# NAVAL POSTGRADUATE SCHOOL
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# THESIS



**ESTIMATE OF MAXIMUM DETECTION RANGE FOR FLIR FROM EOMET 95 MEASUREMENT DATA**

by

Chih-Li Yu

December 1997

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# ESTIMATE OF MAXIMUM DETECTION RANGE FOR FLIR FROM EOMET 95 MEASUREMENT DATA

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Submitted in partial fulfillment
of the requirements for the degree of

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# ABSTRACT

FLIR sensor maximum range predictions for operational use may be based on the intersection of apparent target contrast temperature difference ($\Delta T_{app}$) and sensor minimum resolvable (MRTD) or minimum detectable temperature difference (MDTD), each expressed as a function of range. Ranges obtained using the SEARAD code (MODTRAN modified for sea surface radiance) are compared with those based on Beer's Law with constant extinction coefficient. Physical and meteorological parameters for the common scenario were taken from the database of the EOMET95 measurements in Monterey Bay, with the research vessel POINT SUR as instrumented target and measurement platform. MRTD and MDTD functions were developed as functions of range for a generic Common Module FLIR using the Johnson Criterion for resolution with a parallelepiped geometry model of the POINT SUR. The Beer's Law results underestimate the SEARAD-based ranges by approximately 50% for detection but less for classification and identification. Replacement of Beer's Law with MODTRAN-computed transmittance reduces this discrepancy. SEARAD-based modeled sea radiance and short range contrast temperature show unexpected variation with range.

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# I. INTRODUCTION

Electro-optical and infrared sensors detect and identify targets by discrimination of their thermal contrast against the cluttered background. In the case of targets at sea, this means distinguishing the target radiance from the sea or sky background radiance, attenuated by transmission through the atmosphere, together with the radiance emitted by the atmosphere along the path. The performance of electro-optical sensors is greatly influenced by atmospheric factors related to the marine boundary layer and the scenario geometry. Polarized images of the research vessel POINT SUR (R/V POINT SUR) and of the Netherlands Oceanographic ship HM Tydeman have shown that use of a polarizer can improve contrast temperature difference $\Delta T$ against background.[Ref.1] What action is still needed is a comparison of predicted detection range with polarization and without polarization to see if the increased contrast increases the detection/ recognition range more than the loss of energy (photons) decreases it.

This thesis addresses the prediction of the detection/recognition range without polarization. The concept of the approach is that at the maximum detection/recognition range the projected apparent target background temperature difference ($\Delta T_{app}$) must equal the apparent contrast temperature difference required by the sensor. The sensor performance is described by the parameter Minimum Detectable Temperature Difference (MDTD) or Minimum Resolvable Temperature Difference (MRTD) as appropriate. The apparent temperature contrast $\Delta T$ available at given range is computed from the zero range target temperature converted to apparent blackbody radiance, and background radiance computed using the SEARAD[Ref. 2] atmospheric propagation code, a modified form of the standard MODTRAN code. SEARAD was also used to adjust the radiance for atmospheric attenuation and path radiance. SEARAD is a DOS-compatible program developed at NCCOSC-NRaD (Naval Command, Control and Ocean Surveillance Center-Naval Research and Development) for application to naval problems.

The source of meteorological parameters for the predictions was based on the EOMET95 experiment that was conducted on May 15 to 24, 1995 in which polarized image data was recorded from Monterey Bay Aquarium Research Institute at Moss Landing, CA. The Research Vessel POINT SUR (R/V POINT SUR) was used as a target and as a measurement platform. The ship skin temperature distribution was recorded every 20 seconds throughout the experiment using a set of 15 thermistors on the ship skin. Meteorological and sea surface data measured on board the POINT SUR were used as input to the atmospheric propagation computations. The meteorological parameters and observation range selected in this experiment were used as inputs to the "SEARAD" code to calculate the atmospheric infrared (8 to 12 μm) transmittance and path radiance.

After accessing the transmittance and path radiance calculated from SEARAD, Planck's radiation law was applied to find the apparent radiance difference and corresponding temperature difference (ΔT) at the detection range. Generic common module FLIR parameters tabulated by Shumaker, Wood and Thacker [Ref. 3:p. 8-59] were used to estimate MDTD/MRTD appropriate to a generic "Marine Patrol Aircraft" FLIR sensor, and the conventional Johnsion criterion used to deduce the equivalent operational target spatial frequency.

In selecting the scenario for this analysis the ship location, heading and aspect with respect to the polarizing images in the EOMET95 image data base were collated and processed; the collated data are listed in Appendix H and Appendix I to this thesis, for later analysis. After a brief summary of the relevant radiation propagation theory, the EOMET95 experimental procedure and measurement are discussed, including the procedure for target aspect and apparent dimensions, and the computation and modeling of the FLIR, MRTD, and MDTD functions are described. Computation of target contrast and MRTD and MDTD range estimates are then described, for selected target-sensor scenarios from the EOMET95 data base and followed with discussion of the results.

## II. INFRARED RADIATION FUNDAMENTALS

Optical radiation covers the ultraviolet (UV), visible, and infrared (IR) portions of the electromagnetic spectrum. The ultraviolet portion ranges from about 0.1 to 0.38 μm. The visible portion is from approximately 0.38 to 0.76 μm in wavelength. The infrared portion is divided into the near infrared or short-wavelength infrared (SWIR) region (from 0.77 to 3 μm), the middle-wavelength infrared (MWIR) region (from 3 to 8 μm), the long-wavelength infrared (LWIR) region (from 8-14 μm), and the far and extreme infrared region (from 14 to 1000 μm). The radiant energy received by an optical system from a scene object can be generally broken down into two components: (1) radiant energy due to the self-emission of the object and (2) radiant energy reflected by the object due to external radiation sources. The objects being observed by the optical system can be categorized as either the target or the background.[Ref. 4:p. 37] The radiation emitted and reflected from the target and the background traverse through the atmospheric medium, where absorption and scattering take place by molecular constituents of the atmosphere and the aerosol particles suspended in it. Re-emission and scattering from these atmospheric components also contribute path radiance to the received power. The absorption , scattering, and emission are conventionally computed using standard DOD propagation computer codes. For this study the developmental SEARAD code was used. SEARAD is described further in Appendix D.

### A. THEORY OF BLACKBODY RADIATION

This section summarizes commonly known material which can be found in many tutorial sources, for example " The Infrared Handbook" [Ref. 5]. All objects with a temperature above absolute zero emit radiation. Relative spectral intensity of the radiation is dependent primarily on the temperature of the object and on the radiant properties of the material the object is made of (in particular, the spectral emissivity of the material).[Ref. 6:p. 24] A blackbody is defined as an ideal body or surface that absorbs all radiant energy incident upon it at any wavelength and at any angle of incidence, so that none of the radiant energy is reflected or transmitted. Therefore, the term blackbody refers to a perfect absorber of radiation. Because all radiant energy is absorbed by a blackbody and none is reflected or transmitted, it will appear to be "black".[Ref. 4:p. 44]

### 1. Planck's Radiation Law

Planck's radiation law can be used to calculate the spectral radiance of a blackbody source. Planck's equation satisfies thermodynamic requirements and gives the spectral radiant exitance $M_{bb}(\nu,T)$ of a blackbody in terms of temperature, T, and radiation frequency, ν:

$$M_{BB}(\nu,T) = \frac{2\pi h\nu^5}{c^3(e^{h\nu/kT}-1)} \quad , \qquad 2.1$$

where

h is Planck's constant,

c is the speed of light,

k is Boltzmann's constant ($1.38054\times10^{-23}$ J-K$^{-1}$)

This equation can also be written in terms of wavelength,λ :

$$M_{BB}(\lambda,T) = \frac{2\pi hc^2}{\lambda^5(e^{hc/\lambda kT}-1)} \quad , \qquad 2.2$$

Equation 2.1 and 2.2 express the spectral radiant exitance of a source radiating in a vacuum. For any other media, c should be replaced by the light velocity in the media, c/n, where n is the refractive index of that medium.

### 2. Emissivity

The radiation from all bodies in a wavelength range under consideration is dependent firstly on the temperature and secondly, in the case of non-black bodies, on the material composition and surface condition. The ratio of the emitted radiation of any given temperature radiator to the emitted radiation of a black body of the same temperature is known as the emissivity.[Ref. 6:p. 50]

$$M=\varepsilon M_{BB} \quad , \tag{2.3}$$

### 3. Stefan-Boltzmann Law

The total radiated energy from a unit area of a surface in a unit of time over a $2\pi$ steradian solid angle is called the radiant exitance of that surface. For blackbody source the radiance is proportional to the fourth power of the absolute temperature of the source. This gives [Ref. 4:p.45]

$$M(T)=\sigma T^4 \quad , \tag{2.4}$$

where $\sigma$ is the Stefan-Boltzmann constant $=5.6697\times10^{-12}$ W-cm$^{-2}$K$^{-4}$

For use with non-black-body sources, this law is modified by the inclusion of an "effective emissivity", $\varepsilon$, giving the form

$$M(T)=\varepsilon\sigma T^4 , \tag{2.5}$$

where $\varepsilon<1$. For in-band radiance, the radiance $N$ can be calculated using the universal blackbody curve or the proportional radiation table (Appendix B) with Equation 2.6

$$N=\frac{\varepsilon\sigma T^4}{\pi}\Delta q \ , \tag{2.6}$$

where

$\varepsilon$ = emissivity of the source.

$\Delta q$ = difference of two q values from the proportional radiation table (Appendix B)

The proportional radiation $q = f(\lambda,T)$ represents the fraction of the radiant exitance emitted by a blackbody at temperature $T$ at all wavelengths up to the selected value of $\lambda$. It can be described in Equation 2.7

$$q=\frac{\int_0^{\lambda} M(\lambda,T)d\lambda}{\int_0^{\infty} M(\lambda,T)d\lambda} \ , \tag{2.7}$$

If $q$ values are not shown on the table, they can be calculated by interpolation between two $q$ value entries.

### 4. Kirchhoff's Law

When radiation is incident upon a body, some of it is transmitted, some absorbed, and some is reflected. Thus, the ratios of each of these to the incident power must add up to unity [Ref. 11:p. 1-29] given

$$\alpha(\lambda)+\rho(\lambda)+\tau(\lambda)=1 , \qquad 2.8$$

where

$\alpha(\lambda)$= spectral absorptivity

$\rho(\lambda)$= spectral reflectivity

$\tau(\lambda)$= spectral transmissivity

### 5. Lambert-Beer Law

Atmospheric transmittance is a function of wavelength, which can be described by the Lambert-Beer law

$$\tau(\lambda)=e^{-\mu R} , \qquad 2.9$$

where $\tau(\lambda)$ = spectral atmospheric transmittance,

$\lambda$ = wavelength,

$\mu$ = extinction coefficient,

R = path length.

The extinction coefficient depends on the atmospheric molecular composition and aerosol concentration.

## B. INFRARED RADIATION SOURCES

Optical sensors function by sensing the radiation emitted by an object or the radiation reflected from the object being illuminated by an external radiation source. Detection of a jet engine plume by an infrared detector is an example of the first category whereas the visible detection of an area illuminated by the sun is an example of the second category. In both cases these sensors are passive, as they do not generate their own power. Active sensors on the other hand generate their own power and detect targets from the reflected energy of this power. Electro-optical systems may operate using natural and artificial sources of power.

## C. ATMOSPHERIC PROPAGATION OF INFRARED RADIATION

The attenuation of optical radiation due to the atmosphere arises from the individual or collective effects of the following phenomena

1. Molecular absorption
2. Molecular scattering
3. Aerosol absorption
4. Aerosol scattering

The two main causes of attenuation, however, are molecular absorption by several minor constituents of the atmosphere and scattering due to atmospheric molecules and the particles in the present atmosphere (aerosols). Molecular absorption occurs mainly in several more or less narrow absorption bands and is due to transmittence in certain molecules, matched to that transition from one state of vibration and rotation to another, thereby absorbing or emitting a photon.[Ref. 4:p. 75]

### 1. Absorption Effects

Radiation absorption due to molecules in a gaseous medium can be divided into two processes:

(1) Atomic absorption is due to the transition of electrons in an atom, and usually requires a photon with an energy of a few electron volts. It generally takes place in the visible or ultraviolet region of the spectrum.

(2) Molecular absorption is due to a transition between electronic, vibrational, or rotational energy states of a gas molecule or due to a combination of all of these. This mechanism is dominant in the infrared range.[Ref. 4:p. 76]

### 2. Scattering Effects

Scattering is the process by which the energy in an electromagnetic wave is intercepted and reradiated into $4\pi$ steradians solid angle. It results from the interaction of the wave field with the electron oscillators in the scattering medium. These are excited by the incoming wave field, behaving as forced harmonic oscillators which reradiate at the frequency of the incident wave. The secondary wave, however, shows a phase lag from the primary dependent on the difference between the wave frequency and the oscillator resonance frequency. Any inhomogeneity in refractive index can cause scattering; in the atmosphere the component gas molecules, aerosol particles of various sizes, and fog, rain and hail drops are all effective scatters. The spatial distribution of the scattered radiation is strongly dependent on the relative magnitudes of the particle size and the wavelength. For particles very small compared with the wavelength, the scattering is approximately isotropic; as the ratio of size to wavelength increases, the scattering is concentrated more into the forward hemisphere. For very large scattering objects forward scattering dominates, and secondary lobes develop at other angles in the radiation pattern. In the small particle regime, the scattering can be described by the relatively simple theory developed by Rayleigh, which predicts scattering proportional to the second power of the volume of the wavelength. This describes scattering by atmospheric molecules. For particle sizes greater than one tenth of the wavelength, the Rayleigh approximation is no longer adequate; the more comprehensive Mie theory (1908) is required.[Ref. 7:p. 12-22]

#### *a. Rayleigh Scattering*

When the atmosphere does not contain large size particles, but only the molecules of its gaseous constituents, the scattering phenomenon is dominated primarily by these molecules. The intensity of the scattering depends on the number and index of refraction of these gaseous molecules and on the scattering angle, wavelength, and polarization of the incident radiation. The attenuation of a light beam due to Rayleigh scattering is expressed by

$$I=I_0\exp(-\sigma_m R) \quad , \qquad 2.10$$

where

$I_0$ is the magnitude of the original radiation

I is the magnitude of the scattered radiation

$\sigma_m$ is the Rayleigh scattering coefficient

R is the path length

The Rayleigh scattering coefficient $\sigma_m$ is the product of two parameters

$$\sigma_m=\sigma_r N \ , \qquad 2.11$$

where

$\sigma_r$ is the Rayleigh scattering cross section,

N is the molecular density.

The Rayleigh scattering cross section, $\sigma_r$ , is defined as the cross section of an incident wave, so that the total power scattered by a gaseous molecule in all directions is equal to the power flowing across the cross section. It is given by the expression

$$\sigma_r=\frac{8\pi^3(n^2-1)^2}{3N^2\lambda^4} \ , \qquad 2.12$$

where

n is the index of refraction of the gaseous medium

N is the molecular number density.

Note that the scattering cross section $\sigma_r$ is a function of wavelength and proportional to $\lambda^{-4}$ . It therefore dominates more in the ultraviolet and visible regions than in the infrared region. The formula also indicates that $\sigma_r$ is a function of the index of refraction of air and molecular number density.[Ref. 4:p. 78]

### *b. Mie Scattering*

Aerosol scattering, or Mie scattering, is concerned with the radiation interaction with spherical particles of various sizes. The transmitted beam irradiance here, similar to Rayleigh scattering, is expressed by

$$I = I_0 \exp(-\sigma_a R) , \quad 2.13$$

where I, $I_0$, and R are as defined previously, and $\sigma_a$ is the aerosol attenuation coefficient, which is a function of aerosol density. Aerosol size distribution does not change much with altitude, whereas the aerosol density does. The relationship for aerosol attenuation coefficient at altitude h is given by

$$\sigma_a(h) = \frac{M(h)}{M(0)} \sigma_a(0) , \quad 2.14$$

Where M(h) denotes the aerosol number density at height h and $\sigma_a(0)$ is the aerosol attenuation coefficient at sea level.[Ref. 4:p. 81] These absorption and scattering losses must be compounded when treating propagation through the atmosphere.

# III. EOMET95 EXPERIMENT AND DATA COLLECTION

## A. INTRODUCTION

The data for this thesis were obtained from an ocean field experiment conducted from 15 to 24 May 1995 off the coast of Monterey. The EOMET 95-Spring Cruise involved the R/V POINT SUR, which supported shipboard measurements of atmospheric and oceanic planetary boundary layer data made by the NPS Boundary Layer Meteorology group. In addition, measurements from stationary platforms located in Monterey Bay and its shoreline were collected. The R/V POINT SUR is a 135 foot ship (dimension: 41.5L×9.75W×8.8H (m)) owned by the National Science Foundation and operated by Moss Landing Marine Laboratory. Of particular interest was the availability of the POINT SUR during the mornings of the cruise for imaging operations, which placed the ship at various ranges, and aspect angles, which enabled the collection of polarized IR imager data coincident with the environmental measurements. During these operations, measurements were made of the degree of polarization and contrast improvement factor for ship images as a function of range and aspect angle. The environment impacts these measurements in the following ways:

(1)The observed wave spectrum and wind speed/direction affects the sea surface degree of polarization.

(2)The SST (Sea Surface Temperature) and air temperature impacts the target to background contrast.

(3)The air temperature, humidity, and aerosol content affect the IR path radiance and extinction coefficient.

## B. DATA MEASUREMENTS

### 1. Imaging System

The NPS AGA 780 Thermovision Thermal Imaging System was set up and operated from Moss Landing. The site was the MBARI Building located at approximately 6 meters above sea level. The estimated horizon range from this location was 4.5 nautical miles. The AGA 780 imaging system is a dual band serial scanning infrared imager capable of operation in the 3-5 and 8-14 micron bands. The system utilizes a 7×7 degree field of view lens or an optional 3.5 degree lens for each channel to focus incoming infrared radiation through a polarizing filter wheel, then through a dual rotating prism system onto the corresponding detector. The detectors are cooled to 77 K by dewars filled with liquid nitrogen. The filter wheel was rotated to provide vertical, horizontal and zero polarization settings during data collection. The detectors produce a current, which is called "thermal value" and is proportional to the intensity of the radiation received. The signal is then amplified and converted into a video signal for monitor display.

### 2. Calibration Technique

The AGA 780 imaging system was calibrated with a laboratory blackbody source. The system output or "thermal value " is recorded against the blackbody temperature through a range of temperatures. A calibration curve is generated which takes into account the scanner, lenses and filters (Moretz, 1994). All the data collected during EOMET 95 Spring Cruise was either calibrated or can be calibrated.

### 3. Target Temperature

To provide a means of determining target temperature, the R/V POINT SUR was instrumented with thermistor temperature sensors at numerous points on the ship's skin. Each thermistor was fastened to the skin by use of beryllium adhesive, which is extremely conductive. The thermistor was then covered with white epoxy to assure maximum albedo from sunlight. The sensors were linked by shielded cable to a data collection computer in the instrumentation spaces aboard ship.

### 4. Visual Imaging

Coincident images in the visual range were made from the IR imager site at the MBARI building. These were made with a high quality video recorder system. The polarization analysis of these data will be presented in a further report or thesis.[Ref.8]

# IV. MRTD AND MDTD

Minimum Detectable Temperature Difference (MDTD) and Minimum Resolvable Temperature Difference (MRTD) are two standard descriptions of FLIR performance. They are defined as those temperature contrast differences which make a standard bar chart just resolvable or a square target just detectable, respectively, to a trained observer. Each of these provides a sensitivity measurement of the FLIR system. Both of them employ the concept of the Equivalent Blackbody Temperature of a non-blackbody object. The equivalent blackbody temperature is that temperature a blackbody must have to emit the same radiance as the target. This allows the use of a single value to represent the target's temperature and emissivity. To complete the comparison of apparent $\Delta T$ with the system performance $\Delta T$ requires numerical values of these quantities as functions of spatial frequency and range.

## A. MINIMUM RESOLVABLE TEMPERATURE DIFFERENCE

MRTD (often also abbreviated MRT) is a function of spatial frequency. It gives the $\Delta T$ between the hot (cold) and ambient temperature bars of a standard 4 bar (7:1 aspect ratio) chart required to make the bars just resolvable as a function of the spatial frequency of the bars. MRTD is a measure of the performance of the entire FLIR system. Since the MRTD includes the observer, the measurement is subjective. The computed system MRTD shows an asymptotic value beyond which the detector angular subtense is greater than the reciprocal of the spatial frequency, or the "spatial period" and finer detail cannot be distinguished. For a typical FLIR (Common Module), the instantaneous field of view (IFOV) is approximately 0.25 mRad so that the in-scan detector subtense $\Delta x$ is approximately 0.25 mRad and the cut off spatial frequency (asymptote) is approximately $1/\Delta x = 1/0.25 = 4$ cyc/mRad. If we use the "rule of thumb" asymptote between $0.7/\Delta x$ and

$0.9/\Delta x$, we would find that the asymptote is approximately 3 cyc/mRad. The effective IFOV depends on the magnification of the optics that may be variable in some FLIRs.

Shumaker[Ref. 3:p. 8-52] gives a typical form for the MRTD.

$$MRT(v) = \frac{2\ \mathrm{SNRT}\ \mathrm{NET}\ \rho_x^{1/2}}{\mathrm{MTF_S}(v)} \left[\frac{v^2 \Delta x \Delta y}{L}\right]^{1/2} \left[t_e F_r N_{os} N_{ss}\right]^{-1/2}, \qquad 4.1$$

where SNRT = signal to noise ratio threshold,

NET = noise equivalent temperature,

$\rho_x$ = noise filter factor,

$\Delta x$ = in-scan detector subtense (mRad),

$\Delta y$ = cross-scan detector subtense (mRad),

MTF = modulation transfer function,

$\nu$ = spatial frequency for which MRT is desired in cyc/mRad,

L = length-to- width ratio of the bar (7),

$t_e$ = eye integration time in seconds,

Fr = frame rate $s^{-1}$,

$N_{os}$ = overscan ratio,

$N_{ss}$ = serial scan ratio.

Shumaker [Ref.3:p. 8-7] also provides an expression for the Noise Equivalent Temperature Difference ($NET_D$), the target apparent contrast $\Delta T$ which yields an output SNR of 1, as

$$\mathrm{NET_D} = \frac{10\left(\mathrm{FOV_x}\ \mathrm{FOV}_y\ \mathrm{F_r}\ \mathrm{N_{os}}\ \mathrm{N_{ss}}\right)}{\left(\pi\ \mathrm{N_D} \eta_{SC}\right)^{1/2} \mathrm{D} \Delta x \Delta y \mathrm{D}^{**} \eta_{CS} \,{}^{\partial \mathrm{N}}\!/\!_{\partial \mathrm{T}}\, \tau_0}, \qquad 4.2$$

where $FOV_x$ = in-scan FOV in mRad,

$FOV_y$ = cross-scan FOV in mRad,

$N_D$ = number of detectors,

$\eta_{sc}$ = scan efficiency,

$\partial N/\partial T$ = derivative of Planck's equation in $W/cm^2$–K-Sr,

$D^{**}$ = the band average detectivity in cm $Hz^{1/2}$ /W,

D = aperture diameter in meters,

$\tau_o$ = transmission of the optics.

## B. MINIMUM DETECTABLE TEMPERATURE DIFFERENCE

The MDTD of a FLIR system gives the temperature difference between an isolated square target and a uniform background that renders the square just detectable, as a function of the size of the square. In order to maintain similarity between graphs of MDTD and MRTD, MDTD is plotted as a function of the spatial frequency and range. Shumaker [Ref.3:p. 8-67] provides a typical form for MDTD

$$MDT(v) = \frac{(\text{SNRT})\,(\text{NET})\left(\Omega_T + r_S^2\right)(\Delta x \Delta y)^{1/2}}{\Omega_T\left[\frac{\pi}{4}\left(r_S^2 + r_B^2 + \Omega_T\right)t_e F_r N_{os} N_{ss}\right]^{1/2}} , \qquad 4.3$$

where $\Omega_T$ = target angular subtense ($mRad^2$),

$r_s$ = system resolution (mRad),

$r_B$ = back-end resolution (mRad).

The other definitions of the parameters in Equation 4.1 such as SNRT, NET, $\Delta x$, $\Delta y$, $t_e$ , $F_r$, $N_{os}$, $N_{ss}$, are the same.

## C. MRTD AND MDTD COMPUTATION

Shumaker[Ref.3:p.8-59] provides the following set of parameters that are postulated to be appropriate to the Common Module FLIR in NFOV (Narrow Field of View) mode. $\rho_X=(1+(2v\bullet r_B)^2)^{-1/2}$ is computed from the equivalent back-end resolution $r_B$ which is given for this example as 0.335 mRad.[Ref. 3:p. 8-60] The resulting computation from MATLAB is shown in Figure 5 which shows MRTD and MDTD vs spatial frequency. MATLAB code is shown in Appendix J section B.

| | | | | | |
|---|---|---|---|---|---|
| $FOV_X$ | $6.86^0$ | $FOV_Y$ | $5.16^0$ | L | 7 |
| $F_r$ | 30 $sec^{-1}$ | $N_{os}$ | 1 | $r_E$ | 0.3 mRad |
| $N_{ss}$ | 1 | $N_D$ | 180 | $r_d$ | 0.08 |
| $\eta_{sc}$ | 0.75 | $\tau_0$ | 0.70 | $N_s$ | 2 |
| $t_e$ | 0.1 sec | SNRT | 2.5 | MTF | Tabulated |
| f | 0.20 m | Δy | 0.25mRad | $D^*$ | $4 \times 10^{10}$ |
| D | 0.10 m | Δx | 0.25 mRad | NET | 0.1°K |

Table 1. Parameters of NFOV FLIR

| Spatial Frequency ( ν ) (cyc/mRad) | Δx= 0.25 mRad MTF |
|---|---|
| 0.00 | 1.00 |
| 0.25 | 0.89 |
| 0.50 | 0.79 |
| 0.75 | 0.64 |
| 1.00 | 0.53 |
| 1.25 | 0.43 |
| 1.50 | 0.35 |
| 1.75 | 0.27 |
| 2.00 | 0.20 |
| 2.50 | 0.10 |
| 3.00 | 0.04 |

Table 2. MTF for NFOV

# V. DATA COMPUTATIONS AND ANALYSIS

## A. APPARENT ΔT COMPUTATION

### 1. Data Summary of Infrared Measurements in EOMET95

The intent of the infrared imaging measurements made during the EOMET95 cruise was to observe the variation with range of the sea surface degree of polarization and of the apparent target/background temperature contrast improvement with polarization filtering for the R/V POINT SUR, and to attempt to observe emission polarization effects on facets of the ship image. To attain these ends the available ship operation periods were allotted alternately to two series of measurements;

(1) Rotation of the POINT SUR by small increments of heading angle through 360° at fixed range and bearing from the sensor, for a selection of ranges and bearings. For each target aspect and range images were recorded with vertical and horizontal polarizing filter and no polarizer.

(2) Recording of vertical and horizontally polarized and unpolarized images of the POINT SUR at selected aspect at a set of selected ranges along a constant bearing line to a maximum observation range.

Reference ship skin and sea and air temperature measurements were recorded during the entire observation period, as described below. Global Positional System (GPS) data for ship heading and position and radiosonde vertical atmospheric profiles were recorded on the R/V. POINT SUR. These values were accessed with the assistance of the NPS Boundary Layer Meteorology Group. The appropriate data selections are included in the appendices to this thesis.

For the purposes of this thesis certain data points were selected from this extensive data base, for calculation of predicted detection or recognition range.

### 2. Ship Temperature Computation

Ship skin temperature samples were collected from 15 thermistors attached with epoxy cement to the surfaces of the larger facets of the ship, located and distributed as indicated on Figure 12 and 13. The thermistor voltages were recorded continuously at 20 second intervals. The records were listed by time entries in seconds from midnight GMT for each day. These temperature files are listed in Appendix A. The format of the output files is illustrated by the sample file of Table 3. In each file the first header line gives the file name. The second line gives the Month, Day and Year from the computer clock, followed by the Hour, Minute and Second of the file on the next line. The next line gives the DAC voltage (digital value), start channel, stop channel, number of samples averaged, and reference channel number on each board. Note that thermistor channels 1 and 9 always read 25.00 ° C since they are reference channels. The position data used in this analysis (extracted from the ship GPS data file listed in Appendix H for the period of IR measurement) are for the period from approximately 1830 to 1840 May 16 1995 GMT.

```
May 16.1
 Mon,Day,Year=   5   16 1995
 Hour,Min,Sec=   8   27   36
 volts,istart,istop,nsam,iref 1.49939   1   16  100   1
  1326456 25.001 12.856 13.403 11.963 14.615 11.677 12.359 11.634 25.001 14.242
22.956 12.010 11.617 11.431 15.410 25.874
  1326476 25.001 12.864 13.397 11.959 14.646 11.673 12.371 11.633 25.001 14.200
22.937 12.001 11.607 11.426 15.229 25.535
```

Table 3. File Identification for Ship Temperature Thermistor Reading

These thermistor readings provide ship temperature at selected points; from these an average ship temperature must be derived as input to a range estimation. This has been done by comparing previous detailed radiometric measurements made of the temperature distribution over images of the R/V POINT SUR [Ref.9] with the concurrent thermistor spot temperature. From these data each facet area on the ship profile has been correlated with a representative thermistor location, as shown in Figure 13. Based on this correlation, an area weighting factor is assigned to each recorded thermistor temperature and a weighted average temperature computed for the appropriate ship aspect. While it is realized that the temperature distribution will change with change of ship operating conditions and meteorological conditions, this gives a relatively simple technique for modeling the ship signature, roughly comparable to methods previously used in Tactical Decision Aid models, and has been used here for the input ship temperature for the sample case. Table 7 shows ship average temperature for computation by equation 5.1.

$$\text{Average temperature} = \frac{\sum T_i \Delta A_i}{\sum A_i}, \qquad 5.1$$

### 3. Ship GPS Position and Heading Data Correlation

The times of recording of the ship GPS data and the skin temperature data are not synchronized. The temperature is recorded every 20 seconds while the position is recorded every 10 minutes. For accuracy in target signature modeling, recorded simultaneous ship heading and position values are selected from the GPS files (Appendix H), and the appropriate temperature values interpolated from the temperature files ( Appendix A). As an example, to compute a detection/recognition range for the target at heading 120 degrees, the ship location and atmospheric parameters are interpolated between the measurement points in Appendix H closest to that heading, those entries highlighted in Appendix H. Data were recorded at 1830 GMT at heading 172 degrees, and 1840 GMT at 106 degrees. Interpolating to 120 degrees assuming a constant rotation rate of 66 degrees in 10 minutes, or 0.11 degrees per second, gives us a time of 18:37:53 GMT or 11:37:53 local time. To read the corresponding skin temperatures we convert this time into seconds after the start of file at 08:27:36 at file number 1326456. This lapse time of 11416 seconds corresponds to file number 1337872. The closest skin temperature set to this is file number 1337876, shown in the sample listing below, highlighted in Appendix A, Page 65. It is assumed that no significant changes in meteorological parameters will occur in the 4 seconds discrepancy, so that the data selected for this time will form a consistent set.

1337856 25.001 16.392 17.862 17.334 15.415 15.885 14.338 15.873 25.001 18.294 24.326 15.281 16.169 15.352 22.299 28.721

**1337876 25.001 16.423 17.864 17.291 15.361 15.830 14.368 15.909 25.001 18.333 24.164 15.296 16.151 15.346 22.393 28.829**

1337896 25.001 16.458 17.844 17.241 15.295 15.771 14.383 15.946 25.001 18.366 24.093 15.304 16.117 15.305 22.319 28.933

Table 4. Thermistor Sample Output File

| Side | Σ Pixel | Σ Temperature | ΣTemperature /ΣPixel = Average Temperature |
|---|---|---|---|
| Port | 59 | 976.196 | 16.54569 |
| Starboard | 59 | 1028.287 | 17.42859 |
| Total Average Temperature | 118 | 2004.483 | 16.98714 |

Table 5. Ship Average Temperature vs Pixel for the Sample Case Selected

### 4. Temperature and Radiance Conversion

The average of ship temperature computed for this sample period is 273 + 16.987144 = 289.987144 K. Ship temperature and sea background temperature were converted to in-band radiance by application of the Planck function. The ship temperature is then converted to in-band radiance $N_s$ at zero range

$$N_s = \varepsilon\sigma T^4 \Delta q/\pi$$

$$= 0.95\times5.6697\times10^{-8}\times(289.98714)^4\times0.2486117/\pi = 30.14347844\ (W/m^2Sr)$$

where

$\varepsilon$=0.95, emissivity of R/V POINT SUR and $\Delta q$=q2-q1 is the fraction of the thermally emitted radiance lying in the band from $\lambda_1$ to $\lambda_2$ at source temperature T.

$\lambda_1 T = 8\mu\times289.98714 = 0.23198971$ cm×K =>q1= 0.1314394

$\lambda^2 T = 12\mu\times289.98714 = 0.3479845$ cm×K =>q1= 0.3800511

and $\Delta q$=q2-q1 =0.2486117

The q values have 5 digits as reported in the radiation table (Appendix B) to keep the fraction of the radiant exitance as close as possible to the integral of Planck's Law.

## 5. Transmittance and Path Radiance

The SEARAD program was used to obtain the transmittance and path radiance between the target and the FLIR sensor. Appendix D describes how to install SEARAD and to run the example case. There are some points which need to be noted carefully when inserting radiosonde profile data in the input data file. The maximum number of atmospheric levels that can be inserted is 34. The position of every data point is important for SEARAD, so it is essential that each must be inserted in the correct column and row of the input table. The Windows text editor may cause a problem after the data have been inserted and saved. It is recommended that we use the simplest editor available (i.e. the MS-DOS editor). To run SEARAD it is not necessary to follow all the steps listed in Appendix D. "Tape 5" is the data file which will be read into SEARAD and executed; thus we need only modify the "Tape 5" data. The necessary steps to run SEARAD are shown below:

- Go to DOS program; it should show C:WINDOWS> .
- Under C:WINDOWS type "cd c:\".

- When it shows C:> then type "cd searad".
- It shows C:\searad> then type "edit tape5".
- It shows MS-DOS editor.
- Modify the data and save it; then exit.
- It should return to C:\searad>.
- Under C:\searad> type "searad" which means to execute SEARAD.
- We can use WORD or WORDPERFECT to read the output file "out" under the SEARAD directory.

The inputs of the SEARAD code are tabulated in Appendix F. The transmittance for this typical case is $\tau$ =0.735 and path radiance $N_p$= 7.58028 W/m²Sr. Ship radiance $N_{s+p}$ at full range $=N_s\ \tau + N_p$

$$N_{s+p}=N_s\tau+N_p=30.14347844\times0.735+7.58028=29.7357366\ (W/m^2Sr)$$

It is necessary to convert target radiance at maximum range to equivalent blackbody temperature. In-band radiance at full range can be converted into equivalent blackbody temperature by use of Planck's radiation law using an interactive computer program and look-up table as shown in Appendix C. As an example, when $N_{s+p}$ = 29.7357366 W/m²Sr, the effective $T_{s+p}$ = 284.68 °K. From the SEARAD output (Appendix G shows a typical case), the background radiance $N_b$ at full range is 21.93238 W/m²Sr. By conversion with the computer program in Appendix C, the corresponding apparent temperature is found to be 268.7 K. The apparent temperature difference at full range is then $T_{s+p}$ -$T_b$ =15.98 °C. The whole data set for the typical case are shown in Table 8.

## B. MRTD AND MDTD VS RANGE COMPUTATION

### 1. Range, Elevation and Azimuth Angle

From GPS data (Appendix H) we must compute range and elevation and azimuth angles. There is a 7 hours time difference between GMT and local time (PACIFIC Summer Time). For example the time of 0800 for Monterey will be 1500 for GMT.

Appendix H contains the GPS data, for the time period in which the experiment took place. Figure 3 and 4 show the orientation of the ship and relation between bearing angle and ship's aspect. Since we treat the ship bow and stern aspects as the same, we only consider heading from zero to 180 degree in this thesis.

dx = (ship longitude)-(sensor longitude) (nmi)

dy = (ship latitude)-(sensor latitude) (nmi)

$\alpha$ = arctan (dx/dy) (degree)

range $= \sqrt{dx^2 + dy^2}$ (nmi)

$\theta$ = arctan ((sensor altitude) / range) (elevation angle)

To compute bearing we need to consider two different kinds of situation; those in which the ship is to the north or south of the sensor position. Range is computed by conversion of GPS location difference into distance.

***a. Condition 1***

dy>0. This is illustrated by Figure 3.

If heading > 180 - $\alpha$ , then $\beta$ (bearing) = heading –180 + $\alpha$

If heading < 180 – $\alpha$ , then $\beta$ = 180 – $\alpha$ - heading

***b. Condition 2***

dy<0. See Figure 4.

If heading < $\alpha$ , then $\beta$ = $\alpha$ – heading, if heading > $\alpha$, then $\beta$ = heading – $\alpha$

If $\beta < 90$ then $\phi = 90 - \beta$, if $\beta > 90$ then $\phi = 180 - \beta$

1 degree latitude at 37 degree N latitude is 59.97 nmi

1 degree longitude at 37 degree N latitude is 47.995 nmi

1 nmi (nautical mile ) = 1.852 km =1852 m

The computations are described in Appendix J section A,"MATLAB" code. After computation with previously selected data (see Table 8) we have:

$\alpha = 38.6737$ (degree)

$\beta$ (bearing) = 21.3263 (degree)

range = 0.7681 (nmi) = 1.4225 (km)

$\phi = 1.1985$ (rad) (azimuth angle)

$\theta = 0.0042$ (rad) (elevation angle)

### 2. Projected Area of the Ship $A_t$

From previous calculation we compute projected area.

$$\begin{aligned} A_T &= lw\sin\theta + hw\cos\theta\sin\phi + hl\cos\theta\cos\phi \\ &= 41.5 \cdot 9.75 \cdot \sin(0.0042) + 8.8 \cdot 9.75 \cdot \cos(0.0042)\sin(1.1985) + 41.5 \cdot 8.8 \cdot \cos(0.0042)\cos(1.1985) \\ &= 214.4513\ m^2 \end{aligned}$$

where

$l$ = 41.5 m (ship length)
$w$ = 9.75 m ( ship width)
$h$ = 8.8 m (ship height)
$\phi$ = $1.1985^0$ (azimuth angle)
$\theta$ = $0.0042^0$ (elevation angle)

Figure 1 shows the orientation of a ship target model for calculating the projected area.

### 3. Critical Dimension $D_c$

The comparison of the temperature contrast of a ship target with the standard "bar target " for which the performance parameter MRTD is derived requires the definition of an equivalent resolved spatial frequency required on the target image for target recognition (or detection). In applying the long standing Johnson criterion [Ref.3:p. 2-7] of resolved cycles on the target, we adopt Moser's [Ref. 3:p. 2-6] convention for the "critical dimension" of the ship $= \sqrt{A_T} = 14.64$ m. Dividing the critical dimension $D_c$ by the number of equivalent bars N on the target gives the physical dimension $\chi$ to be resolved (ie. pixel length) to accomplish the task, i.e. $\chi = D_c/N$. From the Johnson Criterion (see Table 6), the number of bars $N$ necessary for pure detection, $N = 1$. The number of bars $N$ necessary to classify the ship is 4 cyc × 2 bars/cyc = 8 bars. The number of bars $N$ necessary to identify the ship is 6.4cyc x 2 bar/cyc = 12.8 bars. The one dimensional resolved "footprint " required on the target is then:

a. For detection the physical dimension $\chi = D_c/N = 19.3/1 = 14.64\ m$

b. For classification the physical dimension $\chi = D_c/N = 19.3/8 = 1.83\ m$

c. For identification the physical dimension $\chi = D_c/N = 19.3/12.8 = 1.144\ m$

| Discrimination Level | Cycles Across Minimum Dimension | Number of Bars |
|---|---|---|
| Detection | 1.0 | 1.0 |
| Classification | 4.0 | 8.0 |
| Identification | 6.4 | 12.8 |

Table 6. Johnson Criterion [Ref. 5:p. 54]

### 4. Conversion of Spatial Frequency to Range

The fundamental spatial frequency $f_c$ characterizing the ship can be written in lines per milliradian as

$$f_c = \frac{R}{2000\chi} \text{ (cyc / m Rad) }, \qquad 5.2$$

where R is the range in meters from sensor to target. The relation of the spatial frequency to range R and physical dimension $\chi$ is shown in Figure 2. The MRTD and MDTD curves as a function of spatial frequency in NFOV for a generic Common Module FLIR have been given in Chapter IV and are shown plotted in Figure 5. The spatial frequency vs range relationship of Equation 5.1 has been used with Equation 4.1 and 4.2 to compute MRTD and MDTD vs range, for the R/V POINT SUR as target, using the required "cycles per critical dimension" $N_c$, in the form $\chi = D_c/N_c$, where $N_c$ expresses the Moser definition of "critical dimension". The detailed calculations are in Appendix J, "MATLAB code". Figure 6 shows MRTD and MDTD for detection as function of range, for the R/V POINT SUR as target. The target available contrast temperature difference against background $\Delta T_{app}$ is also shown on the same range scale. The intersection points of $\Delta T$ with the MRTD and MDTD curves yield the maximum ranges for detection according to the two criteria. Figure 7 shows the corresponding MRTD for classification of the R/V POINT SUR, according to the Johnson criterion of required resolution line pairs on the critical dimension. MDTD cannot be used for classification. Figure 8 shows the equivalent curve for MRTD for identification of the POINT SUR. The value of $\Delta T_{app}(R)$ in these three figures is the simple estimate of $\Delta T_0$ multiplied by the transmittance (see Section VI. A).

# VI. DATA ANALYSIS AND CONCLUSIONS

The computations of target temperature difference $\Delta T$, MDTD and MRTD for the experiment are described in the previous chapter. Meteorological data (including radiosonde measurement) for SEARAD code inputs were taken from the meteorological data that were recorded during the experiment, and are shown in Appendix H and Appendix I. The estimated MRTD curve and MDTD curve were derived from Shumaker's example 8-13[Ref. 3:p. 8-59] for a generic FLIR system in NFOV. The NET was chosen as 0.125 K, between 0.1 K to 0.25 K, due to degradation of the FLIR sensor after being in service for several years. This sensor is a generic common module FLIR model, with the parameters of Table 2. The condition for detection at maximum range is that the apparent target/background temperature difference as modified by atmospheric path attenuation and path radiance will match the required MDTD or MRTD at the same range. We have already expressed the MRTD and MDTD parameters as functions of range. We are now required to calculate the apparent temperature difference between target and background as a function of range from the target. Two methods of differing complexity are available for this computation; the greatly simplified approach of assuming that the temperature difference $\Delta T$ attenuates through the atmosphere in the same way as the irradiance, and the more complicated but more rigorous approach of converting the $\Delta T$ into a radiance difference, computing the transmitted radiance difference due to attenuation and path radiance, and reconverting $\Delta L$ back to $\Delta T_{app}$ through inversion of Planck's Law. Sample computations of both types have been made. These are compared in the following paragraphs, using the sample atmospheric data set of Table 8.

## A. APPARENT ΔT BY ATTENUATION OF SOURCE ΔT

SEARAD with the "typical case" (see Table 8) scenario is found to give a transmittance of 0.735. Transmittance, averaged over a bandwidth which does not contain absorption edges, typically is written as an exponential function of range following Beer's Law. From transmittance we calculate attenuation coefficient averaged over the assumed bandpass of 8 to 12 μm, of

$$\tau = e^{-\mu R} \quad => \quad \ln \tau = -\mu R \quad => \quad \mu = \frac{-\ln \tau}{R}$$

$$0.735 = e^{-\mu R} \quad => \quad \ln(0.735) = -\mu(1.444\text{km}) \quad => \mu = 0.2132\ \text{km}^{-1}$$

For transmittance $\tau = 0.735$ over a range of 1.4444 km for horizontal range 1.4225 km, the attenuation coefficient $\mu = 0.2132\ \text{km}^{-1}$. The apparent temperature difference as a function of range is then computed with the form $\Delta T \times \tau(R) = \Delta T \times e^{-\mu R}$ using MATLAB. For a given target, the functions MRTD, MDTD and $\Delta T_{app}$ can be plotted on the same scale as functions of range. The intersection of the $\Delta T_{app}$ plot with the appropriate MRTD or MDTD curve occurs at the maximum range for the detection, classification or identification, according to the defined criterion. Figure 6 shows The MRTD-derived detection range as 21 km and the MDTD-derived value as 19 km. The classification range (from MRTD) is seen in Figure 7 to be 8.8 km. Figure 8 shows identification range as 6.2 km.

## B. RADIANCE COMPUTATION METHOD

The second method of computation of effective ΔT is to convert the target and background temperatures to radiances, and compute the attenuated ΔT and appropriate path radiance for selected range, and reconvert the result into $\Delta T_{app}$. This method was applied for a set of ranges appropriate to the measurement scenario and data set. Tables 9.1 to 9.5 show a tabulation of the computed parameters for the sensor elevation of 6 meters, the AGEMA imager location at Moss Landing. The locations were selected from those for which observed images were recorded in EOMET95, so that the results may later be applied to comparisons of polarization. All the computed components of ΔT, the difference between the apparent values of ship average temperature corrected for attenuation and background temperature, are shown in this table. The independent variable is the zenith angle, used to define the path geometry for this sensor location. The zero range ship radiance is also input. The SEARAD program computes the corresponding range, transmittance and path radiance, and apparent ship radiance, and the background radiance. The radiance contrast is then converted back into temperature difference. Table 9.5 shows an anomaly in range and a path that does not intersect the sea surface beyond 13.3 km; this range defines the effective horizon for the selected sensor elevation of 6 meters. It follows that we cannot compute predicted maximum range for detection or recognition for ranges greater than this. To allow range predictions to be extended to greater ranges a further set of data was computed, for sensor elevation raised to 250 meters. This allows us to see range limitation by atmospheric effects rather than by geometry. The results of these computations are shown as Tables 10.1 to 10.6. From these tables we can see that ΔT attenuates almost to zero at long range. ΔT is shown plotted against range in Figure 9 and Figure 10. Figure 9 represents the original situation with sensor at 6 meters elevation; Figure 10 represents the same target and atmospheric scenario, but with the sensor raised to an elevation of 250 m. This revised curve allows the intersection of the ΔT(R) curve with MRTD(R) to be observed, and the Maximum Detection Range extracted. This curve is shown as Figure 11. Figure 14 shows ΔT vs MRTD for classification and identification. The apparent MRD is 44 km.

## C. SEARAD

The SEARAD code input file requires the meteorological data inputs wind speed ($W_S$), wind direction ($W_D$), visibility (VIS), air mass character (AM) and the sea temperature. A sample input file for SEARAD is shown in Appendix F. The contents of the three header lines in Appendix F are defined by the "cards" listed in Appendix E.

Since SEARAD reads in the data it must to be in the correct column and row. The sample input file shows "card 2C1" which is for radiosonde data to be inserted. The last digit of the layer altitude must to be in column 10 and the last digit of pressure must be in column 20. The last digit for the temperature of the layer boundary must be in column 30 and the last digit of the relative humidity must be in column 40. The designated specific units must be in columns 61, 62 and 63. From the sample input file we can see they should be lined up column by column and row by row. The sample output from SEARAD (atmospheric transmittance $\tau$ and path radiance $Np$) are shown in Appendix G. To read in a new model atmosphere from radiosonde data, the sensor's altitude can not be greater than the upper layer boundary. SEARAD will use the altitude of the highest layer boundary rather than the sensor elevation. To use a high altitude sensor, it is necessary to use a higher layer boundary for the calculation of atmospheric transmittance $\tau$ and path radiance $Np$ .

## D. DISCUSSION OF THE DATA AND CONCLUSIONS

Based on a sample scenario selected from the data base of the EOMET95 measurement series in Monterey Bay off Moss Landing, ship skin temperature samples measured with a set of transistors were used with historical thermal distributions of the R/V POINT SUR, as measured radiometrically, to estimate an average ship temperature for the selected measurement time. From this together with the sea background temperature computed by SEARAD, a "zero range" contrast temperature difference ΔT was computed as 289.987 - 286.600 = 3.3871. This ΔT has been applied in two ways to estimate the Maximum Detection Range for the R/V POINT SUR. The first and simpler method is to assume that the contrast temperature difference, ΔT, is attenuated by the atmosphere in the same fashion as the radiance, ie $\Delta T_{app} = \Delta T_o e^{-\mu R}$ . The second , more justifiable, method is to convert the temperature difference into in-band background radiance and target radiance, compute the corrections for attenuation and path radiance using SEARAD, and reconvert to an apparent $\Delta T$ as a function of range. For each method $\Delta T_{app}$ is then compared with the MRTD or MDTD of the assumed sensor, as appropriate, also expressed as a function of range. The point of intersection then gives the maximum detection or recognition range. A weakness of this method is that the ship radiance is based solely on the thermal emission from the ship while the background calculation takes into account the reflected radiance also. The following observations are drawn from the results.

We see in Table 9 (page 53) and Figure 9 that the apparent temperature difference at short range initially increases. At 0.345 km $\Delta T_{app}$ is 21.18, much higher than the zero range value of 3.387. After reaching a peak value, the apparent temperature difference then decreases in an approximately exponential fashion with range.

For sensor altitude of 6 meters, beyond elevation angle 0.044, corresponding to a range of 13.262 km the calculated refracted path no longer intersects the earth surface. The path radiance cannot then be calculated, and the MDR cannot be calculated. This geometry is not appropriate for estimation of maximum detection range. The recalculation with assumed higher elevation for the sensor, required a redescription of the atmospheric layer structure, and allows calculation of the path radiance and surface radiance. We see in Table 10, with a sensor altitude of 250 m, $\Delta T_{app}$ has a value of 0.007 degrees at range 33.415 km, with zenith angle 0.550 degrees. The variation of $\Delta T_{app}$ with range (Figure 10) shows small differences from Figure 9. This must be ascribed to the reassignment of layer structure in SEARAD. The initial increase of $\Delta T_{app}$ at short range persists, and the curve is basically similar to Figure 9, except that it is extended to much longer ranges, so that estimation of MDR is possible. A comparison of the $\Delta T_{app}$ (R) as computed by the two methods is shown as Table 7.

A direct comparison of these range predictions indicates that the simple Beer's Law variation of $\Delta T_{app}$ (R) leads to an underestimation of the maximum range, relative to the SEARAD method including computed transmittance and path radiance. The values shown in Table 7 are comparable to values obtained in other range models. However a factor of approximately 2 is apparent between the sets of results for detection with smaller differences for classification or identification. This point requires further discussion. The selection of the MDTD or MRTD criterion for detection appears to be of much lesser importance than the other differences between the model approaches.

| | Detection Range | Classification Range | Identification Range |
|---|---|---|---|
| I. Extinction only | MRTD: 21 km<br>MDTD: 19 km | MRTD: 8.8 km | MRTD:6.2 km |
| II. SEARAD Correction | MRTD: 47 km<br>MDTD: 44 km | MRTD: 13 km | MRTD:8 km |

Table. 7 Comparison of Two Methods

Some insight into the discrepancy may be gained by comparison of the transmittances calculated with the Beer's Law approach and the SEARAD code. Figure 15 shows this direct comparison. It can be seen that the Beer's Law method considerably underestimates the transmittance compared with direct computation. This is probably due to the band averaging over the 8 to 12 band, for which the apparent extinction coefficient decreases initially approaching a constant value only at longer ranges. The coefficient used in this analysis was deduced from extinction at 1.4 km, a measurement point in the EOMET95 data set. The differences observed in Figure 15 will decrease the discrepancy in predicted range but only in a minor way, as can be seen from the plot of apparent temperature difference shown as Figure 16. The SEARAD method shows negative values at very short range rising to values of up to 20°C, giving an increased effective $\Delta T_0$, before decreasing in an approximately exponential fashion. The greatest factor in the range difference is this high $\Delta T_0$. The SEARAD and Beer's Law methods use the same input radiometric sea surface temperature and thermometric target temperature. The SEARAD code then computes the sea surface radiance taking into account the sea surface roughness and emissivity, and the reflection of sky radiance. The corresponding radiance temperature is then computed and used in the initial temperature $\Delta T_o$. This procedure leads to the initial negative temperature difference seen in Tables 9 and 10, and in Figure 16. No equivalent radiance temperature model is available for the ship target.

The increase in $\Delta T_{app}$ at short ranges is an unexpected feature. Examination of Tables 9 and 10 shows that the ship radiance corrected for path radiance and transmittance decreases slowly and monotonically with range. The background radiance, however, decreases from a large initial value to a minimum occurring at 92° zenith angle for the 6 meter sensor and 95° for the 250 meter sensor, and then rises slowly at longer range. This behavior is not completely understood. It is non-intuitive that the sea radiance and the target radiance should behave differently at long range. The initial behavior at short range may be related to the variation of the emissivity and sky radiance. This behavior deserves further study.

It may be concluded that the use of SEARAD for range prediction constitutes a considerable improvement over the Beer's Law method. However a valid target signature radiance model is needed to give confidence in the predicted range. The SHIPSIG and THERMAL CONTRAST MODEL have been used in some previous prediction models, but are very specific to target and conditions, and so not convenient for general application. Addition of a simple facet ship signature representation to the ship orientation model is recommended.

