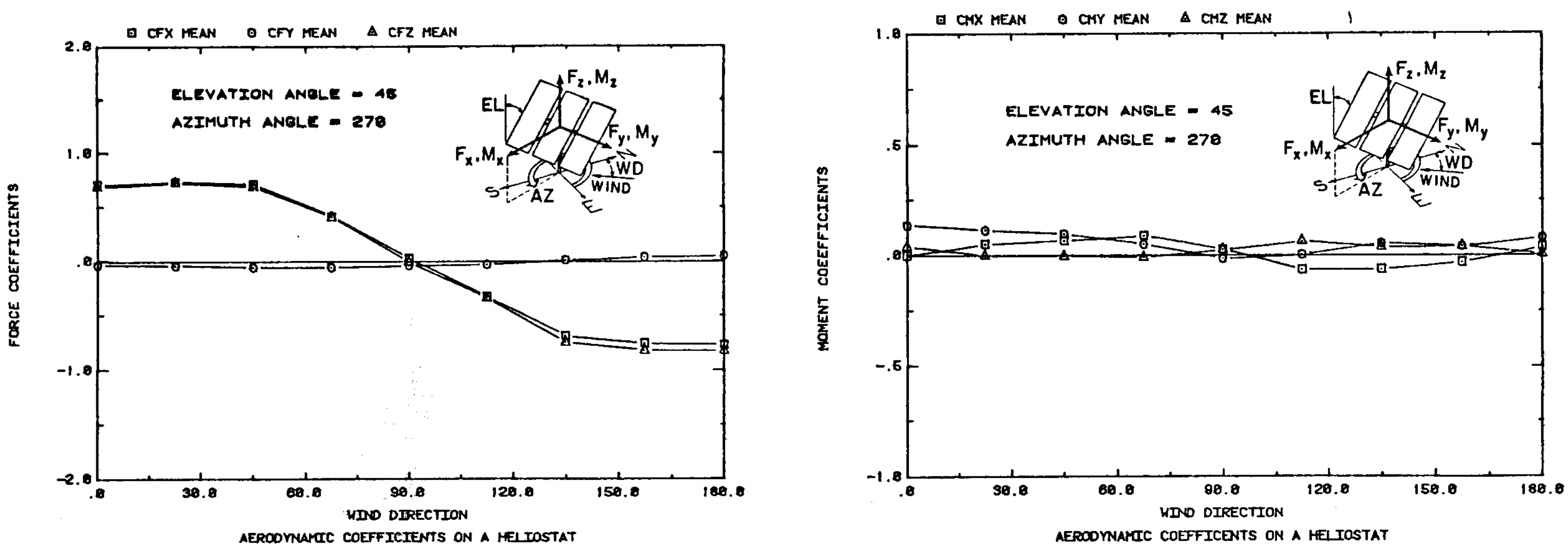


Figure 4-2a,b. Mean Force and Moment Coefficients for an Isolated Heliostat; EL = 45°, AZ = 270°
NOTE: Data values are listed in the Appendix.

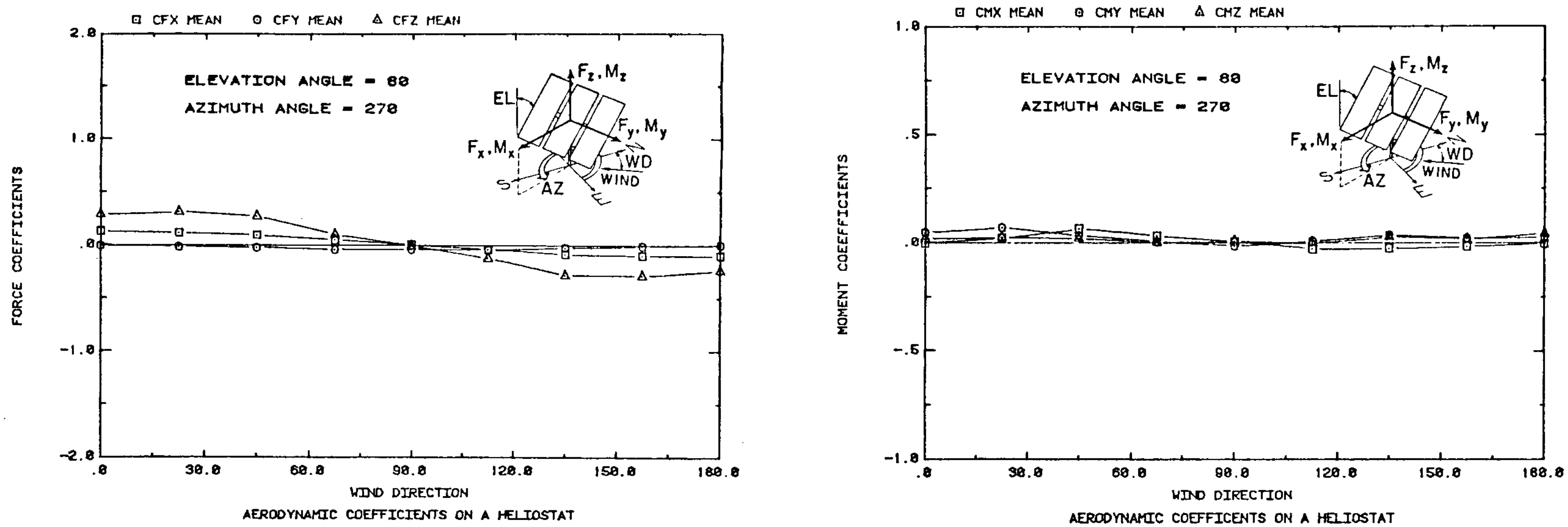


Figure 4-3a,b. Mean Force and Moment Coefficients for an Isolated Heliostat; EL = 80°, AZ = 270°

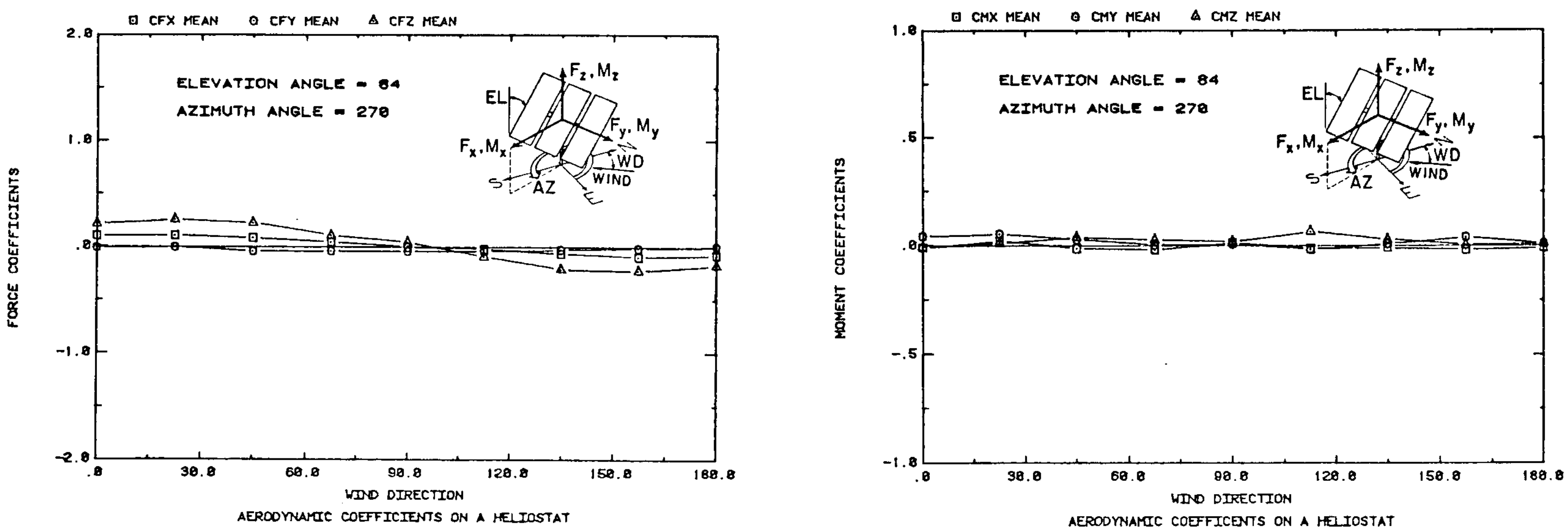


Figure 4-4a,b. Mean Force and Moment Coefficients for an Isolated Heliostat; EL = 84°, AZ = 270°

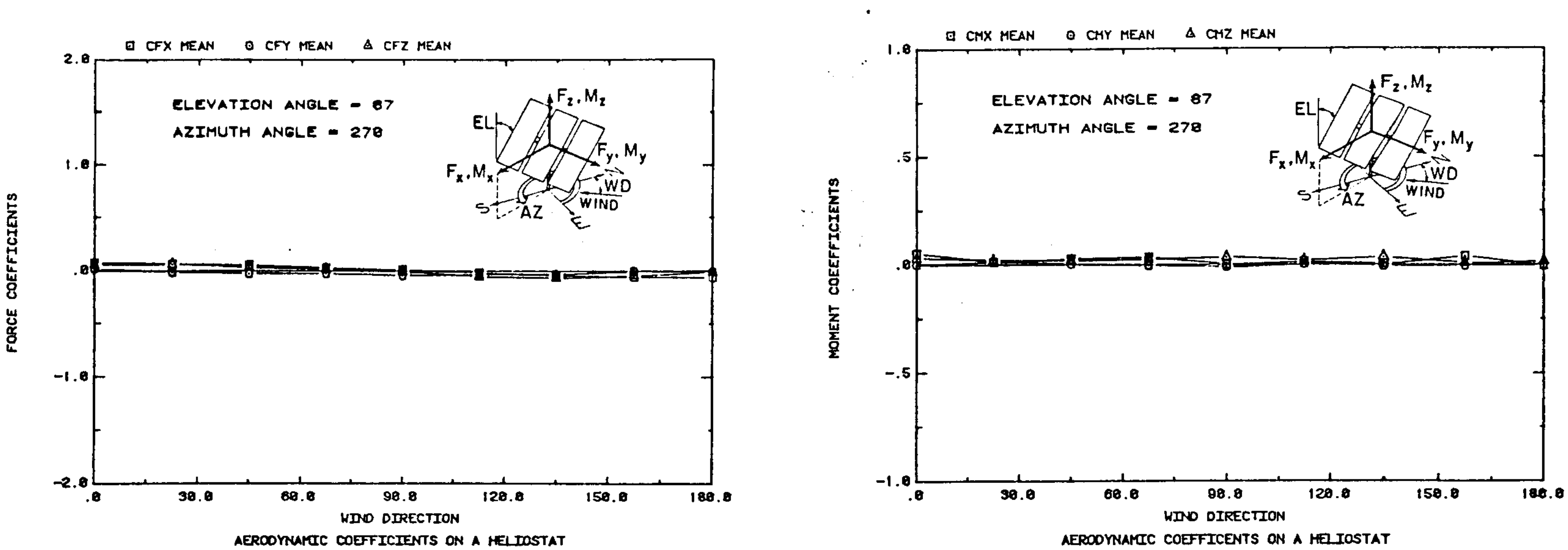


Figure 4-5a,b. Mean Force and Moment Coefficients for an Isolated Heliostat; EL = 87°, AZ = 270°

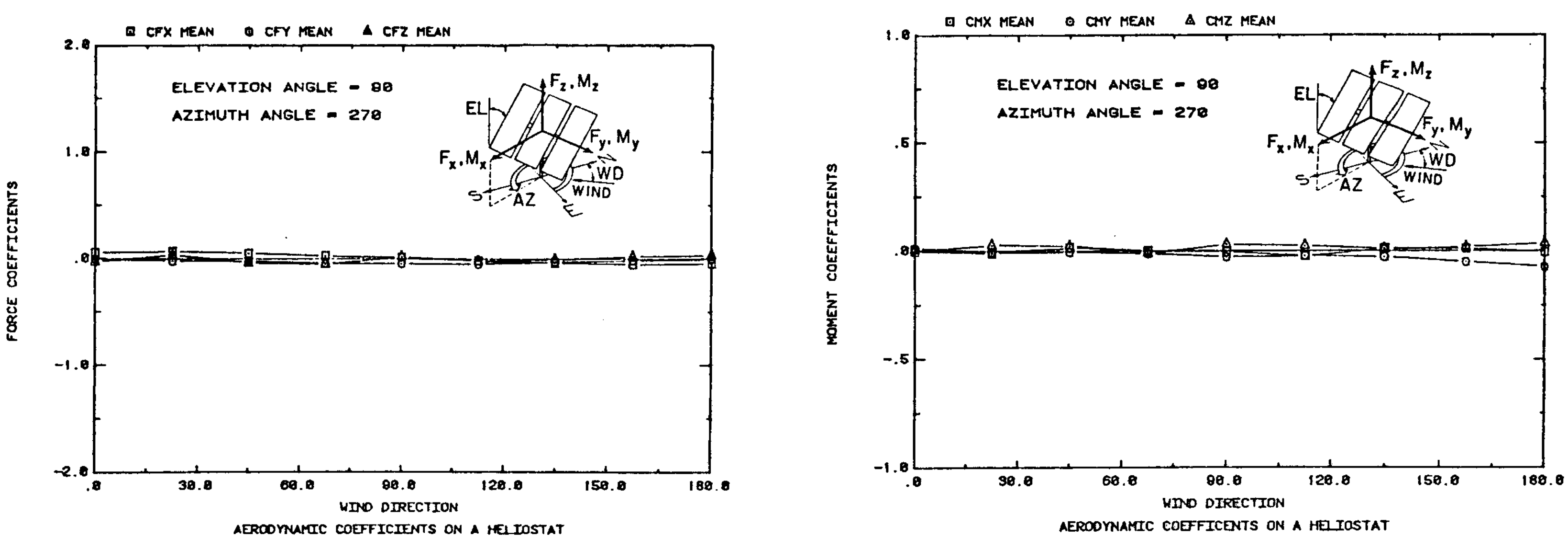


Figure 4-6a,b. Mean Force and Moment Coefficients for an Isolated Heliostat; EL = 90°, AZ = 270°

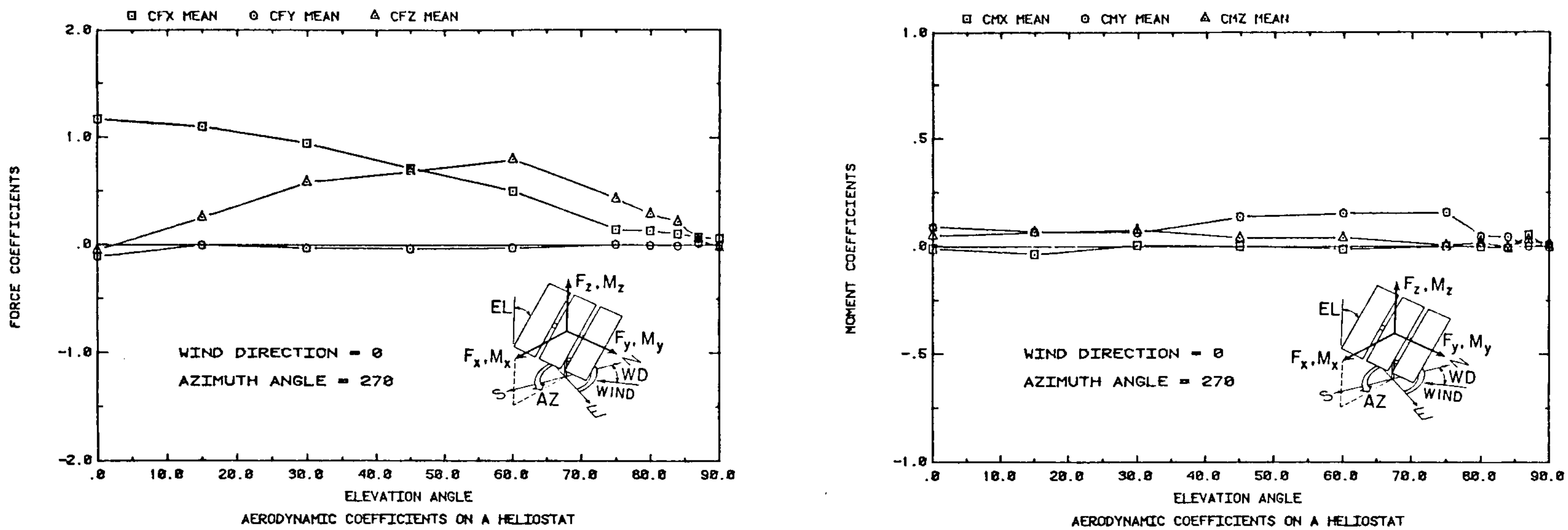


Figure 4-7a,b. Mean Force and Moment Coefficients for an Isolated Heliostat; WD = 0°, AZ = 270°

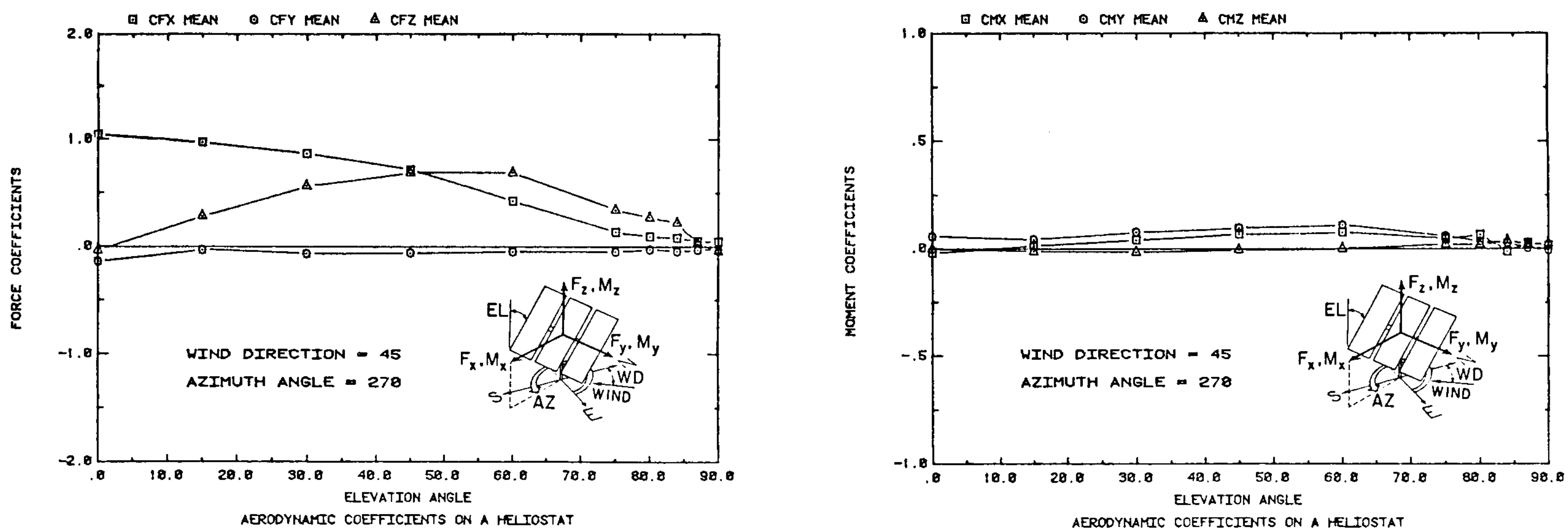
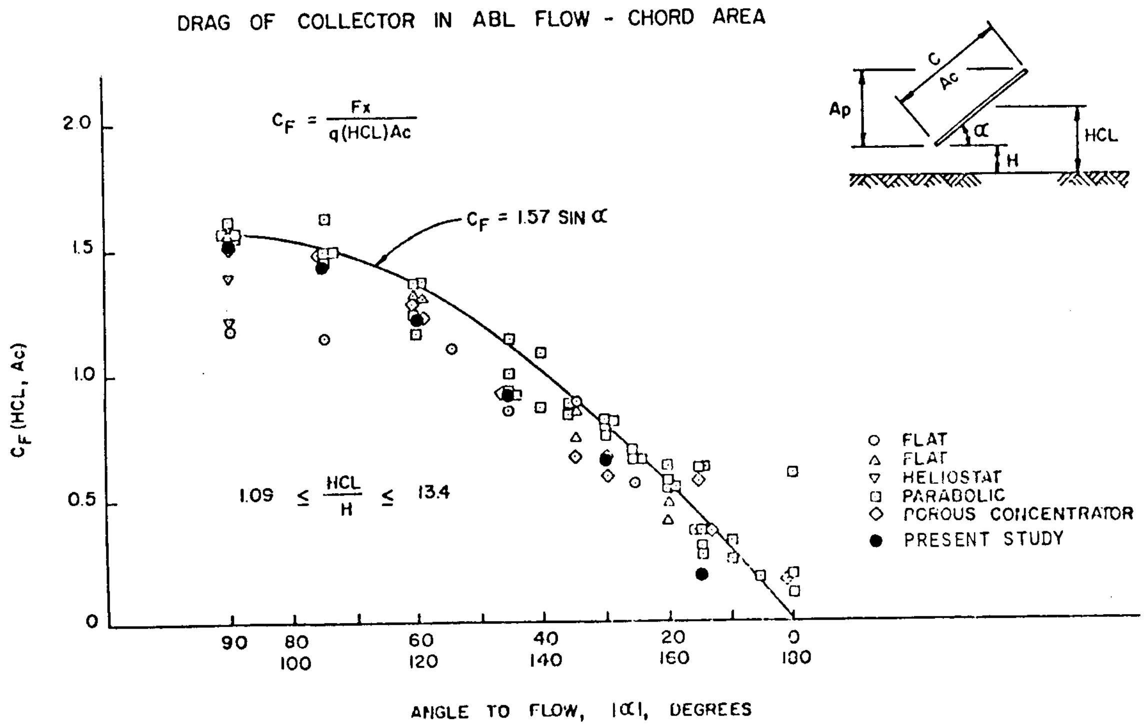


Figure 4-8a,b. Mean Force and Moment Coefficients for an Isolated Heliostat; WD = 45°, AZ = 270°



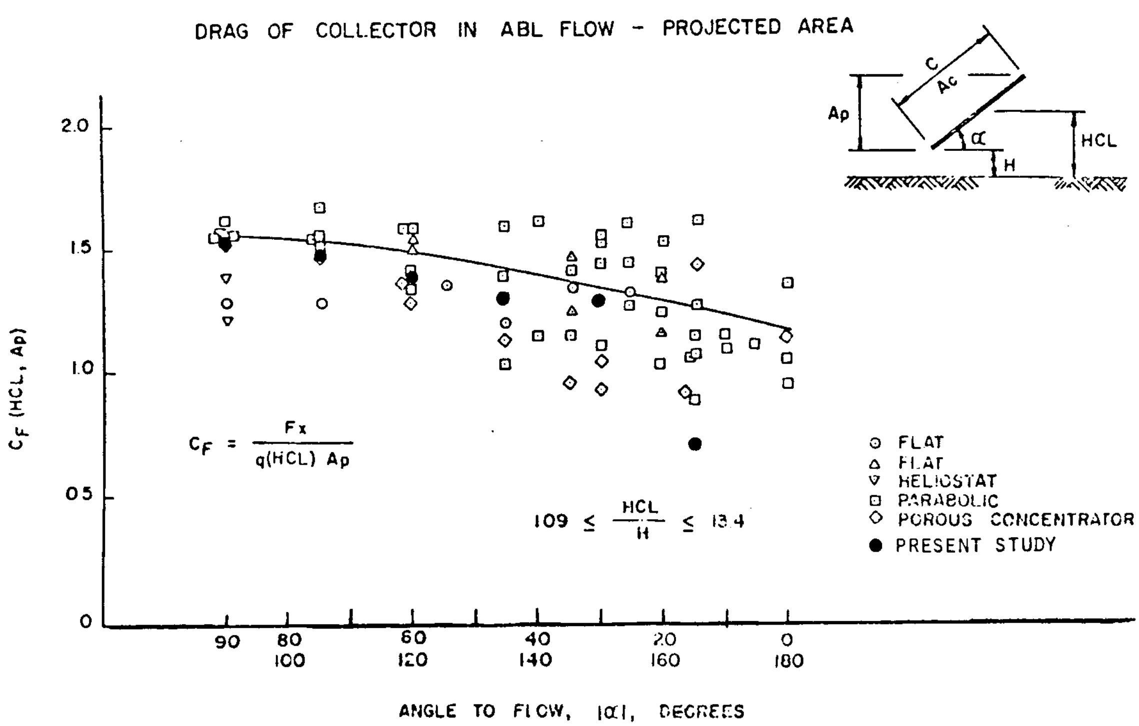


Figure 4-9. Comparison of Measured C_{F_x} to Previous Measurements (data from references 1,3,4,7,10)

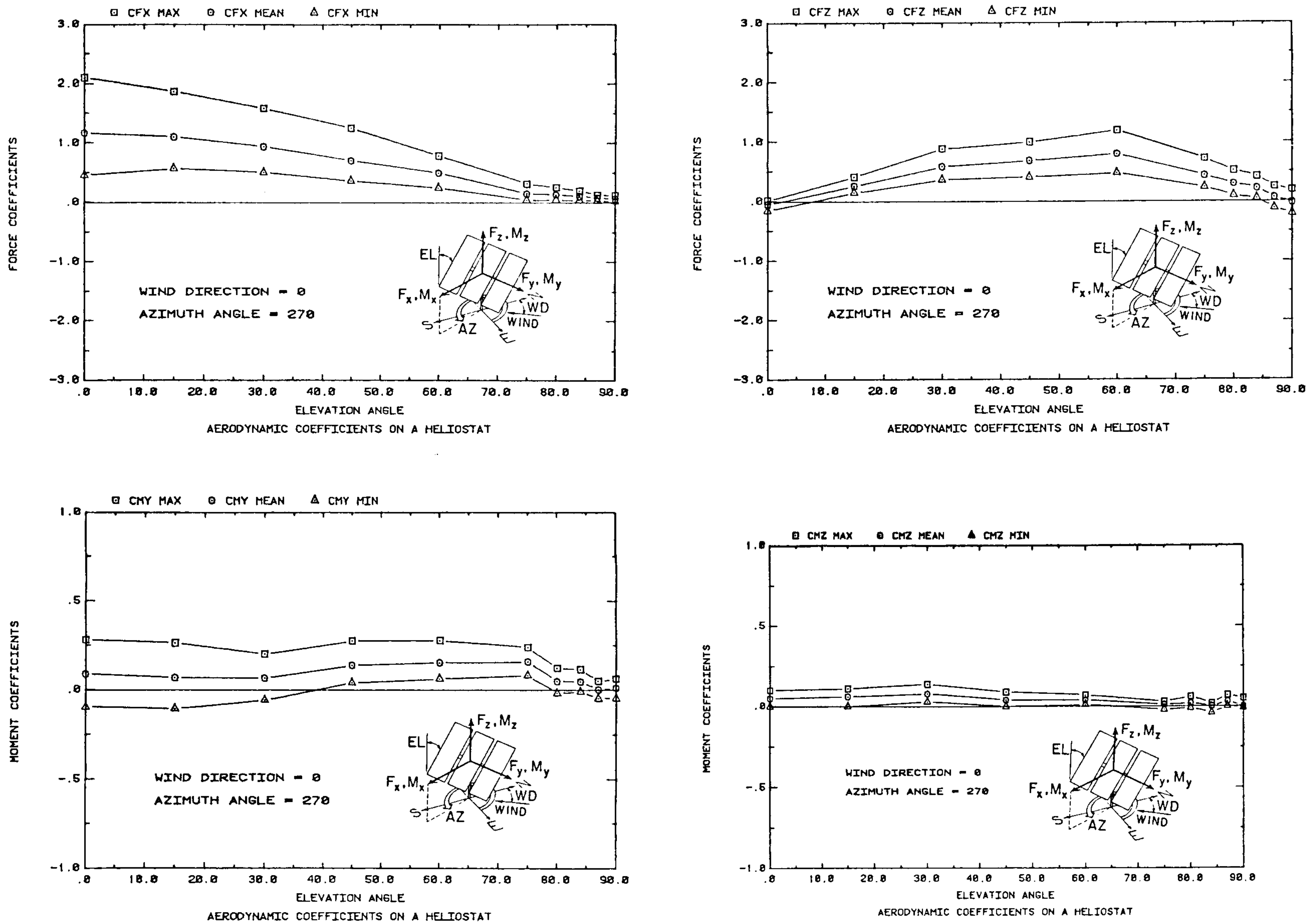


Figure 4-10a,b,c,d. Maximum, Mean and Minimum Force and Moment Coefficients; WD = 0°, AZ = 270°

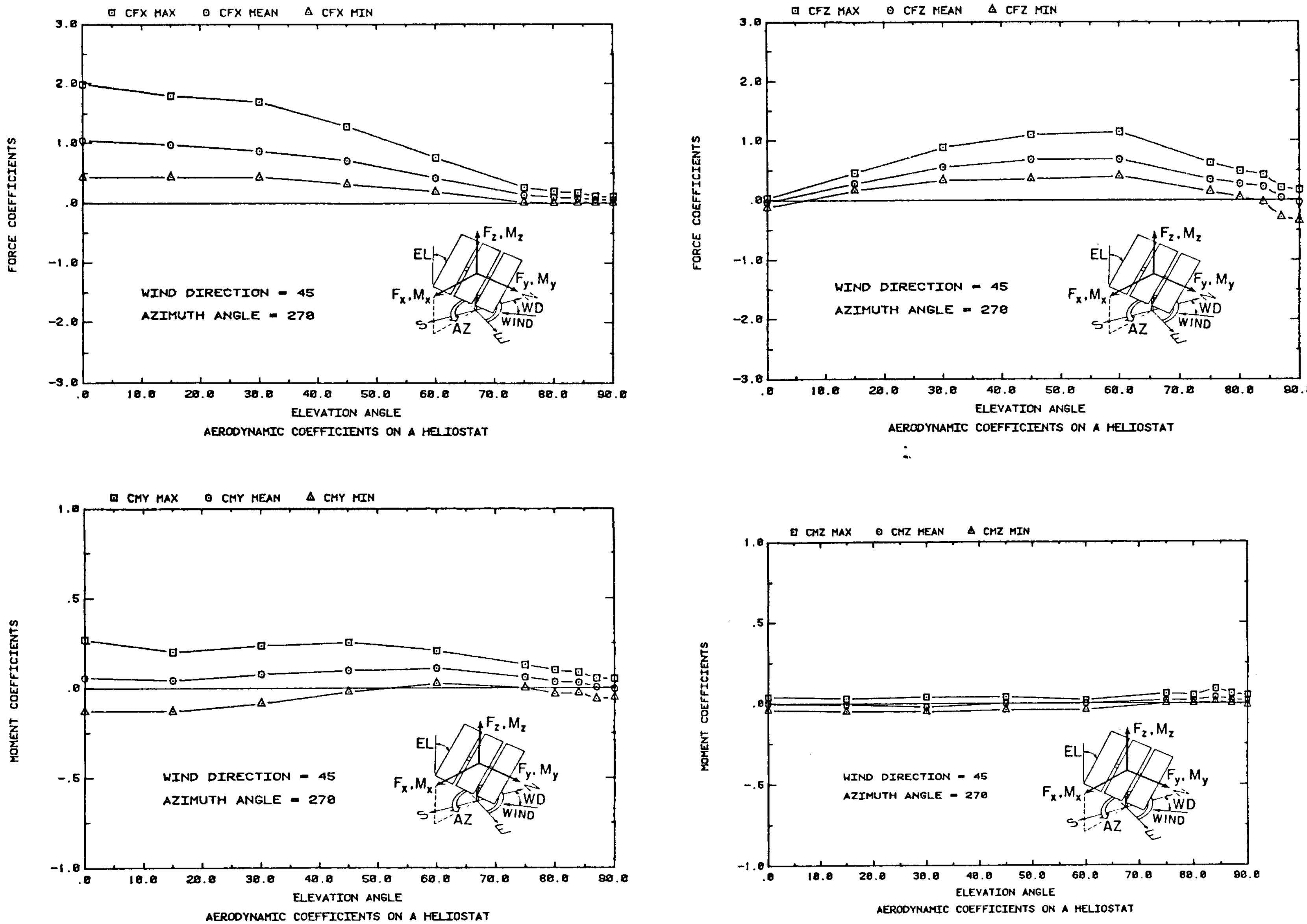


Figure 4-11a,b,c,d. Maximum, Mean and Minimum Force and Moment Coefficients; WD = 45°, AZ = 270°

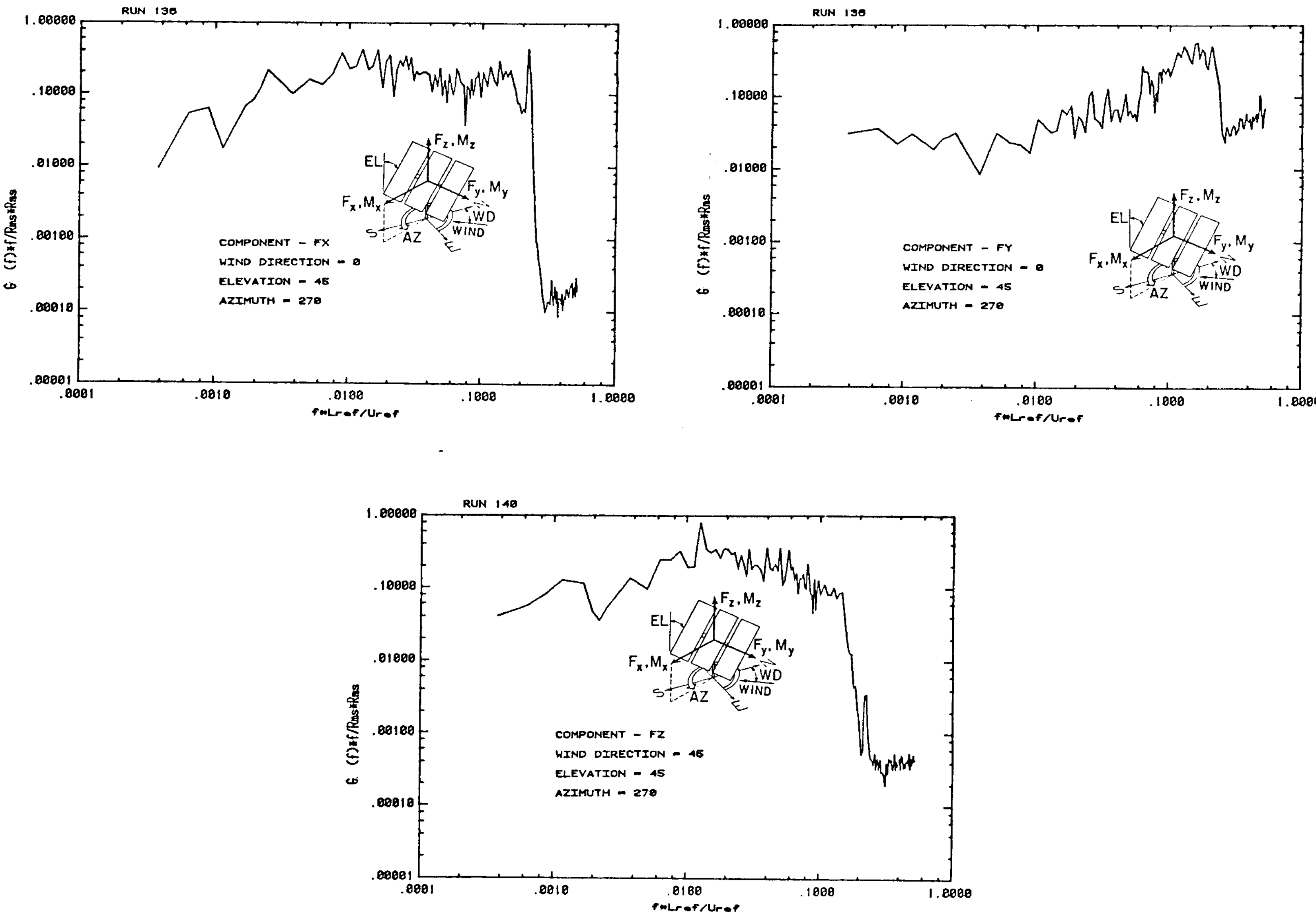


Figure 4-12a,b,c. Power Spectrum of Force Coefficients; WD = 0°, AZ = 270°, EL = 45°

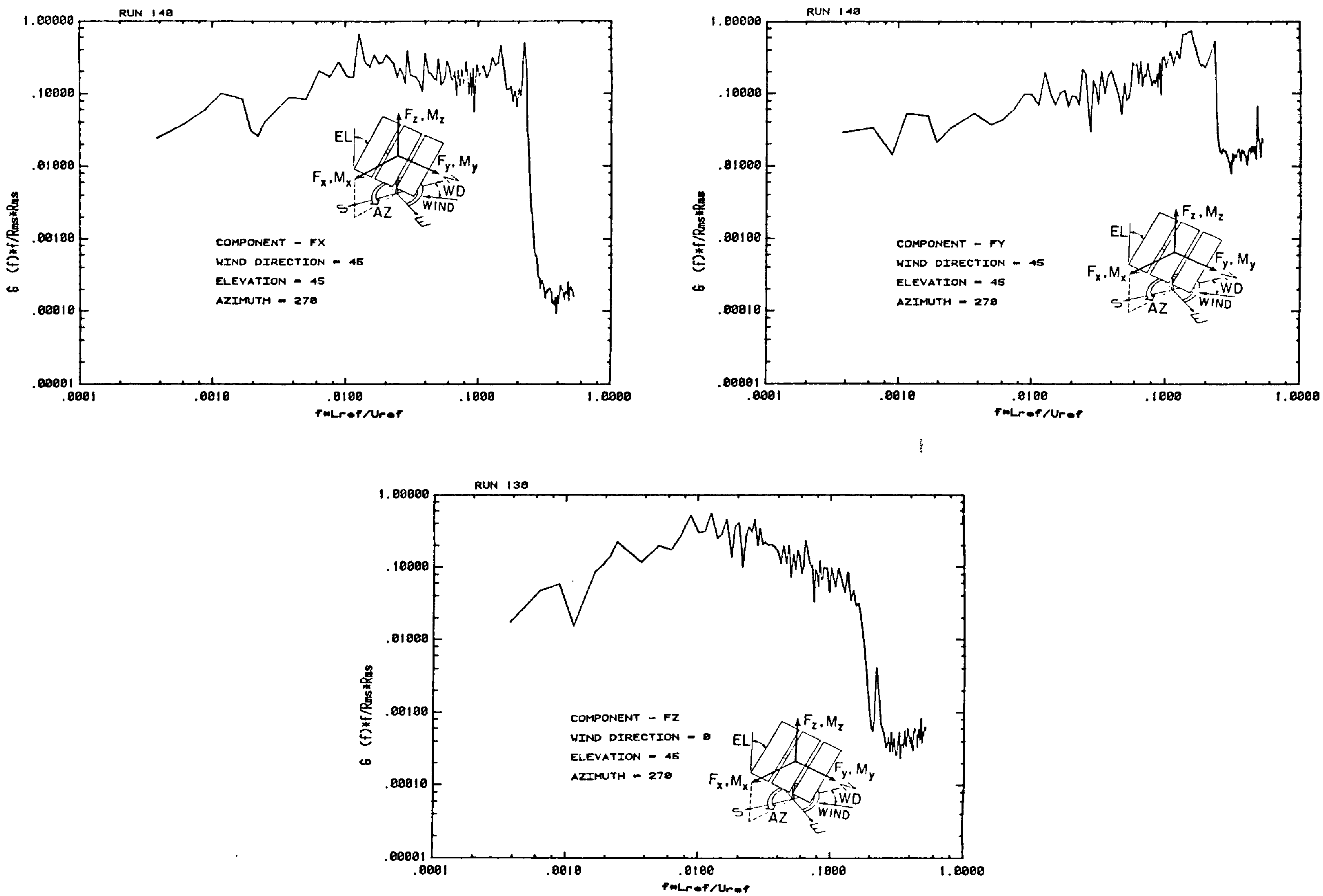


Figure 4-13a,b,c. Power Spectrum of Force Coefficient for an Isolated Heliostat; WD = 45°, AZ = 270°, EL = 45°

These data indicate, for example, that the velocity which would cause the design horizontal peak force with the heliostat in horizontal stow position would be 4.4 times the velocity which would cause the design horizontal peak force in the most sensitive heliostat operational position. For a maximum operational wind of 50 mph, the stow wind speed to cause the same horizontal force would have to be at least 220 mph.

