National Marine Baseline Survey 1995

Gulliver Manual & CD-ROM Questions

ENVIRONMENT AGENCY

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User Guide for GULLIVER

Image decompression

and visualisation software

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Issue 1.0

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Introduction

This document describes how to use the software application GULLIVER which provides the visualisation of previously compressed images. This guide describes the basic operations required to use GULLIVER and the features of the application. This will be achieved through the use of a walk-through example session. The technical details of the image compression and decompression are also omitted here.

Before Starting GULLIVER

Hardware and Software Requirements

In order to run GULLIVER you must ensure that your PC is configured correctly. GULLIVER requires that the PC is an Intel based 80386 (or higher: Pentium recommended) which is running DOS and Windows 3.1 (or higher). The PC should have at least 12Mb of RAM and have at least 5Mb of free disk space. The PC should be set to run Windows with a screen resolution of 800 x 600 and have a minimum of 65,000 colours, since GULLIVER is capable of showing images with full 24-bit colour. If your PC cannot be set in this mode then you do not have a suitable graphics card in the PC and GULLIVER will not be able to represent colour correctly.

Windows Pre-Requisites

It is assumed that the user of GULLIVER has a basic knowledge of Windows. Firstly it is necessary to create a program group for GULLIVER in Windows. This is achieved by selecting File and then New from the Windows Program Manager menubar. This produces the following dialog box

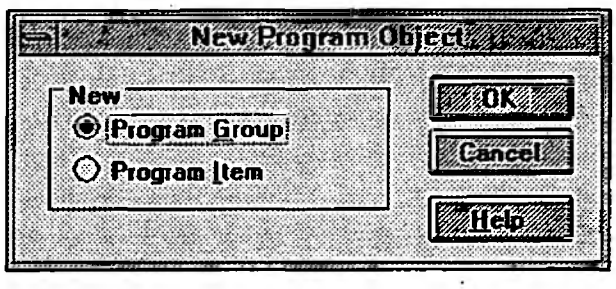

Figure 1: Windows New Program Dialog Box

Select the 'Program Group' item as shown and press OK. Then the following dialog box will appear

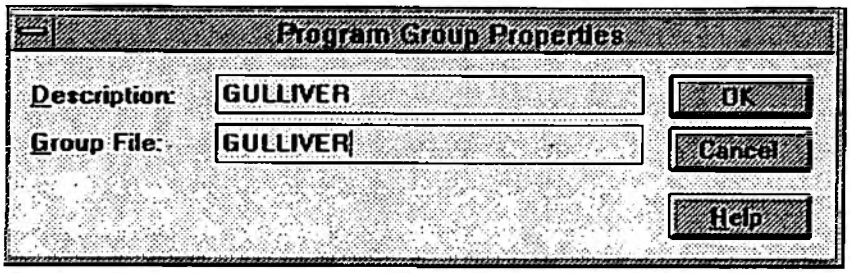

Figure 2 : Windows Program Group Properties Dialog Box

and you can give the 'Description' and 'Group File' as GULLIVER (as shown) then press OK. Following this a new empty program group window will appear with the title GULLIVER as shown in Figure 3

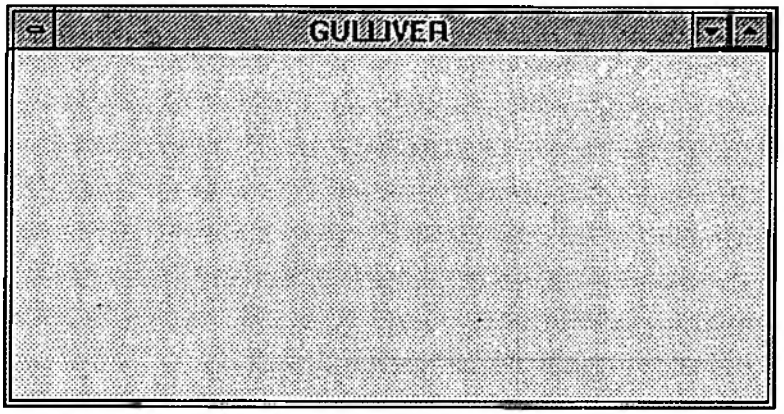

Figure 3 : Empty Program Group

Now we need to add the GULLIVER icon into this empty group window. To do this return to the dialog box of Figure 1 but this time select 'Program Item' option and press OK. This time the following dialog appear

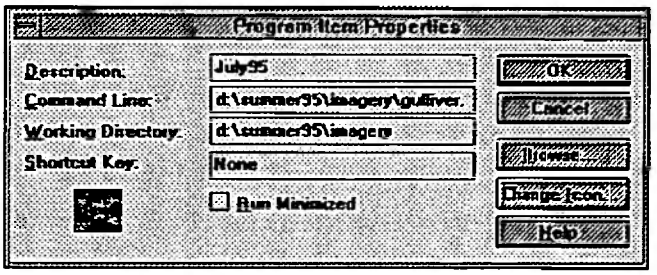

Figure 4 : Setting the GULLIVER Program Properties

In order to fill in the 'Command Line' entry you must state where the GULLIVER executable (gulliver.exe) resides. You can do this by either typing it in directly (if you know where it is) or you can select the 'Browse...' option. Doing this will bring up the file browser allowing you to locate gulliver.exe with the mouse by navigating across the disk(s) and directories.

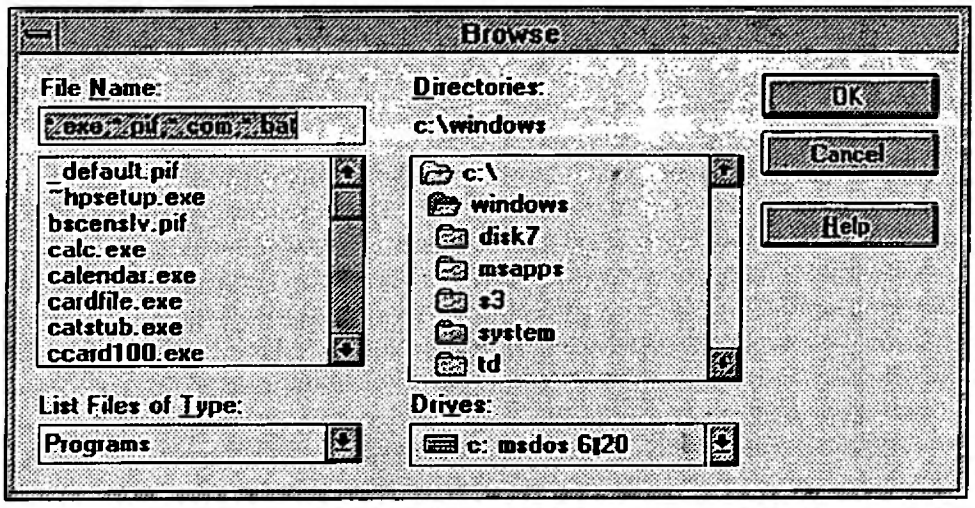

Figure 5 : Windows File Browser

If GULLIVER is on the CD-ROM then select the d: drive from the 'Drives:' list (or if your CD-ROM is on another drive letter, the appropriate letter) and then you will find gulliver.exe in the imagery directory (i.e. d:\summer95\imagery\gulliver.exe for the summer95 CD-ROM). When you have selected the executable and pressed OK you will return to the dialog of Figure 4. Now GULLIVER requires two command line arguments. These must be added after the executable name (on the same line under Command Line). These arguments are;

