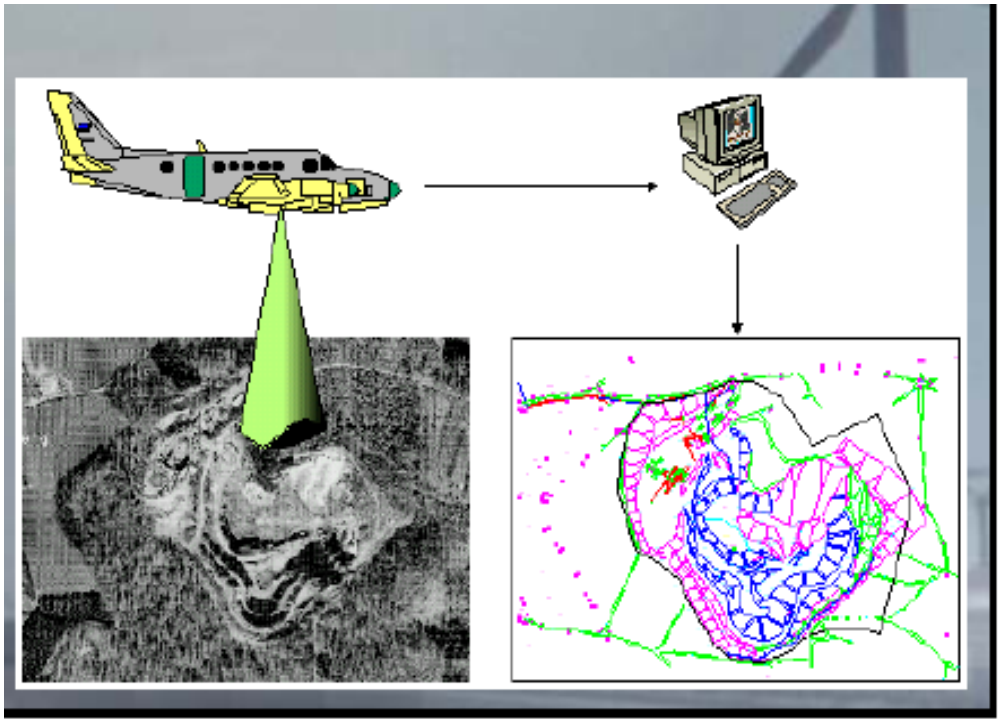
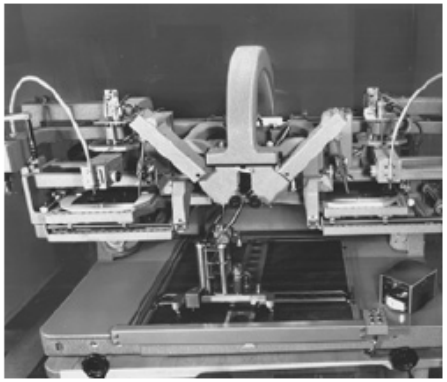
# GEE 3622



# STEREOSCOPIC PLOTTING INSTRUMENTS

## INTRODUCTION

- Stereoplotter
  - Provides rigorous, accurate solution for object point location (X, Y, Z) from images appearing in overlapping pair of photos
- Accuracy depends on 3 orientation processes
  - Interior orientation
  - Relative orientation
  - Absolute orientation

