



Dr. John B. Herbich look over a dredging systems model used in tests at the three-dimensional wave-sediment tank.

### Tank will allow simulation of 21-foot waves

Simulation of up to 21-foot ocean waves, currents of up to two knots and wave lengths of up to 500 feet are now available in a three-dimensional wave-sediment basin here.

"We have the only wave tank of any magnitude in the South and Southwest," said Dr. John B. Herbich, head of the Civil Engineering Department's Coastal and Ocean Engineering Division.

The 32-foot by 86-foot by 2.5-foot basin is located in the university's Hydromechanics Laboratories next to the new \$9 million Engineering Center.

Recently placed in operation, the tank will be used to perform harbor and estuary model studies, wave refraction and diffraction problems and coastal sediment littoral drift and erosion.

Currently, Herbich's staff is running a model study of offshore dredging systems.

Funding for the basin came from Chicago Bridge and Iron Co. It contains tide and portable wave generators and water supply lines to generate the currents.

The tank holds approximately 41,170 gallons of water, Herbich said.

Texas A&M began its coastal and ocean engineering program in 1968 at the graduate level, and Herbich said an undergraduate program will begin within two years.

The first research paper from the wave tank program was presented last month at the Offshore Technology Conference in Houston.

### Texas air plan study continued

A \$385,118 contract for continued research to develop an air transportation plan for Texas has been awarded to the Texas Transportation Institute.

Jack Keese, TTI director, said the research is being conducted under an interagency agreement with the Division of Planning Coordination of the Office of the Governor in cooperation with the Texas Aeronautics Commission.

TTI's contract is part of a \$419,974 grant from the Federal Aviation Administration of the Department of Transportation to the state. It is supplemented by

the state for an estimated \$630,000 to cover the further development of a comprehensive statewide airport system. The work is to be done over a 27-month period.

The TTI research is for Phase II work which involves the drafting of an airport system plan and will include an inventory of existing airports, their usage, and an analysis of future needs. The study will forecast future aircraft demand and provide an examination of passenger and cargo needs in the state.

It also will establish an airport

system plan for Texas that incorporates inputs from other regional systems plans as they are developed.

The air mode is seen as an important element in over-all transportation planning for continued development of market areas, movement of goods and people, and communication throughout the state, Keese said. It is recognized also for its major impact on the fast-growing metropolitan areas of the state where commercial carriers provide inter-city service.

### Student explains danger of wing-generated 'twisters'

Miniature tornadoes which shed off wing tips of in-flight airplanes are becoming dangerous.

All aircraft produce wing tip vortices, a Texas A&M student notes, but the spiraling columns of air generated by big airplanes such as the Boeing 747, the French Concord and Russia's TU-144 are vicious.

Carlos M. Barrera said in a study of the phenomena that the big planes leave behind "twisters" which pose a distinct danger to smaller following aircraft. Structural failure and life loss are possible.

"Giants such as the Concord and B-70 have vortex velocities as high as one and a half to two times the flight speed of light planes," the aerospace engineering major from San Antonio reported.

Barrera noted in a report to Dr. C. A. Rodenberger that Federal Aviation Administration officials are trying to make general aviation pilots aware of the presence and danger of the vortices, and how to avoid them.

Barrera worked in a Texas A&M Flight Mechanics Laboratory experiment to learn more about wing tip vortices. Investigation conducted by Dr. W. P. Jones and Dr. B. M. Rao made the vortices visible and measurable. Smoke bombs attached to

the wings of a Beechcraft T-34 and a 20-foot tower revealed the air flow as a sinusoidal (a continuous "S" shaped) curve.

As the curve dissipated in calm air, puffs of smoke marking individual air swirls formed at regular intervals, Barrera said. They lingered over the runway 20 to 30 seconds. If the bottom of the curve touched the runway, it broke up quickly.

Barrera, who completed his aero engineering studies this spring, noted that FAA reports "vortices formed at 30,000 feet where airliners cruise remain intact, complete with high velocity winds around the core of the vortex."

They fall at 500 feet per minute and level off 700 to 900 feet below and behind the generating plane's flight path. The vortices caused by the 747 may be 60 feet in diameter and encountered 35 miles behind the aircraft that caused them. As one form of clear air turbulence (CAT), they can cause structural damage to planes flying through them.

Vortices produced by big planes

landing and taking off lie over the runway. Some have taken 160 seconds to clear out.

The phenomenon is caused by the slightly arched airplane wing, designed to create lift by generating lower pressure on the upper surface as the wing moves through the air.

"Pressure differences between the top and bottom of the wing disappear gradually toward the wing tip," explained Barrera, a San Antonio Highlands High School graduate. "These pressures do not match at the tips, causing a flow of air from the bottom to the top—from greater pressure to lower pressure. Because the wing is moving forward, this tip air flow is shed as vortices."

Barrera offered three solutions. Heavy vortex generators might be restricted to flying certain zones and special airports. Or, wing loading restrictions might be placed on future aircraft construction, limiting their size. He said it might be possible to design an airfoil which would reduce vortex strength.

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