vectors.asc **image.tbl**

and they represent data files needed by GULLIVER. Failure to give these command-line arguments correctly will result in an error message from GULLIVER and the program will terminate.

The Working Directory type in field should be set to the directory where the GULLIVER program was installed.

Now select the 'Change Icon...' button and the following dialog appears

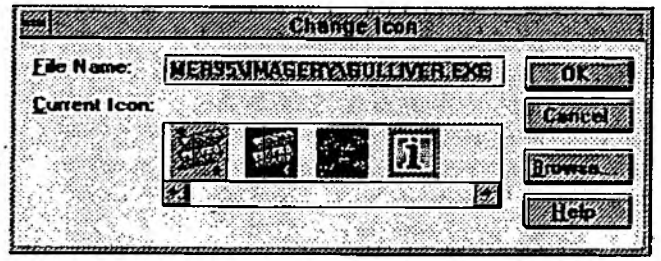

Figure 6 : Change Icon Dialog Box

and press OK. Ignore the warning message (press ok) and the GULLIVER program group window will now contain the GULLIVER application icon thus:

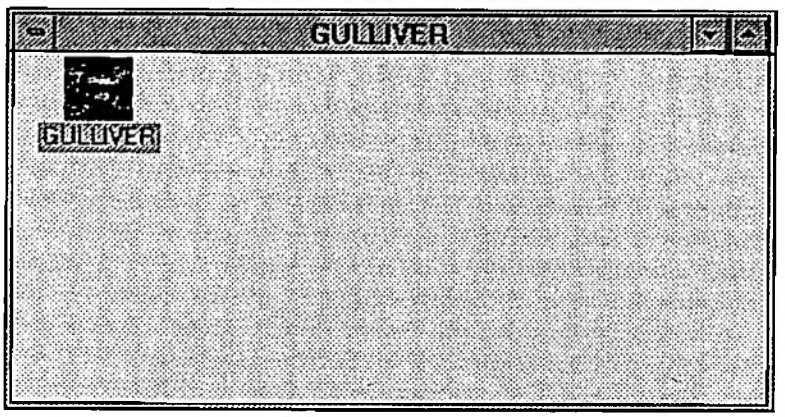

Figure 7 : GULLIVER Group

Running GULLIVER

Once the GULLIVER program icon and group have been set up and the environment variables set, GULLIVER is ready to run. Starting GULLIVER is simply a matter of 'double-clicking' on the icon.

Once GULLIVER is started without error the application screen appears (figure 8). This screen is divided into several parts and these are explained in the following sections:

The Main Screen:

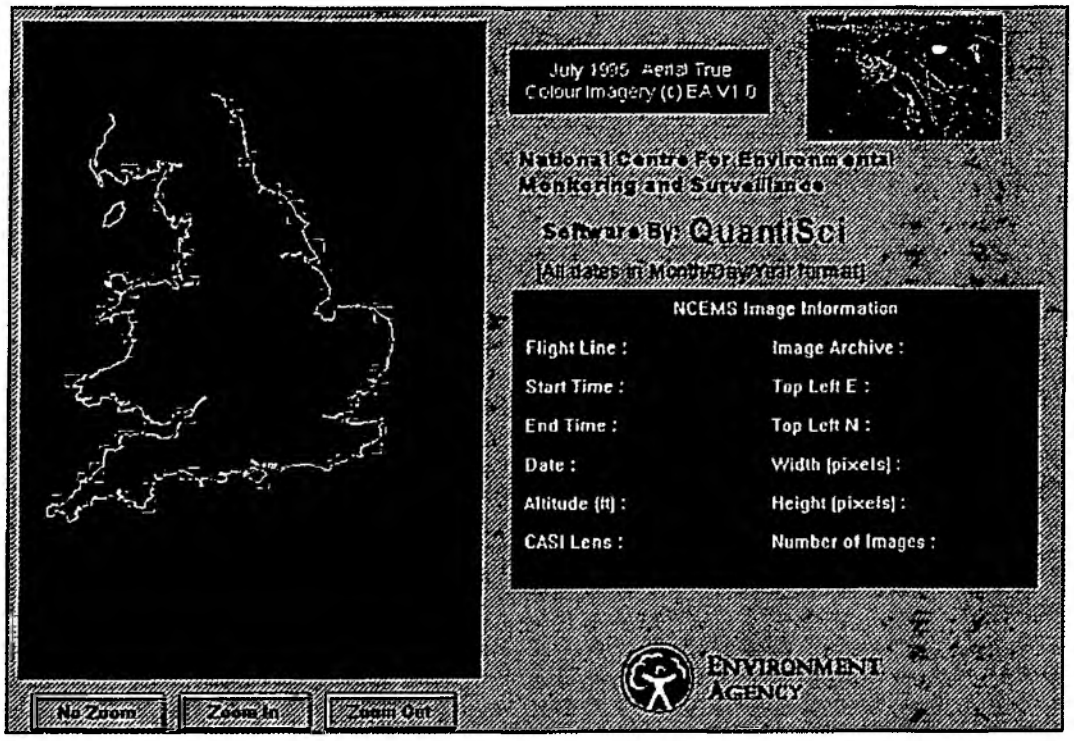

Figure 8: The main screen displayed when GULLIVER starts up.

The map on the left of the screen will initially display the entire area covered by stored images, with each red box (a survey area box) on the map corresponding to a set of stored images covering that area.