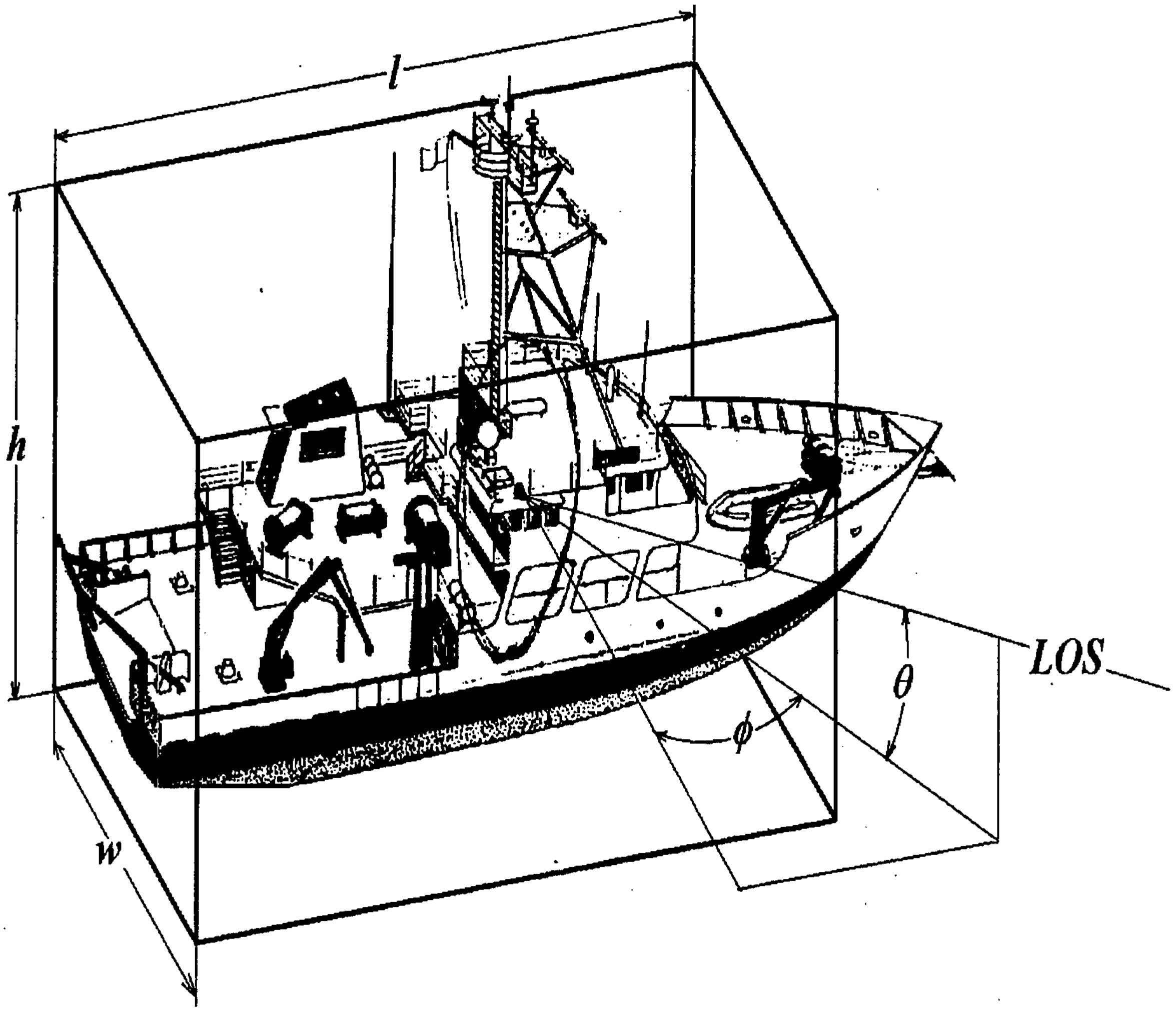
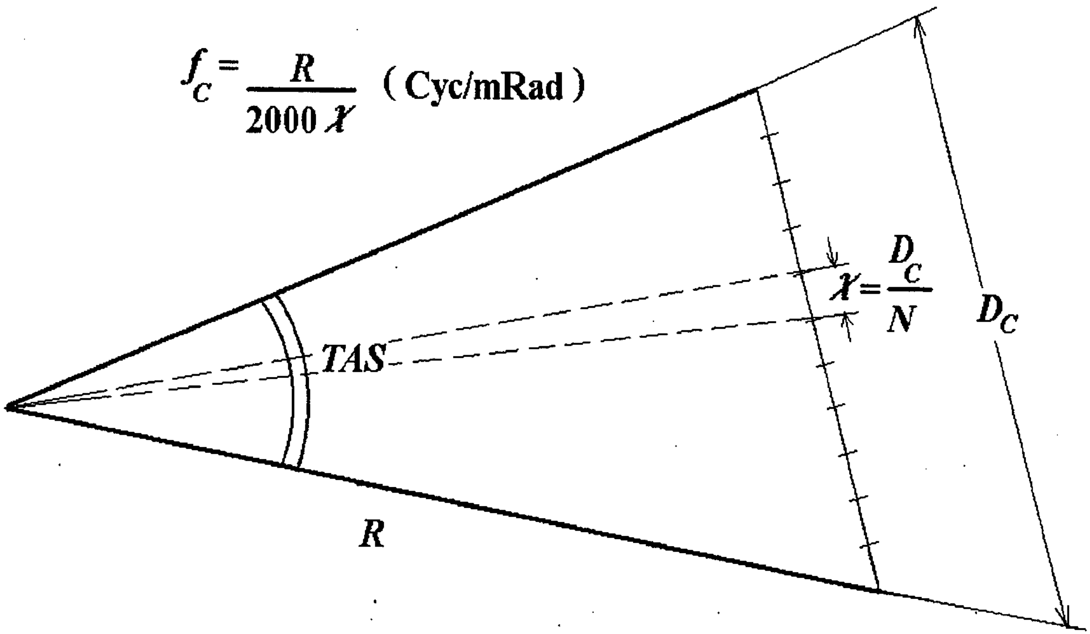
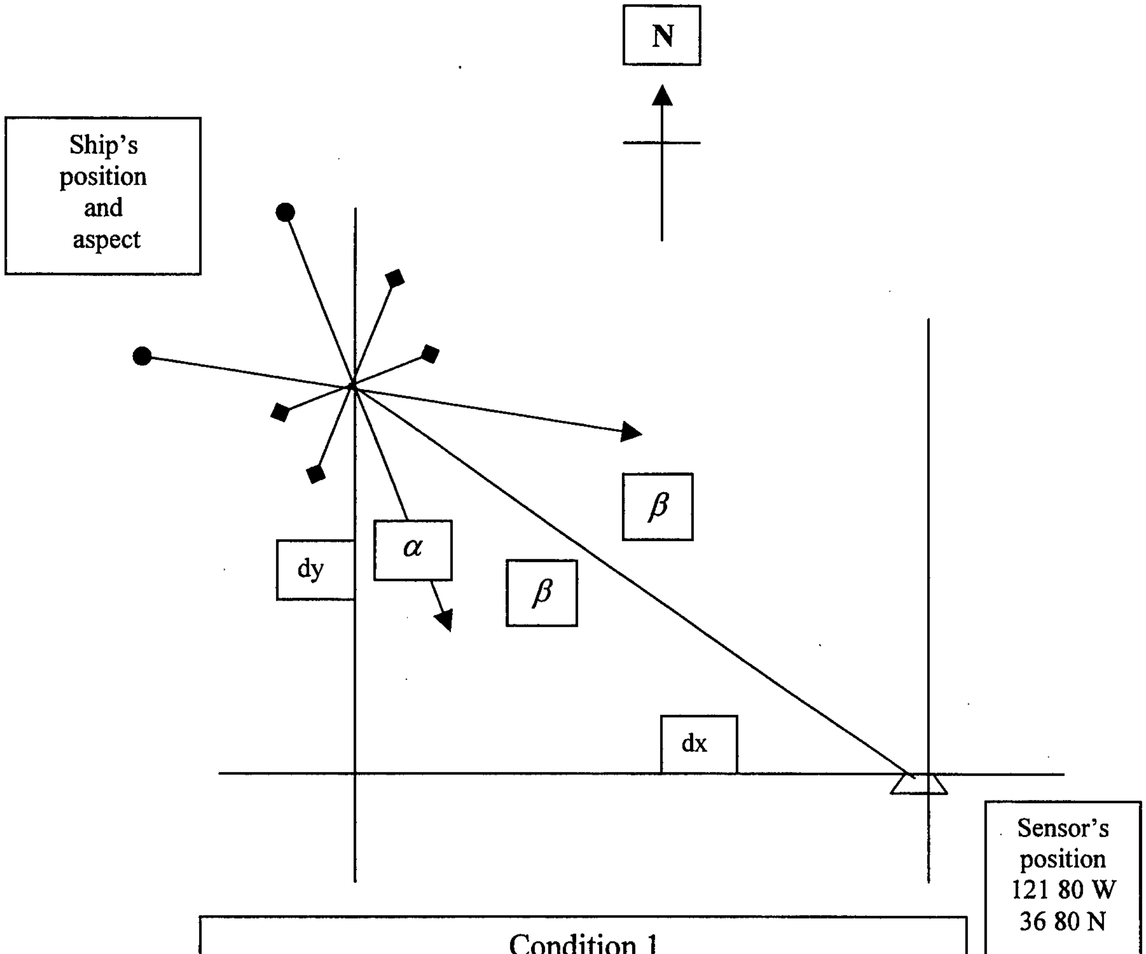



Figure 1. Orientation of Ship Target Model




$N$ = Number of Bars in the Bar Chart
$R$ = Slant Range
$TAS$ = Target Angular Subtense
$D_C$ = Critical Dimension
$\chi$ = Physical Dimension to be Resolved
$f_c$ = Spatial Frequency of Bar

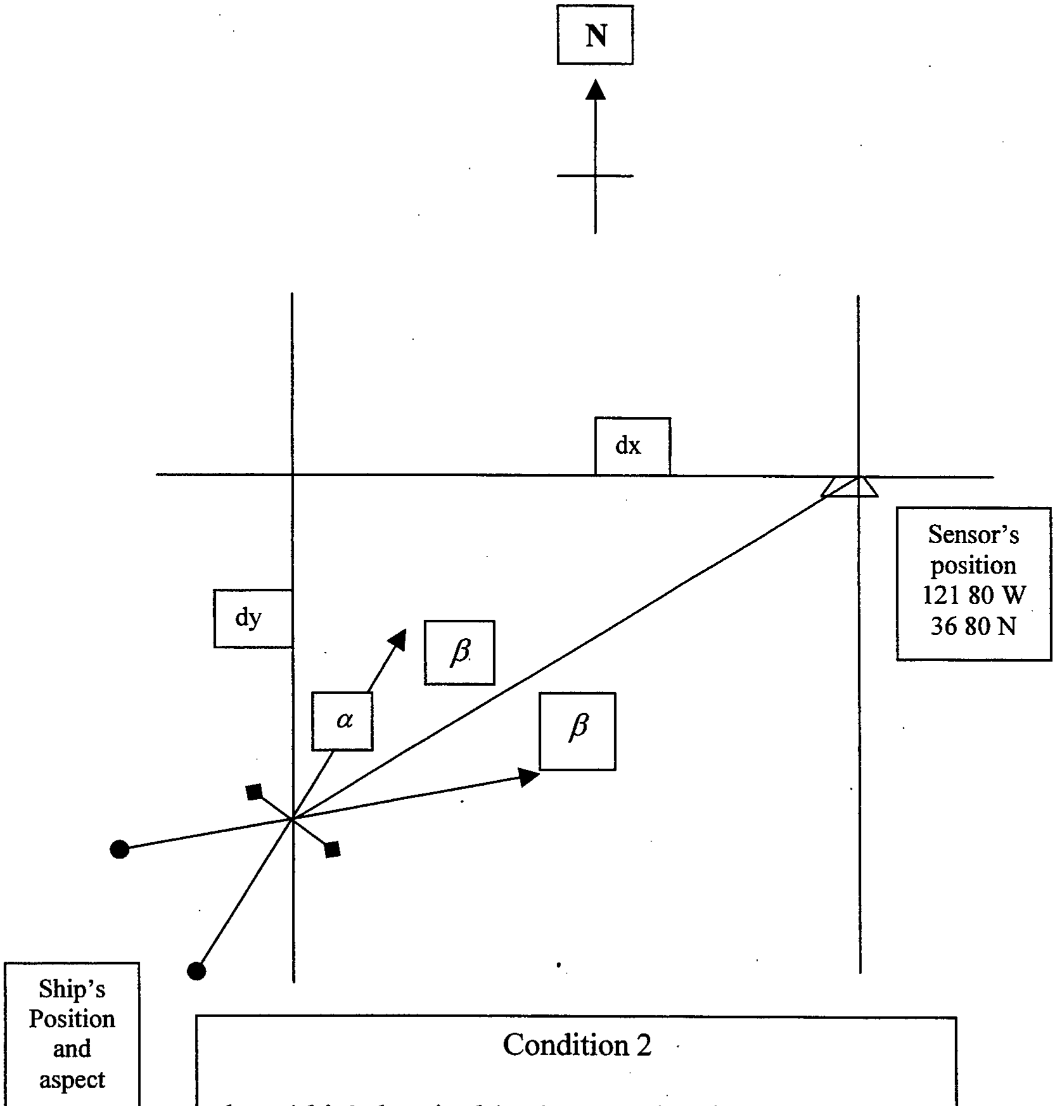
Figure 2. Relation Between Spatial Frequency, Range R and Physical Dimension $\chi$




Condition 1

dx = (ship's longitude) - (sensor's longitude)
dy = (ship's latitude) - (sensor's latitude)
$\alpha = \arctan(dx/dy)$
$\phi = (90 - \beta)$
$\theta = \arctan(6 / \text{Range})$
1 degree latitude at 37 degree N latitude is 59.97 nmi
1 degree longitude at 37 degree N latitude is 47.995 nmi
1 nmi = 1.852 km =1852 m

Figure 3. Relation Between GPS and Ship Aspect Condition 1




Condition 2

dx = (ship's longitude) - (sensor's longitude)
dy = (ship's latitude) - (sensor's latitude)
$\alpha$ = arctan (dx/dy)
$\phi$ = (90 - $\beta$)
$\theta$ = arctan (6 / Range)
1 degree latitude at 37 degree N latitude is 59.97 nmi
1 degree longitude at 37 degree N latitude is 47.995 nmi
1 nmi = 1.852 km =1852 m

Figure 4. Relation Between GPS and Ship Aspect Condition 2

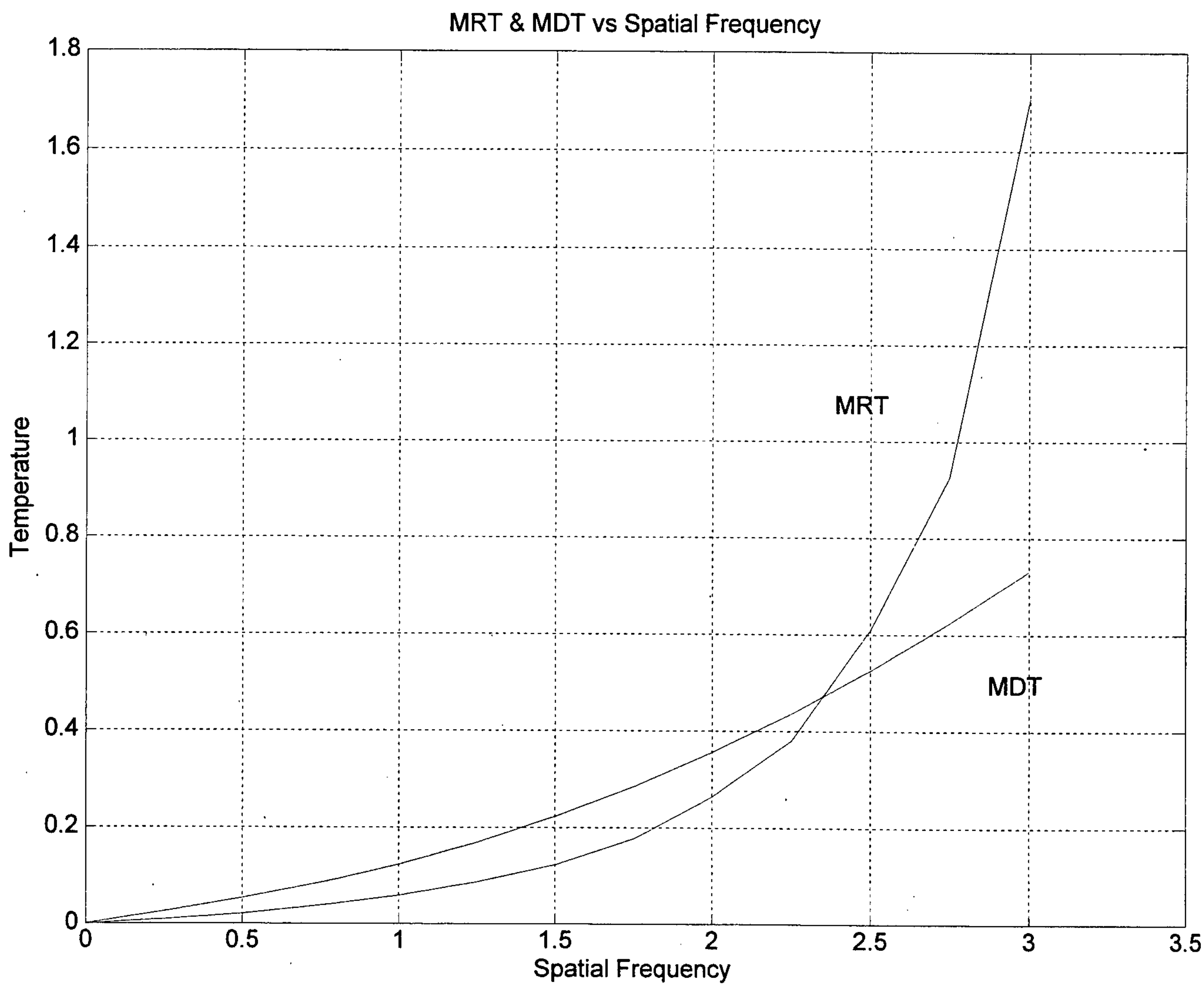



Figure 5. MRTD and MDTD as a Function of Spatial Frequency

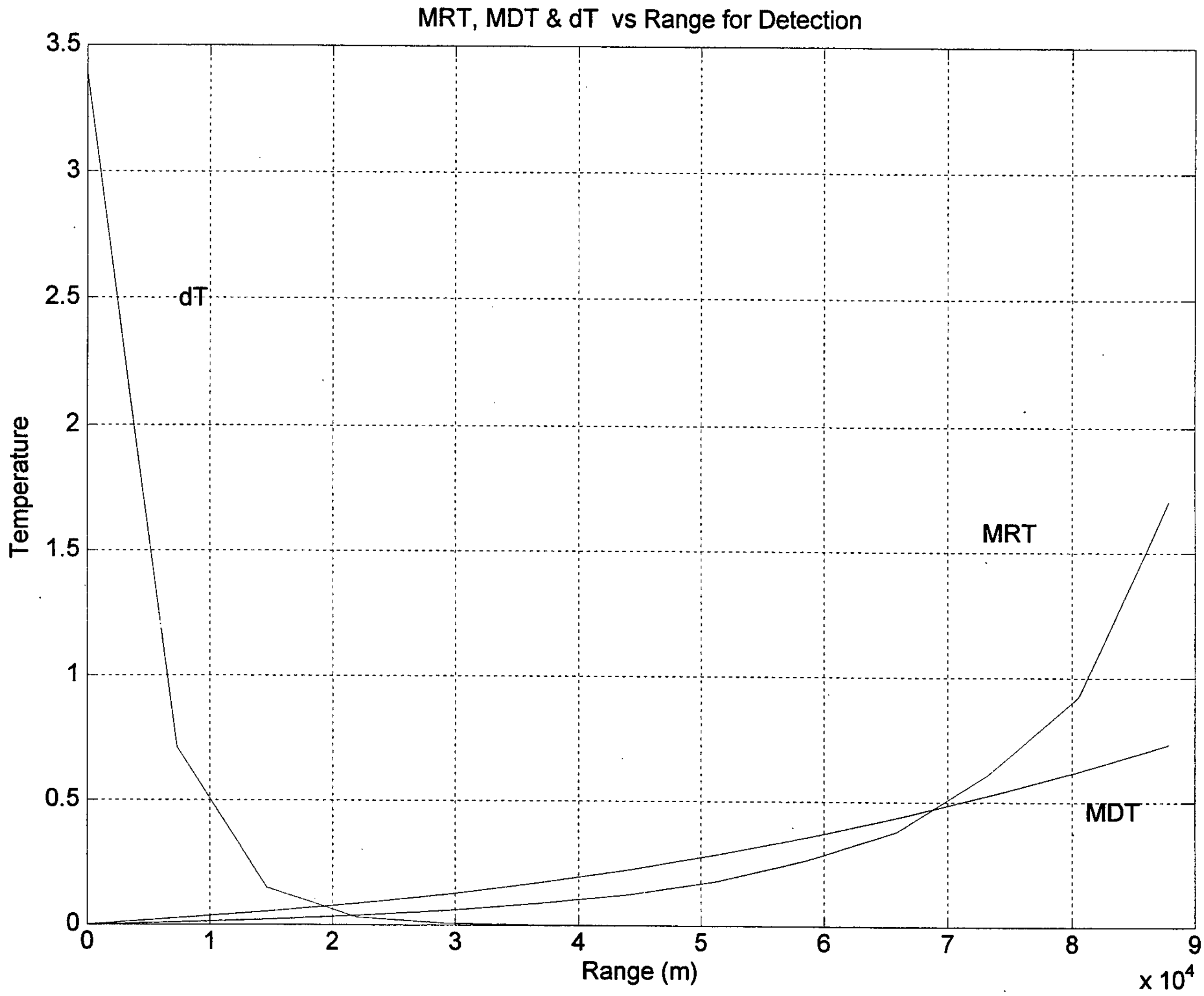



Figure 6. MRTD, MDTD and ΔT as a Function of Range for Detection

of R/V POINT SUR, ΔT by Beer's Law

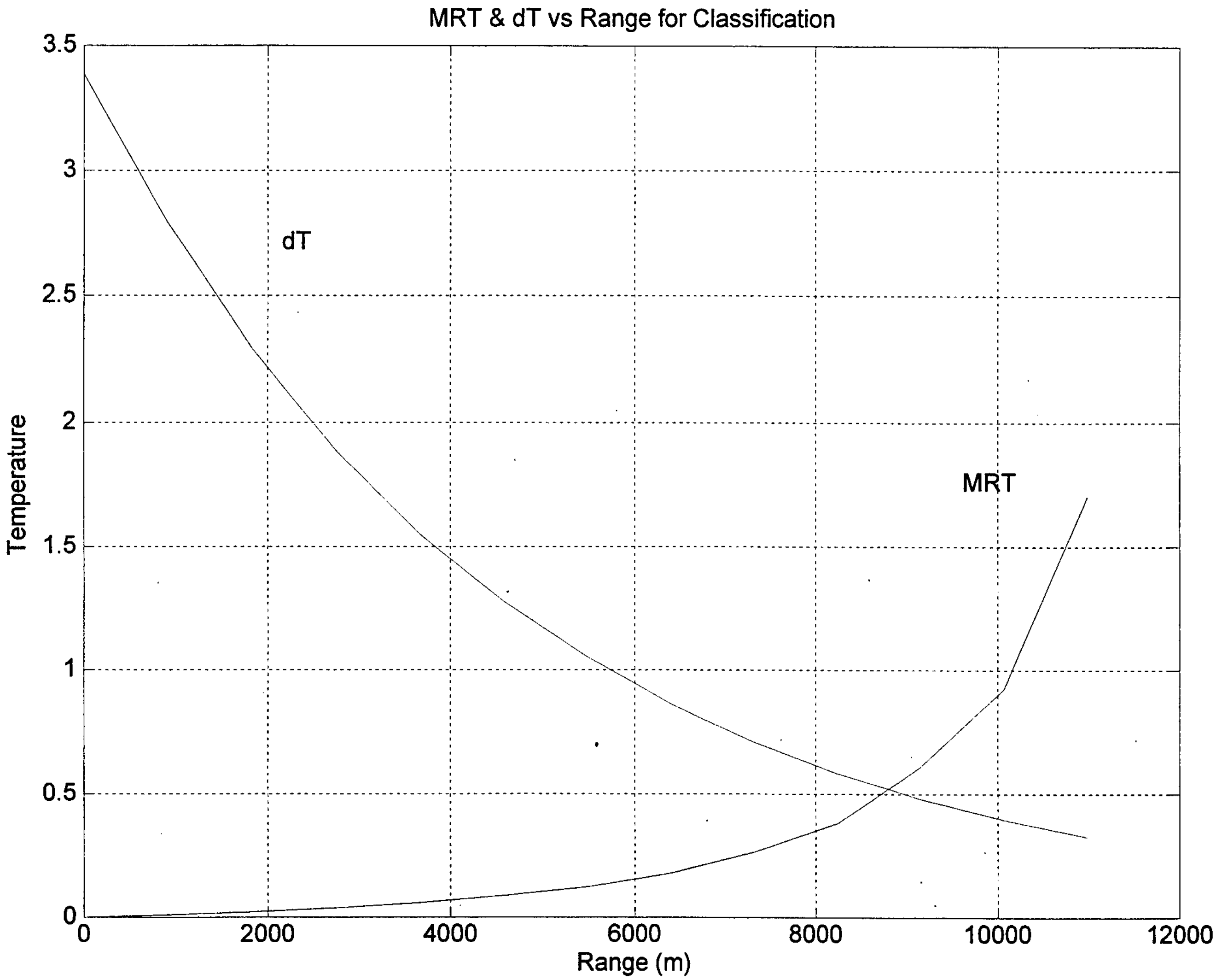



Figure 7. MRTD and ΔT as a Function of Range for Classification;

ΔT by Attenuation of $\Delta T_0$

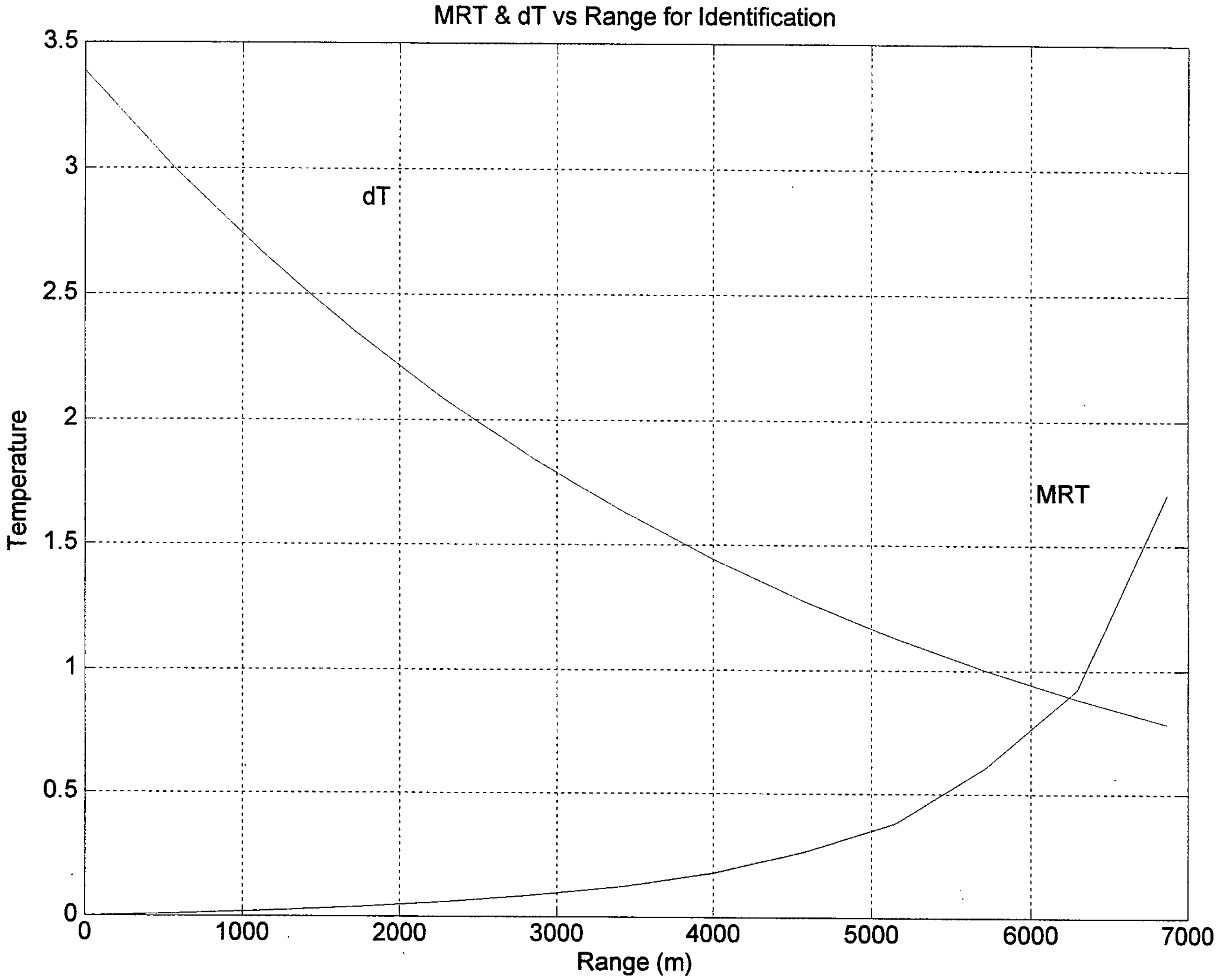



Figure 8. MRTD and ΔT as a Function of Range for Identification:

ΔT by Attenuation of Source Method

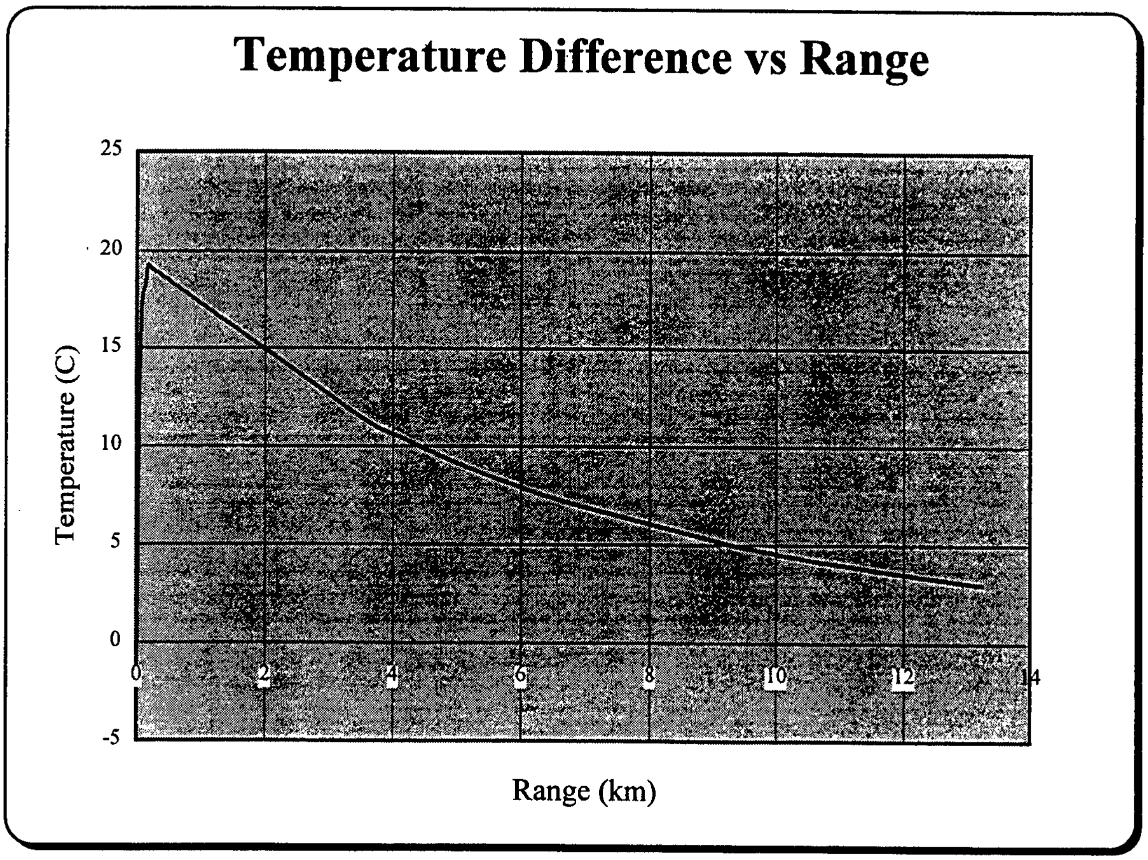



Figure 9. ΔT vs Range for Typical case, by Radiance Compensation Method, (SEARAD) Sensor at 6 meters Elevation

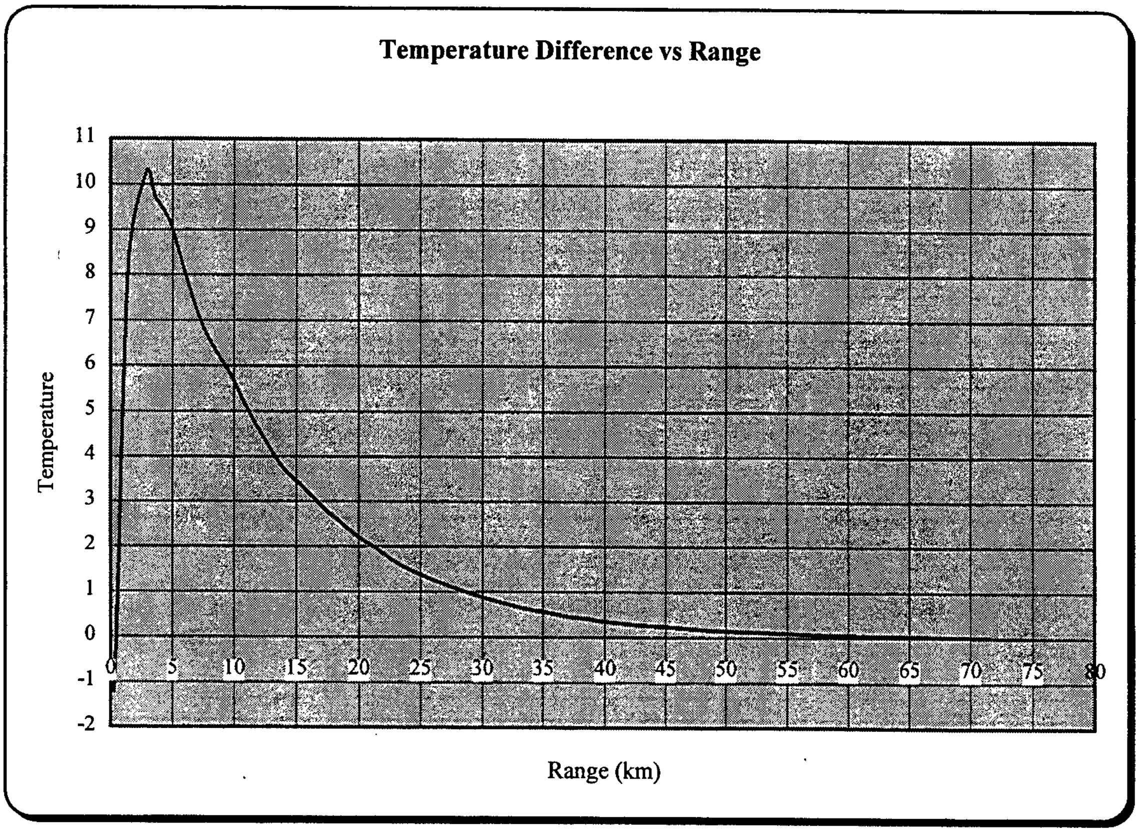



Figure 10. ΔT vs Range for MDR Estimate;

Sensor at 250 meters Elevation

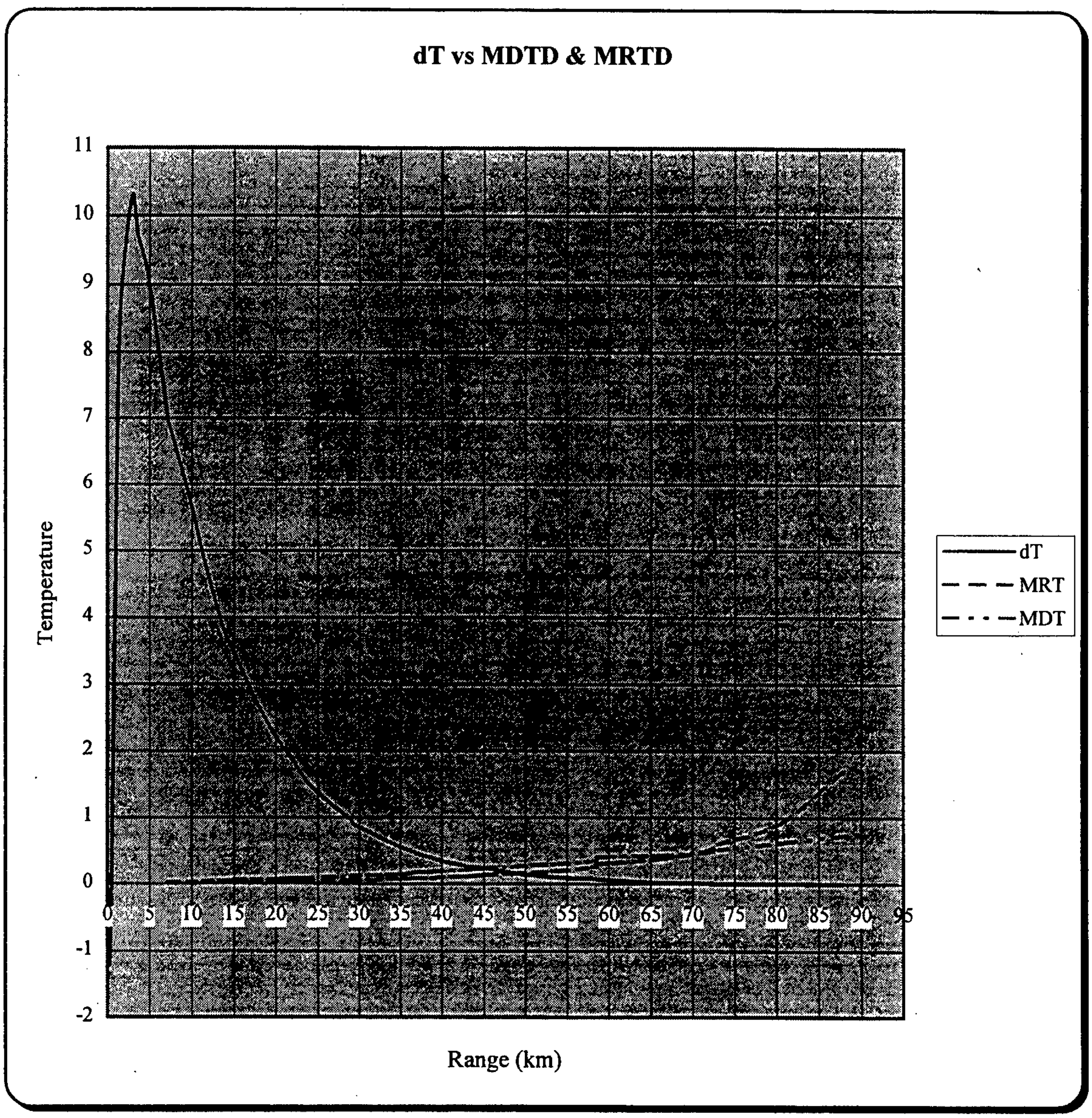



Figure 11. ΔT vs MRTD & MDTD for MDR Estimate

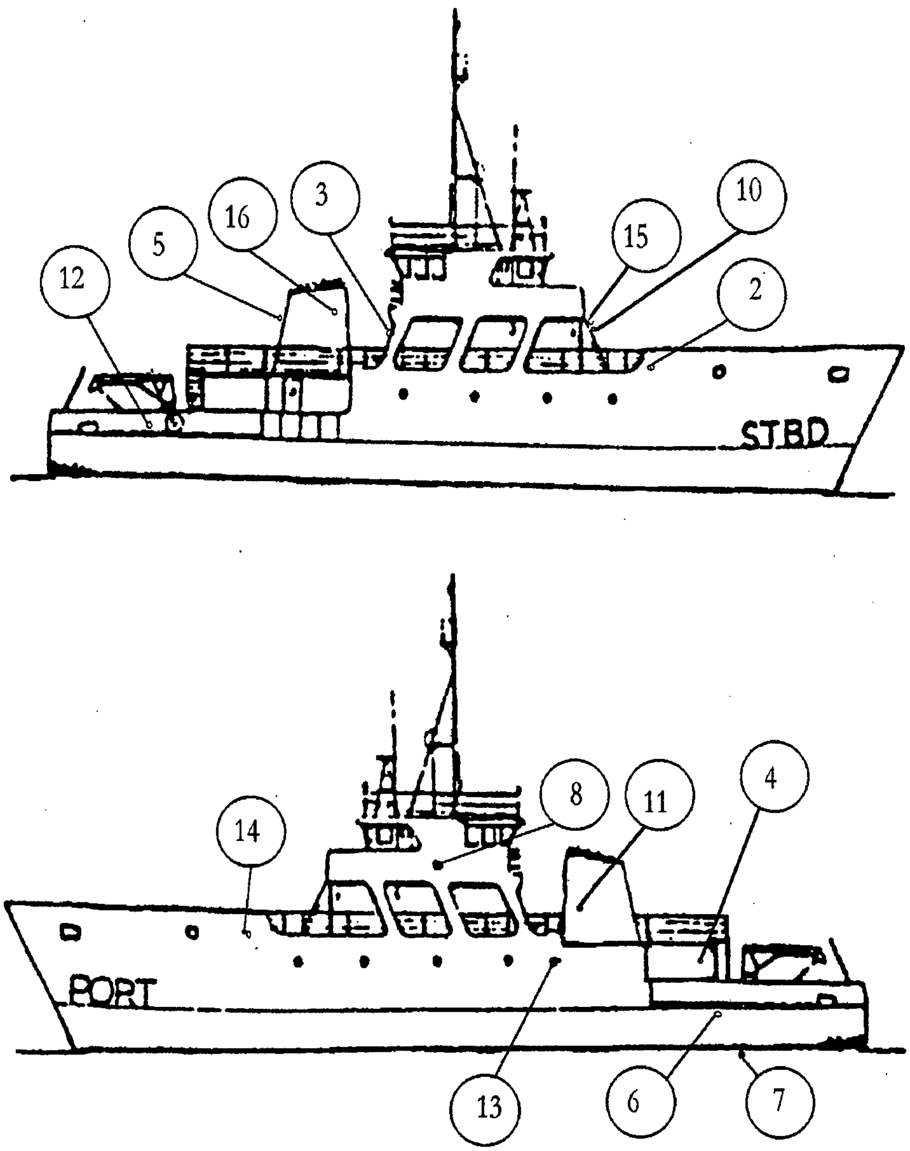
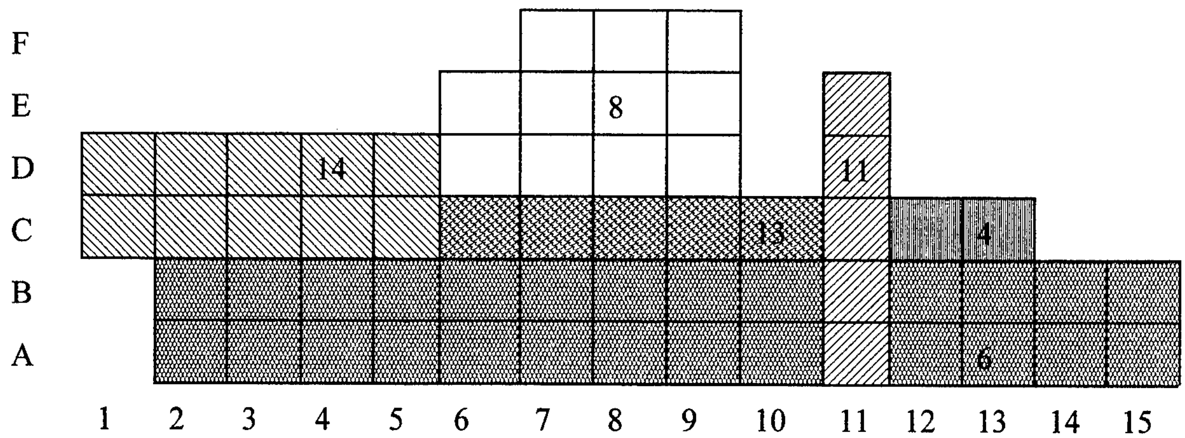



Figure 12. Locations of Thermistors

TEMPERATURE DISTRIBUTION TABLE, R/V POINT SUR PORT BEAM




TEMPERATURE DISTRIBUTION, R/V POINT SUR STARBOARD BEAM

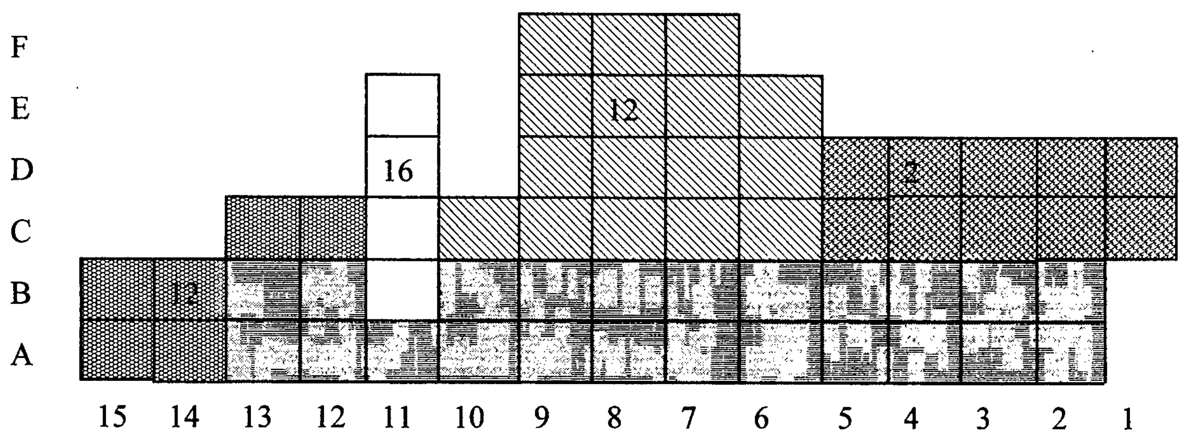



Figure 13. Distribution of Thermistors, and Correlation with Pixels

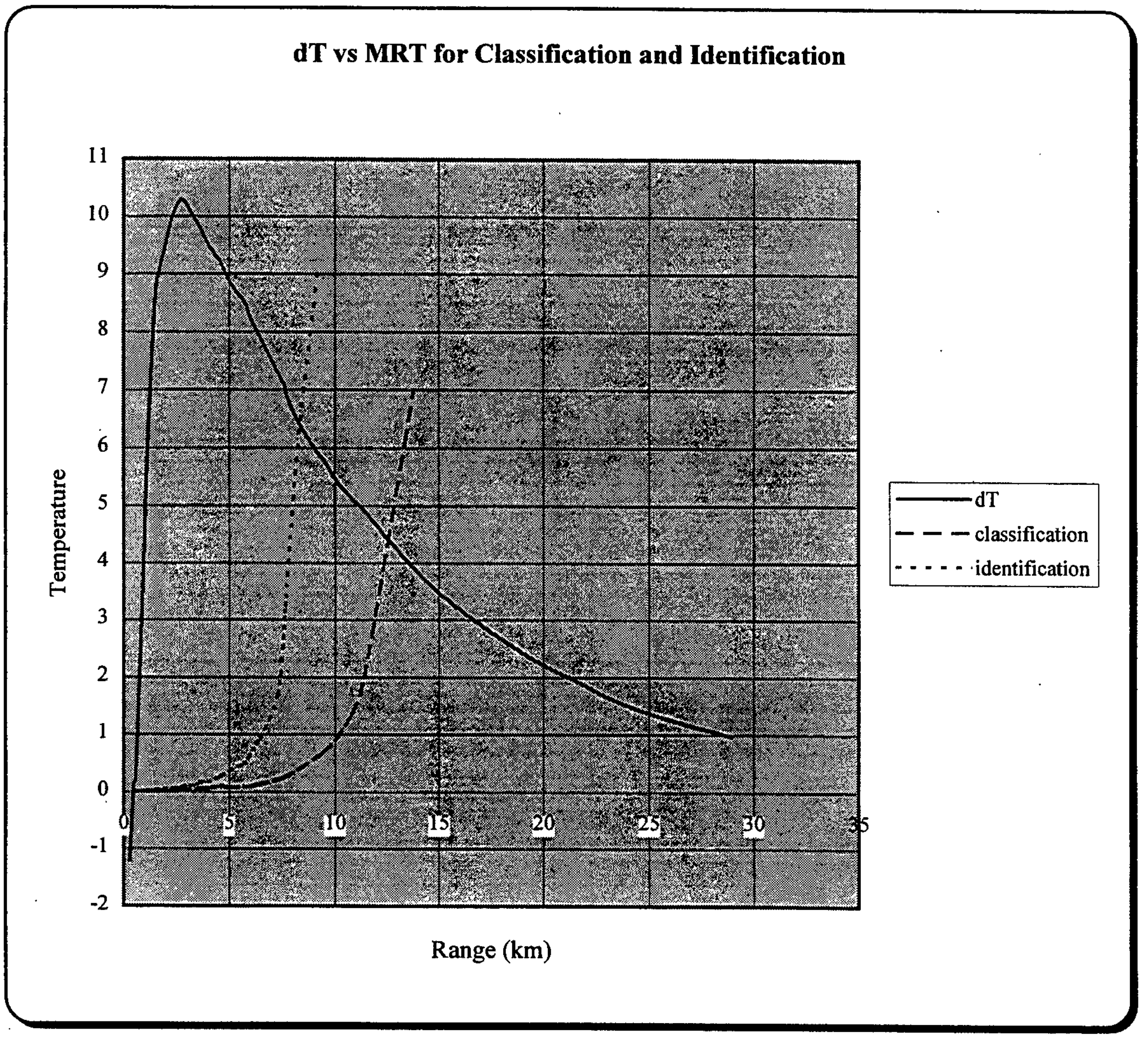



Figure 14. ΔT vs MRTD for Classification and Identification

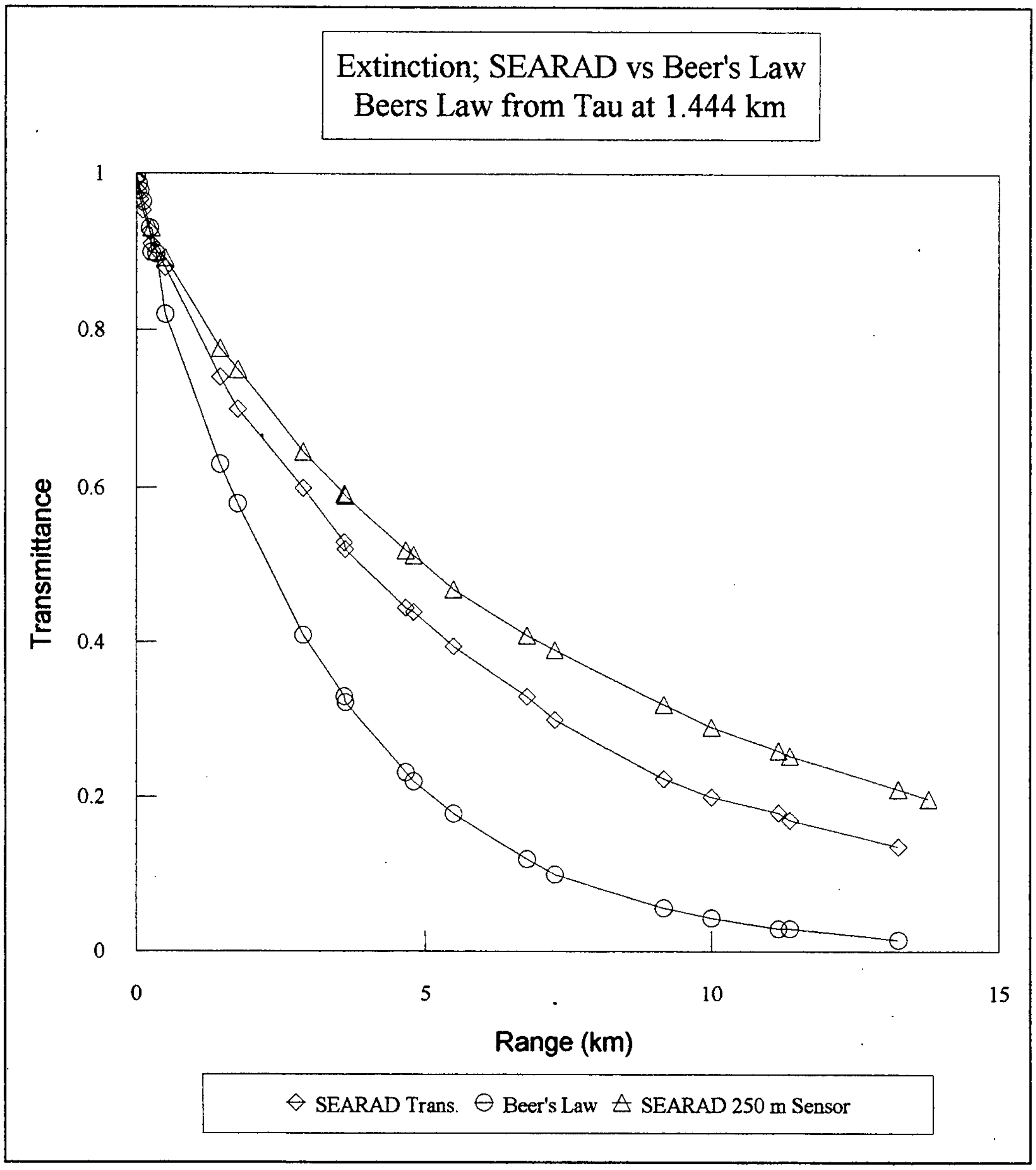



Figure 15. Comparison of Extinction; SEARAD vs Beer's Law

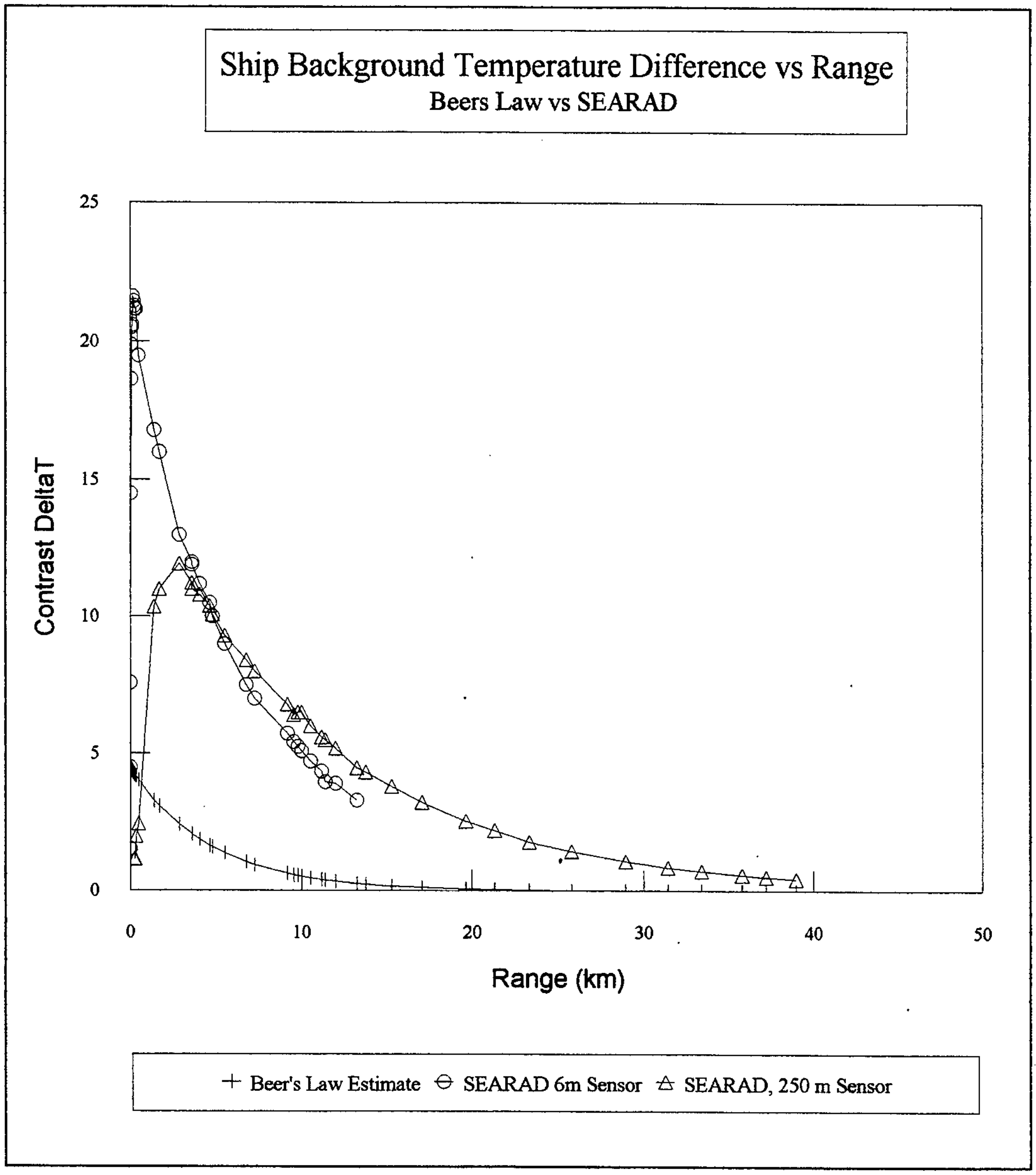



Figure 16. ΔT for Beer's Law vs SEARAD

| | |
|---|---|
| Date | 95/05/16 |
| Time (GMT) | 18:37:53 |
| Time (local) | 11:37:53 |
| Ship Heading | 120 |
| Wind Speed (knot) | 3.69 |
| Wind Speed (m/s) | 1.8966 |
| Wind Speed (knot) 24-H Average | 3.1201 |
| Wind Speed (m/s) 24-H Average | 1.6037 |
| Wind Direction | 252 |
| Air Temperature (°C) | 12.30 |
| Relative Humility (%) | 93.34 |
| Pressure (mb) | 1012 |
| Latitude | 36.81 N |
| Longitude | 121.81 W |
| Ship Temperature (°C) | 16.987144 |
| Ship Temperature (°K) | 289.987144 |
| Sea Temperature (°C) | 13.60 |
| Sea Temperature (°K) | 286.60 |
| Ship Radiance Ns (zero range) | 30.14347844 |
| Transmittance $\tau$ | 0.735 |
| Path Radiance Np | 7.58028 |
| $Ns \times \tau + Np = N_{s+p}$ | 29.7357366 |
| $N_{s+p} \Rightarrow T_{s+p}$ | 284.68 |
| Background Radiance $N_b$ | 21.93238 |
| $N_b \Rightarrow T_b$ | 268.7 |
| $T_{s+p} - T_b = \Delta T_{app}$ | 15.98 |
| Observe Range(km) horizontal | 1.4225 |
| Observe Range (km) | 1.444 |
| $\Delta T$ | 3.387144 |
| Bearing (degree) | 21.326 |
| Azimuth angle (degree) | 68.674 |
| Elevation (degree) | 0.24066 |
| Ship Project Area ($m^2$) | 214.4513 |

Table 8. Data File for Typical Case

| Observed Range (km) | Zero Range | 0.006 | 0.021 | 0.039 | 0.069 |
|---|---|---|---|---|---|
| Zenith Angle | 0.0 | 158.500 | 107.000 | 99.000 | 95.000 |
| Emissivity $\varepsilon$ | ****** | 0.9876 | 0.8518 | 0.6937 | 0.5887 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.0 | 0.9924 | 0.9846 | 0.9773 | 0.9670 |
| Path Radiance Np | ****** | 0.19415 | 0.39946 | 0.59549 | 0.87565 |
| $Ns \times \tau + Np = N_{S+P}$ | ****** | 30.10853 | 30.07872 | 30.05470 | 30.02438 |
| $N_{S+P}$ convert to Temperature | ****** | 285.37 | 285.32 | 285.27 | 285.22 |
| Background Radiance | ****** | 30.63620 | 27.41545 | 23.96328 | 22.04542 |
| $N_b$ convert to Temperature $T_b$ | ****** | 286.35 | 280.25 | 273.25 | 269.05 |
| $T_{S+P} - T_b = \Delta T$ | 3.387144 | - 0.98 | 5.07 | 12.02 | 16.17 |

Table 9.1 Data File for Typical Case Radiance Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 0.086 | 0.115 | 0.138 | 0.172 | 0.230 |
| Zenith Angle | 94.000 | 93.000 | 92.500 | 92.000 | 91.500 |
| Emissivity $\varepsilon$ | 0.5613 | 0.5351 | 0.5227 | 0.5099 | 0.4954 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.9618 | 0.9538 | 0.9478 | 0.9393 | 0.9262 |
| Path Radiance Np | 1.01743 | 1.23811 | 1.40434 | 1.64105 | 2.01083 |
| $Ns \times \tau + Np = N_{S+P}$ | 30.00941 | 29.9889 | 29.97432 | 29.95481 | 29.92926 |
| $N_{S+P}$ convert to Temperature | 285.19 | 285.15 | 285.13 | 285.09 | 285.04 |
| Background Radiance | 21.46527 | 21.19206 | 21.14012 | 20.68977 | 20.70253 |
| $N_b$ convert to Temperature $T_b$ | 267.75 | 267.05 | 266.95 | 265.85 | 265.95 |
| $T_{S+P} - T_b = \Delta T$ | 17.44 | 18.1 | 18.18 | 19.24 | 19.09 |

Table 9.2 Data File for Typical Case Radiance Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 0.345 | 1.740 | 3.616 | 4.071 | 4.669 |
| Zenith Angle | 90.999 | 90.200 | 90.100 | 90.090 | 90.080 |
| Emissivity $\varepsilon$ | 0.4820 | 0.4630 | 0.4617 | 0.4616 | 0.4615 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.9023 | 0.6995 | 0.5210 | 0.4868 | 0.4457 |
| Path Radiance Np | 2.69034 | 8.63780 | 13.99925 | 15.03495 | 16.27719 |
| Ship Radiance $N_{S+P}$ | 29.88879 | 29.72315 | 29.70399 | 29.70879 | 29.71213 |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 284.96 | 284.66 | 284.62 | 284.63 | 284.64 |
| Background Radiance $N_b$ | 20.78745 | 22.26335 | 24.05040 | 24.40729 | 24.83836 |
| $N_b$ convert to Temperature $T_b$ | 266.09 | 269.40 | 273.4 | 274.1 | 275.03 |
| $T_{S+P} - T_b = \Delta T$ | 18.87 | 15.57 | 11.22 | 10.53 | 9.61 |

Table 9.3 Data File for Typical Case Radiance Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 5.501 | 6.772 | 9.167 | 9.557 | 10.008 |
| Zenith Angle | 90.070 | 90.060 | 90.050 | 90.049 | 90.048 |
| Emissivity $\varepsilon$ | 0.4614 | 0.4613 | 0.4611 | 0.4611 | 0.4611 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.3951 | 0.3298 | 0.2366 | 0.2243 | 0.2110 |
| Path Radiance Np | 17.80972 | 19.78584 | 22.60054 | 22.97070 | 23.37262 |
| Ship Radiance $N_{S+P}$ | 29.71940 | 29.72715 | 29.73248 | 29.73188 | 29.73289 |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 284.65 | 284.67 | 284.68 | 284.67 | 284.68 |
| Background Radiance $N_b$ | 25.37396 | 26.06976 | 27.06865 | 27.20058 | 27.34404 |
| $N_b$ convert to Temperature $T_b$ | 276.15 | 277.57 | 279.56 | 279.83 | 280.11 |
| $T_{S+P} - T_b = \Delta T$ | 8.5 | 7.1 | 5.12 | 4.84 | 4.57 |

Table 9.4 Data File for Typical Case Radiance Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 10.534 | 11.174 | 12.009 | 13.262 | 97.261 |
| Zenith Angle | 90.047 | 90.046 | 90.045 | 90.044 | 90.043 |
| Emissivity $\varepsilon$ | 0.4611 | 0.4610 | 0.4610 | 0.4610 | ****** |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.1965 | 0.1802 | 0.1611 | 0.1363 | 0.0001 |
| Path Radiance Np | 23.80918 | 24.29645 | 24.86820 | 25.60797 | ****** |
| Ship Radiance $N_{S+P}$ | 29.73237 | 29.72830 | 29.72431 | 29.71652 | ****** |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 284.66 | 284.67 | 284.66 | 284.65 | ****** |
| Background Radiance $N_b$ | 27.50002 | 27.67432 | 27.87898 | 28.14412 | ****** |
| $N_b$ convert to Temperature $T_b$ | 280.43 | 280.75 | 281.15 | 281.67 | ****** |
| $T_{S+P} - T_b = \Delta T$ | 4.23 | 3.92 | 3.51 | 2.98 | ****** |

Table 9.5 Data File for Typical Case Radiance Computation

| | | | | | |
|---|---|---|---|---|---|
| Observe Range (km) | 0.259 | 0.289 | 0.500 | 1.441 | 2.875 |
| Zenith Angle | 195.000 | 150.000 | 120.000 | 100.000 | 95.000 |
| Emissivity $\varepsilon$ | 0.9877 | 0.9869 | 0.9539 | 0.7180 | 0.5882 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.9311 | 0.9258 | 0.8920 | 0.7764 | 0.6457 |
| Path Radiance Np | 1.86920 | 2.018832 | 2.97817 | 6.34750 | 10.23864 |
| $Ns \times \tau + Np = N_{S+P}$ | 29.93578 | 29.92565 | 29.86614 | 29.75089 | 29.70227 |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 285.06 | 285.04 | 284.93 | 284.71 | 284.62 |
| Background Radiance $N_b$ | 30.59705 | 30.57243 | 29.77694 | 25.48528 | 24.50860 |
| $N_b$ convert to Temperature $T_b$ | 286.27 | 286.23 | 284.76 | 276.35 | 274.35 |
| $T_{S+P} - T_b = \Delta T$ | -1.21 | -1.19 | 0.17 | 8.36 | 10.27 |

Table 10.1 Data File for MDR Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 3.596 | 4.805 | 7.260 | 9.783 | 11.382 |
| Zenith Angle | 94.000 | 93.000 | 92.000 | 91.500 | 91.300 |
| Emissivity $\varepsilon$ | 0.5607 | 0.5344 | 0.5084 | 0.4935 | 0.4882 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.5919 | 0.5140 | 0.3909 | 0.2985 | 0.2526 |
| Path Radiance Np | 11.85932 | 14.21330 | 17.95142 | 20.76567 | 22.16049 |
| $Ns \times \tau + Np = N_{S+P}$ | 29.70123 | 29.70704 | 29.73450 | 29.76349 | 29.77473 |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 284.62 | 284.63 | 284.68 | 284.73 | 284.76 |
| Background Radiance $N_b$ | 24.55046 | 25.01152 | 25.88875 | 26.76083 | 27.20808 |
| $N_b$ convert to Temperature $T_b$ | 274.9 | 275.49 | 277.7 | 278.95 | 279.85 |
| $T_{S+P} - T_b = \Delta T$ | 9.72 | 9.14 | 6.98 | 5.78 | 4.91 |