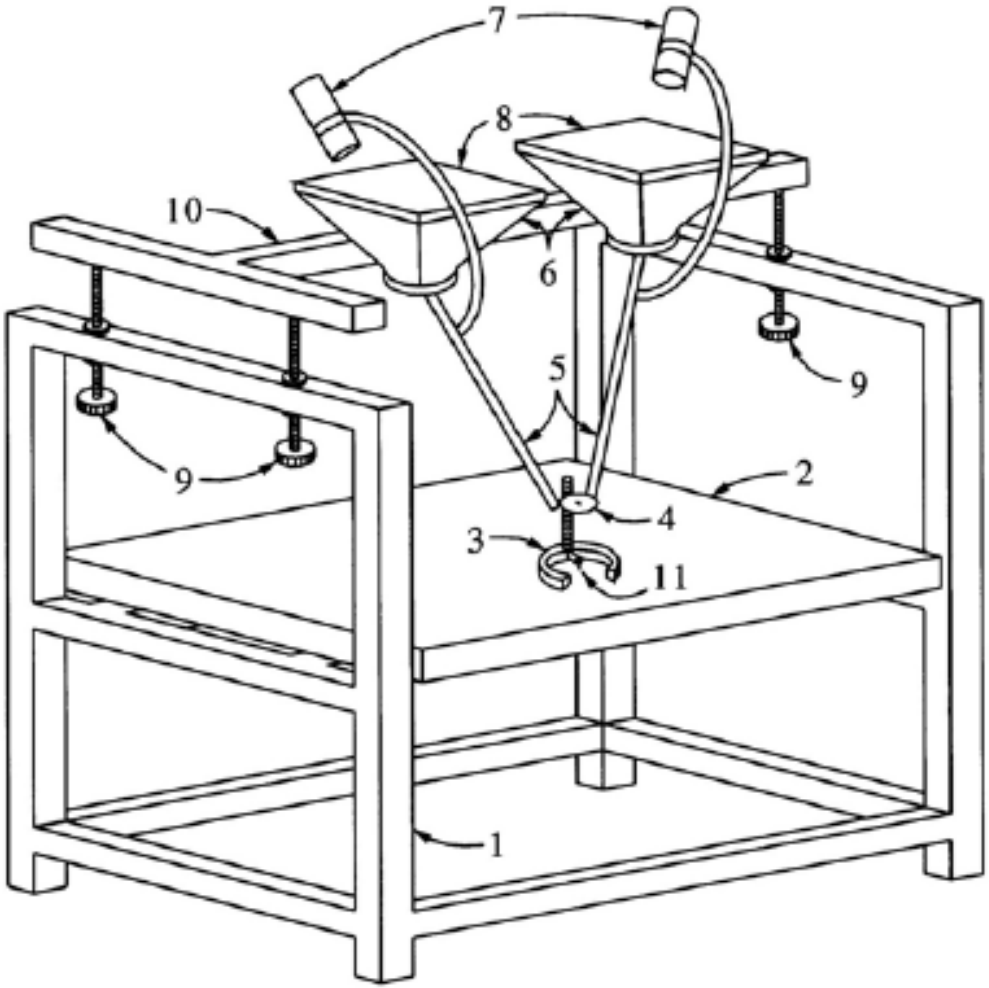


# CLASSIFICATION OF PLOTTERS

- Four general categories
  1. Direct optical projection instruments
  2. Mechanical or optical-mechanical projection instruments
  3. Analytical stereoplotters
  4. Softcopy or digital stereoplotters
- Other classification methods
  1. By accuracy capability (first-, second-, or third order)
  2. According to whether an “approximate” solution or “theoretically correct” solution is obtained

