Visualizing 2D Data in a 3D World

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Agenda

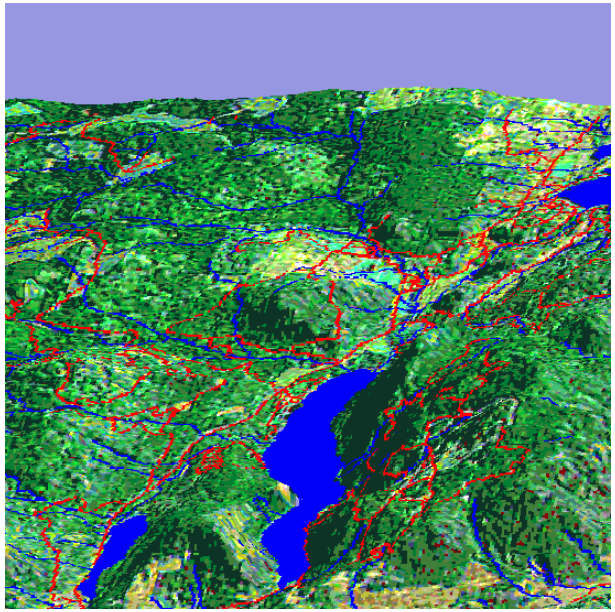
- A Quick History of 3D Views
- Source Data for 3D Views
- Tools to Make 3D Views
- How We Make 3D Views
- Examples:
  - transportation,
  - recreation and
  - real estate.

A Quick History of 3D Views

1. Flat draping of imagery on DEM
2. Draping imagery including building heights on DEM
3. Draping imagery and placing 3D features on DEM

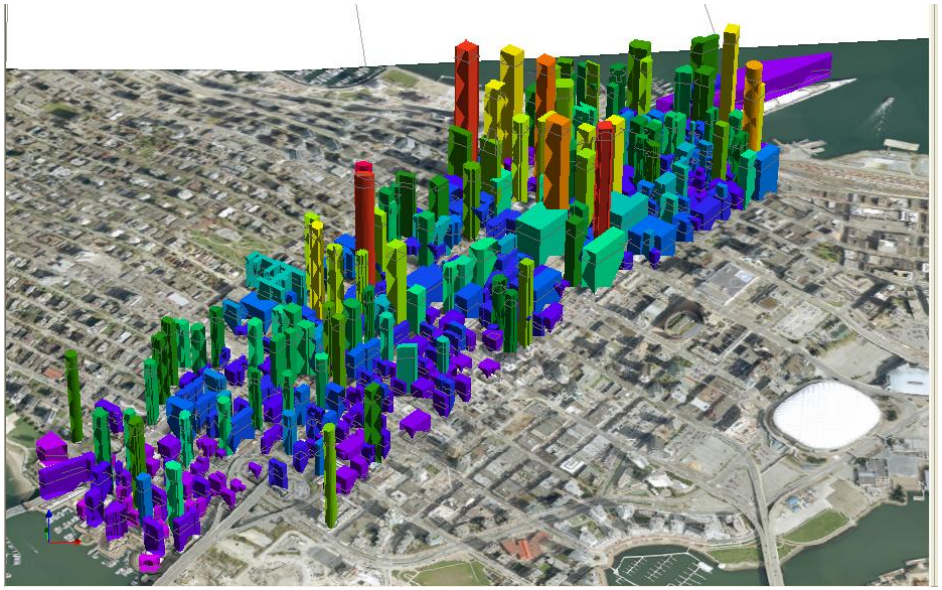
A Quick History of 3D Views

- Flat draping of imagery on DEM
  (typically using satellite imagery or other images with coarse ground resolution)
  - Uses a bare earth DEM
  - Image processing and GIS software provided this basic capability starting late 1980's
  - Example circa 1998



A Quick History of 3D Views

- Draping imagery including building heights in DEM
  - Gives buildings dimension but other supporting features are flat



A Quick History of 3D Views

- Draping imagery and Placing 3D features on DEM
  - Manmade 3D features of interest are typically generated in AutoCAD or other 3D design tool
  - Supporting natural features, (e.g. trees, clouds), and other manmade features, (e.g. golf carts, stop signs), are stored in a library

Image copyright Marco Gualdrini

Source Data for 3D Views

- Orthophotos
- Satellite imagery
- LiDAR and other DEMs
- Vector GIS data
- 3D AutoCAD files
- Terrestrial based photos

Source Data for 3D Views

- Orthophotos
  - Multiple resolutions (10cm to 50cm common)
  - Multiple formats (TIFF and ECW common)
  - Map projections (usually UTM)

- Recommend
  - 50cm
  - ECW format
  - UTM
  - Single seamless image

Source Data for 3D Views

- Satellite imagery
  - Multiple resolutions (50cm to 25m common)
  - Multiple formats (TIFF and ECW common)
  - Map projections (usually UTM)

- Recommend
  - <1m (foreground), background (25m Landsat)
  - ECW format
  - UTM
  - Single seamless image