Table 10.2 Data File for MDR Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 13.776 | 15.334 | 17.098 | 19.663 | 21.299 |
| Zenith Angle | 91.090 | 90.990 | 90.900 | 90.800 | 90.750 |
| Emissivity $\varepsilon$ | 0.4818 | 0.4785 | 0.4756 | 0.4725 | 0.4709 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.1977 | 0.1690 | 0.1418 | 0.1101 | 0.0939 |
| Path Radiance Np | 23.82643 | 24.69582 | 25.51815 | 26.46917 | 26.95469 |
| $Ns \times \tau + Np = N_{S+P}$ | 29.78579 | 29.79006 | 29.79249 | 29.78796 | 29.78516 |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 284.77 | 284.78 | 284.79 | 284.78 | 284.78 |
| Background Radiance $N_b$ | 27.73904 | 28.01768 | 28.28500 | 28.59857 | 28.76048 |
| $N_b$ convert to Temperature $T_b$ | 280.95 | 281.4 | 281.9 | 282.5 | 282.8 |
| $T_{S+P} - T_b = \Delta T$ | 3.82 | 3.38 | 2.89 | 2.28 | 1.98 |

Table 10.3 Data File for MDR Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 23.278 | 25.743 | 28.948 | 31.421 | 33.415 |
| Zenith Angle | 90.700 | 90.650 | 90.600 | 90.570 | 90.550 |
| Emissivity $\varepsilon$ | 0.4694 | 0.4679 | 0.4664 | 0.4655 | 0.4649 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.0776 | 0.0613 | 0.0452 | 0.0358 | 0.0297 |
| Path Radiance Np | 27.44248 | 27.92743 | 28.40245 | 28.67854 | 28.85722 |
| $Ns \times \tau + Np = N_{S+P}$ | 29.78161 | 29.77522 | 29.76493 | 29.75767 | 29.75248 |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 284.77 | 284.76 | 284.74 | 284.72 | 284.71 |
| Background Radiance $N_b$ | 28.92441 | 29.08870 | 29.25099 | 29.34601 | 29.40779 |
| $N_b$ convert to Temperature $T_b$ | 283.16 | 283.47 | 283.77 | 283.95 | 284.07 |
| $T_{S+P} - T_b = \Delta T$ | 1.61 | 1.29 | 0.97 | 0.77 | 0.64 |

Table 10.4 Data File for MDR Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 35.809 | 37.210 | 38.962 | 39.310 | 42.769 |
| Zenith Angle | 90.530 | 90.520 | 90.509 | 90.507 | 90.490 |
| Emissivity $\varepsilon$ | 0.4643 | 0.4640 | 0.4637 | 0.4636 | 0.4630 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.0237 | 0.0208 | 0.0177 | 0.0171 | 0.0124 |
| Path Radiance Np | 29.03059 | 29.11495 | 29.20565 | 29.22193 | 29.35741 |
| $Ns\times\tau+Np = N_{S+P}$ | 29.74499 | 29.74193 | 29.73918 | 29.73738 | 29.73118 |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 284.70 | 284.69 | 284.69 | 284.68 | 284.67 |
| Background Radiance $N_b$ | 29.46800 | 29.49740 | 29.52908 | 29.53478 | 29.58232 |
| $N_b$ convert to Temperature $T_b$ | 284.18 | 284.24 | 284.30 | 284.31 | 284.40 |
| $T_{S+P} - T_b = \Delta T$ | 0.52 | 0.45 | 0.39 | 0.37 | 0.27 |

Table 10.5 Data File for MDR Computation

| | | | | | |
|---|---|---|---|---|---|
| Observed Range (km) | 45.409 | 48.877 | 54.146 | 58.641 | 71.559 |
| Zenith Angle | 90.480 | 90.470 | 90.460 | 90.455 | 90.450 |
| Emissivity $\varepsilon$ | 0.4626 | 0.4623 | 0.4618 | 0.4615 | 0.4610 |
| Ship Radiance Ns | 30.14347 | 30.14347 | 30.14347 | 30.14347 | 30.14347 |
| Transmittance $\tau$ | 0.0097 | 0.0070 | 0.0043 | 0.0028 | 0.0008 |
| Path Radiance Np | 29.43472 | 29.51111 | 29.58875 | 29.63071 | 29.68708 |
| $Ns \times \tau + Np = N_{S+P}$ | 29.72711 | 29.72211 | 29.71836 | 29.71511 | 29.71111 |
| $N_{S+P}$ convert to Temperature $T_{S+P}$ | 284.67 | 284.66 | 284.65 | 284.64 | 284.63 |
| Background Radiance $N_b$ | 29.60958 | 29.63663 | 29.66433 | 29.67943 | 29.69996 |
| $N_b$ convert to Temperature $T_b$ | 284.44 | 284.50 | 284.55 | 284.58 | 284.62 |
| $T_{S+P} - T_b = \Delta T$ | 0.23 | 0.16 | 0.10 | 0.06 | 0.01 |

Table 10.6 Data File for MDR Computation

| Channel | Location | Temperature | Pixel | Temp×Pixel |
|---|---|---|---|---|
| 1 | Reference | 25.001 | **** | ***** |
| 2 | Starboard bow | 16.423 | 10 | 164.23 |
| 3 | Aft pilot house | 17.864 | **** | **** |
| 4 | Port aft of stack | 17.291 | 2 | 34.582 |
| 5 | Aft on stack | 15.361 | **** | **** |
| 6 | Aft port | 15.830 | 26 | 411.58 |
| 7 | Aft port water | 14.368 | **** | **** |
| 8 | Port pilot house | 15.909 | 11 | 174.999 |
| 9 | Reference | 25.001 | **** | **** |
| 10 | Bow pilot house | 18.333 | **** | **** |
| 11 | Port stack | 24.164 | 5 | 120.82 |
| 12 | Aft starboard | 15.296 | 22 | 336.512 |
| 13 | Port below stack | 16.151 | 5 | 80.755 |
| 14 | Port bow | 15.346 | 10 | 153.46 |
| 15 | Bow air | 22.393 | **** | **** |
| 16 | Starboard stack | 28.829 | 4 | 115.316 |
| ** | Starboard above water-line | 17.923 | 23 | 412.229 |
| Total | ********* | ***** | 118 | 2004.483 |

Table 11. Distribution and Location of Thermistors

# APPENDIX A. THERMISTOR SAMPLE OUTPUT FILE

May 16.1

Mon,Day,Year = 5 16 1995

Hour,Min,Sec = 8 27 36

volts,istart,istop,nsam,iref 1.49939 1 16 100 1

1326456 25.001 12.856 13.403 11.963 14.615 11.677 12.359 11.634 25.001 14.242
22.956 12.010 11.617 11.431 15.410 25.874

1326476 25.001 12.864 13.397 11.959 14.646 11.673 12.371 11.633 25.001 14.200
22.937 12.001 11.607 11.426 15.229 25.535

1326496 25.001 12.858 13.394 11.954 14.699 11.662 12.415 11.647 25.001 14.162
22.924 11.993 11.598 11.420 15.138 25.186

1326516 25.001 12.861 13.404 11.950 14.752 11.662 12.437 11.625 25.001 14.145
22.923 11.989 11.593 11.416 15.062 24.958

---

1337856 25.001 16.392 17.862 17.334 15.415 15.885 14.338 15.873 25.001 18.294
24.326 15.281 16.169 15.352 22.299 28.721

**1337876 25.001 16.423 17.864 17.291 15.361 15.830 14.368 15.909 25.001 18.333
24.164 15.296 16.151 15.346 22.393 28.829**

1337896 25.001 16.458 17.844 17.241 15.295 15.771 14.383 15.946 25.001 18.366
24.093 15.304 16.117 15.305 22.319 28.933

1337916 25.001 16.495 17.819 17.200 15.242 15.716 14.404 15.972 25.001 18.395
24.064 15.318 16.083 15.264 22.276 29.048

1337936 25.001 16.528 17.796 17.160 15.188 15.677 14.354 15.997 25.001 18.421
24.021 15.341 16.061 15.248 22.188 29.162

1337956 25.001 16.559 17.799 17.118 15.150 15.638 14.274 15.983 25.001 18.451
23.944 15.370 16.044 15.256 22.322 29.302

## APPENDIX B. PROPORTIONAL RADIATION TABLE

The "Proportional Radiation", q=f(λ , T) represents the fraction of the radiant exitance which is emitted by a blackbody at temperature T at all wavelengths up to the selected values of λ. It is obtained from the integral over the Planck Law for wavelengths up to the selected values divided by the integral over all wavelengths, i.e.

$$q = \frac{\int_0^\lambda M(\lambda T)d\lambda}{\int_0^\infty M(\lambda T)d\lambda}$$

| λT/cm K | q | λT/cm K | q | λT/cm K | q |
|---|---|---|---|---|---|
| 0.050 | 1.3652E-9 | 0.140 | 7.9035E-3 | 0.460 | 5.8075E-1 |
| 0.052 | 3.6788E-9 | 0.150 | 1.3023E-2 | 0.480 | 6.0880E-1 |
| 0.054 | 9.1749E-9 | 0.160 | 1.9962E-2 | 0.500 | 6.3494E-1 |
| 0.056 | 2.1358E-8 | 0.170 | 2.8858E-2 | 0.520 | 6.5912E-1 |
| 0.058 | 4.6745E-8 | 0.180 | 3.9754E-2 | 0.540 | 6.8146E-1 |
| 0.060 | 9.6798E-8 | 0.190 | 5.2613E-2 | 0.560 | 7.0209E-1 |
| 0.062 | 1.9069E-7 | 0.200 | 6.7331E-2 | 0.580 | 7.2116E-1 |
| 0.064 | 3.5907E-7 | 0.210 | 8.3750E-2 | 0.600 | 7.3877E-1 |
| 0.066 | 6.4902E-7 | 0.220 | 1.0168E-1 | 0.620 | 7.5507E-1 |
| 0.068 | 1.1302E-6 | 0.230 | 1.2091E-1 | 0.660 | 7.8402E-1 |
| 0.070 | 1.9025E-6 | 0.240 | 1.4122E-1 | 0.700 | 8.0885E-1 |
| 0.072 | 3.1045E-6 | 0.250 | 1.6239E-1 | 0.740 | 8.3020E-1 |
| 0.074 | 4.9236E-6 | 0.260 | 1.8423E-1 | 0.780 | 8.4861E-1 |
| 0.076 | 7.6070E-6 | 0.270 | 2.0653E-1 | 0.820 | 8.6455E-1 |
| 0.078 | 1.1473E-5 | 0.280 | 2.2911E-1 | 0.860 | 8.7840E-1 |
| 0.080 | 1.6923E-5 | 0.290 | 2.5183E-1 | 0.900 | 8.9048E-1 |
| 0.082 | 2.4453E-5 | 0.300 | 2.7454E-1 | 0.940 | 9.0100E-1 |
| 0.084 | 3.4668E-5 | 0.310 | 2.9712E-1 | 0.980 | 9.1033E-1 |
| 0.086 | 4.8287E-5 | 0.320 | 3.1947E-1 | 1.00 | 9.1455E-1 |
| 0.088 | 6.6159E-5 | 0.330 | 3.4150E-1 | 1.10 | 9.3217E-1 |
| 0.090 | 8.9269E-5 | 0.340 | 3.6314E-1 | 1.20 | 9.4532E-1 |

| | | | | | |
|---|---|---|---|---|---|
| 0.092 | 1.1874E-4 | 0.350 | 3.8432E-1 | 1.30 | 9.5331E-1 |
| 0.094 | 1.5586E-4 | 0.360 | 4.0502E-1 | 1.40 | 9.6304E-1 |
| 0.096 | 2.0204E-4 | 0.370 | 4.2518E-1 | 1.50 | 9.6909E-1 |
| 0.098 | 2.5885E-4 | 0.380 | 4.4479E-1 | 1.60 | 9.7390E-1 |
| 0.100 | 3.2804E-4 | 0.390 | 4.6382E-1 | 1.70 | 9.7777E-1 |
| 0.110 | 9.2957E-4 | 0.400 | 4.8227E-1 | 1.80 | 9.8091E-1 |
| 0.120 | 2.1727E-3 | 0.420 | 5.1738E-1 | 1.90 | 9.8349E-1 |
| 0.130 | 4.3866E-3 | 0.440 | 5.5012E-1 | 2.00 | 9.8563E-1 |

Adapted from "Optoelectronics; Theory and Practice" A. Chappell. Ed., McGraw-Hill Book Company, 1978

## APPENDIX C. LOOK-UP TABLE

In-band Radiance (8-12μm)
and Apparent Temperature Conversion Look-up Table

```
% Numerical Integration for Planck's law
% Integration by midpoint rule
% Matlab program with look-up table outputs
clear;
Tmin=291.; % <--- Guess T to obtain the corresponding radiance
dT=0.01;
n=200;

disp(' Temperature       Radiance');
disp(' -----------    --------------');
h=6.626e-34; c=2.998e8; k=1.382e-23;
a=8e-6; b=12e-6; dx=0.001e-6;

 for T=Tmin:dT:Tmin+n*dT

  sf=0.0;

  for x=a:dx:b-dx

    xm=x+dx/2;          % midpoint of f(x)

    f1=(2*h*c^2)/(xm^5);
    f2=1/(exp((h*c)/(xm*k*T))-1);
    fx=f1*f2;
    sf=sf+fx*dx;

  end;

  disp([T,sf]);

end;

end;
```

(Liu, 1996)

**Look-up Table for Temperature and Radiance Conversions**

| Temp | Radiance | Temp | Radiance | Temp | Radiance | Temp | Radiance |
|---|---|---|---|---|---|---|---|
| ----------- | --------- | ----------- | --------- | ----------- | --------- | ----------- | --------- |
| 283.0000 | 28.8410 | 283.0100 | 28.8463 | 283.0200 | 28.8515 | 283.0300 | 28.8568 |
| 283.0400 | 28.8621 | 283.0500 | 28.8673 | 283.0600 | 28.8726 | 283.0700 | 28.8779 |
| 283.0800 | 28.8832 | 283.0900 | 28.8884 | 283.1000 | 28.8937 | 283.1100 | 28.8990 |
| 283.1200 | 28.9042 | 283.1300 | 28.9095 | 283.1400 | 28.9148 | 283.1500 | 28.9201 |
| 283.1600 | 28.9253 | 283.1700 | 28.9306 | 283.1800 | 28.9359 | 283.1900 | 28.9412 |
| 283.2000 | 28.9464 | 283.2100 | 28.9517 | 283.2200 | 28.9570 | 283.2300 | 28.9623 |
| 283.2400 | 28.9676 | 283.2500 | 28.9728 | 283.2600 | 28.9781 | 283.2700 | 28.9834 |
| 283.2800 | 28.9887 | 283.2900 | 28.9940 | 283.3000 | 28.9993 | 283.3100 | 29.0045 |
| 283.3200 | 29.0098 | 283.3300 | 29.0151 | 283.3400 | 29.0204 | 283.3500 | 29.0257 |
| 283.3600 | 29.0310 | 283.3700 | 29.0363 | 283.3800 | 29.0415 | 283.3900 | 29.0468 |
| 283.4000 | 29.0521 | 283.4100 | 29.0574 | 283.4200 | 29.0627 | 283.4300 | 29.0680 |
| 283.4400 | 29.0733 | 283.4500 | 29.0786 | 283.4600 | 29.0839 | 283.4700 | 29.0892 |
| 283.4800 | 29.0945 | 283.4900 | 29.0998 | 283.5000 | 29.1051 | 283.5100 | 29.1104 |
| 283.5200 | 29.1157 | 283.5300 | 29.1210 | 283.5400 | 29.1263 | 283.5500 | 29.1316 |
| 283.5600 | 29.1369 | 283.5700 | 29.1422 | 283.5800 | 29.1475 | 283.5900 | 29.1528 |
| 283.6000 | 29.1581 | 283.6100 | 29.1634 | 283.6200 | 29.1687 | 283.6300 | 29.1740 |
| 283.6400 | 29.1793 | 283.6500 | 29.1846 | 283.6600 | 29.1899 | 283.6700 | 29.1952 |
| 283.6800 | 29.2005 | 283.6900 | 29.2058 | 283.7000 | 29.2111 | 283.7100 | 29.2164 |
| 283.7200 | 29.2217 | 283.7300 | 29.2270 | 283.7400 | 29.2323 | 283.7500 | 29.2377 |
| 283.7600 | 29.2430 | 283.7700 | 29.2483 | 283.7800 | 29.2536 | 283.7900 | 29.2589 |
| 283.8000 | 29.2642 | 283.8100 | 29.2695 | 283.8200 | 29.2749 | 283.8300 | 29.2802 |
| 283.8400 | 29.2855 | 283.8500 | 29.2908 | 283.8600 | 29.2961 | 283.8700 | 29.3014 |
| 283.8800 | 29.3068 | 283.8900 | 29.3121 | 283.9000 | 29.3174 | 283.9100 | 29.3227 |
| 283.9200 | 29.3280 | 283.9300 | 29.3334 | 283.9400 | 29.3387 | 283.9500 | 29.3440 |
| 283.9600 | 29.3493 | 283.9700 | 29.3547 | 283.9800 | 29.3600 | 283.9900 | 29.3653 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 284.0000 | 29.3706 | 284.0100 | 29.3760 | 284.0200 | 29.3813 | 284.0300 | 29.3866 |
| 284.0400 | 29.3920 | 284.0500 | 29.3973 | 284.0600 | 29.4026 | 284.0700 | 29.4079 |
| 284.0800 | 29.4133 | 284.0900 | 29.4186 | 284.1000 | 29.4239 | 284.1100 | 29.4293 |
| 284.1200 | 29.4346 | 284.1300 | 29.4399 | 284.1400 | 29.4453 | 284.1500 | 29.4506 |
| 284.1600 | 29.4559 | 284.1700 | 29.4613 | 284.1800 | 29.4666 | 284.1900 | 29.4720 |
| 284.2000 | 29.4773 | 284.2100 | 29.4826 | 284.2200 | 29.4880 | 284.2300 | 29.4933 |
| 284.2400 | 29.4987 | 284.2500 | 29.5040 | 284.2600 | 29.5093 | 284.2700 | 29.5147 |
| 284.2800 | 29.5200 | 284.2900 | 29.5254 | 284.3000 | 29.5307 | 284.3100 | 29.5361 |
| 284.3200 | 29.5414 | 284.3300 | 29.5468 | 284.3400 | 29.5521 | 284.3500 | 29.5574 |
| 284.3600 | 29.5628 | 284.3700 | 29.5681 | 284.3800 | 29.5735 | 284.3900 | 29.5788 |
| 284.4000 | 29.5842 | 284.4100 | 29.5895 | 284.4200 | 29.5949 | 284.4300 | 29.6003 |
| 284.4400 | 29.6056 | 284.4500 | 29.6110 | 284.4600 | 29.6163 | 284.4700 | 29.6217 |
| 284.4800 | 29.6270 | 284.4900 | 29.6324 | 284.5000 | 29.6377 | 284.5100 | 29.6431 |
| 284.5200 | 29.6485 | 284.5300 | 29.6538 | 284.5400 | 29.6592 | 284.5500 | 29.6645 |
| 284.5600 | 29.6699 | 284.5700 | 29.6753 | 284.5800 | 29.6806 | 284.5900 | 29.6860 |
| 284.6000 | 29.6913 | 284.6100 | 29.6967 | 284.6200 | 29.7021 | 284.6300 | 29.7074 |
| 284.6400 | 29.7128 | 284.6500 | 29.7182 | 284.6600 | 29.7235 | 284.6700 | 29.7289 |
| 284.6800 | 29.7343 | 284.6900 | 29.7396 | 284.7000 | 29.7450 | 284.7100 | 29.7504 |
| 284.7200 | 29.7557 | 284.7300 | 29.7611 | 284.7400 | 29.7665 | 284.7500 | 29.7719 |
| 284.7600 | 29.7772 | 284.7700 | 29.7826 | 284.7800 | 29.7880 | 284.7900 | 29.7934 |
| 284.8000 | 29.7987 | 284.8100 | 29.8041 | 284.8200 | 29.8095 | 284.8300 | 29.8149 |
| 284.8400 | 29.8202 | 284.8500 | 29.8256 | 284.8600 | 29.8310 | 284.8700 | 29.8364 |
| 284.8800 | 29.8418 | 284.8900 | 29.8471 | 284.9000 | 29.8525 | 284.9100 | 29.8579 |
| 284.9200 | 29.8633 | 284.9300 | 29.8687 | 284.9400 | 29.8740 | 284.9500 | 29.8794 |
| 284.9600 | 29.8848 | 284.9700 | 29.8902 | 284.9800 | 29.8956 | 284.9900 | 29.9010 |
| **285.0000** | **29.9064** | 285.0100 | 29.9118 | 285.0200 | 29.9171 | 285.0300 | 29.9225 |
| 285.0400 | 29.9279 | 285.0500 | 29.9333 | 285.0600 | 29.9387 | 285.0700 | 29.9441 |
| **285.0800** | **29.9495** | 285.0900 | 29.9549 | 285.1000 | 29.9603 | 285.1100 | 29.9657 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 285.1200 | 29.9711 | **285.1300** | **29.9765** | 285.1400 | 29.9819 | 285.1500 | 29.9872 |
| 285.1600 | 29.9926 | 285.1700 | 29.9980 | 285.1800 | 30.0034 | **285.1900** | **30.0088** |
| 285.2000 | 30.0142 | 285.2100 | 30.0196 | **285.2200** | **30.0250** | 285.2300 | 30.0304 |
| 285.2400 | 30.0358 | 285.2500 | 30.0412 | **285.2600** | **30.0467** | 285.2700 | 30.0521 |
| 285.2800 | 30.0575 | **285.2900** | **30.0629** | 285.3000 | 30.0683 | 285.3100 | 30.0737 |
| 285.3200 | 30.0791 | 285.3300 | 30.0845 | 285.3400 | 30.0899 | 285.3500 | 30.0953 |
| 285.3600 | 30.1007 | 285.3700 | 30.1061 | 285.3800 | 30.1115 | 285.3900 | 30.1169 |
| 285.4000 | 30.1224 | 285.4100 | 30.1278 | 285.4200 | 30.1332 | 285.4300 | 30.1386 |
| 285.4400 | 30.1440 | 285.4500 | 30.1494 | 285.4600 | 30.1548 | 285.4700 | 30.1603 |
| 285.4800 | 30.1657 | 285.4900 | 30.1711 | 285.5000 | 30.1765 | 285.5100 | 30.1819 |
| **285.5200** | **30.1874** | 285.5300 | 30.1928 | 285.5400 | 30.1982 | 285.5500 | 30.2036 |
| 285.5600 | 30.2090 | 285.5700 | 30.2145 | 285.5800 | 30.2199 | 285.5900 | 30.2253 |
| 285.6000 | 30.2307 | 285.6100 | 30.2362 | 285.6200 | 30.2416 | 285.6300 | 30.2470 |
| 285.6400 | 30.2524 | 285.6500 | 30.2579 | 285.6600 | 30.2633 | **285.6700** | **30.2687** |
| 285.6800 | 30.2741 | 285.6900 | 30.2796 | 285.7000 | 30.2850 | 285.7100 | 30.2904 |
| 285.7200 | 30.2959 | 285.7300 | 30.3013 | 285.7400 | 30.3067 | 285.7500 | 30.3122 |
| 285.7600 | 30.3176 | 285.7700 | 30.3230 | 285.7800 | 30.3285 | **285.7900** | **30.3339** |
| 285.8000 | 30.3393 | 285.8100 | 30.3448 | 285.8200 | 30.3502 | 285.8300 | 30.3557 |
| 285.8400 | 30.3611 | 285.8500 | 30.3665 | 285.8600 | 30.3720 | 285.8700 | 30.3774 |
| 285.8800 | 30.3829 | **285.8900** | **30.3883** | 285.9000 | 30.3937 | 285.9100 | 30.3992 |
| 285.9200 | 30.4046 | 285.9300 | 30.4101 | 285.9400 | 30.4155 | 285.9500 | 30.4210 |
| 285.9600 | 30.4264 | **285.9700** | **30.4319** | 285.9800 | 30.4373 | 285.9900 | 30.4427 |
| 286.0000 | 30.4482 | 286.0100 | 30.4536 | 286.0200 | 30.4591 | 286.0300 | 30.4645 |
| 286.0400 | 30.4700 | 286.0500 | 30.4754 | 286.0600 | 30.4809 | 286.0700 | 30.4864 |
| 286.0800 | 30.4918 | 286.0900 | 30.4973 | 286.1000 | 30.5027 | 286.1100 | 30.5082 |
| 286.1200 | 30.5136 | 286.1300 | 30.5191 | 286.1400 | 30.5245 | 286.1500 | 30.5300 |
| 286.1600 | 30.5355 | 286.1700 | 30.5409 | 286.1800 | 30.5464 | 286.1900 | 30.5518 |
| 286.2000 | 30.5573 | 286.2100 | 30.5628 | 286.2200 | 30.5682 | 286.2300 | 30.5737 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 286.2400 | 30.5791 | 286.2500 | 30.5846 | 286.2600 | 30.5901 | 286.2700 | 30.5955 |
| 286.2800 | 30.6010 | 286.2900 | 30.6065 | 286.3000 | 30.6119 | 286.3100 | 30.6174 |
| 286.3200 | 30.6229 | 286.3300 | 30.6283 | 286.3400 | 30.6338 | 286.3500 | 30.6393 |
| 286.3600 | 30.6448 | 286.3700 | 30.6502 | 286.3800 | 30.6557 | 286.3900 | 30.6612 |
| 286.4000 | 30.6666 | 286.4100 | 30.6721 | 286.4200 | 30.6776 | 286.4300 | 30.6831 |
| 286.4400 | 30.6885 | 286.4500 | 30.6940 | **286.4600** | **30.6995** | 286.4700 | 30.7050 |
| 286.4800 | 30.7105 | 286.4900 | 30.7159 | 286.5000 | 30.7214 | 286.5100 | 30.7269 |
| 286.5200 | 30.7324 | 286.5300 | 30.7379 | 286.5400 | 30.7433 | 286.5500 | 30.7488 |
| 286.5600 | 30.7543 | 286.5700 | 30.7598 | 286.5800 | 30.7653 | 286.5900 | 30.7708 |
| 286.6000 | 30.7762 | 286.6100 | 30.7817 | 286.6200 | 30.7872 | 286.6300 | 30.7927 |
| 286.6400 | 30.7982 | 286.6500 | 30.8037 | 286.6600 | 30.8092 | 286.6700 | 30.8147 |
| 286.6800 | 30.8201 | 286.6900 | 30.8256 | 286.7000 | 30.8311 | 286.7100 | 30.8366 |
| 286.7200 | 30.8421 | 286.7300 | 30.8476 | 286.7400 | 30.8531 | 286.7500 | 30.8586 |
| 286.7600 | 30.8641 | 286.7700 | 30.8696 | 286.7800 | 30.8751 | 286.7900 | 30.8806 |
| 286.8000 | 30.8861 | 286.8100 | 30.8916 | 286.8200 | 30.8971 | 286.8300 | 30.9026 |
| 286.8400 | 30.9081 | 286.8500 | 30.9136 | 286.8600 | 30.9191 | 286.8700 | 30.9246 |
| 286.8800 | 30.9301 | 286.8900 | 30.9356 | 286.9000 | 30.9411 | 286.9100 | 30.9466 |
| 286.9200 | 30.9521 | 286.9300 | 30.9576 | 286.9400 | 30.9631 | 286.9500 | 30.9686 |
| 286.9600 | 30.9741 | 286.9700 | 30.9796 | 286.9800 | 30.9851 | 286.9900 | 30.9906 |
| 287.0000 | 30.9962 | 287.0000 | 30.9962 | 287.0100 | 31.0017 | 287.0200 | 31.0072 |
| 287.0300 | 31.0127 | 287.0400 | 31.0182 | 287.0500 | 31.0237 | 287.0600 | 31.0292 |
| 287.0700 | 31.0347 | 287.0800 | 31.0403 | 287.0900 | 31.0458 | 287.1000 | 31.0513 |
| 287.1100 | 31.0568 | 287.1200 | 31.0623 | 287.1300 | 31.0678 | 287.1400 | 31.0734 |
| 287.1500 | 31.0789 | 287.1600 | 31.0844 | 287.1700 | 31.0899 | 287.1800 | 31.0954 |
| 287.1900 | 31.1010 | 287.2000 | 31.1065 | 287.2100 | 31.1120 | 287.2200 | 31.1175 |
| 287.2300 | 31.1231 | 287.2400 | 31.1286 | 287.2500 | 31.1341 | 287.2600 | 31.1396 |
| **287.2700** | **31.1452** | 287.2800 | 31.1507 | 287.2900 | 31.1562 | 287.3000 | 31.1617 |
| 287.3100 | 31.1673 | 287.3200 | 31.1728 | 287.3300 | 31.1783 | 287.3400 | 31.1839 |

# APPENDIX D. AUXILIARY PROGRAM ( SEARAD CODE )

## A. INTRODUCTION

"SEARAD" is a FORTRAN computer code that predicts the radiance (brightness) of the ocean surface. SEARAD" is valid for a spectral range extending from the visible to the far infrared regime. It is a self-contained, DOS-compatible program that runs on a personal computer and calculates sea radiance. It is a modified version of the Air Force program MODTRAN2 code that predicts sea radiance between 52.63 and 25000 $cm^{-1}$. MODTRAN is a computer code designed to determine atmospheric transmission and radiance at moderate resolution from 0 to 50,000 $cm^{-1}$ . SEARAD is based on the Cox-Munk (Cox and Munk, 1954,1956) statistical model for wind-driven capillary wave facets. Preliminary comparisons show that SEARAD agrees to within several °C with actual sea radiance measurements in the mid-wave and long-wave in the infrared band.[Ref.1]

## B. UNZIP SEARAD ( INSTALLATION)

The following statement tells how to unzip and run "SEARAD". The zipped files span three disks altogether. The last disk will be disk 3; the first disk will be disk 1. These commands assume that the hard disk in the computer is drive c:, and that the 3 1/2 inch disks will be loaded into drive a:. If another drive is used instead for the 3 1/2 disks, the drive letter (b: for example) should be substituted for a: in the following instructions.

Sentences in parentheses are physical acts; sentences without parentheses are commands that should be typed on the keyboard.

To unzip:

c:\ mkdir searad

cd searad (Insert disk1 in drive a: )

copy a:\pkunzip.exe

pkunzip a:\source

pkunzip a:\input

pkunzip a:\exe    (Follow instructions for disk insertion.)

The files should all be unzipped at this point. The directory c:\searad should now contain:

zip utility : pkunzip.exe

source code : Modnn [nn=10 to 22 ] ( except mod21.for )

Input file : Tape5xxx.std

Log of mods : Note.txt

Executables : Searad.exe, Dirac, and DOSxmsf.exe

To run Searad :

copy tape5rad.std tape5

searad

type out

This should show the output file corresponding to the input file " Tape5rad.std ".[Ref.5]

## C. SEARAD SAMPLE DESCRIPTION

In this section an example is provided to show how to use SEARAD to predict ocean radiance. An input file called " Tape5rad.std " employs a 1976 U.S. standard atmosphere to calculate ocean radiance observed at a zenith angle of 100 degree from a height of 23 m. The Navy aerosol model is used. The calculation is done with multiple scattering at low spectral resolution (LOWTRAN 7) for a single wave number (945 $cm^{-1}$) in the long wave band. The following DOS commands will calculate ocean radiance and print results

copy tape5rad.std tape5

searad

type out

These commands produce an output file called "out". The four contributions to ocean radiance (path to footprint, sea emission, sky reflection, and sun glint) are listed at the end of the "out" file. "TBOUND" in the input file here is interpreted as sea temperature.

## D. SEARAD MODEL

The SEARAD model computes four contributions to sea radiance. The assumption for the model is that the strength of interaction between an optical ray and a capillary wave facet is given by the facet area projected normal to the ray. It does not include multiple reflections, shadowing and gravity waves. It also ignores polarization.

The first contribution is path radiance ($N_{path}$). The footprint of a single pixel in an image of the sea is indicated by the wavy line. The footprint is observed by a receiver at the end of a ray whose zenith angle at the footprint is $\theta_r$ . $N_{path}$ represents the spectral radiance in $W/m^2$ /sr/cm along the path from the footprint to the receiver.

The second contribution is reflected sky radiance ($N_{sky}$). The spectral radiance $N_s$ from part of the sky reaches the footprint along a ray whose zenith angle is $\theta_s$. The contributions are the summation from all portions of the sky after specular reflection by the appropriate facets within the footprint. $N_{sky}$ is the sum leaving the footprint at zenith angle $\theta_S$ . During its path to the receiver, $N_{sky}$ is attenuated by the path transmission $\tau_{path}$.

The third contribution is reflected solar radiance ( $N_{sun}$ ), sun glint . The radiance $N_0$ from the solar center arrives at the footprint along a path whose zenith angle is $\theta_o$. Within the footprint most facets deflect the solar ray away from the receiver and are rejected, but some facets are retained because they deflect the ray specularly toward the receiver along a path with zenith angle $\theta_r$. $N_{sun}$ is the spectral radiance leaving the footprint after summation over rays arriving from all portions of the solar disk. $N_{sun}$ is also attenuated by the path transmission $\tau_{path}$.

The fourth contribution is thermal black body emission ( $N_{sea}$ ). In this portion each facet emits a spectral radiance $N_{bb}$ given by Planck's equation for a black body. The sea temperature is equal to the value of TBOUND in the input file. The spectral emissivity of a given facet in the direction of the receiver is specified by the slope of that facet and the value of $\theta_r$. $N_{sea}$ is the thermal spectral radiance leaving the footprint for the receiver after summation over all facets within the footprint. $N_{sea}$ is also attenuated by path transmission $\tau_{path}$ after leaving the footprint.

The symbol $\rho$ represents the reflectivity of sea water. It is calculated from Fresnel's equations. The total spectral radiance $N(\nu)$ received at wave number ν ($cm^{-1}$) is given by

$$N(\nu) = N_{path}(\nu) f(\nu) + \left[N_{sky}(\nu) + N_{sun}(\nu) + N_{sea}(\nu)\right] \tau_{path}(\nu) f(\nu) \ , \qquad (C.1)$$

where $f(\nu)$ stands for the spectral responsivity of the receiver.

The design of SEARAD is such that the path ($N_{path}$ , $\tau_{path}$) and source ($N_S$, $N_O$, $N_{bb}$) values are taken from the original MODTRAN 2 while Fresnel reflection (ρ) and slope integrated values ($N_{sky}$ ,$N_{sun}$, $N_{sea}$) are introduced in new subroutines. Integration of Equation (C.1) over the wave number band specified in the input file (Tape5) is implemented in a modification of subroutine "TRAN" to produce the band integrated values for sea radiance given in the output file (out).[Ref.1]

## APPENDIX E. DESCRIPTION OF EACH CARD IN SEARAD INPUT FILE

The format of input file is very important. Each number must be in the correct row and column. Below is a listing of the input file parameters in SEARAD and the values used in evaluating the sea radiance.

CARD 1 ( line one )

F ⇒ use LOWTRAN 7

7 ⇒ MODEL : radiosonde data used

3 ⇒ ITYPE : slant path to space

1 ⇒ IEMSCT : program execution in radiance mode

1 ⇒ IMULT : program executed with multiple scattering

"M1,M2,M3" are used to modify or supplement the altitude profiles of temperature and pressure, water vapor, and ozone "M4,M5,M6"

6 ⇒ M1 : default temperature and pressure to specified MODEL atmosphere (M1=1~6)

6 ⇒ M2 : default $H_2O$ to specified MODEL atmosphere ( M2=1~6 )

6 ⇒ M3 : default ozone to specified MODEL atmosphere ( M3=1~6 )

6 ⇒ M4 : default CH4 to specified MODEL atmosphere ( M4=1~6 )

6 ⇒ M5 : default $N_2O$ to specified MODEL atmosphere ( M5=1~6 )

6 ⇒ M6 : default CO to specified MODEL atmosphere ( M6=1~6 )

1 ⇒ MDEF use default profile for CO2, O2, NO, SO2, NO2, NH3, HNO3

1 ⇒ IM : radiosonde data to be read initially

1 ⇒ NORPT : minimize printing of transmittance

xx ⇒ TBOUND : boundary temperature ( $^{o}$k )

0.00 ⇒ SALB : surface albedo ( 0.0 to 1.0 )

CARD 2 (line 2)

3 ⇒ IHAZE : navy maritime extinction, sets own VIS.

0 ⇒ ISEASN : Summer for model 7

0 ⇒ IVULCN : default to stratospheric background

3 ⇒ ICSTL : air mass (1 for open ocean - 10 for strong continental influence) ICSTL now allow non-integer values. Integers from 1 to 10 inclusive will be taken as is, while integers from 11 to 300 inclusive will be divided by 10. Integers outside the range of 1 to 300 will be reset to a default value of "3.0".

0 ⇒ ICLD : no clouds or rain

0 ⇒ IVSA : not used

20 ⇒ VIS : meteorological range

1.897⇒ WSS : specifies current wind speed ( m/s )

1.603⇒ WHH : 24 hour average wind speed ( m/s )

0.00 ⇒ RAINT : rain rate ( mm/hr )

0.00 ⇒ GNDALT altitude of surface relative to sea level ( km )

CARD 2c ( line 3 )

33 ⇒ ML : number of atmospheric layers to be inserted (Maximum of 34)

0 ⇒ IRD1 : no read

0 ⇒ IRD2 : no read

text TITLE : user defined text

CARD 2c1 ( next 33 line )

xx ⇒ ZMDL : altitude of layer ( km )

xx ⇒ P : pressure at layer ( mb )

xx ⇒ T ambient temperature ( °C )

xx ⇒ JCHAR(RH) : relative humidity ( % )

ABH ⇒ set units for P,T,RH

CARD 3 ( line 37 )

0.006⇒ H1 : initial altitude (FLIR sensor altitude) ( km )

0.00 ⇒ H2 : final altitude (seasurface altitude) ( km )

xx ⇒ ANGLE : zenith angle ( degree )

0.000⇒ RANGE : path length ( km )

0.000⇒ BETA : earth center angle subtented by H1 and H2 ( degree )

0.000⇒ RO : default radius of earth ( km )

1 ⇒ LEN for long path through tangent height

90.00⇒ Psi : azimuth of the upwind direction from line of sight positive East of North (degree) 90 ° means that the wind is blowing from right to left, perpendicular to the direction of observation

T ⇒ True : sea radiance will be carried out ( F means that sea radiance will be prevented under all conditions )

CARD 4 ( line 38 )

830 ⇒ V1 : initial wave number ( $cm^{-1}$ )

1250 ⇒ V2 : final wave number ( $cm^{-1}$ )

10 ⇒ DV : wave number increment ( $cm^{-1}$ )

2 ⇒ filter

CARD 5

0 ⇒ IRPT : end program ( 3 means read CARD 3 again )

# APPENDIX F. SEARAD INPUT DATA

## EOMET95 Data Set from NPS Boundary Layer Meteorology Group

Header Entries form Appendix E

```
F   7     3     1     1     6     6     6     6     6     6     1     1     1  286.60    0.00
    3     0     0     3     0     0    10.000    1.897     1.603       .000      .000
   33     0     0      11:37:53 MAY 1995
      0.003  1013.400    12.100      90.0                        ABH
      0.017  1011.700    13.300      70.0                        ABH
      0.021  1011.300    13.000      72.0                        ABH
      0.031  1010.100    12.900      74.0                        ABH
      0.042  1008.800    12.800      75.0                        ABH
      0.046  1008.300    12.800      76.0                        ABH
      0.056  1007.100    12.600      77.0                        ABH
      0.070  1005.300    12.500      78.0                        ABH
      0.075  1004.900    12.500      78.0                        ABH
      0.083  1003.900    12.500      77.0                        ABH
      0.093  1002.600    12.500      75.0                        ABH
      0.103  1001.400    12.500      74.0                        ABH
      0.113  1000.200    12.500      73.0                        ABH
      0.119   999.500    12.400      73.0                        ABH
      0.128   998.500    12.400      73.0                        ABH
      0.137   997.400    12.500      73.0                        ABH
      0.150   995.800    12.500      73.0                        ABH
      0.153   995.500    12.700      72.0                        ABH
      0.160   994.600    12.800      70.0                        ABH
      0.164   994.100    12.800      70.0                        ABH
      0.185   991.700    12.800      69.0                        ABH
      0.190   991.100    12.800      69.0                        ABH
      0.201   989.800    12.800      69.0                        ABH
      0.208   988.900    12.700      69.0                        ABH
      0.218   987.800    12.600      69.0                        ABH
      0.228   986.600    12.600      69.0                        ABH
      0.234   985.900    12.500      69.0                        ABH
      0.244   984.700    12.400      69.0                        ABH
      0.256   983.300    12.300      68.0                        ABH
      0.266   982.100    12.300      69.0                        ABH
      0.275   981.100    12.100      69.0                        ABH
      0.283   980.100    12.100      69.0                        ABH
      0.291   979.200    12.100      69.0                        ABH
      0.006     0.000    90.240      .000      .000      0.00    1   252.000     T
        830      1250        10         1
    0
```

```
F   7     3     1     1     6     6     6     6     6     6     1     1     1  286.60    0.00
    3     0     0     3     0     0    10.000    1.897      1.603       .000       .000
   33     0     0       typical case
      0.003  1013.400    12.100       90.0                          ABH
      0.017  1011.700    13.300       70.0                          ABH
      0.021  1011.300    13.000       72.0                          ABH
      0.031  1010.100    12.900       74.0                          ABH
      0.042  1008.800    12.800       75.0                          ABH
      0.046  1008.300    12.800       76.0                          ABH
      0.056  1007.100    12.600       77.0                          ABH
      0.070  1005.300    12.500       78.0                          ABH
      0.075  1004.900    12.500       78.0                          ABH
      0.083  1003.900    12.500       77.0                          ABH
      0.093  1002.600    12.500       75.0                          ABH
      0.103  1001.400    12.500       74.0                          ABH
      0.113  1000.200    12.500       73.0                          ABH
      0.119   999.500    12.400       73.0                          ABH
      0.128   998.500    12.400       73.0                          ABH
      0.137   997.400    12.500       73.0                          ABH
      0.150   995.800    12.500       73.0                          ABH
      0.153   995.500    12.700       72.0                          ABH
      0.160   994.600    12.800       70.0                          ABH
      0.164   994.100    12.800       70.0                          ABH
      0.185   991.700    12.800       69.0                          ABH
      0.190   991.100    12.800       69.0                          ABH
      0.201   989.800    12.800       69.0                          ABH
      0.208   988.900    12.700       69.0                          ABH
      0.218   987.800    12.600       69.0                          ABH
      0.228   986.600    12.600       69.0                          ABH
      0.234   985.900    12.500       69.0                          ABH
      0.244   984.700    12.400       69.0                          ABH
      0.256   983.300    12.300       68.0                          ABH
      0.266   982.100    12.300       69.0                          ABH
      0.275   981.100    12.100       69.0                          ABH
      0.283   980.100    12.100       69.0                          ABH
      0.291   979.200    12.100       69.0                          ABH
      0.006     0.000    90.043       .000      .000      0.00     1   252.000     T
        830      1250        10          1
    0
```

```
F   7    3    1    1    6    6    6    6    6    6    1    1    1  286.60    0.00
    3    0    0    3    0    0   10.000      1.897      1.603      .000      .000
   33    0    0    MDR Estimate-1
      0.003   1013.400    12.100      90.0                           ABH
      0.017   1011.700    13.300      70.0                           ABH
      0.021   1011.300    13.000      72.0                           ABH
      0.031   1010.100    12.900      74.0                           ABH
      0.042   1008.800    12.800      75.0                           ABH
      0.046   1008.300    12.800      76.0                           ABH
      0.056   1007.100    12.600      77.0                           ABH
      0.070   1005.300    12.500      78.0                           ABH
      0.075   1004.900    12.500      78.0                           ABH
      0.083   1003.900    12.500      77.0                           ABH
      0.093   1002.600    12.500      75.0                           ABH
      0.103   1001.400    12.500      74.0                           ABH
      0.113   1000.200    12.500      73.0                           ABH
      0.119    999.500    12.400      73.0                           ABH
      0.128    998.500    12.400      73.0                           ABH
      0.137    997.400    12.500      73.0                           ABH
      0.150    995.800    12.500      73.0                           ABH
      0.153    995.500    12.700      72.0                           ABH
      0.160    994.600    12.800      70.0                           ABH
      0.164    994.100    12.800      70.0                           ABH
      0.185    991.700    12.800      69.0                           ABH
      0.190    991.100    12.800      69.0                           ABH
      0.201    989.800    12.800      69.0                           ABH
      0.208    988.900    12.700      69.0                           ABH
      0.218    987.800    12.600      69.0                           ABH
      0.228    986.600    12.600      69.0                           ABH
      0.234    985.900    12.500      69.0                           ABH
      0.244    984.700    12.400      69.0                           ABH
      0.256    983.300    12.300      68.0                           ABH
      0.266    982.100    12.300      69.0                           ABH
      0.275    981.100    12.100      69.0                           ABH
      0.283    980.100    12.100      69.0                           ABH
      0.291    979.200    12.100      69.0                           ABH
      0.250      0.000    95.000      .000       .000      0.00    1    252.000      T
        830       1250        10         1
    0
```

```
F   7     3     1     1     6     6     6     6      6     6     1     1     1  286.60    0.00
    3     0     0     3     0     0    10.000      1.897      1.603       .000       .000
   33     0     0    MDR Estimate-2
      0.003  1013.400    12.100       90.0                         ABH
      0.017  1011.700    13.300       70.0                         ABH
      0.021  1011.300    13.000       72.0                         ABH
      0.031  1010.100    12.900       74.0                         ABH
      0.042  1008.800    12.800       75.0                         ABH
      0.046  1008.300    12.800       76.0                         ABH
      0.056  1007.100    12.600       77.0                         ABH
      0.070  1005.300    12.500       78.0                         ABH
      0.075  1004.900    12.500       78.0                         ABH
      0.083  1003.900    12.500       77.0                         ABH
      0.093  1002.600    12.500       75.0                         ABH
      0.103  1001.400    12.500       74.0                         ABH
      0.113  1000.200    12.500       73.0                         ABH
      0.119   999.500    12.400       73.0                         ABH
      0.128   998.500    12.400       73.0                         ABH
      0.137   997.400    12.500       73.0                         ABH
      0.150   995.800    12.500       73.0                         ABH
      0.153   995.500    12.700       72.0                         ABH
      0.160   994.600    12.800       70.0                         ABH
      0.164   994.100    12.800       70.0                         ABH
      0.185   991.700    12.800       69.0                         ABH
      0.190   991.100    12.800       69.0                         ABH
      0.201   989.800    12.800       69.0                         ABH
      0.208   988.900    12.700       69.0                         ABH
      0.218   987.800    12.600       69.0                         ABH
      0.228   986.600    12.600       69.0                         ABH
      0.234   985.900    12.500       69.0                         ABH
      0.244   984.700    12.400       69.0                         ABH
      0.256   983.300    12.300       68.0                         ABH
      0.266   982.100    12.300       69.0                         ABH
      0.275   981.100    12.100       69.0                         ABH
      0.283   980.100    12.100       69.0                         ABH
      0.291   979.200    12.100       69.0                         ABH
      0.250     0.000    90.550       .000       .000       0.00     1   252.000      T
        830      1250        10          1
   0
```

# APPENDIX G. SEARAD OUTPUT DATA

```
                ***** SEARAD, A MODIFICATION OF LOWTRAN7 *****

DATE: 11/21/1997                                      TIME: 12:00:50.69

THERMAL RADIANCE MODE

MULTIPLE SCATTERING USED

MARINE AEROSOL MODEL USED

         WIND SPEED          =     1.90 M/SEC
         WIND SPEED          =     1.60 M/SEC, 24 HR AVERAGE
         RELATIVE HUMIDITY =    89.93 PERCENT
         AIRMASS CHARACTER =     3
         VISIBILITY          =    10.00 KM

SLANT PATH TO SPACE

          H1       =        .006 KM
          HMIN     =        .000 KM
          ANGLE    =      90.240 DEG

FREQUENCY RANGE

          IV1      =          830 CM-1   (   12.05 MICROMETERS)
          IV2      =         1250 CM-1   (    8.00 MICROMETERS)
          IDV      =           10 CM-1
          IFWHM    =            1 CM-1
          IFILTER =            0

SUMMARY OF THE GEOMETRY CALCULATION

          H1       =        .006 KM
          H2       =        .000 KM
          ANGLE    =      90.240 DEG
          RANGE    =       1.444 KM
          BETA     =        .013 DEG
          PHI      =      89.764 DEG
          HMIN     =        .000 KM
          BENDING =        .009 DEG
          LEN      =           0

SEA AT 286.60 K REPLACES BLACK BODY BOUNDARY

          UPWIND   =     252.000 DEG EAST OF LINE OF SIGHT

ZERO RANGE VALUES

          SEA EMISSION            =  14.42182 W M-2 SR-1  (AV. EMISS.
.4636)
          SKY REFLECTION          =   5.22488 W M-2 SR-1
          SUN GLINT               =    .00000 W M-2 SR-1
```

```
          TOTAL RADIANCE            =  19.64670 W M-2 SR-1
          BLACK BODY TEMP.          =     -10.1 C

FULL RANGE VALUES

          PATH TO FOOTPRINT         =   7.95021 W M-2 SR-1  (AV. TRANS.
.7181)
          SEA EMISSION              =  10.50470 W M-2 SR-1
          SKY REFLECTION            =   3.70776 W M-2 SR-1
          SUN GLINT                 =    .00000 W M-2 SR-1

          TOTAL RADIANCE            =  22.16267 W M-2 SR-1
          BLACK BODY TEMP.          =      -4.3 C
```

***** SEARAD, A MODIFICATION OF LOWTRAN7 *****

DATE: 11/21/1997 TIME: 12:03:37.72

THERMAL RADIANCE MODE

MULTIPLE SCATTERING USED

MARINE AEROSOL MODEL USED

```
          WIND SPEED         =     1.90 M/SEC
          WIND SPEED         =     1.60 M/SEC, 24 HR AVERAGE
          RELATIVE HUMIDITY =     89.93 PERCENT
          AIRMASS CHARACTER =      3
          VISIBILITY         =    10.00 KM
```

SLANT PATH TO SPACE

```
          H1      =       .006 KM
          HMIN    =       .000 KM
          ANGLE   =     90.043 DEG
```

FREQUENCY RANGE

```
          IV1     =        830 CM-1  (  12.05 MICROMETERS)
          IV2     =       1250 CM-1  (   8.00 MICROMETERS)
          IDV     =         10 CM-1
          IFWHM   =          1 CM-1
          IFILTER =          0
```

SUMMARY OF THE GEOMETRY CALCULATION

```
          H1      =       .006 KM
          H2      =       .291 KM
          ANGLE   =     90.043 DEG
          RANGE   =     97.261 KM
          BETA    =       .875 DEG
          PHI     =     90.487 DEG
          HMIN    =       .000 KM
          BENDING =       .344 DEG
          LEN     =          1
```

TBOUND SET TO .10 K FOR MARINE SKY

```
INTEGRATED ABSORPTION   =    420.00 CM-1 FROM  830 TO 1250 CM-1
AVERAGE TRANSMITTANCE   =       .0000
MAXIMUM RADIANCE        =  1.033E-01 W M-2 SR-1 (CM-1)-1 AT   830.0 CM-1
MINIMUM RADIANCE        =  4.248E-02 W M-2 SR-1 (CM-1)-1 AT  1250.0 CM-1
BOUNDARY TEMPERATURE    =        .10 K
BOUNDARY EMISSIVITY     =      1.000
FILTERED RADIANCE       =  2.904E+01 W M-2 SR-1
BLACKBODY TEMPERATURE   =        9.8 C
```

***** SEARAD, A MODIFICATION OF LOWTRAN7 *****

```
DATE: 11/21/1997                                          TIME: 12:06:44.19

THERMAL RADIANCE MODE

MULTIPLE SCATTERING USED

MARINE AEROSOL MODEL USED

         WIND SPEED          =     1.90 M/SEC
         WIND SPEED          =     1.60 M/SEC, 24 HR AVERAGE
         RELATIVE HUMIDITY   =    89.93 PERCENT
         AIRMASS CHARACTER   =     3
         VISIBILITY          =    10.00 KM

SLANT PATH TO SPACE

          H1       =        .250 KM
          HMIN     =        .000 KM
          ANGLE    =      95.000 DEG

FREQUENCY RANGE

          IV1      =         830 CM-1   (  12.05 MICROMETERS)
          IV2      =        1250 CM-1   (   8.00 MICROMETERS)
          IDV      =          10 CM-1
          IFWHM    =           1 CM-1
          IFILTER  =           0

SUMMARY OF THE GEOMETRY CALCULATION

          H1       =        .250 KM
          H2       =        .000 KM
          ANGLE    =      95.000 DEG
          RANGE    =       2.875 KM
          BETA     =        .026 DEG
          PHI      =      85.020 DEG
          HMIN     =        .000 KM
          BENDING  =        .006 DEG
          LEN      =           0

SEA AT 286.60 K REPLACES BLACK BODY BOUNDARY

          UPWIND   =     252.000 DEG EAST OF LINE OF SIGHT

ZERO RANGE VALUES

          SEA EMISSION          =  18.29033 W M-2 SR-1   (AV. EMISS.
.5882)
          SKY REFLECTION        =   3.71435 W M-2 SR-1
          SUN GLINT             =    .00000 W M-2 SR-1

          TOTAL RADIANCE        =  22.00468 W M-2 SR-1
          BLACK BODY TEMP.      =      -4.7 C

FULL RANGE VALUES
```

```
        PATH TO FOOTPRINT        =  10.91463 W M-2 SR-1  (AV. TRANS.
.6154)
        SEA EMISSION             =  11.46502 W M-2 SR-1
        SKY REFLECTION           =   2.24949 W M-2 SR-1
        SUN GLINT                =    .00000 W M-2 SR-1

        TOTAL RADIANCE           =  24.62915 W M-2 SR-1
        BLACK BODY TEMP.         =       1.1 C
```

***** SEARAD, A MODIFICATION OF LOWTRAN7 *****

DATE: 11/21/1997 TIME: 12:09:01.17

THERMAL RADIANCE MODE

MULTIPLE SCATTERING USED

MARINE AEROSOL MODEL USED

```
          WIND SPEED          =     1.90 M/SEC
          WIND SPEED          =     1.60 M/SEC, 24 HR AVERAGE
          RELATIVE HUMIDITY =    89.93 PERCENT
          AIRMASS CHARACTER =     3
          VISIBILITY          =    10.00 KM
```

SLANT PATH TO SPACE

```
          H1       =       .250 KM
          HMIN     =       .000 KM
          ANGLE    =     90.550 DEG
```

FREQUENCY RANGE

```
          IV1      =        830 CM-1  (  12.05 MICROMETERS)
          IV2      =       1250 CM-1  (   8.00 MICROMETERS)
          IDV      =         10 CM-1
          IFWHM    =          1 CM-1
          IFILTER =           0
```

SUMMARY OF THE GEOMETRY CALCULATION

```
          H1       =       .250 KM
          H2       =       .000 KM
          ANGLE    =     90.550 DEG
          RANGE    =     33.415 KM
          BETA     =       .300 DEG
          PHI      =     89.683 DEG
          HMIN     =       .000 KM
          BENDING =        .067 DEG
          LEN      =          0
```

SEA AT 286.60 K REPLACES BLACK BODY BOUNDARY

```
          UPWIND  =    252.000 DEG EAST OF LINE OF SIGHT
```

ZERO RANGE VALUES

```
          SEA EMISSION          =  14.46294 W M-2 SR-1   (AV. EMISS.
.4649)
          SKY REFLECTION        =   5.26282 W M-2 SR-1
          SUN GLINT             =    .00000 W M-2 SR-1

          TOTAL RADIANCE        =  19.72575 W M-2 SR-1
          BLACK BODY TEMP.      =      -9.9 C
```

FULL RANGE VALUES

```
PATH TO FOOTPRINT      =  28.50598 W M-2 SR-1  (AV. TRANS.
.0171)
SEA EMISSION           =    .24282 W M-2 SR-1
SKY REFLECTION         =    .07884 W M-2 SR-1
SUN GLINT              =    .00000 W M-2 SR-1

TOTAL RADIANCE         =  28.82764 W M-2 SR-1
BLACK BODY TEMP.       =       9.5 C
```

