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(Spin Tunnel)

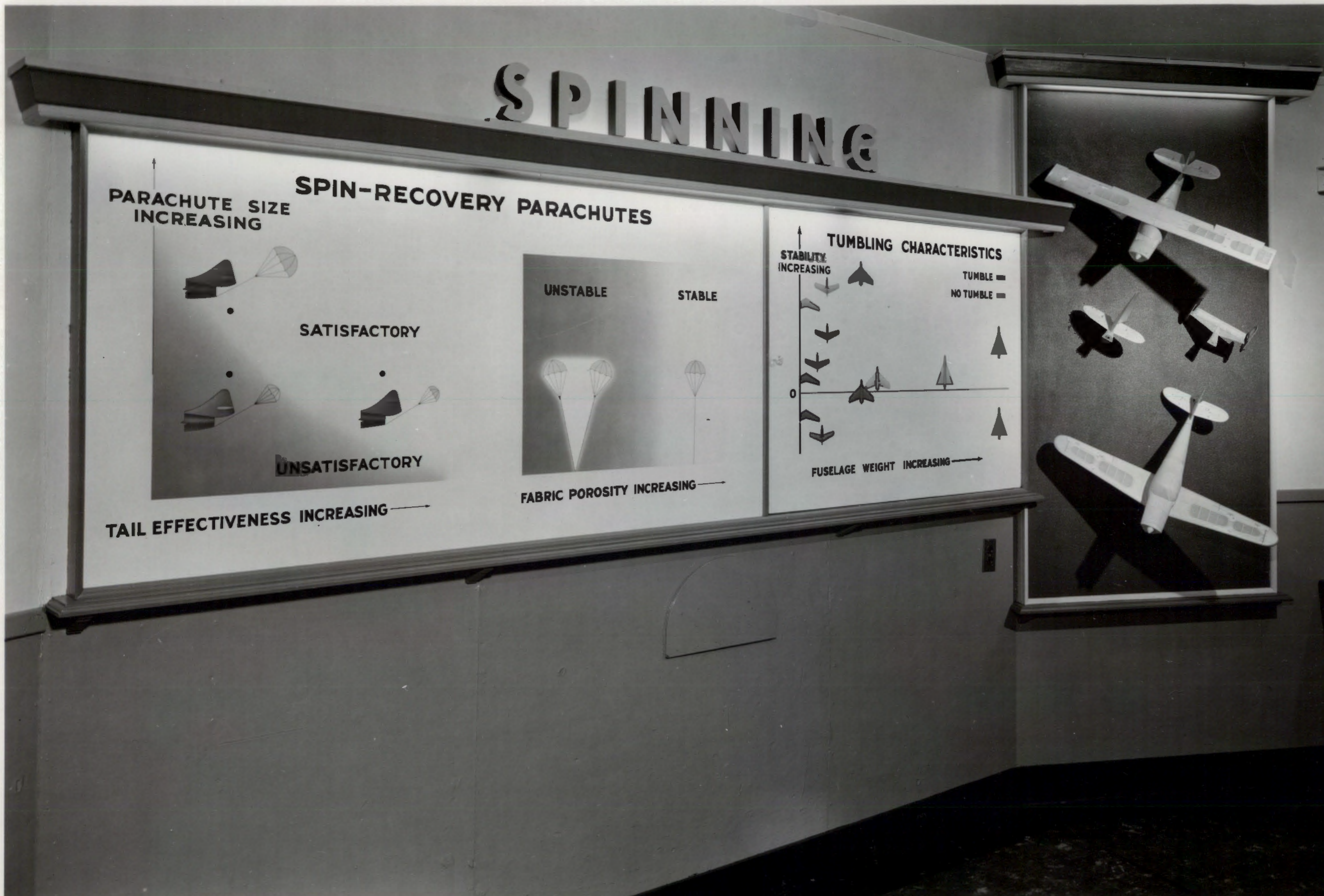
Talk for the 1949 Biennial Inspection

The Langley 20-foot free-spinning tunnel is used in the solution of problems of safety of airplanes and pilots. At the last Langley inspection, criterions were presented for satisfactory spin recovery by movement of controls from with to against the spin for both personal-owner and military type airplanes. Personal-owner type airplanes are currently required by the CAA to recover from the spin by merely releasing controls. When controls are released in a spin, the speed of recovery for a given tail design will be dependent upon where the controls float, which in turn is dependent upon the hinge-moment characteristics of the control surfaces in spinning attitudes. This problem is being studied on several dimensional configurations, some of which are shown here. Results to date indicate that as personal-owner airplanes become heavier, it may become increasingly difficult to meet CAA requirements unless special consideration is given in designing the control surfaces to float against the spin. These results, as well as those of spin-proofing research will be available at a later date.