Source Data for 3D Views

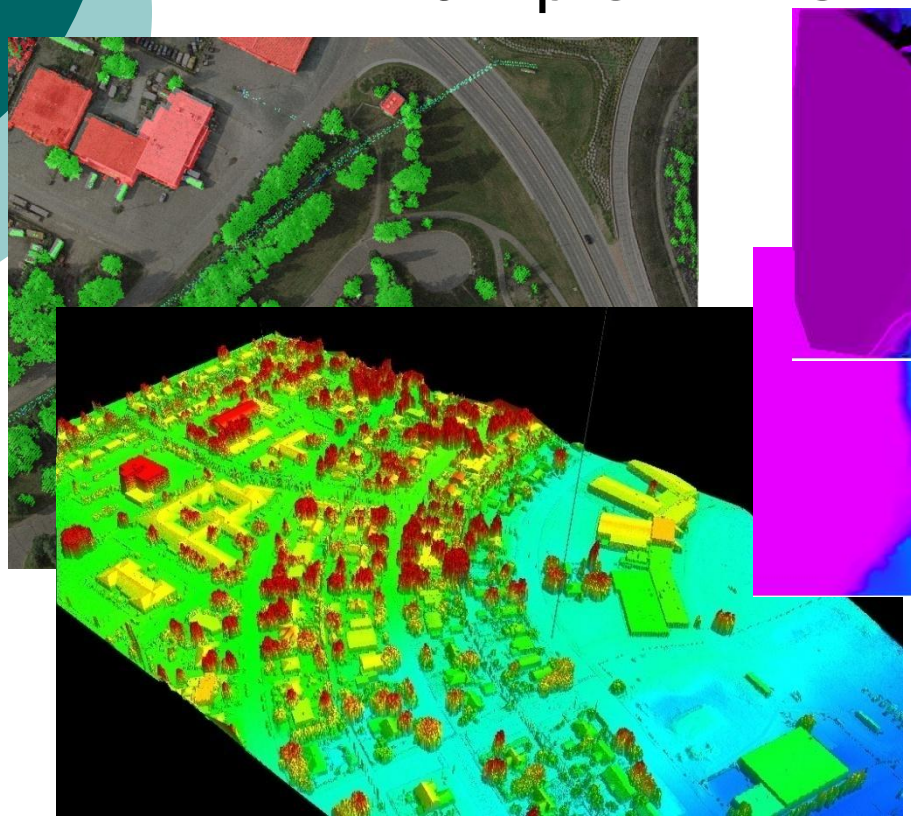
- LiDAR and other DEMs
  - Massive amounts of point cloud data from LiDAR (.LAS format)
  - Request bare earth DEM from LiDAR data
  - Municipal DEMs from LiDAR and/or photogrammetric processes (high precision)
  - Provincial government (1:20,000) DEMs 20m grid
  - Federal government (1:50,000) DEMs 0.75 arc seconds or 23m grid
    (free via GeoBase website)

Source Data for 3D Views

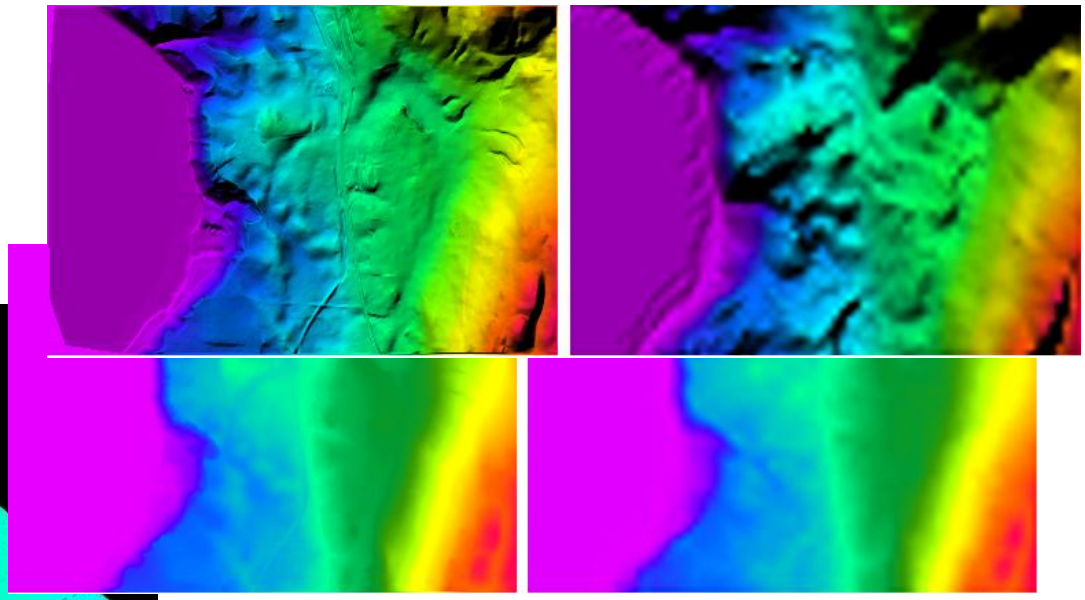
- LiDAR and other DEMs
  - Seams can be a problem - can cause spikes that need to be manually edited
- Recommend
  - 30m for flights over 300m upward
  - for drive throughs (at pavement level) use 5m as more ground detail is needed

