of one or more other intellectual functions such as language, spatial or temporal orientation, judgment, and abstract thought. Onset is usually but not always insidious, and the patient may or may not be aware of the dementia. Deterioration may vary from subtle changes that are overlooked by coworkers, family, and friends, to totally incapacitating.

Is there a level of cognitive dysfunction acceptable in a part 121 pilot? On a particular basis, can pilots be screened for mild cognitive deficits or for the ''normal'' age-related cognitive decline? Can early dementia be identified before the affected pilot becomes a risk? How do we know when the pilot becomes a risk? How specifically are the deficits identified through currently available neuropsychological testing related to performance and to the real requirements of piloting? What is an acceptable level of risk in aviation? When does the incidence of cognitive deficit become unacceptable? Are current proficiency evaluations adequate for determination of a pilot's ability to perform adequately under every reasonably anticipated circumstance regardless of age? At present, adequate answers to these questions have not been provided.

In its 1981 report, the Institute of Medicine (IOM) of the National Academy of Science (on which the NIH report is based) noted that in addition to the increased incidence of cardiovascular disease and degradation in cognitive functions associated with aging, other effects of aging become more prevalent. For example, diabetes, thyroid disease, pulmonary dysfunction, and gastrointestinal malignancy are more common with advancing age.

There is other deterioration with age. For instance, research points to a decline with age in the speed and/or quality of many aspects of perceptual and motor functioning. In the general population, the ability to see fine details declines slightly in adulthood until about 60, and more markedly thereafter. With age, there is typically some loss in ability to hear effectively; the higher the frequency beyond about 1,000 hertz, the greater the loss.

Clearly, there is progressive anatomic, physiological, and cognitive decline associated with aging, albeit variable in severity and onset among individuals. Physicians, psychologists, physiologists, and scientists of other disciplines have identified many age-associated variables, some easily measurable, some not, that may be important to human function. There may be other variables, not yet identified, that play an equally significant role. We know that, at some age, everyone reaches a level of infirmity or unreliability that is unacceptable in a pilot in air transportation. That age will vary from person to person but cannot yet be predicted in a specific individual. Because it is unacceptable for these pilots to work until failure or until there is obvious impairment, the age of 60 has served well as a regulatory limit since 1959. Many commenters state that the Age 60 Rule is arbitrary and there is no scientific basis for it. Others would choose a different arbitrary age. For instance, the Acting Chief, Adult Psychological Development, Behavioral and Social Research Program, NIA, submitted a comment in 1993 on behalf of the NIA. He states the view that the age limit could be increased ''to an age closer to the mid-sixties.'' However, the studies he cites do not point to an age closer to the mid-sixties any more definitively than they point to the age of 60 as an appropriate age limit.

While science does not dictate the age of 60, that age is within the age range during which sharp increases in disease mortality and morbidity occur.

II(b). Hilton Study and Other Accident Rate Studies

Over the years, several reports have examined the rate of accidents as they relate to age in various populations groups, in an effort to better understand how aging may affect safety. As discussed above, the Hilton Study was initiated by the FAA to look at accident rates in pilots. Many commenters state that the report provides justification for a rule change. They point out that the report shows the same accident rate for pilots who are 50 and pilots who are 65. They state that the report finds that accident rates of part 121 pilots decrease with age. Some other commenters, however, state that the report does not provide justification for a rule change. They state that the report is not meaningful since correlating accident rates solely with total flying hours and recent flying hours is not a valid measurement. They also state that it is not meaningful to compare private pilots who fly beyond age 60 with pilots who fly a lot of hours per year in part 121 operations.

David Michaels, Ph.D., MPH, Associate Professor of Epidemiology, The City University of New York Medical School, submitted comments on the Hilton Study. He points out that accident rates are a very crude tool to examine the relationship between pilot age, health, and performance. The IOM, he notes, ''recognized the existence of a fundamental problem: since there are no Class I pilots flying Part 121 flights beyond age 60, there are no medical, performance or even accident data on the group of greatest interest. Needed are data on vision, reaction time, judgment, circadian rhythm and many other neurobehavioral and physiological measures.'' This problem led to the IOM's recommendation that extensive additional data be collected and analyzed to better understand the relationship of aging and pilot performance. Dr. Michaels notes that the Hilton Study did not take the approach recommended by the IOM. Rather than examining the neurobehavioral and physiological measures detailed by the IOM, the authors of the Hilton Study examined only accident rates. (However, the authors of the Hilton Report fully carried out the work statement of their research contract with the agency which asked only that accidents be studied.)

Dr. Michaels further noted that numerous studies have demonstrated that, among various groups of pilots examined, increasing accident risk is associated with increasing age. He includes papers by Golaszewski (1983); Mortimer (1991); and an analysis by the Office of Technology Assessment (1990) which support this finding. He also invites attention to the citation by the NIA Report of studies by Harper (1964); Lategola, et al (1970); Rohde and Ross (1966); and Booze (1977), all demonstrating increasing risk with increasing age. Dr. Michaels warns that it would be contrary to customary epidemiologic practice to accept unconditionally and definitively findings from a single study that are substantially different from those of previous studies.

There is contention regarding the Hilton Study's grouping of pilots for comparison purposes. Richard Golaszewski, the author of two papers on the relationship between pilot age and accident rates, belives that the Hilton Study's conclusions are based on the use of a group of pilots (holders of Class III medical certificates who have more than 500 hours of total flight time and 50 hours of flight time in the last year), inappropriate for inferences about the likely accident rate performance of airline pilots of age 60 and above. He believes this group is least like airline pilots and suggests his own alternative: Professional pilots who did not fly for airlines but who held Class I or II medical certificates. Mr. Golaszewski cites the Second Golaszewski Report for conclusions opposite to the Hilton Study—increases in accident rates with age for professional pilots.