

Longwood Gardens Analemmatic Sundial

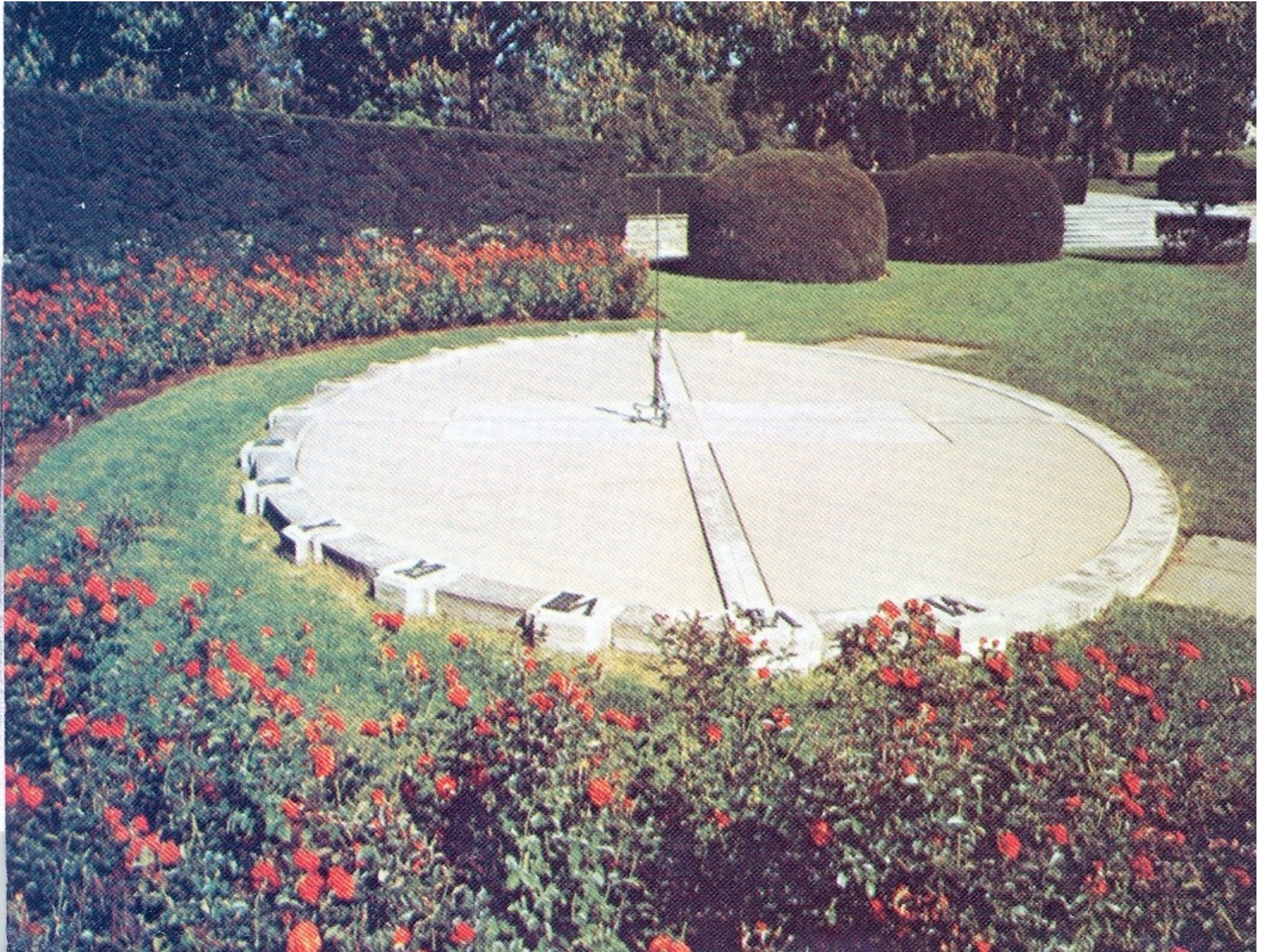
P. Kenneth Seidelmann
University of Virginia

Sundial in 1968

- Art Jarvela – Director of Maintenance
- Job Description covered all standard maintenance requirements
- Last line of Job Description- “Fix the Sundial.”
- He had no idea how to do that
- Contacted the U S Naval Observatory
- Art Jarvela and Ralph Haupt measured the sundial in detail

Longwood Sundial

- 24 x 37 foot size
- Built in 1939
- Based on six years of noon-time observations
- Design based on historic sundial at the Cathedral of Brou, France
- Du Pont commissioned work repositioning the hour markers in 1946
- Morning and afternoon analemma
- Gnomon moved daily
- Original calculated for 11am and 1pm, not other hours



Computations of Analemma

- Ralph Haupt gave me the problem
- Computed a solar ephemeris for the sundial location
- Computed a morning and afternoon location for the gnomon on the analemma and theoretical errors
- Standard mean solar time, not local mean solar time
- Positions were very different (up to 2 feet) from current plot
- There was no single position that gave the correct time for all hours. Should be an hourly analemma
- A helical curve along the analemma was required

Computations of Analemma

- At noon, major axis position most important, early morning and late afternoon minor axis position most important
- Determined a weighted solution for the hours the gardens were opened and to minimize the largest errors
- Offsets in spring and fall due to changes in hours of sunlight
- The computed analemma was checked by determining the errors for all hours of sunlight during the year
- A plot of the analemma was sent to Art Jarvela at Longwood Gardens

Checking the sundial

- Ray Duncombe, Ralph Haupt, and I, and our wives, went up to check the results
- We arrived in the afternoon of the day before we were to meet with people of Longwood Gardens, so we went to see the sundial late that afternoon
- We discovered they had painted the analemma on the surface, so it could be easily removed, if it was wrong
- That afternoon and the next day we confirmed that the sundial was performing as calculated with the expected error values
- In 1978 the analemma was engraved in stone

History of Sundial in Brou

- Analemmas go back to Ptolemy
- Sundial built in 1513 or 1532
- The original sundial was built to determine workmen's times for payments for building the cathedral
- It was located on the cathedral walkways where people walked on it
- The analemma was worn off by the foot traffic
- Rebuilt in 1756 by Jerome Lalande
- Lalande memoir in French Academy of Science in 1758. describes theory and difficulties
- 1644 Vanzelard description of Brou sundial
- Lalande observed Neptune in 1795 and determined that it was a moving object. Only recorded the observations.

Sundial in Brou

- Longwood Gardens sundial was supposed to be a copy of the sundial in Brou, France
- Question:
- Lalande was good.
- Sundial in Brou must have told the time correctly
- Why was the Longwood Gardens Sundial incorrect?

Sundial in Brou

- I contacted the cathedral in Brou
- A historian there reported that the sundial there did not give the correct time either now.
- An amateur with his own ideas had restored the worn away analemma with one of his own design
- A gnomon located on the figure 8 analemma, rather than the meridian was introduced
- The dates were on the figure 8, only months were on the meridian
- They requested my support to have the sundial there corrected



Analemmatic Sundials

- Analemmatic sundials are in Dijon, Montpetlier, and Avignon, France, Vienna, Austria, and Basil, Switzerland
- They have gnomon on the meridian line and a separate equation of time curve
- An amateur artisan designed a sundial that wouldn't tell correct time
- Application of computer technology resulted in an analemmatic sundial to tell mean solar time directly , including the correction for the equation of time