Source Data for 3D Views

- Example DEMs



LiDAR



5m DEM vs 25m DEM from TRIM

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Source Data for 3D Views

- Vector GIS data
  - 3D Shapefiles are most useful (for VNS software)
  - 2D Shapefiles, MapInfo TAB, Microstation DGN are common

Source Data for 3D Views

- 3D AutoCAD files
  - Most 3D structures, such as bridges, are designed in AutoCAD by engineering companies (DWG or DXF formats)
  - Structures can be brought into other 3D visualization packages
  - AutoDesk has their own 3D visualization software

Source Data for 3D Views

- Terrestrial based photos
  - Hand held cameras to capture building facades or for adding unique vegetation to library
- Recommend
  - >3 megapixels
  - Short focal distance (something <18mm is good, aka a wide-angle lens).

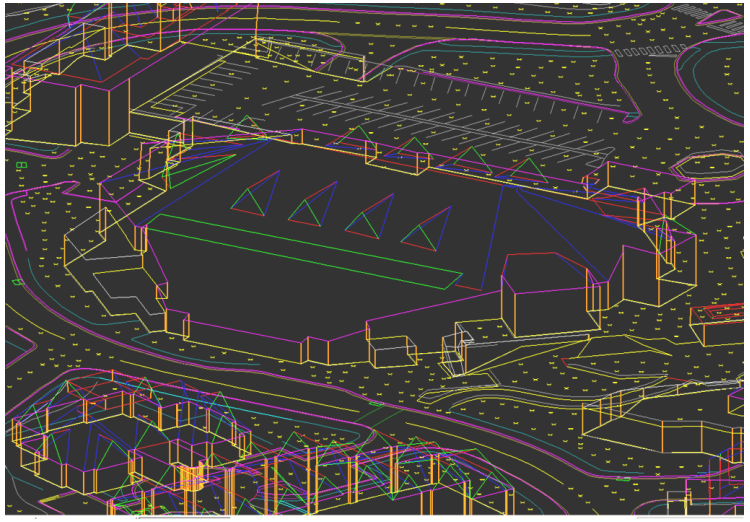
Tools to Make 3D Views

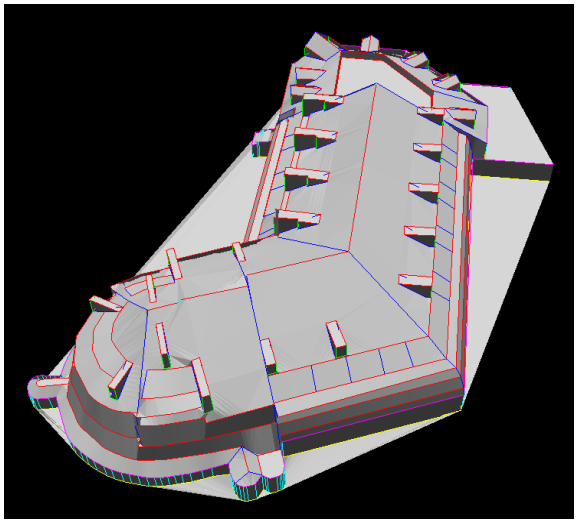
- KLT
- Visual Nature Studio
- Autodesk 3D Studio Max
- Google SketchUp
- ArcGIS
- MapInfo Professional
- Adobe PhotoShop and Premier Elements

No one tool can do everything you need.

Tools to Make 3D Views

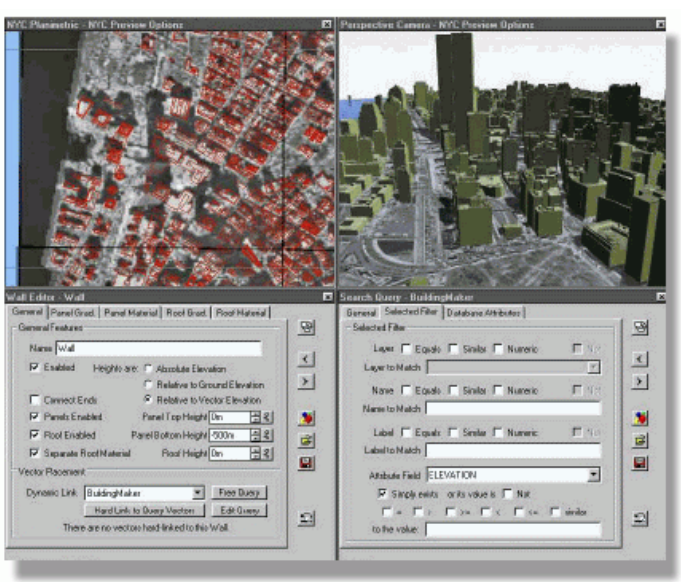
- KLT (WinTINviewer, part of the KLT-TIN package)
  - Part of photogrammetric package by KLT Associates
  - We use to digitize features from airphotos as 3D objects, (e.g. buildings, roads, bridges)

