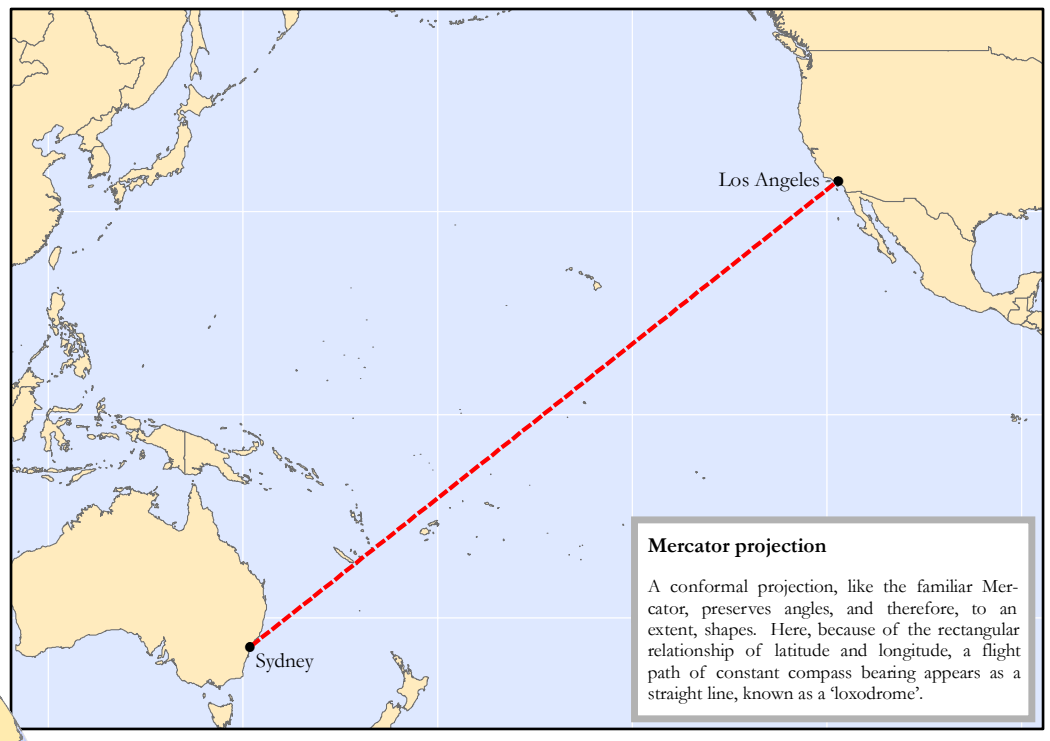
Projection Properties

The Earth is round; paper is flat. From this simple contrast comes the great challenge of map projection. How can we represent a three-dimensional planet on a two-dimensional surface? If we attempt to preserve certain properties of the original spherical surface, we will lose or distort other properties. The mapmaker's craft must include a careful consideration of which properties of the original curved surface are most important to the intended use of the map, or to the story it is meant to tell. If, for example, we wish to depict, or even plan, the flight path of a plane between Sydney and Los Angeles, our choice of projection is key because of how it shows or accommodates the curvature of the Earth. At bottom, the perceived shape of the United States varies significantly depending on the projection.

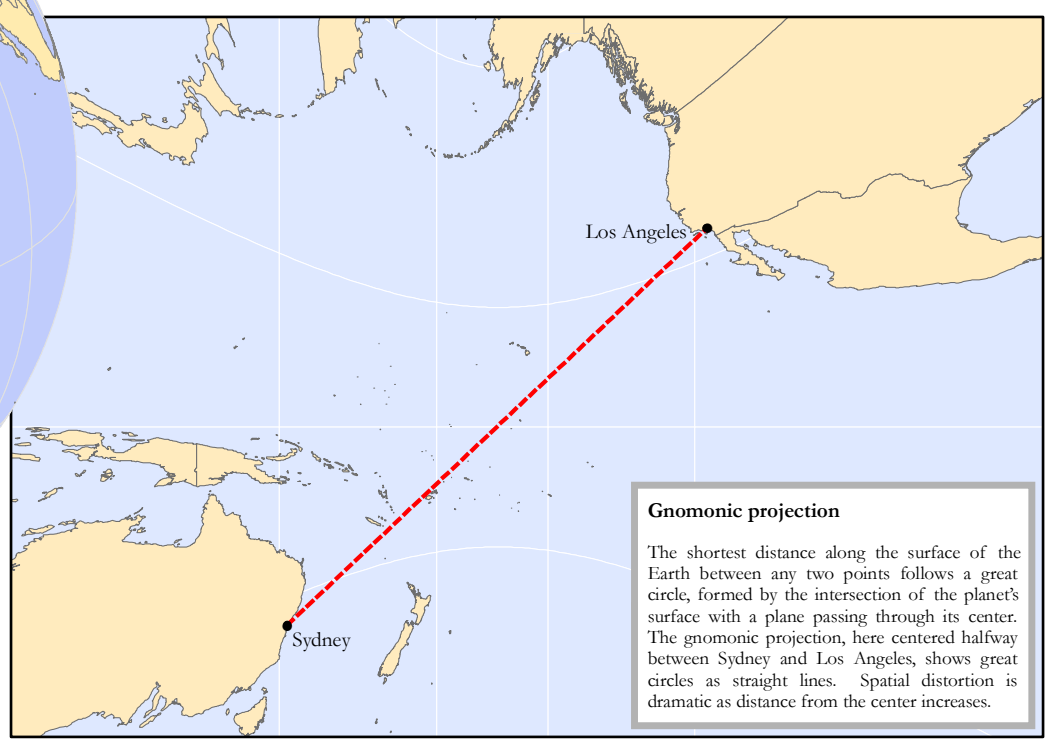


Mercator projection

A conformal projection, like the familiar Mercator, preserves angles, and therefore, to an extent, shapes. Here, because of the rectangular relationship of latitude and longitude, a flight path of constant compass bearing appears as a straight line, known as a 'loxodrome'.

