 1

What are star trails?

- The position of the stars in the Heavens are fixed.
- As the earth turns, they appear to move.
- A long exposure shows the path the stars take through the sky.

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Approach

Star trail images are made by:

•Film:

– Taking an ~hour long exposure of the night sky

•Digital:

– Taking an hour long exposure on a digital camera may overheat sensor.
  - Increases noise
  - May burn out sensor

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Approach

Star trail images are made by:

•Digital:

– Taking multiple ~30 sec exposures taken over an extended period of time, usually about 1 hr.

– Combining the multiple images in post processing (Stacking).
  - Stacking - images are placed one on top of another and the brightest points accumulated in the final image

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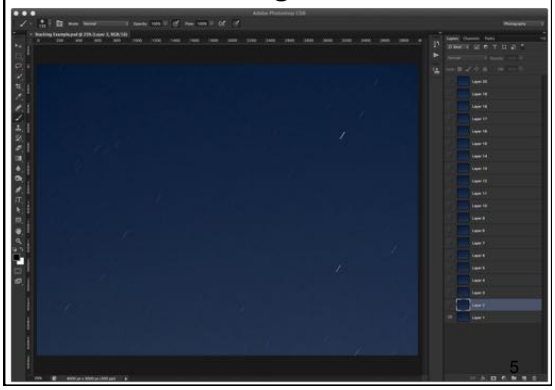
Stacking Demo



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Approach

- Stacking multiple digital images allows greater flexibility in setting exposures.
  - With an hour long exposure, you must shoot in a dark location to avoid over exposing or blowing out the foreground.

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Approach

- Stacking multiple digital images allows greater flexibility in setting exposures.
  - Stacking multiple exposures allows better control of foreground exposure.
    - Can shoot with higher ambient light levels.
    - Can use light painting to highlight foreground.
    - Can also employ High Dynamic Range (HDR) techniques.

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Approach

- Prepare equipment.
- Check equipment operation.
- Select a composition.
  - Scene
  - Appearance or look
- Make exposure(s)
- Post processing:
  - RAW development
  - Stacking

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Equipment

- Tripod
- Freshly charged battery and spare
- Empty memory card
- Small flashlight, headlamp
- Larger flashlight for light painting
- Warm clothes
- Camp chair

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Equipment

- Lens that works best for your scene
- Camera capable of:
  - Manual exposure settings
  - Ability to automatically time consecutive exposures
    - Intervelometer (Built in camera or external)
    - Cable release with a bulb setting and continuous release mode on camera

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Intervelometer vs Continuous Release

- Intervelometer:
  - Advantages:
    - Longer than 30 sec exposures possible.
      - May require an external intervelometer.
      - More flexibility balancing light of scene with sky
    - With built in, no need to purchase cable release.
  - Disadvantages:
    - Intervelometers are expensive
    - Setup can be difficult.
      - Account for time to store image
      - May leave about a 3 sec gap between exposures resulting in dashed lines.

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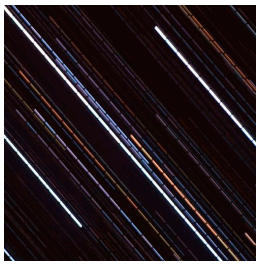
Intervelometer vs Continuous Release



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Intervelometer vs Continuous Release

- Continuous Release:
  - Advantages:
    - Simple to set up.
  - Disadvantages:
    - Limited to less than 30 sec exposure.

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Preparation

- Know how to operate your camera in the dark.
  - Know the location of all controls by feel.
- Check out operation of interval timer beforehand.
- Scout your locations and compositions in the daylight.

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Shooting Conditions

- Clear Skies
- Some ambient light from moon or street lights to light scene is OK.
- Can take pictures during nautical twilight
  - More stars visible as it becomes darker
- Low dew point
  - Lens may fog over part-way through exposures.

