Remarks by

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I am delighted to be here although I must say that when I arrived in the state yesterday morning, I landed at Los Angeles International Airport and was soon confronted with one of those rumbles that go on there periodically and I was wondering whether there was any message that was being directed to me.

Considering the fact that, in recent weeks, we have been through a period of fairly extensive economic news, both financial and for the economy as a whole, I thought I'd like to use this morning to step back and take a look at some of the longer term characteristics of the American economy and Americans' attitudes toward it because you can't really get a useful judgment as to where the short term is coming from or where it is going, unless you have a broader context in which to set the events that we tend to observe hour by hour and day by day.

One of the more interesting characteristics which has come up in recent weeks is that despite what is obviously solid evidence of economic strength -- and I outlined much of this in testimony before various Congressional committees so far this year -- there seemingly inexplicably remains an extraordinarily deep rooted foreboding of the outlook amongst a not insignificant part of our population. For example, recently the Los Angeles Times had a poll which indicated that half those polled expected that the next generation will face lower living standards than currently prevail. And a recent NBC Wall Street Journal poll picked up something which I find surprising -- that two-thirds,

more than two-thirds, are not confident that the lives of their children would not be better than theirs. The question is how do we explain this extraordinary set of affairs.

As a practical matter the implication of standards of living actually falling presuppose that productivity actually goes down, and that in turn would mean we would have to dismantle a significant part of our capital stock and lower our efficiencies to literally lower the level of activity. So it's fairly apparent that what we are observing is something significantly different from a real decline in standards of living. I think the reason that explains this type of response -- and we have been picking it up now in polls for quite a long while -- is essentially the fact that after a period of several decades, income distributions in the United States have begun to disperse.

During most of the post World War II period, the rate of increase of income in the below-average income levels was actually somewhat higher than the above-average which meant that we were beginning to get a convergence of income distributions in the society. Then starting maybe twenty years ago you began to see a dispersion occurring and a fairly significant shift amongst a certain group of wage earners who are not a small part of the population and, in fact, in real terms the wages of the production workers as the Bureau of Labor Statistics likes to call them, actually went down for a good part of the period. Clearly what this implied was that since the average was going up you were getting a spreading out and indeed where we do have

evidence of income distribution spreads, that is very clearly evident.

This is not a problem which is indigenous to the United States alone. Very similar data are showing up in Canada, Germany, Sweden and Australia, implying that what we are dealing with is not something which is strictly related to the United States but a more global force that is at work. If you begin to look into the causes of this process, the first thing that strikes you when you begin to get under the data is that the effect of education is becoming increasingly important to one's level of income. Thirty, forty years ago for example, the average level of income of say a high school drop-out would be here, a high school graduate here, and a college graduate there.

Currently, the numbers look something like here, here, and there. It has been spreading out and what were beginning to see is a very significant skill differential income relationship. And the question here is: what is doing it? When you look beneath that level of causation, what begins to strike you is that it is fundamentally technology, but it's a different type of effect if you look at the economics of it.

The best way of viewing what is happening is that an ever increasing, indeed perhaps an accelerating proportion, of our real gross domestic product is conceptual as distinct from physical. If, for example, we were to take the data that we produce on what it is we turn out in this country in terms of volume, in terms of tons and specific gravity and we added up all

of the iron ore, the lumber, the copper ore, the sand and gravel and the oil -- all of the raw materials that go into the production process -- we would find that the growth in that volume in tons would be very marginal, if at all. Nonetheless, the gross domestic product -- that is, the value adjusted for price change -- is going up quite substantially and hence it means that the ratio of real production versus the physical volume is inexorably rising, and one of the things that we know about ideas is that they are irreversible.

Short of the dark ages there has never been a time in human history where we have lost the knowledge that we have gained and accumulated over time. The important thing to realize about the changing structure of our economy -- and I am certain that the data amongst our trading partners on a lot of this is very much the same as ours -- is that what is happening is that the basic purpose of our economy is fundamentally unchanged. It is to serve human needs because it is human values and value judgments which through the marketplace will determine what is produced and how it is produced and that never changes. So that what we are looking at basically is not that there is any really dramatic change in the nature of our economic society but there is a very fundamental change in the nature of how and what it is we produce.

One needn't look very far to see examples of the issue of comparable utility or value being produced with less physical stuff. For example, fifty years ago we would have these large

radios with vacuum tubes and what we find we have today are pocket transistors with precisely the same function, indeed far superior, yet the physical volume of what is involved for the comparable economic value is demonstrably less. We have displaced and are displacing huge tonnages of copper wire and cable with fiber optics. We even find, for example, that the architecture and engineering professions advances, which are ideas, have made a very substantial change in the way we build buildings. If you try to tear down a building built, say one hundred years ago, it is very difficult. It is full of stuff. Yet the type of buildings we put up today -- thanks to far better engineering understanding, the improvement in the qualities of various different types of steels, the whole notion of architectural design -- means that for comparable space there is very substantially less stuff than in the past.