- Thus for an isolated (or field-edge) heliostat, operational winds tend to control design forces. The opposite is true for moments: moments are controlled by 90 mph stow position loads.

Similar comparisons can be made within the heliostat field. However, insufficient data are available in this study to perform this calculation.

More detailed dynamic measurements on a larger scale model need to be made in order to determine whether or not the current practice of establishing stow moments by using a wind at 6 degrees to the horizontal is too conservative. Tentative measurements in this study showed a possibility that current practice is conservative.

Figure 4-9 shows the value of C_{F_x} in this study in comparison to C_{F_x} values measured on other isolated ground-based solar collectors in previous studies. The dynamic pressure here is referred to velocity at mid-height of the projected area to be consistent with the other data. The comparison is good. The present data is slightly lower in drag than some other collectors whose surfaces were not as smooth. The data is presented two ways in Figure 4-9: once showing the sinusoidal variation in C_{F_x} with elevation angle and a second showing the approximately constant upper bound of C_{F_x} if it is based on projected area instead of actual surface area.

Figures 4-10 and 4-11 show mean, peak maximum, and peak minimum wind loads as a function of elevation angle for wind directions of 0° and 45° respectively. In Figure 4-10a, the peak C_{F_x} at an elevation angle of 0° is 2.11 compared to a mean of 1.17. This implies a gust factor in wind speed of 1.34. This value is lower than the value one would expect from typical gust factors quoted in the literature and is probably due to incomplete modeling of the larger eddy sizes. Thus, the peak measurement is possibly low for the isolated heliostat. Additional measurements combined with appropriate analysis, anticipated for study during the next year, can determine the magnitude of the underestimate. All data of Figures 4-9 and 4-10 indicate that fluctuating loads are due to wind gusting and do not indicate strong wake-dominated or vortex loading.

The power spectrum of a force coefficient represents the frequency decomposition of the fluctuating part of the time varying force coefficient. The power spectrum is defined as:

$$G(\omega) = \frac{1}{2\pi} \int_{-\infty}^{\infty} e^{-i\tau\omega} R(\tau) d\tau$$

where $$R(\tau) = \frac{\int_{-T}^{T} g(t)g(t-\tau)dt}{\int_{-T}^{T} g^2(t)dt}$$

$$\omega = 2\pi f$$

g(t) = fluctuating time sequence of force coefficient

Figures 4-12 and 4-13 present power spectra of each force coefficient for wind directions 0° and 45° at a constant elevation angle of 45°. The abscissa is reduced frequency--frequency in Hz made nondimensional with characteristic length scales. The ordinate is the spectrum multiplied by frequency in Hz and divided by the square of the root-mean-square of the fluctuating signal (the variance). The ordinate is dimensionless. The spectrum made dimensionless in this way applies to the full-scale heliostat as well as to the model and provides a convenient way to scale dynamic loads from model to full scale. The decrease in spectral amplitude near a reduced frequency of 0.2 is due to the sharp cutoff antialiasing low-pass filter used to delete the model natural frequency and represents the upper limit of useful frequency. The absence of large peaks at specific frequencies indicates a broad-band type of wind loading and the absence of an organized vortex shedding phenomena. This is the type of loading expected.

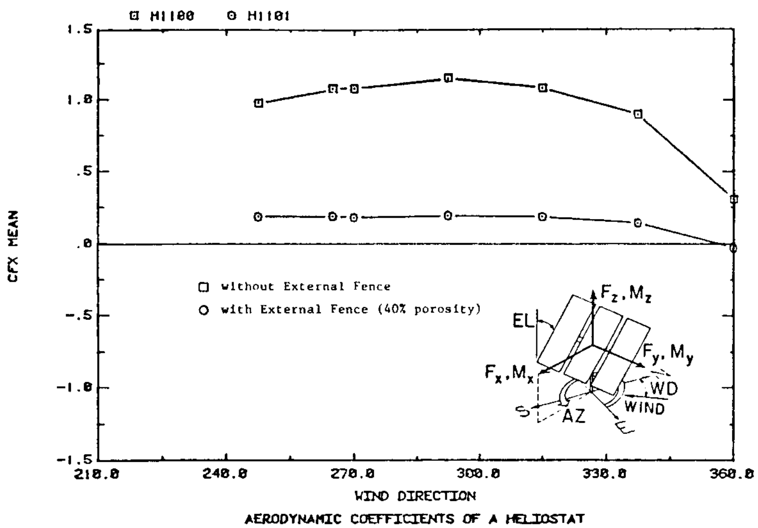
Improvements in the spectra which should be made before full utilization can be made are: an increase in upper frequency limit (higher natural frequency of the model) and decrease in normalized standard error (random variations in ordinate making graph look 'noisy'). The first can be accomplished by testing on a stiffer balance--a device currently in final development stages--and the second by increasing sampling time in the wind tunnel and adjusting segment and frequency averaging parameters in data analysis. Both improvements are planned for the next year testing. Improvements in dynamic load measurement capability will result in definition of peak loads on heliostats. It is the peak loads which provide the largest stresses in the support structure and hence control the design.

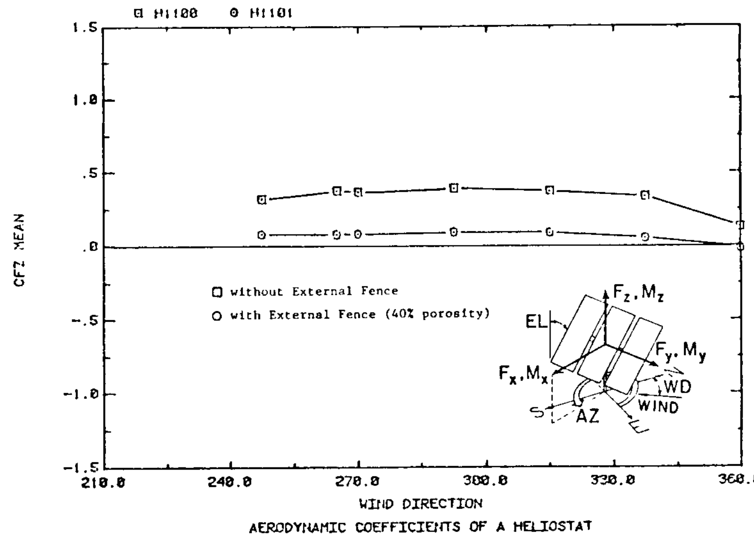
- The strength of a collector should be based on the peak load rather than a mean load multiplied by an assumed gust factor.

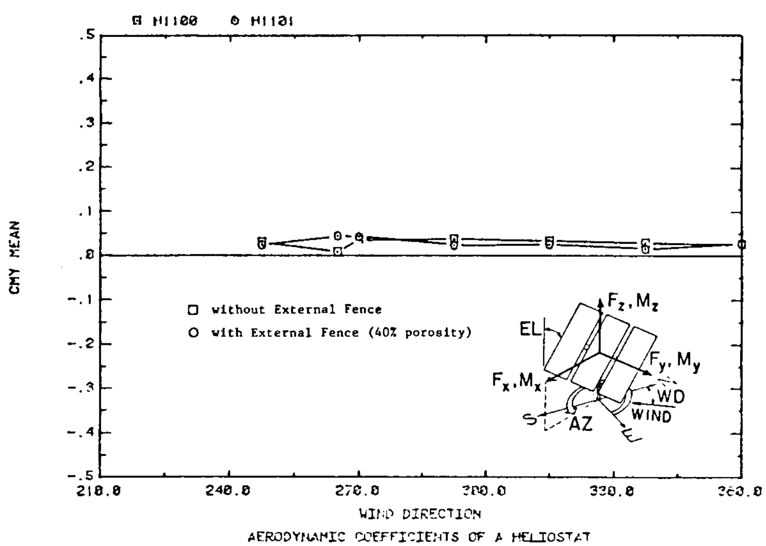
4.2 HELIOSTATS IN FIELD

Data in this section is presented in roughly the order of increasing complexity of upwind blockage. The intent of the various figures is to illustrate the influence of various types of upwind blockage, heliostats, fences, etc., on wind loads. The data in this section is later condensed into two graphs.

Figures 4-14 and 4-15 show the influence of a perimeter fence (see Figure 2-5) on wind loads on heliostat 1 at the edge of the field for summer AM and summer noon conditions. As found in earlier studies cited in the introduction, perimeter fences do provide significant reductions in wind load.







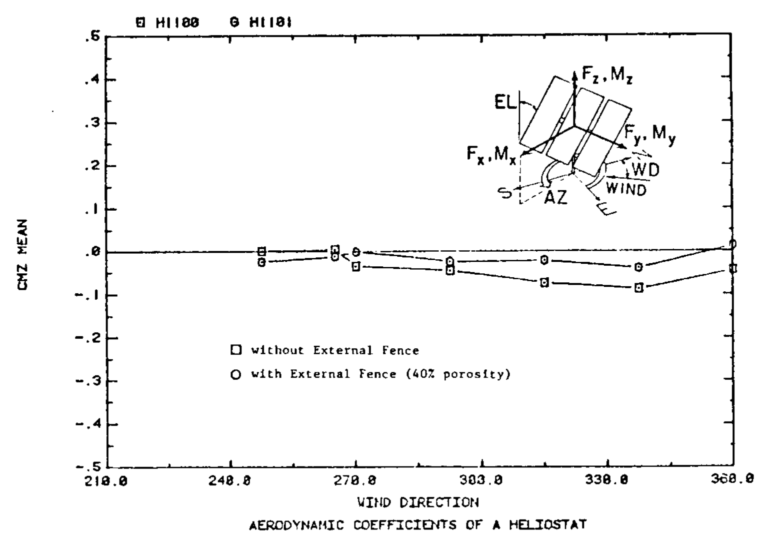


Figure 4-14a,b,c,d. Heliostat 1 - Representative Mean Force and Moment Coefficients, Summer AM

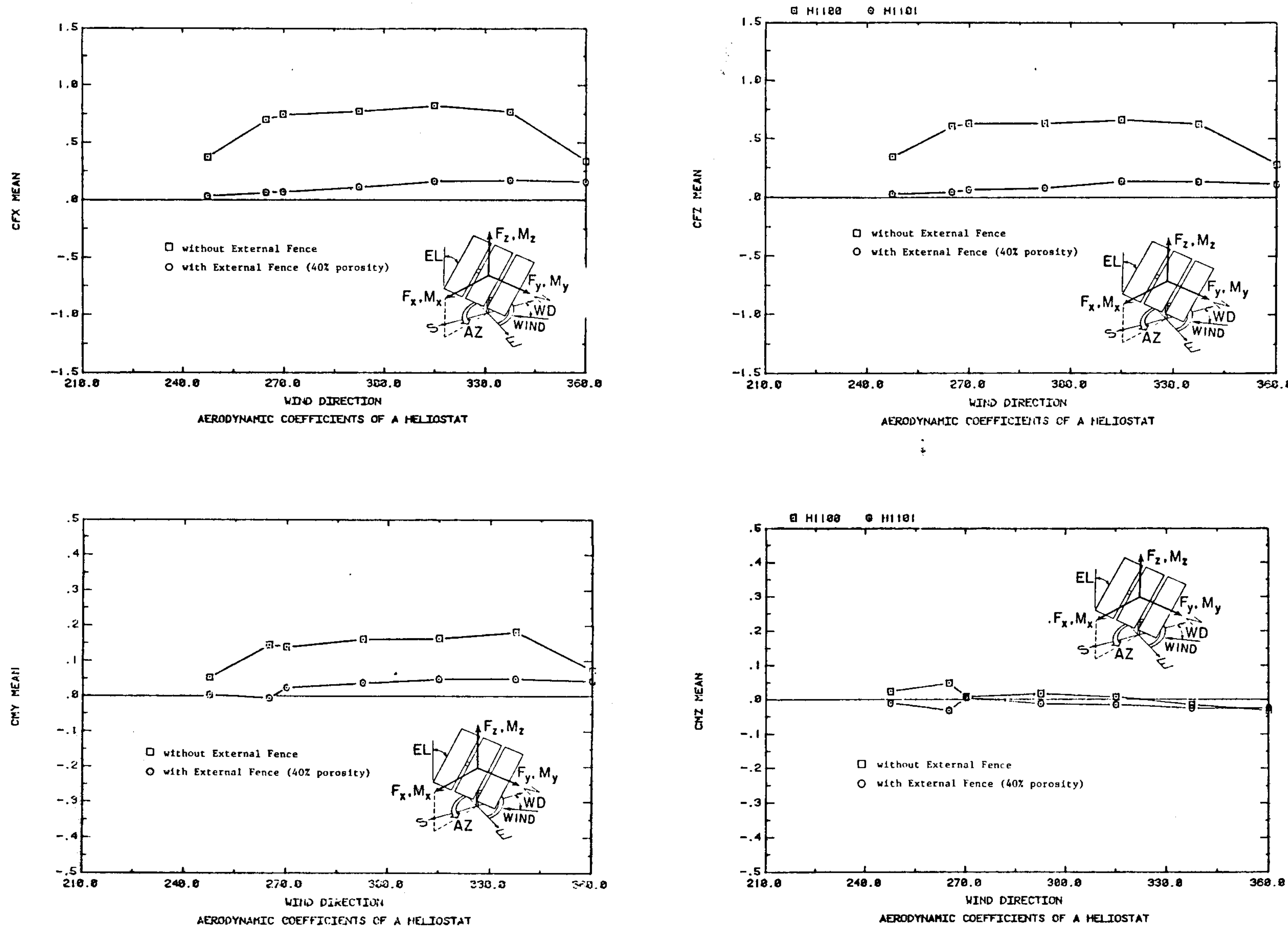


Figure 4-15a,b,c,d. Heliostat 1 - Representative Mean Force and Moment Coefficients, Summer Noon

Heliostat 5 represents an in-field unit in the least dense area A of the Barstow field (see Figure 2-6). Figures 4-16 and 4-17 show the wind loads on this heliostat for the summer AM and summer noon configuration for various fence arrangements. The highest loads shown in each figure are for an isolated heliostat for comparison purposes. The other cases in order of decreasing load are heliostat 5 in its field location without any fences in place, with external fence only and with both external and internal fence. The largest reduction in wind load from the isolated case occurred as a result of basic field density. Both the external and internal fence provided additional load reductions. The field density about heliostat 5 is higher than the low density portion of the field used in reference [2]. In reference [2], load reductions of 20 to 30 percent in the low density field were typical without fences.

- In the Barstow low density field, mean load reductions of 50 to 70 percent were typical with additional decreases due to the addition of fences.

In order to satisfy the desired goal of providing a designer with sound guidelines on what upstream blockage is necessary to produce a particular load reduction, additional tests were run on a typical heliostat varying the properties of the field about the heliostat. Heliostat 3 was selected for this purpose. Figure 4-18 shows the effect of varying the number of upstream rows without fences on both mean and dynamic loads on heliostat 3. The mean load decreases rapidly with number of upstream rows to a value about 20 to 25 percent of the edge case. The peak load decreases rapidly also to a value of about 1/3 of the edge case. The variability in peak load with number of rows upwind from 2 to 10 rows is not due to a change in dynamic loading (the rms is remarkably constant) but is due to use of a single realization from a probability distribution with a fairly high dispersion. In random vibration peak load determination, the peak is often calculated as peak = mean + g * rms where g is a peak factor (of magnitude 3-4 for a broad band loading process) determined semi-empirically, in order to avoid the random variability in single measurement realizations. Because the dynamic loads on interior heliostats are dominated by wake turbulence generated by upstream units, the peak loads measured on these units are more likely to be closer to the correct value than those on edge units (which are believed too low--see Section 4.1 above). Thus, load reduction within the field is probably larger than shown in Figure 4-18.

- An important point shown by Figure 4-18 is that the peak wind loads acting on heliostats within the Barstow field are substantially lower than the peak loads acting on heliostats at the edge of the field.

This finding is in contrast to assumptions made about peak loads by field personnel (see Section 4.4).

- Specific dynamic load mechanisms which can be treated with spoilers on heliostats were not evident. Thus, they were not tried. Additional study in the next year should address this issue with tests.

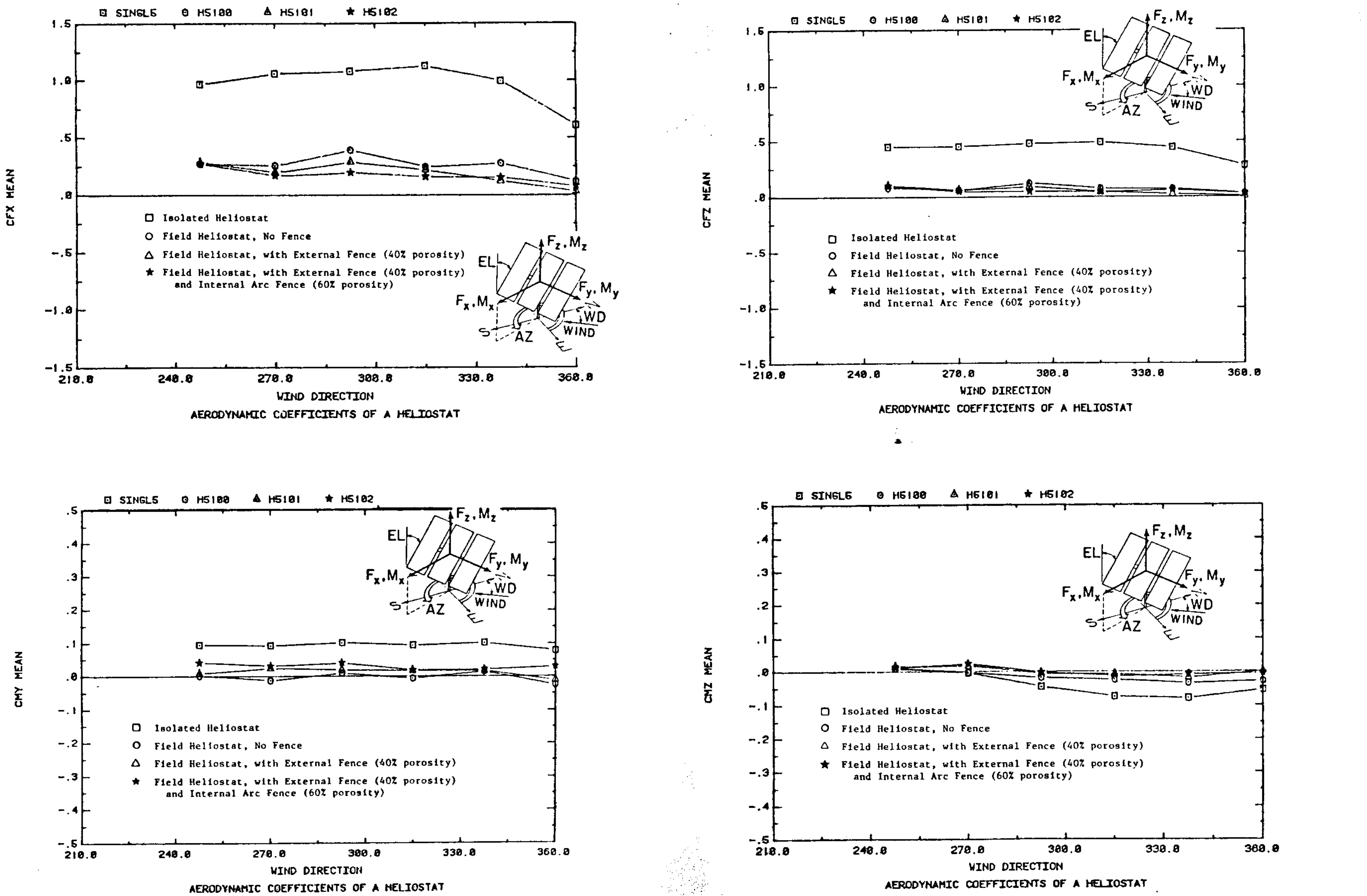


Figure 4-16a,b,c,d. Heliostat 5 - Representative Mean Force and Moment Coefficients, Summer AM

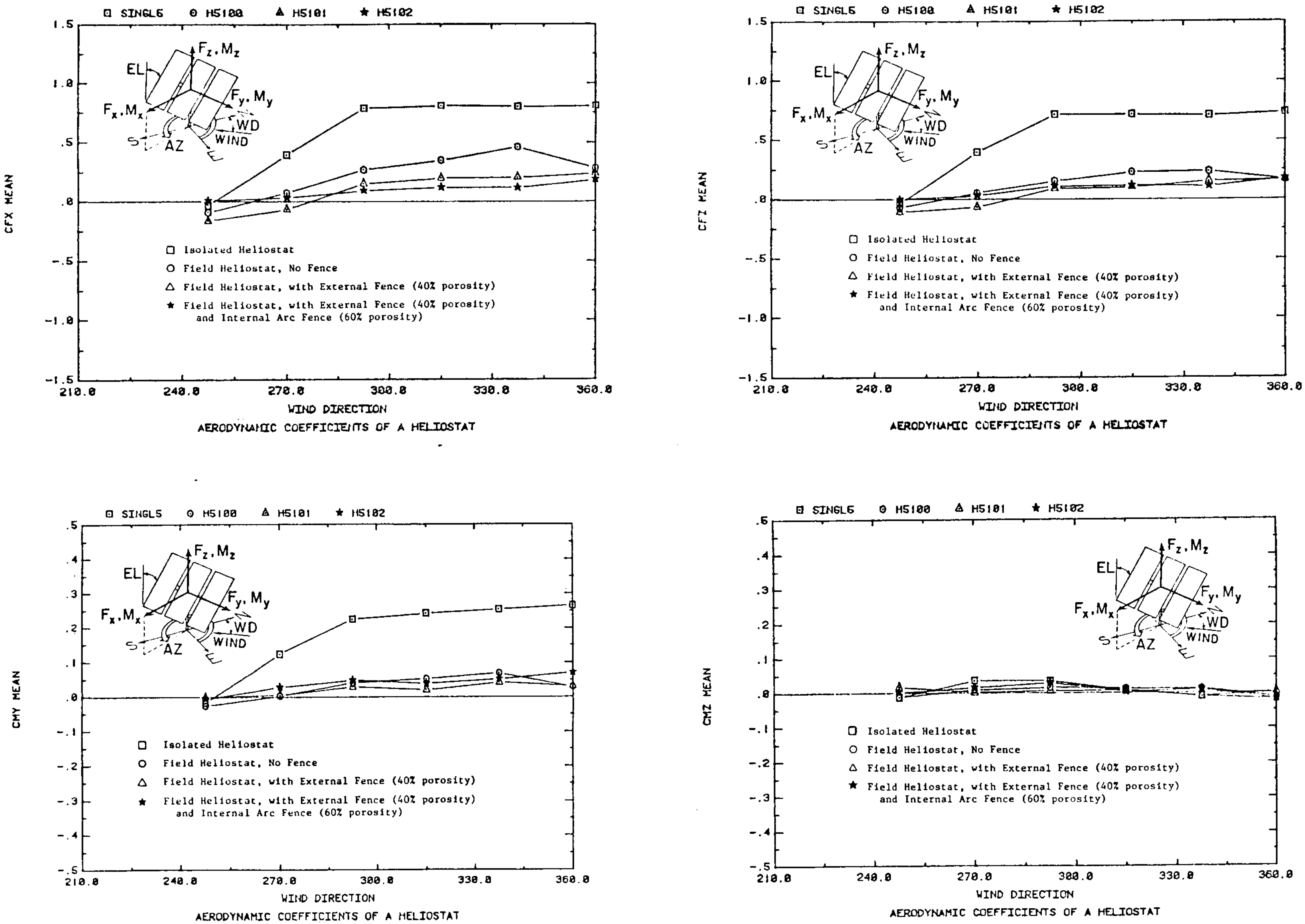


Figure 4-17a,b,c,d. Heliostat 5 - Representative Mean Force and Moment Coefficients, Summer Noon

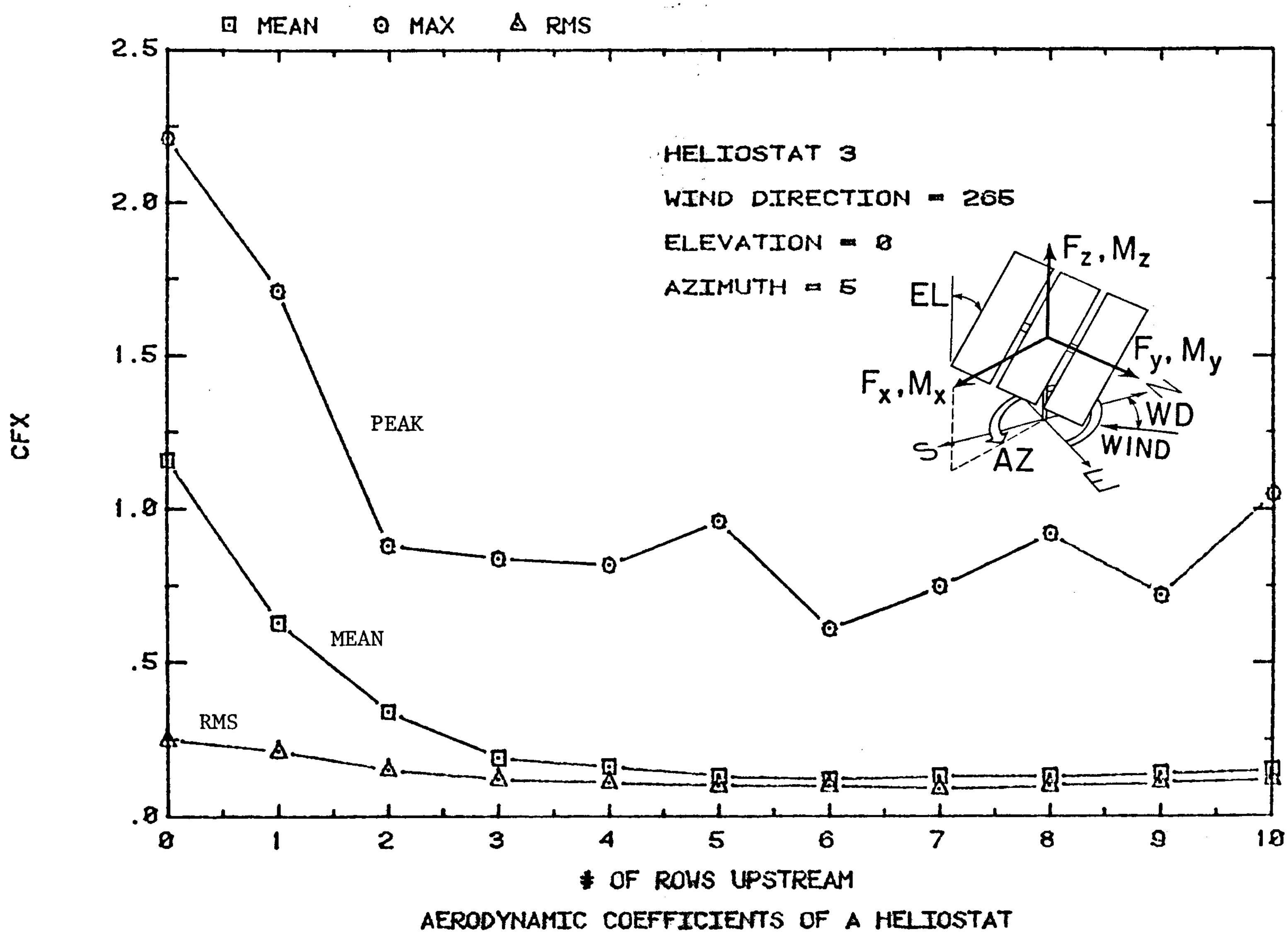


Figure 4-18. Mean, Max and RMS CFX for Heliostat 3--with Varying of Number of Upstream Rows of Heliostats

- Spoilers are not likely to be effective in reducing mean loads because of increased collector area and increased turbulence in the separated shear layer which can increase loading coefficients.

The influence of field density on heliostat loads is shown in Figure 4-19. This figure shows how wind loads transition from isolated to dense field loadings. The generalized blockage area shown in the graph is defined in Figure 4-20 as

$$G_B = A_B/A_F$$

where A_B = solid blockage area of upwind heliostats and fences projected in the approach wind direction

A_F = ground area occupied by the upwind blockage elements included in calculation of A_B

The original density for heliostat 3 in generalized blockage area is 0.24. Wind loads increase steadily as generalized blockage area is decreased with a rapid rise below 0.1.

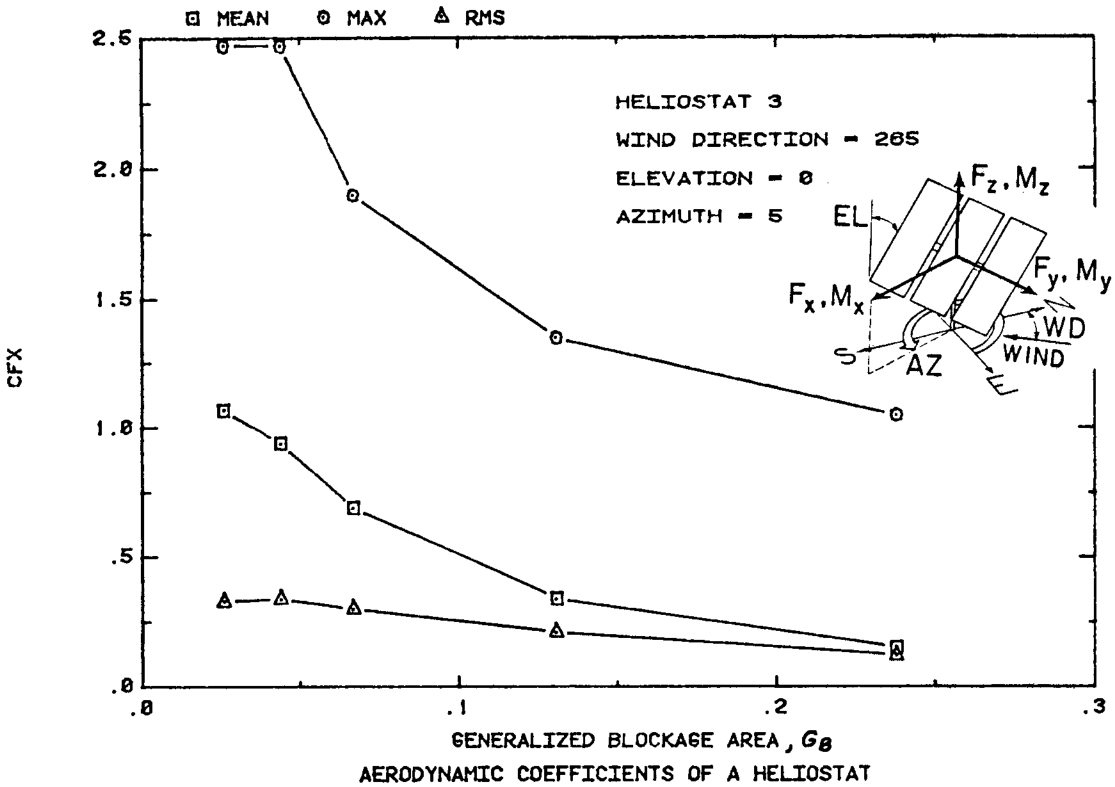
The effects of fences are more easily resolved for fields with lower density. A number of tests were performed with internal fences with various field densities and number of upstream rows. Figures 4-21 through 4-23 represent results from this series of tests for heliostat 3. The reduced density of the field for these results is 1/4 of the original Barstow field density. The results show a steady decrease in wind load with upwind blockage area. It shows that porosity in the in-field fence is important (i.e., that increase in solid area upwind decreases wind loads).

Heliostat 4 is at the inner edge of the heliostat field where velocity speedup might increase wind loads above interior units. This heliostat also is one instrumented in the field. Because of the time-consuming task of setting upwind heliostats, only one wind direction (azimuth 265 degrees) was measured--the direction where full-scale wind loads have been measured. Figure 4-24 shows the results of heliostat 4 wind loads for a summer noon case. Comparison is made to heliostats 1 and 5. Heliostat 4 shows loads significantly lower than the upwind edge heliostat 1 and slightly higher than heliostat 5. For a summer AM case (not shown in a figure), heliostat 4 had loads nearly the same as heliostat 5. The data for heliostat 4 shows that an edge heliostat on the downwind edge of the field may have loads above interior units, but well below upwind edge units.

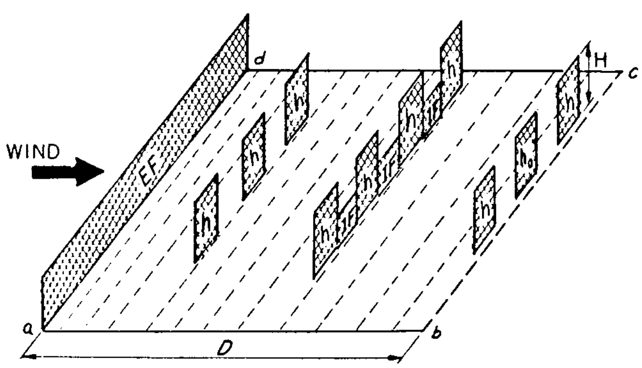
Development of data during the testing phase indicated that the added data obtained on heliostat 3 would be more beneficial than tests on heliostat 2. Thus no data were obtained for heliostat 2.

