Committee V
Cross-Culturalization: The Role of
Transportation and Communication

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AIR TRANSPORT

by

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ABSTRACT

Aviation is faster, cheaper, and safer than other forms of transportation, with all three of these advantages becoming more significant as distances increase. Aviation has enormous impacts on our lives, far beyond the immediate effects due to our own flying. Examples are given of the impacts which aviation has had that affect cross-culturalization: the obvious increase in contacts as people travel; the tendency to increase multilingualism and thereby intercultural communication; and the globalization of manufacture. The paper examines some aspects of the future of aviation with respect to their impacts on cross-culturalization. It is concluded that supersonic aircraft, which cruise in the range of two to three thousand kilometers per hour, will probably be commonly used for transoceanic travel by the early twenty-first century, but that hypersonic aircraft, traveling two or three times that fast, will not be in commercial use in the foreseeable future. Wayports--airports especially designed as transfer hubs with few origin-and-destination passengers--will not be common except for "superports" on the coasts for transfer between transoceanic and domestic traffic. Safety is examined and it is concluded that the present trend to increase weight and cost to obtain ever smaller increments of safety must decrease in the future. The future of automation in aviation is examined with the conclusion that new applications of

computers will be developed, but that human control will remain an important part of both air traffic control and the piloting of aircraft for the foreseeable future.

Do you know where you are? I know where I am. I am at 37 degrees 23.4 minutes North and 126 degrees 48.9 minutes East, which puts me just a few miles north of the center of Seoul, and in this hotel. It says so right here on this little hand-held device, called a GPS (for Global Positioning System) receiver. But it can be much more precise than that, and so if this hotel had been adequately surveyed and if it had an auxiliary device called "differential," I could say with confidence that I was at the front of this room. This receiver is responding to four of the twenty GPS satellites revolving some 20,000 kilometers above the surface of the earth. Russia has a similar system called GLONASS (Global Navigation Satellite System), and both the U.S. and Russia have committed themselves to providing this service (which has cost each of these countries billions of dollars) free to the aviation community and to all other users, at least until 2003. The availability of this receiver, which costs only a bit more than one thousand dollars, has been in significant part due to aviation, although the ultimate market for such receivers, which is surely in the millions, depends upon boaters, hikers, truckers, and numerous other markets. I will talk more about satellites later, but for now I want to concentrate on aviation.

I want you to consider a world without commercial aviation. This is not through lack of invention. I'm asking you to consider a world in which people are just like they are now and they know as

much science and technology as we know now, but the laws of aero-dynamics are such that flying is difficult. The total achievements of aviation in this gedanken world would be about what the present achievements are in man-propelled aircraft. It's been possible to fly a figure-8 course and to go a few miles, but that's the limit.

I think the changes would be more far-reaching than one might at first guess. For example, in my real world I can buy fresh tomatoes in February in my grocery store only because they are flown in from a tropical country. In my nonaviation world I would have to wait until summer for fresh tomatoes, nor could I purchase the enormous variety of other foodstuffs, fresh and preserved, from dozens of countries all over the world; but the grocery store would be different in far more important ways. In my country most grocery stores are now owned by chains. These chains originated seventy years ago because of the availability of other forms of transportation, notably refrigerated railroad cars. They survive today because they are able to exercise efficient management and efficient acquisition. But in a world without aviation the managers would not be able to visit these stores to make them more efficient, unless they were willing to spend lengthy and exhausting trips by surface. The high degree of automation and mechanization of many of the services in my grocery store, which now rely on the availability of spare parts by air express or repair by experts who can be flown in, would

have to have a large inventory of spare parts and would have to be made much more reliable and therefore much more expensive. Supermarkets and hypermarkets wouldn't exist; we would be back to "Mom-and-Pop" stores (which might not be a bad thing).

Of course the grocery-store example is trivial, but I use it to indicate that air transport is involved in everything we do. Surely wars would be very different without aircraft. It is too much to hope that wars would cease. As of this writing, people in Somalia, Armenia/Azerbaijan, Yugoslavia, and other places manage to carry out quite vicious wars without significant use of aircraft. But surely the war against Iraq would have looked very different--not only the absence of bombing, but the fact that the US could not have transported so much materiel to the theatre of war. Finally, nuclear weapons would be less of a threat if they could not be dropped from aircraft.