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Camera Settings

- Turn OFF
  - high ISO noise reduction (jpg images)
  - long exposure noise reduction
  - mirror lockup, timer delay
  - vibration reduction
- Focus set to manual
- Remove filters such as UV filter.
  - Reduces chance of lens flare from lights
- Drive set to high continuous

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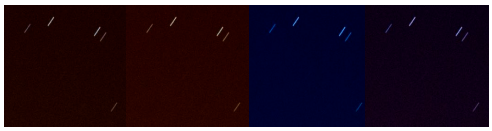
Camera Settings

- White Balance
  - NA if shooting RAW, adjust in post processing.
  - When shooting jpg, after nautical twilight, approximate sky color will be from black to:



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Camera Settings

- File Format
  - Shooting in RAW:
    - Advantages:
      - Can adjust WB, exposure, etc in RAW processor
    - Disadvantage
      - Some stacking software do not take RAW files:
        - » Must convert files to .jpg or .tiff format.
  - Shooting in jpg:
    - Advantages:
      - Can dump directly into stacking software
    - Disadvantage:
      - Can't adjust white balance, exposure, etc.

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Camera Settings

- Set camera to Manual mode
- Shutter speed at 30 seconds (Continuous)
- f stop appropriate for scene
  - f/4 to f/11

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Camera Settings

- ISO set for desired exposure
  - In dark areas, start at ISO 400 – 800
  - Adjust for
    - density (number of) of stars desired
    - lightness of sky
      - can be adjusted in post processing
  - Take test images and look for stars.

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Lighting Examples

Dark Skys

Star Streak in Arches 1 hr f/4 ISO 1600

Photo by Doug Holt

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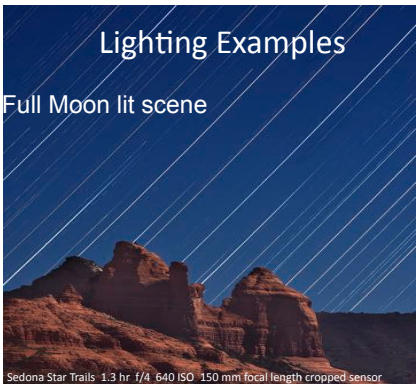
Lighting Examples

Full Moon lit scene



Sedona Star Trails 1.3 hr f/4 640 ISO 150 mm focal length cropped sensor

Photo by Victor Dubbeldam

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Camera Settings

- ISO set for desired exposure
  - In urban settings, adjust ISO to about 1 to 2 stops overexposed when metering on sky.
    - This setting increases the brightness of stars
    - Sky may look grey on camera back
    - Sky darkness will be adjusted in post processing
  - Files must be in RAW
  - Take test images and look for stars.

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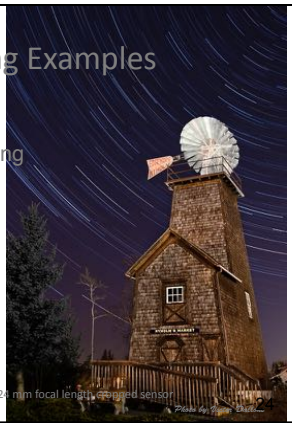
Lighting Examples

- Urban Scenes
  - Foreground lighting provided by gas station across street.



Nyholm Windmill 1 hr f/8 800 ISO 24 mm focal length, cropped sensor

Photo by Victor Dubbeldam

San Francisco Star Trails 2 hr f/11 800 ISO 32 mm cropped sensor

Photo by Victor Dutilla

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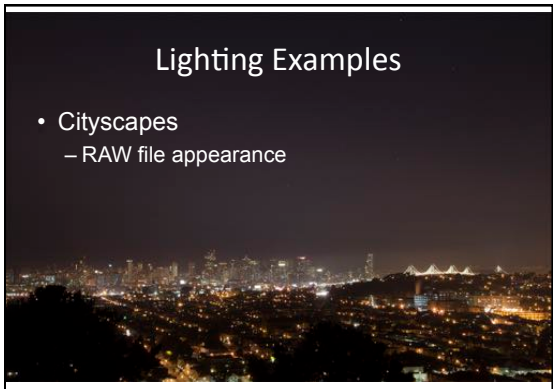

