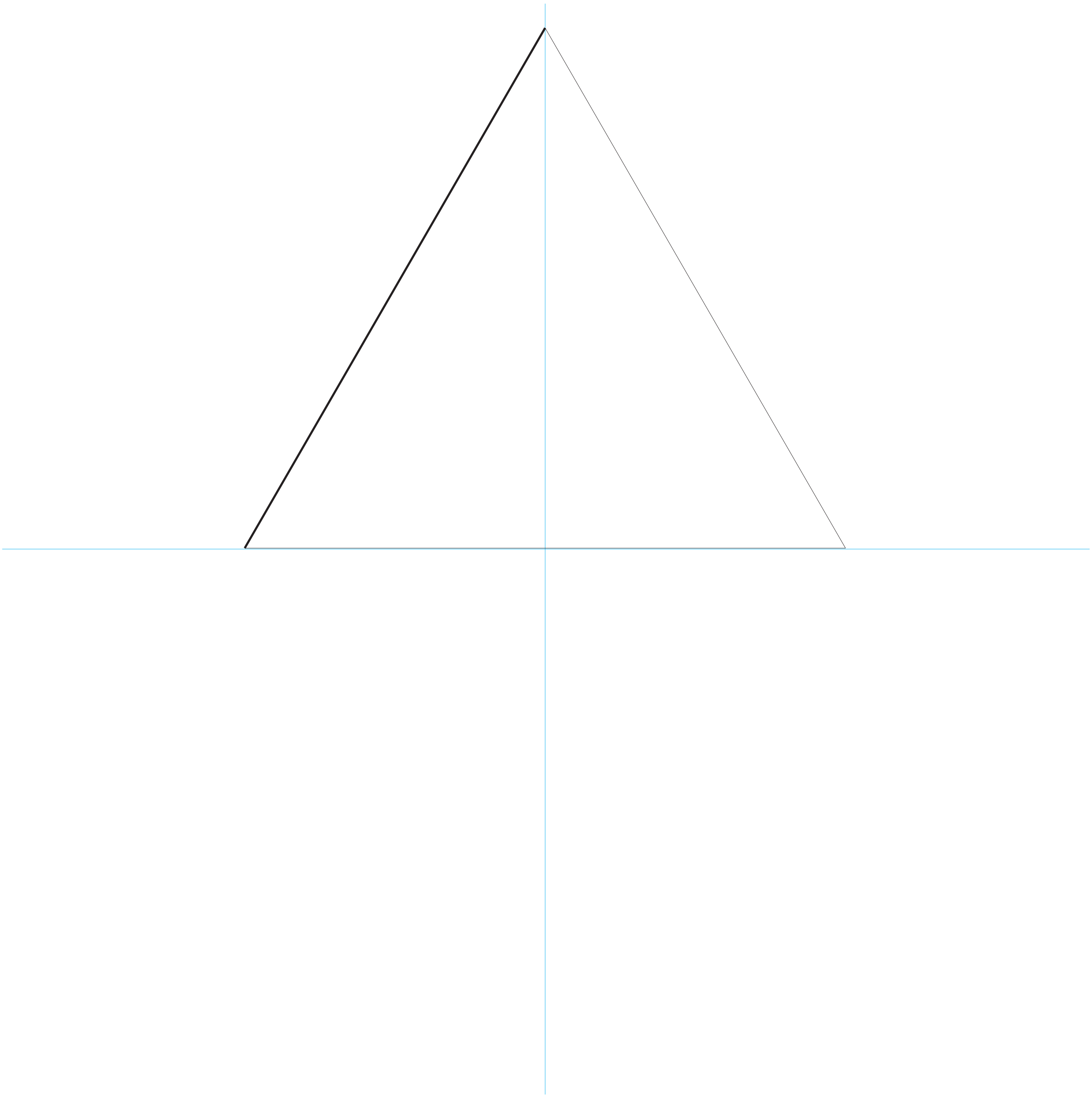
The Moving-path of the Vector equilibrium (Jitterbug)

In this article we shall try to illustrate the construction of the moving path of the the “Vector equilibrium“ (VE) on its way between the octahedron to the cubeoctahedron.

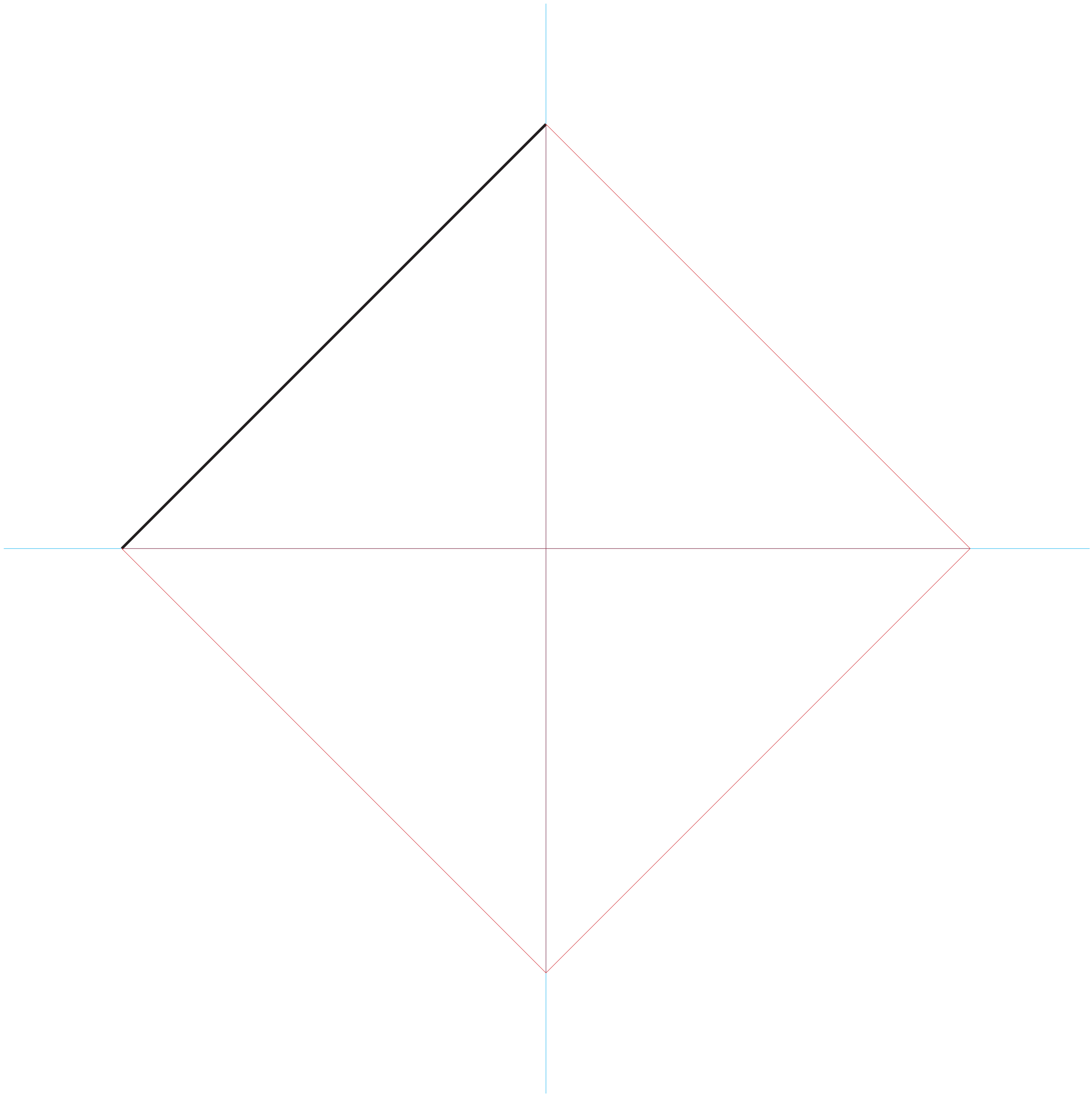
The basis-edge-length 1 of all eight equilateral triangles, which stays constant, results to 100 mm.

This arises:
3 pairs of polyhedra which belong together, and one individual which occupies the middle-position.



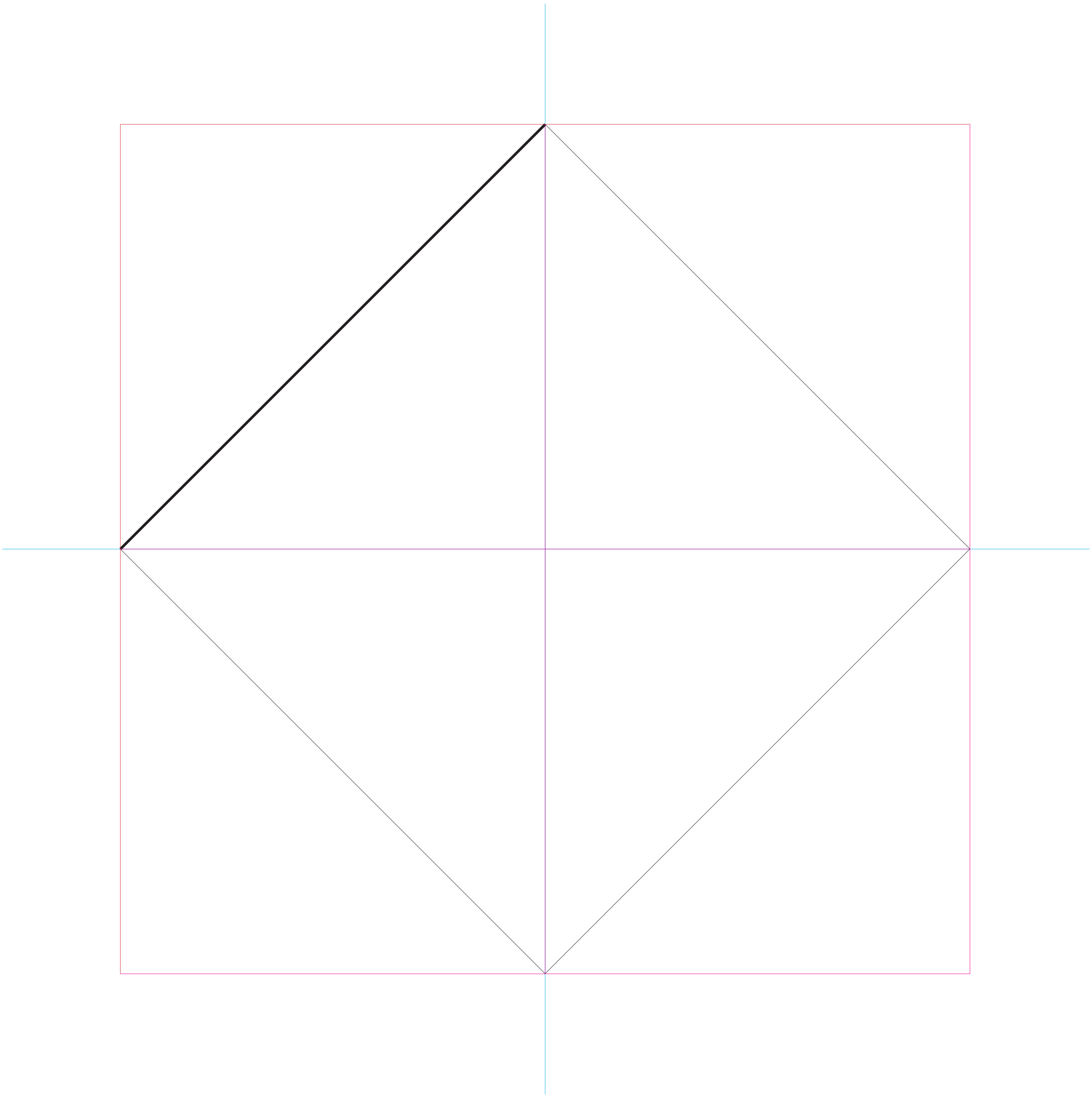
The octahedron with the edge-length 1 = 100mm and his space-plain (red).

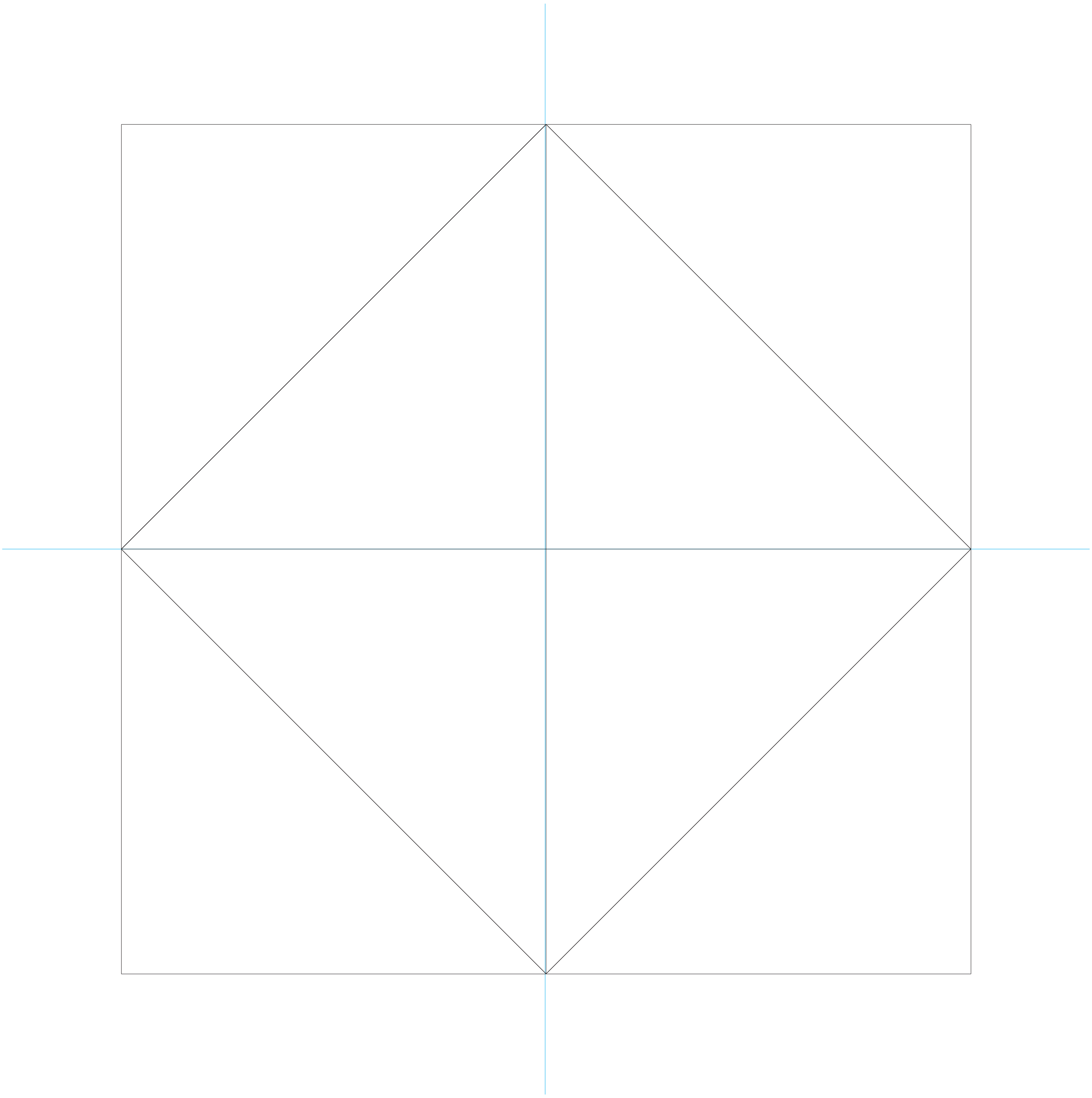
The space-plains are squares with the edge-length 1 = 100mm.