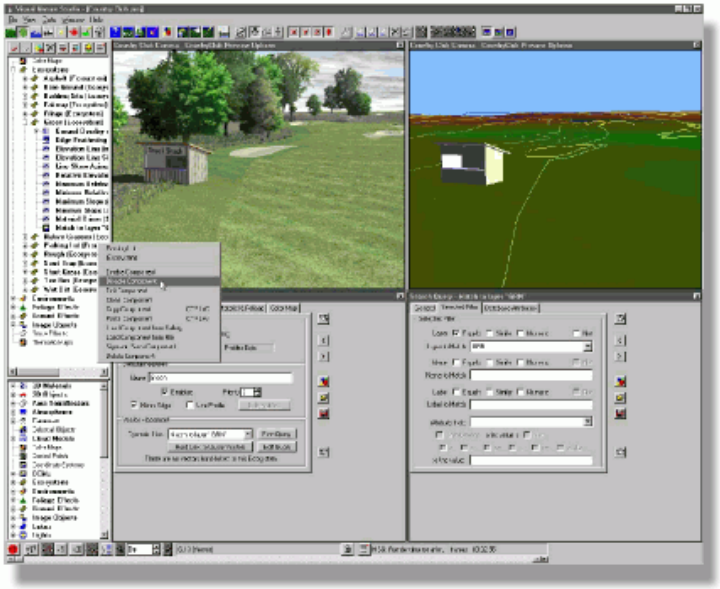




Tools to Make 3D Views

- Visual Nature Studio
  - is a professional photorealistic terrain visualization, modeling & rendering package developed by 3D Nature LLC
  - Also has a real time 3D navigation module





Tools to Make 3D Views

- Google SketchUp
  - Google SketchUp Pro is free software that you can use to create 3D models
  - Build models from scratch, or download objects from a warehouse, or import from AutoCAD and 3DS Max
  - Integrates with Google Earth
  - Google SketchUp Pro paid version allows export to AutoCAD, 3DS Max, or OBJ.

