WHAT IS CLAIMED IS:

1. A hybrid prosthetic heart valve adapted for post-implant expansion and having an inflow end and an outflow end, comprising:

a valve member including a plurality of flexible leaflets configured to ensure one-way blood flow therethrough and a leaflet support structure defining alternating cusps and commissures to which peripheral edges of the leaflets attach; and

a plastically-expandable inflow stent frame secured to and projecting from an inflow end of the leaflet support structure and having a strength requiring a predetermined expansion force to convert to an expanded state, the stent frame comprising a plurality of expandable struts and an upper edge at an outflow end of the stent frame that undulates with peaks and valleys to at least partially conform to the undulating leaflet support structure, and further wherein the upper edge defines an implant circumference with a nominal diameter that enables physiological functioning of the valve member when implanted, and wherein the upper edge is configured to expand a limited amount from the nominal diameter to an enlarged diameter larger than the nominal diameter upon application of an outward dilatory force from within the outflow end substantially larger than forces associated with normal physiological use;

wherein the stent frame includes a plurality of circumferential row struts connected by a series of spaced axial column struts, and the upper edge comprises an outflow row strut that extends continuously around a periphery of the stent frame and has a series of spaced V-shaped notches that permit limited expansion and contraction, and the contraction of the outflow row strut is limited to a predetermined amount by two corners of each V-shaped notch meeting, the limited contraction enabling compression of the stent frame during delivery of the heart valve.

2. The prosthetic heart valve of claim 1, wherein the outflow row strut has limited radially compressibility of between about 7–20% of the nominal diameter to reduce the size of the outflow end during delivery of the heart valve.

3. The prosthetic heart valve of any preceding claim, wherein the leaflet support structure comprises an undulating wireform with alternating cusps and commissures.

4. The prosthetic heart valve of claim 3, wherein the outflow edge of the stent frame includes three integrated commissure posts located adjacent to and radially outward from the wireform commissures to which the leaflets attach outside of the wireform.

5. The prosthetic heart valve of claim 4, wherein the integrated commissure posts are separate elements secured with sutures to the stent frame outflow edge.

6. The prosthetic heart valve of claim 4, wherein the integrated commissure posts are integrally formed of the same homogeneous material as the rest of the stent frame.

7. The prosthetic heart valve of any of claims 1–2, wherein the leaflet support structure comprises a structural support stent having upstanding commissure posts extending in the outflow direction to which the leaflets attach alternating with arcuate inflow cusps, the support stent defining an implant circumference that is non-compressible in normal physiological use and has a first diameter, and wherein the support stent is configured to expand from the first diameter to a second diameter larger than the first diameter upon application of an outward dilatory force from within the support stent substantially larger than forces associated with normal physiological use.

8. The prosthetic heart valve of claim 7, wherein the support stent comprises two concentric bands, one of which is metal and the other of which is plastic.

9. The prosthetic heart valve of claim 7, wherein the support stent includes a support band having a single expandable segment formed by overlapping free ends located at one of the inflow cusps and separated by a sliding insert, and further including a flexible sleeve surrounding the overlapping free ends of the support band to maintain alignment of the free ends.

10. The prosthetic heart valve of claim 9, wherein the single expandable segment is located at one of the inflow cusps of the support stent and a second band concentrically positioned within the support band defines the commissure posts and is configured to expand below each of the commissure posts when the support band expands.

11. The prosthetic heart valve of any preceding claim, wherein the stent frame upper edge has limited radially compressibility to enable compression of the stent frame during delivery of the heart valve.

12. The prosthetic heart valve of any preceding claim, wherein the stent frame is configured to expand below each of the leaflet support structure commissures upon application of the outward dilatory force.

13. The prosthetic heart valve of any preceding claim, further including a unique identifier on the stent frame visible from outside the body after implant that identifies the stent frame as having an expandable outflow end.

14. The prosthetic heart valve of any preceding claim, further including a unique identifier on the leaflet support structure visible from outside the body after implant that identifies the support stent as being expandable.