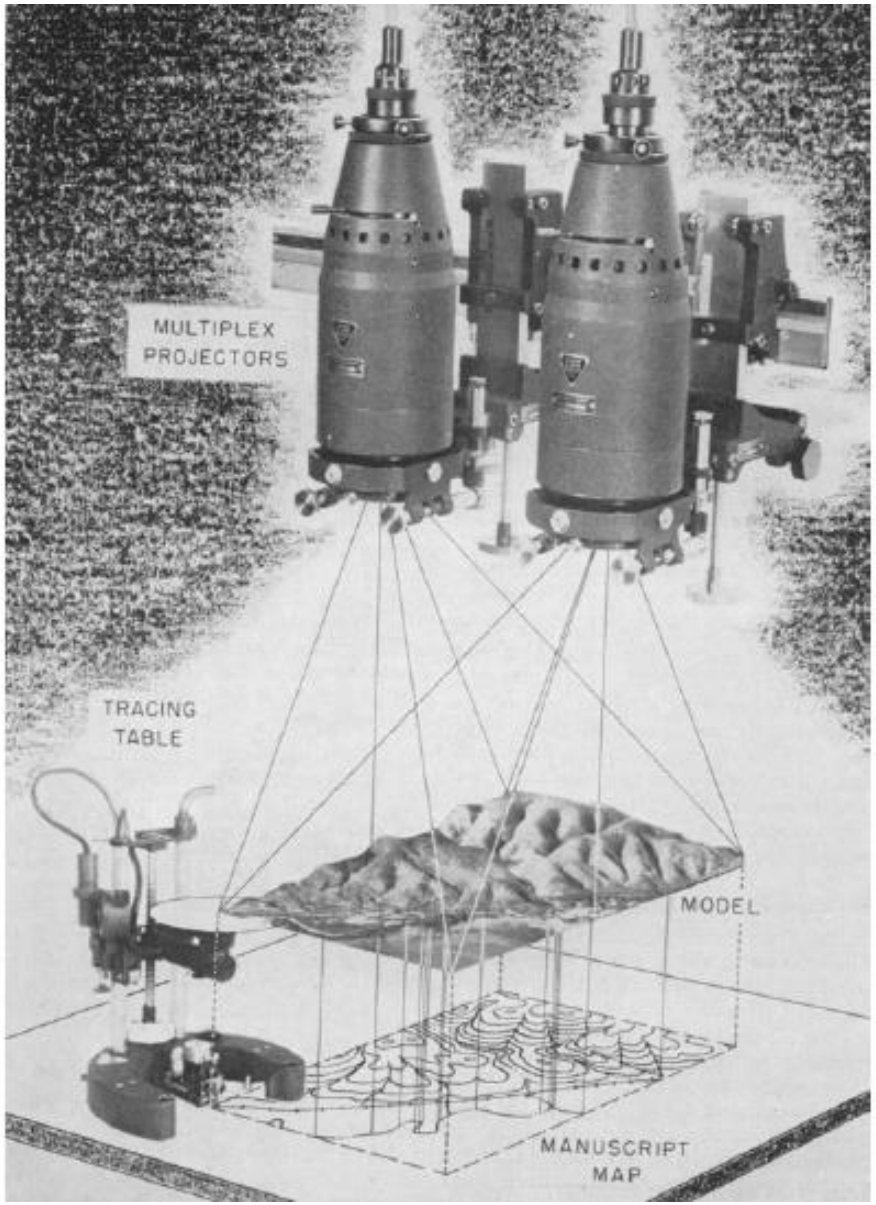
# DIRECT OPTICAL PROJECTION STEREOPLOTTERS

1. Main frame
2. Reference table
3. Tracing table
4. Platen
5. Guide rods
6. Projectors
7. Illumination lamps
8. Diapositives
9. Leveling screws
10. Projector bar
11. Tracing pencil



