SECTION VII

GLOSSARY OF TERMS

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7. GLOSSARY OF TERMS

7.1 CFD Glossary

Advection: The process by which a quantity of fluid is transferred from one point to another due to the movement of the fluid.

Boundary condition(s): *either:* A set of conditions that define the physical problem.
or: A plane at which a known solution is applied to the governing equations.

Boundary layer: A very narrow region next to a solid object in a moving fluid, and containing high gradients in velocity.

CFD: Computational Fluid Dynamics. The study of the behavior of fluids using computers to solve the equations that govern fluid flow.

Clustering: Increasing the number of grid points in a region to better resolve a geometric or flow feature. Increasing the local grid resolution.

Continuum: Having properties that vary continuously with position. The air in a room can be thought of as a continuum because any cube of air will behave much like any other chosen cube of air.

Convection: A similar term to *Advection* but is a more generic description of the *Advection* process.

Convergence: Convergence is achieved when the imbalances in the governing equations fall below an acceptably low level during the solution process.

Diffusion: The process by which a quantity spreads from one point to another due to the existence of a gradient in that variable.

Diffusion, molecular: The spreading of a quantity due to molecular interactions within the fluid.

Diffusion, turbulent: The spreading of a quantity due to the increased mixing rates exhibited by turbulent flows. In the majority of situations turbulent diffusion far exceeds molecular diffusion.

Divergence: Divergence occurs when the imbalances in the governing equations reach unacceptably high levels during the solution process

Eddy viscosity: Eddy viscosity is an additional viscosity that is produced due to the effects of fluid turbulence.

Eddy diffusivity: Eddy diffusivity is the additional diffusivity produced due to the effects of fluid turbulence.

Far-field distance: The approximate distance from the surface of the body to the farthest point in the Computational Domain. "The wing simulation had a far-field distance of 15 wing chords."

Gauss Siedel equation solve: A method by which linear equations are solved on a cell-by-cell basis

Gradient: The amount by which a variable changes in space or time.

Grid resolution: The amount of grid points located in a physical area. "The grid uses 20 grid points to resolve the boundary layer".

Near-wall spacing: The distance of the closest point to the surface of a body. An especially important parameter in viscous flow simulations.

Normal stress: The force/unit area that results from one body directly striking another. For instance, slamming your fist down upon a table top will cause pain due to a normal stress on your hand and the table. Pressure is always a normal stress.

Reynolds number: A non-dimensional number that is used to indicate how turbulent a fluid flow is.

Reynolds stress: In turbulence modeling an instantaneous velocity is broken down into mean and fluctuating components. A Reynolds stress is the averaged product of two of these fluctuating velocity components.

Reynolds flux: A Reynolds flux, as in a Reynolds stress, is the average product of two fluctuating variable components, one of which is a fluctuating velocity component.

Shear stress: The force/unit area that results from one body sliding relative to another. For instance, sliding a book along a table top will cause a shearing stress on both the book and table top.

Solution domain: The computational volume in which the governing equations, together with the boundary conditions, are solved.

Turbulence: Turbulence is a type of flow that occurs when a fluid is moving quickly and / or within an unconfined space. It is characterized by a marked increase in mixing where, superimposed on the principle motion, there are countless irregular fluctuations.

Viscosity: The viscosity of a fluid is ascribed to the movement of one layer of fluid over another, i.e. a viscous fluid like maple syrup will take a long time to pour from a bottle, while beer can be poured quite readily. Viscosity is usually given the Greek symbol "μ". Water is about 100 times as viscous as air, while most oils are around 1000 times as viscous as water. The effects of viscosity are most easily related to a concept like friction. The viscosity of fluids will cause a resistance to motion, a drag, which must be overcome by providing more power. If the drag caused by viscosity is small compared to other forces, or if it is important only in a small region like in Boundary Layer Theory, then the effects of viscosity can be neglected. Such a case is called inviscid flow. It is a point of confusion, even for practicing aeronautical engineers, that an inviscid flow is not the flow of a fluid with zero viscosity, rather an inviscid flow contains negligibly small viscous stresses.

Vorticity: Vorticity is the swirling motion of a fluid. Satellite photographs on the evening news weather forecast often show large rotating masses of fluid, which are special cases of vortices.

7.2 Particle Tracking Glossary

Drag coefficient: A non-dimensional number that relates the dynamic head of the fluid to the drag force.

Eddy's time scale: A measure of the time it takes an eddy to interact with its surroundings.

Euler system: In Euler system, the "field "concept is used to describe the fluid motion. In this case, the fluid motion is given by completely prescribing the necessary properties as functions of space and time. With this system, we obtain information about the flow in terms of what happens at fixed points in space as the fluid flows past those points.

Gaussian distribution: A probability distribution representing a random variation about the mean. It is determined completely by the mean and the standard deviation.

Lagrangian system: This method involves following individual fluid particles as they move about and determining how the flow properfies associated with these particles change as a function of time. That is, the fluid particles are "tagged", or identified, and their properties determined as they move.

Particle's Reynolds number: A non-dimensional similar to the flow Reynolds number that is based on the relative velocity between particle and fluid.

Particle trajectory: The path of a particle traveling in the airflow field as a function of time. It can be different from the stream line of the same start point due to the turbulence fluctuation.

Streamline: The line that is tangent to the velocity vectors throughout the flow field.

Time step: The time interval used in the transient calculation within which the flow properties are assumed to remain constant.

UV dose: The UV dose that a bacteria receives in a time period is defined as the summation of the time interval multiplies the local UV irradiance [Dose = 2: (dt*I)].