4.3 WIND LOAD REDUCTION SUMMARY

The primary purpose of this study was to find ways to reduce mean wind loads on heliostats. One alterative is to specify specific fences required to



Field 4-19. Mean, Max and RMS CFX for Heliostat 3--with Various Field Densities



h = Heliostat

h_o = Heliostat Under Consideration

EF = External Fence

IF = Internal Fence

[dense dot pattern] = Blockage Area for h_o

[light dot pattern] = Field Area (= a b c d) for h_o

A_B = Blockage Area Projected onto a Plane Perpendicular to Approach Wind Direction

A_F = Field Area Containing Blocking Elements Used for A_B

D = Distance from h_o to EF

H = Height of Heliostat at Vertical Stow Position

$$\text{Generalized Blockage } G_B = \frac{\text{Blockge Area } A_B}{\text{Field Area } A_F}$$

Figure 4-20. Definition of Generalized Blockage Area

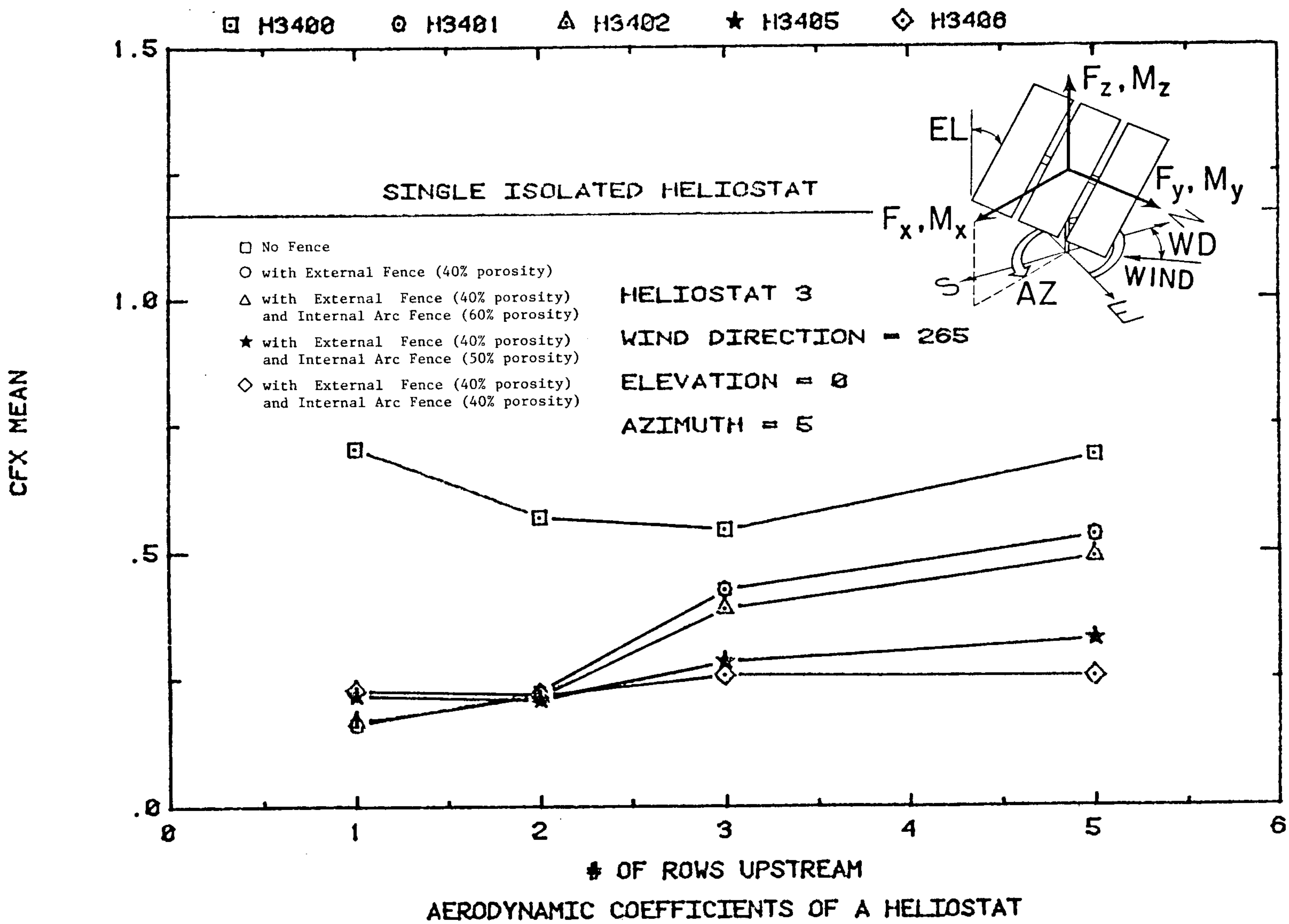


Figure 4-21. Effects of Fences and Number of Upstream Rows of Heliostats on Mean CFX, Heliostat 3 within Low Density Field

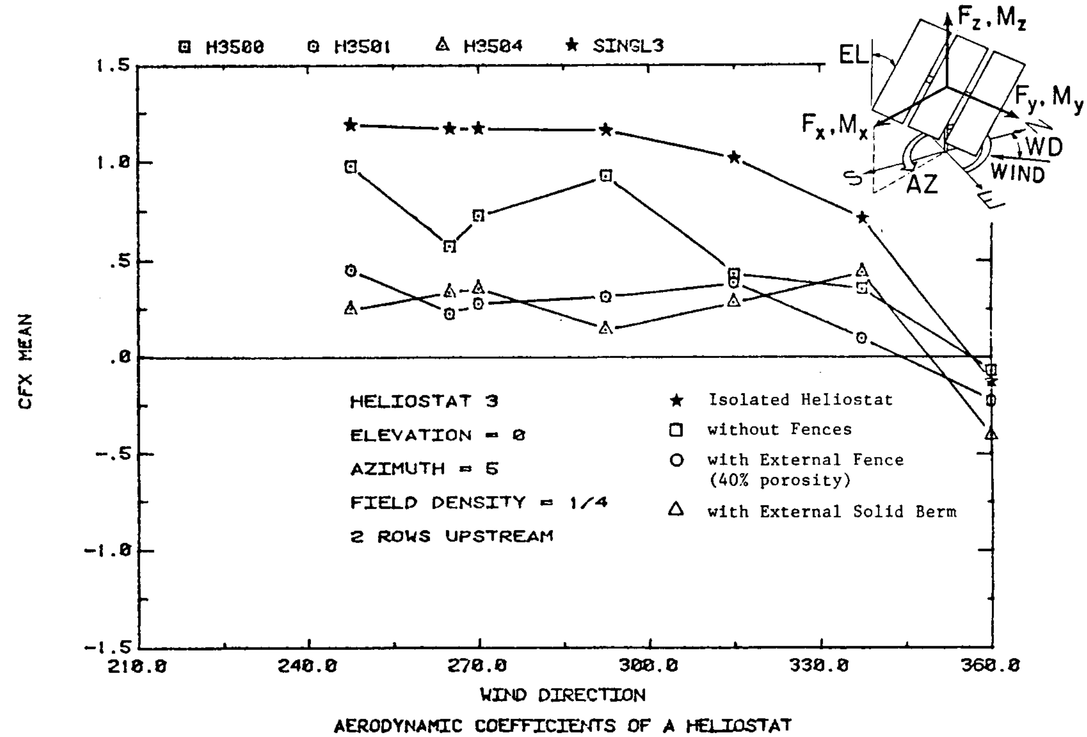


Figure 4-22. Effects of Fences on Mean CFX, Heliostat 3 within Low Density Field with Two Upstream Rows of Heliostats

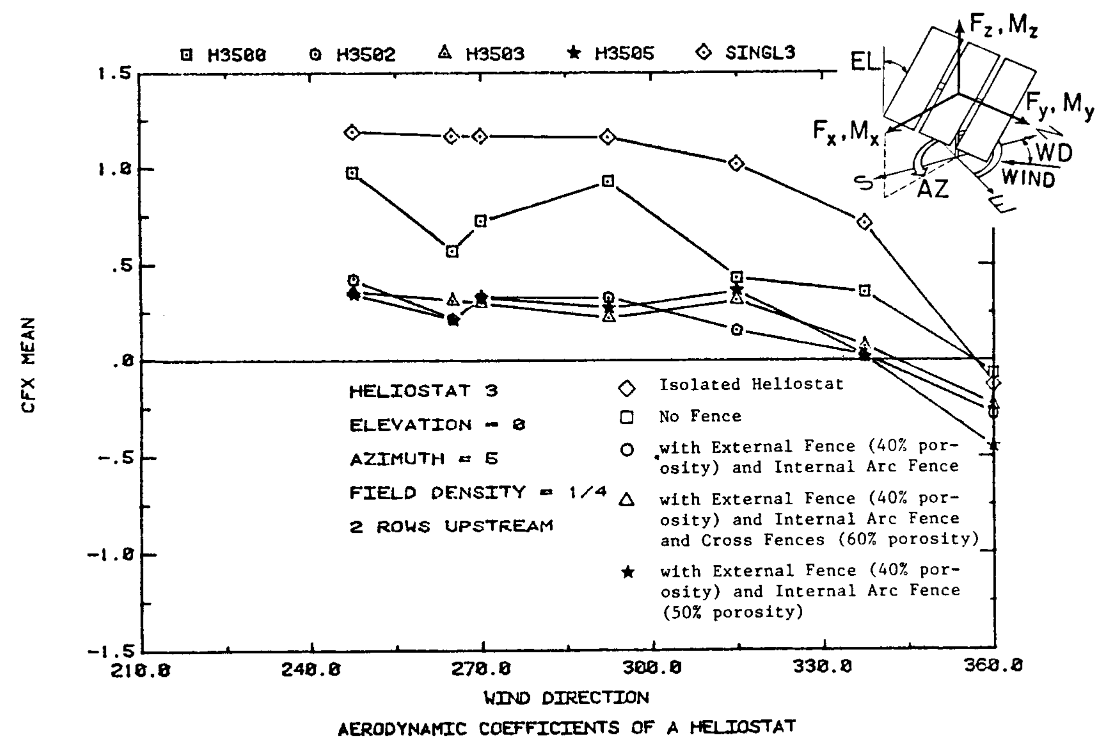


Figure 4-23. Effects of Fences on Mean CFX, Heliostat 3 within Low Density Field with Two Upstream Rows of Heliostats

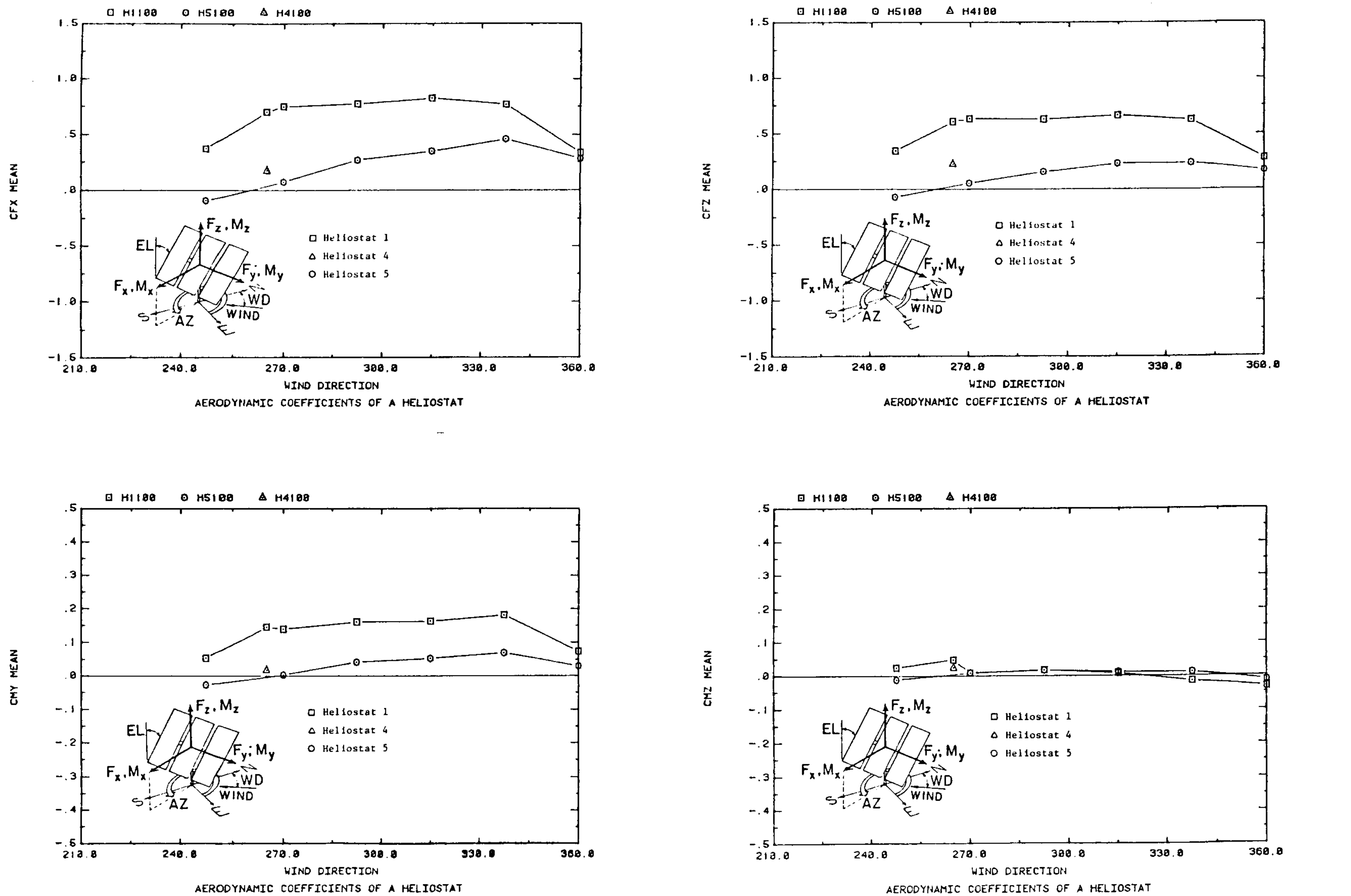


Figure 4-24a,b,c,d. Wind Loads on Heliostat 4 for a Summer Noon Case for Wind Direction 265 Degrees achieve specific reductions for a particular field layout. A second and more attractive alternative is to describe wind load reduction in terms of the characteristics--described in a general but quantifiable way--of the upwind devices interfering with the wind.

- During analysis of the data, it was found that a generalized quantifiable description of the upwind blockage could be found--the generalized blockage shown in Figure 4-20.

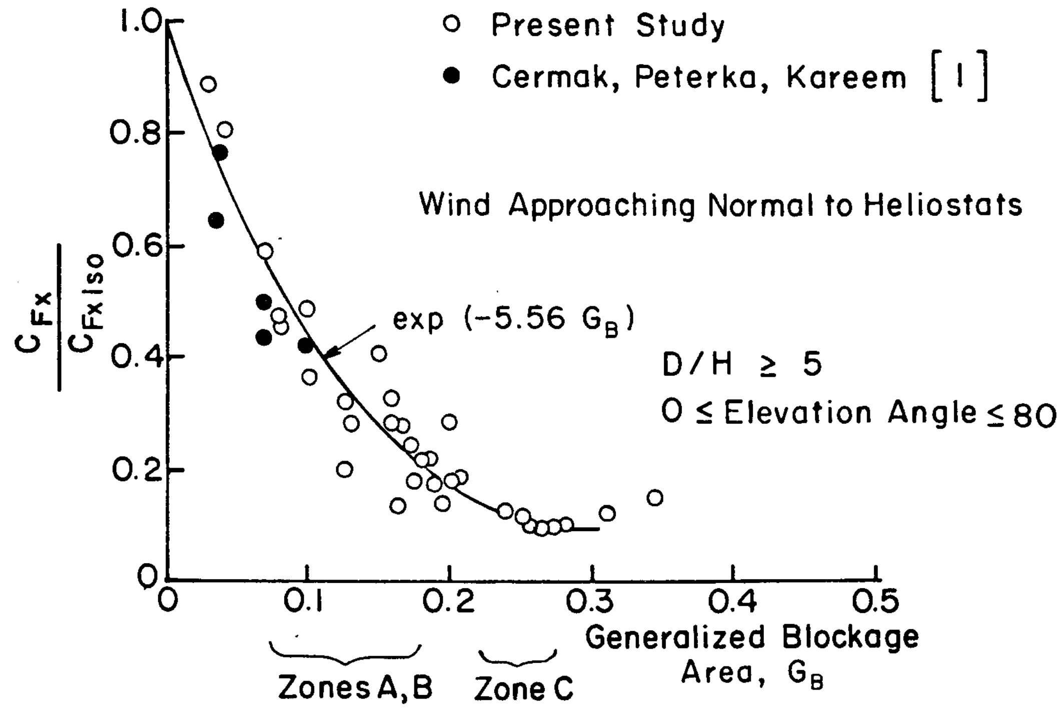
Figure 4-25 shows how data have been collapsed onto or below a single curve of load reduction using the generalized blockage area concept. The solid curve is an exponential decay with exponent -5.56 G_B and was fit to the data in the upper curve by regression. Only data for $D/h \leq 5$ did not collapse onto the curves shown and were omitted from the graphs. For $D/h \leq 5$, the heliostat under consideration is within the first two rows where wind can pass between upwind heliostats for some directions without significant decrease. For these cases, the perimeter fence is needed to provide adequate protection. Figure 4-25 provides a design guide which describes the quantity of upwind solid blockage required to achieve any desired level of load reduction. The blockage may be assembled from heliostats, fences, berms or other elements whose specific shapes and locations can be determined by the economics of the installation. The format used for describing load reduction leaves the field designer the maximum of latitude in selection of field geometry.

- An obvious conclusion is that an efficient load reduction mechanism is high field density (with a perimeter fence) where the upstream blockage elements are also energy producing modules. It may be desirable to trade shading losses for decreased wind loading.

4.4 COMPARISON OF MODEL DATA WITH FULL SCALE

One reason for selecting the Barstow site for the wind-tunnel test was that in the full scale field wind speed measurements had been made, and three heliostats had been fully instrumented with load cells for force measurements (another three had been partially instrumented). It was thus anticipated that a comparison between model and full-scale data would be made. To date, no full-scale load data has become available. Some wind speed data (mainly peak wind speeds) has been made available from anemometers installed on wind towers within the heliostat field [31]; see Figure 2-2 for the locations of the wind towers. At each of the wind towers, the anemometers were located at 10 ft, 20 ft and 32.8 ft above the ground. The anemometer of the west meteorological station was at a height of 32.8 ft. Wind speed data obtained on day 329 (25 Nov) of 1983 were chosen for a model and full-scale comparison of wind speeds for the heliostat under an operational mode.

In the Barstow field, instantaneous wind speeds were measured at three-minute intervals for two hours. Figure 4-26 from [31] shows variation of the wind speeds recorded at the west meteorological station on day 329 from 11 AM to 1 PM. The curve in the figure was obtained by a cubic curve fitting to the data points. The mean of the wind speeds was 23.5 mph and the wind direction was 265 degrees during the period.



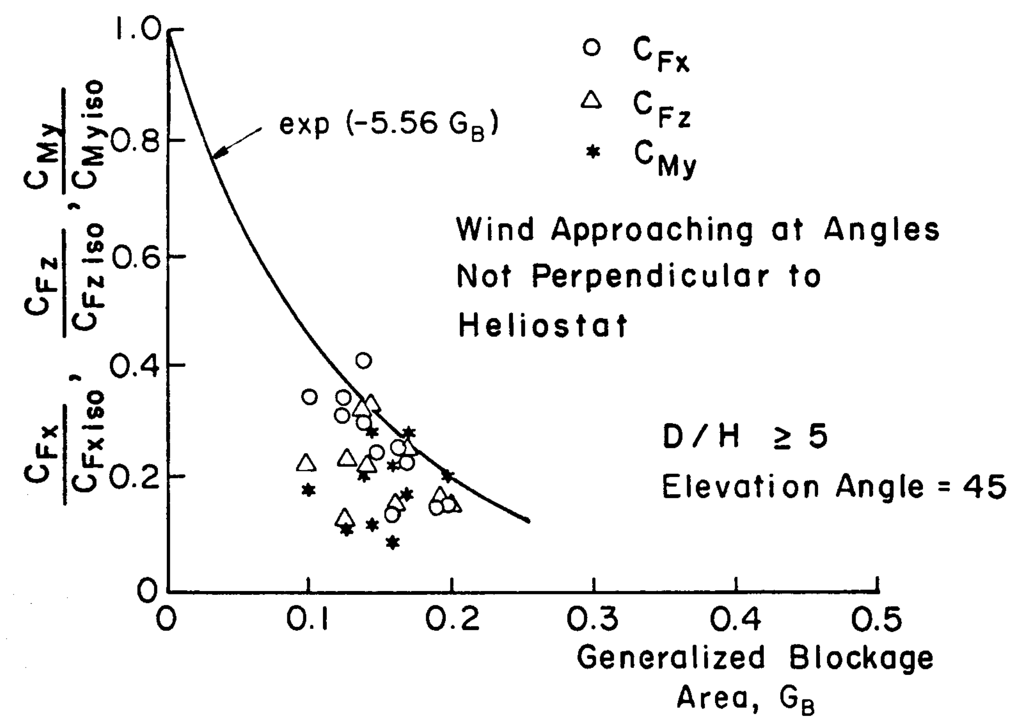


Figure 4-25. Mean Load Reduction as Function of Generalized Blockage

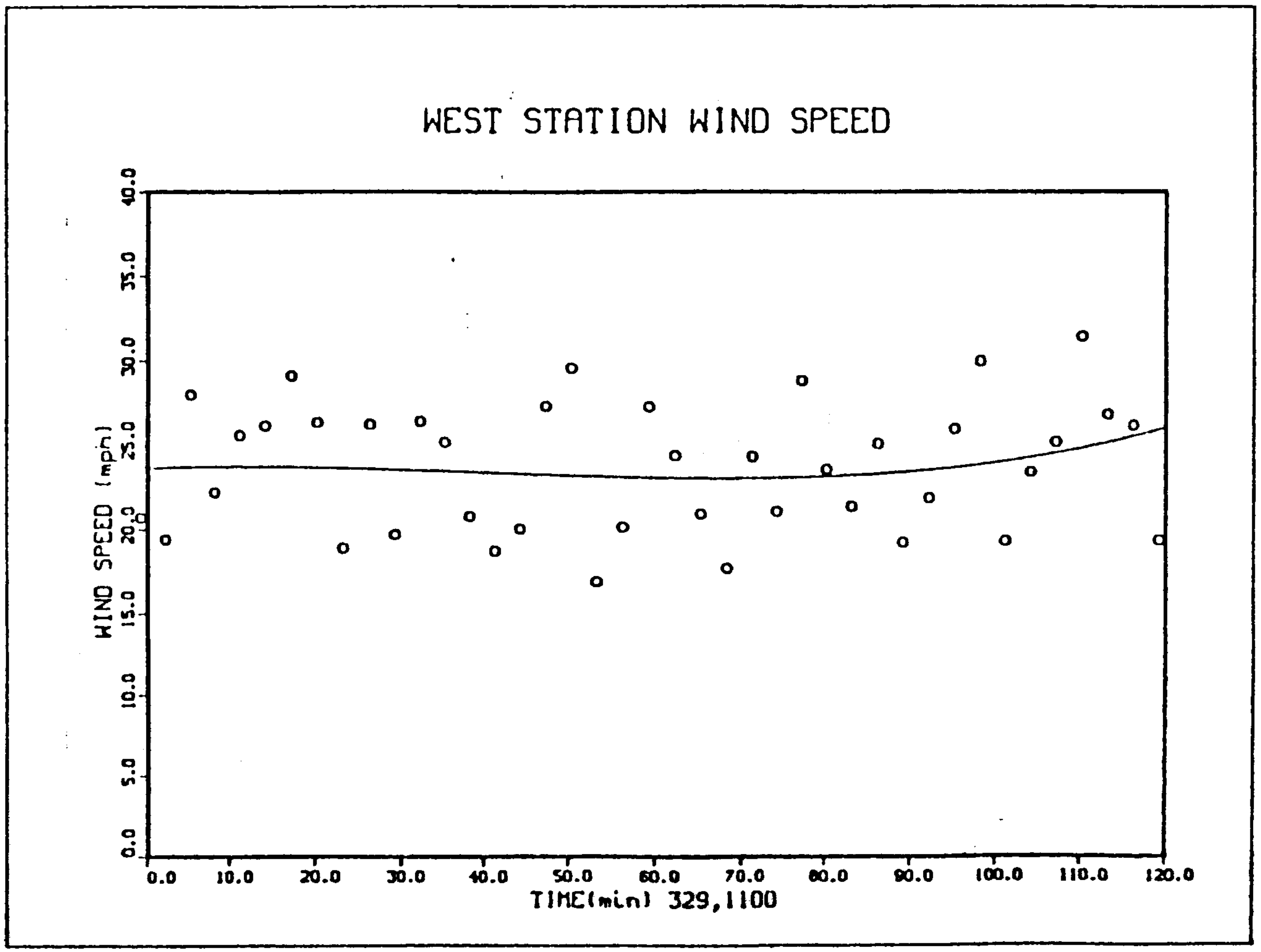
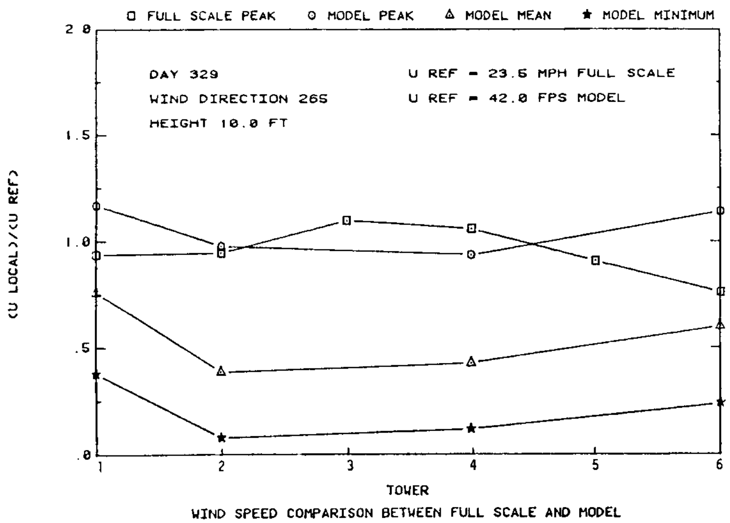


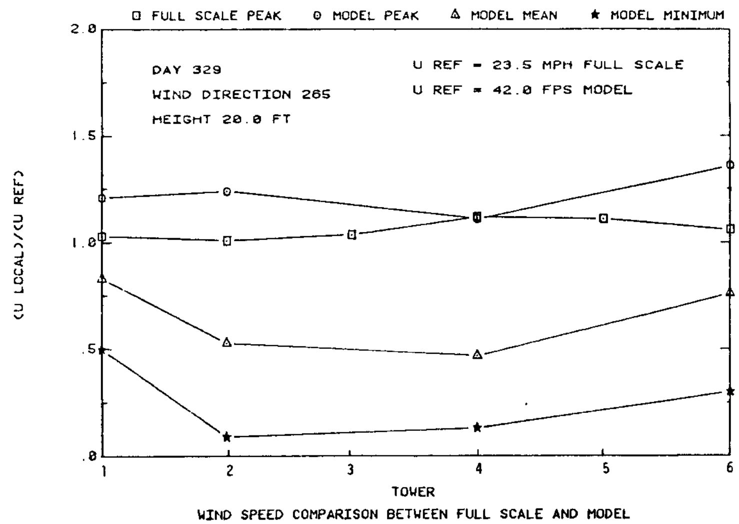
Figure 4-26. Full-Scale Wind Data [Ref. 31]

In the wind tunnel, the heliostat field around and upstream of the wind towers 1, 2 and 4 were fully simulated, and the wind speeds were measured at the corresponding heights of 10 ft, 20 ft and 32.8 ft. Measurements of wind speeds for the wind tower 6 were obtained by partially simulating the field with 11 upwind rows of heliostats (all that were available). The wind speeds were measured by a hot-film anemometer at a rate of 256 samples per second for 32 seconds for each wind tower and height. The maximum, mean and minimum wind speeds were then determined. The measurements were repeated 10 times for each configuration to obtain an ensemble average of the maximum (peak) wind speeds.

Figure 4-27 shows the full-scale peak wind speed and model peak, mean and minimum wind speeds at heights of 10 ft, 20 ft and 32.8 ft, respectively. All the wind speeds were normalized for comparisons using the mean wind speed at the west meteorological station. The full-scale and model peaks are in as good agreement as expected since the full-scale data represents a single realization of a probability distribution with a significant standard deviation. From the wind speed measurements in the wind tunnel, it is evident that the mean wind speeds decreased within the field in comparison to the west edge at 10- and 20-ft levels and to a lesser extent for 32.8 ft. At the location of the wind tower 6, however, the wind speed increased nearly to the level at the wind tower 1. Peak wind speeds within the field did not show a tendency to decrease for either model or full scale. The lack of a decrease in peak wind speed within the full-scale field might lead incorrectly to the assumption that peak wind loads also remained constant across the field. High velocities in the field of small spatial extent cannot fully load a heliostat. Model data presented in Section 4.3 showed peak and mean loads on heliostats decreased.

- Thus, it can be concluded that peak and mean loads in the full-scale field will decrease from those at the field edge for operational positions. In other words, measurement of local wind gust peaks within the full-scale field cannot always be used to deduce peak wind loads on the heliostats.





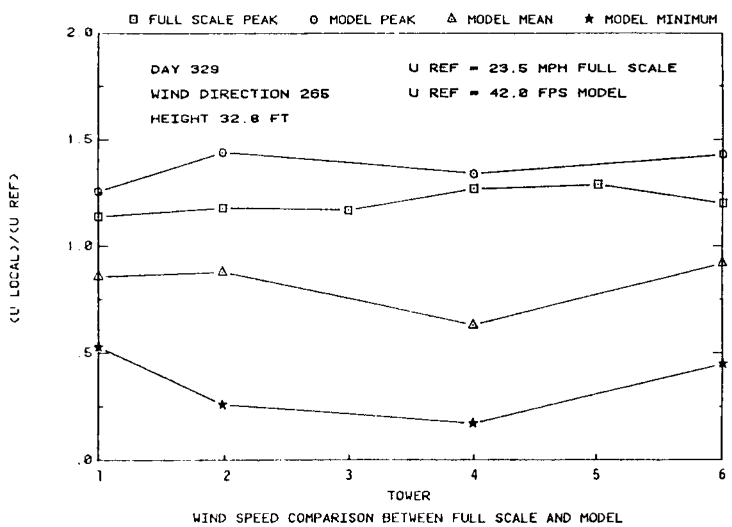


Figure 4-27a,b,c. Model and Full-Scale Wind Speed Comparison

SECTION 5.0

CONCLUSIONS AND RECOMMENDATIONS

A 1:60 scale simulation of wind flow over several fields of heliostats including the Barstow site was performed in a boundary-layer wind tunnel designed to model atmospheric winds. Wind loads were measured on heliostats using a six-component strain-gage balance. Wind load reductions below those of an isolated heliostat were measured as a function of heliostat setting (day of year and hour), position within the field, field density, wind-protective fence, and approach wind direction. On the basis of the data presented, the following conclusions can be made:

- Mean wind loads decrease with:
  - increased distance into the field,
  - increased field density,
  - addition of solid or porous fences upwind.
- Mean wind load reduction data for a given load component can be collapsed onto a common curve which describes load reduction as a function of a generalized blockage calculated from upwind blockage elements.
- Mean wind loads on heliostats within the Barstow fields are substantially lower than those at the edge of the field--in many cases less than 30 percent of edge units.
- Properly designed wind fences and berms surrounding a field of heliostats can reduce edge heliostat loads to 30 percent or less of loads without the fences or berms.
- Limited investigations of fluctuating wind loads did not reveal dynamic loading mechanisms which would indicate that on-heliostat spoilers would be beneficial for mean or dynamic loads. This conclusion should be considered tentative for dynamic loads pending further testing.
- Full-scale wind loads are not available for comparison with wind-tunnel data.
- Design forces perpendicular to the mirror plane for an isolated heliostat are controlled by operational winds (50 mph) while design drive moments are controlled by survival winds (90 mph).
- Fluctuating loads on heliostats can be measured at model scale but additional research needs to be done to decrease certain uncertainties in preliminary measurements.
- Peak wind loads are substantially lower within the heliostat field than at the edge of the field based on wind-tunnel tests in operational positions, including the Barstow field geometry.

- The strength of a collector should be based on the peak load rather than a mean load multiplied by an assumed gust factor.

Additional research needs to be performed to fully exploit the current results:

- additional development of wind load as a function of generalized blockage area is required to develop the data into a codifiable form suitable for use by a designer not familiar with aerodynamic data.

- definition of the limits of applicability of the concept of generalized blockage area.

- complete development of techniques for dynamic force measurements including determination of the influence of model scale.

- investigate the influence of heliostat-mounted spoilers on dynamic loading.

- compare wind-tunnel loads with full-scale loads.

SECTION 6.0

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APPENDIX A

VALIDATION OF WIND-TUNNEL TESTING
IN CIVIL ENGINEERING APPLICATIONS

VALIDATION OF WIND-TUNNEL TESTING
IN CIVIL ENGINEERING APPLICATIONS

Boundary-layer wind tunnels have become an important tool used in physical modeling of various flow phenomena. Over the past 20 years considerable model data has been collected on wind flow over terrain and wind loads on structures. Validity of the wind-tunnel data has been evaluated by comparison with the results of full-scale measurements. Such comparisons have been recently discussed during a workshop on wind-tunnel modeling for wind engineering applications [A1] and during the Sixth International Conference on Wind Engineering [A2]. The presented data, related to wind loading and to flow characteristics, are summarized below.

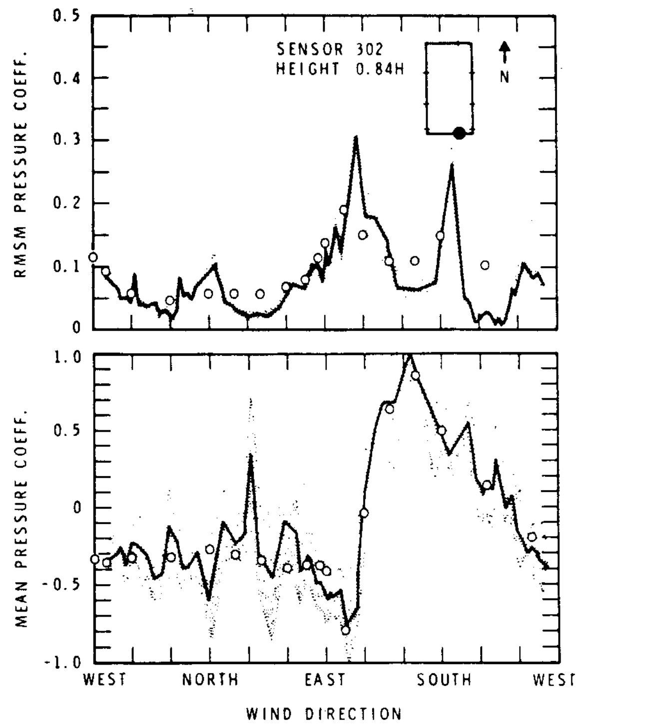
Dalgliesh [A3-A5] discussed data for a tall building. He compared wind pressure on cladding and overall loading [A3,A4] as well as the building response [A5]. A typical comparison for the pressure data is shown in Figure A-1. It can be seen that the agreement between the model and full-scale data is good both for the windward and leeward locations of a pressure tap. A similar agreement was obtained for overall loading: the base shear and the overturning moment, as is depicted in Figure A-2. The degree of agreement between the model and full-scale building response was different for different response modes. The best agreement, shown in Figure A-3, was obtained for translational modes. The agreement for the other modes was not as good, especially for higher frequencies. Based on the analyzed data, Dalgleish [A3] concluded that prediction of full-scale behavior of a tall building is possible to within 10 to 15 percent. A better agreement should not be expected due to many uncontrolled full-scale variables. Similar conclusions were reached by Lee [A6].

Holmes [A7] discussed model and full-scale tests of Aylesbury House. The full-scale study was conducted in England, while the model studies were undertaken in various wind tunnels located in Australia, Canada, U.S.A., U.K., and France. Holmes [A7] used comparative data presented by Tieleman et al. [A8] to discuss observed trends for pressure measurements. Figure A-4 shows "local" pressure coefficients based on the upwind mean wind speed at the height of the pressure tapping for center wall tapping. The mean pressure coefficients, Figure A-4a, are within a relatively narrow range. The agreement with the full-scale data is encouraging, considering the variations in model scaling ratio and boundary-layer simulation procedures used. In the case of the rms pressures, Figure A-4b, the agreement between the wind-tunnel results and full-scale data is again quite good for most of the wind directions tested.

Comparison of model prediction based on wind-tunnel tests and full-scale response of two long-span suspension bridges was presented by Davenport [A9]. The results for the Golden Gate Bridge and Bronx Whitestone Bridge are shown in Figures A-5 and A-6, respectively. It can be seen that full-scale responses fall within the response boundaries established during wind-tunnel studies of the bridge models. A similar conclusion can be drawn for the data presented by Melbourne [A10], depicted in Figure A-7.

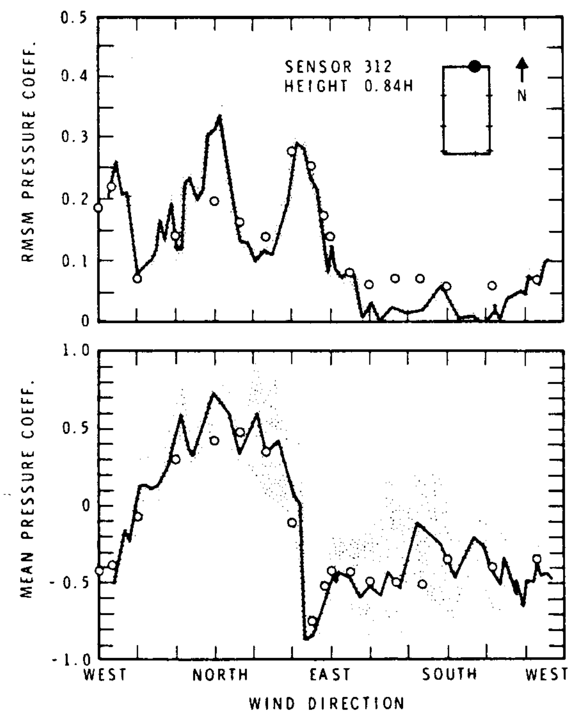
Model/full-scale comparisons for other flow situations and flow-structure interactions were also reported in the literature. They included studies of

(a)



South wall tap 10.7 m from S.E. corner, 50th floor.

(b)



North wall tap 10.7 m from N.E. corner, 50th floor.