At this time we wish to present some results of recent studies involving safety of military airplanes. Because a military airplane must be equipped with an emergency spin-recovery device during its spin demonstration, the size parachute required for spin recovery in an emergency has normally been determined by tests in this tunnel on a model of each specific design. From many tests on numerous designs, an empricial criterion has been established and is shown in the first chart. Plotted along the vertical is a non-dimensional factor proportional to parachute size while plotted along the horizontal is a non-dimensional factor indicating the effectiveness of the tail in damping the spin rotation. As shown here, although this size parachute was not adequate for this tail design, a larger parachute was satisfactory. When, however, the tail was made more effective, as by raising the horizontal tail high upon the vertical tail, the smaller parachute was adequate.

Because of inherent instability of ordinary parachutes, difficulties have been encountered when the parachute installations have been check tested in level flight, and accordingly an investigation was made to determine how parachutes could be made more stable. Results indicate that increased fabric porosity, regardless of parachute shape, resulted in more stable parachutes, which were equally effective for spin recovery. The action of stable and unstable parachutes during both level flight and spin recovery is illustrated in a short movie.

Another problem being considered is that of tumbling tendencies of tailless airplanes. It appears that unless a proper amount of static longitudinal stability exists, a tumbling, end over end motion of the airplane may ensue as a result of a violent maneuver or of a gust. Based merely on empirical results, it appears that an indication of whether or not a given design is likely to tumble may be obtained from this chart. Plotted vertically is a parameter proportional to the airplane static longitudinal stability and plotted horizontally is a non-dimensional factor which indicates the degree to which weight is spread out along the fuselage. Although not shown in the chart, the damping in pitch is also considered to be an important parameter. We will now demonstrate the tumbling tendency of this model which has a relatively rearward center-of-gravity position (falls here on chart). We will then move the center of gravity forward, this increasing the models stability (until it falls here on chart) and demonstrate its resistance to tumbling.



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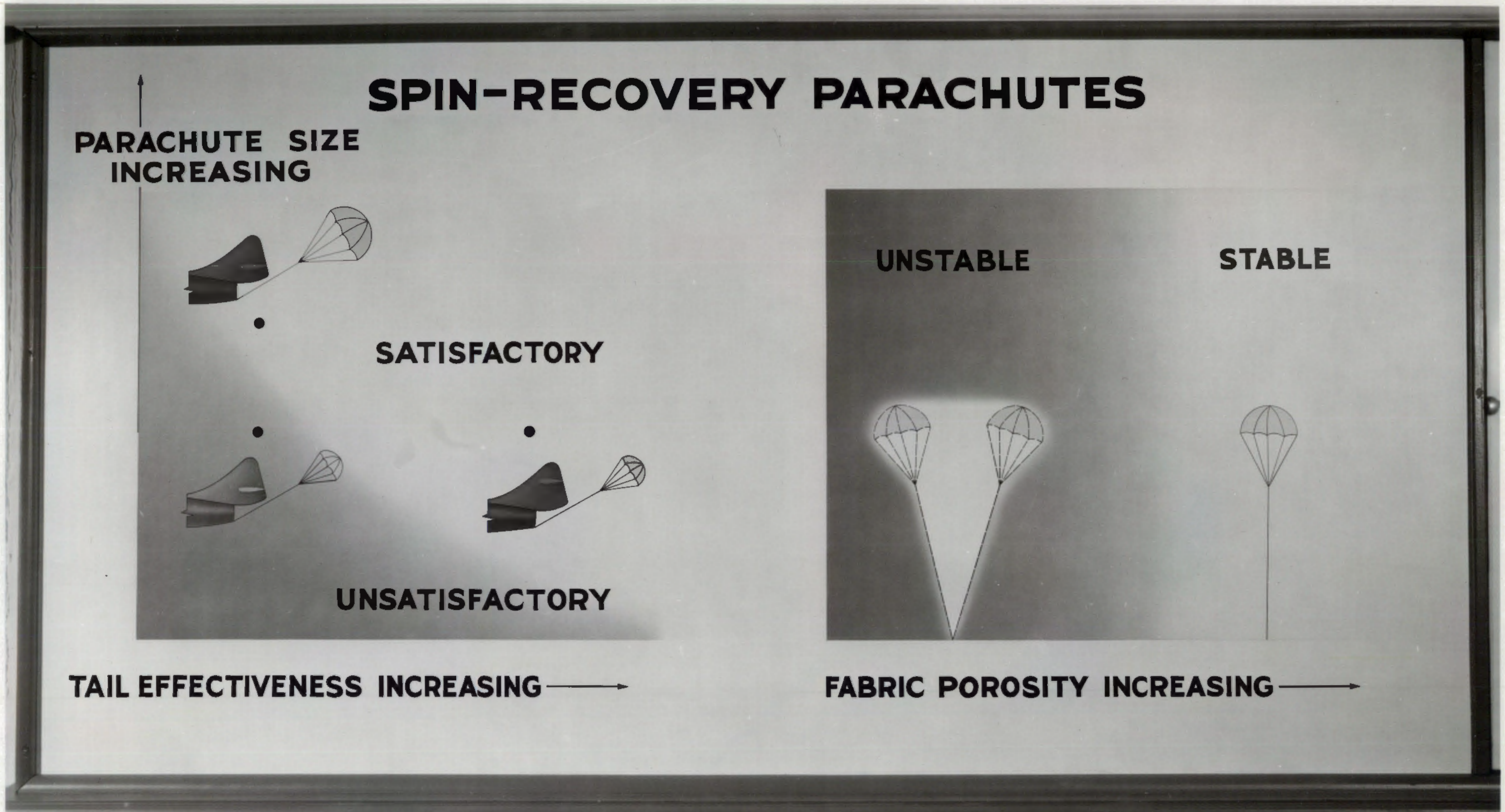