Orthographic projection

The orthographic projection preserves the image of Earth as seen from space. Because Sydney and Los Angeles are equidistant from the Equator, the loxodrome and the great circle route follow approximately the same course, which appears as a curve from any angle other than directly overhead.

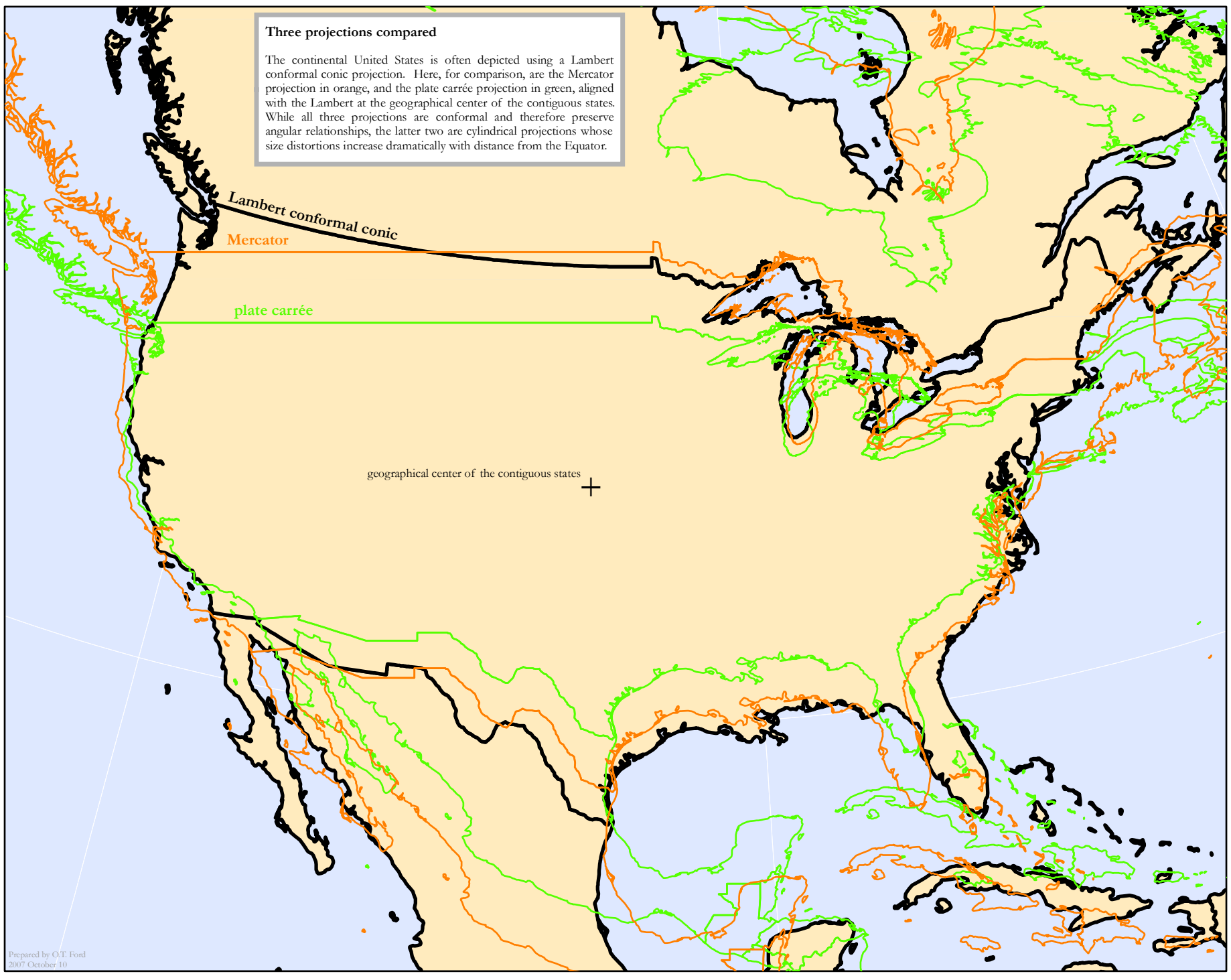


Gnomonic projection

The shortest distance along the surface of the Earth between any two points follows a great circle, formed by the intersection of the planet's surface with a plane passing through its center. The gnomonic projection, here centered halfway between Sydney and Los Angeles, shows great circles as straight lines. Spatial distortion is dramatic as distance from the center increases.

Three projections compared

The continental United States is often depicted using a Lambert conformal conic projection. Here, for comparison, are the Mercator projection in orange, and the plate carrée projection in green, aligned with the Lambert at the geographical center of the contiguous states. While all three projections are conformal and therefore preserve angular relationships, the latter two are cylindrical projections whose size distortions increase dramatically with distance from the Equator.



Prepared by O.T. Ford
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