Figure A-1. Model and Full-Scale Pressure Coefficients, Ref. [A4]

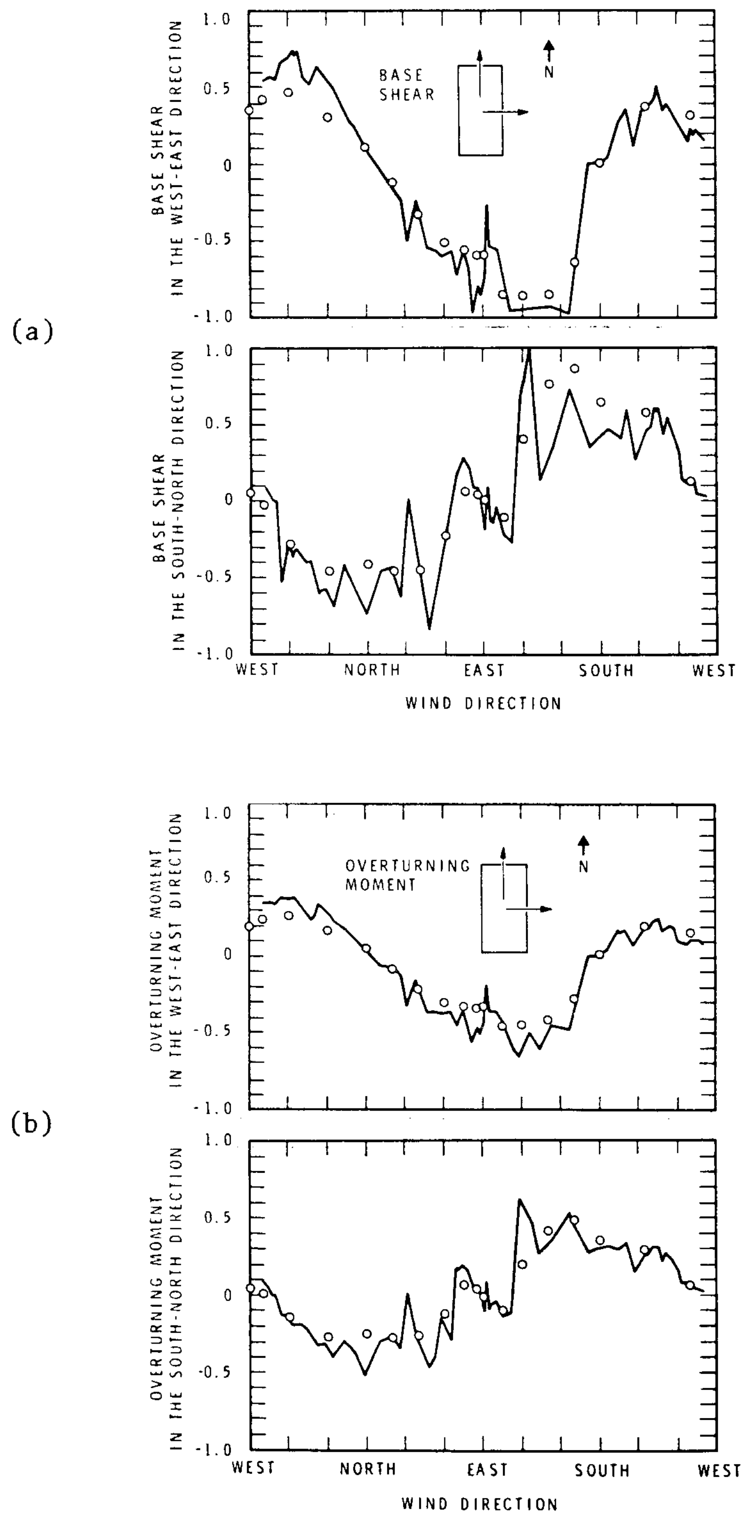


Figure A-2. Model and Full-Scale Overall Mean Loads, Ref. [A4]

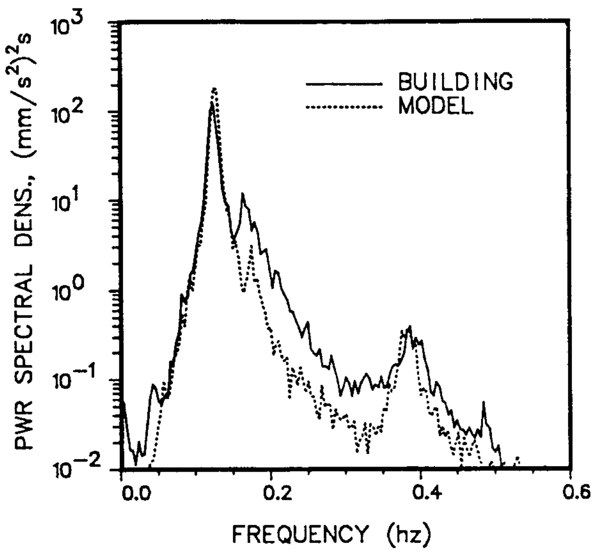
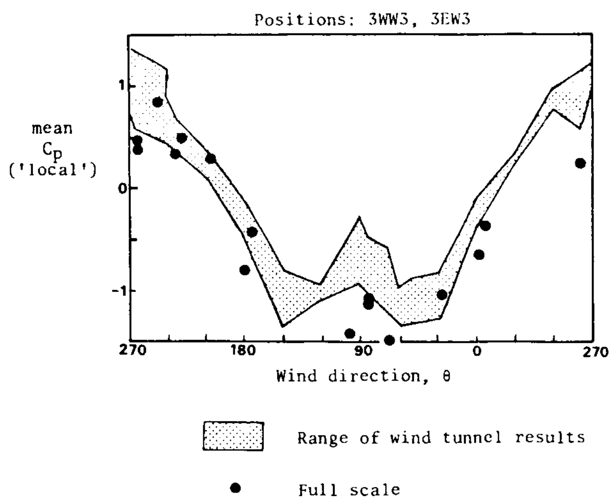


Figure A-3. Comparison of Model and Full-Scale East-West Acceleration Power Spectra - Translational Modes, Ref. [A5]

(a)



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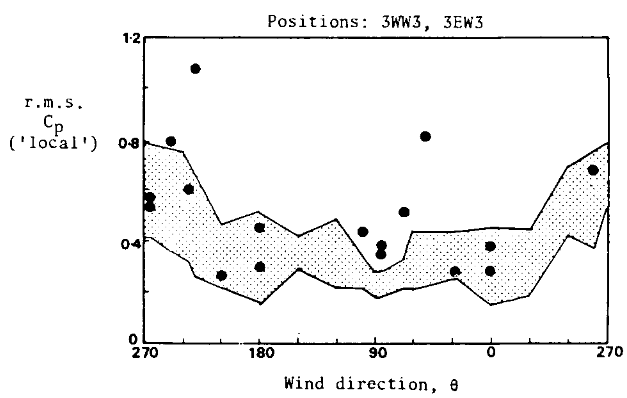

Figure A-4. Comparison of 'Local' Mean and RMS Pressure Coefficients, Refs. [A7] and [A8]

(a)

(b)

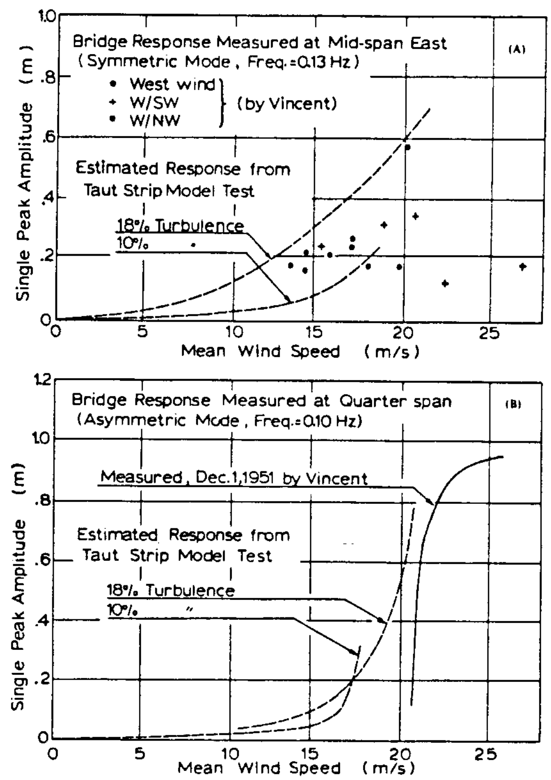

Figure A-5. Comparison of Response Amplitudes of Symmetric and Asymmetric Modes for Golden Gate Bridge, Ref. [A9]

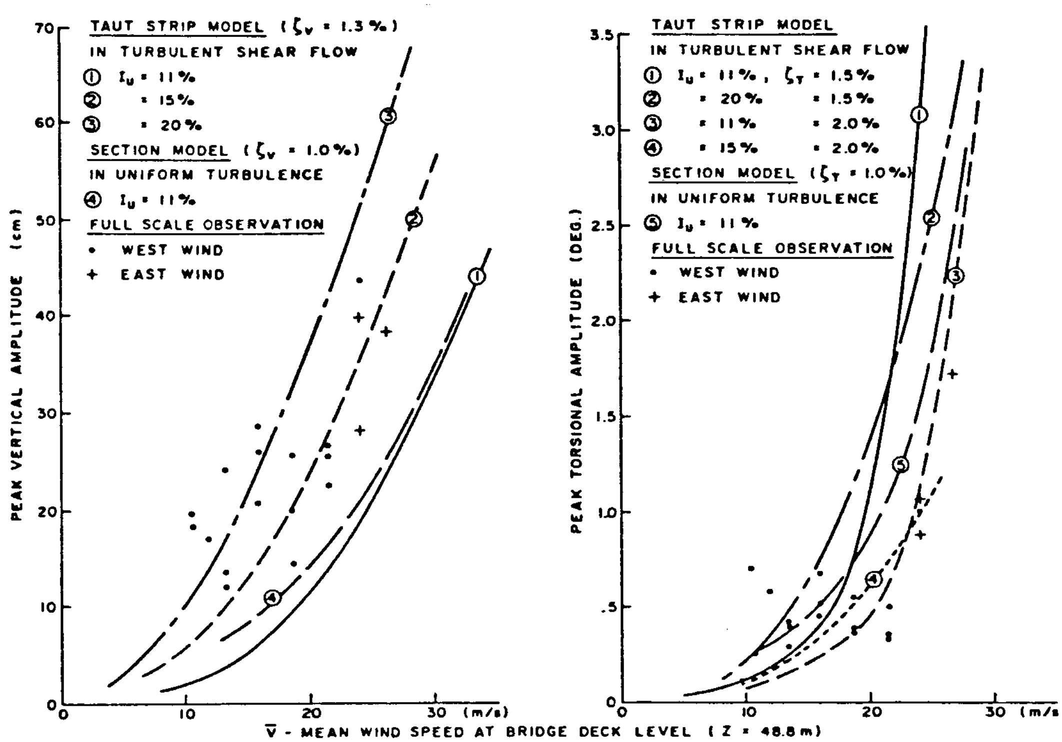

Figure A-6. Summary of Wind Tunnel and Full-Scale Bronx Whitestone Bridge Response, Wind Normal to Bridge Centerline, Ref. [A9]

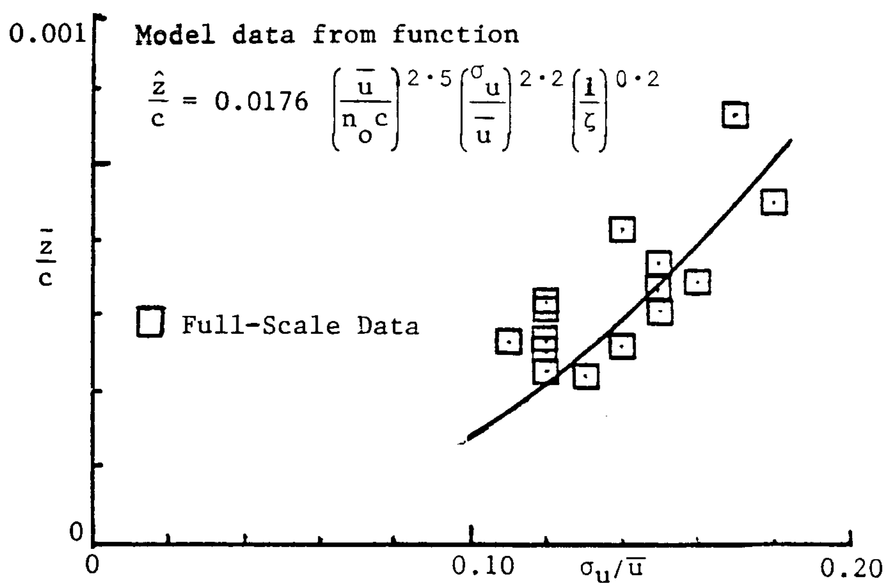

Figure A-7. Full-Scale Average Hourly Maximum Center Deck Vertical Displacement as a Function of the Turbulence Intensity of the Incident Wind Flow, at $\bar{u}/n_o c = 0.1$, $\zeta = 0.01$, $\beta = 0°$, Ref. [A10] behavior in wind of towers and chimneys [A11], natural ventilation studies [A12], investigations of flow over various topographies [A13,A14], and others. Interesting flow data was presented by Flay and Teunissen [A13]. The authors compared simulated (in a wind tunnel) and full-scale wind structure over a suburban airport. The agreement between the compared data, as shown in Figures A-8 and A-9 was good. A similar agreement for a flow over an isolated low hill, see Figure A-10, was reported by Teunissen [A14].

As follows from the preceding discussion of a few of the many published comparisons, agreement between the model and full-scale measurements is generally good. Due to uncertainties associated with full-scale conditions and certain wind-tunnel modeling limitations, addressed by Sparks [A15], the agreement cannot be expected to be perfect. Determination of the error margins require knowledge of the full-scale data, which at the present time are available for only a very limited number of cases. More full-scale studies of flow situations and wind effects on various structures (including heliostats and stretched membrane modules) would be valuable to verify improvements in modeling techniques and to provide better documentation on validity of wind-tunnel testing.

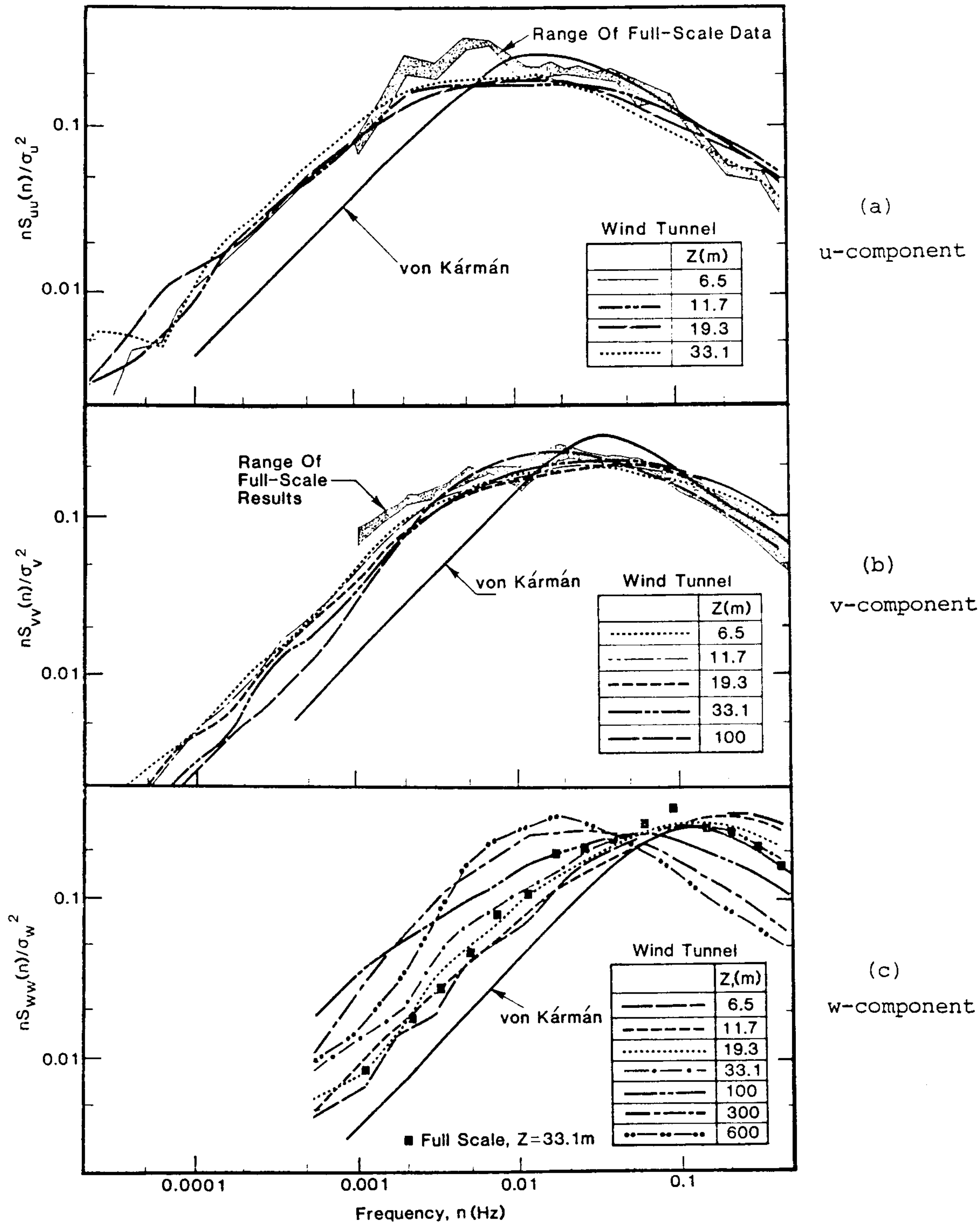

Figure A-8. Wind-Tunnel and Full-Scale Power Spectra at NAE Tower Location, Ref. [A13]

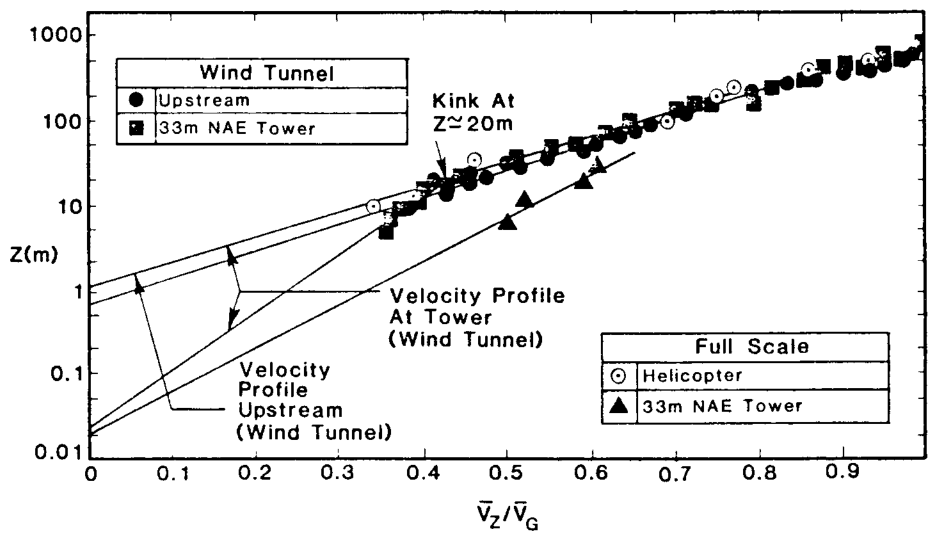

Figure A-9. Wind-Tunnel/Full-Scale Velocity Profile Comparison Above Airport, Ref. [A13]

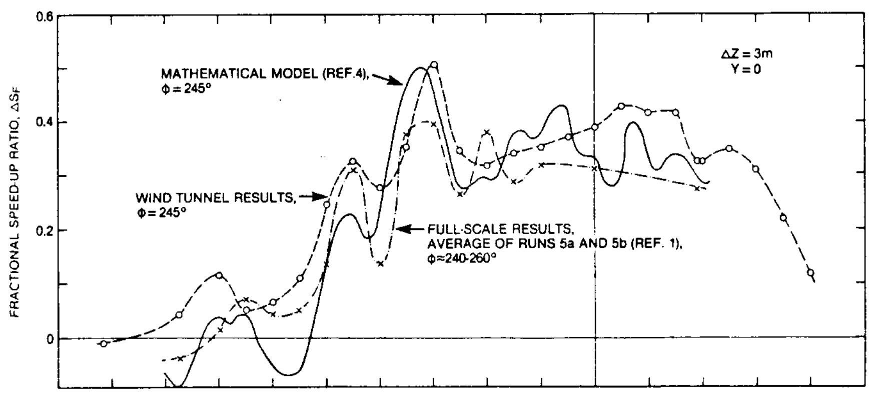

Figure A-10. Comparison of Wind-Tunnel, Full-Scale and Mathematical-Model Values of Fractional Speed-up Ratio at ΔZ = 3 m Above Main East-West Tower Line, Ref. [A14]

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APPENDIX B

WIND-TUNNEL DATA FOR ISOLATED HELIOSTAT

Table B-1.

WD	EL	AZ	Run #
0	80	270	81
22.5	80	270	83
45	80	270	85
67.5	80	270	87
90	80	270	89
112.5	80	270	91
135	80	270	93
157.5	80	270	95
180	80	270	97
0	0	270	115
22.5	0	270	113
45	0	270	111
67.5	0	270	109
90	0	270	107
112.5	0	270	105
135	0	270	103
157.5	0	270	101
180	0	270	99

Table B-1. continued

WD	EL	AZ	Run #
0	45	270	136
22.5	45	270	138
45	45	270	140
67.5	45	270	142
90	45	270	144
112.5	45	270	146
135	45	270	148
157.5	45	270	150
180	45	270	152
0	84	270	170
22.5	84	270	168
45	84	270	166
67.5	84	270	164
90	84	270	162
112.5	84	270	160
135	84	270	158
157.5	84	270	156
180	84	270	155

Table B-1. continued

WD	EL	AZ	Run #
0	87	270	172
22.5	87	270	174
45	87	270	176
67.5	87	270	178
90	87	270	180
112.5	87	270	182
135	87	270	184
157.5	87	270	186
180	87	270	188
0	90	270	206
22.5	90	270	204
45	90	270	202
67.5	90	270	200
90	90	270	198
112.5	90	270	196
135	90	270	194
157.5	90	270	192
180	90	270	190

Table B-1. continued

WD	EL	AZ	Run #
0	15	270	246
45	15	270	244
90	15	270	242
135	15	270	240
180	15	270	238
0	30	270	282
45	30	270	230
90	30	270	232
135	30	270	234
180	30	270	236
0	60	270	226
45	60	270	224
90	60	270	222
135	60	270	220
180	60	270	218
0	75	270	208
45	75	270	210
90	75	270	212
135	75	270	214
180	75	270	216

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
01	0.0	90.0	270.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	.00	.29	.00	.05	.02
MAX :	.25	.02	.51	.04	.12	.06
MIN :	.05	.03	.09	.05	.02	.01
RMS :	.03	.01	.06	.01	.02	.01
GFACT :	1.99	13.29	1.76	53.26	2.54	2.24
PFACT :	4.42	3.40	3.07	3.76	3.02	6.26

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
03	22.5	90.0	270.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.11	.02	.31	.02	.07	.03
MAX :	.23	.02	.51	.07	.16	.05
MIN :	.04	.05	.11	.02	.01	.00
RMS :	.03	.01	.06	.01	.02	.01
GFACT :	2.03	3.31	1.66	3.00	2.29	2.06
PFACT :	4.30	3.76	3.56	3.71	4.56	3.30

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
05	45.0	90.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.09	.02	.27	.07	.03	.02
MAX :	.19	.02	.49	.12	.10	.05
MIN :	.00	.08	.04	.01	.04	.00
RMS :	.03	.01	.06	.01	.02	.01
GFACT :	2.06	3.22	1.81	1.78	2.93	2.25
PFACT :	3.92	4.41	3.69	3.53	3.37	4.01

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
07	67.5	90.0	270.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.05	-.04	.10	.03	.00	.00
MAX :	.14	.00	.30	.09	.07	.02
MIN :	-.03	-.10	.14	.04	.06	.03
RMS :	.02	.01	.06	.02	.02	.01
GFACT :	2.85	2.31	3.01	2.75	14.50	35.94
PFACT :	4.17	3.75	3.10	3.31	3.72	3.35

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
89	90.0	80.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.00	-.04	-.01	.01	.01	.01
MAX :	.07	.02	.19	.00	.04	.04
MIN :	-.07	-.10	.23	-.03	.06	.02
RMS :	.02	.01	.05	.02	.01	.01
GFACT :	21.40	2.59	24.00	14.85	4.58	5.21
PFACT :	3.70	4.18	4.24	4.13	3.67	4.01

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
91	112.5	80.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.04	-.04	.13	.03	.01	.00
MAX :	.02	.01	.08	.05	.07	.01
MIN :	-.13	-.09	-.55	.12	-.04	.02
RMS :	.02	.01	.08	.02	.02	.01
GFACT :	3.15	2.19	4.34	4.09	7.51	15.42
PFACT :	4.40	3.53	5.62	4.61	4.10	3.52

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
93	135.0	80.0	270.0	40.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.09	-.02	.29	.03	.04	.03
MAX :	-.02	.01	.02	.04	.13	.05
MIN :	-.20	-.07	.72	.10	.03	.00
RMS :	.03	.01	.10	.02	.02	.01
GFACT :	2.27	2.86	2.52	4.13	3.58	1.97
PFACT :	4.14	4.02	4.54	4.12	4.28	3.94

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
95	157.5	80.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.10	-.01	.29	.02	.02	.02
MAX :	-.02	.04	.04	.05	.11	.04
MIN :	-.23	-.05	-.68	.07	.05	.01
RMS :	.03	.01	.10	.02	.02	.01
GFACT :	2.28	5.72	2.35	4.09	4.99	2.35
PFACT :	4.33	3.76	3.96	3.02	3.96	3.23

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
97	180.0	80.0	270.0	40.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.10	.00	-.24	.00	.03	.04
MAX :	-.03	.04	-.02	.05	.15	.07
MIN :	-.26	-.03	-.72	.06	.05	.02
RMS :	.03	.01	.09	.02	.02	.01
GFACT :	2.60	9.63	3.02	18.44	5.89	1.66
FFACT :	5.33	3.70	5.30	3.35	5.39	4.30

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
99	180.0	0.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-1.26	.07	-.09	.02	.07	.00
MAX :	-.60	.15	-.04	.06	.62	.04
MIN :	-2.56	.01	-.16	.05	.13	.05
RMS :	.24	.02	.01	.01	.06	.01
GFACT :	2.03	2.21	1.83	3.76	8.88	34.91
FFACT :	5.37	5.00	5.08	3.49	8.49	3.71

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
101	157.5	0.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-1.23	.06	-.01	.02	.04	.02
MAX :	-.63	.12	.04	.06	.24	.06
MIN :	-2.03	.01	-.08	-.03	-.14	.04
RMS :	.23	.02	.01	.01	.05	.02
GFACT :	1.65	1.97	6.17	2.99	5.22	3.84
FFACT :	3.48	3.59	5.48	2.83	4.00	2.77

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
103	135.0	0.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-1.03	.02	.05	.02	.09	.05
MAX :	-.42	.07	-.00	.06	.08	.09
MIN :	-1.98	-.02	.10	.01	-.26	-.00
RMS :	.21	.01	.02	.01	.04	.01
GFACT :	1.92	3.64	2.11	2.60	2.09	1.09
FFACT :	4.58	4.58	3.29	3.90	3.97	3.41

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
105	112.5	0.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.74	-.01	-.02	.02	.07	.08
MAX :	-.17	.04	.02	.07	.10	.13
MIN :	-1.46	-.06	-.07	.02	.23	.02
RMS :	.20	.01	.01	.01	.04	.01
GFACT :	1.96	4.44	3.74	2.78	3.14	1.66
PFACT :	3.62	3.64	4.23	3.73	3.50	3.66

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
107	90.0	0.0	270.0	40.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.05	-.05	.01	.02	.02	.00
MAX :	.51	-.01	.04	.02	.11	.06
MIN :	-.36	-.11	.06	-.07	.18	.04
RMS :	.12	.01	.01	.01	.04	.02
GFACT :	9.33	2.18	4.73	3.41	8.12	15.44
PFACT :	3.77	4.52	3.89	3.93	4.18	3.41

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
109	67.5	0.0	270.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.90	-.12	-.10	-.01	.07	.05
MAX :	1.59	-.05	.04	.03	.23	.01
MIN :	.35	-.22	-.18	-.06	.15	.10
RMS :	.22	.03	.02	.01	.05	.01
GFACT :	1.77	1.84	1.77	5.72	3.48	1.90
PFACT :	3.16	3.46	3.61	3.96	3.48	3.41

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
111	45.0	0.0	270.0	40.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.05	-.14	-.03	.02	.06	.00
MAX :	1.99	-.04	.03	.03	.27	.04
MIN :	.43	-.27	-.12	-.07	-.13	.04
RMS :	.22	.03	.02	.01	.05	.01
GFACT :	1.90	1.96	3.82	3.94	4.65	42.52
PFACT :	4.31	4.28	3.96	3.67	4.24	4.02

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
113	22.5	0.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.19	-.13	-.08	-.01	.08	.01
MAX :	2.22	-.03	.00	.04	.32	.08
MIN :	.60	-.25	-.18	.09	.19	-.04
RMS :	.24	.03	.03	.02	.06	.02
GFACT :	1.86	1.94	2.35	6.09	4.03	7.74
PFACT :	4.23	3.96	3.89	4.69	3.89	4.44

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
115	0.0	0.0	270.0	40.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.17	-.11	-.05	.01	.09	.05
MAX :	2.11	-.03	.02	.04	.28	.10
MIN :	.46	-.23	-.15	.08	.10	.00
RMS :	.24	.03	.03	.01	.05	.02
GFACT :	1.80	2.20	3.21	9.05	3.12	2.07
PFACT :	3.88	4.94	4.08	5.23	3.67	3.32

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
136	0.0	45.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.71	-.03	.68	.00	.14	.04
MAX :	1.25	.00	.99	.06	.27	.09
MIN :	.36	-.08	.41	.05	.04	.00
RMS :	.12	.01	.10	.01	.03	.01
GFACT :	1.76	2.42	1.46	32.67	1.99	2.20
PFACT :	4.42	4.53	3.07	3.01	5.11	4.11

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
138	22.5	45.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.73	-.04	.72	.05	.11	.00
MAX :	1.23	-.00	1.09	.12	.25	.07
MIN :	.39	-.09	.45	.00	.01	.04
RMS :	.13	.01	.11	.02	.03	.01
GFACT :	1.69	2.11	1.51	2.35	2.15	21.57
PFACT :	3.91	3.40	3.39	4.12	4.41	3.09

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
140	45.0	45.0	270.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.71	-.06	.68	.07	.10	.00
MAX :	1.28	-.01	1.10	.12	.25	.04
MIN :	.32	-.12	.35	.01	.02	.04
RMS :	.14	.02	.12	.02	.03	.01
GFACT :	1.81	2.10	1.61	1.83	2.59	7.09
PFACT :	4.23	3.71	3.60	3.67	4.86	3.38

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
142	67.5	45.0	270.0	40.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.41	-.06	.41	.09	.05	.01
MAX :	.71	-.00	.79	.15	.17	.04
MIN :	.06	-.13	.12	.04	.05	.04
RMS :	.11	.02	.10	.02	.03	.01
GFACT :	2.20	2.34	1.95	1.67	3.44	4.82
PFACT :	4.31	4.23	3.87	3.75	4.03	3.17

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
144	90.0	45.0	270.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	-.04	-.01	.03	.02	.03
MAX :	.34	.01	.24	.08	.08	.09
MIN :	-.24	-.10	-.22	.04	-.11	.03
RMS :	.07	.01	.05	.02	.03	.01
GFACT :	12.25	2.65	31.80	3.08	6.78	3.42
PFACT :	4.24	4.43	3.92	3.17	3.25	4.47

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
146	112.5	45.0	270.0	40.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.33	-.03	-.34	-.07	.00	.06
MAX :	-.02	.02	-.11	-.01	.15	.11
MIN :	-.75	-.08	-.70	-.16	.13	.02
RMS :	.11	.01	.10	.02	.04	.01
GFACT :	2.28	2.82	2.04	2.38	39.14	1.67
PFACT :	3.84	3.73	3.67	5.16	4.14	3.58

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
148	135.0	45.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.69	.01	-.74	-.06	.05	.04
MAX :	-.29	.08	-.40	.01	.24	.09
MIN :	-1.41	-.05	-1.39	-.14	-.06	-.01
RMS :	.16	.02	.15	.02	.04	.01
GFACT :	2.05	6.74	1.87	2.26	4.39	2.46
PFACT :	4.58	3.88	4.39	3.85	4.55	3.02

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
150	157.5	45.0	270.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.75	.04	-.82	-.03	.04	.04
MAX :	-.29	.09	-.42	.05	.22	.09
MIN :	-1.34	-.02	-1.36	-.11	-.16	-.01
RMS :	.16	.01	.14	.02	.04	.02
GFACT :	1.77	2.07	1.66	3.65	5.26	2.08
PFACT :	3.71	3.19	3.75	3.88	4.26	2.97

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
152	180.0	45.0	270.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.77	.05	-.82	.04	.08	.00
MAX :	-.35	.11	-.43	.10	.26	.05
MIN :	-1.47	.01	-1.47	-.03	.06	-.06
RMS :	.16	.01	.15	.02	.04	.01
GFACT :	1.91	2.17	1.78	2.50	3.17	11.67
PFACT :	4.46	4.33	4.36	3.12	4.17	3.15

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
154	180.0	84.0	270.0	40.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.08	.00	-.17	-.01	.01	.01
MAX :	-.02	.04	.02	.03	.11	.06
MIN :	-.18	-.03	-.55	-.05	-.04	-.03
RMS :	.02	.01	.07	.01	.02	.01
GFACT :	2.35	17.04	3.14	5.01	10.65	5.21
PFACT :	4.67	3.93	5.14	2.98	5.37	3.49

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
156	157.5	84.0	270.0	40.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.09	-.01	-.23	.02	.04	.00
MAX :	-.03	.05	-.01	.06	.11	.05
MIN :	-.19	-.05	-.56	-.08	-.02	.04
RMS :	.02	.01	.09	.02	.02	.01
GFACT :	2.08	4.85	2.49	4.48	2.67	16.04
PFACT :	4.11	3.58	3.96	3.46	3.71	3.96

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
158	135.0	84.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.07	-.03	-.21	.01	.01	.03
MAX :	-.00	.02	.03	.06	.08	.06
MIN :	-.16	-.08	-.58	-.09	-.06	.01
RMS :	.02	.01	.08	.02	.02	.01
GFACT :	2.45	2.96	2.71	8.25	8.23	2.31
PFACT :	4.40	3.97	4.39	4.15	3.59	3.65

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
160	112.5	84.0	270.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.02	-.04	-.09	-.01	-.02	.07
MAX :	.04	.01	.12	.05	.04	.11
MIN :	-.09	-.08	-.34	-.07	-.09	.03
RMS :	.02	.01	.07	.02	.02	.01
GFACT :	4.33	2.15	3.66	5.59	4.80	1.73
PFACT :	4.16	3.35	3.61	3.12	4.18	4.82

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
162	90.0	84.0	270.0	40.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.00	-.04	.04	.01	.01	.02
MAX :	.05	.00	.20	.08	.05	.07
MIN :	-.06	-.10	-.24	-.07	.03	.02
RMS :	.01	.01	.05	.02	.01	.01
GFACT :	41.56	2.42	4.81	5.83	6.82	3.49
PFACT :	4.55	4.59	3.32	4.17	3.87	4.60

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
164	67.5	84.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.04	-.04	.11	.02	.00	.03
MAX :	.12	.00	.34	.04	.05	.08
MIN :	-.03	-.09	-.15	-.09	.05	.00
RMS :	.02	.01	.06	.02	.01	.01
GFACT :	2.78	2.24	3.19	4.98	14.66	2.81
PFACT :	4.08	3.52	4.04	4.05	3.45	4.13

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
166	45.0	84.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.08	-.04	.22	-.01	.03	.04
MAX :	.17	.00	.42	.06	.08	.09
MIN :	.01	-.09	-.04	.07	.03	.01
RMS :	.02	.01	.06	.02	.02	.01
GFACT :	2.09	2.15	1.90	5.80	2.75	2.38
PFACT :	4.09	4.26	3.30	2.64	3.59	4.59

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
168	22.5	84.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.11	-.00	.25	.02	.05	.01
MAX :	.21	.02	.45	.06	.12	.06
MIN :	.03	-.04	-.04	-.02	.01	.02
RMS :	.02	.01	.05	.01	.02	.01
GFACT :	1.95	12.75	1.80	2.81	2.27	5.29
PFACT :	4.34	4.01	3.78	3.15	4.16	4.03

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
170	0.0	84.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.10	-.01	.21	.01	.04	.00
MAX :	.19	.02	.41	.04	.11	.02
MIN :	.04	-.03	.04	.06	.01	.04
RMS :	.02	.01	.05	.01	.02	.01
GFACT :	1.87	4.39	1.91	6.60	2.55	9.67
PFACT :	4.19	3.68	4.09	3.82	4.23	4.04

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
172	0.0	87.0	270.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.08	.02	.06	.05	.00	.03
MAX :	.13	.04	.24	.09	.05	.07
MIN :	.03	-.01	-.13	.02	.05	.00
RMS :	.02	.01	.04	.01	.01	.01
GFACT :	1.67	2.23	4.24	1.67	14.26	2.41
PFACT :	3.32	3.58	4.39	3.62	3.66	5.19

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
174	22.5	87.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.06	-.01	.06	.01	.01	.02
MAX :	.14	.02	.26	.05	.06	.06
MIN :	.00	-.05	-.23	.03	.04	.00
RMS :	.02	.01	.05	.01	.02	.01
GFACT :	2.26	3.36	4.04	4.01	4.52	2.60
PFACT :	4.94	3.69	4.03	2.93	3.11	4.70

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
176	45.0	87.0	270.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.05	-.03	.03	.03	.00	.02
MAX :	.11	.01	.20	.07	.05	.06
MIN :	.01	-.07	-.29	.02	.06	.00
RMS :	.01	.01	.06	.01	.01	.01
GFACT :	2.14	2.52	6.60	2.75	15.35	3.23
PFACT :	4.18	3.51	3.08	3.26	3.68	5.9[illegible]

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
178	67.5	87.0	270.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	-.03	.02	.04	.00	.02
MAX :	.07	.02	.19	.09	.05	.07
MIN :	-.02	-.08	-.22	-.03	.07	.00
RMS :	.01	.01	.06	.02	.02	.01
GFACT :	2.71	2.95	12.38	2.68	16.83	2.92
PFACT :	3.43	3.98	3.10	3.70	3.66	6.37

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
180	90.0	87.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	-.04	-.01	-.00	.01	.04
MAX :	.04	.00	.15	.05	.07	.06
MIN :	-.02	-.10	-.20	-.08	.07	.01
RMS :	.01	.01	.05	.02	.01	.01
GFACT :	6.24	2.35	34.37	880.49	6.38	1.81
PFACT :	4.01	4.36	4.14	4.09	3.96	3.72

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
182	112.5	87.0	270.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.02	-.03	-.05	.01	.00	.02
MAX :	.01	.01	.15	.07	.06	.06
MIN :	-.06	-.09	-.31	.05	.04	-.01
RMS :	.01	.01	.06	.02	.02	.01
GFACT :	2.62	2.75	5.83	5.38	14.52	2.85
PFACT :	3.41	4.31	4.32	3.58	3.63	3.25

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
184	135.0	87.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.04	-.03	-.07	.00	.01	.03
MAX :	-.01	.01	.13	.07	.07	.08
MIN :	-.09	-.08	.37	.07	.06	-.00
RMS :	.01	.01	.07	.02	.02	.02
GFACT :	2.03	2.80	5.40	20.26	10.06	2.43
PFACT :	3.51	4.24	4.58	2.93	3.43	2.60

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
186	157.5	87.0	270.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.06	.00	-.04	.04	.00	.01
MAX :	-.02	.05	.17	.10	.07	.03
MIN :	-.11	-.03	-.32	-.02	.06	.01
RMS :	.01	.01	.06	.01	.02	.01
GFACT :	1.89	47.85	7.28	2.40	11.07	5.02
PFACT :	3.48	4.71	4.61	3.99	3.18	2.99

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
188	180.0	87.0	270.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.06	-.01	-.01	-.01	-.00	.02
MAX :	-.02	.02	.24	.04	.06	.04
MIN :	-.12	-.04	-.32	-.04	-.00	.01
RMS :	.01	.01	.05	.01	.01	.01
GFACT :	1.88	5.86	30.32	7.44	27.07	2.79
PFACT :	3.75	4.49	6.67	3.59	5.18	2.65

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
190	180.0	90.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.05	-.00	.04	.01	.07	.03
MAX :	.00	.03	.25	.04	.01	.06
MIN :	-.11	-.03	-.22	.06	.13	.01
RMS :	.01	.01	.05	.01	.02	.01
GFACT :	2.48	8.12	6.79	10.40	1.74	1.60
PFACT :	4.45	2.78	4.69	3.72	3.49	2.56

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
192	157.5	90.0	270.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.05	-.01	.02	.01	-.05	.02
MAX :	-.00	.02	.23	.06	.01	.05
MIN :	-.10	-.05	-.25	.05	.10	.00
RMS :	.02	.01	.06	.01	.02	.01
GFACT :	2.01	3.84	10.78	5.15	2.06	2.12
PFACT :	3.33	4.03	3.73	3.62	3.42	4.11

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
194	135.0	90.0	270.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.04	-.03	-.01	.01	.03	.01
MAX :	.01	.02	.25	.07	.04	.02
MIN :	-.09	-.09	-.27	.06	.10	.02
RMS :	.01	.01	.06	.02	.02	.01
GFACT :	2.20	2.83	47.18	5.96	3.46	2.38
PFACT :	3.84	4.39	4.40	3.28	4.31	2.44

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
196	112.5	90.0	270.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.02	-.05	-.02	.02	.02	.02
MAX :	.01	-.01	.17	.04	.04	.06
MIN :	-.05	-.10	-.30	-.09	.07	.00
RMS :	.01	.01	.06	.02	.02	.01
GFACT :	3.04	2.05	13.26	3.74	3.27	2.33
PFACT :	3.63	3.78	4.57	3.60	3.00	3.17

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
198	90.0	90.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	-.04	.02	-.00	.03	.03
MAX :	.05	.00	.18	.05	.01	.06
MIN :	-.01	-.10	-.20	-.07	.00	.00
RMS :	.01	.01	.05	.02	.01	.01
GFACT :	3.68	2.17	9.36	15.26	2.75	1.87
PFACT :	4.95	3.82	3.10	3.84	4.35	3.30

