

PRAKLA-SEISMOS INFORMATION No.58

COMputer-aided STATic Correction System

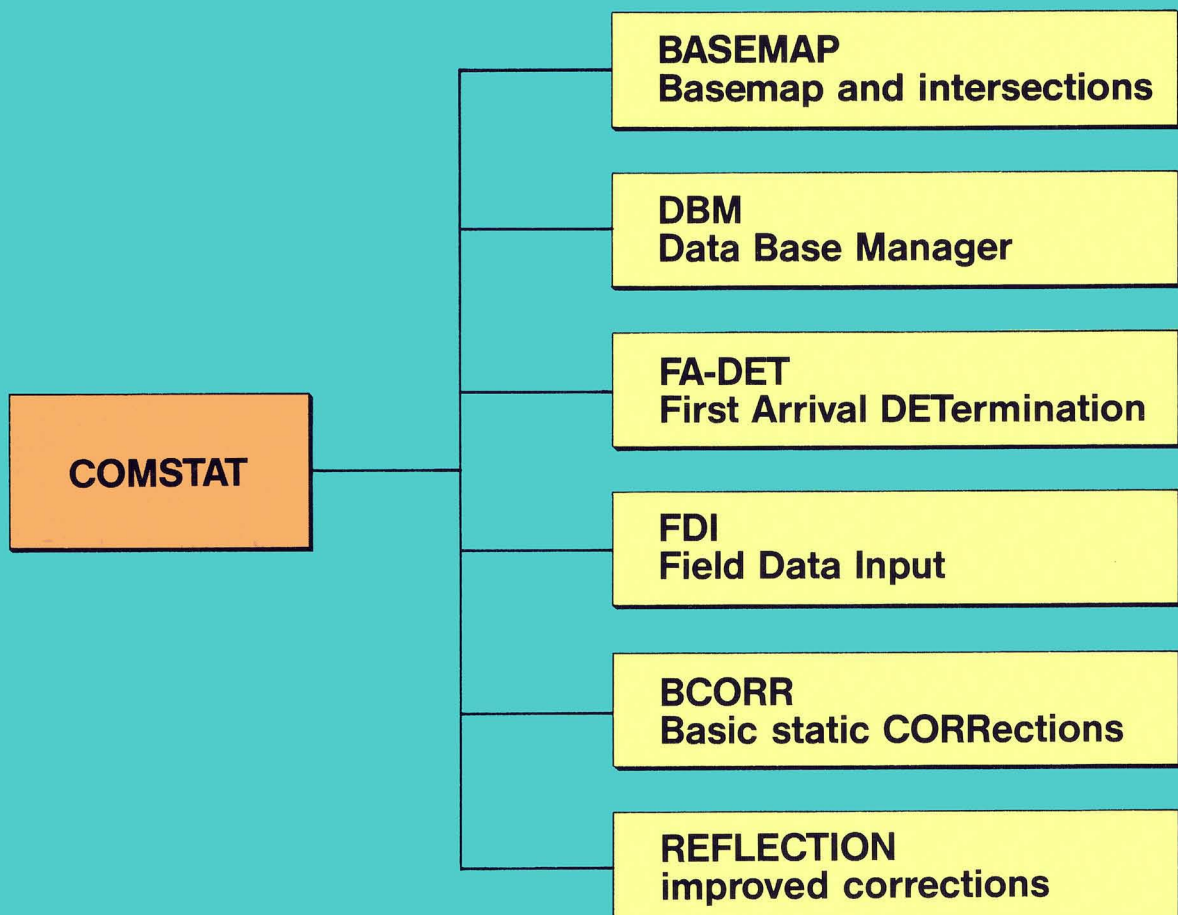
The background of the lower half of the page is a complex abstract design. It features a dark blue field filled with numerous thin, horizontal, wavy green lines. A wide, bright yellow diagonal band cuts across the middle of the image from the bottom left towards the top right. The word "COMSTAT" is printed in large, bold, blue, serif capital letters within this yellow band. In the lower right area, there is a solid black rectangle. Overlaid on this rectangle are several thin, red, intersecting lines that form a star-like or web-like pattern.

COMSTAT

COMputer-aided **STAT**ic correction system

- Handles 2-D and 3-D surveys
- Checks field geometries
- Determines first arrivals
 - Automatic picking
 - Semi-automatic digitizing on screen
 - Manual digitizing
 - Editing
- Calculates refractor velocities
- Computes basic corrections
 - Intercept time
 - Plus-time method
 - Delay time
- Improves corrections via reflections
 - Semi-automatic digitizing on screen
 - Manual digitizing
- Adjusts at line intersections
- Creates basemaps including results
- Stores results in archive system

Main components of the COMSTAT system



COMSTAT is a program package for determining static corrections in 2-D and 3-D surveys. It has two different objectives:

- the determination of basic corrections from refraction data, and
- the improvement of basic corrections from refraction and reflection data.