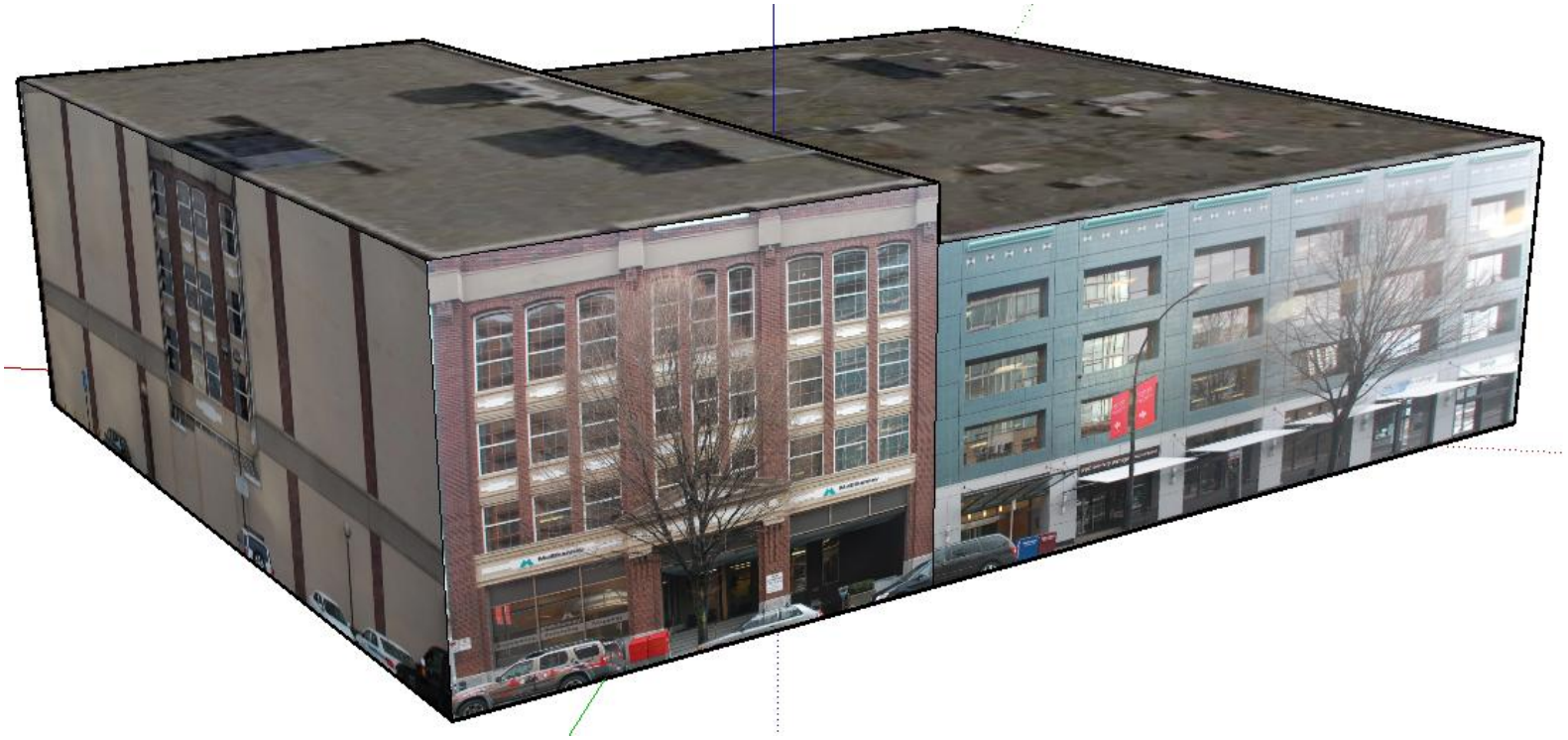
Tools to Make 3D Views

- Google SketchUp Pro Example

© Google

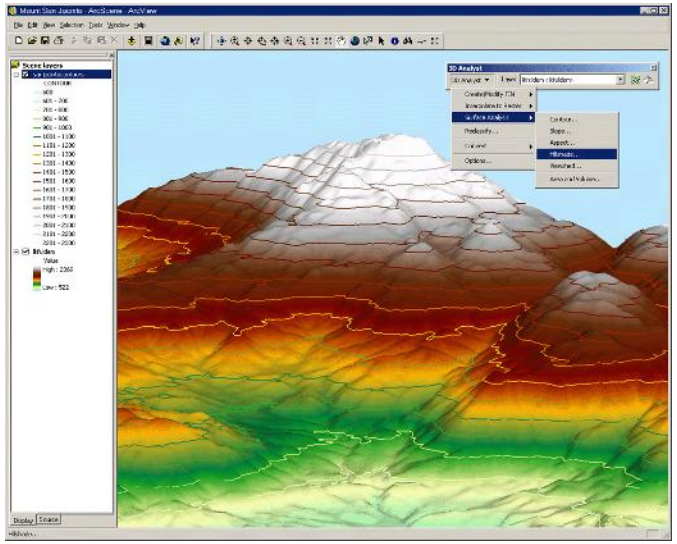
Tools to Make 3D Views

- Google SketchUp Pro Example - Textures



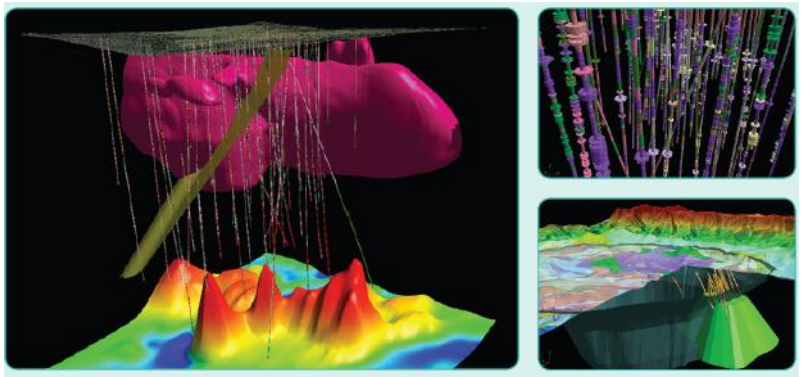
Tools to Make 3D Views

- ArcGIS
  - Many municipalities have data in this format
  - 3D Analyst extension (with ArcScene) can be used for 3D visualization
  - McElhanney uses ArcGIS for compiling data and export to Shape file for VNS work



Tools to Make 3D Views

- MapInfo Professional
  - TAB files are 2D data format
  - Engage 3D extension to MapInfo Professional can be used for 3D visualization
  - McElhanney uses MapInfo to compile vector datasets for import to VNS and for 3D visualization of mining company drill hole data



Tools to Make 3D Views

- Adobe PhotoShop and Premier Elements
  - Photoshop for touching up 3D still views and
  - Premier Elements for putting together stills to form a video, adding annotation, and to convert from one video format to another (avi, mov, flash, NVW).

How We Make 3D Views

- General Work Flow
  1. Format GIS / CAD to common projection and datum
  2. Resample raster images / DEMs to appropriate pixel size and projection/datum
  3. Clean up any 3D AutoCAD drawings (e.g. close polygons)
  4. Draw / design additional structures with SketchUp
  5. Photograph building facades if needed

