Report No. 12127
Date: 03/08/04

Fuel Reduction Pilot Program

CONDUCTED AT

FORT DIX MILITARY BASE

LOCATED IN

Ft. Dix, New Jersey

TEST RESULTS
FOR
HYDRONIC AND STEAM HEATING/HOT WATER
BOILERS

A Confidential Report
Prepared by
Intellidyne LLC

March 2004

EXECUTIVE SUMMARY

The attached technical report summarizes the Energy Saving Performance of the ***IntelliCon®*** "LCH" and "CHS" energy saving controls which were installed on 2 gas-fired Lochinvar hydronic boilers with 1mbh input and 1 gas-fired Burnham steam boiler with 3mbh input. The ***IntelliCon®*** units were installed at the Fort Dix Military Base and the validation data was collected from February 5, 2004 to February 26th, 2004. The test data was collected using "alternating day" methodology which is further describe later in this report. Detailed data on solar load, outdoor temperature and indoor temperature was also collected and is part of this final report.

Both of the heating systems were programmed to operate on a 24/7 basis and both systems were remotely monitored by Honeywell for operational performance and/or operating faults. The test data in this report reflects a reduction in run time and a significant reduction in cycling on both systems. The two Lochinvar boilers achieved a reduction in total run time of **15.36%** and a dramatic reduction in cycling of **61.5**% with the ***IntelliCon®*** controls installed. The Burnham steam boiler also realized a reduction in total run time of **15.43%** and a reduction in cycling of **23.2%** with the ***IntelliCon®*** control installed.

The individual reports contain the documentation that supports the summary results and further details the specific length of each test as well as documenting the overall temperature performance and predictability of the two systems ***after the IntelliCon® affect.***

This validation analysis clearly shows the ***IntelliCon®*** controls deliver above the minimum guaranteed savings of 10% and, by significantly reducing "cycling", should provide the additional benefit of extending the operational life of the boilers and reducing the amount of fuel pollutants that are vented into the atmosphere. This improvement in operational efficiency was achieved while providing consistent and predictable space comfort.

These results present a compelling financial benefit resulting from the implementation of the ***IntelliCon®*** Energy Saving Controls. Based on these validation results, Manufacture's name-plate firing rates, and at current natural gas prices, the calculated savings for the two Lochinvar boilers should be approximately $800 per month of operation. Similarly the calculated savings for Burnham Steam boiler would be approximately $1035 per month for a total of $1835 savings per month of operation for the two systems. (Assumes natural gas prices in the $.80 per Therm range and no financial benefit from the reduced maintenance costs that should come from reduced cycling)

The ***IntelliCon®*** Energy Saving Controls will deliver the following benefits to the owner and come with a 15 year warranty against manufacturing defects.

- Guaranteed Energy Consumption Reductions
- Reduced Wear and Tear from excessive on/off cycling
- Consistent Temperature Performance
- No Maintenance or Programming
- Low Upfront Cost and High ROI

INTELLIDYNE
"Smart ways to save energy"

90 Pratt Oval
Glen Cove, NY 11542
Phone:516-676-0777
Fax: 516-676-2640

Testing Methodology

EQUIPMENT USED FOR TESTING PURPOSES

Specific timing and data logging devices are used to gather detailed information about the unit(s) being evaluated. Each device has been carefully selected for its reliability, capability and function. The individual devices INTELLIDYNE uses are explained below.

1. TIME CLOCK:

Manufacturer: Tork Model: 8007V-0

Is used to switch the IntelliCon® product in and out of the circuit. This is done on a 24 hour basis. The result is that the IntelliCon® product is in control ("in" the circuit) one day and not in control ("out" of circuit) the next day. A 14 day time clock was selected so that a complete alternation of days that IntelliCon® is in control would result.

2. CURRENT SWITCH:

Manufacturer: Veris Industries Model: Hawkeye 608/908

The current switch is used to monitor when current is being drawn by the cooling/refrigeration compressor or heating burner. When current is sensed it is "On" when no-current is sensed it is off "OFF". The current switch is used in conjunction with the "Change-of-State" data logger.

3. "CHANGE–OF–STATE" DATA LOGGER:

Manufacturer: Onset Computer Corp. Model: H06-001-02

This device monitors and logs the "change-of-states" (the on / off status) of the unit being tested. It is used in conjunction with the CURRENT SWITCH, above, and time and date-stamps (logs) each change of status. By processing the logged data, the durations for each cycle can be determined.