What would happen if scientists from around the world could not easily compare notes to take advantage of the research of others by holding international meetings? Quite apart from the transportation of goods, would industry become internationalized if the people from various countries could not easily visit each other? Would Thomson-CSF have come from France to Kansas to visit Wilcox and then purchased that company if they could not have traveled easily? If governments could not easily meet at the United Nations, what would happen to world peace? Would we

just let millions of people die if there were drought in Africa or a flood in Bangladesh or an earthquake in Armenia? Would there even be a UNICEF or a World Health Organization or any other of the world-wide organizations which are so beneficial to our civilization?

It would be fun to continue playing this game, but I don't think it's necessary. I think we are all prepared to stipulate that aviation has had an indelible effect upon the lives of all of us--far beyond the primary effects due to our own travel. I wish to explore how it has effected cross-culturalization in the recent past and how it will affect it in the future.

None of this is new. I quote from Samuel Smiles in 1862: "every limitation of movement on the part of the members of society amounts to a positive abridgement of their personal liberty. Hence roads, canals, and railways, by providing the greatest possible facility for locomotion and information, are essential for the freedom of all classes, of the poorest as well as the richest." Had Smiles been writing 130 years later, he would surely have mentioned aircraft.

In 1940 I wanted to personally kill Hitler, so I went to Floyd Bennett Field (which no longer exists) in Brooklyn, NY, to enlist in the U.S. Marine Corps as an Aviation Cadet. I had to be interviewed by a Capt. Winston, and when I went to his office I

was told "sit down and wait, he'll be back in a few minutes. He just went to Philadelphia." I couldn't believe it. Going to Philadelphia was something one planned for, and spent a day at. I tell this anecdote to illustrate how much our attitude toward transportation has changed. Today if I stated that I had gone from Washington, D.C., to Europe for the day, no one would be surprised (except those who know that I'm not rich enough to fly the Concorde).

As recently as 1800, many (perhaps most) people never went farther than walking distance from their homes in their entire lives. There were roads (but not very good ones, and they were subject to brigandry), so it was possible to travel by horse-drawn wagon or on horseback, and even to go overseas by slow, unreliable, and dangerous sailing vessels. Very few people in America or western Europe ever visited the Orient, and even fewer made the reverse trip. Such trips were not only dangerous and exhausting; they took a large fraction of one's lifetime, and the expense exceeded a year's wages for an ordinary workman. Englishmen who emigrated to Australia in the early nineteenth century generally never again saw any of their family. By contrast, I visit my grandchildren in Utah, 3000 kilometers from my home in Washington, D.C., frequently; it takes a bit over three hours, and costs only a day's salary.

Let me give another example. At the end of each year I send out greeting cards to my friends. Almost half of those go outside of my country, and more than half of the remainder go outside of my city and its immediate vicinity. Of course without aviation those letters to other countries would take weeks to deliver instead of days. But the point is that I wouldn't be sending most of those cards because I wouldn't have friends in those other countries and distant cities. Yes, people traveled before we had aviation, but rarely. I would not be at this meeting if I were not able to come by air (and neither would most of the rest of you other than the Koreans), and then I would never have met most of you wonderful people and my horizons would have been drastically restricted.

International travel by air became significant less than thirty-five years ago with the commercial introduction of jet aircraft--the British Comet, and in the U.S. the Boeing 707 and Douglas DC-8. In 1960 you could fly from New York to London (albeit at a considerably higher price than today); but if you wanted to go from Pittsburgh to Frankfurt you had to take three airplanes, which was at best tedious and at worst involved delays, lost luggage, and missed connections. Today you can fly at modest cost nonstop from Pittsburgh to Frankfurt, and as a result people are flying from
Western Pennsylvania to Germany, and maybe even learning to speak a little German.

Let me expatiate a little on the language question. Clearly if two people do not speak the same language they are limited in their ability to exchange insights into one another's cultures. A person who can speak many languages is said to be multilingual. A person who can speak two languages is said to be bilingual. A person who can speak only one language is said to be an American. But the situation is improving. To obtain a doctorate I had to prove that I could read French and German but I was never expected to speak these languages. My two youngest grandchildren (the oldest is under seven) are completely bilingual (Spanish and English). And aviation is helping in several ways. My oldest grandchild is fluent in French because she has been able to spend time in France. Many United State airlines are encouraging (or even requiring) their flight attendants to speak one or more foreign languages.