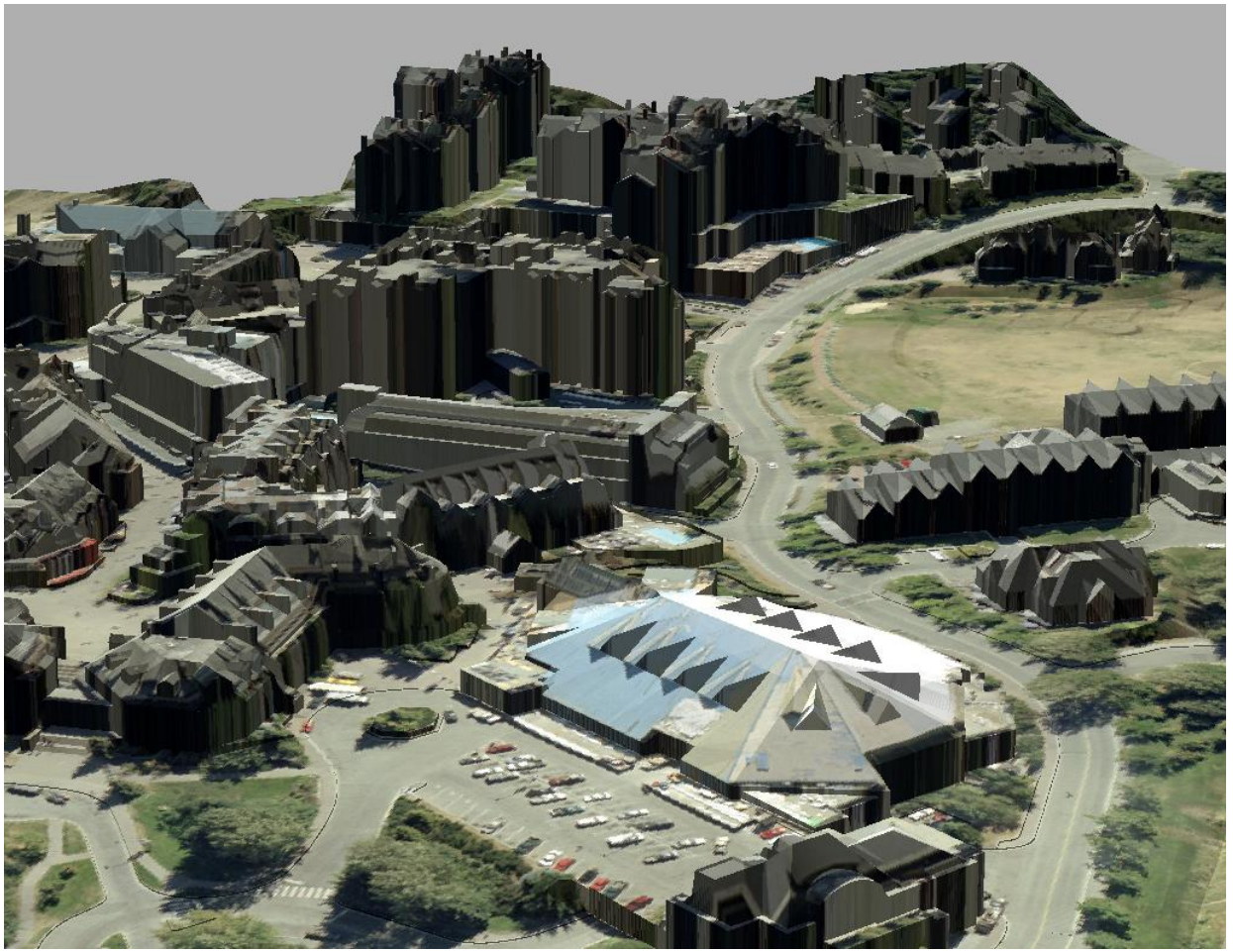
How We Make 3D Views

- General Work Flow
  6. Import external GIS / CAD / raster images / DEMs to VNS
  7. Add terrain (trees, concrete, water, sky, clouds, date)
  8. Set camera and flightpaths
  9. Render, tweak and re-render
  10. Post-production work (Photoshop, Premiere)