# APPENDIX H. GPS DATA

Source: EOMET95 Data Set

ws: wind speed
wd: wind direction
shs: ship seep
shd: ship direction

ta: air temperature
ts: sea temperature
rh: relative humidity
pr: pressure

lat: latitude
lon: longitude

| date | time | ws | wd | ta | rh | pr | shs | shd | lat | lon | ts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 950515 | 2030 | 1.00 | 153 | 14.55 | 70.40 | 1010 | 0.01 | 264 | 36.80 | -121.79 | 16.90 |
| 950515 | 2040 | 0.45 | 204 | 13.98 | 72.84 | 1010 | 0.02 | 30 | 36.80 | -121.79 | 16.50 |
| 950515 | 2050 | 0.01 | 309 | 14.22 | 72.70 | 1011 | 0.02 | 48 | 36.80 | -121.79 | 17.60 |
| 950515 | 2100 | 0.64 | 243 | 15.02 | 69.92 | 1011 | 0.01 | 300 | 36.80 | -121.79 | 18.20 |
| 950515 | 2110 | 0.24 | 274 | 15.74 | 70.76 | 1011 | 0.05 | 37 | 36.80 | -121.79 | 19.10 |
| 950515 | 2120 | 2.14 | 275 | 16.28 | 68.09 | 1012 | 1.24 | 340 | 36.81 | -121.79 | 14.20 |
| 950515 | 2130 | 5.17 | 240 | 14.77 | 76.57 | 1010 | 4.77 | 247 | 36.80 | -121.80 | 12.30 |
| 950515 | 2140 | 4.25 | 248 | 13.91 | 82.30 | 1011 | 5.11 | 254 | 36.80 | -121.83 | 13.10 |
| 950515 | 2150 | 6.64 | 258 | 13.06 | 87.38 | 1011 | 4.84 | 257 | 36.79 | -121.87 | 13.40 |
| 950515 | 2200 | 6.12 | 261 | 13.05 | 87.31 | 1011 | 4.71 | 256 | 36.78 | -121.90 | 12.40 |
| 950515 | 2210 | 6.09 | 274 | 13.19 | 85.85 | 1011 | 4.56 | 254 | 36.78 | -121.93 | 12.30 |
| 950515 | 2220 | 5.66 | 289 | 13.01 | 86.30 | 1011 | 4.53 | 250 | 36.77 | -121.96 | 12.70 |
| 950515 | 2230 | 5.46 | 299 | 13.07 | 83.25 | 1011 | 4.46 | 250 | 36.76 | -121.98 | 13.00 |
| 950515 | 2240 | 4.68 | 304 | 13.30 | 81.02 | 1011 | 2.59 | 257 | 36.75 | -122.01 | 13.50 |
| 950515 | 2250 | 3.94 | 300 | 13.52 | 82.33 | 1011 | 0.50 | 275 | 36.75 | -122.02 | 13.80 |
| 950515 | 2300 | 2.98 | 298 | 13.48 | 84.72 | 1011 | 0.51 | 282 | 36.75 | -122.02 | 13.90 |
| 950515 | 2310 | 2.68 | 302 | 13.40 | 84.98 | 1011 | 0.59 | 284 | 36.76 | -122.02 | 13.90 |
| 950515 | 2320 | 2.62 | 314 | 13.47 | 84.37 | 1011 | 0.58 | 279 | 36.76 | -122.03 | 13.90 |
| 950515 | 2330 | 2.74 | 331 | 13.53 | 84.75 | 1011 | 0.59 | 280 | 36.76 | -122.03 | 13.90 |
| 950515 | 2340 | 2.90 | 308 | 13.54 | 85.24 | 1011 | 0.55 | 291 | 36.76 | -122.04 | 14.10 |
| 950515 | 2350 | 3.00 | 294 | 13.48 | 86.07 | 1011 | 0.49 | 293 | 36.76 | -122.04 | 13.90 |
| 950516 | 0 | 3.01 | 276 | 13.23 | 88.50 | 1010 | 0.48 | 268 | 36.76 | -122.04 | 13.80 |
| 950516 | 10 | 3.84 | 279 | 12.94 | 89.52 | 1010 | 0.48 | 258 | 36.76 | -122.05 | 13.70 |
| 950516 | 20 | 4.68 | 287 | 12.79 | 88.76 | 1011 | 0.50 | 245 | 36.76 | -122.05 | 13.60 |
| 950516 | 30 | 4.67 | 296 | 12.73 | 88.49 | 1011 | 0.47 | 264 | 36.76 | -122.05 | 13.80 |
| 950516 | 40 | 3.39 | 316 | 12.80 | 90.10 | 1011 | 0.51 | 281 | 36.76 | -122.06 | 13.80 |
| 950516 | 50 | 2.84 | 307 | 12.90 | 89.16 | 1011 | 0.48 | 273 | 36.76 | -122.06 | 13.90 |
| 950516 | 100 | 2.56 | 304 | 13.03 | 88.12 | 1010 | 0.51 | 284 | 36.76 | -122.06 | 13.80 |
| 950516 | 110 | 2.97 | 279 | 12.90 | 89.18 | 1010 | 0.47 | 280 | 36.76 | -122.06 | 13.70 |
| 950516 | 120 | 3.31 | 277 | 12.79 | 89.80 | 1010 | 0.47 | 275 | 36.76 | -122.07 | 13.60 |
| 950516 | 130 | 2.20 | 270 | 12.76 | 89.59 | 1010 | 0.50 | 268 | 36.76 | -122.07 | 13.40 |
| 950516 | 140 | 2.75 | 284 | 12.84 | 88.16 | 1010 | 0.52 | 273 | 36.76 | -122.07 | 13.50 |
| 950516 | 150 | 2.39 | 292 | 12.87 | 88.92 | 1010 | 0.55 | 274 | 36.76 | -122.08 | 13.30 |
| 950516 | 200 | 3.15 | 290 | 12.82 | 87.96 | 1011 | 0.63 | 258 | 36.76 | -122.08 | 13.20 |
| 950516 | 210 | 3.35 | 284 | 12.79 | 88.42 | 1011 | 0.64 | 261 | 36.76 | -122.09 | 13.10 |
| 950516 | 220 | 3.27 | 278 | 12.79 | 89.44 | 1011 | 0.60 | 264 | 36.76 | -122.09 | 13.00 |
| 950516 | 230 | 2.70 | 275 | 12.73 | 90.49 | 1011 | 0.67 | 269 | 36.76 | -122.10 | 12.80 |
| 950516 | 240 | 2.62 | 259 | 12.74 | 91.73 | 1011 | 0.89 | 241 | 36.76 | -122.10 | 12.80 |
| 950516 | 250 | 1.90 | 259 | 12.79 | 91.96 | 1011 | 1.00 | 242 | 36.75 | -122.11 | 13.10 |
| 950516 | 300 | 2.34 | 206 | 12.81 | 91.82 | 1011 | 1.05 | 242 | 36.75 | -122.11 | 13.20 |
| 950516 | 310 | 3.64 | 207 | 12.69 | 91.33 | 1011 | 0.78 | 249 | 36.75 | -122.12 | 12.90 |
| 950516 | 320 | 4.18 | 201 | 12.72 | 90.70 | 1011 | 0.79 | 249 | 36.75 | -122.12 | 12.80 |
| 950516 | 330 | 3.89 | 190 | 12.74 | 89.32 | 1011 | 0.75 | 243 | 36.75 | -122.13 | 13.00 |
| 950516 | 340 | 4.13 | 207 | 12.79 | 88.34 | 1011 | 0.76 | 251 | 36.74 | -122.13 | 13.10 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 950516 | 420 | 3.23 | 244 | 12.82 | 89.98 | 1011 | 0.82 | 254 | 36.74 | -122.15 | 13.40 |
| 950516 | 430 | 3.52 | 245 | 12.77 | 90.73 | 1011 | 0.76 | 255 | 36.74 | -122.16 | 13.50 |
| 950516 | 440 | 3.45 | 252 | 12.77 | 90.58 | 1011 | 0.78 | 254 | 36.74 | -122.16 | 13.40 |
| 950516 | 450 | 3.09 | 264 | 12.72 | 90.53 | 1011 | 0.81 | 261 | 36.74 | -122.17 | 13.30 |
| 950516 | 500 | 2.90 | 263 | 12.72 | 90.76 | 1011 | 0.88 | 259 | 36.74 | -122.17 | 13.20 |
| 950516 | 510 | 2.83 | 254 | 12.67 | 91.26 | 1011 | 0.90 | 262 | 36.73 | -122.18 | 13.10 |
| 950516 | 520 | 2.98 | 245 | 12.66 | 92.01 | 1011 | 0.91 | 265 | 36.73 | -122.18 | 13.20 |
| 950516 | 530 | 2.07 | 254 | 12.62 | 92.70 | 1011 | 0.88 | 263 | 36.73 | -122.19 | 13.10 |
| 950516 | 540 | 2.32 | 261 | 12.59 | 93.39 | 1012 | 0.92 | 260 | 36.73 | -122.20 | 13.10 |
| 950516 | 550 | 2.66 | 279 | 12.58 | 93.88 | 1012 | 0.97 | 261 | 36.73 | -122.20 | 13.00 |
| 950516 | 600 | 2.48 | 279 | 12.55 | 94.00 | 1012 | 0.94 | 257 | 36.73 | -122.21 | 12.90 |
| 950516 | 610 | 1.79 | 308 | 12.55 | 94.07 | 1011 | 0.77 | 247 | 36.73 | -122.21 | 12.90 |
| 950516 | 620 | 1.67 | 318 | 12.49 | 94.98 | 1011 | 0.80 | 253 | 36.73 | -122.22 | 13.00 |
| 950516 | 630 | 1.96 | 358 | 12.36 | 95.72 | 1011 | 0.83 | 251 | 36.73 | -122.22 | 13.00 |
| 950516 | 640 | 2.18 | 36 | 12.26 | 95.94 | 1011 | 0.82 | 258 | 36.73 | -122.23 | 13.00 |
| 950516 | 650 | 1.51 | 53 | 12.20 | 95.95 | 1011 | 0.81 | 258 | 36.72 | -122.23 | 12.90 |
| 950516 | 700 | 1.45 | 61 | 12.14 | 96.00 | 1011 | 0.77 | 259 | 36.72 | -122.24 | 12.80 |
| 950516 | 710 | 2.11 | 39 | 12.19 | 96.02 | 1011 | 0.79 | 262 | 36.72 | -122.24 | 12.90 |
| 950516 | 720 | 2.53 | 3 | 12.23 | 96.02 | 1011 | 0.78 | 262 | 36.72 | -122.25 | 13.00 |
| 950516 | 730 | 2.68 | 338 | 12.30 | 96.11 | 1011 | 0.73 | 256 | 36.72 | -122.26 | 13.10 |
| 950516 | 740 | 2.29 | 332 | 12.42 | 96.05 | 1011 | 0.77 | 254 | 36.72 | -122.26 | 13.30 |
| 950516 | 750 | 3.23 | 7 | 12.38 | 94.99 | 1011 | 0.77 | 254 | 36.72 | -122.26 | 13.30 |
| 950516 | 800 | 3.68 | 343 | 12.45 | 94.50 | 1011 | 0.74 | 251 | 36.72 | -122.27 | 13.10 |
| 950516 | 810 | 3.83 | 344 | 12.44 | 94.11 | 1011 | 0.74 | 252 | 36.72 | -122.27 | 13.00 |
| 950516 | 820 | 3.65 | 354 | 12.37 | 94.90 | 1011 | 0.76 | 253 | 36.72 | -122.28 | 13.00 |
| 950516 | 830 | 3.53 | 22 | 12.27 | 95.60 | 1011 | 0.78 | 268 | 36.71 | -122.28 | 13.00 |
| 950516 | 840 | 3.63 | 25 | 12.13 | 95.98 | 1011 | 0.79 | 266 | 36.71 | -122.29 | 13.00 |
| 950516 | 850 | 3.88 | 21 | 12.09 | 96.23 | 1011 | 0.81 | 258 | 36.71 | -122.30 | 13.10 |
| 950516 | 900 | 4.18 | 31 | 12.04 | 96.50 | 1011 | 0.79 | 261 | 36.71 | -122.30 | 13.10 |
| 950516 | 910 | 4.53 | 53 | 11.86 | 96.91 | 1011 | 0.87 | 261 | 36.71 | -122.31 | 13.00 |
| 950516 | 920 | 4.45 | 47 | 11.81 | 97.61 | 1011 | 0.89 | 252 | 36.71 | -122.31 | 13.00 |
| 950516 | 930 | 3.56 | 47 | 11.79 | 97.98 | 1011 | 0.64 | 260 | 36.71 | -122.32 | 13.00 |
| 950516 | 940 | 2.41 | 57 | 11.75 | 98.04 | 1011 | 0.26 | 254 | 36.71 | -122.32 | 13.10 |
| 950516 | 950 | 2.63 | 47 | 11.65 | 98.15 | 1011 | 1.00 | 251 | 36.71 | -122.32 | 13.10 |
| 950516 | 1000 | 2.56 | 67 | 11.69 | 98.54 | 1011 | 0.92 | 263 | 36.71 | -122.33 | 13.10 |
| 950516 | 1010 | 1.68 | 57 | 11.73 | 98.85 | 1011 | 0.78 | 263 | 36.71 | -122.34 | 13.10 |
| 950516 | 1020 | 1.72 | 54 | 11.76 | 98.98 | 1011 | 0.71 | 268 | 36.71 | -122.34 | 13.20 |
| 950516 | 1030 | 1.70 | 65 | 11.80 | 98.99 | 1011 | 0.73 | 269 | 36.71 | -122.35 | 13.20 |
| 950516 | 1040 | 1.69 | 78 | 11.74 | 99.02 | 1011 | 0.75 | 272 | 36.71 | -122.35 | 13.20 |
| 950516 | 1050 | 0.95 | 90 | 11.79 | 99.02 | 1011 | 0.77 | 269 | 36.71 | -122.36 | 13.20 |
| 950516 | 1100 | 0.91 | 99 | 11.96 | 99.46 | 1011 | 0.68 | 272 | 36.71 | -122.36 | 13.20 |
| 950516 | 1110 | 1.23 | 104 | 12.13 | 99.65 | 1011 | 0.67 | 273 | 36.71 | -122.36 | 13.30 |
| 950516 | 1120 | 0.59 | 88 | 12.12 | 99.16 | 1011 | 0.59 | 269 | 36.71 | -122.37 | 13.20 |
| 950516 | 1130 | 0.63 | 76 | 11.96 | 99.06 | 1011 | 0.66 | 270 | 36.71 | -122.37 | 13.20 |
| 950516 | 1140 | 1.30 | 360 | 11.85 | 99.28 | 1011 | 0.66 | 270 | 36.71 | -122.38 | 13.10 |
| 950516 | 1150 | 2.03 | 355 | 11.83 | 99.74 | 1011 | 0.60 | 271 | 36.71 | -122.38 | 13.20 |
| 950516 | 1200 | 2.17 | 0 | 11.84 | 99.95 | 1011 | 0.65 | 269 | 36.71 | -122.39 | 13.20 |
| 950516 | 1210 | 1.96 | 1 | 11.80 | 100.00 | 1011 | 0.59 | 267 | 36.71 | -122.39 | 13.20 |
| 950516 | 1220 | 2.34 | 20 | 11.81 | 100.00 | 1011 | 0.59 | 269 | 36.71 | -122.39 | 13.20 |
| 950516 | 1230 | 2.26 | 44 | 11.80 | 100.02 | 1011 | 0.60 | 271 | 36.71 | -122.40 | 13.20 |
| 950516 | 1240 | 2.09 | 37 | 11.64 | 100.02 | 1011 | 0.53 | 270 | 36.71 | -122.40 | 13.10 |
| 950516 | 1250 | 2.42 | 40 | 11.70 | 100.09 | 1011 | 0.49 | 270 | 36.71 | -122.41 | 13.10 |
| 950516 | 1300 | 3.18 | 56 | 11.60 | 100.07 | 1011 | 1.91 | 74 | 36.71 | -122.40 | 13.20 |
| 950516 | 1310 | 3.29 | 73 | 11.58 | 99.71 | 1011 | 4.68 | 78 | 36.71 | -122.38 | 13.30 |
| 950516 | 1320 | 2.15 | 61 | 11.43 | 98.70 | 1011 | 4.68 | 77 | 36.72 | -122.35 | 13.10 |
| 950516 | 1330 | 1.94 | 61 | 11.36 | 97.50 | 1011 | 4.76 | 77 | 36.72 | -122.32 | 13.10 |
| 950516 | 1340 | 2.24 | 74 | 11.38 | 96.42 | 1011 | 4.83 | 80 | 36.73 | -122.29 | 13.00 |
| 950516 | 1350 | 2.70 | 83 | 11.40 | 95.96 | 1011 | 4.81 | 81 | 36.73 | -122.25 | 12.90 |
| 950516 | 1400 | 1.72 | 79 | 11.31 | 95.69 | 1011 | 4.74 | 82 | 36.73 | -122.22 | 12.70 |
| 950516 | 1410 | 1.79 | 68 | 11.28 | 95.62 | 1011 | 4.63 | 82 | 36.74 | -122.19 | 12.70 |
| 950516 | 1420 | 2.48 | 63 | 11.21 | 94.65 | 1011 | 4.74 | 78 | 36.74 | -122.16 | 12.70 |
| 950516 | 1430 | 2.17 | 57 | 11.30 | 93.32 | 1011 | 4.86 | 78 | 36.75 | -122.13 | 12.80 |
| 950516 | 1440 | 2.67 | 37 | 11.39 | 93.54 | 1012 | 4.95 | 80 | 36.75 | -122.10 | 13.10 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 950516 | 1450 | 2.53 | 36 | 11.37 | 93.59 | 1012 | 4.98 | 81 | 36.76 | -122.06 | 12.90 |
| 950516 | 1500 | 2.27 | 42 | 11.33 | 95.13 | 1012 | 4.93 | 80 | 36.76 | -122.03 | 12.80 |
| 950516 | 1510 | 2.19 | 32 | 11.21 | 95.21 | 1011 | 4.87 | 79 | 36.77 | -122.00 | 12.90 |
| 950516 | 1520 | 1.83 | 57 | 11.13 | 94.04 | 1011 | 4.85 | 79 | 36.77 | -121.97 | 12.60 |
| 950516 | 1530 | 0.72 | 75 | 11.05 | 94.85 | 1012 | 5.01 | 77 | 36.78 | -121.93 | 12.30 |
| 950516 | 1540 | 0.91 | 83 | 10.92 | 93.78 | 1011 | 5.10 | 77 | 36.78 | -121.90 | 12.60 |
| 950516 | 1550 | 0.69 | 91 | 10.88 | 92.17 | 1011 | 5.16 | 76 | 36.79 | -121.87 | 12.70 |
| 950516 | 1600 | 0.66 | 257 | 11.02 | 92.16 | 1012 | 5.13 | 76 | 36.79 | -121.83 | 13.20 |
| 950516 | 1610 | 2.22 | 266 | 11.31 | 92.04 | 1012 | 4.79 | 64 | 36.80 | -121.80 | 13.20 |
| 950516 | 1620 | 2.20 | 281 | 11.75 | 90.69 | 1012 | 1.23 | 187 | 36.80 | -121.79 | 15.80 |
| 950516 | 1630 | 0.72 | 216 | 11.92 | 89.46 | 1012 | 0.04 | 107 | 36.80 | -121.79 | 19.90 |
| 950516 | 1640 | 1.50 | 298 | 11.96 | 87.99 | 1012 | 0.32 | 52 | 36.80 | -121.79 | 16.50 |
| 950516 | 1650 | 2.93 | 287 | 11.94 | 89.66 | 1012 | 1.70 | 251 | 36.81 | -121.79 | 13.90 |
| 950516 | 1700 | 2.09 | 289 | 11.75 | 91.78 | 1011 | 0.38 | 26 | 36.80 | -121.80 | 12.60 |
| 950516 | 1710 | 1.96 | 238 | 12.08 | 90.68 | 1012 | 0.38 | 32 | 36.80 | -121.80 | 13.30 |
| 950516 | 1720 | 2.53 | 308 | 12.10 | 91.00 | 1012 | 0.68 | 8 | 36.81 | -121.80 | 13.60 |
| 950516 | 1730 | 2.85 | 317 | 12.00 | 90.94 | 1012 | 0.78 | 330 | 36.81 | -121.80 | 13.30 |
| 950516 | 1740 | 2.23 | 345 | 11.92 | 91.28 | 1012 | 0.31 | 274 | 36.81 | -121.80 | 12.50 |
| 950516 | 1750 | 2.49 | 279 | 12.05 | 90.49 | 1012 | 0.58 | 174 | 36.81 | -121.80 | 13.30 |
| 950516 | 1800 | 2.98 | 248 | 12.30 | 90.04 | 1012 | 0.36 | 95 | 36.81 | -121.80 | 13.50 |
| 950516 | 1810 | 3.35 | 275 | 12.41 | 89.91 | 1012 | 2.15 | 280 | 36.81 | -121.80 | 13.60 |
| 950516 | 1820 | 2.53 | 341 | 12.11 | 92.24 | 1012 | 0.15 | 339 | 36.81 | -121.81 | 13.40 |
| **950516** | **1830** | **2.92** | **230** | **12.15** | **92.58** | **1012** | **0.27** | **172** | **36.81** | **-121.81** | **13.60** |
| **950516** | **1840** | **3.69** | **252** | **12.30** | **93.34** | **1012** | **0.66** | **106** | **36.81** | **-121.81** | **13.60** |
| 950516 | 1850 | 0.08 | 321 | 12.64 | 92.91 | 1012 | 0.20 | 87 | 36.81 | -121.80 | 13.70 |
| 950516 | 1900 | 4.50 | 274 | 12.49 | 93.33 | 1012 | 0.58 | 311 | 36.81 | -121.80 | 13.50 |
| 950516 | 1910 | 4.68 | 261 | 12.29 | 93.87 | 1012 | 4.15 | 256 | 36.81 | -121.82 | 13.70 |
| 950516 | 1920 | 4.69 | 272 | 12.23 | 94.21 | 1012 | 4.71 | 252 | 36.80 | -121.85 | 13.80 |
| 950516 | 1930 | 6.03 | 281 | 12.08 | 93.71 | 1012 | 4.71 | 251 | 36.79 | -121.88 | 13.00 |
| 950516 | 1940 | 10.26 | 288 | 11.98 | 92.91 | 1011 | 4.70 | 248 | 36.78 | -121.91 | 12.40 |
| 950516 | 1950 | 10.49 | 292 | 12.04 | 92.26 | 1011 | 4.56 | 251 | 36.78 | -121.94 | 12.40 |
| 950516 | 2000 | 10.37 | 292 | 12.15 | 92.28 | 1011 | 4.62 | 251 | 36.77 | -121.97 | 12.50 |
| 950516 | 2010 | 10.31 | 292 | 12.16 | 91.94 | 1011 | 4.57 | 249 | 36.76 | -122.00 | 12.90 |
| 950516 | 2020 | 9.59 | 265 | 12.18 | 91.22 | 1012 | 0.93 | 232 | 36.75 | -122.01 | 13.00 |
| 950516 | 2030 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.10 |
| 950516 | 2040 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.20 |
| 950516 | 2050 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.30 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950517 | 1200 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.50 |
| 950517 | 1210 | 3.30 | 3 | 12.08 | 88.67 | 1014 | 0.62 | 341 | 36.70 | -122.39 | 13.50 |
| 950517 | 1220 | 3.76 | 338 | 12.04 | 88.82 | 1013 | 0.70 | 330 | 36.71 | -122.39 | 13.50 |
| 950517 | 1230 | 3.46 | 338 | 12.04 | 88.29 | 1013 | 0.75 | 324 | 36.71 | -122.39 | 13.50 |
| 950517 | 1240 | 3.19 | 339 | 11.99 | 89.30 | 1014 | 0.80 | 338 | 36.71 | -122.39 | 13.50 |
| 950517 | 1250 | 3.62 | 341 | 11.95 | 89.75 | 1014 | 3.73 | 78 | 36.72 | -122.38 | 13.50 |
| 950517 | 1300 | 3.06 | 359 | 11.93 | 88.38 | 1014 | 4.60 | 82 | 36.72 | -122.35 | 13.40 |
| 950517 | 1310 | 3.61 | 355 | 11.90 | 88.07 | 1014 | 4.62 | 83 | 36.72 | -122.32 | 13.30 |
| 950517 | 1320 | 3.63 | 352 | 11.89 | 87.68 | 1014 | 4.58 | 83 | 36.73 | -122.29 | 13.20 |
| 950517 | 1330 | 3.29 | 358 | 11.78 | 87.85 | 1014 | 4.71 | 83 | 36.73 | -122.26 | 13.10 |
| 950517 | 1340 | 3.13 | 1 | 11.70 | 86.64 | 1014 | 4.82 | 83 | 36.73 | -122.23 | 12.90 |
| 950517 | 1350 | 2.88 | 25 | 11.57 | 86.27 | 1014 | 4.72 | 81 | 36.74 | -122.20 | 12.80 |
| 950517 | 1400 | 2.47 | 21 | 11.49 | 85.74 | 1014 | 4.70 | 82 | 36.74 | -122.16 | 12.80 |
| 950517 | 1410 | 1.74 | 14 | 11.48 | 86.56 | 1014 | 4.76 | 80 | 36.74 | -122.13 | 12.60 |
| 950517 | 1420 | 1.63 | 342 | 11.49 | 86.48 | 1014 | 4.79 | 79 | 36.75 | -122.10 | 12.70 |
| 950517 | 1430 | 2.01 | 347 | 11.46 | 87.93 | 1014 | 4.84 | 78 | 36.75 | -122.07 | 12.90 |
| 950517 | 1440 | 1.51 | 10 | 11.42 | 90.04 | 1014 | 4.81 | 78 | 36.76 | -122.04 | 12.90 |
| 950517 | 1450 | 0.96 | 56 | 11.41 | 90.47 | 1014 | 4.71 | 79 | 36.76 | -122.01 | 12.70 |
| 950517 | 1500 | 0.97 | 350 | 11.35 | 91.46 | 1015 | 4.81 | 79 | 36.77 | -121.98 | 12.60 |
| 950517 | 1510 | 1.48 | 342 | 11.31 | 92.19 | 1015 | 4.79 | 77 | 36.77 | -121.94 | 12.50 |
| 950517 | 1520 | 1.66 | 315 | 11.28 | 92.22 | 1015 | 4.90 | 75 | 36.78 | -121.91 | 13.40 |
| 950517 | 1530 | 2.40 | 307 | 11.36 | 92.02 | 1015 | 4.96 | 76 | 36.79 | -121.88 | 13.60 |
| 950517 | 1540 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.60 |
| 950517 | 1550 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.40 |
| 950517 | 1600 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.90 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950517 | 1610 | 1.79 | 314 | 11.55 | 92.30 | 1015 | 0.60 | 195 | 36.81 | -121.80 | 14.00 |
| 950517 | 1620 | 1.58 | 349 | 11.47 | 92.42 | 1015 | 0.24 | 323 | 36.81 | -121.80 | 14.00 |
| 950517 | 1630 | 3.39 | 288 | 11.47 | 92.48 | 1015 | 0.80 | 282 | 36.81 | -121.80 | 14.00 |
| 950517 | 1640 | 2.62 | 284 | 11.47 | 92.18 | 1015 | 0.83 | 277 | 36.81 | -121.81 | 14.10 |
| 950517 | 1650 | 2.51 | 288 | 11.52 | 92.25 | 1015 | 1.22 | 275 | 36.81 | -121.82 | 13.70 |
| 950517 | 1700 | 2.58 | 290 | 11.50 | 92.08 | 1015 | 1.64 | 277 | 36.81 | -121.82 | 13.60 |
| 950517 | 1710 | 1.07 | 278 | 11.60 | 91.72 | 1016 | 0.18 | 260 | 36.81 | -121.83 | 13.80 |
| 950517 | 1720 | 1.59 | 306 | 11.78 | 90.44 | 1016 | 0.84 | 272 | 36.81 | -121.83 | 13.80 |
| 950517 | 1730 | 1.38 | 332 | 11.85 | 90.01 | 1015 | 0.46 | 255 | 36.81 | -121.84 | 14.00 |
| 950517 | 1740 | 0.99 | 278 | 12.40 | 88.37 | 1016 | 0.60 | 88 | 36.81 | -121.83 | 14.10 |
| 950517 | 1750 | 1.94 | 272 | 12.76 | 86.46 | 1016 | 1.41 | 96 | 36.81 | -121.82 | 13.90 |
| 950517 | 1800 | 1.96 | 273 | 12.87 | 83.67 | 1016 | 1.53 | 96 | 36.81 | -121.81 | 14.00 |
| 950517 | 1810 | 2.31 | 274 | 12.81 | 83.26 | 1016 | 1.10 | 85 | 36.81 | -121.81 | 14.10 |
| 950517 | 1820 | 2.13 | 270 | 12.77 | 83.23 | 1016 | 0.76 | 93 | 36.81 | -121.80 | 14.40 |
| 950517 | 1830 | 3.18 | 273 | 12.37 | 84.44 | 1015 | 2.00 | 253 | 36.80 | -121.80 | 13.90 |
| 950517 | 1840 | 3.81 | 272 | 11.80 | 86.42 | 1015 | 4.34 | 253 | 36.80 | -121.82 | 13.70 |
| 950517 | 1850 | 4.14 | 271 | 11.69 | 86.96 | 1015 | 4.25 | 253 | 36.79 | -121.85 | 13.90 |
| 950517 | 1900 | 2.83 | 253 | 11.66 | 86.41 | 1016 | 4.19 | 253 | 36.79 | -121.88 | 13.90 |
| 950517 | 1910 | 2.97 | 254 | 11.68 | 86.78 | 1016 | 4.28 | 252 | 36.78 | -121.91 | 13.50 |
| 950517 | 1920 | 4.16 | 264 | 11.68 | 87.65 | 1016 | 4.26 | 251 | 36.77 | -121.93 | 13.00 |
| 950517 | 1930 | 4.25 | 276 | 11.68 | 88.83 | 1016 | 4.20 | 266 | 36.77 | -121.96 | 13.00 |
| 950517 | 1940 | 4.16 | 275 | 11.66 | 89.88 | 1016 | 3.74 | 245 | 36.76 | -121.99 | 13.00 |
| 950517 | 1950 | 4.23 | 271 | 11.62 | 90.72 | 1016 | 1.09 | 258 | 36.76 | -122.00 | 13.10 |
| 950517 | 2000 | 4.31 | 269 | 11.65 | 90.82 | 1016 | 0.94 | 256 | 36.76 | -122.01 | 13.20 |
| 950517 | 2010 | 3.88 | 260 | 11.77 | 91.52 | 1016 | 0.95 | 252 | 36.76 | -122.01 | 13.20 |
| 950517 | 2020 | 3.69 | 257 | 11.89 | 92.36 | 1016 | 0.86 | 249 | 36.76 | -122.02 | 13.30 |
| 950517 | 2030 | 4.40 | 259 | 11.89 | 93.66 | 1016 | 0.87 | 258 | 36.75 | -122.03 | 13.30 |
| 950517 | 2040 | 4.41 | 245 | 11.85 | 94.60 | 1016 | 0.82 | 244 | 36.75 | -122.03 | 13.30 |
| 950517 | 2050 | 4.58 | 248 | 11.89 | 95.48 | 1016 | 0.79 | 248 | 36.75 | -122.04 | 13.40 |
| 950517 | 2100 | 4.74 | 256 | 11.91 | 95.87 | 1016 | 0.74 | 253 | 36.75 | -122.04 | 13.40 |
| 950517 | 2110 | 4.56 | 258 | 11.98 | 95.89 | 1016 | 0.79 | 246 | 36.75 | -122.05 | 13.40 |
| 950517 | 2120 | 4.93 | 263 | 12.04 | 95.49 | 1015 | 0.78 | 261 | 36.75 | -122.05 | 13.40 |
| 950517 | 2130 | 5.38 | 270 | 12.05 | 95.71 | 1015 | 0.89 | 271 | 36.75 | -122.06 | 13.50 |
| 950517 | 2140 | 5.21 | 270 | 12.15 | 95.89 | 1015 | 0.78 | 263 | 36.75 | -122.06 | 13.40 |
| 950517 | 2150 | 5.44 | 261 | 12.20 | 95.87 | 1015 | 0.82 | 248 | 36.75 | -122.07 | 13.30 |
| 950517 | 2200 | 5.84 | 268 | 12.20 | 95.53 | 1015 | 0.82 | 250 | 36.74 | -122.07 | 13.40 |
| 950517 | 2210 | 5.03 | 276 | 12.17 | 95.64 | 1015 | 0.10 | 163 | 36.74 | -122.08 | 13.50 |
| 950517 | 2220 | 6.16 | 303 | 12.12 | 95.87 | 1015 | 2.78 | 82 | 36.74 | -122.07 | 13.70 |
| 950517 | 2230 | 6.04 | 299 | 12.06 | 95.95 | 1015 | 2.81 | 79 | 36.75 | -122.05 | 13.60 |
| 950517 | 2240 | 5.83 | 297 | 12.03 | 95.98 | 1015 | 2.85 | 79 | 36.75 | -122.03 | 13.60 |
| 950517 | 2250 | 5.20 | 293 | 12.08 | 95.91 | 1015 | 2.09 | 71 | 36.75 | -122.01 | 13.40 |
| 950517 | 2300 | 5.79 | 272 | 12.09 | 95.84 | 1015 | 0.67 | 262 | 36.75 | -122.01 | 13.10 |
| 950517 | 2310 | 5.86 | 273 | 12.07 | 95.63 | 1015 | 0.71 | 266 | 36.75 | -122.01 | 13.30 |
| 950517 | 2320 | 5.90 | 269 | 12.08 | 95.73 | 1015 | 0.67 | 260 | 36.75 | -122.02 | 13.50 |
| 950517 | 2330 | 6.23 | 266 | 11.99 | 95.89 | 1015 | 0.70 | 257 | 36.75 | -122.02 | 13.50 |
| 950517 | 2340 | 6.94 | 274 | 11.92 | 96.03 | 1015 | 0.96 | 264 | 36.75 | -122.03 | 13.50 |
| 950517 | 2350 | 6.97 | 275 | 11.90 | 96.48 | 1015 | 0.79 | 258 | 36.75 | -122.03 | 13.40 |
| 950518 | 0 | 7.13 | 277 | 11.87 | 96.38 | 1015 | 0.73 | 260 | 36.75 | -122.04 | 13.40 |
| 950518 | 10 | 8.09 | 271 | 11.90 | 94.63 | 1015 | 0.70 | 250 | 36.75 | -122.04 | 13.30 |
| 950518 | 20 | 7.75 | 268 | 11.92 | 93.95 | 1014 | 0.67 | 240 | 36.75 | -122.05 | 13.30 |
| 950518 | 30 | 8.35 | 273 | 11.82 | 94.02 | 1014 | 0.63 | 257 | 36.75 | -122.05 | 13.30 |
| 950518 | 40 | 8.38 | 272 | 11.75 | 94.22 | 1014 | 0.63 | 263 | 36.75 | -122.06 | 13.20 |
| 950518 | 50 | 8.58 | 272 | 11.79 | 94.02 | 1014 | 0.72 | 258 | 36.75 | -122.06 | 13.20 |
| 950518 | 100 | 8.72 | 274 | 11.83 | 94.00 | 1014 | 0.70 | 258 | 36.74 | -122.07 | 13.20 |
| 950518 | 110 | 9.56 | 272 | 11.75 | 93.62 | 1014 | 0.66 | 256 | 36.74 | -122.07 | 13.10 |
| 950518 | 120 | 10.48 | 253 | 11.75 | 92.09 | 1014 | 0.59 | 227 | 36.74 | -122.07 | 13.00 |
| 950518 | 130 | 10.16 | 260 | 11.69 | 92.07 | 1014 | 0.56 | 247 | 36.74 | -122.08 | 12.90 |
| 950518 | 140 | 10.22 | 276 | 11.67 | 92.02 | 1014 | 0.77 | 258 | 36.74 | -122.08 | 12.90 |
| 950518 | 150 | 10.69 | 267 | 11.57 | 91.98 | 1014 | 0.64 | 249 | 36.74 | -122.09 | 12.90 |
| 950518 | 200 | 9.98 | 277 | 11.57 | 92.07 | 1014 | 0.76 | 257 | 36.74 | -122.09 | 12.80 |
| 950518 | 210 | 10.39 | 276 | 11.52 | 91.99 | 1014 | 0.78 | 254 | 36.74 | -122.10 | 12.90 |
| 950518 | 220 | 10.35 | 275 | 11.55 | 91.96 | 1014 | 0.73 | 253 | 36.74 | -122.10 | 13.00 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950518 | 230 | 10.42 | 275 | 11.57 | 92.02 | 1014 | 0.77 | 258 | 36.73 | -122.11 | 12.90 |
| 950518 | 240 | 10.07 | 282 | 11.54 | 91.58 | 1014 | 0.70 | 265 | 36.73 | -122.11 | 12.90 |
| 950518 | 250 | 11.01 | 279 | 11.52 | 91.70 | 1014 | 0.63 | 267 | 36.73 | -122.11 | 12.80 |
| 950518 | 300 | 11.43 | 285 | 11.48 | 90.80 | 1014 | 0.79 | 270 | 36.73 | -122.12 | 12.80 |
| 950518 | 310 | 10.77 | 284 | 11.52 | 91.89 | 1014 | 0.77 | 271 | 36.73 | -122.12 | 12.90 |
| 950518 | 320 | 11.74 | 279 | 11.51 | 90.66 | 1014 | 0.85 | 247 | 36.73 | -122.13 | 12.80 |
| 950518 | 330 | 10.56 | 281 | 11.49 | 91.20 | 1014 | 0.89 | 250 | 36.73 | -122.14 | 12.90 |
| 950518 | 340 | 10.85 | 283 | 11.57 | 91.27 | 1014 | 0.94 | 255 | 36.73 | -122.14 | 12.90 |
| 950518 | 350 | 9.81 | 282 | 11.48 | 91.83 | 1014 | 0.84 | 254 | 36.73 | -122.15 | 12.90 |
| 950518 | 400 | 9.80 | 276 | 11.45 | 91.86 | 1014 | 0.86 | 248 | 36.73 | -122.15 | 12.90 |
| 950518 | 410 | 10.08 | 284 | 11.40 | 91.65 | 1014 | 0.90 | 256 | 36.73 | -122.16 | 12.90 |
| 950518 | 420 | 11.11 | 269 | 11.42 | 90.30 | 1014 | 0.82 | 244 | 36.72 | -122.16 | 12.90 |
| 950518 | 430 | 10.70 | 279 | 11.44 | 90.43 | 1015 | 0.85 | 252 | 36.72 | -122.17 | 12.80 |
| 950518 | 440 | 10.14 | 272 | 11.42 | 90.02 | 1015 | 0.85 | 252 | 36.72 | -122.17 | 12.70 |
| 950518 | 450 | 10.04 | 290 | 11.45 | 91.02 | 1015 | 0.88 | 270 | 36.72 | -122.18 | 12.80 |
| 950518 | 500 | 10.64 | 288 | 11.42 | 90.00 | 1015 | 0.96 | 268 | 36.72 | -122.19 | 12.70 |
| 950518 | 510 | 9.97 | 289 | 11.40 | 89.52 | 1015 | 0.95 | 267 | 36.72 | -122.19 | 12.70 |
| 950518 | 520 | 9.34 | 291 | 11.43 | 89.92 | 1015 | 0.88 | 265 | 36.72 | -122.20 | 12.60 |
| 950518 | 530 | 8.61 | 297 | 11.43 | 90.50 | 1015 | 0.89 | 265 | 36.72 | -122.20 | 12.50 |
| 950518 | 540 | 9.56 | 298 | 11.30 | 89.38 | 1015 | 0.84 | 257 | 36.72 | -122.21 | 12.60 |
| 950518 | 550 | 9.32 | 295 | 11.27 | 88.96 | 1015 | 0.84 | 255 | 36.72 | -122.22 | 12.60 |
| 950518 | 600 | 8.43 | 305 | 11.28 | 89.43 | 1015 | 0.82 | 258 | 36.72 | -122.22 | 12.60 |
| 950518 | 610 | 7.40 | 298 | 11.31 | 90.93 | 1015 | 0.81 | 262 | 36.72 | -122.23 | 12.70 |
| 950518 | 620 | 8.22 | 288 | 11.26 | 89.88 | 1015 | 0.69 | 263 | 36.72 | -122.23 | 12.70 |
| 950518 | 630 | 7.94 | 285 | 11.24 | 89.07 | 1015 | 0.67 | 253 | 36.71 | -122.24 | 12.70 |
| 950518 | 640 | 7.28 | 297 | 11.24 | 90.23 | 1015 | 0.73 | 263 | 36.71 | -122.24 | 12.70 |
| 950518 | 650 | 8.03 | 292 | 11.23 | 89.52 | 1015 | 0.70 | 264 | 36.71 | -122.25 | 12.70 |
| 950518 | 700 | 8.02 | 286 | 11.18 | 89.08 | 1015 | 0.76 | 253 | 36.71 | -122.25 | 12.60 |
| 950518 | 710 | 7.61 | 289 | 11.16 | 89.06 | 1015 | 0.75 | 256 | 36.71 | -122.26 | 12.70 |
| 950518 | 720 | 7.52 | 303 | 11.13 | 89.32 | 1015 | 0.80 | 268 | 36.71 | -122.26 | 12.70 |
| 950518 | 730 | 8.20 | 294 | 11.15 | 88.99 | 1015 | 0.77 | 258 | 36.71 | -122.27 | 12.70 |
| 950518 | 740 | 7.41 | 295 | 11.15 | 89.67 | 1015 | 0.84 | 264 | 36.71 | -122.27 | 12.70 |
| 950518 | 750 | 7.73 | 293 | 11.14 | 88.97 | 1015 | 0.80 | 262 | 36.71 | -122.28 | 12.70 |
| 950518 | 800 | 7.98 | 285 | 11.19 | 88.96 | 1015 | 0.75 | 264 | 36.71 | -122.28 | 12.90 |
| 950518 | 810 | 7.53 | 297 | 11.20 | 88.63 | 1015 | 0.74 | 268 | 36.71 | -122.29 | 12.90 |
| 950518 | 820 | 7.19 | 290 | 11.21 | 87.77 | 1015 | 0.77 | 259 | 36.71 | -122.29 | 13.00 |
| 950518 | 830 | 7.33 | 301 | 11.33 | 88.28 | 1015 | 0.73 | 268 | 36.71 | -122.30 | 13.00 |
| 950518 | 840 | 6.69 | 285 | 11.32 | 88.85 | 1015 | 0.64 | 242 | 36.71 | -122.30 | 13.00 |
| 950518 | 850 | 7.46 | 287 | 11.33 | 88.18 | 1015 | 0.49 | 260 | 36.71 | -122.30 | 13.10 |
| 950518 | 900 | 7.22 | 274 | 11.31 | 87.96 | 1015 | 0.47 | 256 | 36.70 | -122.31 | 13.10 |
| 950518 | 910 | 7.32 | 285 | 11.32 | 88.77 | 1015 | 0.67 | 246 | 36.70 | -122.31 | 13.10 |
| 950518 | 920 | 7.25 | 299 | 11.30 | 89.02 | 1015 | 0.78 | 256 | 36.70 | -122.32 | 13.10 |
| 950518 | 930 | 7.05 | 298 | 11.29 | 89.35 | 1015 | 0.77 | 253 | 36.70 | -122.32 | 13.10 |
| 950518 | 940 | 6.57 | 280 | 11.31 | 89.72 | 1015 | 0.70 | 253 | 36.70 | -122.33 | 13.20 |
| 950518 | 950 | 6.43 | 292 | 11.26 | 88.98 | 1015 | 0.65 | 275 | 36.70 | -122.33 | 13.20 |
| 950518 | 1000 | 5.92 | 305 | 11.30 | 89.16 | 1015 | 0.70 | 276 | 36.70 | -122.33 | 13.20 |
| 950518 | 1010 | 6.49 | 293 | 11.31 | 89.30 | 1015 | 0.74 | 261 | 36.70 | -122.34 | 13.20 |
| 950518 | 1020 | 5.82 | 302 | 11.33 | 89.56 | 1015 | 0.64 | 277 | 36.70 | -122.34 | 13.20 |
| 950518 | 1030 | 6.71 | 297 | 11.25 | 88.46 | 1015 | 0.60 | 255 | 36.70 | -122.35 | 13.20 |
| 950518 | 1040 | 7.79 | 289 | 11.30 | 88.09 | 1015 | 0.56 | 263 | 36.70 | -122.35 | 13.20 |
| 950518 | 1050 | 7.03 | 301 | 11.27 | 88.13 | 1015 | 0.67 | 254 | 36.70 | -122.36 | 13.20 |
| 950518 | 1056 | 7.64 | 288 | 11.31 | 88.14 | 1015 | 0.65 | 253 | 36.70 | -122.36 | -99.00 |
| 950518 | 1100 | 7.02 | 309 | 11.22 | 87.52 | 1015 | 0.67 | 273 | 36.70 | -122.36 | 13.10 |
| 950518 | 1110 | 7.85 | 305 | 11.24 | 88.37 | 1015 | 0.79 | 267 | 36.70 | -122.36 | 13.20 |
| 950518 | 1120 | 7.91 | 303 | 11.24 | 87.70 | 1015 | 0.66 | 271 | 36.70 | -122.37 | 13.20 |
| 950518 | 1130 | 7.69 | 305 | 11.24 | 88.15 | 1015 | 0.58 | 275 | 36.70 | -122.37 | 13.20 |
| 950518 | 1140 | 7.31 | 306 | 11.19 | 87.43 | 1015 | 0.65 | 274 | 36.70 | -122.38 | 13.10 |
| 950518 | 1150 | 6.37 | 317 | 11.24 | 88.33 | 1015 | 0.71 | 289 | 36.70 | -122.38 | 13.10 |
| 950518 | 1200 | 7.75 | 313 | 11.26 | 87.92 | 1015 | 0.58 | 297 | 36.70 | -122.39 | 13.20 |
| 950518 | 1210 | 7.85 | 304 | 11.20 | 87.02 | 1015 | 0.57 | 286 | 36.70 | -122.39 | 13.10 |
| 950518 | 1220 | 6.36 | 331 | 11.20 | 87.43 | 1015 | 1.06 | 80 | 36.70 | -122.39 | 13.10 |
| 950518 | 1230 | 6.64 | 345 | 11.20 | 87.73 | 1015 | 4.02 | 77 | 36.70 | -122.37 | 13.20 |
| 950518 | 1240 | 6.54 | 334 | 11.20 | 88.13 | 1015 | 4.57 | 78 | 36.71 | -122.34 | 13.10 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950518 | 1250 | 5.99 | 321 | 11.12 | 87.94 | 1015 | 4.57 | 78 | 36.71 | -122.31 | 12.90 |
| 950518 | 1300 | 5.64 | 334 | 11.10 | 88.54 | 1015 | 4.59 | 78 | 36.72 | -122.28 | 12.60 |
| 950518 | 1310 | 5.13 | 317 | 11.02 | 88.95 | 1015 | 4.60 | 79 | 36.72 | -122.25 | 12.60 |
| 950518 | 1320 | 5.11 | 334 | 11.02 | 89.82 | 1015 | 4.52 | 80 | 36.73 | -122.22 | 12.60 |
| 950518 | 1330 | 4.86 | 342 | 10.97 | 89.71 | 1015 | 4.52 | 81 | 36.73 | -122.19 | 12.60 |
| 950518 | 1340 | 4.98 | 335 | 10.86 | 89.82 | 1015 | 4.48 | 80 | 36.73 | -122.16 | 12.50 |
| 950518 | 1350 | 3.69 | 338 | 10.78 | 90.33 | 1015 | 4.52 | 80 | 36.74 | -122.13 | 12.50 |
| 950518 | 1400 | 4.33 | 336 | 10.72 | 91.24 | 1015 | 4.50 | 79 | 36.74 | -122.10 | 12.60 |
| 950518 | 1410 | 3.91 | 346 | 10.60 | 93.29 | 1016 | 4.55 | 76 | 36.75 | -122.07 | 12.50 |
| 950518 | 1420 | 3.50 | 332 | 10.47 | 93.79 | 1016 | 4.72 | 74 | 36.75 | -122.04 | 12.30 |
| 950518 | 1430 | 3.27 | 325 | 10.40 | 93.72 | 1016 | 4.72 | 77 | 36.76 | -122.01 | 12.50 |
| 950518 | 1440 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 12.50 |
| 950518 | 1450 | 1.21 | 4 | 10.36 | 92.46 | 1016 | 4.89 | 78 | 36.77 | -121.94 | 12.50 |
| 950518 | 1500 | 0.78 | 275 | 10.40 | 93.06 | 1016 | 4.85 | 77 | 36.78 | -121.92 | 12.60 |
| 950518 | 1510 | 0.63 | 238 | 10.42 | 93.44 | 1016 | 4.97 | 75 | 36.78 | -121.89 | 13.20 |
| 950518 | 1520 | 0.61 | 147 | 10.50 | 93.12 | 1016 | 4.95 | 74 | 36.79 | -121.85 | 13.60 |
| 950518 | 1530 | 1.72 | 166 | 10.53 | 92.28 | 1016 | 4.85 | 74 | 36.80 | -121.82 | 13.70 |
| 950518 | 1540 | 1.18 | 142 | 10.52 | 92.04 | 1016 | 1.68 | 56 | 36.80 | -121.80 | 13.30 |
| 950518 | 1550 | 0.46 | 90 | 10.77 | 92.17 | 1016 | 0.32 | 254 | 36.81 | -121.80 | 13.10 |
| 950518 | 1600 | 0.55 | 127 | 11.03 | 90.90 | 1016 | 0.24 | 169 | 36.80 | -121.80 | 12.50 |
| 950518 | 1610 | 0.65 | 141 | 10.74 | 90.49 | 1016 | 0.20 | 2 | 36.80 | -121.80 | 12.50 |
| 950518 | 1620 | 0.97 | 167 | 10.65 | 90.75 | 1016 | 0.41 | 132 | 36.80 | -121.80 | 12.90 |
| 950518 | 1630 | 0.44 | 168 | 10.68 | 90.83 | 1016 | 0.41 | 47 | 36.80 | -121.80 | 13.10 |
| 950518 | 1640 | 0.59 | 168 | 10.82 | 90.63 | 1017 | 1.89 | 284 | 36.81 | -121.80 | 13.20 |
| 950518 | 1650 | 0.96 | 147 | 10.81 | 90.95 | 1016 | 0.43 | 223 | 36.81 | -121.81 | 13.90 |
| 950518 | 1700 | 0.40 | 168 | 10.87 | 91.15 | 1017 | 0.14 | 43 | 36.81 | -121.81 | 13.40 |
| 950518 | 1710 | 0.72 | 208 | 10.99 | 90.82 | 1017 | 0.29 | 98 | 36.81 | -121.81 | 13.90 |
| 950518 | 1720 | 1.09 | 169 | 10.92 | 91.11 | 1016 | 1.90 | 281 | 36.81 | -121.81 | 14.00 |
| 950518 | 1730 | 0.87 | 174 | 11.00 | 91.63 | 1016 | 0.70 | 112 | 36.81 | -121.82 | 14.00 |
| 950518 | 1740 | 1.20 | 166 | 10.87 | 91.63 | 1016 | 3.78 | 87 | 36.80 | -121.80 | 13.80 |
| 950518 | 1750 | 0.69 | 201 | 10.91 | 92.02 | 1016 | 0.95 | 157 | 36.81 | -121.79 | 15.70 |
| 950518 | 1800 | 0.34 | 214 | 11.21 | 91.57 | 1017 | 0.01 | 99 | 36.80 | -121.79 | 20.20 |
| 950518 | 1810 | 0.35 | 68 | 11.51 | 89.93 | 1017 | 0.02 | 352 | 36.80 | -121.79 | 20.40 |
| 950518 | 1820 | 0.15 | 165 | 11.51 | 89.09 | 1016 | 0.01 | 171 | 36.80 | -121.79 | 21.30 |
| 950518 | 1830 | 0.06 | 33 | 11.65 | 88.97 | 1016 | 0.01 | 238 | 36.80 | -121.79 | 20.70 |
| 950518 | 1840 | 0.30 | 168 | 11.79 | 88.67 | 1016 | 0.00 | 304 | 36.80 | -121.79 | 21.60 |
| 950518 | 1850 | 0.24 | 217 | 12.06 | 88.07 | 1016 | 0.02 | 189 | 36.80 | -121.79 | 23.30 |
| 950518 | 1900 | 0.41 | 356 | 12.24 | 87.13 | 1016 | 0.01 | 260 | 36.80 | -121.79 | 23.40 |
| 950518 | 1910 | 0.35 | 104 | 12.52 | 86.57 | 1016 | 0.01 | 56 | 36.80 | -121.79 | 23.20 |
| 950518 | 1920 | 0.34 | 36 | 12.74 | 84.95 | 1016 | 0.01 | 346 | 36.80 | -121.79 | 24.50 |
| 950518 | 1930 | 0.42 | 236 | 12.76 | 84.58 | 1016 | 0.03 | 170 | 36.80 | -121.79 | 23.80 |
| 950518 | 1940 | 0.39 | 85 | 12.94 | 83.96 | 1016 | 0.02 | 91 | 36.80 | -121.79 | 24.80 |
| 950518 | 1950 | 0.09 | 6 | 12.27 | 85.51 | 1015 | 0.01 | 61 | 36.80 | -121.79 | 26.60 |
| 950518 | 2000 | 0.50 | 245 | 11.79 | 88.23 | 1015 | 0.01 | 211 | 36.80 | -121.79 | 26.60 |
| 950518 | 2010 | 0.97 | 228 | 12.02 | 87.86 | 1015 | 0.01 | 152 | 36.80 | -121.79 | 27.90 |
| 950518 | 2020 | 0.05 | 63 | 12.35 | 87.48 | 1015 | 0.00 | 159 | 36.80 | -121.79 | 22.70 |
| 950518 | 2030 | 0.74 | 119 | 12.62 | 85.90 | 1015 | 0.01 | 67 | 36.80 | -121.79 | 23.30 |
| 950518 | 2040 | 0.64 | 290 | 12.71 | 85.28 | 1015 | 0.03 | 207 | 36.80 | -121.79 | 21.10 |
| 950518 | 2050 | 0.78 | 77 | 12.72 | 84.86 | 1015 | 0.01 | 13 | 36.80 | -121.79 | 21.00 |
| 950518 | 2100 | 0.30 | 281 | 12.93 | 83.77 | 1015 | 0.01 | 198 | 36.80 | -121.79 | -99.00 |
| 950518 | 2110 | 0.42 | 200 | 13.00 | 83.81 | 1015 | 0.03 | 52 | 36.80 | -121.79 | -99.00 |
| 950518 | 2120 | 2.82 | 265 | 12.56 | 85.51 | 1015 | 1.03 | 351 | 36.81 | -121.79 | -99.00 |
| 950518 | 2130 | 5.85 | 246 | 11.61 | 88.86 | 1015 | 4.49 | 234 | 36.80 | -121.80 | -99.00 |
| 950518 | 2140 | 5.86 | 248 | 11.26 | 90.18 | 1015 | 4.68 | 252 | 36.79 | -121.83 | -99.00 |
| 950518 | 2150 | 6.31 | 256 | 11.23 | 90.42 | 1015 | 4.61 | 261 | 36.78 | -121.86 | -99.00 |
| 950518 | 2200 | 6.07 | 259 | 11.21 | 89.80 | 1015 | 4.56 | 260 | 36.78 | -121.89 | -99.00 |
| 950518 | 2210 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 12.70 |
| 950518 | 2220 | 6.51 | 267 | 11.25 | 89.02 | 1015 | 4.29 | 256 | 36.77 | -121.95 | 12.70 |
| 950518 | 2230 | 5.89 | 275 | 11.30 | 89.89 | 1015 | 3.50 | 254 | 36.77 | -121.97 | 13.00 |
| 950518 | 2240 | 5.00 | 313 | 11.38 | 89.17 | 1015 | 0.32 | 307 | 36.76 | -121.98 | 13.00 |
| 950518 | 2250 | 5.28 | 283 | 11.39 | 89.27 | 1015 | 0.63 | 278 | 36.77 | -121.99 | 13.20 |
| 950518 | 2300 | 5.67 | 288 | 11.37 | 89.13 | 1015 | 0.58 | 276 | 36.77 | -121.99 | 13.00 |
| 950518 | 2310 | 5.09 | 288 | 11.34 | 89.42 | 1015 | 0.57 | 275 | 36.77 | -121.99 | 13.00 |

