FIG. **3** shows the synchronization ring **62** shifted to the rearmost extreme of its range of motion to produce a minimum throat area/radius condition. Specifically, FIG. **3** shows this in a high mode condition as discussed above. During the transition of the synchronization ring, there is associated telescoping (contraction as shown) of the external flap. The need to accommodate a sufficient range of telescoping across the throat area range may, as noted above, exceed a desired range of extensibility associated with the mode shift. Thus the mode strut may still operate to restrict and as means for restricting a range of movement of the divergent flap and external flap combination and extensibility of the external flap. FIG. **4** shows the flap in a low mode minimum throat area/radius condition.

Advantageously, the actuation linkage and flap geometry is chosen to permit a range of throat area conditions effective to address the desired performance envelope. An exemplary envelope would include a maximum throat radius which is about 150% of a minimum throat radius (e.g., in excess of 140%). Similarly, the mode strut and its mounting are configured to provide a desired mode range. An exemplary mode range involves a minimum θ of between −5° and 5° and a maximum θ of between 10° and 25°. Such range may advantageously be provided across all throat areas.

The present nozzle may be engineered as a redesign of an existing nozzle or otherwise engineered for an existing environment (e.g., as a drop-in replacement for an existing nozzle). For example, the illustrated nozzle may be formed as a replacement for a generally similar nozzle but wherein a bell crank is connected to the convergent flap (or the hinge point between the convergent and divergent flaps) rather than to the divergent flaps. The reengineering could preserve the synchronization ring and potentially portions of the linkage including the bell crank. Reengineering also could preserve basic details of the external flap and mode strut, although potentially requiring minor geometry tweaks if the exact ranges of throat area and flap angle are to be maintained.

One or more embodiments of the present invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention. For example, when implemented as a reengineering of an existing nozzle, various details of the existing nozzle may be preserved either by necessity or for convenience. Additionally, the principles may be applied to non-axisymmetric nozzles in addition to axisymmetric nozzles and to vectoring nozzles in addition to non-vectoring nozzles. Accordingly, other embodiments are within the scope of the following claims.

What is claimed is:

1. A turbine engine nozzle subassembly comprising:

an upstream flap;

a downstream flap pivotally coupled to the upstream flap for relative rotation about a hinge axis; and

an actuator linkage coupled to the downstream flap along a forward half thereof for actuating the upstream and downstream flaps between a plurality of throat area conditions while permitting aerodynamically-induced orientation changes of the downstream flap.

2. The subassembly of claim **1** further comprising:

an external flap pivotally coupled to the downstream flap and to an environmental structure so that a span between respective coupling locations with said downstream flap and environmental structure is extensible and contractable responsive to aerodynamic forces; and

means for restricting an extensibility range of said external flap.

3. The subassembly of claim **2** wherein:

said means for restricting comprises a secondary link having a first pivotal coupling location to the environmental structure and a second pivotal coupling location to the downstream flap, the second pivotal coupling location being intermediate the coupling location of the downstream flap to the external flap and a coupling location of the actuator linkage to the downstream flap; and

the secondary link has a restricted free float range relative to the downstream flap.

4. The subassembly of claim **1** wherein:

said throat is formed along a longitudinally convex surface portion of the downstream flap.

5. The subassembly of claim **1** wherein:

said throat is formed downstream of a hinge axis coupling the upstream flap to the downstream flap.

6. A nozzle comprising:

a circumferential array of subassemblies of claim **1**; and

a synchronization ring mounted for longitudinal translation between first and second positions and coupled to said linkage of each of the subassemblies so that said translation causes said actuating.

7. The nozzle of claim **6** wherein:

the linkage of each of the subassemblies comprises a bell crank and a transfer link coupling the bell crank to the downstream flap.

8. A turbine engine nozzle comprising:

a static structure;

a plurality of flap subassemblies comprising:

an upstream flap pivotally coupled to the static structure for relative rotation about an axis essentially fixed relative to the static structure; and

a downstream flap pivotally coupled to the upstream flap for relative rotation about a hinge axis permitting aerodynamically-induced mode changes of the downstream flap; and

means for actuating articulation of the upstream and downstream flaps of the plurality of flap subassemblies within a range of areas of a throat along the downstream flap while minimizing changes in throat area at a given design point induced by said mode changes.

9. The nozzle of claim **8** wherein:

the plurality of flap subassemblies are axisymmetrically arranged about an engine centerline;

said articulation is simultaneous for each of the flap subassemblies; and

each of the plurality of flap subassemblies further comprises an external flap pivotally coupled to the downstream flap.

10. The nozzle of claim **8** wherein:

said throat is formed along a longitudinally convex surface portion of the downstream flap.

11. A turbine engine nozzle subassembly comprising:

an upstream flap;

a downstream flap pivotally coupled to the upstream flap for relative rotation about a hinge axis; and

an actuator linkage coupled to the downstream flap along a forward half thereof for actuating the upstream and downstream flaps between a plurality of throat area conditions, said throat being formed along a longitudinally convex surface portion of the downstream flap, the actuator linkage coupled to the upstream flap only via the downstream flap.