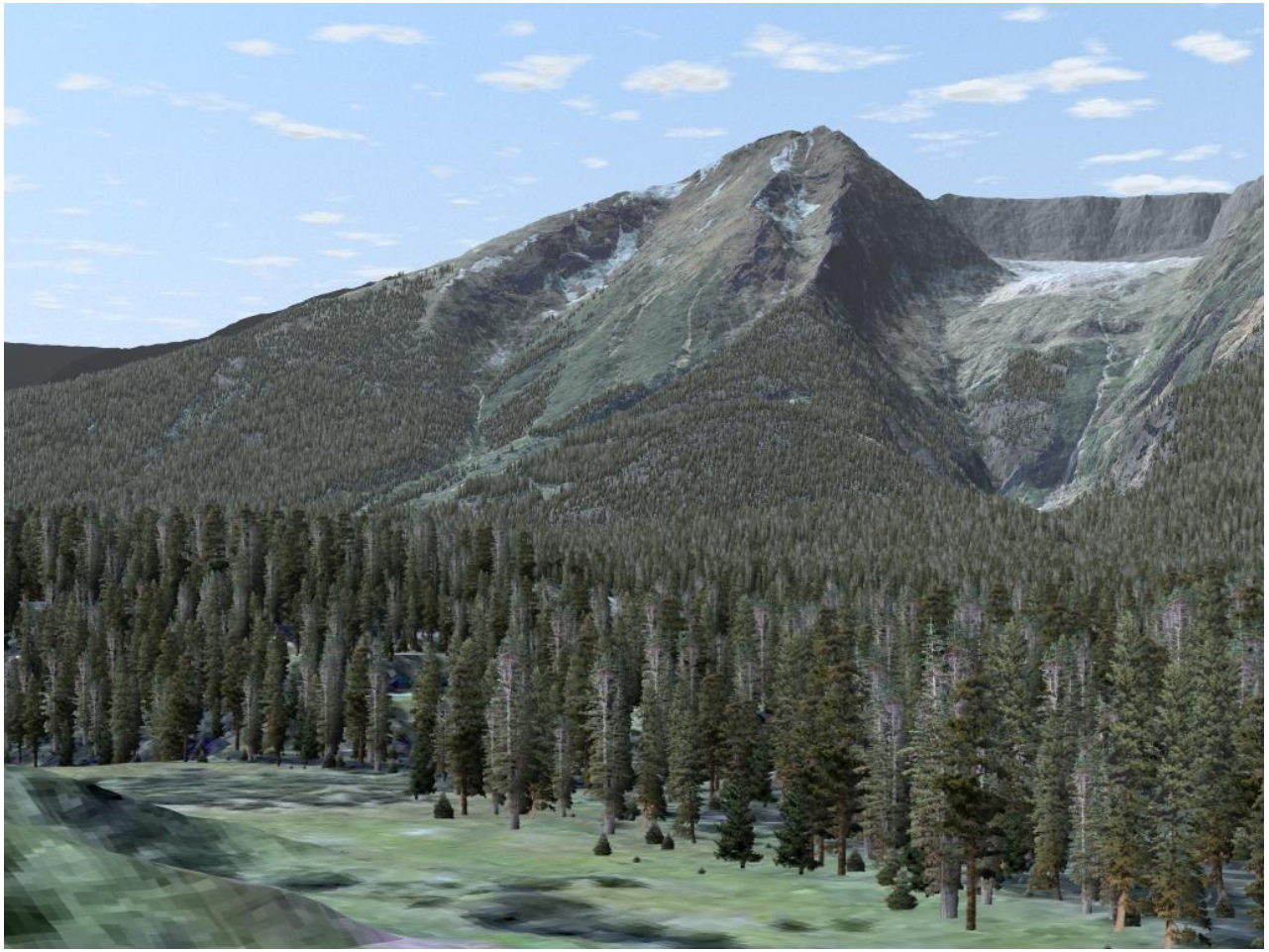
How We Make 3D Views

- Our Tips For Producing a 3D Visualization
  - Put all data in same projection/datum
  - Don’t use data with too much detail
  - Try to keep smooth flythrough path
  - Add annotations *after* the visualization
  - Render individual frames and piece together afterwards, instead of one AVI
  - Be a resource hog (multi-CPU’s, fast videocard, 4GB or more RAM)