It is possible to zoom in and out on the map by using the left mouse button and the three on screen buttons immediately below the map. The 'No Zoom' button returns to the original full size map at any time. To zoom in on (magnify) a specific region of the map; enclose it in a white box by clicking and holding down the left mouse button at one corner, then dragging the box over the area. Once this is done, click the 'Zoom In' button and the map will change to become a magnified view of the enclosed area. By repeating the process you may zoom in further. Nothing will happen if the 'Zoom In' button is clicked with no white box having been defined first. Clicking the 'Zoom Out' button will take you out one level of magnification, it is not necessary to form a box.

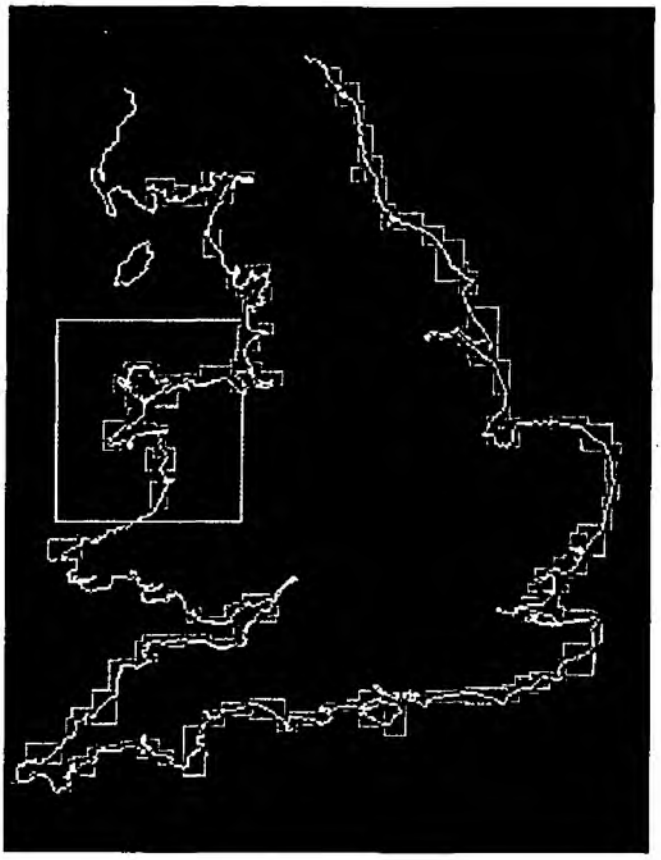

Figure 9: Zooming in on the map using the white box.

A red survey area box is selected by clicking on it once with the right mouse button. The box on the right will display information about the area on the map that has been selected, including the scanning flight details, archive number of the images, grid reference of the area and the size and number of images held.

Viewing An Image

To view one of the images associated with a region, 'double-click' with either mouse button on the red survey area box and the image will be loaded. If more than one image is available in an area, clicking on the part of the map that is covered by a single image will select it.

GULLIVER will now display a processing status window, indicating its progress through the decompression routine, ***for large images this may take some time***. When the image has been decompressed it will be displayed in a new window, as in Figure 11.

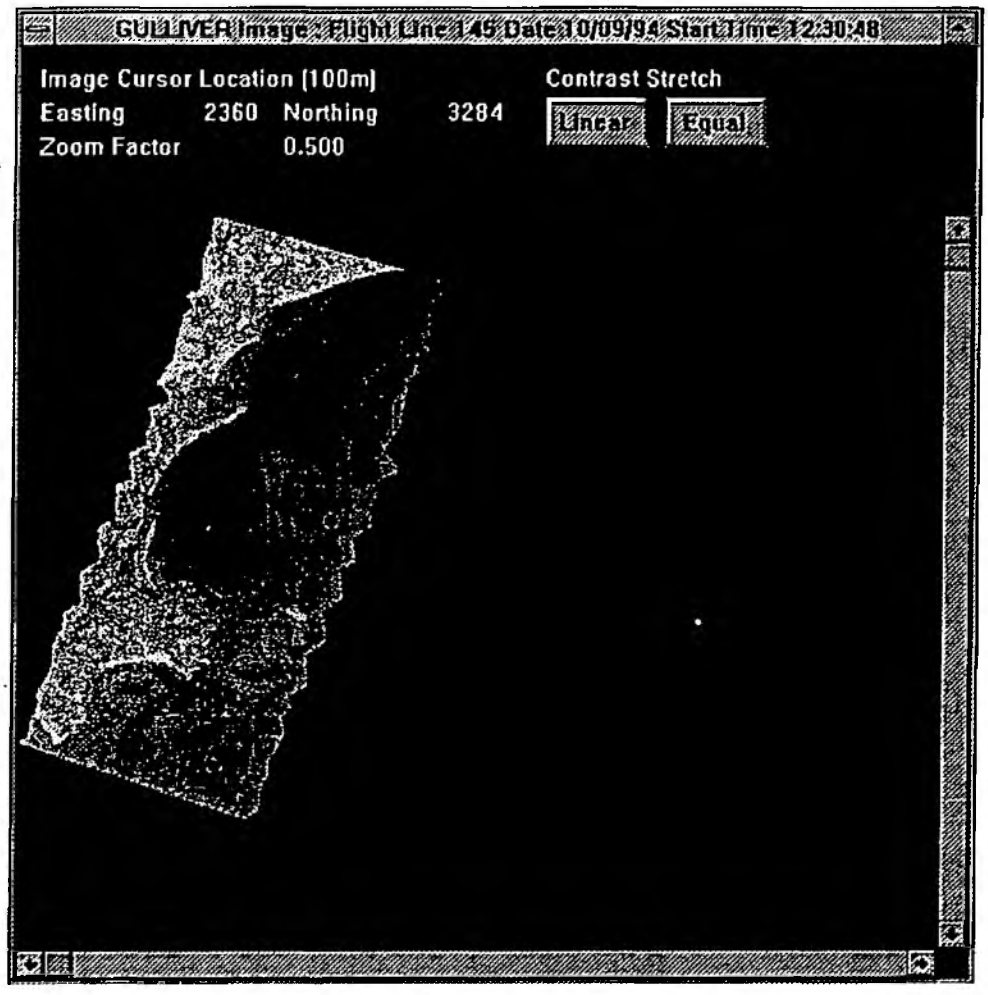

Figure 11: The decompressed image.

The image may be viewed in one of two contrast schemes; 'Linear' and 'Equal'. These change the contrast to display more or less detail within an image and correspond to a linear and equalised histogram mapping for the original image. The image is initially displayed in the 'Equal' state. Each contrast scheme may be selected by clicking on the appropriate button in the top right of the window, although doing so requires the image to be re-processed and may take a short while.