4. "LIGHT INTENSITY" DATA LOGGER

Manufacturer: Onset Computer Corp. Model: HLI

This data logger is used to monitor and log Light Intensity and is used to determine the solar-load influence on the facility.

5. "T/Rh " DATA LOGGER

Manufacturer: Onset Computer Corp. Model: H08-004-02

This data logger is used to monitor and log the temperature and relative humidity in the conditioned space.

6. "TEMPERATURE" DATA LOGGER

Manufacturer: Onset Computer Corp. Model: H08-001-02

This data logger is used to monitor and log the outdoor air temperature, and is used to determine the degree-day influence on the facility

WHAT DATA IS COLLECTED

Linking all of the above together with the IntelliCon® product being “in” and “out” of the circuit, on alternating days, yields the following data:

? How many on/off cycles per day (if applicable).
? Total “on time” per cycle, per day.
? Total “off time” per cycle, per day.
? What the solar load of the facility was during the test period (if applicable).
? What the relative humidity in the conditioned space was during the test period (if applicable).
? What the temperature of the conditioned space was during the test period (if applicable).
? What the outdoor air temperature was during the test period (if applicable).

How The Data Is Analyzed

Upon completion of the test, all the data is evaluated to calculate the reduction of consumption (savings).

Short-term testing analysis can only be performed properly by the elimination and reduction of as many variables as possible and through the analysis of the data on a statistical basis. The alternating “in” circuit / “out” of circuit testing has the advantage of minimizing the variations due to time-sensitivity, day-of-week sensitivity, degree-day effects, etc.

In order to properly evaluate the data, the following must be determined:

1. A baseline must be established. Baseline consumption data is the “use” or consumption information that is unaffected by the IntelliCon economizer (“out” of circuit). This may be derived during the test (which is what is done here) or from historical records. The advantage of deriving the base-line during the test is that site specific degree-day and solar data may be determined as opposed to weather-service data that may or may not be indicative of the test site.

2. It is necessary to determine what effects or influences are caused by solar- load and degree-day variations. This is done by performing a statistical analysis on the solar and degree-day data collected during the base-line phase.

3. In order to properly compare the two consumption cases (IntelliCon “in” and “out” of circuit), and determine the savings, it is necessary to adjust (or “normalize”) the data collected during the “in-circuit” phase. The consumption data collected when the IntelliCon economizer was “in-circuit”, is “normalized” by compensating for the effects of the solar and degree-day influences that occurred during the same phase of the test. This is accomplished by applying the statistical analysis results of the solar and degree-day influences (collected during the base-line phase) as a means to compensate for the solar and degree-day variations that occurred during the “in” circuit phase of the test.

4. The normalized consumption data acquired during the “in” circuit phase is compared to the base-line data and the savings determined.

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90 Pratt Oval
Glen Cove, NY 11542
Phone:516-676-0777
Fax: 516-676-2640

Test Report

Report No. 12127-1

Date: 03/08/04

Customer:

Allied Energy Systems
634 E. Earl Ave.
Somerdale, NJ 08083

Contact: Bill Tarves

Test Site Location:

FORT DIX
New Jersey

Test Type: ☑ HEATING ☐ AIR CONDITIONING ☐ REFRIGERATION ☐ OTHER:

Product Tested: ☐ HW ☑ LCH ☐ LCS ☐ CHW ☐ CHS ☐ AC ☐ CAC ☐ RU ☐ OTHER:

Type of Equipment:

Make: Lochinvar (2 Units)
Type, Fire-Rate, Fuel: Hydronic, 1mbh, Nat. Gas (each)
Usage: Heating, Domestic Hot Water
Location: Building # 5606 Boiler Room

Test Start Date: 02/05/04

Test End Date: 02/26/04

No. of Days in Test: 22

BURNER RUN-TIME:

☑ in HRS. ☐ in MIN.

***IntelliCon* ON-DAYS:** 239:46:31

***IntelliCon* OFF-DAYS:** 276:35:38

RUN-TIME Savings: 15.36%

BURNER USAGE FACTOR:

***IntelliCon* On-Days:** 45%

***IntelliCon* Off-Days:** 52%

HEATING DEGREE-DAYS (FOR TEST PERIOD)

IntelliCon ON-DAYS: 169

It was 0.3% **Colder on the On-Days.**

IntelliCon OFF-DAYS: 168

Total Degree-Days: 337

SOLAR LOAD COMPENSATION: (Lumens/Sq. Ft.)