San Francisco Star Trails 1 hr f/11 800 ISO 32 mm cropped sensor

Photo by Victor Dutilla

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Camera Settings

- ISO and noise
  - Image stacking inherently reduces noise.
    - Stacking 4 images cuts the noise in half
    - Stacking 16 images cuts the noise to ¼
    - Stacking 120 images (1 hr) cuts the noise by 1/11th
    - Stacking 256 images cuts the noise to 1/16th
  - Considering stacking noise reduction, keep your ISO low enough to avoid noise.
    - Noise levels in light painted areas will be greater than in the sky.
    - Know the noise levels in your camera.

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Camera Settings - Advanced

- Balancing foreground/background exposures
  - Dark foreground
    - Set ISO for foreground
      - Darken sky in post processing
        - limited to several stops
    - HDR
      - Use long exposure on one image – 5 min or more
    - Use intervelometer with all long exposures.
    - Light Painting

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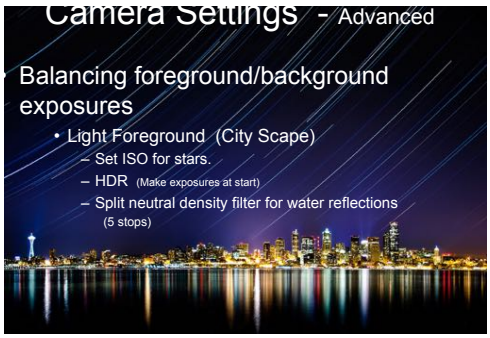

Seattle Stars 120 min f/5.6 400 ISO 28 mm focal length cropped sensor

Photo by Victor Dutilla

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Star Trails

- Total Exposure Duration
  - Usually about 1 hr duration
  - Longer times for longer trails
    - Will also increase density of star trails

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Total Exposure Duration

- Focal length impacts length of star trails
  - Star trails will appear longer with telephoto lens
- Time needed for star trail to cover ¼ of frame on diagonal

DX Focal length	11	13	16	23	33	47	57	67	133	200
FF Focal length	16	20	24	35	50	70	85	100	200	300
Hours	1.8	1.6	1.4	1.0	0.8	0.6	0.5	0.4	0.21	0.14

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Focusing

- Focusing after dark is difficult.
- Focus at infinity or use hyperfocal distance.
- Focusing approaches:
  - Set up before dark and focus then
  - Focus on bright object such as distant lights, moon, etc,
  - Bring a powerful light to temporarily light your mid-ground subject.
  - Trial and error.
- Set focus to manual

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Composition

- Large sky
- Interesting foreground / mid-ground
  - Consider light painting
- Density of stars preferred
  - Adjust ISO and cumulative exposure time
  - Can make adjustments in post processing.
  - Greater star density higher above horizon.
- Think about direction of star movement.

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Star Trail View Direction
West

Scatter Creek Star Trails 1 hr f/2.8 400-800 ISO 24 mm focal length full frame

Photo by Doug Hall

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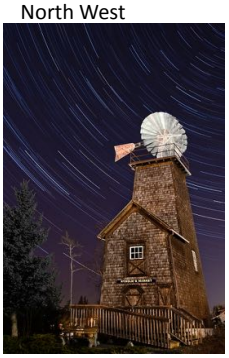
Star Trail View Direction
North West