In the top left of the window, the location of the yellow cursor is given in Eastings and Northings to the nearest 100m. The cursor may be moved by pointing to the new position with the mouse and clicking its left button.

The current Zoom Factor is also in the top left of the window. You may zoom in and out of the picture using the right mouse button. Clicking the button on its own will zoom in one magnification level (up to a factor of 8). The point on the picture where the button was clicked forms the centre of the magnified image, this is represented by a pair of circles. To zoom out one level (down to a factor of 0.25), hold down the SHIFT key on the keyboard while clicking the right mouse button.

This window should be closed before another image may be displayed, a warning message is displayed should you fail to do this.

This process can be used to retrieve any of the images in any red survey area box.

Capturing Images

If an image window is the currently selected ("front") window, then using the Windows option of <Shift>+<Print Screen> keys will place a copy of the image on the Windows clipboard which can then be pasted into any drawing/painting package that will accept the clipboard image (in fact this is a Windows bitmap), such as Paintbrush.

Example Session with GULLIVER

Suppose that we are interested in the collection of images concerning the Harlech Bay area and we wish to view some of them. For this we need to run Gulliver, so from Windows, locate the Gulliver icon and double-click on it. Gulliver will now start up and display the main screen.

For clarity, we will magnify the map area of interest by drawing a white box around it as in Figure 12.

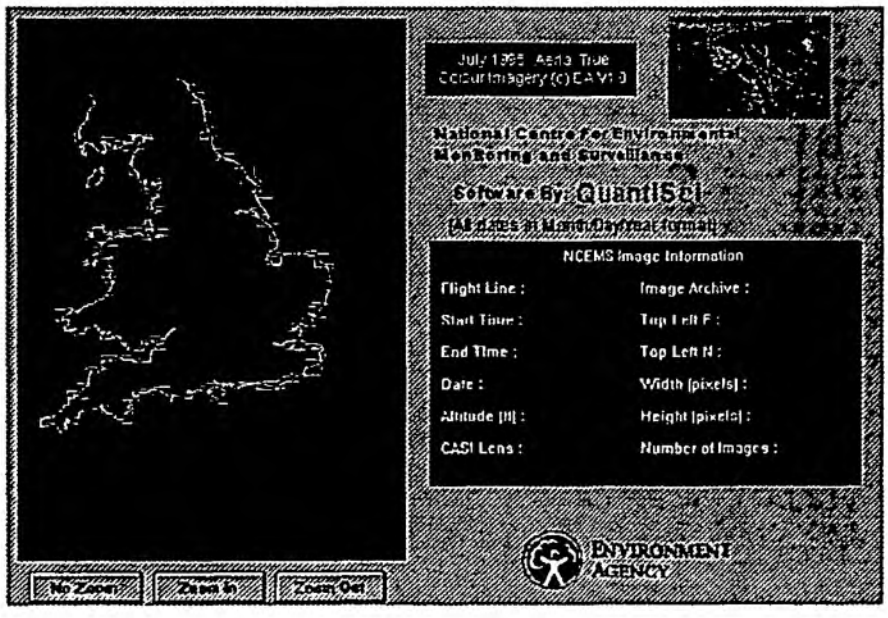

Figure 12: Magnifying the Harlech Bay area using the white box.

Click the Zoom In button located below the map and the main map will be replaced by a close up of the area. We may then clearly select our required area, bounded by the red box, by clicking inside it with the right mouse button. The box will be highlighted as in Figure 13.

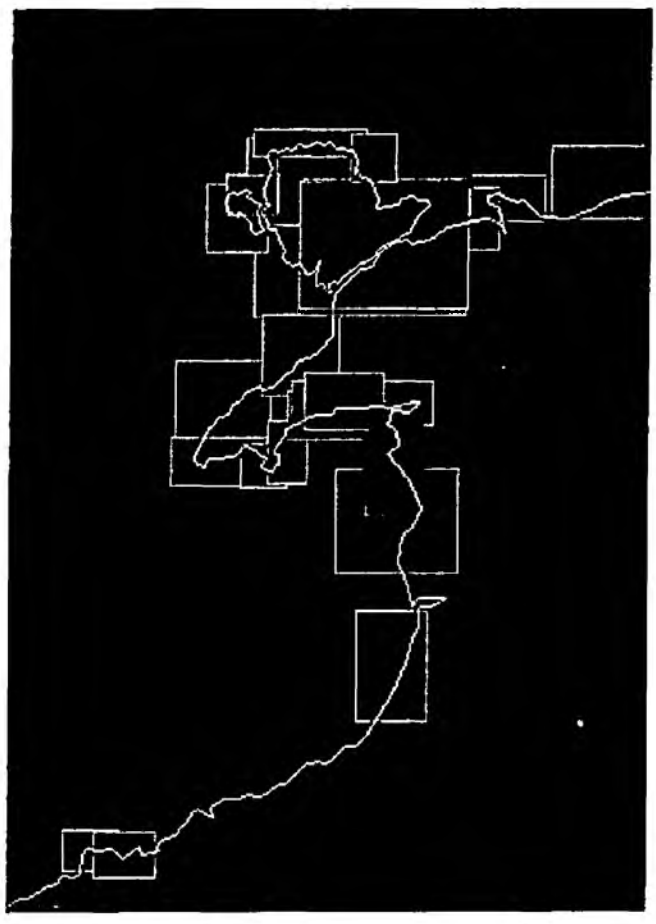

Figure 13: Clicking in the box highlights it and selects the area.

Once the area has been highlighted in this way, the blue box on the right hand side of the screen displays the information regarding this series of images (see Figure 14). As well as giving the scanning flight details, we are told the date of the flight, the location in Northings and Eastings and the name of the NCIMS archive that contains the original picture.

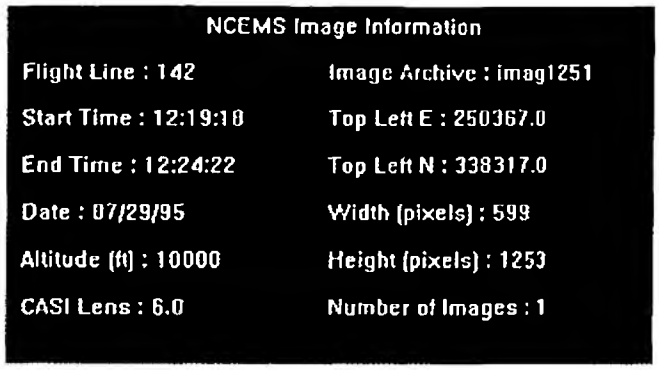

Figure 14: selecting the red box causes the images data to be displayed.