IntelliCon ON-DAYS: 2068

IntelliCon OFF-DAYS: 2083

It was < 1% **Sunnier on the OFF-Days.**

BURNER CYCLING REDUCTION:

IntelliCon ON-DAYS: 1462

IntelliCon OFF-DAYS: 3793

Cycling was reduced by: 61.5%

Savings = 15.36%

COMMENTS:

The run-times for the boilers were combined and treated as "one" since they were controlled by a lead/lag control scheme. Runtime for the left-hand boiler was approx. 160 Hrs on the "On" days and 177 Hrs. on the "Off" days. The right-hand boiler run-time was approx. 80 Hrs. on the "On" days, 100 Hrs. on the "Off" days. Heating Degree-Day and Solar Loading differences were negligible and thus not compensated for in the savings calculations. There were significant reductions in Burner cycling.

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Glen Cove, NY 11542
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Fax: 516-676-2640

Test Report

Report No. 12127-2

Date: 03/08/04

Customer:

Allied Energy Systems
634 E. Earl Ave.
Somerdale, NJ 08083

Contact: Bill Tarves

Test Site Location:

FORT DIX
New Jersey

Test Type: ☑ HEATING ☐ AIR CONDITIONING ☐ REFRIGERATION ☐ OTHER:

Product Tested: ☐ HW ☐ LCH ☐ LCS ☐ CHW ☑ CHS ☐ AC ☐ CAC ☐ RU ☐ OTHER:

Type of Equipment:

Make: Burnham V11 Series, with Gordon-Piatt Burner
Type, Fire-Rate, Fuel: Steam, 3mbh plus, Nat. gas
Usage: Heating
Location: Building # 5631 Boiler Room

Test Start Date: 02/05/04

Test End Date: 02/24/04

No. of Days in Test: 20

BURNER RUN-TIME:

☑ in HRS. ☐ in MIN.

***IntelliCon* ON-DAYS:** 93:58:38

***IntelliCon* OFF-DAYS:** 108:28:44

RUN-TIME Savings: 15.43%

BURNER USAGE FACTOR:

***IntelliCon* On-Days:** 39%

***IntelliCon* Off-Days:** 45%

HEATING DEGREE-DAYS (FOR TEST PERIOD)

IntelliCon ON-DAYS: 169

IntelliCon OFF-DAYS: 168

Total Degree-Days: 337

It was 0.3% Colder on the On-Days.

SOLAR LOAD COMPENSATION: (Lumens/Sq. Ft.)

IntelliCon ON-DAYS: 2068

IntelliCon OFF-DAYS: 2083

It was < 1% Sunnier on the OFF-Days.

BURNER CYCLING REDUCTION:

IntelliCon ON-DAYS: 1945

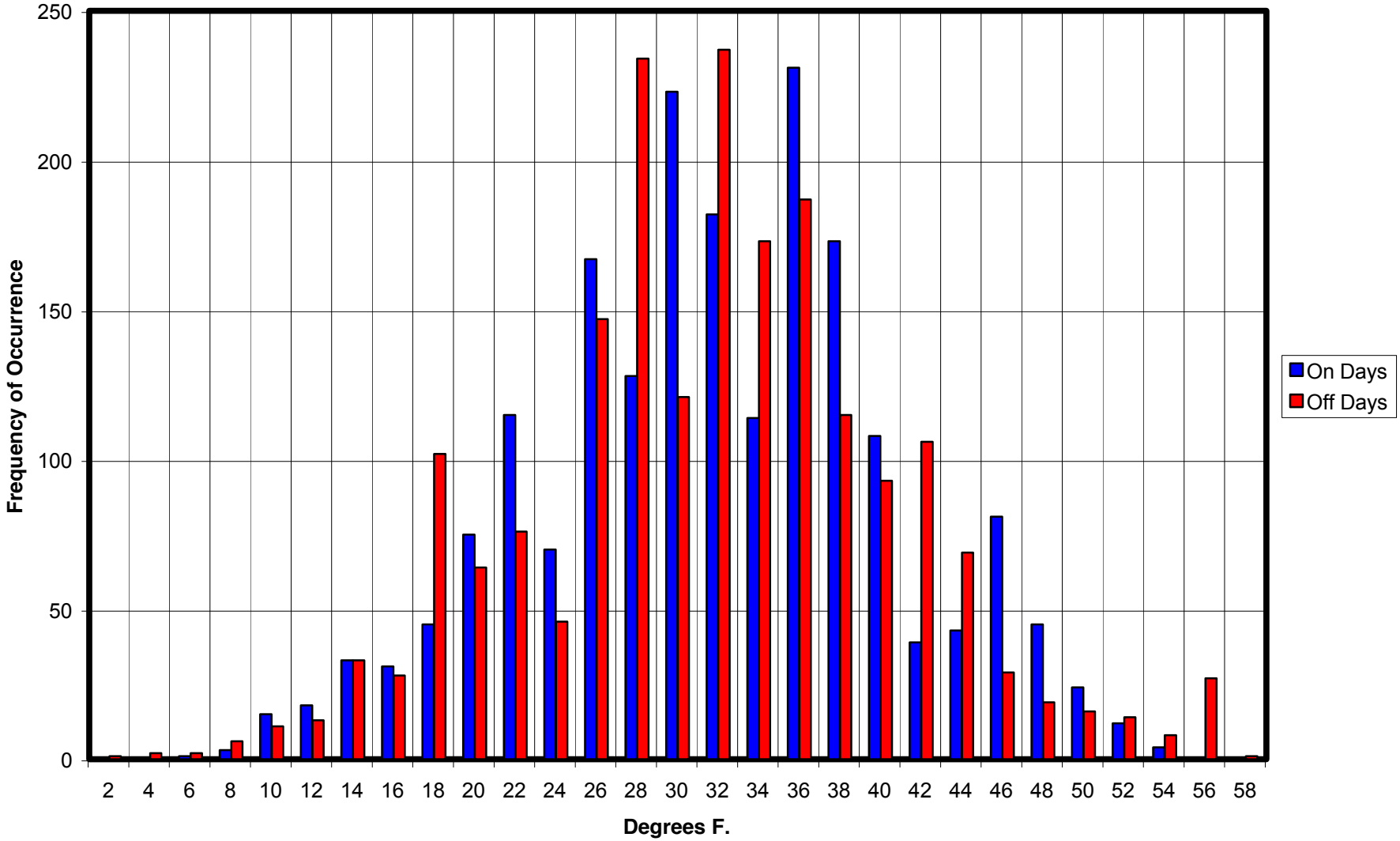
IntelliCon OFF-DAYS: 2534

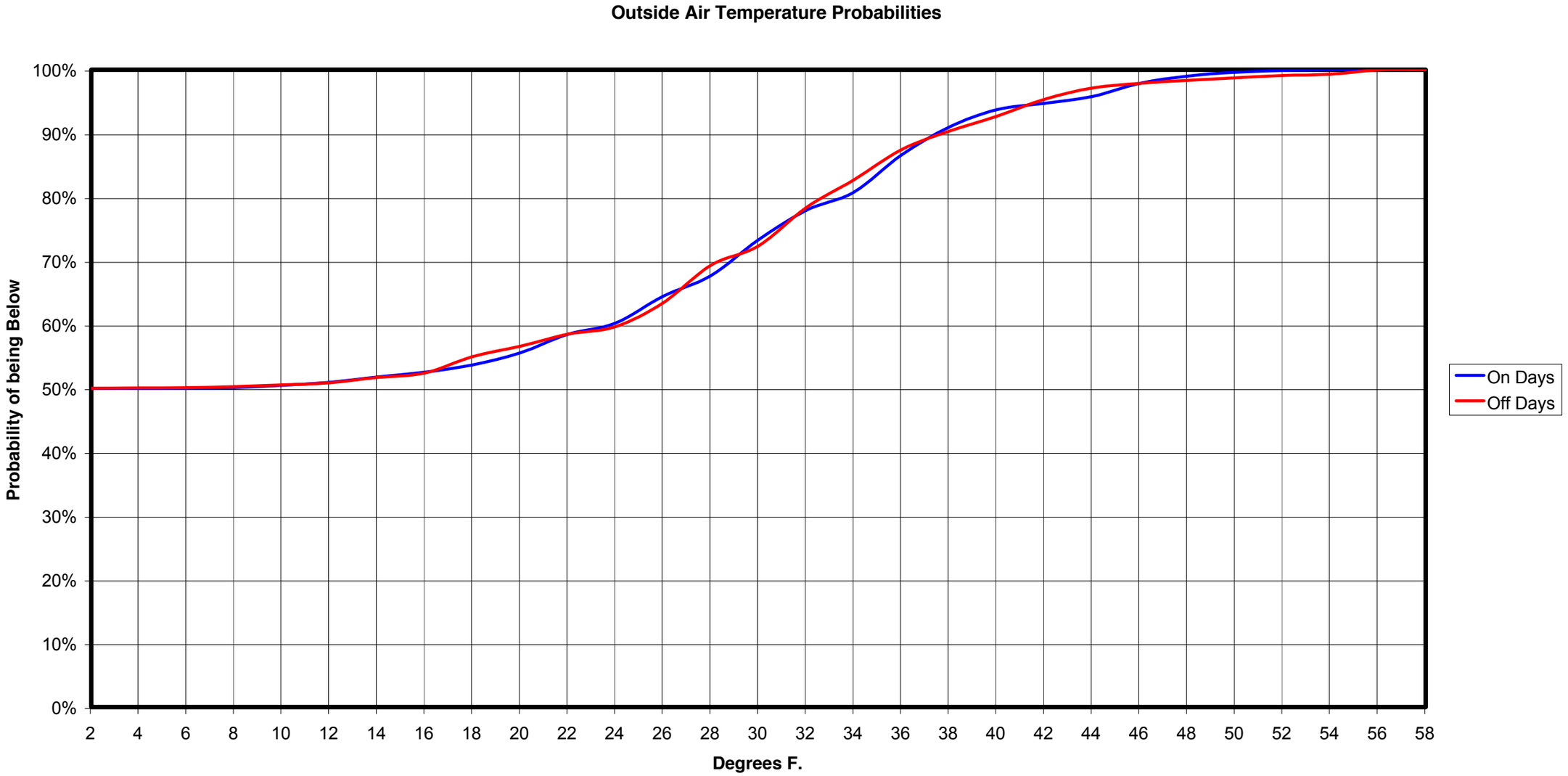
Cycling was reduced by: 23.2%

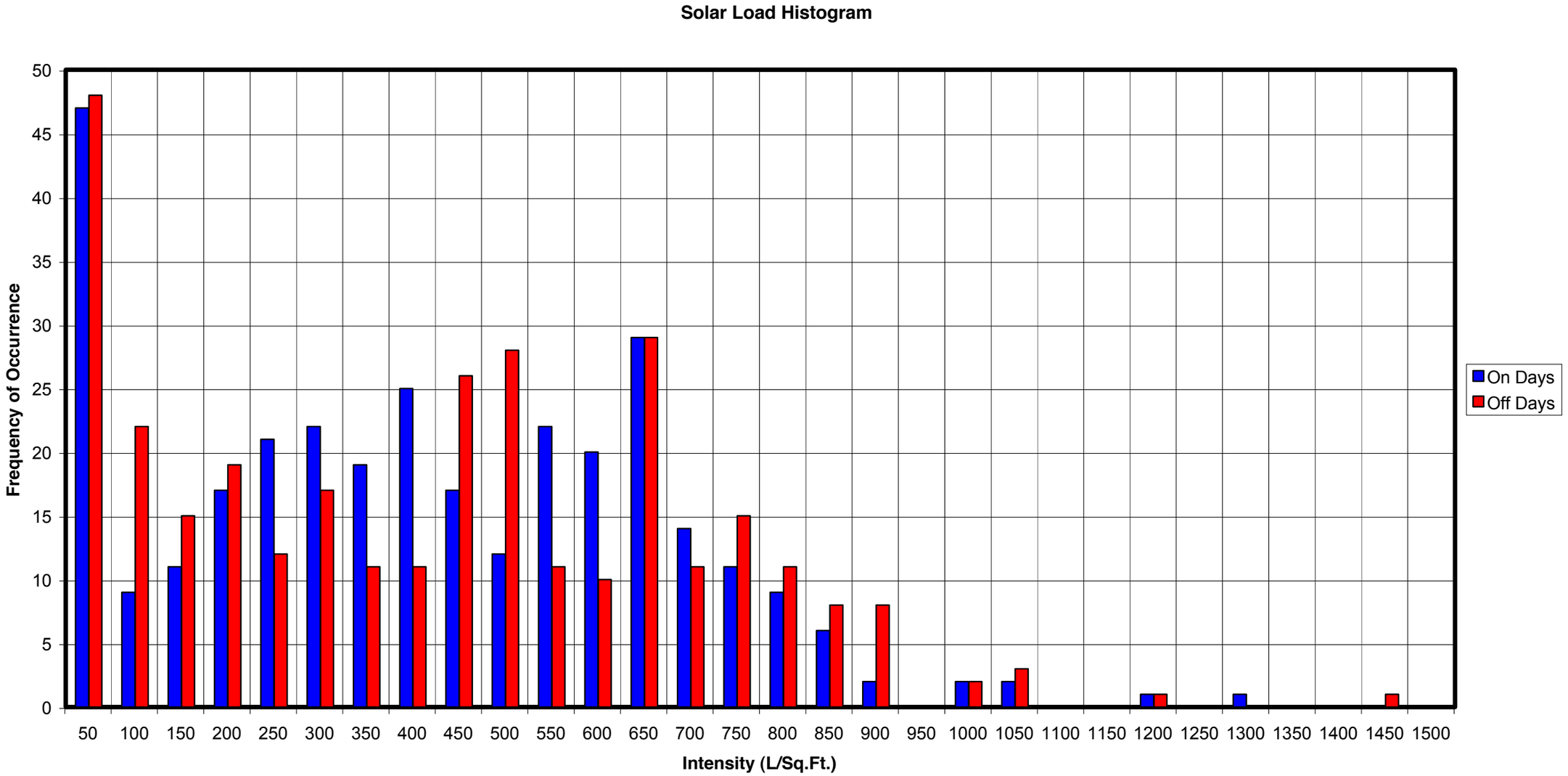
Savings = 15.43%

COMMENTS: Heating Degree-Day and Solar Loading differences were negligible and thus not compensated for in the savings calculations. There were significant reductions in Burner cycling.