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
200	67.5	90.0	270.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	-.04	-.05	.00	-.01	.01
MAX :	.07	-.00	.19	.06	.04	.01
MIN :	-.01	-.09	-.34	-.08	.06	.03
RMS :	.01	.01	.06	.02	.01	.01
GFACT :	2.41	2.15	7.01	87.07	4.80	3.19
PFACT :	3.43	3.83	4.76	3.72	3.56	3.54

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
202	45.0	90.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.05	-.02	-.04	.01	.01	.02
MAX :	.10	.01	.17	.07	.05	.05
MIN :	.00	-.06	-.35	-.05	.05	.01
RMS :	.01	.01	.07	.02	.01	.01
GFACT :	2.06	2.68	8.42	4.81	9.72	2.28
PFACT :	3.97	3.48	4.54	3.45	3.45	2.84

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
204	22.5	90.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.07	-.02	.04	.01	.01	.03
MAX :	.13	.01	.26	.03	.04	.06
MIN :	.02	-.05	-.18	-.06	.00	.00
RMS :	.02	.01	.06	.01	.02	.01
GFACT :	1.86	2.49	6.85	5.20	15.58	2.13
PFACT :	3.78	3.45	3.88	3.85	3.86	4.40

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
206	0.0	90.0	270.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.06	-.00	-.03	.00	.01	.00
MAX :	.12	.03	.18	.03	.06	.05
MIN :	.02	-.02	-.21	-.04	-.05	.01
RMS :	.01	.01	.04	.01	.01	.01
GFACT :	1.92	21.24	8.38	27.82	5.42	10.67
PFACT :	3.87	3.54	4.29	4.07	3.40	7.47

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
208	0.0	75.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.14	.01	.43	.00	.16	.01
MAX :	.31	.04	.71	.06	.24	.03
MIN :	.04	-.02	.23	-.06	.00	.02
RMS :	.04	.01	.07	.01	.02	.01
GFACT :	2.16	5.80	1.66	52.67	1.51	5.06
PFACT :	4.61	4.40	3.99	4.43	3.73	3.63

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
210	45.0	75.0	270.0	40.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	-.05	.34	.05	.06	.02
MAX :	.26	-.00	.62	.10	.13	.06
MIN :	.01	-.09	.13	-.00	.00	.00
RMS :	.03	.01	.07	.01	.02	.01
GFACT :	1.94	1.96	1.83	2.15	2.18	2.75
PFACT :	3.74	3.75	4.00	3.50	3.83	4.23

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
212	90.0	75.0	270.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.00	-.03	-.03	.02	.01	.02
MAX :	.10	.01	.18	.08	.04	.06
MIN :	-.11	-.09	-.27	.04	.07	.01
RMS :	.02	.01	.05	.02	.01	.01
GFACT :	19.63	2.62	8.45	4.56	5.03	3.22
PFACT :	4.17	4.04	4.53	3.63	4.00	5.32

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
214	135.0	75.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.12	-.04	-.36	-.07	.02	.06
MAX :	-.02	.01	-.05	.00	.13	.07
MIN :	-.26	-.10	-.76	-.14	.07	.03
RMS :	.04	.01	.11	.02	.03	.01
GFACT :	2.19	2.76	2.10	2.06	5.25	1.61
PFACT :	3.63	4.32	3.52	3.44	4.36	3.00

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
216	180.0	75.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.15	.01	-.37	.02	.07	.02
MAX :	-.04	.06	-.05	.07	.18	.05
MIN :	-.31	-.04	-.76	-.04	-.01	.00
RMS :	.04	.01	.11	.02	.03	.01
GFACT :	2.02	5.71	2.04	4.34	2.48	2.15
PFACT :	3.72	3.82	3.40	3.08	3.80	2.75

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
218	180.0	60.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.49	.02	-.80	.01	.13	.01
MAX :	-.19	.08	-.38	.05	.28	.04
MIN :	-.85	-.04	-1.32	-.09	.01	.02
RMS :	.11	.02	.17	.02	.04	.01
GFACT :	1.75	4.03	1.66	6.11	2.18	3.35
PFACT :	3.24	3.85	3.08	3.49	3.45	3.08

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
220	135.0	60.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.41	-.01	.69	-.07	.03	.02
MAX :	-.12	.05	-.26	.02	.22	.05
MIN :	-.80	-.07	-1.25	.15	.01	.01
RMS :	.10	.02	.15	.02	.04	.01
GFACT :	1.96	8.24	1.82	2.27	2.57	2.14
PFACT :	3.93	3.95	3.72	3.74	3.72	2.70

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
222	90.0	60.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.02	-.04	.02	.02	.02	.01
MAX :	.19	.01	.27	.09	.06	.04
MIN :	-.19	-.10	-.27	.05	.10	.01
RMS :	.05	.02	.06	.02	.02	.01
GFACT :	12.87	2.83	11.37	4.34	4.49	2.96
PFACT :	3.78	4.36	4.20	3.71	3.07	3.03

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
224	45.0	60.0	270.0	40.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.42	-.05	.68	.03	.11	.00
MAX :	.75	-.00	1.14	.14	.21	.02
MIN :	.19	-.10	.40	.02	.03	.04
RMS :	.09	.01	.12	.02	.03	.01
GFACT :	1.80	2.22	1.67	1.92	1.87	70.04
PFACT :	3.83	3.74	3.98	3.74	3.46	4.43

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
226	0.0	60.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.50	-.02	.79	.01	.15	.04
MAX :	.79	.02	1.19	.05	.20	.07
MIN :	.25	-.06	.47	.03	.06	.01
RMS :	.09	.01	.12	.02	.03	.01
GFACT :	1.59	2.53	1.50	6.58	1.00	1.65
PFACT :	3.27	3.87	3.32	3.93	4.05	3.64

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
228	0.0	30.0	270.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.94	-.03	.58	.01	.07	.08
MAX :	1.58	.01	.88	.07	.20	.14
MIN :	.51	-.07	.36	.05	.06	.03
RMS :	.17	.01	.09	.01	.04	.02
GFACT :	1.68	2.49	1.52	9.15	3.04	1.79
PFACT :	3.83	3.71	3.29	4.43	3.00	4.04

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
230	45.0	30.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.86	-.07	.56	.04	.08	.02
MAX :	1.70	-.01	.89	.10	.24	.04
MIN :	.43	-.14	.33	.01	.09	.05
RMS :	.17	.02	.09	.01	.04	.01
GFACT :	1.97	2.09	1.59	2.56	3.05	3.09
PFACT :	4.97	4.18	3.61	4.49	4.30	2.72

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
232	90.0	30.0	270.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.05	-.05	.01	.01	.04	.03
MAX :	.46	.00	.21	.05	.08	.07
MIN :	-.37	-.11	.18	.06	.19	.01
RMS :	.10	.02	.05	.02	.04	.01
GFACT :	8.97	2.37	40.18	7.78	4.23	2.87
PFACT :	4.08	4.21	4.07	3.20	3.92	4.06

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
234	135.0	30.0	270.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.88	.01	.64	.07	.01	.06
MAX :	-.38	.07	-.35	.01	.23	.09
MIN :	-1.67	-.04	-1.06	.13	.17	.02
RMS :	.19	.01	.12	.02	.05	.01
GFACT :	1.89	8.23	1.67	1.90	10.50	1.58
PFACT :	4.06	4.26	3.59	3.77	[illegible]	3.37

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
236	180.0	30.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.95	.04	-.68	.01	.04	.02
MAX :	-.40	.09	-.39	.07	.27	.06
MIN :	-1.72	-.00	-1.11	-.06	.13	.03
RMS :	.19	.01	.12	.02	.05	.01
GFACT :	1.80	2.14	1.62	5.99	6.46	3.53
PFACT :	3.93	3.62	3.60	3.12	5.00	3.33

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
238	180.0	15.0	270.0	40.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-1.09	.00	-.39	.03	.06	.00
MAX :	-.51	.03	-.20	.09	.17	.04
MIN :	-2.07	-.02	-.64	.01	.36	-.06
RMS :	.23	.01	.07	.01	.06	.01
GFACT :	1.90	8.50	1.67	2.64	5.57	57.98
PFACT :	4.21	4.42	3.69	3.66	5.21	3.13

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
240	135.0	15.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-1.00	-.02	.34	.00	.04	.04
MAX :	-.44	.01	-.16	.03	.24	.09
MIN :	-1.91	-.06	-.60	.04	.23	.00
RMS :	.21	.01	.06	.01	.05	.02
GFACT :	1.91	2.89	1.75	10.46	6.46	2.30
PFACT :	4.27	3.71	4.07	3.93	3.87	3.20

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
242	90.0	15.0	270.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.00	-.04	.01	.01	.03	.03
MAX :	.39	-.01	.12	.03	.11	.00
MIN :	-.45	-.10	-.10	.05	.17	.01
RMS :	.12	.01	.03	.01	.04	.01
GFACT :	211.10	2.20	7.81	3.60	5.63	2.75
PFACT :	3.32	4.72	3.61	3.26	3.90	3.72

1

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
244	45.0	15.0	270.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.97	-.03	.28	.01	.04	.01
MAX :	1.80	.02	.46	.06	.20	.03
MIN :	.43	-.08	.16	.03	.13	.05
RMS :	.20	.01	.04	.01	.04	.01
GFACT :	1.85	2.80	1.64	4.24	4.61	4.11
PFACT :	4.17	4.07	4.20	4.37	3.74	3.23

DATA FOR FILE : SINGL

RUN #	WIND	EL	AZ	VEL
246	0.0	15.0	270.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.10	-.00	.26	.04	.07	.06
MAX :	1.87	.03	.41	.00	.26	.11
MIN :	.57	-.03	.15	-.00	.11	.00
RMS :	.21	.01	.04	.01	.05	.02
GFACT :	1.70	13.75	1.59	2.31	3.86	1.78
PFACT :	3.69	2.83	3.55	3.77	4.32	2.75

1

APPENDIX C

WIND-TUNNEL DATA FOR ISOLATED HELIOSTAT

Heliostat 1, Configuration 1-A

Case	Run #	WD	EL	AZ	Day	Time
Smr AM	348	0	25	350	172	8 AM
	349	337.5	25	350	172	8 AM
	350	315	25	350	172	8 AM
	351	292.5	25	350	172	8 AM
	352	270	25	350	172	8 AM
	353	265	25	350	172	8 AM
	354	247.5	25	350	172	8 AM
Smr Noon	355	247.5	45	305	172	0 PM
	356	265	45	305	172	0 PM
	357	270	45	305	172	0 PM
	358	292.5	45	305	172	0 PM
	359	315	45	305	172	0 PM
	360	337.5	45	305	172	0 PM
	361	0	45	305	172	0 PM
Wntr AM	331	0	10	330	355	8 AM
	325	337.5	10	330	355	8 AM
	326	315	10	330	355	8 AM
	327	292.5	10	330	355	8 AM
	328	270	10	330	355	8 AM
	329	265	10	330	355	8 AM
	330	247.5	10	330	355	8 AM

Heliostat 1, Configuration 1-A. continued

Case	Run #	WD	EL	AZ	Day	Time
Wntr Noon	345	0	20	305	355	0 PM
	344	337.5	20	305	355	0 PM
	343	315	20	305	355	0 PM
	342	292.5	20	305	355	0 PM
	341	270	20	305	355	0 PM
	340	265	20	305	355	0 PM
	339	247.5	20	305	355	0 PM
Wntr PM	338	247.5	10	275	355	4 PM
	337	265	10	275	355	4 PM
	336	270	10	275	355	4 PM
	335	292.5	10	275	355	4 PM
	334	315	10	275	355	4 PM
	333	337.5	10	275	355	4 PM
	332	0	10	275	355	4 PM
Ver. Stow	346	337.5	0	330	355	8 AM
Hor. Stow	347	337.5	90	330	355	8 AM

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
325	337.5	10.0	330.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.07	.03	.14	.12	.11	.06
MAX :	2.29	.04	.27	.26	.45	.01
MIN :	-.30	.11	.06	.00	.19	.11
RMS :	.26	.02	.02	.03	.07	.03
GFACT :	2.13	4.00	1.62	2.17	4.29	1.72
PFACT :	4.77	4.05	3.70	4.05	4.67	3.66

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
326	315.0	10.0	330.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.20	.02	.16	.13	.12	.05
MAX :	2.27	.06	.25	.28	.41	.09
MIN :	-.56	.10	.10	.01	.19	.10
RMS :	.25	.02	.02	.04	.07	.02
GFACT :	1.90	5.43	1.49	2.20	3.33	2.08
PFACT :	4.25	3.64	3.52	4.40	4.09	3.56

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
327	292.5	10.0	330.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.24	.00	.17	.12	.10	.00
MAX :	2.23	.06	.24	.26	.37	.04
MIN :	-.62	.06	.11	.01	.17	.06
RMS :	.24	.02	.02	.03	.07	.01
GFACT :	1.80	28.60	1.40	2.07	3.54	20.48
PFACT :	4.20	-3.20	3.14	4.14	3.95	-4.19

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
328	270.0	10.0	330.0	42.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.17	.01	.17	.11	.13	.02
MAX :	2.46	.08	.25	.26	.39	.06
MIN :	-.47	.06	.09	.01	.12	.02
RMS :	.24	.02	.03	.03	.06	.01
GFACT :	2.10	6.18	1.52	2.41	2.91	3.60
PFACT :	5.47	3.35	3.41	4.04	4.15	3.91

1

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
329	265.0	10.0	330.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.13	.02	.16	.09	.10	.02
MAX :	1.94	.09	.24	.22	.33	.05
MIN :	.49	.05	.09	.02	.17	.02
RMS :	.23	.02	.02	.03	.06	.01
GFACT :	1.71	5.52	1.46	2.27	3.39	3.28
PFACT :	3.54	3.66	3.23	3.90	3.93	[illegible]

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
330	247.5	10.0	330.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.01	.03	.15	.07	.09	.04
MAX :	2.00	.10	.26	.20	.34	.10
MIN :	.33	-.05	.07	.03	.15	.00
RMS :	.22	.02	.02	.03	.06	.02
GFACT :	1.97	3.91	1.68	2.05	3.00	2.38
PFACT :	4.51	3.36	4.41	4.12	4.27	[illegible]

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
331	0.0	10.0	330.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.21	-.01	.04	.04	.03	.02
MAX :	1.01	.06	.10	.16	.39	.01
MIN :	.37	.00	.00	.09	.29	.07
RMS :	.15	.02	.01	.03	.06	.01
GFACT :	4.08	14.78	2.46	4.06	14.47	3.04
PFACT :	5.36	3.68	4.22	4.00	5.05	4.59

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
332	0.0	10.0	275.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.51	.04	.03	-.00	.14	.01
MAX :	1.05	.16	.10	.08	.50	.07
MIN :	.35	-.08	.04	.09	.23	.04
RMS :	.34	.03	.02	.03	.09	.01
GFACT :	3.61	4.31	3.17	41.97	3.56	7.57
PFACT :	3.93	3.67	3.54	3.41	3.76	4.19

1

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
333	337.5	10.0	275.0	42.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.10	.09	.09	.02	.28	.02
MAX :	1.86	.17	.14	.08	.47	.07
MIN :	.43	.02	.03	.04	.11	.02
RMS :	.23	.02	.01	.02	.05	.01
GFACT :	1.69	1.94	1.59	5.00	1.69	4.37
PFACT :	3.28	3.87	3.39	3.33	3.50	4.00

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
334	315.0	10.0	330.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.73	-.85	.09	.23	.14	.06
MAX :	1.30	-.37	.15	.40	.27	.11
MIN :	.33	-1.56	.02	.09	.02	.01
RMS :	.14	.17	.02	.04	.03	.01
GFACT :	1.79	1.83	1.57	1.73	1.99	1.93
PFACT :	4.03	4.10	3.35	4.10	3.97	3.74

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
335	292.5	10.0	275.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.95	.11	.11	.00	.23	.08
MAX :	1.65	.20	.16	.05	.42	.14
MIN :	.30	.03	.06	.07	.04	.01
RMS :	.20	.03	.02	.02	.05	.02
GFACT :	1.73	1.87	1.46	38.69	1.87	1.86
PFACT :	3.44	3.49	3.28	3.89	3.93	3.53

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
336	270.0	10.0	275.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.20	.06	.03	.01	.06	.05
MAX :	.88	.15	.08	.05	.25	.10
MIN :	-.34	-.02	.02	.07	.13	.00
RMS :	.14	.02	.01	.02	.04	.02
GFACT :	4.34	2.55	2.96	7.44	4.24	2.27
PFACT :	4.67	3.76	3.50	3.32	4.64	3.79

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
337	265.0	10.0	275.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	.04	-.01	.01	.02	.01
MAX :	.63	.12	.05	.06	.17	.09
MIN :	-.54	-.04	-.07	.09	.16	.04
RMS :	.14	.02	.02	.02	.04	.03
GFACT :	18.74	2.79	11.53	9.82	7.50	6.43
PFACT :	4.41	3.37	3.51	3.79	3.69	[illegible]

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
338	247.5	10.0	275.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.54	.01	-.10	.01	.11	.03
MAX :	.04	.10	.02	.11	.04	.03
MIN :	-1.46	-.08	-.23	.07	.33	.09
RMS :	.19	.03	.03	.03	.05	.02
GFACT :	2.68	16.30	2.25	9.31	2.90	3.01
PFACT :	4.82	3.70	4.32	3.89	4.35	3.90

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
339	247.5	20.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.26	.05	.07	.03	.01	.03
MAX :	.91	.14	.18	.14	.21	.08
MIN :	-.23	-.06	-.03	.06	.17	.02
RMS :	.14	.03	.03	.03	.04	.01
GFACT :	3.56	2.88	2.57	3.21	11.20	2.70
PFACT :	4.73	3.13	3.57	3.38	4.40	3.38

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
340	265.0	20.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.76	.01	.23	.05	.14	.06
MAX :	1.49	.12	.37	.17	.33	.11
MIN :	.28	-.10	.09	.05	.03	.01
RMS :	.18	.03	.04	.03	.05	.01
GFACT :	1.96	24.28	1.65	3.18	2.28	1.94
PFACT :	3.97	3.91	3.52	3.95	3.93	3.90

1

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
341	270.0	20.0	305.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.86	-.01	.26	.04	.10	.05
MAX :	1.60	.09	.40	.15	.35	.11
MIN :	.29	-.12	.13	.05	.01	.01
RMS :	.19	.03	.05	.03	.05	.01
GFACT :	1.86	9.38	1.54	3.20	1.98	2.10
PFACT :	3.80	3.93	3.11	3.70	3.65	3.92

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
342	292.5	20.0	305.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.02	-.03	.29	.07	.20	.05
MAX :	1.99	.05	.44	.18	.44	.09
MIN :	.48	-.12	.16	.03	.04	.00
RMS :	.21	.03	.04	.03	.05	.01
GFACT :	1.95	3.49	1.52	2.57	2.16	2.03
PFACT :	4.71	3.07	3.38	3.90	4.90	3.67

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
343	315.0	20.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.16	-.05	.34	.11	.23	.03
MAX :	2.05	.03	.50	.21	.43	.07
MIN :	.55	-.13	.22	.03	.05	.01
RMS :	.23	.02	.04	.02	.05	.01
GFACT :	1.76	2.61	1.49	1.86	1.90	2.32
PFACT :	3.91	3.57	3.77	4.01	3.99	3.33

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
344	337.5	20.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.04	-.06	.28	.12	.20	.00
MAX :	2.15	.04	.46	.22	.45	.05
MIN :	.39	-.15	.16	.00	.00	.04
RMS :	.22	.02	.04	.03	.05	.01
GFACT :	2.07	2.68	1.61	1.84	2.19	25.47
PFACT :	5.09	3.85	4.12	3.84	4.67	3.53

1

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
345	0.0	20.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.27	-.01	.07	.04	.05	.02
MAX :	1.46	.11	.25	.10	.30	.03
MIN :	-.20	-.15	.02	.07	.21	.05
RMS :	.19	.04	.03	.04	.06	.01
GFACT :	5.40	12.57	3.63	4.19	6.15	3.08
PFACT :	6.27	3.49	5.23	3.70	4.20	3.79

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
346	337.5	0.0	330.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.06	-.07	-.06	.10	.07	.06
MAX :	2.13	.03	.01	.24	.35	.01
MIN :	.37	-.17	-.10	.02	.23	.11
RMS :	.24	.03	.02	.03	.07	.01
GFACT :	2.02	2.57	3.11	2.37	5.00	1.07
PFACT :	4.45	3.00	5.08	4.30	4.04	3.54

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
347	337.5	90.0	330.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.06	-.04	-.10	.01	.01	.00
MAX :	.13	.01	.18	.06	.07	.03
MIN :	.01	-.08	.46	.05	.05	.02
RMS :	.02	.01	.08	.02	.02	.01
GFACT :	2.12	2.22	4.77	4.50	6.29	2.83
PFACT :	3.70	3.45	4.31	3.17	3.59	3.04

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
348	0.0	25.0	350.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.30	.05	.13	.05	.03	.04
MAX :	.90	-.00	.29	.12	.35	.01
MIN :	-.16	.11	.00	.02	.29	.10
RMS :	.16	.02	.05	.02	.07	.02
GFACT :	2.94	2.13	2.31	2.31	13.79	2.94
PFACT :	3.72	3.71	3.55	3.30	4.37	[illegible]

1

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
349	337.5	25.0	350.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.90	-.05	.34	.08	.03	.09
MAX :	1.73	.01	.59	.16	.35	.02
MIN :	.18	.12	.14	.00	.29	.16
RMS :	.23	.02	.07	.02	.08	.02
GFACT :	1.92	2.44	1.76	2.10	12.23	1.79
PFACT :	3.63	4.00	3.83	3.91	4.14	3.43

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
350	315.0	25.0	350.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.08	-.04	.37	.08	.03	.07
MAX :	2.01	.01	.62	.17	.31	.03
MIN :	.45	-.10	.20	.01	.25	.13
RMS :	.23	.02	.06	.02	.07	.02
GFACT :	1.86	2.48	1.68	1.94	9.16	1.76
PFACT :	4.03	3.53	3.99	4.11	3.08	3.59

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
351	292.5	25.0	350.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.15	-.03	.39	.06	.04	.04
MAX :	2.20	.01	.64	.14	.35	.01
MIN :	.47	-.08	.24	.01	.27	.11
RMS :	.25	.01	.06	.02	.08	.02
GFACT :	1.91	2.63	1.62	2.35	9.29	2.39
PFACT :	4.26	4.03	3.83	4.03	4.16	3.07

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
352	270.0	25.0	350.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.08	-.02	.37	.02	.04	.03
MAX :	2.09	.03	.62	.11	.40	.01
MIN :	.39	-.07	.20	.04	.33	.08
RMS :	.24	.01	.07	.02	.07	.01
GFACT :	1.93	3.75	1.68	5.28	11.12	2.39
PFACT :	4.19	3.99	3.85	4.87	5.07	3.69

1

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
353	265.0	25.0	350.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.08	-.02	.38	.01	.01	.00
MAX :	2.14	.03	.62	.08	.29	.05
MIN :	.48	-.06	.20	.05	.28	.04
RMS :	.22	.01	.06	.02	.07	.01
GFACT :	1.98	3.20	1.65	6.75	34.76	10.60
PFACT :	4.83	3.21	4.14	3.60	4.24	4.06

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
354	247.5	25.0	350.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.98	.00	.32	.01	.03	.00
MAX :	1.87	.09	.54	.07	.29	.04
MIN :	.39	-.05	.12	.06	.25	.04
RMS :	.21	.01	.06	.02	.07	.01
GFACT :	1.91	37.67	1.69	5.59	9.59	51.55
PFACT :	4.16	5.64	3.53	3.60	3.94	3.26

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
355	247.5	45.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.37	.08	.34	.02	.05	.02
MAX :	.91	.19	.72	.07	.18	.05
MIN :	.02	-.03	.13	.13	.11	.00
RMS :	.11	.03	.07	.03	.03	.01
GFACT :	2.46	2.51	2.11	5.97	3.46	2.24
PFACT :	4.89	4.04	5.16	4.07	3.76	3.30

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
356	265.0	45.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.70	.09	.61	.02	.15	.05
MAX :	1.24	.19	.97	.07	.31	.09
MIN :	.26	-.02	.32	.12	.02	.01
RMS :	.15	.03	.11	.03	.04	.01
GFACT :	1.77	2.18	1.60	5.23	2.11	1.79
PFACT :	3.68	3.24	3.40	3.42	4.20	3.43

1

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
357	270.0	45.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.75	.09	.63	.02	.14	.01
MAX :	1.28	.20	.93	.10	.27	.05
MIN :	.30	.00	.32	.07	.02	.05
RMS :	.15	.03	.11	.02	.04	.01
BFACT :	1.71	2.14	1.48	5.43	1.27	6.38
PFACT :	3.49	3.65	2.76	3.25	3.71	3.14

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
358	292.5	45.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.78	.07	.63	.03	.16	.02
MAX :	1.34	.14	.94	.12	.29	.05
MIN :	.35	.01	.33	.06	.00	.02
RMS :	.15	.02	.11	.02	.04	.01
BFACT :	1.73	2.05	1.49	4.67	1.77	3.13
PFACT :	3.69	3.05	2.96	4.07	3.51	3.39

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
359	315.0	45.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.82	.07	.66	.06	.16	.01
MAX :	1.40	.14	.97	.10	.31	.05
MIN :	.32	.00	.38	.02	.03	.04
RMS :	.16	.02	.11	.02	.04	.01
BFACT :	1.71	2.06	1.46	2.76	1.90	6.72
PFACT :	3.67	3.48	2.89	4.08	3.01	3.57

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
360	337.5	45.0	305.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.77	.05	.62	.09	.10	.02
MAX :	1.40	.11	.96	.20	.34	.02
MIN :	.29	-.02	.35	.00	.04	.06
RMS :	.16	.02	.10	.03	.04	.01
BFACT :	1.82	2.38	1.54	2.08	1.90	3.84
PFACT :	3.91	3.16	3.31	3.59	3.09	3.78

DATA FOR FILE : H1100

RUN #	WIND	EL	AZ	VEL
361	0.0	45.0	305.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.34	.02	.28	.06	.07	.03
MAX :	1.04	.12	.55	.20	.31	.00
MIN :	.02	-.09	.09	.07	.10	.08
RMS :	.13	.03	.07	.04	.05	.01
OFACT :	3.09	5.78	1.99	3.31	4.30	2.42
PFACT :	5.30	3.06	3.97	3.70	5.17	4.70

1

Heliostat 1, Configuration 1-B

Case	Run #	WD	EL	AZ	Day	Time
Smr AM	394	0	25	350	172	8 AM
	395	337.5	25	350	172	8 AM
	396	315	25	350	172	8 AM
	397	292.5	25	350	172	8 AM
	398	270	25	350	172	8 AM
	399	265	25	350	172	8 AM
	400	247.5	25	350	172	8 AM
Smr Noon	385	247.5	45	305	172	0 PM
	386	265	45	305	172	0 PM
	387	270	45	305	172	0 PM
	388	292.5	45	305	172	0 PM
	389	315	45	305	172	0 PM
	390	337.5	45	305	172	0 PM
	391	0	45	305	172	0 PM
Wntr AM	362	0	10	330	355	8 AM
	363	337.5	10	330	355	8 AM
	364	315	10	330	355	8 AM
	365	292.5	10	330	355	8 AM
	366	270	10	330	355	8 AM
	367	265	10	330	355	8 AM
	368	247.5	10	330	355	8 AM

Heliostat 1, Configuration 1-B. continued

Case	Run #	WD	EL	AZ	Day	Time
Wntr Noon	377	0	20	305	355	0 PM
	378	337.5	20	305	355	0 PM
	379	315	20	305	355	0 PM
	381	292.5	20	305	355	0 PM
	382	270	20	305	355	0 PM
	383	265	20	305	355	0 PM
	384	247.5	20	305	355	0 PM
Wntr PM	369	247.5	10	275	355	4 PM
	370	265	10	275	355	4 PM
	370	270	10	275	355	4 PM
	372	292.5	10	275	355	4 PM
	373	315	10	275	355	4 PM
	374	337.5	10	275	355	4 PM
	375	0	10	275	355	4 PM
Ver. Stow	392	337.5	0	330	355	8 AM
Hor. Stow	393	337.5	90	330	355	8 AM

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
362	0.0	10.0	330.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.07	-.02	.00	.01	.03	.01
MAX :	.58	.12	.06	.12	.20	.02
MIN :	-.46	-.14	.04	.10	.16	.05
RMS :	.12	.03	.01	.03	.05	.01
GFACT :	8.21	8.84	10.49	7.76	7.64	3.01
PFACT :	4.19	3.95	3.01	3.00	4.05	3.46

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
363	337.5	10.0	330.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.27	-.05	.04	.05	.07	.03
MAX :	.96	.05	.07	.15	.37	.00
MIN :	-.14	-.17	-.01	.05	.17	.08
RMS :	.13	.03	.01	.03	.06	.01
GFACT :	3.58	3.73	2.26	3.01	5.15	2.50
PFACT :	5.34	4.36	3.47	3.51	5.14	4.70

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
364	315.0	10.0	330.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.26	-.04	.03	.05	.07	.00
MAX :	.62	.05	.07	.12	.25	.03
MIN :	.02	-.13	.00	.02	.04	.02
RMS :	.07	.02	.01	.02	.04	.01
GFACT :	2.38	3.03	2.26	2.52	3.40	7.55
PFACT :	4.82	4.03	3.61	3.81	4.77	3.15

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
365	292.5	10.0	330.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	-.04	.03	.03	.06	.02
MAX :	.60	.02	.08	.10	.19	.01
MIN :	.01	-.10	.01	.03	.05	.05
RMS :	.07	.02	.01	.02	.03	.01
GFACT :	2.69	2.79	2.43	3.63	3.11	2.25
PFACT :	5.38	3.71	3.67	4.17	3.90	3.32

1

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
366	270.0	10.0	330.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.18	-.02	.04	.03	.04	.00
MAX :	.49	.05	.09	.11	.17	.02
MIN :	-.07	-.08	-.01	.04	.00	.03
RMS :	.07	.02	.01	.02	.03	.01
QFACT :	2.71	4.37	2.51	3.15	4.00	5.07
PFACT :	4.39	3.13	4.10	3.04	3.69	2.99

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
367	265.0	10.0	330.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.02	-.00	.02	.06	.00
MAX :	.42	.03	.04	.08	.17	.03
MIN :	-.05	-.08	.05	.03	.04	.02
RMS :	.06	.02	.01	.02	.03	.01
QFACT :	2.66	3.93	9.91	3.23	2.81	172.39
PFACT :	4.15	3.75	3.44	3.41	3.52	[illegible]

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
368	247.5	10.0	330.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.09	-.01	.03	.01	.07	.03
MAX :	.43	.06	.09	.09	.25	.08
MIN :	-.23	-.09	.01	.08	.08	.00
RMS :	.07	.02	.01	.02	.04	.01
QFACT :	4.86	6.49	3.00	11.33	3.42	2.62
PFACT :	4.56	3.40	4.57	4.00	4.75	2.69

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
369	247.5	10.0	275.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.03	.00	-.02	.01	-.00	-.01
MAX :	.26	.06	.03	.04	.09	.02
MIN :	-.41	-.05	-.06	.06	.15	.03
RMS :	.07	.02	.01	.02	.03	.01
QFACT :	12.54	12.78	2.99	10.75	46.82	4.11
PFACT :	5.35	3.03	3.16	3.09	5.28	2.96

1

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
370	265.0	10.0	275.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	.02	-.00	.04	.02	.02
MAX :	.33	.06	.05	.09	.12	.02
MIN :	-.28	-.02	-.05	.00	.07	.05
RMS :	.06	.01	.02	.01	.02	.01
GFACT :	37.48	2.74	46.21	2.12	5.22	2.68
PFACT :	5.16	2.00	3.43	3.39	4.05	3.14

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
371	270.0	10.0	275.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	.01	.00	-.00	.00	.01
MAX :	.39	.05	.05	.04	.14	.03
MIN :	-.21	-.05	.04	.06	.08	.05
RMS :	.06	.02	.01	.02	.02	.01
GFACT :	12.97	8.86	149.51	12.90	94.93	3.93
PFACT :	6.15	2.91	3.20	3.08	5.96	3.20

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
372	292.5	10.0	275.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	.02	.01	.01	.06	.00
MAX :	.41	.07	.06	.06	.16	.02
MIN :	-.12	-.03	-.03	.04	.03	.02
RMS :	.06	.01	.01	.01	.02	.01
GFACT :	3.30	3.04	4.44	6.01	2.64	7.13
PFACT :	5.02	3.31	3.44	3.56	4.08	3.44

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
373	315.0	10.0	275.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.21	.02	.02	.01	.09	.02
MAX :	.57	.07	.08	.05	.22	.06
MIN :	-.02	-.03	.02	.05	.01	.01
RMS :	.07	.01	.02	.01	.03	.01
GFACT :	2.76	3.15	3.36	6.20	2.28	3.24
PFACT :	5.29	3.72	3.64	3.21	4.30	4.01

1

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
374	337.5	10.0	275.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.32	.04	.05	.01	.11	.01
MAX :	1.10	.14	.10	.11	.34	.03
MIN :	-.17	.06	.00	.07	.07	.04
RMS :	.14	.03	.01	.02	.05	.01
GFACT :	3.41	3.64	2.02	8.44	3.03	4.85
PFACT :	5.40	3.82	3.51	4.03	4.30	3.25

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
375	0.0	10.0	275.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	.02	.04	.01	.09	.01
MAX :	1.10	.10	.12	.06	.36	.05
MIN :	-.28	-.07	-.02	.09	.09	.03
RMS :	.18	.02	.02	.02	.06	.01
GFACT :	4.87	5.05	3.30	6.95	3.92	4.45
PFACT :	4.91	3.30	4.34	3.74	4.74	3.57

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
377	0.0	20.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	-.01	.04	.03	.06	.02
MAX :	.83	.07	.17	.11	.22	.01
MIN :	-.17	-.10	-.02	.05	.06	.05
RMS :	.11	.02	.02	.02	.04	.01
GFACT :	6.25	10.35	3.87	3.66	3.81	3.00
PFACT :	6.46	3.66	5.10	3.53	4.68	3.40

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
378	337.5	20.0	305.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.25	-.03	.07	.03	.09	.02
MAX :	.82	.07	.19	.13	.25	.02
MIN :	-.13	-.16	.01	.07	.04	.07
RMS :	.12	.03	.02	.03	.05	.01
GFACT :	3.26	5.02	2.65	3.99	2.90	3.99
PFACT :	4.70	3.96	4.09	3.52	3.65	4.41

1

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
379	315.0	20.0	305.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.25	-.02	.10	.05	.06	.01
MAX :	.65	.03	.19	.10	.23	.02
MIN :	.07	.10	.04	-.00	.04	.05
RMS :	.06	.02	.02	.02	.03	.01
BFACT :	2.56	4.47	1.92	2.03	4.02	3.12
PFACT :	6.43	4.30	6.11	2.01	6.50	2.51

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
381	292.5	20.0	305.0	41.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.17	-.00	.05	.04	.06	.00
MAX :	.46	.05	.12	.09	.17	.02
MIN :	-.02	-.07	.01	.00	.01	.03
RMS :	.05	.02	.02	.01	.02	.01
BFACT :	2.66	14.67	2.14	2.07	2.98	22.76
PFACT :	5.29	4.03	3.06	3.20	4.77	3.11

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
382	270.0	20.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.09	.01	.04	.04	.03	.01
MAX :	.36	.06	.08	.08	.13	.02
MIN :	-.06	-.05	-.01	-.03	.03	.03
RMS :	.05	.02	.01	.01	.02	.01
BFACT :	3.93	8.78	2.02	2.28	4.30	3.38
PFACT :	5.31	3.11	3.20	3.30	4.54	3.39

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
383	255.0	20.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.07	.00	.05	.01	.03	.02
MAX :	.32	.06	.10	.07	.12	.01
MIN :	-.13	-.07	.01	.07	.06	.04
RMS :	.06	.02	.01	.02	.02	.01
BFACT :	4.45	21.97	2.06	8.03	4.52	2.16
PFACT :	4.43	3.04	4.07	2.78	3.92	3.25

1

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
384	247.5	20.0	305.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	-.00	.01	.01	.01	.00
MAX :	.34	.07	.04	.07	.14	.03
MIN :	-.30	-.09	-.06	.09	.08	.03
RMS :	.06	.02	.01	.02	.03	.01
GFACT :	12.24	21.65	4.31	13.60	10.15	8.40
PFACT :	4.09	3.64	3.13	3.49	4.52	2.74

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
385	247.5	45.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	.01	.03	.03	.00	.01
MAX :	.25	.07	.11	.10	.09	.01
MIN :	-.17	-.06	-.04	.05	.09	.04
RMS :	.06	.02	.02	.02	.03	.01
GFACT :	7.13	6.13	3.74	3.55	29.25	4.31
PFACT :	3.61	2.57	4.00	2.07	3.32	4.67

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
386	265.0	45.0	305.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.07	.02	.05	.05	.01	.03
MAX :	.38	.07	.20	.11	.09	.00
MIN :	-.12	.04	-.01	.01	-.09	.07
RMS :	.05	.02	.02	.02	.02	.01
GFACT :	5.66	4.30	4.29	2.21	14.29	2.19
PFACT :	6.48	3.12	7.64	3.54	3.71	3.74

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
387	270.0	45.0	305.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.07	.00	.07	.02	.02	.00
MAX :	.26	.07	.18	.08	.11	.04
MIN :	-.11	-.06	.01	.05	.05	.02
RMS :	.05	.02	.02	.02	.02	.01
GFACT :	3.63	25.18	2.79	4.82	4.45	7.07
PFACT :	4.10	3.62	6.61	3.41	3.04	4.16

1

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
388	292.5	45.0	305.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.11	.00	.08	.02	.04	.01
MAX :	.29	.05	.16	.08	.12	.01
MIN :	-.02	-.06	.03	.03	.05	.04
RMS :	.04	.02	.02	.02	.02	.01
GFACT :	2.52	150.24	1.94	3.26	3.04	2.88
PFACT :	3.97	3.34	3.79	3.32	3.53	3.51

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
389	315.0	45.0	305.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.01	.14	.04	.05	.02
MAX :	.36	.05	.22	.09	.15	.00
MIN :	.00	-.07	.08	-.02	.03	.03
RMS :	.05	.02	.02	.02	.02	.00
GFACT :	2.22	6.57	1.57	2.67	2.98	2.11
PFACT :	4.17	3.76	4.00	3.77	4.13	3.49

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
390	337.5	45.0	305.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.17	-.01	.13	.07	.05	.02
MAX :	.54	.10	.31	.18	.23	.00
MIN :	-.12	-.14	.03	-.05	.09	.05
RMS :	.10	.03	.04	.03	.05	.01
GFACT :	3.14	13.22	2.36	2.63	4.67	2.20
PFACT :	3.64	3.79	4.73	3.40	3.96	3.62

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
391	0.0	45.0	305.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.01	.11	.04	.04	.02
MAX :	.74	.06	.32	.13	.20	.01
MIN :	-.13	-.11	.01	.05	.08	.06
RMS :	.09	.02	.04	.02	.03	.01
GFACT :	4.62	8.69	2.92	3.28	4.67	2.25
PFACT :	6.42	4.14	5.30	3.59	4.40	2.96

1

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
392	337.5	0.0	330.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.28	.02	.01	.04	.03	.05
MAX :	1.39	.12	.04	.21	.10	.01
MIN :	-.36	-.07	-.13	-.11	.27	.10
RMS :	.17	.02	.02	.04	.08	.01
GFACT :	4.96	5.86	8.61	4.93	13.10	1.88
PFACT :	6.57	3.99	6.31	4.54	4.44	3.04

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
393	337.5	90.0	330.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.00	-.00	.02	.00	.01	.00
MAX :	.05	.04	.22	.06	.05	.03
MIN :	-.05	-.04	-.28	.07	.04	.03
RMS :	.01	.01	.06	.01	.01	.01
GFACT :	34.38	40.68	9.09	74.95	5.47	13.95
PFACT :	4.33	3.90	3.09	3.76	3.46	3.27

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
394	0.0	25.0	350.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.03	-.02	-.02	.01	.03	.01
MAX :	.62	.02	.14	.05	.39	.05
MIN :	-.73	-.06	-.14	.11	.31	.05
RMS :	.15	.01	.03	.02	.09	.01
GFACT :	24.83	3.12	7.52	8.69	13.81	4.38
PFACT :	4.75	3.27	3.75	5.21	4.11	3.14

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
395	337.5	25.0	350.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.14	.00	.05	.04	.02	.04
MAX :	.66	.05	.17	.09	.30	.00
MIN :	-.30	-.03	-.02	-.02	.23	.08
RMS :	.11	.01	.03	.02	.06	.01
GFACT :	4.61	11.38	3.15	2.27	19.47	2.07
PFACT :	4.65	3.27	4.56	3.20	4.41	3.65

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
396	315.0	25.0	350.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.19	-.00	.09	.02	.03	.02
MAX :	.50	.03	.16	.07	.19	.01
MIN :	-.04	-.04	.04	.02	.12	.05
RMS :	.07	.01	.02	.01	.04	.01
GFACT :	2.71	7.37	1.80	3.09	7.29	2.23
PFACT :	4.79	3.22	4.22	3.74	3.95	3.06

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
397	292.5	25.0	350.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.19	-.01	.09	.01	.02	.02
MAX :	.51	.03	.16	.05	.16	.00
MIN :	.03	-.04	.04	.03	.09	.05
RMS :	.06	.01	.02	.01	.03	.01
GFACT :	2.66	6.37	1.70	5.49	6.55	1.98
PFACT :	5.52	2.87	4.00	3.76	4.10	2.03

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
398	270.0	25.0	350.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.18	.00	.08	.02	.04	.00
MAX :	.49	.03	.16	.06	.17	.03
MIN :	-.01	-.03	.03	.02	.09	.03
RMS :	.06	.01	.02	.01	.03	.01
GFACT :	2.74	7.54	1.93	2.74	3.98	176.72
PFACT :	5.17	3.34	4.10	3.30	4.05	3.37

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
399	265.0	25.0	350.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.19	.01	.08	.01	.04	.01
MAX :	.47	.04	.14	.05	.17	.01
MIN :	-.02	.02	.02	.04	.10	.04
RMS :	.06	.01	.02	.01	.03	.01
GFACT :	2.50	6.81	1.83	5.01	3.78	4.11
PFACT :	4.43	3.38	3.67	3.45	3.74	4.34

1

DATA FOR FILE : H1101

RUN #	WIND	EL	AZ	VEL
400	247.5	25.0	350.0	41.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.17	.00	.08	.00	.02	.02
MAX :	.51	.04	.16	.04	.20	.01
MIN :	-.04	-.04	.01	.05	.12	.05
RMS :	.07	.01	.02	.01	.04	.01
GFACT :	2.77	12.57	1.77	12.68	8.26	2.01
PFACT :	4.60	3.03	3.59	3.67	4.61	2.02

1

Heliostat 5, Configuration 5-A

Case	Run #	WD	EL	AZ	Day	Time
Wntr AM	136	0	10	320	355	8 AM
	137	337.5	10	320	355	8 AM
	138	315	10	320	355	8 AM
	139	292.5	10	320	355	8 AM
	140	270	10	320	355	8 AM
	141	247.5	10	320	355	8 AM
Wntr Noon	148	0	20	290	355	0 PM
	149	337.5	20	290	355	0 PM
	150	315	20	290	355	0 PM
	151	292.5	20	290	355	0 PM
	152	270	20	290	355	0 PM
	153	247.5	20	290	355	0 PM
Wntr PM	142	247.5	10	265	355	4 PM
	143	270	10	265	355	4 PM
	144	292.5	10	265	355	4 PM
	145	315	10	265	355	4 PM
	146	337.5	10	265	355	4 PM
	147	0	10	265	355	4 PM
Ver. Stow	154	315	0	320	355	8 AM
Hor. Stow	155	315	90	320	355	8 AM

This set to check the effectiveness of presence of the upstream heliostat.