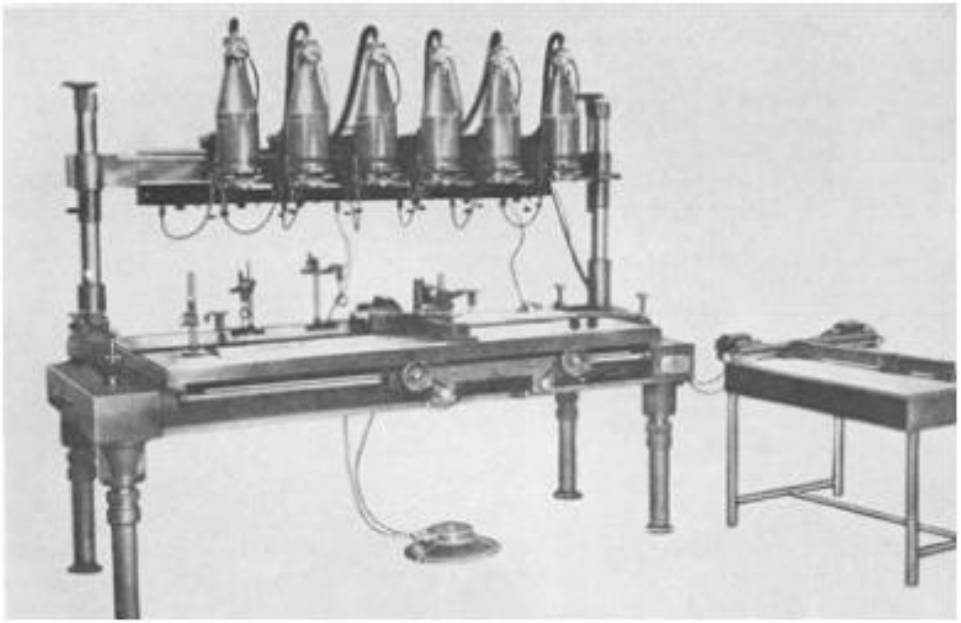
# DIRECT OPTICAL PROJECTION PLOTTER

# MULTIPLEX MODEL SKETCH

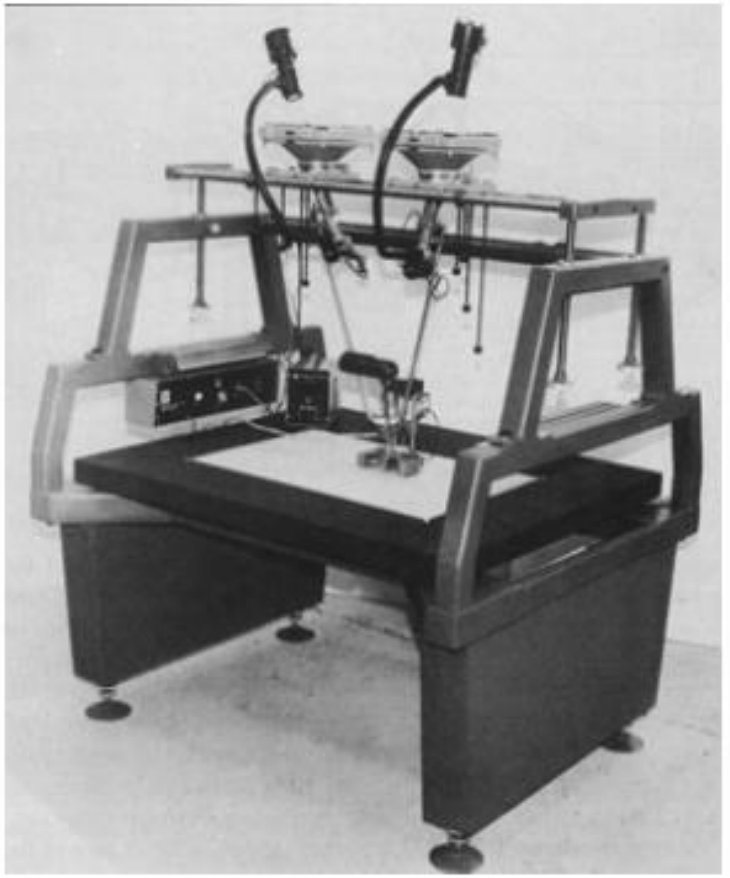


# DIRECT OPTICAL PROJECTION STEREOPLOTTERS

- Nistri Photomultiplex Model D III



- Kelsh Stereoplotter



# PROJECTION SYSTEM

- Light rays projected through projector objective lenses and intercepted below on platen
- Requires operation in dark room
- Lens formula must be satisfied