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| 950518 | 2320 | 5.17 | 278 | 11.35 | 89.70 | 1015 | 0.68 | 268 | 36.77 | -122.00 | 13.10 |
| 950518 | 2330 | 5.35 | 274 | 11.35 | 89.48 | 1015 | 0.64 | 269 | 36.77 | -122.00 | 13.00 |
| 950518 | 2340 | 5.44 | 280 | 11.35 | 89.71 | 1015 | 0.64 | 277 | 36.77 | -122.01 | 13.10 |
| 950518 | 2350 | 4.96 | 275 | 11.34 | 90.02 | 1015 | 0.64 | 275 | 36.77 | -122.01 | 13.20 |
| 950519 | 0 | 4.73 | 277 | 11.26 | 90.69 | 1014 | 0.76 | 254 | 36.77 | -122.02 | 13.10 |
| 950519 | 10 | 4.82 | 283 | 11.18 | 90.52 | 1014 | 0.72 | 252 | 36.76 | -122.02 | 13.10 |
| 950519 | 20 | 4.67 | 277 | 11.13 | 91.13 | 1014 | 0.70 | 262 | 36.76 | -122.03 | 13.20 |
| 950519 | 30 | 3.60 | 286 | 11.11 | 91.41 | 1014 | 0.74 | 274 | 36.76 | -122.03 | 13.10 |
| 950519 | 40 | 4.24 | 307 | 11.10 | 92.00 | 1014 | 0.67 | 285 | 36.76 | -122.04 | 13.10 |
| 950519 | 50 | 4.03 | 293 | 11.06 | 92.18 | 1014 | 0.74 | 292 | 36.77 | -122.04 | 13.10 |
| 950519 | 100 | 4.10 | 299 | 11.04 | 92.91 | 1014 | 0.74 | 290 | 36.77 | -122.05 | 12.90 |
| 950519 | 110 | 4.27 | 306 | 11.06 | 93.22 | 1014 | 0.81 | 293 | 36.77 | -122.05 | 12.80 |
| 950519 | 120 | 3.98 | 303 | 11.02 | 93.52 | 1014 | 0.78 | 291 | 36.77 | -122.06 | 12.70 |
| 950519 | 130 | 3.87 | 295 | 11.07 | 93.73 | 1014 | 0.90 | 290 | 36.77 | -122.06 | 12.70 |
| 950519 | 140 | 4.04 | 283 | 11.10 | 93.40 | 1014 | 0.85 | 279 | 36.77 | -122.07 | 13.00 |
| 950519 | 150 | 3.95 | 283 | 11.07 | 93.68 | 1014 | 0.79 | 270 | 36.77 | -122.07 | 13.10 |
| 950519 | 200 | 3.88 | 272 | 11.07 | 93.98 | 1014 | 0.75 | 265 | 36.77 | -122.08 | 13.10 |
| 950519 | 210 | 3.83 | 261 | 11.08 | 94.03 | 1014 | 0.78 | 256 | 36.77 | -122.08 | 13.10 |
| 950519 | 220 | 3.81 | 272 | 11.06 | 94.47 | 1014 | 0.85 | 258 | 36.77 | -122.09 | 13.10 |
| 950519 | 230 | 3.44 | 265 | 10.99 | 95.27 | 1014 | 0.89 | 256 | 36.77 | -122.09 | 13.10 |
| 950519 | 240 | 3.52 | 257 | 10.91 | 95.70 | 1014 | 0.84 | 262 | 36.77 | -122.10 | 13.00 |
| 950519 | 250 | 3.85 | 265 | 10.79 | 96.01 | 1014 | 0.74 | 252 | 36.77 | -122.10 | 12.80 |
| 950519 | 300 | 2.98 | 276 | 10.65 | 96.44 | 1014 | 0.77 | 253 | 36.77 | -122.11 | 12.70 |
| 950519 | 310 | 3.24 | 264 | 10.69 | 97.07 | 1014 | 0.68 | 250 | 36.77 | -122.11 | 12.80 |
| 950519 | 320 | 3.51 | 266 | 10.73 | 97.38 | 1014 | 0.66 | 253 | 36.77 | -122.12 | 12.80 |
| 950519 | 330 | 4.04 | 272 | 10.72 | 97.47 | 1014 | 0.70 | 256 | 36.76 | -122.12 | 12.80 |
| 950519 | 340 | 3.76 | 276 | 10.68 | 97.64 | 1014 | 0.75 | 246 | 36.76 | -122.13 | 12.70 |
| 950519 | 350 | 4.14 | 300 | 10.63 | 97.88 | 1014 | 0.76 | 254 | 36.76 | -122.13 | 12.70 |
| 950519 | 400 | 4.38 | 295 | 10.62 | 98.00 | 1014 | 0.70 | 252 | 36.76 | -122.13 | 12.70 |
| 950519 | 410 | 4.28 | 297 | 10.62 | 98.08 | 1014 | 0.77 | 244 | 36.76 | -122.14 | 12.70 |
| 950519 | 420 | 4.12 | 307 | 10.58 | 98.62 | 1014 | 0.82 | 247 | 36.76 | -122.14 | 12.60 |
| 950519 | 430 | 3.86 | 317 | 10.59 | 98.98 | 1014 | 0.67 | 253 | 36.76 | -122.15 | 12.60 |
| 950519 | 440 | 3.89 | 328 | 10.55 | 98.99 | 1014 | 0.99 | 265 | 36.76 | -122.15 | 12.50 |
| 950519 | 450 | 3.73 | 324 | 10.55 | 98.50 | 1014 | 1.13 | 261 | 36.75 | -122.16 | 12.50 |
| 950519 | 500 | 3.24 | 328 | 10.73 | 98.17 | 1014 | 1.11 | 256 | 36.75 | -122.17 | 12.60 |
| 950519 | 510 | 2.58 | 330 | 10.91 | 97.93 | 1015 | 1.13 | 249 | 36.75 | -122.18 | 12.60 |
| 950519 | 520 | 3.19 | 331 | 10.95 | 97.56 | 1015 | 1.13 | 247 | 36.75 | -122.18 | 12.70 |
| 950519 | 530 | 3.54 | 324 | 10.98 | 97.16 | 1014 | 1.10 | 251 | 36.75 | -122.19 | 12.70 |
| 950519 | 540 | 4.10 | 327 | 11.03 | 97.07 | 1014 | 1.15 | 249 | 36.75 | -122.20 | 12.60 |
| 950519 | 550 | 4.08 | 320 | 11.01 | 97.18 | 1014 | 1.03 | 245 | 36.74 | -122.20 | 12.60 |
| 950519 | 600 | 4.12 | 324 | 10.88 | 97.25 | 1014 | 0.73 | 238 | 36.74 | -122.21 | 12.60 |
| 950519 | 610 | 4.67 | 310 | 10.79 | 97.47 | 1014 | 0.78 | 235 | 36.74 | -122.21 | 12.60 |
| 950519 | 620 | 4.08 | 321 | 10.81 | 97.83 | 1014 | 0.79 | 239 | 36.74 | -122.22 | 12.60 |
| 950519 | 630 | 4.94 | 314 | 10.84 | 97.61 | 1014 | 0.77 | 233 | 36.73 | -122.22 | 12.60 |
| 950519 | 640 | 4.74 | 316 | 10.94 | 97.17 | 1014 | 0.70 | 235 | 36.73 | -122.23 | 12.60 |
| 950519 | 650 | 4.42 | 315 | 10.98 | 96.98 | 1014 | 0.82 | 223 | 36.73 | -122.23 | 12.60 |
| 950519 | 700 | 5.10 | 315 | 11.00 | 96.58 | 1014 | 0.76 | 227 | 36.73 | -122.23 | 12.60 |
| 950519 | 710 | 4.81 | 317 | 11.10 | 96.07 | 1014 | 0.62 | 235 | 36.72 | -122.24 | 12.70 |
| 950519 | 720 | 3.83 | 312 | 11.09 | 96.18 | 1014 | 0.77 | 223 | 36.72 | -122.24 | 12.70 |
| 950519 | 730 | 4.21 | 325 | 11.04 | 96.44 | 1014 | 0.67 | 239 | 36.72 | -122.24 | 12.70 |
| 950519 | 740 | 4.12 | 326 | 11.03 | 96.84 | 1014 | 0.60 | 235 | 36.72 | -122.25 | 12.60 |
| 950519 | 750 | 4.33 | 317 | 10.98 | 96.76 | 1014 | 0.61 | 232 | 36.72 | -122.25 | 12.60 |
| 950519 | 800 | 5.01 | 321 | 11.00 | 96.55 | 1014 | 0.64 | 235 | 36.71 | -122.26 | 12.60 |
| 950519 | 810 | 5.86 | 312 | 10.97 | 96.65 | 1014 | 0.60 | 226 | 36.71 | -122.26 | 12.60 |
| 950519 | 820 | 5.22 | 325 | 11.01 | 96.01 | 1014 | 0.43 | 243 | 36.71 | -122.26 | 12.60 |
| 950519 | 830 | 5.20 | 327 | 11.04 | 95.90 | 1014 | 0.72 | 241 | 36.71 | -122.26 | 12.60 |
| 950519 | 840 | 4.90 | 331 | 11.05 | 96.00 | 1014 | 0.71 | 239 | 36.71 | -122.27 | 12.60 |
| 950519 | 850 | 3.81 | 340 | 11.03 | 96.19 | 1014 | 0.76 | 245 | 36.70 | -122.27 | 12.60 |
| 950519 | 900 | 4.75 | 304 | 10.97 | 95.54 | 1014 | 0.70 | 237 | 36.70 | -122.28 | 12.60 |
| 950519 | 910 | 6.34 | 316 | 10.99 | 94.04 | 1014 | 0.67 | 231 | 36.70 | -122.28 | 12.60 |
| 950519 | 920 | 6.22 | 313 | 10.99 | 93.96 | 1013 | 0.68 | 229 | 36.70 | -122.28 | 12.60 |
| 950519 | 930 | 6.39 | 298 | 10.96 | 93.73 | 1013 | 0.76 | 227 | 36.69 | -122.29 | 12.60 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 950519 | 940 | 6.19 | 295 | 10.95 | 93.70 | 1013 | 0.69 | 234 | 36.69 | -122.29 | 12.60 |
| 950519 | 950 | 6.42 | 282 | 10.93 | 93.88 | 1013 | 0.67 | 225 | 36.69 | -122.30 | 12.50 |
| 950519 | 1000 | 6.36 | 293 | 10.79 | 93.94 | 1013 | 0.73 | 236 | 36.69 | -122.30 | 12.40 |
| 950519 | 1010 | 6.29 | 310 | 10.74 | 93.99 | 1013 | 0.81 | 253 | 36.69 | -122.30 | 12.50 |
| 950519 | 1020 | 6.31 | 291 | 10.72 | 94.00 | 1013 | 0.63 | 244 | 36.68 | -122.31 | 12.50 |
| 950519 | 1030 | 5.62 | 288 | 10.72 | 94.00 | 1013 | 0.35 | 243 | 36.68 | -122.31 | 12.50 |
| 950519 | 1040 | 5.97 | 315 | 10.67 | 93.99 | 1013 | 0.64 | 274 | 36.68 | -122.32 | 12.50 |
| 950519 | 1050 | 6.25 | 311 | 10.58 | 94.00 | 1013 | 0.76 | 269 | 36.68 | -122.32 | 12.50 |
| 950519 | 1100 | 6.00 | 312 | 10.53 | 94.00 | 1013 | 0.71 | 273 | 36.68 | -122.32 | 12.50 |
| 950519 | 1110 | 5.87 | 317 | 10.49 | 94.20 | 1013 | 0.70 | 269 | 36.68 | -122.33 | 12.50 |
| 950519 | 1120 | 6.37 | 309 | 10.45 | 94.12 | 1013 | 0.68 | 267 | 36.68 | -122.33 | 12.40 |
| 950519 | 1130 | 6.00 | 308 | 10.42 | 94.43 | 1013 | 0.66 | 268 | 36.68 | -122.34 | 12.40 |
| 950519 | 1140 | 5.78 | 301 | 10.40 | 94.51 | 1013 | 0.65 | 268 | 36.68 | -122.34 | 12.50 |
| 950519 | 1150 | 6.67 | 307 | 10.41 | 95.05 | 1013 | 0.54 | 286 | 36.68 | -122.35 | 12.60 |
| 950519 | 1200 | 6.46 | 307 | 10.32 | 94.90 | 1013 | 0.60 | 287 | 36.68 | -122.35 | 12.60 |
| 950519 | 1210 | 6.26 | 308 | 10.35 | 95.15 | 1013 | 0.56 | 293 | 36.69 | -122.35 | 12.60 |
| 950519 | 1220 | 6.33 | 301 | 10.34 | 95.03 | 1013 | 0.62 | 281 | 36.69 | -122.36 | 12.70 |
| 950519 | 1230 | 6.61 | 305 | 10.35 | 94.93 | 1013 | 0.59 | 292 | 36.69 | -122.36 | 12.60 |
| 950519 | 1240 | 6.45 | 298 | 10.28 | 94.40 | 1013 | 0.60 | 283 | 36.69 | -122.36 | 12.60 |
| 950519 | 1250 | 5.35 | 342 | 10.30 | 94.48 | 1013 | 3.63 | 78 | 36.69 | -122.36 | 12.60 |
| 950519 | 1300 | 5.67 | 349 | 10.32 | 94.84 | 1013 | 4.57 | 78 | 36.70 | -122.33 | 12.40 |
| 950519 | 1310 | 5.53 | 350 | 10.27 | 95.56 | 1013 | 4.58 | 76 | 36.70 | -122.30 | 12.40 |
| 950519 | 1320 | 4.84 | 355 | 10.19 | 95.79 | 1013 | 4.70 | 74 | 36.71 | -122.27 | 12.40 |
| 950519 | 1330 | 4.49 | 350 | 10.10 | 96.07 | 1013 | 4.61 | 74 | 36.71 | -122.24 | 12.40 |
| 950519 | 1340 | 4.22 | 354 | 10.03 | 96.74 | 1013 | 4.77 | 75 | 36.72 | -122.21 | 12.40 |
| 950519 | 1350 | 4.30 | 339 | 9.99 | 97.65 | 1013 | 4.64 | 75 | 36.73 | -122.18 | 12.50 |
| 950519 | 1400 | 3.95 | 341 | 10.01 | 98.03 | 1013 | 4.66 | 77 | 36.73 | -122.15 | 12.60 |
| 950519 | 1410 | 3.64 | 348 | 9.93 | 98.92 | 1013 | 4.79 | 78 | 36.74 | -122.12 | 12.70 |
| 950519 | 1420 | 3.24 | 358 | 9.85 | 99.88 | 1013 | 4.84 | 75 | 36.74 | -122.08 | 12.80 |
| 950519 | 1430 | 2.62 | 7 | 9.64 | 100.14 | 1013 | 4.80 | 75 | 36.75 | -122.05 | 12.60 |
| 950519 | 1440 | 0.72 | 9 | 9.53 | 100.49 | 1013 | 4.84 | 73 | 36.76 | -122.02 | 12.50 |
| 950519 | 1450 | 0.89 | 288 | 9.57 | 101.10 | 1013 | 4.78 | 74 | 36.77 | -121.99 | 12.40 |
| 950519 | 1500 | 0.36 | 67 | 9.79 | 101.52 | 1013 | 4.72 | 74 | 36.77 | -121.96 | 12.70 |
| 950519 | 1510 | 0.86 | 27 | 9.85 | 101.87 | 1013 | 4.70 | 76 | 36.78 | -121.93 | 12.70 |
| 950519 | 1520 | 0.55 | 17 | 9.95 | 101.99 | 1013 | 4.83 | 77 | 36.78 | -121.90 | 12.80 |
| 950519 | 1530 | 0.86 | 94 | 10.05 | 102.00 | 1013 | 4.95 | 78 | 36.79 | -121.86 | 13.40 |
| 950519 | 1540 | 0.60 | 107 | 10.02 | 102.00 | 1013 | 4.80 | 79 | 36.80 | -121.83 | 13.20 |
| 950519 | 1550 | 0.35 | 247 | 10.04 | 102.00 | 1013 | 2.94 | 60 | 36.80 | -121.80 | 13.30 |
| 950519 | 1600 | 0.40 | 140 | 10.13 | 102.00 | 1014 | 0.11 | 9 | 36.81 | -121.80 | 13.00 |
| 950519 | 1610 | 1.05 | 314 | 10.17 | 102.00 | 1014 | 0.43 | 162 | 36.80 | -121.80 | 13.10 |
| 950519 | 1620 | 0.93 | 1 | 10.31 | 102.03 | 1013 | 0.37 | 146 | 36.80 | -121.80 | 14.30 |
| 950519 | 1630 | 1.40 | 298 | 10.32 | 102.01 | 1013 | 1.32 | 307 | 36.80 | -121.80 | 14.20 |
| 950519 | 1640 | 0.66 | 281 | 10.33 | 102.02 | 1013 | 0.78 | 282 | 36.81 | -121.81 | 13.40 |
| 950519 | 1650 | 0.42 | 72 | 10.72 | 102.02 | 1013 | 0.06 | 298 | 36.81 | -121.81 | 13.40 |
| 950519 | 1700 | 0.39 | 93 | 10.58 | 102.01 | 1013 | 0.13 | 256 | 36.81 | -121.81 | 13.10 |
| 950519 | 1710 | 0.62 | 196 | 10.45 | 102.00 | 1013 | 0.90 | 205 | 36.80 | -121.81 | 13.50 |
| 950519 | 1720 | 1.55 | 223 | 10.44 | 102.00 | 1013 | 1.00 | 27 | 36.80 | -121.81 | 13.60 |
| 950519 | 1730 | 2.03 | 248 | 10.53 | 102.00 | 1013 | 0.40 | 308 | 36.81 | -121.81 | 13.40 |
| 950519 | 1740 | 3.24 | 259 | 10.43 | 102.00 | 1013 | 0.25 | 289 | 36.81 | -121.81 | 13.50 |
| 950519 | 1750 | 2.41 | 263 | 10.37 | 102.00 | 1013 | 0.34 | 176 | 36.81 | -121.81 | 13.50 |
| 950519 | 1800 | 1.96 | 262 | 10.44 | 102.00 | 1013 | 1.34 | 117 | 36.80 | -121.81 | 13.70 |
| 950519 | 1810 | 1.41 | 221 | 10.49 | 102.00 | 1013 | 0.49 | 134 | 36.80 | -121.80 | 13.40 |
| 950519 | 1820 | 1.37 | 263 | 10.51 | 102.00 | 1013 | 0.89 | 50 | 36.80 | -121.80 | 13.40 |
| 950519 | 1830 | 2.15 | 239 | 10.44 | 102.00 | 1013 | 0.34 | 146 | 36.80 | -121.80 | 12.70 |
| 950519 | 1840 | 2.37 | 287 | 10.45 | 102.01 | 1013 | 0.25 | 320 | 36.80 | -121.80 | 13.40 |
| 950519 | 1850 | 2.25 | 269 | 10.40 | 102.00 | 1013 | 1.30 | 66 | 36.80 | -121.80 | 13.60 |
| 950519 | 1900 | 2.70 | 281 | 10.46 | 102.00 | 1013 | 0.96 | 155 | 36.81 | -121.79 | 15.90 |
| 950519 | 1910 | 0.87 | 255 | 10.54 | 102.00 | 1013 | 0.85 | 18 | 36.80 | -121.79 | 16.70 |
| 950519 | 1920 | 3.36 | 280 | 10.41 | 101.59 | 1013 | 2.58 | 243 | 36.81 | -121.79 | 14.00 |
| 950519 | 1930 | 3.46 | 265 | 10.27 | 100.93 | 1013 | 4.47 | 255 | 36.80 | -121.82 | 14.30 |
| 950519 | 1940 | 3.80 | 271 | 10.26 | 100.22 | 1013 | 4.48 | 253 | 36.79 | -121.84 | 13.90 |
| 950519 | 1950 | 4.44 | 270 | 10.27 | 99.48 | 1013 | 4.52 | 251 | 36.78 | -121.87 | 13.20 |
| 950519 | 2000 | 4.41 | 274 | 10.25 | 98.52 | 1013 | 4.51 | 253 | 36.78 | -121.90 | 13.10 |

