



Streamlining

Water flow can be *laminar* (smooth), *turbulent* (irregular), or *transitional*. Laminar flow creates the least drag, and turbulent flow the most. In practice, any fish or mammal or man-made hull produces transitional flow, as perfect laminar or totally turbulent flows are never encountered.

Streamlined bodies promote laminar flow and the faster an object travels through water, the more streamlined it must be.

Turbulence begins to set in when the thin layer of water immediately next to the moving body (the "boundary layer") becomes unstable. Such instability is, at least partially, inevitable in man-made rigid hulls. If the turbulence in the boundary layer can be stabilized, then laminar flow can be maintained over the entire organism. It seems

A / Pointed nose. This shape eases cutting through the water, but the broadness of the after portion causes heavy drag and boiling up of water just behind the body.

B / Long and slim. This characteristic bullet shape of the fusiform body like that of a barracuda or a shark. It creates less turbulence as this drawing based on a photographic study indicates.

C / Blunt front. This is the least efficient shape shown; it stirs water and creates the most turbulence.

D / Shortened and broadened. This shape creates greater turbulence than does the fusiform body.

E / Angular on the sides. This shape creates still greater turbulence.

that fish and marine mammals have such a stabilization mechanism: by constantly changing their shape to conform their body surfaces to the lines of flow they are able to move at speeds that could not be matched by exact, but rigid, replicas of their forms.