$$\frac{1}{f'} = \frac{1}{p} + \frac{1}{h}$$

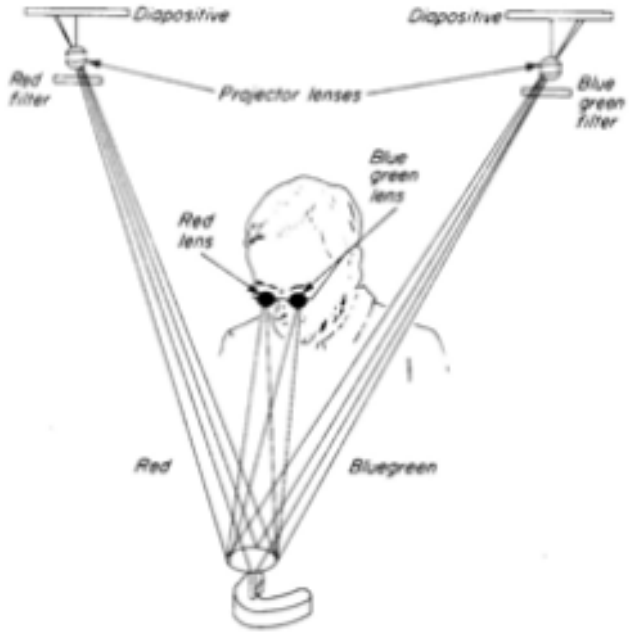
- Intersection must occur within depth of field of projector lens

# PROJECTION SYSTEMS

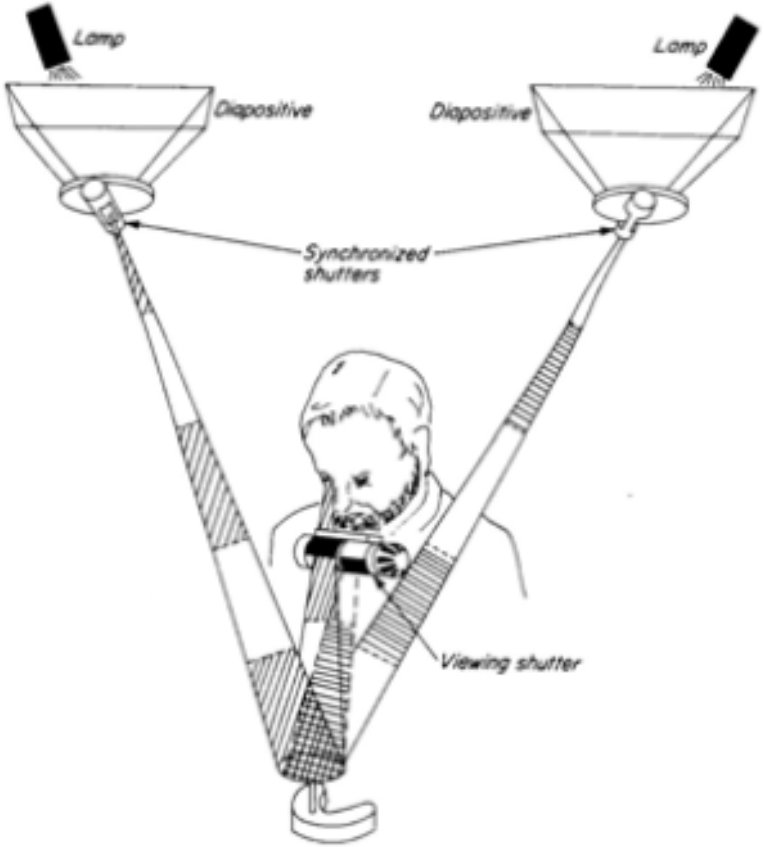
- To recreate relative angular relationships
  - Projectors must have rotational and translational movement capabilities
  - 6 possible for each projector
    - $\omega$ (omega) – x rotation also called tilt
    - $\varphi$ (phi) – y rotation also called tip
    - $\kappa$ (kappa) – z rotation also called swing
    - X translation
    - Y translation
    - Z translation