The cubeoctahedron with the edge-length 1 = 100mm and his space-plain (red)

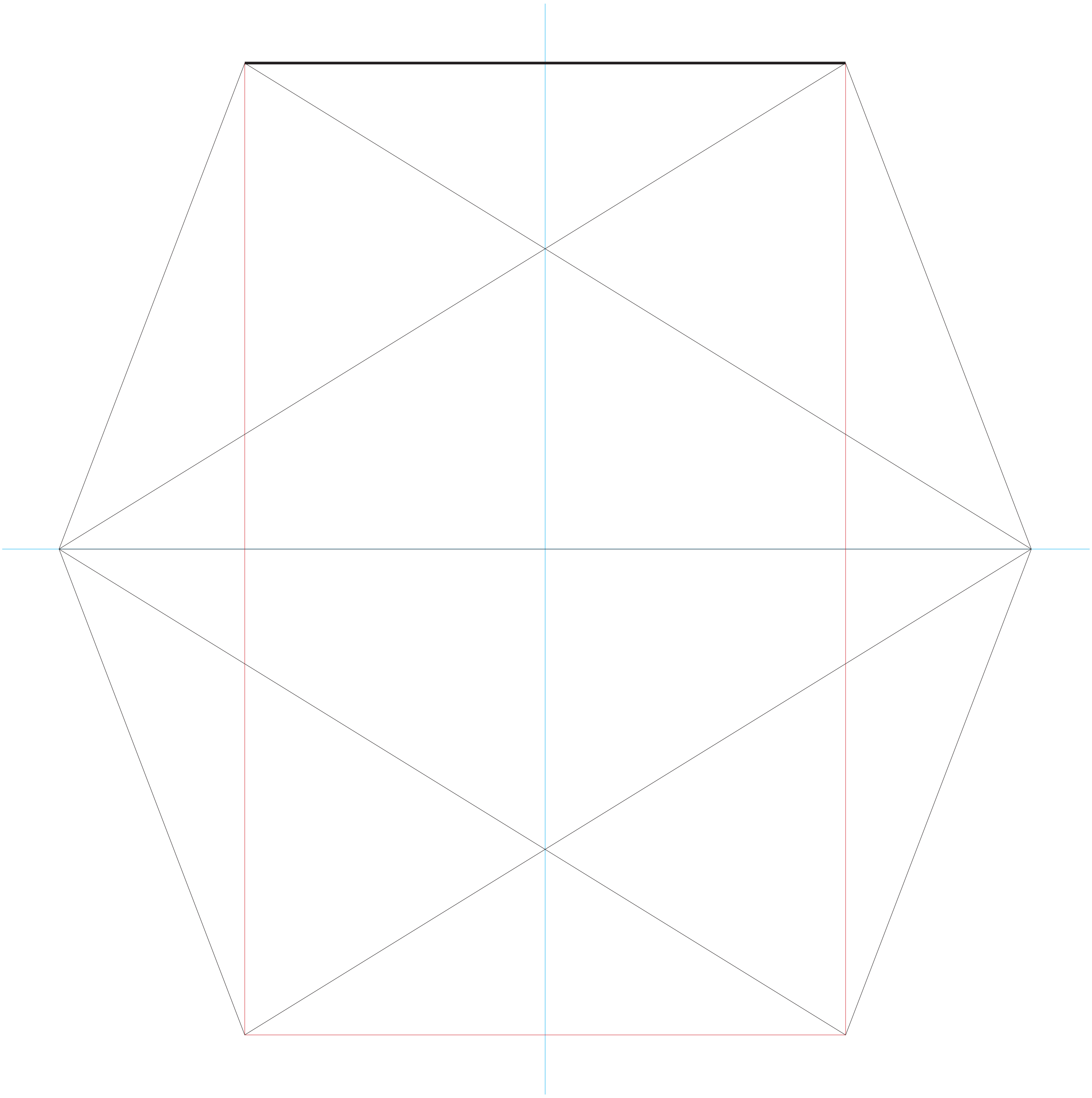
The space-plains are squares with the edge-length 1* sqrt 2 = 141,421mm.



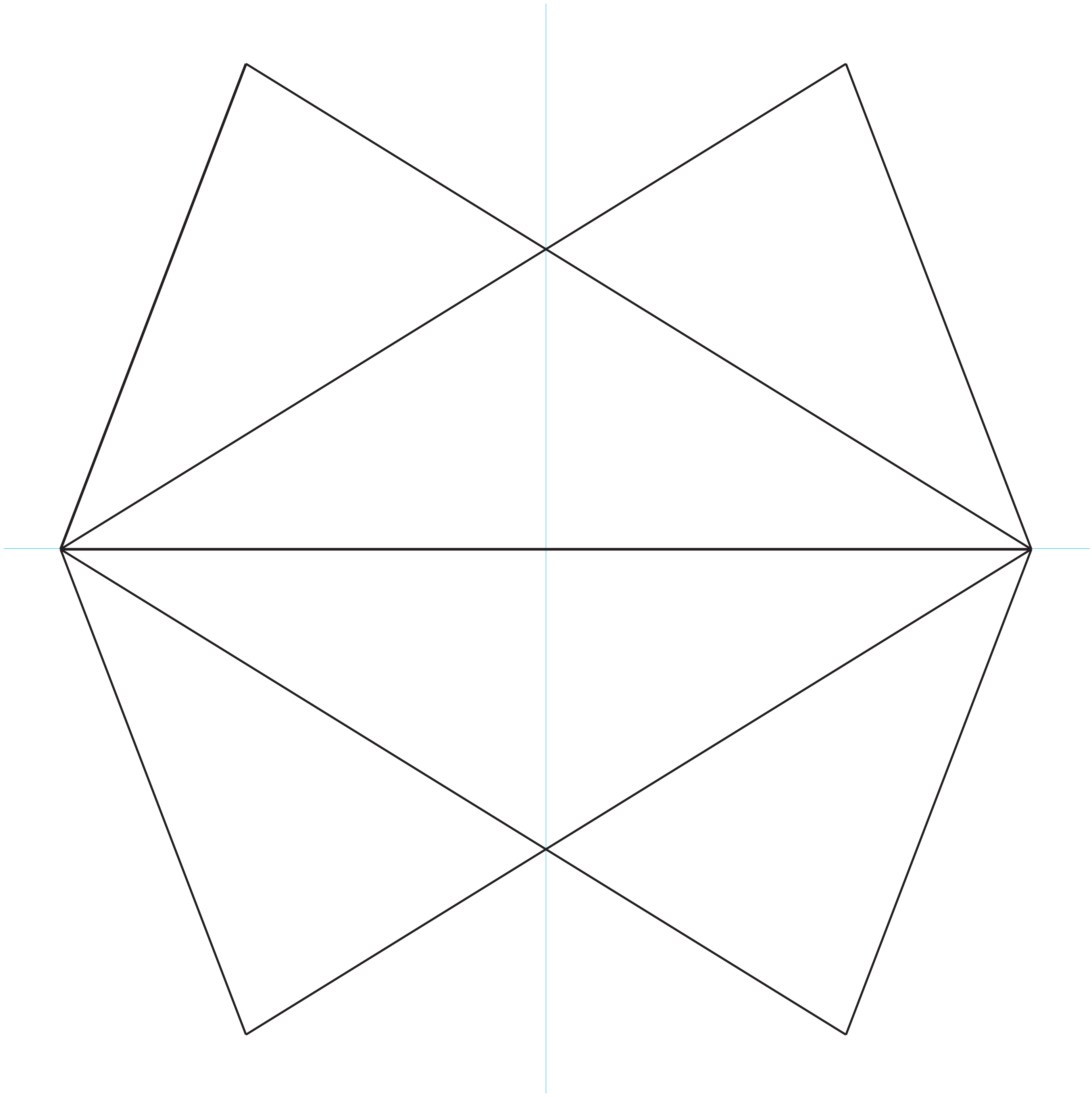


The icosahedron with the edge-length 1 = 100mm and his space-plain (red).

The space-plains are golden rectangles with the edge-length: Short edge1 = 100mm and long edge = 100* phi = 161,803mm.



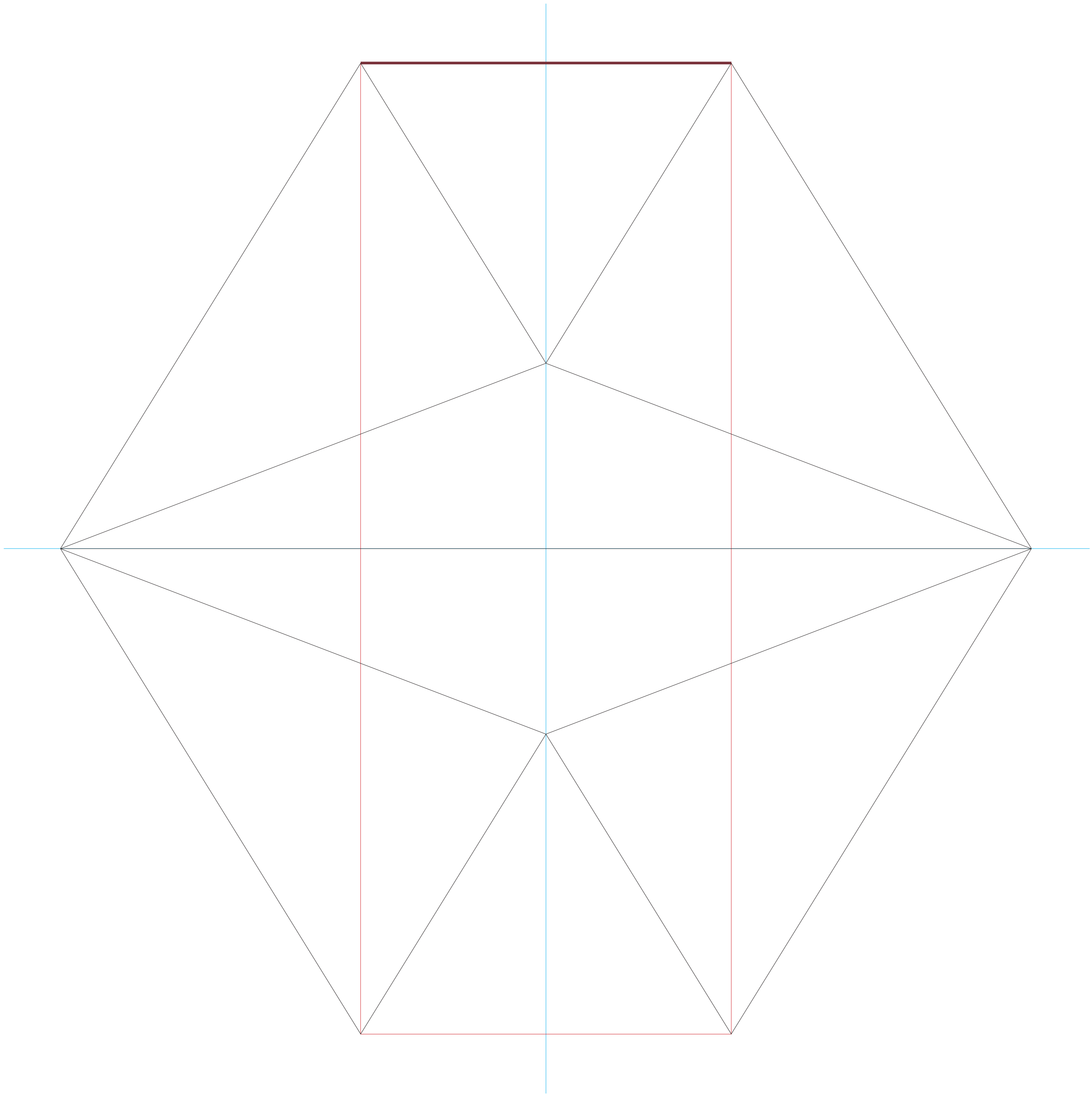
The concave
brother-solid
of the
icosahedron.



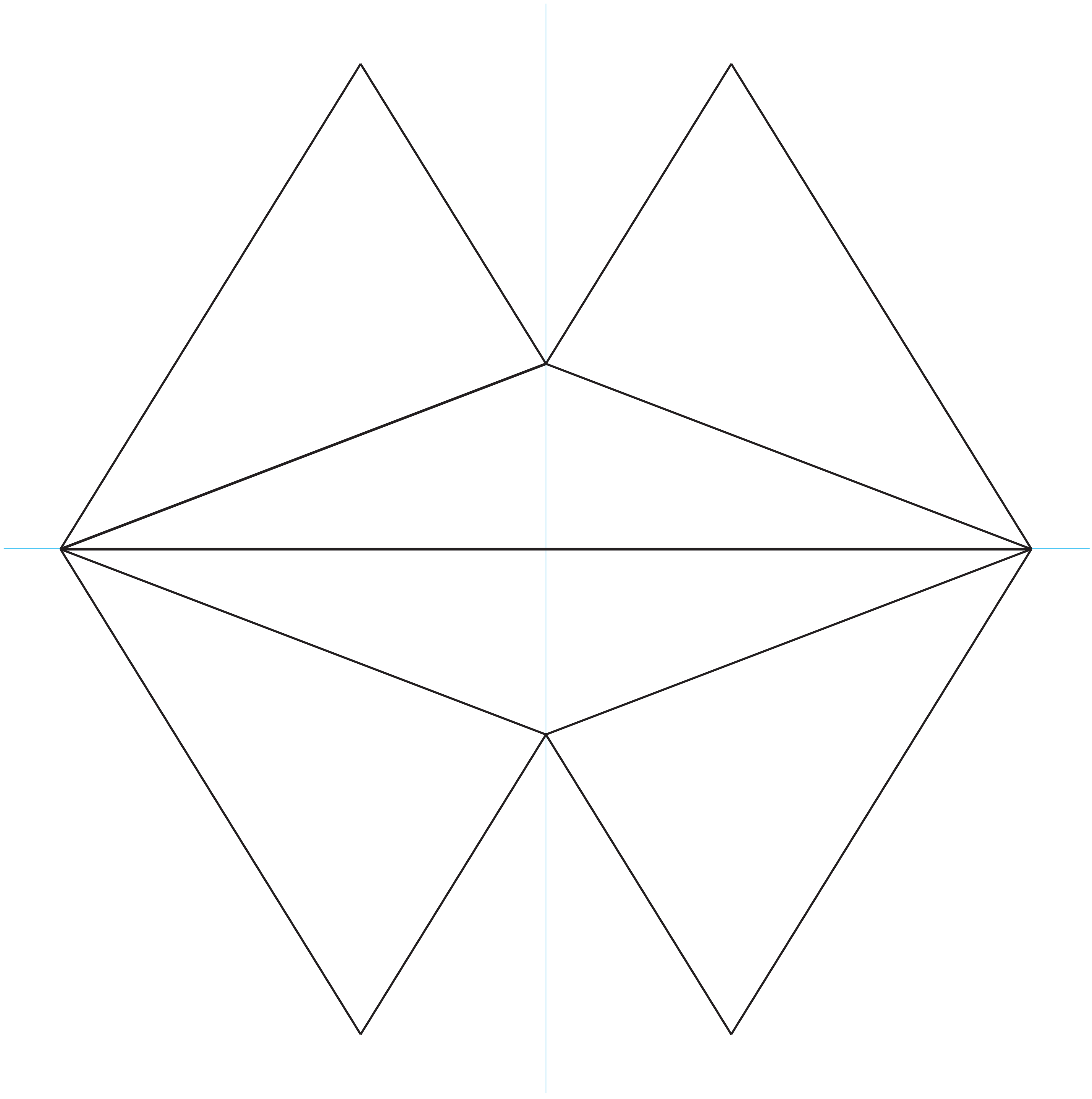
The golden icosahedron with the edge-length
1 = 100mm : phi = 61,803
and its space-plain (red).