When working with refraction data it is necessary first of all to define the first arrivals, and **COMSTAT** offers three possibilities for doing this:

- automatic picking of first arrivals,
- semi-automatic picking by digitizing the first arrivals on a screen,
- manual picking of the first arrivals via digitizer.

By analysing the redundancy, mispicks can be removed from the traveltimes curves either automatically or manually. Time windows are then used to mark the different refractors within the traveltimes curves. The velocity of each refractor can be calculated using Hagedoorn's minus-time method. Subsequently a velocity model can be obtained from the refractor depths, which are found by means of three methods:

- intercept time method
- delay time method
- Hagedoorn's plus-time method.

The velocity model describes the near-surface conditions and allows the static corrections to be calculated for the source and receiver positions.

COMSTAT also enables the static corrections to be statistically improved by interpreting the reflection times. Two methods are available for finding the reflections times:

- semi-automatic picking by digitizing the reflection times on the screen, and
- manual picking of reflection times via digitizer.

In the semi-automatic method a seismic record is displayed on the screen and a reflection or a part of a reflection is automatically picked after the start and end point have been given. The reflection hyperbola can be simultaneously displayed.

Now and again when calculating static corrections effects occur which are not caused by the static corrections themselves. In such cases **COMSTAT** offers assistance in investigating the field geometry.

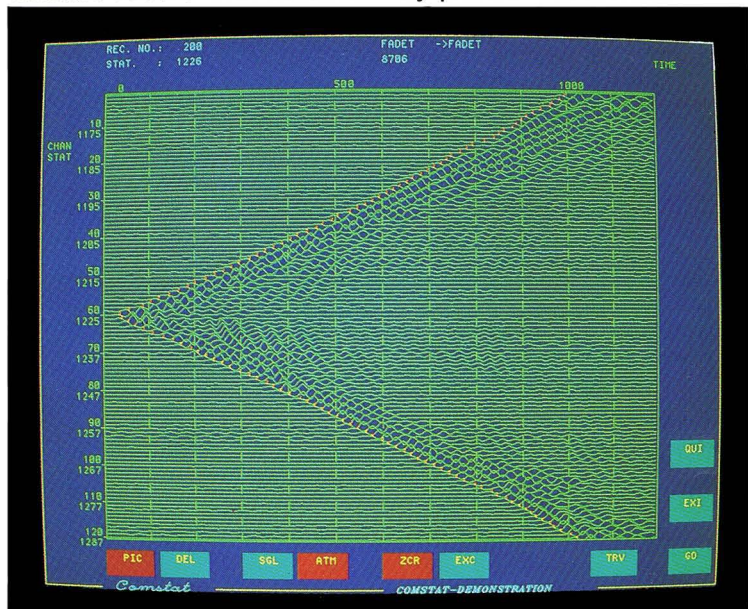
The display of results in a location map is especially advantageous for evaluating the static corrections as well as the velocity models. **COMSTAT** proves to be useful here, too, by displaying

- receiver positions,
- source positions,
- CDP positions,
- results along the lines, e.g. velocity model, velocities, static corrections, and
- differences in results at line intersections.

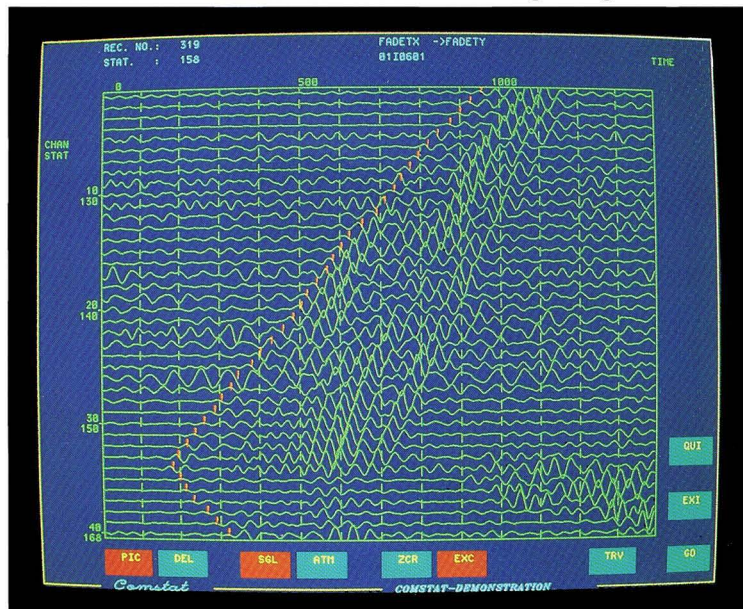
A comparison of the values at line intersections enables the result to be adjusted accordingly.

All the data and results used in the processing are stored so that **COMSTAT** can be used to compare the results of different survey campaigns which occur in the same survey area.

