Remote Sensing

Topic 6: Principles of Stereoscopic Vision

Chapter 3: Lillesand and Keifer
Chapters 2 and 3 Avery and Berlin
Chapter 3: Paine (also on reserve in Map Library)

Stereoscopy

- Science that deals with the use of binocular vision to achieve a 3-D effect
- Observation from two different perspectives
  - e.g. two adjacent photos (aka stereo-pair)
  - or a stereogram
Parallax

- Refers to apparent shift in position of object
- Result of change in viewing position
- Amount depends on height!

Parallax Height Determination
Stereo-coverage

Alignment of Stereo Model

Pseudoscopic Vision
### Stereoscopic Viewing

- **Advantages**
  - Adjustable inter-ocular distance
  - Frame fixes distance from stereogram
  - Small/portable

- **Disadvantages**
  - Low magnification
  - Overlapping photos

### Pocket Stereoscope

- **Advantages**
  - Adjustable inter-ocular distance
  - Frame fixes distance from stereogram
  - Small/portable

- **Disadvantages**
  - Low magnification
  - Overlapping photos

### Mirror Stereoscope

- Mirrors enable entire area to be viewed without overlap
- Variable magnification (3 - 15 or 20x)
- Individually focused eye-pieces
- Scanning mirror stereoscope allows you to roam over the image without readjusting the stereo-pair
**Zoom Stereoscope**

- Higher magnification (2 - 64X)
- Usually designed to work with rolls of photo transparencies and incorporating a light table
- Each eye-piece rotates independently to adjust for crab

**Vertical Exaggeration**

- Objects have exaggerated vertical distances
- Due to exaggerated distance between successive photographs
- Varies slightly for everyone

**Calculating VE**

\[
VE = \left(\frac{AB}{H}\right) \left(\frac{h}{EB}\right)
\]

where:
- \(AB\) = air-base
- \(H\) = aircraft height
- \(h\) = distance b/w eyes and plane of stereo model
- \(EB\) = eye base

\(h/EB\) is difficult to determine so is generally considered a constant equal to 6.5

Therefore, this formula may be rewritten as:

\[
VE = \left(\frac{AB}{H}\right) \left(6.5\right)
\]

where:
- \((AB/H)\) is referred to as the base-height ratio
Calculating VE

VE = \((AB/H) \times 6.5\)

where: \((AB/H)\) is referred to as the base-height ratio

Example:
Brandon Photoset Roll Number 18698 (15 photos)

VE = \((1630 \text{ m} / 3048 \text{ m}) \times 6.5 = 3.47\)

Note: \(AB\) can also be estimated by \((1-%\text{Endlap}) \times \text{Photo Width}\)

example:
\((1-60\%) \times 9 \text{ in} \times \text{PSR} = 0.40 \times 9 \text{ in} \times 20000/12 = 6000 \text{ ft} \text{ or } 1829 \text{ m}\)

VE = \((1829 \text{ m} / 3048 \text{ m}) \times 6.5 = 3.3\)

at 80% endlap: \(AB = 0.20 \times 9 \text{ in} \times 20000/12 = 3000 \text{ ft} \text{ or } 915 \text{ m}\)

VE = \((915 \text{ m} / 3048 \text{ m}) \times 6.5 = 1.9\)