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
136	0.0	10.0	320.0	39.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.42	.07	.04	.07	.07	.09
MAX :	1.19	.03	.09	.18	.35	.01
MIN :	-.13	-.20	-.04	.03	.20	.09
RMS :	.18	.03	.01	.03	.07	.01
GFACT :	2.83	3.06	2.41	2.54	4.71	2.33
PFACT :	4.36	4.24	3.57	4.09	4.08	4.03

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
137	337.5	10.0	320.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.45	.08	.06	.05	.08	.00
MAX :	1.50	.02	.13	.16	.40	.06
MIN :	.18	-.25	-.00	.06	-.19	.05
RMS :	.20	.03	.02	.03	.08	.01
GFACT :	3.30	3.26	2.02	3.14	5.29	24.02
PFACT :	5.13	5.06	3.79	3.55	4.13	4.07

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
138	315.0	10.0	320.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.52	-.08	.07	.02	.12	.02
MAX :	1.81	.03	.14	.14	.49	.07
MIN :	-.32	-.26	-.00	.16	-.27	.04
RMS :	.24	.04	.02	.04	.10	.01
GFACT :	3.50	3.08	2.05	6.70	3.25	4.01
PFACT :	5.32	4.44	3.67	3.11	3.59	3.91

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
139	292.5	10.0	320.0	39.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.31	.04	.03	.03	.05	.01
MAX :	1.01	.05	.08	.14	.32	.05
MIN :	-.23	-.16	-.03	-.07	.20	.06
RMS :	.17	.03	.02	.03	.07	.01
GFACT :	3.27	3.82	2.82	4.16	5.81	6.45
PFACT :	4.01	4.05	3.19	3.36	3.56	3.60

1

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
140	270.0	10.0	320.0	39.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.26	-.02	.02	.01	.00	.02
MAX :	1.10	.05	.09	.17	.39	.07
MIN :	-.43	-.15	-.04	.14	.24	.02
RMS :	.21	.03	.02	.04	.09	.01
GFACT :	4.21	5.95	3.97	17.46	4.83	4.08
PFACT :	3.95	4.32	3.38	4.32	3.41	3.75

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
141	247.5	10.0	320.0	39.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.10	.01	.02	.00	.01	.01
MAX :	.70	.07	.07	.10	.18	.08
MIN :	-.37	-.06	.04	-.13	.24	.03
RMS :	.13	.02	.02	.03	.05	.02
GFACT :	7.05	5.86	4.41	25.76	38.81	5.54
PFACT :	4.68	3.41	3.44	3.64	4.52	3.70

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
142	247.5	10.0	265.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.16	.04	.03	.01	.13	.00
MAX :	.33	.13	.04	.07	.07	.05
MIN :	-.86	.01	-.13	.03	.38	.08
RMS :	.16	.02	.03	.01	.06	.02
GFACT :	5.32	3.25	4.63	5.89	2.98	18.21
PFACT :	4.44	5.65	3.81	4.83	4.60	3.96

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
143	270.0	10.0	265.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.06	.03	.02	.03	.02	-.02
MAX :	.22	.08	.07	.08	.11	.02
MIN :	-.52	-.01	-.05	-.01	.18	.07
RMS :	.09	.01	.01	.01	.03	.01
GFACT :	9.40	2.71	4.10	2.47	7.31	3.53
PFACT :	5.08	3.73	3.70	4.30	4.63	3.79

1

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
144	292.5	10.0	265.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.10	.02	.04	.00	.04	.00
MAX :	.78	.08	.10	.05	.32	.06
MIN :	-.52	-.03	.02	.03	.17	.07
RMS :	.14	.01	.02	.01	.06	.01
GFACT :	7.52	3.72	2.60	13.82	8.79	39.66
PFACT :	4.83	3.95	3.67	4.38	5.06	4.58

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
145	315.0	10.0	265.0	30.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.53	.02	.09	.01	.14	.03
MAX :	1.54	.07	.15	.08	.42	.12
MIN :	-.24	-.05	.00	.09	.19	.04
RMS :	.25	.02	.02	.03	.08	.02
GFACT :	2.92	4.68	1.68	9.61	2.95	4.10
PFACT :	4.05	3.42	2.84	2.99	3.34	4.16

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
146	337.5	10.0	265.0	39.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.44	.01	.06	.01	.11	.04
MAX :	1.28	.08	.13	.06	.33	.09
MIN :	-.17	.05	.00	.08	.19	.01
RMS :	.18	.02	.02	.02	.06	.02
GFACT :	2.90	5.58	2.14	13.82	3.09	2.67
PFACT :	4.64	3.68	3.89	3.83	3.51	3.73

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
147	0.0	10.0	265.0	39.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.32	-.02	.01	.04	.07	.04
MAX :	.90	.03	.07	.03	.26	.08
MIN :	-.18	-.06	.07	-.08	.12	.03
RMS :	.14	.01	.02	.02	.05	.01
GFACT :	2.80	2.59	5.06	2.22	3.03	2.10
PFACT :	4.06	3.20	2.72	3.04	3.79	2.92

1

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
148	0.0	20.0	290.0	39.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.40	-.04	.10	.06	.09	.03
MAX :	1.10	.03	.20	.12	.29	.01
MIN :	-.03	-.13	.00	.00	.10	.08
RMS :	.15	.02	.03	.02	.05	.01
GFACT :	2.77	3.73	2.00	1.75	3.36	2.80
PFACT :	4.76	4.06	3.43	3.33	4.08	4.31

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
149	337.5	20.0	290.0	39.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.44	-.03	.10	.02	.06	.01
MAX :	1.23	.03	.23	.09	.34	.07
MIN :	-.05	-.09	.02	.04	.16	.05
RMS :	.16	.02	.02	.02	.06	.01
GFACT :	2.83	3.43	2.39	3.70	5.48	6.36
PFACT :	4.87	3.54	5.36	3.49	4.09	4.20

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
150	315.0	20.0	290.0	39.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.48	-.02	.11	.03	.11	.01
MAX :	1.56	.07	.21	.11	.41	.07
MIN :	-.23	-.13	.03	.08	.16	.03
RMS :	.21	.03	.03	.02	.07	.01
GFACT :	3.27	6.21	2.01	4.04	3.64	4.53
PFACT :	5.26	3.89	3.76	3.39	4.20	3.52

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
151	292.5	20.0	290.0	38.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.00	.02	.02	.02	.03
MAX :	1.05	.10	.16	.06	.25	.01
MIN :	-.33	-.07	-.06	.05	.19	.07
RMS :	.14	.01	.02	.02	.05	.01
GFACT :	6.68	339.19	7.68	3.88	10.69	2.08
PFACT :	6.34	4.84	6.00	3.10	4.19	3.40

1

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
152	270.0	20.0	290.0	39.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.01	.01	.03	.01	.02	.01
MAX :	.44	.18	.08	.09	.18	.07
MIN :	-.54	-.09	-.13	-.06	.20	.03
RMS :	.11	.02	.04	.02	.04	.01
GFACT :	38.98	13.89	4.92	14.18	8.98	5.36
PFACT :	4.92	7.50	2.93	5.35	4.00	3.11

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
153	247.5	20.0	290.0	39.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.25	.04	-.08	-.03	-.09	-.01
MAX :	.20	.17	.02	.06	.07	.04
MIN :	-.72	-.06	-.20	-.09	-.28	-.07
RMS :	.13	.03	.03	.02	.05	.01
GFACT :	2.87	3.85	2.45	3.69	3.12	5.50
PFACT :	3.51	3.74	3.51	3.51	3.89	3.72

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
154	315.0	0.0	320.0	39.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.40	.00	.02	.03	.07	.01
MAX :	1.51	.07	.05	.21	.43	.05
MIN :	-.47	-.09	-.13	-.15	.32	.07
RMS :	.23	.02	.02	.05	.10	.01
GFACT :	3.78	21.05	8.44	6.55	6.13	5.08
PFACT :	4.78	3.26	5.61	3.83	3.52	3.75

DATA FOR FILE : H5000

RUN #	WIND	EL	AZ	VEL
155	315.0	90.0	320.0	39.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.08	.01	.09	.01	.01	.02
MAX :	.15	.04	.26	.06	.06	.04
MIN :	.02	-.03	-.16	-.05	-.04	.05
RMS :	.02	.01	.05	.02	.02	.01
GFACT :	1.88	7.03	2.72	4.61	6.41	3.09
PFACT :	4.14	3.91	3.45	2.99	3.32	3.36

1

Heliostat 5, Configuration 5-B

Case	Run #	WD	EL	AZ	Day	Time
Smr AM	176	0	25	340	172	8 AM
	178	337.5	25	340	172	8 AM
	179	315	25	340	172	8 AM
	180	292.5	25	340	172	8 AM
	181	270	25	340	172	8 AM
	182	247.5	25	340	172	8 AM
Smr Noon	183	247.5	45	290	172	0 PM
	184	270	45	290	172	0 PM
	185	292.5	45	290	172	0 PM
	186	315	45	290	172	0 PM
	187	337.5	45	290	172	0 PM
	188	0	45	290	172	0 PM
Wntr AM	158	0	10	320	355	8 AM
	159	337.5	10	320	355	8 AM
	160	315	10	320	355	8 AM
	161	292.5	10	320	355	8 AM
	162	270	10	320	355	8 AM
	163	247.5	10	320	355	8 AM
Wntr Noon	170	0	20	290	355	0 PM
	171	337.5	20	290	355	0 PM
	172	315	20	290	355	0 PM
	173	292.5	20	290	355	0 PM
	174	270	20	290	355	0 PM
	175	247.5	20	290	355	0 PM

Heliostat 5, Configuration 5-B. continued

Case	Run #	WD	EL	AZ	Day	Time
Wntr PM	164	247.5	10	265	355	4 PM
	165	270	10	265	355	4 PM
	166	292.5	10	265	355	4 PM
	167	315	10	265	355	4 PM
	168	337.5	10	265	355	4 PM
	169	0	10	265	355	4 PM
Ver. Stow	157	315	0	320	355	8 AM
Hor. Stow	156	315	90	320	355	8 AM

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
156	315.0	90.0	320.0	39.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	-.00	.01	.00	.01	.01
MAX :	.07	.04	.30	.09	.04	.03
MIN :	-.03	-.04	-.46	.07	.09	.01
RMS :	.01	.01	.09	.02	.02	.01
GFACT :	6.26	956.23	30.97	441.80	11.47	3.83
PFACT :	5.02	4.58	4.81	4.94	4.63	2.95

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
157	315.0	0.0	320.0	39.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.21	.01	-.02	.03	.04	.01
MAX :	1.64	.08	.03	.20	.35	.03
MIN :	-.24	-.05	.12	.08	.18	.06
RMS :	.17	.02	.02	.03	.06	.01
GFACT :	7.82	5.21	5.38	6.44	10.06	4.65
PFACT :	8.42	3.95	4.98	5.35	5.41	3.06

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
158	0.0	10.0	320.0	39.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.49	-.03	.07	.06	.09	.04
MAX :	1.64	.05	.16	.23	.49	.02
MIN :	-.51	-.12	.02	.13	.32	.11
RMS :	.31	.02	.03	.05	.13	.02
GFACT :	3.31	3.50	2.27	4.12	5.17	2.68
PFACT :	3.70	3.90	3.26	3.27	3.01	3.73

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
159	337.5	10.0	320.0	39.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.60	-.03	.05	.08	.09	.02
MAX :	1.68	.04	.15	.24	.56	.05
MIN :	-.29	-.12	-.02	.15	.35	.09
RMS :	.28	.02	.03	.05	.11	.02
GFACT :	2.77	3.64	3.34	3.17	6.30	3.68
PFACT :	3.78	3.88	3.02	3.67	4.23	3.72

1

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
160	315.0	10.0	320.0	39.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	-.00	.02	.02	.02	.01
MAX :	1.11	.05	.08	.14	.29	.06
MIN :	-.32	-.07	-.03	-.11	-.23	-.05
RMS :	.16	.02	.02	.03	.06	.01
GFACT :	5.05	17.90	3.90	6.19	11.89	4.61
PFACT :	5.46	3.28	3.36	3.84	4.37	3.50

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
161	292.5	10.0	320.0	39.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	.00	.01	.04	.03	.00
MAX :	1.48	.07	.07	.19	.36	.05
MIN :	-.29	-.07	-.07	.08	-.27	.06
RMS :	.19	.02	.02	.03	.07	.01
GFACT :	6.54	37.89	5.36	5.05	12.28	14.23
PFACT :	6.73	2.98	2.65	4.31	4.97	4.20

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
162	270.0	10.0	320.0	38.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.49	.03	.04	.03	.06	.04
MAX :	1.84	.14	.13	.25	.55	.10
MIN :	-.38	-.12	-.03	-.21	-.38	.01
RMS :	.31	.03	.02	.06	.13	.02
GFACT :	3.76	4.44	3.12	7.29	8.90	2.33
PFACT :	4.41	3.43	3.92	3.45	3.65	3.65

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
163	247.5	10.0	320.0	39.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.17	.02	.03	.02	.02	.01
MAX :	.93	.10	.09	.16	.32	.05
MIN :	-.43	-.08	-.03	-.13	-.25	-.03
RMS :	.18	.02	.02	.04	.08	.01
GFACT :	5.56	4.63	3.22	7.24	17.19	6.17
PFACT :	4.24	3.85	3.24	3.48	3.05	3.08

1

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
164	247.5	10.0	265.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.26	.04	-.04	.02	.10	.02
MAX :	.22	.23	.09	.16	.10	.03
MIN :	-1.05	-.04	-.16	.02	.34	.10
RMS :	.16	.02	.04	.02	.06	.02
GFACT :	3.99	5.69	3.91	6.71	3.43	4.71
PFACT :	4.99	8.75	3.05	8.12	4.40	4.60

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
165	270.0	10.0	265.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	.04	.00	.02	.01	.02
MAX :	.57	.10	.07	.08	.19	.03
MIN :	-.45	-.01	-.06	.01	.17	.07
RMS :	.10	.01	.02	.01	.04	.02
GFACT :	62.25	2.73	20.48	3.61	15.38	3.53
PFACT :	5.39	4.69	3.63	5.53	4.40	3.39

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
166	292.5	10.0	265.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.14	.03	.02	.02	.06	.00
MAX :	.72	.11	.08	.06	.30	.04
MIN :	-.49	-.04	-.05	-.03	.12	.07
RMS :	.14	.02	.02	.01	.06	.01
GFACT :	5.01	3.99	5.18	3.80	5.06	17.67
PFACT :	4.10	4.94	3.64	3.79	4.22	4.96

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
167	315.0	10.0	265.0	39.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.31	.01	.05	.01	.11	.01
MAX :	1.26	.08	.12	.05	.46	.09
MIN :	-.38	-.05	.03	.06	.26	.05
RMS :	.22	.02	.02	.02	.08	.02
GFACT :	4.01	7.39	2.49	8.89	4.02	11.26
PFACT :	4.25	4.44	3.32	3.35	4.42	4.35

1

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
168	337.5	10.0	265.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	.02	.03	.04	.04	.01
MAX :	1.11	.07	.08	.07	.32	.04
MIN :	-.19	-.02	-.03	.01	.15	.05
RMS :	.15	.01	.02	.01	.05	.01
GFACT :	4.81	3.89	2.61	1.95	7.78	5.52
PFACT :	5.80	4.79	2.99	2.72	5.65	3.79

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
169	0.0	10.0	265.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.51	.00	.07	.00	.12	.01
MAX :	1.58	.07	.14	.07	1.07	.07
MIN :	-.24	-.04	-.01	-.06	.24	.05
RMS :	.24	.01	.03	.02	.08	.02
GFACT :	3.10	21.13	2.11	91.74	9.00	6.83
PFACT :	4.42	4.85	2.71	3.54	11.71	3.71

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
170	0.0	20.0	290.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.43	-.03	.07	.05	.13	-.03
MAX :	1.69	.07	.21	.15	.42	.02
MIN :	-.26	-.12	-.02	-.07	.17	.08
RMS :	.25	.03	.03	.03	.08	.02
GFACT :	3.93	4.71	2.78	2.72	3.10	2.74
PFACT :	5.07	3.37	4.13	3.24	3.55	3.45

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
171	337.5	20.0	290.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.43	-.02	.06	.05	.11	.01
MAX :	1.43	.07	.16	.14	.35	.06
MIN :	-.18	-.11	.04	.06	.12	.07
RMS :	.22	.03	.03	.03	.07	.02
GFACT :	3.32	7.11	2.70	3.12	3.24	6.91
PFACT :	4.56	3.85	3.63	3.49	3.54	3.55

1

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
172	315.0	20.0	290.0	39.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.39	-.01	.09	.04	.10	.01
MAX :	1.17	.09	.17	.13	.32	.04
MIN :	-.20	-.10	.02	.07	.15	.06
RMS :	.20	.02	.02	.03	.07	.01
GFACT :	2.99	18.01	1.84	3.04	3.35	5.86
PFACT :	3.90	3.76	3.52	3.16	3.43	3.30

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
173	292.5	20.0	290.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.35	.01	.05	.03	.07	.02
MAX :	1.26	.09	.12	.12	.37	.09
MIN :	-.31	-.07	.02	.07	.19	.03
RMS :	.20	.02	.02	.02	.07	.02
GFACT :	3.64	15.76	2.39	3.91	5.41	4.96
PFACT :	4.49	3.64	3.77	3.66	4.26	4.45

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
174	270.0	20.0	290.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.28	.01	.04	.02	.06	.02
MAX :	.96	.10	.11	.12	.33	.07
MIN :	-.42	-.08	.06	.10	.17	.03
RMS :	.19	.02	.02	.02	.07	.02
GFACT :	3.42	9.50	2.79	7.27	5.32	4.18
PFACT :	3.61	4.50	2.83	5.14	3.79	3.45

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
175	247.5	20.0	290.0	40.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.05	.03	-.04	.00	.11	.03
MAX :	.33	.17	.09	.09	.00	.04
MIN :	-.42	-.08	-.14	.08	.28	.09
RMS :	.11	.03	.03	.02	.04	.02
GFACT :	8.35	5.27	3.90	32.24	2.55	3.10
PFACT :	3.42	4.77	3.34	4.13	3.84	3.56

1

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
176	0.0	25.0	340.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	-.02	.04	.01	.01	-.01
MAX :	1.13	.04	.27	.12	.50	.05
MIN :	-.70	-.09	-.13	.10	-.54	.08
RMS :	.21	.02	.05	.03	.11	.02
QFACT :	33.02	5.27	6.53	17.70	35.56	8.85
PFACT :	5.25	4.72	4.61	3.64	4.26	4.26

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
178	337.5	25.0	340.0	39.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.31	-.02	.14	.03	.03	.02
MAX :	1.31	.04	.35	.15	.41	.03
MIN :	-.32	-.09	.00	-.08	.37	.08
RMS :	.21	.02	.05	.03	.11	.02
QFACT :	4.18	4.72	2.54	5.70	15.59	4.26
PFACT :	4.79	4.10	4.33	4.54	3.62	4.02

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
179	315.0	25.0	340.0	39.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.48	-.02	.18	.04	.01	-.04
MAX :	1.58	.04	.43	.16	.50	.02
MIN :	-.30	-.07	.02	.07	.43	.11
RMS :	.25	.02	.06	.03	.11	.02
QFACT :	3.28	3.60	2.35	4.12	34.65	2.57
PFACT :	4.40	3.42	4.31	4.62	4.29	3.25

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
180	292.5	25.0	340.0	39.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.45	-.00	.17	.05	-.02	-.03
MAX :	1.43	.05	.41	.14	.37	.02
MIN :	-.18	-.06	.04	.05	.37	-.09
RMS :	.20	.02	.05	.02	.09	.01
QFACT :	3.19	17.28	2.35	3.00	20.62	2.49
PFACT :	4.86	3.75	5.11	3.93	3.04	3.63

1

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
181	270.0	25.0	340.0	40.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.36	-.01	.14	-.01	.01	.00
MAX :	1.31	.06	.37	.08	.36	.06
MIN :	-.28	-.07	.01	.10	.29	.04
RMS :	.19	.02	.05	.02	.08	.01
GFACT :	3.61	13.08	2.75	10.85	69.47	12.60
PFACT :	5.04	4.06	5.25	4.19	4.49	4.71

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
182	247.5	25.0	340.0	40.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.44	.01	.17	.01	.01	.02
MAX :	1.36	.08	.33	.11	.49	.05
MIN :	-.38	-.07	.05	.15	.56	.02
RMS :	.23	.02	.04	.03	.12	.01
GFACT :	3.12	9.48	1.93	14.14	48.95	2.86
PFACT :	4.07	3.54	3.66	4.67	4.49	3.59

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
183	247.5	45.0	290.0	40.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.13	.04	.12	.01	.03	.01
MAX :	.31	.20	.09	.18	.19	.02
MIN :	-.68	-.13	-.35	.15	.26	.06
RMS :	.12	.04	.06	.04	.05	.01
GFACT :	5.25	5.54	2.90	21.73	8.15	4.14
PFACT :	4.50	4.43	3.98	4.69	4.34	3.40

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
184	270.0	45.0	290.0	40.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.02	.03	.01	.01	.00	.01
MAX :	.54	.15	.28	.12	.18	.03
MIN :	-.39	-.10	-.16	.12	.20	.04
RMS :	.12	.04	.06	.04	.05	.01
GFACT :	22.68	5.48	26.56	16.53	3448.22	4.08
PFACT :	4.26	3.42	4.62	3.13	3.61	3.34

1

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
185	292.5	45.0	290.0	40.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.25	.01	.19	-.02	.04	.03
MAX :	.91	.14	.50	.12	.29	.07
MIN :	-.32	-.11	.00	.15	.26	.01
RMS :	.16	.03	.07	.04	.06	.01
GFACT :	3.68	12.18	2.58	8.94	6.47	2.82
PFACT :	4.17	3.85	4.31	3.80	3.90	4.07

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
186	315.0	45.0	290.0	40.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.45	-.01	.33	-.04	.08	.05
MAX :	1.45	.13	.69	.10	.37	.13
MIN :	-.13	-.16	.12	.18	.18	.00
RMS :	.19	.04	.08	.04	.07	.02
GFACT :	3.21	12.14	2.09	3.98	4.38	2.54
PFACT :	5.28	3.74	4.66	3.63	4.17	4.91

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
187	337.5	45.0	290.0	40.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.55	-.01	.35	.03	.06	.02
MAX :	1.29	.11	.59	.16	.29	.06
MIN :	-.02	-.13	.15	.09	.18	.03
RMS :	.17	.03	.06	.03	.06	.01
GFACT :	2.36	22.65	1.70	5.03	4.66	3.31
PFACT :	4.31	4.14	3.79	4.26	3.68	3.52

DATA FOR FILE : H5001

RUN #	WIND	EL	AZ	VEL
188	0.0	45.0	290.0	40.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.42	-.03	.29	.07	.05	.03
MAX :	1.28	.09	.59	.18	.27	.00
MIN :	-.18	-.14	.07	.05	.22	.08
RMS :	.18	.04	.07	.03	.07	.01
GFACT :	3.07	4.58	2.03	2.83	5.35	2.42
PFACT :	4.75	3.06	4.07	3.67	3.37	4.30

1

Heliostat 5, Configuration 5-C

Case	Run #	WD	EL	AZ	Day	Time
Smr AM	213	0	25	340	172	8 AM
	210	337.5	25	340	172	8 AM
	209	315	25	340	172	8 AM
	206	292.5	25	340	172	8 AM
	205	270	25	340	172	8 AM
	202	247.5	25	340	172	8 AM
Smr Noon	201	247.5	45	290	172	0 PM
	198	270	45	290	172	0 PM
	197	292.5	45	290	172	0 PM
	194	315	45	290	172	0 PM
	191	337.5	45	290	172	0 PM
	190	0	45	290	172	0 PM
Wntr AM	253	0	10	320	355	8 AM
	252	337.5	10	320	355	8 AM
	249	315	10	320	355	8 AM
	248	292.5	10	320	355	8 AM
	245	270	10	320	355	8 AM
	244	247.5	10	320	355	8 AM
Wntr Noon	230	0	20	290	355	0 PM
	227	337.5	20	290	355	0 PM
	226	315	20	290	355	0 PM
	222	292.5	20	290	355	0 PM
	221	270	20	290	355	0 PM
	218	247.5	20	290	355	0 PM

Heliostat 5, Configuration 5-C. continued

Case	Run #	WD	EL	AZ	Day	Time
Wntr PM	241	247.5	10	265	355	4 PM
	240	270	10	265	355	4 PM
	237	292.5	10	265	355	4 PM
	236	315	10	265	355	4 PM
	234	337.5	10	265	355	4 PM
	231	0	10	265	355	4 PM
Ver. Stow	217	315	0	320	355	8 AM
Hor. Stow	215	315	90	320	355	8 AM

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
190	0.0	45.0	290.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.20	.02	.17	.02	.03	.01
MAX :	.97	.08	.46	.12	.21	.02
MIN :	-.10	-.13	.02	-.08	-.16	-.05
RMS :	.14	.03	.06	.03	.05	.01
GFACT :	3.45	5.69	2.76	5.38	7.07	3.97
PFACT :	4.86	3.78	4.73	3.79	3.66	4.06

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
191	337.5	45.0	290.0	43.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.46	-.02	.24	.03	.07	.01
MAX :	1.14	.08	.42	.11	.26	.07
MIN :	.06	-.12	.10	.08	.12	-.03
RMS :	.15	.03	.05	.03	.05	.01
GFACT :	2.48	5.54	1.77	3.74	3.77	5.70
PFACT :	4.49	3.49	3.40	2.92	3.99	4.27

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
194	315.0	45.0	290.0	43.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.35	-.01	.23	.00	.05	.01
MAX :	.99	.09	.47	.10	.25	.05
MIN :	-.07	-.10	.09	-.07	.12	.01
RMS :	.15	.03	.06	.03	.05	.01
GFACT :	2.83	11.31	2.01	40.02	4.67	3.75
PFACT :	4.38	3.06	3.84	3.60	3.63	3.60

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
197	292.5	45.0	290.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.27	.00	.16	.01	.04	.02
MAX :	.80	.11	.36	.10	.24	.06
MIN :	-.12	-.10	.01	-.12	.17	.02
RMS :	.13	.03	.05	.03	.05	.01
GFACT :	2.96	60.65	2.30	16.50	5.61	3.35
PFACT :	4.01	3.27	3.75	3.53	3.07	3.56

1

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
198	270.0	45.0	290.0	43.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.08	.01	.06	-.02	.00	.01
MAX :	.48	.10	.20	.08	.23	.05
MIN :	-.33	-.08	-.14	.11	.14	.04
RMS :	.10	.03	.04	.03	.04	.01
GFACT :	6.37	8.98	3.61	4.73	56.07	5.32
PFACT :	4.03	3.01	3.82	2.99	5.11	3.7[illegible]

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
201	247.5	45.0	290.0	43.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.09	.02	-.07	.00	.03	.01
MAX :	.34	.10	.05	.08	.11	.02
MIN :	-.50	-.06	.26	.07	.20	.05
RMS :	.10	.03	.04	.03	.04	.01
GFACT :	5.56	5.08	3.68	30.22	7.76	4.09
PFACT :	4.32	3.02	4.85	2.07	4.24	3.95

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
202	247.5	25.0	340.0	41.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.27	.01	.08	.00	.00	.01
MAX :	.87	.06	.22	.09	.35	.05
MIN :	-.25	-.06	-.04	.10	.33	.03
RMS :	.16	.02	.04	.02	.09	.01
GFACT :	3.21	12.34	2.73	280.63	608.18	5.14
PFACT :	3.79	3.53	3.84	4.13	3.08	4.62

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
205	270.0	25.0	340.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.25	-.01	.06	.02	.01	.00
MAX :	1.03	.04	.22	.09	.26	.03
MIN :	-.18	-.05	.02	.05	.27	.04
RMS :	.14	.01	.03	.02	.06	.01
GFACT :	4.05	9.34	3.52	5.31	22.61	19.61
PFACT :	5.56	3.61	4.01	4.05	4.16	3.17

1

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
206	292.5	25.0	340.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.39	-.02	.12	.04	.01	.02
MAX :	1.08	.03	.20	.11	.34	.02
MIN :	-.08	-.07	.02	.03	.28	.07
RMS :	.16	.01	.04	.02	.07	.01
GFACT :	2.78	4.41	2.26	3.06	37.02	4.04
PFACT :	4.35	3.68	4.18	3.46	4.13	3.05

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
209	315.0	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.24	-.01	.08	.02	.01	.02
MAX :	.94	.03	.21	.11	.26	.02
MIN :	-.18	-.06	.02	.05	.28	.06
RMS :	.14	.01	.03	.02	.07	.01
GFACT :	3.86	4.19	2.84	4.56	43.74	2.72
PFACT :	5.08	3.42	4.29	3.97	3.05	3.08

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
210	337.5	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.27	-.02	.07	.03	.01	.03
MAX :	1.11	.02	.24	.12	.39	.00
MIN :	-.27	-.08	.02	.06	.34	.09
RMS :	.14	.01	.03	.02	.07	.01
GFACT :	4.06	3.84	3.44	3.88	28.53	2.75
PFACT :	6.00	4.63	5.08	4.22	5.61	4.04

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
213	0.0	25.0	340.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.12	-.02	.03	.02	.03	.03
MAX :	.87	.05	.17	.13	.43	.01
MIN :	-.54	-.09	-.07	.09	.48	.08
RMS :	.17	.02	.03	.03	.11	.01
GFACT :	7.43	4.91	5.69	6.84	18.59	2.88
PFACT :	4.44	4.44	4.01	3.67	4.11	4.06

1

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
214	315.0	90.0	320.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.06	.00	.07	.00	.02	.00
MAX :	.16	.06	.33	.06	.09	.02
MIN :	-.02	-.05	.20	.07	.06	.04
RMS :	.03	.01	.06	.02	.02	.01
GFACT :	2.62	24.07	4.46	16.92	5.31	11.34
PFACT :	4.02	3.64	4.35	3.22	3.92	5.04

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
217	315.0	0.0	320.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.37	.00	.01	.03	.02	.01
MAX :	1.07	.09	.05	.16	.38	.02
MIN :	-.30	-.09	.04	.11	.31	.05
RMS :	.18	.03	.01	.04	.08	.01
GFACT :	2.90	20.85	8.21	5.20	21.17	6.15
PFACT :	3.99	2.96	3.56	3.60	4.61	4.35

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
218	247.5	20.0	290.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.05	.02	.01	.00	.00	.00
MAX :	.60	.15	.11	.11	.19	.06
MIN :	-.54	-.11	.09	-.13	.22	.05
RMS :	.14	.04	.03	.04	.05	.01
GFACT :	12.89	7.62	16.59	35.42	107.69	11.61
PFACT :	4.08	3.49	3.85	3.54	4.26	3.58

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
221	270.0	20.0	290.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	.02	.04	.01	.03	.01
MAX :	.71	.14	.17	.11	.22	.06
MIN :	-.38	-.11	.06	.13	-.19	.04
RMS :	.13	.03	.03	.03	.05	.01
GFACT :	4.62	7.95	3.84	10.96	8.55	5.05
PFACT :	4.37	3.68	4.33	3.61	4.20	3.94

1

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
222	292.5	20.0	290.0	42.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.32	-.01	.10	.05	.09	.05
MAX :	1.04	.12	.23	.08	.34	.10
MIN :	-.32	-.16	-.02	.21	.13	.00
RMS :	.17	.04	.04	.04	.06	.02
GFACT :	3.26	17.16	2.31	3.76	3.97	2.07
PFACT :	4.17	3.37	3.57	3.62	4.14	3.46

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
226	315.0	20.0	290.0	43.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.35	-.02	.13	.04	.08	.05
MAX :	1.36	.09	.26	.07	.33	.10
MIN :	-.24	-.13	.05	.15	.21	.01
RMS :	.18	.04	.03	.03	.06	.01
GFACT :	3.88	5.42	2.00	3.51	3.78	2.11
PFACT :	5.69	3.13	3.69	3.37	4.12	4.25

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
227	337.5	20.0	290.0	43.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.25	-.01	.07	.00	.04	.01
MAX :	.83	.06	.17	.07	.20	.04
MIN :	-.08	-.09	-.00	.08	.09	.05
RMS :	.11	.02	.02	.02	.04	.01
GFACT :	3.34	6.98	2.39	33.90	4.51	7.13
PFACT :	5.14	3.83	4.10	3.05	3.99	3.51

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
230	0.0	20.0	290.0	43.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.30	-.02	.11	.02	.06	.01
MAX :	1.24	.09	.27	.13	.26	.02
MIN :	-.15	-.14	.03	.07	.12	.06
RMS :	.14	.03	.03	.02	.04	.01
GFACT :	4.11	6.95	2.54	6.26	4.45	4.86
PFACT :	6.76	4.42	5.28	4.31	4.49	5.08

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
231	0.0	10.0	265.0	43.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.28	-.00	.01	.00	.06	.01
MAX :	1.04	.03	.05	.05	.26	.06
MIN :	-.09	-.04	.03	-.06	.11	.03
RMS :	.14	.01	.01	.01	.05	.01
GFACT :	3.70	14.34	3.73	16.17	4.76	10.21
PFACT :	5.52	4.01	3.26	3.67	4.62	4.31

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
234	337.5	10.0	265.0	43.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.25	.00	.03	.01	.05	.03
MAX :	.88	.04	.07	.06	.22	.08
MIN :	-.19	-.04	-.02	.06	.12	.01
RMS :	.13	.01	.01	.01	.05	.01
GFACT :	3.58	22.74	2.40	5.63	4.78	2.72
PFACT :	4.97	3.50	3.60	3.83	3.74	4.22

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
236	315.0	10.0	265.0	42.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.20	.01	.02	.01	.04	.03
MAX :	.96	.05	.06	.06	.30	.10
MIN :	-.36	-.04	-.02	.06	.26	.02
RMS :	.16	.01	.01	.02	.06	.02
GFACT :	4.79	8.85	2.71	8.98	7.97	2.75
PFACT :	4.64	3.65	3.03	3.25	4.10	3.79