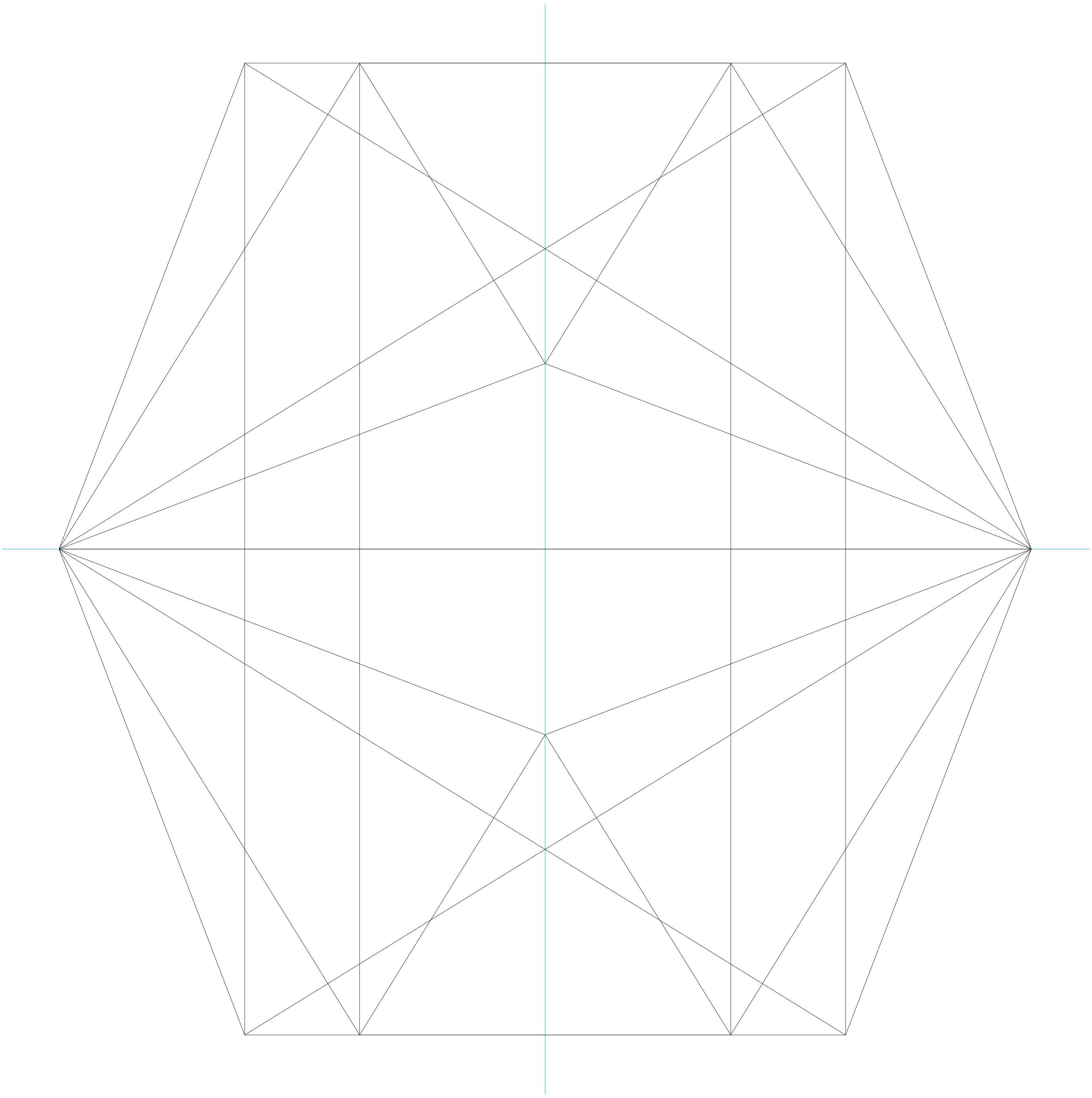
The space-plains are golden rectangles with
the edge-length: Short edge = 100 : phi = 61,803mm
and long edge = 100* phi = 161,803mm.

4. The golden
icosahedron



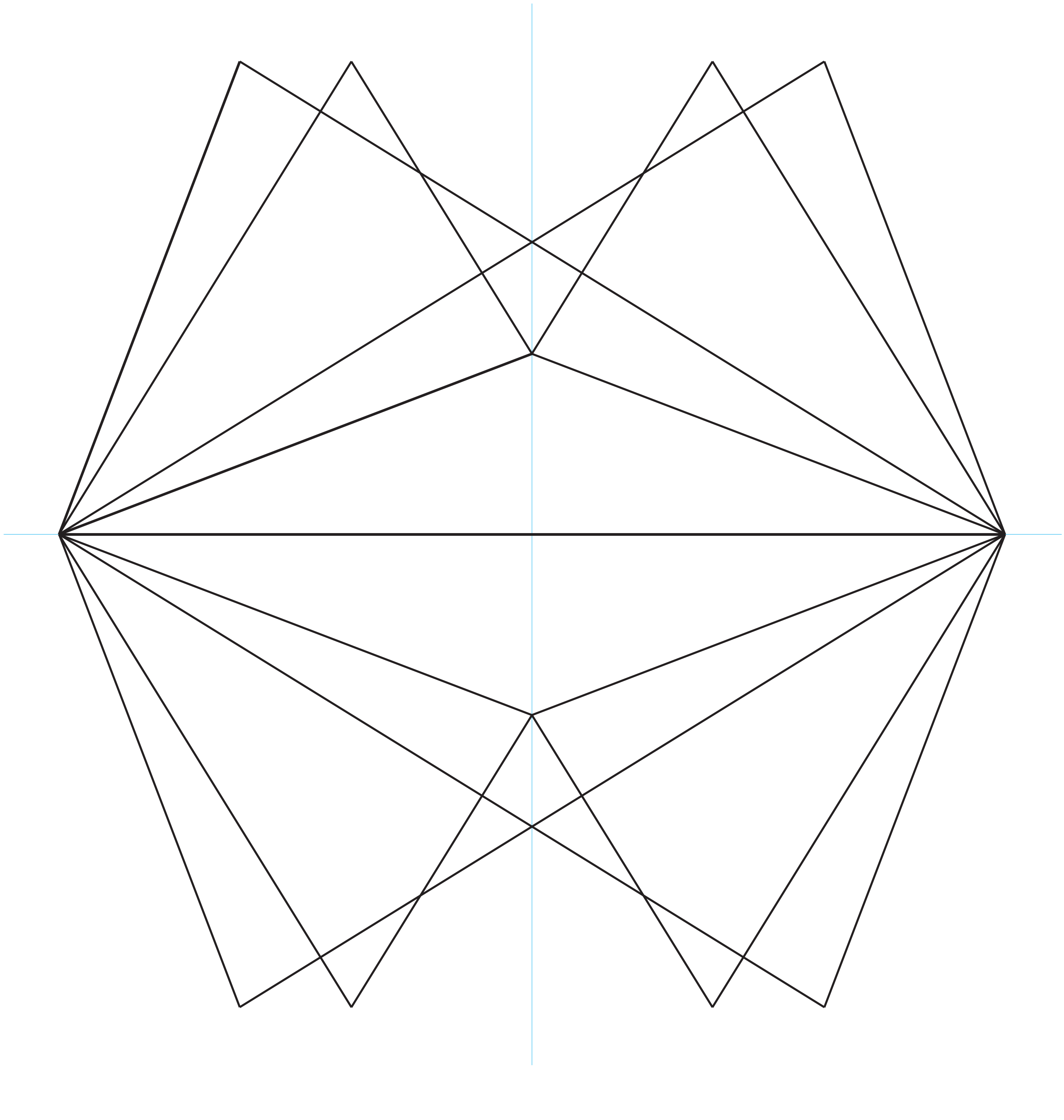
The concave
brother-solid
of the golden
icosahedron.





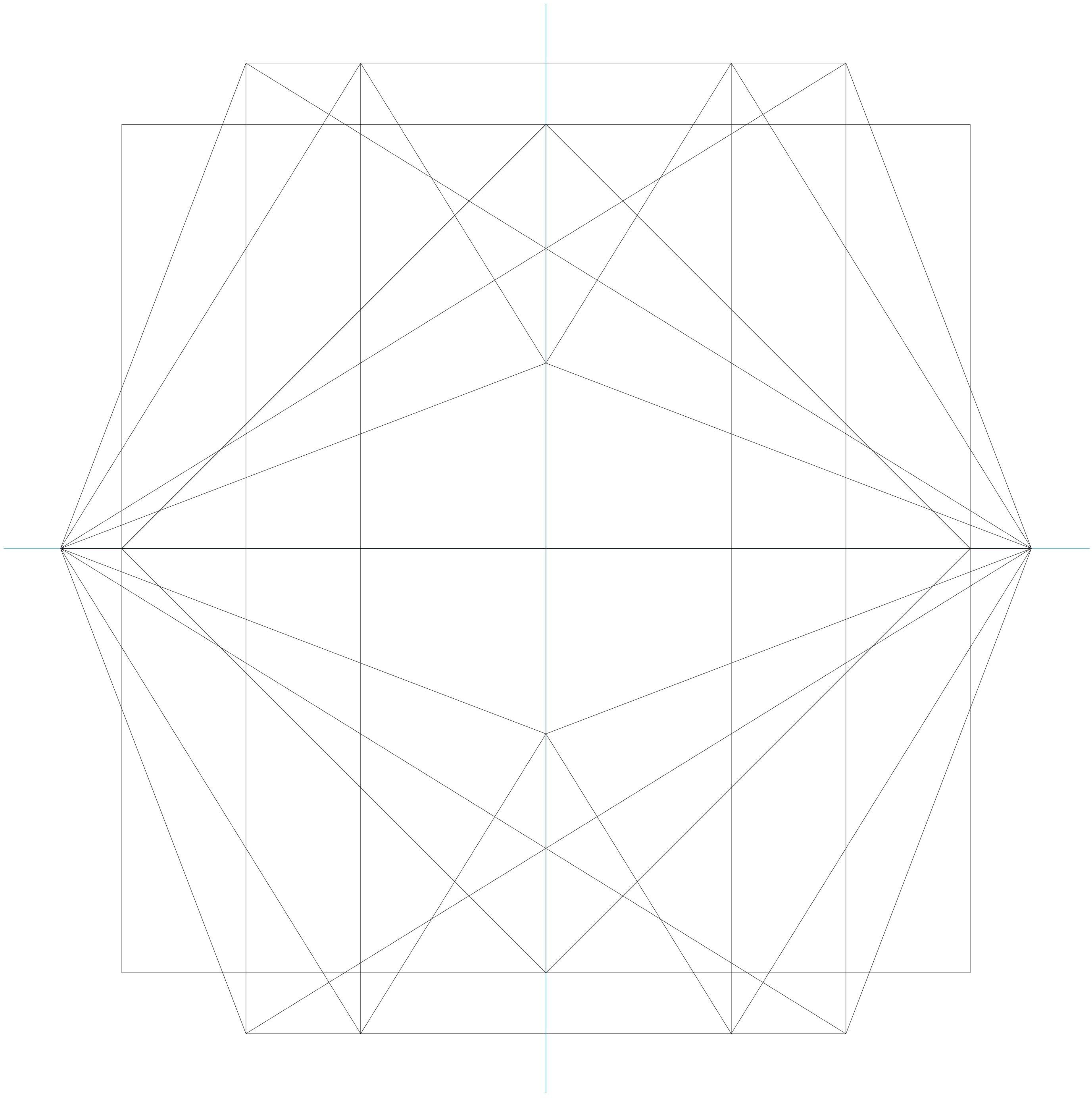
The volume of the surface remains unchanged, but the space-volume of the solid has changed.