We would like to look at one of the images concerning this area and we can do this by double-clicking on the red box. Gulliver will decompress and transform the image, displaying a window showing its progress through the procedure (Figure 15). When it has done, Gulliver will bring up a new window displaying the image as in Figure 16.

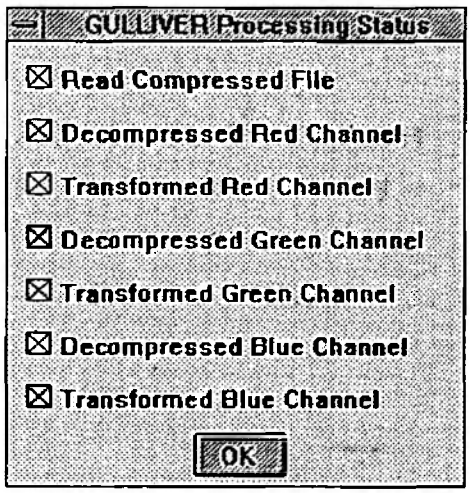

Figure 15: the window showing our progression through the decompression routine.

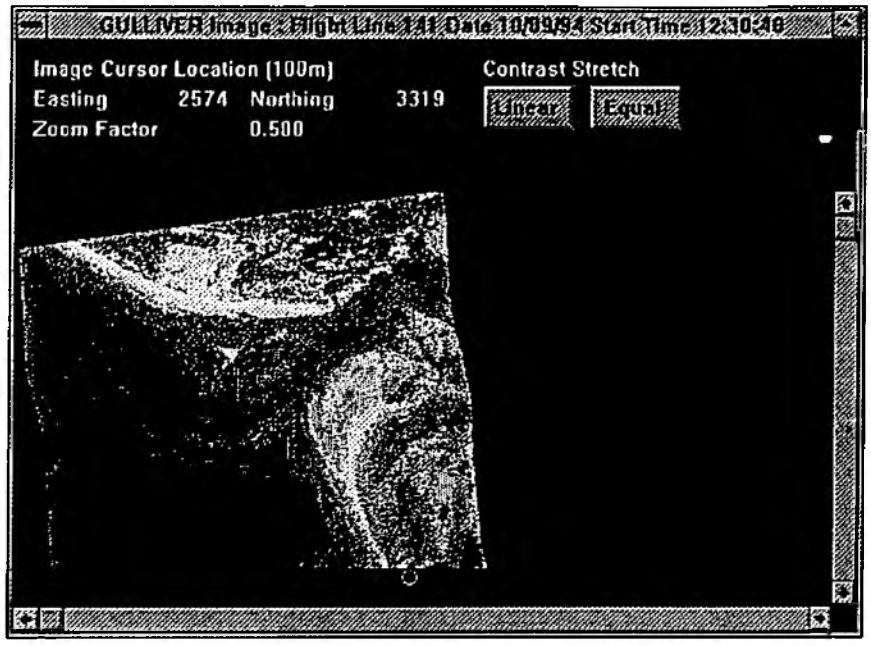

Figure 16: our selected figure as displayed by Gulliver.

By moving the yellow circle around by clicking the left mouse button we can pick off locations to the nearest 100m. Clicking the right mouse button lets us zoom in interesting parts of the image, such as the mouth of the estuary.

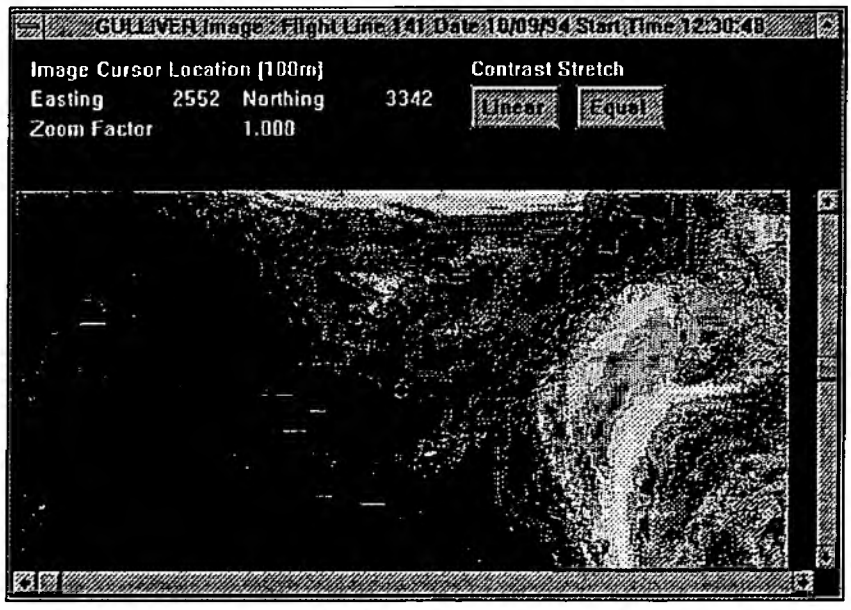

Figure 17: zooming on the mouth of the estuary.

Should we wish to see the other (Linear) contrast scheme we may simply click on the Linear button and Gulliver will switch the image.

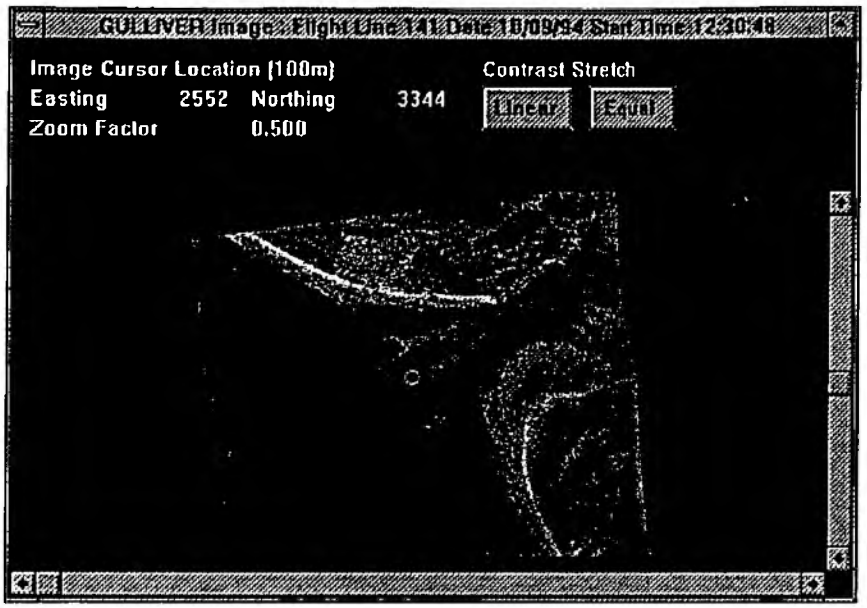

Figure 18: the Linear contrast scheme for our image.