Language has been a source of conflict between cultures. The Japanese have long complained that one of the reasons Americans have so much trouble selling goods in Japan is because Americans have refused to learn the Japanese language, and have even been unwilling to come to grips with Japanese culture. The Americans complain that in the numerous Japanese-owned factories in the U.S. the workers are almost all Americans and the executives are almost all Japanese. Both are correct. The Japanese culture must change to admit foreigners into their management schemes and

the Americans must change by trying to speak foreign languages. Aviation is helping in all these things because more and more it is bringing people from their own countries into other countries where they see the necessity for these changes.

The Boeing Company is developing a new commercial air transport, the B-777; this development is completely different from the development of its first commercial jet, the B-707, almost forty years earlier. To develop the 707 Boeing went to its customers, which were airlines of the U.S.--American, United, TWA, Pan Am, etc.--and asked them what they wanted. But today the majority of the 777s will probably be sold overseas. And so today Boeing cannot talk just to American-flag carriers; it has to ask JAL and even Air Zaire what they want. Furthermore, the 707 was essentially a totally American plane in all of its components, but the 777, while it is designed and assembled in the U.S., will consist largely of components manufactured elsewhere. In part this is because no profit-making company can afford to "bet your company," that is to undertake single-handed the multibillion dollar risk of the development of such an aircraft. But it is also due in part to the reduced cost of transport, which means that it may be cheaper to buy a part manufactured in Europe or Asia and fly it to the U.S. than to try to manufacture it locally. The manufacture of aircraft, perhaps more than any other industry, has become completely globalized.

Another matter is the metric system. Clearly the United States, the last major holdout, will eventually have to go metric, and aviation is helping here. If American manufacturers are making parts for Airbus planes and European and Asian manufacturers are making parts for Boeing and McDonnell-Douglas planes, those parts are going to have to be metric. A couple of countries (China and Russia) are already giving ATC altitude clearances in meters. Inevitably the present international system of altitudes in feet, speeds in knots, and distances in nautical miles (which aren't even the same as ordinary miles) is going to have to go, and it may go soon in international aviation.[1]

What is going to happen to aviation? Let me talk first about safety, a topic on which people tend to be rather irrational. Any DGCA (Director General of Civil Aviation, a generic term--in the U.S. we call him the Administrator of the FAA), any chief executive of an aircraft manufacturer or of an airline, will invariably say that safety is the most important thing, that there can be no tradeoff for safety. But that's nonsense--of course there are tradeoffs for safety. Surely we want more people to survive after an airplane crashes, and so, for example, the recent change to more fire-proof fabrics in aircraft has been a very worthwhile expenditure. But do we really want to carry hundreds of liters of water to spray on a fire after the crash, as is being widely urged? Do we really want to carry "smoke hoods" which people can put on their heads so that they can

breath while they're evacuating a smoke-filled aircraft? According to the British Civil Aviation Authority, "Analysis of fire accidents over the past five years shows that the potential for smoke hoods to save lives has been reduced to about one life per year worldwide even on the unrealistic assumption that smoke hoods would have introduced no additional delay in the evacuation." But in fact there are many reasons to believe that smoke hoods would indeed delay evacuation and cause many additional fatalities. Nonetheless there is considerable pressure to require smoke hoods.

Consider "infant restraint seats," a seat like a car-seat which can be strapped into a regular airplane seat. Infants under two years of age are now permitted in the U.S. to be carried in the lap of an adult. In certain types of crashes such infants are inevitably torn from the arms of the adult, and in the crash of a DC-10 at Sioux City, Iowa, in 1989, one infant did die who could have been saved had it been in an infant restraint seat. However, in U.S. jet aircraft crashes in the past ten years that was the only infant death that could have been prevented by such seats. If adults were required to purchase an extra seat for an infant, our calculations indicate that 80% of the two million infants who fly today on U.S. jets would have seats purchased for them, but in the other 20% the adults would instead choose to drive. Because driving is so much more dangerous than flying, for each infant death prevented there would be six deaths and

dozens of extra injuries. Nonetheless U.S. Congressmen have introduced legislation requiring the use of such seats for all infants.