Both concave-solids together



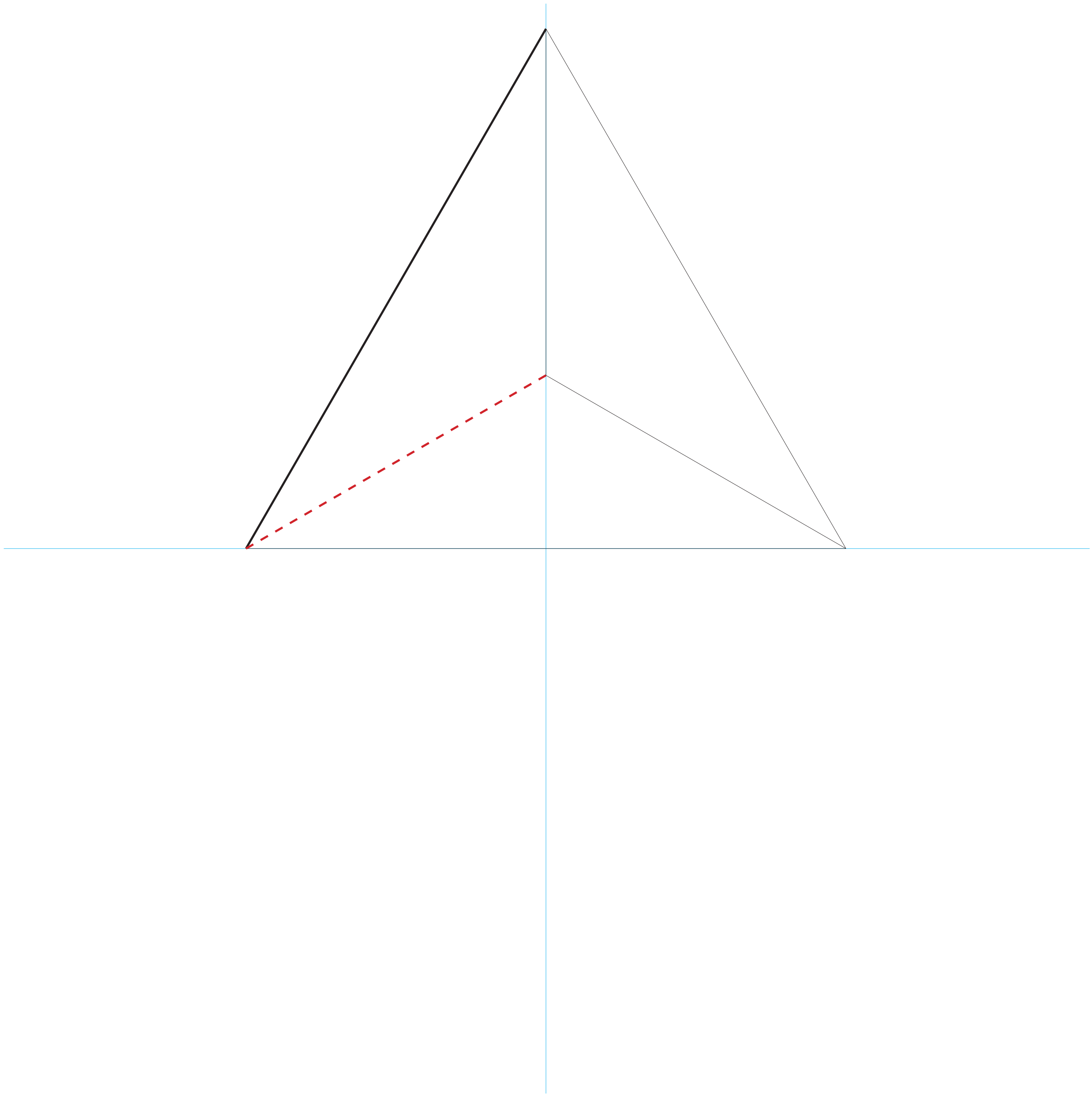
Octahedron
Cubeoctahedron
Icosahedron
Golden Icosahedron

Pair 1 and
pair 2 together



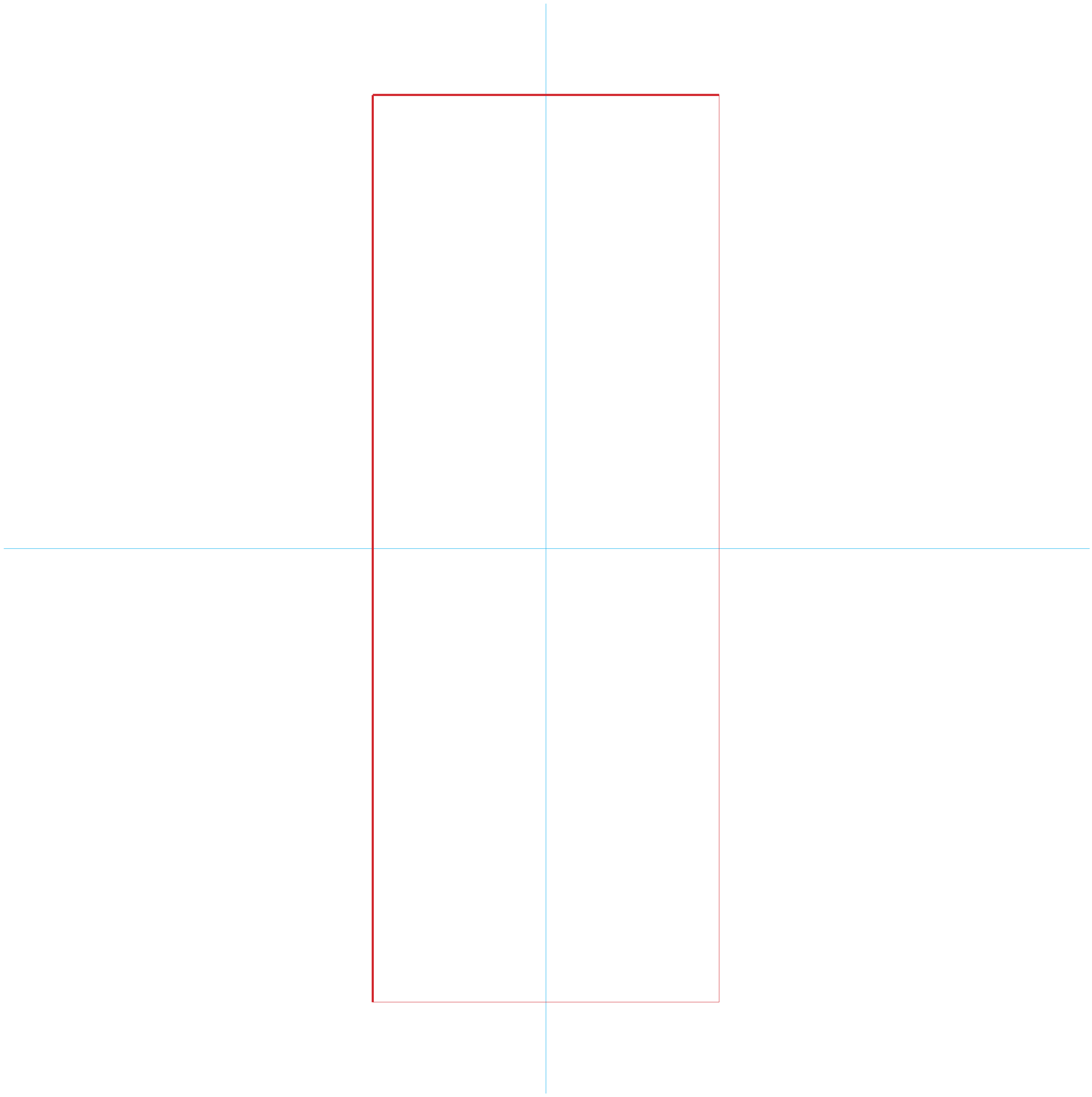
To be able to implement the next step, we must know, that the length of the radius of the circumcircle of the equilateral triangle with the edge-length1 = 100mm is the same, as the edge-length of the inside the „VE“ hidden dodecahedron.

Radius =
1/3 * sqrt 3* 100mm
= 57,735mm



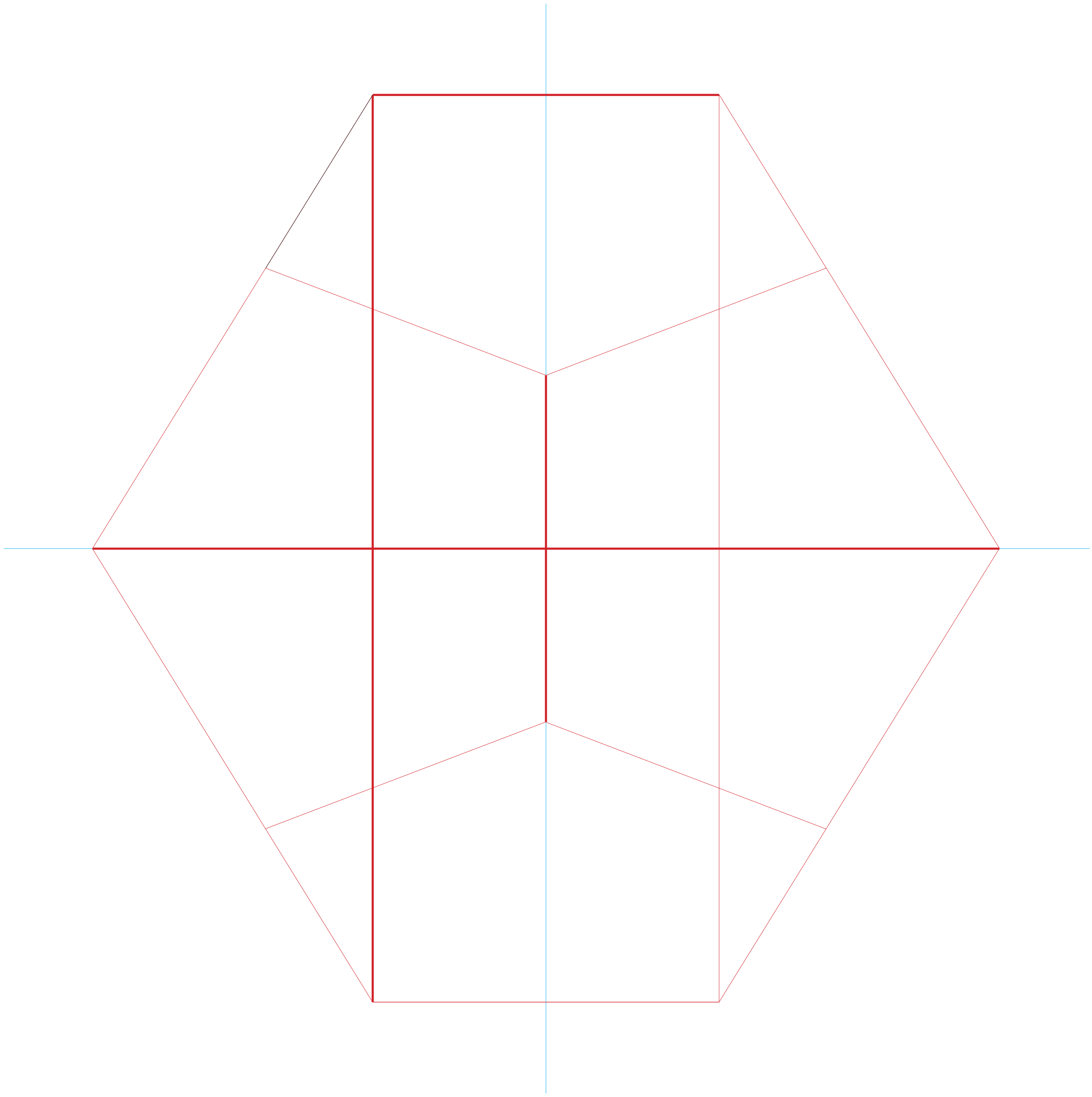
First we construct the space-plain of the dodecahedron in the golden ratio. The long edge correlates, as we can see, with the long edge of the searched „big twenty-surface-solid“.

Short edge = minor
(radius of the circumcircle)
= 57,735
Long edge = major + minor =
57,735mm + 93,417mm =
151,152mm



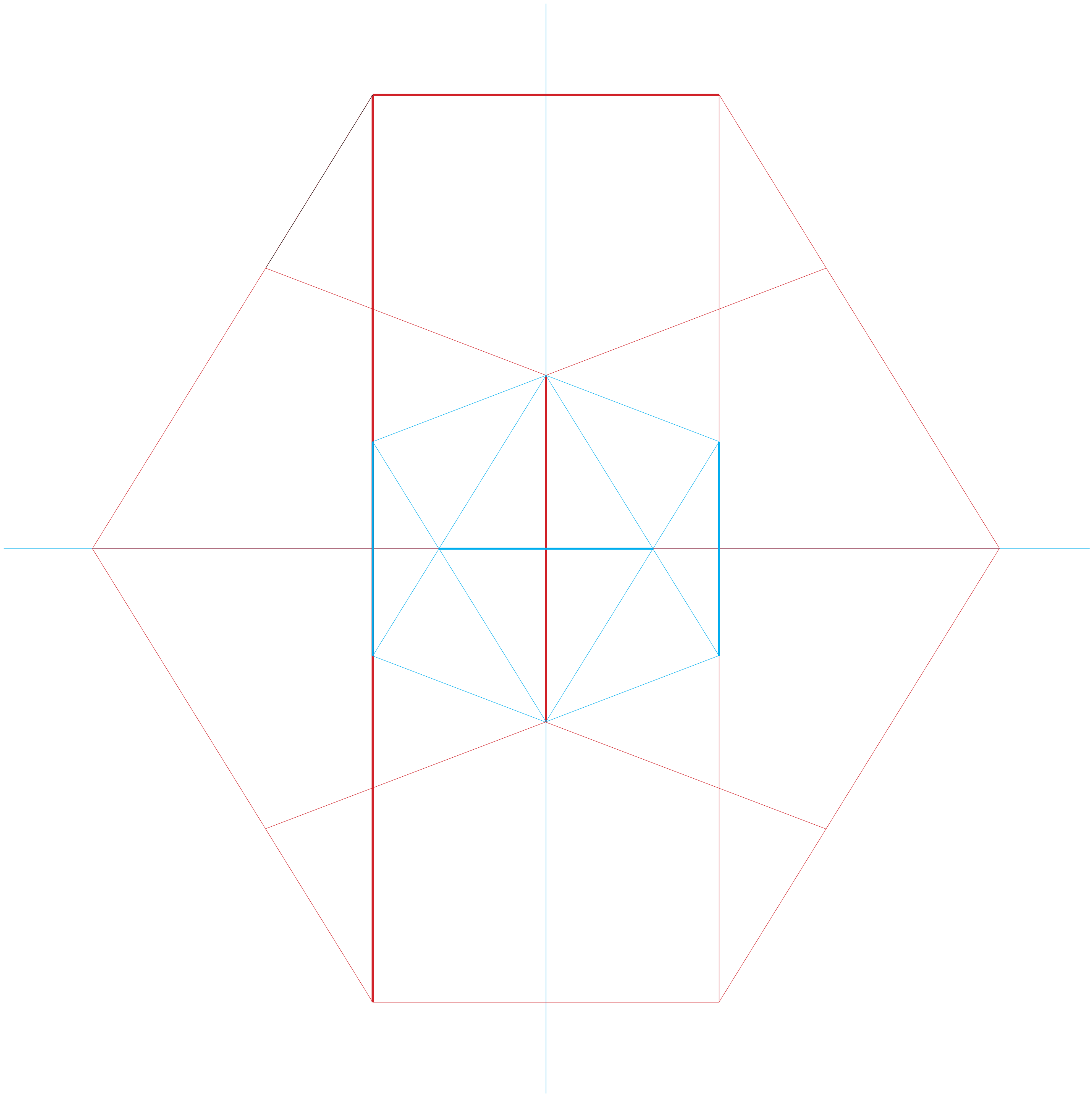
The following step shows us the complete dodecahedron.