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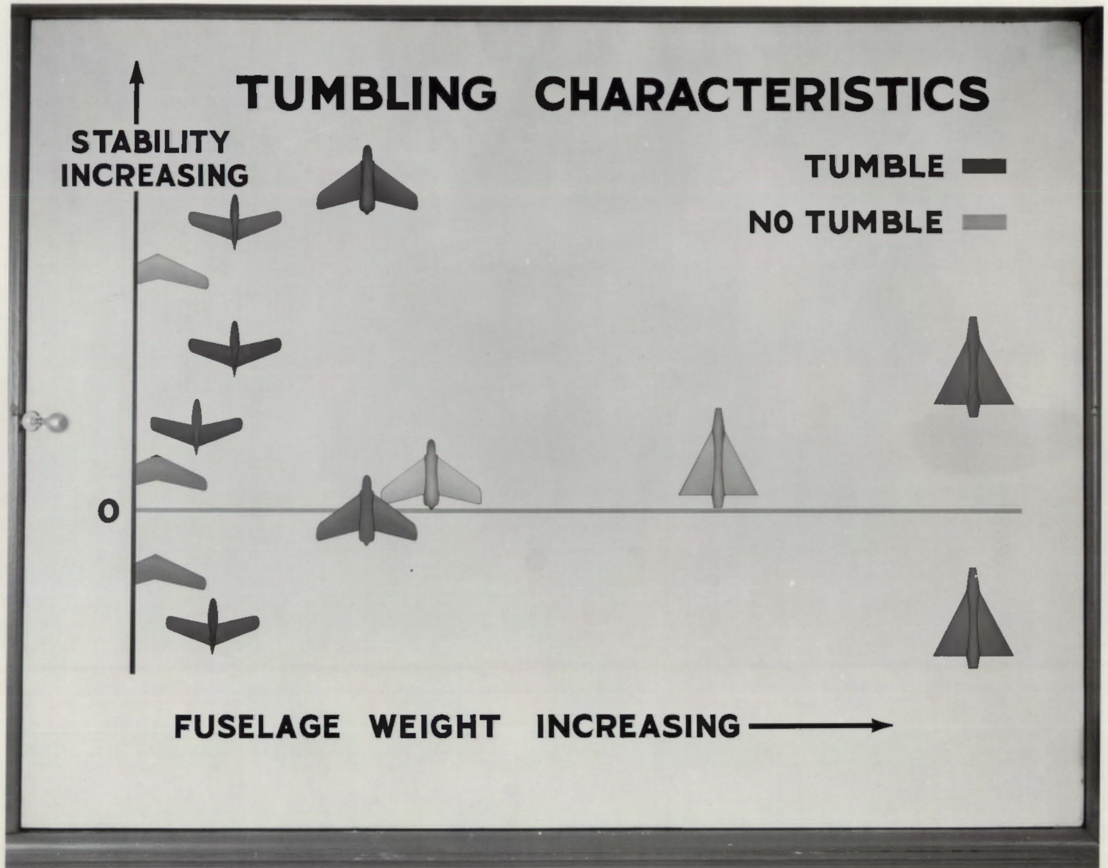

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