Having finished with the image for now, we close the window and are returned to the zoomed in map with our region highlighted. Should we wish to have a look at any further images we are quite free to zoom out or in around the map again and load in any of the available images. Once we have seen all we wish to, we select Quit from the File menu. Gulliver exits and we are returned to Windows.

Environment Agency
National Centre for Environmental Monitoring and Surveillance.

CD-ROM - COASTAL AIRBORNE IMAGERY .

Some Questions Answered:

- What's on this CD-ROM?
- How is the data collected ?
- How is the data processed and compressed to fit onto the CD-ROM ?
- What other data is available ?
- What can I do with it ?
- How do I obtain coverage of other areas and times?

SURVEY FLIGHTLINE MAPS

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- *What's on this CD-ROM?*

This CD-ROM is intended as a shop window on the aerial coastal survey conducted by the Environment Agency (EA). It covers the whole coastline of England and Wales over a specific time period(s) (see CD-ROM). It contains the following:

- Full colour imagery for the coastline
- Laboratory Data from the boat surveys
- Electrochemical "underway" data from the boat surveys (Qubit)
- On board chemical analysis of Nutrients from the boat surveys (Skalar)

It presents full colour imagery in a geographically referenced format so that you can select the area of interest quickly. All the programs to do this are provided on the CD-ROM and run on common PC hardware. It does not represent the full total of the data collected - the data presented here is a carefully processed fraction of the total survey, designed to provide the user with tools to view the coastal environment and request the full resolution data, if applicable.

- *How is the data collected ?*

The image data presented on this CD-ROM are collected from a small twin engined light aircraft platform using a state of the art recording system called a CASI (Compact Aerial Spectrographic Imager). This system records the brightness of the surfaces below in very specific parts of the spectrum in thin strips at right angles to the aircraft's track. A sequence of these strips are recorded over time as the aircraft progresses along the track and can be reconstituted from the recording tape into images of the surfaces below. The sensitivity of the recording system is far above that achieved by conventional photography, videography or the human eye. The recorded data can be processed within computers using "image processing" to reveal features hidden within the data that could never be achieved using conventional techniques. By carefully selecting parts of the spectrum that yield information about water quality and can be correlated to real world phenomenon in terms of oceanographic features and water quality parameters the EA uses this data to monitor, inventorise and safeguard the coastal environment. These surveys have been undertaken since 1993, using set flight lines to cover the entire coastline of England and Wales. A map of the planned flight lines is provided at the end of this document.

- *How is the data processed and compressed to fit onto the CD-ROM ?*

The data are initially read off the tape and collated with attitude (roll & pitch) information and global positioning satellite information (GPS - position, heading and altitude) recorded on the same tape. This information is then processed to produce an image that has a ground resolution of 20 metres, and is fitted to the British national grid projection system. This means that each dot on the computer screen that makes up the image represents 20 metres on the ground. The EA data is collected at approximately 10 metres resolution, thus achieving a saving of 25% on the original data set. This processing and "georegistration" is a challenging task that has only

recently been made possible by advances in positional technology, software and computer hardware.

The data is quality controlled, and any images that are seriously affected by clouds or sun glint are not included on the CD-ROM. However, the survey is conducted so that repeat images are taken for areas where these conditions are encountered within the survey period. A coverage of 80% to 90% of the coastline with top class imagery is usual, with a coverage of the coastline of 95 to 100%, depending on air traffic control and military rage restrictions.

The EA airborne system usually collects 12 or 15 "slices" of the visible and near infra-red (also known as reflected infra-red or photographic infra-red). The human eye can only visualise three slices at once - one as red, one as green, one as blue. To avoid confusion, the matching parts of the spectrum to these colours are presented using their real colours: red as red, green as green, blue as blue, thereby building up a "true colour composite". Only 3 of the 15 channels are thereby presented, about 20% of the total spectral information. In addition, the number of "bits per pixel" or the range of possible tones for each sample is carefully reduced from 12 to 8, achieving a 50% space saving. Coupled with the reductions in resolution & spectral channels, the data set has been reduced to 2.5% of its original size, which is approximately 40 Gigabytes for a 15 channel, 12bit survey, georegistered to 10 metres. This approximates to 1 Gigabyte, which is twice the size of a CD-ROM. In order to fit a whole survey and ancillary information on a CD-ROM a novel compression algorithm has been applied, based on the latest mathematical compression techniques. This achieves the final saving that allows a complete survey (and in some cases, two) to be fitted on a single CD-ROM.

- ***What can I do with it ?***

The data is presented with a map-based interface called Gulliver. This allows the user to navigate the coastline and peruse images at will. The mathematical transform is reversed and the images are then placed on the computer screen to be inspected. A default image analysis technique is applied to pull out the features in the water. This technique is known as "histogram equalisation". A second technique is available, a "linear" contrast enhancement, that is usually better at showing land based features. Supporting information (date, time, archive number, image size etc) is supplied to allow the user to place the image in the context of the tide and time of year.

The images can be cut from the viewing application and pasted into other packages, some of which will be able to process the images in a limited fashion. This is particularly useful for illustrative purposes.

The data remains the copyright of the EA. Extemal agencies are free to use it with the following conditions:

1. The words "Copyright (c) Environment Agency (1996)" are placed legibly next to the images whenever it is visualised.

2. The images are not sold onto a third party or used as part of a report or statement to a third party that is charged for.

3. No statements on the environment are associated with the imagery without the prior permission of the EA.

4. Any reports or papers that use the images are copied to the National Centre for Instrumentation and Marine Surveillance.

- ***What other data is available ?***

Please bear in mind that this CD-ROM comprises about 2% of the information in the imagery. Whilst this 2% is very carefully chosen to make best use of the space and to represent the maximum detail other features will be present in the full scale imagery held by the EA. Features that are indistinct in this imagery may well be plainly depicted by specific processing of the full data set by the EA. This data is available - contact the National Centre at the address shown. The flight line locations for the national surveys are appended to the end of this document.

In conjunction with the CASI survey, a thermal video system is run, collecting analogue data in the thermal part of the spectrum. This data is not easily placed on such a medium as CD-ROM, yet. Please contact the National Centre for details.