Short edge = minor
Long edge = minor+major



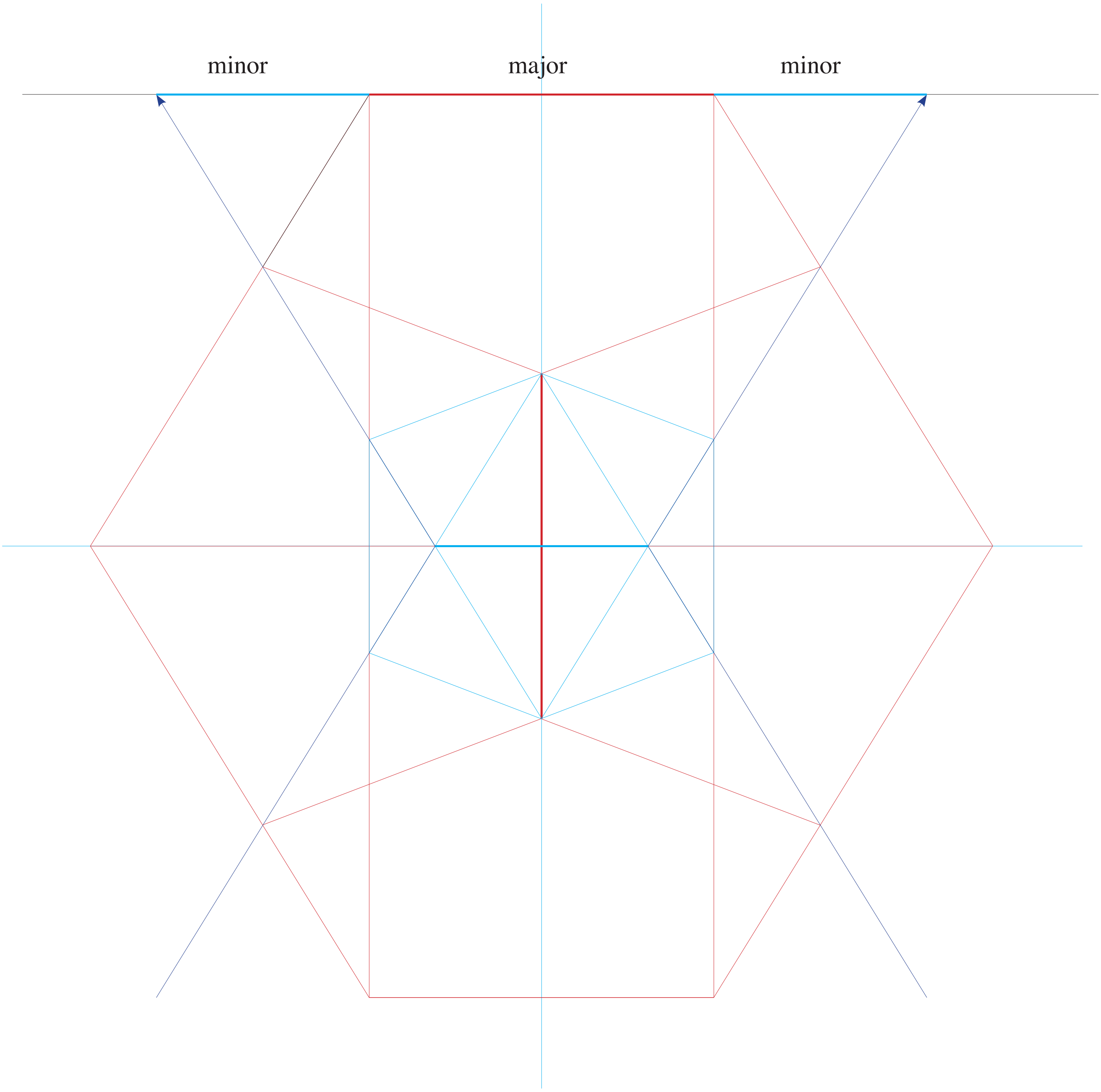
Now we draw the inscribed icosahedron, whose edge-lengtht is the minor of the edge-length of the dodecahedron.

Dodecahedron edge-length
= major = 57,735mm
Icosahedron edge-length
= minor = 35,682mm



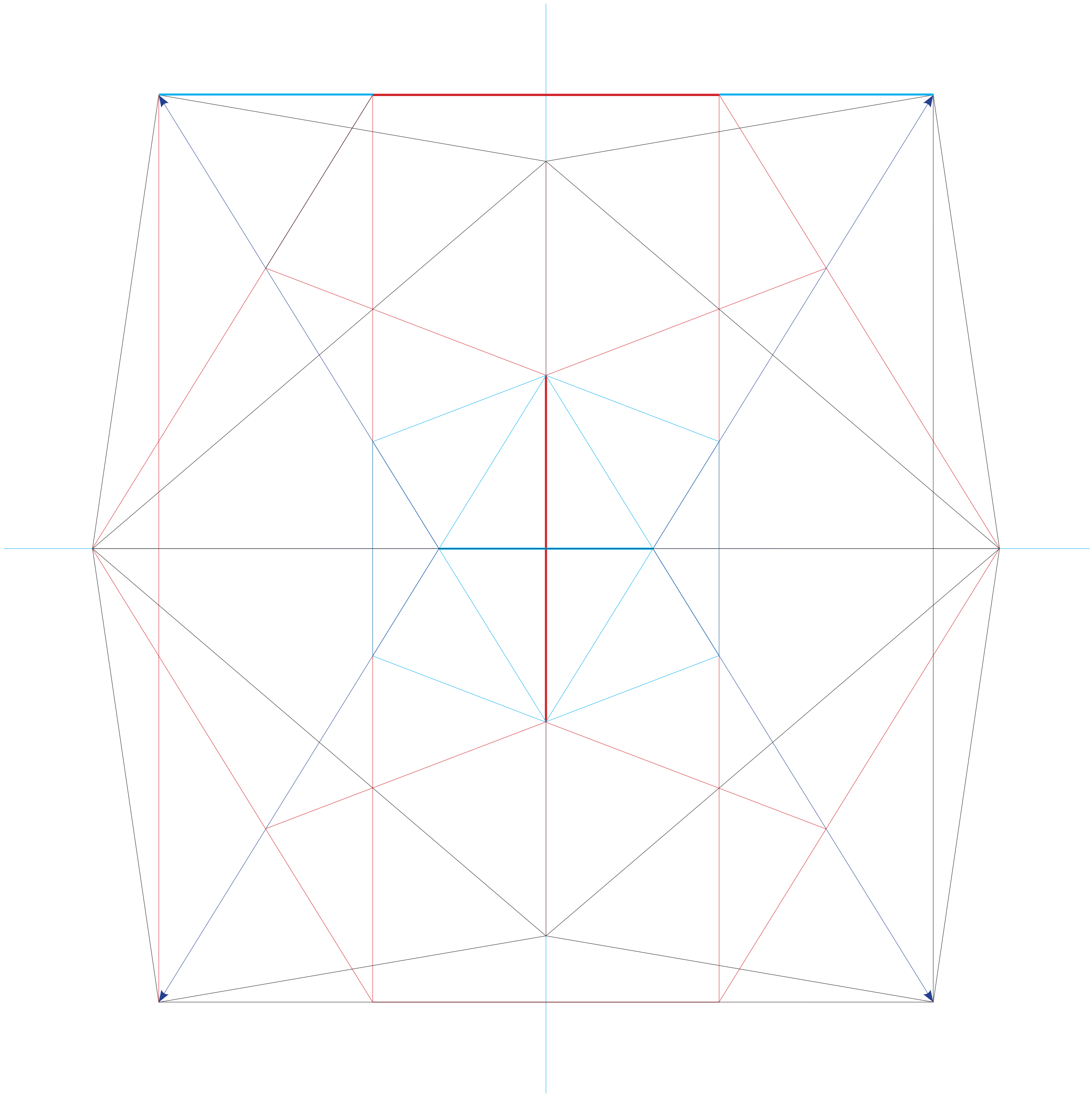
Now we can complete the edge-length of the dodecahedron (major) on both sides with the edge-length of the icosahedron (2 x minor) and we get the short edge of the space-plain of the „big twenty-surface-solid“.

Dodecahedron-edge = major (red)
Icosahedron-edge = minor (blue)



Now we can draw the
twenty-surface-solid.

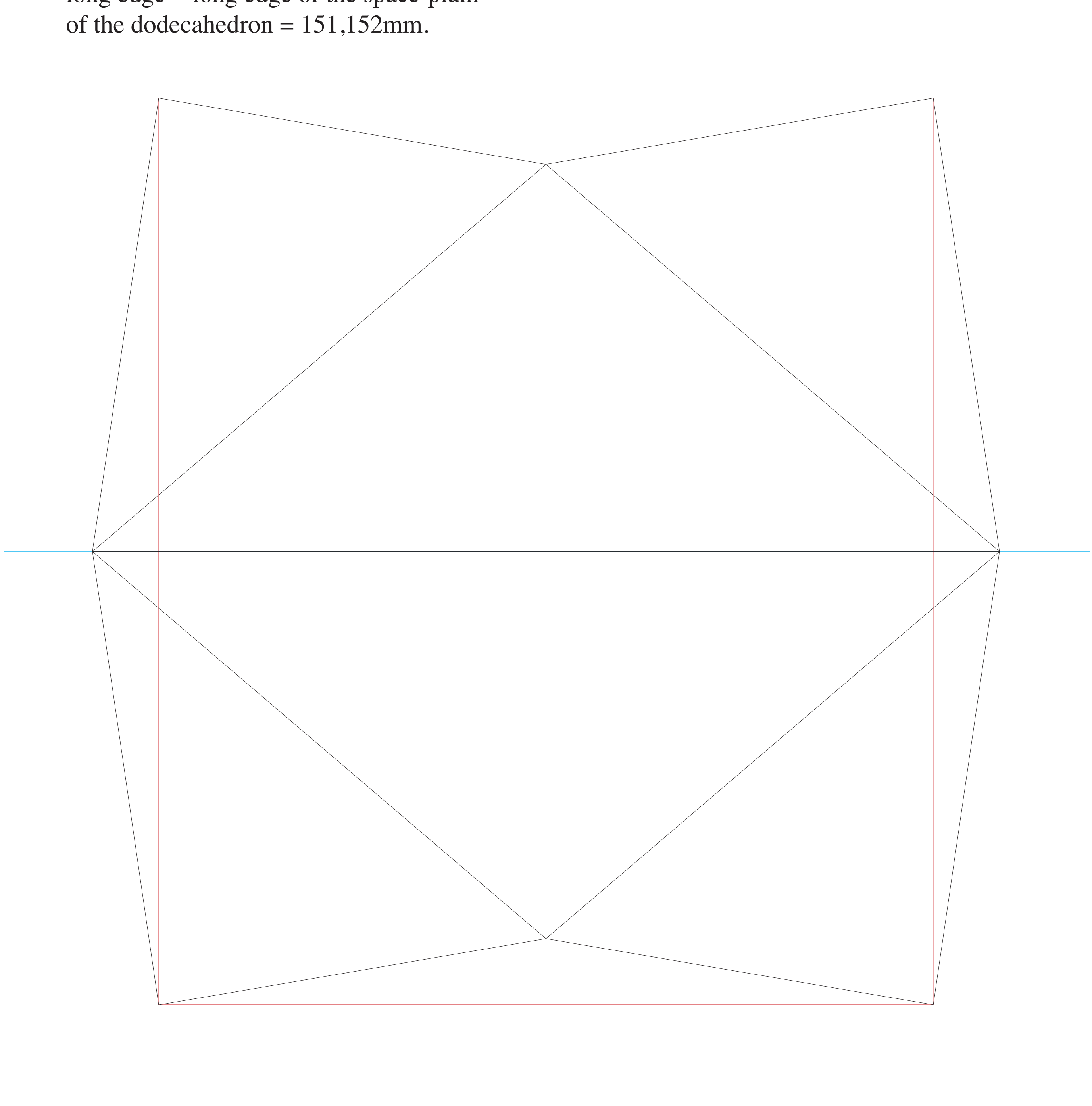
Dodecahedron-edge = major
Icosahedron-edge = minor



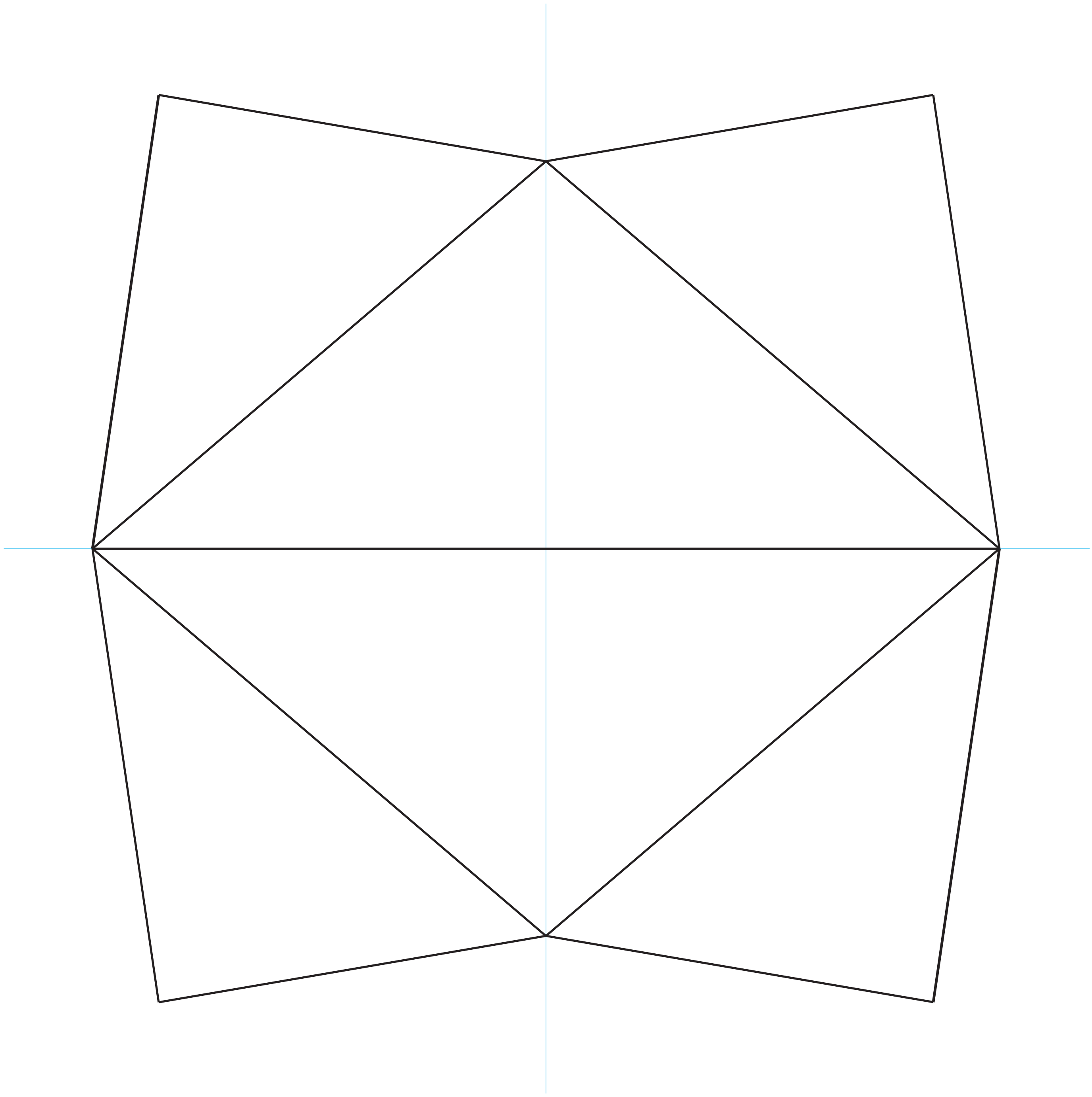
The „big twenty-surface-solid“
and his space-plain (red).