How much safety is enough? It may depend on the culture. If certain stereotypes were true, Russians are perhaps more fatalistic than Americans; perhaps the Spaniards would find it "macho" to accept a risk; Italians perhaps are more interested in a gamble (which implies a risk). But there's also something very personal in a question like this. Today if you or I pick a flight at random on a scheduled commercial jet of one of the developed countries, the probability of getting killed on that flight is about one in five million. Other types of flying are more dangerous: on U.S. "commuter" aircraft (usually turboprops rather than jets), the probability of getting killed is about one in one million; on a commercial jet of an LDC (Less Developed Country), the probability is about one in half a million. Charter aircraft may be more dangerous than scheduled aircraft, and small private planes may be far more dangerous. But people who are terribly afraid to fly, willingly do things which are much, <u>much</u> more dangerous, such as smoking, eating excessively or unhealthily, or failing to buckle seat belts in cars.

Let us consider a hypothetical situation in which I was told that the flight I was about to take was going through some very dangerous weather or other situation, and my probability of

getting killed was fifty times as great as one in five million, namely one in a hundred thousand. Personally, if I were in a hurry and felt strongly about getting there, I don't think the probability of one in a hundred thousand would bother me. On the other hand the DGCA could not accept such a risk; we have millions of flights in the U.S. each year and the DGCA could not accept dozens of accidents.

How much safety can we afford? In the future there will be far more airplane flights than there are now, so that even if the accident rate remains the same the number of accidents may go up to an unacceptable level; and because the increased number of flights will create an increase in congestion, the accident rate may actually increase. But suppose we could bring that risk down from one in five million to one in ten million by doubling the cost of flying. Would we want to do that? Will there be international standards? Will one country decide that it is willing to accept a risk of one in two million rather than one in five million in exchange for cheaper flights or flights that are more reliable in the sense that they are less likely to be cancelled? These are significant cultural questions.

What's going to happen to "General Aviation", the private planes--usually small ones--which make up the bulk of the aircraft? In the U.S. there are more than fifty times as many small, privately owned airplanes as there are commercial jet

airliners. These planes are a sign of affluence, and other countries are rapidly rivaling or exceeding the U.S. in their level of affluence. Will they begin to experience increases in general aviation? Will a German find it easy and even routine to hop into his single-engine plane to go to France for lunch?

If the abundance of private flying in the US is related (as I am sure it is) to both the vast distances of that country and to its affluence, what is to keep the same thing from happening in China or India in the 21st century. If South Korea can go from a devastated and impoverished country to a tremendous economic power in forty years, why cannot China? And if they do indeed become affluent, what will be the effect of millions of Chinese becoming tourists in Europe and America? Could a restrictive government survive that type of cross-culturalization? Surely not!

One of the things that has led to considerable cross-culturalization is the availability of commercial air transport even in small cities. We are now developing a whole new fleet of vertical-flight aircraft and STOL (Short TakeOff and Landing) aircraft, which will make it ever more convenient for rural people to travel. This will surely increase cross-cultural contacts.

I mentioned earlier GPS and GLONASS which utilize satellites to permit navigation with accuracies of a few tens of meters; with a ground-based modification called differential, the accuracy can be improved to about a meter. GPS is now in experimental use over the North Pacific Ocean, whereby a plane determines its position and then this position is sent automatically to an air traffic control center which is then able to control traffic just as if it had a display from a radar. This allows planes to be much closer together and still be completely safe, especially since they now carry a collision-avoidance system which alerts them to any plane which is close by. Satellites are also being used more and more for communications. Air traffic control instructions and weather information--even weather maps--can now be sent, either orally or through a data link, via satellite, directly to and from the cockpits of aircraft anywhere in the world (except in the polar regions). I cite this as an example of how the latest technology is making aviation more efficient and safer--as well as the way in which aviation is permitting such advanced technologies to be developed so that they may be applied to other aspects of our increasingly complicated civilization.