# VIEWING SYSTEMS

- Anaglyphic system



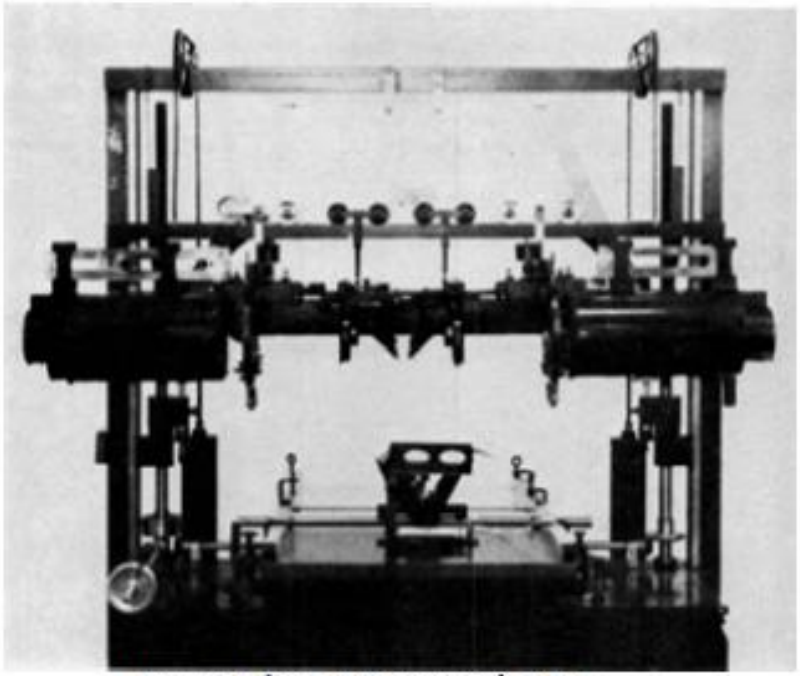

- Stereo-image alternator (SIA)




- Polarized platen viewing similar system

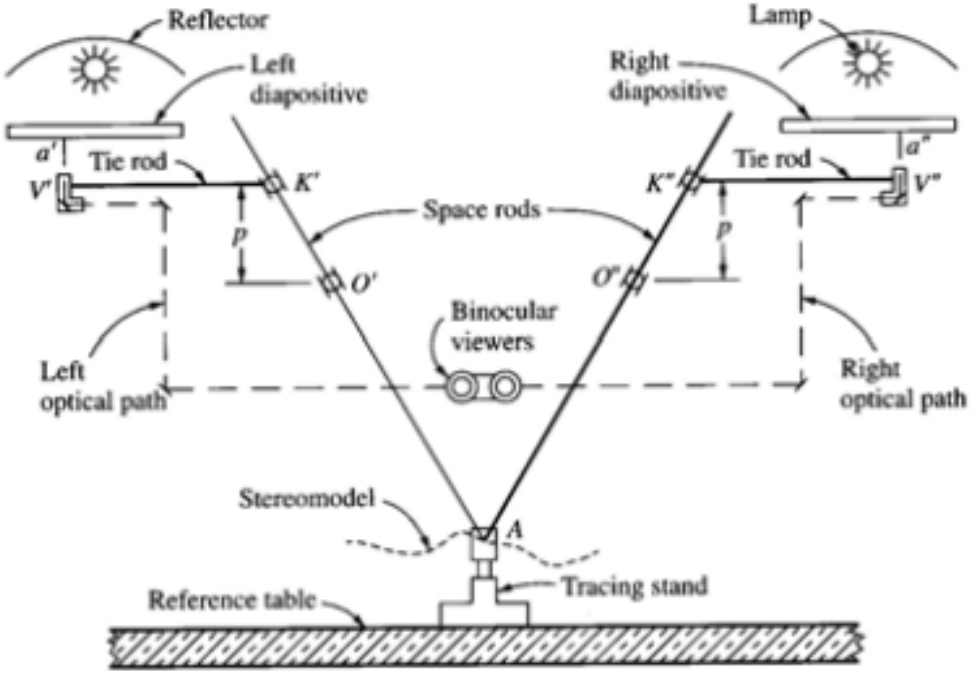
# MECHANICAL PROJECTION PLOTTER

- Space rods used to simulate direct optical projection of light rays
- Preferred instrument over direct optical plotters
  - More versatile
  - Higher accuracy
  - Better overall stability
  - Need not be operated in dark room