The space-plains are golden rectangles with the edge-length: Short edge = 2*35,682mm+57,735 = 129,099mm
and
long edge = long edge of the space-plain of the dodecahedron = 151,152mm.

5. The „big twenty-surface-solid“.



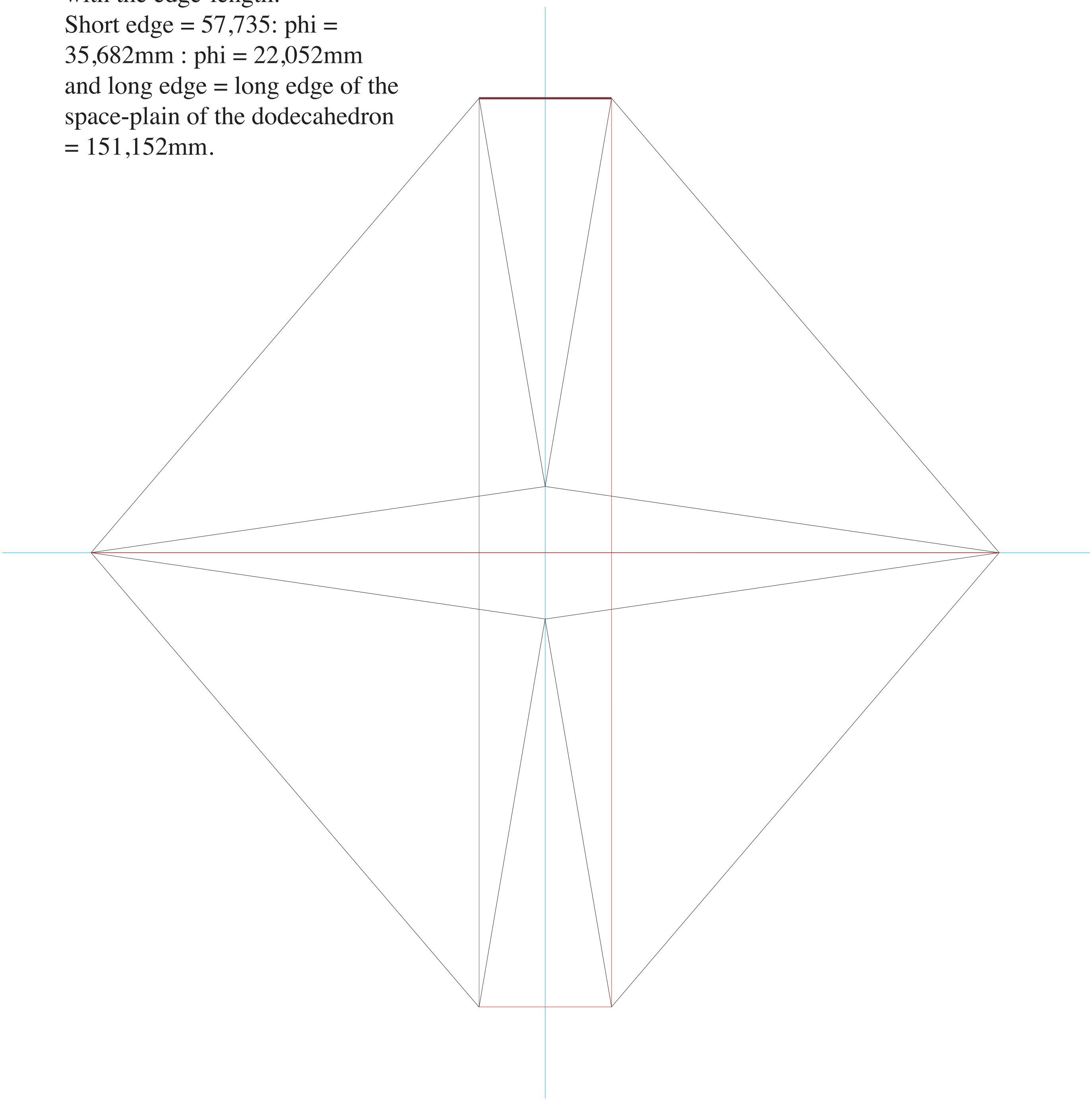
The concave brother-solid
of the
„big twenty-surface-solid“



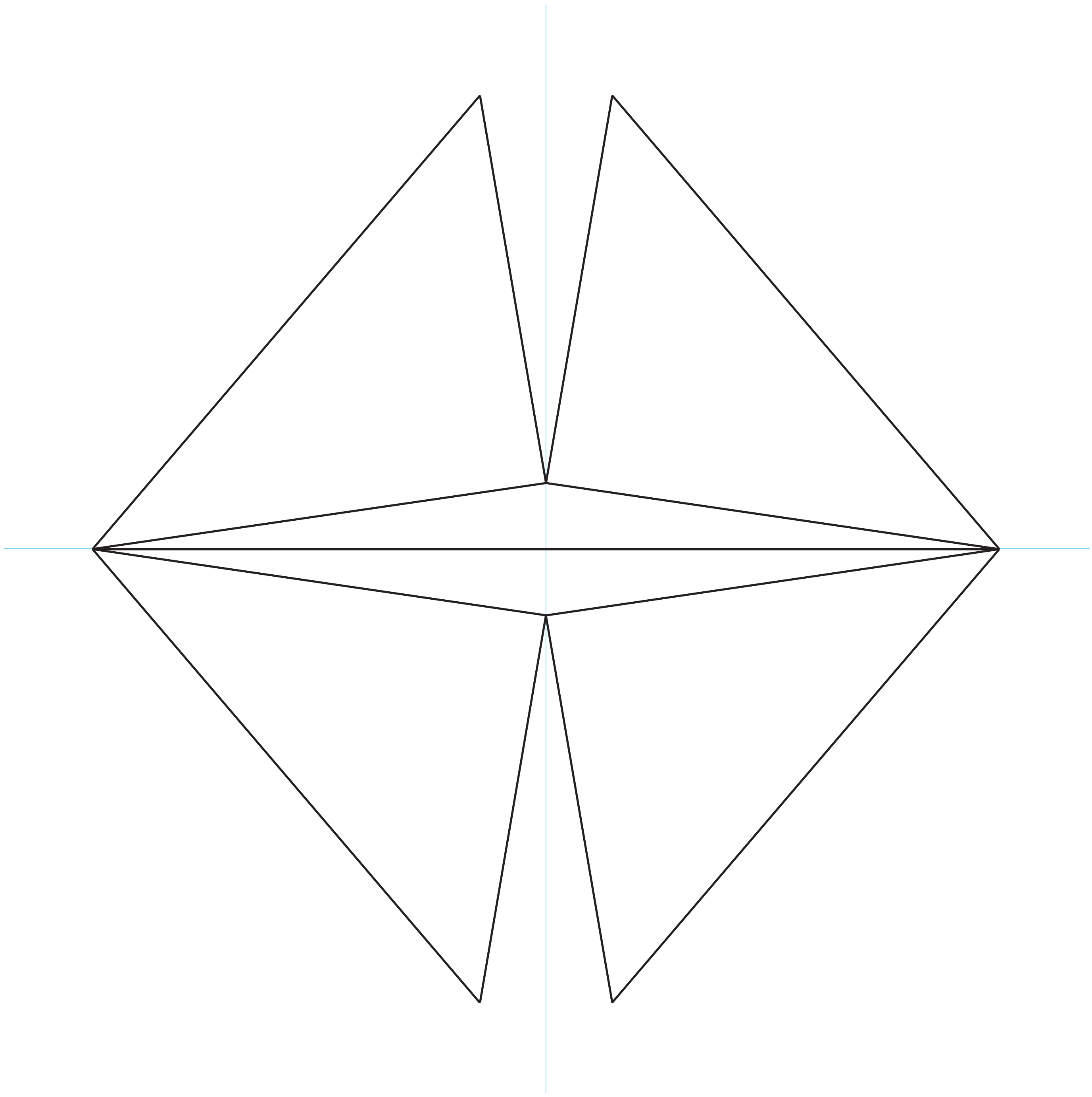
6. The small
twenty surface solid

The small twenty surface solid
and his space-plain (red).
The short edge of the space-plain is
the minor of the edge of the in the dodeca-
hedron inscribed icosahedron.

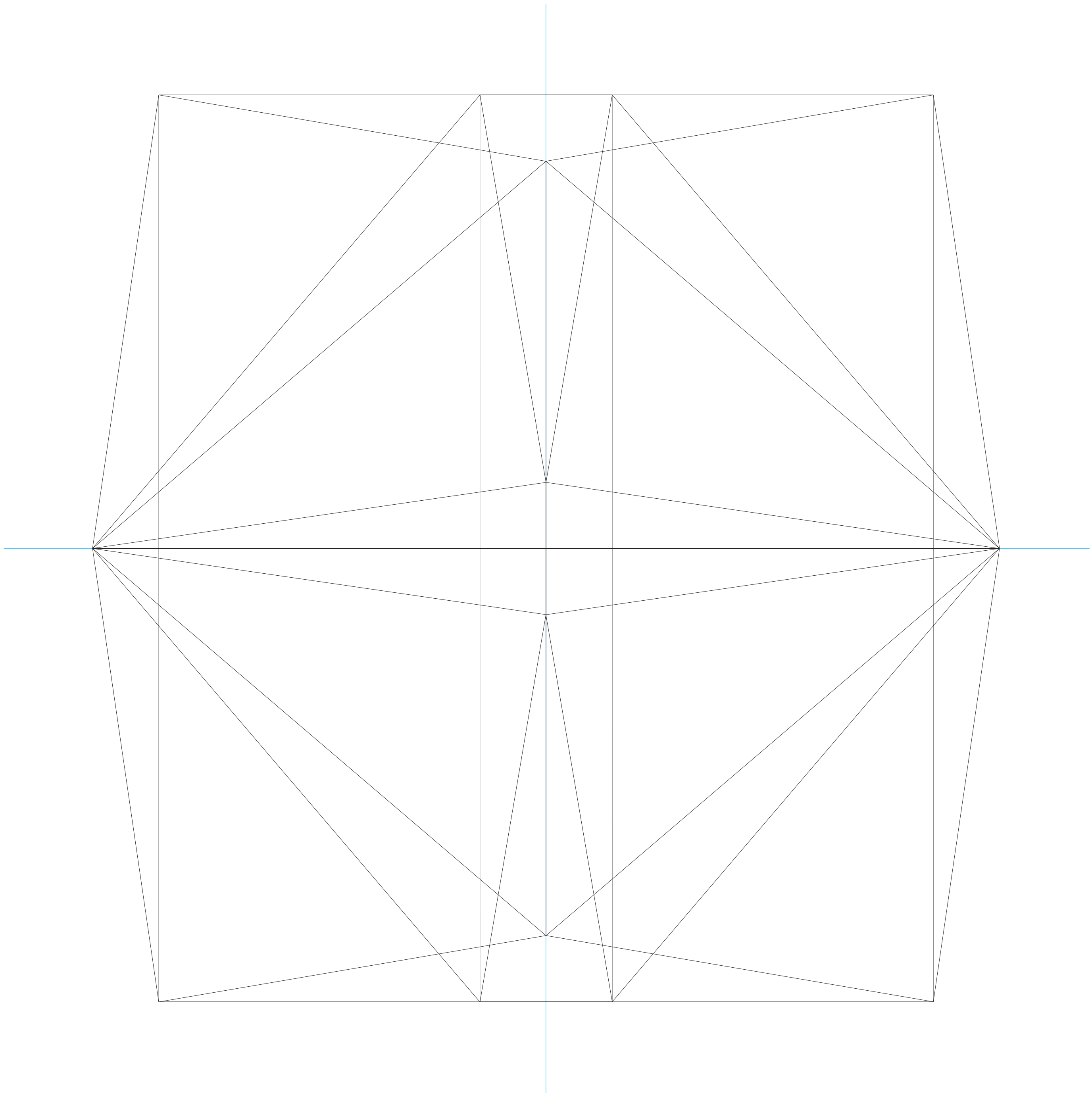
The space-plains are golden rectangles
with the edge-length:
Short edge = 57,735: phi =
35,682mm : phi = 22,052mm
and long edge = long edge of the
space-plain of the dodecahedron
= 151,152mm.