We even see that with the conceptual advent of central heating and air conditioning, the clothes we wear are much lighter, the fabrics are no longer that heavy woolen materials that used to be the main output of our textile mills. We even have a fairly substantial shift in the types of products which we consider of value which have very little in the way of physical output. For example, medical care is a crucial one in the sense that as the technology has increased in a substantial manner, the demand has really absorbed a huge amount of resources because that is what the society wants. It is ephemeral and conceptual

but it is just as important an economic good as a cold finished bar coming out of the nearest rolling mill.

We even fundamentally changed the way we produce goods and services. It's true, for example, that we have a fairly dramatic change in the way we create our manufacturing processes. But it really is startling when you don't look at it from a day-by-day or week-by-week basis, but you go back and look, say over a fifty-year period. Take the issue of the cold finished bar I just mentioned. Fifty years ago, these bars would be run through a steel rolling mill and you would have a lot of people, who in today's environment would probably be the tackles and guards of our professional football teams, lifting this stuff up and moving it and that was an economic value but it was physical. Today, you have somebody merely putting a few instructions into a keyboard and we get a whole new crane system which will pick up the bars and move them to a different location. And the issue of location is itself an economic value which we all learn in our textbooks. At the turn of the century, for example, we would take Mesabi iron ore and Western Pennsylvania coal, and move it into the Pittsburgh district and produce steel. Both the coal and ore had far greater value in the Pittsburgh district as indeed a century earlier coals in New Castle had less value than coals in London.

In the Twenty First Century, what we are very likely to see is the conceptual value units which are so critical -- which would be data, information, all of the things which people now

hold of significant value -- that a goodly part of economic value creation will be the locational changes that occur through telecommunications and all of the extraordinary transmissions that we have that exist in today's markets.

I said before that we are seeing very much the same thing in other countries. And the reason we know that is fairly simple because if we are downsizing our output, as indeed we are in a very dramatic and continuous sense, one would expect that because goods are easier to move, they are easier to move across national boarders and one would expect and indeed one finds a very dramatic increase in the proportion of the world's consolidated output which is involved in international trade.

If we look, for example, at U.S. exports for which we have data on the value, on the price by various different types of products, and the pounds which are shipped out, what we find is a fairly significant and progressive rise of several percent per year in the price-adjusted value per pound of what we export. In other words, there is an ever-increasing downsizing of what it is that we produce. And when we look at the products which are coming from all of our trading partners, we see precisely the same numbers -- that the world at large is downsizing which has extraordinary implications, incidentally, on the whole question of the environment and the use of resources on the physical amounts of stuff which creates pollution, waste and various different types of disposal difficulties as the population increases.

The one important issue about ideas is that they have none of those problems but they really matter. If one looks into the Twenty-First century and beyond and wonders how with an increasing population are we going to deal with the required outputs that one would normally associate with an industrial society, the answer is very obvious that this trend that we are looking at and have been looking at for quite a while is fundamentally irreversible and that more and more of value is going to be of that nature. This obviously raises a very interesting, and I must say disturbing, question which is: If, in fact -- and I think the evidence is very strongly in this direction -- that the basic thrust of the dispersion of incomes that we are looking at and the difficulties of numbers of elements within our society keeping up the levels of skills that are required, are we doomed into a much more dispersed income with all of the difficulties that one would consider that would create. I think the answer is probably not. And the reason really rests with the question of technology.

When I was much younger I was so proud we had this new big IBM computer and I had learned Fortran and all the computer software languages and I would write this stuff out and we'd punch up the cards and we would stick it in -- the thing would chug away and paper would come popping out and boy, this was a lot better than the abacus or slide rules. Today, all of that effort which I might have put in for two weeks, some lowly clerk typing into a very sophisticated software program will turn out

all of the economic value -- at least arguably the economic value I was producing -- in a fraction of the time, much higher quality, very little in a way of resources. And this raises something terribly interesting with respect to the whole process. While we have had a major improvement in the hardware in the system, the really important changes are in software. What this means is -- if you take a look at basically what it is we can do, you recognize something which we are learning ever increasingly to be the case, namely that there is no displacement of human intelligence, no matter what the level, by a machine.

There are certain types of things that every human being can do by the very nature of being human and making valued choices which my suspicion is we will never be able to fully replicate in a software system. One need only look at some of the problems that used to exist when people were trying to construct robots and they tried to construct how a hand moves -- you know the various different movements -- and they were going berserk. The complexity of what one does when you move your hand is beyond comprehension, or at least beyond comprehension to those who try to replicate it in a simple software program. And what this means is -- and we are already beginning to see it -- that there are certain types of jobs which one doesn't need even to have to know how to read to actually create a significant amount of value added.