Fourcade's Stereoprojector

# MECHANICAL PROJECTION PLOTTER




- Diapositives placed in carriers and illuminated above
- Space rods are free to rotate about gimbal joints O' and O" and can slide up and down through joints
- Model air base defined by O'O"
- Joints fixed in position except their spacing can be changed

# MECHANICAL PROJECTION PLOTTER

- Viewing system – 2 optical trains of lenses, mirrors, and prisms
- Reference half mark superimposed on optical axis of each lens V’ and V”
- Movement imparted to lenses from space rods by means of tie rods connected to another set of gimbal joints
  - These joints fixed in vertical position
  - Vertical distance O’ and O” to corresponding upper gimbal joint K’ and K” – principal distance (p)

# MECHANICAL PROJECTION PLOTTER

- Space rods intersect at tracing stand
- Moving tracing stands moves space rods
- When properly oriented, moving tracing stand moves lenses V’ and V” to a’ and a” in corresponding imagery
  - With half marks merged, floating mark will appear on surface of model point A
- Orientation very similar to optical plotters

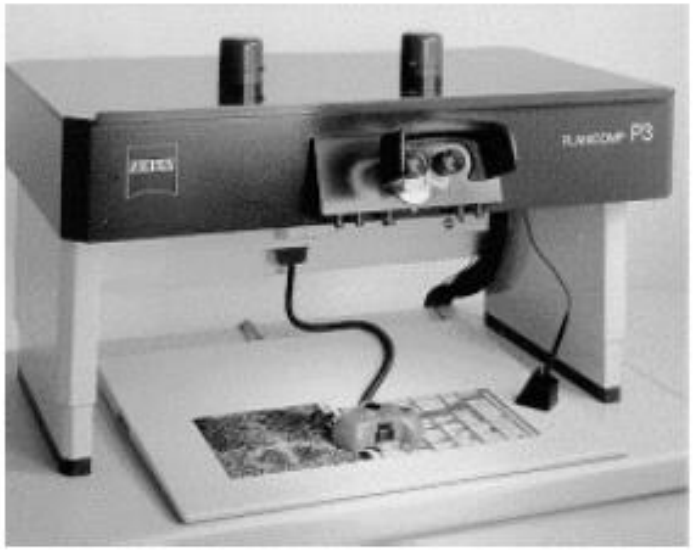
# ANALYTICAL PLOTTERS

- Development possible with advances in computers, digital encoders and servosystems
- Use exact mathematical calculations to define stereomodel
- Capabilities
  - Precisely measure x and y photo coordinates on both photos of a stereopair
  - Accurately move to defined x and y photo locations

# ANALYTICAL PLOTTERS

- Wild BC-1

- Zeiss P-3




- Kern DSR 14

# ADVANTAGES OF AP

- No optical or mechanical limitations in forming models
  - Great versatility
  - Can handle vertical, tilted, low oblique, convergent, high oblique, panoramic, terrestrial images, and satellite images
- Accommodate photography from any focal-length camera
- Provide superior results than analog plotters
  - Optical and mechanical errors are not introduced
  - Can correct for any combination of systematic errors
  - Take advantage of redundant observations and incorporate into least squares solution

# SOFTCOPY PLOTTERS

- Similar to analytical plotters
  - Rely on digital imagery
  - Less expensive and more versatile than analytical plotters
- Essential component – computer with high-resolution graphics display
  - Must be capable of displaying both photos simultaneously

# SOFTCOPY PLOTTERS

- Socet Set

- ZI ImageStation