The concave brother-solid
of the small
twenty surface solid

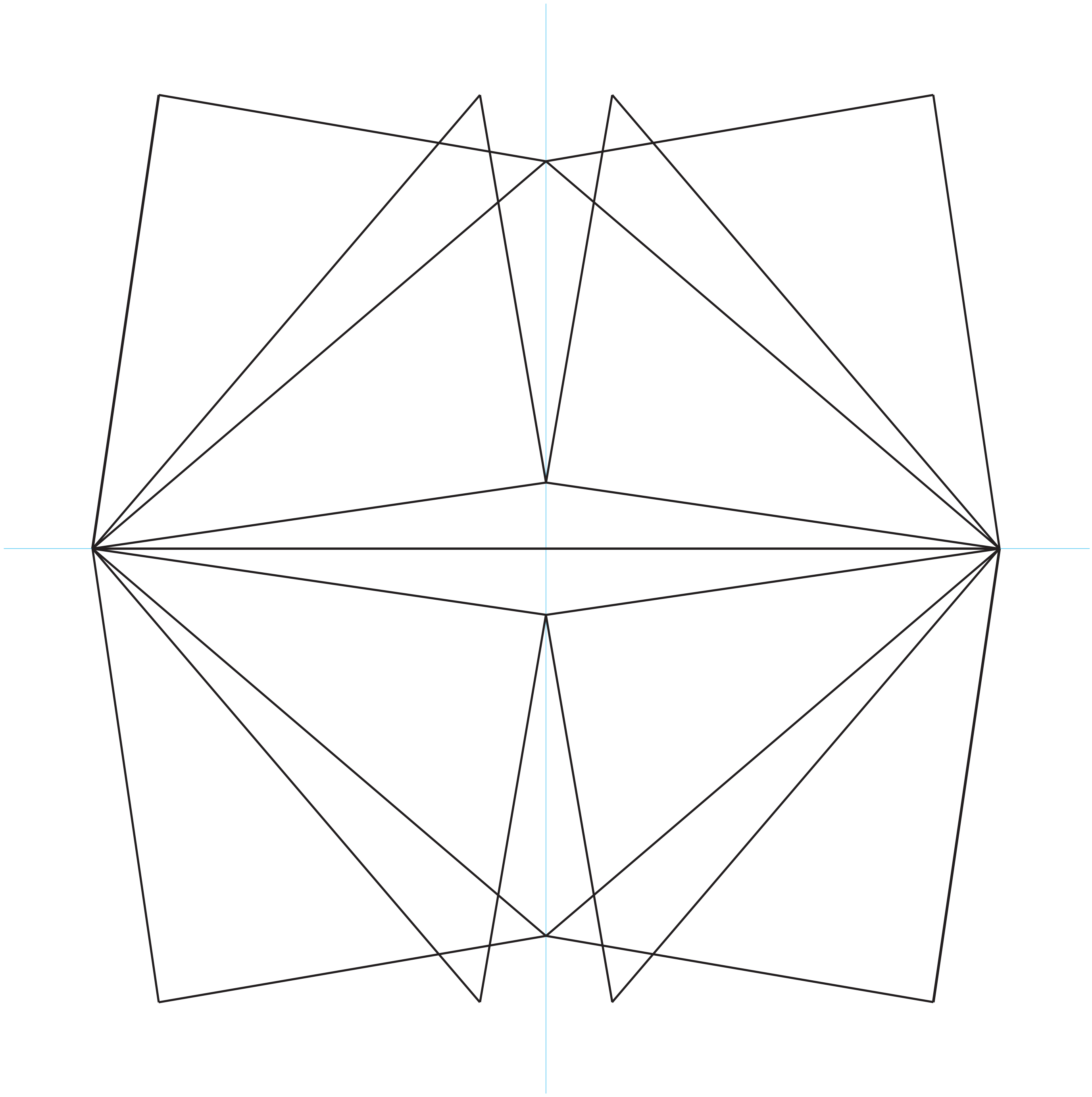


Big- and small twen-
ty-surface-solid



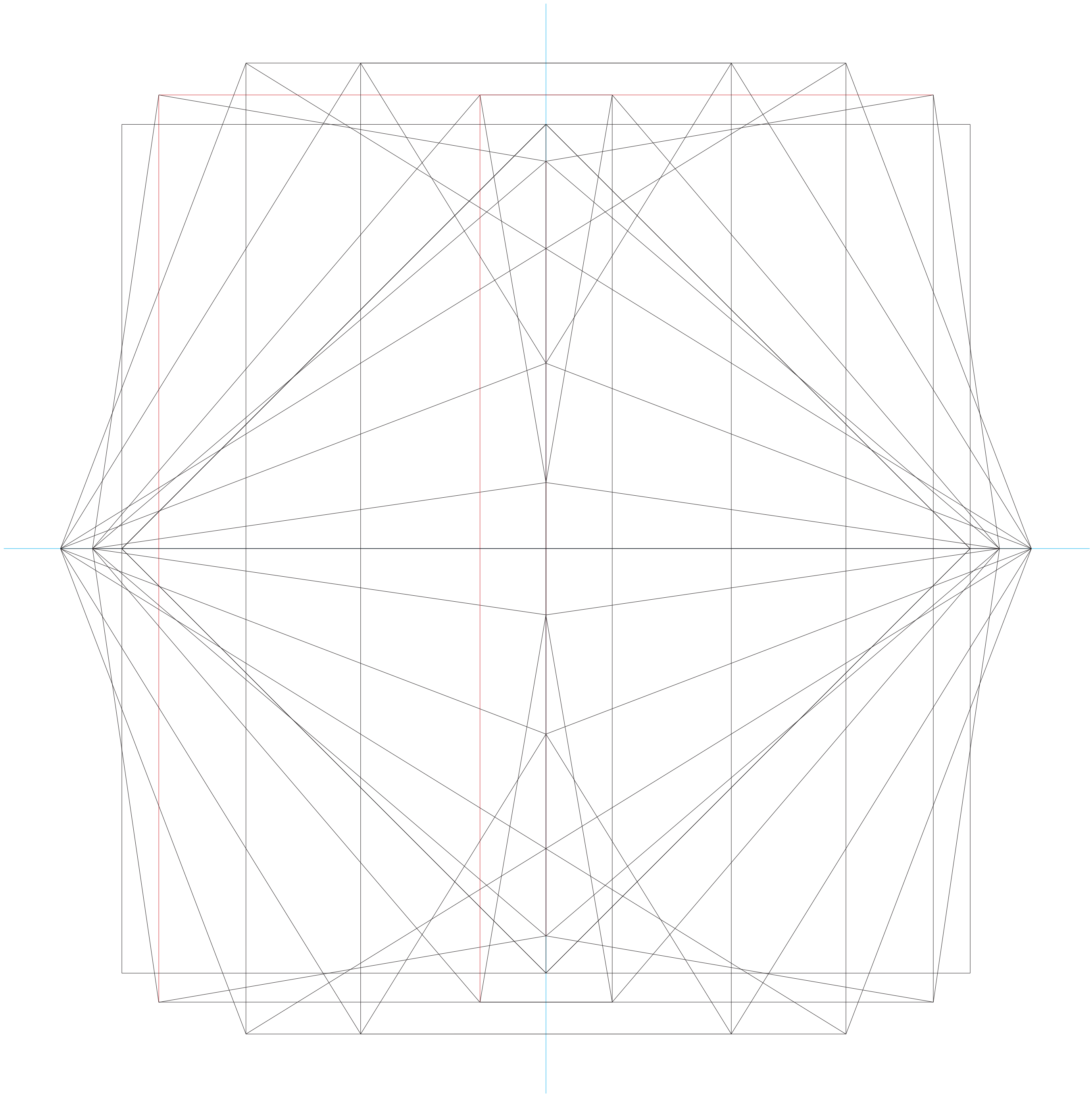
The volume of the surface remains unchanged, but the space-volume of the solid has changed.

Both concave-solids together



Octahedron
Cuboctahedron
Icosahedron
Golden Icosahedron
Big twenty-surface-solid
Small twenty-surface-solid

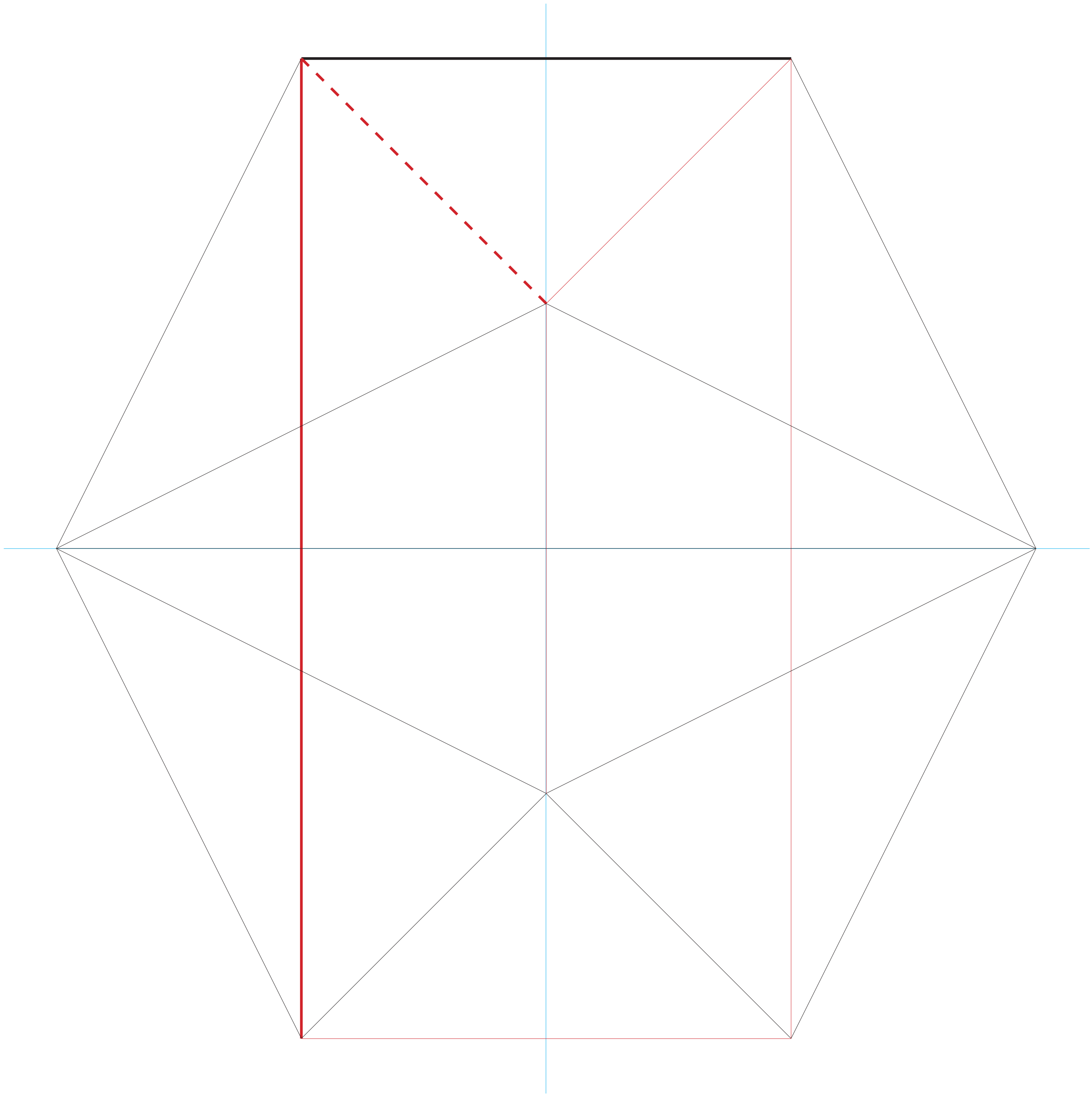
Pair 1 and
pair 2 and
pair 3 together



7. The „medium twenty surface solid”

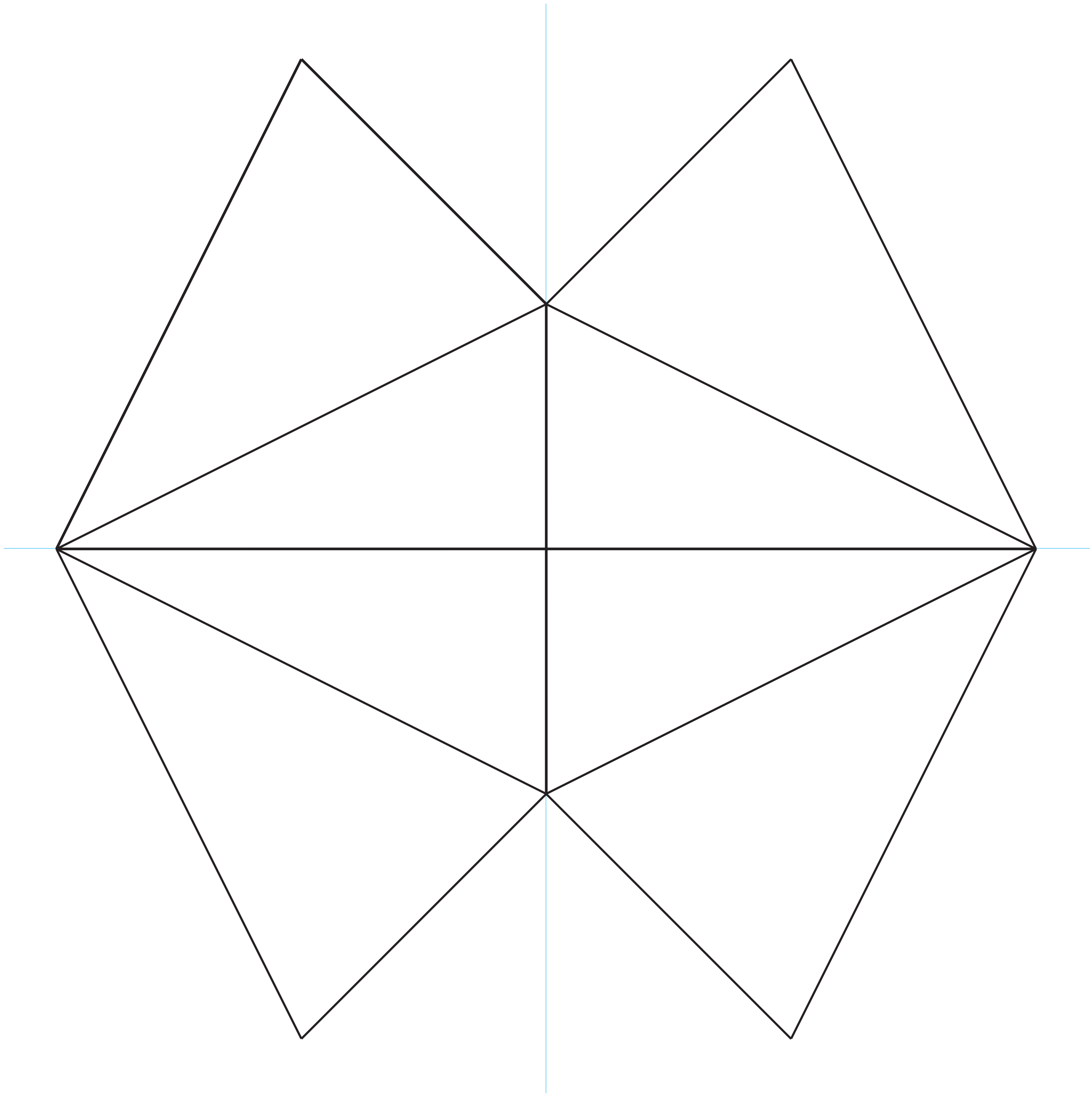
The „medium twenty surface solid” and his space-plain (red).
The short edge of the space-plain now appears as a*sqrt 2, whereby (a) again is the radius of the circumcircle of the equilateral triangele with the edge-lengt 1 = 100mm , namely 57,735mm.

The space-plains are double-squares.
The short edges are at the ratio of approx 1:sqrt 1,5.