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
237	292.5	10.0	265.0	42.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.01	.02	-.01	.00	.04	.02
MAX :	.83	.09	.04	.09	.32	.09
MIN :	-.77	-.05	.10	.00	.20	.06
RMS :	.21	.02	.02	.02	.08	.02
GFACT :	101.74	3.68	11.35	19.42	8.52	3.85
PFACT :	3.62	3.57	5.20	3.55	3.30	3.64

1

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
240	270.0	10.0	265.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.05	.01	-.01	-.02	.01	.00
MAX :	.42	.06	.03	.05	.20	.04
MIN :	-.55	-.04	-.07	.08	-.30	-.05
RMS :	.14	.01	.01	.02	.06	.01
GFACT :	10.57	6.65	4.99	4.75	58.09	23.89
PFACT :	3.48	3.57	4.33	3.60	4.95	3.70

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
241	247.5	10.0	265.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.16	.03	.02	.03	.04	.02
MAX :	.61	.10	.04	.11	.22	.05
MIN :	-1.33	-.03	-.11	.05	.35	-.11
RMS :	.19	.02	.02	.02	.07	.02
GFACT :	8.45	3.73	5.17	3.52	8.15	5.77
PFACT :	6.03	4.66	4.94	3.79	4.22	4.92

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
244	247.5	10.0	320.0	43.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	.00	.01	.00	.01	.01
MAX :	.85	.08	.05	.12	.29	.05
MIN :	-.46	-.10	-.05	-.13	.27	.02
RMS :	.14	.03	.02	.03	.06	.01
GFACT :	6.72	128.58	8.21	36.29	23.11	3.77
PFACT :	5.01	3.01	2.98	3.52	4.76	3.91

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
245	270.0	10.0	320.0	42.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.29	.01	.03	.02	.05	.04
MAX :	1.19	.11	.08	.17	.33	.10
MIN :	-.30	-.11	-.01	.13	.22	.00
RMS :	.18	.03	.01	.04	.07	.01
GFACT :	4.15	17.13	2.53	9.70	6.35	2.29
PFACT :	5.08	3.10	4.04	3.55	3.90	4.07

1

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
248	292.5	10.0	320.0	42.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.39	.01	.04	.05	.04	.00
MAX :	1.14	.12	.08	.22	.31	.05
MIN :	-.13	-.11	.00	-.07	.23	.05
RMS :	.17	.03	.01	.04	.07	.02
GFACT :	2.89	14.91	2.00	4.09	8.39	23.15
PFACT :	4.45	3.57	3.28	4.47	4.06	2.92

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
249	315.0	10.0	320.0	43.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.28	-.00	.03	.04	.01	.02
MAX :	1.06	.09	.07	.17	.36	.02
MIN :	-.42	-.12	.01	-.14	.35	-.06
RMS :	.16	.03	.01	.04	.07	.01
GFACT :	3.75	26.79	2.29	4.80	51.70	3.05
PFACT :	4.75	3.08	3.44	3.70	5.16	4.01

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
252	337.5	10.0	320.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.32	-.01	.03	.03	.03	.01
MAX :	1.21	.07	.07	.15	.24	.02
MIN :	-.17	-.10	.02	-.00	.23	.06
RMS :	.15	.03	.01	.04	.06	.01
GFACT :	3.82	6.53	2.65	4.36	8.58	5.32
PFACT :	5.93	3.04	3.48	3.29	3.55	4.35

DATA FOR FILE : H5100

RUN #	WIND	EL	AZ	VEL
253	0.0	10.0	320.0	42.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.26	-.02	.03	.01	.01	.01
MAX :	.86	.08	.08	.14	.27	.03
MIN :	-.20	-.15	.01	.16	.20	-.07
RMS :	.14	.03	.01	.04	.06	.01
GFACT :	3.32	7.55	2.50	11.40	25.73	8.43
PFACT :	4.21	3.75	3.46	3.14	4.23	4.15

1

Heliostat 5, Configuration 5-D

Case	Run #	WD	EL	AZ	Day	Time
Smr AM	212	0	25	340	172	8 AM
	211	337.5	25	340	172	8 AM
	208	315	25	340	172	8 AM
	207	292.5	25	340	172	8 AM
	204	270	25	340	172	8 AM
	203	247.5	25	340	172	8 AM
Smr Noon	200	247.5	45	290	172	0 PM
	199	270	45	290	172	0 PM
	196	292.5	45	290	172	0 PM
	193	315	45	290	172	0 PM
	195	337.5	45	290	172	0 PM
	189	0	45	290	172	0 PM
Wntr AM	254	0	10	320	355	8 AM
	251	337.5	10	320	355	8 AM
	250	315	10	320	355	8 AM
	247	292.5	10	320	355	8 AM
	246	270	10	320	355	8 AM
	243	247.5	10	320	355	8 AM
Wntr Noon	229	0	20	290	355	0 PM
	228	337.5	20	290	355	0 PM
	225	315	20	290	355	0 PM
	223	292.5	20	290	355	0 PM
	220	270	20	290	355	0 PM
	219	247.5	20	290	355	0 PM

Heliostat 5, Configuration 5-D. continued

Case	Run #	WD	EL	AZ	Day	Time
Wntr PM	242	247.5	10	265	355	4 PM
	239	270	10	265	355	4 PM
	238	292.5	10	265	355	4 PM
	235	315	10	265	355	4 PM
	233	337.5	10	265	355	4 PM
	232	0	10	265	355	4 PM
Ver. Stow	216	315	0	320	355	8 AM
Hor. Stow	215	315	90	320	355	8 AM

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
189	0.0	45.0	290.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.24	-.02	.17	.02	.03	.00
MAX :	1.14	.09	.50	.12	.29	.05
MIN :	-.16	-.13	.02	.06	.20	.04
RMS :	.16	.03	.07	.03	.05	.01
GFACT :	4.81	6.36	3.01	4.90	9.17	13.02
PFACT :	5.79	3.61	5.05	3.37	5.04	4.22

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
193	315.0	45.0	290.0	43.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.20	.01	.10	.01	.02	.01
MAX :	.94	.09	.39	.11	.20	.05
MIN :	-.18	-.08	-.04	.09	.14	.03
RMS :	.13	.03	.06	.02	.04	.01
GFACT :	4.75	17.96	3.69	7.63	9.81	6.40
PFACT :	5.58	3.40	4.63	3.74	4.09	3.79

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
195	337.5	45.0	290.0	43.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.20	-.00	.16	.02	.04	.01
MAX :	.85	.09	.43	.11	.23	.03
MIN :	-.20	-.10	.02	.08	.15	.04
RMS :	.13	.02	.06	.03	.05	.01
GFACT :	4.18	26.42	2.72	4.74	5.52	4.10
PFACT :	4.90	4.06	4.32	3.40	4.24	3.37

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
196	292.5	45.0	290.0	42.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	.00	.09	.01	.03	.01
MAX :	.85	.11	.39	.11	.25	.05
MIN :	-.22	-.12	.06	.11	.18	.03
RMS :	.14	.04	.06	.04	.05	.01
GFACT :	5.57	39.12	4.16	13.80	8.32	7.42
PFACT :	5.07	2.96	5.11	2.96	4.20	3.43

1

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
199	270.0	45.0	290.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.07	.02	.07	-.01	.01	.00
MAX :	.53	.12	.15	.10	.22	.05
MIN :	-.51	-.09	-.22	.13	.10	.04
RMS :	.11	.03	.04	.04	.05	.01
GFACT :	7.74	7.02	3.35	19.34	34.37	24.70
PFACT :	4.13	3.16	3.40	3.49	4.62	3.99

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
200	247.5	45.0	290.0	43.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.16	.04	-.11	.02	.00	.02
MAX :	.29	.14	.05	.14	.17	.07
MIN :	-.58	-.07	.26	.09	.17	.03
RMS :	.11	.03	.04	.03	.05	.01
GFACT :	3.57	3.89	2.44	7.94	298.21	3.85
PFACT :	3.84	3.02	3.40	3.43	3.73	3.97

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
203	247.5	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.28	.01	.10	.02	.01	.02
MAX :	1.19	.08	.29	.10	.43	.05
MIN :	-.27	-.06	.03	.07	.32	.02
RMS :	.19	.02	.04	.03	.10	.01
GFACT :	4.23	8.72	2.82	5.05	55.30	3.26
PFACT :	4.90	3.80	4.71	3.27	4.36	3.30

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
204	270.0	25.0	340.0	42.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.20	-.01	.06	.00	.02	.02
MAX :	.94	.03	.22	.07	.27	.06
MIN :	-.23	-.06	-.03	.07	.20	.02
RMS :	.14	.01	.04	.02	.06	.01
GFACT :	4.80	7.60	3.60	22.46	11.55	3.47
PFACT :	5.15	4.29	4.51	3.09	4.01	4.05

1

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
207	292.5	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.29	-.02	.09	.02	.02	.01
MAX :	1.18	.03	.26	.11	.33	.05
MIN :	-.19	-.07	-.01	-.06	-.25	-.06
RMS :	.17	.01	.04	.02	.07	.01
DFACT :	4.11	3.81	2.88	6.32	17.74	9.10
PFACT :	5.32	3.66	4.36	4.34	4.20	3.79

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
208	315.0	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	-.02	.04	.00	.02	.01
MAX :	1.12	.03	.23	.11	.34	.03
MIN :	-.32	-.10	-.06	-.09	-.26	-.05
RMS :	.16	.02	.03	.02	.07	.01
DFACT :	5.18	4.75	5.11	29.01	20.25	6.79
PFACT :	5.78	5.00	5.27	4.54	4.30	4.14

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
211	337.5	25.0	340.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.12	-.01	.02	.02	.02	.02
MAX :	1.11	.03	.21	.11	.43	.02
MIN :	-.37	-.06	-.08	-.06	-.32	-.07
RMS :	.13	.01	.03	.02	.06	.01
DFACT :	9.09	7.79	9.51	5.30	26.63	4.35
PFACT :	7.37	4.44	6.01	4.32	6.88	4.90

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
212	0.0	25.0	340.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	-.01	.01	.02	.01	.00
MAX :	.65	.05	.14	.12	.36	.06
MIN :	-.58	-.07	-.10	-.08	-.37	-.05
RMS :	.17	.02	.03	.03	.10	.01
DFACT :	22.37	5.72	24.26	6.48	31.69	72.79
PFACT :	3.72	3.71	3.94	3.66	3.00	4.11

1

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
215	315.0	90.0	320.0	42.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	-.00	.03	.00	.02	.00
MAX :	.10	.04	.23	.07	.05	.02
MIN :	-.06	-.06	-.30	.07	.00	.02
RMS :	.02	.01	.06	.02	.02	.01
GFACT :	8.04	22.24	8.72	16.19	5.17	8.10
PFACT :	4.72	4.39	3.17	3.29	3.90	3.40

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
216	315.0	0.0	320.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	-.00	.01	.01	.01	.04
MAX :	.84	.06	.04	.11	.23	.00
MIN :	-.26	-.06	-.04	.09	.19	.09
RMS :	.14	.02	.01	.03	.05	.01
GFACT :	5.66	67.65	6.75	18.12	24.36	2.15
PFACT :	5.12	3.04	3.48	3.90	4.33	4.90

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
219	247.5	20.0	290.0	42.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.05	.03	-.03	.02	.02	.02
MAX :	.49	.14	.07	.13	.15	.03
MIN :	-.59	-.08	-.17	.08	-.20	.08
RMS :	.14	.04	.03	.04	.05	.02
GFACT :	10.84	5.04	5.26	5.45	10.03	4.66
PFACT :	3.91	3.10	4.42	2.96	3.78	3.93

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
220	270.0	20.0	290.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	.01	.01	.02	.01	.02
MAX :	.49	.12	.12	.09	.15	.06
MIN :	-.46	-.11	.00	.13	.14	.03
RMS :	.11	.03	.03	.03	.04	.01
GFACT :	19.39	12.19	11.97	8.69	24.66	3.75
PFACT :	4.32	3.80	4.00	4.10	3.75	3.56

1

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
223	292.5	20.0	290.0	42.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	-.01	.04	.05	.03	.02
MAX :	.87	.10	.17	.07	.27	.08
MIN :	-.34	-.14	.03	.18	.10	.03
RMS :	.16	.04	.03	.04	.05	.01
GFACT :	6.62	17.04	3.99	3.58	10.03	5.21
PFACT :	4.71	3.61	4.21	3.61	4.58	4.00

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
225	315.0	20.0	290.0	43.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.11	.01	.04	.02	.00	.01
MAX :	.54	.06	.14	.09	.15	.07
MIN :	-.17	-.05	.03	.04	.11	.02
RMS :	.10	.02	.02	.02	.03	.01
GFACT :	5.15	10.65	3.33	6.02	34.05	5.19
PFACT :	4.45	3.10	4.35	3.00	4.31	4.91

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
228	337.5	20.0	290.0	43.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.20	-.02	.08	-.00	.04	.02
MAX :	.80	.09	.19	.10	.22	.07
MIN :	-.18	-.11	.01	.08	.10	.02
RMS :	.12	.02	.03	.02	.04	.01
GFACT :	3.97	7.34	2.27	839.58	5.20	3.96
PFACT :	4.99	3.95	4.12	3.41	4.58	4.01

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
229	0.0	20.0	290.0	43.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.33	-.02	.13	.05	.07	.03
MAX :	1.33	.10	.30	.17	.37	.00
MIN :	-.28	-.15	.02	.07	.22	.08
RMS :	.19	.04	.04	.03	.06	.01
GFACT :	4.02	8.86	2.31	3.64	5.03	2.68
PFACT :	5.23	3.72	4.53	3.77	4.60	4.41

1

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
232	0.0	10.0	265.0	43.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.29	-.02	.04	.03	.05	.01
MAX :	1.10	.03	.10	.03	.25	.04
MIN :	-.32	-.07	-.02	.08	.18	.04
RMS :	.17	.01	.01	.01	.05	.01
GFACT :	3.81	4.40	2.29	2.72	5.41	7.42
PFACT :	4.80	4.36	3.77	3.45	3.87	3.73

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
233	337.5	10.0	265.0	43.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.18	.00	.00	.01	.03	.02
MAX :	.82	.04	.04	.07	.21	.07
MIN :	-.23	-.04	.04	.04	.15	.02
RMS :	.13	.01	.01	.01	.05	.01
GFACT :	4.47	8.99	72.40	10.10	7.31	4.56
PFACT :	4.78	3.74	3.30	4.69	4.06	5.22

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
235	315.0	10.0	265.0	41.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.10	-.00	.00	.01	.02	.00
MAX :	.79	.03	.05	.04	.21	.06
MIN :	-.31	-.04	.04	.06	.15	.04
RMS :	.13	.01	.01	.01	.04	.02
GFACT :	8.06	78.49	10.68	4.71	8.58	14.32
PFACT :	5.38	4.73	3.01	3.89	4.21	3.26

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
238	292.5	10.0	265.0	43.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	.02	-.03	.01	.02	.04
MAX :	1.00	.08	.02	.08	.29	.04
MIN :	-.75	-.04	-.11	.06	.28	.11
RMS :	.18	.02	.02	.02	.07	.02
GFACT :	33.91	5.06	3.91	6.90	16.43	2.57
PFACT :	5.47	4.28	5.54	3.40	3.99	3.46

1

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
239	270.0	10.0	265.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.10	.01	-.02	.03	.02	.01
MAX :	.48	.06	.03	.04	.21	.08
MIN :	-.85	-.05	-.09	.09	.26	.05
RMS :	.16	.01	.02	.02	.06	.02
GFACT :	8.31	9.93	5.20	3.41	16.12	8.63
PFACT :	4.59	3.59	4.97	3.34	4.09	4.64

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
242	247.5	10.0	265.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.20	.02	-.02	.02	.04	.01
MAX :	.47	.08	.04	.08	.10	.03
MIN :	-.99	-.03	-.10	.04	.20	.08
RMS :	.18	.01	.02	.02	.06	.01
GFACT :	5.07	4.00	3.96	3.58	7.24	8.17
PFACT :	4.53	4.54	3.88	3.38	4.01	4.84

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
243	247.5	10.0	320.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.09	.03	.02	.04	.01	.02
MAX :	.65	.15	.07	.16	.26	.06
MIN :	-.36	-.09	-.03	.13	.26	.02
RMS :	.15	.04	.02	.04	.07	.01
GFACT :	7.46	5.57	3.18	4.64	36.79	3.21
PFACT :	3.82	3.41	2.90	3.08	3.66	3.31

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
246	270.0	10.0	320.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.32	.00	.02	.02	.05	.06
MAX :	1.30	.14	.07	.21	.39	.12
MIN :	-.37	-.11	.04	.15	.34	.01
RMS :	.21	.04	.02	.05	.08	.01
GFACT :	4.07	31.59	4.08	11.49	7.39	1.93
PFACT :	4.77	3.58	3.42	4.00	4.08	4.15

1

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
247	292.5	10.0	320.0	42.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	.00	.01	.02	.03	.02
MAX :	.92	.11	.06	.12	.27	.07
MIN :	-.34	-.08	.02	.09	.10	.02
RMS :	.14	.03	.01	.03	.05	.01
GFACT :	4.26	112.18	4.37	7.20	8.99	3.23
PFACT :	5.11	4.08	4.09	3.35	4.76	4.06

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
250	315.0	10.0	320.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	-.01	.01	.01	.02	.01
MAX :	.70	.06	.05	.10	.21	.05
MIN :	-.22	-.08	-.04	.10	-.12	.04
RMS :	.12	.02	.02	.03	.04	.01
GFACT :	5.26	7.69	9.51	16.32	8.70	6.45
PFACT :	4.60	2.93	2.75	3.19	4.09	3.52

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
251	337.5	10.0	320.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.20	.00	.01	.04	.02	.02
MAX :	1.07	.08	.07	.10	.22	.01
MIN :	-.27	-.09	-.04	.10	.21	.00
RMS :	.16	.03	.02	.04	.06	.01
GFACT :	5.33	175.39	4.78	4.14	14.39	3.46
PFACT :	5.40	2.90	3.32	3.01	3.66	5.27

DATA FOR FILE : H5101

RUN #	WIND	EL	AZ	VEL
254	0.0	10.0	320.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.12	-.02	.03	.00	.01	.00
MAX :	.99	.09	.03	.16	.20	.05
MIN :	-.52	-.13	.06	.15	.30	.06
RMS :	.15	.03	.01	.04	.06	.02
GFACT :	8.12	6.78	2.53	47.20	19.20	9.54
PFACT :	5.80	3.55	2.81	3.43	4.44	2.63

1

Heliostat 5, Configuration 5-E

Case	Run #	WD	EL	AZ	Day	Time
Smr AM	279	0	25	340	172	8 AM
	281	337.5	25	340	172	8 AM
	282	315	25	340	172	8 AM
	283	292.5	25	340	172	8 AM
	284	270	25	340	172	8 AM
	285	247.5	25	340	172	8 AM
Smr Noon	286	274.5	45	290	172	0 PM
	287	270	45	290	172	0 PM
	288	292.5	45	290	172	0 PM
	289	315	45	290	172	0 PM
	290	337.5	45	290	172	0 PM
	291	0	45	290	172	0 PM
Wntr AM	255	0	10	320	355	8 AM
	256	337.5	10	320	355	8 AM
	257	315	10	320	355	8 AM
	258	292.5	10	320	355	8 AM
	259	270	10	320	355	8 AM
	260	247.5	10	320	355	8 AM
Wntr Noon	267	0	20	290	355	0 PM
	268	337.5	20	290	355	0 PM
	269	315	20	290	355	0 PM
	270	292.5	20	290	355	0 PM
	271	270	20	290	355	0 PM
	272	247.5	20	290	355	0 PM

Heliostat 5, Configuration 5-E. continued.

Case	Run #	WD	EL	AZ	Day	Time
Wntr PM	261	247.5	10	265	355	4 PM
	262	270	10	265	355	4 PM
	263	292.5	10	265	355	4 PM
	264	315	10	265	355	4 PM
	265	337.5	10	265	355	4 PM
	266	0	10	265	355	4 PM
Ver. Stow	213	315	0	320	355	8 AM
Hor. Stow	274	315	90	320	355	8 AM

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
255	0.0	10.0	320.0	42.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.12	-.01	.01	.00	.03	.01
MAX :	1.06	.12	.05	.18	.31	.04
MIN :	-.45	-.14	-.03	.15	.25	.08
RMS :	.19	.04	.01	.05	.07	.02
GFACT :	8.64	9.98	8.14	111.53	10.33	8.47
PFACT :	5.01	3.10	3.59	3.77	3.71	4.63

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
256	337.5	10.0	320.0	41.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.19	-.01	.03	.01	.02	.00
MAX :	.87	.07	.07	.15	.29	.05
MIN :	-.23	-.09	-.01	.10	.22	.07
RMS :	.15	.02	.01	.03	.05	.01
GFACT :	4.61	10.02	2.45	12.82	16.12	64.85
PFACT :	4.49	3.44	3.63	4.55	5.27	5.14

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
257	315.0	10.0	320.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.29	-.00	.03	.04	.03	.01
MAX :	1.13	.11	.07	.23	.35	.02
MIN :	-.29	-.12	-.01	.12	.30	.07
RMS :	.18	.03	.01	.04	.07	.01
GFACT :	3.94	24.14	2.65	6.36	10.04	5.00
PFACT :	4.57	3.42	3.53	4.73	4.28	4.58

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
258	292.5	10.0	320.0	41.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.31	-.01	.03	.00	.04	.02
MAX :	1.50	.11	.07	.21	.36	.09
MIN :	-.31	-.13	-.01	.16	.28	.02
RMS :	.21	.03	.01	.04	.08	.01
GFACT :	4.90	9.22	2.36	140.22	8.57	3.74
PFACT :	5.58	3.50	3.46	4.98	4.15	4.29

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
259	270.0	10.0	320.0	41.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	.00	.02	.04	.03	.03
MAX :	.99	.11	.06	.19	.28	.08
MIN :	-.30	-.10	.02	-.10	.22	.01
RMS :	.17	.03	.01	.04	.06	.01
GFACT :	4.37	23.79	2.66	4.85	8.40	3.28
PFACT :	4.55	3.52	2.97	4.05	3.06	4.30

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
260	247.5	10.0	320.0	42.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.10	.00	.04	.01	.02	.02
MAX :	.82	.10	.09	.12	.26	.07
MIN :	-.41	-.11	.01	-.16	.22	.01
RMS :	.15	.03	.01	.04	.06	.01
GFACT :	8.03	71.66	2.48	11.47	15.25	2.78
PFACT :	4.78	3.21	3.96	3.87	3.79	4.04

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
261	247.5	10.0	265.0	41.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.20	.01	-.02	.03	-.05	.02
MAX :	.46	.10	.05	.11	.22	.04
MIN :	-1.26	-.09	-.14	.05	-.38	.09
RMS :	.22	.02	.03	.02	.07	.02
GFACT :	6.18	7.92	6.83	3.22	7.26	5.77
PFACT :	4.72	3.56	4.91	3.00	4.46	3.93

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
262	270.0	10.0	265.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.03	.01	.02	.01	.00	.01
MAX :	.53	.08	.06	.04	.16	.06
MIN :	-.50	-.06	.03	.06	.17	.03
RMS :	.12	.02	.01	.02	.05	.01
GFACT :	18.83	16.06	3.49	10.91	170.78	4.33
PFACT :	3.79	4.52	3.38	3.17	3.26	3.81

1

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
263	292.5	10.0	265.0	43.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.10	.02	.01	.02	.02	.03
MAX :	1.07	.14	.06	.04	.23	.11
MIN :	-.45	-.05	.03	-.08	.22	.02
RMS :	.15	.02	.01	.02	.06	.01
GFACT :	10.57	8.55	5.22	3.79	12.08	4.23
PFACT :	6.41	6.04	4.59	3.45	3.75	5.02

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
264	315.0	10.0	265.0	43.1

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	.03	.02	.01	.05	.03
MAX :	.96	.11	.07	.04	.29	.09
MIN :	-.30	-.03	.02	-.06	.16	.02
RMS :	.17	.02	.01	.01	.06	.01
GFACT :	4.29	3.58	2.79	6.34	5.03	3.36
PFACT :	4.42	4.01	4.07	3.61	4.13	4.23

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
265	337.5	10.0	265.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.25	.03	.01	.02	.05	.03
MAX :	1.09	.10	.05	.03	.32	.10
MIN :	-.32	-.05	.04	-.08	.21	.02
RMS :	.16	.02	.01	.02	.05	.01
GFACT :	4.26	4.08	3.35	4.27	6.76	3.18
PFACT :	5.25	4.20	2.94	4.04	5.30	4.79

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
266	0.0	10.0	265.0	43.4

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.18	.01	.02	.02	.04	.00
MAX :	.85	.07	.06	.03	.20	.04
MIN :	-.14	-.03	.02	.06	.10	.03
RMS :	.11	.01	.01	.01	.04	.01
GFACT :	4.65	8.33	3.08	3.37	5.35	18.15
PFACT :	5.00	4.81	3.78	2.75	4.26	4.37

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
267	0.0	20.0	290.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.17	.00	.05	.01	.04	.01
MAX :	.73	.06	.15	.08	.19	.05
MIN :	-.21	-.06	.00	.06	.09	.03
RMS :	.11	.02	.02	.02	.03	.01
GFACT :	4.29	97.46	2.76	7.76	4.60	5.61
PFACT :	5.10	3.22	4.17	3.35	4.44	4.69

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
268	337.5	20.0	290.0	42.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.01	.03	.01	.03	.01
MAX :	.75	.07	.14	.08	.19	.04
MIN :	-.23	-.10	.03	.11	.14	.05
RMS :	.12	.03	.02	.03	.04	.01
GFACT :	4.57	16.51	4.22	8.00	6.67	6.91
PFACT :	4.72	3.59	4.89	3.75	4.22	3.83

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
269	315.0	20.0	290.0	44.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	.00	.05	.00	.02	.01
MAX :	.77	.08	.13	.08	.17	.06
MIN :	-.18	-.08	.01	.08	.12	.02
RMS :	.10	.02	.02	.02	.03	.01
GFACT :	5.72	101.92	2.82	22.48	8.47	5.02
PFACT :	6.14	3.57	4.66	3.31	4.24	4.04

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
270	292.5	20.0	290.0	43.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	.01	.04	.00	.04	.01
MAX :	1.41	.13	.19	.13	.31	.07
MIN :	-.47	-.11	.04	.16	.29	.03
RMS :	.16	.04	.03	.04	.05	.01
GFACT :	8.87	11.29	5.48	63.70	8.61	5.66
PFACT :	8.00	3.17	6.23	3.61	5.41	4.39

1

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
271	270.0	20.0	290.0	43.6

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.01	.02	-.01	.01	.02	.00
MAX :	.61	.14	.10	.13	.25	.05
MIN :	-.42	-.10	.09	.11	.17	.04
RMS :	.13	.04	.02	.04	.05	.01
GFACT :	41.67	7.03	6.48	10.70	13.50	71.59
PFACT :	3.15	3.18	3.14	3.16	4.79	3.86

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
272	247.5	20.0	290.0	43.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.16	.01	-.06	.02	.04	.01
MAX :	.43	.21	.03	.17	.17	.03
MIN :	-.74	-.19	.15	.24	.24	.05
RMS :	.15	.05	.02	.05	.06	.01
GFACT :	4.55	14.68	2.46	13.07	6.42	4.47
PFACT :	3.82	4.03	3.52	4.69	3.46	3.26

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
273	315.0	0.0	320.0	44.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	.01	.01	.01	.01	.01
MAX :	.84	.10	.04	.12	.27	.03
MIN :	-.29	-.07	.07	-.10	-.21	.05
RMS :	.13	.02	.01	.03	.05	.01
GFACT :	5.76	7.00	5.91	9.35	23.16	5.91
PFACT :	5.34	3.31	4.87	3.64	5.17	3.72

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
274	315.0	90.0	320.0	43.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	.01	-.00	.01	.00	.00
MAX :	.10	.06	.26	.11	.06	.02
MIN :	-.07	-.06	.38	.08	.06	.02
RMS :	.02	.01	.07	.02	.02	.01
GFACT :	10.78	10.78	97.60	15.71	31.69	16.72
PFACT :	5.72	4.08	5.12	5.20	3.45	2.70

1

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
279	0.0	25.0	340.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.08	-.02	.03	.01	.03	.00
MAX :	.75	.04	.19	.12	.39	.05
MIN :	-.53	-.00	.07	.11	.31	.05
RMS :	.17	.02	.04	.03	.09	.01
GFACT :	9.83	3.67	6.83	10.34	12.92	13.20
PFACT :	3.05	3.53	4.57	3.24	3.09	3.40

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
281	337.5	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	-.01	.06	.00	.02	.01
MAX :	1.03	.03	.22	.10	.29	.06
MIN :	-.30	-.07	.01	.10	.22	.07
RMS :	.14	.01	.03	.03	.06	.01
GFACT :	6.92	5.43	3.66	81.07	13.92	8.57
PFACT :	6.22	4.22	5.80	3.70	4.51	4.94

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
282	315.0	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.01	.04	.01	.02	.01
MAX :	.71	.03	.17	.09	.30	.04
MIN :	-.25	-.06	.03	-.07	.21	.05
RMS :	.12	.01	.02	.02	.05	.01
GFACT :	4.53	9.33	3.83	12.06	16.51	4.00
PFACT :	4.48	4.09	5.17	4.13	5.52	3.44

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
283	292.5	25.0	340.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.19	-.00	.05	.02	.04	.00
MAX :	.97	.04	.14	.12	.31	.05
MIN :	-.25	-.04	.02	.06	.21	.05
RMS :	.15	.01	.02	.02	.06	.01
GFACT :	5.05	93.88	2.95	5.32	7.70	30.98
PFACT :	5.22	3.80	4.11	4.37	4.41	4.45

1

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
284	270.0	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.17	-.01	.05	.01	.03	.02
MAX :	.94	.03	.15	.09	.27	.08
MIN :	-.30	-.05	.00	.07	.16	.01
RMS :	.12	.01	.02	.02	.05	.01
GFACT :	5.60	9.33	3.04	11.02	8.52	3.27
PFACT :	6.28	4.28	5.83	4.00	4.60	5.42

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
285	247.5	25.0	340.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.27	.00	.10	.02	.04	.01
MAX :	1.03	.05	.22	.11	.34	.07
MIN :	-.30	-.06	.03	.07	.24	.02
RMS :	.17	.01	.02	.03	.08	.01
GFACT :	3.78	68.02	2.30	6.47	8.36	6.32
PFACT :	4.35	3.62	5.23	3.69	3.75	6.30

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
286	247.5	45.0	290.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	.02	.00	.00	.01	.00
MAX :	.44	.15	.21	.11	.16	.05
MIN :	-.45	-.11	.22	-.12	.18	.03
RMS :	.11	.04	.05	.03	.04	.01
GFACT :	58.05	6.85	1168.44	27.06	30.33	28.05
PFACT :	3.85	3.40	3.85	3.09	4.34	4.59

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
287	270.0	45.0	290.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.03	.01	.03	.00	.03	.02
MAX :	.43	.11	.27	.08	.15	.06
MIN :	-.29	-.07	.15	.07	.10	.02
RMS :	.09	.03	.05	.02	.03	.01
GFACT :	12.93	10.07	7.84	79.99	5.19	3.64
PFACT :	4.40	3.63	4.79	3.47	3.92	3.59

1

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
288	292.5	45.0	290.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.10	.00	.11	.01	.05	.03
MAX :	.60	.10	.47	.09	.24	.06
MIN :	-.24	-.09	-.05	.10	.09	.00
RMS :	.10	.03	.06	.03	.04	.01
GFACT :	6.31	26.32	4.12	7.93	4.79	2.12
PFACT :	4.99	3.41	5.09	3.51	4.97	3.68

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
289	315.0	45.0	290.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.12	.01	.12	.00	.04	.00
MAX :	.52	.09	.39	.08	.21	.03
MIN :	-.14	-.06	.00	.06	.06	.02
RMS :	.09	.02	.05	.02	.03	.01
GFACT :	4.34	14.14	3.28	24.61	5.34	11.29
PFACT :	4.56	4.06	5.08	3.87	5.38	4.17

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
290	337.5	45.0	290.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.12	.00	.11	.01	.05	.01
MAX :	.66	.08	.41	.10	.25	.04
MIN :	-.18	-.08	.02	.07	.06	.02
RMS :	.09	.02	.05	.02	.03	.01
GFACT :	5.61	28.46	3.59	11.86	4.72	3.12
PFACT :	5.97	3.44	5.48	4.28	5.72	3.43

DATA FOR FILE : H5102

RUN #	WIND	EL	AZ	VEL
291	0.0	45.0	290.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.18	-.00	.18	.03	.07	.02
MAX :	.67	.08	.47	.14	.25	.01
MIN :	-.13	-.11	.02	.04	.03	.05
RMS :	.11	.02	.07	.02	.04	.01
GFACT :	3.62	23.06	2.65	4.16	3.51	2.91
PFACT :	4.43	4.57	4.52	4.62	4.60	4.32

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Heliostat 3, Configuration 3-A

Case	Run #	WD	EL	AZ
Ver. Stow	411	265	0	5

DATA FOR FILE : H3100

RUN #	WIND	EL	AZ	VEL
311	265.0	0.0	5.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	.01	.00	.00	.01	.02
MAX :	1.05	.05	.10	.04	.26	.03
MIN :	.21	-.09	.05	-.04	.19	.09
RMS :	.12	.02	.02	.01	.05	.01
DFACT :	6.78	7.49	116.70	17.44	22.47	4.97
PFACT :	7.31	4.33	2.42	3.37	5.03	5.60

Heliostat 3, Configuration 3-B

Case	Run	WD	EL	AZ	# of Rows Upstream
Ver. Stow	411	265	0	5	10
	412	265	0	5	9
	413	265	0	5	8
	414	265	0	5	7
	415	265	0	5	6
	416	265	0	5	5
	417	265	0	5	4
	418	265	0	5	3
	420	265	0	5	2
	421	265	0	5	1
	422	265	0	5	0

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
411	265.0	0.0	5.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	.01	.00	.00	.01	.02
MAX :	1.05	.05	.10	.04	.26	.03
MIN :	-.21	-.09	-.05	.04	.19	.09
RMS :	.12	.02	.02	.01	.05	.01
GFACT :	6.78	7.49	116.70	17.44	22.47	1.97
PFACT :	7.34	4.33	2.42	3.37	5.03	5.60

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
412	265.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.14	-.01	.02	.01	.02	.02
MAX :	.72	.04	.11	.04	.26	.01
MIN :	.19	-.08	.07	.03	.10	.08
RMS :	.11	.02	.02	.01	.05	.01
GFACT :	5.09	12.10	4.08	6.94	15.03	3.36
PFACT :	5.13	4.78	2.16	3.20	4.95	1.91

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
413	265.0	0.0	5.0	43.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	-.00	.01	.02	.00	.02
MAX :	.92	.04	.07	.07	.18	.03
MIN :	-.17	.07	-.06	.03	.22	-.08
RMS :	.10	.01	.02	.01	.05	.01
GFACT :	7.27	54.38	6.04	3.70	71.79	3.58
PFACT :	7.01	4.31	3.37	3.91	1.90	1.42

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
414	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	-.01	.01	.00	.00	.01
MAX :	.75	.04	.10	.05	.22	.01
MIN :	-.21	.06	-.04	.04	.18	.06
RMS :	.09	.01	.02	.01	.04	.01
GFACT :	5.90	7.80	8.04	326.07	369.81	3.97
PFACT :	6.07	3.63	1.60	3.33	1.52	3.93

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DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
415	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.12	-.01	-.02	.01	.01	.02
MAX :	.61	.04	.07	.04	.26	.02
MIN :	-.23	-.07	.07	.04	.16	.08
RMS :	.10	.01	.02	.01	.04	.01
GFACT :	5.02	12.38	3.76	4.70	40.73	3.62
PFACT :	5.15	4.60	2.03	3.17	5.73	4.76

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
416	265.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.13	-.01	.02	.01	.00	.02
MAX :	.96	.04	.12	.04	.27	.01
MIN :	-.13	-.08	.04	.03	.16	.09
RMS :	.10	.01	.02	.01	.05	.01
GFACT :	7.21	15.05	6.52	4.68	441.73	9.54
PFACT :	8.66	5.05	5.31	2.95	5.79	6.78

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
417	265.0	0.0	5.0	41.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.02	.01	.01	.01	.02
MAX :	.92	.04	.10	.03	.32	.01
MIN :	.17	-.08	.04	.06	.22	.08
RMS :	.11	.02	.02	.01	.05	.01
GFACT :	9.97	4.61	12.49	7.67	21.64	3.68
PFACT :	5.82	3.69	5.47	4.07	5.74	4.48

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
418	265.0	0.0	5.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.19	-.01	-.01	.00	.04	.00
MAX :	.84	.05	.08	.05	.36	.04
MIN :	-.23	-.09	.06	.06	.39	.05
RMS :	.12	.02	.02	.02	.07	.01
GFACT :	4.43	7.47	7.25	24.43	9.11	44.94
PFACT :	5.28	3.70	2.33	3.44	4.77	3.59

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
420	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.34	-.02	.02	.01	.03	.02
MAX :	.80	.05	.07	.06	.38	.03
MIN :	-.24	-.12	.07	.04	.29	.07
RMS :	.15	.03	.02	.01	.09	.01
GFACT :	2.62	4.91	3.21	4.31	10.85	2.93
PFACT :	3.58	3.64	2.55	3.01	3.73	3.44

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
421	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.63	.06	.01	.04	.03	.07
MAX :	1.71	.05	.09	.09	.37	.01
MIN :	-.04	.20	.07	.03	.34	.15
RMS :	.21	.03	.02	.01	.09	.02
GFACT :	2.73	3.40	6.04	2.09	11.10	2.17
PFACT :	5.24	4.47	3.21	3.02	3.64	4.74

DATA FOR FILE : H3200

RUN #	WIND	EL	AZ	VEL
422	265.0	0.0	5.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.16	-.09	.03	.01	.09	.05
MAX :	2.21	.02	.12	.05	.40	.01
MIN :	.51	-.18	.05	.03	.24	.12
RMS :	.25	.02	.04	.01	.08	.02
GFACT :	1.91	2.01	4.33	5.25	4.38	2.43
PFACT :	4.19	3.69	2.48	3.70	3.61	3.76

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Heliostat 3, Configuration 3-C

Case	Run	WD	EL	AZ	Field Density GA
Ver. Stow	411	265	0	5	0.238
	423	265	0	5	0.131
	424	265	0	5	0.067
	425	265	0	5	0.044
	426	265	0	5	0.026