If, for example, you had somebody who was unable to know what a certain type of product was in a retail store, but there

is a picture and if the person just punches the picture as an item is sold, a sophisticated software program will go fetch the good, deliver it, do the bookkeeping, do the accounting, and the whole thing will come out. Now, the interesting issue is that the person who pushed the button may not know how to read, but that person will know when to push it and when not, and that decision is very complex because you have to be able to communicate with another human being and it is really quite remarkable when we realize that the differential in human skill levels are really quite narrow.

The vast majority of things which human beings can do, everyone can do, and the difference between those basic skills and the highest human skills relative to what the base is, is really very small and not replicable in a computer system. This means that the economic value of those who are capable of making human judgments, if as we move toward an increasingly conceptual environment, the economic value of that is bound to rise because it is not machinerally reproducible. And while I don't know for sure, I do say that this process means that it is certainly possible for this issue of dispersion of incomes to stop and it is intriguing to conceive of the possibility that it may even well reverse. So I don't look at this whole question of income dispersion and technology as leading us into the types of problems which, I must say, several years ago worried me a great deal because it is terribly important in this country that to have a viable economy that everyone participate. You cannot have

a society which functions effectively for all unless all participate and contribute.

What this means essentially is that this whole computer technology structure -- as it evolves and as the software becomes ever increasingly important -- is going to create, as indeed it already has, a major increase in the market value of software companies. It's interesting the shift that has occurred over the years between hardware producers and software and the higher that the markets value the software the more the need for human actions -- human skills or semi-skills, the types of things that in order to make the software valuable you need people to do things and that means that what you do is you pull up the economic value, the marginal productivity of everyone in the society.

User friendly is a notion which is going to become not only sort of a cliche in the software business but something which is going to be crucial to the economic future of this country. Because all of this is to a very substantial extent international, it is not a surprise that we are seeing a very significant transfer of resources across borders and we are going to see in the United States, as far as I can judge, a world-wide competitive struggle which we have been involved with for quite a while, but it's pretty obvious to those of us who are looking at the data that the notions that the United States somehow can't cut it are clearly wrong. One of the reasons basically is that imbued in our culture is a very extraordinary sense of incentives

for risk-taking. It goes back to the beginnings of our society and economy.

One of the things that economists knew fairly early on is that risk-taking is a pre-condition, an essential, necessary condition for the creation of wealth. When you have a dynamic society in which risk-taking is a crucial element as ours is, it moves and churns in extraordinary ways -- the way, for example, Professor Joseph Schumpeter said a couple of generations ago what he called creative destruction. We are continuously renewing our system and in so doing what we do not realize is how dynamic everything is. For example, job loss in this country is something on the order of 300,000 a week. Since jobs are growing, obviously the job creation is even greater than that, and when you begin to look at this churning of new firms coming in and those who can't cut it falling by the wayside, you see this fairly dramatic change that is continuously going on. And when you got a cut across the technologies of the country, you see that in the high tech areas one of the most unusual things is that it is very difficult to stay up.

You may remember it is only relatively a few years ago when Japanese companies were about to take over permanently big chunks of the consumer electronics and related areas in this country. And it was true that back in 1987 and 1988 the trends were going very demonstrably against American companies. But what you have to remember is that many products that were at technology's leading edge, say five years ago, are virtually unsalable in

today's market. What you are dealing with is a new model every year and the whole system is up for grabs every year, which is the reason why the risk-taking propensity of America has been so crucial to the fact we just put our shoulders to the -- that is the wrong analogy that goes back to the nineteenth century -- we put our minds to work and we really made a really quite significant difference and now we are preeminent as all of you know in a very substantial part of the structure of what it is we produce.

In closing, let me say that many of the challenges that we face today have evolved from the rapid changes in the economy of recent years -- intensified international competition, spreading deregulation, technological advances and financial innovations. Also changes in the structure of the economy naturally create frictions and human stress, at least temporarily. All those frictions dissipate, however, but as they dissipate I have no doubt that our economy will emerge healthier and be perceived of in the longer run as healthier. And if we are able to boost our investments in people, ideas, processes, and machines, the economy can generate a significant amount of progress and operate far more effectively than we perceive it or at least that our concerns about the future which confront so many of us as we adapt to this irreversible change. Such an outlook would create a much greater, broader payoff in standards of living -- and I mean that for all Americans. I trust that as such trends become increasingly evident the current fears of the future among the

significant segment of our population will fade and the optimism that is characterized Americans through the generations will again become predominant. Thank you very much ladies and gentlemen. I am glad to be here.