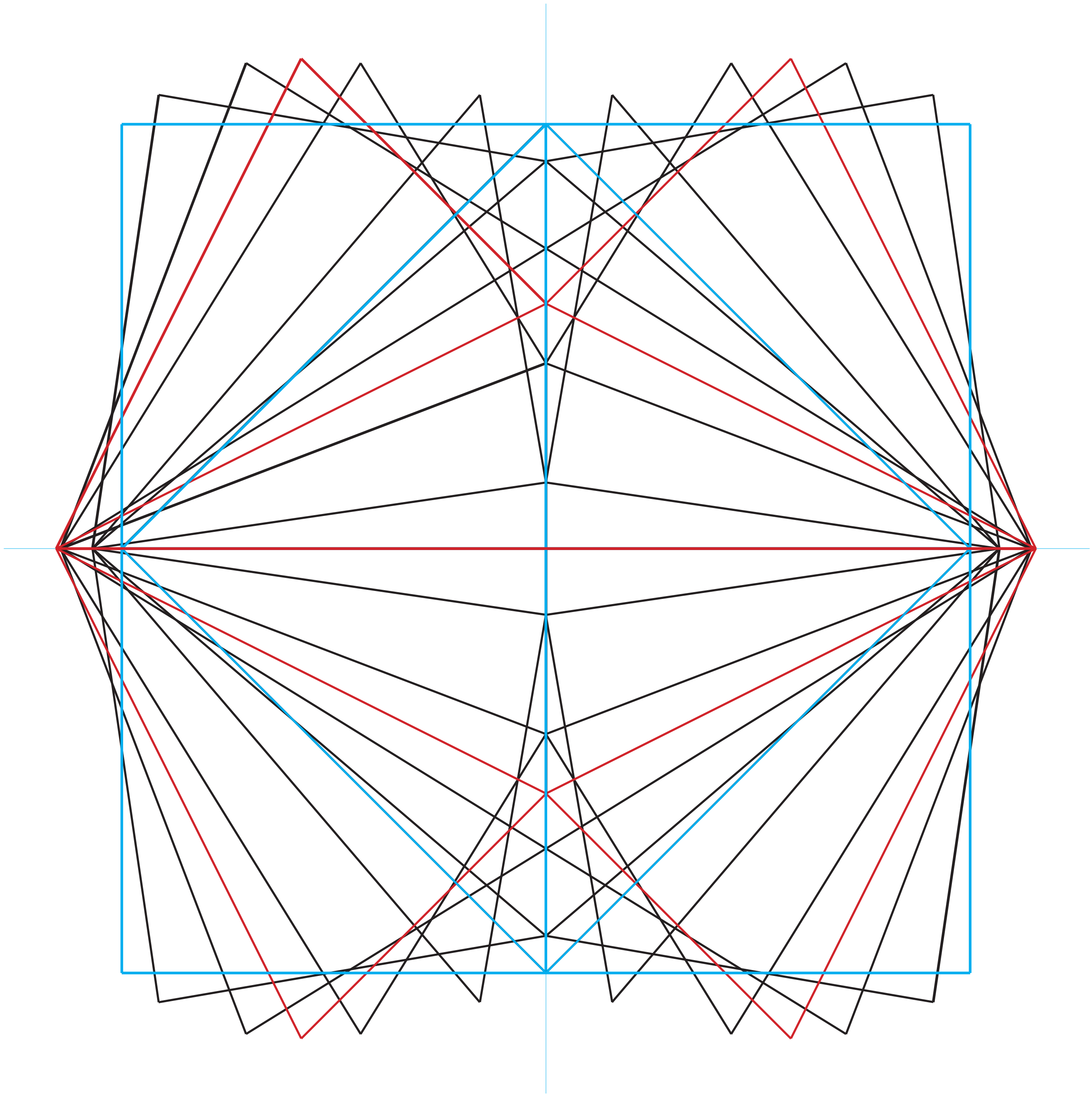
The Jessen´s
orthogonal icosahedron (JOI)
is the concave brother-solid of
the medium twenty surface solid.

At the same time the JOI marks the furthest position from the middle of the VE on his path from octahedron to cubeoctahedron.



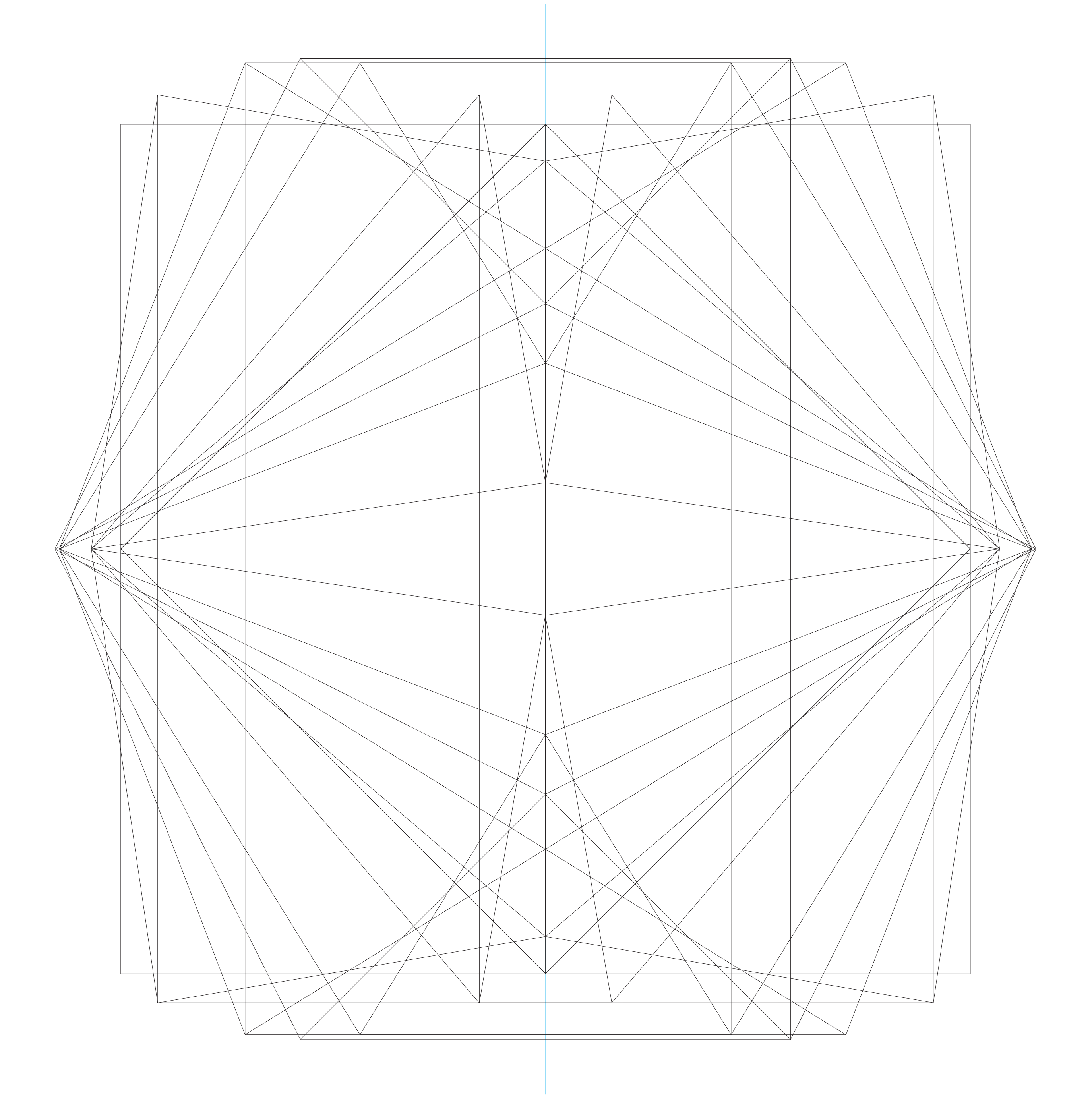
All the five concave-solids plus octahedron and cubeoctahedron on their moving-path.

Octahedron and cubeoctahedron (blue), Jessen´s orthogonal icosahedron (red).

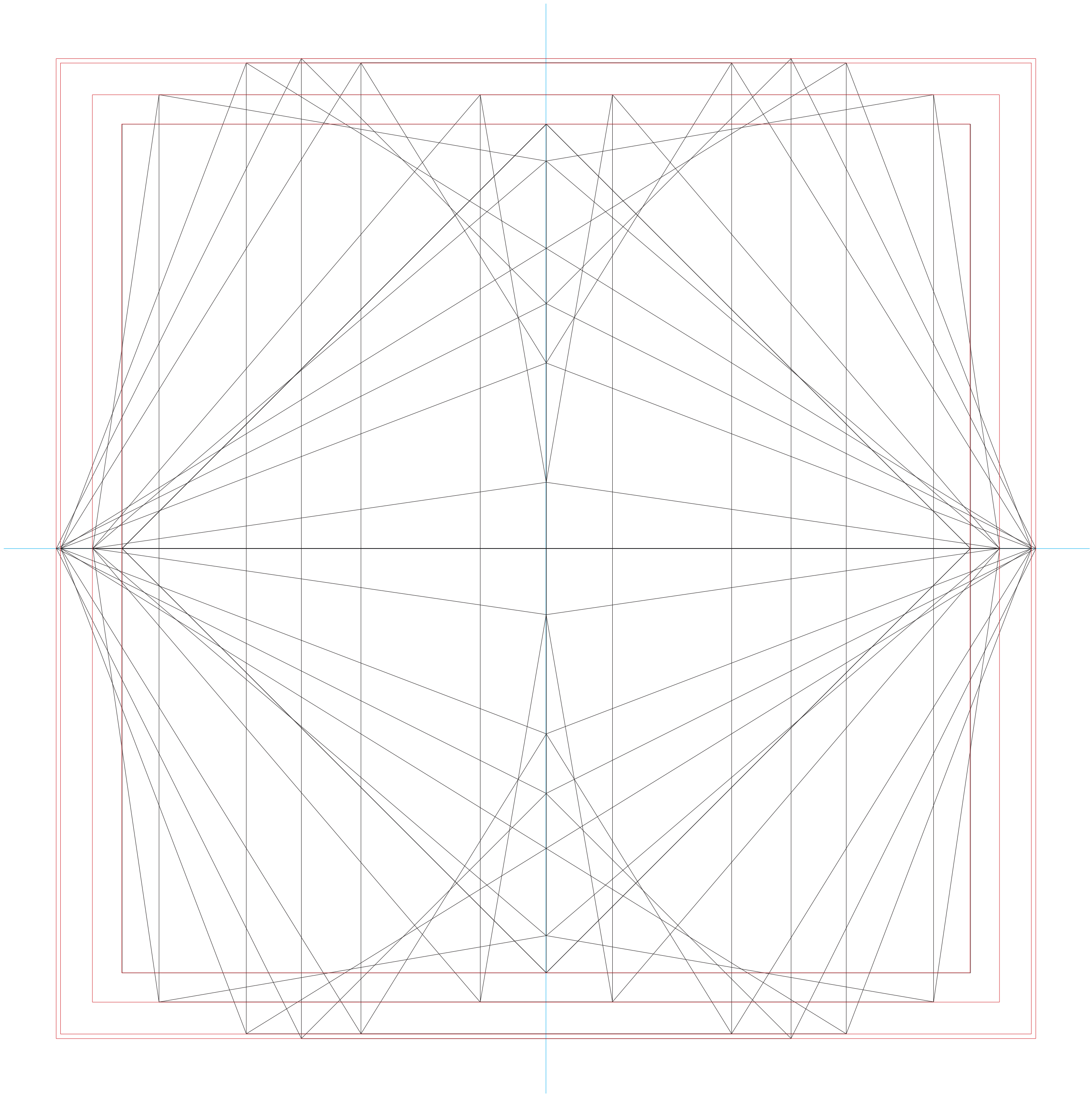


Octahedron
Cuboctahedron
Icosahedron
Golden Icosahedron
Big twenty-surface-solid
Small twenty-surface-solid
Medium twenty-surface-solid

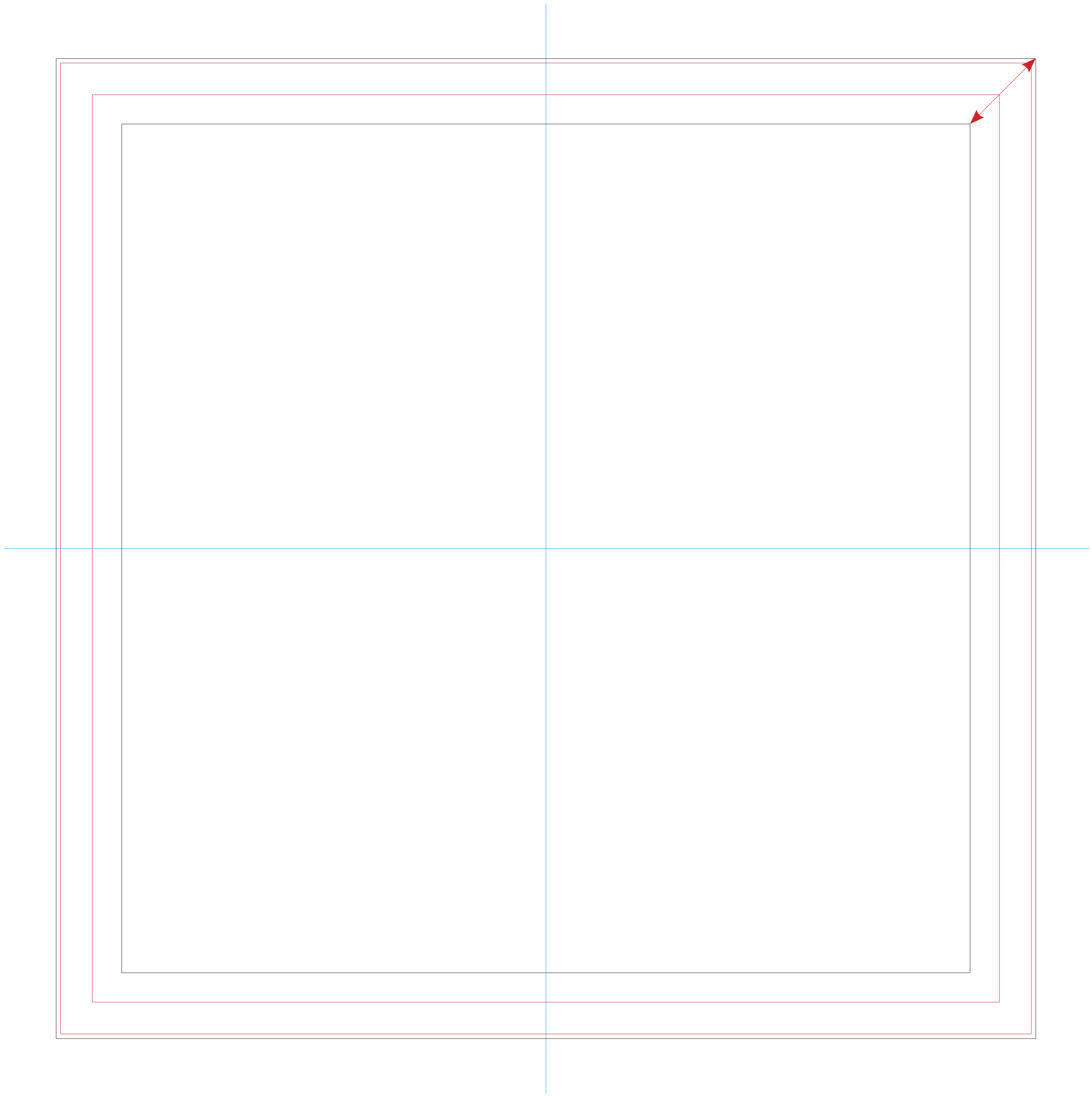
Pair 1 and
pair 2 and
pair 3 and
the medium twenty-surface-
solid together.



The “cover-solids“ of all polyhedra are cubes (red).



This cubes “pulsate“ during the moving-path from the “smallest“ (octahedron-cubeoctahedron) to the “biggest“ (medium twenty-surface-solid resp. Jessen´s orthogonal icosahedron) and back again, in the “rhythm“ sqrt 1,333!!!!



Although the “Vector equilibriun“ is really a “living“ entity (as shown by the described “pulsating-process“), NONE of the described polyhedra (twenty-surface-solids), neither the convex or the concave, are in any way “movable“, not even infinitesimally.

Their characteristics appear in different „space-forms“, holding their surface-volme whilst transforming their space-volume. Through this arise pairs of connected-solids, both concave and convex polyhedra.

They are pairs which belong together.

With help from a third element, the belonging tetrahedron, they can fill the space without leaving any gaps.

(Refer to article “How Shaky Is The Jessen´s orthogonal icosahederon?“ D.Junker / September 2008).

The pictures below shows the described polyhedra, the “different“ space planes (white) and in the center the inscribed octahedron (blue)