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| 950519 | 2010 | 4.49 | 284 | 10.39 | 97.88 | 1013 | 4.56 | 252 | 36.77 | -121.93 | 13.40 |
| 950519 | 2020 | 5.16 | 288 | 10.63 | 96.90 | 1013 | 4.57 | 256 | 36.76 | -121.96 | 13.20 |
| 950519 | 2030 | 5.05 | 294 | 10.76 | 95.92 | 1013 | 2.32 | 260 | 36.76 | -121.99 | 12.90 |
| 950519 | 2040 | 5.89 | 281 | 10.88 | 95.68 | 1012 | 0.99 | 248 | 36.76 | -121.99 | 12.80 |
| 950519 | 2050 | 5.88 | 278 | 10.97 | 95.27 | 1012 | 0.91 | 243 | 36.75 | -122.00 | 12.70 |
| 950519 | 2100 | 6.10 | 285 | 10.97 | 94.73 | 1012 | 0.92 | 246 | 36.75 | -122.01 | 12.60 |
| 950519 | 2110 | 6.22 | 280 | 10.99 | 94.28 | 1012 | 0.80 | 250 | 36.75 | -122.01 | 12.70 |
| 950519 | 2120 | 6.13 | 275 | 11.01 | 94.63 | 1012 | 0.72 | 247 | 36.75 | -122.02 | 12.80 |
| 950519 | 2130 | 6.03 | 277 | 11.06 | 94.49 | 1012 | 0.67 | 246 | 36.75 | -122.02 | 12.90 |
| 950519 | 2140 | 6.02 | 276 | 11.03 | 94.27 | 1012 | 0.65 | 247 | 36.75 | -122.02 | 12.90 |
| 950519 | 2150 | 5.82 | 276 | 11.04 | 95.13 | 1012 | 0.57 | 255 | 36.74 | -122.03 | 13.00 |
| 950519 | 2200 | 6.62 | 270 | 11.13 | 95.77 | 1012 | 0.53 | 243 | 36.74 | -122.03 | 13.10 |
| 950519 | 2210 | 6.55 | 272 | 11.07 | 95.79 | 1012 | 0.52 | 257 | 36.74 | -122.03 | 13.20 |
| 950519 | 2220 | 6.65 | 260 | 11.08 | 95.67 | 1012 | 0.42 | 241 | 36.74 | -122.04 | 13.30 |
| 950519 | 2230 | 6.44 | 261 | 11.06 | 95.45 | 1012 | 0.45 | 243 | 36.74 | -122.04 | 13.30 |
| 950519 | 2240 | 7.47 | 266 | 11.10 | 95.67 | 1012 | 0.53 | 255 | 36.74 | -122.04 | 13.40 |
| 950519 | 2250 | 7.60 | 280 | 11.11 | 95.41 | 1012 | 0.76 | 263 | 36.74 | -122.05 | 13.20 |
| 950519 | 2300 | 7.56 | 279 | 11.09 | 95.66 | 1012 | 0.77 | 264 | 36.74 | -122.05 | 13.30 |
| 950519 | 2310 | 8.01 | 284 | 11.08 | 95.25 | 1012 | 0.64 | 267 | 36.74 | -122.06 | 13.20 |
| 950519 | 2320 | 7.89 | 280 | 11.07 | 95.03 | 1012 | 0.62 | 264 | 36.74 | -122.06 | 13.30 |
| 950519 | 2330 | 7.54 | 279 | 11.09 | 94.90 | 1012 | 0.62 | 265 | 36.74 | -122.07 | 13.30 |
| 950519 | 2340 | 7.25 | 284 | 11.08 | 94.58 | 1012 | 0.69 | 268 | 36.74 | -122.07 | 13.10 |
| 950519 | 2350 | 7.53 | 283 | 11.10 | 94.21 | 1012 | 0.56 | 268 | 36.74 | -122.07 | 13.20 |
| 950520 | 0 | 7.15 | 293 | 11.14 | 95.02 | 1012 | 0.62 | 279 | 36.74 | -122.08 | 13.30 |
| 950520 | 10 | 7.53 | 287 | 11.15 | 94.57 | 1012 | 0.59 | 276 | 36.74 | -122.08 | 13.40 |
| 950520 | 20 | 8.11 | 276 | 11.13 | 94.01 | 1012 | 0.64 | 264 | 36.74 | -122.09 | 13.20 |
| 950520 | 30 | 7.51 | 287 | 11.13 | 94.30 | 1012 | 0.67 | 275 | 36.74 | -122.09 | 13.20 |
| 950520 | 40 | 7.66 | 275 | 11.08 | 94.63 | 1012 | 0.67 | 255 | 36.74 | -122.09 | 13.10 |
| 950520 | 50 | 7.73 | 272 | 10.88 | 95.48 | 1012 | 0.68 | 253 | 36.74 | -122.10 | 13.20 |
| 950520 | 100 | 7.58 | 271 | 10.92 | 95.87 | 1012 | 0.67 | 253 | 36.74 | -122.10 | 13.10 |
| 950520 | 110 | 6.92 | 268 | 10.93 | 95.93 | 1012 | 0.67 | 246 | 36.73 | -122.11 | 13.10 |
| 950520 | 120 | 7.00 | 259 | 10.85 | 95.99 | 1012 | 0.66 | 246 | 36.73 | -122.11 | 13.00 |
| 950520 | 130 | 6.88 | 259 | 10.80 | 96.27 | 1012 | 0.75 | 250 | 36.73 | -122.12 | 13.10 |
| 950520 | 140 | 6.73 | 265 | 10.69 | 96.23 | 1012 | 0.67 | 255 | 36.73 | -122.12 | 13.10 |
| 950520 | 150 | 6.15 | 274 | 10.71 | 96.96 | 1012 | 0.73 | 253 | 36.73 | -122.12 | 13.10 |
| 950520 | 200 | 6.46 | 273 | 10.73 | 97.13 | 1012 | 0.72 | 259 | 36.73 | -122.13 | 13.10 |
| 950520 | 210 | 6.41 | 286 | 10.62 | 97.19 | 1012 | 0.78 | 259 | 36.73 | -122.13 | 12.90 |
| 950520 | 220 | 7.07 | 274 | 10.61 | 97.31 | 1012 | 0.75 | 261 | 36.73 | -122.14 | 12.90 |
| 950520 | 230 | 6.17 | 279 | 10.46 | 97.14 | 1012 | 0.75 | 258 | 36.73 | -122.14 | 12.90 |
| 950520 | 240 | 6.06 | 286 | 10.53 | 97.32 | 1012 | 0.78 | 265 | 36.73 | -122.15 | 12.90 |
| 950520 | 250 | 6.60 | 270 | 10.52 | 96.80 | 1012 | 0.77 | 258 | 36.72 | -122.16 | 12.80 |
| 950520 | 300 | 5.92 | 270 | 10.52 | 96.81 | 1012 | 0.84 | 250 | 36.72 | -122.16 | 12.70 |
| 950520 | 310 | 6.20 | 281 | 10.53 | 96.71 | 1012 | 0.90 | 256 | 36.72 | -122.17 | 12.70 |
| 950520 | 320 | 6.53 | 292 | 10.43 | 96.10 | 1012 | 0.92 | 260 | 36.72 | -122.17 | 12.70 |
| 950520 | 330 | 6.06 | 300 | 10.32 | 95.90 | 1012 | 0.84 | 261 | 36.72 | -122.18 | 12.60 |
| 950520 | 340 | 5.32 | 298 | 10.32 | 95.91 | 1012 | 0.85 | 264 | 36.72 | -122.18 | 12.50 |
| 950520 | 350 | 5.54 | 285 | 10.42 | 96.05 | 1012 | 0.78 | 268 | 36.72 | -122.19 | 12.50 |
| 950520 | 400 | 5.73 | 296 | 10.28 | 95.86 | 1012 | 0.77 | 264 | 36.72 | -122.19 | 12.60 |
| 950520 | 410 | 5.50 | 303 | 10.32 | 95.98 | 1013 | 0.79 | 262 | 36.72 | -122.20 | 12.60 |
| 950520 | 420 | 5.61 | 301 | 10.32 | 95.99 | 1013 | 0.80 | 261 | 36.72 | -122.21 | 12.60 |
| 950520 | 430 | 4.89 | 294 | 10.39 | 96.02 | 1013 | 0.70 | 262 | 36.72 | -122.21 | 12.50 |
| 950520 | 440 | 4.52 | 283 | 10.37 | 95.65 | 1013 | 0.79 | 265 | 36.72 | -122.22 | 12.50 |
| 950520 | 450 | 4.32 | 299 | 10.40 | 95.16 | 1013 | 0.71 | 277 | 36.72 | -122.22 | 12.50 |
| 950520 | 500 | 4.77 | 303 | 10.41 | 95.10 | 1013 | 0.80 | 269 | 36.72 | -122.23 | 12.50 |
| 950520 | 510 | 4.16 | 297 | 10.48 | 95.73 | 1013 | 0.84 | 255 | 36.72 | -122.23 | 12.50 |
| 950520 | 520 | 5.00 | 316 | 10.52 | 95.61 | 1013 | 0.72 | 269 | 36.72 | -122.24 | 12.50 |
| 950520 | 530 | 4.56 | 306 | 10.34 | 94.25 | 1013 | 0.85 | 270 | 36.71 | -122.24 | 12.50 |
| 950520 | 540 | 3.72 | 312 | 10.27 | 94.07 | 1013 | 0.86 | 267 | 36.71 | -122.25 | 12.60 |
| 950520 | 550 | 4.34 | 320 | 10.36 | 94.29 | 1013 | 1.01 | 260 | 36.71 | -122.25 | 12.60 |
| 950520 | 600 | 4.35 | 318 | 10.44 | 94.04 | 1013 | 1.29 | 259 | 36.71 | -122.26 | 12.60 |
| 950520 | 610 | 4.88 | 312 | 10.46 | 93.97 | 1013 | 1.16 | 264 | 36.71 | -122.27 | 12.60 |
| 950520 | 620 | 4.58 | 317 | 10.36 | 92.77 | 1013 | 1.08 | 263 | 36.71 | -122.28 | 12.40 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 950520 | 630 | 3.61 | 320 | 10.32 | 93.23 | 1013 | 1.05 | 266 | 36.71 -122.28 | 12.40 |
| 950520 | 640 | 3.27 | 313 | 10.33 | 93.47 | 1013 | 0.85 | 267 | 36.71 -122.29 | 12.40 |
| 950520 | 650 | 4.55 | 322 | 10.36 | 93.98 | 1013 | 0.83 | 262 | 36.71 -122.30 | 12.40 |
| 950520 | 700 | 4.09 | 325 | 10.19 | 93.73 | 1013 | 0.74 | 257 | 36.71 -122.30 | 12.40 |
| 950520 | 710 | 3.47 | 335 | 10.18 | 93.96 | 1013 | 0.74 | 266 | 36.71 -122.31 | 12.50 |
| 950520 | 720 | 3.51 | 314 | 10.23 | 94.00 | 1013 | 0.79 | 263 | 36.71 -122.31 | 12.70 |
| 950520 | 730 | 3.37 | 316 | 10.33 | 94.00 | 1013 | 0.82 | 262 | 36.71 -122.32 | 12.80 |
| 950520 | 740 | 3.65 | 331 | 10.30 | 93.68 | 1013 | 0.78 | 260 | 36.71 -122.32 | 12.60 |
| 950520 | 750 | 3.54 | 326 | 10.19 | 93.05 | 1013 | 0.84 | 259 | 36.70 -122.33 | 12.50 |
| 950520 | 800 | 2.61 | 310 | 10.03 | 92.62 | 1013 | 0.78 | 253 | 36.70 -122.33 | 12.40 |
| 950520 | 810 | 3.31 | 331 | 10.07 | 93.74 | 1013 | 0.77 | 270 | 36.70 -122.34 | 12.40 |
| 950520 | 820 | 3.08 | 320 | 10.13 | 93.57 | 1013 | 0.83 | 261 | 36.70 -122.34 | 12.40 |
| 950520 | 830 | 3.00 | 328 | 10.15 | 93.37 | 1012 | 0.85 | 254 | 36.70 -122.35 | 12.50 |
| 950520 | 840 | 3.72 | 327 | 10.25 | 93.18 | 1013 | 0.85 | 256 | 36.70 -122.35 | 12.50 |
| 950520 | 850 | 4.24 | 318 | 10.21 | 92.88 | 1012 | 0.86 | 251 | 36.70 -122.36 | 12.50 |
| 950520 | 900 | 3.36 | 314 | 10.22 | 93.18 | 1012 | 0.80 | 252 | 36.70 -122.36 | 12.60 |
| 950520 | 910 | 3.77 | 297 | 10.28 | 93.02 | 1012 | 0.82 | 258 | 36.70 -122.37 | 12.60 |
| 950520 | 920 | 3.72 | 300 | 10.24 | 92.28 | 1012 | 0.84 | 264 | 36.70 -122.38 | 12.60 |
| 950520 | 930 | 3.59 | 299 | 10.21 | 92.06 | 1012 | 0.76 | 262 | 36.69 -122.38 | 12.60 |
| 950520 | 940 | 2.86 | 317 | 10.21 | 92.53 | 1012 | 0.84 | 263 | 36.69 -122.39 | 12.60 |
| 950520 | 950 | 4.23 | 330 | 10.29 | 93.06 | 1012 | 0.66 | 292 | 36.69 -122.39 | 12.70 |
| 950520 | 1000 | 3.99 | 334 | 10.22 | 92.07 | 1012 | 0.67 | 308 | 36.70 -122.40 | 12.70 |
| 950520 | 1010 | 4.03 | 325 | 10.20 | 92.02 | 1012 | 0.76 | 305 | 36.70 -122.40 | 12.60 |
| 950520 | 1020 | 3.91 | 334 | 10.20 | 92.04 | 1012 | 0.78 | 308 | 36.70 -122.40 | 12.70 |
| 950520 | 1030 | 3.59 | 318 | 10.17 | 92.03 | 1012 | 0.69 | 315 | 36.70 -122.41 | 12.70 |
| 950520 | 1040 | 3.58 | 313 | 10.21 | 92.03 | 1012 | 0.65 | 308 | 36.71 -122.41 | 12.70 |
| 950520 | 1050 | 3.47 | 324 | 10.24 | 91.98 | 1012 | 0.68 | 309 | 36.71 -122.41 | 12.70 |
| 950520 | 1100 | 3.66 | 326 | 10.20 | 90.88 | 1012 | 0.65 | 313 | 36.71 -122.42 | 12.70 |
| 950520 | 1110 | 3.90 | 320 | 10.25 | 90.83 | 1012 | 0.63 | 316 | 36.71 -122.42 | 12.80 |
| 950520 | 1120 | 3.94 | 328 | 10.29 | 90.43 | 1012 | 0.61 | 320 | 36.72 -122.42 | 12.80 |
| 950520 | 1130 | 3.95 | 329 | 10.44 | 90.72 | 1012 | 0.72 | 313 | 36.72 -122.43 | 12.80 |
| 950520 | 1140 | 3.75 | 334 | 10.52 | 90.93 | 1012 | 0.67 | 318 | 36.72 -122.43 | 12.80 |
| 950520 | 1150 | 4.22 | 326 | 10.64 | 90.90 | 1012 | 0.72 | 312 | 36.72 -122.43 | 12.90 |
| 950520 | 1200 | 4.29 | 314 | 10.66 | 89.64 | 1012 | 0.72 | 321 | 36.73 -122.44 | 12.90 |
| 950520 | 1210 | 4.11 | 321 | 10.79 | 90.09 | 1013 | 0.76 | 320 | 36.73 -122.44 | 13.00 |
| 950520 | 1220 | 4.33 | 311 | 10.85 | 89.43 | 1012 | 0.73 | 320 | 36.73 -122.44 | 12.90 |
| 950520 | 1230 | 4.36 | 314 | 10.92 | 89.26 | 1013 | 0.69 | 322 | 36.74 -122.44 | 13.00 |
| 950520 | 1240 | 4.36 | 314 | 11.02 | 89.17 | 1013 | 0.64 | 303 | 36.74 -122.45 | 13.00 |
| 950520 | 1250 | 3.92 | 322 | 11.01 | 89.07 | 1013 | 0.68 | 302 | 36.74 -122.45 | 13.00 |
| 950520 | 1300 | 4.83 | 326 | 11.04 | 89.02 | 1013 | 0.67 | 308 | 36.74 -122.45 | 13.00 |
| 950520 | 1310 | 4.37 | 314 | 11.10 | 88.59 | 1013 | 0.17 | 334 | 36.75 -122.46 | 13.00 |
| 950520 | 1320 | 4.53 | 315 | 11.09 | 88.84 | 1013 | 3.13 | 135 | 36.74 -122.45 | 13.10 |
| 950520 | 1330 | 4.53 | 328 | 11.27 | 88.15 | 1013 | 3.13 | 133 | 36.73 -122.43 | 13.10 |
| 950520 | 1340 | 5.07 | 324 | 11.73 | 86.98 | 1013 | 3.11 | 133 | 36.72 -122.42 | 13.10 |
| 950520 | 1350 | 4.18 | 317 | 11.64 | 86.77 | 1013 | 3.13 | 131 | 36.70 -122.40 | 13.00 |
| 950520 | 1400 | 4.16 | 313 | 11.58 | 86.33 | 1014 | 2.86 | 128 | 36.69 -122.39 | 12.90 |
| 950520 | 1410 | 4.81 | 319 | 11.27 | 86.31 | 1013 | 0.73 | 311 | 36.69 -122.38 | 12.80 |
| 950520 | 1420 | 3.77 | 321 | 11.15 | 86.10 | 1014 | 0.75 | 313 | 36.69 -122.39 | 12.80 |
| 950520 | 1430 | 4.70 | 325 | 11.15 | 87.77 | 1014 | 0.70 | 319 | 36.70 -122.39 | 12.90 |
| 950520 | 1440 | 4.50 | 319 | 11.13 | 86.74 | 1014 | 0.54 | 316 | 36.70 -122.39 | 12.90 |
| 950520 | 1450 | 3.79 | 319 | 11.12 | 85.65 | 1014 | 0.48 | 310 | 36.70 -122.40 | 13.00 |
| 950520 | 1500 | 3.52 | 320 | 11.18 | 86.19 | 1014 | 0.48 | 312 | 36.70 -122.40 | 12.90 |
| 950520 | 1510 | 4.24 | 326 | 11.12 | 86.63 | 1014 | 0.42 | 319 | 36.70 -122.40 | 12.90 |
| 950520 | 1520 | 2.89 | 331 | 11.08 | 85.33 | 1014 | 0.42 | 319 | 36.71 -122.40 | 12.90 |
| 950520 | 1530 | 3.66 | 326 | 11.12 | 85.92 | 1014 | 0.42 | 316 | 36.71 -122.40 | 12.90 |
| 950520 | 1540 | 2.96 | 325 | 11.09 | 85.83 | 1014 | 0.43 | 318 | 36.71 -122.41 | 13.00 |
| 950520 | 1550 | 2.77 | 338 | 11.12 | 86.63 | 1014 | 0.37 | 321 | 36.71 -122.41 | 13.10 |
| 950520 | 1600 | 2.98 | 338 | 11.10 | 86.77 | 1014 | 0.38 | 312 | 36.71 -122.41 | 13.00 |
| 950520 | 1610 | 2.91 | 340 | 11.09 | 86.06 | 1014 | 0.48 | 320 | 36.71 -122.41 | 13.00 |
| 950520 | 1620 | 2.66 | 332 | 11.12 | 85.83 | 1014 | 0.41 | 332 | 36.72 -122.41 | 13.20 |
| 950520 | 1630 | 2.25 | 334 | 11.13 | 84.84 | 1014 | 0.37 | 338 | 36.72 -122.41 | 13.30 |
| 950520 | 1640 | 2.19 | 344 | 11.15 | 85.86 | 1014 | 0.37 | 342 | 36.72 -122.41 | 13.30 |
| 950520 | 1650 | 2.39 | 354 | 11.12 | 85.90 | 1014 | 0.35 | 340 | 36.72 -122.42 | 13.20 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 950520 | 1700 | 2.63 | 347 | 11.16 | 85.91 | 1014 | 0.33 | 327 | 36.72 | -122.42 | 13.20 |
| 950520 | 1710 | 2.67 | 349 | 11.15 | 85.38 | 1014 | 0.35 | 341 | 36.72 | -122.42 | 13.30 |
| 950520 | 1720 | 2.26 | 356 | 11.19 | 84.31 | 1015 | 0.33 | 347 | 36.73 | -122.42 | 13.30 |
| 950520 | 1730 | 1.96 | 343 | 11.24 | 85.13 | 1015 | 0.20 | 325 | 36.73 | -122.42 | 13.40 |
| 950520 | 1740 | 1.87 | 25 | 11.19 | 87.50 | 1015 | 0.24 | 335 | 36.73 | -122.42 | 13.20 |
| 950520 | 1750 | 1.43 | 47 | 11.16 | 88.78 | 1015 | 0.43 | 354 | 36.73 | -122.42 | 13.20 |
| 950520 | 1800 | 1.02 | 2 | 11.16 | 88.92 | 1015 | 1.34 | 128 | 36.73 | -122.42 | 13.40 |
| 950520 | 1810 | 1.21 | 2 | 11.18 | 88.28 | 1015 | 3.23 | 138 | 36.72 | -122.40 | 13.50 |
| 950520 | 1820 | 0.91 | 29 | 11.21 | 88.71 | 1015 | 3.27 | 139 | 36.71 | -122.39 | 13.50 |
| 950520 | 1830 | 1.12 | 56 | 11.17 | 89.92 | 1015 | 0.03 | 282 | 36.70 | -122.38 | 13.50 |
| 950520 | 1840 | 1.27 | 73 | 11.28 | 89.27 | 1015 | 0.49 | 321 | 36.70 | -122.38 | 13.70 |
| 950520 | 1850 | 0.48 | 114 | 11.42 | 89.09 | 1015 | 0.48 | 330 | 36.70 | -122.39 | 13.80 |
| 950520 | 1900 | 0.51 | 126 | 11.70 | 88.64 | 1015 | 0.54 | 328 | 36.71 | -122.39 | 13.90 |
| 950520 | 1910 | 0.52 | 145 | 12.03 | 88.07 | 1015 | 0.51 | 328 | 36.71 | -122.39 | 14.10 |
| 950520 | 1920 | 0.53 | 129 | 12.26 | 86.63 | 1015 | 0.43 | 333 | 36.71 | -122.39 | 14.00 |
| 950520 | 1930 | 0.65 | 131 | 12.39 | 85.99 | 1015 | 0.43 | 329 | 36.71 | -122.39 | 13.70 |
| 950520 | 1940 | 0.53 | 148 | 12.62 | 85.62 | 1015 | 0.47 | 334 | 36.71 | -122.39 | 13.80 |
| 950520 | 1950 | 0.45 | 124 | 12.73 | 83.88 | 1015 | 0.44 | 338 | 36.72 | -122.40 | 13.80 |
| 950520 | 2000 | 0.46 | 152 | 12.85 | 83.57 | 1015 | 0.46 | 332 | 36.72 | -122.40 | 14.00 |
| 950520 | 2010 | 0.42 | 137 | 13.21 | 82.54 | 1015 | 0.42 | 320 | 36.72 | -122.40 | 14.10 |
| 950520 | 2020 | 0.38 | 150 | 13.43 | 81.47 | 1015 | 0.40 | 326 | 36.72 | -122.40 | 14.50 |
| 950520 | 2030 | 0.74 | 231 | 13.42 | 80.29 | 1015 | 0.37 | 325 | 36.72 | -122.40 | 14.70 |
| 950520 | 2040 | 1.39 | 252 | 12.96 | 80.57 | 1015 | 0.41 | 326 | 36.73 | -122.40 | 14.40 |
| 950520 | 2050 | 2.21 | 289 | 12.49 | 82.26 | 1015 | 0.35 | 319 | 36.73 | -122.40 | 14.30 |
| 950520 | 2100 | 2.27 | 272 | 12.22 | 83.00 | 1015 | 0.33 | 309 | 36.73 | -122.41 | 14.10 |
| 950520 | 2110 | 2.65 | 274 | 12.14 | 83.39 | 1015 | 0.30 | 307 | 36.73 | -122.41 | 14.40 |
| 950520 | 2120 | 2.85 | 271 | 12.09 | 83.82 | 1015 | 0.33 | 289 | 36.73 | -122.41 | 14.10 |
| 950520 | 2130 | 3.37 | 272 | 12.09 | 84.31 | 1015 | 0.32 | 288 | 36.73 | -122.41 | 13.90 |
| 950520 | 2140 | 3.75 | 265 | 12.08 | 84.56 | 1015 | 0.35 | 278 | 36.73 | -122.41 | 13.90 |
| 950520 | 2150 | 3.65 | 281 | 12.10 | 85.16 | 1015 | 0.34 | 293 | 36.73 | -122.42 | 13.80 |
| 950520 | 2200 | 3.41 | 274 | 12.12 | 85.38 | 1015 | 0.40 | 286 | 36.73 | -122.42 | 13.80 |
| 950520 | 2210 | 2.93 | 280 | 12.17 | 85.91 | 1015 | 0.41 | 295 | 36.73 | -122.42 | 14.00 |
| 950520 | 2220 | 3.30 | 282 | 12.23 | 85.01 | 1015 | 0.37 | 286 | 36.73 | -122.42 | 14.00 |
| 950520 | 2230 | 3.28 | 277 | 12.28 | 84.27 | 1015 | 0.36 | 284 | 36.73 | -122.43 | 14.00 |
| 950520 | 2240 | 3.61 | 295 | 12.31 | 84.20 | 1015 | 0.30 | 294 | 36.73 | -122.43 | 14.10 |
| 950520 | 2250 | 3.15 | 274 | 12.27 | 84.38 | 1014 | 0.30 | 279 | 36.73 | -122.43 | 13.90 |
| 950520 | 2300 | 3.37 | 292 | 12.28 | 84.65 | 1014 | 0.32 | 289 | 36.74 | -122.43 | 13.80 |
| 950520 | 2310 | 3.39 | 298 | 12.23 | 84.73 | 1014 | 0.96 | 143 | 36.74 | -122.43 | 13.90 |
| 950520 | 2320 | 3.57 | 302 | 12.34 | 84.67 | 1014 | 3.29 | 139 | 36.73 | -122.42 | 14.00 |
| 950520 | 2330 | 3.58 | 308 | 12.44 | 84.22 | 1014 | 3.17 | 134 | 36.71 | -122.41 | 14.00 |
| 950520 | 2340 | 3.28 | 309 | 12.66 | 84.16 | 1014 | 3.22 | 129 | 36.70 | -122.39 | 14.20 |
| 950520 | 2350 | 3.29 | 320 | 12.71 | 83.59 | 1014 | 0.53 | 103 | 36.69 | -122.38 | 14.00 |
| 950521 | 0 | 3.47 | 315 | 12.43 | 85.12 | 1014 | 0.33 | 313 | 36.70 | -122.38 | 13.90 |
| 950521 | 10 | 3.31 | 308 | 12.35 | 84.60 | 1014 | 0.32 | 301 | 36.70 | -122.38 | 14.10 |
| 950521 | 20 | 3.91 | 293 | 12.30 | 85.43 | 1014 | 0.36 | 292 | 36.70 | -122.38 | 13.90 |
| 950521 | 30 | 3.27 | 281 | 12.28 | 84.64 | 1014 | 0.39 | 284 | 36.70 | -122.39 | 13.80 |
| 950521 | 40 | 3.88 | 291 | 12.29 | 82.67 | 1014 | 0.39 | 287 | 36.70 | -122.39 | 14.00 |
| 950521 | 50 | 3.96 | 279 | 12.32 | 81.47 | 1014 | 0.43 | 284 | 36.70 | -122.39 | 14.20 |
| 950521 | 100 | 4.41 | 286 | 12.35 | 80.32 | 1014 | 0.37 | 290 | 36.70 | -122.39 | 14.10 |
| 950521 | 110 | 4.57 | 279 | 12.34 | 80.58 | 1014 | 0.28 | 293 | 36.70 | -122.40 | 14.00 |
| 950521 | 120 | 4.32 | 279 | 12.34 | 79.82 | 1014 | 0.29 | 293 | 36.70 | -122.40 | 14.10 |
| 950521 | 130 | 4.50 | 285 | 12.36 | 80.25 | 1014 | 0.29 | 294 | 36.70 | -122.40 | 13.90 |
| 950521 | 140 | 4.39 | 278 | 12.30 | 79.25 | 1014 | 0.30 | 285 | 36.70 | -122.40 | 13.80 |
| 950521 | 150 | 4.93 | 280 | 12.27 | 79.77 | 1014 | 0.30 | 278 | 36.70 | -122.40 | 13.80 |
| 950521 | 200 | 5.13 | 270 | 12.27 | 79.61 | 1014 | 0.25 | 284 | 36.70 | -122.41 | 13.70 |
| 950521 | 210 | 4.92 | 269 | 12.32 | 79.98 | 1014 | 0.33 | 274 | 36.70 | -122.41 | 13.60 |
| 950521 | 220 | 3.66 | 288 | 12.35 | 80.33 | 1014 | 0.42 | 282 | 36.70 | -122.41 | 13.70 |
| 950521 | 230 | 4.25 | 287 | 12.33 | 80.93 | 1014 | 0.34 | 278 | 36.70 | -122.41 | 13.70 |
| 950521 | 240 | 4.12 | 279 | 12.29 | 80.52 | 1014 | 0.36 | 281 | 36.70 | -122.41 | 13.70 |
| 950521 | 250 | 4.17 | 300 | 12.31 | 81.98 | 1014 | 0.37 | 297 | 36.70 | -122.42 | 13.70 |
| 950521 | 300 | 5.37 | 296 | 12.25 | 80.63 | 1014 | 0.19 | 294 | 36.71 | -122.42 | 13.60 |
| 950521 | 310 | 4.60 | 295 | 12.21 | 79.63 | 1014 | 0.41 | 298 | 36.71 | -122.42 | 13.50 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950521 | 320 | 5.14 | 296 | 12.22 | 79.62 | 1014 | 0.71 | 299 | 36.71 | -122.42 | 13.60 |
| 950521 | 330 | 4.65 | 308 | 12.20 | 79.75 | 1014 | 0.75 | 292 | 36.71 | -122.43 | 13.70 |
| 950521 | 340 | 4.72 | 298 | 12.22 | 80.34 | 1014 | 0.70 | 301 | 36.71 | -122.43 | 13.70 |
| 950521 | 350 | 6.13 | 301 | 12.22 | 80.02 | 1014 | 0.62 | 303 | 36.71 | -122.44 | 13.70 |
| 950521 | 400 | 5.46 | 301 | 12.16 | 78.68 | 1014 | 0.70 | 296 | 36.71 | -122.44 | 13.60 |
| 950521 | 410 | 5.66 | 303 | 12.23 | 80.22 | 1014 | 0.72 | 300 | 36.72 | -122.45 | 13.60 |
| 950521 | 420 | 5.21 | 313 | 12.25 | 79.44 | 1014 | 0.74 | 297 | 36.72 | -122.45 | 13.60 |
| 950521 | 430 | 4.72 | 306 | 12.33 | 80.38 | 1015 | 0.82 | 299 | 36.72 | -122.45 | 13.70 |
| 950521 | 440 | 4.12 | 311 | 12.34 | 81.17 | 1015 | 0.32 | 315 | 36.72 | -122.46 | 13.60 |
| 950521 | 450 | 5.50 | 331 | 12.36 | 80.99 | 1015 | 3.13 | 114 | 36.72 | -122.45 | 13.60 |
| 950521 | 500 | 5.81 | 333 | 12.27 | 78.94 | 1015 | 3.09 | 114 | 36.71 | -122.43 | 13.60 |
| 950521 | 510 | 4.98 | 329 | 12.19 | 77.91 | 1015 | 3.22 | 110 | 36.71 | -122.41 | 13.40 |
| 950521 | 520 | 3.94 | 326 | 12.19 | 77.93 | 1015 | 2.72 | 95 | 36.70 | -122.39 | 13.30 |
| 950521 | 530 | 4.83 | 316 | 12.20 | 79.21 | 1015 | 0.67 | 309 | 36.70 | -122.38 | 13.20 |
| 950521 | 540 | 4.72 | 315 | 12.23 | 79.57 | 1015 | 0.60 | 313 | 36.70 | -122.39 | 13.30 |
| 950521 | 550 | 5.40 | 321 | 12.25 | 80.58 | 1015 | 0.60 | 327 | 36.71 | -122.39 | 13.30 |
| 950521 | 600 | 5.31 | 322 | 12.20 | 79.48 | 1015 | 0.55 | 326 | 36.71 | -122.39 | 13.30 |
| 950521 | 610 | 4.97 | 323 | 12.19 | 77.81 | 1015 | 0.53 | 320 | 36.71 | -122.39 | 13.30 |
| 950521 | 620 | 4.36 | 321 | 12.25 | 78.70 | 1015 | 0.55 | 308 | 36.71 | -122.40 | 13.30 |
| 950521 | 630 | 4.48 | 319 | 12.27 | 80.16 | 1015 | 0.61 | 309 | 36.72 | -122.40 | 13.30 |
| 950521 | 640 | 5.65 | 322 | 12.21 | 79.90 | 1015 | 0.56 | 319 | 36.72 | -122.40 | 13.30 |
| 950521 | 650 | 4.15 | 322 | 12.24 | 78.02 | 1015 | 0.60 | 321 | 36.72 | -122.40 | 13.30 |
| 950521 | 700 | 5.40 | 319 | 12.20 | 79.73 | 1015 | 0.57 | 304 | 36.72 | -122.41 | 13.40 |
| 950521 | 710 | 4.80 | 325 | 12.17 | 78.39 | 1015 | 0.53 | 312 | 36.72 | -122.41 | 13.40 |
| 950521 | 720 | 4.84 | 330 | 12.21 | 79.23 | 1015 | 0.56 | 308 | 36.73 | -122.41 | 13.40 |
| 950521 | 730 | 4.74 | 341 | 12.19 | 79.23 | 1015 | 0.60 | 302 | 36.73 | -122.42 | 13.40 |
| 950521 | 740 | 3.64 | 347 | 12.16 | 80.33 | 1015 | 0.61 | 314 | 36.73 | -122.42 | 13.40 |
| 950521 | 750 | 3.45 | 346 | 12.18 | 79.79 | 1015 | 0.68 | 336 | 36.73 | -122.42 | 13.40 |
| 950521 | 800 | 3.10 | 352 | 12.19 | 80.26 | 1015 | 0.76 | 337 | 36.74 | -122.42 | 13.40 |
| 950521 | 810 | 3.31 | 350 | 12.17 | 80.23 | 1015 | 0.71 | 341 | 36.74 | -122.42 | 13.40 |
| 950521 | 820 | 2.97 | 349 | 12.22 | 81.43 | 1015 | 0.70 | 340 | 36.74 | -122.43 | 13.40 |
| 950521 | 830 | 2.88 | 338 | 12.14 | 81.81 | 1015 | 0.76 | 336 | 36.75 | -122.43 | 13.40 |
| 950521 | 840 | 3.66 | 337 | 12.17 | 82.93 | 1015 | 0.79 | 331 | 36.75 | -122.43 | 13.30 |
| 950521 | 850 | 4.43 | 338 | 12.09 | 80.86 | 1015 | 0.75 | 327 | 36.75 | -122.43 | 13.30 |
| 950521 | 900 | 4.37 | 321 | 12.12 | 77.17 | 1015 | 0.75 | 336 | 36.76 | -122.44 | 13.30 |
| 950521 | 910 | 3.31 | 341 | 12.11 | 77.32 | 1015 | 0.71 | 324 | 36.76 | -122.44 | 13.30 |
| 950521 | 920 | 3.96 | 326 | 12.08 | 77.53 | 1014 | 0.70 | 323 | 36.76 | -122.44 | 13.30 |
| 950521 | 930 | 3.84 | 329 | 12.08 | 78.75 | 1014 | 0.72 | 315 | 36.77 | -122.44 | 13.30 |
| 950521 | 940 | 3.66 | 336 | 11.98 | 78.29 | 1014 | 0.57 | 153 | 36.77 | -122.45 | 13.30 |
| 950521 | 950 | 3.13 | 334 | 11.98 | 78.56 | 1014 | 3.00 | 145 | 36.76 | -122.44 | 13.40 |
| 950521 | 1000 | 3.52 | 335 | 11.99 | 78.79 | 1014 | 3.12 | 142 | 36.75 | -122.43 | 13.40 |
| 950521 | 1010 | 3.18 | 329 | 11.93 | 79.03 | 1014 | 3.14 | 148 | 36.73 | -122.41 | 13.40 |
| 950521 | 1020 | 3.77 | 325 | 11.97 | 78.57 | 1014 | 3.13 | 148 | 36.72 | -122.40 | 13.40 |
| 950521 | 1030 | 3.18 | 319 | 11.95 | 78.34 | 1014 | 2.85 | 144 | 36.70 | -122.39 | 13.30 |
| 950521 | 1040 | 4.22 | 326 | 12.02 | 78.84 | 1014 | 0.63 | 303 | 36.70 | -122.39 | 13.20 |
| 950521 | 1050 | 5.68 | 315 | 11.96 | 80.66 | 1014 | 0.61 | 300 | 36.70 | -122.39 | 13.20 |
| 950521 | 1100 | 6.32 | 311 | 11.93 | 79.94 | 1014 | 0.57 | 321 | 36.70 | -122.40 | 13.30 |
| 950521 | 1110 | 5.68 | 303 | 11.93 | 78.05 | 1014 | 3.05 | 84 | 36.71 | -122.39 | 13.30 |
| 950521 | 1120 | 5.43 | 298 | 11.84 | 77.96 | 1014 | 3.16 | 87 | 36.71 | -122.37 | 13.30 |
| 950521 | 1130 | 3.57 | 316 | 11.79 | 77.13 | 1014 | 3.10 | 82 | 36.71 | -122.34 | 13.20 |
| 950521 | 1140 | 4.07 | 309 | 11.72 | 77.28 | 1014 | 3.05 | 79 | 36.71 | -122.32 | 13.00 |
| 950521 | 1150 | 3.62 | 311 | 11.69 | 77.93 | 1014 | 3.27 | 80 | 36.71 | -122.30 | 12.80 |
| 950521 | 1200 | 4.33 | 316 | 11.62 | 78.37 | 1014 | 4.80 | 78 | 36.72 | -122.28 | 12.90 |
| 950521 | 1210 | 4.44 | 300 | 11.65 | 78.50 | 1014 | 4.83 | 75 | 36.72 | -122.24 | 13.00 |
| 950521 | 1220 | 4.08 | 307 | 11.70 | 80.00 | 1014 | 4.85 | 77 | 36.73 | -122.21 | 13.00 |
| 950521 | 1230 | 3.15 | 320 | 11.70 | 81.67 | 1014 | 4.97 | 79 | 36.73 | -122.18 | 13.00 |
| 950521 | 1240 | 3.40 | 319 | 11.63 | 80.26 | 1014 | 5.04 | 80 | 36.74 | -122.15 | 12.90 |
| 950521 | 1250 | 2.68 | 344 | 11.67 | 81.02 | 1014 | 4.90 | 79 | 36.74 | -122.11 | 13.00 |
| 950521 | 1300 | 2.80 | 336 | 11.59 | 81.42 | 1014 | 4.88 | 77 | 36.75 | -122.08 | 13.20 |
| 950521 | 1310 | 2.98 | 334 | 11.61 | 81.19 | 1014 | 4.79 | 74 | 36.76 | -122.05 | 13.20 |
| 950521 | 1320 | 3.49 | 342 | 11.61 | 81.16 | 1014 | 4.71 | 74 | 36.76 | -122.02 | 13.10 |
| 950521 | 1330 | 3.17 | 338 | 11.58 | 81.13 | 1014 | 4.72 | 77 | 36.77 | -121.99 | 13.10 |
| 950521 | 1340 | 2.37 | 342 | 11.49 | 81.28 | 1014 | 4.72 | 78 | 36.77 | -121.96 | 13.20 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950521 | 1350 | 2.01 | 340 | 11.44 | 80.73 | 1014 | 4.73 | 79 | 36.78 | -121.93 | 13.40 |
| 950521 | 1400 | 1.87 | 325 | 11.42 | 80.13 | 1014 | 4.68 | 77 | 36.78 | -121.90 | 13.90 |
| 950521 | 1410 | 2.45 | 325 | 11.44 | 80.01 | 1014 | 4.69 | 79 | 36.79 | -121.87 | 13.90 |
| 950521 | 1420 | 2.63 | 320 | 11.43 | 79.76 | 1014 | 4.66 | 78 | 36.79 | -121.83 | 13.50 |
| 950521 | 1430 | 2.95 | 309 | 11.47 | 78.90 | 1014 | 4.52 | 66 | 36.80 | -121.80 | 13.40 |
| 950521 | 1440 | 2.52 | 301 | 11.45 | 79.27 | 1014 | 0.90 | 128 | 36.81 | -121.79 | 13.60 |
| 950521 | 1450 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.90 |
| 950521 | 1500 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.90 |
| 950521 | 1510 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.90 |
| 950521 | 1520 | 0.32 | 309 | 11.63 | 78.55 | 1015 | 0.01 | 214 | 36.80 | -121.79 | 14.20 |
| 950521 | 1530 | 0.23 | 281 | 11.59 | 78.06 | 1015 | 0.01 | 111 | 36.80 | -121.79 | 14.40 |
| 950521 | 1540 | 0.69 | 91 | 11.66 | 77.85 | 1015 | 0.01 | 342 | 36.80 | -121.79 | 14.80 |
| 950521 | 1550 | 0.40 | 284 | 11.75 | 77.99 | 1015 | 0.00 | 176 | 36.80 | -121.79 | 14.60 |
| 950521 | 1600 | 0.32 | 215 | 11.85 | 78.01 | 1015 | 0.95 | 14 | 36.80 | -121.79 | 14.10 |
| 950521 | 1610 | 1.55 | 259 | 11.69 | 78.50 | 1015 | 4.02 | 245 | 36.80 | -121.80 | 13.80 |
| 950521 | 1620 | 2.08 | 256 | 11.60 | 79.59 | 1015 | 4.85 | 253 | 36.79 | -121.83 | 13.20 |
| 950521 | 1630 | 2.99 | 255 | 11.70 | 80.55 | 1015 | 4.62 | 257 | 36.79 | -121.86 | 13.70 |
| 950521 | 1640 | 2.71 | 256 | 11.69 | 82.11 | 1015 | 4.65 | 257 | 36.78 | -121.89 | 13.90 |
| 950521 | 1650 | 2.58 | 262 | 11.71 | 84.40 | 1015 | 4.73 | 257 | 36.78 | -121.92 | 13.70 |
| 950521 | 1700 | 3.16 | 260 | 11.73 | 85.93 | 1015 | 4.63 | 255 | 36.77 | -121.95 | 13.10 |
| 950521 | 1710 | 3.12 | 272 | 11.65 | 86.29 | 1015 | 4.56 | 251 | 36.76 | -121.98 | 13.10 |
| 950521 | 1720 | 2.78 | 288 | 11.53 | 85.92 | 1015 | 2.34 | 225 | 36.75 | -122.00 | 13.10 |
| 950521 | 1730 | 2.52 | 304 | 11.65 | 84.91 | 1015 | 0.40 | 289 | 36.75 | -122.00 | 13.20 |
| 950521 | 1740 | 3.09 | 286 | 11.63 | 84.22 | 1015 | 0.65 | 284 | 36.75 | -122.01 | 13.30 |
| 950521 | 1750 | 2.87 | 289 | 11.65 | 85.22 | 1016 | 0.61 | 286 | 36.75 | -122.01 | 13.30 |
| 950521 | 1800 | 3.60 | 293 | 11.69 | 84.87 | 1016 | 0.59 | 285 | 36.75 | -122.02 | 13.30 |
| 950521 | 1810 | 3.73 | 305 | 11.77 | 85.55 | 1016 | 0.56 | 283 | 36.75 | -122.02 | 13.30 |
| 950521 | 1820 | 3.28 | 303 | 11.78 | 85.90 | 1016 | 0.61 | 283 | 36.75 | -122.02 | 13.30 |
| 950521 | 1830 | 3.18 | 297 | 11.81 | 85.76 | 1016 | 0.57 | 285 | 36.76 | -122.03 | 13.30 |
| 950521 | 1840 | 2.89 | 296 | 11.91 | 85.88 | 1016 | 0.58 | 285 | 36.76 | -122.03 | 13.40 |
| 950521 | 1850 | 2.84 | 286 | 11.95 | 84.89 | 1016 | 0.60 | 284 | 36.76 | -122.03 | 13.40 |
| 950521 | 1900 | 2.84 | 286 | 12.00 | 83.53 | 1016 | 0.60 | 284 | 36.76 | -122.04 | 13.40 |
| 950521 | 1910 | 3.02 | 300 | 12.04 | 82.73 | 1016 | 0.57 | 290 | 36.76 | -122.04 | 13.30 |
| 950521 | 1920 | 3.09 | 296 | 12.06 | 83.04 | 1016 | 0.53 | 288 | 36.76 | -122.05 | 13.40 |
| 950521 | 1930 | 2.28 | 301 | 12.09 | 83.48 | 1016 | 0.59 | 291 | 36.76 | -122.05 | 13.40 |
| 950521 | 1940 | 3.24 | 283 | 12.11 | 83.26 | 1016 | 0.61 | 294 | 36.76 | -122.05 | 13.50 |
| 950521 | 1950 | 3.67 | 274 | 12.07 | 85.66 | 1016 | 0.63 | 297 | 36.76 | -122.06 | 13.50 |
| 950521 | 2000 | 3.35 | 284 | 12.02 | 85.94 | 1016 | 0.63 | 280 | 36.76 | -122.06 | 13.60 |
| 950521 | 2010 | 2.92 | 278 | 12.26 | 86.17 | 1016 | 2.31 | 96 | 36.76 | -122.06 | 13.60 |
| 950521 | 2020 | 3.48 | 262 | 12.42 | 84.32 | 1016 | 2.77 | 111 | 36.76 | -122.04 | 13.40 |
| 950521 | 2030 | 3.36 | 254 | 12.28 | 85.27 | 1015 | 2.70 | 111 | 36.76 | -122.02 | 13.30 |
| 950521 | 2040 | 2.87 | 260 | 12.12 | 86.21 | 1015 | 1.62 | 112 | 36.75 | -122.00 | 13.30 |
| 950521 | 2050 | 3.32 | 275 | 12.04 | 85.70 | 1015 | 0.51 | 292 | 36.75 | -122.00 | 13.30 |
| 950521 | 2100 | 3.15 | 271 | 12.02 | 84.96 | 1015 | 0.59 | 286 | 36.75 | -122.01 | 13.30 |
| 950521 | 2110 | 3.12 | 283 | 12.06 | 84.93 | 1015 | 0.55 | 294 | 36.75 | -122.01 | 13.40 |
| 950521 | 2120 | 3.33 | 285 | 12.07 | 84.38 | 1015 | 0.51 | 281 | 36.75 | -122.01 | 13.40 |
| 950521 | 2130 | 2.53 | 280 | 12.19 | 84.47 | 1015 | 0.76 | 272 | 36.75 | -122.02 | 13.40 |
| 950521 | 2140 | 2.70 | 265 | 12.24 | 85.13 | 1015 | 1.97 | 68 | 36.75 | -122.02 | 13.50 |
| 950521 | 2150 | 4.29 | 257 | 12.55 | 84.49 | 1015 | 4.59 | 77 | 36.76 | -122.00 | 13.50 |
| 950521 | 2200 | 4.78 | 254 | 12.74 | 83.85 | 1015 | 5.01 | 77 | 36.77 | -121.97 | 13.40 |
| 950521 | 2210 | 4.85 | 255 | 12.87 | 83.15 | 1015 | 5.12 | 78 | 36.77 | -121.93 | 13.40 |
| 950521 | 2220 | 5.30 | 253 | 12.87 | 83.26 | 1015 | 5.16 | 77 | 36.78 | -121.90 | 13.60 |
| 950521 | 2230 | 5.16 | 251 | 13.07 | 83.68 | 1015 | 5.08 | 73 | 36.78 | -121.87 | 14.20 |
| 950521 | 2240 | 5.14 | 241 | 13.06 | 82.21 | 1014 | 5.00 | 73 | 36.79 | -121.83 | 14.00 |
| 950521 | 2250 | 4.53 | 237 | 12.76 | 82.70 | 1014 | 4.94 | 61 | 36.80 | -121.80 | 14.00 |
| 950521 | 2300 | 2.66 | 228 | 12.68 | 82.94 | 1014 | 0.92 | 153 | 36.80 | -121.79 | 14.90 |
| 950521 | 2310 | 1.15 | 249 | 12.59 | 84.73 | 1014 | 0.80 | 15 | 36.80 | -121.79 | 15.50 |
| 950521 | 2320 | 4.14 | 253 | 12.53 | 85.32 | 1014 | 2.90 | 245 | 36.81 | -121.79 | 14.00 |
| 950521 | 2330 | 4.60 | 256 | 12.25 | 87.14 | 1013 | 4.74 | 256 | 36.80 | -121.82 | 14.00 |
| 950521 | 2340 | 5.51 | 258 | 12.22 | 88.74 | 1013 | 4.80 | 256 | 36.79 | -121.85 | 14.00 |
| 950521 | 2350 | 6.66 | 266 | 12.09 | 91.93 | 1013 | 4.69 | 256 | 36.78 | -121.88 | 13.60 |
| 950522 | 0 | 6.17 | 272 | 11.88 | 91.96 | 1013 | 4.52 | 254 | 36.78 | -121.91 | 13.30 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950522 | 10 | 6.09 | 277 | 11.82 | 92.17 | 1013 | 4.59 | 254 | 36.77 | -121.94 | 13.30 |
| 950522 | 20 | 6.50 | 286 | 11.88 | 89.82 | 1013 | 4.66 | 256 | 36.77 | -121.97 | 13.40 |
| 950522 | 30 | 6.72 | 286 | 11.94 | 92.18 | 1013 | 3.60 | 257 | 36.76 | -122.00 | 13.30 |
| 950522 | 40 | 6.64 | 283 | 11.90 | 94.03 | 1013 | 0.63 | 262 | 36.76 | -122.01 | 13.10 |
| 950522 | 50 | 6.90 | 283 | 11.81 | 92.91 | 1013 | 0.69 | 264 | 36.76 | -122.02 | 13.20 |
| 950522 | 100 | 6.90 | 283 | 11.83 | 93.50 | 1013 | 0.64 | 265 | 36.76 | -122.02 | 13.30 |
| 950522 | 110 | 6.77 | 281 | 11.71 | 93.70 | 1013 | 0.64 | 256 | 36.76 | -122.03 | 13.30 |
| 950522 | 120 | 6.86 | 284 | 11.61 | 93.33 | 1013 | 0.67 | 257 | 36.76 | -122.03 | 13.20 |
| 950522 | 130 | 6.44 | 281 | 11.53 | 93.57 | 1013 | 0.69 | 258 | 36.75 | -122.03 | 13.00 |
| 950522 | 140 | 6.55 | 283 | 11.56 | 92.32 | 1013 | 0.69 | 259 | 36.75 | -122.04 | 12.90 |
| 950522 | 150 | 6.89 | 278 | 11.67 | 90.86 | 1013 | 0.65 | 253 | 36.75 | -122.04 | 12.80 |
| 950522 | 200 | 6.65 | 278 | 11.68 | 91.32 | 1013 | 0.66 | 253 | 36.75 | -122.05 | 12.90 |
| 950522 | 210 | 6.50 | 276 | 11.59 | 92.95 | 1013 | 0.51 | 250 | 36.75 | -122.05 | 12.90 |
| 950522 | 220 | 6.50 | 279 | 11.47 | 94.09 | 1013 | 0.52 | 256 | 36.75 | -122.05 | 13.00 |
| 950522 | 230 | 6.51 | 278 | 11.42 | 94.63 | 1013 | 0.58 | 258 | 36.75 | -122.06 | 13.00 |
| 950522 | 240 | 6.73 | 278 | 11.37 | 95.38 | 1013 | 0.55 | 260 | 36.75 | -122.06 | 13.10 |
| 950522 | 250 | 6.56 | 275 | 11.37 | 95.79 | 1013 | 0.83 | 258 | 36.75 | -122.07 | 13.00 |
| 950522 | 300 | 6.91 | 273 | 11.36 | 95.99 | 1013 | 0.80 | 258 | 36.75 | -122.07 | 12.80 |
| 950522 | 310 | 7.09 | 276 | 11.31 | 95.98 | 1013 | 0.80 | 260 | 36.75 | -122.08 | 12.90 |
| 950522 | 320 | 7.37 | 278 | 11.35 | 94.72 | 1013 | 0.83 | 259 | 36.75 | -122.08 | 12.90 |
| 950522 | 330 | 7.89 | 281 | 11.44 | 92.89 | 1013 | 0.84 | 254 | 36.74 | -122.09 | 12.90 |
| 950522 | 340 | 7.90 | 283 | 11.48 | 92.77 | 1013 | 0.86 | 254 | 36.74 | -122.09 | 12.90 |
| 950522 | 350 | 8.34 | 283 | 11.52 | 92.95 | 1013 | 1.03 | 250 | 36.74 | -122.10 | 12.80 |
| 950522 | 400 | 7.85 | 285 | 11.49 | 93.40 | 1013 | 1.09 | 251 | 36.74 | -122.11 | 12.60 |
| 950522 | 410 | 7.76 | 285 | 11.46 | 93.03 | 1013 | 1.13 | 252 | 36.74 | -122.11 | 12.60 |
| 950522 | 420 | 7.53 | 288 | 11.49 | 93.38 | 1013 | 1.09 | 255 | 36.74 | -122.12 | 12.60 |
| 950522 | 430 | 8.12 | 288 | 11.57 | 93.07 | 1013 | 1.02 | 253 | 36.74 | -122.13 | 12.70 |
| 950522 | 440 | 8.63 | 287 | 11.58 | 92.72 | 1013 | 0.93 | 252 | 36.73 | -122.13 | 12.90 |
| 950522 | 450 | 9.35 | 284 | 11.65 | 91.48 | 1013 | 0.81 | 255 | 36.73 | -122.14 | 13.00 |
| 950522 | 500 | 9.72 | 278 | 11.67 | 90.46 | 1014 | 0.80 | 251 | 36.73 | -122.14 | 13.00 |
| 950522 | 510 | 9.56 | 281 | 11.66 | 90.65 | 1014 | 0.82 | 254 | 36.73 | -122.15 | 12.90 |
| 950522 | 520 | 9.18 | 292 | 11.68 | 90.30 | 1014 | 0.88 | 260 | 36.73 | -122.15 | 12.80 |
| 950522 | 530 | 7.57 | 303 | 11.64 | 90.32 | 1014 | 0.96 | 263 | 36.73 | -122.16 | 13.00 |
| 950522 | 540 | 6.28 | 309 | 11.64 | 91.66 | 1014 | 1.02 | 264 | 36.73 | -122.17 | 13.10 |
| 950522 | 550 | 6.29 | 304 | 11.55 | 92.02 | 1014 | 0.81 | 258 | 36.73 | -122.17 | 13.10 |
| 950522 | 600 | 6.58 | 303 | 11.57 | 92.15 | 1014 | 0.86 | 257 | 36.73 | -122.18 | 13.00 |
| 950522 | 610 | 6.46 | 299 | 11.53 | 89.43 | 1014 | 0.85 | 259 | 36.73 | -122.18 | 13.00 |
| 950522 | 620 | 6.06 | 306 | 11.69 | 88.01 | 1014 | 0.82 | 257 | 36.72 | -122.19 | 13.00 |
| 950522 | 630 | 6.43 | 305 | 11.71 | 86.46 | 1014 | 0.84 | 253 | 36.72 | -122.20 | 13.00 |
| 950522 | 640 | 6.60 | 301 | 11.70 | 85.53 | 1014 | 0.78 | 255 | 36.72 | -122.20 | 12.90 |
| 950522 | 650 | 6.67 | 299 | 11.67 | 84.45 | 1014 | 0.85 | 257 | 36.72 | -122.21 | 12.90 |
| 950522 | 700 | 5.90 | 298 | 11.63 | 85.24 | 1014 | 0.87 | 261 | 36.72 | -122.21 | 12.90 |
| 950522 | 710 | 5.61 | 305 | 11.54 | 85.86 | 1014 | 0.80 | 264 | 36.72 | -122.22 | 12.80 |
| 950522 | 720 | 5.45 | 302 | 11.51 | 83.84 | 1014 | 0.63 | 258 | 36.72 | -122.22 | 12.80 |
| 950522 | 730 | 5.42 | 295 | 11.54 | 84.02 | 1014 | 0.57 | 260 | 36.72 | -122.23 | 12.80 |
| 950522 | 740 | 5.24 | 300 | 11.53 | 83.93 | 1014 | 0.61 | 261 | 36.72 | -122.23 | 12.90 |
| 950522 | 750 | 5.69 | 301 | 11.54 | 82.05 | 1014 | 0.56 | 263 | 36.72 | -122.23 | 12.90 |
| 950522 | 800 | 6.15 | 288 | 11.53 | 81.48 | 1014 | 0.53 | 253 | 36.72 | -122.24 | 12.90 |
| 950522 | 810 | 5.36 | 293 | 11.58 | 82.63 | 1014 | 0.55 | 257 | 36.72 | -122.24 | 13.00 |
| 950522 | 820 | 5.52 | 291 | 11.61 | 80.66 | 1014 | 0.59 | 257 | 36.72 | -122.24 | 13.00 |
| 950522 | 830 | 5.16 | 289 | 11.58 | 81.30 | 1014 | 0.57 | 261 | 36.72 | -122.25 | 13.00 |
| 950522 | 840 | 6.49 | 280 | 11.58 | 83.25 | 1013 | 0.56 | 247 | 36.71 | -122.25 | 12.90 |
| 950522 | 850 | 6.02 | 275 | 11.45 | 83.08 | 1013 | 0.49 | 238 | 36.71 | -122.25 | 12.90 |
| 950522 | 900 | 6.36 | 279 | 11.43 | 81.06 | 1013 | 0.52 | 241 | 36.71 | -122.26 | 12.90 |
| 950522 | 910 | 6.54 | 267 | 11.44 | 77.48 | 1013 | 0.44 | 241 | 36.71 | -122.26 | 12.90 |
| 950522 | 920 | 6.02 | 267 | 11.46 | 76.71 | 1013 | 0.41 | 238 | 36.71 | -122.26 | 12.90 |
| 950522 | 930 | 5.80 | 269 | 11.47 | 77.49 | 1013 | 0.48 | 243 | 36.71 | -122.27 | 12.90 |
| 950522 | 940 | 5.55 | 272 | 11.52 | 77.62 | 1013 | 0.53 | 245 | 36.71 | -122.27 | 12.90 |
| 950522 | 950 | 6.27 | 256 | 11.55 | 77.02 | 1013 | 0.45 | 242 | 36.71 | -122.27 | 12.90 |
| 950522 | 1000 | 5.82 | 271 | 11.57 | 76.28 | 1013 | 0.52 | 249 | 36.70 | -122.27 | 12.90 |
| 950522 | 1010 | 6.12 | 270 | 11.71 | 76.68 | 1013 | 0.58 | 250 | 36.70 | -122.28 | 13.00 |
| 950522 | 1020 | 5.61 | 273 | 11.74 | 76.99 | 1013 | 0.70 | 257 | 36.70 | -122.28 | 13.10 |
| 950522 | 1030 | 4.82 | 268 | 11.85 | 78.58 | 1013 | 0.73 | 252 | 36.70 | -122.29 | 13.10 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950522 | 1040 | 4.48 | 269 | 11.82 | 80.13 | 1013 | 0.75 | 258 | 36.70 | -122.29 | 13.20 |
| 950522 | 1050 | 4.28 | 277 | 11.87 | 81.24 | 1013 | 0.76 | 265 | 36.70 | -122.30 | 13.20 |
| 950522 | 1100 | 5.99 | 277 | 12.00 | 82.18 | 1013 | 0.76 | 259 | 36.70 | -122.30 | 13.20 |
| 950522 | 1110 | 6.38 | 285 | 11.98 | 85.61 | 1013 | 0.64 | 263 | 36.70 | -122.31 | 13.30 |
| 950522 | 1120 | 7.23 | 273 | 11.88 | 86.16 | 1013 | 0.68 | 258 | 36.70 | -122.31 | 13.20 |
| 950522 | 1130 | 6.28 | 283 | 11.76 | 86.79 | 1013 | 0.71 | 261 | 36.70 | -122.32 | 13.20 |
| 950522 | 1140 | 6.32 | 290 | 11.78 | 85.79 | 1013 | 0.68 | 265 | 36.70 | -122.32 | 13.30 |
| 950522 | 1150 | 7.19 | 286 | 11.72 | 85.13 | 1013 | 0.67 | 257 | 36.70 | -122.32 | 13.30 |
| 950522 | 1200 | 6.22 | 290 | 11.69 | 87.22 | 1013 | 0.74 | 261 | 36.70 | -122.33 | 13.30 |
| 950522 | 1210 | 6.33 | 287 | 11.65 | 88.76 | 1013 | 0.69 | 261 | 36.70 | -122.33 | 13.30 |
| 950522 | 1220 | 6.02 | 288 | 11.51 | 89.74 | 1013 | 0.74 | 263 | 36.70 | -122.34 | 13.30 |
| 950522 | 1230 | 5.97 | 288 | 11.35 | 91.53 | 1013 | 0.70 | 262 | 36.69 | -122.34 | 13.30 |
| 950522 | 1240 | 6.84 | 297 | 11.21 | 91.68 | 1013 | 0.31 | 285 | 36.69 | -122.35 | 13.30 |
| 950522 | 1250 | 5.81 | 313 | 10.94 | 93.90 | 1013 | 4.71 | 80 | 36.70 | -122.33 | 13.20 |
| 950522 | 1300 | 5.46 | 314 | 10.79 | 94.92 | 1013 | 4.72 | 79 | 36.70 | -122.30 | 13.10 |
| 950522 | 1310 | 5.41 | 313 | 10.80 | 95.35 | 1013 | 4.79 | 79 | 36.71 | -122.27 | 12.80 |
| 950522 | 1320 | 4.84 | 314 | 10.84 | 95.91 | 1013 | 4.77 | 76 | 36.71 | -122.24 | 12.80 |
| 950522 | 1330 | 4.75 | 317 | 10.86 | 96.01 | 1013 | 4.79 | 74 | 36.72 | -122.21 | 12.80 |
| 950522 | 1340 | 4.80 | 316 | 10.98 | 95.79 | 1013 | 4.79 | 74 | 36.73 | -122.18 | 13.10 |
| 950522 | 1350 | 4.59 | 319 | 11.09 | 94.64 | 1013 | 4.86 | 75 | 36.73 | -122.15 | 12.90 |
| 950522 | 1400 | 4.62 | 315 | 11.13 | 93.95 | 1013 | 4.82 | 73 | 36.74 | -122.11 | 12.80 |
| 950522 | 1410 | 4.86 | 314 | 11.15 | 94.00 | 1013 | 4.83 | 76 | 36.75 | -122.08 | 13.10 |
| 950522 | 1420 | 5.00 | 306 | 11.16 | 94.00 | 1013 | 4.77 | 76 | 36.75 | -122.05 | 13.00 |
| 950522 | 1430 | 4.87 | 298 | 11.13 | 94.02 | 1013 | 4.65 | 76 | 36.76 | -122.02 | 13.00 |
| 950522 | 1440 | 5.16 | 292 | 11.10 | 94.02 | 1013 | 4.63 | 78 | 36.76 | -121.99 | 13.20 |
| 950522 | 1450 | 5.03 | 287 | 11.06 | 94.25 | 1013 | 4.61 | 79 | 36.77 | -121.96 | 13.40 |
| 950522 | 1500 | 5.56 | 284 | 11.10 | 94.68 | 1013 | 4.68 | 79 | 36.77 | -121.93 | 13.50 |
| 950522 | 1510 | 5.23 | 281 | 11.12 | 95.45 | 1013 | 4.72 | 75 | 36.78 | -121.90 | 13.60 |
| 950522 | 1520 | 4.96 | 281 | 11.17 | 95.46 | 1014 | 4.75 | 76 | 36.79 | -121.87 | 13.70 |
| 950522 | 1530 | 4.29 | 281 | 11.23 | 94.69 | 1014 | 4.70 | 74 | 36.79 | -121.84 | 13.70 |
| 950522 | 1540 | 4.08 | 279 | 11.25 | 93.56 | 1014 | 4.14 | 67 | 36.80 | -121.81 | 13.60 |
| 950522 | 1550 | 3.31 | 282 | 11.30 | 91.91 | 1014 | 0.54 | 91 | 36.80 | -121.79 | 13.40 |
| 950522 | 1600 | 2.06 | 336 | 11.29 | 92.63 | 1014 | 0.84 | 294 | 36.80 | -121.80 | 12.90 |
| 950522 | 1610 | 3.47 | 315 | 11.18 | 93.78 | 1014 | 0.26 | 109 | 36.81 | -121.80 | 13.50 |
| 950522 | 1620 | 2.83 | 297 | 11.11 | 92.35 | 1014 | 1.00 | 294 | 36.81 | -121.80 | 13.50 |
| 950522 | 1630 | 3.77 | 282 | 11.12 | 91.03 | 1014 | 0.88 | 281 | 36.81 | -121.80 | 13.40 |
| 950522 | 1640 | 2.67 | 284 | 11.06 | 92.72 | 1014 | 0.46 | 279 | 36.81 | -121.81 | 13.50 |
| 950522 | 1650 | 3.44 | 290 | 11.08 | 93.73 | 1014 | 0.97 | 292 | 36.81 | -121.82 | 13.30 |
| 950522 | 1700 | 4.47 | 292 | 11.19 | 92.73 | 1014 | 1.68 | 283 | 36.81 | -121.82 | 13.50 |
| 950522 | 1710 | 3.53 | 320 | 11.20 | 91.73 | 1014 | 0.09 | 351 | 36.81 | -121.83 | 13.70 |
| 950522 | 1720 | 4.94 | 308 | 11.20 | 90.23 | 1014 | 0.19 | 317 | 36.81 | -121.83 | 13.60 |
| 950522 | 1730 | 1.43 | 138 | 11.30 | 89.92 | 1014 | 0.62 | 151 | 36.81 | -121.83 | 13.70 |
| 950522 | 1740 | 4.04 | 17 | 11.32 | 89.39 | 1014 | 0.33 | 129 | 36.81 | -121.83 | 13.80 |
| 950522 | 1750 | 1.58 | 306 | 11.40 | 89.06 | 1014 | 1.92 | 295 | 36.81 | -121.83 | 13.60 |
| 950522 | 1800 | 4.71 | 304 | 11.42 | 88.45 | 1014 | 0.34 | 280 | 36.81 | -121.84 | 13.70 |
| 950522 | 1810 | 3.43 | 329 | 11.44 | 89.49 | 1014 | 0.79 | 296 | 36.82 | -121.85 | 13.90 |
| 950522 | 1820 | 5.65 | 286 | 11.49 | 89.35 | 1014 | 1.25 | 295 | 36.82 | -121.85 | 13.90 |
| 950522 | 1830 | 4.69 | 295 | 11.35 | 89.92 | 1014 | 0.29 | 27 | 36.82 | -121.86 | 14.00 |
| 950522 | 1840 | 4.75 | 277 | 11.37 | 89.63 | 1014 | 2.04 | 285 | 36.82 | -121.86 | 13.70 |
| 950522 | 1850 | 4.69 | 292 | 11.41 | 89.61 | 1014 | 0.88 | 95 | 36.82 | -121.86 | 13.90 |
| 950522 | 1900 | 4.56 | 287 | 11.59 | 89.03 | 1014 | 2.56 | 245 | 36.82 | -121.87 | 13.60 |
| 950522 | 1910 | 5.09 | 271 | 11.28 | 89.79 | 1014 | 3.70 | 244 | 36.81 | -121.89 | 13.70 |
| 950522 | 1920 | 4.29 | 262 | 11.24 | 90.13 | 1014 | 3.68 | 242 | 36.80 | -121.91 | 13.80 |
| 950522 | 1930 | 4.32 | 261 | 11.25 | 90.04 | 1014 | 3.70 | 244 | 36.80 | -121.93 | 13.60 |
| 950522 | 1940 | 4.20 | 259 | 11.26 | 89.82 | 1014 | 3.73 | 238 | 36.79 | -121.96 | 13.60 |
| 950522 | 1950 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.50 |
| 950522 | 2000 | -99.00 | -99 | -99.00 | -99.00 | -99 | -99.00 | -99 | -99.00 | -99.00 | 13.20 |
| 950522 | 2010 | 5.85 | 266 | 11.19 | 91.91 | 1014 | 0.49 | 276 | 36.76 | -122.01 | 13.10 |
| 950522 | 2020 | 5.90 | 280 | 11.07 | 94.14 | 1014 | 0.37 | 293 | 36.76 | -122.02 | 13.10 |
| 950522 | 2030 | 5.45 | 276 | 10.95 | 95.95 | 1014 | 0.45 | 282 | 36.76 | -122.02 | 13.20 |
| 950522 | 2040 | 5.46 | 269 | 10.93 | 96.28 | 1014 | 0.43 | 269 | 36.76 | -122.02 | 13.30 |
| 950522 | 2050 | 5.45 | 274 | 10.93 | 96.54 | 1014 | 0.39 | 274 | 36.76 | -122.02 | 13.20 |
| 950522 | 2100 | 5.64 | 304 | 10.97 | 96.93 | 1014 | 0.40 | 311 | 36.76 | -122.03 | 13.00 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950522 | 2110 | 5.68 | 308 | 10.95 | 97.24 | 1014 | 0.40 | 312 | 36.76 | -122.03 | 13.00 |
| 950522 | 2120 | 5.44 | 308 | 10.99 | 97.46 | 1014 | 0.29 | 312 | 36.76 | -122.03 | 13.10 |
| 950522 | 2130 | 5.99 | 300 | 11.06 | 97.06 | 1014 | 0.26 | 293 | 36.76 | -122.03 | 13.10 |
| 950522 | 2140 | 5.85 | 297 | 11.13 | 96.21 | 1014 | 0.26 | 288 | 36.76 | -122.03 | 13.00 |
| 950522 | 2150 | 5.85 | 289 | 11.18 | 95.97 | 1014 | 0.22 | 280 | 36.76 | -122.03 | 13.10 |
| 950522 | 2200 | 6.67 | 276 | 11.31 | 94.74 | 1014 | 0.28 | 264 | 36.76 | -122.04 | 13.00 |
| 950522 | 2210 | 6.90 | 267 | 11.33 | 93.66 | 1014 | 0.22 | 249 | 36.76 | -122.04 | 13.00 |
| 950522 | 2220 | 5.78 | 248 | 11.34 | 92.81 | 1014 | 0.22 | 223 | 36.76 | -122.04 | 13.00 |
| 950522 | 2230 | 8.47 | 267 | 11.32 | 92.02 | 1014 | 0.48 | 254 | 36.76 | -122.04 | 13.10 |
| 950522 | 2240 | 8.31 | 269 | 11.35 | 90.24 | 1014 | 0.44 | 255 | 36.76 | -122.04 | 13.00 |
| 950522 | 2250 | 9.07 | 266 | 11.43 | 89.88 | 1014 | 0.48 | 254 | 36.76 | -122.05 | 13.10 |
| 950522 | 2300 | 9.44 | 264 | 11.45 | 89.63 | 1013 | 0.42 | 253 | 36.76 | -122.05 | 13.20 |
| 950522 | 2310 | 9.12 | 256 | 11.41 | 88.86 | 1013 | 0.36 | 241 | 36.76 | -122.05 | 13.20 |
| 950522 | 2320 | 8.84 | 258 | 11.42 | 88.19 | 1013 | 0.42 | 242 | 36.76 | -122.05 | 13.30 |
| 950522 | 2330 | 8.19 | 255 | 11.45 | 87.36 | 1013 | 0.47 | 240 | 36.76 | -122.06 | 13.30 |
| 950522 | 2340 | 8.26 | 260 | 11.42 | 87.55 | 1013 | 0.48 | 240 | 36.76 | -122.06 | 13.30 |
| 950522 | 2350 | 8.77 | 255 | 11.47 | 87.95 | 1013 | 0.50 | 238 | 36.75 | -122.06 | 13.20 |
| 950523 | 0 | 9.30 | 252 | 11.44 | 87.96 | 1013 | 0.42 | 237 | 36.75 | -122.07 | 13.20 |
| 950523 | 10 | 8.21 | 249 | 11.47 | 88.43 | 1013 | 0.35 | 234 | 36.75 | -122.07 | 13.20 |
| 950523 | 20 | 9.53 | 246 | 11.43 | 88.09 | 1013 | 0.53 | 233 | 36.75 | -122.07 | 13.20 |
| 950523 | 30 | 9.03 | 263 | 11.44 | 87.85 | 1013 | 0.58 | 250 | 36.75 | -122.07 | 12.90 |
| 950523 | 40 | 8.46 | 264 | 11.51 | 87.82 | 1013 | 0.64 | 249 | 36.75 | -122.08 | 12.90 |
| 950523 | 50 | 7.72 | 275 | 11.56 | 87.70 | 1013 | 0.59 | 267 | 36.75 | -122.08 | 12.80 |
| 950523 | 100 | 8.61 | 290 | 11.63 | 87.32 | 1013 | 0.43 | 288 | 36.75 | -122.09 | 12.70 |
| 950523 | 110 | 9.02 | 266 | 11.51 | 87.49 | 1013 | 0.44 | 260 | 36.75 | -122.09 | 12.70 |
| 950523 | 120 | 9.07 | 277 | 11.50 | 87.15 | 1013 | 0.72 | 272 | 36.75 | -122.09 | 12.60 |
| 950523 | 130 | 8.71 | 272 | 11.45 | 87.55 | 1013 | 0.69 | 264 | 36.75 | -122.10 | 12.60 |
| 950523 | 140 | 8.52 | 273 | 11.45 | 87.38 | 1013 | 0.86 | 253 | 36.75 | -122.10 | 12.60 |
| 950523 | 150 | 8.49 | 270 | 11.50 | 86.42 | 1013 | 0.84 | 250 | 36.75 | -122.11 | 12.60 |
| 950523 | 200 | 8.73 | 274 | 11.48 | 86.83 | 1013 | 0.87 | 253 | 36.74 | -122.11 | 12.50 |
| 950523 | 210 | 8.91 | 259 | 11.36 | 87.09 | 1013 | 0.65 | 243 | 36.74 | -122.12 | 12.60 |
| 950523 | 220 | 8.86 | 273 | 11.29 | 87.32 | 1013 | 0.73 | 261 | 36.74 | -122.12 | 12.70 |
| 950523 | 230 | 9.84 | 270 | 11.29 | 85.63 | 1013 | 0.66 | 259 | 36.74 | -122.13 | 12.80 |
| 950523 | 240 | 9.99 | 261 | 11.31 | 85.43 | 1013 | 0.62 | 249 | 36.74 | -122.13 | 12.70 |
| 950523 | 250 | 10.61 | 259 | 11.32 | 85.39 | 1013 | 0.63 | 244 | 36.74 | -122.13 | 12.70 |
| 950523 | 300 | 10.37 | 264 | 11.32 | 85.52 | 1013 | 0.66 | 249 | 36.74 | -122.14 | 12.80 |
| 950523 | 310 | 9.20 | 266 | 11.32 | 86.28 | 1014 | 0.70 | 248 | 36.74 | -122.14 | 12.80 |
| 950523 | 320 | 8.72 | 275 | 11.28 | 87.43 | 1014 | 0.80 | 254 | 36.74 | -122.15 | 12.90 |
| 950523 | 330 | 8.38 | 281 | 11.28 | 87.96 | 1014 | 0.78 | 258 | 36.73 | -122.15 | 13.00 |
| 950523 | 340 | 8.02 | 281 | 11.33 | 88.71 | 1014 | 0.87 | 257 | 36.73 | -122.16 | 13.00 |
| 950523 | 350 | 7.13 | 279 | 11.33 | 89.92 | 1014 | 0.89 | 255 | 36.73 | -122.16 | 13.10 |
| 950523 | 400 | 7.07 | 276 | 11.32 | 90.55 | 1014 | 0.92 | 255 | 36.73 | -122.17 | 13.00 |
| 950523 | 410 | 7.93 | 256 | 11.30 | 89.76 | 1014 | 0.78 | 236 | 36.73 | -122.18 | 12.90 |
| 950523 | 420 | 7.77 | 276 | 11.34 | 90.13 | 1014 | 0.85 | 252 | 36.73 | -122.18 | 12.90 |
| 950523 | 430 | 7.59 | 279 | 11.39 | 90.32 | 1014 | 0.80 | 252 | 36.73 | -122.19 | 13.00 |
| 950523 | 440 | 6.82 | 283 | 11.39 | 91.45 | 1014 | 0.92 | 256 | 36.73 | -122.19 | 13.00 |
| 950523 | 450 | 6.47 | 282 | 11.27 | 92.03 | 1014 | 0.84 | 255 | 36.72 | -122.20 | 12.90 |
| 950523 | 500 | 5.10 | 297 | 11.28 | 92.66 | 1014 | 0.88 | 266 | 36.72 | -122.20 | 12.90 |
| 950523 | 510 | 4.66 | 295 | 11.31 | 93.19 | 1014 | 0.71 | 262 | 36.72 | -122.21 | 13.00 |
| 950523 | 520 | 4.82 | 286 | 11.27 | 93.18 | 1014 | 0.52 | 248 | 36.72 | -122.21 | 13.00 |
| 950523 | 530 | 4.51 | 279 | 11.33 | 93.58 | 1014 | 0.55 | 244 | 36.72 | -122.22 | 13.00 |
| 950523 | 540 | 4.57 | 279 | 11.31 | 94.00 | 1014 | 0.64 | 252 | 36.72 | -122.22 | 13.00 |
| 950523 | 550 | 4.41 | 285 | 11.29 | 94.31 | 1014 | 0.58 | 257 | 36.72 | -122.22 | 13.10 |
| 950523 | 600 | 4.49 | 297 | 11.28 | 95.38 | 1014 | 0.82 | 261 | 36.72 | -122.23 | 13.10 |
| 950523 | 610 | 4.26 | 291 | 11.31 | 95.86 | 1014 | 0.70 | 262 | 36.72 | -122.23 | 13.20 |
| 950523 | 620 | 4.08 | 294 | 11.27 | 95.99 | 1014 | 0.73 | 266 | 36.72 | -122.24 | 13.20 |
| 950523 | 630 | 4.12 | 293 | 11.29 | 96.19 | 1014 | 0.72 | 269 | 36.72 | -122.24 | 13.30 |
| 950523 | 640 | 4.06 | 295 | 11.26 | 96.25 | 1014 | 0.65 | 267 | 36.72 | -122.25 | 13.30 |
| 950523 | 650 | 3.62 | 295 | 11.31 | 96.53 | 1014 | 0.75 | 271 | 36.72 | -122.25 | 13.30 |
| 950523 | 700 | 3.11 | 289 | 11.31 | 97.02 | 1014 | 0.69 | 272 | 36.72 | -122.26 | 13.30 |
| 950523 | 710 | 3.40 | 290 | 11.33 | 97.36 | 1014 | 0.68 | 273 | 36.72 | -122.26 | 13.40 |
| 950523 | 720 | 3.77 | 292 | 11.39 | 97.52 | 1013 | 0.65 | 279 | 36.72 | -122.27 | 13.40 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 950523 | 730 | 3.52 | 286 | 11.40 | 97.54 | 1013 | 0.75 | 270 | 36.72 | -122.27 | 13.40 |
| 950523 | 740 | 3.53 | 296 | 11.40 | 97.77 | 1013 | 0.76 | 271 | 36.72 | -122.28 | 13.40 |
| 950523 | 750 | 3.33 | 298 | 11.44 | 97.77 | 1013 | 0.83 | 255 | 36.72 | -122.28 | 13.40 |
| 950523 | 800 | 3.98 | 310 | 11.53 | 97.22 | 1013 | 0.64 | 261 | 36.72 | -122.29 | 13.30 |
| 950523 | 810 | 3.67 | 320 | 11.59 | 97.09 | 1013 | 0.74 | 269 | 36.71 | -122.29 | 13.20 |
| 950523 | 820 | 4.46 | 307 | 11.61 | 96.53 | 1013 | 0.73 | 260 | 36.71 | -122.30 | 13.20 |
| 950523 | 830 | 4.33 | 306 | 11.66 | 95.70 | 1013 | 0.53 | 252 | 36.71 | -122.30 | 13.20 |
| 950523 | 840 | 4.87 | 316 | 11.73 | 93.44 | 1013 | 0.59 | 254 | 36.71 | -122.31 | 13.20 |
| 950523 | 850 | 4.47 | 323 | 11.83 | 92.62 | 1013 | 0.51 | 263 | 36.71 | -122.31 | 13.20 |
| 950523 | 900 | 4.86 | 309 | 11.89 | 92.09 | 1013 | 0.64 | 251 | 36.71 | -122.31 | 13.20 |
| 950523 | 910 | 4.42 | 296 | 11.84 | 92.84 | 1013 | 0.62 | 237 | 36.71 | -122.32 | 13.10 |
| 950523 | 920 | 4.34 | 310 | 11.83 | 92.24 | 1013 | 0.53 | 252 | 36.71 | -122.32 | 13.10 |
| 950523 | 930 | 4.99 | 305 | 11.82 | 92.51 | 1013 | 0.52 | 248 | 36.71 | -122.32 | 13.10 |
| 950523 | 940 | 4.91 | 301 | 11.77 | 92.67 | 1013 | 0.58 | 257 | 36.70 | -122.33 | 13.20 |
| 950523 | 950 | 5.00 | 308 | 11.70 | 92.35 | 1013 | 0.53 | 261 | 36.70 | -122.33 | 13.20 |
| 950523 | 1000 | 5.93 | 304 | 11.68 | 91.90 | 1012 | 0.72 | 261 | 36.70 | -122.33 | 13.20 |
| 950523 | 1010 | 5.39 | 311 | 11.67 | 92.02 | 1012 | 0.83 | 255 | 36.70 | -122.34 | 13.30 |
| 950523 | 1020 | 5.03 | 316 | 11.68 | 92.11 | 1012 | 0.76 | 263 | 36.70 | -122.34 | 13.30 |
| 950523 | 1030 | 4.72 | 321 | 11.60 | 92.33 | 1012 | 0.77 | 260 | 36.70 | -122.35 | 13.30 |
| 950523 | 1040 | 4.30 | 317 | 11.61 | 92.94 | 1012 | 0.55 | 256 | 36.70 | -122.35 | 13.30 |
| 950523 | 1050 | 4.47 | 321 | 11.60 | 92.65 | 1012 | 0.55 | 266 | 36.70 | -122.36 | 13.30 |
| 950523 | 1100 | 4.30 | 316 | 11.64 | 92.65 | 1012 | 0.55 | 250 | 36.70 | -122.36 | 13.40 |
| 950523 | 1110 | 5.88 | 304 | 11.63 | 92.08 | 1012 | 0.46 | 258 | 36.70 | -122.36 | 13.40 |
| 950523 | 1120 | 6.78 | 298 | 11.53 | 91.77 | 1012 | 0.47 | 254 | 36.70 | -122.37 | 13.30 |
| 950523 | 1130 | 6.73 | 302 | 11.51 | 91.09 | 1012 | 0.46 | 262 | 36.70 | -122.37 | 13.30 |
| 950523 | 1140 | 6.09 | 308 | 11.45 | 91.95 | 1012 | 0.43 | 264 | 36.70 | -122.37 | 13.30 |
| 950523 | 1150 | 5.84 | 315 | 11.44 | 92.30 | 1012 | 0.30 | 276 | 36.70 | -122.38 | 13.30 |
| 950523 | 1200 | 7.01 | 304 | 11.38 | 92.06 | 1012 | 0.43 | 267 | 36.70 | -122.38 | 13.30 |
| 950523 | 1210 | 6.38 | 308 | 11.35 | 92.37 | 1012 | 0.47 | 267 | 36.70 | -122.38 | 13.30 |
| 950523 | 1220 | 6.84 | 303 | 11.35 | 92.56 | 1012 | 0.46 | 264 | 36.70 | -122.38 | 13.30 |
| 950523 | 1230 | 6.80 | 302 | 11.35 | 92.52 | 1012 | 0.47 | 258 | 36.70 | -122.39 | 13.40 |
| 950523 | 1240 | 6.20 | 309 | 11.34 | 92.70 | 1012 | 0.42 | 263 | 36.70 | -122.39 | 13.40 |
| 950523 | 1250 | 6.12 | 346 | 11.37 | 92.35 | 1012 | 3.71 | 76 | 36.70 | -122.38 | 13.40 |
| 950523 | 1300 | 6.57 | 352 | 11.29 | 91.97 | 1012 | 4.61 | 77 | 36.71 | -122.35 | 13.30 |
| 950523 | 1310 | 5.78 | 346 | 11.25 | 92.14 | 1012 | 4.83 | 78 | 36.71 | -122.32 | 13.10 |
| 950523 | 1320 | 4.71 | 342 | 11.18 | 92.77 | 1012 | 4.74 | 78 | 36.72 | -122.29 | 12.90 |
| 950523 | 1330 | 4.31 | 334 | 11.15 | 93.81 | 1012 | 4.66 | 78 | 36.72 | -122.26 | 12.90 |
| 950523 | 1340 | 4.07 | 333 | 11.13 | 94.08 | 1012 | 4.72 | 77 | 36.73 | -122.23 | 12.90 |
| 950523 | 1350 | 3.06 | 341 | 11.12 | 95.72 | 1013 | 4.92 | 79 | 36.73 | -122.20 | 12.80 |
| 950523 | 1400 | 2.52 | 330 | 11.07 | 96.56 | 1013 | 4.97 | 79 | 36.74 | -122.17 | 12.80 |
| 950523 | 1410 | 1.57 | 275 | 11.10 | 97.96 | 1013 | 4.88 | 77 | 36.74 | -122.13 | 12.90 |
| 950523 | 1420 | 1.83 | 251 | 11.09 | 98.33 | 1013 | 4.82 | 75 | 36.75 | -122.10 | 13.10 |
| 950523 | 1430 | 1.89 | 250 | 11.09 | 98.41 | 1013 | 4.89 | 75 | 36.75 | -122.07 | 13.10 |
| 950523 | 1440 | 1.23 | 258 | 11.14 | 98.25 | 1013 | 4.69 | 75 | 36.76 | -122.04 | 13.10 |
| 950523 | 1450 | 1.60 | 240 | 11.24 | 98.21 | 1013 | 4.68 | 76 | 36.77 | -122.01 | 13.30 |
| 950523 | 1500 | 2.07 | 233 | 11.33 | 98.18 | 1013 | 4.65 | 76 | 36.77 | -121.98 | 13.40 |
| 950523 | 1510 | 1.82 | 238 | 11.33 | 97.56 | 1013 | 4.69 | 79 | 36.78 | -121.95 | 13.30 |
| 950523 | 1520 | 2.46 | 221 | 11.43 | 97.03 | 1013 | 4.76 | 78 | 36.78 | -121.92 | 13.30 |
| 950523 | 1530 | 3.13 | 230 | 11.35 | 94.56 | 1013 | 4.74 | 79 | 36.79 | -121.89 | 13.50 |
| 950523 | 1540 | 2.66 | 233 | 11.48 | 93.94 | 1013 | 4.66 | 79 | 36.79 | -121.85 | 13.60 |
| 950523 | 1550 | 2.55 | 221 | 11.58 | 92.66 | 1013 | 4.68 | 73 | 36.80 | -121.82 | 13.70 |
| 950523 | 1600 | 1.56 | 212 | 11.58 | 92.85 | 1013 | 1.77 | 73 | 36.80 | -121.80 | 13.40 |
| 950523 | 1610 | 2.21 | 255 | 11.63 | 93.03 | 1013 | 0.27 | 55 | 36.80 | -121.80 | 13.30 |
| 950523 | 1620 | 2.86 | 240 | 11.53 | 92.38 | 1013 | 0.85 | 295 | 36.81 | -121.80 | 13.60 |
| 950523 | 1630 | 1.87 | 245 | 11.53 | 92.09 | 1013 | 0.13 | 99 | 36.81 | -121.80 | 13.60 |
| 950523 | 1640 | 1.64 | 229 | 11.59 | 91.93 | 1013 | 1.52 | 294 | 36.81 | -121.81 | 13.80 |
| 950523 | 1650 | 1.59 | 245 | 11.83 | 91.52 | 1014 | 0.38 | 109 | 36.81 | -121.81 | 13.90 |
| 950523 | 1700 | 0.67 | 185 | 11.72 | 90.93 | 1013 | 0.16 | 145 | 36.81 | -121.81 | 13.40 |
| 950523 | 1710 | 2.03 | 224 | 11.59 | 91.19 | 1013 | 0.94 | 264 | 36.81 | -121.81 | 13.60 |
| 950523 | 1720 | 2.11 | 241 | 11.58 | 91.88 | 1013 | 1.09 | 269 | 36.81 | -121.82 | 13.80 |
| 950523 | 1730 | 2.30 | 238 | 11.58 | 92.18 | 1013 | 0.59 | 266 | 36.81 | -121.82 | 13.90 |
| 950523 | 1740 | 2.67 | 254 | 11.67 | 93.74 | 1013 | 0.56 | 264 | 36.81 | -121.82 | 13.90 |
| 950523 | 1750 | 2.94 | 259 | 11.57 | 93.98 | 1013 | 0.54 | 263 | 36.81 | -121.83 | 13.90 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 950523 | 1800 | 2.68 | 259 | 11.56 | 94.00 | 1013 | 0.52 | 263 | 36.81 | -121.83 | 14.00 |
| 950523 | 1810 | 2.61 | 245 | 11.59 | 94.04 | 1014 | 0.55 | 234 | 36.81 | -121.84 | 14.00 |
| 950523 | 1820 | 3.34 | 253 | 11.60 | 94.43 | 1014 | 0.65 | 231 | 36.81 | -121.84 | 13.90 |
| 950523 | 1830 | 3.32 | 250 | 11.56 | 94.64 | 1014 | 0.57 | 228 | 36.80 | -121.84 | 13.90 |
| 950523 | 1840 | 3.72 | 247 | 11.52 | 95.43 | 1014 | 0.44 | 222 | 36.80 | -121.84 | 13.90 |
| 950523 | 1850 | 3.21 | 260 | 11.45 | 95.95 | 1014 | 0.43 | 225 | 36.80 | -121.85 | 13.90 |
| 950523 | 1900 | 3.35 | 269 | 11.48 | 95.78 | 1014 | 0.59 | 243 | 36.80 | -121.85 | 13.90 |
| 950523 | 1910 | 2.98 | 269 | 11.49 | 95.44 | 1014 | 0.61 | 241 | 36.80 | -121.85 | 13.90 |
| 950523 | 1920 | 2.77 | 268 | 11.50 | 95.13 | 1014 | 0.60 | 243 | 36.80 | -121.86 | 13.90 |
| 950523 | 1930 | 2.81 | 265 | 11.53 | 95.07 | 1014 | 0.67 | 243 | 36.79 | -121.86 | 14.00 |
| 950523 | 1940 | 2.44 | 257 | 11.54 | 94.95 | 1014 | 0.56 | 244 | 36.79 | -121.86 | 14.10 |
| 950523 | 1950 | 2.04 | 256 | 11.63 | 94.43 | 1014 | 0.62 | 242 | 36.79 | -121.87 | 14.20 |
| 950523 | 2000 | 2.10 | 255 | 11.70 | 93.95 | 1014 | 0.55 | 248 | 36.79 | -121.87 | 14.40 |
| 950523 | 2010 | 2.01 | 240 | 11.71 | 93.62 | 1014 | 0.66 | 240 | 36.79 | -121.87 | 14.30 |
| 950523 | 2020 | 2.02 | 240 | 11.75 | 93.23 | 1014 | 0.53 | 249 | 36.79 | -121.88 | 14.10 |
| 950523 | 2030 | 2.07 | 228 | 11.78 | 93.42 | 1013 | 0.56 | 245 | 36.79 | -121.88 | 14.10 |
| 950523 | 2040 | 1.59 | 248 | 11.75 | 93.75 | 1013 | 0.61 | 253 | 36.79 | -121.88 | 14.10 |
| 950523 | 2050 | 1.67 | 245 | 11.79 | 93.43 | 1013 | 0.69 | 234 | 36.78 | -121.89 | 14.20 |
| 950523 | 2100 | 1.86 | 236 | 11.88 | 93.02 | 1013 | 0.67 | 235 | 36.78 | -121.89 | 14.20 |
| 950523 | 2110 | 2.00 | 234 | 11.89 | 92.33 | 1013 | 0.62 | 240 | 36.78 | -121.90 | 14.20 |
| 950523 | 2120 | 2.75 | 251 | 11.89 | 92.13 | 1013 | 0.55 | 245 | 36.78 | -121.90 | 14.20 |
| 950523 | 2130 | 4.09 | 251 | 11.84 | 92.24 | 1013 | 0.49 | 241 | 36.78 | -121.90 | 14.20 |
| 950523 | 2140 | 4.68 | 256 | 11.71 | 93.20 | 1013 | 0.48 | 244 | 36.78 | -121.91 | 14.00 |
| 950523 | 2150 | 4.77 | 262 | 11.65 | 93.69 | 1013 | 0.46 | 236 | 36.77 | -121.91 | 13.90 |
| 950523 | 2200 | 5.41 | 265 | 11.61 | 93.88 | 1013 | 0.43 | 251 | 36.77 | -121.91 | 13.90 |
| 950523 | 2210 | 6.04 | 262 | 11.53 | 94.00 | 1013 | 0.37 | 250 | 36.77 | -121.91 | 13.80 |
| 950523 | 2220 | 6.04 | 276 | 11.52 | 94.04 | 1013 | 0.31 | 264 | 36.77 | -121.92 | 13.80 |
| 950523 | 2230 | 7.17 | 299 | 11.37 | 94.13 | 1013 | 0.40 | 301 | 36.77 | -121.92 | 13.80 |
| 950523 | 2240 | 7.26 | 301 | 11.38 | 93.91 | 1013 | 0.32 | 304 | 36.77 | -121.92 | 13.80 |
| 950523 | 2250 | 7.48 | 264 | 11.39 | 93.32 | 1012 | 0.34 | 257 | 36.77 | -121.92 | 13.80 |
| 950523 | 2300 | 7.56 | 261 | 11.38 | 92.76 | 1012 | 0.34 | 256 | 36.77 | -121.92 | 13.80 |
| 950523 | 2310 | 7.32 | 267 | 11.40 | 92.36 | 1012 | 0.36 | 263 | 36.77 | -121.93 | 13.80 |
| 950523 | 2320 | 7.26 | 268 | 11.36 | 92.07 | 1012 | 0.41 | 267 | 36.77 | -121.93 | 13.70 |
| 950523 | 2330 | 6.76 | 261 | 11.44 | 91.77 | 1012 | 0.39 | 258 | 36.77 | -121.93 | 13.60 |
| 950523 | 2340 | 7.25 | 275 | 11.46 | 91.48 | 1012 | 0.33 | 274 | 36.77 | -121.93 | 13.50 |
| 950523 | 2350 | 7.41 | 258 | 11.48 | 90.99 | 1012 | 0.31 | 259 | 36.77 | -121.94 | 13.50 |
| 950524 | 0 | 7.63 | 262 | 11.53 | 90.61 | 1012 | 0.36 | 261 | 36.77 | -121.94 | 13.60 |
| 950524 | 10 | 7.44 | 270 | 11.54 | 90.27 | 1012 | 0.45 | 265 | 36.77 | -121.94 | 13.60 |
| 950524 | 20 | 7.60 | 260 | 11.57 | 90.25 | 1012 | 0.61 | 258 | 36.77 | -121.95 | 13.60 |
| 950524 | 30 | 7.96 | 259 | 11.61 | 90.28 | 1012 | 0.63 | 255 | 36.77 | -121.95 | 13.50 |
| 950524 | 40 | 8.56 | 263 | 11.56 | 90.42 | 1012 | 0.53 | 262 | 36.77 | -121.95 | 13.50 |
| 950524 | 50 | 8.00 | 258 | 11.58 | 90.65 | 1012 | 0.62 | 259 | 36.77 | -121.96 | 13.50 |
| 950524 | 100 | 7.30 | 255 | 11.59 | 90.95 | 1012 | 0.53 | 250 | 36.77 | -121.96 | 13.50 |
| 950524 | 110 | 7.74 | 275 | 11.61 | 91.17 | 1012 | 0.64 | 271 | 36.77 | -121.97 | 13.40 |
| 950524 | 120 | 8.29 | 267 | 11.54 | 91.25 | 1012 | 0.58 | 267 | 36.77 | -121.97 | 13.30 |
| 950524 | 130 | 8.19 | 260 | 11.56 | 91.43 | 1012 | 0.54 | 262 | 36.77 | -121.97 | 13.30 |
| 950524 | 140 | 8.18 | 258 | 11.57 | 91.29 | 1012 | 0.65 | 256 | 36.77 | -121.98 | 13.10 |
| 950524 | 150 | 8.35 | 247 | 11.62 | 91.57 | 1012 | 0.54 | 240 | 36.77 | -121.98 | 13.00 |
| 950524 | 200 | 8.24 | 266 | 11.55 | 91.46 | 1012 | 0.60 | 251 | 36.77 | -121.98 | 13.00 |
| 950524 | 210 | 7.46 | 264 | 11.61 | 92.12 | 1012 | 0.64 | 250 | 36.76 | -121.99 | 13.10 |
| 950524 | 220 | 7.70 | 278 | 11.56 | 91.93 | 1012 | 0.74 | 263 | 36.76 | -121.99 | 13.00 |
| 950524 | 230 | 7.31 | 288 | 11.59 | 91.87 | 1012 | 0.57 | 274 | 36.76 | -122.00 | 13.00 |
| 950524 | 240 | 7.36 | 274 | 11.58 | 91.99 | 1012 | 0.61 | 263 | 36.76 | -122.00 | 13.00 |
| 950524 | 250 | 6.93 | 278 | 11.59 | 91.64 | 1012 | 0.73 | 262 | 36.76 | -122.01 | 13.00 |
| 950524 | 300 | 6.96 | 266 | 11.57 | 91.64 | 1012 | 0.74 | 261 | 36.76 | -122.01 | 13.10 |
| 950524 | 310 | 7.42 | 279 | 11.57 | 91.85 | 1012 | 0.77 | 271 | 36.76 | -122.02 | 13.10 |
| 950524 | 320 | 7.24 | 276 | 11.60 | 92.16 | 1012 | 0.79 | 265 | 36.76 | -122.02 | 13.10 |
| 950524 | 330 | 7.31 | 275 | 11.54 | 92.10 | 1012 | 0.78 | 265 | 36.76 | -122.03 | 13.10 |
| 950524 | 340 | 7.11 | 275 | 11.51 | 92.06 | 1012 | 0.78 | 260 | 36.76 | -122.03 | 13.00 |
| 950524 | 350 | 6.41 | 286 | 11.52 | 92.47 | 1012 | 0.73 | 270 | 36.76 | -122.04 | 13.00 |
| 950524 | 400 | 6.72 | 279 | 11.50 | 92.07 | 1012 | 0.77 | 270 | 36.76 | -122.04 | 13.00 |
| 950524 | 410 | 6.71 | 295 | 11.46 | 92.29 | 1012 | 0.76 | 290 | 36.76 | -122.05 | 13.10 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 950524 | 420 | 7.02 | 300 | 11.43 | 92.06 | 1012 | 0.76 | 290 | 36.76 | -122.05 | 13.00 |
| 950524 | 430 | 6.52 | 300 | 11.44 | 92.08 | 1012 | 0.76 | 289 | 36.76 | -122.06 | 13.10 |
| 950524 | 440 | 6.90 | 300 | 11.44 | 92.18 | 1012 | 0.66 | 288 | 36.76 | -122.06 | 13.20 |
| 950524 | 450 | 6.85 | 294 | 11.37 | 92.32 | 1012 | 0.63 | 289 | 36.77 | -122.06 | 13.10 |
| 950524 | 500 | 6.83 | 290 | 11.32 | 92.05 | 1012 | 0.72 | 283 | 36.77 | -122.07 | 13.10 |
| 950524 | 510 | 6.62 | 304 | 11.38 | 91.68 | 1012 | 1.37 | 111 | 36.77 | -122.07 | 13.10 |
| 950524 | 520 | 5.82 | 303 | 11.41 | 92.03 | 1012 | 3.04 | 109 | 36.76 | -122.05 | 13.20 |
| 950524 | 530 | 5.14 | 301 | 11.55 | 92.18 | 1012 | 3.05 | 110 | 36.76 | -122.03 | 13.20 |
| 950524 | 540 | 5.41 | 293 | 11.51 | 91.74 | 1012 | 1.91 | 114 | 36.75 | -122.02 | 12.90 |
| 950524 | 550 | 5.67 | 289 | 11.38 | 91.59 | 1012 | 0.56 | 279 | 36.75 | -122.01 | 12.90 |
| 950524 | 600 | 6.09 | 292 | 11.36 | 91.80 | 1012 | 0.51 | 288 | 36.75 | -122.02 | 12.90 |
| 950524 | 610 | 6.02 | 291 | 11.35 | 91.50 | 1012 | 0.58 | 281 | 36.75 | -122.02 | 12.80 |
| 950524 | 620 | 6.13 | 279 | 11.40 | 91.64 | 1012 | 0.52 | 271 | 36.75 | -122.02 | 13.00 |
| 950524 | 630 | 6.03 | 279 | 11.39 | 91.25 | 1012 | 0.54 | 267 | 36.75 | -122.03 | 13.00 |
| 950524 | 640 | 5.44 | 293 | 11.41 | 91.54 | 1012 | 0.60 | 278 | 36.75 | -122.03 | 13.00 |
| 950524 | 650 | 5.39 | 290 | 11.36 | 90.87 | 1012 | 0.63 | 271 | 36.75 | -122.04 | 13.00 |
| 950524 | 700 | 5.24 | 290 | 11.39 | 90.47 | 1012 | 0.64 | 276 | 36.75 | -122.04 | 13.00 |
| 950524 | 710 | 4.75 | 305 | 11.44 | 90.70 | 1012 | 0.67 | 283 | 36.75 | -122.04 | 12.90 |
| 950524 | 720 | 4.93 | 301 | 11.44 | 90.98 | 1012 | 0.66 | 286 | 36.75 | -122.05 | 12.90 |
| 950524 | 730 | 4.38 | 307 | 11.45 | 90.63 | 1012 | 0.70 | 289 | 36.75 | -122.05 | 13.10 |
| 950524 | 740 | 4.20 | 303 | 11.43 | 90.57 | 1012 | 0.69 | 291 | 36.76 | -122.06 | 13.10 |
| 950524 | 750 | 4.54 | 318 | 11.43 | 90.76 | 1012 | 0.72 | 303 | 36.76 | -122.06 | 13.20 |
| 950524 | 800 | 4.76 | 319 | 11.42 | 90.22 | 1012 | 0.60 | 326 | 36.76 | -122.06 | 13.20 |
| 950524 | 810 | 4.67 | 328 | 11.48 | 90.15 | 1012 | 0.71 | 328 | 36.76 | -122.07 | 13.20 |
| 950524 | 820 | 4.67 | 314 | 11.45 | 90.77 | 1012 | 0.66 | 322 | 36.77 | -122.07 | 13.20 |
| 950524 | 830 | 5.09 | 327 | 11.43 | 90.69 | 1012 | 0.64 | 332 | 36.77 | -122.07 | 13.20 |
| 950524 | 840 | 4.48 | 330 | 11.41 | 90.49 | 1012 | 0.72 | 334 | 36.77 | -122.07 | 13.20 |
| 950524 | 850 | 4.53 | 315 | 11.47 | 90.69 | 1012 | 0.48 | 6 | 36.77 | -122.08 | 13.20 |
| 950524 | 900 | 4.53 | 293 | 11.45 | 90.55 | 1012 | 2.85 | 114 | 36.77 | -122.07 | 13.20 |
| 950524 | 910 | 4.71 | 296 | 11.42 | 90.63 | 1012 | 2.74 | 116 | 36.76 | -122.05 | 13.10 |
| 950524 | 920 | 5.20 | 290 | 11.38 | 90.23 | 1012 | 2.78 | 124 | 36.76 | -122.03 | 13.00 |
| 950524 | 930 | 5.28 | 283 | 11.38 | 89.96 | 1011 | 2.12 | 127 | 36.75 | -122.02 | 13.00 |
| 950524 | 940 | 4.68 | 309 | 11.34 | 89.30 | 1011 | 0.76 | 315 | 36.75 | -122.02 | 13.00 |
| 950524 | 950 | 4.82 | 302 | 11.35 | 90.01 | 1011 | 0.77 | 309 | 36.75 | -122.02 | 12.90 |
| 950524 | 1000 | 4.53 | 304 | 11.33 | 89.74 | 1011 | 0.79 | 307 | 36.75 | -122.02 | 12.90 |
| 950524 | 1010 | 4.47 | 296 | 11.30 | 90.07 | 1011 | 0.82 | 314 | 36.76 | -122.03 | 12.80 |
| 950524 | 1020 | 4.99 | 306 | 11.34 | 89.88 | 1011 | 0.76 | 318 | 36.76 | -122.03 | 12.90 |
| 950524 | 1030 | 4.21 | 315 | 11.31 | 89.18 | 1011 | 0.79 | 312 | 36.76 | -122.04 | 12.90 |
| 950524 | 1040 | 4.49 | 301 | 11.33 | 89.37 | 1011 | 0.84 | 308 | 36.76 | -122.04 | 12.90 |
| 950524 | 1050 | 4.97 | 307 | 11.37 | 89.74 | 1011 | 0.84 | 315 | 36.77 | -122.04 | 12.90 |
| 950524 | 1100 | 4.43 | 309 | 11.28 | 89.53 | 1011 | 0.82 | 312 | 36.77 | -122.05 | 12.90 |
| 950524 | 1110 | 4.38 | 318 | 11.27 | 88.93 | 1011 | 0.78 | 315 | 36.77 | -122.05 | 13.00 |
| 950524 | 1120 | 4.29 | 324 | 11.28 | 88.60 | 1011 | 0.75 | 324 | 36.78 | -122.06 | 13.00 |
| 950524 | 1130 | 4.80 | 319 | 11.26 | 88.92 | 1011 | 0.62 | 329 | 36.78 | -122.06 | 13.00 |
| 950524 | 1140 | 4.09 | 297 | 11.27 | 89.02 | 1011 | 0.34 | 116 | 36.78 | -122.06 | 13.10 |
| 950524 | 1150 | 5.95 | 290 | 11.16 | 88.63 | 1011 | 2.69 | 128 | 36.77 | -122.05 | 13.00 |
| 950524 | 1200 | 4.85 | 287 | 11.16 | 88.23 | 1011 | 2.32 | 130 | 36.77 | -122.04 | 12.90 |
| 950524 | 1210 | 5.27 | 283 | 11.17 | 88.74 | 1011 | 2.23 | 130 | 36.76 | -122.03 | 12.90 |
| 950524 | 1220 | 4.22 | 285 | 11.19 | 88.82 | 1011 | 1.90 | 134 | 36.75 | -122.01 | 13.10 |
| 950524 | 1230 | 5.74 | 310 | 11.19 | 89.80 | 1011 | 0.65 | 320 | 36.75 | -122.01 | 13.00 |
| 950524 | 1240 | 6.22 | 309 | 11.12 | 88.37 | 1011 | 0.59 | 352 | 36.75 | -122.01 | 13.00 |
| 950524 | 1250 | 4.87 | 291 | 11.16 | 87.92 | 1011 | 4.56 | 73 | 36.76 | -122.00 | 13.10 |
| 950524 | 1300 | 4.93 | 276 | 11.14 | 88.38 | 1011 | 4.63 | 74 | 36.76 | -121.97 | 13.40 |
| 950524 | 1310 | 5.20 | 272 | 11.16 | 88.67 | 1011 | 4.68 | 76 | 36.77 | -121.94 | 13.40 |
| 950524 | 1320 | 4.93 | 265 | 11.12 | 88.63 | 1011 | 4.72 | 76 | 36.78 | -121.91 | 13.30 |
| 950524 | 1330 | 5.25 | 267 | 11.12 | 89.04 | 1011 | 4.68 | 75 | 36.78 | -121.88 | 13.40 |
| 950524 | 1340 | 4.83 | 257 | 11.10 | 89.62 | 1011 | 4.63 | 74 | 36.79 | -121.85 | 13.60 |
| 950524 | 1350 | 4.72 | 252 | 11.24 | 89.47 | 1011 | 4.74 | 71 | 36.80 | -121.82 | 13.60 |
| 950524 | 1400 | 4.82 | 253 | 11.17 | 90.23 | 1011 | 2.76 | 67 | 36.81 | -121.79 | 13.30 |
| 950524 | 1410 | 1.39 | 281 | 11.01 | 91.94 | 1011 | 0.46 | 196 | 36.80 | -121.79 | 13.30 |
| 950524 | 1420 | 1.05 | 275 | 11.04 | 90.94 | 1011 | 0.00 | 242 | 36.80 | -121.79 | 13.00 |

# APPENDIX I. RADIOSONDE METEOROLOGICAL DATA

```
Sounding program REV 7.62 using Omega
Ship      :PT_SUR
Location : 36.80 N 122.00 W      3 m
Rejected Sigma stations: a,b,c
Phase fitting length is 250 s from   0 min to 120 min
Sounding : 4
RS-number: 158735751
No PTU editing
No wind editing
Started at:       16 MAY 95 14:59 GMT
```