Seismic record with automatically picked first arrivals



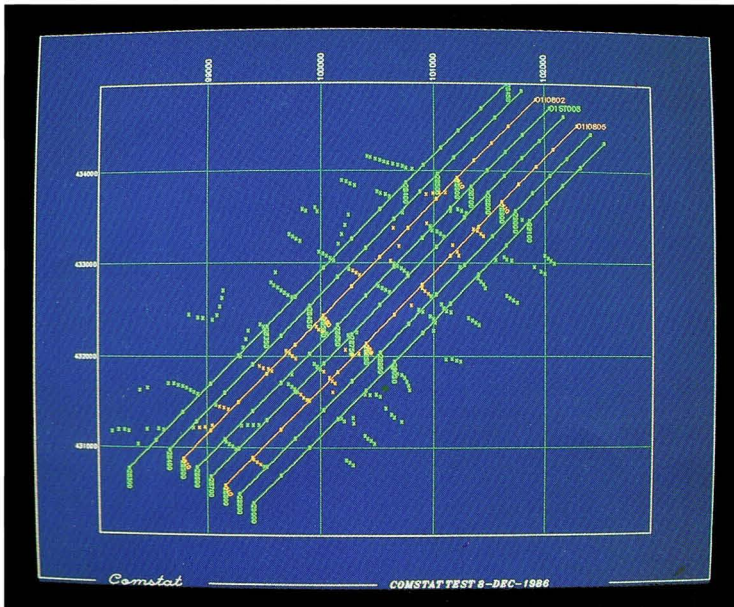
Seismic record after semi-automatic digitizing on screen



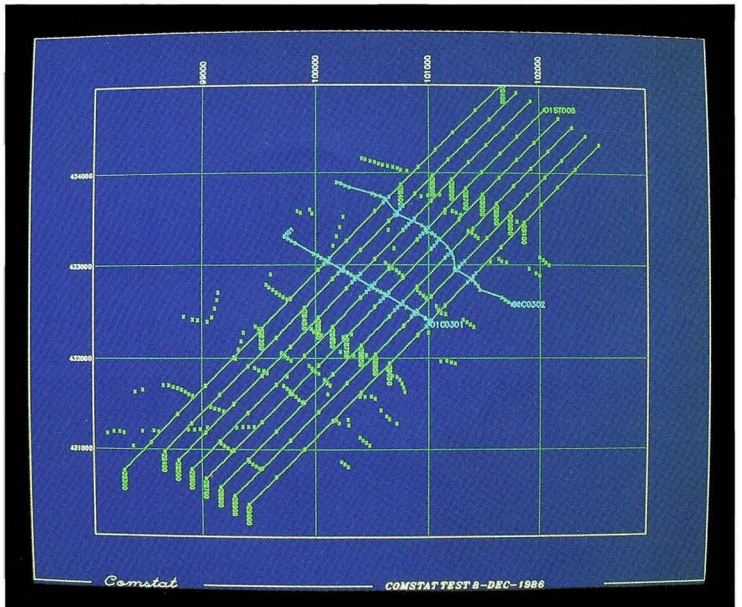
Application of **COMSTAT** to 3-D surveys

- The above application of **COMSTAT** to 2-D surveys can also be applied to 3-D operations. If the field geometry allows, the data along the receiver lines are sorted in the "common shot domain", while data along the source traverses are subject to the "common receiver domain". As the majority of 3-D surveys have irregular geometries this method is more generally applied to 2-D meander lines.
- **COMSTAT** also offers a program for the areal interpolation of data, including static corrections. Results from the short refraction and uphole surveys can also be incorporated here.
- A new concept is being developed for determining static corrections within the framework of **COMSTAT**. The procedure will involve an initial check and correction of the coordinates of source and receiver positions, and subsequently the delay times will be determined as well as the areal distribution of the refractor velocities. The procedure will make use of the entire redundancy of the recorded data and moreover it will provide an ideal solution for recording geometries in which the source and receiver positions are distributed areally rather than linearly.

To compute receiver corrections for a 3-D survey, 2-D lines can be sorted out — in common shot domain — and corrected line by line. Two of these lines are highlighted in orange.



To compute shot corrections for a 3-D survey, 2-D lines can be sorted out — in common receiver domain — and corrected traverse by traverse. Two of these traverses are highlighted in blue.



The **COMSTAT** interactive program package can be run on all VAX computers using the VMS operating system. Use of the standard software GKS (Graphical Kernel System), which is hardware-independent, means that the **COMSTAT** system is not tied to specific hardware types and manufacturers.

The system supports various graphic units:

- dual screen workstation,
- b/w plotter,
- colour plotter,
- digitizer.

An important part of the **COMSTAT** system is represented by the database, which stores data such as

- first arrivals, reflections,
- seismic records,
- field data,
- results, e.g. velocity models, corrections,
- graphic metafiles.

Access to the database is open to all system components and this is characterized by fast transfer to any desired data set. The connection to other systems is formed by special interface programs which enable field data and seismic traces to be stored in the database and which give the processing access to the corrections.

Data flow of the COMSTAT system