What about supersonic and hypersonic flight? Supersonic planes are those that go faster than the speed of sound, which is about twelve hundred kilometers per hour; hypersonic usually means that a plane can go faster than five or six thousand kilometers per

hour. The Concorde, which carries about 100 passengers, has been flying commercially for nearly twenty years; it cruises at more than 2000 kilometers per hour. But it has been an economic failure, and if there were more than a handful of these planes they would have been an environmental disaster. Countries all over the world are now designing new High Speed Civil Transports (HSCT). They will go at most only a little faster than the Concorde, but they will be wide-bodied and carry 250 to 300 passengers, which will make them more economically viable. They will have twice the range of the Concorde, which will allow them to cross the Pacific (the Concorde is confined to the Atlantic). Obviously if I could get to Seoul in five hours instead of twelve, I'd be much more likely to come here. And note that during those five hours I will be in constant contact with my office, if necessary, through satellite communications. But there remain serious questions as to whether these HSCTs can meet the stringent environmental constraints that are being imposed by an increasingly environment-conscious world. The noise level at landing and takeoff may be intolerable; the "sonic boom" that always accompanies supersonic flight is surely intolerable and will probably prevent any commercial plane from flying supersonically over land in the foreseeable future; and the nitrogen oxides in the exhaust from the engines of supersonic aircraft are particularly destructive to the ozone layer because they are released in the stratosphere where supersonic planes must fly.

I would guess that there is a fifty-fifty chance that these problems will be solved; if they are solved, commercial HSCT's will be flying over the Pacific Ocean in large numbers twenty years from now. I think it more likely that Dr. Singer's idea of a high-speed unmanned freighter will be practical in that era. It can have quick turnaround, and can be operated twenty-four hours a day. It requires no amenities, not even pressurization. And it need not have anywhere near that one-in-five-million safety target. So it will be much cheaper. But the hypersonic plane which will go over the Pacific in a couple of hours, while technically feasible, is probably not going to be available for routine commercial traffic in the lifetime of anyone in this room.

Most people involved with the design of the HSCT and its supporting systems believe that it must be designed to operate from existing airports, but I personally disagree with that conclusion. I believe that we will see "superports" specifically designed for the HSCT. The HSCT will be too tall for existing terminals, and too long for existing taxiways; it may require special fuels; and there may be other differences in the requirements for airport infrastructure. I envision one superport on the east coast of the U.S., perhaps in Delaware or southern New Jersey, and one on the west coast, perhaps in Oregon or in the deserts of southern California. There should be one in northwestern Europe (Shannon, Ireland; Prestwick, Scotland; or

somewhere in Scandinavia seem possible locations). There should be one in northeastern Asia, maybe in Kamchatka, and there might be one in southeastern Asia, India, Australia, South America, and/or southern Africa.

The superport would also be designed to handle aircraft larger than any now flying or even on the drawing boards, for example a plane designed to carry 1000 passengers. This larger aircraft is not easy to build. The laws of physics state that if you take a 125-passenger plane, say a Boeing B-737, and make it twice as long, twice as wide, and twice as high, with all components doubled in that way, it would be eight times as big (and hence could carry 1000 passengers), but it wouldn't fly: it would have four times the wing area and therefore four times the lift, but it would have eight times the weight, and so the weight would greatly exceed the lifting capability. Nonetheless such large aircraft could be designed and would be economical; airlines would want them (and so manufacturers would build them) if they thought the demand were there and the airports and associated infrastructure were available. Note also that the 1000-passenger plane gets more passengers in and out of an airport per landing and takeoff, where the number of landings and takeoffs may be the limiting factor in the capacity of the airport. Present airports could not support the weight of such planes, and again different terminals would be required (the planes would be too wide for the alleys between terminals, and simultaneous use of several doors

and jetways would be required to emplane or deplane 1000 people). Our superports will be designed for all that.

The superport will be specifically designed as a "hub" by having many parallel runways so that lots of aircraft can land in a short period of time, then all the passengers and baggage will shuffle off to other airplanes, and then all of these aircraft will take off to their varied destinations--domestic or international--again in a very short time. Passengers coming from or going to nearby domestic points would travel in tiltrotors (a new airplane which takes off like a helicopter and then flies like a conventional aircraft), while those whose domestic origin or destination is farther away would utilize conventional jets.

The principal problem would be that our passenger who wants to go from Pittsburgh to Frankfurt doesn't wish to change planes twice by going through superports. Of course many passengers flying from Pittsburgh don't live there, and had to fly from somewhere else anyhow. Nonetheless, to make the superports work we are going to have to persuade these passengers to use them, either by low landing fees there and large landing fees at all other airports for transoceanic flights, or by regulation, forbidding transoceanic planes from landing at other airports. Whether our cultures will be ready to accept such regulation is hard to state at this time. But if they are, our future passenger will have

his choice of saving time (the HSCT) or of saving money (the 1000-passenger plane).