Nyholm Windmill 1 hr f/8 800 ISO 24 mm focal length cropped sensor

Photo by Victor Dallas

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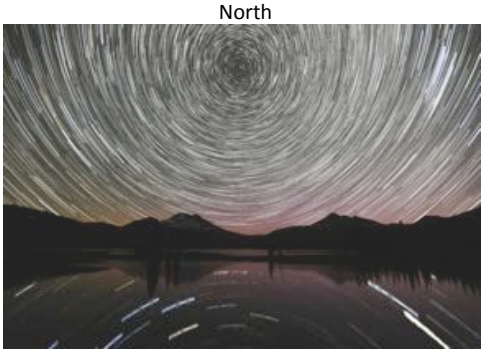
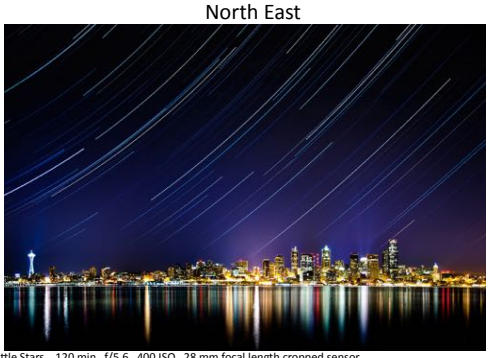
Star Trail View Direction North



Sparks Lake Star Trail 1 hr f/2.8 3200 ISO 16 mm focal length full frame

Photo by Doug Hall 37

Star Trail View Direction North East



Seattle Stars 120 min f/5.6 400 ISO 28 mm focal length cropped sensor

Photo by Victor Dallons 38

Star Trail View Direction East

Bernal Heights Trees 30 min f/8 800 ISO 100 mm focal length cropped sensor

Photo by Victor Dallons 39

Star Trail View Direction South East

Mt St Helens Star Trails 1 hr f/4 400-800 ISO 20 mm focal length full frame

Photo by Doug Hall 40

Star Trail View Direction South

Hot Shop Reflections 50 min f/4 800 ISO 24 mm focal length cropped sensor

Photo by Victor Dallons 41

Light Painting

- Use an incandescent bulb flashlight to add warmth.
- Length of time light is on is trial and error, depending on strengthe of light and camera settings.
- Paint several frames to even out light.

Photo by Doug Hall 42

Light Painting - Stacking

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Start Simple

- Start Simple
  - Go into backyard or park and shoot straight up to test out your technique.
    - Go through entire process – shooting through post processing.
  - Start with simple compositions in dark areas.
- Advance to more complicated lighting situations.

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Post Processing

- Multiple images need to be combined to make up final image.
  - 1 hr exposure has about 120 thirty second segments to combine.
  - Images are combined by "Stacking"
- 2 general approaches:
  - Star Stacking program
  - Manual stacking in Elements or Photoshop

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Star Trails - Post Processing

- Star Stacking program
  - Suggest trying StarStaX
    - http://markus-enzweiler.de/StarStaX/StarStaX.html
  - Advantages
    - Very fast
    - Can add some special effects.
    - Don't need photoshop or elements
  - Disadvantages
    - Includes temporal distractions in final image
    - RAW images must be converted to tiff or jpg first.
      - Can convert in Lightroom as a batch process.

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Star Trails - Post Processing

- Manual stacking in Photoshop or Elements
  - Advantages
    - Can remove temporal distractions such as airplanes.
    - Can work with processed RAW files.
  - Disadvantages
    - Time consuming and tedious to handle many images
    - Requires photoshop, elements, or other software that have layers.

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RAW File Development

- To darken sky while retaining stars:
  - Set black point with "blacks" slider
  - Increase contrast with "contrast slider"
  - Adjust "exposure" for number of stars visible
  - Do not use clarity
  - Can also use curves to darken skies.
- Set color of sky to your preference with "temperature" and "tint" sliders
- Do not apply noise reduction

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Preparing for Stacking

- Lightroom
  - Export files as tiff files
    - Retains 16 bit information
- Photoshop/Bridge
  - Load layers into Photoshop from Bridge
    - Menu: Tools/Photoshop/Load files into Photoshop layers
  - Suggest working in batches of 40 – 50 files, flattening the stack, and saving as a sub collection. Then combine the sub-collections the same way as the individual files.

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Photoshop Stacks

- In Photoshop, select all layers and change blending mode to "lighten"
- To delete airplane trails:
  - Find the layer that contains the airplane trail
  - Paint the airplane trail with black.
- Sharpening
  - After flattening the layers:
    - Duplicate the layer, set layer blend mode to "lighten", then sharpen.
    - Sharpening will increase the brightness of the star trails.

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