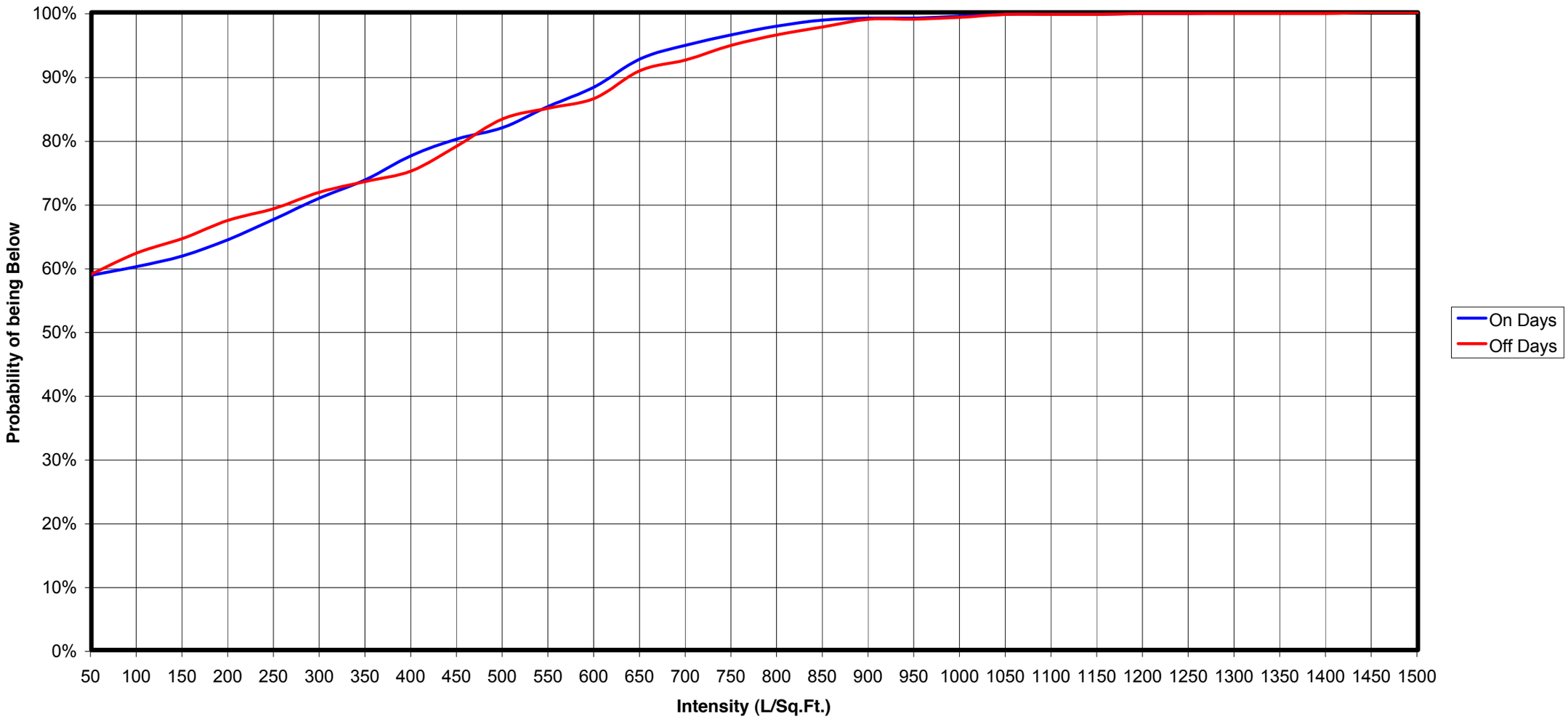
Outside Air Temperature Histogram

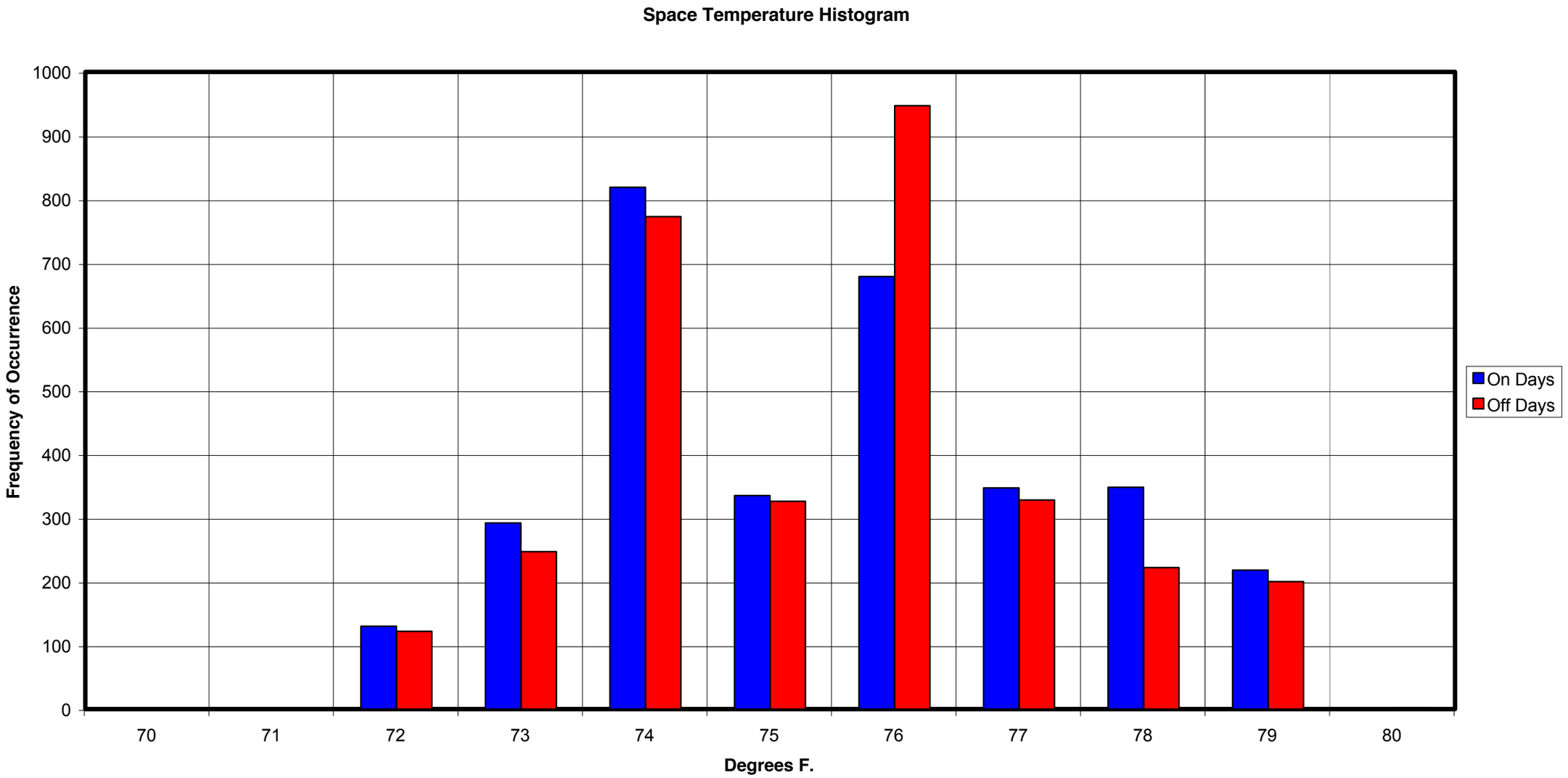


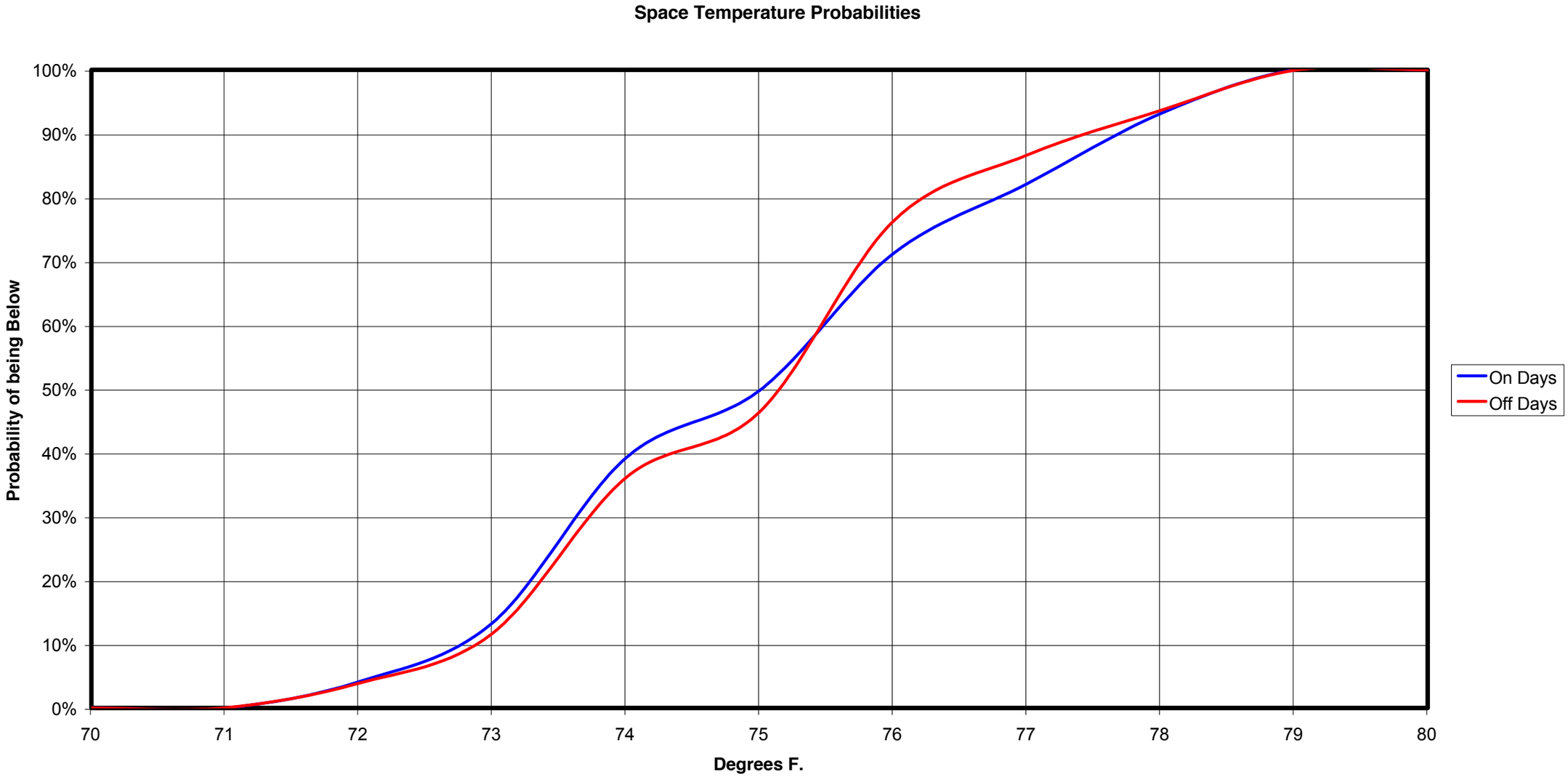

Outside Air Temperature Probabilities
Probability of being Below
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
Degrees F.
On Days
Off Days


Solar Load Histogram
Frequency of Occurrence
0
5
10
15
20
25
30
35
40
45
50
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200
1250
1300
1350
1400
1450
1500
Intensity (L/Sq.Ft.)
On Days
Off Days

Solar Load Probabilities




Space Temperature Histogram
Frequency of Occurrence
1000
900
800
700
600
500
400
300
200
100
0
70
71
72
73
74
75
76
77
78
79
80
Degrees F.
On Days
Off Days


Space Temperature Probabilities
Probability of being Below
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
70
71
72
73
74
75
76
77
78
79
80
Degrees F.
On Days
Off Days