Suggestions for smaller domestic airports which, like the superport, are primarily designed for people who will change planes (rather than for origin-and-destination passengers) have been made frequently recently, especially in the U.S. The idea is that such "wayports" will relieve the congestion at hubs such as Chicago's O'Hare, the world's busiest airport, where half the passengers are merely changing planes. But there are problems. Many airports make up to half their income from parking lots, automobile rentals, and other "concessions" which would not be present at a wayport. They would therefore have to charge larger landing fees, in which case airlines would need some enticement to stop at them. An airline would probably prefer O'Hare in any case, because in addition to the transfer passengers there would be lots of customers who wish to start or end their travel in Chicago.

We have examined what airports might look like in the future. What will the aircraft of the future be like? There may well be minor national differences. In August 1985 a Japanese 747 crashed with a loss of 520 lives. This seems incredible to Americans who would not tolerate the closely spaced seating required to put 520 people on a 747.

More generally, what level of automation will take place in the early twenty-first century? Most airplane accidents are caused by human error, and so it seems obvious that if we replace the human decision-maker by a computer this will decrease the accident rate. Like many things which seem obvious, this is wrong. We are aware of dozens of accidents which have occurred because the automation systems failed or were not well adapted to interact with the human controllers of the system. Yes, automation is wonderful, but it must be designed with the man-machine link in mind. We frequently hear the assertion that 65% of all accidents are caused by human error. This is wrong; 100% of all accidents are caused by human error. If it was mechanical malfunction then it was human error in maintenance or human error in the design. If it was weather-related then there was human error on the part of the pilot in going into the storm, or on the part of the weather service giving inadequate warning to the pilot.

We are now far more conscious of "Human Factors" or, as it's called in Europe, "Ergonomics," and we're beginning to apply these concepts in a much more sophisticated fashion. When I wrote a chapter on "Human Engineering" in a book on "System Engineering" published thirty-five years ago, the subject was largely concerned with the design of knobs, dials, and other input-output equipment. Today we are deeply concerned with the selection and training of people who will be monitors as much as

they will be controllers. How do we keep operators (be he or she pilot or air traffic controller) from being bored and becoming inattentive when much of their time is spent watching an automated system take care of itself? How do we keep their skills from rusting away to the point where they are unable to take over in an emergency or when the automation fails? These are fundamental questions which are being studied intensively. We do know that it is possible in the most modern airplane (such as the Airbus A-320) to set a group of buttons and knobs and controls on the runway before takeoff and then allow the plane to take off, fly to its destination, and land, without ever having the pilot touch the controls (that is why Dr. Singer's high-speed unmanned freighter is surely technically feasible). We know that such hands-off operation is technically possible today; we doubt very strongly that it will occur operationally within the foreseeable future. Even if it were safe, it would not be subjectively acceptable.

And finally, let me tell you an anecdote about a transAtlantic flight that occurred in the year 2000. The loudspeaker came on, and the captain's voice was heard announcing "we have reached our cruising altitude of 11,000 meters, the outside temperature is minus thirty degrees Celsius, our cruising speed is 900 kilometers per hour. Our flight time will be five hours thirty-seven minutes, and we will be touching down at London's Heathrow Airport at 6:32 A.M. local time. This is a recorded

announcement. I want you to know that you are privileged to be flying on the first fully automated flight from the United States to Europe. There are no personnel in the cockpit, everything on this airplane is being run by computers. These computers and this automated flight have gone through the most exhaustive tests, and so we want you to lean back and relax and have complete confidence. You have our assurance that nothing can go wrong...nothing can go wrong...nothing can go wrong..."

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Notes.

1. This is my personal opinion. However, the Secretariat of ICAO (International Civil Aviation Organization) has concluded that "there is little or no prospect in the foreseeable future that the majority of States will agree to the use of the metric instead of the foot for the measurement of height" or the substitution of kilometers for nautical miles in measurement of distances and speeds. The "FAA (U.S. Federal Aviation Administration) has no plans at this time to support such a conversion either domestically or internationally through ICAO. However, the FAA will continue to work through ICAO to evaluate and consider any feasible efforts in regard to metric transportation." The FAA, like most other U.S. government agencies, is working hard to expedite metric conversion where it will not impact safety, e.g. in procurements, specifications and drawings for airport design, etc.