positive strain at a certain direction without increasing the applied voltage. The difference of this innovation from the HYBAS is that all the elements can be made from one-of-a-kind materials.

Stacked HYBATS can provide an extremely effective piezoelectric constant at both resonance and off resonance frequencies. The effective piezoelectric constant can be alternated by varying the size of each component, the degree of the pre-curvature of the positive strain components, the thickness of each layer in the multilayer stacks, and the piezoelectric constant of the material used. Because all of the elements are piezoelectric components, Stacked HYBATS can serve as projector and receiver for underwater detection. The performance of this innovation can be enhanced by improving the piezoelectric properties.

This work was done by Ji Su of Langley Research Center, Xiaoning Jiang of TSR Technologies, and Tian-Bing Zu of the National Institute of Aerospace. Further information is contained in a TSP (see page 1). ***LAR-17671-1***

Active Flow Effectors for Noise and Separation Control

These variable effectors provide enhanced vehicle and aeroelastic control.

Langley Research Center, Hampton, Virginia

New flow effector technology for separation control and enhanced mixing is based upon shape memory alloy hybrid composite (SMAHC) technology. The technology allows for variable shape control of aircraft structures through actively deformable surfaces. The flow effectors are made by embedding shape memory alloy actuator material in a composite structure. When thermally actuated, the flow effector def1ects into or out of the flow in a prescribed manner to enhance mixing or induce separation for a variety of applications, including aeroacoustic noise reduction, drag reduction, and f1ight control. The active flow effectors were developed for noise reduction as an alternative to fixed-configuration effectors, such as static chevrons, that cannot be optimized for airframe installation effects or variable operating conditions and cannot be retracted for off-design or fail-safe conditions.

Benefits include:

- Increased vehicle control, overall efficiency, and reduced noise throughout all f1ight regimes,
- Reduced flow noise,
- Reduced drag,
- Simplicity of design and fabrication,
- Simplicity of control through direct current stimulation, autonomous response to environmental heating, fast response, and a high degree of geometric stability.

The concept involves embedding prestrained SMA actuators on one side of the chevron neutral axis in order to generate a thermal moment and def1ect the structure out of plane when heated. The force developed in the host structure during def1ection and the aerodynamic load is used for returning the structure to the retracted position. The chevron design is highly scalable and versatile, and easily affords active and/or autonomous (environmental) control.

The technology offers wide-ranging market applications, including aerospace, automotive, and any application that requires flow separation or noise control.

This work was done by Travis L. Turner of Langley Research Center. For further information, contact the Langley Innovative Partnerships Office at (757) 864-8881. ***LAR-17332-1***

Method and System for Temporal Filtering in Video Compression Systems

This filtering improvement increases efficiency for visual signal components for low-power applications.

Stennis Space Center, Mississippi

Three related innovations combine improved non-linear motion estimation, video coding, and video compression. The first system comprises a method in which side information is generated using an adaptive, non-linear motion model. This method enables extrapolating and interpolating a visual signal, including determining the first motion vector between the first pixel position in a first image to a second pixel position in a second image; determining a second motion vector between the second pixel position in the second image and a third pixel position in a third image; determining a third motion vector between the first pixel position in the first image and the second pixel position in the second image, the second pixel position in the second image, and the third pixel position in the third image using a non-linear model; and determining a position of the fourth pixel in a fourth image based upon the third motion vector.

For the video compression element, the video encoder has low computational complexity and high compression efficiency. The disclosed system comprises a video encoder and a decoder. The encoder converts the source frame into a space-frequency representation, estimates the conditional statistics of at least one vector of space-frequency coefficients with similar frequencies, and is conditioned on previously encoded data. It estimates an encoding rate based on the conditional statistics and applies a Slepian-Wolf code with the computed encoding rate. The method for decoding includes generating a side-information vector of frequency coefficients based on previously decoded source data and encoder statistics and previous reconstructions of the source frequency vector. It also performs Slepian-Wolf decoding of a source frequency vector based on the