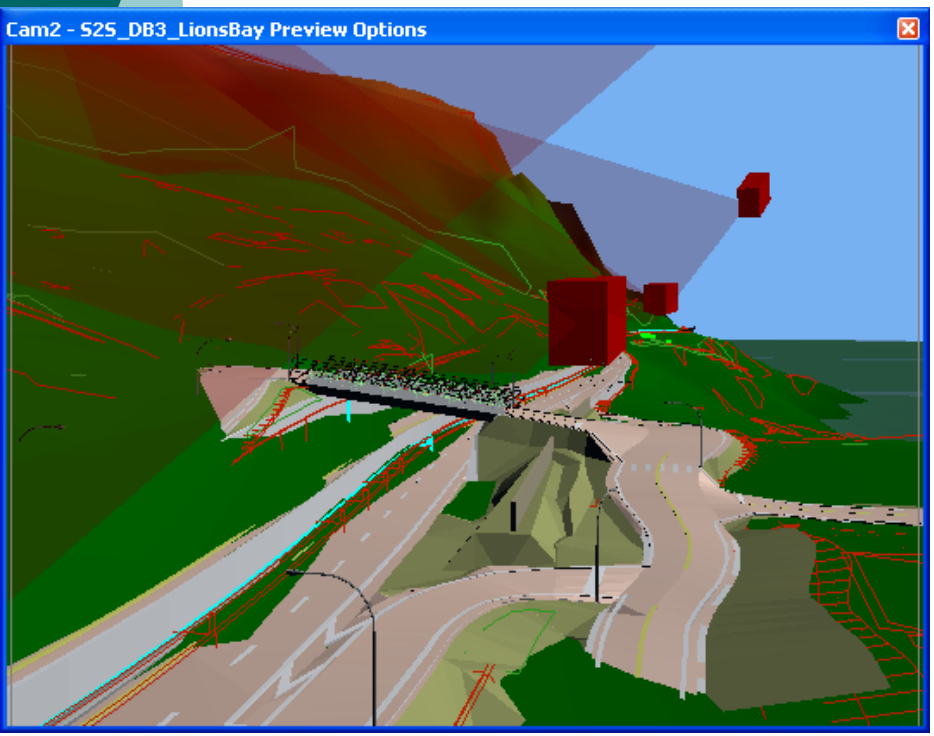
Examples – Real Estate



Examples – Impact Assessment



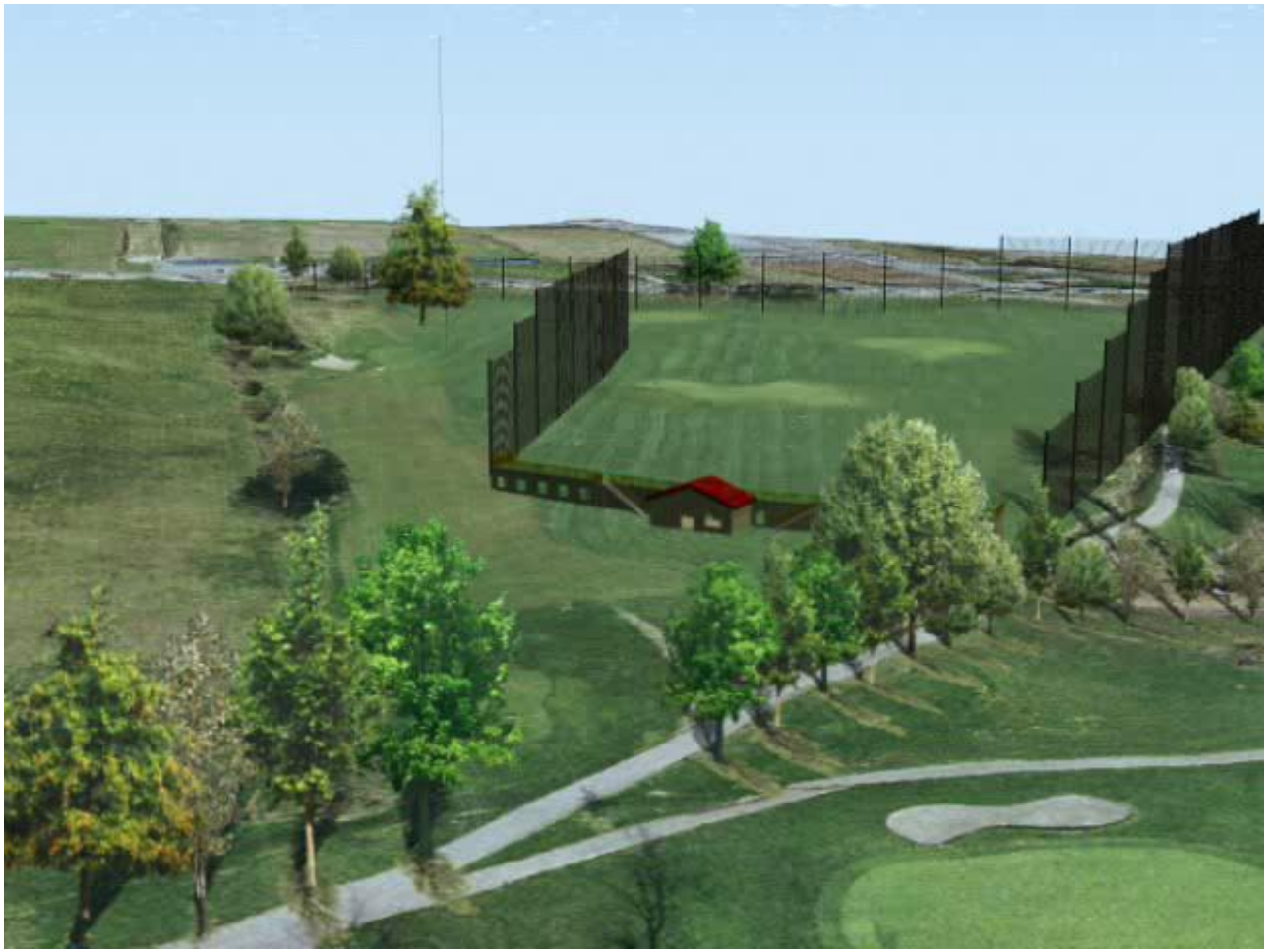
Examples – Preliminary Design



Examples – Preliminary Design

Examples – Preliminary Design

Examples - Recreation



Examples - Transportation

Examples – Mineral Exploration

Prices of Tools

- KLT (US$25,000 plus specialized hardware to buy separately)
- Visual Nature Studio (US$2500)
- Autodesk 3D Studio Max (US$3495)
- Google SketchUp Pro (US$500)
- ArcGIS 3D Analyst (US$2500)
- Engage 3D (US$4000)
- PhotoShop (US$700)
- Adobe Premier Elements (US$800)

More Information

- For more 3D views and flythroughs, go to *www.MapsByAir.com*

Thank You

- Any questions?

Thank You!

Hsieh hsieh

Gracias

Merci

Danke

Grazie