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1013.8 | 11.4 | 94 | 10.5 | 36 | 2.5 | --------- |
| 0 | 5 | 7.8 | 42 | 1009.0 | 11.7 | 75 | 7.5 | /// | //// | --CD-FGH- |
| 0 | 10 | 5.7 | 60 | 1006.8 | 11.5 | 77 | 7.7 | 345 | 1.9 | --CD-FGH- |
| 0 | 15 | 4.9 | 82 | 1004.1 | 11.6 | 72 | 6.8 | /// | //// | --CD-FGH- |
| 0 | 20 | 6.8 | 139 | 997.3 | 12.1 | 68 | 6.4 | 342 | 2.4 | --CD-FGH- |
| 0 | 25 | 6.1 | 159 | 995.0 | 12.2 | 60 | 4.7 | /// | //// | --CD-FGH- |
| 0 | 30 | 6.0 | 184 | 991.9 | 12.3 | 60 | 4.8 | 345 | 2.5 | --CD-FGH- |
| 0 | 35 | 5.7 | 216 | 988.2 | 12.2 | 62 | 5.2 | /// | //// | --CD-FGH- |
| 0 | 40 | 6.3 | 248 | 984.5 | 12.1 | 61 | 4.9 | 345 | 2.9 | --CD-FGH- |
| 0 | 45 | 6.6 | 276 | 981.1 | 11.9 | 62 | 4.9 | /// | //// | --CD-FGH- |
| 0 | 50 | 5.7 | 309 | 977.3 | 11.7 | 63 | 4.9 | 344 | 3.1 | --CD-FGH- |
| 0 | 55 | 6.0 | 336 | 974.1 | 11.6 | 64 | 5.1 | /// | //// | --CD-FGH- |
| 1 | 0 | 6.0 | 364 | 970.9 | 11.6 | 64 | 5.1 | 342 | 3.6 | --CD-FGH- |
| 1 | 5 | 5.7 | 390 | 967.8 | 11.7 | 63 | 4.9 | /// | //// | --CD-FGH- |
| 1 | 10 | 6.0 | 427 | 963.5 | 11.6 | 63 | 4.9 | 343 | 3.2 | --CD-FGH- |
| 1 | 15 | 6.2 | 455 | 960.2 | 12.0 | 60 | 4.5 | /// | //// | --CD-FGH- |
| 1 | 20 | 5.7 | 480 | 957.4 | 12.4 | 58 | 4.4 | 342 | 3.3 | --CD-FGH- |
| 1 | 25 | 5.7 | 510 | 953.9 | 12.4 | 57 | 4.2 | /// | //// | --CD-FGH- |
| 1 | 30 | 5.9 | 541 | 950.4 | 12.1 | 58 | 4.1 | 343 | 3.5 | --CD-FGH- |
| 1 | 35 | 6.1 | 572 | 946.9 | 11.8 | 58 | 3.9 | /// | //// | --CD-FGH- |
| 1 | 40 | 5.8 | 600 | 943.7 | 11.5 | 59 | 3.8 | 343 | 3.9 | --CD-FGH- |
| 1 | 45 | 5.7 | 626 | 940.8 | 11.3 | 60 | 3.9 | /// | //// | --CD-FGH- |
| 1 | 50 | 5.7 | 651 | 938.0 | 11.0 | 61 | 3.8 | 343 | 4.0 | --CD-FGH- |
| 1 | 55 | 5.7 | 685 | 934.1 | 10.8 | 62 | 3.9 | /// | //// | --CD-FGH- |
| 2 | 0 | 5.7 | 712 | 931.2 | 10.6 | 62 | 3.7 | 344 | 4.2 | --CD-FGH- |
| 2 | 5 | 5.7 | 740 | 928.0 | 10.4 | 62 | 3.5 | /// | //// | --CD-FGH- |
| 2 | 10 | 5.7 | 772 | 924.4 | 10.4 | 60 | 3.0 | 345 | 4.3 | --CD-FGH- |
| 2 | 15 | 5.9 | 804 | 920.9 | 10.4 | 59 | 2.8 | /// | //// | --CD-FGH- |
| 2 | 20 | 6.0 | 831 | 917.8 | 10.1 | 59 | 2.5 | 346 | 4.4 | --CD-FGH- |
| 2 | 25 | 6.1 | 863 | 914.4 | 9.9 | 59 | 2.3 | /// | //// | --CD-FGH- |
| 2 | 30 | 6.1 | 896 | 910.7 | 9.6 | 59 | 2.0 | 348 | 4.4 | --CD-FGH- |
| 2 | 35 | 5.6 | 913 | 908.8 | 9.4 | 60 | 2.1 | /// | //// | --CD-FGH- |
| 2 | 40 | 5.6 | 940 | 905.8 | 9.2 | 60 | 1.9 | 350 | 4.2 | --CD-FGH- |
| 2 | 45 | 5.3 | 970 | 902.6 | 9.1 | 60 | 1.8 | /// | //// | --CD-FGH- |
| 2 | 50 | 5.3 | 991 | 900.3 | 8.9 | 60 | 1.6 | 352 | 4.3 | --CD-FGH- |

Sounding program REV 7.62 using Omega
Ship :PT_SUR
Location : 36.80 N 121.80 W 3 m
Rejected Sigma stations: a,b,c
Phase fitting length is 250 s from 0 min to 120 min
Sounding : 5
RS-number: 309140543
No PTU editing
No wind editing
Started at: 16 MAY 95 18:01 GMT

| Time | | AscRate | Hgt/MSL | Pressure | Temp | RH | Dewp | Dir | Speed | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| min | s | m/s | m | hPa | degC | % | degC | deg | m/s | |
| 0 | 0 | 0.0 | 3 | 1013.4 | 12.1 | 90 | 10.5 | 279 | 2.2 | --------- |
| 0 | 5 | 2.7 | 17 | 1011.7 | 13.3 | 70 | 8.0 | /// | //// | -BCD--GH- |
| 0 | 10 | 1.8 | 21 | 1011.3 | 13.0 | 72 | 8.1 | 285 | 2.3 | -BCD--GH- |
| 0 | 15 | 1.7 | 31 | 1010.1 | 12.9 | 74 | 8.4 | /// | //// | -BCD--GH- |
| 0 | 20 | 2.0 | 42 | 1008.8 | 12.8 | 75 | 8.5 | 281 | 2.1 | -BCD--GH- |
| 0 | 25 | 1.7 | 46 | 1008.3 | 12.8 | 76 | 8.7 | /// | //// | -BCD-FGH- |
| 0 | 30 | 1.8 | 56 | 1007.1 | 12.6 | 77 | 8.7 | 281 | 2.3 | -BCD-FGH- |
| 0 | 35 | 1.8 | 70 | 1005.3 | 12.5 | 78 | 8.8 | /// | //// | -BCD-FGH- |
| 0 | 40 | 1.8 | 75 | 1004.9 | 12.5 | 78 | 8.8 | 261 | 2.3 | -BCD-FGH- |
| 0 | 45 | 1.8 | 83 | 1003.9 | 12.5 | 77 | 8.6 | /// | //// | -BCD-FGH- |
| 0 | 50 | 1.7 | 93 | 1002.6 | 12.5 | 75 | 8.2 | 257 | 2.3 | -BCD-FGH- |
| 0 | 55 | 2.0 | 103 | 1001.4 | 12.5 | 74 | 8.0 | /// | //// | -BCD-FGH- |
| 1 | 0 | 1.9 | 113 | 1000.2 | 12.5 | 73 | 7.8 | 249 | 2.4 | -BCD-FGH- |
| 1 | 5 | 1.6 | 119 | 999.5 | 12.4 | 73 | 7.7 | /// | //// | -BCD-FGH- |
| 1 | 10 | 1.8 | 128 | 998.5 | 12.4 | 73 | 7.7 | 249 | 2.5 | -BCD-FGH- |
| 1 | 15 | 1.9 | 137 | 997.4 | 12.5 | 73 | 7.8 | /// | //// | -BCD-FGH- |
| 1 | 20 | 1.9 | 150 | 995.8 | 12.5 | 73 | 7.8 | 249 | 2.7 | -BCD-FGH- |
| 1 | 25 | 1.6 | 153 | 995.5 | 12.7 | 72 | 7.8 | /// | //// | -BCD-FGH- |
| 1 | 30 | 1.6 | 160 | 994.6 | 12.8 | 70 | 7.5 | 249 | 2.7 | -BCD-FGH- |
| 1 | 35 | 1.4 | 164 | 994.1 | 12.8 | 70 | 7.5 | /// | //// | -BCD-FGH- |
| 1 | 40 | 1.9 | 185 | 991.7 | 12.8 | 69 | 7.3 | 252 | 2.7 | -BCD-FGH- |
| 1 | 45 | 1.7 | 190 | 991.1 | 12.8 | 69 | 7.3 | /// | //// | -BCD-FGH- |
| 1 | 50 | 1.7 | 201 | 989.8 | 12.8 | 69 | 7.3 | 250 | 2.7 | -BCD-FGH- |
| 1 | 55 | 1.8 | 208 | 988.9 | 12.7 | 69 | 7.2 | /// | //// | -BCD-FGH- |
| 2 | 0 | 1.9 | 218 | 987.8 | 12.6 | 69 | 7.1 | 247 | 2.8 | -BCD-FGH- |
| 2 | 5 | 2.3 | 228 | 986.6 | 12.6 | 69 | 7.1 | /// | //// | -BCD-FGH- |
| 2 | 10 | 1.6 | 234 | 985.9 | 12.5 | 69 | 7.0 | 247 | 2.9 | -BCD-FGH- |
| 2 | 15 | 1.8 | 244 | 984.7 | 12.4 | 69 | 6.9 | /// | //// | -BCD-FGH- |
| 2 | 20 | 1.8 | 256 | 983.3 | 12.3 | 68 | 6.6 | 247 | 2.9 | -BCD-FGH- |
| 2 | 25 | 2.0 | 266 | 982.1 | 12.3 | 69 | 6.8 | /// | //// | -BCD-FGH- |
| 2 | 30 | 1.9 | 275 | 981.1 | 12.1 | 69 | 6.6 | 253 | 2.9 | -BCD-FGH- |
| 2 | 35 | 1.7 | 283 | 980.1 | 12.1 | 69 | 6.6 | /// | //// | -BCD-FGH-- |
| 2 | 40 | 1.9 | 291 | 979.2 | 12.1 | 69 | 6.6 | 257 | 3.0 | -BCD-FGH-- |
| 2 | 45 | 1.9 | 302 | 977.9 | 11.9 | 70 | 6.7 | /// | //// | -BCD-FGH-- |
| 2 | 50 | 1.8 | 311 | 976.8 | 11.8 | 70 | 6.6 | 251 | 3.1 | -BCD-FGH-- |
| 2 | 55 | 1.8 | 320 | 975.7 | 11.9 | 71 | 6.9 | /// | //// | -BCD-FGH-- |

Start Up Date 16 MAY 95 20:09 GMT
System test passed -No errors found
Sounding program REV 7.62 using Omega
Ship :PT_SUR
Location : 36.80 N 122.00 W 3 m
Rejected Sigma stations: a,b,c
Phase fitting length is 250 s from 0 min to 120 min
Sounding : 6
RS-number: 309140540
No PTU editing
No wind editing
Started at: 16 MAY 95 20:17 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1011.3 | 12.1 | 92 | 10.8 | 292 | 10.4 | --------- |
| 0 | 5 | -1.7 | -7 | 1012.5 | 15.5 | 59 | 7.6 | /// | //// | --CD-FGH- |
| 0 | 10 | -1.0 | -7 | 1012.5 | 15.6 | 61 | 8.2 | 300 | 10.5 | --CD-FGH- |
| 0 | 15 | -0.6 | -7 | 1012.5 | 15.5 | 63 | 8.5 | /// | //// | --CD-FGH- |
| 0 | 20 | 1.5 | 34 | 1007.6 | 14.9 | 64 | 8.2 | 301 | 10.7 | --CD-FGH- |
| 0 | 25 | 4.6 | 119 | 997.4 | 13.6 | 70 | 8.3 | /// | //// | --CD-FGH- |
| 0 | 30 | 4.9 | 149 | 993.9 | 12.9 | 74 | 8.4 | 298 | 10.2 | --CD-FGH- |
| 0 | 35 | 6.4 | 178 | 990.5 | 12.7 | 75 | 8.4 | /// | //// | --CD--GH- |
| 0 | 40 | 6.9 | 200 | 987.8 | 12.4 | 76 | 8.3 | 299 | 9.9 | --CD--GH- |
| 0 | 45 | 8.0 | 228 | 984.6 | 12.6 | 69 | 7.1 | /// | //// | --CD-FGH- |
| 0 | 50 | 7.2 | 251 | 981.8 | 13.2 | 58 | 5.2 | 298 | 9.7 | --CD-FGH- |
| 0 | 55 | 4.9 | 265 | 980.1 | 13.4 | 54 | 4.3 | /// | //// | -BCD-FGH- |
| 1 | 0 | 4.6 | 286 | 977.7 | 13.7 | 50 | 3.5 | 299 | 9.7 | -BCD-FGH- |
| 1 | 5 | 4.4 | 312 | 974.8 | 13.9 | 46 | 2.5 | /// | //// | -BCD-FGH- |
| 1 | 10 | 4.3 | 329 | 972.7 | 14.1 | 43 | 1.8 | 297 | 9.1 | -BCD-FGH- |
| 1 | 15 | 3.6 | 337 | 971.8 | 14.2 | 42 | 1.5 | /// | //// | -BCD-FGH- |
| 1 | 20 | 3.4 | 352 | 970.1 | 14.3 | 41 | 1.3 | 298 | 9.1 | -BCD-FGH- |
| 1 | 25 | 3.3 | 366 | 968.5 | 14.4 | 41 | 1.4 | /// | //// | -BCD-FGH- |
| 1 | 30 | 3.1 | 380 | 966.8 | 14.4 | 41 | 1.4 | 299 | 9.0 | -BCD-FGH- |
| 1 | 35 | 2.8 | 396 | 965.1 | 14.5 | 40 | 1.1 | /// | //// | -BCD-FGH- |
| 1 | 40 | 2.7 | 409 | 963.5 | 14.6 | 40 | 1.2 | 300 | 9.1 | -BCD-FGH- |
| 1 | 45 | 2.8 | 421 | 962.1 | 14.5 | 40 | 1.1 | /// | //// | -BCD-FGH- |
| 1 | 50 | 2.9 | 440 | 960.0 | 14.5 | 40 | 1.1 | 298 | 8.7 | -BCD-FGH- |
| 1 | 55 | 3.0 | 451 | 958.7 | 14.4 | 39 | 0.7 | /// | //// | -BCD-FGH- |
| 2 | 0 | 2.8 | 465 | 957.2 | 14.3 | 39 | 0.6 | 298 | 8.8 | -BCD-FGH- |
| 2 | 5 | 2.8 | 482 | 955.2 | 14.3 | 38 | 0.2 | /// | //// | -BCD-FGH- |
| 2 | 10 | 3.0 | 498 | 953.5 | 14.2 | 38 | 0.2 | 299 | 9.0 | -BCD-FGH- |
| 2 | 15 | 3.1 | 514 | 951.6 | 14.2 | 38 | 0.2 | /// | //// | -BCD-FGH- |
| 2 | 20 | 2.8 | 524 | 950.4 | 14.1 | 37 | -0.3 | 300 | 8.9 | -BCD-FGH- |
| 2 | 25 | 2.8 | 539 | 948.8 | 14.1 | 37 | -0.3 | /// | //// | -BCD-FGH- |
| 2 | 30 | 2.9 | 551 | 947.4 | 14.0 | 37 | -0.4 | 299 | 8.9 | -BCD-FGH- |
| 2 | 35 | 2.8 | 565 | 945.8 | 14.0 | 37 | -0.4 | /// | //// | -BCD-FGH- |

Sounding program REV 7.62 using Loran-C
Ship     :PT_SUR
Location : 36.80 N 121.80 W      3 m
Loran-C chain 1:  9940
Phase fitting length is  60 s from   0 min to  10 min
Phase fitting length is 120 s from  10 min to  45 min
Phase fitting length is 240 s from  45 min to 120 min
Sounding : 10
RS-number: 108234745
No PTU editing
No wind editing
Started at:      17 MAY 95 17:47 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1016.8 | 12.4 | 88 | 10.5 | 278 | 1.0 | 000000000 |
| 0 | 5 | 4.2 | 24 | 1014.1 | 12.7 | 63 | 5.9 | /// | //// | 111100000 |
| 0 | 10 | 4.1 | 44 | 1011.7 | 12.4 | 66 | 6.3 | 268 | 2.2 | 111100000 |
| 0 | 15 | 3.8 | 60 | 1009.8 | 12.3 | 69 | 6.8 | /// | //// | 111100000 |
| 0 | 20 | 3.5 | 74 | 1008.0 | 12.1 | 70 | 6.8 | 263 | 2.5 | 111100000 |
| 0 | 25 | 3.5 | 91 | 1006.1 | 12.0 | 72 | 7.2 | /// | //// | 111100000 |
| 0 | 30 | 3.5 | 107 | 1004.1 | 11.8 | 72 | 7.0 | 263 | 2.3 | 111100000 |
| 0 | 35 | 3.4 | 125 | 1001.9 | 11.6 | 73 | 7.0 | /// | //// | 111100000 |
| 0 | 40 | 3.3 | 144 | 999.7 | 11.4 | 74 | 7.0 | 259 | 2.4 | 111100000 |
| 0 | 45 | 3.3 | 158 | 998.0 | 11.3 | 75 | 7.1 | /// | //// | 111100000 |
| 0 | 50 | 3.3 | 174 | 996.1 | 11.1 | 76 | 7.1 | 256 | 2.3 | 111100000 |
| 0 | 55 | 3.7 | 198 | 993.1 | 10.9 | 77 | 7.1 | /// | //// | 111100000 |
| 1 | 0 | 3.5 | 213 | 991.5 | 10.7 | 78 | 7.1 | 254 | 2.3 | 111100000 |
| 1 | 5 | 3.6 | 234 | 988.9 | 10.5 | 79 | 7.1 | /// | //// | 111100000 |
| 1 | 10 | 3.7 | 255 | 986.4 | 10.3 | 80 | 7.1 | 250 | 2.3 | 111100000 |
| 1 | 15 | 4.0 | 280 | 983.5 | 10.0 | 82 | 7.1 | /// | //// | 111100000 |
| 1 | 20 | 4.3 | 302 | 980.9 | 9.8 | 83 | 7.1 | 251 | 2.3 | 111100000 |
| 1 | 25 | 3.9 | 318 | 978.9 | 9.7 | 85 | 7.3 | /// | //// | 111100000 |
| 1 | 30 | 4.0 | 332 | 977.3 | 9.5 | 85 | 7.2 | 250 | 2.2 | 111100000 |
| 1 | 35 | 3.8 | 346 | 975.6 | 9.4 | 86 | 7.2 | /// | //// | 111100000 |
| 1 | 40 | 4.0 | 375 | 972.3 | 9.1 | 88 | 7.3 | 246 | 1.8 | 111100000 |
| 1 | 45 | 4.0 | 399 | 969.4 | 8.9 | 89 | 7.2 | /// | //// | 111100000 |
| 1 | 50 | 3.8 | 417 | 967.3 | 8.6 | 89 | 6.9 | 247 | 1.3 | 111100000 |
| 1 | 55 | 4.0 | 434 | 965.3 | 8.6 | 90 | 7.1 | /// | //// | 111100000 |
| 2 | 0 | 4.2 | 457 | 962.6 | 8.4 | 90 | 6.9 | 241 | 1.7 | 111100000 |
| 2 | 5 | 4.6 | 483 | 959.5 | 8.2 | 90 | 6.7 | /// | //// | 111100000 |
| 2 | 10 | 4.5 | 509 | 956.5 | 8.1 | 91 | 6.8 | 237 | 2.1 | 111100000 |
| 2 | 15 | 4.6 | 537 | 953.4 | 8.1 | 88 | 6.3 | /// | //// | 111100000 |
| 2 | 20 | 4.4 | 548 | 952.1 | 8.7 | 79 | 5.3 | 240 | 2.9 | 111100000 |
| 2 | 25 | 4.2 | 562 | 950.4 | 10.2 | 70 | 5.0 | /// | //// | 111100000 |
| 2 | 30 | 4.0 | 576 | 948.8 | 11.8 | 63 | 5.0 | 240 | 3.4 | 111100000 |
| 2 | 35 | 3.4 | 590 | 947.2 | 12.6 | 59 | 4.9 | /// | //// | 111100000 |
| 2 | 40 | 3.2 | 605 | 945.6 | 12.7 | 55 | 4.0 | 237 | 4.0 | 111100000 |
| 2 | 45 | 2.8 | 620 | 943.9 | 12.8 | 52 | 3.3 | /// | //// | 111100000 |
| 2 | 50 | 2.9 | 635 | 942.1 | 13.1 | 50 | 3.0 | 236 | 4.2 | 111100000 |

Sounding program REV 7.62 using Loran-C
Ship      :PT_SUR
Location : 36.80 N 122.00 W      3 m
Loran-C chain 1:  9940
Phase fitting length is  60 s from   0 min to  10 min
Phase fitting length is 120 s from  10 min to  45 min
Phase fitting length is 240 s from  45 min to 120 min
Sounding : 11
RS-number: 108234743
No PTU editing
No wind editing
Started at:      17 MAY 95 21:54 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1016.3 | 12.2 | 96 | 11.6 | 261 | 5.4 | 000000000 |
| 0 | 5 | 3.8 | 20 | 1014.1 | 13.3 | 72 | 8.4 | /// | //// | 111100000 |
| 0 | 10 | 4.1 | 44 | 1011.3 | 12.6 | 76 | 8.5 | 309 | 5.3 | 111100000 |
| 0 | 15 | 4.2 | 67 | 1008.4 | 12.4 | 78 | 8.7 | /// | //// | 111100000 |
| 0 | 20 | 4.1 | 85 | 1006.3 | 12.2 | 79 | 8.7 | 302 | 5.7 | 111100000 |
| 0 | 25 | 3.8 | 100 | 1004.5 | 12.1 | 81 | 9.0 | /// | //// | 111100000 |
| 0 | 30 | 3.7 | 115 | 1002.6 | 11.9 | 83 | 9.2 | 300 | 5.8 | 111100000 |
| 0 | 35 | 3.7 | 129 | 1000.9 | 11.8 | 83 | 9.1 | /// | //// | 111100000 |
| 0 | 40 | 3.5 | 148 | 998.7 | 11.6 | 84 | 9.0 | 286 | 7.0 | 111100000 |
| 0 | 45 | 3.2 | 160 | 997.3 | 11.5 | 84 | 8.9 | /// | //// | 110100000 |
| 0 | 50 | 3.3 | 185 | 994.4 | 11.3 | 85 | 8.9 | 272 | 9.7 | 110100000 |
| 0 | 55 | 3.3 | 197 | 992.9 | 11.2 | 86 | 9.0 | /// | //// | 111100000 |
| 1 | 0 | 3.3 | 215 | 990.7 | 11.0 | 87 | 9.0 | 281 | 8.0 | 111100000 |
| 1 | 5 | 3.3 | 229 | 989.0 | 10.9 | 86 | 8.7 | /// | //// | 111100000 |
| 1 | 10 | 3.4 | 250 | 986.6 | 10.7 | 87 | 8.7 | 291 | 7.1 | 111100000 |
| 1 | 15 | 3.5 | 265 | 984.8 | 10.7 | 87 | 8.7 | /// | //// | 111100000 |
| 1 | 20 | 3.3 | 284 | 982.5 | 10.5 | 87 | 8.5 | 291 | 7.3 | 111100000 |
| 1 | 25 | 3.4 | 296 | 981.1 | 10.4 | 87 | 8.4 | /// | //// | 111100000 |
| 1 | 30 | 3.2 | 312 | 979.2 | 10.2 | 87 | 8.2 | 291 | 7.2 | 111100000 |
| 1 | 35 | 3.5 | 336 | 976.4 | 10.1 | 88 | 8.2 | /// | //// | 111100000 |
| 1 | 40 | 3.4 | 351 | 974.7 | 9.9 | 88 | 8.1 | 292 | 7.1 | 111100000 |
| 1 | 45 | 3.4 | 368 | 972.6 | 9.7 | 89 | 8.0 | /// | //// | 111100000 |
| 1 | 50 | 3.2 | 379 | 971.3 | 9.6 | 89 | 7.9 | 290 | 7.2 | 111100000 |
| 1 | 55 | 3.4 | 401 | 968.7 | 9.6 | 90 | 8.1 | /// | //// | 111100000 |
| 2 | 0 | 3.5 | 416 | 967.1 | 9.4 | 90 | 7.9 | 288 | 7.0 | 111100000 |
| 2 | 5 | 3.4 | 439 | 964.4 | 9.3 | 91 | 8.0 | /// | //// | 111100000 |
| 2 | 10 | 3.4 | 452 | 962.8 | 9.2 | 91 | 7.9 | 287 | 6.9 | 111100000 |
| 2 | 15 | 3.3 | 468 | 960.9 | 9.1 | 92 | 7.9 | /// | //// | 111100000 |
| 2 | 20 | 3.7 | 490 | 958.4 | 8.9 | 91 | 7.6 | 285 | 6.5 | 111100000 |
| 2 | 25 | 3.4 | 505 | 956.6 | 8.9 | 91 | 7.6 | /// | //// | 111100000 |
| 2 | 30 | 3.5 | 522 | 954.6 | 9.4 | 89 | 7.7 | 285 | 5.6 | 111100000 |
| 2 | 35 | 3.3 | 538 | 952.9 | 9.5 | 88 | 7.7 | /// | //// | 111100000 |
| 2 | 40 | 3.4 | 555 | 950.9 | 9.8 | 83 | 7.1 | 283 | 4.9 | 111100000 |
| 2 | 45 | 3.4 | 571 | 949.1 | 10.2 | 78 | 6.6 | /// | //// | 111100000 |

Sounding program REV 7.62 using Loran-C
Ship      :PT_SUR
Location : 36.70 N 121.90 W      3 m
Loran-C chain 1:  9940
Phase fitting length is  60 s from   0 min to  10 min
Phase fitting length is 120 s from  10 min to  45 min
Phase fitting length is 240 s from  45 min to 120 min
Sounding : 14
RS-number: 108234746
No PTU editing
No wind editing
Started at:      18 MAY 95 15:17 GMT

| Time | | AscRate | Hgt/MSL | Pressure | Temp | RH | Dewp | Dir | Speed | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| min | s | m/s | m | hPa | degC | % | degC | deg | m/s | |
| 0 | 0 | 0.0 | 3 | 1016.6 | 10.4 | 93 | 9.3 | 237 | 0.6 | 000000000 |
| 0 | 5 | 4.0 | 25 | 1014.0 | 11.6 | 72 | 6.8 | /// | //// | 111100000 |
| 0 | 10 | 3.5 | 38 | 1012.5 | 11.0 | 75 | 6.8 | 240 | 3.1 | 111100000 |
| 0 | 15 | 3.8 | 57 | 1010.1 | 10.9 | 78 | 7.3 | /// | //// | 111100000 |
| 0 | 20 | 3.5 | 72 | 1008.3 | 10.8 | 79 | 7.4 | 241 | 2.6 | 111100000 |
| 0 | 25 | 3.3 | 85 | 1006.7 | 10.7 | 81 | 7.6 | /// | //// | 111100000 |
| 0 | 30 | 3.3 | 103 | 1004.6 | 10.5 | 82 | 7.6 | 237 | 1.0 | 111100000 |
| 0 | 35 | 3.3 | 123 | 1002.2 | 10.3 | 83 | 7.6 | /// | //// | 111100000 |
| 0 | 40 | 3.5 | 143 | 999.7 | 10.1 | 84 | 7.6 | 254 | 0.5 | 111100000 |
| 0 | 45 | 3.5 | 163 | 997.3 | 10.0 | 85 | 7.6 | /// | //// | 111100000 |
| 0 | 50 | 3.7 | 182 | 995.1 | 9.7 | 86 | 7.5 | 243 | 2.1 | 111100000 |
| 0 | 55 | 3.8 | 198 | 993.1 | 9.6 | 88 | 7.8 | /// | //// | 110100000 |
| 1 | 0 | 3.7 | 214 | 991.2 | 9.4 | 88 | 7.6 | 246 | 2.5 | 110100000 |
| 1 | 5 | 3.7 | 234 | 988.8 | 9.3 | 89 | 7.6 | /// | //// | 111100000 |
| 1 | 10 | 3.8 | 256 | 986.1 | 9.1 | 90 | 7.6 | 254 | 1.8 | 111100000 |
| 1 | 15 | 3.6 | 274 | 984.0 | 8.9 | 91 | 7.6 | /// | //// | 111100000 |
| 1 | 20 | 3.6 | 291 | 982.1 | 8.8 | 92 | 7.6 | 274 | 0.6 | 111100000 |
| 1 | 25 | 3.6 | 304 | 980.5 | 8.7 | 92 | 7.5 | /// | //// | 111100000 |
| 1 | 30 | 3.6 | 321 | 978.5 | 8.6 | 92 | 7.4 | 313 | 0.8 | 111100000 |
| 1 | 35 | 3.6 | 341 | 976.1 | 8.5 | 93 | 7.5 | /// | //// | 111100000 |
| 1 | 40 | 3.7 | 367 | 973.0 | 8.4 | 93 | 7.4 | 326 | 0.8 | 111100000 |
| 1 | 45 | 3.8 | 385 | 970.9 | 8.3 | 93 | 7.3 | /// | //// | 111100000 |
| 1 | 50 | 3.8 | 405 | 968.5 | 8.1 | 93 | 7.1 | 334 | 0.9 | 111100000 |
| 1 | 55 | 3.9 | 423 | 966.4 | 8.1 | 94 | 7.2 | /// | //// | 111100000 |
| 2 | 0 | 3.9 | 437 | 964.7 | 8.0 | 94 | 7.1 | 347 | 1.0 | 111100000 |
| 2 | 5 | 3.7 | 454 | 962.7 | 7.9 | 94 | 7.0 | /// | //// | 111100000 |
| 2 | 10 | 3.5 | 472 | 960.7 | 7.8 | 94 | 6.9 | 338 | 1.0 | 111100000 |
| 2 | 15 | 3.6 | 493 | 958.3 | 7.7 | 94 | 6.8 | /// | //// | 111100000 |
| 2 | 20 | 3.5 | 510 | 956.3 | 7.6 | 94 | 6.7 | 336 | 0.9 | 111100000 |
| 2 | 25 | 3.5 | 528 | 954.2 | 7.5 | 94 | 6.6 | /// | //// | 111100000 |
| 2 | 30 | 3.7 | 548 | 951.8 | 7.4 | 94 | 6.5 | 338 | 1.0 | 111100000 |
| 2 | 35 | 3.9 | 567 | 949.6 | 7.3 | 94 | 6.4 | /// | //// | 111100000 |
| 2 | 40 | 3.7 | 582 | 947.9 | 7.2 | 94 | 6.3 | 348 | 1.1 | 111100000 |
| 2 | 45 | 3.7 | 604 | 945.4 | 7.0 | 94 | 6.1 | /// | //// | 111100000 |

Sounding program REV 7.62 using Omega
Ship :PT_SUR
Location : 36.80 N 121.90 W 3 m
Rejected Sigma stations: a,b,c
Phase fitting length is 250 s from 0 min to 120 min
Sounding : 16
RS-number: 158735752
No PTU editing
No wind editing
Started at: 18 MAY 95 21:53 GMT

| Time min | AscRate s | Hgt/MSL m/s | Pressure m | Temp hPa | RH degC | Dewp % | Dir degC | Speed deg | m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1015.5 | 11.2 | 90 | 9.6 | 255 | 6.3 | -------- |
| 0 | 5 | 3.7 | 21 | 1013.2 | 12.4 | 63 | 5.6 | /// | //// | --CD--GH |
| 0 | 10 | 4.5 | 48 | 1010.0 | 11.8 | 67 | 5.9 | 287 | 4.3 | --CD--GH |
| 0 | 15 | 5.4 | 77 | 1006.5 | 11.6 | 70 | 6.4 | /// | //// | --CD--GH |
| 0 | 20 | 5.2 | 107 | 1002.9 | 11.2 | 72 | 6.4 | 288 | 3.9 | --CD--GH |
| 0 | 25 | 5.3 | 137 | 999.2 | 11.0 | 74 | 6.6 | /// | //// | --CD--GH |
| 0 | 30 | 5.5 | 168 | 995.6 | 10.7 | 76 | 6.7 | 283 | 3.5 | --CD--GH |
| 0 | 35 | 5.8 | 190 | 992.9 | 10.4 | 77 | 6.6 | /// | //// | --CD--GH |
| 0 | 40 | 5.6 | 216 | 989.8 | 10.2 | 78 | 6.6 | 283 | 3.3 | --CD--GH |
| 0 | 45 | 5.5 | 252 | 985.5 | 9.8 | 80 | 6.6 | /// | //// | --CD--GH |
| 0 | 50 | 5.7 | 279 | 982.3 | 9.6 | 81 | 6.5 | 277 | 3.0 | --CD--GH |
| 0 | 55 | 5.5 | 301 | 979.7 | 9.3 | 82 | 6.4 | /// | //// | --CD-FGH |
| 1 | 0 | 5.3 | 328 | 976.6 | 9.2 | 83 | 6.5 | 277 | 2.8 | --CD-FGH |
| 1 | 5 | 5.1 | 346 | 974.4 | 9.3 | 83 | 6.6 | /// | //// | --CD-FGH |
| 1 | 10 | 5.0 | 366 | 972.0 | 9.4 | 83 | 6.7 | 264 | 2.3 | --CD-FGH |
| 1 | 15 | 4.4 | 383 | 970.0 | 9.7 | 81 | 6.6 | /// | //// | --CD-FGH |
| 1 | 20 | 4.0 | 398 | 968.2 | 10.1 | 78 | 6.5 | 258 | 2.3 | --CD-FGH |
| 1 | 25 | 3.9 | 418 | 966.0 | 12.3 | 63 | 5.5 | /// | //// | --CD-FGH |
| 1 | 30 | 3.7 | 439 | 963.5 | 13.0 | 59 | 5.2 | 258 | 2.3 | --CD-FGH |
| 1 | 35 | 3.9 | 460 | 961.1 | 13.2 | 59 | 5.4 | /// | //// | --CD-FGH |
| 1 | 40 | 3.7 | 478 | 959.1 | 13.4 | 51 | 3.5 | 260 | 2.3 | --CD-FGH |
| 1 | 45 | 3.7 | 494 | 957.2 | 15.1 | 33 | -1.0 | /// | //// | --CD-FGH |
| 1 | 50 | 3.8 | 513 | 955.1 | 15.9 | 38 | 1.7 | 261 | 2.3 | --CD-FGH |
| 1 | 55 | 3.5 | 525 | 953.7 | 16.0 | 39 | 2.1 | /// | //// | -BCD-FGH |
| 2 | 0 | 3.2 | 536 | 952.5 | 16.0 | 39 | 2.1 | 258 | 2.3 | -BCD-FGH |
| 2 | 5 | 3.1 | 559 | 949.9 | 15.9 | 40 | 2.4 | /// | //// | -BCD-FGH |
| 2 | 10 | 3.1 | 571 | 948.6 | 15.8 | 41 | 2.6 | 260 | 2.2 | -BCD-FGH |
| 2 | 15 | 3.3 | 592 | 946.2 | 15.8 | 43 | 3.3 | /// | //// | -BCD-FGH |
| 2 | 20 | 3.1 | 606 | 944.7 | 15.8 | 44 | 3.6 | 254 | 2.1 | -BCD-FGH |
| 2 | 25 | 3.3 | 625 | 942.5 | 15.9 | 44 | 3.7 | /// | //// | -BCD-FGH |
| 2 | 30 | 3.6 | 643 | 940.5 | 15.9 | 44 | 3.7 | 261 | 2.0 | -BCD-FGH |
| 2 | 35 | 3.5 | 658 | 938.8 | 16.1 | 41 | 2.9 | /// | //// | -BCD-FGH |
| 2 | 40 | 3.4 | 674 | 937.1 | 16.3 | 37 | 1.7 | 266 | 1.8 | -BCD-FGH |
| 2 | 45 | 3.3 | 693 | 935.0 | 16.3 | 38 | 2.0 | /// | //// | -BCD-FGH |
| 2 | 50 | 3.5 | 711 | 933.0 | 16.2 | 39 | 2.3 | 267 | 1.8 | -BCD-FGH |
| 2 | 55 | 3.5 | 730 | 930.9 | 16.1 | 41 | 2.9 | /// | //// | -BCD-FGH |

Sounding program REV 7.62 using Omega
Ship :PT_SUR
Location : 36.78 N 121.90 W 3 m
Rejected Sigma stations: a,b,c
Phase fitting length is 250 s from 0 min to 120 min
Sounding : 18
RS-number: 158735842
No PTU editing
No wind editing
Started at: 19 MAY 95 15:35 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1014.6 | 10.0 | 100 | 10.0 | 93 | 0.9 | -------- |
| 0 | 5 | 3.3 | 22 | 1012.4 | 11.0 | 80 | 7.7 | /// | //// | --CD-FGH |
| 0 | 10 | 3.9 | 42 | 1010.0 | 10.7 | 81 | 7.6 | 9 | 1.4 | --CD-FGH |
| 0 | 15 | 3.4 | 55 | 1008.4 | 10.7 | 83 | 8.0 | /// | //// | --CD-FGH |
| 0 | 20 | 3.3 | 70 | 1006.6 | 10.5 | 84 | 8.0 | 6 | 1.6 | --CD-FGH |
| 0 | 25 | 3.3 | 87 | 1004.5 | 10.4 | 86 | 8.2 | /// | //// | --CD-FGH |
| 0 | 30 | 3.3 | 102 | 1002.6 | 10.3 | 86 | 8.1 | 1 | 2.2 | --CD-FGH |
| 0 | 35 | 3.4 | 122 | 1000.3 | 10.2 | 87 | 8.2 | /// | //// | --CD-FGH |
| 0 | 40 | 3.3 | 141 | 998.0 | 10.1 | 87 | 8.1 | 5 | 2.1 | --CD-FGH |
| 0 | 45 | 3.4 | 156 | 996.2 | 10.0 | 88 | 8.1 | /// | //// | --CD-FGH |
| 0 | 50 | 3.4 | 173 | 994.1 | 9.9 | 88 | 8.1 | 15 | 1.9 | --CD-FGH |
| 0 | 55 | 3.4 | 189 | 992.2 | 9.8 | 88 | 8.0 | /// | //// | --CD-FGH |
| 1 | 0 | 3.4 | 204 | 990.5 | 9.7 | 88 | 7.9 | 23 | 1.9 | --CD-FGH |
| 1 | 5 | 3.3 | 220 | 988.6 | 9.7 | 89 | 8.0 | /// | //// | -BCD-FGH |
| 1 | 10 | 3.2 | 238 | 986.4 | 9.6 | 89 | 7.9 | 23 | 2.0 | -BCD-FGH |
| 1 | 15 | 3.3 | 255 | 984.3 | 9.5 | 89 | 7.8 | /// | //// | -BCD-FGH |
| 1 | 20 | 3.2 | 270 | 982.5 | 9.4 | 89 | 7.7 | 24 | 2.2 | -BCD-FGH |
| 1 | 25 | 3.3 | 289 | 980.3 | 9.3 | 89 | 7.6 | /// | //// | -BCD-FGH |
| 1 | 30 | 3.4 | 305 | 978.5 | 9.2 | 89 | 7.5 | 29 | 2.2 | -BCD-FGH |
| 1 | 35 | 3.4 | 322 | 976.4 | 9.1 | 89 | 7.4 | /// | //// | -BCD-FGH |
| 1 | 40 | 3.4 | 341 | 974.2 | 9.0 | 89 | 7.3 | 33 | 2.2 | -BCD-FGH |
| 1 | 45 | 3.3 | 354 | 972.6 | 9.0 | 89 | 7.3 | /// | //// | -BCD-FGH |
| 1 | 50 | 3.3 | 369 | 970.9 | 9.2 | 89 | 7.5 | 31 | 2.2 | -BCD-FGH |
| 1 | 55 | 3.2 | 382 | 969.3 | 10.1 | 90 | 8.6 | /// | //// | -BCD-FGH |
| 2 | 0 | 3.0 | 395 | 967.8 | 10.6 | 90 | 9.1 | 30 | 2.2 | -BCD-FGH |
| 2 | 5 | 2.9 | 409 | 966.2 | 11.4 | 90 | 9.9 | /// | //// | -BCD-FGH |
| 2 | 10 | 2.6 | 418 | 965.2 | 11.6 | 88 | 9.7 | 28 | 2.3 | -BCD-FGH |
| 2 | 15 | 2.5 | 429 | 963.9 | 12.1 | 88 | 10.2 | /// | //// | -BCD-FGH |
| 2 | 20 | 2.3 | 438 | 962.8 | 12.3 | 86 | 10.1 | 31 | 2.1 | -BCD-FGH |
| 2 | 25 | 2.5 | 454 | 960.9 | 12.3 | 82 | 9.4 | /// | //// | -BCD-FGH |
| 2 | 30 | 2.4 | 467 | 959.5 | 12.4 | 78 | 8.7 | 31 | 2.2 | -BCD-FGH |
| 2 | 35 | 2.4 | 481 | 957.9 | 12.5 | 78 | 8.8 | /// | //// | -BCD-FGH |
| 2 | 40 | 2.5 | 493 | 956.5 | 12.9 | 79 | 9.4 | 38 | 2.1 | -BCD-FGH |
| 2 | 45 | 2.6 | 506 | 955.0 | 13.2 | 80 | 9.9 | /// | //// | -BCD-FGH |
| 2 | 50 | 2.7 | 518 | 953.7 | 13.3 | 81 | 10.2 | 44 | 2.1 | -BCD-FGH |
| 2 | 55 | 2.6 | 533 | 952.0 | 13.7 | 77 | 9.8 | /// | //// | -BCD-FGH |

Sounding program REV 7.62 using Loran-C
Ship      :PT_SUR
Location : 36.80 N 121.80 W      3 m
Loran-C chain 1:  9940
Phase fitting length is  60 s from   0 min to  10 min
Phase fitting length is 120 s from  10 min to  45 min
Phase fitting length is 240 s from  45 min to 120 min
Sounding : 19
RS-number: 108234748
No PTU editing
No wind editing
Started at:      19 MAY 95 18:27 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1013.4 | 10.5 | 96 | 9.9 | 263 | 1.4 | 000000000 |
| 0 | 5 | 2.7 | 13 | 1012.2 | 11.3 | 78 | 7.7 | /// | //// | 110100000 |
| 0 | 10 | 2.6 | 29 | 1010.3 | 11.0 | 82 | 8.1 | 299 | 1.7 | 110100000 |
| 0 | 15 | 3.2 | 51 | 1007.7 | 10.9 | 85 | 8.5 | /// | //// | 111100000 |
| 0 | 20 | 3.5 | 72 | 1005.1 | 10.7 | 88 | 8.8 | 281 | 2.0 | 111100000 |
| 0 | 25 | 3.7 | 95 | 1002.3 | 10.6 | 89 | 8.9 | /// | //// | 111100000 |
| 0 | 30 | 3.7 | 115 | 1000.0 | 10.5 | 90 | 9.0 | 271 | 2.2 | 111100000 |
| 0 | 35 | 3.9 | 136 | 997.4 | 10.3 | 90 | 8.8 | /// | //// | 111100000 |
| 0 | 40 | 3.9 | 147 | 996.1 | 10.3 | 90 | 8.8 | 318 | 1.3 | 111100000 |
| 0 | 45 | 3.7 | 161 | 994.4 | 10.3 | 90 | 8.8 | /// | //// | 111100000 |
| 0 | 50 | 3.6 | 179 | 992.2 | 10.1 | 90 | 8.6 | 250 | 3.2 | 111100000 |
| 0 | 55 | 3.4 | 200 | 989.8 | 10.1 | 90 | 8.6 | /// | //// | 111100000 |
| 1 | 0 | 3.4 | 216 | 987.8 | 10.0 | 90 | 8.5 | 270 | 1.4 | 111100000 |
| 1 | 5 | 3.3 | 234 | 985.7 | 9.9 | 90 | 8.4 | /// | //// | 111100000 |
| 1 | 10 | 3.2 | 244 | 984.5 | 9.8 | 90 | 8.3 | 12 | 1.2 | 111100000 |
| 1 | 15 | 3.3 | 257 | 982.9 | 9.8 | 90 | 8.3 | /// | //// | 111100000 |
| 1 | 20 | 3.4 | 281 | 980.1 | 9.7 | 89 | 8.0 | 14 | 1.1 | 111100000 |
| 1 | 25 | 3.4 | 300 | 977.9 | 9.7 | 89 | 8.0 | /// | //// | 111100000 |
| 1 | 30 | 3.0 | 305 | 977.3 | 9.6 | 89 | 7.9 | 358 | 0.6 | 111100000 |
| 1 | 35 | 3.4 | 337 | 973.5 | 9.5 | 89 | 7.8 | /// | //// | 111100000 |
| 1 | 40 | 3.6 | 353 | 971.6 | 9.4 | 89 | 7.7 | 0 | 0.0 | 111100000 |
| 1 | 45 | 3.5 | 369 | 969.8 | 9.3 | 89 | 7.6 | /// | //// | 111100000 |
| 1 | 50 | 3.5 | 386 | 967.8 | 9.1 | 88 | 7.3 | 4 | 0.5 | 111100000 |
| 1 | 55 | 3.3 | 398 | 966.4 | 10.2 | 91 | 8.8 | /// | //// | 111100000 |
| 2 | 0 | 3.4 | 406 | 965.4 | 11.6 | 89 | 9.9 | 31 | 1.0 | 111100000 |
| 2 | 5 | 2.6 | 419 | 963.9 | 12.6 | 86 | 10.4 | /// | //// | 111100000 |
| 2 | 10 | 3.0 | 443 | 961.2 | 13.3 | 77 | 9.4 | 44 | 1.1 | 111100000 |
| 2 | 15 | 2.6 | 449 | 960.5 | 13.3 | 75 | 9.0 | /// | //// | 111100000 |
| 2 | 20 | 2.1 | 449 | 960.5 | 13.2 | 72 | 8.3 | 52 | 1.5 | 111100000 |
| 2 | 25 | 3.1 | 490 | 955.8 | 13.6 | 69 | 8.1 | /// | //// | 111100000 |
| 2 | 30 | 3.1 | 498 | 954.9 | 13.7 | 70 | 8.4 | 66 | 1.2 | 111100000 |
| 2 | 35 | 3.4 | 515 | 952.9 | 14.1 | 71 | 9.0 | /// | //// | 111100000 |
| 2 | 40 | 2.8 | 527 | 951.6 | 14.6 | 66 | 8.4 | 107 | 1.2 | 111100000 |
| 2 | 45 | 3.2 | 544 | 949.6 | 15.1 | 64 | 8.4 | /// | //// | 111100000 |

Sounding program REV 7.62 using Loran-C
Ship :PT_SUR
Location : 36.80 N 122.00 W 3 m
Loran-C chain 1: 9940
Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min
Sounding : 20
RS-number: 108234840
No PTU editing
No wind editing
Sounding program REV 7.62 using Loran-C
Ship :PT_SUR
Location : 36.80 N 122.00 W 3 m
Loran-C chain 1: 9940
Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min
Sounding : 20
RS-number: 108234753
No PTU editing
No wind editing
Started at: 19 MAY 95 21:31 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1012.3 | 11.0 | 95 | 10.2 | 275 | 6.1 | 000000000 |
| 0 | 5 | 1.3 | 9 | 1011.5 | 12.4 | 71 | 7.3 | /// | //// | 111100000 |
| 0 | 10 | 2.7 | 30 | 1009.0 | 11.8 | 74 | 7.4 | 292 | 5.8 | 111100000 |
| 0 | 15 | 3.3 | 53 | 1006.2 | 11.6 | 75 | 7.4 | /// | //// | 111100000 |
| 0 | 20 | 3.5 | 72 | 1003.9 | 11.4 | 76 | 7.4 | 289 | 6.3 | 111100000 |
| 0 | 25 | 3.3 | 84 | 1002.4 | 11.2 | 78 | 7.6 | /// | //// | 111100000 |
| 0 | 30 | 3.3 | 103 | 1000.2 | 11.0 | 79 | 7.5 | 294 | 5.7 | 111100000 |
| 0 | 35 | 3.9 | 125 | 997.5 | 10.8 | 81 | 7.7 | /// | //// | 111100000 |
| 0 | 40 | 3.8 | 143 | 995.3 | 10.6 | 81 | 7.5 | 293 | 5.7 | 111100000 |
| 0 | 45 | 3.5 | 157 | 993.6 | 10.5 | 81 | 7.4 | /// | //// | 111100000 |
| 0 | 50 | 3.3 | 170 | 992.2 | 10.4 | 82 | 7.5 | 296 | 5.3 | 111100000 |
| 0 | 55 | 3.2 | 182 | 990.7 | 10.3 | 83 | 7.6 | /// | //// | 111100000 |
| 1 | 0 | 3.0 | 192 | 989.5 | 10.3 | 82 | 7.4 | 298 | 4.8 | 111100000 |
| 1 | 5 | 2.6 | 204 | 988.1 | 10.2 | 82 | 7.3 | /// | //// | 111100000 |
| 1 | 10 | 2.4 | 216 | 986.6 | 10.3 | 81 | 7.2 | 298 | 4.4 | 111100000 |
| 1 | 15 | 2.3 | 229 | 985.1 | 10.4 | 79 | 7.0 | /// | //// | 111100000 |
| 1 | 20 | 2.4 | 241 | 983.7 | 10.9 | 79 | 7.5 | 292 | 4.2 | 111100000 |
| 1 | 25 | 2.3 | 251 | 982.5 | 11.2 | 79 | 7.7 | /// | //// | 111100000 |
| 1 | 30 | 2.2 | 259 | 981.6 | 11.4 | 79 | 7.9 | 292 | 3.8 | 111100000 |
| 1 | 35 | 2.3 | 274 | 979.8 | 11.5 | 79 | 8.0 | /// | //// | 111100000 |
| 1 | 40 | 2.3 | 285 | 978.5 | 11.5 | 79 | 8.0 | 285 | 3.7 | 111100000 |
| 1 | 45 | 2.3 | 298 | 977.0 | 11.6 | 79 | 8.1 | /// | //// | 111100000 |
| 1 | 50 | 2.2 | 308 | 975.8 | 12.0 | 77 | 8.1 | 279 | 3.5 | 111100000 |
| 1 | 55 | 2.2 | 318 | 974.7 | 13.2 | 59 | 5.4 | /// | //// | 111100000 |
| 2 | 0 | 2.3 | 328 | 973.5 | 14.6 | 43 | 2.2 | 276 | 3.4 | 111100000 |
| 2 | 5 | 2.3 | 340 | 972.0 | 15.5 | 43 | 3.0 | /// | //// | 111100000 |
| 2 | 10 | 2.1 | 349 | 971.1 | 15.9 | 57 | 7.5 | 273 | 3.2 | 111100000 |
| 2 | 15 | 2.2 | 363 | 969.4 | 16.0 | 57 | 7.6 | /// | //// | 111100000 |
| 2 | 20 | 2.2 | 374 | 968.2 | 16.4 | 52 | 6.6 | 275 | 2.8 | 111100000 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 25 | 2.2 | 385 | 966.9 | 16.9 | 53 | 7.3 | /// | //// | 111100000 |
| 2 | 30 | 2.3 | 396 | 965.7 | 17.7 | 45 | 5.7 | 277 | 2.4 | 111100000 |
| 2 | 35 | 2.2 | 407 | 964.5 | 18.1 | 47 | 6.7 | /// | //// | 111100000 |
| 2 | 40 | 2.3 | 417 | 963.3 | 18.1 | 47 | 6.7 | 282 | 2.0 | 111100000 |
| 2 | 45 | 2.2 | 428 | 962.1 | 18.0 | 48 | 6.9 | /// | //// | 111100000 |
| 2 | 50 | 2.2 | 440 | 960.7 | 18.0 | 49 | 7.2 | 284 | 1.7 | 111100000 |
| 2 | 55 | 2.2 | 450 | 959.5 | 17.9 | 49 | 7.1 | /// | //// | 111100000 |
| 3 | 0 | 2.2 | 461 | 958.4 | 17.9 | 49 | 7.1 | 285 | 1.6 | 111100000 |
| 3 | 5 | 2.1 | 470 | 957.3 | 18.1 | 49 | 7.3 | /// | //// | 111100000 |
| 3 | 10 | 2.0 | 478 | 956.5 | 18.2 | 48 | 7.1 | 296 | 1.4 | 111100000 |
| 3 | 15 | 1.9 | 488 | 955.3 | 18.4 | 47 | 7.0 | /// | //// | 111100000 |
| 3 | 20 | 1.9 | 498 | 954.2 | 18.4 | 46 | 6.6 | 306 | 1.3 | 111100000 |
| 3 | 25 | 1.9 | 509 | 953.0 | 18.4 | 46 | 6.6 | /// | //// | 111100000 |
| 3 | 30 | 1.9 | 517 | 952.1 | 18.4 | 45 | 6.3 | 301 | 1.2 | 111100000 |
| 3 | 35 | 1.8 | 525 | 951.1 | 18.5 | 45 | 6.4 | /// | //// | 111100000 |
| 3 | 40 | 1.9 | 534 | 950.2 | 18.4 | 44 | 6.0 | 283 | 1.2 | 111100000 |
| 3 | 45 | 1.8 | 542 | 949.3 | 18.5 | 42 | 5.4 | /// | //// | 111100000 |
| 3 | 50 | 1.8 | 551 | 948.4 | 18.6 | 41 | 5.2 | 285 | 1.1 | 111100000 |
| 3 | 55 | 1.8 | 561 | 947.2 | 18.7 | 41 | 5.3 | /// | //// | 111100000 |
| 4 | 0 | 1.7 | 569 | 946.3 | 18.9 | 42 | 5.8 | 288 | 1.1 | 111100000 |
| 4 | 5 | 1.7 | 575 | 945.6 | 19.1 | 41 | 5.6 | /// | //// | 111100000 |
| 4 | 10 | 1.7 | 584 | 944.7 | 19.1 | 38 | 4.5 | 283 | 1.3 | 111100000 |
| 4 | 15 | 1.7 | 592 | 943.7 | 19.2 | 37 | 4.2 | /// | //// | 111100000 |
| 4 | 20 | 1.7 | 601 | 942.8 | 19.2 | 37 | 4.2 | 281 | 1.5 | 111100000 |
| 4 | 25 | 1.6 | 609 | 941.9 | 19.1 | 37 | 4.1 | /// | //// | 111100000 |
| 4 | 30 | 1.5 | 615 | 941.2 | 19.1 | 36 | 3.8 | 271 | 1.8 | 111100000 |
| 4 | 35 | 1.5 | 620 | 940.6 | 19.1 | 36 | 3.8 | /// | //// | 111100000 |
| 4 | 40 | 1.6 | 632 | 939.4 | 19.0 | 36 | 3.7 | 265 | 2.0 | 111100000 |
| 4 | 45 | 1.5 | 638 | 938.7 | 18.9 | 35 | 3.2 | /// | //// | 111100000 |
| 4 | 50 | 1.5 | 647 | 937.8 | 18.9 | 35 | 3.2 | 259 | 2.6 | 111100000 |
| 4 | 55 | 1.5 | 653 | 937.1 | 18.9 | 35 | 3.2 | /// | //// | 111100000 |
| 5 | 0 | 1.5 | 659 | 936.4 | 18.8 | 35 | 3.1 | 256 | 3.2 | 111100000 |
| 5 | 5 | 1.6 | 668 | 935.4 | 18.9 | 36 | 3.6 | /// | //// | 111100000 |
| 5 | 10 | 1.3 | 672 | 935.0 | 19.0 | 35 | 3.3 | 252 | 3.9 | 111100000 |
| 5 | 15 | 1.5 | 681 | 934.0 | 19.1 | 31 | 1.7 | /// | //// | 111100000 |
| 5 | 20 | 1.3 | 686 | 933.4 | 19.2 | 28 | 0.3 | 253 | 3.9 | 111100000 |
| 5 | 25 | 1.3 | 694 | 932.6 | 19.3 | 24 | -1.7 | /// | //// | 111100000 |
| 5 | 30 | 1.3 | 699 | 932.1 | 19.3 | 23 | -2.3 | 250 | 4.0 | 111100000 |
| 5 | 35 | 1.2 | 705 | 931.4 | 19.4 | 19 | -4.7 | /// | //// | 111100000 |
| 5 | 40 | 1.3 | 711 | 930.7 | 19.5 | 18 | -5.4 | 251 | 4.1 | 111100000 |
| 5 | 45 | 1.3 | 718 | 930.0 | 19.5 | 17 | -6.1 | /// | //// | 111100000 |
| 5 | 50 | 1.3 | 724 | 929.3 | 19.5 | 17 | -6.1 | 247 | 4.5 | 111100000 |
| 5 | 55 | 1.2 | 730 | 928.7 | 19.5 | 17 | -6.1 | /// | //// | 111100000 |

Sounding program REV 7.62 using Loran-C
Ship      :PT_SUR
Location : 36.80 N 122.00 W      3 m
Loran-C chain 1:  9940
Phase fitting length is  60 s from   0 min to  10 min
Phase fitting length is 120 s from  10 min to  45 min
Phase fitting length is 240 s from  45 min to 120 min
Sounding : 21
RS-number: 108234651
No PTU editing
No wind editing
Started at:      19 MAY 95 21:55 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1013.9 | 11.0 | 95 | 10.2 | 276 | 5.8 | 000000000 |
| 0 | 5 | 3.0 | 20 | 1011.9 | 12.0 | 71 | 7.0 | /// | //// | 111100000 |
| 0 | 10 | 3.5 | 38 | 1009.8 | 11.7 | 74 | 7.3 | 304 | 6.5 | 111100000 |
| 0 | 15 | 3.9 | 60 | 1007.1 | 11.5 | 76 | 7.5 | /// | //// | 111100000 |
| 0 | 20 | 3.5 | 74 | 1005.3 | 11.3 | 77 | 7.5 | 308 | 5.9 | 111100000 |
| 0 | 25 | 3.5 | 93 | 1003.1 | 11.1 | 79 | 7.6 | /// | //// | 111100000 |
| 0 | 30 | 3.5 | 109 | 1001.2 | 11.0 | 80 | 7.7 | 305 | 5.7 | 111100000 |
| 0 | 35 | 3.5 | 125 | 999.2 | 10.8 | 81 | 7.7 | /// | //// | 111100000 |
| 0 | 40 | 3.4 | 141 | 997.3 | 10.6 | 81 | 7.5 | 312 | 5.4 | 111100000 |
| 0 | 45 | 3.2 | 157 | 995.3 | 10.5 | 82 | 7.6 | /// | //// | 111100000 |
| 0 | 50 | 3.3 | 172 | 993.6 | 10.4 | 83 | 7.7 | 309 | 5.1 | 111100000 |
| 0 | 55 | 3.3 | 191 | 991.3 | 10.2 | 85 | 7.8 | /// | //// | 111100000 |
| 1 | 0 | 3.6 | 218 | 988.1 | 10.0 | 85 | 7.6 | 315 | 4.6 | 111100000 |
| 1 | 5 | 3.9 | 239 | 985.5 | 10.0 | 84 | 7.5 | /// | //// | 111100000 |
| 1 | 10 | 4.1 | 263 | 982.8 | 10.3 | 82 | 7.4 | 308 | 4.1 | 111100000 |
| 1 | 15 | 4.0 | 278 | 981.0 | 10.6 | 80 | 7.3 | /// | //// | 111100000 |
| 1 | 20 | 4.1 | 295 | 978.9 | 11.1 | 79 | 7.6 | 294 | 3.7 | 111100000 |
| 1 | 25 | 4.0 | 311 | 977.0 | 11.3 | 81 | 8.2 | /// | //// | 111100000 |
| 1 | 30 | 3.8 | 332 | 974.7 | 11.4 | 82 | 8.5 | 287 | 3.5 | 111100000 |
| 1 | 35 | 3.6 | 348 | 972.7 | 11.9 | 80 | 8.6 | /// | //// | 111100000 |
| 1 | 40 | 3.4 | 364 | 970.9 | 13.8 | 40 | 0.5 | 286 | 3.2 | 111100000 |
| 1 | 45 | 3.4 | 379 | 969.2 | 15.0 | 41 | 1.9 | /// | //// | 111100000 |
| 1 | 50 | 3.3 | 395 | 967.3 | 15.6 | 51 | 5.6 | 284 | 2.7 | 111100000 |
| 1 | 55 | 3.3 | 412 | 965.4 | 16.3 | 53 | 6.8 | /// | //// | 111100000 |
| 2 | 0 | 3.3 | 431 | 963.3 | 17.3 | 47 | 6.0 | 279 | 2.5 | 111100000 |
| 2 | 5 | 3.2 | 445 | 961.7 | 17.9 | 49 | 7.1 | /// | //// | 111100000 |
| 2 | 10 | 3.1 | 458 | 960.2 | 17.9 | 49 | 7.1 | 274 | 2.5 | 111100000 |
| 2 | 15 | 3.0 | 474 | 958.4 | 17.9 | 49 | 7.1 | /// | //// | 111100000 |
| 2 | 20 | 3.2 | 491 | 956.5 | 17.8 | 50 | 7.3 | 273 | 2.3 | 111100000 |
| 2 | 25 | 3.2 | 508 | 954.5 | 17.9 | 49 | 7.1 | /// | //// | 111100000 |
| 2 | 30 | 3.2 | 526 | 952.5 | 18.1 | 47 | 6.7 | 272 | 2.2 | 111100000 |
| 2 | 35 | 2.9 | 535 | 951.6 | 18.4 | 45 | 6.3 | /// | //// | 111100000 |
| 2 | 40 | 2.9 | 545 | 950.4 | 18.7 | 42 | 5.6 | 273 | 2.1 | 111100000 |
| 2 | 45 | 3.2 | 569 | 947.8 | 18.8 | 41 | 5.3 | /// | //// | 111100000 |