DATA FOR FILE : H3300

RUN #	WIND	EL	AZ	VEL
411	265.0	0.0	5.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	.01	.00	.00	.01	.02
MAX :	1.05	.05	.10	.04	.26	.03
MIN :	-.21	-.09	.05	.04	-.19	.09
RMS :	.12	.02	.02	.01	.05	.01
GFACT :	6.78	7.49	116.70	17.44	22.47	4.97
PFACT :	7.34	4.33	2.92	3.37	5.03	5.60

DATA FOR FILE : H3300

RUN #	WIND	EL	AZ	VEL
423	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.34	-.03	.02	.01	.03	.02
MAX :	1.35	.04	.13	.03	.46	.03
MIN :	-.35	-.13	-.04	.05	.31	.09
RMS :	.21	.02	.03	.01	.08	.02
GFACT :	4.01	4.54	5.73	5.07	15.58	4.88
PFACT :	4.95	4.20	3.41	3.21	5.19	4.16

DATA FOR FILE : H3300

RUN #	WIND	EL	AZ	VEL
424	265.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.69	-.05	.01	.00	.07	.03
MAX :	1.90	.05	.10	.05	.58	.03
MIN :	-.14	-.18	.04	-.04	.39	.11
RMS :	.30	.03	.02	.01	.12	.02
GFACT :	2.75	3.56	12.00	12.09	8.33	3.34
PFACT :	3.99	4.40	4.04	3.12	4.10	4.60

DATA FOR FILE : H3300

RUN #	WIND	EL	AZ	VEL
425	265.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.94	-.07	.02	.01	.05	.03
MAX :	2.47	.03	.09	.06	.58	.04
MIN :	.01	-.22	-.08	.04	.50	.11
RMS :	.34	.03	.02	.01	.14	.02
GFACT :	2.61	3.00	4.48	5.95	11.41	4.35
PFACT :	4.52	4.23	3.21	3.41	3.04	4.52

1

DATA FOR FILE : H3300

RUN #	WIND	EL	AZ	VEL
426	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	1.07	-.09	-.02	.01	.07	.03
MAX :	2.47	.02	.07	.05	.50	.03
MIN :	.21	-.20	.07	-.04	.40	.10
RMS :	.33	.03	.02	.01	.12	.02
DFACT :	2.31	2.33	3.20	6.56	6.08	3.30
PFACT :	4.25	3.01	2.33	3.12	3.49	3.54

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Heliostat 3, Configuration 3-D

Case	Run	WD	EL	AZ	# Rows Upstream
Ver. Stow	424	265	0	5	5
	429	265	0	5	3
	432	265	0	5	2
	435	265	0	5	1

DATA FOR FILE : H3400

RUN #	WIND	EL	AZ	VEL
424	265.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.69	-.05	.01	.00	.07	.03
MAX :	1.90	.05	.10	.05	.58	.03
MIN :	-.14	-.18	.04	-.04	.39	.11
RMS :	.30	.03	.02	.01	.12	.02
GFACT :	2.75	3.56	12.00	12.09	8.33	3.34
PFACT :	3.99	4.40	4.04	3.12	4.10	4.68

DATA FOR FILE : H3400

RUN #	WIND	EL	AZ	VEL
429	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.55	-.04	.01	.01	.03	.01
MAX :	1.60	.08	.18	.07	.59	.05
MIN :	-.24	-.21	.07	-.00	.48	.08
RMS :	.25	.03	.02	.02	.12	.02
GFACT :	2.94	5.23	15.23	7.03	17.05	10.13
PFACT :	4.26	5.32	7.09	3.45	4.50	3.59

DATA FOR FILE : H3400

RUN #	WIND	EL	AZ	VEL
432	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.57	-.05	.04	.01	.03	.03
MAX :	1.60	.05	.13	.06	.49	.03
MIN :	-.15	-.16	-.02	.04	.41	.12
RMS :	.25	.03	.02	.01	.12	.02
GFACT :	2.81	3.44	3.30	9.34	17.14	3.57
PFACT :	4.09	4.10	4.03	3.53	4.00	4.34

DATA FOR FILE : H3400

RUN #	WIND	EL	AZ	VEL
435	265.0	0.0	5.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.71	-.06	.01	.00	.04	.03
MAX :	2.34	.06	.08	.07	.62	.04
MIN :	-.21	-.27	.05	.07	.74	.12
RMS :	.29	.04	.02	.02	.14	.02
GFACT :	3.32	4.67	14.33	19.59	16.52	3.59
PFACT :	5.61	5.30	4.36	3.22	4.05	3.58

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Heliostat 3, Configuration 3-E

Case	Run	WD	EL	AZ	# Rows Upstream
Ver. Stow	427	265	0	5	5
	430	265	0	5	3
	433	265	0	5	2
	436	265	0	5	1

DATA FOR FILE : H3401

RUN #	WIND	EL	AZ	VEL
427	265.0	0.0	5.0	43.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.53	.05	.02	.00	.05	.03
MAX :	1.85	.05	.07	.05	.59	.05
MIN :	-.22	.20	.08	.04	.44	-.12
RMS :	.27	.03	.02	.01	.12	.02
GFACT :	3.46	4.10	3.21	75.26	10.82	4.00
PFACT :	4.86	4.74	3.03	3.64	4.15	4.09

DATA FOR FILE : H3401

RUN #	WIND	EL	AZ	VEL
430	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.43	.03	.02	.01	.01	.00
MAX :	1.36	.04	.11	.05	.38	.06
MIN :	-.29	.13	-.02	.04	.41	-.07
RMS :	.22	.02	.02	.01	.10	.02
GFACT :	3.19	4.75	5.16	5.28	25.48	103.81
PFACT :	4.19	4.40	5.83	3.46	3.69	4.48

DATA FOR FILE : H3401

RUN #	WIND	EL	AZ	VEL
433	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	-.02	.01	.00	.01	.02
MAX :	.96	.05	.10	.04	.36	.03
MIN :	-.31	-.10	-.07	-.05	.26	.09
RMS :	.18	.02	.02	.01	.08	.02
GFACT :	4.22	6.17	17.44	178.01	24.47	4.51
PFACT :	4.16	3.87	4.04	3.65	4.08	4.34

DATA FOR FILE : H3401

RUN #	WIND	EL	AZ	VEL
436	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.02	.02	.00	.03	.00
MAX :	1.31	.04	.08	.04	.45	.04
MIN :	-.27	-.12	-.08	.05	.37	.06
RMS :	.13	.02	.02	.01	.07	.01
GFACT :	8.07	6.80	3.83	14.04	16.45	29.33
PFACT :	8.53	5.69	3.05	3.58	5.86	4.46

1

Heliostat 3, Configuration 3-F

Case	Run	WD	EL	AZ	# Rows Upstream
Ver. Stow	428	265	0	5	5
	431	265	0	5	3
	434	265	0	5	2
	438	265	0	5	1

DATA FOR FILE : H3402

RUN #	WIND	EL	AZ	VEL
428	265.0	0.0	5.0	44.0

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.49	-.04	.02	.00	.03	-.02
MAX :	1.47	.05	.05	.04	.41	.05
MIN :	-.11	-.16	.07	-.07	.37	-.10
RMS :	.23	.03	.01	.01	.10	.02
GFACT :	2.99	3.74	3.53	23.25	16.10	4.36
PFACT :	4.26	4.13	3.45	4.20	3.71	3.94

DATA FOR FILE : H3402

RUN #	WIND	EL	AZ	VEL
431	265.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.39	-.03	-.01	.01	.03	.02
MAX :	1.31	.05	.08	.05	.44	.03
MIN :	-.29	-.13	-.06	.04	.34	.08
RMS :	.21	.02	.02	.01	.09	.02
GFACT :	3.36	5.20	9.26	6.19	15.00	5.12
PFACT :	4.47	4.77	3.10	3.10	4.40	4.11

DATA FOR FILE : H3402

RUN #	WIND	EL	AZ	VEL
434	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	-.01	-.01	.02	.01	.01
MAX :	1.14	.06	.09	.07	.37	.05
MIN :	-.29	-.10	.06	-.04	.29	.06
RMS :	.17	.02	.02	.01	.08	.01
GFACT :	5.25	16.05	9.46	3.31	35.46	8.09
PFACT :	5.33	4.67	2.41	3.61	4.52	3.52

DATA FOR FILE : H3402

RUN #	WIND	EL	AZ	VEL
438	265.0	0.0	5.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.17	-.01	.00	.02	.01	.01
MAX :	.92	.07	.07	.06	.41	.03
MIN :	-.32	.09	.06	.04	.35	-.06
RMS :	.14	.02	.02	.01	.08	.01
GFACT :	5.50	10.87	12.71	3.30	28.07	7.14
PFACT :	5.37	4.19	3.32	3.21	4.97	3.97

1

Heliostat 3, Configuration 3-G

Case	Run	WD	EL	AZ	# Rows Upstream
Ver. Stow	493	265	0	5	5
	496	265	0	5	3
	497	265	0	5	2
	501	265	0	5	1

DATA FOR FILE : H3405

RUN #	WIND	EL	AZ	VEL
493	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.33	.00	.00	-.01	.02	.00
MAX :	1.55	.00	.00	.03	.42	.06
MIN :	-.47	-.06	.01	-.06	.51	.06
RMS :	.25	.02	.01	.01	.11	.02
GFACT :	4.72	27.98	352.30	6.25	25.44	22.07
PFACT :	4.08	3.98	5.77	4.07	4.54	3.50

DATA FOR FILE : H3405

RUN #	WIND	EL	AZ	VEL
496	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.29	.00	.01	-.02	.00	.01
MAX :	1.39	.00	.04	.03	.43	.04
MIN :	-.38	-.07	-.06	.08	.47	.08
RMS :	.24	.02	.01	.02	.11	.01
GFACT :	4.87	326.53	5.69	5.08	102.22	6.57
PFACT :	4.55	3.59	3.50	3.93	3.92	5.03

DATA FOR FILE : H3405

RUN #	WIND	EL	AZ	VEL
497	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.21	.00	.00	.01	.02	.03
MAX :	1.42	.08	.07	.04	.41	.03
MIN :	-.44	-.08	-.04	.06	.49	.10
RMS :	.21	.02	.01	.02	.11	.02
GFACT :	6.74	79.99	100.27	7.49	26.47	3.54
PFACT :	5.74	3.61	5.13	3.40	4.20	4.64

DATA FOR FILE : H3405

RUN #	WIND	EL	AZ	VEL
501	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	.00	-.02	.00	.01	.02
MAX :	1.02	.06	.06	.05	.37	.02
MIN :	-.26	-.06	-.07	-.04	.34	.09
RMS :	.16	.02	.02	.01	.10	.01
GFACT :	4.69	17.70	2.76	10.27	47.50	3.67
PFACT :	4.00	2.99	2.79	3.01	3.69	5.37

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Heliostat 3, Configuration 3-H

Case	Run	WD	EL	AZ	# Rows Upstream
Ver. Stow	494	265	0	5	5
	495	265	0	5	3
	498	265	0	5	2
	499	265	0	5	1

DATA FOR FILE : H3406

RUN #	WIND	EL	AZ	VEL
494	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.26	.00	.00	.01	.01	.01
MAX :	1.49	.08	.07	.03	.36	.04
MIN :	-.45	-.07	-.05	.08	.52	-.09
RMS :	.23	.02	.01	.01	.10	.01
GFACT :	5.83	27.56	46.30	5.50	41.60	7.44
PFACT :	5.33	4.02	3.24	4.40	5.21	5.01

DATA FOR FILE : H3406

RUN #	WIND	EL	AZ	VEL
495	265.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.26	.00	-.00	.02	-.01	.01
MAX :	1.30	.08	.08	.02	.47	.05
MIN :	-.34	-.07	-.05	-.07	-.41	.08
RMS :	.23	.02	.01	.01	.10	.02
GFACT :	5.03	108.34	18.91	4.33	44.62	5.62
PFACT :	4.50	4.43	3.53	3.71	3.90	3.87

DATA FOR FILE : H3406

RUN #	WIND	EL	AZ	VEL
498	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	-.00	-.02	-.02	.01	.01
MAX :	.82	.08	.03	.03	.37	.03
MIN :	-.20	-.06	-.06	-.07 @	.31	.06
RMS :	.15	.02	.01	.01	.08	.01
GFACT :	3.74	24.54	3.47	3.72	32.90	4.74
PFACT :	3.93	3.81	3.19	3.00	4.81	3.51

DATA FOR FILE : H3406

RUN #	WIND	EL	AZ	VEL
499	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	-.00	-.02	.02	.00	.02
MAX :	.93	.07	.04	.04	.40	.05
MIN :	-.30	-.09	.06	.08	.34	-.08
RMS :	.16	.02	.01	.02	.10	.02
GFACT :	4.07	43.86	3.33	3.73	652.63	3.67
PFACT :	4.48	4.14	3.06	3.40	3.99	2.04

Heliostat 3, Configuration 3-I

Case	Run	WD	EL	AZ
Ver. Stow	432	265	0	5
	439	247.5	0	5
	440	270	0	5
	441	292.5	0	5
	442	315	0	5
	443	337.5	0	5
	444	0	0	5

DATA FOR FILE : H3500

RUN #	WIND	EL	AZ	VEL
432	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.57	-.05	.04	.01	.03	.03
MAX :	1.60	.05	.13	.06	.49	.03
MIN :	-.15	-.16	-.02	-.04	-.41	.12
RMS :	.25	.03	.02	.01	.12	.02
GFACT :	2.81	3.44	3.30	9.34	17.14	3.57
PFACT :	4.09	4.10	4.03	3.53	4.00	4.34

DATA FOR FILE : H3500

RUN #	WIND	EL	AZ	VEL
439	247.5	0.0	5.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.98	-.05	.02	.02	.05	.01
MAX :	2.18	.03	.09	.05	.32	.04
MIN :	.15	-.14	-.03	-.02	.47	.06
RMS :	.28	.02	.01	.01	.10	.01
GFACT :	2.23	2.63	5.62	2.86	10.83	8.08
PFACT :	4.23	3.60	5.42	3.05	4.26	4.61

DATA FOR FILE : H3500

RUN #	WIND	EL	AZ	VEL
440	270.0	0.0	5.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.73	-.06	-.01	.01	.02	-.04
MAX :	1.79	.07	.12	.07	.54	.04
MIN :	-.10	-.22	-.07	.05	-.60	-.14
RMS :	.30	.04	.02	.02	.14	.02
GFACT :	2.46	3.56	7.49	6.36	39.49	3.77
PFACT :	3.57	4.13	2.60	3.26	4.27	4.52

DATA FOR FILE : H3500

RUN #	WIND	EL	AZ	VEL
441	292.5	0.0	5.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.93	-.10	-.00	-.02	-.06	.07
MAX :	2.32	.02	.07	.04	.65	-.00
MIN :	.06	-.25	-.07	-.07	-.01	.15
RMS :	.29	.04	.02	.02	.14	.02
GFACT :	2.49	2.50	40.23	4.57	12.70	2.30
PFACT :	4.85	4.29	3.87	3.53	5.27	3.07

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DATA FOR FILE : H3500

RUN #	WIND	EL	AZ	VEL
442	315.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.43	-.03	.02	.02	.00	.04
MAX :	1.45	.06	.09	.06	.50	.01
MIN :	-.34	-.16	-.03	-.03	-.45	.11
RMS :	.27	.03	.02	.01	.13	.02
GFACT :	3.37	5.43	3.74	3.63	140.41	2.95
PFACT :	3.84	4.31	4.28	3.34	3.86	3.96

DATA FOR FILE : H3500

RUN #	WIND	EL	AZ	VEL
443	337.5	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.36	-.06	.02	.00	.01	.05
MAX :	1.45	.04	.07	.05	.65	.02
MIN :	-.47	-.18	-.02	.06	.59	.13
RMS :	.23	.03	.01	.02	.14	.02
GFACT :	4.07	2.91	3.45	62.00	87.43	2.80
PFACT :	4.72	4.01	4.76	3.50	4.70	3.95

DATA FOR FILE : H3500

RUN #	WIND	EL	AZ	VEL
444	0.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.07	-.03	.01	.02	.01	.00
MAX :	.33	.02	.04	.05	.22	.05
MIN :	-.57	-.11	.04	.02	-.20	.06
RMS :	.12	.02	.01	.01	.06	.02
GFACT :	7.89	3.35	7.39	3.35	37.84	13.35
PFACT :	4.00	4.60	2.60	3.02	3.38	3.19

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Heliostat 3, Configuration 3-J

Case	Run	WD	EL	AZ
Ver. Stow	433	265	0	5
	451	247.5	0	5
	450	270	0	5
	449	292.5	0	5
	448	315	0	5
	447	337.5	0	5
	446	0	0	5

DATA FOR FILE : H3501

RUN #	WIND	EL	AZ	VEL
433	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	-.02	.01	-.00	.01	.02
MAX :	.96	.05	.10	.04	.36	.03
MIN :	-.31	-.10	.07	.05	.26	.09
RMS :	.10	.02	.02	.01	.08	.02
GFACT :	4.22	6.17	17.44	178.01	24.47	4.51
PFACT :	4.16	3.87	4.04	3.65	4.08	4.34

DATA FOR FILE : H3501

RUN #	WIND	EL	AZ	VEL
446	0.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.23	-.01	.00	.01	.03	.03
MAX :	.68	.08	.08	.06	.69	.09
MIN :	-1.03	.12	.05	.05	.56	.04
RMS :	.23	.03	.01	.02	.15	.02
GFACT :	4.55	11.25	15.52	5.05	20.02	2.91
PFACT :	3.54	3.59	3.60	2.86	4.42	2.99

DATA FOR FILE : H3501

RUN #	WIND	EL	AZ	VEL
447	337.5	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.10	.03	.03	.00	.01	.03
MAX :	1.34	.10	.03	.06	.84	.04
MIN :	-1.00	.16	.08	.07	.77	.14
RMS :	.30	.04	.01	.02	.20	.03
GFACT :	13.50	5.57	2.67	130.27	66.93	5.19
PFACT :	4.08	3.49	3.60	3.04	4.14	4.39

DATA FOR FILE : H3501

RUN #	WIND	EL	AZ	VEL
448	315.0	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.39	-.04	.00	.01	.01	.04
MAX :	1.61	.07	.08	.05	.62	.03
MIN :	-.57	-.17	.03	.05	.68	.14
RMS :	.33	.04	.01	.02	.19	.03
GFACT :	4.13	3.84	16.72	8.30	98.03	3.43
PFACT :	3.71	3.51	5.83	2.83	3.26	3.75

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DATA FOR FILE : H3501

RUN #	WIND	EL	AZ	VEL
149	292.5	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.32	.03	.02	.01	.00	.03
MAX :	1.39	.05	.05	.06	.44	.03
MIN :	-.36	-.14	-.07	.04	.42	.12
RMS :	.25	.03	.01	.01	.12	.02
GFACT :	4.39	5.00	3.12	7.42	375.09	1.55
PFACT :	4.37	3.01	3.93	3.57	1.00	1.54

DATA FOR FILE : H3501

RUN #	WIND	EL	AZ	VEL
150	270.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.28	.02	.00	.01	.00	.01
MAX :	1.42	.05	.04	.04	.37	.04
MIN :	-.40	.12	.06	.04	.42	.09
RMS :	.20	.02	.01	.01	.09	.02
GFACT :	5.08	5.60	43.51	6.92	98.60	6.46
PFACT :	5.62	4.04	4.12	2.96	4.50	5.10

DATA FOR FILE : H3501

RUN #	WIND	EL	AZ	VEL
151	247.5	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.45	-.03	.01	.01	.02	.00
MAX :	1.08	.05	.07	.04	.18	.07
MIN :	.38	-.14	-.05	.06	.60	.05
RMS :	.29	.03	.01	.01	.14	.01
GFACT :	4.16	4.36	4.07	5.51	29.02	27.90
PFACT :	4.03	3.89	2.59	3.60	4.17	3.73

Heliostat 3, Configuration 3-K

Case	Run	WD	EL	AZ
Ver. Stow	434	265	0	5
	452	247.5	0	5
	453	270	0	5
	454	292.5	0	5
	455	315	0	5
	456	337.5	0	5
	458	0	0	5

DATA FOR FILE : H3502

RUN #	WIND	EL	AZ	VEL
434	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	-.01	.01	.02	.01	.01
MAX :	1.14	.06	.09	.07	.37	.05
MIN :	-.29	-.10	.06	-.04	.29	.06
RMS :	.17	.02	.02	.01	.09	.01
BFACT :	5.25	16.05	7.46	3.31	35.16	9.09
PFACT :	5.33	4.67	2.41	3.61	4.52	3.52

DATA FOR FILE : H3502

RUN #	WIND	EL	AZ	VEL
452	247.5	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.42	-.03	.01	.00	.04	.01
MAX :	1.74	.06	.07	.05	.44	.09
MIN :	-.35	-.16	.06	.05	.51	.07
RMS :	.27	.03	.01	.01	.13	.02
BFACT :	4.11	6.47	6.08	28.92	13.69	11.57
PFACT :	4.08	5.13	3.11	3.34	3.93	3.97

DATA FOR FILE : H3502

RUN #	WIND	EL	AZ	VEL
453	270.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.33	-.03	-.02	.00	.00	.02
MAX :	1.52	.05	.04	.04	.47	.03
MIN :	-.33	-.14	.07	.05	.40	.07
RMS :	.22	.03	.01	.01	.11	.02
BFACT :	4.77	4.93	3.47	34.05	640.33	5.07
PFACT :	5.60	4.22	3.51	3.57	4.53	4.21

DATA FOR FILE : H3502

RUN #	WIND	EL	AZ	VEL
454	292.5	0.0	5.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.33	-.03	.01	-.00	.03	.04
MAX :	1.43	.05	.05	.05	.50	.03
MIN :	-.38	-.15	.06	.06	.39	.14
RMS :	.24	.03	.01	.02	.12	.02
BFACT :	4.31	4.35	8.68	26.73	12.79	3.42
PFACT :	4.57	3.92	3.65	3.31	3.09	4.70

DATA FOR FILE : H3502

RUN #	WIND	EL	AZ	VEL
455	315.0	0.0	5.0	12.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.16	-.02	.00	.00	.01	.02
MAX :	1.44	.06	.08	.04	.60	.05
MIN :	-.19	-.11	.04	.01	.69	.09
RMS :	.20	.02	.01	.01	.11	.02
GFACT :	9.07	6.49	33.69	24.72	51.55	5.59
PFACT :	6.30	3.72	3.50	3.07	5.56	4.23

DATA FOR FILE : H3502

RUN #	WIND	EL	AZ	VEL
456	337.5	0.0	5.0	12.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.02	-.01	.01	.01	.03	.01
MAX :	.89	.09	.07	.05	.47	.06
MIN :	-.74	-.12	.02	.05	.11	.09
RMS :	.21	.03	.01	.02	.13	.02
GFACT :	13.39	11.05	6.63	7.21	15.12	9.82
PFACT :	4.14	1.08	4.96	3.01	3.17	1.44

DATA FOR FILE : H3502

RUN #	WIND	EL	AZ	VEL
458	0.0	0.0	5.0	12.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.28	.00	.00	.00	.01	.03
MAX :	.60	.10	.09	.04	.75	.11
MIN :	-1.28	-.10	.06	.06	.51	.05
RMS :	.24	.03	.02	.01	.15	.02
GFACT :	1.52	83.97	61.06	30.00	53.59	1.03
PFACT :	4.08	3.00	1.00	2.22	1.09	1.28

1

Heliostat 3, Configuration 3-L

Case	Run	WD	EL	AZ
Ver. Stow	486	247.5	0	5
	485	265	0	5
	484	270	0	5
	482	292.5	0	5
	481	315	0	5
	480	337.5	0	5
	479	0	0	5

DATA FOR FILE : H3503

RUN #	WIND	EL	AZ	VEL
479	0.0	0.0	5.0	41.8

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.24	-.03	.01	.01	-.05	.02
MAX :	.69	.03	.06	.06	.36	.09
MIN :	-1.09	-.10	-.04	-.04	-.41	.09
RMS :	.20	.02	.01	.01	.11	.02
GFACT :	4.54	3.53	7.64	5.59	8.88	5.12
PFACT :	4.17	4.05	4.03	3.87	3.37	3.00

DATA FOR FILE : H3503

RUN #	WIND	EL	AZ	VEL
480	337.5	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.07	-.02	-.01	.01	.02	.02
MAX :	1.18	.05	.03	.04	.56	.06
MIN :	-.74	-.09	-.07	-.06	.49	.13
RMS :	.25	.02	.01	.01	.14	.02
GFACT :	16.13	5.04	4.54	10.57	31.15	6.51
PFACT :	4.40	3.29	4.38	3.98	3.81	4.90

DATA FOR FILE : H3503

RUN #	WIND	EL	AZ	VEL
481	315.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.32	-.01	-.02	.00	.06	.03
MAX :	1.63	.09	.02	.05	.65	.05
MIN :	-.65	-.11	-.09	.06	.53	.13
RMS :	.30	.03	.01	.02	.16	.02
GFACT :	5.11	15.40	3.73	13.23	10.03	4.83
PFACT :	4.42	3.24	4.60	3.25	3.54	4.37

DATA FOR FILE : H3503

RUN #	WIND	EL	AZ	VEL
482	292.5	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	-.00	.00	.00	.02	.03
MAX :	1.21	.07	.04	.05	.42	.02
MIN :	-.34	-.06	-.05	.04	.30	.10
RMS :	.20	.02	.01	.01	.10	.02
GFACT :	5.39	47.01	14.43	32.72	21.65	3.60
PFACT :	4.79	3.01	3.15	3.10	3.97	4.16

1

DATA FOR FILE : H3503

RUN #	WIND	EL	AZ	VEL
484	270.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.30	.00	-.03	.01	.03	.01
MAX :	1.40	.07	.03	.03	.52	.04
MIN :	-.46	-.06	-.09	.06	.35	.08
RMS :	.23	.02	.01	.01	.10	.02
GFACT :	4.65	35.46	3.44	4.22	16.01	6.26
PFACT :	4.82	3.42	4.61	3.39	4.97	4.67

DATA FOR FILE : H3503

RUN #	WIND	EL	AZ	VEL
485	265.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.31	.01	-.04	.00	.04	.02
MAX :	1.94	.08	.02	.05	.53	.03
MIN :	-.39	-.06	-.09	-.05	.30	.12
RMS :	.25	.02	.02	.01	.11	.02
GFACT :	6.17	12.20	2.50	99.74	13.00	6.36
PFACT :	6.48	3.18	3.57	3.17	4.30	6.66

DATA FOR FILE : H3503

RUN #	WIND	EL	AZ	VEL
486	247.5	0.0	5.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.36	.01	-.01	.00	.01	.00
MAX :	1.45	.08	.05	.04	.43	.06
MIN :	-.38	-.06	.09	-.05	.37	-.06
RMS :	.25	.02	.02	.01	.11	.02
GFACT :	4.05	8.71	10.16	42.85	29.92	15.61
PFACT :	4.32	3.33	4.60	3.21	3.94	3.46

1

Heliostat 3, Configuration 3-M

Case	Run	WD	EL	AZ
Ver. Stow	467	247.5	0	5
	469	265	0	5
	470	270	0	5
	471	292.5	0	5
	475	315	0	5
	477	337.5	0	5
	478	0	0	5

DATA FOR FILE : H3504

RUN #	WIND	EL	AZ	VEL
467	247.5	0.0	5.0	41.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.25	.01	.00	.01	.02	.01
MAX :	1.61	.12	.05	.04	.45	.04
MIN :	-.52	-.06	-.06	-.06	.39	.10
RMS :	.25	.02	.02	.01	.10	.02
GFACT :	6.40	9.70	11.72	6.84	23.17	7.17
PFACT :	5.32	4.36	2.90	3.27	4.41	5.36

DATA FOR FILE : H3504

RUN #	WIND	EL	AZ	VEL
469	265.0	0.0	5.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.34	.02	.01	.01	.04	.00
MAX :	1.64	.18	.06	.05	.71	.05
MIN :	-.77	-.10	-.06	.08	.51	-.07
RMS :	.31	.03	.02	.02	.13	.02
GFACT :	4.85	7.99	6.45	6.01	16.20	10.80
PFACT :	4.22	4.60	2.97	3.67	5.31	4.62

DATA FOR FILE : H3504

RUN #	WIND	EL	AZ	VEL
470	270.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.36	.02	.01	.01	.07	.01
MAX :	1.88	.17	.05	.05	.68	.08
MIN :	-.71	-.09	-.06	-.07	.39	-.08
RMS :	.30	.03	.02	.02	.12	.02
GFACT :	5.26	7.03	6.43	7.37	9.76	6.00
PFACT :	5.02	4.61	2.84	3.83	4.09	3.94

DATA FOR FILE : H3504

RUN #	WIND	EL	AZ	VEL
471	292.5	0.0	5.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.14	-.00	.01	.02	.01	.03
MAX :	2.08	.11	.05	.03	.57	.04
MIN :	-.66	-.09	-.07	-.09	-.55	.15
RMS :	.26	.03	.01	.02	.11	.02
GFACT :	14.47	30.77	4.07	4.93	41.16	5.36
PFACT :	7.35	3.32	2.87	4.22	5.04	5.54

1

DATA FOR FILE : H3504

RUN #	WIND	EL	AZ	VEL
475	315.0	0.0	5.0	42.3

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.29	-.02	.00	.01	.07	.04
MAX :	3.10	.09	.04	.06	1.11	.11
MIN :	-1.60	-.13	-.10	.00	1.22	.21
RMS :	.49	.03	.02	.02	.24	.04
GFACT :	10.85	7.90	36.86	13.24	15.72	5.93
PFACT :	5.75	3.55	5.66	3.02	4.42	4.30

DATA FOR FILE : H3504

RUN #	WIND	EL	AZ	VEL
477	337.5	0.0	5.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.44	-.04	.01	.00	.03	.08
MAX :	1.80	.01	.04	.05	.51	.02
MIN :	-.38	-.11	-.06	.04	.40	.19
RMS :	.26	.02	.02	.01	.11	.03
GFACT :	4.09	2.57	4.77	35.97	15.31	2.45
PFACT :	5.33	3.69	3.17	3.58	4.41	4.12

DATA FOR FILE : H3504

RUN #	WIND	EL	AZ	VEL
478	0.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.40	-.06	-.04	.03	.03	.06
MAX :	.86	.02	.00	.08	.41	.17
MIN :	-1.50	.14	-.08	.03	.49	.07
RMS :	.25	.02	.01	.01	.12	.03
GFACT :	3.70	2.28	2.36	2.57	19.27	2.70
PFACT :	4.30	3.51	4.07	3.42	3.95	4.30

1

Heliostat 3, Configuration 3-N

Case	Run	WD	EL	AZ
Ver. Stow	502	247.5	0	5
	497	265	0	5
	503	270	0	5
	504	292.5	0	5
	505	315	0	5
	506	337.5	0	5
	507	0	0	5

DATA FOR FILE : H3505

RUN #	WIND	EL	AZ	VEL
497	265.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.21	-.00	.00	.01	.02	.03
MAX :	1.42	.08	.07	.04	.41	.03
MIN :	-.44	-.08	-.04	.06	.49	.10
RMS :	.21	.02	.01	.02	.11	.02
GFACT :	6.74	79.99	100.27	7.49	26.47	3.54
PFACT :	5.74	3.61	5.13	3.40	4.20	4.64

DATA FOR FILE : H3505

RUN #	WIND	EL	AZ	VEL
502	247.5	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.35	.00	.01	.02	.01	.01
MAX :	1.37	.07	.07	.03	.43	.03
MIN :	-.25	-.07	.06	.07	.50	.08
RMS :	.22	.02	.02	.01	.10	.01
GFACT :	3.92	56.08	6.17	4.17	49.87	7.97
PFACT :	4.62	3.15	3.49	3.59	4.69	5.02

DATA FOR FILE : H3505

RUN #	WIND	EL	AZ	VEL
503	270.0	0.0	5.0	42.5

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.33	.00	-.02	.01	.02	.01
MAX :	1.36	.05	.05	.03	.35	.04
MIN :	-.23	-.06	-.07	.06	.42	.07
RMS :	.20	.02	.02	.01	.09	.01
GFACT :	4.10	92.44	3.89	4.19	23.34	4.97
PFACT :	5.15	3.10	3.36	3.45	4.25	4.07

DATA FOR FILE : H3505

RUN #	WIND	EL	AZ	VEL
504	292.5	0.0	5.0	42.2

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.28	-.00	-.01	.01	.01	.02
MAX :	1.25	.07	.07	.03	.35	.05
MIN :	-.24	-.08	.04	.06	.40	.10
RMS :	.10	.02	.01	.01	.09	.02
GFACT :	4.51	17.33	6.83	5.63	30.62	4.09
PFACT :	5.43	3.69	3.09	3.60	4.35	4.40

1

DATA FOR FILE : H3505

RUN #	WIND	EL	AZ	VEL
505	315.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.37	-.01	.02	.01	.00	.05
MAX :	1.47	.06	.06	.05	.45	.01
MIN :	-.35	-.08	-.06	-.07	.45	-.13
RMS :	.23	.02	.01	.01	.13	.02
GFACT :	4.03	7.03	3.31	4.75	152.81	2.70
PFACT :	4.76	3.53	2.90	3.56	3.59	4.36

DATA FOR FILE : H3505

RUN #	WIND	EL	AZ	VEL
506	337.5	0.0	5.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.02	-.02	-.02	.01	.02	-.02
MAX :	1.08	.06	.04	.05	.66	.05
MIN :	-.92	-.10	-.05	-.06	.62	.11
RMS :	.23	.02	.01	.01	.13	.02
GFACT :	61.39	5.69	2.70	8.60	34.78	4.92
PFACT :	4.59	3.78	2.54	3.40	4.05	3.74

DATA FOR FILE : H3505

RUN #	WIND	EL	AZ	VEL
507	0.0	0.0	5.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.45	-.04	-.00	.01	.07	.06
MAX :	.46	.04	.08	.09	.64	.14
MIN :	-1.29	-.11	-.05	.04	.45	.01
RMS :	.23	.02	.01	.02	.14	.02
GFACT :	2.84	2.82	16.62	11.62	9.28	2.23
PFACT :	3.61	3.02	3.46	5.15	3.94	4.11

1

Heliostat 4, Configuration 4-A

Case	Run	WD	EL	AZ	Day	Time
Smr AM	465	265	40	350	172	8 AM
Smr Noon	466	265	60	305	172	0 PM
Wntr AM	461	265	25	330	355	8 AM
Wntr Noon	464	265	40	305	355	0 PM
Wntr PM	463	265	25	270	172	4 PM
Ver. Stow	459	265	0	330	355	8 AM
Hor. Stow	460	265	90	330	355	8 AM

DATA FOR FILE : H4100

RUN #	WIND	EL	AZ	VEL
459	265.0	0.0	330.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.22	.08	.00	.02	.03	.01
MAX :	.91	.31	.04	.15	.25	.03
MIN :	-.19	-.06	-.05	.15	.30	.08
RMS :	.13	.05	.01	.03	.06	.01
GFACT :	4.12	4.03	22.10	8.39	10.69	9.86
PFACT :	5.14	5.00	3.29	3.99	4.19	5.26

DATA FOR FILE : H4100

RUN #	WIND	EL	AZ	VEL
460	265.0	90.0	330.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.01	.01	.02	.01	.01	.02
MAX :	.05	.06	.18	.04	.06	.05
MIN :	-.03	-.02	-.27	.05	.04	.01
RMS :	.01	.01	.05	.01	.02	.01
GFACT :	4.04	5.37	12.94	6.33	9.06	2.92
PFACT :	3.93	4.69	5.18	3.18	3.49	4.67

DATA FOR FILE : H4100

RUN #	WIND	EL	AZ	VEL
461	265.0	25.0	330.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	.09	.09	.03	.01	.00
MAX :	.79	.32	.23	.15	.20	.04
MIN :	-.07	-.03	.00	-.08	.22	.06
RMS :	.12	.05	.03	.03	.05	.01
GFACT :	3.43	3.44	2.58	5.63	33.12	66.76
PFACT :	4.54	4.08	4.45	3.96	3.97	4.67

DATA FOR FILE : H4100

RUN #	WIND	EL	AZ	VEL
463	265.0	25.0	270.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	-.04	.01	.03	-.01	.01	.01
MAX :	.49	.08	.06	.07	.16	.03
MIN :	-.61	-.05	-.16	-.08	.24	.08
RMS :	.11	.02	.03	.02	.04	.01
GFACT :	17.22	5.72	6.00	10.77	15.98	7.82
PFACT :	5.15	3.87	4.88	3.46	5.03	5.79

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DATA FOR FILE : H4100

RUN #	WIND	EL	AZ	VEL
464	265.0	40.0	305.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.15	.01	.11	.02	.02	.01
MAX :	.74	.14	.27	.16	.21	.05
MIN :	-.24	-.13	-.01	.12	.20	.02
RMS :	.13	.04	.04	.04	.06	.01
GFACT :	5.01	21.75	2.57	9.70	11.05	4.75
PFACT :	4.54	3.21	3.76	3.53	3.50	3.43

DATA FOR FILE : H4100

RUN #	WIND	EL	AZ	VEL
465	265.0	40.0	350.0	42.7

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.23	.00	.12	.00	.01	.01
MAX :	.79	.05	.31	.06	.23	.04
MIN :	-.10	-.03	-.00	.05	.20	.04
RMS :	.12	.01	.05	.01	.06	.01
GFACT :	3.49	14.94	2.57	266.19	46.45	8.06
PFACT :	4.75	4.59	4.21	3.72	3.91	3.37

DATA FOR FILE : H4100

RUN #	WIND	EL	AZ	VEL
466	265.0	60.0	305.0	42.9

COMP :	CFX	CFY	CFZ	CMX	CMY	CMZ
MEAN :	.17	.03	.23	.02	.02	.02
MAX :	.62	.17	.59	.10	.20	.06
MIN :	-.16	-.07	.01	.14	.16	.01
RMS :	.10	.04	.08	.04	.05	.01
GFACT :	3.54	5.04	2.59	7.34	11.58	2.48
PFACT :	4.25	3.03	4.55	3.27	3.97	3.49

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Technical Report

14.

15. Supplementary Notes
Technical Monitor: L. M. Murphy

16. Abstract (Limit: 200 words)
This report presents the results of wind-tunnel tests supported through the Solar Energy Research Institute (SERI) by the Office of Solar Thermal Technology of the U.S. Department of Energy as part of the SERI research effort on innovative concentrators. As gravity loads on drive mechanisms are reduced through stretched-membrane technology, the wind-load contribution of the required drive capacity increases in percentage. Reduction of wind loads can provide economy in support structure and heliostat drive. Wind-tunnel tests have been directed at finding methods to reduce wind loads on heliostats. The tests investigated primarily the mean forces, moments, and the possibility of measuring fluctuating forces in anticipation of reducing those forces. A significant increase in ability to predict heliostat wind loads and their reduction within a heliostat field was achieved.

17. Document Analysis

a. Descriptors Dynamic Loads; Heliostats; Solar Collectors, Stresses; Wind; Wind Loads

b. Identifiers/Open-Ended Terms

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