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3.2.6 Cooper-Harper Rating Scale

General description - The Cooper-Harper Rating Scale is a decision tree that uses adequacy for the task, aircraft characteristics, and demands on the pilot to rate handling qualities of an aircraft (see Figure 6).

Strengths and limitations - The Cooper-Harper Rating Scale is the current standard for evaluating aircraft handling qualities. It reflects differences in both performance and workload and is behaviorally anchored. It requires minimum training and a briefing guide has been developed (see Cooper and Harper, 1969, pp. 34-39). Cooper-Harper ratings have been sensitive to variations in controls, displays, and aircraft stability (Crabtree, 1975; Krebs and Wingert, 1976; Labacqz and Aiken, 1975; Schultz, Newell, and Whitbeck, 1970; Wierwille and Connor, 1983). Harper and Cooper (1984) describe a series of evaluations of the rating scale.

Connor and Wierwille (1983) reported significant increases in Cooper-Harper ratings as the levels of wind gust increased and/or as the aircraft pitch stability decreased. Ntuen, Park, Strickland, and Watson (1996) reported increases in Cooper-Harper ratings as instability in a compensatory tracking task increased. The highest ratings were for acceleration control; the lowest for position control; rate control was in the middle.

Data requirements - The scale provides ordinal data that must be analyzed accordingly. The Cooper-Harper scale should be used for workload assessment only if handling difficulty is the major determinant of workload. The task must be fully defined for a common reference.

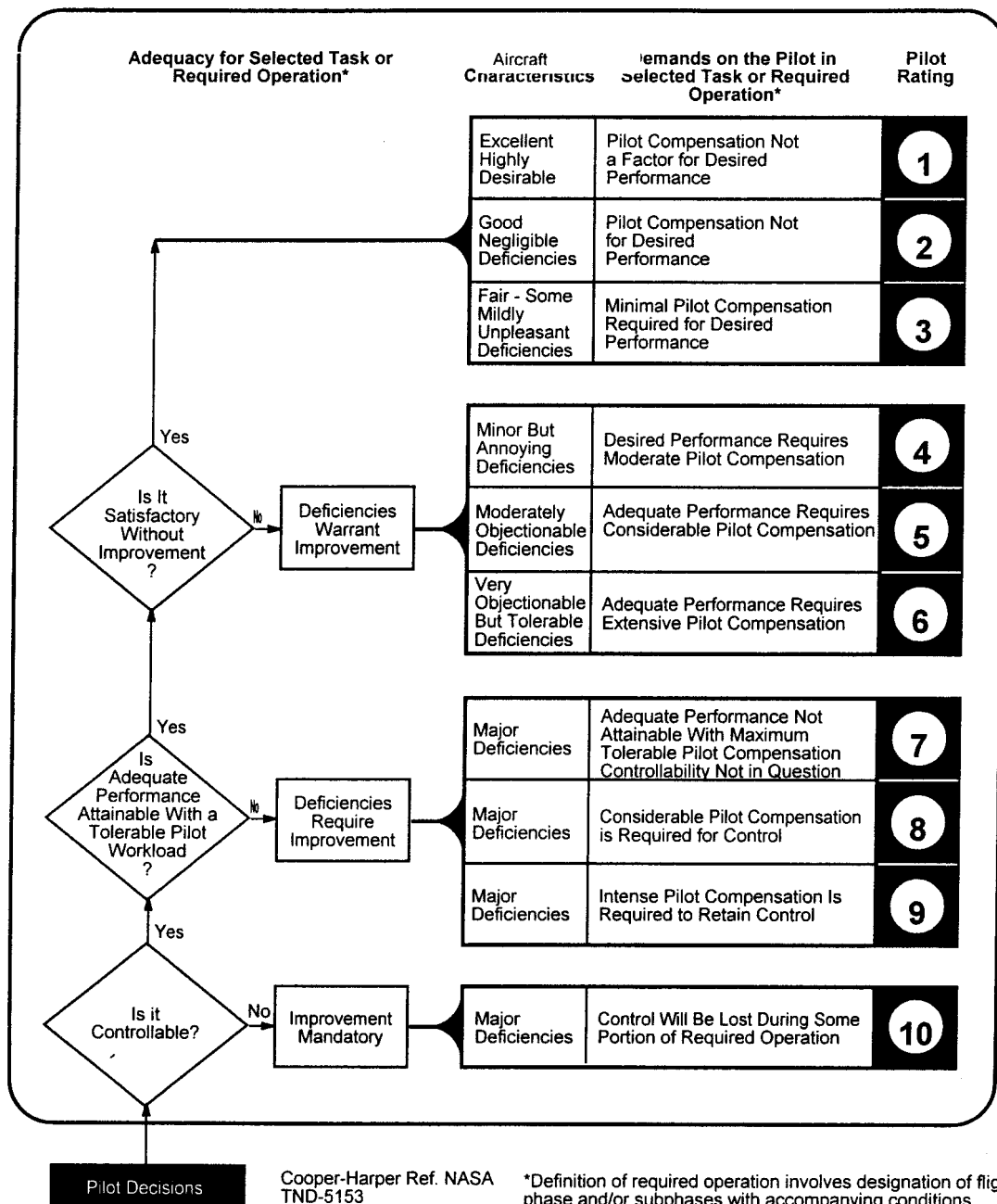


FIG. 6. Cooper-Harper Rating Scale

Thresholds - Ratings vary from 1 (excellent, highly desirable) to 10 (major deficiencies). Noninteger ratings are not allowed.

Sources -

Connor, S.A. and Wierwille, W.W. Comparative evaluation of twenty pilot workload assessment measures using a psychomotor task in a moving base aircraft simulator (Report 166457). Moffett Field, CA: NASA Ames Research Center; January 1983.

Cooper, G.E. and Harper, R.P. The use of pilot rating in the evaluation of aircraft handling qualities (AGARD Report 567). London: Technical Editing and Reproduction Ltd.; April 1969.

- Crabtree, M.S. Human factors evaluation of several control system configurations, including workload sharing with force wheel steering during approach and flare (AFFDL-TR-75-43). Wright-Patterson Air Force Base, OH: Flight Dynamics Laboratory; April 1975.
- Harper, R.P. and Cooper, G.E. Handling qualities and pilot evaluation. AIAA, AHS, ASEE, Aircraft Design Systems and Operations meeting, AIAA Paper 84-2442; 1984.
- Krebs, M.J. and Wingert, J.W. Use of the oculometer in pilot workload measurement (NASA CR-144951). Washington, DC: National Aeronautics and Space Administration; February 1976.
- Lebacqz, J.V. and Aiken, E.W. A flight investigation of control, display, and guidance requirements for decelerating descending VTOL instrument transitions using the X-22A variable stability aircraft (AK-5336-F-1). Buffalo, NY: Calspan Corporation; September 1975.
- Ntuen, C.A., Park, E., Strickland, D. and Watson, A.R. A frizzy model for workload assessment in complex task situations. IEEE 0-8186-7493, August 1996, pp. 101-107.
- Schultz, W.C., Newell, F.D., and Whitbeck, R.F. A study of relationships between aircraft system performance and pilot ratings. Proceedings of the Sixth Annual NASA University Conference on Manual Control, Wright-Patterson Air Force Base, OH. 339-340; April 1970.
- Wierwille, W.W. and Connor, S.A. Evaluation of 20 workload measures using a psychomotor task in a moving-base aircraft simulator. Human Factors. 25(1), 1-16, 1983.