Sounding program REV 7.62 using Loran-C
Ship :PT_SUR
Location : 36.70 N 122.40 W 3 m
Loran-C chain 1: 9940
Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min
Sounding : 23
RS-number: 108234843
No PTU editing
No wind editing
Started at: 20 MAY 95 15:19 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1014.9 | 11.1 | 87 | 9.0 | 326 | 4.2 | 000000000 |
| 0 | 5 | 6.5 | 31 | 1011.5 | 12.1 | 65 | 5.8 | /// | //// | 111100000 |
| 0 | 10 | 5.5 | 58 | 1008.3 | 11.6 | 67 | 5.7 | 326 | 3.7 | 111100000 |
| 0 | 15 | 6.0 | 93 | 1004.1 | 11.3 | 71 | 6.3 | /// | //// | 111100000 |
| 0 | 20 | 6.0 | 123 | 1000.4 | 10.9 | 72 | 6.1 | 329 | 3.5 | 111100000 |
| 0 | 25 | 6.1 | 156 | 996.4 | 10.7 | 74 | 6.3 | /// | //// | 111100000 |
| 0 | 30 | 6.1 | 186 | 992.9 | 10.3 | 75 | 6.1 | 325 | 3.5 | 111100000 |
| 0 | 35 | 5.9 | 214 | 989.5 | 10.1 | 77 | 6.3 | /// | //// | 111100000 |
| 0 | 40 | 6.3 | 247 | 985.7 | 9.7 | 78 | 6.1 | 320 | 3.5 | 111100000 |
| 0 | 45 | 5.9 | 269 | 983.0 | 9.5 | 79 | 6.1 | /// | //// | 111100000 |
| 0 | 50 | 6.1 | 305 | 978.7 | 9.2 | 80 | 6.0 | 311 | 3.5 | 111100000 |
| 0 | 55 | 5.9 | 331 | 975.6 | 8.9 | 82 | 6.0 | /// | //// | 111100000 |
| 1 | 0 | 5.7 | 356 | 972.7 | 8.7 | 83 | 6.0 | 316 | 3.3 | 111100000 |
| 1 | 5 | 5.9 | 391 | 968.6 | 8.4 | 85 | 6.1 | /// | //// | 111100000 |
| 1 | 10 | 5.8 | 420 | 965.2 | 8.0 | 86 | 5.8 | 323 | 3.2 | 111100000 |
| 1 | 15 | 6.0 | 452 | 961.4 | 7.8 | 88 | 6.0 | /// | //// | 111100000 |
| 1 | 20 | 5.8 | 480 | 958.1 | 7.6 | 89 | 5.9 | 330 | 3.0 | 111100000 |
| 1 | 25 | 5.9 | 513 | 954.3 | 7.4 | 89 | 5.8 | /// | //// | 111100000 |
| 1 | 30 | 6.3 | 544 | 950.7 | 7.2 | 89 | 5.6 | 324 | 2.6 | 111100000 |
| 1 | 35 | 6.2 | 572 | 947.4 | 7.0 | 90 | 5.5 | /// | //// | 111100000 |
| 1 | 40 | 6.4 | 613 | 942.8 | 6.8 | 90 | 5.3 | 344 | 2.4 | 111100000 |
| 1 | 45 | 5.9 | 629 | 941.0 | 6.7 | 90 | 5.2 | /// | //// | 111100000 |
| 1 | 50 | 5.8 | 655 | 938.0 | 6.4 | 90 | 4.9 | 309 | 1.6 | 111100000 |
| 1 | 55 | 6.1 | 692 | 933.7 | 6.1 | 90 | 4.6 | /// | //// | 111100000 |
| 2 | 0 | 6.5 | 738 | 928.4 | 6.0 | 27 | -11.5 | 265 | 1.9 | 111100000 |
| 2 | 5 | 6.0 | 760 | 925.9 | 7.2 | 19 | -14.9 | /// | //// | 111100000 |
| 2 | 10 | 5.7 | 783 | 923.5 | 10.2 | 14 | -16.1 | 241 | 1.8 | 111100000 |
| 2 | 15 | 5.7 | 801 | 921.4 | 13.2 | 10 | -17.7 | /// | //// | 111100000 |
| 2 | 20 | 5.5 | 821 | 919.2 | 15.3 | 9 | -17.4 | 237 | 1.9 | 111100000 |
| 2 | 25 | 4.5 | 830 | 918.3 | 15.9 | 11 | -14.5 | /// | //// | 111100000 |
| 2 | 30 | 3.7 | 848 | 916.3 | 16.1 | 11 | -14.3 | 230 | 2.1 | 111100000 |
| 2 | 35 | 3.6 | 865 | 914.5 | 16.0 | 11 | -14.4 | /// | //// | 111100000 |
| 2 | 40 | 3.3 | 883 | 912.5 | 16.0 | 10 | -15.6 | 226 | 2.3 | 111100000 |
| 2 | 45 | 3.3 | 902 | 910.5 | 16.0 | 8 | -18.2 | /// | //// | 111100000 |

Sounding program REV 7.62 using Loran-C
Ship :PT_SUR
Location : 36.70 N 122.40 W 3 m
Loran-C chain 1: 9940
Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min
Sounding : 24
RS-number: 108234747
No PTU editing
No wind editing
Sounding program REV 7.62 using Loran-C
Ship :PT_SUR
Location : 36.70 N 122.40 W 3 m
Loran-C chain 1: 9940
Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min
Sounding : 24
RS-number: 108234747
No PTU editing
No wind editing
Started manually by operator
Started at: 20 MAY 95 17:26 GMT

| Time | | AscRate | Hgt/MSL | Pressure | Temp | RH | Dewp | Dir | Speed | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| min | s | m/s | m | hPa | degC | % | degC | deg | m/s | |
| 0 | 0 | 0.0 | 3 | 1015.2 | 11.2 | 84 | 8.6 | 355 | 2.3 | 000000000 |
| 0 | 5 | 175.5 | 1057 | 895.4 | 15.6 | 11 | -14.7 | /// | //// | 000100000 |
| 0 | 10 | 104.2 | 1045 | 896.6 | 15.8 | 11 | -14.6 | /// | //// | 000100000 |
| 0 | 15 | 64.7 | 1041 | 897.0 | 15.9 | 11 | -14.5 | /// | //// | 011100000 |
| 0 | 20 | 50.9 | 1021 | 899.2 | 16.0 | 10 | -15.6 | 204 | 5.6 | 011100000 |
| 0 | 25 | 39.0 | 1017 | 899.5 | 16.0 | 10 | -15.6 | /// | //// | 111100000 |
| 0 | 30 | 33.4 | 1006 | 900.7 | 16.0 | 10 | -15.6 | 211 | 3.2 | 111100000 |
| 0 | 35 | -2.1 | 997 | 901.7 | 16.0 | 11 | -14.4 | /// | //// | 111100000 |
| 0 | 40 | -1.8 | 990 | 902.5 | 15.9 | 11 | -14.5 | 225 | 4.8 | 111100000 |
| 0 | 45 | -2.1 | 979 | 903.6 | 15.9 | 11 | -14.5 | /// | //// | 111100000 |
| 0 | 50 | -1.7 | 969 | 904.7 | 16.0 | 12 | -13.3 | 232 | 4.1 | 111100000 |
| 0 | 55 | -2.0 | 960 | 905.7 | 16.1 | 11 | -14.3 | /// | //// | 111100000 |
| 1 | 0 | -1.9 | 950 | 906.7 | 16.1 | 11 | -14.3 | 222 | 2.2 | 111100000 |
| 1 | 5 | -1.8 | 941 | 907.7 | 16.2 | 11 | -14.3 | /// | //// | 111100000 |
| 1 | 10 | -2.0 | 930 | 908.9 | 16.3 | 11 | -14.2 | 231 | 2.8 | 111100000 |
| 1 | 15 | -1.9 | 921 | 909.8 | 16.3 | 11 | -14.2 | /// | //// | 111100000 |
| 1 | 20 | -1.9 | 913 | 910.7 | 16.3 | 12 | -13.1 | 231 | 2.0 | 111100000 |
| 1 | 25 | -1.9 | 902 | 911.9 | 16.4 | 13 | -12.0 | /// | //// | 111100000 |
| 1 | 30 | -1.9 | 892 | 912.9 | 16.4 | 12 | -13.0 | 232 | 2.5 | 111100000 |
| 1 | 35 | -2.0 | 882 | 914.0 | 16.5 | 12 | -12.9 | /// | //// | 111100000 |
| 1 | 40 | -1.8 | 876 | 914.7 | 16.5 | 12 | -12.9 | 234 | 3.0 | 111100000 |
| 1 | 45 | -1.8 | 865 | 915.8 | 16.6 | 12 | -12.9 | /// | //// | 111100000 |
| 1 | 50 | -1.9 | 855 | 916.9 | 16.5 | 12 | -12.9 | 235 | 3.2 | 111100000 |
| 1 | 55 | -2.0 | 844 | 918.2 | 16.5 | 12 | -12.9 | /// | //// | 111100000 |

```
Sounding program REV 7.62 using Loran-C
Ship      :PT_SUR
Location : 36.70 N 122.40 W       3 m
Loran-C chain 1:  9940
Phase fitting length is  60 s from   0 min to  10 min
Phase fitting length is 120 s from  10 min to  45 min
Phase fitting length is 240 s from  45 min to 120 min
Sounding : 25
RS-number: 108234749
No PTU editing
No wind editing
Ground check  :    Ref      RS    Corr
  Pressure    : 1016.2 1016.2   -0.0
  Temperature :    22.7   22.7     0.0
  Humidity    :     42     42       0
Started manually by operator
Started at:       20 MAY 95 17:52 GMT
```

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1016.2 | 11.2 | 88 | 9.3 | 25 | 1.9 | 000000000 |
| 0 | 5 | 0.0 | 2 | 1016.3 | 12.9 | 73 | 8.2 | /// | //// | 111100000 |
| 0 | 10 | -0.2 | 1 | 1016.5 | 12.9 | 72 | 8.0 | 219 | 2.2 | 111100000 |
| 0 | 15 | -0.1 | 1 | 1016.5 | 12.9 | 72 | 8.0 | /// | //// | 111100000 |
| 0 | 20 | -0.1 | 1 | 1016.5 | 12.8 | 73 | 8.1 | 228 | 2.8 | 111100000 |
| 0 | 25 | -0.2 | 1 | 1016.5 | 12.8 | 73 | 8.1 | /// | //// | 111100000 |
| 0 | 30 | -0.1 | 1 | 1016.5 | 12.7 | 73 | 8.0 | 234 | 2.7 | 111100000 |
| 0 | 35 | -0.1 | 1 | 1016.5 | 12.7 | 74 | 8.2 | /// | //// | 111100000 |
| 0 | 40 | 0.0 | 1 | 1016.5 | 12.6 | 74 | 8.1 | 242 | 2.4 | 111100000 |
| 0 | 45 | 0.0 | 1 | 1016.5 | 12.6 | 74 | 8.1 | /// | //// | 111100000 |
| 0 | 50 | 0.0 | 1 | 1016.5 | 12.6 | 74 | 8.1 | 287 | 0.8 | 111100000 |
| 0 | 55 | 0.1 | 1 | 1016.5 | 12.6 | 74 | 8.1 | /// | //// | 111100000 |
| 1 | 0 | 0.0 | 1 | 1016.5 | 12.5 | 74 | 8.0 | 324 | 1.0 | 111100000 |
| 1 | 5 | -0.1 | -2 | 1016.8 | 12.5 | 75 | 8.2 | /// | //// | 111100000 |
| 1 | 10 | -0.1 | -1 | 1016.7 | 12.5 | 75 | 8.2 | 325 | 1.6 | 111100000 |
| 1 | 15 | -0.1 | -2 | 1016.8 | 12.4 | 74 | 7.9 | /// | //// | 111100000 |
| 1 | 20 | -0.1 | -1 | 1016.7 | 12.4 | 77 | 8.5 | 323 | 1.9 | 111100000 |
| 1 | 25 | -0.1 | -1 | 1016.7 | 12.3 | 77 | 8.4 | /// | //// | 111100000 |
| 1 | 30 | -0.1 | -1 | 1016.7 | 12.3 | 77 | 8.4 | 311 | 2.2 | 111100000 |
| 1 | 35 | 0.0 | -3 | 1016.9 | 12.5 | 78 | 8.8 | /// | //// | 111100000 |
| 1 | 40 | 0.1 | 3 | 1016.2 | 12.2 | 77 | 8.3 | 316 | 2.5 | 111100000 |
| 1 | 45 | 0.4 | 8 | 1015.6 | 12.4 | 77 | 8.5 | /// | //// | 111100000 |
| 1 | 50 | 0.3 | 9 | 1015.5 | 12.3 | 76 | 8.2 | 318 | 2.7 | 111100000 |
| 1 | 55 | 0.3 | 8 | 1015.6 | 12.4 | 76 | 8.3 | /// | //// | 111100000 |
| 2 | 0 | 0.3 | 9 | 1015.5 | 12.6 | 76 | 8.5 | 318 | 2.7 | 111100000 |
| 2 | 5 | 0.4 | 9 | 1015.5 | 12.4 | 75 | 8.1 | /// | //// | 111100000 |
| 2 | 10 | 0.1 | 7 | 1015.7 | 12.5 | 75 | 8.2 | 314 | 2.9 | 111100000 |
| 2 | 15 | 0.1 | 10 | 1015.3 | 12.5 | 76 | 8.4 | /// | //// | 111100000 |
| 2 | 20 | -0.1 | 7 | 1015.7 | 12.4 | 75 | 8.1 | 313 | 3.2 | 111100000 |
| 2 | 25 | -0.1 | 7 | 1015.7 | 12.6 | 76 | 8.5 | /// | //// | 111100000 |
| 2 | 30 | -0.1 | 7 | 1015.7 | 12.6 | 76 | 8.5 | 311 | 3.2 | 111100000 |
| 2 | 35 | -0.1 | 5 | 1016.0 | 12.7 | 75 | 8.4 | /// | //// | 111100000 |
| 2 | 40 | -0.2 | 1 | 1016.5 | 12.6 | 75 | 8.3 | 312 | 3.1 | 111100000 |
| 2 | 45 | -0.4 | 0 | 1016.6 | 12.6 | 75 | 8.3 | /// | //// | 111100000 |
| 2 | 50 | -0.3 | -1 | 1016.7 | 12.9 | 75 | 8.6 | 317 | 3.1 | 111100000 |

Sounding program REV 7.62 using Loran-C
Ship      :PT_SUR
Location : 36.70 N 122.40 W      3 m
Loran-C chain 1:  9940
Phase fitting length is  60 s from   0 min to  10 min
Phase fitting length is 120 s from  10 min to  45 min
Phase fitting length is 240 s from  45 min to 120 min
Sounding : 25
RS-number: 108234749
No PTU editing
No wind editing

| Ground check | Ref | RS | Corr |
|---|---|---|---|
| Pressure | 1016.9 | 1016.9 | 0.0 |
| Temperature | 13.3 | 13.3 | -0.0 |
| Humidity | 71 | 71 | 0 |

Started manually by operator
Started at:       20 MAY 95 19:54 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1016.9 | 13.3 | 71 | 8.2 | 124 | 0.5 | 000000000 |
| 0 | 5 | 0.0 | 3 | 1016.9 | 13.2 | 72 | 8.3 | /// | //// | 111100000 |
| 0 | 10 | 0.4 | 7 | 1016.5 | 13.1 | 72 | 8.2 | 218 | 1.2 | 111100000 |
| 0 | 15 | 0.0 | 3 | 1016.9 | 13.2 | 72 | 8.3 | /// | //// | 111100000 |
| 0 | 20 | 0.0 | 3 | 1016.9 | 13.0 | 71 | 7.9 | 217 | 1.2 | 111100000 |
| 0 | 25 | 0.0 | 4 | 1016.8 | 13.0 | 72 | 8.1 | /// | //// | 111100000 |
| 0 | 30 | 0.0 | 3 | 1016.9 | 12.7 | 70 | 7.4 | 218 | 1.1 | 111100000 |
| 0 | 35 | 0.0 | 2 | 1017.1 | 13.0 | 71 | 7.9 | /// | //// | 111100000 |
| 0 | 40 | -0.1 | 3 | 1016.9 | 13.1 | 71 | 8.0 | 216 | 0.8 | 111100000 |
| 0 | 45 | -0.1 | 3 | 1016.9 | 13.0 | 71 | 7.9 | /// | //// | 111100000 |
| 0 | 50 | 0.0 | 3 | 1016.9 | 13.4 | 72 | 8.5 | 208 | 0.5 | 111100000 |
| 0 | 55 | 0.1 | 4 | 1016.8 | 13.2 | 71 | 8.1 | /// | //// | 111100000 |
| 1 | 0 | 0.0 | 3 | 1016.9 | 12.9 | 71 | 7.8 | 208 | 0.6 | 111100000 |
| 1 | 5 | 0.0 | 3 | 1016.9 | 12.8 | 72 | 7.9 | /// | //// | 111100000 |
| 1 | 10 | 0.0 | 3 | 1016.9 | 12.9 | 75 | 8.6 | 187 | 0.5 | 111100000 |
| 1 | 15 | 0.1 | 5 | 1016.7 | 13.0 | 73 | 8.3 | /// | //// | 111100000 |
| 1 | 20 | 0.1 | 7 | 1016.5 | 12.8 | 71 | 7.7 | 119 | 0.6 | 111100000 |
| 1 | 25 | 0.0 | 5 | 1016.7 | 13.1 | 72 | 8.2 | /// | //// | 111100000 |
| 1 | 30 | 0.1 | 7 | 1016.5 | 12.9 | 70 | 7.6 | 139 | 0.6 | 111100000 |
| 1 | 35 | 0.2 | 8 | 1016.3 | 12.8 | 69 | 7.3 | /// | //// | 111100000 |
| 1 | 40 | 0.1 | 7 | 1016.5 | 12.8 | 69 | 7.3 | 106 | 0.7 | 111100000 |
| 1 | 45 | 0.1 | 9 | 1016.2 | 12.7 | 70 | 7.4 | /// | //// | 111100000 |
| 1 | 50 | 0.1 | 9 | 1016.2 | 12.6 | 70 | 7.3 | 133 | 0.5 | 111100000 |
| 1 | 55 | 0.1 | 7 | 1016.5 | 12.7 | 70 | 7.4 | /// | //// | 111100000 |
| 2 | 0 | 0.1 | 9 | 1016.2 | 12.6 | 71 | 7.5 | 99 | 0.8 | 111100000 |
| 2 | 5 | 0.1 | 9 | 1016.2 | 12.7 | 70 | 7.4 | /// | //// | 111100000 |
| 2 | 10 | 0.3 | 15 | 1015.5 | 12.6 | 70 | 7.3 | 108 | 0.8 | 111100000 |
| 2 | 15 | 0.3 | 17 | 1015.2 | 12.6 | 72 | 7.7 | /// | //// | 111100000 |
| 2 | 20 | 0.2 | 15 | 1015.5 | 12.5 | 72 | 7.6 | 95 | 1.0 | 111100000 |
| 2 | 25 | 0.4 | 18 | 1015.1 | 12.5 | 71 | 7.4 | /// | //// | 111100000 |
| 2 | 30 | 0.3 | 17 | 1015.2 | 12.5 | 72 | 7.6 | 98 | 0.7 | 111100000 |
| 2 | 35 | 0.3 | 19 | 1015.0 | 12.6 | 72 | 7.7 | /// | //// | 111100000 |
| 2 | 40 | 0.2 | 21 | 1014.7 | 12.3 | 72 | 7.5 | 136 | 0.5 | 111100000 |
| 2 | 45 | 0.3 | 25 | 1014.2 | 12.3 | 72 | 7.5 | /// | //// | 111100000 |
| 2 | 50 | 0.6 | 32 | 1013.5 | 12.3 | 72 | 7.5 | 112 | 0.5 | 111100000 |

Start Up Date 22 MAY 95 15:42 GMT
System test passed -No errors found
Sounding program REV 7.62 using Loran-C
Ship :PT_SUR
Location : 36.80 N 121.80 W 3 m
Loran-C chain 1: 9940
Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min
Sounding : 31
RS-number: 108234842
No PTU editing
No wind editing
Started at: 22 MAY 95 15:52 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1015.1 | 11.2 | 94 | 10.3 | 279 | 4.1 | 000000000 |
| 0 | 5 | 3.7 | 23 | 1012.7 | 12.1 | 75 | 7.9 | /// | //// | 111100000 |
| 0 | 10 | 3.7 | 40 | 1010.8 | 11.9 | 77 | 8.0 | 270 | 4.4 | 111100000 |
| 0 | 15 | 3.4 | 56 | 1008.8 | 11.7 | 79 | 8.2 | /// | //// | 111100000 |
| 0 | 20 | 3.3 | 70 | 1007.1 | 11.6 | 80 | 8.3 | 273 | 4.3 | 111100000 |
| 0 | 25 | 3.2 | 81 | 1005.7 | 11.5 | 81 | 8.4 | /// | //// | 111100000 |
| 0 | 30 | 3.1 | 97 | 1003.9 | 11.3 | 82 | 8.4 | 277 | 4.0 | 111100000 |
| 0 | 35 | 3.1 | 115 | 1001.7 | 11.2 | 83 | 8.5 | /// | //// | 111100000 |
| 0 | 40 | 3.1 | 133 | 999.5 | 11.0 | 84 | 8.4 | 285 | 3.5 | 111100000 |
| 0 | 45 | 3.1 | 149 | 997.5 | 10.9 | 85 | 8.5 | /// | //// | 111100000 |
| 0 | 50 | 3.3 | 168 | 995.3 | 10.7 | 86 | 8.5 | 276 | 3.9 | 111100000 |
| 0 | 55 | 3.5 | 188 | 992.9 | 10.5 | 85 | 8.1 | /// | //// | 111100000 |
| 1 | 0 | 3.7 | 208 | 990.5 | 10.3 | 82 | 7.4 | 275 | 4.0 | 111100000 |
| 1 | 5 | 4.0 | 229 | 987.9 | 10.2 | 83 | 7.5 | /// | //// | 111100000 |
| 1 | 10 | 3.7 | 245 | 986.1 | 10.1 | 82 | 7.2 | 275 | 3.8 | 111100000 |
| 1 | 15 | 3.6 | 259 | 984.5 | 9.9 | 83 | 7.2 | /// | //// | 111100000 |
| 1 | 20 | 3.5 | 273 | 982.8 | 9.7 | 83 | 7.0 | 275 | 3.6 | 111100000 |
| 1 | 25 | 3.5 | 293 | 980.4 | 9.6 | 84 | 7.1 | /// | //// | 111100000 |
| 1 | 30 | 3.4 | 311 | 978.2 | 9.5 | 81 | 6.5 | 289 | 2.7 | 111100000 |
| 1 | 35 | 3.2 | 326 | 976.6 | 9.5 | 81 | 6.5 | /// | //// | 111100000 |
| 1 | 40 | 3.2 | 340 | 974.9 | 9.4 | 81 | 6.4 | 292 | 2.4 | 111100000 |
| 1 | 45 | 3.1 | 352 | 973.5 | 9.3 | 81 | 6.3 | /// | //// | 111100000 |
| 1 | 50 | 3.2 | 370 | 971.3 | 9.1 | 81 | 6.1 | 290 | 2.5 | 111100000 |
| 1 | 55 | 3.0 | 381 | 970.0 | 9.0 | 82 | 6.1 | /// | //// | 111100000 |
| 2 | 0 | 2.8 | 394 | 968.5 | 8.8 | 82 | 5.9 | 281 | 2.6 | 111100000 |
| 2 | 5 | 2.7 | 409 | 966.7 | 8.7 | 83 | 6.0 | /// | //// | 111100000 |
| 2 | 10 | 2.7 | 422 | 965.2 | 8.5 | 83 | 5.8 | 281 | 2.6 | 111100000 |
| 2 | 15 | 2.8 | 434 | 963.8 | 8.5 | 84 | 6.0 | /// | //// | 111100000 |
| 2 | 20 | 2.6 | 447 | 962.4 | 8.3 | 85 | 6.0 | 290 | 2.3 | 111100000 |

Sounding program REV 7.62 using Loran-C

Ship :PT_SUR
Location : 36.80 N 121.80 W 3 m

Loran-C chain 1: 9940

Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min

Sounding : 32
RS-number: 108234754

No PTU editing
No wind editing

Started at: 22 MAY 95 17:57 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1016.7 | 11.4 | 89 | 9.7 | 306 | 1.6 | 000000000 |
| 0 | 5 | 5.8 | 29 | 1013.5 | 12.6 | 70 | 7.3 | /// | //// | 110100000 |
| 0 | 10 | 5.1 | 54 | 1010.5 | 12.1 | 73 | 7.5 | 313 | 4.5 | 110100000 |
| 0 | 15 | 5.2 | 80 | 1007.3 | 11.9 | 74 | 7.5 | /// | //// | 110100000 |
| 0 | 20 | 4.6 | 95 | 1005.6 | 11.7 | 75 | 7.5 | 326 | 4.2 | 110100000 |
| 0 | 25 | 4.8 | 123 | 1002.2 | 11.4 | 77 | 7.6 | /// | //// | 110100000 |
| 0 | 30 | 4.9 | 150 | 999.0 | 11.1 | 79 | 7.6 | 317 | 4.2 | 110100000 |
| 0 | 35 | 4.7 | 173 | 996.2 | 10.9 | 79 | 7.5 | /// | //// | 110100000 |
| 0 | 40 | 4.6 | 192 | 993.9 | 10.7 | 78 | 7.1 | 332 | 4.0 | 110100000 |
| 0 | 45 | 4.4 | 216 | 991.1 | 10.6 | 78 | 7.0 | /// | //// | 110100000 |
| 0 | 50 | 5.1 | 247 | 987.3 | 10.4 | 77 | 6.6 | 318 | 3.8 | 110100000 |
| 0 | 55 | 4.7 | 264 | 985.3 | 10.3 | 77 | 6.5 | /// | //// | 110100000 |
| 1 | 0 | 4.4 | 282 | 983.3 | 10.2 | 76 | 6.2 | 309 | 3.6 | 110100000 |
| 1 | 5 | 4.1 | 301 | 981.0 | 10.2 | 76 | 6.2 | /// | //// | 110100000 |
| 1 | 10 | 4.5 | 326 | 978.0 | 10.0 | 77 | 6.2 | 303 | 3.5 | 110100000 |
| 1 | 15 | 4.5 | 351 | 975.0 | 9.7 | 78 | 6.1 | /// | //// | 110100000 |
| 1 | 20 | 4.3 | 375 | 972.3 | 9.5 | 79 | 6.1 | 298 | 3.1 | 110100000 |
| 1 | 25 | 4.5 | 397 | 969.7 | 9.4 | 80 | 6.2 | /// | //// | 110100000 |
| 1 | 30 | 4.4 | 415 | 967.5 | 9.2 | 81 | 6.2 | 291 | 3.1 | 110100000 |
| 1 | 35 | 4.6 | 436 | 965.1 | 9.0 | 82 | 6.1 | /// | //// | 110100000 |
| 1 | 40 | 4.7 | 467 | 961.4 | 8.7 | 84 | 6.2 | 277 | 3.3 | 110100000 |
| 1 | 45 | 4.9 | 496 | 958.1 | 8.5 | 86 | 6.3 | /// | //// | 111100000 |
| 1 | 50 | 4.6 | 512 | 956.3 | 8.3 | 87 | 6.3 | 285 | 2.1 | 111100000 |
| 1 | 55 | 4.4 | 532 | 953.9 | 8.1 | 88 | 6.3 | /// | //// | 111100000 |
| 2 | 0 | 4.5 | 550 | 951.8 | 8.0 | 89 | 6.3 | 281 | 1.8 | 111100000 |
| 2 | 5 | 4.5 | 572 | 949.3 | 7.8 | 90 | 6.3 | /// | //// | 111100000 |
| 2 | 10 | 4.2 | 592 | 947.0 | 7.7 | 90 | 6.2 | 274 | 1.9 | 111100000 |
| 2 | 15 | 3.7 | 607 | 945.2 | 7.6 | 91 | 6.3 | /// | //// | 111100000 |
| 2 | 20 | 3.8 | 626 | 943.1 | 7.5 | 91 | 6.2 | 261 | 2.2 | 111100000 |
| 2 | 25 | 3.9 | 650 | 940.3 | 7.4 | 91 | 6.1 | /// | //// | 111100000 |
| 2 | 30 | 3.9 | 668 | 938.2 | 7.3 | 91 | 6.0 | 257 | 2.3 | 111100000 |
| 2 | 35 | 3.9 | 687 | 936.1 | 7.2 | 91 | 5.9 | /// | //// | 111100000 |
| 2 | 40 | 3.8 | 706 | 933.9 | 7.1 | 91 | 5.8 | 249 | 2.4 | 111100000 |
| 2 | 45 | 3.9 | 726 | 931.6 | 7.0 | 92 | 5.8 | /// | //// | 111100000 |

May 23 1600

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 5 | 4.5 | 23 | 1011.5 | 12.9 | 69 | 7.4 | /// | //// | --CD-FGH |
| 0 | 10 | 4.7 | 50 | 1008.3 | 12.2 | 72 | 7.4 | 263 | 2.6 | --CD-FGH |
| 0 | 15 | 4.6 | 71 | 1005.7 | 12.0 | 74 | 7.6 | /// | //// | --CD-FGH |
| 0 | 20 | 4.6 | 95 | 1002.9 | 11.7 | 75 | 7.5 | 228 | 2.3 | --CD-FGH |
| 0 | 25 | 4.5 | 115 | 1000.4 | 11.6 | 76 | 7.6 | /// | //// | --CD-FGH |
| 0 | 30 | 4.4 | 136 | 998.0 | 11.3 | 77 | 7.5 | 226 | 2.3 | --CD-FGH |
| 0 | 35 | 4.3 | 153 | 995.9 | 11.2 | 78 | 7.6 | /// | //// | --CD-FGH |
| 0 | 40 | 4.0 | 170 | 993.9 | 11.0 | 78 | 7.4 | 234 | 2.2 | --CD-FGH |
| 0 | 45 | 4.0 | 191 | 991.3 | 10.8 | 79 | 7.4 | /// | //// | --CD-FGH |
| 0 | 50 | 3.8 | 209 | 989.3 | 10.6 | 80 | 7.3 | 231 | 2.2 | --CD-FGH |
| 0 | 55 | 3.9 | 230 | 986.7 | 10.4 | 81 | 7.3 | /// | //// | -BCD-FGH |
| 1 | 0 | 3.7 | 247 | 984.7 | 10.2 | 81 | 7.1 | 222 | 2.2 | -BCD-FGH |
| 1 | 5 | 4.3 | 276 | 981.2 | 10.0 | 83 | 7.3 | /// | //// | -BCD-FGH |
| 1 | 10 | 4.3 | 298 | 978.7 | 9.7 | 84 | 7.2 | 230 | 2.0 | -BCD-FGH |
| 1 | 15 | 4.1 | 315 | 976.7 | 9.6 | 86 | 7.4 | /// | //// | -BCD-FGH |
| 1 | 20 | 4.0 | 330 | 974.9 | 9.5 | 86 | 7.3 | 214 | 2.1 | -BCD-FGH |
| 1 | 25 | 3.8 | 350 | 972.5 | 9.4 | 87 | 7.4 | /// | //// | -BCD-FGH |
| 1 | 30 | 3.8 | 362 | 971.1 | 9.2 | 87 | 7.2 | 226 | 1.8 | -BCD-FGH |
| 1 | 35 | 3.9 | 394 | 967.4 | 9.1 | 87 | 7.1 | /// | //// | -BCD-FGH |
| 1 | 40 | 3.8 | 413 | 965.2 | 9.0 | 87 | 7.0 | 228 | 1.6 | -BCD-FGH |
| 1 | 45 | 4.0 | 436 | 962.5 | 8.9 | 88 | 7.1 | /// | //// | -BCD-FGH |
| 1 | 50 | 4.2 | 457 | 960.0 | 8.8 | 88 | 7.0 | 233 | 1.5 | -BCD-FGH |
| 1 | 55 | 4.4 | 471 | 958.4 | 8.7 | 88 | 6.9 | /// | //// | -BCD-FGH |
| 2 | 0 | 4.5 | 497 | 955.3 | 8.6 | 88 | 6.8 | 240 | 1.3 | -BCD-FGH |
| 2 | 5 | 4.0 | 517 | 953.1 | 8.5 | 88 | 6.7 | /// | //// | -BCD-FGH |
| 2 | 10 | 4.5 | 548 | 949.5 | 8.4 | 88 | 6.6 | 253 | 1.1 | -BCD-FGH |
| 2 | 15 | 4.4 | 567 | 947.3 | 8.3 | 88 | 6.5 | /// | //// | -BCD-FGH |
| 2 | 20 | 4.6 | 594 | 944.2 | 8.1 | 88 | 6.3 | 259 | 1.0 | -BCD-FGH |
| 2 | 25 | 4.3 | 612 | 942.1 | 8.1 | 88 | 6.3 | /// | //// | -BCD-FGH |
| 2 | 30 | 4.7 | 638 | 939.1 | 7.9 | 87 | 5.9 | 273 | 0.8 | -BCD-FGH |
| 2 | 35 | 4.3 | 647 | 938.1 | 7.9 | 87 | 5.9 | /// | //// | -BCD-FGH |
| 2 | 40 | 4.3 | 678 | 934.6 | 8.3 | 89 | 6.6 | 303 | 0.8 | -BCD-FGH |
| 2 | 45 | 4.7 | 708 | 931.3 | 9.8 | 90 | 8.3 | /// | //// | -BCD-FGH |
| 2 | 50 | 4.2 | 721 | 929.8 | 10.5 | 90 | 9.0 | 331 | 1.1 | -BCD-FGH |
| 2 | 55 | 4.2 | 737 | 928.0 | 10.8 | 90 | 9.3 | /// | //// | -BCD-FGH |
| 3 | 0 | 3.9 | 755 | 925.9 | 10.8 | 87 | 8.8 | 345 | 1.5 | -BCD-FGH |
| 3 | 5 | 4.2 | 772 | 924.0 | 10.8 | 85 | 8.4 | /// | //// | -BCD-FGH |
| 3 | 10 | 3.6 | 786 | 922.6 | 11.1 | 85 | 8.7 | 350 | 1.9 | -BCD-FGH |
| 3 | 15 | 3.6 | 811 | 919.7 | 11.6 | 84 | 9.0 | /// | //// | -BCD-FGH |
| 3 | 20 | 3.8 | 835 | 917.2 | 12.1 | 82 | 9.2 | 356 | 2.6 | -BCD-FGH |
| 3 | 25 | 3.8 | 847 | 915.8 | 12.2 | 80 | 8.9 | /// | //// | -BCD-FGH |
| 3 | 30 | 3.6 | 863 | 914.0 | 12.3 | 79 | 8.8 | 6 | 2.9 | -BCD-FGH |
| 3 | 35 | 3.7 | 883 | 911.8 | 12.3 | 80 | 9.0 | /// | //// | -BCD-FGH |
| 3 | 40 | 3.7 | 896 | 910.5 | 12.5 | 81 | 9.4 | 6 | 3.5 | -BCD-FGH |
| 3 | 45 | 3.4 | 914 | 908.5 | 12.7 | 81 | 9.6 | /// | //// | -BCD-FGH |
| 3 | 50 | 3.3 | 933 | 906.5 | 12.8 | 80 | 9.5 | 6 | 4.0 | -BCD-FGH |
| 3 | 55 | 3.5 | 953 | 904.3 | 13.0 | 80 | 9.7 | /// | //// | -BCD-FGH |
| 4 | 0 | 3.9 | 980 | 901.4 | 13.0 | 81 | 9.9 | 5 | 4.4 | -BCD-FGH |
| 4 | 5 | 3.4 | 991 | 900.2 | 12.9 | 80 | 9.6 | /// | //// | -BCD-FGH |
| 4 | 10 | 3.7 | 1008 | 898.3 | 12.8 | 79 | 9.3 | 360 | 5.5 | -BCD-FGH |
| 4 | 15 | 4.0 | 1040 | 894.9 | 13.1 | 79 | 9.6 | /// | //// | -BCD-FGH |
| 4 | 20 | 4.7 | 1074 | 891.3 | 13.0 | 80 | 9.7 | 359 | 6.1 | -BCD-FGH |
| 4 | 25 | 4.5 | 1091 | 889.5 | 13.0 | 79 | 9.5 | /// | //// | -BCD-FGH |
| 4 | 30 | 4.0 | 1100 | 888.5 | 13.1 | 74 | 8.6 | 358 | 6.8 | -BCD-FGH |
| 4 | 35 | 4.5 | 1121 | 886.3 | 13.1 | 72 | 8.2 | /// | //// | -BCD-FGH |
| 4 | 40 | 4.4 | 1141 | 884.2 | 13.3 | 72 | 8.4 | 357 | 7.1 | -BCD-FGH |

Sounding program REV 7.62 using Loran-C
Ship : PT_SUR
Location : 36.80 N 121.80 W 3 m
Loran-C chain 1: 9940
Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min
Sounding : 35
RS-number: 108234749
No PTU editing
No wind editing
Start Up Date 23 MAY 95 16:57 GMT
System test passed -No errors found
Sounding program REV 7.62 using Loran-C
Ship : PT_SUR
Location : 36.80 N 121.80 W 3 m
Loran-C chain 1: 9940
Phase fitting length is 60 s from 0 min to 10 min
Phase fitting length is 120 s from 10 min to 45 min
Phase fitting length is 240 s from 45 min to 120 min
Sounding : 35
RS-number: 108234749
No PTU editing
Started manually by operator
Started at: 23 MAY 95 17:05 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1015.0 | 12.7 | 76 | 8.6 | 184 | 0.7 | 000000000 |
| 0 | 5 | -0.7 | -1 | 1015.5 | 12.8 | 77 | 8.9 | 134 | 2.6 | 111100000 |
| 0 | 10 | -0.6 | -3 | 1015.7 | 12.7 | 78 | 9.0 | 109 | 3.6 | 111100000 |
| 0 | 15 | -0.3 | -2 | 1015.6 | 12.8 | 79 | 9.3 | 97 | 3.9 | 111100000 |
| 0 | 20 | -0.2 | -1 | 1015.5 | 12.7 | 78 | 9.0 | 86 | 3.9 | 111100000 |
| 0 | 25 | -0.1 | 2 | 1015.1 | 12.8 | 78 | 9.1 | 82 | 3.6 | 111100000 |
| 0 | 30 | -0.1 | 1 | 1015.2 | 12.7 | 78 | 9.0 | 82 | 3.2 | 111100000 |
| 0 | 35 | 0.1 | 2 | 1015.1 | 12.7 | 78 | 9.0 | 85 | 2.9 | 111100000 |
| 0 | 40 | 0.1 | 1 | 1015.2 | 12.6 | 78 | 8.9 | 90 | 2.4 | 111100000 |
| 0 | 45 | 0.1 | 2 | 1015.1 | 12.7 | 79 | 9.2 | 95 | 2.1 | 111100000 |
| 0 | 50 | 0.1 | 1 | 1015.2 | 12.7 | 78 | 9.0 | 100 | 1.7 | 111100000 |
| 0 | 55 | 0.0 | 2 | 1015.1 | 12.7 | 79 | 9.2 | 100 | 1.8 | 111100000 |
| 1 | 0 | 0.1 | 3 | 1015.0 | 13.1 | 79 | 9.6 | 101 | 1.6 | 111100000 |
| 1 | 5 | 0.1 | 6 | 1014.6 | 13.2 | 78 | 9.5 | 103 | 1.5 | 111100000 |
| 1 | 10 | 0.2 | 7 | 1014.5 | 13.3 | 77 | 9.4 | 103 | 1.4 | 111100000 |
| 1 | 15 | 0.1 | 8 | 1014.3 | 13.5 | 77 | 9.6 | 103 | 1.3 | 111100000 |
| 1 | 20 | 0.1 | 5 | 1014.7 | 14.0 | 76 | 9.9 | 101 | 1.2 | 111100000 |
| 1 | 25 | 0.2 | 7 | 1014.5 | 13.6 | 76 | 9.5 | 99 | 1.1 | 111100000 |
| 1 | 30 | 0.2 | 9 | 1014.2 | 13.0 | 75 | 8.7 | 96 | 1.0 | 111100000 |
| 1 | 35 | 0.3 | 12 | 1013.8 | 12.6 | 77 | 8.7 | 95 | 1.0 | 111100000 |
| 1 | 40 | 0.1 | 11 | 1014.0 | 12.5 | 77 | 8.6 | 94 | 1.0 | 111100000 |
| 1 | 45 | 0.3 | 14 | 1013.6 | 12.4 | 79 | 8.9 | 93 | 1.0 | 111100000 |
| 1 | 50 | 0.3 | 15 | 1013.5 | 12.4 | 81 | 9.3 | 93 | 0.9 | 111100000 |
| 1 | 55 | 0.2 | 13 | 1013.7 | 12.3 | 81 | 9.2 | 93 | 0.9 | 111100000 |
| 2 | 0 | 0.1 | 13 | 1013.7 | 12.2 | 80 | 8.9 | 93 | 0.9 | 111100000 |
| 2 | 5 | -0.1 | 12 | 1013.8 | 12.3 | 81 | 9.2 | 93 | 0.9 | 111100000 |
| 2 | 10 | 0.0 | 11 | 1014.0 | 12.3 | 81 | 9.2 | 94 | 0.9 | 111100000 |

```
Sounding program REV 7.62 using Loran-C
Ship       :PT_SUR
Location : 36.80 N 121.86 W       3 m
Loran-C chain 1:  9940
Phase fitting length is  60 s from   0 min to  10 min
Phase fitting length is 120 s from  10 min to  45 min
Phase fitting length is 240 s from  45 min to 120 min
Sounding : 36
RS-number: 108234749
No PTU editing
Started manually by operator
Started at:       23 MAY 95 19:16 GMT
```

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 1015.8 | 12.6 | 86 | 10.3 | 269 | 3.0 | 000000000 |
| 0 | 5 | 0.0 | 2 | 1015.8 | 12.6 | 85 | 10.2 | 243 | 2.0 | 111100000 |
| 0 | 10 | 0.0 | 3 | 1015.7 | 12.6 | 84 | 10.0 | 219 | 1.4 | 111100000 |
| 0 | 15 | 0.0 | 4 | 1015.6 | 12.6 | 84 | 10.0 | 215 | 1.1 | 111100000 |
| 0 | 20 | 0.0 | 3 | 1015.7 | 12.6 | 84 | 10.0 | 199 | 0.8 | 111100000 |
| 0 | 25 | -0.1 | 1 | 1016.0 | 12.5 | 84 | 9.9 | 165 | 0.6 | 111100000 |
| 0 | 30 | -0.1 | 1 | 1016.0 | 12.8 | 84 | 10.2 | 116 | 0.5 | 111100000 |
| 0 | 35 | -0.1 | -1 | 1016.2 | 12.4 | 85 | 10.0 | 109 | 0.5 | 111100000 |
| 0 | 40 | -0.1 | -1 | 1016.2 | 12.4 | 85 | 10.0 | 112 | 0.5 | 111100000 |
| 0 | 45 | 0.1 | 4 | 1015.6 | 12.8 | 85 | 10.4 | 103 | 0.5 | 111100000 |
| 0 | 50 | 0.1 | 7 | 1015.2 | 12.6 | 85 | 10.2 | 78 | 0.6 | 111100000 |
| 0 | 55 | 0.2 | 8 | 1015.1 | 12.8 | 84 | 10.2 | 68 | 0.7 | 111100000 |
| 1 | 0 | 0.1 | 5 | 1015.5 | 12.6 | 84 | 10.0 | 56 | 0.6 | 111100000 |
| 1 | 5 | 0.3 | 6 | 1015.3 | 12.5 | 85 | 10.1 | 42 | 0.5 | 111100000 |
| 1 | 10 | 0.2 | 5 | 1015.5 | 12.4 | 84 | 9.8 | 0 | 0.0 | 111100000 |
| 1 | 15 | -0.1 | 5 | 1015.5 | 12.5 | 85 | 10.1 | 0 | 0.0 | 111100000 |
| 1 | 20 | 0.1 | 9 | 1015.0 | 12.6 | 85 | 10.2 | 0 | 0.0 | 111100000 |
| 1 | 25 | 0.1 | 12 | 1014.6 | 12.4 | 84 | 9.8 | 0 | 0.0 | 111100000 |
| 1 | 30 | 0.4 | 17 | 1014.0 | 12.1 | 85 | 9.7 | 0 | 0.0 | 111100000 |
| 1 | 35 | 0.5 | 22 | 1013.4 | 12.0 | 85 | 9.6 | 0 | 0.0 | 111100000 |
| 1 | 40 | 0.7 | 25 | 1013.0 | 12.0 | 85 | 9.6 | 0 | 0.0 | 111100000 |
| 1 | 45 | 1.0 | 35 | 1011.9 | 11.9 | 86 | 9.7 | 0 | 0.0 | 111100000 |
| 1 | 50 | 1.0 | 40 | 1011.3 | 11.8 | 86 | 9.6 | 328 | 0.5 | 111100000 |
| 1 | 55 | 1.2 | 46 | 1010.5 | 11.8 | 86 | 9.6 | 332 | 0.5 | 111100000 |
| 2 | 0 | 1.2 | 54 | 1009.5 | 11.7 | 86 | 9.5 | 332 | 0.5 | 111100000 |
| 2 | 5 | 1.3 | 60 | 1008.8 | 11.7 | 87 | 9.7 | 326 | 0.5 | 111100000 |
| 2 | 10 | 1.3 | 64 | 1008.3 | 11.6 | 87 | 9.6 | 320 | 0.5 | 111100000 |
| 2 | 15 | 1.3 | 73 | 1007.2 | 11.5 | 87 | 9.5 | 314 | 0.5 | 111100000 |
| 2 | 20 | 1.2 | 76 | 1006.8 | 11.5 | 87 | 9.5 | 0 | 0.0 | 111100000 |
| 2 | 25 | 1.1 | 81 | 1006.2 | 11.4 | 88 | 9.5 | 0 | 0.0 | 111100000 |
| 2 | 30 | 0.9 | 82 | 1006.1 | 11.4 | 88 | 9.5 | 0 | 0.0 | 111100000 |
| 2 | 35 | 1.0 | 89 | 1005.3 | 11.3 | 88 | 9.4 | 0 | 0.0 | 111100000 |
| 2 | 40 | 1.0 | 95 | 1004.6 | 11.3 | 88 | 9.4 | 0 | 0.0 | 111100000 |
| 2 | 45 | 1.0 | 103 | 1003.6 | 11.2 | 88 | 9.3 | 0 | 0.0 | 111100000 |

Sounding program REV 7.62 using Omega
Ship :PT_SUR
Location : 36.77 N 121.90 W 3 m
Rejected Sigma stations: a,b,c
Phase fitting length is 250 s from 0 min to 120 min
Sounding : 37
RS-number: 309140455
No PTU editing
No wind editing
Started at: 23 MAY 95 21:06 GMT

| Time min | s | AscRate m/s | Hgt/MSL m | Pressure hPa | Temp degC | RH % | Dewp degC | Dir deg | Speed m/s | WndStat |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.0 | 3 | 104.3 | 11.9 | 93 | 10.8 | 236 | 1.9 | -------- |
| 0 | 5 | -461.8 | ////// | 1011.4 | 12.9 | 76 | 8.8 | /// | //// | --CD--GH |
| 0 | 10 | -277.1 | ////// | 1009.0 | 12.3 | 80 | 9.0 | 190 | 2.3 | --CD--GH |
| 0 | 15 | -173.2 | ////// | 1005.6 | 12.0 | 83 | 9.3 | /// | //// | --CD--GH |
| 0 | 20 | -138.6 | ////// | 1002.9 | 11.8 | 84 | 9.2 | 201 | 1.9 | --CD--GH |
| 0 | 25 | -106.6 | ////// | 998.9 | 11.6 | 85 | 9.2 | /// | //// | --CD--GH |
| 0 | 30 | -92.4 | ////// | 997.0 | 11.4 | 86 | 9.2 | 244 | 1.5 | --CD--GH |
| 0 | 35 | 0.0 | ////// | 994.8 | 11.2 | 87 | 9.2 | /// | //// | --CD-FGH |
| 0 | 40 | 0.0 | ////// | 992.7 | 11.0 | 88 | 9.1 | 249 | 1.6 | --CD-FGH |
| 0 | 45 | 0.0 | ////// | 991.2 | 10.9 | 89 | 9.2 | /// | //// | --CD-FGH |
| 0 | 50 | 0.0 | ////// | 989.5 | 10.7 | 89 | 9.0 | 285 | 2.2 | --CD-FGH |
| 0 | 55 | 0.0 | ////// | 987.0 | 10.6 | 90 | 9.1 | /// | //// | --CD-FGH |
| 1 | 0 | 0.0 | ////// | 984.5 | 10.4 | 91 | 9.0 | 260 | 1.6 | --CD-FGH |
| 1 | 5 | 0.0 | ////// | 983.3 | 10.3 | 92 | 9.1 | /// | //// | --CD-FGH |
| 1 | 10 | 0.0 | ////// | 981.1 | 10.1 | 93 | 9.1 | 257 | 1.5 | --CD-FGH |
| 1 | 15 | 0.0 | ////// | 979.1 | 10.0 | 94 | 9.1 | /// | //// | --CD-FGH |
| 1 | 20 | 0.0 | ////// | 977.0 | 9.9 | 95 | 9.2 | 255 | 1.6 | --CD-FGH |
| 1 | 25 | 0.0 | ////// | 974.3 | 9.7 | 96 | 9.1 | /// | //// | --CD-FGH |
| 1 | 30 | 0.0 | ////// | 970.6 | 9.6 | 96 | 9.0 | 296 | 2.6 | --CD-FGH |
| 1 | 35 | 0.0 | ////// | 967.8 | 9.5 | 96 | 8.9 | /// | //// | --CD-FGH |
| 1 | 40 | 0.0 | ////// | 964.7 | 9.3 | 97 | 8.9 | 304 | 3.1 | --CD-FGH |
| 1 | 45 | 0.0 | ////// | 962.7 | 9.2 | 96 | 8.6 | /// | //// | --CD-FGH |
| 1 | 50 | 0.0 | ////// | 959.1 | 9.0 | 96 | 8.4 | 311 | 3.9 | --CD-FGH |
| 1 | 55 | 0.0 | ////// | 956.4 | 9.0 | 97 | 8.6 | /// | //// | --CD-FGH |
| 2 | 0 | 0.0 | ////// | 953.7 | 8.8 | 97 | 8.4 | 311 | 3.9 | --CD-FGH |
| 2 | 5 | 0.0 | ////// | 950.3 | 8.7 | 97 | 8.3 | /// | //// | --CD-FGH |
| 2 | 10 | 0.0 | ////// | 946.7 | 9.1 | 98 | 8.8 | 314 | 4.1 | --CD-FGH |
| 2 | 15 | 0.0 | ////// | 944.2 | 10.0 | 99 | 9.9 | /// | //// | --CD-FGH |
| 2 | 20 | 0.0 | ////// | 942.1 | 10.3 | 98 | 10.0 | 316 | 4.6 | --CD-FGH |
| 2 | 25 | 0.0 | ////// | 940.3 | 10.5 | 94 | 9.6 | /// | //// | --CD-FGH |
| 2 | 30 | 0.0 | ////// | 938.5 | 10.6 | 92 | 9.4 | 319 | 5.0 | --CD-FGH |
| 2 | 35 | 0.0 | ////// | 936.2 | 11.2 | 95 | 10.5 | /// | //// | --CD-FGH |
| 2 | 40 | 0.0 | ////// | 933.4 | 12.5 | 95 | 11.8 | 319 | 4.8 | --CD-FGH |
| 2 | 45 | 0.0 | ////// | 932.0 | 13.0 | 93 | 11.9 | /// | //// | --CD-FGH |
| 2 | 50 | 0.0 | ////// | 930.0 | 13.2 | 91 | 11.8 | 322 | 5.6 | --CD-FGH |
| 2 | 55 | 0.0 | ////// | 927.4 | 13.3 | 88 | 11.4 | /// | //// | --CD-FGH |

# APPENDIX J. MATLAB CODE FOR COMPUTATION

## A. GPS, ELEVATION AND AZIMUTH ANGLE CALCULATION

```
% GPS & elevation & azimuth angle caculation
% File name gps.m

ship_longitude=121.81;
ship_latitude=36.81;
sensor_longitude=121.8;
sensor_latitude=36.8;
heading=120;

dx=(ship_longitude-sensor_longitude)*47.995;
dy=(ship_latitude-sensor_latitude)*59.97;

a=(atan(abs(dx/dy)))*57.3

if dy>0
  if heading>(180-a)
    bearing=(heading-180+a);
   else
    bearing=180-a-heading
  end
 else
  if heading<a
    bearing=a-heading;
   else
    bearing=heading-a;
  end
end

if bearing<90
  phi=(90-bearing)/57.3
 else
  phi=(180-bearing)/57.3
end

range_in_nmi=sqrt(dx*dx+dy*dy)
range_in_km=(range_in_nmi)*1.852
```

```
theta=atan(0.0032/range_in_nmi)

l=41.5;                  %ship length
w=9.75;                  %ship width
h=8.8;                   %ship height

Area=l*w*sin(theta)+h*w*cos(theta)*sin(phi)+h*l*cos(theta)*cos(phi)
```

## B. MRT &MDT vs Spatial Frequency

```
% MRT & MDT vs Spatial Frequency
% File name drt_fre

SNRT=2.5;            % Shumaker Example 8-13
NET=0.125;
dx=0.25;
dy=0.25;
L=7;
Te=0.1;
Fr=30;
Nos=1;
Nss=1;
rb=0.335;
rs=0.456;

v=0.000001:0.25:3.000001;
MTF=[1 0.89 0.79 0.64 0.53 0.43 0.35 0.27 0.2 0.15 0.1 0.07 0.04];

omigaT=1./(4*v.*v);
ROx=(1+(2*2*v.*v*rb.*rb)).^(-0.5);

MRT=2*SNRT*NET*(ROx.^0.5).*((v.*v*dx*dy/L).^0.5).*((Te*Fr*Nos*Nss)^(-
0.5))./MTF;

MDT_1=SNRT*NET*(omigaT+rs*rs)*((dx*dy)^0.5);
MDT_2=omigaT.*(( ((pi/4)*(rs*rs+rb*rb+omigaT)*Te*Fr*Nos*Nss)).^0.5);
MDT=MDT_1./MDT_2;

plot(v,MDT,v,MRT);
title('MRT & MDT vs Spatial Frequency');
xlabel('Spatial Frequency');
ylabel('Temperature');
gtext('MRT');
gtext('MDT');
grid;
```

## C. MRT, MDT & ΔT vs Range for Detection

```
% MRT & MDT vs & Range
% N=1 for Detection
% File name r_n_1_f

SNRT=2.5;                 % Shumaker Example 8-13
NET=0.125;
dx=0.25;
dy=0.25;
L=7;
Te=0.1;
Fr=30;
Nos=1;
Nss=1;
rb=0.335;
rs=0.456;

N=1;                      % physical dimension
At=214.4513;
Dc=(At)^(0.5);
X=Dc/N;

dt=3.387144;
u=0.0002132;

v=0.000001:0.25:3.000001;
MTF=[1 0.89 0.79 0.64 0.53 0.43 0.35 0.27 0.2 0.15 0.1 0.07 0.04];

Range=v*2000*X;
omigaT=1./(4*v.*v);
ROx=(1+(2*2*v.*v*rb.*rb)).^(-0.5);

tau=exp(-u.*Range);
dtapp=dt*tau;

MRT=2*SNRT*NET*(ROx.^0.5).*((v.*v*dx*dy/L).^0.5).*((Te*Fr*Nos*Nss)^(-
0.5))./MTF;

MDT_1=SNRT*NET*(omigaT+rs*rs)*((dx*dy)^0.5);
MDT_2=omigaT.*(( ((pi/4)*(rs*rs+rb*rb+omigaT)*Te*Fr*Nos*Nss)).^0.5);
MDT=MDT_1./MDT_2;
```

```
plot(Range,MDT,Range,MRT,Range,dtapp);
title('MRT, MDT & dT  vs Range for Detection');
xlabel('Range (m)');
ylabel('Temperature');
gtext('MRT');
gtext('MDT');
grid;
```

## D. MRT & ΔT vs Range for Classificaton

```
% MRT & dt vs Range
% N=8 for Classification
% File name r_n_8_f

SNRT=2.5;                    % Shumaker Example 8-13
NET=0.125;
dx=0.25;
dy=0.25;
L=7;
Te=0.1;
Fr=30;
Nos=1;
Nss=1;
rb=0.335;
rs=0.456;

N=8;                         % physical dimension
At=214.4513;
Dc=(At)^(0.5);
X=Dc/N;

dt=3.387144;
u=0.0002132;

v=0.000001:0.25:3.000001;
MTF=[1 0.89 0.79 0.64 0.53 0.43 0.35 0.27 0.2 0.15 0.1 0.07 0.04];

Range=v*2000*X;
omigaT=1./(4*v.*v);
ROx=(1+(2*2*v.*v*rb.*rb)).^(-0.5);

tau=exp(-u.*Range);
dtapp=dt*tau;

MRT=2*SNRT*NET*(ROx.^0.5).*((v.*v*dx*dy/L).^0.5).*((Te*Fr*Nos*Nss)^(-
0.5))./MTF;

MDT_1=SNRT*NET*(omigaT+rs*rs)*((dx*dy)^0.5);
MDT_2=omigaT.*(( ((pi/4)*(rs*rs+rb*rb+omigaT)*Te*Fr*Nos*Nss)).^0.5);
MDT=MDT_1./MDT_2;
```

```
plot(Range,MRT,Range,dtapp);
title('MRT & dT vs Range for Classification');
xlabel('Range (m)');
ylabel('Temperature');
gtext('MRT');
grid;
```

## E. MRTD AND ΔT VS RANGE FOR IDENTIFICATION

```
% MRT & dT vs Range
% N=12.8 for Identification
% File name r_n_128_f

SNRT=2.5;                % Shumaker Example 8-13
NET=0.125;
dx=0.25;
dy=0.25;
L=7;
Te=0.1;
Fr=30;
Nos=1;
Nss=1;
rb=0.335;
rs=0.456;

N=12.8;                  % physical dimension
At=214.4513;
Dc=(At)^(0.5);
X=Dc/N;

dt=3.387144;
u=0.0002132

v=0.000001:0.25:3.000001;
MTF=[1 0.89 0.79 0.64 0.53 0.43 0.35 0.27 0.2 0.15 0.1 0.07 0.04];

Range=v*2000*X;
omigaT=1./(4*v.*v);
ROx=(1+(2*2*v.*v*rb.*rb)).^(-0.5);

tau=exp(-u.*Range);
dtapp=dt*tau;

MRT=2*SNRT*NET*(ROx.^0.5).*((v.*v*dx*dy/L).^0.5).*((Te*Fr*Nos*Nss)^(-
0.5))./MTF;

MDT_1=SNRT*NET*(omigaT+rs*rs)*((dx*dy)^0.5);
MDT_2=omigaT.*(( ((pi/4)*(rs*rs+rb*rb+omigaT)*Te*Fr*Nos*Nss)).^0.5);
MDT=MDT_1./MDT_2;
```

```
plot(Range,MRT,Range,dtapp);
title('MRT & dT vs Range for Identification');
xlabel('Range (m)');
ylabel('Temperature');
gtext('MRT');
grid;
```

# LIST OF REFERENCES


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