In addition to the aerial surveys, a marine survey is run within the same timeframe. This comprises laboratory samples and underway continuous measurements of various physical and chemical parameters, and covers the entire coastline. This data is written on to the CD-ROM; please refer to the relevant information supplied with the CD-ROM.

The National Centre processes the imagery to provide high level assessments of physical parameters around the coast using a combination of airborne and ship based data. Contact the National Centre for more information.

When contacting the National Centre about specific images please have the date, time, flight line number and archive number available. These are available on the GULLIVER screen and with reference to the maps appended to this document.

- ***How do I obtain coverage of other areas and times?***

The National Centre provides opportunities for the EA and external organisations to request and obtain imagery of greater spatial and spectral detail of specific targets at specific times. The users of these opportunities have covered a wide range of targets and applications, not all coastal or water based. Please contact the National Centre for information. It may be that we have already covered the area you are interested in and can supply the data.

Data from previous surveys is also available from the National Centre. It is envisaged that "back processing" of the data will occur and these data will appear on CD-ROMS in the future.

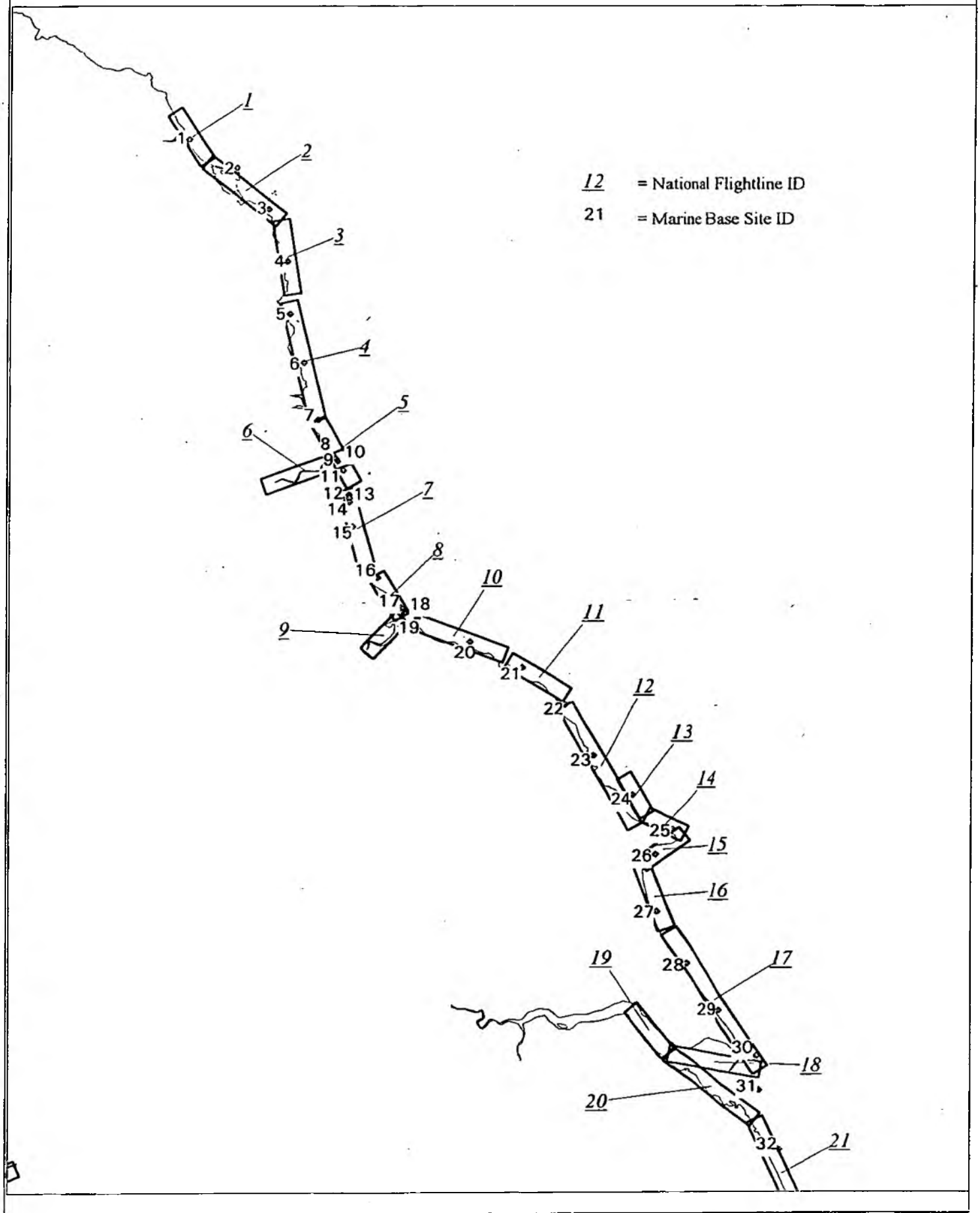
NATIONAL CENTRE FOR ENVIRONMENTAL MONITORING AND SURVEILLANCE

NATIONAL COASTAL BASELINE SURVEY

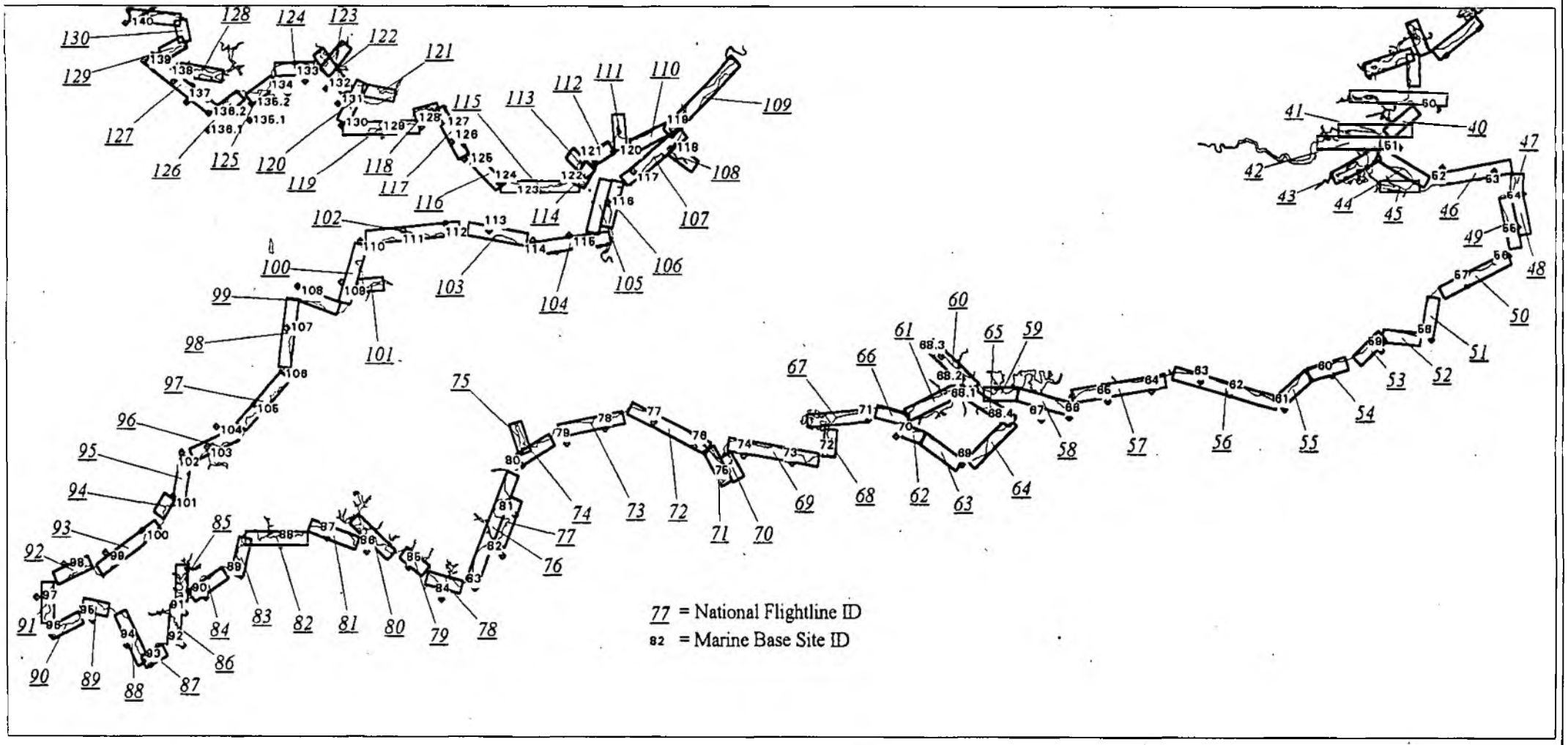
FLIGHTLINE LOCATION MAPS

1: North (flightlines 1 to 21)
2: Anglian (flightlines 18 to 47)
3. South (flightlines 40 to 130)
4. North West (flightlines 127 to 189)

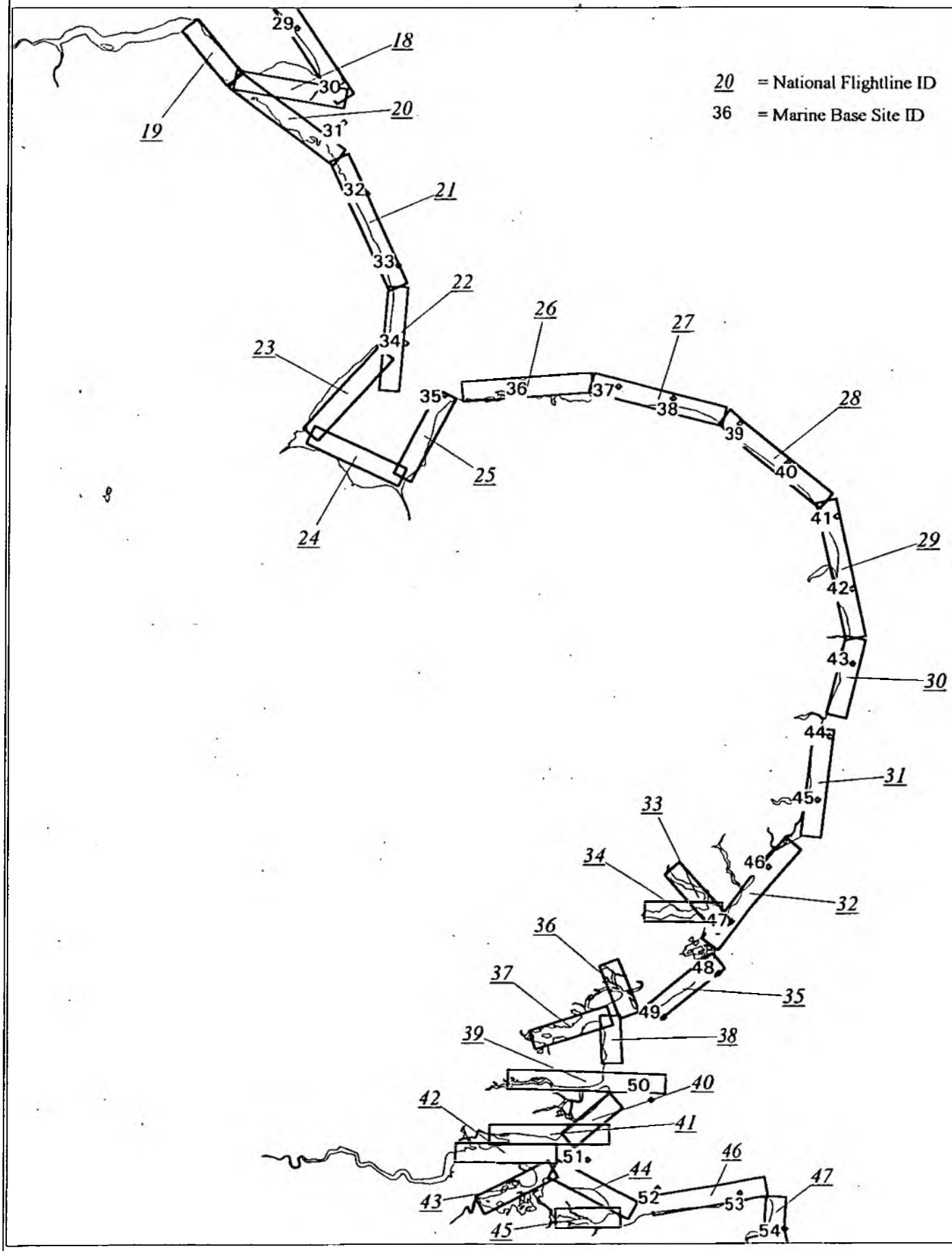
National Marine Baseline Survey, Lab Site and Flightline ID's, North.



National Marine Baseline Survey, Lab Site and Flightline ID's, South.



National Marine Baseline Survey, Lab Site and Flightline ID's, Anglian.



National Marine Baseline Survey, Lab Site and Flightline ID's, North West.